25th ANNUAL
MANAGEMENT OF THE HOSPITALIZED PATIENT
Hyatt Regency San Francisco • San Francisco, CA

Thursday - Saturday
October 21-23, 2021

Praise from past attendees...
“The best conference ever!
By far!!!”

COURSE CHAIR
Robert M. Wachter, MD
Professor and Chair, Department of Medicine
University of California, San Francisco

2021

The course that started it all returns for its 25th year!
This course serves as the West Coast Regional Meeting of
the Society of Hospital Medicine.
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The State of the Covid-19 Pandemic
George Rutherford, MD

Advances in Interventional Endoscopy
Craig Munroe, MD

Small Group Workshops: Session II
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Vanja Douglas, MD

Radiology Refresher: Chest Imaging
Brett M. Elicker, MD

Fundamentals of Preoperative Evaluation
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Interesting Cases in Hospital Rheumatology
Sarah Goglin, MD

Bedside Ultrasound for Diagnosis
Trevor Jensen, MD, MS

The Art of Diagnostic Reasoning: An Interactive Case
Gurpreet Dhaliwal, MD

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Radiology Refresher: Chest Imaging (repeat)
Brett M. Elicker, MD

Thromboembolism Q&A: Cases and Controversies (repeat)
Tracy Minichiello, MD and Erika Price, MD, MPH

Tough Cases in Medical Consultation
H. Quinny Cheng, MD

Bedside Ultrasound for Diagnosis (repeat)
Trevor Jensen, MD, MS

Management of COVID-19 Patients in the ICU
Antonio Gomez, MD

Diagnosis and Management of Acute Kidney Injury
Lowell Lo, MD

Current Controversies in Medical Consultation
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Cardiology Pearls for the Hospitalist
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25th Annual Management of the Hospitalized Patient

October 21 - 23, 2021

Course Chair
Robert M. Wachter, MD
Professor and Chair, Department of Medicine
University of California, San Francisco
Exhibitors

Alexion
Astellas
AstraZeneca
Baylor Scott & White Health
Boehringer Ingelheim
Genentech
Janssen
Theravance
25th Annual
Management of the Hospitalized Patient

We are thrilled that you’re joining us for the Management of the Hospitalized Patient CME course

Overview
This course, chaired by Dr. Robert Wachter, covers the clinical issues most relevant to hospitalists and other clinicians who care for inpatients. Taught by UCSF’s top teachers and selected guest faculty, the course – now in its 25th year – highlights recent advances and current controversies. To promote active learning, the course uses a mobile audience response system and features multiple workshops in a variety of disciplines to allow for small group discussions. The course will be offered both in-person and virtually.

The course includes broad content in critical care, perioperative care, patient safety, hospital neurology, cardiology, GI, hematology, oncology, nephrology, and infectious diseases (including Covid).

This course is presented by the UCSF Division of Hospital Medicine and is sponsored by the Office of Continuing Medical Education, University of California, San Francisco School of Medicine. It also serves as the West Coast regional meeting of the Society of Hospital Medicine.

Educational Objectives
An attendee completing the Management of the Hospitalized Patient course should be able to:

- Improve diagnosis of common inpatient clinical presentations;
- Perform an evidence-based work-up for common inpatient clinical presentations;
- Apply modern therapeutic approaches to common inpatient disorders;
- More effectively respond to patients questions in hospital medicine using the latest clinical literature.
ACCREDITATION

The University of California, San Francisco School of Medicine (UCSF) is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

UCSF designates this educational activity for a maximum of 18.50 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

This CME activity meets the requirements under California Assembly Bill 1195, continuing education and cultural and linguistic competency.

Geriatric Medicine:
The approved credits shown above include 2.50 Geriatric Credits toward meeting the requirement under California Assembly Bill 1820, Geriatric Medicine.

ABIM Maintenance of Certification Points:
Successful completion of this CME activity, which includes participation in the evaluation component, enables the participant to earn up to 18.50 MOC points in the American Board of Internal Medicine’s (ABIM) Maintenance of Certification (MOC) program. Participants will earn MOC points equivalent to the amount of CME credits claimed for the activity. It is the CME activity provider’s responsibility to submit participant completion information to ACCME for the purpose of granting ABIM MOC credit.

Family Physicians:
The AAFP has reviewed 25th Annual Management of the Hospitalized Patient and deemed it acceptable for up to 18.50 In-Person, Live (could include online) AAFP Prescribed credit. Term of Approval is from 10/21/2021 to 10/23/2021. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Nurses:
For the purpose of recertification, the American Nurses Credentialing Center accepts AMA PRA Category 1 Credit™ issued by organizations accredited by the ACCME.

Pharmacotherapeutics CEUs for Nurses:
This activity is designated for a maximum of 2.50 pharmacotherapeutic credits towards meeting the requirement for nursing pharmacology continuing education. Nurses should claim 0.1 CEUs for each contact hour of participation in designated pharmacotherapeutic continuing education.

Pharmacists:
The California Board of Pharmacy accepts as continuing professional education those courses that meet the standard of relevance to pharmacy practice and have been approved for AMA PRA Category 1 Credit™.

Physician Assistants
AAPA accepts category 1 credit from AOACCME, Prescribed credit from AAFP, and AMA PRA Category 1 credit™ for organizations accredited by the ACCME.
GENERAL INFORMATION

ATTENDANCE VERIFICATION
Please remember to sign-in on the sign-in sheet when you check in on your first day at the UCSF Registration Desk, located in the Market Street Foyer on the Street Level. You only need to sign-in once for the course, when you first check in.

Those attending virtually will be verified upon logging into the Live Stream.

EVALUATIONS / CREDITS / MOC
Visit the MHP Evaluation Site to do all of these things!

Tap the Evaluation tile from the app’s home screen. OR Visit https://tinyurl.com/MHP21Eval from a web browser.

If asked to login, use the email address and access key you used for the app. If you didn’t use the mobile app, click the Create Account button.

Select a “Task” to complete it:
- Speaker Evaluations
- Course Evaluation (required for credit)
- Claim CME / MOC
- Download Certificate
  - Print it
  - Save it as a PDF
  - Email it
CONTINENTAL BREAKFAST AND COFFEE BREAKS

Breakfasts and coffee breaks provided for the registered attendees will be served in the Grand Ballroom Foyer on the Street Level along with the exhibits and have been ordered according to registration numbers. You name badge will be required to access the exhibitor and meal service area. Guests and travel companions are not permitted.

LUNCH

Lunch is on your own on Thursday 10/21. A list of are restaurants is provided in the MHP2021 app along with a map.

On Friday 10/22, a boxed lunch will be provided. If you have any dietary restrictions that you did not list when you registered, please be sure to let us know as soon as possible so we may prepare accordingly. We will have vegetarian as well as a limited number of vegan and vegan/gluten-free options available. You will have 30 minutes (12:10PM- 12:40PM) to collect your boxed lunch before the start of the small group workshop sessions.

COURSE RECEPTION

On Thursday 10/21, we will host the course reception on the east end of the Atrium Lobby located on the Lobby Level and is for registered attendees only. Please make sure to wear your course name badge.

Due to San Francisco Vaccine Verification protocols, we are not able to accommodate guests this year.

GENERAL SESSION

The general session will take place in the Grand Ballroom. We will provide a warning bell during breakfasts and coffee breaks to allow you ample time to re-enter the room before the course reconvenes.
Federal and State Law
Regarding Linguistic Access and Services for Limited English Proficient Persons

I. Purpose.
This document is intended to satisfy the requirements set forth in California Business and Professions code 2190.1. California law requires physicians to obtain training in cultural and linguistic competency as part of their continuing medical education programs. This document and the attachments are intended to provide physicians with an overview of federal and state laws regarding linguistic access and services for limited English proficient (“LEP”) persons. Other federal and state laws not reviewed below also may govern the manner in which physicians and healthcare providers render services for disabled, hearing impaired or other protected categories.

The Federal Civil Rights Act of 1964, as amended, and HHS regulations require recipients of federal financial assistance (“Recipients”) to take reasonable steps to ensure that LEP persons have meaningful access to federally funded programs and services. Failure to provide LEP individuals with access to federally funded programs and services may constitute national origin discrimination, which may be remedied by federal agency enforcement action. Recipients may include physicians, hospitals, universities and academic medical centers who receive grants, training, equipment, surplus property and other assistance from the federal government.

HHS recently issued revised guidance documents for Recipients to ensure that they understand their obligations to provide language assistance services to LEP persons. A copy of HHS’s summary document entitled “Guidance for Federal Financial Assistance Recipients Regarding Title VI and the Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons – Summary” is available at HHS’s website at: http://www.hhs.gov/ocr/lep/.

As noted above, Recipients generally must provide meaningful access to their programs and services for LEP persons. The rule, however, is a flexible one and HHS recognizes that “reasonable steps” may differ depending on the Recipient’s size and scope of services. HHS advised that Recipients, in designing an LEP program, should conduct an individualized assessment balancing four factors, including: (i) the number or proportion of LEP persons eligible to be served or likely to be encountered by the Recipient; (ii) the frequency with which LEP individuals come into contact with the Recipient’s program; (iii) the nature and importance of the program, activity or service provided by the Recipient to its beneficiaries; and (iv) the resources available to the Recipient and the costs of interpreting and translation services.

Based on the Recipient’s analysis, the Recipient should then design an LEP plan based on five recommended steps, including: (i) identifying LEP individuals who may need assistance; (ii) identifying language assistance measures; (iii) training staff; (iv) providing notice to LEP persons; and (v) monitoring and updating the LEP plan.

A Recipient’s LEP plan likely will include translating vital documents and providing either on-site interpreters or telephone interpreter services, or using shared interpreting services with other Recipients. Recipients may take other reasonable steps depending on the emergent or non-emergent needs of the LEP individual, such as hiring bilingual staff who are competent in the skills required for medical translation, hiring staff interpreters, or contracting with outside public or private agencies that provide interpreter services. HHS’s guidance provides detailed examples of the mix of services that a Recipient should consider and implement.

HHS’s guidance also establishes a “safe harbor” that Recipients may elect to follow when determining whether vital documents must be translated into other languages. Compliance with the safe harbor will be strong evidence that the Recipient has satisfied its written translation obligations.

In addition to reviewing HHS guidance documents, Recipients may contact HHS’s Office for Civil Rights for technical assistance in establishing a reasonable LEP plan.
The California legislature enacted the California’s Dymally-Alatorre Bilingual Services Act (Govt. Code 7290 et seq.) in order to ensure that California residents would appropriately receive services from public agencies regardless of the person’s English language skills. California Government Code section 7291 recites this legislative intent as follows:

“The Legislature hereby finds and declares that the effective maintenance and development of a free and democratic society depends on the right and ability of its citizens and residents to communicate with their government and the right and ability of the government to communicate with them.

The Legislature further finds and declares that substantial numbers of persons who live, work and pay taxes in this state are unable, either because they do not speak or write English at all, or because their primary language is other than English, effectively to communicate with their government. The Legislature further finds and declares that state and local agency employees frequently are unable to communicate with persons requiring their services because of this language barrier. As a consequence, substantial numbers of persons presently are being denied rights and benefits to which they would otherwise be entitled.

It is the intention of the Legislature in enacting this chapter to provide for effective communication between all levels of government in this state and the people of this state who are precluded from utilizing public services because of language barriers.”

The Act generally requires state and local public agencies to provide interpreter and written document translation services in a manner that will ensure that LEP individuals have access to important government services. Agencies may employ bilingual staff, and translate documents into additional languages representing the clientele served by the agency. Public agencies also must conduct a needs assessment survey every two years documenting the items listed in Government Code section 7299.4, and develop an implementation plan every year that documents compliance with the Act. You may access a copy of this law at the following url: http://www.spb.ca.gov/bilingual/dymallyact.htm
FACULTY LIST

Course Chair

Robert M. Wachter, MD
Professor and Chair, Department of Medicine
University of California, San Francisco

Visiting Faculty

Linda DeCherrie, MD
Professor of Geriatrics and Palliative Medicine; Associate Professor of Medicine, General Internal Medicine,
Icahn School of Medicine at Mount Sinai, New York, NY

Course Faculty (University of California, San Francisco, School of Medicine)

Jennifer Babik, MD, PhD
Associate Professor of Medicine, Division of Infectious Diseases; Associate Program Director, Internal Medicine Residency

Danielle Brandman, MD, MAS
Associate Professor of Clinical Medicine; Program Director, Transplant Hepatology Fellowship, Division of Gastroenterology/Liver Transplant

Sam Brondfield, MD, MA
Assistant Professor of Medicine, Division of Hematology/Oncology

H. Quinny Cheng, MD
Professor of Medicine; Medical Director, Medicine Consultation Service and Neurosurgery Co-Management Service

Gurpreet Dhalwal, MD
Professor of Medicine, Medicine Clerkship Site Director, San Francisco VA Health Care System

Vanja Douglas, MD
Associate Professor of Neurology; Sara & Evan Williams Foundation Endowed Neurohospitalist Chair

Brett M. Elicker, MD
Professor of Radiology & Biomedical Imaging; Chief, Cardiac & Pulmonary Imaging

Monica Gandhi, MD, MPH
Professor of Medicine; Associate Division Chief, Division of HIV, Infectious Diseases, and Global Medicine, UCSF/San Francisco General Hospital; Director of the UCSF Center for AIDS Research; Medical Director, HIV Clinic at SFGH

Sarah Goglin, MD
Assistant Professor of Medicine, Department of Rheumatology

Antonio Gomez, MD
Associate Professor of Medicine

Trevor Jensen, MD, MS
Assistant Professor of Medicine, Division of Hospital Medicine

S. Andrew Josephson, MD
Carmen Castro Franceschi and Gladyne K. Mitchell Neurohospitalist Distinguished Professor and Chair, Department of Neurology
Course Faculty (University of California, San Francisco, School of Medicine)

Lowell Lo, MD  
Assistant Professor of Medicine, Division of Nephrology

Gregory M. Marcus, MD  
Professor of Medicine, Division of Cardiology

Marlene Martin, MD  
Associate Professor of Medicine, Division of Hospital Medicine

Tracy Minichiello, MD  
Professor of Medicine; Chief, Anticoagulation and Thrombosis Service,  
San Francisco VA Health Care System

Bradley Monash, MD  
Associate Professor of Medicine and of Pediatrics; Chief of Medicine Service

Craig Munroe, MD  
Associate Professor of Medicine, Division of Gastroenterology; Associate Chief for Clinical Innovation

Erika Price, MD, MPH  
Associate Clinical Professor  
VA Medicine Home, Hospital Medicine, Hospital Medicine VA

George Rutherford, III, MD  
Professor of Epidemiology & Biostatistics  
Director, Prevention and Public Health

Lekshmi Santhosh, MD  
Assistant Professor of Pulmonary and Critical Care Medicine

Anne Schafer, MD  
Associate Professor of Medicine and of Epidemiology & Biostatistics;  
Chief of Endocrinology and Metabolism, San Francisco VA Health Care System

Bradley A. Sharpe, MD  
Professor of Medicine; Chief, Division of Hospital Medicine

Krishan Soni, MD, MBA, FACC  
Assistant Professor, Division of Cardiology
DISCLOSURES

The following faculty speakers, moderators, and planning committee members have disclosed they have no financial interest/arrangement or affiliation with any commercial companies who have provided products or services relating to their presentation(s) or commercial support for this continuing medical education activity:

Jennifer Babik, MD, PhD
H. Quinny Cheng, MD
Linda DeCherrie, MD
Gurpreet Dhaliwal, MD
Vanja Douglas, MD
Brett M. Elicker, MD
Monica Gandhi, MD, MPH
Sarah Goglin, MD
Antonio Gomez, MD
S. Andrew Josephson, MD
Lowell Lo, MD
Marlene Martin, MD
Tracy Minichiello, MD
Bradley Monash, MD
Craig Munroe, MD
Erika Price, MD, MPH
George Rutherford, III, MD
Lekshmi Santhosh, MD
Bradley A. Sharpe, MD
Krishan Soni, MD

The following faculty speakers have disclosed a financial interest/arrangement or affiliation with a commercial company who has provided products or services relating to their presentation(s) or commercial support for this continuing medical education activity. All conflicts of interest have been resolved in accordance with the ACCME Standards for Commercial Support:

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<tr>
<th>Faculty Speaker</th>
<th>Company</th>
<th>Financial Interest/Arrangement or Affiliation</th>
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<tbody>
<tr>
<td>Danielle Brandman, MD, MAS</td>
<td>Allergan, Gilead, Genentech, Grifols, NGM</td>
<td>Grant/Research Support</td>
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<tr>
<td>Sam Brondfield, MD, MA</td>
<td>Doximity, PAI Pharmaceuticals, Blackstone, Gemini Health, IDEO, American Physician Institute</td>
<td>Honorarium Recipient</td>
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<td>Trevor Jensen, MD</td>
<td>Caption Health</td>
<td>Consultant</td>
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<td>Gregory M. Marcus, MD</td>
<td>Johnson &amp; Johnson, InCarda, Baylis Medical</td>
<td>Advisor/Reviewer, Consultant, Stock Shareholder (excluding mutual funds)</td>
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<tr>
<td>Anne Schafer, MD</td>
<td>Amgen</td>
<td>Grant/Research Support</td>
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<td>Robert M. Wachter, MD</td>
<td>Curai, EarlySense</td>
<td>Consultant</td>
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This UCSF CME educational activity was planned and developed to uphold academic standards to ensure balance, independence, objectivity, and scientific rigor; adhere to requirements to protect health information under the Health Insurance Portability and Accountability Act of 1996 (HIPAA); and, include a mechanism to inform learners when unapproved or unlabeled uses of therapeutic products or agents are discussed or referenced.

This activity has been reviewed and approved by members of the UCSF CME Governing Board in accordance with UCSF CME accreditation policies. Office of CME staff, planners, reviewers, and all others in control of content have disclosed no relevant financial relationships.
COURSE PROGRAM

Thursday, October 21, 2021

7:00 AM  Registration and Continental Breakfast

8:00  Welcome and Overview  Robert M. Wachter, MD

8:10  Rx  Diagnosis and Management of VTE in the Hospitalized Patient  Tracy Minichiello, MD

9:00  Update on Clinical Manifestations and Inpatient Management of Covid-19  Jennifer Babik, MD, PhD

9:50  Break

10:15  GRx  Managing Anticoagulation in the Hospitalized Patients  Tracy Minichiello, MD

11:10  GRx  Update in Diagnosis and Management of Stroke  S. Andrew Josephson, MD

12:00 PM  Lunch Break

1:30  Small Group Workshops: Session I

1. The Neurological Exam  S. Andrew Josephson, MD
2. Tough Cases in the Hospitalized Patient with Liver Disease  Danielle Brandman, MD, MAS
3. Thromboembolism Q&A: Cases and Controversies  Tracy Minichiello, MD, Erika Price, MD, MPH
4. Tough Cases in Inpatient Pulmonary Medicine  Lekshmi Santhosh, MD
5. Common Hospital Consults in Infectious Disease  Jennifer Babik, MD, PhD
6. Caring for the Hospitalized Patient with Addictions  Marlene Martin, MD
7. Meet the Professor  Robert M. Wachter, MD

2:50  Break

3:15  ICU Management Pearls for the Hospitalist  Lekshmi Santhosh, MD
4:10  Setting Up a Successful Hospital at Home Program  Linda DeCherrie, MD

5:00 PM  Adjourn

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<td>2:00</td>
<td>Session Break- Transition to Next Workshop</td>
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<td>Small Group Workshops: Session III</td>
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<td>14. The Neurological Exam (repeat #2)</td>
<td>Vanja Douglas, MD</td>
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<td>Tracy Minichiello, MD</td>
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<td>17. Tough Cases in Medical Consultation (repeat)</td>
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Diagnosis and Management of VTE in the Hospitalized Patient

Tracy Minichiello, MD
Professor of Medicine
University of California, San Francisco
Chief, Anticoagulation and Thrombosis Services
San Francisco, VA Medical Center

Conflicts of Interest

- I have no actual or potential conflicts of interest in relation to this program or presentation to disclose.

AC FORUM Literature Updates & Rapid Resources

https://acforum-excellence.org/
Objectives

- Splanchnic vein thrombosis
- Calf vein thrombosis
- Outpatient management of PE
- DOACs for VTE in obesity
- Management of anticoagulation in recurrent VTE

A 62 year old man with cirrhosis and history of alcohol use presents with abdominal pain. On exam vitals are stable but abdomen is tender in right upper quadrant. Labs are significant for PLT count of 105K, creatinine 0.8, AST/ALT: 60/30 normal bili, INR 1.0. ultrasound of RUQ shows thrombosis in left and right portal veins. **What anticoagulation regimen do you recommend?**

1) None - we always see portal vein thrombosis in cirrhosis
2) DOAC
3) LMWH
4) LMWH → warfarin
5) I really don’t like any of these options

Anticoagulation for splanchnic thrombosis

Di Nisio et al. JTN 2020 https://doi.org/10.1111/jth.14836

Splanchnic Vein Thrombosis

- 10% of cirrhotic have PVT
- 10% of all splanchnic vein thrombosis cases have myeloproliferative disorder
- 10% of cancer associated splanchnic vein thrombosis is due to pancreatic CA
- Up to 15% of those with “unprovoked” PVT are diagnosed with cancer in subsequent 1.5 years

### Splanchnic Vein Thrombosis Management

**WHO TO TREAT?**

- **Acute SVT**
  - Goal is to prevent bowel ischemia and portal HTN
  - Consider GI eval prior to anticoagulation—particularly in chronic PVT due to varices, portal HTN, GIB risk

- **Chronic SVT**
  - Goal is to prevent progression
  - Risk: benefit less clear

### Splanchnic Vein Thrombosis-Anticoagulation

**HOW TO TREAT?**

- **Non cirrhotic SVT** → DOAC
- **Cancer associated symptomatic SVT** → LMWH or DOAC
  - Favor LMWH if high bleed risk
- **Cirrhotic** → LMWH and then switch to DOAC or warfarin if able
- Above assumes not high bleed risk. If high bleed risk multidisciplinary discussion. Consider delay, low intensity AC, withholding

### Case

**A 62 year old man with cirrhosis** and history of alcohol use presents with abdominal pain. On exam vitals are stable but abdomen is tender in right upper quadrant. Labs are significant for **PLT count of 105K**, creatinine 0.8, AST/ALT: 60/30 normal bili, INR 1.0. Ultrasound of RUQ shows thrombosis in left and right portal veins. **What anticoagulation regimen do you recommend?**

1) None—we always see portal vein thrombosis in cirrhosis
2) DOAC
3) LMWH
4) LMWH → warfarin
5) I really don't like any of these options
A 79-year-old man is diagnosed with a **posterior tibial vein DVT**. He is started on therapeutic anticoagulation but a week later he returns to ED with **upper gastrointestinal bleed**. EGD shows gastric ulcer. **Should anticoagulation be resumed on discharge?**

1) Yes, he had a DVT one week ago
2) No, let’s just get a follow up ultrasound
3) I like these options even less than the last case

---

**Calf Vein DVT**

- Calf trifurcation DVT (the popliteal vein distal to the knee crease, where it divides into the anterior tibial, posterior tibial and peroneal veins) like proximal DVTs, have annual recurrence risk of 4.7%
- Muscular DVTs (e.g. in the gastrocnemius and soleus veins) have a similar risk of recurrence to deep calf DVT (1.7% vs. 1.6% annual recurrence)
- Proximal DVTs tend to recur more commonly as proximal DVTs and distal DVTs tend to recur more commonly as IDVT

---

**Calf Trifurcation**

- The popliteal vein distal to the knee crease, where it divides into the anterior tibial, posterior tibial and peroneal veins

---

**Table: Risk factors for venous thromboembolic disease recurrence in patients with initial diagnosis with venous thromboembolism**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Low Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Female</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Obesity</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Age &gt; 60</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Surgery</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Immobilization</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Immunosuppressive</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Injury to the leg</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Cancer</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Oral contraceptive</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Heart failure</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Prior venous thromboembolism</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Prior deep vein thromboembolism</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Prior pulmonary embolism</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Prior stroke</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Prior deep vein thromboembolism</td>
<td>Low</td>
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</tr>
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<td>Prior stroke</td>
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</tbody>
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A 79-year-old man is diagnosed with a posterior tibial vein DVT. He is started on therapeutic anticoagulation but a week later he returns to ED with upper gastrointestinal bleed. EGD shows gastric ulcer. Should anticoagulation be resumed on discharge?

1) Yes, he had a DVT one week ago
2) No, let’s just get a follow up ultrasound
3) I like these options even less than the last case

A 65 year old man with HTN, weight 130 kg, presents with pleuritic chest pain. He is hemodynamically stable, O2 sat 95% on RA. CTPE shows segmental PE in RLL. Trop & BNP neg. PESI-O Hestia score NEGATIVE. Should this patient be admitted?

1) Yes, he has a PE
2) No, looks like he can head home
More than a third of PE patients were treated at home using either the Hestia rule or the sPESI, with a low 30-day rate of complications. All had timely follow-up/clear instructions for discharged patients. This may have contributed to the low rate of complications.

Case

A 65-year-old man with HTN, weight 130 kg, presents with pleuritic chest pain. He is hemodynamically stable, O2 sat 95% on RA. CTPE shows segmental PE in RLL. Trop & BNP neg. PESI=O Hestia score NEGATIVE. Should this patient be admitted?

“In patients with low-risk PE we recommend outpatient treatment over hospitalization provided access to medication, ability to access outpatient care, and home circumstance are adequate (strong recommendation).”
A 65 year old man with HTN, weight **130 kg**, presents with pleuritic chest pain. He is hemodynamically stable, O2 sat 95% on RA. CTPE shows segmental PE in RLL. Trop & BNP neg. PESI=O Hestia score NEGATIVE. He will be sent home with close follow up with AC clinic and his PCP. What anticoagulation regimen do you recommend?

1) LMWH → warfarin
2) Rivaroxaban
3) Apixaban
4) IV heparin → DOAC
5) Any of the above would work for me

---

**DOACS in VTE & OBESITY**

Use of direct oral anticoagulants in patients with obesity for treatment and prevention of venous thromboembolism: Updated communication from the ISTH SSC Subcommittee on Control of Anticoagulation

- DOAC levels not recommended: avoid dabigatran/edoxaban due to
- Use LMWH for 1st 4 weeks after bariatric surgery

---

**DOACS in BARIATRIC SURGERY**

Martin et al J Thromb Haemost 2021

- Use LMWH for 1st 4 weeks after bariatric surgery

---

**DOACS in BARIATRIC SURGERY**

We suggest that switching to VKA or DOAC may be considered after at least 4 weeks of parenteral treatment, and so, suggest obtaining a DOAC trough level to check for drug absorption and bioavailability.
CASE

A 65 year old man with HTN, weight **130 kg**, presents with pleuritic chest pain. He is hemodynamically stable, O2 sat 95% on RA. CTPE shows segmental PE in RLL. Trop & BNP neg. PESI=O Hestia score NEGATIVE. He will be sent home with close follow up with AC clinic and his PCP. **What anticoagulation regimen do you recommend?**

1) LMWH→warfarin  
2) Rivaroxaban  
3) Apixaban  
4) IV heparin→DOAC  
5) Any of the above would work for me

51 yo man with diffuse b cell lymphoma undergoing chemotherapy presents with LUESwelling. He has PICC line on that side. U/S shows DVT in brachial→subclavian vein. He is started on enoxaparin 1mg/kg BID. One week later he returns with increased LUE swelling and dilated venous pattern over shoulder and chest and pleuritic chest pain. CT shows thrombosis up to brachiocephalic vein and **2 subsegmental pulmonary emboli**. **What do you recommend?**

1) Pull PICC and continue dalteparin at current dose  
2) Pull PICC and increase dalteparin dose  
3) Pull PICC and switch to rivaroxaban

VTE Recurrence on Anticoagulation

Shulman Blood 2017

VTE Recurrence on Anticoagulation

Shulman Blood 2017
Case

51 year old man with diffuse b cell lymphoma undergoing chemotherapy presents with left upper extremity swelling. He has PICC line on that side. u/s shows DVT in brachial→subclavian vein. He is started on dalteparin 200 IU/kg/day. One week later he returns with increased LUE swelling and dilated venous pattern over shoulder and chest as well as pleuritic chest pain. CT shows thrombosis up to brachiocephlic vein but not into SVC as well as a sub segmental pulmonary emboli. What do you recommend?

1. Pull PICC and continue dalteparin at current dose
2. Pull PICC and increase dalteparin dose
3. Pull PICC and switch to rivaroxaban

Case

65 year old man with lung cancer undergoing chemo presents with sudden onset chest pain and SOB. BP 130/80 HR 115, O2 sat 89%. He is found to have bilateral lobar PE. Trop and BNP are negative. U/S shows DVT in right proximal femoral vein. What anticoagulant regimen do you start him on?

1. DOAC-anyone will do
2. LMWH-this is 1st line in cancer associated thrombosis
3. IV heparin, I am thinking about thrombolysis
4. Are we done yet?
Case

65 year old man with lung cancer undergoing chemo presents with sudden onset chest pain and SOB. BP 130/80 HR 115, O2 sat 86%. He is found to have bilateral lobar PE. Trop and BNP are negative. U/S shows DVT in right proximal femoral vein. What anticoagulant regimen do you start him on?

1) DOAC-any one will do
2) LMWH-this is 1st line in cancer associated thrombosis
3) Are we done yet?
Case

65 year old man with lung cancer undergoing chemo presents with sudden onset chest pain and SOB. BP 130/80 HR 115, O2 sat 91%. He is found to have bilateral lobar PE. Trop and BNP are negative. U/S shows DVT in right proximal femoral vein. What anticoagulant regimen do you start him on if his PLT count is 50K?

Objectives

- Splanchnic vein thrombosis
  - Timing dictates if anticoag considered; explore etiology; DOACs reasonable in select patients
  - Calf vein thrombosis
    - Low risk outpatients options include serial u/s, lower intensity, shorter period of time; for most hospitalized patients anticoagulation will be considered BUT know that serial u/s is option in very high bleeding risk patient, or perhaps lower intensity dosing
- Outpatient management of PE
  - DOACs for VTE in obesity
    - Reasonable to use but when approaching BMI 50 we are in completely data free zone; always explore history of GI surgery/bariatric surgery; avoid use of DOACs first month post op at least and if used beyond that check trough levels
  - Management of anticoagulation in recurrent VTE
    - Make sure it is real. If so ask why (patient factors, disease factors), situation dictates anticoagulation choice, maybe switching to DOAC, may be switching oral agents, maybe starting LMWH. THINK CANCER
Questions?

Tracy Minichiello, MD
Update on Clinical Manifestations and Inpatient Management of COVID-19

Management of the Hospitalized Patient
October 21, 2021

Jennifer Babik, MD, PhD
Associate Clinical Professor
Division of Infectious Diseases
University of California, San Francisco

Disclosures

- I have no disclosures.

Learning Objectives

At the end of this lecture, you will be able to:

1. Recognize the diverse clinical manifestations of COVID
2. Identify the indications for COVID-specific and general diagnostic tests in patients admitted with COVID
3. Describe the evidence-based treatments for COVID

Outline

- Clinical Manifestations
- Diagnostics
- Treatment
### Outline

- **Clinical Manifestations**
- **Diagnostics**
- **Treatment**

### Case #1

31 y/o man with no PMH admitted with fever, sore throat, conjunctival injection, N/V, and chest pain. Found to have elevated troponin (4.55), EF 25%, with course c/b cardiac arrest. Cardiac cath was negative. Chest CTA was negative. CRP was 327.

COVID PCR: initial test negative but repeat **positive** (Ct value 34)

COVID Ab: nucleocapsid Ab **positive**

---

### His Troponin Leak is Most Likely:

A. Cardiac injury from demand ischemia  
B. Viral myocarditis  
C. Pulmonary embolism  
D. MIS-A

---

### Case Continued

He was thought to have fulminant myocarditis, possibly due to MIS-A given it seemed COVID infection may have been several weeks prior. He was treated with methylprednisone and IVIG. His cardiac function improved.
Almost Every Organ System Can Be Affected

Neurologic: AMS, delirium, HA, stroke (rare), GBs (rare), encephalitis (rare)
Ocular: conjunctivitis (rare)
ENT: taste and/or smell disorders
Respiratory: cough, dyspnea > URI symptoms
Cardiac: arrhythmias, cardiac injury, myocarditis (rare)
Gastrointestinal: N/V, diarrhea
Renal: acute kidney injury, rhabdo (rare)
Hematologic: DVT/PE (?more common than other respiratory viruses)
Dermatologic: rash (erythematous, articular, vesicular), COVID toes

Clinical Course

In incubation period,
- Day 0
- Symptom onset
- First week of illness
  - Fever, cough, myalgias, loss of taste/smell, diarrhea
- Second week of illness
  - Dyspnea
  - Risk for clinical decompensation, ICU admission, intubation
- Day 14
- Day 60
- Persistent Symptoms (Long COVID)
  - Fatigue, SOB, sleep disturbance

Multisystem Inflammatory Syndrome in Adults

Systematic review of 221 adults w/ MIS-A

- Demographics:
  - Median age 21, 70% M, 30% Latinx, 36% Black
  - 58% no underlying comorbidity

- Clinical
  - 68% prior (recovered) symptomatic COVID
  - Time from symptom onset to MIS-A = 28 days
  - Systemic/Cardiac: fever 96%, hypotension 60%, cardiac dysfunction 54%, myocarditis 30%, SOB 52%
  - GI/dERM: diarrhea 52%, vomiting 44%, rash 38%, conjunctival injection 26%, mucocutaneous lesions 16%

- Diagnostics
  - Elevated CRP in 90%
  - (+) COVID Ab 40%, PCR 25%, both 32%

- Treatment
  - Steroids 74%, IVIG 55%, other immunomodulators 21%
  - 7% died

Think you have a case?

- CDC criteria for MIS-A: https://www.cdc.gov/mis/a/hcp.html
- NIH Rx guidelines for MIS-C: IVIG/stereoids
- First line, IL-1 antagonist if refractory
- Consult ID, peds ID, rheum, cards

Outline

- Clinical Manifestations
- Diagnostics
- Treatment
Case #1 Revisited

31 y/o M with no PMH admitted with fever, sore throat, conjunctivitis, N/V, and chest pain. Found to have elevated troponin (4.55), EF 25%, with course c/b cardiac arrest. Cardiac cath was negative. Chest CTA was negative.

COVID PCR: initial test negative but repeat positive (Ct value 34)
COVID Ab: nucleocapsid Ab positive

What Does a High Cycle Threshold Value Mean?

1. High Viral Load
2. Low Viral Load
3. Does Not Correlate with Viral Load

Nucleocapsid Antibody Should Be Positive in:

1. Prior Natural Infection
2. Prior Vaccination
3. Both

Molecular Testing Algorithm in IDSA Guidelines
Molecular Testing: Highlights of IDSA Guidelines

- Avoid use of OP swab alone
- Patient collected samples acceptable unless NP swab
- Obtain an upper tract sample first → if negative and high suspicion, collect a lower tract sample
- Obtain repeat testing if initial test is negative only in patients where there is high suspicion

Primer on Cycle Threshold (Ct) Values

- Ct value in PCR = number of amplification cycles required to amplify the target gene past a threshold level
- In general, high Ct value = low viral load = less likely to be infectious = longer time from symptom onset
- Beware: sampling technique can affect Ct value

Serology: Timing of the Ab Response In Infection

- Abs become detectable in most patients >14d after symptom onset
- IDSA recommends against using Abs to diagnose COVID in first 2 weeks given risk of false (-)
- Note that IgM and IgG rise at the same time

Key point: Serology may have an adjunct role in diagnosis when suspicion is high and molecular tests are negative - optimal timing is 3-4 weeks after infection

Serology Test Indications

1. To evaluate for COVID in patients where there is high suspicion but molecular testing is repeatedly negative (optimal timing 3-4 weeks after onset)
2. For assessment of MIS-C or MIS-A
3. Epidemiologic surveillance
4. To assess for vaccination response
Nucleocapsid vs Spike Antibodies

- **Natural infection**
  - Anti-nucleocapsid
  - Anti-spike

- **Vaccine induced antibodies**
  - Anti-spike

Case #2

65 y/o woman with asthma presents with 1 week of shortness of breath and is found to be hypoxic requiring 4L. She is COVID positive and admitted. What diagnostic testing does she need?

What labs should you order?

A. Basic labs only (CBC, BMP, LFTs, coags)
B. Basic labs and CRP
C. Basic labs and CRP, D-dimer, ferritin, fibrinogen
D. #3 and trend q72 hours

What Labs to Order in a COVID (+) Inpatient?

- **Initial Labs:**
  - All patients: CBC with diff, BMP, LFTs, coags
  - Consider: procalcitonin, troponin, BNP, lactate
  - Consider to estimate risk for severe disease: D-dimer, CRP, LDH, CK

- **Monitoring**
  - CBC with diff and BMP per usual practice
  - Trent LFTs at least q48h if abnormal at baseline or on remdesivir
Other Microbiology Testing

- Respiratory viral testing?
  - Send during flu season (declared by infection control/hospital leadership based on Bay Area flu incidence – currently NOT in flu season)
  - Note, most studies show <0.5% viral coinfection at presentation
- Blood cultures and sputum culture?
  - If considering bacterial coinfection or starting antibiotics
  - Note, most studies show <1.3% bacterial coinfection at presentation
  - Secondary infections can occur (VAP, bloodstream infections, Aspergillus)
- Send an HIV test if no recent testing

Outline

- Clinical Manifestations
- Diagnostics
- Treatment

Imaging

- All patients should have a baseline CXR
- Chest CT not needed routinely but consider if there is concern for an additional process (e.g., PE, superimposed bacterial/fungal infection)

Treatment Resources

**UCSF Health Internal Guidelines:**
https://infectioncontrol.ucsfmedicalcenter.org/coronavirus/clinical-guidance

**NIH Guidelines on Therapeutic Management of Adults with COVID**

IDSA Guidelines on Treatment of Patients with COVID
Clinical Course

Incubation Period

- Day 0
- Symptom Onset

First week of illness:
- • Fevers, cough, myalgias, loss of taste/smell, diarrhea

Second week of illness:
- • Dyspnea
- Risk for clinical decompensation, ICU admission, intubation

Day 7 - Day 5

Persistent Symptoms (Long COVID)
- • Fatigue, SOB, sleep disturbance

Day 60

Clinical Course

Viral Phase

Antiviral Therapies

Immune Phase

Immunomodulators

Persistent Symptoms
- Fatigue, SCOR, sleep disturbance

Treatment Overview in Hospitalized Patients

Antivirals
- Remdesivir

Immnomodulators
- Steroids
- Tocilizumab or Baricitinib

Antibodies
- Convalescent plasma
- Monoclonal Antibodies

Treatment By Clinical Status

Inpatient, no O2

Inpatient, requires O2 by nasal cannula

Inpatient, requires O2 by HFNC or NIMV

Inpatient, requires MV or ECMO
Case #3

39 y/o F with no PMH admitted with COVID pneumonia, requiring 2L O2.

She had been taking high doses of acetaminophen and is found to have AST 1250, ALT 1070. She also has AKI with a Cr of 3.5 (normal baseline).

Would You Give Her Remdesivir?

A. Yes
B. No, she is not on enough O2
C. No, because of her LFTs
D. No, because of her AKI

ACTT-1: Most RDV Benefit if only Supplemental O2?

- RCT of 1062 patients w/severe COVID (SaO2<94%, CXR infiltrates, or on O2)
- RDV vs placebo x 10d
- Shortened recovery time from 15 to 10d (p<0.001)
- Benefit greatest if on supplemental O2 only - 7 b/c this was largest group (confidence intervals wide in smaller groups) or b/c intubated patients require longer t/v

Remdesivir: Summary of Data/Guidelines

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Clinical Benefit</th>
<th>Mortality Benefit</th>
<th>NIH Guidelines</th>
<th>UCSF Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient, no O2</td>
<td>May have modest benefit</td>
<td>None</td>
<td>Insufficient data to recommend for or against</td>
<td>Use in patients at high risk for progression or with radiographic x/o LRTI</td>
</tr>
<tr>
<td>Inpatient, requires O2 by nasal cannula</td>
<td>Time to recovery</td>
<td>Possible mortality benefit</td>
<td>Recommended use</td>
<td>Give remdesivir</td>
</tr>
<tr>
<td>Inpatient, requires O2 by HFNC or NIMV</td>
<td>No clear benefit</td>
<td>None</td>
<td>Recommended only with d/e (not monotherapy)</td>
<td>Give remdesivir</td>
</tr>
<tr>
<td>Inpatient, requires MV or ECMO</td>
<td>No clear benefit</td>
<td>None</td>
<td>Recommended against use</td>
<td>Give remdesivir</td>
</tr>
</tbody>
</table>
Remdesivir: How to Use

Administration:
- 200mg IV x 1 then 100mg IV q24h for 4 additional days
- Do not need to stay inpatient to finish if otherwise ready for discharge
- May consider 10d course if not improving at 5d (usually HFNC, ICU)
- Watch for elevated ALT/AST (discontinue if > 5-10 times ULN)

Renal failure?
- Cyclodextrin vehicle can accumulate in renal failure but likely safe for short course
- Consider risk/benefit if CrCl<30 or HD/CRRT, but usually benefit > risk
- Dose adjustment not needed

Treatment Overview in Hospitalized Patients

Antivirals
- Remdesivir

Immunomodulators
- Steroids
- Tocilizumab
- Baricitinib

Antibodies
- Convalescent plasma
- Monoclonal

Case #4
92 y/o M with CAD, DM, dementia is admitted with COVID. He is sitting 94% on 2L. Blood sugars are in the 300s. He is started on remdesivir.

Would You Start Dexamethasone?
A. Yes
B. No
Case Follow-Up

Steroids were initially held given he was on 2L and hyperglycemia, risk of delirium.

He then worsened to required 4L and steroids were started. Blood sugars went into the 400s-500s and steroids were held.

He recovered well and was eventually discharged.

RECOVERY: Dexamethasone by Level of O2

Dexamethasone: Pooled Analysis/Guidelines

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Mortality Benefit</th>
<th>NIH Guidelines</th>
<th>UCSF Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient, no O2</td>
<td>Trend towards harm</td>
<td>Recommend against</td>
<td>Do not give</td>
</tr>
<tr>
<td>Inpatient, requires O2</td>
<td>Mortality by 2.7% if on supplemental O2 (level with most benefit)</td>
<td>Recommend use when patients require increasing amounts of O2</td>
<td>Give dex when requiring &gt;3-4L O2</td>
</tr>
<tr>
<td>Inpatient, requires O2</td>
<td>Mortality by 2.7% if on supplemental O2 (level with most benefit)</td>
<td>Recommend use</td>
<td>Give dex</td>
</tr>
<tr>
<td>inpatient, EOMD</td>
<td>Mortality by 34%</td>
<td>Recommend use</td>
<td>Give dex</td>
</tr>
</tbody>
</table>

Dexamethasone: How to Use

- 6mg IV/PO x 10d or until hospital discharge, whichever comes first (PO preferred)
- If dexamethasone is unavailable, equivalent doses of other glucocorticoids may be used
- Factors to consider if you might withhold or stop steroids:
  - Uncontrolled invasive fungal infection
  - Uncontrolled hyperglycemia
  - Existing delirium
  - Active GI bleeding
Case #5

71 y/o M with melanoma (not on chemo) admitted with COVID 2 days ago. On admission he was requiring 2-3L but has had rapid worsening since admission and is just now transferred to the ICU requiring 30L HFNC.

What Treatments Would You Give?

A. Remdesivir, dexamethasone
B. Remdesivir, dexamethasone, baricitinib
C. Remdesivir, dexamethasone, tocilizumab
D. Remdesivir, dexamethasone, baricitinib, tocilizumab

Tocilizumab (Anti-IL6R)

- Multiple smaller RCTs showed no mortality benefit
- The 2 largest RCTs (REMAP-CAP and RECOVERY) did show a mortality benefit
- May be due to differences in patient population or baseline steroid use
  - Benefit seen in sicker patients early in course with associated inflammatory response
  - Benefit seen in studies with high background steroid use

Tocilizumab: RCTs with Mortality Benefit

<table>
<thead>
<tr>
<th>Study</th>
<th>Inclusion Criteria</th>
<th>Characteristics</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECOVERY (n=4138)</td>
<td>SaO2&lt;92% RA or on O2 and CRP ≥75 mg/L</td>
<td>82% steroids, median duration of hospitalization 2 days, 41% HFNC/NIMV, 14% MV</td>
<td>Lower mortality - 29% toci vs 33% SOC (RR 0.86, CI 0.77-0.96), shorter time to d/c, less secondary bacterial infections</td>
</tr>
<tr>
<td>REMAP-CAP (n=865)</td>
<td>Admitted to ICU within 24 hrs</td>
<td>90% steroids, median duration of hospitalization 1.2d, 71% HFNC/NIMV, 29% MV</td>
<td>Lower mortality - 28% toci vs 36% SOC (RR 1.64, CI 1.14-2.35), shorter duration of organ support, less secondary bacterial infections, thought due to toci</td>
</tr>
</tbody>
</table>
**Baricitinib (JAK inhibitor): RCT Data**

<table>
<thead>
<tr>
<th>Trial Design</th>
<th>Characteristics (note lack of data for MV)</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTT-2</td>
<td>Only 12% got steroids</td>
<td>Improved recovery if &gt;70% mortality, no difference in mortality</td>
</tr>
<tr>
<td>CVB BARRIER</td>
<td>79% got steroids</td>
<td>No difference in progression to HFNC/NIMV/MV</td>
</tr>
<tr>
<td>STOP COVID</td>
<td>85% got steroids</td>
<td>No death/mortality between 17% overall (in all baseline severity groups)</td>
</tr>
</tbody>
</table>

**Tocilizumab and Baricitinib: Guidelines**

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>NIH Guidelines</th>
<th>UCSF Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient, no O2</td>
<td>&gt;4</td>
<td>Do not give</td>
</tr>
<tr>
<td>Inpatient, requires O2 by nasal cannula</td>
<td>Insufficient evidence to clearly characterize subgroups who would benefit</td>
<td>Do not give</td>
</tr>
<tr>
<td>Inpatient, requires O2 by HFNC or NIMV</td>
<td>Recommended baricitinib or tocilizumab if recently hospitalized (&lt;3d), rapidly increased O2, systemic inflammation</td>
<td>Baricitinib if recent hospitalization (≤3-4d) and rapidly worsening</td>
</tr>
<tr>
<td>Inpatient, requires MV or ECMO</td>
<td>Recommended tocilizumab if within 24h of admission to the ICU</td>
<td>Tocilizumab if hospitalized &lt;3d and in ICU O2 04H and rapidly progressing to MV or requiring MV</td>
</tr>
</tbody>
</table>

**How to Give**

<table>
<thead>
<tr>
<th>Tocilizumab</th>
<th>Baricitinib</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tocilizumab 8mg/kg IV × 1 (based on actual body weight, max dose 800mg)</td>
<td>Baricitinib 4 mg PO daily × 14d or until hospital d/h (whichever comes first)</td>
</tr>
<tr>
<td>Contraindicated if ANC &lt; 500, platelets &lt; 50, ALT &gt; 5x ULN</td>
<td>Renally dose if CrCl&lt;60, contraindicated if CrCl&lt;30</td>
</tr>
<tr>
<td>Need to discontinue if ALT&gt;200, ANC&lt;500, or AST/ALT &gt;10x ULN</td>
<td>Direct to discontinuation if ANC&lt;200, AST&gt;500, ALT&gt;10x ULN</td>
</tr>
</tbody>
</table>

**Tocilizumab and Baricitinib: Notes**

- Give one or the other, NOT both
- They should be given in combination with steroids
- If there are drug shortages, per NIH Guidelines can substitute tofacitinib (for baricitinib) or sarilumab (for tocilizumab)
- Consider screening for (or empirically treating for) Strongyloides before starting toci in patients from endemic areas
- Use with caution in immunocompromised patients (but we still usually give)
- Relatively contraindicated if a patient has a concomitant serious infection

- Contraindicated if ANC < 500, platelets < 50, ALT > 5x ULN
- Renally dose if CrCl<60, contraindicated if CrCl<30
- Direct to discontinuation if ANC<200, AST>500, ALT>10x ULN
Case #5: continued

Given ICU team’s suspicion he would be intubated that evening, we gave tocilizumab x 1.

He was not actually intubated until several days later. He had a prolonged ICU stay with multiple complications and was eventually transitioned to comfort care.

Convalescent Plasma

- **Data:**
  - Multiple RCTs, pooled analysis of 11 RCTs → no mortality benefit
  - One exception: Libster et al showed ↓-risk progression if early, mild disease, high risk patient

- **Guidelines**
  - NIH: Recommends against
  - UCSF: <72h symptom onset + non-severe disease (~RA) + high risk for progression (criteria from Libster et al, rare to meet these in practice)

Convalescent Plasma in Immunocompromised?

- **Data**
  - Little comparative data although in REMAP-CAP there was possible benefit (↑ organ support free days) in the subgroup of immunosuppressed patients (but only 6% of the trial)

- **Guidelines**
  - NIH: insufficient data to recommend for or against
  - UCSF: consider in patients with severe immunocompromise + not expected to mount Ab response

Treatment Overview in Hospitalized Patients

- **Antivirals**
  - Remdesivir

- **Immunomodulators**
  - Steroids
  - Tocilizumab
  - Baricitinib

- **Antibodies**
  - Convalescent plasma
  - Monoclonal Antibodies
Monoclonal Abs in Hospitalized Patients

- ACTIV-3 → no benefit of bamlanivimab in hospitalized patients
- Guidelines in hospitalized patients:
  - NIH: Monoclonal Abs not authorized for hospitalized patients unless patient is hospitalized for another reason and happens to have mild-moderate COVID (e.g., admitted for hip fracture but then found to have mild-moderate COVID)
- Recovery Trial (still in preprint):
  - Casirivimab/imdevimab combination reduced risk of death by 20% in hospitalized patients who were seronegative (24% vs 30%, HR 0.8, p=0.001)
  - Also led to shorter LOS and lower risk progression to MV/death
- Stay tuned but not currently authorized for use in hospitalized patients

Molnupiravir

- Studied in outpatients with mild-moderate COVID with symptom onset <5 days → reduced risk of hospitalization or death by 50% (press release)
- EUA application filed with FDA → stay tuned

Summary: NIH Treatment Guidelines

- Inpatient, no O2
  - Remdesivir
  - No steroids, baricitinib, or tocilizumab
- Inpatient, requires O2 by nasal cannula
  - Remdesivir
  - Dexamethasone if >3-4 L
  - No baricitinib or tocilizumab
- Inpatient, requires O2 by HFNC or NIMV
  - Remdesivir
  - Dexamethasone
  - Baricitinib if recent hospitalization (≤3-4 days) rapidly worsening

Summary: UCSF Treatment Guidelines

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>UCSF Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient, no O2</td>
<td>Remdesivir</td>
</tr>
<tr>
<td>Inpatient, requires O2 by nasal cannula</td>
<td>Dexamethasone if &gt;3-4L</td>
</tr>
<tr>
<td>Inpatient, requires O2 by HFNC or NIMV</td>
<td>Remdesivir</td>
</tr>
<tr>
<td>Inpatient, requires MV or ECOMO</td>
<td>Dexamethasone</td>
</tr>
<tr>
<td></td>
<td>Baricitinib if recent hospitalization (≤3-4 days) rapidly worsening</td>
</tr>
<tr>
<td></td>
<td>Remdesivir</td>
</tr>
<tr>
<td></td>
<td>Dexamethasone</td>
</tr>
<tr>
<td></td>
<td>Tocilizumab if hosp &lt;34 and ICU &lt;24H and rapidly progressing to MV or requiring MV</td>
</tr>
</tbody>
</table>
Antibiotics

- Bacterial coinfection on admission to the hospital is very uncommon (<1-3% across multiple studies)
- Most patients do not need to be covered for CAP

Anticoagulation

- Prophylactic anticoagulation should be given unless contraindicated
- Therapeutic anticoagulation
  - Critically ill: No benefit, ↑ major bleeding – do not use
  - Noncritically ill:
    - REMAP-CAP, ACTIV-4, ATTACC (n=2231): ↑ survival without organ support (79% vs 75%); no difference in survival; ↑ major bleeding (1.9% vs 0.9%)
    - HEP-COVID (n=253): ↓ composite thrombosis/death (but did axx screening for VTE, small study), no difference in major bleeding
    - Jury still out here, could consider in patients with noncritical COVID and no contraindications

Take Home Points

- COVID can affect all organ systems
- Most admitted patients just need basic labs
- For most patients, consider if they need remdesivir, dexamethasone, and baricitinib vs tocilizumab
- Most patients do not need antibiotics

Questions?

October 2020 October 2021
MANAGEMENT OF ANTICOAGULATION IN THE HOSPITALIZED PATIENT

Tracy Minichiello, MD
Professor of Medicine
University of California, San Francisco
Chief, Anticoagulation and Thrombosis Services
San Francisco, VA Medical Center

Conflicts of Interest

I have no actual or potential conflicts of interest in relation to this program or presentation to disclose.

Objectives

- Anticoagulation in COVID-19
- ASA + anticoagulation
- Anticoagulation for AFIB in ESRD


A. Prophylactic dose
B. Intermediate dose
C. Therapeutic dose
D. Yes
SARS-COV2 AND THROMBOSIS

Iba et al. CCMJ July 2020

Clotting of CRRT/ECMO circuits
5.5% to 14.1%
Implicated in disease progression ARDS

Joan Loo et al. Thorax 2021;76:412-420

Ackermann NEJM May 2020

Autopsy studies identified unsuspected VTE in situ pulmonary arterial thrombosis in more than 60% of pts w/COVID-19, suggesting thrombosis contributes to mortality.

↑ D-dimer, especially > 4x ULN predict a more than 2-fold ↑ risk of VTE mortality

Coagulation laboratory characteristics of COVID-19 infection

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal</th>
<th>Elevated</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT/aPTT</td>
<td>10-15 sec</td>
<td>&gt;15 sec</td>
</tr>
<tr>
<td>INR</td>
<td>0.8-1.2</td>
<td>&gt;1.2</td>
</tr>
<tr>
<td>Platelets</td>
<td>&gt;150,000</td>
<td>&lt;150,000</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>150-400 mg/dL</td>
<td>&gt;400 mg/dL</td>
</tr>
<tr>
<td>D-dimer</td>
<td>&lt;0.5 mg/dL</td>
<td>&gt;0.5 mg/dL</td>
</tr>
<tr>
<td>Protein C</td>
<td>50-80%</td>
<td>&lt;50%</td>
</tr>
<tr>
<td>Protein S</td>
<td>50-80%</td>
<td>&lt;50%</td>
</tr>
</tbody>
</table>
Anticoagulation for Thrombosis Prevention in COVID

- What dose of anticoagulation should be used in critically ill patients hospitalized with COVID
- What dose of anticoagulation should be used in moderately ill patients hospitalized with COVID
- Should patients hospitalized with COVID be discharged on anticoagulation for thrombosis prevention

MULTIPLATFORM TRIALS

Therapeutic Anticoagulation with Heparin in Critically Ill Patients with Covid-19


What dose of anticoagulation in the Critically Ill COVID 19

What Dose of Anticoagulation in Moderately Ill COVID

Regardless of D-dimer
MULTIPLATFORM TRIALS

CRITICALLY ILL PATIENTS
PROPHYLACTIC DOSING OF ANTICOAGULATION

Therapeutic Anticoagulation with Heparin in Critically Ill Patients with Covid-19

NONCRITICALLY ILL PATIENTS
THERAPEUTIC DOSING OF ANTICOAGULATION

ACTION TRIAL – Rivaroxaban in COVID 19

Is therapeutic anticoagulation with rivaroxaban effective in preventing complications in patients hospitalized with COVID (90% moderately ill) & ↑ D-dimer?

In patients hospitalized with COVID-19 with elevated D-dimer levels, initial in-hospital therapeutic anticoagulation with rivaroxaban 20 mg once daily for stable patients or enoxaparin for unstable patients followed by rivaroxaban through 30 days did not improve clinical outcomes and increased bleeding compared with in-hospital prophylactic anticoagulation.

Lopes RD et al. Lancet 2021; https://doi.org/10.1016/S0140-6736(21)01203-4

Therapeutic Anticoagulation in Moderately Ill Covid

Survival to DC
• therapeutic anticoagulation 92.7%
• usual care 91.8%

Progression to intubation/death
• Therapeutic anticoagulation 10.9%
• Usual care 12.1%

Major thrombosis or death
• Therapeutic anticoagulation 8%
• Usual care 9-9%


Therapeutic Anticoagulation for Thromboprophylaxis in COVID 19

Spyropolos AC et al. JAMA Intern Med 2021
Therapeutic Anticoagulation for Thromboprophylaxis in COVID-19

- 257 patient hospitalized with COVID-19
- Supplemental O2 and D-dimer > 4x ULN or SIC score ≥4.
- Primary outcome composite of VTE, ATE, and all-cause mortality within 30 days of hospitalization
- All had U/S at HD 10 + 4 or at discharge if sooner.

<table>
<thead>
<tr>
<th></th>
<th>standard</th>
<th>therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary endpoint (VTE)</td>
<td>40.9% (29%)</td>
<td>28.7% (16.9%)</td>
</tr>
<tr>
<td>ICU</td>
<td>55.3%</td>
<td>51.1%</td>
</tr>
<tr>
<td>Non ICU</td>
<td>36.1%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Death</td>
<td>25%</td>
<td>19.4% (NS)</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>2.6%</td>
<td>4.7% (NS)</td>
</tr>
</tbody>
</table>

Symposium AC et al JAMA Int Med 2021

POST DISCHARGE PROPHYLAXIS FOR COVID

MICHELLE trial-publication pending
- Evaluate rivaroxaban 10 mg po daily vs control among discharged patients hospitalized for 3+ days WITHOUT CKD, dual antiplt, surgery/trauma in past month or any bleeding in past 3 months with COVID-19
- IMPROVE score ≥4 OR IMPROVE SCORE > 2-3 PLUS elevated d-dimer (> 500 ng/ml)
- Primary outcome symptomatic VTE, VTE death, ATE, MI., stroke
  - 3.1% rivaroxaban 9.4% control, no major bleeding in either arm

Ramacciotti et al Am Heart J 2021

Example Randomized Trials

COVID-19 and Thrombosis: Searching for Evidence: Anticoagulation

ASH Guidelines

How I Treat

Case

62 yo admitted to hospital with COVID-19 requiring 3 L oxygen

A. Prophylactic dose
B. Intermediate dose
C. Therapeutic dose
D. Yes

MODERATELY ILL PATIENTS—Consider D-dimer, Oxygen status, bleeding risk

PROPHYLACTIC vs. THERAPEUTIC ANTICOAGULATION
A 75 year old man with HFpEF, DM, HTN is admitted with CHF exacerbation and new AFIB. You are going to start him on a DOAC. He is on ASA for primary CAD prevention. **Do you continue this in addition to his full dose DOAC?**

1) Yes, he has a lot of risk factors for CAD  
2) No, I think the DOAC should cover it  
3) I am going to defer this to the PCP
You have this slide on RISK. You really need a slide on BENEFIT of combo therapy - or lack thereof.

Moll, Stephan, 9/16/2021
Case

A 75 year old man with HFpEF, DM, HTN is admitted with CHF exacerbation and new AFIB. You are going to start him on a DOAC. He is on ASA for primary CAD prevention. Do you continue this in addition to his full dose DOAC?

1) Yes, he has a lot of risk factors for CAD
2) No, I think the DOAC should cover it
3) I am going to defer this to the PCP

A 75 year old man with PAD (iliac bypass 18 months ago), HTN DM is admitted with new AFIB with rapid ventricular response. You are going to start him on a DOAC. He is on ASA for his PAD. Do you continue this in addition to his full dose DOAC?

1) Yes, he needs it for PAD
2) No, I think the DOAC should cover it
3) I am going to defer this to the PCP

European Society of Cardiology 2021 Consensus

Peripheral Artery Disease

If peripheral stent short term clopidogrel in addition to AC (~1 month)
Add ASA (triple therapy) ONLY in select cases at highest risk ie., prior stent thrombosis, slow flow
A 75 year old man with PAD (iliac bypass 18 months ago), HTN DM is admitted with new AFIB with rapid ventricular response. You are going to start him on a DOAC. He is on ASA for his PAD. Do you continue this in addition to his full dose DOAC?
1) Yes, he needs it for PAD
2) No, I think the DOAC should cover it
3) I am going to defer this to the PCP

A 60 year old man with HTN and mechanical aortic valve placed 2017 is on warfarin and ASA. He is admitted for GIB. INR is 2.0 on admission, warfarin is held and he has EGD which shows gastric ulcer which is treated endoscopically. His Hgb stabilizes and he resumes his warfarin. Should he resume his ASA as well?
1) Yes, he needs it for his mechanical valve
2) No, I think the warfarin should cover it
3) I am going to defer this to the PCP

Prior recommendations to add low-dose ASA to therapeutic VKA were based on studies performed decades ago that included older generation prostheses and additional risk factors.
It is decided to resume warfarin therapy but to stop the ASA. Should he be bridged?

1) Yes, he needs it for his mechanical valve
2) No, I think the warfarin monotherapy should cover it
3) I am going to defer this to his PCP

79-year-old female with DM and ESRD is transferred to the ED from her dialysis center for dizziness, shortness of breath. She is 62 kg, normal BP HR, normal aPTT/PT, CBC, thyroid, liver; SCr 6.3 mg/dL. ECG shows AFIB. ECHO without valvular disease. Should she be started on anticoagulation?

1) Yes, would start apixaban
2) Yes, would start warfarin
3) No, I am going to defer this to the PCP
ANTICOAGULATION FOR AFIB IN ESRD

WHAT ABOUT AGE?
Declining benefit:
Age > 87: warfarin
Age > 92: apixaban

WARFARIN FOR AFIB IN ESRD
Randawa JAMA 2020 Kuno JACC 2020 Pokorney 2020

DOACS FOR AFIB IN ESRD
- Apixaban FDA approved for use in ESRD for AFIB (not VTE)
- Based on SINGLE dose of 5 mg apixaban recommended no dose adjustment—same dosing algorithm as those not on HD but subsequent studies showed accumulation of drug at this dose, but not at 2.5 mg BID dosing.
ESRD-specific Risk Assessment?

- 90% ESRD have CHADS2-vasc ≥ 2
- Not validated in ESRD
- Overestimates stroke risk
- Risk may outweigh benefits

What the AF Guidelines Say

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Stroke prevention with anticoagulation in ESRD ± dialysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC/AHA/HRS 2019</td>
<td>May be reasonable to prescribe warfarin or apixaban (IIb)</td>
</tr>
<tr>
<td>KDIGO 2020</td>
<td>• Primary prevention</td>
</tr>
<tr>
<td></td>
<td>• Decision to anticoagulate and choice of agent should be discussed with nephrologist</td>
</tr>
<tr>
<td></td>
<td>• Refers to ACC/AHA/HRS recommendations</td>
</tr>
<tr>
<td></td>
<td>• Consider left atrial appendage occlusion if additional bleed risks</td>
</tr>
<tr>
<td>CCS/CHRS 2020</td>
<td>• Secondary prevention</td>
</tr>
<tr>
<td></td>
<td>• Suggest patients not routinely receive antithrombotic therapy (Weak recommendation)</td>
</tr>
<tr>
<td></td>
<td>• Individualized on risk vs. benefit and patient preference</td>
</tr>
<tr>
<td>ESC/EACTS 2021</td>
<td>• Evidence is limited (no specific recommendation)</td>
</tr>
</tbody>
</table>

Dr. Yvinec et al, Nephrol Dial Transplant 2021


De Vriese et al, Nephrol Dial Transplant 2021

Ionescu et al, Eur Journ of Hematology 2021

Ionescu et al Eur Journ of Hematology 2021

Siontis CK, Circulation 2018

APIXABAN FOR AFIB IN ESRD

Medicare Patients with Afib on Dialysis

APIXABAN FOR AFIB IN ESRD

Watch the antiplatelets!
CONSIDER ANTICOAGULATION FOR AFIB IN ESRD

IF

Patient amenable through shared-decision making
Places higher value on avoiding stroke than bleed
Apixaban is an option for the patient

AND

Thorough risk/benefit analysis of thrombosis/bleed/frailty is done
No need for DAPT (recent stent, TAVR)
Optimization of other parameters to avoid adverse events (BP, etc)

BUT

If these are not possible, consider LAEO with Watchman or Amulet recognizing patient will require brief period of antithrombotic therapy after placement

1. www.cardiosmart.org/SDMAFib?_ga=2.87317343.67355683.1631903462-1257589260.1631903462

79-year-old female with DM and ESRD is transferred to the ED from her dialysis center for dizziness, shortness of breath and “flip-flopping” sensation in her chest, “similar to episodes over the last month but worse…”

She is 62 kg, normal BP HR, normal aPTT/PT, CBC, thyroid, liver Scr 6.3 mg/dL. ECG shows AFIB. ECHO without valvular disease.

Should she be started on anticoagulation?
1) Yes, would start apixaban
2) Yes, would start warfarin
3) No, I am going to defer this to the PCP

Case

Objectives

- Anticoagulation in COVID 19
  - No anticoagulation prior to admission, no compelling evidence of anticoagulation after DC in all patients; all patient admitted with COVID receive at least prophylactic anticoagulation-critically ill PROPHYLAXIS, moderately ill PROPHYLAXIS vs THERAPEUTIC
- ASA + anticoagulation
  - Avoid when possible. Reserve for those in whom benefit outweighs the risk, TALK TO YOUR COLLEAGUES vascular, cardiology, neurology
- Anticoagulation for AFIB in ESRD
  - NO GOOD DATA; warfarin not benign, DOACs maybe alternative but high level data lacking and dosing still unclear

Questions?

Tracy Minichiello, MD
ASA IS A HUGE RISK FACTOR FOR GIB ON AC. 40% of AC related bleeds on ASA.

We don't know if PPI provide PRIMARY prevention of GIB obstruction.

RESUMPTION OF AC AFTER GIB

<table>
<thead>
<tr>
<th>Indication</th>
<th>Mortality of Recurrent event</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF51</td>
<td>2%</td>
</tr>
<tr>
<td>Secondary prevention VTE</td>
<td>4%</td>
</tr>
<tr>
<td>Secondary prevention VTE in cancer</td>
<td>15%</td>
</tr>
</tbody>
</table>

Benefit of ASA outweigh risk?
Case 1

- A 65-year-old right-handed man with a history of HTN presented to the ED in a delayed fashion after the sudden onset of right-sided weakness.
- Exam shows an expressive aphasia, R face and arm weakness as well as R visual field cut and L gaze deviation.
- He was last seen normal at 1 p.m., and it is now 10:45 pm.

UCSF “Stroke Protocol” CT

- Obtained at UCSF in suspected acute stroke and TIA patients hours from onset
  1. Non-contrast CT of the head
  2. CT Angiography from aortic arch to the top of the head
  3. CT Perfusion study
  4. Post-contrast CT of the head

What treatment should this patient likely receive?

A. IV t-PA alone
B. IV t-PA followed by embolectomy
C. Embolectomy alone
D. IV heparin
E. Antiplatelets
The 2021 Acute Stroke Timeline

- Time of onset = last time seen normal
  - 0-4.5 Hours: IV-tPA
  - 0-6 Hours: Mechanical Embolectomy for all
  - 6-24 Hours: Mechanical Embolectomy for some

Intravenous t-PA: Broad Success


Intravenous t-PA: Broad Success


Speed Matters: Time is Brain

- Examination of the Get With the Guideline Registry in the U.S. over the last decade
  - 1400 hospitals, nearly 59,000 patients
  - Mean time to treatment was 144 minutes
    - Earlier on weekdays, more severe stroke, arrival in ambulance
- For every 15 min earlier administration...
  - Significantly lower in-house mortality
  - Significantly lower rates of ICH
  - Significantly more independent ambulation at d/c
  - Significantly higher rate of d/c to home

Embolectomy in NeuroIR Suite

The 2015 Endovascular Revolution

- Five major positive trials of endovascular therapy all published in 2015 in NEJM
- Trial design somewhat differed, but common to each:
  - 1. Used newer-generation devices
  - 2. Selected patients who were eligible via CTA
  - 3. IV t-PA in those who were eligible followed by embolectomy
  - 4. Typically a 6 hour time window

The 2018 Second Revolution

- DAWN and DEFUSE3 Trials
- Select patients with LVO treated up to 24 hours based on CT perfusion selection
  - Automated CT software widely available
- Has led to major reexamination of triage and ED/hospital protocols

What do we do given this data?

- 1. All patients eligible for IV t-PA should receive it (quickly)
- 2. Patients within 6 hours should receive a CTA to look for a large vessel occlusion (LVO)
- 3. If LVO present, endovascular therapy should occur, even following IV t-PA regardless of perfusion data

What do we do given this data?

- 4. If the patient has a LVO and presents between 6-24 hours, CT perfusion is required and selects patients who should receive endovascular therapy
- 5. Very late endovascular cases may emerge as still possible with favorable perfusion
What is coming up in acute stroke?

- Tenecteplase as an alternative to t-PA
  - Easier to administer with identical outcomes
- Skip the t-PA before embolectomy?
  - Large study failed to show benefit


What is coming up in acute stroke?

- Very late treatment of LVO in patients with favorable perfusion
  - 24 hours was selected for trials on no specific scientific basis

Kim B et al: JAMA Neuro 2020

Case 2

- A 65 year-old man with a history of HTN presents with 3 days of R arm weakness
- Examination shows a R pronator drift and mild weakness in the extensors of the R hand and arm
- The patient takes aspirin 81mg daily as well as HCTZ

Which of the following is not part of the standard embolic stroke workup?

A. Echocardiogram
B. Extended cardiac telemetry
C. Lipid panel
D. B12, TSH, RPR, ESR
E. Carotid evaluation
Standard Large-Vessel Stroke Workup

- Cardioembolic: afib, clot in heart, paradoxical embolus
  - 1. Telemetry
  - 2. TEE with bubble study
- Aortic Arch
  - 2. TEE with bubble study
- Carotids
  - 3. Carotid Imaging (CTA, US, MRA, angio)
- Intracranial Vessels
  - 4. Intracranial Imaging (CTA, MRA, angio)

And evaluate stroke risk factors

TEE vs. TTE

- 231 consecutive TIA and stroke patients of unknown etiology underwent TTE and TEE
- 127 found to have a cardiac cause of emboli, 90 of which (71 percent) only seen on TEE
- TEE superior to TTE for: LA appendage, R to L shunt, examination of aortic arch
- More recently: TEE found additional findings in 52% and changed management in 10%


Atrial Fibrillation Detection

- EKG
- 48 Hours of Telemetry
- Long-term cardiac event monitor (>21d)
  - 15-20% of patients with cryptogenic stroke otherwise unexplained had afib detected
  - Clearly changes management
  - Probably cost effective


Really Long Term Monitoring: 2021

- STROKE-AF: randomized trial comparing usual care with ICM for 1 year
  - 492 patients aged 60 (or 50 with 1 stroke risk factor) who had stroke within 10 days
  - Afib found in 12.1% vs 1.8%
  - Large and small vessel strokes included
  - Clinical significance not certain

Bernstein RA et al: JAMA 325:2169, 2021
Approach to Stroke Treatment

Acute Stroke Therapy?
- No
  Anticoagulants?
- No
  Antiplatelets

Shrinking Indications for Anticoagulation in Stroke
1. Atrial Fibrillation
2. Some other cardioembolic sources
   - Thrombus seen in heart
   - EF < 35%  
   - PFO with associated Atrial Septal Aneurysm  
3. Vertebral or Carotid dissection
4. Rare hypercoagulable states: APLS

The “Absolute Mess” of PFO in Stroke
- Around 20-25% of all patients have a PFO
- PFO alone is not necessarily associated with higher risk of recurrent stroke
  - Higher risk: Larger PFO, associated atrial septal aneurysm, perhaps younger age
- Three previous negative trials of closure devices but cardiologists pre-2017 were still performing these procedures widely

More Actionable Data

<table>
<thead>
<tr>
<th>RESPECT</th>
<th>Gore REDUCE</th>
<th>CLOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusion Criteria</td>
<td>Cryptogenic stroke within past 270 days + PFO</td>
<td>Cryptogenic stroke within past 180 days + PFO</td>
</tr>
<tr>
<td>Participants</td>
<td>940 participants</td>
<td>644 participants</td>
</tr>
<tr>
<td>Intervention Arm</td>
<td>PFO closure</td>
<td>PFO closure + antiplatelet</td>
</tr>
</tbody>
</table>
| Medical Rx Arm | Antiplatelet or anticoagulation | Antiplatelet | Arm 1: antiplatelet  
Arm 2: anticoagulation |
| Results | Less recurrent stroke with PFO closure (NNT 42) | Less recurrent clinical and 
clinical/radiographic 
stroke with PFO closure  
(NNT 28) | Less recurrent stroke with PFO closure (NNT 20) |

* N Engl J Med, 2017
What now?
“Let’s close all these PFOs!”

• DO NOT close all these PFOs
• DO screen patients for PFO (?how)
• It is sensible to discuss with your cardiologists some “Rules of the Road”
• At the end of the day, this is an exciting advance for some (young) people with stroke that can make a substantial impact on recurrence rates

Rules of the Road

• Consider PFO closure if:
  – The patient is younger than 60 years old
  – AND you can be sure the PFO is the most likely etiology after a thorough workup
  – AND the qualifying event is a stroke (not TIA) that appears embolic (not lacunar)
  – Likely concentrate on large PFOs or those with an atrial septal defect
  • Cardiologists new task: start counting bubbles

Heparin in Acute Stroke

• Study examined the largest trials of heparin, heparinoids, LMWH in acute stroke
• Could find no benefit even in those patients with highest risk of recurrent ischemia and lowest risk of hemorrhage
• Considering use of heparin for “selected patients” therefore seems unwise


Case 3

• A 70 year-old woman with a history of DM, smoking presents 10 hours after the onset of slurred speech and right arm and leg weakness.
• The patient is taking ASA 81mg daily
Stroke workup is unrevealing.

your Treatment?

A. Increase ASA to 325mg daily
B. Add Plavix to ASA
C. Stop ASA, start Plavix
D. Stop ASA, start Aggrenox
E. Anticoagulate

Approach to Stroke Treatment

Acute Stroke Therapy?

  No

Anticoagulants?

  No

Antiplatelets

Antiplatelet Options

• 1. ASA
  – 50mg to 1.5g equal efficacy long-term
• 2. Aggrenox
  – 25mg ASA/200mg ER Dipyridamole
• 3. Clopidogrel (Plavix)
  – Multiple secondary prevention studies (CHARISMA, SPS3) show no long-term benefit in combination with ASA

Antiplatelet Options

• If on no antiplatelet medication
  – Plavix vs. Aggrenox (or ASA)
• If already on ASA
  – Switch to Plavix vs. Aggrenox
• If already on Plavix or Aggrenox
  – ???
Clopidogrel + ASA: Ever A Winning Combination?

- POINT trial
- Select those with only minor or no deficits (NIHSS 3 or less or ABCD2 of 4 or more)
- Nearly 5000 TIA or Minor Stroke patients assigned to 90d of daily ASA + Placebo versus daily ASA + Clopidogrel following 600mg load
- Modestly improved efficacy (1.5%)
- Minimally (0.5%) more hemorrhage


Ticagrelor: Another Short-term DAPT Option

- THALES trial (like POINT trial)
- Nearly 11000 TIA or Minor Stroke patients assigned to 30d of daily ASA + Placebo versus daily ASA + Ticagrelor following 180mg load
- Modestly improved efficacy (1.1%)
- Severe bleeding in 0.5%
- When to use?


When to use Dual Antiplatelets

- NOT all the time!
- After minor stroke or TIA for only 21* days
- After a fresh carotid or coronary stent
- With severe intracranial atherosclerosis (>70%) and stroke/TIA in that territory for only 90 days

Other Acute Stroke Management

- Statins for (almost) all patients with stroke or TIA – 80mg atorvastatin if LDL>100 for at least 5 years
- Tight Glucose and Fever control in acute period
- Enoxaparin for DVT prophylaxis (better than compression stockings or UFH)
Permissive Hypertension

• National Guidelines
  – To at least 220/120
  – After IV tPA: less than 185 systolic for 24 hours
• We typically stop all meds except half-dose β-blockers and (maybe) clonidine

Permissive Hypertension

• When to stop remains controversial
• Situations where more important
  – Large Vessel Occlusion
  – Fluctuating symptoms
• We begin a medicine before discharge (~72h) and aim for normotension over a matter of weeks
  – Choose thiazides and ACEI first

Case 4

• A 73 year-old woman with HTN comes to the ED after a 5 minute episode of right arm weakness that has since resolved.
• Exam is normal except blood pressure is elevated at 176/97

Other than TIA, what is the most common neurologic diagnosis here?

A. Conversion disorder
B. Migraine
C. Focal Seizure
D. UTI
E. Cervical spine lesion
TIA versus Stroke

• Up to 30-50% of TIA have infarct on MRI
• Conceptually the same disorder
  – Same workup, same treatment
• Pendulum swing
  – Pre-2001: Much more aggressive with stroke
  – 2002-2007: TIA and stroke equally aggressive
  – 2008-present: A more aggressive approach with TIA outside of the acute treatment window

Risk of Future Stroke with TIA: ABCD² Score

• 7-day risk overall 8.6-10.5 percent
• Age
  – >60 =1 point
• Blood Pressure
  – SBP>140 or DBP>90 =1 point
• Clinical Features
  – Unilateral weakness =2 points
  – Speech disturbance without weakness =1 point
• Duration
  – >60 minutes =2 points
  – 10-59 minutes =1 point
• Diabetes=1 point

Aggressive Therapy for TIA

• 1. SOS-TIA trial
  – 1085 patients with TIA admitted to a 24-hour center
  – All treated with standard therapy
    • 74 percent discharged on same day, stroke risk reduced 80 percent from ABCD² prediction
• 2. EXPRESS study
  – 80 percent reduction in risk with urgent TIA clinic visit versus usual primary care visit in 1278 patients

TIA Aggressive Therapy: A Modern Look

• 2009-2011 TIA registry of nearly 5000 patients
• Population at baseline was high risk as with historical cohorts
• 78% saw a stroke specialist within 24 hours
  – Hospitalists not mentioned in this European study
• 1-year stroke rate was 5.1%
• Rates at 2d, 7d, 30d, 90d, 1y were all less than half of that in historical cohorts
**CT Angiogram: 95% L ICA stenosis**

---

**When to Fix the Carotid?**

- NASCET in early 1990s
  - Benefit of endarterectomy in patients with symptoms ipsilateral to 70-99% stenosis
    - Comparison: best medical management at the time
  - 50-69% symptomatic stenosis revascularization has limited benefit, especially in women
- In stroke management don’t miss carotid disease or atrial fibrillation

---

**How to Fix the Carotid?**

- Stenting vs. CEA: CREST Trial
- 4-year study of 1321 symptomatic and 1181 asymptomatic patients randomized to CEA vs. carotid stenting
- Combined endpoint of stroke, MI, death not significantly different
  - More strokes in first 90 days in stenting group, more MIs in surgical group
  - After 90 days, similar endpoints

Examination Approach

• Two types of neurologic examinations
  – 1. Screening Examination
  – 2. Testing Hypotheses
• Select high-yield tests and techniques

Examination Approach

• Organization
  1. Mental Status
  2. Cranial Nerves
  3. Motor
  4. Reflexes
  5. Sensory
  6. Coordination
  7. Gait

The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

1. If the patient can give a completely coherent history, then the mental status examination is probably normal
**Digits Forward**

- Outstanding test of attention to screen for delirium
- Given successively long strings of digits 1 second apart
  - 6-8-2-4
  - 5-1-9-3-5
  - 8-6-2-6-3-7
  - 5-4-6-9-7-5-2
- Less than 5 is abnormal and indicates an attentional deficit

**Case 1: Mental Status**

- A 73 year-old woman comes to the ER with 2 days of feeling fatigued
- General physical examination is normal and there is no weakness on neurological examination
- Language testing is abnormal

---

**The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination**

1. If the patient can give a completely coherent history, then the mental status examination is probably normal
2. Speech does not equal language: test three elements of language in each patient

**Aphasia Testing**

- Fluency: Use Naming and Conversation
- Comprehension: More difficult commands
- Repetition: “Today is a sunny day…”
### Aphasia Chart

<table>
<thead>
<tr>
<th>Name</th>
<th>Fluency</th>
<th>Comp</th>
<th>Rep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broca’s</td>
<td>Bad</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Wernicke’s</td>
<td>Good</td>
<td>Bad</td>
<td>Bad</td>
</tr>
<tr>
<td>Global</td>
<td>Bad</td>
<td>Bad</td>
<td>Bad</td>
</tr>
<tr>
<td>Conduction</td>
<td>Good</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Transcort Motor</td>
<td>Bad</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td>Transcort Sens.</td>
<td>Good</td>
<td>Bad</td>
<td>Good</td>
</tr>
<tr>
<td>Transcort Mixed</td>
<td>Bad</td>
<td>Bad</td>
<td>Good</td>
</tr>
</tbody>
</table>

### Cranial Nerve Testing

- II: Pupils, Acuity, Visual Fields
- III, IV, VI: Extraocular Movements
- V: Facial Sensation
- VII: Facial Strength
- VIII: Hearing
- IX, X: Palatal Elevation and Gag
- XI: SCM and Trapezius Power
- XII: Tongue Power

### The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

1. If the patient can give a completely coherent history, then the mental status examination is probably normal
2. Speech does not equal language: test three elements of language in each patient
3. Visual field testing is highly informative and underutilized by the non-neurologist

### Screening for Visual Field Deficits

- **Cooperative patient:** Move examiner finger in the center of each quadrant with patient gaze fixed
  - Test each eye by covering the opposite eye, present stimulus in all 4 quadrants
- **Uncooperative patient:** Use a single digit to suddenly approach each half of the visual fields; normally elicits a blink
  - Avoid using entire hand: elicits corneal reflex
  - Report as “Does/Does not blink to threat”
Central vs. Peripheral: Vertigo Exam Findings

- Always central, always needs imaging
  - 1. Any Cranial Nerve Lesion
  - 2. Any Asymmetric Cerebellar Finding
  - 3. Complete Absence of Peripheral Signs

HINTS

- Three step screen
  - 1. Head Impulse (should perform last)
  - 2. Nystagmus
  - 3. Test of Skew

Coma

- Definition:
  - Not Awake
  - Not Arousable
  - Not Aware
The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

4. After establishing new-onset coma, the pupillary examination is the most important initial neurologic examination test.

Two Localizations of Coma

• 1. Brainstem
• 2. Bilateral Hemispheres

• Step 1: CN exam to localize to brainstem or hemispheres
• Step 2: Pupils uneven: Structural not metabolic etiology

Case 2: Cranial Nerves

• A 54 year-old man with no PMH presents after being hit in the right temple with a baseball while playing with his son.
• General physical exam is normal. On neurologic examination the patient is lethargic. The right pupil is 7mm and minimally reactive while the left reacts briskly 3 to 2mm. The rest of the neurologic examination is normal.

“Fixed” Pupils and Coma

• Dilated (7-9mm): Early Herniation
• Mid-Position (3-5mm): Late Herniation
• Caveats
  – ? Adequacy of light stimulus
  – ? Drug Effect
Case 2: Cranial Nerves

- Over the next hour, the patient becomes unresponsive and develops extensor posturing on his left side

Cranial Nerve Testing: Coma

- II: Pupils, Visual Fields
- III, IV, VI: Oculocephalic Maneuver
- V, VII: Corneal Reflex
- VIII: Cold Calorics
- IX, X: Gag, Cough, Spontaneous Respirations

The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

4. After establishing new-onset coma, the pupillary examination is the most important initial neurologic examination test
5. Use an appropriate screen for Upper Motor Neuron-type weakness

Case 3: Motor

- A 75 yo male with HTN, DM and current tobacco use comes to the ED with mild problems walking and a complaint of “my left arm is not working right.”
Case 3: Motor

- The ED physician tells you that he knows the patient has no weakness in his extremities as his own exam shows equal hand grasps, moving all fours, and “stepping on the gas” in the lower extremities.

Upper Motor Neurons of the Pyramidal Tract

**Predictable Pattern of Weakness**
Distal Extensors of the UEs and Distal (Dorsi)Flexors of the LEs

Quick Screen for Upper Motor Neuron/Pyramidal Weakness

- Pronator Drift
- Fine Finger Movements/Toe Taps
- One muscle in each of four extremities
  - Upper Extremities: 1st DI or finger extensors
  - Lower Extremities: Extensor of big toe
- Common ED screen VERY insensitive!

The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

4. After establishing new-onset coma, the pupillary examination is the most important initial neurologic examination test
5. Use an appropriate screen for Upper Motor Neuron-type weakness
6. Use the exam to localize the weakness in the nervous system
### Pattern of Weakness

<table>
<thead>
<tr>
<th>Function/Dexterity</th>
<th>UMN</th>
<th>LMN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Tendon Reflex</td>
<td>Increased</td>
<td>Decreased, absent or normal</td>
</tr>
</tbody>
</table>

### Tone

- Increased
- Decreased
- Absent

### Tendon Reflex

- Increased
- Decreased, absent or normal

### Other signs

- Babinski sign, other CNS signs (e.g. aphasia, visual field cut)
- Atrophy (except with problem of neuromuscular junction)

### Weakness Pattern

<table>
<thead>
<tr>
<th>DTR</th>
<th>Motor Neuron Disease</th>
<th>Neuropathy</th>
<th>NMJ</th>
<th>Myopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Increased, normal and/or decreased</td>
<td>Distal</td>
<td>Decreased or absent</td>
<td>Normal or decreased</td>
</tr>
</tbody>
</table>

### Sensory Testing Modalities

- Vibration (128Hz Tuning Fork)
- Joint Position Sense/Proprioception
- Temperature
- Pinprick
- Light Touch (Not Useful)
Sensory Testing Modalities

- Vibration (128Hz Tuning Fork)
- Joint Position Sense/Proprioception
- Temperature
- Pinprick

Case 4: Sensory

- A 45 yo man presents with 2 days of progressive tingling and weakness of the lower extremities. He now is having trouble walking and rising from a chair.

Case 4: Sensory

- Exam
  - MS, CN normal
  - Motor: normal tone throughout, normal power in upper ext., 4/5 throughout in the lower extremities
  - Sensory: decreased PP/Vib/temp patchy in lower extremities
    - A sensory level is found at T10

The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

8. Symmetry of reflexes is important, rather than absolute value
Reflex Tips

• Know the cord level of each reflex
  – Biceps: C5-6
  – Triceps: C7-8
  – Patella: L2-4
  – Ankle: L5-S1

• Symmetric positioning is key
• Expose the muscle being tested
• Strike with only moderate force

Case 5: Coordination

• A 54 year-old woman presents with vertigo and gait difficulties
• On finger-nose-finger, she exhibits dysmetria with the right upper extremity, but not with the left

The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

8. Symmetry of reflexes is important, rather than absolute value
9. In the coordination exam, bilateral abnormalities are often benign

Key Cerebellar Exam Tips

• Bilateral dysfunction is often benign and drug/medication related
• Unilateral dysfunction is a cerebellar lesion until proven otherwise
  – CT insensitive in this region
• Cerebellar tracts run through the brainstem
  – Cerebellar signs with cranial nerve deficits is a brainstem lesion until proven otherwise
The “High-Yield” Neurologic Examination: Top Ten Suggestions for a Better Neurologic Examination

8. Symmetry of reflexes is important, rather than absolute value
9. In the coordination exam, bilateral abnormalities are often benign
10. The single most useful test on the neurologic exam is having the patient ambulate

The (Misunderstood) Romberg

• How to perform
• What systems help us stand?
  – 1. Cerebellum
  – 2. Motor
  – 3. Vestibular
  – 4. Dorsal Columns
  – 5. Vision

Part of the Sensory Exam!
NOT Gait or Coordination Exam

The Quick Screening Exam

1. Mental Status: Digits forward, 3 elements of language
2. Cranial Nerves: Pupils, visual fields, EOMs, facial droop
3. Motor: 3-step screen for UMN weakness
4. Reflexes:
5. Sensory: Test toes w/ 2 modalities (1 from each path); Romberg
6. Coordination: Finger-nose-finger
7. Gait: Walk the patient
Challenging cases of hospitalized patients with cirrhosis

Danielle Brandman, MD, MAS
Associate Professor of Clinical Medicine
Program Director, Transplant Hepatology Fellowship
Inpatient Chief of Service, Hepatology

October 21, 2021

Improving Mortality In Hospitalized Cirrhotic Patients

Disclosures

- Grant/research support: Gilead, NGM, Genentech

Development of Quality Measures in Cirrhosis by the Practice Metrics Committee of the American Association for the Study of Liver Diseases

S. Miniati,1,2 K. Heaton,1 G. Disario,1 A. Lebrec,1 S. Sarno,2 M. Asselah,2 T. Waziri,3 K. Lord,3 F. Heffernan,4 S. Bhatia,5 A. Bandyk,6 S. Tandon,7 D. Yeung,8 and K. Sy,9
Tough consult questions

- Beta blockers: what the heck should I do with them?
- My patient is in pain, what do I do?
- My patient has AKI. Is it hepatorenal syndrome?
- Should this patient get a TIPS?
- What can I do for this patient with refractory hydrothorax?
- This patient is admitted with ascites again. Do I really need to tap them?
- Does my patient need a liver transplant?

Case 1

55yo woman with NASH cirrhosis, Child’s class B, with moderate ascites previously controlled on diuretics and hepatic encephalopathy. She has no history of prior variceal bleeding. She undergoes screening endoscopy and is noted to have medium varices. She is started on a nonselective beta blocker for primary prevention of variceal hemorrhage.

6 months later, she is hospitalized with tense ascites and acute kidney injury.

What should be done with her beta blocker?
What should happen to a NSBB in a patient with worsening ascites/decompensation?

A. Stop the beta blocker
B. Switch to a selective beta blocker
C. Increase the beta blocker dose
D. It depends
E. I don’t know, please tell me, that’s why you’re here

Beta blockers may be associated with increased risk of AKI in refractory ascites

Impact of NSBB

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Impact of NSBB</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cause mortality</td>
<td>None</td>
</tr>
<tr>
<td>Refractory ascites</td>
<td>None</td>
</tr>
<tr>
<td>Nonrefractory ascites</td>
<td>None</td>
</tr>
<tr>
<td>Short-term (6-month) mortality</td>
<td>Trend toward poorer survival</td>
</tr>
</tbody>
</table>
Patients who respond to beta blockers and maintain response (based on portal pressures) have superior survival than those who never respond or lose response to beta blockers.

Survival benefit of beta blockers may be lost in patients with baseline MAP of <65.

What is happening?
- Beta blockers can blunt compensatory increases in cardiac output
- Worsened hypotension in patients with baseline low SVR
- Decreased renal perfusion

Case 1 (cont’d)
55yo woman with NASH cirrhosis, with recent worsening of ascites, hospitalized with tense ascites, rising MELD score, AKI. She is on a NSBB for primary prevention of variceal bleeding.

Diagnostic paracentesis shows evidence of spontaneous bacterial peritonitis (SBP).

Now what should be done with her beta blocker?
What should you do with a NSBB in a patient with SBP?

A. Stop the beta blocker during hospitalization
B. Switch to a selective beta blocker
C. Increase the beta blocker dose
D. I don’t know, please tell me, that’s why you’re here

Beta blockers reduce risk of developing SBP

<table>
<thead>
<tr>
<th>n</th>
<th>Child A/B/C (%)</th>
<th>Ascites (%)</th>
<th>Follow-up (months)</th>
<th>SBP BB vs control (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>83/17/0</td>
<td>35</td>
<td>76</td>
<td>8 vs 15</td>
</tr>
<tr>
<td>230</td>
<td>22/57/21</td>
<td>64</td>
<td>23</td>
<td>10 vs 15</td>
</tr>
<tr>
<td>77</td>
<td>42/47/11</td>
<td>31</td>
<td>70</td>
<td>4 vs 18</td>
</tr>
<tr>
<td>134</td>
<td>9/59/32</td>
<td>100</td>
<td>36</td>
<td>24 vs 33</td>
</tr>
<tr>
<td>139</td>
<td>--</td>
<td>100</td>
<td>96</td>
<td>5 vs 28</td>
</tr>
</tbody>
</table>

Beta blockers increase risk of death after first episode of SBP

\[ p=0.089 \]
Beta blockers increase risk of HRS/AKI after first episode of SBP

- Patients treated with beta blockers were sicker
  - More often Child’s C cirrhosis (67% vs 53%)
  - Higher bilirubin (5 vs 3)

Summary: NSBB

- Beta blockers may have deleterious effects in cirrhosis
  - Poorer survival in patients with refractory ascites
  - Increased risk of HRS/AKI in SBP
- Some of the effects of beta blockers observed may be due to sicker patients treated with beta blockers
- Beta blocker effect may vary over time
  - Discontinuation or nonadherence due to side effects
  - Loss of response over time
- No RCT level data to help guide decision making in decompensated cirrhosis
Take home points: NSBB

- Consider stopping NSBB in patients with refractory ascites if they have:
  - Systolic blood pressure <90mmHg or MAP <65
  - Na <130 and/or Cr >1.5
  - No history of variceal bleeding or large varices
- Stop NSBB during a hospitalization for SBP
- Consider limiting NSBB dose to:
  - Propranolol <120mg/day
  - Nadolol <80mg/day

Case 1 (cont’d)
55yo woman with NASH cirrhosis, hospitalized with tense ascites, rising MELD score, and AKI, found to have SBP.

She reports problems with abdominal pain that is preventing her from sleeping and ambulating.

How should you manage her pain?
A. Ibuprofen
B. Hydrocodone/acetaminophen
C. Oxycodone
D. Acetaminophen

E. Did you really include acetaminophen as an option? That’s crazy talk.

How should you manage pain in a patient with decompensated cirrhosis?
- Ibuprofen
- Hydrocodone/acetaminophen
- Oxycodone
- Acetaminophen
- Did you really include acetaminophen as an option? That’s crazy talk.
How should you manage pain in a patient with decompensated cirrhosis?

- Ibuprofen
- Hydrocodone/acetaminophen
- Oxycodone
- **Acetaminophen**
- Did you really include acetaminophen as an option? That’s crazy talk.

Challenges of pain management in cirrhosis

**PATIENT**
- Metabolic comorbidities
- Substance use disorders
- Psychiatric disease
- Low socioeconomic status / health literacy

**PHARMAKOLOGIC**
- Impaired hepatic metabolism
- No biomarkers to measure hepatic function
- Impaired renal excretion
- Risk for adverse effects
- Renal failure
- Hepatic encephalopathy
- Potential for abuse

**DISEASE**
- Variable presentations
- Minimal research on cirrhosis-related pain

**CLINICIAN**
- No guidelines
- Discomfort with analgesic options
- Stigma/bias

**SYSTEM**
- Regulatory issues
- Transplant center requirements
- Fragmentation of care


*Slide used with permission from Jessica Rubin MD

Myth: patients with cirrhosis can’t take acetaminophen

- Acetaminophen (APAP) is the leading cause of drug-induced liver injury in the US
  - This occurs when APAP is taken above recommended limits (4g/day in patients without liver disease)
- Upper limit of APAP in chronic liver disease = 2 grams/day
- Potential for decreased metabolism of APAP
- Chronic alcohol use depletes glutathione stores, thereby lowering the threshold for APAP toxicity
- Combination opioid/APAP formulations may be high risk due to habituation to opioid component leading to escalating use and increased APAP intake
NSAIDs are high risk in cirrhosis

- Acute kidney injury
  - Prostaglandin inhibition reduces renal perfusion
  - Higher risk in patients with ascites on diuretics
- Gastrointestinal bleeding risk
  - Gastric mucosal injury
  - Decreased platelet aggregation due to thromboxane inhibition

Acute kidney injury

- Prostaglandin inhibition reduces renal perfusion
- Higher risk in patients with ascites on diuretics

Gastrointestinal bleeding risk

- Gastric mucosal injury
- Decreased platelet aggregation due to thromboxane inhibition

Prostaglandin inhibition reduces renal perfusion

- Higher risk in patients with ascites on diuretics

Gastrointestinal bleeding risk

- Gastric mucosal injury
- Decreased platelet aggregation due to thromboxane inhibition

Opioid impact on morbidity and mortality

- Mechanisms that impact hepatic encephalopathy (HE)
  - Decreased metabolism and clearance
  - Increased brain sensitivity to opioids in patients with HE
  - Decreased gut motility
- Outcomes
  - Increased risk of (all cause) hospitalization
  - Post-transplant outcomes in pre-transplant opioid users
    - Poorer graft survival
    - Increased hospitalizations

Mechanisms that impact hepatic encephalopathy (HE)

- Decreased metabolism and clearance
- Increased brain sensitivity to opioids in patients with HE
- Decreased gut motility

Outcomes

- Increased risk of (all cause) hospitalization
- Post-transplant outcomes in pre-transplant opioid users
  - Poorer graft survival
  - Increased hospitalizations

Take home points: Pain management in cirrhosis

- Acetaminophen is the safest pain reliever in patients with cirrhosis
  - Limit intake to <2g/day
- Avoid NSAIDs, particularly in patients with ascites
- Avoid opioids, particularly in patients with hepatic encephalopathy

Acetaminophen is the safest pain reliever in patients with cirrhosis

- Limit intake to <2g/day
- Avoid NSAIDs, particularly in patients with ascites
- Avoid opioids, particularly in patients with hepatic encephalopathy

Wait, what about the AKI?

55yo woman with NASH cirrhosis, hospitalized with tense ascites, rising MELD score, and AKI, found to have SBP.

Labs:
- Cr 2.87, Na 130, WBC 5, hct 32, plts 83, INR 2.0, tbili 7, albumin 2.7
- Baseline Cr 0.5
Wait, what about the AKI?

55yo woman with NASH cirrhosis, hospitalized with tense ascites, rising MELD score, and AKI found to have SBP.

Labs: Cr 2.87, Na 130, WBC 5, hct 32, plt 83, INR 2.0, tbi 7, albumin 2.7
Baseline Cr 0.5

So, does she have hepatorenal syndrome? What do I do about it?

What are the next steps in evaluation of AKI in this patient?

- This is hepatorenal syndrome. Start midodrine and octreotide.
- The patient is volume overloaded. Increase diuretics.
- Hold diuretics, give IV albumin, diagnostic paracentesis
- Hold diuretics, give IV NS, diagnostic paracentesis
- Continue diuretics, give IV albumin, diagnostic paracentesis

AKI in cirrhosis
International Ascites Club criteria

<table>
<thead>
<tr>
<th>Subject</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Baseline sCr | • sCr obtained within 3 months prior to admission
  • If >1 value within the previous 3 months, the value closest to the admission
  • If no previous sCr, the sCr on admission should be used |
| Definition of AKI | • Increase in sCr ≥0.3 mg/dl (≥26.5 µmol/L) within 48 hours
  • Increase sCr ≥50% within the prior 7 days |

- AKI as defined is associated with ICU transfer, longer hospital stay, and increased in-hospital and 90-day mortality
Management of AKI
- Investigate non-HRS causes:
  - Review medication history: diuretic dose change or initiation, NSAIDs or other nephrotoxic drugs, iodinated contrast
  - Urinalysis with microscopy
  - Renal ultrasound
  - Evaluate for infection
  - Administer volume expansion: IV albumin 1g/kg (using 25% albumin) x 2 days

Hepatorenal syndrome (HRS)-AKI
- Cirrhosis with ascites
- AKI as defined by ICA-AKI criteria
- No response after 2 consecutive days of diuretic withdrawal and volume expansion
- Absence of shock
- No nephrotoxins
- No signs of structural kidney injury
  - Urine protein <500mg/day
  - No microscopic hematuria
  - Normal renal ultrasound

Treatment of hepatorenal syndrome
- Vasoconstriction of systemic and splanchnic circulation to improve effective circulating volume and renal perfusion
  - Oral: midodrine
  - IV/SQ
    - Octreotide 100-200mcg SQ TID (with midodrine)
    - Norepinephrine: requires ICU level of care or special floor protocol
    - Terlipressin: not approved for use in the US
  - Albumin dose of 40-50g/day

AKI progression is associated with illness severity and survival
Management of AKI in cirrhosis

- Acute rise in Cr by >0.3 above baseline
- Evaluate for precipitants of AKI
- Non-HRS cause
- No dx identified
- Hold diuretics
- Cr >0.3 above or 1.5-2x baseline Cr
- Hold diuretics
- Cr >2x baseline Cr
- No improvement
- IV albumin x 2 days
- No improvement
- HRS criteria met
- Treat for HRS

Should my patient get a TIPS?

- Which patient(s) is (are) candidates for TIPS?
  - 57F with refractory ascites, MELD 32
  - 57F with refractory ascites, MELD 16
  - 43M with large varices on routine endoscopy, platelet count 43, MELD 15
  - 43M admitted with variceal bleeding, Child's B cirrhosis
  - A&C
  - BAD
  - All of the above

- Which patient(s) is (are) candidates for TIPS?
  - 57F with refractory ascites, MELD 32
  - 57F with refractory ascites, MELD 16
  - 43M with large varices on routine endoscopy, platelet count 43, MELD 15
  - 43M admitted with variceal bleeding, Child's B cirrhosis
  - A&C
  - BAD
  - All of the above
**Case 3a**

- 57F with cirrhosis due to autoimmune hepatitis with refractory ascites.
- She has been getting therapeutic paracentesis for the past 4 months, and the frequency has now increased to every 5 days, with removal of 8-10L each time.
- She is hospitalized frequently due to intermittent problems with volume overload, AKI, and/or hyponatremia.
- Labs: INR 1.5, Na 136, Cr 1.1, tBil 2.2, MELD-Na 16.

**TIPS confers survival benefit over serial paracentesis**

Labs: INR 1.5, Na 136, Cr 1.1, tBil 2.2, MELD-Na 16.

**Predictors of mortality**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>HR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIPS</td>
<td>0.61</td>
<td>0.41-0.91</td>
</tr>
<tr>
<td>Age</td>
<td>1.024</td>
<td>1.001-1.048</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>1.22</td>
<td>1.039-1.48</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.95</td>
<td>0.92-0.99</td>
</tr>
</tbody>
</table>

**TIPS vs. serial paracentesis**

- Incidence of hepatic encephalopathy is similar between TIPS vs paracentesis groups, though severe HE may be more common with TIPS.

**Most other portal hypertensive complications improve with TIPS**

<table>
<thead>
<tr>
<th>Complication</th>
<th>TIPS</th>
<th>LVP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>15%</td>
<td>28%</td>
</tr>
<tr>
<td>GI bleeding</td>
<td>8%</td>
<td>13%</td>
</tr>
<tr>
<td>SBP</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>HRS</td>
<td>5%</td>
<td>13%</td>
</tr>
</tbody>
</table>
Contraindications to TIPS

<table>
<thead>
<tr>
<th>Relative</th>
<th>Absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatocellular carcinoma, especially centrally located</td>
<td>Portal vein thrombosis</td>
</tr>
<tr>
<td>Obstruction of all limbs</td>
<td>Moderate pulmonary hypertension</td>
</tr>
<tr>
<td>Severe encephalopathy</td>
<td>Severe pulmonary hypertension</td>
</tr>
<tr>
<td>Thrombocytopenia of ≤20,000 cells/μL</td>
<td>Uncontrolled systemic infection or sepsis</td>
</tr>
<tr>
<td>Hepatic encephalopathy</td>
<td>Portal hypertension</td>
</tr>
</tbody>
</table>

MELD >15-18 and/or total bilirubin >3

Case 3b
- 43yo man with alcohol related cirrhosis who is hospitalized with hematemesis
- Recent onset ascites and jaundice
- VS: HR 120 BP 95/63 RR 20 SpO2 95%
- Gen: uncomfortable, lethargic, hematemesis in ED
- Abd: distended, bulging flanks, mildly uncomfortable to palpation but no peritoneal signs. +melena stool
- Labs: WBC 4, Hb 5.7, plt 80, INR 1.6, Na 136, Cr 0.9, total bil 4.3, albumin 2.9, CP C10, MELDNa 18
- Intubated for airway protection, 2 PIVs, transfused 2u pRBCs, protonix gtt, octreotide gtt, ceftriaxone
- Urgent EGD shows actively bleeding EVs

Take home points
- TIPS has a survival benefit in patients with refractory ascites and select patients with variceal bleeding
- If you are considering TIPS, you should also be considering referral for liver transplant evaluation
- Pre-TIPS checklist:
  - TTE to rule out heart failure and pulmonary hypertension
  - CT to evaluate hepatic vasculature
- Several studies (incl meta-analysis) show similar findings supporting use of pre-emptive TIPS

Early TIPS in variceal bleeding
- Greatest benefit in Child’s C cirrhosis in this RCT
- Several studies (incl meta-analysis) show similar findings supporting use of pre-emptive TIPS
Quickfire Challenge

Quickfire Case 1
- 57F with NASH cirrhosis is hospitalized for the 4th time in 2 months with shortness of breath
- She has a history of hepatic hydrothorax that has gotten progressively worse over time
- She undergoes therapeutic thoracentesis now twice weekly, with 1-2L fluid removed each time
- She is frustrated with her frequent hospitalizations and poor quality of life
- Diuretic doses have been increased to the highest tolerable dose, with higher doses associated with AKI, hyponatremia, and/or hyperkalemia in the past

Quickfire Case 1
- VS: T36.4 HR 73 BP 109/53 RR 24 SpO2 95% 2LNC
- Gen: chronically ill
- Resp: Decreased breath sounds throughout all lung fields on the right
- Labs: WBC 6, hct 28, plt 51, INR 1.4, Na 134, Cr 1.02, total bili 2, albumin 2.7, MELD-Na 16

QC1: What is the best treatment option available to this patient with refractory hepatic hydrothorax, MELD-Na 16?
- Pleurex catheter insertion
- Serial therapeutic thoracentesis
- TIPS
- Pleurodesis
QC1. What is the best treatment option available to this patient with refractory hepatic hydrothorax, MELD-Na 16?

A. Pleurex catheter insertion
B. Serial therapeutic thoracentesis
C. TIPS
D. Pleurodesis

TIPS and hepatic hydrothorax

- Response rates: 59-82%
- Mortality
  - 30-day: 5-25%
  - 1-year: 36-52%

Pleural catheter for HH

- Attractive option for patients who need frequent thoracentesis or who are at higher risk of bleeding
- May result in spontaneous pleurodesis in 33%
- Risk of complications: 36%
  - 10-16% SBE
  - Deaths typically due to sepsis
- If used as a bridge to transplant, plan should be made in conjunction with transplant team.

Patients with HH are at high risk of death regardless of management
Quickfire Case 2

- 47M with alcohol related cirrhosis is brought into the ED with altered mental status
- He had been taking lactulose as prescribed, but his family notes that he has not had a bowel movement in the past 24 hours

VS: T36.7 HR 80 BP 117/62 RR 12 SpO2 99%
Gen: chronically ill, muscle wasting
Neuro: Unarousable to verbal stimuli, occasionally grunts in response to deep physical stimuli. Oriented x 0. +clonus

Labs: WBC 5, hct 33, plt 95, INR 1.9, Na 136, Cr 0.97, total bili 4.7, albumin 2.6

QC2. What are your next steps for management of severe HE?

A. Check ammonia. Titrate lactulose dose according to serial ammonia levels
B. Intubate. Place feeding tube for frequent administration of lactulose and rifaximin +/- PEG. Adjust dose according to mental status and stool output
C. Give flumazenil
D. Intubate. Use midazolam for sedation. Administer lactulose PR
Management of hepatic encephalopathy (HE)

- **Overt HE**
  - Triage to appropriate level of care
  - Severe HE
    - Intubate if needed
    - Lactulose* and rifaximin per NGT/FT, titrate to mental status
    - Rifaximin
  - Non-severe HE
    - Lactulose PO, titrate to mental status
    - Add rifaximin if not already taking
  - If no improvement in 24 hrs
    - Add Zn sulfate
    - CT head +/- neuro consult
    - Evaluate for PS shunt
  - Continue maintenance therapy once HE resolves

**Rifaximin reduces hospitalization and its use is cost-effective**
- Rifaximin reduces episodes of breakthrough HE, need for HE-related hospitalization, and length of hospitalization
- Numerous studies have demonstrated cost-effectiveness of rifaximin

**Coordination of care after HE hospitalization**
- ~40-50% of patients discharged after a hospitalization for HE may not fill prescriptions for HE meds, in part related to medication cost (rifaximin >>> lactulose)
- Measures should be taken to ensure patients can access rifaximin after hospital discharge
- Patients and families should be educated about HE management
Quickfire Case 3

- 55F with NASH cirrhosis with a history of ascites on diuretics, presents to the emergency department with complaints of abdominal pain and increasing distension.
- Ascitic fluid analysis from paracentesis in 2018 and 2019 showed high SAAG and low total protein.
- VS: T37 HR 65 BP 110/70 RR 20 SpO2 98%
- Gen: chronically ill, slightly uncomfortable due to abdominal distension
- Resp: normal other than decreased BS at bases
- GI: tensely distended abdomen with dullness to percussion, nontender
- Neuro: AAOx3, no asterixis
- Labs: WBC 5, hct 30, plt 55, INR 2.3, Na 130, BUN 53, Cr 1.6, total bili 5, albumin 3.0

QC3a. What are your next steps for evaluating worsening ascites?

- Diagnostic paracentesis, with fluid sent for culture in blood culture bottles
- Diagnostic paracentesis, with fluid sent for culture in a sterile tube
- No need for paracentesis, there is no abdominal tenderness, fever, nor leukocytosis
- Arrange for urgent TIPS
QC3a. What are your next steps for evaluating worsening ascites?

A. Diagnostic paracentesis, with fluid sent for culture in blood culture bottles
B. Diagnostic paracentesis, with fluid sent for culture in a sterile tube
C. No need for paracentesis, there is no abdominal tenderness, fever, nor leukocytosis
D. Arrange for urgent TIPS

Evaluation of ascites

*Serum ascites albumin gradient (SAAG) = serum ascites – albumin ascites

Diagnose Paracentesis

- SAAG < 1 g/dL
- Acute Protein < 2.5 g/dL
- Acute Protein > 2.5 g/dL

- Abdominal Imaging
- Liver Biopsy

- wewnętrzn czynnik renine
- Lipasz

- Leczenie
-癯KWK
- Antybiotyka

*Serum ascites albumin gradient (SAAG) = serum ascites – albumin ascites

Biggins et al., Hepatology, 2021.
Diagnostic paracentesis

<table>
<thead>
<tr>
<th></th>
<th>1st paracentesis</th>
<th>Subsequent paracentesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAAG</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cell count w/ diff</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Culture</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protein</td>
<td>Yes</td>
<td>Maybe*</td>
</tr>
<tr>
<td>Glucose</td>
<td>Only as driven by clinical suspicion (e.g., no cirrhosis, secondary peritonitis, malignancy, pancreatitis)</td>
<td></td>
</tr>
<tr>
<td>Amylase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If needed to determine primary SBP prophylaxis and/or concerned about secondary peritonitis

QC3b. When should I do paracentesis on this patient?

- Within 4 hours of admission
- Within 1 day of admission
- I told you I’m not doing paracentesis, there is no abdominal tenderness, fever, nor leukocytosis
- Whenever IR can do the procedure
Spontaneous bacterial peritonitis (SBP)

- ~30% of patients with SBP may lack typical signs/symptoms of fever, abdominal pain, and/or leukocytosis
- Diagnosis: ≥250 PMNs/mm³
- Prognosis
  - In-hospital death: 10-20%
  - Median survival: 0 months
  - Recurrent SBP: 40-70% at 1 year

Quickfire Case 3 (cont’d)

55F with NASH cirrhosis presents to the emergency department with complaints of abdominal pain and distension

Paracentesis with removal of 5L amber fluid
- WBC 893 (75% PMNs), RBC 100
- Albumin 1.0, total protein 1.2
- Cultures pending

QC3b. What are your next steps in management?

A. Supportive care. Wait to start antibiotics until culture results return
B. Treat for SBP with vancomycin.
C. Arrange for urgent TIPS
D. Treat for SBP with ceftriaxone. Give 1.5g/kg IV albumin on day 1, 1g/kg IV albumin on day 3
Prevention of HRS in SBP

- RCT of 126 patients with SBP treated with cefotaxime, albumin vs no albumin
  - 1.5g/kg on day 1, 1g/kg on day 3

Impact may be greatest in patients with:
- Cr>1, BUN>30, and/or tbili >4

<table>
<thead>
<tr>
<th>Albumin</th>
<th>Control</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal impairment</td>
<td>10%</td>
<td>33%</td>
</tr>
<tr>
<td>Death</td>
<td>10%</td>
<td>22%</td>
</tr>
<tr>
<td>3 months</td>
<td>29%</td>
<td>41%</td>
</tr>
</tbody>
</table>

QC4. Which patient(s) should you refer for liver transplant evaluation urgently?

- 35M with alcohol associated cirrhosis with 3 months sobriety, refractory ascites, AKI/HRS, MELD 32
- 53F with NASH cirrhosis, BMI 41, DM, frequent admissions for AKI and/or HE, MELD 32
- 71M with cirrhosis due to HBV + NASH, acute decompensation from HBV flares, MELD 37. Working full time and exercising regularly right before hospitalization
- 65F with cirrhosis due to autoimmune hepatitis, CKD stage 3, worsening liver failure and AKI on CKD after variceal bleeding, MELD 31
- All of the above

Narrow window for LT in acute on chronic liver failure (ACLF)

Cases or questions from the audience

Thank you!

Danielle.Brandman@ucsf.edu
THROMBOEMBOLISM
Q & A
2021

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SERVICE-SAN FRANCISCO VAMC

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Objectives
• Lingering questions from this morning's presentations
• Duration of anticoagulation for VTE
• Approach to subsegmental PE, calf vein DVT and superficial vein thrombosis
• Role of thrombophilia work up
• Resuming anticoagulation after a bleed

Resources
• AC Forum clinical guidance-VTE, splanchnic vein, reversal etc. https://acforum.org/web/education-guidance.php
• University of Washington Anticoagulation http://depts.washington.edu/anticoag/home

Case
51 year old man with no PMHX presents with acute CP and SOB, BP stable, HR 120s O2 sat 92%, d-dimer 1500, CT PE with bilateral PE in all lobes with RV/LV ratio > 1.0. BNP 370, trop 1.5. He is started on rivaroxaban. He has no identifiable provoking factors. How long should he remain on anticoagulation?
1) At least 3 months
2) One year
3) Forever
ESC PE Guidelines—Duration of Therapy

Duration of Anticoagulation for VTE:
2016 CHEST and AC Forum Guidelines/Guidance

VTE and Bleeding Risk: 2016 CHEST Guideline
**CHEST 2021**—suggest reduced dose DOAC over full dose for extended phase anticoagulation

**UNPROVOKED VTE**

- All - 3-6 months of FULL intensity anticoagulation
  - At 3-6 months determine candidacy for secondary prevention
  - ~50% will develop recurrent VTE in 10 years off anticoagulation; Case fatality rate of VTE is ~4% in all comers but closer to 9% in PE
  - Case fatality rate of bleeding is ~10%
  - Case by case decision...consider continuation if not high bleeding risk. Most compelling in low bleed risk patients and in those with PE

**Secondary Prevention Options**

- Low dose DOAC
- Full dose anticoagulation
- ASA

**Case**

51 year old man with no PMHX presents with acute CP and SOB, BP stable, HR 120s O2 sat 92%, d-dimer 1500, CT PE with bilateral PE in all lobes with RV/LV ratio > 1.0. BNP 370, trop 1.5. He is started on rivaroxaban. He has no identifiable provoking factors. How long should he remain on anticoagulation?

1) At least 3 months
2) One year
3) Forever
A 77 yo man had undergone colectomy for recurrent bleeding from diverticulosis. On POD #3 he becomes tachycardic to the 110s. WBC is elevated. The surgical team orders an abdominal CT which shows a fluid collection concerning for early abscess. It also shows an isolated RLL subsegmental PE. A dedicated CTa shows a single isolated RLL subsegmental PE. Do you anticoagulate this patient?

a) Sure, it is a PE.
b) No this is incidental. Let’s pretend we don’t know it is there.
Subsegmental PE

A 77 yo man had undergone colectomy for recurrent bleeding from diverticulosis. On POD #3 he becomes tachycardic to the 110s. WBC is elevated. The surgical team orders an abdominal CT which shows a fluid collection concerning for early abscess. It also shows an isolated RLL subsegmental PE. Do you anticoagulate this patient?

a) Sure, it is a PE.
b) No this is incidental. Lets pretend we don’t know it is there

Superficial Vein Thrombosis

A 67 year old man with cirrhosis, new diagnosis of HCC is admitted with diarrhea, lowish BP and AKI. On exam he has bilateral lower extremity swelling, R>L. In the ED he has an ultrasound which shows thrombosis of the greater saphenous vein extending from the calf proximally and terminating 6 cm from the deep femoral vein. What do you recommend?

a. Prophylactic fondaparinux
b. Prophylactic rivaroxaban
c. Full dose DOAC or warfarin
d. Full dose LMWH
e. Warm compresses, no anticoagulation

Superficial Vein Thrombosis –CHEST Guidelines

- Factors that favor the use of AC: extensive SVT; above the knee, close to saphenofemoral junction; severe symptoms; involvement of the greater saphenous vein; history of VTE or SVT; active cancer; recent surgery
- In patients with superficial vein thrombosis of the lower limb of at least 5 cm in length, we suggest the use of a prophylactic dose of fondaparinux or LMWH for 45 days over no anticoagulation (Grade 2B).

Superficial Vein Thrombosis

Prevention of thromboembolic complications in patients with superficial vein thrombosis given rivaroxaban or fondaparinux: the open-label, randomised, non-inferiority SURPRISE phase 3 trial

- >400 pts symptomatic SVT riva 10 mg v fonda 2.5mg
- Symptomatic above the knee SVT of at least ≥ 5 cm length + other risk factor (>65, male, hx VTE, cancer, autoimmune disease, non-varicose veins)
- No difference in primary efficacy outcome
- After 6 weeks 7% recurrence risk in high risk patients (v 1.2% in CALISTO)

A 67 year old man with cirrhosis, new diagnosis of HCC is admitted with diarrhea, lowish BP and AKI. On exam he has bilateral lower extremity swelling, R> L. In the ED he has an ultrasound which shows thrombosis of the greater saphenous vein extending from the calf proximally and terminating 6 cm from the deep femoral vein. What do you recommend?

- Prophylactic fondaparinux
- Prophylactic rivaroxaban
- Full dose DOAC or warfarin
- Warm compresses, no anticoagulation
50 year old man presents with unprovoked PE. He is hemodynamically stable but CT PE shows elevated RV/LV ratio. ECHO is ordered. He is admitted and started on rivaroxaban. Should you send a work up for thrombophilia?

- Yes-why not, he is here.
- No-then I am going to have interpret it and who needs that

No current guidance/guidelines
EXCEPT ASH Choosing Wisely Campaign-“do not test in provoked VTE”

Results of thrombophilia testing should RARELY affect clinical decisions about VTE treatment-no strong influence on recurrence risk beyond stratification based on clinical presentation
Can help explain “why”
Can be of interest to family members
Current tests are insufficient for identifying inherited VTE risk

Who should we suspect harbors thrombophilia?

- PROTEIN C, S, ANTITHROMBIN DEFICIENCY>OFTEN POSITIVE FAMILY HISTORY
- FACTORY LEIDEN MUTATION AND PROTHROMBIN GENE MUTATION - Northern European descent
- APLS-PRIMARY OR SECONDARY (lupus)
- MAY THURNERS SYNDROME- Iliac Vein Compression Syndrome...Left Lower Extrem Venous Compression-Left Iliac Vein Compressed By Right Iliac Artery
- UPPER EXTREMITY DVT-PAGET SCHROEDERS SYNDROME-THORACIC OUTLET SYNDROME WITH VENOUS COMPRESSION
- NEPHROTIC SYNDROME/IBD/PNH
- PREGNANCY, IVF
- CANCER (less likely < 50 yo)
VENOUS AND ARTERIAL THROMBOSIS

- APLS
- PFO-with paradoxical embolism
- HYPERHOMOCYSTIENEMIA
- SICKLE CELL
- P VERA
- PNH
- HIT
- CANCER
- DIC
- Beurgers disease
- Hyperviscosity-MGUS, MM

Summary of Recommendations Regarding Testing for Thrombophilia.

Algorithm for Selecting Patients with a First Venous Thromboembolism (VTE) for Thrombophilia Testing.
IMPACT OF ANTICOAGULATION & THROMBOSIS ON THROMBOPHILIA LABS

<table>
<thead>
<tr>
<th>Lab</th>
<th>Acute Thrombosis</th>
<th>Warfarin</th>
<th>Heparin</th>
<th>DOAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein C/Protein S</td>
<td>↓ (False Positive)</td>
<td>↑ Effect</td>
<td>↑ Effect</td>
<td>↓ Effect</td>
</tr>
<tr>
<td>Antithrombin</td>
<td>↓ (False Positive)</td>
<td>↑ Effect</td>
<td>↑ Effect</td>
<td>↓ Effect</td>
</tr>
<tr>
<td>Lupus Anticoagulant</td>
<td>No Effect</td>
<td>False Positive</td>
<td>False Positive</td>
<td>False Positive</td>
</tr>
<tr>
<td>RfGP, Ad Abs</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Factor V Leiden</td>
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<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Prothrombin Gène Mutation</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
</tbody>
</table>

DEFER TESTING (3-6 MOS) RARELY WE SEND APLS ACUTELY IF STRONG SUSPICION CAN SEND ELY/PTG BUT IN HETEROZYGOUS FORM NOT IMPORTANT

Antiphospholipid Antibody Syndrome

- **WHY** - risk of recurrence off AC much higher; at risk for arterial disease, bridge therapy; DOACs generally avoided
- **WHO** - arterial and venous events, unexpected arterial events, recurrent thrombosis ON anticoagulation, underlying autoimmune d/o, prolonged aPTT
- **WHAT** - send Lupus anticoagulant, Beta 2 glycoprotein antibodies and anticardiolipin antibodies (IgG & Ig M)
- **WHEN** - LAC - don’t do it on anticoagulation; antibodies you can send anytime
- **IF POSITIVE** -
  - must repeat in 12 weeks - high rate of transient positivity
  - LAC most predictive of 1st and recurrent VTE, triple positives at highest risk

Antiphospholipid Antibody Syndrome

50 year old man presents with unprovoked PE. He is hemodynamically stable but CT PE shows elevated RV/LV ratio. ECHO is ordered. He is admitted and started on rivaroxaban. Should you send a work up for thrombophilia?

- Yes - why not, he is here.
- No - then I am going to have interpret it and who needs that
What To Do After the Bleed

76 y/o man with CAD (NSTEMI 2006), AFIB CHADS-Vasc=4 on warfarin and ASA is admitted with UGIB. INR is 3.0. He requires 3u PRBCs, vit K and FFP. EGD shows peptic ulcer disease. He is started on high dose PPI therapy, bx for H Pylori done. When should his anticoagulation be restarted?

a) Never
b) In two weeks
c) In three months
d) Let the primary provider deal with this one

Witt Hematology 2016
AC FORUM Clinical Guidance
Antithrombotic Therapy for VTE

"IN THE EVENT OF GI BLEED
WE SUGGEST WAITING AT LEAST 7 DAYS WITHOUT EVIDENCE OF ACTIVE BLEEDING AND AFTER ENDOSCOPIC TX BEFORE REINITIATING AC"
What To Do After the Bleed

76 y/o man with CAD (NSTEMI 2006), AFIB CHADS-Vasc=4 on warfarin and ASA is admitted with UGIB. INR is 3.0. He requires 3u PRBCs, vit K and FFP. EGD shows peptic ulcer disease. He is started on high dose PPI therapy, bx for H Pylori done. When should his anticoagulation be restarted?

a) Never
b) In two weeks
c) In three months
d) Let the primary provider deal with this one

“Two weeks may provide the best balance among GI bleed recurrence, thromboembolism and mortality”

Resumption of DOACs

Anticoagulation Fully therapeutic within 1-2 hours

Only dabigatran has a reversal agent

Considerations After GIB on AC

- Reassess risk benefit of anticoagulation
- Secondary prevention of VTE therapy, low CHADS-vasc
- Assess risk of rebleeding from source
- Identifiable source, treatable lesion?
- Take steps to decrease risk of bleeding related to AC regimen
- Reconsider need for antiplatelet therapy
  - Spurious elevation in INR or poor TTR → DOAC increase INR monitoring → home POC INR?
- If ongoing strong indication for AC determine best time to restart therapy in multidisciplinary meeting with proceduralist - Remember DOAC immediately active

Questions?

Tracy Minichiello, MD
Tough Problems in Inpatient Pulmonary Disease

LEKSHMI SANTHOSH, M.D., M.A.ED.

10/21/2021
MANAGEMENT OF THE HOSPITALIZED PATIENT
SMALL GROUP WORKSHOP

Disclosures
None.

Introductions & Ground Rules

- I want to create a fun, casual, engaging environment – both in-person & over Zoom! I will try to engage the audience in this hybrid era.
- Please introduce yourself when you are engaging w/ the speaker so that we can all get to know each other.
- If you are virtual, we are mindful of barriers to turning video on, however, if you have the capacity to do so, we encourage you to ‘show your face’ so we can see each other – not required.
- Feel free to use the chatbox which I will keep an eye on or the Raise Hand function of Zoom.
- Please mute yourself 😊
- We’re all here to learn & have fun so please enjoy our cases!
Choose Your Own Adventure! Top 6 Cases

<table>
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And of Course the COVID-19 Case!

Choose Your Own Adventure: Let's Vote!

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G. And of course the COVID-19 Case!
Case: Mrs. S

- **Patient:** 57 year old woman with suspected COVID-19 pneumonia presents to the hospital with shortness of breath and fever
- **Review of Systems:** + loss of smell/taste, headaches, decreased appetite for 1 week, previously healthy, no sick contacts
- **Exam:** SpO2 84% on RA, bilateral rhonchi, HR 100, RR 25, BP 133/90
- **Diagnostics:** CXR with mild infiltrates

**Q1: What PPE should you wear for patient exam?**

1. Surgical mask
2. N95 or higher respirator
3. Contact and droplet precautions

**Audience Response Q: Click 1, 2, or 3!**

Choice A is correct

**Contact and droplet precautions** by health workers caring for suspected and confirmed COVID-19 patients. Surgical facemask at minimum, N95 or higher respirators are preferred if available.
Case: Mrs. S

- **Patient:** 57 year old woman with suspected COVID-19 pneumonia presents to the hospital with shortness of breath and fever
- **Review of Systems:** + loss of smell/taste, headaches, decreased appetite for 1 week, previously healthy, no sick contacts
- **Exam:** SpO2 84% on RA, bilateral rhonchi, HR 100, RR 25, BP 133/90
- **Diagnostics:** CXR with mild infiltrates

Quick Q
You start her on 2 L NC but she quickly desaturates and requires 6 L NC to keep O2 saturation up. You closely monitor her work of breathing and SaO2 and note that she continues to desaturate, but appears comfortable without tachypnea.

Quick Q: Which oxygen delivery device?

- Nasal Cannula
- Face Mask
- Venturi Mask
- Non-rebreather
- High Flow Nasal Cannula
- CPAP & NIPPV
- Ventilator

Audience Response Q

1. NC
2. Face Mask
3. Venturi Mask
4. Non-Rebreather
5. HFNc
6. CPAP & NIPPV
7. Ventilator
Case (Continued)

- Your patient is started on NRB mask at 15 LPM for decreasing saturations
- With this SpO2 increases to 94%
- RR 27 BPM, patient feels comfortable
- Chest X-Ray worse bilateral infiltrates
- Over next 24 hours SpO2 decreases to 88%
- Patient remains awake and comfortable

Audience Response Q

- Which of the following is the most appropriate next step?
  a. Proning
  b. Intubation
  c. Paralysis
  d. BiPAP

Why does proning work in ARDS?

- Prone positioning redistributes opacities from dorsal to ventral zones
- If the patient can tolerate, we may see a marked improvement in oxygenation and ventilation
- If no improvement, need to consider more invasive support

Published in: Luciano Gattinoni; Paolo Taccone; Eleonora Carlesso; John J. Marini; Am J Respir Crit Care Med 181:1286-1293.
3 are there any from NEJM or others anyone has come across?
Michael Lipnick, 9/28/2020

2 There is the NEJM original proning video. We are working on making a video for proning in COVID times 
:) If USAID wants to throw some $$$
Lekshmi Santhosh, 10/2/2020

4 what resources do you need? 
what are limitations in existing videos?
Michael Lipnick, 10/2/2020

1 Here can have picture of proning - just threw this one in with reference: 
https://emcrit.org/pulmcrit/awake-prone-covid/
Lekshmi Santhosh, 10/2/2020

5 https://www.youtube.com/watch?v=cCkHPYpwg2g
Michael Lipnick, 10/2/2020

6 Source = https://www.embeds.co.uk/2020/04/08/
Better if drawn
Michael Lipnick, 10/2/2020
Oxyhemoglobin Saturation (Spo2) 1 Hour After Initiation of the Prone Position in Awake, Nonintubated Patients With COVID-19

Spo2 before and 1 h after initiation of the prone position in awake, nonintubated patients with COVID-19 severe hypoxic respiratory failure (n = 25).

Figure Legend:
21 Proning non-intubated COVID-19 patients may improve oxygenation
22 Prone positioning in non-intubated COVID-19 patients

● Proning ventilated patients with ARDS leads to lower mortality.
● Evidence is limited but promising in non-intubated (“awake”) patients.
● A trial of proning in the setting of escalating oxygen requirements in “awake” patients is low-risk and may be beneficial, but requires close monitoring in case of deterioration.

Case: Key learning points
- COVID-19 pneumonia cases with mild to moderate hypoxemia can be managed with 1-10 L/min
  - 1-6 LPM via NC and 6-10 LPM via facemask (or use both)
  - Humidification should be included for any flow > 6 LPM.
  - A non-rebreather face mask (with bag and reservoir) can increase oxygen delivery to 15 L/min
- Be aware of your facilities oxygen delivery capacity and resources
- Prone positioning may help both oxygenation and ventilation by preventing compression of the lungs and redistributing ventilation and blood flow
- Prone positioning of awake, non-intubated patients may be helpful, is generally quite safe, but requires close monitoring and patient participation
  - but it is unclear if it is specifically helpful in patients with COVID-19

Case #2 (Continued)
- Despite proning and NRB at 15LPM, over the next 12 hours she worsens. Spo2 remains at 88%. Repeat CXR is shown here.
- PI is tachypneic though appears comfortable without significant accessory muscle use.
- The term ‘happy hypoxic’ has commonly been used to describe patients with COVID19. While frequently observed, the phenomenon of profound hypoxemia and relative absence of symptoms or increased work of breathing is not a new phenomenon, nor specific to COVID.
Quick Q: Which oxygen delivery device would you select?

- High Flow Nasal Cannula
- Facemask
- Venturi Mask
- Non-rebreather
- High Flow Nasal Cannula
- CPAP & NIPPV
- Ventilator

Audience Response Q

1. NC
2. Face Mask
3. Venturi Mask
4. Non-Rebreather
5. HFNC
6. CPAP & NIPPV
7. Ventilator

High pressure high flow delivery devices

- **High Flow Nasal Cannula**
  - Nasally delivered
  - Can deliver 100% oxygen
  - Uses a lot of flow (up to 60 liters per minute)
  - Requires active heat and humidification to keep airways from drying out
  - Tolerated well and may help avoid mechanical ventilation for a number of COVID patients

- **CPAP & NIPPV**
  - Delivered by face mask, nasal mask, or helmet
  - Can deliver 100% oxygen if device accepts high pressure flow
  - Wide range of flow needs (~10-60 liters per minute depending on seal)
  - Provides pressure in addition to oxygen = more support
  - Limited long-term tolerance (e.g., skin ulcerations)
  - Requires adequate mental status

- **Ventilators**
  - Delivered via a breathing circuit
  - Rate is adjusted
  - Can deliver 100% oxygen
  - Provides higher pressure delivery than CPAP/NIPPV
  - Wide range of flow needs (~10-30 liters per minute depending on patient settings and vent type)
  - Delivered to a hospital ventilator

Case: Key Learning Points

- Stepwise approach to increasing oxygen therapy
  - Unless the patient requires immediate intubation
- HFNC may be effective in COVID-19 for treatment of hypoxemia
  - It can use a lot of oxygen
  - May increase aerosolization - N95 for provider, surgical mask for patient!
- NIPPV is controversial in COVID-19
  - Unclear if helpful in hypoxemia due to COVID-19
  - May increase aerosolization and HCW risk
- HFNC and NIPPV require close monitoring for deterioration
  - Don’t delay intubation if the patient needs intubation!
Initial management of the hypoxic COVID-19 patient

**Choice of oxygen delivery device and SpO2 goals may be influenced by available resources (e.g. O2 supply, monitors, staff)**

- Consider
  - Low flow nasal cannula (<6 LPM)
  - Facemask (<10 LPM)

  Wean to SpO2 > 88-95%

- Consider*
  - Invasive Mechanical Ventilation
  - Use Lung Protective Ventilation Strategy

**YES**

Does the patient need intubation?

Consider if accessory muscle use, PaCO2>45, pH<7.30, profound tachypnea, P:F<100, depressed mental status or shock state

**NO**

On frequent evaluation (~q2h), is the patient meeting treatment goals:

- SpO2 (>~88%)
- Improving work of breathing
- pH>7.30
- PaCO2<45
- Adequate mental status

If your therapy has not resulted in patient improvement in the above parameters, consider alternative therapies

- Consider ~1-2 hour trial of High flow nasal cannula (30-60 LPM)
- or if unavailable then Non-rebreather (10-15 LPM)
- or if unavailable then CPAP**

**YES**

NIPPV - non-invasive positive pressure ventilation (BiPAP)

CHF - Congestive heart failure

COPD - chronic obstructive pulmonary disease

LPM - liters per minute

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**The Case**

- CC: Shortness of breath, diarrhea
HPI

- 32 year old man with no real PMHx comes to ED for 1 week of diarrhea, abdominal pain, cough and shortness of breath
- PMHx & PSHx: None
- SHx: Never-smoker, rare alcohol, +MJ *
- FHx: None

Physical Exam

VS: T 37, HR 110, BP 100/63, RR 28, O2 83% RA
General: Ill-appearing, diaphoretic, tachypneic
HEENT: Mucus membranes moist, OP clear
CV: RRR, no murmurs/rubs/gallops
Lungs: Bilateral coarse crackles, tachypnea
Abdomen: Benign, +BS, no rebound/guarding
Ext: No clubbing, cyanosis

Imaging

Could this be VAPI?

Vapi
City in India

Vapi, a city and municipality in Valsad District in the state of Gujarat. It is situated on the banks of the Danapani River, around 20 km south of the district headquarters in the city of Valsad. It is surrounded by the Union Territory of Daman to the west and Dadra and Nagar Haveli to the west. Wikipedia

Weather: 89°F (32°C), Wind: 1 mph (1 km/h), 67% Humidity
Could this be VAPI?

Your Differential Diagnosis? BESIDES VAPI?
- Type in the ChatBox!

Rapidly Progressive Respiratory Failure
- ARDS (Acute Respiratory Distress Syndrome)
- Acute infection – viral +/- bacterial pneumonia
- Massive aspiration
- Acute eosinophilic pneumonia
- Lipoid pneumonia
- (Pulmonary embolism)

Clinical Course
- His hypoxemia worsens and he develops worsened hypoxic respiratory failure requiring intubation
- Now how do you manage him?
### Management Pearls for VAPI

- Supportive care
- Limited role for steroids
- Bronchoscopy to rule-out infection
- Lung-protective ventilation strategy
- Fluid-conservative strategy
- Report to CDC, SFDPH, and local research teams

### Summary: Key Learning Points

1. Think of VAPI in people who have vaped within 90 days who have respiratory failure
2. GI sx are common & often people don’t disclose immediately
3. Treat with supportive care & report to CDC and SFDPH & local research teams

### Pulmonary Advocacy re: VAPI

**Rx Action Steps**

- Report all suspected cases to CDC.
- Screen all patients for the use of tobacco and vaping devices.
- Offer smoking and vaping cessation counselling to all patients who report use.
- Support legislation to prevent the sale of vaping and tobacco products to anyone under the age of 21.
- Support stronger penalties for retailers who illegally sell tobacco, nicotine, and vaping devices to minors.
- Encourage the FDA and Congress to ban flavors in tobacco products.
- Support research on prevention and cessation strategies for smoking and vaping.

### Choose Your Own Adventure! Top 6 Cases

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It’s Not Easy Being Wheezy

- A 55 year old man who has a history of COPD, OSA, CAD, CKD, jaundice, & childhood asthma admitted for dyspnea. He is still wheezing & hypoxemic despite 5 d steroids & antibiotics.

What is your differential diagnosis for his wheezing? Type in the chat box!

ACOS (Asthma-COPD Overlap Syndrome)

- Vocal cord dysfunction
- Allergic bronchopulmonary aspergillosis
- Vasculitides such as Eosinophilic Granulomatosis with Polyangiitis
- Infections such as Strongyloides
- Malignancy (lung or mets)

All that Wheezes is not Asthma or COPD

- Pulmonary embolism
- Decompensated CHF
- Obesity
- Bronchiectasis
- Occupational lung diseases
- Interstitial lung diseases
What About Reactive Airways Disease?

Different from Reactive Airways Dysfunction Syndrome -
• Acute wheezing in response to inhaled irritant

Diagnostically, When to C/S Pulm?
• Basic diagnostics are not helpful (PFTs, Chest CT)
• You need advanced testing (e.g. methacholine/bronchoprovocation testing, exercise testing, bronchoscopy, etc.)
• You suspect an asthma/COPD mimic
• You just need extra diagnostic help!

Therapeutically, When to C/S Pulm?
• Severe asthma requiring ICU stay - ICU Admission for asthma and intubation are strong predictors for fatal or near-fatal asthma!
• Uncontrolled asthma despite step-up therapy
• You are considering omalizumab or other IgE-mediated tx

Audience Response Q
• What is the BIGGEST change in asthma guidelines?
  A. Start with PRN albuterol for all mild asthma
  B. Start with ATC albuterol for all mild asthma
  C. Start with PRN LABA/ICS for all mild asthma
  D. Start with ATC LABA/ICS for all mild asthma
  E. No big changes, I didn’t hear anything!
New Data from 2019: START Trial

PRN Symbicort is superior to PRN Albuterol for Prevention of Asthma Exacerbations!

New Data from 2019: SYGMA Trials

PRN Symbicort prolonged time to first severe exacerbation

BIG Change in 2019 GINA Guidelines

“The 2019 GINA strategy report represents the most important change in asthma management in 30 years.

For safety, GINA no longer recommends treatment with SABA alone...

GINA now recommends that all adults with asthma should receive either symptom-driven or daily low-dose ICS-containing controller treatment.”

The Changes in Asthma Management
Summary: Key Learning Points

1. All that wheezes is not asthma/COPD
2. Remember ICU admission for asthma is a predictor for fatal asthma in future
3. BIG change in guidelines this year – no more Albuterol PRN only – consider Symbicort PRN
4. Remember non-pharmacologic management & when to consult Pulmonary

Choose Your Own Adventure! Top 6 Cases

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Effusion Confusion: Audience Response Q!

A 65 year old woman is readmitted for pleural effusion of unknown etiology. Last thoracentesis had negative cytology & cx. You:

a. Repeat the thoracentesis
b. Refer for pleurodesis
c. Refer for pleural biopsy
d. Place a PleurX catheter
Never Forget Your Light's

1. Fluid/serum protein ≥ 0.5
   [pentagon]
2. Fluid/serum LDH ≥ 0.6
   [hexagon]
3. LDH ≥ 2/3 normal serum LDH

Chest Tube/Effusion Troubleshooting

- Never place a chest tube to drain hepatohydrothorax.
- Consider serial drainage + diuretics for recurrent transudates
- If drainage slows but effusion persists:
  - Consider reimaging: loculation? tube position?
  - Consider TPA and DNAase
- If chest pain with chest tube beyond expected:
  - Consider: tube dysfunction/malpositioning?
  - Consider complications like infxn, lung lac, diaphragm injury, reexpansion pulm edema

### Effusion Size | Bacteriology | Chemistry | Treatment
--- | --- | --- | ---
Minimal, free-flowing (<10mm) | Neg ox/Gram stain |  | Antibiotics
Small-to-moderate free-flowing (>10 mm, but <⅓ hemithorax) | Neg ox/Gram stain | pH ≥ 7.2 | Antibiotics
Large, free-flowing, >⅓ hemithorax, loculated, effusion w/ thickened parietal pleura | Pos ox/Gram stain or frank pus | pH < 7.2 | Chest tube drainage

2018 ATS Guidelines on MPEs
Summary: Key Learning Points

1. Tap, tap & **retap** to increase cyto yield
2. Avoid tapping a hepatic **hydrothorax**
3. For MPE, let **prognosis** be your guide for next step in management
4. Remember your chest tube **troubleshooting** tips

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A Tickle in the Throat

55yoM w/ HIV on and off HAART w/ dyspnea

Dyspnea began on July 4th while walking around

Presented to ED & given albuterol nebs → sx resolved → D/Ced from ED w/ albuterol inhaler

Had been using inhaler once/day → q5 minutes

+Wheezing & sensation of tickle in throat

The Consult Question

New C/S: Bronch to r/o PCP. Thx.

History of Present Illness

• Reports no cough, hemoptysis, fevers/chills/sweats

• No myalgias and no sick contacts

• No chest pain/palpitations/PND/orthopnea/lower extremity edema

• No recent travel

• ...Except to his home country of Fiji 2 months ago
To Bronch or Not to Bronch?

Can we? Should we?

A Diagnostic Test Returns....

Type your thoughts in the chat box!
A Diagnostic Test Returns…
**Viewpoints**

- NOT a traditional risk factor
- Biggest risk factors are corticosteroid use & HTLV-1
- Only 40 cases of disseminated Strongyloides in HIV pts – many were also receiving steroids

**Diagnosis**

- Classic sx: GI symptoms (diarrhea), respiratory symptoms (dry cough, throat irritation), skin (itchy red rash when worm enters skin and can get recurrent red rash along thighs & buttocks)
- Diagnosis usually depends on visualization of the larvae in stool or respiratory culture
- Stool specimens are very insensitive (<50%)
- Serology (ELISA) is 83-89% sensitive, 97% specific

**Management**

- Treatment is usually ivermectin (200mcg/kg) as first-line treatment, use up to 14 days in case of disseminated strongyloides
- Can combine with albendazole therapy
- Monitor w/ repeat stool studies, CBC w/ diff, anti-Strongyloides antibodies
- Prognosis is good unless you develop bacteremia/sepsis

**Summary: Key Learning Points**

1. In HIV patients, travel history is key
2. Bronchoscopy is the gold standard for diagnosis of PCP ~ 99% yield!
3. Think of Strongyloides with the triad of eosinophilia, respiratory sx & GI sx
4. Absence of GGOs on HRCT makes PCP unlikely
Choose Your Own Adventure! Top 6 Cases

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An International Enigma

Chief Complaint

- Abdominal Pain
**History of Present Illness**

- 42yo woman visiting SF from Canada
- H/o unilateral lung transplant 16 months ago
- For the last 10 days, has been going to multiple OSH ERs with nausea, vomiting, crampy abdominal pain
- Numerous negative CT Scans

**Past Medical History**

- s/p single lung transplant for NSIP
- GERD
- Obesity

**Medications**

- CellCept
- Tacrolimus (Prograf)
- PPI
- Septra ppx
- Calcium/Vitamin D

**VS:** 37.2, HR 79, 132/86, RR 18, 93% RA
- General: Cushingoid appearing woman lying down, appearing fatigued, no acute distress
- Lungs: Fine crackles throughout R lung field, L lung with basilar crackles, no wheezes
- Abdomen: Hypoactive bowel sounds, tender to palpation in mid-epigastrium and RUQ but no rebound/guarding/peritoneal signs, no CVA tenderness, no suprapubic tenderness, no Murphy's signs
OSH Results

- Normal CBC
- Normal CHEM
- Normal LFTs
- Normal CT Abdomen/Pelvis

A Diagnostic Test Returned....

- Type your thoughts in the chat box!

A Diagnostic Test Returned....

- Tacrolimus level of 21.2!

Tacrolimus Toxicity

- Common sx: fatigue, anorexia, malaise, abdominal pain
- Labs: AKI, hyperkalemia, metabolic acidosis
- Beware of interactions with other drugs!
- Chronic >> acute, especially in renal patients
Summary: Key Learning Points

1. When in doubt, call Transplant team!

1. In any transplant patient, think of:
   a. Infection
   b. Rejection
   c. Recurrence of underlying disease
   d. Medication effect
   e. Post-transplant lymphoproliferative dz

Choose Your Own Adventure! Top 6 Cases

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Chief Complaint

- Shortness of breath

History of Present Illness

- 73yoM with multiple myeloma s/p chemo (cyclophosphamide, bortezomib, dexamethasone)
- Was admitted with pneumonia a week ago but since discharge still feeling poorly and requiring 6 L NC on readmission
- +Dry cough, no fevers/chills/LEE/orthopnea/PND

Past Medical History

- Multiple myeloma s/p chemo & radiation to ribs
- Meds: Amlodipine, Lexapro, PPI
- Never-smoker, no alcohol, drugs
- No family history

Physical Exam

- VS 37, HR 83, BP 119/69, RR 20, 93% 6 L NC
- Gen: Lying in bed in NAD
- Lungs: RLL and RML crackles, no wheezes, no increased work of breathing
- CV: RRR no murmurs, no JVD
- Ext: No edema
Labs

- Normal CBC & CHEM
- Lower Extremity DVT U/S: No DVT
- Blood cultures negative, Rapid flu negative
- Sputum culture negative

Chest CT Scan

To Bronch or Not to Bronch?

Bronchoscopy

- Bronchoscopy showed no e/o bacterial, fungal, viral infection and cytology showed no PCP
- So we decided to treat and this happened ...
What was the Diagnosis?

Radiation Pneumonitis!

Radiation Pneumonitis/OP 2/2 XRT

- Acute phase usually 4-12 weeks after XRT
- Sx: cough, dyspnea, low-grade fever, chest pain
- Immune-mediated change in capillary permeability
- Classically you see well-demarcated imaging findings
- Treatment is high-dose steroids (1mg/kg) for loooong

Summary: Key Learning Points

1. Always ask re: timing of XRT
2. Check drugs on www.pneumotox.com – ESPECIALLY PD1-inhibitors
3. Have to r/o infection before high-dose steroids (& don’t forget PJP prophylaxis!)
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Common Inpatient ID Consults

Management of the Hospitalized Patient
October 21, 2021

Jennifer Babik, MD, PhD
Associate Clinical Professor
Division of Infectious Diseases
University of California, San Francisco

Disclosures

- I have no disclosures.

Learning Objectives

At the end of this talk, you will be able to:

- Describe the situations in which formal in-person consultation is preferred over curbside consultation
- Outline an approach to common ID questions that arise in the inpatient setting

Outline

- Curbsides vs Formal Consults
- Top ID Consults
  - Staph aureus bacteremia
  - Blood culture contaminant vs real
  - GNR bacteremia treatment
  - Asymptomatic bacteriuria vs UTI
  - Indeterminate Quantiferon
Outline

**Curbsides vs Formal Consults**
- Top ID Consults
  - Staph aureus bacteremia
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---

**Curbside #1**

What is the dose of ertapenem when the CrCl is <30?

---

**Is This An Appropriate Curbside?**

1. Yes
2. No

---

**Curbside #2**

[Image of a medical device displaying text: 248!curbside 2; esinophils 5, meningitis &/2 angiostrongylus. right? Thru]
Is This An Appropriate Curbside?

1. Yes
2. No

Curbside #3

Patient with hx of kidney transplant in 1998 on i.v. heparin and prednisone, now with new rash on face and rhinorhea congestion. Considering medical treatment. Should we be concerned about infection from the rash? Is sign of SSWRRR adequate for prophylaxis?

Curbside #4

I have a theoretical patient with mild cystitis due to VRE that is only sensitive to doxycycline. Does doxycycline penetrate into the urine?
Is This An Appropriate Curbside?

1. Yes
2. No

Curbsides vs Formal Consults

- **Curbsides**
  - Information inaccurate or incomplete in 51%

- **Formal Consults**
  - Changed Rx in 60% (36% “major changes”)
  - If info was inaccurate, then it changed Rx in 92% (45% “major changes”)

Study of 47 curbsides vs. formal consults

- Medicine consult
- Curbside → formal consult by a colleague
- Curbsided providers could not look in chart

Are Curbsides Okay?

- Formal consult is preferred in general, but need to balance patient safety, provider workload, education
- Curbside volume in ID is high
- Use e-consults when possible
- Impossible in many practices to convert all inpatient curbsides into formal consults

What is an Appropriate Curbside?

- The Goldilocks of Curbside Consultation
  - Not too simple: can be easily looked up
  - Not too complicated: requires nuanced clinical judgment, data interpretation, reading the literature
  - Just right: Hypothetical, factual question

- We also tell our ID fellows it should be a consult if:
  - You need to look up the answer
  - It’s early in the year
  - The team calls you back several times
  - The patient’s history is complicated
  - Calls from the ED
Outline

- Curbsides vs Formal Consults
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Case #1

60 year old man with lung cancer undergoing chemo admitted with a PICC line infection due to MRSA c/b bacteremia and psoas abscess. PICC line is removed. Cultures only clear after the psoas abscess is drained (positive for 4 days). TEE is negative.

How Long Should He Be Treated With Vancomycin?

1. 2 weeks
2. 3 weeks
3. 4 weeks
4. 6 weeks

ID Consults and Staph aureus Bacteremia

- Benefits of ID consultation (vs no consult):
  - detection of metastatic foci of infection, endocarditis
  - removal of prosthetic devices
  - Improved antibiotic choice and duration
  - risk of relapse
  - mortality (by ~20-30%)

- All patients with SAB should have an ID Consult if possible

Curbsides for Staph aureus Bacteremia?

- Curbside consult is associated with:
  - Less identification of deep infectious foci (and fewer radiologic tests ordered)
  - Longer duration of fever
  - Less likely to receive the proper duration of therapy
  - Mortality by > 2-fold compared to bedside consult

- No curbsides for Staph bacteremia!

My Approach to Staph aureus Bacteremia

1. Look for metastatic foci of infection → source control
   - Exam: Brain, lungs, spleen/liver/kidneys, spine, skin, MSK
   - Low threshold for imaging
2. Get surveillance blood cultures
3. Evaluate for endocarditis (TTE vs TEE)
4. Decide appropriate ABx choice
   - Always IV
   - Beta-lactam for MSSA
5. Decide appropriate ABx duration (complicated vs uncomplicated bacteremia)

Antibiotic Choice

- MSSA
  - Cefazolin
  - Nafcillin (if need CNS penetration)
  - "Inoculum effect" of cefazolin likely not clinically significant
- MRSA
  - Vancomycin
  - Daptomycin
  - If need CNS penetration consider adding rifampin or adding/switching to linezolid

Antibiotic Duration

Uncomplicated Bacteremia

1. No endocarditis
2. No metastatic foci of infection
3. Repeat blood cx neg at 2-4 days
4. Defervesce in <3 days of ABx
5. No prostheses (e.g., prosthetic valves, cardiac devices, joints)
6. No immunocompromise?

Duration = minimum 2 weeks (this will be uncommon!)

Complicated Bacteremia

Does not meet criteria for uncomplicated disease

Duration = 4-6 weeks


Implanted Prostheses and Antibiotic Duration

- Presence of prosthetic implants in SAB → poor outcomes/complications
  - 2-4 fold risk death, stroke, recurrent infection, metastatic foci
  - This is true even if prosthetic material is not the primary infection/source of bacteremia

- Implanted prostheses have high rates of being seeded hematogenously during unrelated SAB
  - 20-50% risk of seeding prosthetic heart valves/value rings
  - 30% risk of seeding of prosthetic joints, cardiac devices

Echocardiography in SAB

- Purpose of echo:
  - At least 5-15% of patients with SAB have endocarditis
  - Echo serves to rule out endocarditis as an etiology for or subsequent complication of SAB

- Needed for all?
  - Although there is some debate, most experts agree that all patients with Staph aureus bacteremia should undergo echocardiography (start with TTE)

Transesophageal Echocardiography (TEE)

- Important points about TEE:
  - More sensitive for vegetations (85-90% vs 75% for TTE)
  - Better to evaluate prosthetic valves, device leads
  - Better to evaluate for myocardial abscess
  - May be less sensitive for tricuspid lesions
  - Increased cost and risk compared to TTE

  - IDSA: TEE is “preferred” because of higher sensitivity

  - In practice, TEE is performed in only 15-80% of patients with SAB

What about TTE in “Low Risk” SAB?

- TTE may have good NPV in a subset of patients with low risk for endocarditis (low quality evidence, somewhat controversial)

- Some experts define low risk as meeting all of the following:
  - Nosocomial-acquired bacteremia
  - Negative blood cultures within 4 days after initial set
  - Absence of prosthetic valve or cardiac device
  - No hemodialysis
  - No clinical signs of IE or secondary foci of infection

A Real World Approach to Echo in SAB

If initial TTE is negative

**Low Risk**
- Low risk patient
- Low clinical suspicion
- Alternative source

**High Risk**
- Prosthetic valve, cardiac device, congenital heart disease
- Prior IE
- IDU or hemodialysis

**Moderate-high clinical suspicion**
- Community-acquired bacteremia
- New murmur or new conduction abnormalities
- Multiple metastatic foci, embolic lesions, peripheral stigmata
- Prolonged bacteremia or fever

Get TEE only if:
- Poor quality TTE
- ? suspicion during course

Get TEE

Other TEE Considerations

- May consider deferring TEE in:
  - Patients with significant co-morbidities
  - Patients whose GDC are to avoid invasive procedures
  - Patients getting 6 wks of ABx for another reason (eg osteomyelitis) where:
    - There is no concern for intra-cardiac complications (eg conduction abnormalities)
    - ABx regimen would not change if the patient had endocarditis
  - Important to use clinical judgment
  - If defer TEE and give a short course of ABx, consider getting surveillance cultures after stopping

Take Home Points: Approach to Staph Bacteremia

1. Look for metastatic foci of infection → source control
2. Get surveillance cultures
3. Evaluate for endocarditis
   - TTE in all patients
   - TEE if low quality TTE, high risk patient, moderate to high clinical suspicion
4. Decide appropriate Abx (always IV, beta lactam for MSSA)
5. Decide appropriate ABx duration (define bacteremia as complicated or uncomplicated)

My SAB Checklist

SAB checklist:
- [ ] Surveillance blood cultures: ***
- [ ] Echo: ***
- [ ] Original source: ***
- [ ] Possible sites of metastatic infection: ***
- [ ] Antibiotic choice: ***
- [ ] Antibiotic duration: ***
Case #2

Do I need to worry about Bacillus if it grew in the blood? The patient is totally fine and this grew out at 3 days, right after discharge.

Do you need to worry about the Bacillus?

1. Yes
2. No
3. Not sure

How to Determine a Contaminant vs True Infection

What is the clinical situation?

What is the organism? Most common contaminants:
- Coagulase-negative Staph (82%)
- Corynebacterium (not jeikieum) (>88%)
- Bacillus spp. (not anthracis) (>92%)
- Propionibacterium acnes (>94%)
- Viridans group streptococci (50-55%)

How many blood culture sets are positive?
- More likely real if 2 out of 2 sets
- Caveat: 2/2 common for coag-neg Staph. Check species or antibiograms (100% sensitive for same strain, 84% specific)

# blood culture bottles positive in a set does NOT correlate

When did it turn positive?
- Growth at ≥3-5d → more likely contaminant

Case #3

55 year old woman with MS and h/o neurogenic bladder is admitted with sepsis.

Her urine and blood cultures are growing pan-sensitive Klebsiella pneumoniae.

She is currently on ceftriaxone and doing well.
How Long Should She Be Treated?

1. 5 days
2. 7 days
3. 10 days
4. 14 days

What Would You Send Her Home On?

1. PO TMP-SMX
2. PO Ciprofloxacin
3. PO Cephalexin
4. IV Ceftriaxone

GNR Bacteremia: Major Questions

How long to treat?
2 major RCTs on duration of Rx in GNR bacteremia

Are oral Abx ok?
Which ones?
1 large retrospective study and 1 meta-analysis
In General, Shorter is Usually Better!

Table 1 - Evidence for Which Duration Antibiotic Therapy Has Been Found to Be Equally Effective in Longer Traditional Courses of Therapy (With Reference)

<table>
<thead>
<tr>
<th>Program</th>
<th>Shorter</th>
<th>Longer</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterobacteriaceae (Glied)</td>
<td>7</td>
<td>14</td>
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RCT #1 on Duration for GNR Bacteremia

<table>
<thead>
<tr>
<th>Study #1</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>Patient Characteristics</th>
<th>Results</th>
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<tr>
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<td>Afebrile</td>
<td>Stable by day 5</td>
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<td>No difference in composite outcome of all cause mortality, clinical failure, readmission, LOS&gt;14d (at 90 days)</td>
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RCT #2 on Duration for GNR Bacteremia

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<th>Study #2</th>
<th>Inclusion</th>
<th>Exclusion</th>
<th>Patient Characteristics</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Dach et al, JAMA 2020</td>
<td>Afebrile x 24H</td>
<td>Stable by day 5</td>
<td>Source control</td>
<td>No difference in composite outcome of all cause mortality, clinical failure, readmission, LOS&gt;14d (at 90 days)</td>
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GNR Bacteremia: Back to Our Questions

How long to treat?

- RCT data supports 7 day course of antibiotics for:
  - Enterobacteriaceae bacteremia
    - Urinary, GI source
    - Have source control
    - Clinically stable by day 5

Unanswered questions:

- Non-urinary/GI source? (yes)
- ESBL? (yes)
- Immunosuppression? (yes, if not severe)
- When can you switch to orals? Can you use an oral beta-lactam?
**GNR Bacteremia: Major Questions**

- **How long to treat?**
  - 2 major RCTs on duration of Rx in GNR bacteremia

- **Are oral Abx ok? Which ones?**
  - 1 large retrospective study and 1 meta-analysis

**Studies of Oral Step Down Rx for GNR Bacteremia**

**Tamta et al, JAMA IM 2019**

- Retrospective (n=1478)
- Inclusion:
  - Enterobacteriaceae bacteremia
  - Stable, could take PO, had source control
- Exclusion: complicated infections (e.g. osteo)
- Compared oral step down (got 3d IV then PO) vs all IV for total 14 days
- Source: GU 40%, GI/biliary 34%, line 18%

**Results**

- No diff in mortality, oral group had 🍀 LOS
- Oral group: 70% FQ, 13% TMP-SMX, 17% oral BL
- No diff between FQ/TMP-SMX vs oral BL

**Punjabi et al, OFID 2019**

- Meta-analysis (8 studies, n=2289)
- Compared FQ/TMP-SMX vs oral BL for stepdown after 3-5 days of IV therapy (total 14-16 days)
- 65% FQ, 8% TMP-SMX, 27% oral BL

**Results**

- No difference in mortality between oral beta-lactams vs FQ/TMP-SMX
- Recurrence of infection was more common (OR 2.05) in the oral BL group

**What about for ESBL?**

- 10-20% of patients in the 7 vs 14 day RCTs had ESBL
- Two additional (small) retrospective studies show that FQ or TMP-SMX are effective as step-down therapy for ESBL bacteremia
- IDSA Guidelines on Treatment of Antimicrobial Resistant Gram Negative Infections: oral therapy with FQ or TMP-SMX is a viable option if otherwise meet clinical milestones for oral therapy

**GNR Bacteremia: Back to Our Questions**

**How long to treat?**

- RCT data supports 7 day course of antibiotics for:
  - Enterobacteriaceae bacteremia
  - Urinary, GI source
  - Have source control
  - Clinically stable by day 5

**Are oral Abx ok?**

- Oral step-down therapy (by day 3) is safe and effective in:
  - Enterobacteriaceae bacteremia
  - From urinary, GI, lines
  - Source control and clinically stable
  - Especially with FQ or TMP-SMX but likely also oral beta-lactams
GNR Bacteremia Summary

**Inclusion:**
- Controlled source of infection
- Active IV therapy for at least 48 hours
- Clinically stable, no pressors x 48h
- AF x 48h without anti-pyretics
- Able to tolerate/absorb oral meds
- Organism is susceptible

**Exclusion:**
- Severe immunocompromise
- SOT in last 3 mo or augmented IS
- Neutropenia, HSCT <12 mo, active GVHD
- Complicated infections
- Endocarditis, CNS infection, empyema
- Nec fasc, osteo, septic arthritis
- Undrainable abscess or infected prosthesis
- Complex urinary anatomy or prostatitis
- Polymicrobial infection

Step-down to Oral Antibiotics to Complete 7d

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An Approach to Oral Options

**Notes**
- Assuming normal renal fxn
- Cefuroxime > cefpodoxime > cefdinir for GU penetration
- Consider renal function, side effects (eg QTc), DDIs, ADRs of IV, clinical situation, immunosuppression
- AmpC = Enterobacter, Citrobacter, Providencia, Morganella, Serratia, Hafnia

1. **1st tier: FQ**
   - Ciprofloxacin or levofloxacin (750mg dosing)

2. **2nd tier: TMP-SMX**
   - TMP-SMX 8-10mg/kg/day in 2-3 divided doses

3. **3rd tier: oral BL**
   - Cefuroxime 500mg PO bid
   - Amoxicillin 1gm PO tid
   - Cephalexin 500mg PO qid
   - Amox-clav 875/125 bid

Case #4

An 89 year old woman with mild cognitive impairment is admitted after a fall with mild mental status changes and inability to care for herself at home. She has no clear localizing symptoms except pain at the site of her fall.

Afebrile, vitals stable.
WBC 10.0
UA 25-50 WBC/hpf

Does She Need Antibiotics?

1. Yes
2. No
3. Not sure
Case Continued
She was started on ceftriaxone and improved overnight. PT/OT eval for discharge recs is pending.
Urine culture grows >100K E coli ESBL (sensitive to amp/sulbactam, cipro, ertapenem)

What Would You Do with Her Antibiotics?
1. Amox/clav
2. Ciprofloxacin
3. Ertapenem
4. No antibiotics

New IDSA GUIDELINES for ASB (2019)
Asymptomatic Bacteriuria: Definition
ASB = positive urine culture
AND no signs/symptoms of UTI
irrespective of the presence of pyuria

Caveats:
- Voided specimen or indwelling catheter: ≥10^5 cfu/mL, straight cath specimen: ≥10^2 cfu/mL
- For women: need 2 consecutive specimens (since often repeat is negative)
Asymptomatic Bacteriuria is COMMON!

- Seen in up to:
  - 20% of elderly, diabetic, HD patients
  - 50% of patients in long term care facilities
  - 70% of patients with spinal cord injury
  - ~100% of patients with long-term catheters
  - Of positive urine cultures obtained on the wards after hospital admission \( \rightarrow \) ~90% are ASB


Exceptions: Who With ASB Should Be Treated?

- Pregnancy
  - \( \bigstar \) risk pyelo, premature delivery
- GU procedures w/mucosal bleeding
  - \( \bigstar \) post-procedure bacteremia/sepsis
  - 2019 guidelines: Give 1-2 doses, start 30-60 min before the procedure
- Immunosuppressed patients (2019 guidelines)
  - Renal transplant in the first month
  - High risk neutropenia? (IDSA makes no formal rec for or against, but state GU tract is an infrequent source for bacteremia)


Hazards of ASB Treatment

- Side effects of antibiotics
- \( \bigstar \) risk of Cdiff
- \( \bigstar \) risk of resistance
- May increase risk of recurrent UTI by getting rid of "good" interfering bacteria
- Increased LOS


The Heart of the Problem

- It's Hard to Ignore a Positive Culture

Proof of concept study:
- At Mount Sinai, 80% of their inpatient urine cultures were ASB, and 50% were treated with ABx
- They stopped reporting these (+) urine cultures in the EMR
- Results:
  - The % of ASB that was treated dropped by 80%
  - No untreated UTIs and no sepsis

How To Distinguish ASB vs. UTI?

- Does the UA help? Yes, but only if negative
  - Pyuria is seen in >50% of catheterized patients with ASB
  - But the absence of pyuria suggests an alternative dx

- Does the organism help? NO
  - The same organisms cause ASB and UTI

- Use clinical context – does the patient have signs/symptoms of UTI?

What if I Can’t Assess Symptoms?

How to define UTI in patients with a catheter?

- Surrogate signs/symptoms of UTI
  - Fever, rigors, malaise
  - Flank pain, CVAT, pelvic pain
  - Acute hematuria
  - Spinal cord injury: spasticity, autonomic dysreflexia, unease

AND No other source of infection (i.e., diagnosis of exclusion)

Interpreting Urine Studies in a Patient With a Foley

- Fever, S/WBC, etc.
  - Alternate Diagnosis Likely? (Signs/ sx of other illness present)
  - Yes
    - Do not order UA, urine cx
  - No
    - Send UA, urine cx

- UA (-) urine cx (-)
  - Do not treat for UTI

- UA (-) urine cx (+)
  - Asymptomatic bacteriuria

- UA (+) urine cx (+)
  - Treat for UTI if no alternate dx

- UA (+) urine cx (-)
  - No other source of infection

What About Older Patients with Confusion?

- An elderly patient with functional/cognitive impairment presents with bacteriuria and either AMS or fall

IDSA Guidelines 2019

- If no local GU symptoms or other systemic signs of infection look for other causes; careful observation without antibiotics (strong rec, low quality evidence)

Why?

- Current data does not show causality between bacteriuria and MS changes, and treatment does not improve clinical outcomes
- Places high value on avoiding adverse effects of Abx (Cdiff, resistance)


Slide courtesy of Catherine Liu.
ASB vs UTI: Take-Home Points

- For elderly patients admitted with bacteriuria and AMS, look for other causes and closely observe without antibiotics
- ASB is very common and rarely needs treatment
- Pyuria ≠ UTI, but its absence suggests an alternative dx
- UTI diagnosis in a patient with a catheter requires surrogate signs/symptoms of UTI and no other source of infection

Case #5

23 y/o woman with Takayasu arteritis on prednisone who needs escalation of immunosuppression to infliximab. She has had an indeterminate QuantiFERON (QFT) x 2, negative PPD, and no lung pathology on chest CT. She was born in California and has no known TB exposures or other risk factors. Should she be treated for latent TB infection (LTBI)?

An Indeterminate QFT Means:

1. Intermediate probability of LTBI
2. Borderline/equivocal result
3. Low level positive result
4. The test didn’t work

QuantiFERON Interferon Gamma Release Assay (IGRA)

1) Nil tube: Negative control
2) TB antigen tube:
   • ESAT-6 + CEP-10
   • Not in BCG or most NTM
3) Mitogen tube: Positive control

Test Readout
- Positive
- Negative
- Indeterminate
Definition of an Indeterminate Assay

Indeterminate = TEST FAILURE

- Positive control (mitogen) didn’t work
- Negative control (nil) had too much background IFN-γ
  (>85% of indeterminate results)

Reasons for an Indeterminate QFT

<table>
<thead>
<tr>
<th>Test Factors</th>
<th>Patient Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of blood drawn</td>
<td>Immunocompromise impairs ability of T cells to produce IFN-γ in response to mitogen</td>
</tr>
<tr>
<td>Suboptimal handling</td>
<td></td>
</tr>
<tr>
<td>Delays from blood draw to incubation step</td>
<td></td>
</tr>
</tbody>
</table>

How Common is an Indeterminate QFT?

- HCWs and TB Screening Programs: 1%
- Tertiary care inpatient settings: 20%
- Immunocompromise: 5-60%

Indeterminate QFT and Immunocompromise

- HCWs: 1%
- HIV: 5%
- HIV (CD4<100): 15%
- SLE: 15%
- SOT/HSCT: 20%
- Critical illness: 60%

References:
- Fabre, Open Forum Infect Dis 2014.
- Lucet et al, Infect Control Hosp Epidemiol 2015.
How to Manage Indeterminate QFT?

- If high risk patient → repeat and/or perform a PPD
- Repeat QFT
  - May eliminate possibility of lab-related factors
  - Many will still be indeterminate (40-70%)
  - Consider waiting until CD4 is higher or immunosuppression is decreased
- In a high risk patient, use epidemiologic risk factors, clinical history, chest imaging

T-SPOT TB Test: This DOES Have a Borderline Result

- Mix blood PBMC and TB antigens
- Check for IFN-γ production by ELISPOT
- Also uses a positive and negative control

**Test Readout**
- Positive (>8 spots)
- Negative (<4 spots)
- Borderline (5-7 spots)
- Invalid (failure of positive or negative control)

Indeterminate QFT: Take-Home Point

- **Indeterminate QFT = test failure** due to failure of either the positive (most likely) or negative control

Thanks For Your Attention!

- Questions?
Caring for the Hospitalized Patient with Addictions

Marlene Martin
Director, Addiction Care Team, Division of Hospital Medicine, SFGH
Associate Professor of Clinical Medicine, UCSF

25th Annual Management of the Hospitalized Patient CME Course
October 21, 2021

35 Y man admitted with right upper extremity erythema, pain, and swelling

- Started on empiric treatment for cellulitis
- You are receiving sign out from your overnight colleague when you get paged that he is complaining of diarrhea, abdominal pain, headache, and nausea.
- You evaluate the patient and note he is yawning and that his pupils are dilated. He endorses last using heroin right before admission.

Objectives

- Diagnose substance use disorders (SUD) most commonly encountered by hospitalists
- Initiate evidence-based medication for alcohol and opioid use disorder treatment
- Identify how to link hospitalized patients with SUD to addiction treatment on discharge

I have nothing to disclose
Tobacco, Alcohol, and Drugs

- 20.4 million (7.4%) had an alcohol or drug use disorder in the last year
- 26.8 million (8.2% of population) smoke cigarettes daily

COVID-19 and SUD

- More than 485,000 tobacco, 25,000 alcohol, and 95,000 drug-related deaths yearly.
- Stimulant-related deaths are increasing.
- Cocaine-related deaths have increased between 2011-2016.
- Methamphetamine-related deaths are occurring independent of opioids.
- Alcohol-related deaths also rising.
- Increasing unhealthy alcohol use among women, older adults, and adolescents.
- More rapid acceleration in the last few years most prominently among younger age groups and women.

Outline

- National Landscape of SUD
- Hospitalized patients with SUD
- Diagnosing SUD
- Medication treatment for OUD and AUD

SUD Crisis

- National Landscape of SUD
- Hospitalized patients with SUD
- Diagnosing SUD
- Medication treatment for OUD and AUD

SUD is prevalent among hospitalizations

- Alcohol-related emergency department visits and hospitalizations account for $13.2 billion of healthcare spending/year.

- SUD-related emergency department visits and hospitalizations account for $13.2 billion of healthcare spending/year.

- More than 485,000 tobacco, 25,000 alcohol, and 95,000 drug-related deaths yearly.
- Stimulant-related deaths are increasing.
- Cocaine-related deaths have increased between 2011-2016.
- Methamphetamine-related deaths are occurring independent of opioids.
- Alcohol-related deaths also rising.
- Increasing unhealthy alcohol use among women, older adults, and adolescents.
- More rapid acceleration in the last few years most prominently among younger age groups and women.

Outline

- National Landscape of SUD
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- Increasing unhealthy alcohol use among women, older adults, and adolescents.
- More rapid acceleration in the last few years most prominently among younger age groups and women.
Percentage, cost, and length of stay for primary mental and substance use disorder diagnoses

SUD among hospitalized patients
- More likely to be admitted from the emergency department
- Longer lengths of stay, costlier, higher readmission
- High self-discharge rates
- Lowest quartile of income
- Unconnected to care

Why treat SUD in the hospital?
2/3 Patients are Motivated to Reduce Use
Pivotal Touch Point

Outline
- National Landscape of SUD
- Hospitalized patients with SUD
- Diagnosing SUD
- Medication for opioid and alcohol use disorder treatment
- Care Transitions
### Diagnosing SUD

**Symptoms**
- Withdrawal
- Intoxication

**Diagnoses**
- Skin and soft tissue infections
- Endocarditis, osteomyelitis
- Trauma
- Alcohol withdrawal
- Overdose
- Heart failure exacerbation

Not all who use substances have SUD.

---

35 Y man with cellulitis. He uses heroin 3-4 times daily and has been unable to cut back. He lost his job due to missing work and has distanced himself from his parents due to his use. Does he have OUD?

A) Yes
B) No
C) Need more information

---

### Outline

- National Landscape of SUD
- Prevalence, demographics, and characteristics of hospitalized patients with SUD
- Diagnosing SUD
- Medication treatment for OUD and AUD
- Care Transitions
35 Y man with cellulitis and OUD. What treatments would you offer?

A) Buprenorphine
B) Methadone
C) Clonidine, diphenhydramine, loperamide, Tylenol
D) Extended-release Naltrexone
E) Need more information

Medications for OUD

**Opioids:** full mu agonist
- Heroin, oxycodone, fentanyl

**Methadone:** full mu agonist

**Buprenorphine:** partial mu agonist
- High affinity, ceiling effect

**Extended-release naltrexone:**
- Full antagonist, high affinity

Initiating Buprenorphine

- Withdrawal prior to initiation OR
- Gradual uptitration/microdosing

<table>
<thead>
<tr>
<th>Medications for OUD</th>
<th>Methadone</th>
<th>Buprenorphine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment initiation</td>
<td>Higher than buprenorphine</td>
<td>Increased retention at doses &gt;16 mg</td>
</tr>
<tr>
<td>Office visits</td>
<td>Daily visits to Opiate Treatment Program (OTP – methadone clinic)</td>
<td>Daily monthly, can also provide as DOT in OTP</td>
</tr>
<tr>
<td>Who can prescribe in acute care?</td>
<td>Any inpatient clinician during hospitalization</td>
<td>Any inpatient clinician during hospitalization</td>
</tr>
<tr>
<td>Who can prescribe at discharge?</td>
<td>OTP</td>
<td>Any provider with DEA2000 X waiver</td>
</tr>
<tr>
<td>Initiation</td>
<td>Yes, high doses, non-tolerant patients or slow metabolizers</td>
<td>Ceiling effect for respiratory depression</td>
</tr>
<tr>
<td>Withdrawal when starting</td>
<td>Takes time to reach comfortable dose</td>
<td>Gradual uptitration/microdosing</td>
</tr>
</tbody>
</table>
In methadone
Out of methadone
In buprenorphine
Out of buprenorphine

Decreased Mortality
All cause mortality per 1000 person years

Source: Sordo et al, BMJ, 2017

Hospital Initiation of Buprenorphine

<table>
<thead>
<tr>
<th>% Patients</th>
<th>Received bup in the 6 months after discharge</th>
<th>Days in bup over 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>72 %</td>
<td>64</td>
</tr>
<tr>
<td>Detox</td>
<td>12 %</td>
<td>7</td>
</tr>
</tbody>
</table>

Received bup initiation, percentage in blue: Maintenance, percentage in orange: Detox

Source: Liebschutz et al, JAMA Internal Medicine, 2014

Detox Doesn’t Last

Patients reporting detachment (%) vs Days Post-detoxification

Source: Schuckit et al, The American Journal of Drug and Alcohol Abuse, 2005

Back to our patient. He wants to start buprenorphine. How would you start it?

A) Low-dose or gradual initiation, “microdosing”
B) 2mg buprenorphine
C) 4mg buprenorphine
D) 8mg buprenorphine
E) Need more information
He wants to start buprenorphine. How would you start it?

- Traditionally
  - At least mild withdrawal prior to initiation (COWS 8-11)
- Recent opioids
  - Wait for mild-moderate withdrawal
  - 8-12h after short acting and 24-48h after long acting
- Transitioning from methadone or fentanyl or no opioid free period
  - Ask for help!
- Low-dose buprenorphine/microdose

Traditional Buprenorphine Initiation

When COWS ≥ 8, give 2-8 mg
Reassess in 1 hour, then q4-6 hours thereafter.
- Max day 1: 16 mg
- Max day 2: 24 mg

Therapeutic dose 16-24mg/day

Increase dose: craving, withdrawal, pain
Decrease dose: insomnia/mania, sedation
Precipitated withdrawal: more buprenorphine or short acting full opioid agonist

Works well with pill-based OUD and heroin use disorder

Withdrawal Assessment

- COWS shortcut: Subjective symptoms AND at least 1 objective withdrawal sign
  - Subjective: Nausea, abdominal pain, myalgias, chills
  - Objective (at least 1): Restlessness, sweating, rhinorrhea, dilated pupils, watery eyes, tachycardia, yawning, goose bumps, vomiting, diarrhea, tremor

On full opioid agonists or using fentanyl: low-dose, microdosing method

- Depends on buprenorphine formulations available in hour hospital
- Sublingual films or tabs (cut 2mg films or tabs into quarters)
- Buprenorphine patches (patch protocols on next 2 slides)
- Buccal buprenorphine
- Intravenous buprenorphine

- Example protocol using films or tabs:
  - Day 1: 0.5mg q6h = 2mg total
  - Day 2: 1.0mg q6h = 4mg total
  - Day 3: 2.0mg q6h = 8mg total and start decreasing/Stopping full agonists (except if acute pain)
  - Day 4: 12-32 mg
As you are ordering buprenorphine via a traditional initiation (since he is in moderate withdrawal after last using heroin yesterday) he asks about methadone. What methadone dose would you start?

A) 5mg  
B) 20mg  
C) 100mg  
D) None, we cannot start methadone in the hospital  
E) Need more information

Yes, we can start methadone in the hospital

https://www.deadiversion.usdoj.gov

Methadone

Day 1
Start with 10-30 mg, reassess in 3-4 hrs, add 10mg PRN withdrawal or cravings. max 40 mg
Check for sedation at 3-4 hours. Ok to give additional short acting opioids throughout.

Day 2
Total Day 1 + 5-10 mg in 3-4 hrs PRN, max 50 mg

Day 3
Today Day 2+ 5-10 mg in 3-4 hrs PRN, max 60 mg
Monitor on 60mg daily for 5 days before increasing again by 5-10mg, then hold that dose for 5 days, etc.
Target daily dose 80-120mg
Our patient ultimately chooses buprenorphine and is doing well on 16mg daily. However, he has an abscess and goes to the OR for debridement. How would you treat his pain post procedure?

A) Regional block  
B) Morphine  
C) Tylenol  
D) Adjust buprenorphine dosing/frequency  
E) Stop buprenorphine  
F) All of the above

Medication for OUD management in the perioperative period

<table>
<thead>
<tr>
<th>Medication</th>
<th>Verify dose</th>
<th>Before procedure</th>
<th>After procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methadone</td>
<td>Call OTP</td>
<td>Continue full dose</td>
<td>Continue full dose, consider splitting dose in the hospital</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>Records, PDMP, pharmacy</td>
<td>Continue full dose</td>
<td>Continue/increase dose, consider splitting</td>
</tr>
</tbody>
</table>

Managing acute pain in the setting of medications for OUD treatment

<table>
<thead>
<tr>
<th>Pain Level</th>
<th>Interactions to consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>- Sublingual naltrexone, methadone TID</td>
</tr>
<tr>
<td>Moderate</td>
<td>- Acupuncture, acamprosate, acute naltrexone, TCA, SNRI, gabapentin, ketamine</td>
</tr>
<tr>
<td>Severe</td>
<td>- Regional/local anesthesia, ketamine, morphine, remember to adjust higher doses due to tolerance</td>
</tr>
</tbody>
</table>

A week later, you admit a 46-year-old woman with depression for alcohol withdrawal and mild alcohol-related hepatitis. She has no primary care clinician, and this is her first presentation. You diagnose her with AUD using the DSM-5 criteria. What options does she have for alcohol use disorder treatment?

A) Naltrexone  
B) Extended-release naltrexone  
C) Acamprosate  
D) Psychosocial treatment (e.g., residential, mutual help group)  
E) All of the above
A U D Treatment

Psychosocial Treatment

Medication Treatment

7.3% receive any treatment
Only 1.6% receive medication for AUD

2nd Line AUD Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Route</th>
<th>Mechanism</th>
<th>Adverse Effects</th>
<th>Contraindications</th>
<th>Dose</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topiramate</td>
<td>PO/IV</td>
<td>Decreases glutamate release, decreases GABA uptake</td>
<td>• Cognitive slowing, memory impairment, depression, mood swings</td>
<td>• Elevated amniotic fluid pH, newborns &gt; 7 months</td>
<td>25 mg</td>
<td>Clinical trials, RCTs</td>
</tr>
</tbody>
</table>

1st Line AUD Medications

<table>
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<th>Adverse Effects</th>
<th>Contraindications</th>
<th>Dose</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naltrexone</td>
<td>PO/IV</td>
<td>Antagonist of EtOH receptor in CB1, CB2 receptors, reduces EtOH craving</td>
<td>• Somnolence, Paresthesias, Cognitive impairment, Headache, Bowel dysfunction</td>
<td>• Abnormal liver function tests, ALT&gt;2 ULN</td>
<td>50 mg</td>
<td>Clinical trials, RCTs</td>
</tr>
</tbody>
</table>

AUD Medications

**MAINTAIN ABstinence**
- Naltrexone / extended-release naltrexone
- Acamprosate
- Gabapentin*

**DECREASE USE**
- Naltrexone / extended-release naltrexone
- Acamprosate
- Gabapentin*
- Topiramate*
Back to our case

46-year-old woman with depression and moderate AUD. Alcohol withdrawal resolves. Her AST/ALT are both <200 and she does not have cirrhosis. She is not receiving opioids. You discuss medications for AUD and psychosocial treatment options with her. She chooses to start naltrexone because of her strong cravings for alcohol and you initiate before discharge.

Increasing Rates of AUD

<table>
<thead>
<tr>
<th></th>
<th>2001-2002</th>
<th>2012-2013</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol use</td>
<td>65.4%</td>
<td>72.7%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Risky Drinking</td>
<td>0.7%</td>
<td>12.5%</td>
<td>20.8%</td>
</tr>
<tr>
<td>AUD</td>
<td>8.5%</td>
<td>12.7%</td>
<td>49.4%</td>
</tr>
</tbody>
</table>

Increasing Alcohol-related deaths

Table: Age-adjusted rates of alcohol-related deaths and AUD, 2001-2014/15

<table>
<thead>
<tr>
<th>Year</th>
<th>Age-adjusted Rates (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>65.4%</td>
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<tr>
<td>2002</td>
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<td>2012</td>
<td>12.7%</td>
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<tr>
<td>2013</td>
<td>12.7%</td>
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As clinicians, we see patients with AUD for...
Outline

- National Landscape of SUD
- Prevalence, demographics, and characteristics of hospitalized patients with SUD
- Diagnosing SUD
- Medication treatment for OUD and AUD
- Care Transitions

Objectives

- Diagnose substance use disorders (SUD) most commonly encountered by hospitalists
- Initiate evidence-based medication for alcohol and opioid use treatment
- Identify how to link hospitalized patients with SUD to addiction treatment on discharge

Opportunities for you to improve SUD care

- DIAGNOSE SUD
- TREAT SUD
- LINK TO CARE
How you can help today

1. Get your X-waiver now!
2. Prescribe naloxone for overdose prevention including stimulants
3. Assess your patients for SUD and their SUD goals
4. Continue SUD medications during admission

Get your X-Waiver Now!

1. Go to: https://buprenorphine.samhsa.gov/forms/select‐practitioner‐type.php
2. To complete the application:
   a. Under training you received, click other and mark "practice guidelines"
   b. Date: today
   c. City: type "Practice Guidelines"
   d. State: Type in your state
   e. Select 30 patients

Lead systems change

Offer medications for addiction treatment to patients with SUD
Create hospital order set or guideline for new starts
Partner with stakeholders to link patients to community care
Disseminate knowledge with colleagues
Become a SUD champion in your hospital

Reflections

Take 1 minute to write down (or tweet):

One concept or tool that you commit to incorporating to improve your care of patients with SUD now
Thank You!
Questions?

ACT.UCSF.EDU
marlene.martin@ucsf.edu
@MarleneMartinMD

Harm Reduction

- MAF = treatment & HR
- Needle exchange programs
- Review injection practices
- Supervised injection facilities
- Buddy system
- HCV and HIV education, screening, and treatment
- HAV, HBV, & Tdap vaccines
- Naloxone
ICU Management Pearls for the Hospitalist

Lekshmi Santhosh, M.D., M.A.Ed.
Assistant Professor, Pulmonary/Critical Care & Hosp Med
Associate Program Director, UCSF Pulm/CC Fellowship
@LekshmiMD

Management of the Hospitalized Patient

ICU Management Pearls for the Hospitalist

Disclosures

I have no conflicts of interest to disclose.
Wherever you Practice, Ward, ICU, Or Neither…

**ICU Management Pearls for the Hospitalist**

1. Volume, Pressors & Shock
2. Blood, Sweat & Tears
3. Non-Invasive Ventilation
4. Demystifying Tracheostomy
Volume Status: The Holy Grail

Classic debate b/w specialties: hospitalists are often the ‘arbiters of truth’

Q: When someone is hypotensive, I:

A. Start vasopressors
B. Fluid resuscitate with NS
C. Fluid resuscitate with Albumin
D. Fluid resuscitate with Plasmalyte/LR
E. POCUS, POCUS, more POCUS
F. Just lower the MAP goal.

SALT-ED Trial

Resist the “Lacto-Bolo Reflex”!

“Fluids for everyone hypotensive!”
All that is Hypotensive is NOT Sepsis: Sepsis Mimics

**More Common:**
- Hypovolemic
- Hemorrhagic
- Pulmonary Embolism
- Cardiogenic
- Obstructive/Tamponade

**More Rare:**
- Anaphylactic Shock
- Adrenal Crisis
- Myxedema Coma
- HLH
- Toxidromes

Reassess Patient at the Bedside – Beyond the EHR

The New 65 Trial Addresses a Perennial Question


dates: 1088 to 1097

locations: 61 cases in 2018

primary outcome: 30-day mortality

Interpretation
1260 patients included
1271 permissive hypotension
1242 usual care

Findings
Permissive hypotension
Number needed to treat = 2.92
Permissive hypotension
Number needed to treat = 2.92

LaMontagne et al. JAMA 2020

How to Resuscitate? Some Practical Tips

- If not responsive to fluids & escalating pressors, consider “the septic heart” – TTE
- Caution! Normal EF may actually be low in sepsis w/ vasopressors
- Smaller IVF boluses in CHF, ESRD, peri-intubation (250 ccs at a time) – reassess

www.middng.com
New Trial! How Quickly to Resuscitate? 999 Ain’t Bad

- BaSICS RCT (Zampieri, JAMA 2021)
- 10,520 patients in ICUs – 333ml/hr (slow infusion) vs 999ml/hr (fast infusion) rate
- No mortality difference! Bolus away if you need to!

Don’t forget to D/C IVF long before D/C Home!

Key Point

Volume status is dynamic and difficult to assess: reassess frequently and de-escalate & diurese early.

Q: My 1st line vasopressor of choice for shock is:

A. Norepinephrine (Levophed)
B. Phenylephrine (“Neo”)  
C. Dopamine
D. Vasopressin
E. Epinephrine
F. Just lower the MAP goal.
**Vasopressor of Choice**

- "Fill the tank" & check for volume-responsiveness
- CENSER Trial discussed early escalation to vasopressors – will need to be replicated
- Almost no role for Phenylephrine “Neo”

**A Plea to Use Generic Names**

Norepinephrine “Levo”
Phenylephrine “Neo”

**Vasopressors → ICU. But What about via PIV?**

Small single-centered studies → small systematic review ~3% complications

<table>
<thead>
<tr>
<th>Principle</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vein size</td>
<td>&gt; 4 mm, measured by U/S</td>
</tr>
<tr>
<td>Location</td>
<td>Upper extremity (no hand or wrist)</td>
</tr>
<tr>
<td>IV line size</td>
<td>20 g or 18 g</td>
</tr>
<tr>
<td>Assessment</td>
<td>RNs assess q2 hrs per protocol</td>
</tr>
<tr>
<td>Maximum dose/time</td>
<td>Low-dose norepi &lt; 24 hrs</td>
</tr>
</tbody>
</table>

**Quick Pearl on Mixed Shock: Compartments!**

- LV
- RV
- Pulmonary Vasculature
**Key Point**

Pressors are like antibiotics: select the correct drug for the patient’s physiology.

**New Recs: 93 Recs in October Surviving Sepsis Guidelines!**

**Highlights of the New Surviving Sepsis Recs**

<table>
<thead>
<tr>
<th>KEEP</th>
<th>STOP</th>
<th>START</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Abx (&lt;1 hr)</td>
<td>Using qSOFA!</td>
<td>Balanced crystalloids</td>
</tr>
<tr>
<td>Norepi as 1st line</td>
<td>Starches/ gelatins!</td>
<td>HFNC &gt; NIPPV</td>
</tr>
<tr>
<td>Addressing GOC early</td>
<td>Using Vitamin C!</td>
<td>?Steroids?</td>
</tr>
</tbody>
</table>

**ICU Management Pearls for the Hospitalist**

1. Volume, Pressors & Shock
2. Blood, Sweat & Tears
3. Non-Invasive Ventilation
4. Demystifying Tracheostomy
What Defines a “Massive Transfusion”? 

3 most common definitions:
1. Transfusion of ≥ 10 RBCs within 24 hours
   - This approximates the total blood volume of an adult!
2. Transfusion of ≥ 4 RBCs within 1 hr & anticipating more
3. Replacement of >50% total blood volume by products in 3 hrs

Pham et al, Br J Anesthesia, 2011

Epidemiology of Massive Transfusion

1. Major surgeries (spinal, liver transplant, cardiac cases)
2. Trauma (40% of trauma-related death 2/2 hemorrhage)
3. Obstetric hemorrhage (#1 cause of maternal mortality)
4. Gastrointestinal hemorrhage (variceal bleeding esp)
5. Hematologic malignancy

Pathophysiology of Massive Transfusion
Permissive Hypotension

- Conceptually part of damage-control resuscitation
- Minimize bloody vicious triad
- Maintain organ perfusion & avoid rebleed & vasoconstriction
- Caveat: CPP = MAP - ICP

Kahn et al, Trauma Reports, 2013

Key Point

For massive resuscitation, permissive hypotension is ok, except for brain & spinal cord injury pts

GI Bleed Trials: A Classic Trial

- Villaneuva et al NEJM 2013 study

Quick Pearls: Jehovah’s Witnesses

- The Case: 60yo woman, Jehovah’s Witness, admitted with Hb of 4 and hypotension.
- Humans can tolerate severe anemia!
- Consider fluids, FeSO4, EPO as adjunct therapies
- Try to get source control; consider Ethics consultation

Quick Pearls: End-of-Life

- The Case: 96yo woman admitted with aortoenteric fistula and hypotension
- Key Point: Massive transfusion is a bridge
- Knowing when to stop is equally important . . .

Key Point

ICU 1 Pager on Massive Resuscitation

1. Volume, Pressors & Shock
2. Blood, Sweat & Tears
3. Non-Invasive Ventilation
4. Demystifying Tracheostomy
Q: Not Indicated for Non-Invasive Ventilation?
A. Hypercapnic respiratory failure
B. Cardiogenic pulmonary edema
C. Hypoxemia in a DNR/DNI Yoda
D. Weaning from the ventilator

Non-Invasive Ventilation: When to Use it?
- COPD exacerbation with hypercapnic acidosis
- Cardiogenic pulmonary edema
- Post-extubation respiratory failure

Contraindications to Non-Invasive Ventilation
- Cardiac or respiratory arrest
- Facial or neurological surgery/trauma/deformity
- Inability to protect airway/cooperate
- Inability to clear secretions
- High risk for aspiration
- Goals of care

Flow vs. Pressure: Who Wins?

<table>
<thead>
<tr>
<th></th>
<th>NIV</th>
<th>HFNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counterbalances</td>
<td>auto-PEEP</td>
<td>More comfortable than NIV</td>
</tr>
<tr>
<td>Reduces work of</td>
<td>breathing</td>
<td>Higher FiO2 delivery</td>
</tr>
<tr>
<td>Improves lung</td>
<td></td>
<td>Decreased dead space</td>
</tr>
<tr>
<td>Mask can be</td>
<td>uncomfortable</td>
<td>Not good for hypercapnia</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Key Point

Think carefully about contraindications and to what you are bridging. Continually reassess if they need intubation, whether HFNC or NIV.

ICU Management Pearls for the Hospitalist

1. Volume, Pressors & Shock
2. Blood, Sweat & Tears
3. Non-Invasive Ventilation
4. Demystifying Tracheostomy
Trach management & recovery

- Indications for tracheostomy
  - Prolonged intubation
  - Facilitation of ventilation support/weaning
  - Upper airway obstruction
  - Inability to intubate
  - Adjunct to major HEENT surgery/trauma
  - Airway protection (neurologic diseases, TBI)

<table>
<thead>
<tr>
<th>Trach management &amp; recovery</th>
<th>Tracheostomy</th>
<th>Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pt comfort/decreases work of breathing</td>
<td></td>
<td>- Easily done in most settings</td>
</tr>
<tr>
<td>- Better speech, swallowing, mobility</td>
<td></td>
<td>- Not surgical (risk, $)</td>
</tr>
<tr>
<td>- Easier to suction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Facilitates weaning/x-fer out of ICU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Easily done in most settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not surgical (risk, $)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trach management &amp; recovery</th>
<th>Tracheostomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disadvantages</td>
<td></td>
</tr>
<tr>
<td>- Surgical procedure related risks</td>
<td></td>
</tr>
<tr>
<td>- Possible laryngeal nerve injury</td>
<td></td>
</tr>
<tr>
<td>- Possible tracheo-arterial fistula</td>
<td></td>
</tr>
<tr>
<td>- Stomal/cuff complications</td>
<td></td>
</tr>
<tr>
<td>- Easily changed/managed by RNs/RTs</td>
<td></td>
</tr>
<tr>
<td>- High mortality if mistakenly decannulated before trach matures</td>
<td></td>
</tr>
</tbody>
</table>

- For these reasons, tracheostomy when indicated may facilitate weaning from mechanical ventilation. Tracheostomy is not a failure!
Trach management: What about COVID?

- Highly infectious pathogen
- Aerosol generating procedure
- Prolonged ventilation
- Prolonged sedation
- Scarce resources

Trach management: Pathways

On Vent - AC/VC Mode
- Trach & Vent - AC/VC Mode
- Cuffless Trach
- Trach Downsize
- Capping Trial
- Decannulation

LTACHs and Weaning

Weaning at an LTACH can go more quickly than you think!
Key Point

Think about specific indications/advantages of a trach & remember a trach is not a failure. Know the progression pathway to weaning & set patient/family expectations accordingly.

ICU Management Pearls for the Hospitalist

1. Volume, Pressors & Shock
2. Blood, Sweat & Tears
3. Non-Invasive Ventilation
4. Demystifying Tracheostomy
Thank You!

Questions?

Lekshmi.Santhosh@ucsf.edu
@LekshmiMD
ARS: How many COVID-19 vaccines are currently being rolled out worldwide?

1. Three
2. Five
3. Six
4. Nine
5. Fifteen

6 vaccine candidates to date involve spike protein and receptor binding domain of SARS-CoV-2 either mRNA or adenoviral-vector DNA vaccines or protein adjuvant itself; 3 inactivated virus

<table>
<thead>
<tr>
<th>Category or name</th>
<th>Form of publication for phase 3 data/type of vaccine</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderna</td>
<td>Peer reviewed publication/abstract</td>
<td>Baden NEJM, Feb 4, 2021</td>
</tr>
<tr>
<td>Pfizer</td>
<td>Peer reviewed publication/abstract</td>
<td>Polack NEJM, December 31, 2020</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>Peer review press release/adenovirus + DNA</td>
<td>Press release, Jan 25, 2021; FDA announcement, Feb 24</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>Two peer-reviewed publications but ongoing (adenovirus + DNA)</td>
<td>Lancet December 2, 2020; Press release, Dec 1, 2021</td>
</tr>
<tr>
<td>Sputnik 5</td>
<td>Peer-reviewed publication/DNA plus adenovirus</td>
<td>Logunov Lancet, Feb 1, 2021</td>
</tr>
<tr>
<td>Sinopharm</td>
<td>Publication (whole inactivated)</td>
<td>Sinopharm, JAMA, May 28, 2021</td>
</tr>
<tr>
<td>Sinovac</td>
<td>Publication (whole inactivated)</td>
<td>Sinovac, JAMA May 28, 2021</td>
</tr>
<tr>
<td>Bharat</td>
<td>Press release (whole inactivated)</td>
<td>Bharat, April 21, 2021</td>
</tr>
</tbody>
</table>

There are actually 9 vaccines out there for COVID-19, three authorized in U.S.
Three types of vaccines involving spike protein

- mRNA vaccines (2)
- Adenoviral vector DNA vaccines (3)
- Spike protein + M-adjuvant vaccine (1)

Three vaccines whole inactivated virions

---

**Remember immunity - antibodies and cell-mediated**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Method</th>
<th>B with vaccine (some placebo)</th>
<th>Protection from COVID-19 pneumonia</th>
<th>Protection from COVID-19 severe disease</th>
<th>Efficacy against hospital COVID-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>AstraZeneca</td>
<td>rAd (Johnson &amp; Johnson)</td>
<td>~15,000</td>
<td>90% (in vaccine arm, after first injection)</td>
<td>99% (in vaccine arm, after second injection)</td>
<td>70%</td>
</tr>
<tr>
<td>Pfizer</td>
<td>BNT162</td>
<td>~18,600</td>
<td>100%</td>
<td>100% (in severe disease)</td>
<td>95%</td>
</tr>
<tr>
<td>Moderna</td>
<td>mRNA</td>
<td>~21,000</td>
<td>94.1%</td>
<td>95%</td>
<td>94.1%</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>rAd (J&amp;J)</td>
<td>~25,000</td>
<td>95%</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>rAd (Johnson &amp; Johnson)</td>
<td>~31,848</td>
<td>100%</td>
<td>90%</td>
<td>72% US, 66% w/ duration, 66% S, Africa, 63% B, EU, 62%</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>rAd (Johnson &amp; Johnson)</td>
<td>~40,000</td>
<td>100%</td>
<td>93%</td>
<td>60% US, 60% w/ duration, 60% S, Africa, 50% B, EU, 42%</td>
</tr>
<tr>
<td>Moderna</td>
<td>mRNA</td>
<td>~51,000</td>
<td>95%</td>
<td>90%</td>
<td>70% US, 50% w/ duration, 58% S, Africa, 60% B, EU, 50%</td>
</tr>
<tr>
<td>Moderna</td>
<td>mRNA</td>
<td>~56,000</td>
<td>94.1%</td>
<td>95%</td>
<td>94.1%</td>
</tr>
</tbody>
</table>

---

**Remember immunity - antibodies and cell-mediated**

- T cells are the major immune defense against viruses; preserved

**Memory T cells**
- CD4+ T cell
- CD8+ T cell

**Memory B cell**
- Produces antibodies (remember antibodies will wane with time, but memory B cells are blueprint to make more)

---

**Most vaccine trials measured antibodies and T cell responses**

---

**How does functional T-cell response modulate severity of disease?**

- T cell responses modulate the severity of disease
- Strong T cell responses in all of these trials seem to have led to prevention of severe disease
- J&J study shows us that those with asymptomatic infection mounted good T cell responses to COVID-19
- If you get re-infected after natural infection or vaccine (late), should be mild if mounted good T cell response
- Fun fact: Study from 1918 survivors of influenza pandemic show durable B cell immunity (memory B; Al) 90 years later!
**Company** | **Platform** | **Non-clinical results** | **F with vaccine (same placebo)** | **Protection (non-COVID-19 hospitalization)** | **Efficacy against COVID-19**
--- | --- | --- | --- | --- | ---
Bharat | Inactivated whole virus | 2 Neutralizing Abc; Strong SARS-CoV-1 (N protein) response | 11,000 doses | 100% | 78%
Sinovac | Whole inactivated virus | 2 Neutralizing Abc; SARS-CoV-2 S1 (T cell) responses | 13,618 doses | 100% | 72.6%
Sinopharm | Whole inactivated virus | 2 Neutralizing Abc; SARS-CoV-2 S1 (T cell) responses | 13,618 doses | 100% | 78.1%

Will vaccines work against variants and all against severe disease?
Short answer: yes because of T cells

Why T cell response will work against variants? First look at natural infection

Broad T cell repertoire (100s of T cells across spike protein) after infection. Means viral escape of T cell immunity (from both natural infection and vaccination) unlikely, re-infection if happens mild
Then look at T-cell response to variants after vaccines - still intact

- Looked at SARS-CoV-2-specific CD4+ & CD8+ T cell responses from those with natural infection with non-variant & examined activity against alpha, beta, gamma variants.
- T cell reactivity against those variants remained intact if you had natural infection or mRNA vaccination (Pfizer/Moderna).
- Same finding from UCSF paper - after vaccines, T cell response intact against alpha, beta variants.

Are vaccines waning in effectiveness with delta?
We need to first discuss B versus T cells!

Vaccine effectiveness – depends on many factors

- Virus factors: Variants, vaccine dose
- Immune factors: Immune status, vaccination
- Vaccine factors: Vaccine type, route of administration
- Host factors: Age, comorbidities
- Environmental factors: Setting of vaccination

Efficacy of mRNA vaccines against severe disease in settings where Delta variant is circulating, Sept 2021
You are 29.2 times more likely to get hospitalized if unvaccinated than vaccinated in time of delta.

ARS: What is the protection against hospitalization from Moderna in the US (with delta)

- 1. 63%
- 2. 72%
- 3. 80%
- 4. 88%
- 5. 93%

Protection against hospitalization with delta:
- Moderna: 93%
- Pfizer: 88%
- Johnson and Johnson: 71%

Memory B cells from vax or infection happily adapt to whatever variant they see.
Why have we seen more symptomatic breakthroughs with delta?

- Could be higher viral load
- Think more likely waning antibodies with time (protection in nose)
- Increasing duration between doses leads to higher antibodies (e.g., 8-12 weeks done in Canada and UK), less symptomatic breakthroughs in those two countries
- Less re-infection with Moderna than Pfizer2 (Mayo Clinic study with delta) – Moderna given at 4 weeks, Pfizer at 3 weeks
- Luckily, waning antibodies NORMAL, not a GLITCH and are made anew by memory B cells – that is what they do

1https://www.nature.com/articles/d41586-021-01295
2https://www.science.org/doi/10.1126/science.abm0829

Data from Canada shows Pfizer works better if extend interval to 7-8 weeks

Myocarditis (although mild/rare) more common with Pfizer q3 weeks (Israel) than longer intervals (usually 8)

0.66/100,000 total myocarditis cases

So, boosters for everyone or a tiered approach?
Antibodies come down naturally, but memory B cells produce more if they see the virus again. Memory B cells ADAPT their antibodies so they can cover variants. A booster will code for the same antibodies as ancestral strain.

Boosters approved for:
- Immunocompromised
- 65+ years
- 18-64+ with medical conditions

Given India data from WHO: 6.6 billion doses administered worldwide, what % have been administered in low-income countries?
1. 20%
2. 10.2%
3. 5.8%
4. 2.7%
5. 1.2%

Given J&J data from CDC, strong reason to boost J&J: Meeting OCTOBER 15.

ARS: Of the 6.6 billion doses given out worldwide, what % have been administered in low-income countries?
Do vaccines reduce transmission?
Yes, but with delta less so

**Will vaccines decrease transmission? Biological plausibility (4 main reasons)**

1. IgG antibodies measured in trials found in high levels in nasal mucosa
2. Systemic vaccines induce IgA (mucosal immunoglobulin) and recent study shows mRNA COVID-19 vaccines induce IgA
3. Monoclonal antibodies hasten viral clearance from airways
4. Challenge experiments with macaques in pre-clinical trials show blocking of viral replication (or no/low viral RNA) in BAL and nasal swabs (Mercado Nature J&J vax, 2020; Guebre-Xabier Vaccine Novavax 2020)

**PRIOR TO THE DELTA VARIANT**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Reduction in asymptomatic infections or transmission</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare workers in England</td>
<td>95%</td>
<td>Hall, Lancet, April 23, 2021</td>
</tr>
<tr>
<td>Healthcare workers in Israel</td>
<td>75% and 86%</td>
<td>Hall, Lancet, May 6</td>
</tr>
<tr>
<td>Patients in Japanese Health system</td>
<td>86.7%</td>
<td>FreeMed, February 17, 2021</td>
</tr>
<tr>
<td>Ministry of Health (nationwide)</td>
<td>86% (largest study)</td>
<td>FreeMed, February 17, 2021</td>
</tr>
<tr>
<td>Israel general population (Pfizer)</td>
<td>93%</td>
<td>Guebre-Xabier April 20, 2021</td>
</tr>
<tr>
<td>Non-surgical patients in Mayo Clinic system trained asymptptomatically</td>
<td>85%</td>
<td>Hall, Lancet, March 6, 2021</td>
</tr>
<tr>
<td>Healthcare workers in Cambridge University hospital</td>
<td>75%</td>
<td>Weekes, Authorea, February 24, 2021</td>
</tr>
<tr>
<td>First responders and medical staff in China</td>
<td>93%</td>
<td>Dagan, NEJM, February 24, 2021</td>
</tr>
<tr>
<td>Rural populations (with children unvaccinated)</td>
<td>93%</td>
<td>Thompson, MMWR, March 30, 2021</td>
</tr>
<tr>
<td>Long-term care facility, Spain</td>
<td>66%</td>
<td>Salazar, Medrxiv, April 13, 2021</td>
</tr>
<tr>
<td>Nursing homes, U.S. (non-students)</td>
<td>100%</td>
<td>Cavanaugh, MMWR, April 21, 2021</td>
</tr>
</tbody>
</table>

**Health**

How Provincetown, Mass., stress-tested the coronavirus vaccine with summer partying and delta

Showed us that
1) Delta variant likely to transmit from symptomatic breakthroughs but less so – will explain (no evidence from asymptomatic)
2) lots of exposure, lots of mild breakthroughs “stress test” but vaccines held up to their promise - prevented severe disease!
Delta variant not as infectious in vaccinated as unvaccinated though

- More transmissible
- Likely not as infectious from vaccinated than unvaccinated (Provincetown outbreak data looked at one point in time of CT values of PCR tests in vaccinated & unvaccinated being same)
- Singapore study of delta breakthroughs did serial testing and found viral loads (by CT) drop more quickly among the vaccinated
- NPIs work against delta

Delta variant outbreak in Singapore: https://www.medrxiv.org/content/10.1101/2021.07.28.21261295v1.full.pdf

Singapore tracing study showing asymptomatic vax'd spread rare (our post-doc counted 1 transmission from asymptomatic vax’d)

![Singapore tracing study showing asymptomatic vax'd spread rare](https://covid.viz.sg/historic.html)

CDC breakthrough data

- CDC keeping track of breakthrough infections in U.S.
- Out of >187 million Americans who are fully vaccinated against COVID-19
  - 13,775 hospitalised breakthroughs (0.01%) – 67% >65 years
  - Deaths 0.003% for COVID-19 (85% >65 years)

https://www.cdc.gov/vaccine/covid-19/health-departments/breakthrough-cases.html
ARS: What are the only two infectious diseases that have been eradicated worldwide?

1. Polio and smallpox
2. Filariasis and smallpox
3. Rinderpest and smallpox
4. Measles and smallpox
5. Filariasis and polio

Features of eradicable infectious diseases – like smallpox

- No animal reservoir
- Clear pathogenic features
- Short period of infectiousness
- Immune for life and then highly effective vaccine
- (COVID-19 looks like other respiratory illnesses, can spread when presymptomatic, in animals, vaccine good)
Pertussis comes under control/elimination with vaccines (measles) and vaccines/treatment (pertussis).

ARS: What is the only outpatient oral treatment for COVID-19 that looks like it works?

1. Hydroxychloroquine
2. Ivermectin
3. Molnupiravir
4. Monoclonal antibodies
5. AZT

**MOVe-OUT**

- Outpatients with mild-moderate COVID (O2 sat ≥93%)
  - Symptom onset within 5 days
  - One or more risk factors for severe COVID (including age >60, obesity, diabetes, CAD)
  - 800mg BID x 5 days vs Placebo
- Interim analysis of 775 patients of planned n=1550
- Latin America (55%), Europe (23%), Africa (15%) in addition to US
- 14.1% > 7.3% reduction in 1st endpoint of all-cause hospitalization/death
- No deaths in MOV vs 8 deaths PCBO
- Adverse events: 35% vs 40%, Drug related 12% vs 11%, D/c due to AE 1.3% vs 3.4%
- Viral sequencing in 40%: similar efficacy in Delta, Gamma & Mu
PFIZER AND BIONTech Announce Positive Topline Results from Pivotal Trial of COVID-19 Vaccine in Children 5 to 11 Years

September 20, 2021

- Results and data from a pivotal trial of any COVID-19 vaccine in children under 12 years of age
- In participants 5 to 11 years of age, the vaccine was safe, well tolerated, and induced robust neutralizing antibody responses
- Considers plans to submit these data to the FDA, EMA, and other regulatory agencies around the world as soon as possible
- Results in children under 5 years of age are expected as soon as later this year

Summary

- Vaccine trials show amazing efficacy and safety
- All vaccines reduce severe disease significantly, likely due to T-cell response
- Vaccines decrease transmission but more symptomatic and transmission with delta
- Variants can be managed – B cells
- Rare safety concerns – much more rare than COVID itself
- Molnupiravir, child vaccines coming – COVID getting under control
The state of the Covid-19 pandemic

Where did we come from?

Excerpts from an early COVID lecture, 7 March 2020

COVID-19 by date of report, China, 18 February-5 March 2020

COVID-19 outside of China by region and week, 20 January to 6 March 2020

*To date, 6 March
How will this end?

• Containment - increasingly unlikely
  • Keep large bulk of infection in China (currently 89%)
  • But large new clusters in Iran, Italy and South Korea with regional spread
  • New clusters of transmission will require aggressive follow-up, isolation and quarantine
  • Spring weather may give us a break
  • Key: rapid response to suspected cases
  • Can Italy and the EU contain their outbreaks?
  • How much has it already spread in the U.S.?

• Pandemic spread
  • Spread outside of China and sustained person-to-person transmission in other countries
  • Iran, Italy and South Korea
  • U.S. (Washington state, California)
  • How the EU handles COVID-19 will be key
  • Attack rate somewhere between <1% and 20%
  • Potentially very taxing on healthcare system (5% with critical disease)
  • Endemic cause of viral pneumonia?
  • Summer Olympics in Tokyo – what will happen?

Where do we stand?

Worldwide, national, statewide and local epidemiology of COVID-19 and SARS-CoV-2

COVID-19 cases world by day and country, 2020-2021

Worldwide:
234,809,103 total cases
-3,116,852 new cases last week (-8.62%)
4,800,375 total deaths
+54,170 last week (-3.89%)

COVID-19 cases and deaths are decreasing, United States and California, 2020-2021

United States
New reported case (per 100,000 people)
-3,760,260 +55,860 +1,090
New
Hospitalized
3,760,260 +55,860 +1,090

California
New reported case (per 100,000 people)
2,000,000 +400 +100
New
Hospitalized
1,000,000 +200 +50

1 October 2021
COVID-19 cases per 100,000 by state, last 7 days, United States, October 2021

Risk levels for unvaccinated people

Hospital ICU utilization by catchment area, United States, July-September 2021

COVID-19 mortality rates by county, United States, June 16-October 1, 2021
Statewide indicators, SARS-CoV-2 infection, California, 2021

- \( R_0 = 0.81 \)
- 2.6% test positivity
- Hospitalizations S 292 (14-day change: -21%)

Where are we going?

What can still go wrong?

1. Maldistribution of vaccine with substantial pockets of underimmunization that can sustain epidemic transmission
2. Emergence of more transmissible and less immunologically susceptible variants
3. Loss of confidence in vaccines and more vaccine hesitancy
4. Underutilization of newer technologies
5. Ignoring international spread
Vaccination coverage is highly variable in the U.S.

COVID-19 death rates by vaccination status, California and United States, 2021

COVID-19 vaccine doses administered, California, 2021

Currently vaccinating
- All Californians ≥12 years old
- Those requiring third doses and booster doses

- 49,028,206 doses administered
- 91,276 average per day for the last 7 days
- 67% of Californians have received ≥1 dose
- 60.4% have been fully vaccinated
- San Francisco: 80.8% with ≥1 dose, 75.9% fully vaccinated

1. Maldistribution of vaccine with substantial pockets of underimmunization that can sustain epidemic transmission
2. Emergence of more transmissible and less immunologically susceptible variants
3. Loss of confidence in vaccines and more vaccine hesitancy
4. Underutilization of newer technologies
5. Ignoring international spread
What is a variant?

• A group of coronaviruses that share the same inherited set of distinctive mutations is called a variant. If enough mutations accumulate in a lineage, the viruses may evolve clear-cut differences in how they function.

• SARS-CoV-2 variants of public health interest are in the spike protein (1,273 amino acids long)

Key mutations present in variants with reduced neutralization are around edge of ACE2 binding site

SARS-CoV-2 variants of concern, United States and California, 2021

Region including: California, Arizona, Hawaii, Nevada and all territories

<table>
<thead>
<tr>
<th>Variant</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1.617.2 (δ)</td>
<td>98.9%</td>
</tr>
<tr>
<td>Delta Plus (δ+)</td>
<td>0.6%</td>
</tr>
<tr>
<td>AV.2</td>
<td>0.2%</td>
</tr>
<tr>
<td>AV.1</td>
<td>0.4%</td>
</tr>
<tr>
<td>B.1.1.7 (α)</td>
<td>0.0%</td>
</tr>
<tr>
<td>P.1 (γ)</td>
<td>0.0%</td>
</tr>
<tr>
<td>B.1.621</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Rate of change

Covid-19, estimated transmissibility* of variants compared with original SARS-CoV-2 virus

<table>
<thead>
<tr>
<th>Variant</th>
<th>Scientific name</th>
<th>Relative transmissibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deltaδ</td>
<td>B.1.617.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Gamma</td>
<td>FI</td>
<td>1.5</td>
</tr>
<tr>
<td>Alpha</td>
<td>FI</td>
<td>2.0</td>
</tr>
<tr>
<td>Beta</td>
<td>FI</td>
<td>2.5</td>
</tr>
<tr>
<td>Delta Plus</td>
<td>FI</td>
<td>3.0</td>
</tr>
<tr>
<td>Epsilon</td>
<td>FI</td>
<td>3.5</td>
</tr>
<tr>
<td>SARS-CoV-2</td>
<td>FI</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Variant with higher number is more transmissible
Considerations for future variant emergence

- Lower transmission = less viral replication = fewer opportunities for variants to emerge
- But, as more people are vaccinated, there will be more immune pressure and possible escape
- However, the delta variant seems to be outcompeting other variants suggesting that our worst problem is before us right now
- And the current vaccines work pretty well against delta
- We have redundant immune systems and both cellular (T-cell) and humoral (B-cell, antibodies) immune systems
- Herd immunity is a moving target (waning immunity vs. boosters)
- Lower transmission
- Immunocompromised individuals will be protected by the herd

1. Maldistribution of vaccine with substantial pockets of underimmunization that can sustain epidemic transmission
2. Emergence of more transmissible and less immunologically susceptible variants
3. Loss of confidence in vaccines and more vaccine hesitancy
4. Underutilization of newer technologies
5. Ignoring international spread
Reasons for vaccine failure

• Mishandling
• Immunocompromise
• Therapeutics (e.g., tocilizumab)
• Genetic drift – variants
• Waning immunity

Failure to vaccinate (or to seek vaccination)
COVID-19 cases by vaccination status, Los Angeles County, May-July, 2021


FDA and CDC recommend booster dose for certain Pfizer-BioNTech vaccine recipients

- Newest recommendations
  - All adults ≥65 years old
  - Residents of long-term care facilities
  - People with underlying medical conditions that place them at risk of severe COVID-19
    - Grid
  - 18-64 years olds need to be assessed individually
  - Persons whose occupations but them at risk of exposure
    - Healthcare workers
    - Certain frontline institutional workers
  - Moderna and J&J boosters will be considered on October 14-15

Who’s eligible for Pfizer-BioNTech booster?

- People with certain medical conditions that place them at higher risk of severe COVID-19 outcomes (50-64 years old should 18-49 may)
  - Cancer
  - Chronic kidney disease*
  - Chronic lung diseases
  - Dementia or other neurologic conditions
  - Diabetes mellitus
  - Down syndrome
  - Heart conditions
  - HIV infection
  - Immunocompromised state*
  - Liver disease
  - Overweight and obesity
  - Pregnancy and recent postpartum
  - Sickle cell disease or thalassemia
  - Smoking, current or former
  - Solid organ or blood stem cell transplant*
  - Stroke or cerebrovascular disease
  - Substance use disorders
  - People aged 18-64 years at increased risk for COVID-19 exposure and transmission because of occupational or institutional setting
    - First responders (healthcare workers, firefighters, police, congregate care staff)
    - Correctional institutions
    - Childcare workers
    - Support staff, daycare workers
    - Food and agriculture workers
    - Manufacturing workers
    - Corrections workers
    - U.S. Postal Service workers
    - Public transit workers
    - Grocery store workers
  - *Should receive additional dose regardless of age or primary series

Status of pediatric COVID-19 vaccines

• Pfizer announced results today
• Study of >2,000 5-11 year olds
• Comparable neutralizing antibody levels as in previous study of 16-25 year olds (proxy marker)
• Common side effects: pain, fatigue, headaches, chills, mild fever, myalgia for 1-3 days; no cases of myocarditis
• Now goes to FDA for approval of extended EUA (October 26)

1. Maldistribution of vaccine with substantial pockets of underimmunization that can sustain epidemic transmission
2. Emergence of more transmissible and less immunologically susceptible variants
3. Loss of confidence in vaccines and more vaccine hesitancy
4. Underutilization of newer technologies
5. Ignoring international spread

SARS-CoV-2 antigen tests

• Test for the presence of viral proteins rather than viral RNA (which is what PCR tests for)
• Lower sensitivity than PCR but highly sensitive during period of peak infectiousness
• Several are available over the counter or by prescription for home use
• Additionally, two nucleic acid tests have been authorized for home use

FDA-Approved SARS-CoV-2 antigen tests for home use

<table>
<thead>
<tr>
<th>Name</th>
<th>Manufacturer</th>
<th>How to use</th>
<th>Retail price (per test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BinaxNOW</td>
<td>Abbott</td>
<td>2-3X with 24-36 hours between tests</td>
<td>$14-24 for two</td>
</tr>
<tr>
<td>Flowflex</td>
<td>ACON</td>
<td>One time</td>
<td>$25 for one test</td>
</tr>
<tr>
<td>Elluminate</td>
<td>Elluminate</td>
<td>One test</td>
<td>$26-39 for one test</td>
</tr>
<tr>
<td>QuickVue</td>
<td>Quidel</td>
<td>2X with 24-36 hours between tests</td>
<td>$24-25 for two</td>
</tr>
</tbody>
</table>

Other authorized home tests: Becton Dickinson (BD Veritor), Acros Bio (Cantaburn), Oralure (Intelvene)

Post-exposure prophylaxis with REGEN-COV antibody, household contacts of COVID-19 patients

One 1200 mg dose of REGENCOV (600 mg each of casirivimab and imdevimab) subcutaneously within 96 hours of household exposure
1. Maldistribution of vaccine with substantial pockets of underimmunization that can sustain epidemic transmission
2. Emergence of more transmissible and less immunologically susceptible variants
3. Loss of confidence in vaccines and more vaccine hesitancy
4. Underutilization of newer technologies
5. Ignoring international spread

U.S. will support compulsory licensing of COVID vaccines
- Waiver of intellectual property for public health emergencies
- WTO allows under TRIPS
- Countries who apply for waiver can manufacture their own vaccines or biologics without IP infringement

What have we learned?
What could we have done differently and how do we respond next time?
### Lessons learned for future pandemics

- Early warning systems are key with focus on human-animal interfaces (OneHealth approach)
- Internationalism is essential
- Employ private sector solutions for manufacturing and distributing early prototype diagnostic and screening tests
- Strengthen domestic and global health architecture for pandemic preparedness and response
- Invest in public health and rebuild public health infrastructure

### In summary

- As with any vaccine preventable disease, primary reason for incident cases is failure to vaccinate
- Counties with highest incidence have lowest immunity (natural plus vaccine-acquired immunity)
- Breakthroughs remain rare (about 1/3600 fully vaccinated people)
- We seem to be coping with the delta variant (at least in California)
- Likely to continue to see outbreaks in non-immune populations through fall – will we see another winter peak like in 2020-2021?
- What eventually happens in school children will depend on (1) community levels of transmission, (2) 12-to-17-year-old vaccination coverage (currently very high) and (3) how soon mRNA vaccine will be approved for 5-to-11-year-old students (FDA will review on 26 October)
- Potential for influenza A and RSV syndemics
High Yield Neurological Examination

Vanja Douglas, MD
Sara & Evan Williams Foundation Endowed Neurohospitalist Chair
Director, Neurohospitalist Division
Associate Professor of Clinical Neurology
UCSF Department of Neurology

Disclosures
None

Purpose of Neuro Exam

• Screen asymptomatic patients
• Screen patients with symptoms that could indicate a focal neurologic lesion (e.g. back pain, headache, seizure)
• Localize the lesion in patients with neurologic deficits
  • Generate a differential diagnosis
  • Decide what test to get next (e.g. brain MRI, spine MRI, EMG/NCS, CK)

Typical “Screening” Neuro Exam

• Mental Status: Level of alertness, orientation, attention, language, memory
• Cranial Nerves: I through XII
• Motor: Bulk, tone, power in all muscles in both arms and legs
• Sensory: Light touch, vibration/joint position sense, pain/temperature, Romberg
• Reflexes: Biceps, triceps, brachioradialis, knees, ankles, plantar response
• Coordination: Finger-nose-finger, heel-knee-shin
• Gait: Observe gait, include tandem, heel, and toe walking
High Yield Screening Neuro Exam

- Mental Status
- Cranial Nerves
- Motor
- Sensory
- Coordination
- Reflexes
- Gait

Language

Expressive Aphasia

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>Intact</td>
</tr>
<tr>
<td>Repetition</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

Receptive Aphasia

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Intact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>Impaired</td>
</tr>
<tr>
<td>Repetition</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

Conduction Aphasia

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Intact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>Intact</td>
</tr>
<tr>
<td>Repetition</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

Extraocular Movements
High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor
- Sensory
- Coordination
- Reflexes
- Gait

Motor System

2 minute screen for upper motor neuron weakness:

- Pronator Drift
- Finger taps & Foot taps
- Distal extensor power:
  - Finger extensors
  - Tibialis anterior
High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor: Pronator drift, finger and foot taps, finger extensor and extensor hallucis longus power
- Sensory
- Coordination
- Reflexes: Biceps, knees, and ankles
- Gait

Coordination & Gait

- Hemispheres:
  - Finger-nose-finger
  - Heel-knee-shin
- Vermis:
  - Gait

Why Do A Sensory Exam?

- If there are sensory complaints
- If there are balance complaints or a gait disorder
- If there is weakness
High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor: Pronator drift, finger and foot taps, finger extensor and extensor hallucis longus power
- Sensory: (If done, do pain OR temp + vibration OR JPS)
- Coordination: Finger-nose-finger and heel-knee-shin (can replace HKS with gait)
- Reflexes: Biceps, knees, and ankles
- Gait: Observe gait (base, stride, posture, arm swing, turn), tandem

Think Like A Neurologist

- Chief Complaint: suspected localization
- History: refine the localization
- Exam: pick maneuvers that rule in or rule out your suspicions

Let’s practice!
Case Scenarios
Patient #1

- A 23 y/o woman with a history of migraine headaches is admitted to the hospital with left leg cellulitis. On hospital day 2, she complains of a new headache. She says it’s different from her previous migraines because it is “much worse” and is wondering if she needs an MRI.

Headache

- Suspected localization
- Focal brain lesion

Patient #2

- 57 y/o man hospitalized with MI is altered after his cardiac cath. He is somnolent but arousable, mumbling incoherently. His family is very concerned that he has had a stroke.
Altered Mental Status

Suspected localization
• Bilateral hemispheres
• Brainstem

Patient #2 Exam
• Arouses to touch
• Names simple objects, repeats short phrases, follows simple commands
• Disoriented and unable to test attention
• EOMI; face symmetric; blinks to threat bilaterally
• Left arm drifts and hand is clumsy
• Withdraws less briskly to pain in the left leg
• Head CT is normal

Multifocal Strokes

Patient #3
• A 65 y/o man with prostate cancer presents with bilateral leg weakness and urinary urgency.
Bilateral Leg Weakness

Suspected localization
• Spinal cord
• Cauda equina
• Neuropathy
• Neuromuscular junction
• Muscle

<table>
<thead>
<tr>
<th></th>
<th>UMN</th>
<th>LMN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern of Weakness</td>
<td>Predominant</td>
<td>Variable</td>
</tr>
<tr>
<td>Function/Decrement</td>
<td>Slow alternate motion rate</td>
<td>Impairment of function is mostly due to weakness</td>
</tr>
<tr>
<td>Tone</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Tendon Reflex</td>
<td>Increased</td>
<td>Decreased, absent or normal</td>
</tr>
<tr>
<td>Other signs</td>
<td>Babinski sign, other CNS signs (e.g., aphasia, visual field cut)</td>
<td>Atrophy (except with problem of neuromuscular junction)</td>
</tr>
</tbody>
</table>

Spinal Cord Cross-Section

Patient #3: Exam

• Decreased EHL power bilaterally
• Slow foot taps
• Brisk knee jerk and ankle jerk reflexes
• Reduced joint position sense in toes
• Sensory level to pinprick at T5
Metastatic Spinal Cord Compression

Vertigo

Suspected localization
• Brainstem (central)
• Cerebellum (central)
• Inner ear (peripheral)

Patient #4

• A 30 y/o woman with lupus, APLAS, and history of endocarditis on gentamycin presents with acute vertigo.

Hypothesis-Driven Neuro Exam
HINTS

- Head Impulse Test
  - Abnormal = peripheral
- Nystagmus
  - Unidirectional = peripheral
  - Direction-changing = central
- Test of Skew
  - Skew deviation = central
- https://youtu.be/3q-VTKPweuk

Patient #4: Exam

- Left beating nystagmus in left-gaze only
- Positive head thrust test to the right

Gentamycin Toxicity

Summary

- High yield screening exam
- Hypothesis driven approach to:
  - Suspected focal brain lesion
  - Altered mental status
  - Suspected spinal cord lesion
  - Vertigo
**Bonus Case**

- A 32 y/o woman presents with tingling in the hands and feet that progressed to diffuse weakness in the arms and legs over four days. She is now so weak she can no longer sit up.

**Diffuse Weakness**

- **Suspected localization**
  - High spinal cord
  - Neuropathy
  - Neuromuscular junction
  - Myopathy

**Localization of Weakness**

<table>
<thead>
<tr>
<th>Pattern of weakness</th>
<th>Tone</th>
<th>Bulk</th>
<th>Reflexes</th>
<th>Sensory Loss</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Motor Neuron</td>
<td>Pyramidal</td>
<td>Normal</td>
<td>Increased</td>
<td>Varies</td>
<td></td>
</tr>
<tr>
<td>Anterior Horn Cell</td>
<td>Pyramidal or myotomal</td>
<td>Spastic or normal</td>
<td>Atrophy</td>
<td>Increased or decreased</td>
<td>None Fasciculations</td>
</tr>
<tr>
<td>Peripheral Nerve</td>
<td>In distribution of root or nerve</td>
<td>Normal or reduced</td>
<td>Atrophy</td>
<td>Decreased</td>
<td>Prominent</td>
</tr>
<tr>
<td>Neuromuscular Junction</td>
<td>Diffuse</td>
<td>Normal</td>
<td>Normal (myasthenia) orAbsent (botulism)</td>
<td>None</td>
<td>Phosisis and ophthalmo paresis</td>
</tr>
<tr>
<td>Muscle</td>
<td>Proximal &gt; Distal</td>
<td>Normal</td>
<td>Normal or patterned atrophy</td>
<td>Normal</td>
<td>None</td>
</tr>
</tbody>
</table>
Next Step?

- Lumbar puncture:
  - Protein 143
  - WBC 2
- Guillain-Barre Syndrome

Acknowledgements

- Hooman Kamel
- Andy Josephson
- Dan Lowenstein
- Ann Poncelet
Algorithmic Approach to Lung Opacities

Brett M. Elicker, MD
University of California, San Francisco

Approach to lung opacities

- This is hard!
- You will not be an expert today
- Approach
- Practice
- Think like a pathologist

Categories of lung opacities

- 1. Consolidation
- 2. Interstitial (diffuse lines or nodules)
- 3. Airways
- 4. One or a few nodules
Consolidation

- Confluent opacity
- Fluffy around periphery
- Air bronchograms
- Lack of volume loss

Confluent opacity, no volume loss

Air bronchograms
Well-defined: interstitial
Ill-defined: alveolar

Consolidation

- Acute vs. chronic symptoms
- Distribution
- Acuity of changes
- Differential diagnosis in acute setting
  - Focal: pneumonia/aspiration, hemorrhage
  - Diffuse: edema, acute lung injury, pneumonia, hemorrhage

Invasive mucinous adenocarcinoma

2 month f/u
Chronic alveolar disease

• Tumor
  – Invasive mucinous adenocarcinoma (aka multifocal bronchoalveolar CA)
  – Lymphoma (recurrent or 1° pulmonary)
• Inflammatory
  – Organizing pneumonia
  – Chronic eosinophilic pneumonia
  – Sarcoidosis
• Other
  – Lipid pneumonia
  – Alveolar proteinosis

Comparison

Signs of atelectasis: volume loss

Fissure displacement
Deviating mediastinal structures
Elevated diaphragm
Atelectasis (types)

- Obstructive/resorptive (obstruction of bronchus)
- Passive (compression of lungs)
- Cicatricial (related to scarring)
- Adhesive (surfactant deficiency)
Lung cancer (Golden S sign)

Lower lobe atelectasis

Combined RML/RLL atelectasis
Left upper lobe collapse

- Veil-like density
- Volume loss
  - Elevated diaphragm
  - Elevated left PA
- Luftsichel sign

Interstitial opacities

Nodules

Nodules: diff dx

- Hematogenous spread
  - Miliary tuberculosis
  - Miliary fungal infection (e.g. coccidioidomycosis)
  - Metastases
- Lymphatic spread
  - Sarcoidosis
  - Lymphangitic spread of tumor
  - Pneumoconioses (e.g. silica)
Histoplasmosis

Miliary tuberculosis

Interstitial: lines

Causes of interstitial lines

- Edema
- Malignancy
- Fibrotic lung diseases (this is a long list)

Kerley-b lines may be present

These lines are typically thick, wavy and irregular
Linear opacities

Pulmonary edema (kerley-b lines)
Reticular opacities (distribution)

- Lower lobe predominant
  - Idiopathic pulmonary fibrosis
  - Connective tissue disease
  - Drugs
  - Asbestosis
  - Hypersensitivity pneumonitis
- Upper lobe predominant
  - Sarcoidosis
  - Prior TB/fungus
  - Pneumoconioses

Idiopathic pulmonary fibrosis

Hypersensitivity pneumonitis

Tuberculosis
Airways disease

- Circular
- Tubular
Differential diagnosis of airways disease

• Mild:
  – Asthma
  – Viral infection
  – Chronic bronchitis
  – Etc.

• Severe:
  – Bronchiolitis obliterans
  – Immunodeficiency
  – Ciliary dyskinesia
  – Cystic fibrosis
  – ABPA
  – Tuberculosis
  – Cartilage diseases

Which compartment of lung is affected?

Solitary pulmonary nodule: differential diagnosis

• Granuloma
• Hamartoma
• Primary bronchogenic carcinoma
• Metastasis
• Lots of others
## Nodules: benign vs. malignant

<table>
<thead>
<tr>
<th>Benign</th>
<th>Malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small size</td>
<td>Large size</td>
</tr>
<tr>
<td>Smooth border</td>
<td>Spiculated border</td>
</tr>
<tr>
<td>Diffuse calcification</td>
<td>No or irregular calcification</td>
</tr>
<tr>
<td>Stability over time</td>
<td>Growth over time</td>
</tr>
</tbody>
</table>
So you see a nodule on CXR…

- 1. Is it actually a nodule?
So you see a nodule on CXR…

- 1. Is it actually a nodule?
- 2. Look for prior films?
- 3. Is diffuse calcification present?
So you see a nodule on CXR…

- 1. Is it actually a nodule?
- 2. Look for prior films?
- 3. Is diffuse calcification present?
- 4. Get a CT scan or a follow-up CXR

### Algorithmic Approach to Lung Opacities

#### Category Subcategory CXR features Common causes

#### Alveolar
- Nodules
  - Confluent opacities
  - Air bronchograms
  - Fluffy edges
  - Edema
  - Acute lung injury
  - Infection

#### Interstitial
- Nodules
  - Small, well-defined nodules
  - Opacities not confluent
  - Normal lung between nodules
  - Tuberculosis
  - Fungal infection
  - Metastases
  - Sarcoidosis

- Lines (kerley-b)
  - Thin, fine, delicate lines
  - Lines at periphery of lung (kerley-b)
  - Pulmonary edema
  - Cancer

- Lines (reticular)
  - Thick, wavy, irregular lines
  - Fibrotic lung disease

#### Airways
- Circular or tubular
- Thin or thick walled
- Numerous causes

#### Not in a single compartment
- One or a few nodules (≤3 cm) or masses (>3 cm)
- Lung cancer
- Metastasis
- Granuloma
- Hamartoma

On to the cases…
Cardiac & Pulmonary Risk Assessment in the Surgical Patient

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University of California, San Francisco

Preoperative Evaluation Guidelines

Cardiac:

Pulmonary:

Preoperative Cardiac Evaluation

1. Is this patient at increased risk for perioperative cardiac complications?
2. Does the patient need further preoperative medical tests to clarify this risk?
3. What should be done to reduce the risk of cardiac complications?

Clinical Risk Prediction

What increases this patient's risk for perioperative cardiac complications?
70-y.o. man with progressive weakness due to cervical myelopathy need spinal decompression & fusion. He needs help with some ADLs and walks slowly with a cane.

He has stable coronary artery disease & HTN
He is an active smoker.
**Question 1: What increases this patient’s risk for perioperative cardiac complications?**

1. History of coronary disease  
2. History of HTN  
3. Current smoker  
4. Limited functional status  
5. All of the above

**Identifying Higher Risk Patients**

- Heart disease (and equivalents) predicts risk
- Heart disease risk factors do not

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic heart disease</td>
<td>2.4</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.9</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.8</td>
</tr>
<tr>
<td>History of Stroke or TIA</td>
<td>3.2</td>
</tr>
<tr>
<td>Poor functional status</td>
<td>1.8</td>
</tr>
</tbody>
</table>

**Surgery Specific Risk**

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Procedures</th>
</tr>
</thead>
</table>
| High (> 5% risk) | Major aortic or peripheral vascular surgery  
|             | Emergent major surgery  
|             | Long cases w/ large fluid shifts or blood loss                              |
| Intermediate (< 5% risk) | Carotid endarterectomy  
|                          | Head & Neck  
|                          | Abdominal & Thoracic  
|                          | Orthopedic                                   |
| Low (< 1% risk) | Endoscopic procedures  
|                 | Skin & Breast                                      |

**Revised Cardiac Risk Index**

- Predictors:  
  - Ischemic heart disease  
  - Congestive heart failure  
  - Diabetes requiring insulin  
  - Creatinine > 2 mg/dL  
  - Stroke or TIA  
  - "High Risk" operation (intraperitoneal, intrathoracic, or suprainguinal vascular)

<table>
<thead>
<tr>
<th># of RCRI</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>2</td>
<td>2.4%</td>
</tr>
<tr>
<td>≥ 3</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

RCRI ≥ 2 is “Elevated Risk”

NSQIP Cardiac Risk Prediction Tool

Derived from National Surgical Quality Improvement Program (NSQIP) database:
• > 400,000 patients in derivation & validation cohorts
• Wide range of operations
• "Complication" = 30-day incidence of MI & cardiac arrest

| Independent Predictors | 1. Type of surgery | 2. Age | 3. Serum creatinine > 1.5 mg/dL | 4. Functional status (dependency for ADLs) | 5. American Society of Anesth (ASA) class |


What is ASA Classification?

American Society of Anesthesiologists Physical Classification:
1. Healthy, normal
2. Mild systemic disease
3. Severe systemic disease
4. Severe systemic disease that is a constant threat to life
5. Moribund patient not expected to survive without surgery

70-y.o. with h/o CAD, now undergoing cervical spine surgery. Needs help with some ADLs.
Age 70
Cr < 1.5
ASA Class 3
Partially dependent
Spine surgery

https://qxmd.com/calculate/calculator_245/gupta-perioperative-cardiac-risk

70-y.o. with h/o CAD undergoing cervical spine surgery for progressive weakness.

https://qxmd.com/calculate-online/cardiology/gupta-perioperative-cardiac-risk

NSQIP Prediction Tool:
• Excellent performance (AUC = 0.88)
• Doesn’t account for all available information
• ACC/AHA defines risk > 1% as "elevated risk"
Which Prediction Tool is Better?

<table>
<thead>
<tr>
<th></th>
<th>RCRI</th>
<th>NSQIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>~ 4000</td>
<td>~ 400,000</td>
</tr>
<tr>
<td># of hospitals</td>
<td>1</td>
<td>&gt; 200</td>
</tr>
<tr>
<td>Currency of data</td>
<td>1989 – 94</td>
<td>2007 – 08</td>
</tr>
<tr>
<td>Screen for MI?</td>
<td>CK-MB, ECG</td>
<td>No</td>
</tr>
</tbody>
</table>

2014 ACC/AHA guideline endorses both tools:
- Elevated risk defined as RCRI > 2 or NSQIP risk > 1%

ACC/AHA: When is Risk Excessive?

- Unstable coronary syndromes
  - Recent MI with post-infarct ischemia
  - Class III or IV angina
- Decompensated CHF
- Significant arrhythmia
  - High grade atrioventricular block
  - Symptomatic ventricular arrhythmia
  - Supraventricular arrhythmia with uncontrolled rate
- Severe valve disease (e.g., critical aortic stenosis)

Utility of Stress Testing

Is further preoperative cardiac testing indicated?

A 63 y.o. man will undergo a Whipple procedure for newly diagnosed pancreatic cancer. He had a remote myocardial infarction, diabetes, and HTN. He has not had chest pain in the past year. Fair functional capacity.

Meds: lovastatin, atenolol, glyburide, benazepril, ASA
PEx: BP=115 / 70 HR=60; normal heart & lung exam
ECG: NSR, LVH, otherwise normal

Severe or unstable cardiac disease that requires urgent evaluation & treatment, regardless of planned surgery
Question 2:

63 y.o. man s/f Whipple procedure. Remote MI, long-standing diabetes & HTN. No chest pain.

Should this patient receive further preoperative tests?
1. No further testing
2. Yes, perform a stress test

Noninvasive Stress Testing

Predictive value:
- Mainly studied in vascular surgery patients
- Strong negative predictive value ~ 98% (neg LR = 0.1 - 0.2)
- Weak positive predictive value ~ 10 - 20% (pos LR = 2 - 3)
- Adds little information to lower risk patients
- More useful for cases with increased risk

2014 ACC/AHA Guideline

Low Clinical Risk? (≤ 1% or RCRI = 0 or 1)
- no

Functional Capacity?
- < 4 METs or ?

Will stress test result change management?
- yes

Revascularization

Should this patient have coronary revascularization?

A 63 y.o. man pancreatic cancer is being considered for a Whipple procedure. History of remote MI, diabetes, HTN. No chest pain in the past year. Fair functional capacity. Persantine-Mibi last year showed mild inferior reversibility. Coronary cath showed a 75% RCA lesion and normal LVEF. He did not receive PCI.
Question 3:

63 y.o. man with CAD undergoing Whipple procedure. His P-Mibi showed mild inferior reversibility. Angiogram showed a 75% RCA lesion and normal LVEF.

Should this patient have coronary revascularization?

1. No, proceed to surgery
2. Consult cardiologist for possible PCI

Carp Trial: Coronary Artery Revascularization Prophylaxis

510 patients undergoing vascular surgery
- At least 1 vessel with 70% occlusion
- Excluded left main dz, AS, or LVEF < 20%

Choice of CABG or PCI plus Medical management
- Medical management alone

1st Endpoint: Long-term mortality
2nd Endpoint: MI, Stroke, Limb loss, Dialysis

Carp: Complications After CABG or PCI

<table>
<thead>
<tr>
<th>Complication</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>1.7%</td>
</tr>
<tr>
<td>MI</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

Carp: Outcomes After Vascular Surgery

<table>
<thead>
<tr>
<th></th>
<th>Revascularized (n=225)</th>
<th>Med Mgt Only (n=237)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death before surgery</td>
<td>10 (4%)</td>
<td>1</td>
</tr>
<tr>
<td>Death &lt; 30 days post-op</td>
<td>7 (3%)</td>
<td>8 (3%)</td>
</tr>
<tr>
<td>Postoperative MI</td>
<td>26 (12%)</td>
<td>34 (14%)</td>
</tr>
<tr>
<td>Long-term mortality (2.7 yrs after randomization)</td>
<td>70 (22%)</td>
<td>67 (23%)</td>
</tr>
</tbody>
</table>

p = NS for all comparisons

ACC/AHA Guidelines for PCI

- Indications for PCI are same as for nonsurgical patients
- Avoid PCI if antiplatelet drugs will need to be held prematurely
- Delay elective surgery after elective PCI:
  - Bare metal stent: 30 days
  - Drug eluting stent: 6 months (optimal) 3 months (if harm in delay)
- Continue or restart antiplatelet agents (especially ASA) as soon as possible, unless bleeding risk precludes

Medical Management

Question 4:
Which medication(s) should before surgery? 80-y.o. woman with a remote stroke, diabetes, and HTN will undergo repair of hip fracture. She has been out of care, and she is not taking any medications other than metformin for diabetes.

1. Metoprolol
2. Aspirin
3. Atorvastatin

Rise & Fall of Beta-blockers

- Early trials showed that starting beta-blockers prevented postoperative MI and reduce mortality
- Subsequent studies less impressive, and some positive studies discredited for fraud
- Largest study found small benefit on MI prevention, but increased overall mortality

POISE Trial Results

Metoprolol XL:
Reduced cardiac events (mostly nonfatal MI) but increased risk of stroke & total mortality

Lancet, 2008; DOI: 10.1016/S0140-6736(08)60601-7
2014 ACC / AHA Guideline for \(\beta\)-blockers

**Definite indications to continue if...** (Helps)
- Already using \(\beta\)-blocker to treat angina, HTN, arrhythmia

**Reasonable to consider initiation if...** (Maybe)
- High clinical risk (RCRI score > 3)
- Ischemia seen on preoperative stress test
- Compelling indication for long-term beta-blockade

**Avoid initiation...** (Harms)
- On day of surgery

---

POISE 2: Aspirin Results

<table>
<thead>
<tr>
<th></th>
<th>Aspirin</th>
<th>Placebo</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or MI</td>
<td>7.0%</td>
<td>7.1%</td>
<td>0.99 (NS)</td>
</tr>
<tr>
<td>Non-fatal MI</td>
<td>6.2%</td>
<td>6.3%</td>
<td>0.98 (NS)</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>4.6%</td>
<td>3.8%</td>
<td>1.23 (p = 0.04)</td>
</tr>
</tbody>
</table>

Devereaux, PJ et al. NEJM 2014; 370:1494-03

POISE 2 – Patients with PCI

Non-prespecified analysis of subgroup of the 470 patients with history of prior PCI:

<table>
<thead>
<tr>
<th></th>
<th>Aspirin</th>
<th>Placebo</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or MI</td>
<td>6.0%</td>
<td>11.5%</td>
<td>0.50 (p = 0.038)</td>
</tr>
<tr>
<td>Non-fatal MI</td>
<td>5.1%</td>
<td>11.0%</td>
<td>0.44 (p = 0.02)</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>5.6%</td>
<td>4.2%</td>
<td>1.26 (p = 0.04)</td>
</tr>
</tbody>
</table>


2014 ACC / AHA Guidelines

**Aspirin (for patients without stent)**
- Not unreasonable to continue ASA in elective surgery if benefits outweigh risks from bleeding (Class 2b)
- Initiation of ASA does not benefit patients undergoing elective noncardiac surgery (Class 3)

**Trial of Statins in Vascular Surgery**

- Placebo: 10.1%
- Fluvastatin XL: 4.8%

Reduced nonfatal MI
No difference in rates of LFT or CPK elevation

---

**2014 ACC / AHA Guideline (Statins)**

**Definitely continue if...** (Class I)
- Patient is already taking statins chronically

**Reasonable to initiate if...** (Class 2a)
- Patient is having vascular surgery

**Not unreasonable to initiate if...** (Class 2b)
- Patient has elevated clinical risk and is undergoing a moderate or high risk operation

---

**Take Home Points**

**Use a validated clinical prediction tool:**
- RCRI is easy to use & has become the "new standard"
- NSQIP tool may be more broadly applicable

**Reserve stress testing for highest risk patients:**
- Elevated risk and poor functional status
- Only do stress test if results will change management (e.g., cancel, delay, or modify surgery)

---

**Take Home Points**

**Beware perioperative coronary revascularization:**
- Indications are the same as for non-surgical patients
- Don’t perform PCI if patient may have upcoming surgery that requires stopping antiplatelet therapy

**Medical management:**
- Only consider beta-blockers in very high risk patients after considering risks, and not immediately before surgery
- Possible role for initiating statin
Preoperative Pulmonary Evaluation

1. Is this patient at increased risk for perioperative pulmonary complications?

2. Does the patient need further preoperative medical tests to clarify this risk?

3. What should be done to reduce the risk of pulmonary complications?

Pulmonary Risk Prediction

What do you recommend for this patient?

A 65 y.o. man is to undergo repair of an abdominal aortic aneurysm. He has COPD and continues to smoke. He denies change in cough, or worsening of his chronic dyspnea when walking uphill.

Exam: Resp Rate 20 O2 sat 95% RA
Lungs: prolonged expiration, no wheeze

Question 5:

65 y.o. man is s/f repair of an AAA. He has COPD and smokes. No change in cough or usual chronic dyspnea.

Which of the following will be helpful?

1. Obtain PFTs
2. Quit smoking first before surgery
3. Incentive spirometry after surgery
Pathophysiology of Postoperative Pulmonary Complications

Normal

Tidal Breathing

Closing Volume

Decreased FRC

• Incisional pain
• Anesthesia
• Supine position

Abnormally high Closing Volume

• Age
• COPD
• Smoking

Procedure Related Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurosurgery</td>
<td>2.5</td>
</tr>
<tr>
<td>Head &amp; Neck</td>
<td>2.2</td>
</tr>
<tr>
<td>Aortic</td>
<td>6.9</td>
</tr>
<tr>
<td>Thoracic</td>
<td>4.2</td>
</tr>
<tr>
<td>Abdominal</td>
<td>3.0</td>
</tr>
<tr>
<td>Vascular</td>
<td>2.1</td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>2.2</td>
</tr>
<tr>
<td>Prolonged surgery</td>
<td>2.3</td>
</tr>
<tr>
<td>General anesthesia</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Patient Related Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 80 - 89</td>
<td>2.3</td>
</tr>
<tr>
<td>70 - 79</td>
<td>5.6</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>2.9</td>
</tr>
<tr>
<td>COPD</td>
<td>2.4</td>
</tr>
</tbody>
</table>

ASA Class ≥ II vs. Class I: Odds ratio = 4.9
ASA Class ≥ III vs. Class I or II: Odds ratio = 3.1

Respiratory Failure Prediction Tool

- Derived from National Surgical Quality Improvement Program (NSQIP) database:
  - > 400 K patients in derivation & validation cohorts
  - Wide range of operations
  - "Respiratory Failure" = on vent > 48 hrs or reintubation

Independent Predictors

1. American Society of Anesthes (ASA) class
2. Functional status (dependency)
3. Type / location of surgery
4. Emergency surgery
5. Preoperative sepsis or SIRS

**Respiratory Failure Prediction Tool**

- Emergency surgery? No
- ASA Class 3 (severe systemic)
- Function/dependency Independent
- Surgery type Aortic
- Sepsis or SIRS? No

**Pulmonary Function Tests & Spirometry**

PFT & spirometry add little to risk assessment
- Usually just tells you what you already know
- Abnormal chest exam findings more predictive of PPC
- Can’t use results to identify patients with prohibitively high risk of PPC or mortality
- Use as diagnostic tool to evaluate unexplained findings

**Preoperative Prevention Strategies**

- Optimize chronic lung disease
  - Treat COPD exacerbation (steroids, antibiotics)
- Smoking cessation
  - Limited evidence for benefit for PPC but other benefits
  - May require 8 weeks of cessation for benefit
- Respiratory conditioning
  - Education on lung expansion & Inspiratory muscle training
  - Benefit seen in RCTs in cardiac surgery
Preoperative Smoking Cessation Counseling

RCTs of Preoperative Smoking Cessation Counseling:
1. 120 patients undergoing arthroplasty in 6-8 weeks
2. 60 patients undergoing colorectal resection in 2-3 weeks

**Intervention:** Smoking cessation counseling & offer free nicotine replacement products

**Outcomes:** Postop complications, especially wound related (e.g., dehiscence, infection, hematoma)

**Smoking Cessation 6-8 Weeks Before TKA or THA**

**Smoking Cessation 2-3 Weeks Before Colorectal Surgery**

Postoperative Prevention Strategies

**Lung expansion maneuvers**
- Deep breathing or incentive spirometry recommended, though quality of evidence poor
- Consideration of CPAP for very high risk patients

**I COUGH – a multi-intervention strategy to prevent PPC**
- Incentive spirometry, Coughing & deep breathing, Oral care, Understanding, Get out of bed tid, Head of bed elevated
- Reduced postop pneumonia and unplanned reintubation
Causes of Postoperative Hypoxemia

Upper airway obstruction
- Early onset - often POD 0 or prior to leaving PACU
- Airway edema, vocal cord injury, laryngospasm, OSA

Atelectasis
- Often onset POD 1-2
- Secretion management: chest therapy, pulmonary toilet
- Positive airway pressure: CPAP, BiPAP, EzPAP

Pulmonary edema
- Often onset by POD 2
- Cardiogenic vs. non-cardiogenic

Pneumonia
- Most common in first 5 days postop (unless on ventilator)
- Think Staph aureus & gram negative rods
- Pseudomonas? Risk with ≥ 5 days hospitalization or prior antibiotic exposure, dialysis, nursing home

Other etiologies:
- Pulmonary embolism
- Bronchospasm
- Effusions – common after abdominal surgery, usually small, exudative and usually don’t require treatment

Take Home Points

Patient related risks:
- Elderly
- COPD
- Severe medical comorbidity
- Functionally dependent or generally debilitated

Procedure related risks:
- Thoracic surgery
- Abdominal surgery
- Emergency surgery
- Prolonged surgery > 3 hrs
- General anesthesia

Pulmonary function tests:
- Should not be done routinely
- Consider to help evaluate unexplained symptoms

Risk reduction:
- Patients at increased risk for pulmonary complications should receive lung expansion maneuvers
- Smoking cessation likely beneficial but may require two months lead time to be effective
Thank You

quinny.cheng@ucsf.edu
Session Outline

Point-of-Care Ultrasound (POCUS) is the future of the physical exam

- Questions we’ll address around this topic:
  - What is POCUS for hospitalized patients?
  - Why learn POCUS?
  - How POCUS is used (cases + demo)?
  - How to get started with POCUS (for you & your institution)?

What is POCUS?

- Performed and interpreted by primary provider…
- …at the bedside…
- …to help answer a specific clinical question…
- …quickly

Disclosures

- Consultant for Caption Health
**How we use POCUS in Hospital Medicine?**

- Diagnostic
- Therapeutic (procedural guidance)
- Treatment monitoring
- Disease screening

**Why learn POCUS?**

**Reason 1: It makes you a better doctor...**

- Procedural complications
- Efficiency and accuracy of diagnosis
- Patient satisfaction

**Reason 2: Most IM/HM doctors don’t know much...**

(Especially if you trained awhile ago)

**Reason 3: Despite lack of knowledge, people think it’s important...**

2017 Needs Assessment of UCSF Hospitalists

- 93% I believe POCUS is important for diagnostic purposes in internal medicine.
- 88% I believe POCUS should be a formal part of residency training.
- 93% I believe faculty would benefit from faculty development in POCUS.
Why learn POCUS?

It’s coming whether you like it or not…

Cases: Inpatient Care as a POCUS Hospitalist

- Four common inpatient scenarios
  - Brief HPI and exam
  - Demo image acquisition and review normal anatomy/findings
  - Review abnormal images from the case
  - Discuss how POCUS impacted care delivery

---

Case 1: Mr. Seth is short of breath

- **HPI:** 61 M with HF/EF, COPD admitted for COPD exacerbation & CAP.
  - Nebulizers, prednisone, antibiotics
  - HD #3: increasing respiratory distress and anxiety
- **Vitals:** AF, HR 102, BP 192/97, RR 26, O2 sat 82% on RA → 93% on 6L NC
- **Exam:**
  - General: moderate distress
  - CV: Tachycardic, no MRG. Unable to assess JVP. 1+ pitting edema of b/l LEs.
  - Lung: tachypneic, increased WOB, scattered wheeze with bilateral lower lobe rales.
- **Labs:** normal CBC and BMP, BNP 421, TnI pending, EKG non-ischemic. CXR ordered.

+ POCUS!

On admission, >3 b-lines in R anterior lung, otherwise normal. IVC 1.8cm and collapsible.

Now, diffuse b-lines in bilateral lung fields, bilateral pleural effusions. IVC 2.4cm and minimally collapsible.

(You were done with your POCUS assessment by the time the CXR was ordered 😊)

Case 1: Mr. Seth is short of breath

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- **Labs:** normal CBC and BMP, BNP 421, TnI pending, EKG non-ischemic. CXR ordered.
Demo: Lung Ultrasound (LZ 1-3)

Demo: Lung Ultrasound (LZ 4)

Demo: IVC Ultrasound

- **B-lines**
  - Pattern helps you with ddx:
    - Bilateral (interstitial syndrome) vs Focal
    - Higher sensitivity than CXR
    - Useful for dynamic monitoring
Case 1 Resolution

- Pleural effusion
  - Anechoic space (black) surrounded by anatomic borders
  - Spine sign
  - Simple vs. complex
  - Sensitivity > CXR

- IVC
  - Dilated >2cm
  - Non-collapsible <50%
  - In a dyspneic patient:
    - >80% sensitivity & specificity for HF/Volume overload
    - Most confusing/controversial POCUS exam

Case 1 Take Home Points

- POCUS diagnosis: interstitial syndrome, pleural effusions, volume overload
- You give him IV Lasix and treat his blood pressure \(\rightarrow\) BP normalized and hypoxia improving
- You make a mental note to check his lung and IVC US again tomorrow to decide about thoracentesis and further need for diuretics

- When possible:
  - Have an algorithmic approach
  - Combine multiple pous exams and integrate with other data
Case 2: Mrs. Essig is hypotensive

- **HPI**: 52F with metastatic breast cancer c/o L malignant pleural effusion on chemotherapy p/w generalized weakness, dyspnea, lethargy, HR 123 BP 82/40
  - 2L given 25% with improvement.
- **Vitals**: AF, HR 112, BP 90/47, RR 16, O2 sat 96% on RA
- **Exam**:
  - General: arousable but somnolent, comfortable
  - CV: Tachycardic, regular, no MRG. JVP 6cm. Chronic lymphedema of the b/l LEs
  - Lung: breathing comfortably on RA, diminished breath sounds LLL but otherwise CTA bilaterally
- **Labs**: CBC and BMP normal. Tbi 1.6, normal AST/ALT. BNP 235 (unknown baseline). TnI negative.

**POCUS!**

Cardiac US with mild reduced LVEF, pericardial effusion, Lungs with a-lines throughout, moderate L pleural effusion, IVC 1.8cm with ~50% collapse with inspiration.

Demo: Cardiac US (Parasternal Long Axis)

Demo: Cardiac US (Parasternal Short Axis)
Case 2 Resolution

- **POCUS** diagnosis: new mild-moderate LVEF reduction, new small pericardial effusion
- Repeat TTE on HD#1 confirms new EF 40%, pericardial effusion enlarging
- HD#3 she develops tamponade, undergoes pericardial drain placement. Patient and family opt for hospice referral.

Case 2 Take Home Points

- **POCUS** led you to a faster, new diagnosis of HFrEF.
  - Clinical management: more cautious with IVF
  - Further diagnostic testing: ordered TTE from admission
  - Monitoring evolution of pericardial effusion
  - Assist with prognostication & GOC

---

### LV Ejection Fraction
- Evaluation
  - End-point Septal Separation (EPSS)
  - Fractional Shortening
  - Myocardial Thickening
- Qualitative assessment
  - Hypodynamic
  - Normal
  - Mild-moderately reduced
  - Severely reduced
- LV dysfunction by hospitalists: 91% sensitivity, 88% specificity

### Pericardial Effusion
- Qualitative assessment:
  - Small
  - Moderate
  - Large
- Pericardial effusion by hospitalists: 100% sensitivity, 87% specificity

Apical 4 chamber, sub-xiphoid best for evaluating signs of chamber collapse (tamponade)

---

### Table a — Comparative sensitivities of Rapid-Care TTE echocardiography using standard echocardiography as the reference standard in 314 participants

<table>
<thead>
<tr>
<th>Condition</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>LR (+)</th>
<th>LR (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEF ≤ 29%</td>
<td>61 (50-78)</td>
<td>98 (95-100)</td>
<td>3.2 (1.8-5.2)</td>
<td>0.2 (0.1-0.7)</td>
</tr>
<tr>
<td>LV septal separation</td>
<td>67 (59-75)</td>
<td>98 (95-100)</td>
<td>2.7 (1.7-4.4)</td>
<td>0.3 (0.2-0.7)</td>
</tr>
</tbody>
</table>

*Adapted from Lucas et al, Am J Med 2011*
Case 3: Dr. Nye has an AKI

- **HPI:** 84M with BPH, HTN, DM2 presents with AMS, lower abdominal pain, decreased urination, K 6.4. ED POCUS shows hydronephrosis and a distended bladder.
  - Foley with 400cc urine output. HyperK treatment.
- **Vitals:** within normal limits
- **Exam:**
  - General: mildly agitated but redirectable, no distress
  - Abd: soft, + suprapubic tenderness, no CVA tenderness, no distension, NABS
  - GU: Foley in place draining cloudy yellow urine
- **Labs:** WBC 11.7, BUN 48, Cr 2.6, K 6.1, otherwise normal. UA + WBC, + nitrite, + LE, + blood. Urine culture pending. CTAP pending.

+ POCUS!

Renal US:
- Bilateral hydronephrosis
- Bladder still distended with Foley balloon visible
- IVC 1.4cm, collapsible with inspiration
- FAST negative for free fluid
- WBC 1.4k, no evidence of infection

**Demo: Renal Ultrasound (RUQ)**

**Demo: Renal Ultrasound (LUQ)**
Hydronephrosis
- Arises from renal pelvis and extends through kidney
- Grading:
  - Mild-moderate
  - Severe

Bladder Volume
- Measure in transverse and longitudinal planes
- $L \times W \times H \times 0.5$

Case 3 Resolution
- POCUS diagnosis: severe hydronephrosis, foley dysfunction with urinary retention
- Foley is flushed and repositioned → additional 800cc urine output. He is started on ceftriaxone for UTI and Tamsulosin for BPH. His abdominal pain resolves; you cancel the CT scan.
- HD #2: urine culture + for pan-sensitive E Coli → abx narrowed to cephalaxin. K, Cr improved. Foley is removed and he passes a trial of void prior to discharge.
Case 3: Take Home Points

- POCUS helped you quickly identify a complication in your treatment plan — avoided a potential bad outcome & unnecessary CT scan.
- Accuracy of bladder volume by POCUS > bladder scan
- Detecting hydronephrosis is a readily attainable skill — IM residents x5 hrs of renal US practice = 94% sensitivity; 93% specificity for moderate-severe hydronephrosis

Case 4: Ms. Nidus has cellulitis

- HPI: 36YF with IVDU. DVT not on anticoagulation presents Saturday night with a red, swollen, and painful RLE. No fevers or chills.
  - IVF, empiric antibiotics for cellulitis and orders a RLE Doppler
- Vitals: Afebrile, HR 98, BP 108/55, RR 16, O2 sat 98% RA
- Exam:
  - General: awake, alert, cooperative. In mild distress 2/2 pain.
  - CV: RRR, no MRG.
  - MSK: RLE tender, erythematous, warm to touch distally. No fluctuance or purulence. She is diffusely TTP overlying the area. Mild pitting edema of R>LLE. Intact pulses.
- Labs: WBC 12.3, CMP normal. Lactate 3.0. D-dimer 755. Doppler RLE is ordered, but won’t be performed until the techs arrive on Monday morning.

How many people would anticoagulate her?

Demo: Soft Tissue Ultrasound
Case 4 Resolution

- POCUS diagnosis: cellulitis, no abscess, +DVT. Safe for further fluid resuscitation.
- You give an additional 1L IVF, lactate, BP normalizes.
- You start her on therapeutic lovenox for DVT seen on POCUS; confirmed by radiology DVT study 36 hours later.
- She tolerates oral antibiotics well, cellulitis improves. Prior to discharge, switch to oral DOAC with plans to follow up with a community PCP.
Case 4 Take Home Points

- In a resource-limited environment (overnights, weekends) POCUS can lead to faster initiation of appropriate therapy.
- POCUS can help guide fluid resuscitation in the setting of hypotension or tachycardia.
- Just because you POCUS, doesn’t mean you can’t order the formal study!

So why do we POCUS?

- Earlier diagnosis and treatment
- Avoids additional tests and reduces radiation exposure
- Safe treatment monitoring, prognostication
- Skills are attainable and lead to better quality care delivery than exam alone

**POCUS doesn’t replace the physical exam; it enhances the physical exam.**

It IS the physical exam.

Data for the POCUS we covered

<table>
<thead>
<tr>
<th>Exam</th>
<th>Statistical Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVC</td>
<td>Correlation coefficient 0.7-0.9</td>
</tr>
<tr>
<td>LVEF</td>
<td>LR +5.4; LR -0.2</td>
</tr>
<tr>
<td>Pericardial Effusion</td>
<td>LR +7.7; LR -0.0</td>
</tr>
<tr>
<td>Pulmonary Edema</td>
<td>Sensitivity 94%; Specificity 92%</td>
</tr>
<tr>
<td>Pleural Effusion</td>
<td>Sensitivity 99%; Specificity 96%</td>
</tr>
<tr>
<td>Hydronephrosis</td>
<td>Sensitivity 94%; Specificity 93%</td>
</tr>
<tr>
<td>DVT</td>
<td>Sensitivity 100%; Specificity 96%</td>
</tr>
<tr>
<td>Abscess</td>
<td>Sensitivity 97%; Specificity 84%</td>
</tr>
</tbody>
</table>

Data for POCUS Algorithms

- **Rapid Ultrasound in Shock and Hypotension (RUSH)**

<table>
<thead>
<tr>
<th>Findings Diagnosis</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lines (normal)</td>
<td>89</td>
<td>97</td>
</tr>
<tr>
<td>Diffuse B lines (&gt;2 lung zones)</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>93</td>
<td>96</td>
</tr>
</tbody>
</table>

- **BLUE protocol for dyspnea/hypoxia**

<table>
<thead>
<tr>
<th>Findings Description</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A line without pleural sliding, lung point</td>
<td>81</td>
<td>96</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>93</td>
<td>96</td>
</tr>
</tbody>
</table>

- Sensitivity (Sens) = True Positive / (True Positive + False Negative) x 100
- Specificity (Spec) = True Negative / (True Negative + False Positive) x 100
What is the scope of POCUS in HM?

How should you integrate POCUS into your practice?

- Many factors to think through:
  - Context
  - Frequency
  - Difficulty
  - Data

Addressing Barriers

- Hardware
- Training
- Time and money constraints
- Credentialing and privileging
POCUS Learning Pathways
- Pursue a certificate program (SHM, CHEST)
- Attend workshops (SHM, ACP, AIUM, UCSF)
- Learn from local experts (EM, critical care colleagues)
- Self-learning, ad hoc (FOAMed)

Our institution’s experience
Getting started…
- Champion(s)
- Leadership buy-in
  - Education
  - Research
  - Cost savings
  - Clinical outcomes

Our institution’s experience
Building momentum…
- Training program development
- Equipment investment

Making it official
1. Privileging and Credentialing
2. Quality assurance
3. Integration into EMR and billing

IMAGE HERE: Notary stamp?
"The larger issue now is to decide whether we believe that—in this case hospitalists—building competency in ultrasound among generalist physicians will enhance patient safety, quality, and value. **Personally, I do.**"
- Bob Wachter, 2012

Review of Session Goals

- What is POCUS for hospitalized patients?
- Why learn POCUS?
- How POCUS is used (cases + demo)?
- How to get started with POCUS (for you & your institution)?

**POCUS is the future of the physical exam.**
High Yield Neurological Examination

Vanja Douglas, MD
Sara & Evan Williams Foundation Endowed Neurohospitalist Chair
Director, Neurohospitalist Division
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Disclosures
None

Purpose of Neuro Exam

• Screen asymptomatic patients
• Screen patients with symptoms that could indicate a focal neurologic lesion (e.g. back pain, headache, seizure)
• Localize the lesion in patients with neurologic deficits
  • Generate a differential diagnosis
  • Decide what test to get next (e.g. brain MRI, spine MRI, EMG/NCS, CK)

Typical “Screening” Neuro Exam

• Mental Status: Level of alertness, orientation, attention, language, memory
• Cranial Nerves: I through XII
• Motor: Bulk, tone, power in all muscles in both arms and legs
• Sensory: Light touch, vibration/joint position sense, pain/temperature, Romberg
• Reflexes: Biceps, triceps, brachioradialis, knees, ankles, plantar response
• Coordination: Finger-nose-finger, heel-knee-shin
• Gait: Observe gait, include tandem, heel, and toe walking
High Yield Screening Neuro Exam

- Mental Status
- Cranial Nerves
- Motor
- Sensory
- Coordination
- Reflexes
- Gait

Language

<table>
<thead>
<tr>
<th>Aphasia Type</th>
<th>Fluency</th>
<th>Comprehension</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressive Aphasia</td>
<td>Impaired</td>
<td>Intact</td>
<td>Impaired</td>
</tr>
<tr>
<td>Conduction Aphasia</td>
<td>Intact</td>
<td>Intact</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

Receptive Aphasia

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Comprehension</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact</td>
<td>Impaired</td>
<td>Impaired</td>
</tr>
</tbody>
</table>

Extraocular Movements

- SR₂
- IO₄
- SR₃
- LR₆
- MR₃
- SO₄
- IR₃
- LR₃
- R
- L
Facial Symmetry

Visual Fields

High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor
- Sensory
- Coordination
- Reflexes
- Gait

Motor System

2 minute screen for upper motor neuron weakness:

- Pronator Drift
- Finger taps & Foot taps
- Distal extensor power:
  - Finger extensors
  - Tibialis anterior
High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor: Pronator drift, finger and foot taps, finger extensor and extensor hallucis longus power
- Sensory
- Coordination
- Reflexes: Biceps, knees, and ankles
- Gait

Coordination & Gait

- Hemispheres:
  - Finger-nose-finger
  - Heel-knee-shin
- Vermis:
  - Gait

Why Do A Sensory Exam?

- If there are sensory complaints
- If there are balance complaints or a gait disorder
- If there is weakness
High Yield Screening Neuro Exam

- Mental Status: language, orientation, and attention
- Cranial Nerves: visual fields, eye movements, and facial symmetry
- Motor: Pronator drift, finger and foot taps, finger extensor and extensor hallucis longus power
- Sensory: (If done, do pain OR temp + vibration OR JPS)
- Coordination: Finger-nose-finger and heel-knee-shin (can replace HKS with gait)
- Reflexes: Biceps, knees, and ankles
- Gait: Observe gait (base, stride, posture, arm swing, turn), tandem

Think Like A Neurologist

- Chief Complaint: suspected localization
- History: refine the localization
- Exam: pick maneuvers that rule in or rule out your suspicions

Let’s practice!

Case Scenarios
Patient #1

- A 23 y/o woman with a history of migraine headaches is admitted to the hospital with left leg cellulitis. On hospital day 2, she complains of a new headache. She says it’s different from her previous migraines because it is “much worse” and is wondering if she needs an MRI.

Headache

- Suspected localization
  - Focal brain lesion

Hypothesis-Driven Neuro Exam

Patient #2

- 57 y/o man hospitalized with MI is altered after his cardiac cath. He is somnolent but arousable, mumbling incoherently. His family is very concerned that he has had a stroke.
Altered Mental Status

**Suspected localization**
- Bilateral hemispheres
- Brainstem

Patient #2 Exam

- Arouses to touch
- Names simple objects, repeats short phrases, follows simple commands
- Disoriented and unable to test attention
- EOMI; face symmetric; blinks to threat bilaterally
- Left arm drifts and hand is clumsy
- Withdraws less briskly to pain in the left leg
- Head CT is normal

Multifocal Strokes

Patient #3

- A 65 y/o man with prostate cancer presents with bilateral leg weakness and urinary urgency.
Bilateral Leg Weakness

Suspected localization
- Spinal cord
- Cauda equina
- Neuropathy
- Neuromuscular junction
- Muscle

<table>
<thead>
<tr>
<th></th>
<th>UMN</th>
<th>LMN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern of Weakness</td>
<td>Predominant</td>
<td>Variable</td>
</tr>
<tr>
<td>Function/Velocity</td>
<td>Slow alternate motion rate</td>
<td>Impairment of function is mostly due to weakness</td>
</tr>
<tr>
<td>Tone</td>
<td>Increased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Tendon Reflex</td>
<td>Increased</td>
<td>Decreased, absent or normal</td>
</tr>
<tr>
<td>Other signs</td>
<td>Babinski sign, other CNS signs, e.g. aphasia, visual field cut</td>
<td>Atrophy (except with problems of neuromuscular junction)</td>
</tr>
</tbody>
</table>

Spinal Cord Cross-Section

Patient #3: Exam
- Decreased EHL power bilaterally
- Slow foot taps
- Brisk knee jerk and ankle jerk reflexes
- Reduced joint position sense in toes
- Sensory level to pinprick at T5
Metastatic Spinal Cord Compression

Patient #4

- A 30 y/o woman with lupus, APLAS, and history of endocarditis on gentamycin presents with acute vertigo.

Vertigo

Suspected localization
- Brainstem (central)
- Cerebellum (central)
- Inner ear (peripheral)

Hypothesis-Driven Neuro Exam
HINTS

- Head Impulse Test
  - Abnormal = peripheral
- Nystagmus
  - Unidirectional = peripheral
  - Direction-changing = central
- Test of Skew
  - Skew deviation = central
- https://youtu.be/1q-VTKPweuk

Patient #4: Exam

- Left beating nystagmus in left-gaze only
- Positive head thrust test to the right

Gentamycin Toxicity

Summary

- High yield screening exam
- Hypothesis driven approach to:
  - Suspected focal brain lesion
  - Altered mental status
  - Suspected spinal cord lesion
  - Vertigo
**Bonus Case**

A 32 y/o woman presents with tingling in the hands and feet that progressed to diffuse weakness in the arms and legs over four days. She is now so weak she can no longer sit up.

<table>
<thead>
<tr>
<th>Pattern of weakness</th>
<th>Tone</th>
<th>Bulk</th>
<th>Reflexes</th>
<th>Sensory Loss</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Motor Neuron</td>
<td>Pyramidal</td>
<td>Spastic</td>
<td>Normal</td>
<td>Increased</td>
<td>Varies</td>
</tr>
<tr>
<td>Anterior Horn Cell</td>
<td>Pyramidal or myotomal</td>
<td>Spastic or normal</td>
<td>Atrophy</td>
<td>Increased or decreased</td>
<td>None</td>
</tr>
<tr>
<td>Peripheral Nerve</td>
<td>In distribution of root or nerve</td>
<td>Normal or reduced</td>
<td>Atrophy</td>
<td>Decreased</td>
<td>Prominent</td>
</tr>
<tr>
<td>Neuromuscular Junction</td>
<td>Diffuse</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal (myasthenia) or Absent (botulism)</td>
<td>None</td>
</tr>
<tr>
<td>Muscle</td>
<td>Proximal &gt; Distal</td>
<td>Normal</td>
<td>Normal or patterned atrophy</td>
<td>Normal</td>
<td>None</td>
</tr>
</tbody>
</table>

**Diffuse Weakness**

**Suspected localization**
- High spinal cord
- Neuropathy
- Neuromuscular junction
- Myopathy

**Localization of Weakness**

**Bonus Case**

- Diffuse weakness throughout both arms and legs in both flexors and extensors
- No sensory level
- Decreased pinprick sensation in the feet
- Diffusely absent reflexes
Next Step?

• Lumbar puncture:
  • Protein 143
  • WBC 2
• Guillain-Barre Syndrome

Acknowledgements

• Hooman Kamel
• Andy Josephson
• Dan Lowenstein
• Ann Poncelet
Algorithmic Approach to Lung Opacities

Approach to lung opacities

- This is hard!
- You will not be an expert today
- Approach
- Practice
- Think like a pathologist

Categories of lung opacities

- 1. Consolidation
- 2. Interstitial (diffuse lines or nodules)
- 3. Airways
- 4. One or a few nodules
Consolidation

- Confluent opacity
- Fluffy around periphery
- Air bronchograms
- Lack of volume loss

Confluent opacity, no volume loss

Air bronchograms
Well-defined: interstitial
Ill-defined: alveolar

Consolidation

- Acute vs. chronic symptoms
- Distribution
- Acuity of changes
- Differential diagnosis in acute setting
  - Focal: pneumonia/aspiration, hemorrhage
  - Diffuse: edema, acute lung injury, pneumonia, hemorrhage

2 month f/u

Invasive mucinous adenocarcinoma
Chronic alveolar disease

- Tumor
  - Invasive mucinous adenocarcinoma (aka multifocal bronchoalveolar CA)
  - Lymphoma (recurrent or 1° pulmonary)
- Inflammatory
  - Organizing pneumonia
  - Chronic eosinophilic pneumonia
  - Sarcoidosis
- Other
  - Lipoid pneumonia
  - Alveolar proteinosis

Comparison

Signs of atelectasis: volume loss

- Fissure displacement
- Deviation of mediastinal structures
- Elevated diaphragm
Atelectasis (types)

• Obstructive/resorptive (obstruction of bronchus)

• Passive (compression of lungs)

• Cicatricial (related to scarring)

• Adhesive (surfactant deficiency)
Lung cancer (Golden S sign)

Lower lobe atelectasis

Combined RML/RLL atelectasis
Left upper lobe collapse

- 1. Veil-like density
- 2. Volume loss
  - Elevated diaphragm
  - Elevated left PA
- Luftsichel sign

Interstitial opacities

Nodules: diff dx

- Hematogenous spread
  - Miliary tuberculosis
  - Miliary fungal infection (e.g. cocci)
  - Metastases
- Lymphatic spread
  - Sarcoidosis
  - Lymphangitic spread of tumor
  - Pneumoconioses (e.g. silica)
Histoplasmosis

Miliary tuberculosis

Interstitial: lines

Causes of interstitial lines

- Edema
- Malignancy
- Fibrotic lung diseases (this is a long list)

Kerley-b lines may be present

These lines are typically thick, wavy and irregular
Linear opacities

Pulmonary edema (kerley-b lines)
Reticular opacities (distribution)

- Lower lobe predominant
  - Idiopathic pulmonary fibrosis
  - Connective tissue disease
  - Drugs
  - Asbestosis
  - Hypersensitivity pneumonitis
- Upper lobe predominant
  - Sarcoidosis
  - Prior TB/fungus
  - Pneumoconioses

Idiopathic pulmonary fibrosis

Hypersensitivity pneumonitis

Tuberculosis
Airways disease

• Circular

• Tubular
Differential diagnosis of airways disease

• Mild:
  - Asthma
  - Viral infection
  - Chronic bronchitis
  - Etc.

• Severe:
  - Bronchiolitis obliterans
  - Immunodeficiency
  - Ciliary dyskinesia
  - Cystic Fibrosis
  - ABPA
  - Tuberculosis
  - Cartilage diseases

Which compartment of lung is affected?

Solitary pulmonary nodule: differential diagnosis

• Granuloma
• Hamartoma
• Primary bronchogenic carcinoma
• Metastasis
• Lots of others
Which one is malignant?

### Nodules: benign vs. malignant

<table>
<thead>
<tr>
<th></th>
<th>Benign</th>
<th>Malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Small size</td>
<td>Large size</td>
</tr>
<tr>
<td>Border</td>
<td>Smooth border</td>
<td>Spiculated border</td>
</tr>
<tr>
<td>Calcification</td>
<td>Diffuse calcification</td>
<td>No or irregular calcification</td>
</tr>
<tr>
<td>Stability over time</td>
<td>Stability over time</td>
<td>Growth over time</td>
</tr>
</tbody>
</table>

Nodule: size
So you see a nodule on CXR…

- 1. Is it actually a nodule?
So you see a nodule on CXR…

- 1. Is it actually a nodule?
- 2. Look for prior films?
- 3. Is diffuse calcification present?
Dual energy subtraction x-ray

So you see a nodule on CXR…

- 1. Is it actually a nodule?
- 2. Look for prior films?
- 3. Is diffuse calcification present?
- 4. Get a CT scan or a follow-up CXR

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>CXR features</th>
<th>Common causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alveolar</td>
<td></td>
<td>• Confluent opacities</td>
<td>• Edema</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Air bronchograms</td>
<td>• Acute lung injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fluffy edges</td>
<td>• Infection</td>
</tr>
<tr>
<td>Interstitial</td>
<td>Nodules</td>
<td>• Small, well-defined nodules</td>
<td>• Tuberculosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Opacities not confluent</td>
<td>• Fungal infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Normal lung between nodules</td>
<td>• Metastases</td>
</tr>
<tr>
<td></td>
<td>Lines (kerley-b)</td>
<td>• Thin, fine, delicate lines</td>
<td>• Pulmonary edema</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lines at periphery of lung (kerley-b)</td>
<td>• Cancer</td>
</tr>
<tr>
<td></td>
<td>Lines (reticular)</td>
<td>• Thick, wavy, irregular lines</td>
<td>• Fibrotic lung disease</td>
</tr>
<tr>
<td>Airways</td>
<td></td>
<td>• Circular or tubular</td>
<td>• Numerous causes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Thin or thick walled</td>
<td></td>
</tr>
<tr>
<td>Not in a single</td>
<td>One or a few nodules (≤3 cm) or</td>
<td>• Lung cancer</td>
<td>• Hamartoma</td>
</tr>
<tr>
<td>compartment</td>
<td>masses (&gt;3 cm)</td>
<td>• Metastasis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Granuloma</td>
<td></td>
</tr>
</tbody>
</table>
Objectives

- Lingering questions from this mornings presentations
- Duration of anticoagulation for VTE
- Approach to subsegmental PE, calf vein DVT and superficial vein thrombosis
- Role of thrombophilia work up
- Resuming anticoagulation after a bleed

Resources

- University of Washington Anticoagulation http://depts.washington.edu/anticoag/home

Case

51 year old man with no PMHX presents with acute CP and SOB, BP stable, HR 120s O2 sat 92%, d-dimer 1500, CT PE with bilateral PE in all lobes with RV/LV ratio > 1.0. BNP 370, trop 1.5. He is started on rivaroxaban. He has no identifiable provoking factors. How long should he remain on anticoagulation?
1) At least 3 months
2) One year
3) Forever
Duration of Anticoagulation for VTE: 2016 CHEST and AC Forum Guidelines/Guidance

<table>
<thead>
<tr>
<th>Indication</th>
<th>CHEST 2016*</th>
<th>AC Forum 2016‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st provoked VTE</td>
<td>3 mo</td>
<td>3 mo (surgical)‡ 3 mo (medical)</td>
</tr>
<tr>
<td>1st unprovoked VTE</td>
<td>Extended‡</td>
<td>Extended</td>
</tr>
<tr>
<td>2nd unprovoked VTE</td>
<td>Extended‡</td>
<td>Extended</td>
</tr>
</tbody>
</table>

*Unless risk factors for recurrence persist
‡No scheduled stop date, unless high bleeding risk.


VTE and Bleeding Risk: 2016 CHEST Guideline

<table>
<thead>
<tr>
<th>Risk of Major Bleeding After 3 Mo of Anticoagulation, %/y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (6 risk factors)</td>
</tr>
<tr>
<td>Baseline risk</td>
</tr>
<tr>
<td>Increased risk</td>
</tr>
<tr>
<td>Total risk</td>
</tr>
</tbody>
</table>

Risk Factors for Bleeding with Anticoagulation

• Age >75
• Anemia
• Recent bleeding
• Cancer
• Renal or hepatic failure
• Hemoglobinopenia
• Previous stroke
• NSAID use

CHEST 2021—suggest reduced dose DOAC over full dose for extended phase anticoagulation

UNPROVOKED VTE
- All - 3-6 months of FULL intensity anticoagulation
  - At 3-6 months determine candidacy for secondary prevention
  - ~50% will develop recurrent VTE in 10 years off anticoagulation; Case fatality rate of VTE is ~4% in all comers but closer to 9% in PE
  - Case fatality rate of bleeding is ~10%
  - Case by case decision...consider continuation if not high bleeding risk. Most compelling in low bleed risk patients and in those with PE

Secondary Prevention Options
- Low dose DOAC
- Full dose anticoagulation
- ASA

Do not use dose reduced DOAC:
- Cancer
- Recurrent VTE on AC
- Obesity

Case
A 51-year-old man with no PMHx presents with acute CP and SOB, BP stable, HR 120s O₂ sat 92%, d-dimer 1500, CT PE with bilateral PE in all lobes with RV/LV ratio >1.0. BNP 370, trop 1.5. He is started on rivaroxaban. He has no identifiable provoking factors. How long should he remain on anticoagulation?
1) At least 3 months
2) One year
3) Forever
A 77 yo man had undergone colectomy for recurrent bleeding from diverticulosis. On POD #3 he becomes tachycardic to the 110s. WBC is elevated. The surgical team orders an abdominal CT which shows a fluid collection concerning for early abscess. It also shows an isolated RLL subsegmental PE. A dedicated CTa shows a single isolated RLL subsegmental PE. Do you anticoagulate this patient?

a) Sure, it is a PE.
b) No this is incidental. Let’s pretend we don’t know it is there.

Isolated Subsegmental PE

Definition: PE shown on CT angiography that occurred in a subsegmental branch but no larger order of vessels. The subsegmental PE may involve one or more than one subsegmental branch.

Identification of ISSPE has tripled over past decade

Anticoagulant treatment for subsegmental pulmonary embolism


Summary of main results

There is currently no evidence from randomised controlled trials to assess the effectiveness and safety of anticoagulation therapy versus no intervention in patients with isolated subsegmental pulmonary embolism (ISSPE) or incidental ISSPE.

IS IT REAL?

ISSPE is more likely to be TRUE if…good quality scan, mult defects, centrally located, d-dimer elevated, seen on mult cuts, patient symptomatic vs incidental, high pretest prob of PE.

Get u/s of bilateral lower extrem (upper if CVC)

Consider risk of recurrence—higher if not post op; immobile; active cancer

IF high bleed risk—don’t AC; get serial u/s.

A 77 yo man had undergoes colectomy for recurrent bleeding from diverticulosis. On POD # 3 he becomes tachycardic to the 110s. WBC is elevated. The surgical team orders an abdominal CT which shows a fluid collection concerning for early abscess. It also shows an isolated RLL subsegmental PE. A dedicated CTA shows a single isolated RLL subsegmental PE. Do you anticoagulate this patient?

a) Sure, it is a PE.
b) No this is incidental. Lets pretend we don’t know it is there.

A 67 year old man with cirrhosis, new diagnosis of HCC is admitted with diarrhea, lowish BP and AKI. On exam he has bilateral lower extremity swelling, R> L. In the ED he has an ultrasound which shows thrombosis of the greater saphenous vein extending from the calf proximally and terminating 6 cm from the deep femoral vein. What do you recommend?

a. Prophylactic fondaparinux
b. Prophylactic rivaroxaban
c. Full dose DOAC or warfarin
d. Full dose LMWH
e. Warm compresses, no anticoagulation

Superficial Vein Thrombosis – CHEST Guidelines

- Factors that favor the use of AC: extensive SVT; above the knee, close to saphenofemoral junction; severe symptoms; involvement of the greater saphenous vein; history of VTE or SVT; active cancer; recent surgery
- In patients with superficial vein thrombosis of the lower limb of at least 5 cm in length, we suggest the use of a prophylactic dose of fondaparinux or LMWH for 45 days over no anticoagulation (Grade 2B).

Superficial Vein Thrombosis

Prevention of thromboembolic complications in patients with superficial vein thrombosis given rivaroxaban or fondaparinux: the open-label, randomised, non-inferiority SURPRISE phase 3 trial.

- >400 pts symptomatic SVT riva 10 mg v fonda 2.5mg
- Symptomatic above the knee SVT of at least ≥5 cm length + other risk factor (>65, male, hx VTE, cancer, autoimmune disease, non-varicose veins)
- No difference in primary efficacy outcome
- After 6 weeks 7% recurrence risk in high risk patients (v 1.2% in CALISTO)

A 67 year old man with cirrhosis, new diagnosis of HCC is admitted with diarrhea, lowish BP and AKI. On exam he has bilateral lower extremity swelling, R> L. In the ED he has an ultrasound which shows thrombosis of the greater saphenous vein extending from the calf proximally and terminating 6 cm from the deep femoral vein. What do you recommend?

a. Prophylactic fondaparinux
b. Prophylactic rivaroxaban
c. Full dose DOAC or warfarin
d. Warm compresses, no anticoagulation

Superficial Vein Thrombosis

CCN Guidelines Version 1.2017
Cute Superficial Vein Thrombosis (SVT)

Guide to management of superficial venous thrombosis of lower extremity

Does the patient have active cancer, prior VTE, or known thrombophilia?

- Yes to TIA
- No to ALL

Prephylactic dose anticoagulation 6 weeks
Rivaroxaban 15mg daily
If high bleeding risk can consider deferring anticoagulation and perform follow-up ultrasound

Is the patient hospitalized, immobilized or still recent surgery?

- YES: In 7-10 days, consider stopping rivaroxaban daily if tolerated
- NO: Clinical follow-up

Full dose anticoagulation for at least 6 weeks
50 year old man presents with unprovoked PE. He is hemodynamically stable but CT PE shows elevated RV/LV ratio. ECHO is ordered. He is admitted and started on rivaroxaban. Should you send a work up for thrombophilia?

- Yes - why not, he is here.
- No - then I am going to have interpret it and who needs that

No current guidelines
EXCEPT ASH Choosing Wisely Campaign - "do not test in provoked VTE"
Results of thrombophilia testing should RARELY affect clinical decisions about VTE treatment - no strong influence on recurrence risk beyond stratification based on clinical presentation
Can help explain "why"
Can be of interest to family members
Current tests are insufficient for identifying inherited VTE risk

Who should we suspect harbors thrombophilia?

<table>
<thead>
<tr>
<th>Table 1. Clinical Characteristics suggestive of Inherited Thrombophilia in Patients with Venous Thromboembolism (VTE).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrombosis at a young age (&lt;50 yr), especially in association with weak provoking factors (minor surgery, combination oral contraceptives, or immobility) or unprovoked VTE</td>
</tr>
<tr>
<td>Strong family history of VTE (first degree family members affected at a young age)</td>
</tr>
<tr>
<td>Recurrent VTE events, especially at a young age#</td>
</tr>
<tr>
<td>VTE in unusual sites such as splanchic or cerebral veins†</td>
</tr>
</tbody>
</table>

*The antiphospholipid syndrome must also be considered, but it is not inherited.
†Patients with splanchic vein VTE should be assessed for myeloproliferative neoplasms and paroxysmal nocturnal hemoglobinuria.

UNPROVOKED THROMBOSIS IN YOUNG PATIENT THINK ABOUT:

- PROTEIN C, S, ANTITHROMBIN DEFICIENCY → OFTEN POSITIVE FAMILY HISTORY
- FACTORY LEIDEN MUTATION AND PROTHROMBIN GENE MUTATION - Northern European descent
- APLS - PRIMARY OR SECONDARY (lupus)
- MAY THURNERS SYNDROME - ILLAC VEIN COMPRESSION SYNDROME... LEFT LOWER EXTREMITY VENOUS COMPRESSION - LEFT ILLAC VEIN COMPRESSED BY RIGHT ILLAC ARTERY
- UPPER EXTREMITY DVT - PAGET SCHROEDERS SYNDROME - THORACIC OUTLET SYNDROME WITH VENOUS COMPRESSION
- NEPHROTIC SYNDROME/IBD/PNH
- PREGNANCY, IVF
- CANCER (less likely < 50 yo)
Summary of Recommendations Regarding Testing for Thrombophilia.

Algorithm for Selecting Patients with a First Venous Thromboembolism (VTE) for Thrombophilia Testing.

VENOUS AND ARTERIAL THROMBOSIS

- APLS
- PFO-with paradoxical embolism
- HYPERHOMOCYSTIENEMIA
- SICKLE CELL
- P VERA
- PNH
- HIT
- CANCER
- DIC
- Beurgers disease
- Hyperviscosity-MGUS, MM

Thrombophilia Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Assay</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor V</td>
<td>Activity assay</td>
<td>5-10%</td>
</tr>
<tr>
<td>Factor VIII</td>
<td>Activity assay</td>
<td>5-10%</td>
</tr>
<tr>
<td>Protein C</td>
<td>Assay</td>
<td>50-70%</td>
</tr>
<tr>
<td>Protein S</td>
<td>Assay</td>
<td>50-70%</td>
</tr>
</tbody>
</table>

*Note: This list is not exhaustive and may vary based on clinical context and patient history.*

Table 1: Thrombophilia Tests and Prevalence of Risk Factors

1. **Factor V Deficiency**: Activity assay
2. **Factor VIII Deficiency**: Activity assay
3. **Protein C Deficiency**: Assay
4. **Protein S Deficiency**: Assay

*Patients with VTE, 15-20%: Patients with VTE have a higher risk of thrombophilia.*

Spinal venous thrombosis
Cerebral vein thrombosis

*Note: Additional tests may include antithrombin, PAI-1, and lupus anticoagulant.*
### IMPACT OF ANTICOAGULATION & THROMBOSIS ON THROMBOPHILIA LABS

<table>
<thead>
<tr>
<th>Protein/C Protein S</th>
<th>Acute Thrombosis</th>
<th>Warfarin</th>
<th>Heparin</th>
<th>DOAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein C/ Protein S</td>
<td>False Positive</td>
<td>False Positive</td>
<td>No Effect</td>
<td>False Normal</td>
</tr>
<tr>
<td>Antithrombin</td>
<td>False Positive</td>
<td>False Positive</td>
<td>No Effect</td>
<td>False Normal</td>
</tr>
<tr>
<td>Lupus Anticoagulant</td>
<td>No Effect</td>
<td>False Positive</td>
<td>False Positive</td>
<td>False Positive</td>
</tr>
<tr>
<td>Factor V Leiden</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
<tr>
<td>Prothrombin Gene</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
<td>No Effect</td>
</tr>
</tbody>
</table>

**DEFER TESTING (3-6 MOS)**
- RARELY WE SEND APLS ACUTELY IF STRONG SUSPICION
- CAN SEND ELY/PTG BUT IN HETEROZYGOUS FORM NOT IMPORTANT

### Antiphospholipid Antibody Syndrome

**WHY** - risk of recurrence off AC much higher; at risk for arterial disease, bridge therapy; DOACs generally avoided
- WHO - arterial and venous events, unexpected arterial events, recurrent thrombosis ON anticoagulation, underlying autoimmune d/o, prolonged aPTT
- WHAT - send Lupus anticoagulant, Beta 2 glycoprotein antibodies and anticardiolipin antibodies (IgG & Ig M)
- WHEN - LAC don't do it on anticoagulation; antibodies you can send anytime
- IF POSITIVE -
  - must repeat in 12 weeks-high rate of transient positivity
  - LAC most predictive of 1st and recurrent VTE, triple positives at highest risk

### Thrombophilia Testing

50 year old man presents with unprovoked PE. He is hemodynamically stable but CT PE shows elevated RV/LV ratio. ECHO is ordered. He is admitted and started on rivaroxaban. Should you send a work up for thrombophilia?
- Yes-why not, he is here.
- No-then I am going to have interpret it and who needs that
What To Do After the Bleed

76 y/o man with CAD (NSTEMI 2006), AFIB CHADS-Vasc=4 on warfarin and ASA is admitted with UGIB. INR is 3.0. He requires 3u PRBCs, vit K and FFP. EGD shows peptic ulcer disease. He is started on high dose PPI therapy, bx for H Pylori done. When should his anticoagulation be restarted?

a) Never  
b) In two weeks  
c) In three months  
d) Let the primary provider deal with this one
AC FORUM Clinical Guidance
Antithrombotic Therapy for VTE

“IN THE EVENT OF GI BLEED WE SUGGEST WAITING AT LEAST 7 DAYS WITHOUT EVIDENCE OF ACTIVE BLEEDING AND AFTER ENDOSCOPIC TX BEFORE REINITIATING AC”


GIBs: DOACs vs Warfarin

GIBs: DOACs vs Warfarin

GIBs: DOACs vs Warfarin
### Resumption of DOACs

- **Anticoagulation FULLY therapeutic within 1-2 hours**
- Only dabigatran has a reversal agent

### Considerations After GIB on AC

- Reassess risk benefit of anticoagulation
- Secondary prevention of VTE therapy, low CHADS-vasc
- Assess risk of rebleeding from source
  - Identifiable source, treatable lesion?
- Take steps to decrease risk of bleeding related to AC regimen
- Reconsider need for antiplatelet therapy
  - If warfarin was INR in range, is control good? Spurious elevation in INR or poor TTR → DOAC increases INR monitoring → home POC INR?
- If ongoing strong indication for AC determine best time to restart therapy in multidisciplinary meeting with proceduralist - Remember DOAC immediately active

### What To Do After the Bleed

76 y/o man with CAD (NSTEMI 2006), AFIB CHADS-Vasc=4 on warfarin and ASA is admitted with UGIB, INR is 3.0. He requires 3u PRBC, Vit K and FFP. EGD shows peptic ulcer disease. He requires PPI therapy, bx for H Pylori done. When should his anticoagulation be restarted?

- a) Never
- b) In two weeks
- c) In three months
- d) Let the primary provider deal with this one

"Two weeks may provide the best balance among GI bleed recurrence, thromboembolism and mortality"
Postoperative Delirium

An 80-year-old woman falls and sustains a hip fracture at her assisted living facility. She has a history of stroke and uses a walker. She has mild dementia. She is alert, oriented to self & place but not date (baseline).

1. How likely is this patient to develop delirium?
2. What can be done to prevent delirium?
3. What should you do if she becomes delirious?
**Postoperative Delirium**

**Clinical Features:**
- Acute, fluctuating disturbance of consciousness
- Reduced ability to focus & attend
- Accompanied by cognitive and perceptual disturbances
- Postop delirium has onset peak 1-3 days after surgery

Usually self-limited but associated with bad outcomes:
- Increased mortality (10-20% rise per 48 hours of delirium)
- Increased LOS, higher risk of institutionalization

**Incidence of Delirium**

<table>
<thead>
<tr>
<th>Population</th>
<th>Incidence</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-hip fracture</td>
<td>44 - 61% (up to one-third delirious on admission)</td>
<td>Berggren et al., Dolan et al.</td>
</tr>
<tr>
<td>Elective orthopedic</td>
<td>18%</td>
<td>Fisher et al.</td>
</tr>
<tr>
<td>Major elective surgery</td>
<td>9% (46% in aortic surgery)</td>
<td>Marcantonio et al.</td>
</tr>
</tbody>
</table>

**Risk Factors (a partial list)**

<table>
<thead>
<tr>
<th>Patient (Chronic) Factors</th>
<th>Acute Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced age</td>
<td>Hip fracture</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>Aortic or thoracic surgery</td>
</tr>
<tr>
<td>Functional impairment</td>
<td>Fluid / electrolyte disorder</td>
</tr>
<tr>
<td>Severe chronic illness</td>
<td>Sepsis</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>Uncontrolled pain</td>
</tr>
<tr>
<td>Sensory deficits</td>
<td>Polypharmacy</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>Anemia</td>
</tr>
<tr>
<td></td>
<td>Kidney injury</td>
</tr>
<tr>
<td></td>
<td>Sleep deprivation</td>
</tr>
</tbody>
</table>

**Assessing the Risk of Delirium**

AGS guideline recommends preoperative assessment of risk of delirium:
- Consider age > 65, cognitive impairment, sensory deficit, severe illness, and infection
- Validated prediction tools available, but less practical
- For increased risk, would counsel patient & family and consider applying multi-component delirium prevention interventions (if available at your hospital)
### Prevention: Care Packages

Multi-component intervention packages:
- e.g., Acute Care for Elderly (ACE) units, Comprehensive Geriatric Assessment (CGA), delirium prevention order sets
- Reorientation, non-drug sleep hygiene, bowel/bladder care, early PT/OT, nutrition, pain assessment, delirium screening
- Moderate evidence for benefit from numerous trials but requires institutional support & group effort

### Prevention: Pharmacology

Avoid high-risk medications:
- Anticholinergics, meperidine, BZD & other sedatives
- Minimize opiates by using non-opiate analgesics

Role for prophylactic neuroleptics?
- Several trials of neuroleptics to prevent delirium
- Inconsistent findings, poor study quality
- Bottom line: insufficient evidence for or against

### Screening & Diagnosis

- AGS doesn’t take position on whether to screen
- Hyperactive (agitated) delirium usually obvious but hypoactive (sedated) delirium often missed

**Confusion Assessment Method (CAM):**
1. Acute change or fluctuation in mental status
2. Inattention (trouble focusing or distractable)
3. Disorganized thinking or altered level of consciousness

### Evaluating the Delirious Patient

Specific, reversible etiology seldom identified

Approach to working up postoperative delirium:
- CBC, basic chemistry, urinalysis, EKG
- Other studies only if indicated by clinical findings
- Brain imaging rarely useful
- Low yield for thyroid tests, vitamin levels, RPR, LP, etc.

Review medications closely:
- Anticholinergic, BZD, opiate, antiemetic, antispasmodic
Treating Postoperative Delirium

Identify & treat reversible causes:
- Recommended but beware of excessive work-up

Multidisciplinary teams & multicomponent interventions:
- Similar to delirium prevention packages
- Weak & inconclusive evidence for benefit (vs. prevention)

Physical restraints:
- Not recommended unless no other option to prevent harm

Recommendations are based largely on expert opinion:
- Treat specific causes
- Adequate pain control
- Eliminate unnecessary medications, lines, catheters
- Mobilization during daytime
- Quiet, uninterrupted sleep at night
- Frequent re-orientation and reassurance
- Reserve sedation for patients at high risk for self-harm

Morrison RS, et al. AIM, 1998

Red Pill, White Pill, Blue Pill

Antipsychotics for Management of Postoperative Delirium

Commonly used but poorly studied
- Lack of placebo-controlled trials in postop patients
- Are we changing natural history or just sedating patients?

Indications & Recommendations:
- Only for severe agitation or distress, if threatening substantial harm to self and/or others
- Try behavioral interventions first
- Use lowest effective dose for the shortest possible duration
- Don’t treat hypoactive delirium with antipsychotics

JAMA Intern Med. 2017;177(1):34-42
Antipsychotic Regimens for Delirium

Haloperidol:
- Start 0.5 – 1 mg (PO, IV, IM); can repeat in 30-60 min

Risperidal
- Start at 0.5 – 1 mg (PO) BID; peak 1 hr; renal dose

Quetiapine
- Start 25 mg (PO) QHS or BID; peak 1.5 hr
- Preferred for patients with Parkinsonism

Olanzapine
- Start 2.5 mg (PO – also available IV/IM) QHS; peak 6 hr

IV Haldol & Long QTc

- Haldol not approved for IV use, but commonly done
- Risk of QTc prolongation and torsades de pointes
- Risk mainly if ≥ 2 mg single dose or ≥ 20 mg / 24 hrs
- Watch for other drugs that prolong QTc (e.g., methadone)
- UCSF policy:
  - Tele or daily ECG needed if exceeding above doses
  - IV haldol held if QTc > 440 ms

Screening for Postoperative MI

Findings from POISE (2008 beta-blocker trial):
- 5% of these “elevated risk” patients had postop MI, defined as elevated biomarker + ECG changes
- Most MI occurred by POD #3 (74% within 48 hr)
- Postoperative MI predicted 5-fold mortality
- Majority of postoperative MI were asymptomatic
- Silent MI had similar mortality as symptomatic MI

Postop Troponin Predicts Mortality

<table>
<thead>
<tr>
<th>Study</th>
<th>Biomarker</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>POISE (2011)</td>
<td>Troponin or CK-MB</td>
<td>2.5x mortality with isolated biomarker elevation</td>
</tr>
<tr>
<td>VISION (2012)</td>
<td>Troponin-T</td>
<td>4x mortality with any Tn-T elevation</td>
</tr>
<tr>
<td>Meta-analysis of 14 earlier studies (2011)</td>
<td>Troponin</td>
<td>3x mortality with elevation</td>
</tr>
</tbody>
</table>

Arguments Against Screening

Too late to do anything:
- Nearly 2/3 of deaths in patients with MI occurred by POD 3
- Many deaths in MI patients are not cardiac-related
- Elevated troponin just identifies obviously crashing patients

No known effective intervention:
- Don’t order the test unless it will change management

MANAGE Trial

Question: Does the direct thrombin inhibitor dabigatran improve outcomes in patients with elevated postop troponin?

Patients: 1754 patients who evidence of myocardial injury after noncardiac surgery (MINS), defined as elevated postop troponin either with clinical, ECG or imaging evidence of new ischemia or no other explanation (e.g., PE, sepsis, atrial fib)

Intervention: Dabigatran 110 mg bid vs. placebo for up to 2 yrs

Outcome: CV mortality, nonfatal MI, stroke, peripheral arterial thrombosis, and symptomatic PE

Amputation and symptomatic proximal DVT added post hoc

MANAGE Trial Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Dabigatran</th>
<th>Placebo</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary cardiac or vascular outcome</td>
<td>11%</td>
<td>15%</td>
<td>25 (p = .012)</td>
</tr>
<tr>
<td>Mortality – CV Mortality – All cause</td>
<td>6%</td>
<td>7%</td>
<td>NS</td>
</tr>
<tr>
<td>Mortality – All cause</td>
<td>11%</td>
<td>13%</td>
<td>NS</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>4%</td>
<td>5%</td>
<td>NS</td>
</tr>
<tr>
<td>Bleeding complications</td>
<td>3%</td>
<td>4%</td>
<td>NS</td>
</tr>
</tbody>
</table>

Screening for Myocardial Injury

Limitations of MANAGE trial:
- Design problems (changing sample size & outcomes)
- Outcomes too broad and individually no significant effect
- Comparison group was placebo
- Just too weird – very different from usual practice

So now what?
- Statin & ASA: Association between their use and lower mortality in patients with MINS or postop MI (retrospective study only)
Canadian Cardiovascular Society (CCS)

- Measure BNP or NT-proBNP before major noncardiac surgery in all patients with CV disease, over age 65, or RCRI score > 1
- Use biomarker instead of stress test for risk stratification
- BNP > 92 or NT-proBNP > 300 indicate increased risk
- Measure troponin daily for 48-72 hours after surgery if preoperative biomarker level elevated
- Patients with elevated postoperative troponin should receive long-term aspirin & statin therapy

Biomarkers in Clinical Practice

A 63-year-old man suffers an acute myocardial infarction, treated without PCI. He was already scheduled for prostate cancer surgery in one month.

Because of his recent MI, surgery should be delayed for:

A. 1 month
B. 2 months
C. 3 months
D. 6 months
E. At least a year


Delaying Surgery After Acute MI

Question: How does time between acute MI and surgery affect the risk of postoperative MI?

563,842 patients (1999-2004) discharged after hip surgery, colectomy, cholecystectomy, AAA repair, or lower extremity amputation:

- 2.9% of cohort had experienced acute MI in prior year
- Outcome: 30-day postoperative MI

How Long to Wait after MI?

Conclusions:
- Surgery within one year of acute MI associated with high risk of postoperative MI
- Risk falls over time; most of the reduction within 2 months
- Trend is similar when only elective surgery considered

Caveats:
- Nonrandomized, observational study

ACC/AHA Guidelines:
- Delay elective surgery for at least 2 months after MI

Delaying Surgery After Stroke

A 63-year-old man suffers an acute stroke that is managed without thrombolysis. Brain MRI incidentally detects a large meningioma. The neurosurgeon wants to do a craniotomy to resect the tumor in 2 weeks.

Because of his stroke, you recommend delaying surgery for:

A. 1 month
B. 3 months
C. 6 months
D. 9 months
E. At least a year

Question: How does time between stroke and surgery affect the risk of cardiovascular complications?

Danish cohort study of all adults undergoing elective noncardiac surgery from 2005-2011:
- 7137 patients had prior stroke (1.5% of total cohort)
- Outcome: 30-d postop Major Adverse Cardiac Events (MACE): cardiovascular death, nonfatal MI, ischemic stroke
- Looked at effect of time since stroke on MACE rate

Jorgenson ME et al. JAMA 2014; 312:269-277
How Long to Wait after CVA?

Conclusions:
- Surgery after CVA associated with high CV risk
- Risk falls over 9 months, biggest drop after first 3 months

Caveats:
- Nonrandomized, observational study

My take-away:
- Delay elective surgery for at least 3 months (up to 9 months) if possible

Perioperative Transfusion Threshold

82 y.o. woman has undergone repair of a femoral neck fracture. She denies heart disease, but has old pathologic Q-waves on her ECG. On post-op day #2, she only complains of hip pain.

Exam: BP 140/80 HR 75
Heart, Lung, Abdomen exams normal
Labs: Hemoglobin = 8.3 (Hct = 25%)

When should she receive a blood transfusion?

Perioperative Transfusion Threshold

1. Transfuse to keep Hgb > 10
2. Transfuse to keep Hgb > 9
3. Transfuse to keep Hgb > 8
4. Transfuse to keep Hgb > 7
5. Only if symptomatic

FOCUS* Trial

(*Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair)

Patients: 2016 patients undergoing hip fracture repair. All patients had either diagnosis of or risk factors for cardiovascular disease.
- Mean age = 82
- HTN (82%); CAD (40%); DM (25%); CVA (24%); CHF(17%)

Treatment: Randomized to 2 transfusion strategies:
1. Hemoglobin < 10 g/dL
2. Symptoms of anemia (also permitted for hgb < 8)

Carson JL et al. NEJM 2011; 365:2453-62
### FOCUS Trial Results

<table>
<thead>
<tr>
<th></th>
<th>PRBC Units Transfused</th>
<th>Total Units Transfused</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 g/dL Trigger</td>
<td>2 (1,2)</td>
<td>1866</td>
</tr>
<tr>
<td>Symptomatic Trigger (or 8 g/dL)</td>
<td>0 (0,1)</td>
<td>652</td>
</tr>
</tbody>
</table>

Caveats to FOCUS Trial

- Small difference in hemoglobin levels may not be clinically significant
- Inadequate power to determine if presence of CV disease affects outcome
- Restrictive transfusion strategy leads to more symptomatic anemia (mostly ↑HR or ↓BP)

### FOCUS Trial Results

<table>
<thead>
<tr>
<th></th>
<th>In-hospital mortality</th>
<th>In-hospital mortality, cardiac complication</th>
<th>60-day mortality</th>
<th>60-day mortality + disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 g/dL Trigger</td>
<td>2.0%</td>
<td>4.3%</td>
<td>7.6%</td>
<td>35%</td>
</tr>
<tr>
<td>Symptom Triggered</td>
<td>1.4%</td>
<td>5.2%</td>
<td>6.5%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Conclusion: No increased mortality or morbidity with a restrictive transfusion protocol.

### AABB Transfusion Guidelines

The society formerly known as the American Association of Blood Banks:

- "In postoperative surgical patients, transfusion should be considered at a hemoglobin concentration of 8 g/dL or less or for symptoms (chest pain, orthostatic hypotension or tachycardia unresponsive to fluid resuscitation, or congestive heart failure)."  
  - Strong recommendation
- Same recommendation if patient has pre-existing CV disease  
  - Weak recommendation

Carson JL et al. NEJM 2011; 365:2453-62

Carson JL et al. NEJM 2011; 365:2453-62
A 65-y.o. man with cirrhosis from HCV desires a hip arthroplasty. He feels well and has no current signs of ascites or encephalopathy on examination.

Labs:
- Creatinine = 1.6
- Total Bilirubin = 1.9
- Albumin = 3.5
- INR = 1.6

How would you advise this patient about his postoperative mortality risk?

65-y.o. man with cirrhosis from HCV desires a hip arthroplasty. He’s asymptomatic and has no signs of encephalopathy or ascites.

1. Patients with cirrhosis are not candidates for elective surgery
2. Your mild cirrhosis (Childs-Pugh class A) makes you an acceptable surgical candidate
3. Perioperative risk is acceptable, but long-term mortality risk makes surgery unappealing

Question: How does his cirrhosis affect mortality risk?

Background:
- Risk traditionally assessed by Childs-Pugh classification (http://www.mdcalc.com/child-pugh-score-for-cirrhosis-mortality)
- Mortality after GI surgery: Class A = 10%
  - Class B = 30%
  - Class C = 70%
- Limitations: single time point, less known about non-GI surgery; sensitive to minor laboratory result differences

MELD Score as Risk Predictor

MELD Score (Model for Endstage Liver Disease):
- Main use in organ allocation
- Variables: INR, bilirubin, creatinine
- Retrospective multivariate analysis of 772 cirrhotic patients undergoing GI, orthopedic, and CV surgery
  - Independent predictors of mortality: Age & MELD Score
  - Predicts mortality @ 1 wk, 1 mo, 3 mo, 1 yr, 5 yr


Teh et al. Gastroenterology, 2007
65 y.o. man with stable HCV-related cirrhosis. He has no current signs of encephalopathy or ascites.

Labs: Creatinine = 1.6  
Total Bilirubin = 1.9  
Albumin = 3.5  
INR = 1.6

Childs-Pugh Class A  
MELD Score = 19

Mortality Prediction:
- Childs-Pugh: 10% in-hospital mortality
- MELD Score: 6.5% 1 week mortality  
24% 1 month mortality  
36% 3 month mortality  
50% 1 year mortality

OSA & The Surgical Patient

A 55-y.o. morbidly obese man is scheduled to undergo knee arthroplasty. He has hypertension but no other medical history. He reports occasional fatigue and somnolence. He doesn’t know if he snores or has apneic spells. Exam and recent lab tests are unremarkable.

What should be done?
1. Notify surgical team of suspected OSA  
2. Notify surgical team & recommend empiric CPAP postop  
3. Delay surgery for formal polysomnography

Obstructive Sleep Apnea in Surgical Patients

OSA probably increases postoperative complications:
- Pulmonary complications (11 of 17 studies)  
- Postop atrial fibrillation (5 of 6 studies)

Previously undiagnosed OSA may be associated with more complications than known OSA  
Clinical screening tools have high + predictive value  
Benefits of positive airway pressure (CPAP, BiPAP) for surgical patients with OSA uncertain

1. Screen patients clinically for OSA risk
   - Snoring
   - Tired or sleepy
   - Observe apnea
   - Pressure (HTN)
   - BMI > 35 kg/m²
   - Age > 50 years
   - Neck > 17” (M)/16” (F)
   - Gender is male

   **STOP-BANG**
   High risk for OSA if either
   - 5 or more total points
   - 2 STOP points + B, N, or G

   http://www.stopbang.ca/osa/screening.php

2. Patient and care team should be informed about known or suspected OSA

3. Insufficient evidence to recommend delaying surgery to perform advanced testing (polysomnography)
   Exception: patients with evidence of severe or uncontrolled systemic complications of OSA or impaired gas exchange (e.g., severe pulm HTN, hypoventilation, resting hypoxia)

4. Continue PAP after surgery
   Insufficient evidence to recommend empiric PAP

---

**Are Curbside Consults Safe?**

You’re happily about to leave the hospital…
…when the orthopedic surgeon calls to say, “My patient’s glucose levels are elevated. She’s otherwise stable. Maybe you could give curbside advice?”

**Elevated glucose?**
Tell your patient to stop eating.

1. I never do curbside consults
2. I ask questions to determine whether curbside is appropriate
3. I’m pretty open to giving curbside advice

---
Curbside Consults

Studied 47 requests for curbside advice to hospitalist
- Curbside consultant could ask questions ad lib
- Made recommendations without seeing patient or chart
- Different hospitalist performed formal, in-person evaluation

Questions:
- Did curbside consultant obtain accurate information?
- Did advice and management differ?

Curbside vs. Formal Medicine Consult

<table>
<thead>
<tr>
<th>Compared to formal consultation, how often did curbside evaluation lead to:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete clinical information</td>
<td>34%</td>
</tr>
<tr>
<td>Inaccurate clinical information</td>
<td>28%</td>
</tr>
<tr>
<td>Any difference in management</td>
<td>60%</td>
</tr>
<tr>
<td>Major difference in management</td>
<td>36%</td>
</tr>
</tbody>
</table>

Curbside with Caution

Be wary when giving (or requesting) informal advice:
- Only for basic, generic questions
- If you’re asking a lot of questions, do a formal consult
- Avoid in unstable or critically ill patients
- Offer to perform formal consultation; insist on it if “curbsided” again on same patient
- Don’t visit patient, write orders, review chart, or submit bill

Thank You

quinny.cheng@ucsf.edu
Session Outline

**Point-of-Care Ultrasound (POCUS) is the future of the physical exam**

- Questions we'll address around this topic:
  - What is POCUS for hospitalized patients?
  - Why learn POCUS?
  - How POCUS is used (cases + demo)?
  - How to get started with POCUS (for you & your institution)?

What is POCUS?

- Performed and interpreted by primary provider...
- ...at the bedside...
- ...to help answer a specific clinical question...
- ...quickly
How we use POCUS in Hospital Medicine?

- Diagnostic
- Therapeutic (procedural guidance)
- Treatment monitoring
- Disease screening

Why learn POCUS?

Reason 1: It makes you a better doctor...
- Procedural complications
- Efficiency and accuracy of diagnosis
- Patient satisfaction

Why learn POCUS?

Reason 2: Most IM/HM doctors don’t know much....
(Especially if you trained awhile ago)

Why learn POCUS?

Reason 3: Despite lack of knowledge, people think its important....

2017 Needs Assessment of UCSF Hospitalists

- 93% I believe POCUS is important for diagnostic purposes in internal medicine.
- 88% I believe POCUS should be a formal part of residency training.
- 93% I believe faculty would benefit from faculty development in POCUS.
Why learn POCUS?

It's coming whether you like it or not...

Cases: Inpatient Care as a POCUS Hospitalist

- Four common inpatient scenarios
  - Brief HPI and exam
  - Demo image acquisition and review normal anatomy/findings
  - Review abnormal images from the case
  - Discuss how POCUS impacted care delivery

---

Case 1: Mr. Seth is short of breath

- HPI: 61 M with HFrEF, COPD admitted for COPD exacerbation & CAP.
  - Nebulizers, prednisone, and antibiotics
  - HD #3: increasing respiratory distress and anxiety

- Vitals: AF, HR 102, BP 192/97, RR 26, O2 sat 82% on RA → 93% on 6L NC

- Exam:
  - General: moderate distress.
  - CV: Tachycardic, no MRG. Unable to assess JVP. 1+ pitting edema of b/l LEs.
  - Lung: tachypneic, increased WOB, scattered wheeze with bilateral lower lobe rales.

- Labs: normal CBC and BMP, BNP 421, Troponin pending, EKG non-ischemic. CXR ordered.

- On admission, >3 b-lines in R anterior lung, otherwise normal.

- Now, diffuse b-lines in bilateral lung fields, bilateral pleural effusions. IVC 2.4 cm and minimally collapsible.

- You rewrote the POCUS assessment by the time the CXR was ordered 😊

---
Demo: Lung Ultrasound (LZ 1-3)

Demo: Lung Ultrasound (LZ 4)

Demo: IVC Ultrasound

**B-lines**
- Pattern helps you with ddx:
  - Bilateral (interstitial syndrome) vs Focal
  - Higher sensitivity than CXR
  - Useful for dynamic monitoring
- **Pleural effusion**
  - Anechoic space (black) surrounded by anatomic borders
  - Spine sign
  - Simple vs. complex
  - Sensitivity > CXR

- **IVC**
  - Dilated >2cm
  - Non-collapsible <50%
  - In a dyspneic patient:
    - >80% sensitivity & specificity for HF/volume overload
    - Most confusing/controversial POCUS exam

---

**Case 1 Resolution**
- POCUS diagnosis: interstitial syndrome, pleural effusions, volume overload
- You give him IV Lasix and treat his blood pressure → BP normalized and hypoxia improving
- You make a mental note to check his lung and IVC US again tomorrow to decide about thoracentesis and further need for diuretics

**Case 1 Take Home Points**
- **POCUS**
  - improved the quality of your index exam
  - helped you quickly identify why his condition acutely changed
  - When possible:
    - Have an algorithmic approach
    - Combine multiple pocus exams and integrate with other data

---

*Image credits: Kajimoto et al., Cardiovascular Ultrasound, 2012.*
Case 2: Mrs. Essig is hypotensive

- **HPI:** 52W with metastatic breast cancer c/o L malignant pleural effusion on chemotherapy p/w generalized weakness, dyspnea, lethargy, HR 123, BP 82/40 → given 2L IVF with improvement.
- **Vitals:** AF, HR 112, BP 90/47, RR 16, 02 sat 96% on RA
- **Exam:**
  - **General:** arousable but somnolent, comfortable
  - **CV:** Tachycardic, regular, no MRG. JVP 6cm. Chronic lymphedema of the b/l LEs
  - **Lung:** breathing comfortably on RA, diminished breath sounds LLE but otherwise CTA bilaterally
- **Labs:** CBC and BMP normal. Tlbi 1.6, normal AST/ALT. BNP 235 (unknown baseline), TnI negative.

---

**POCUS!**

Lungs with a-lines through throughout, moderate L pleural effusion

Cardiac US with mildly reduced LVEF, pericardial effusion

**Demo:** Cardiac US (Parasternal Long Axis)
**Case 2 Resolution**

- POCUS diagnosis: new mild-moderate LVEF reduction, new small pericardial effusion
- Repeat TTE on HD#1 confirms new EF 40%, pericardial effusion enlarging
- HD#3 she develops tamponade, undergoes pericardial drain placement. Patient and family opt for hospice referral.

**Case 2 Take Home Points**

- POCUS led you to a faster, new diagnosis of HFrEF.
  - Clinical management: more cautious with IVF
  - Further diagnostic testing: ordered TTE from admission
  - Monitoring evolution of pericardial effusion
  - Assist with prognostication & GOC

---

**Table A** — Diagnostic capabilities of Randomized Cardiac Ultrasound Using Audible Echocardiography vs the Reference Standard in 254 Participants

<table>
<thead>
<tr>
<th></th>
<th>Predicted LVEF</th>
<th>Sensitivity*</th>
<th>Specificity*</th>
<th>LR (Sens)</th>
<th>LR (Spec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFrEF</td>
<td>47 (50)</td>
<td>84 (59, 94)</td>
<td>86 (55, 94)</td>
<td>0.13 (0.5)</td>
<td>0.13 (0.5)</td>
</tr>
<tr>
<td>Pericardial effusion</td>
<td>30 (29)</td>
<td>55 (28,80)</td>
<td>87 (60, 97)</td>
<td>0.72 (0.89)</td>
<td>0.72 (0.89)</td>
</tr>
</tbody>
</table>

* - Adapted from Lucas et al, Am J Med 2011
Case 3: Dr. Nye has an AKI

- **HPI:** 84M with BPH, HTN, DM2 presents with AMS, lower abdominal pain, decreased urination, K 6.4. ED POCUS shows hydronephrosis and a distended bladder
  - → foley with 400cc urine output. hyperK treatment.

- **Vitals:** within normal limits

- **Exam:**
  - General: mildly agitated but redirectable, no distress
  - Abd: soft, suprapubic tenderness, no CVA tenderness, no distension, NABS
  - GU: foley in place draining cloudy yellow urine

- **Labs:** WBC 11.7, BUN 48, Cr 6.1, otherwise normal. UA +WBC, +nitrite, +LE, +blood. Urine culture pending. CTAP pending.

---

**Demo: Renal Ultrasound (RUQ)**

---

**Demo: Renal Ultrasound (LUQ)**
Demo: Bladder Ultrasound

- **Hydronephrosis**
  - Arises from renal pelvis and extends through kidney
  - Grading:
    - Mild-moderate
    - Severe

- **Bladder Volume**
  - Measure in transverse and longitudinal planes
  - \( L \times W \times H \times 0.5 \)

---

Case 3 Resolution

- POCUS diagnosis: severe hydronephrosis, foley dysfunction with urinary retention
- Foley is flushed and repositioned → additional 800cc urine output. He is started on ceftriaxone for UTI and Tamsulosin for BPH. His abdominal pain resolves; you cancel the CT scan.
- HD #2: urine culture + for pan-sensitive E Coli → abx narrowed to cephalexin. K, Cr improved. Foley is removed and he passes a trial of void prior to discharge.
Case 3 Take Home Points

- POCUS helped you quickly identify a complication in your treatment plan
  - avoided a potential bad outcome & unnecessary CT scan.
- Accuracy of bladder volume by POCUS > bladder scan
- Detecting hydronephrosis is a readily attainable skill
  - IM residents x5 hrs of renal US practice = 94% sensitivity, 93% specificity for moderate-severe hydronephrosis

Case 4: Ms. Nidus has cellulitis

- HPI: 36Y with IVDU, DVT not on anticoagulation presents Saturday night with a red, swollen, and painful RLE. No fevers or chills.
  - IVF, empiric antibiotics for cellulitis and orders a RLE Doppler
- Vitals: Afebrile, HR 98, BP 108/55, RR 16, O2 sat 98% RA
- Exam:
  - General: awake, alert, cooperative. In mild distress 2/2 pain.
  - CV: RRR, no MRG.
  - MSK: RLE tender, erythematous, warm to touch distally. No fluctuance or purulence. She is diffusely TTP overlying the area. Mild pitting edema of R>LLE. Intact pulses.
- Labs: WBC 12.3, CBC otherwise normal. Lactate 2.1. D-dimer 785. Doppler RLE is ordered, but won’t be performed until the techs arrive on Monday morning.

How many people would anticoagulate her?

Case 4: Ms. Nidus has cellulitis

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- Labs: WBC 12.3, CBC otherwise normal. Lactate 2.1. D-dimer 785. Doppler RLE is ordered, but won’t be performed until the techs arrive on Monday morning.

How many people would anticoagulate her?
- SSTI
  - Cobblestoning (cellulitis)
  - Deep fluid pocket (abscess)
  - Hospitalists ID’ing abscess: 97% sensitivity, 84% specificity

- DVT US
  - Compression-only
  - 5 branch points (including popliteal)
  - Sensitivity 100%, specificity 99% compared to radiology

Case 4 Resolution

- POCUS diagnosis: cellulitis, no abscess, +DVT. Safe for further fluid resuscitation.
- You give an additional 1L IVF → lactate, BP normalizes
- You start her on therapeutic lovenox for DVT seen on POCUS; confirmed by radiology DVT study 36 hours later.
- She tolerates oral antibiotics well, cellulitis improves. Prior to discharge, switch to oral DOAC with plans to follow up with a community PCP
Case 4 Take Home Points

- In a resource-limited environment (overnights, weekends) POCUS can lead to faster initiation of appropriate therapy.
- POCUS can help guide fluid resuscitation in the setting of hypotension or tachycardia.
- Just because you POCUS, doesn’t mean you can’t order the formal study!

So why do we POCUS?

- Earlier diagnosis and treatment
- Avoids additional tests and reduces radiation exposure
- Safe treatment monitoring, prognostication
- Skills are attainable and lead to better quality care delivery than exam alone

POCUS doesn’t replace the physical exam; it enhances the physical exam.

It IS the physical exam

Data for the POCUS we covered

<table>
<thead>
<tr>
<th>Exam</th>
<th>Statistical Performance</th>
</tr>
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<tbody>
<tr>
<td>IVC</td>
<td>Correlation coefficient 0.7-0.9</td>
</tr>
<tr>
<td>LVEF</td>
<td>LR +5.4; LR -0.2</td>
</tr>
<tr>
<td>Pericardial Effusion</td>
<td>LR +7.7; LR -0.0</td>
</tr>
<tr>
<td>Pulmonary Edema</td>
<td>Sensitivity 94%; Specificity 92%</td>
</tr>
<tr>
<td>Pleural Effusion</td>
<td>Sensitivity 99%; Specificity 96%</td>
</tr>
<tr>
<td>Hydronephrosis</td>
<td>Sensitivity 94%; Specificity 93%</td>
</tr>
<tr>
<td>DVT</td>
<td>Sensitivity 100%; Specificity 96%</td>
</tr>
<tr>
<td>Abscess</td>
<td>Sensitivity 97%; Specificity 84%</td>
</tr>
</tbody>
</table>

Data for POCUS Algorithms

- Rapid Ultrasound in Shock and Hypotension (RUSH)
- BLUE protocol for dyspnea/hypoxia

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma/COPD</td>
<td>89</td>
<td>97</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>97</td>
<td>96</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>81</td>
<td>78</td>
</tr>
</tbody>
</table>
What is the scope of POCUS in HM?

Soni et al, “Point-of-Care Ultrasound for Hospitalists: A Position Statement of the Society of Hospital Medicine.” JHM 2019

How should you integrate POCUS into your practice?

- Many factors to think through:
  - Context
  - Frequency
  - Difficulty
  - Data

Scope of POCUS in HM at UCSF

Addressing Barriers

- Hardware
- Training
- Time and money constraints
- Credentialing and privileging
POCUS Learning Pathways

- Pursue a certificate program (SHM, CHEST)
- Attend workshops (SHM, ACP, AIUM, UCSF)
- Learn from local experts (EM, critical care colleagues)
- Self-learning, ad hoc (FOAMed)

Our institution’s experience

Getting started…

- Champion(s)
- Leadership buy-in
  - Education
  - Research
  - Cost savings
  - Clinical outcomes

Building momentum…

- Training program development
- Equipment investment

Level 1: Basic Knowledge
- Portfolio building & Credentialing

Level 2: Early User
- Building Network, Workshops

Level 3: Independent Use
- Modules, Didactics

Making it official

1. Privileging and Credentialing
2. Quality assurance
3. Integration into EMR and billing

IMAGE HERE: Notary stamp?
"The larger issue now is to decide whether we believe that – in this case hospitalists – building competency in ultrasound among generalist physicians will enhance patient safety, quality, and value. Personally, I do."

- Bob Wachter, 2012

Review of Session Goals

- What is POCUS for hospitalized patients?
- Why learn POCUS?
- How POCUS is used (cases + demo)?
- How to get started with POCUS (for you & your institution)?

POCUS is the future of the physical exam.
Diagnosis and Management of Acute Kidney Injury

25th Annual Management of the Hospitalized Patient

Lowell Lo, MD
Associate Clinical Professor
Renal Ambulatory Service and Practice Chief
Mount Zion Dialysis Unit Medical Director
Division of Nephrology
University of California San Francisco

Disclosure

There are no conflicts of interest to disclose.

My Boss's Boss Instruction

Thou shalt “have a good sense of what the audience need to know about diagnosing and managing inpatients with rising creatinine”

Objectives

- Differentiate scenarios that may not be JUST acute tubular necrosis (ATN)
- Explain the limitation of common lab tests
- Devise a treatment plan for non-oligouric ATN
Overview

- The pre, post, and “intrinsic” (15 mins)
- The patient’s Cr bumped (45 mins)
- Will the patient need dialysis (5 mins)
- Will the patient recover (5 mins)
- Covid-19 and kidney injury (5 mins)

A Word about ARF to AKI

“The diagnosis of ‘injury’, by contrast, does not presuppose a reduction in glomerular filtration...The analogy to cardiology may be instructive: clinicians diagnosing acute myocardial infarction do not wait until a reduction in cardiac output, but rather make the diagnosis of myocardial injury on the basis of elevations of tissue-specific biomarkers in the serum.”

Walkar Curr Opin Nephrol Hypertens 2007

Cr Bump – 3 Variations

Objectives

- Differentiate scenarios that may not be JUST acute tubular necrosis (ATN)
- Explain the limitation of common lab tests
- Devise treatment plan for non-oligouric ATN
Case 1 (ARS)

- 52 y/o male with PMH of poorly controlled T2DM over 10 years, HTN over 15 years, ongoing tobacco use, PVD, and CKD stage 3b with baseline ~Cr 1.9 admitted for non-healing foot ulcer and possible osteomyelitis of the toes. He was started on IV vanc and PO cipro. On day 4 of admission, his SBP dropped to 80s (baseline 130s on Losartan, Amlodipine, and Carvediol). He received 2L of LR and was urgently operated with toe amputation. On day 5, his Cr increased to 2.5 and received 2 more liter of LR. On day 6, his Cr increased to 2.8 and surgical bone Cx grew mixed GPC and GNR. On day 7, his Cr increased to 3.6 and nephrology was consulted. What’s the cause of his AKI?

A: Pre-renal
B: Acute tubular necrosis
C: Acute interstitial nephritis
D: Post-renal

A Wise Nephrologist Once Told Me:

“If you fell asleep during Nephrology Clerkship and woke up by the dreaded question of why did this patient have renal failure, just say ATN”
Case 1

- 52 y/o male with PMH of poorly controlled T2DM over 10 years, HTN over 15 years, ongoing tobacco use, PVD, and CKD stage 3b with baseline ~Cr 1.9 consulted for AKI with Cr increased to 3.6. Urine microscopy showed:

Case 1 – "Intrinsic"

- Acute renal failure
- Intrinsic causes
  - Acute tubular necrosis (10% of cases)
  - Acute interstitial nephritis (15% of cases)
  - Acute glomerulonephritis (5% of cases)
- Pre-renal causes
- Post-renal causes

Case 1 – What is ATN

- 52 y/o male with PMH T2DM, HTN, tobacco use, PVD, and CKD stage 3b with baseline ~Cr 1.9 consulted for AKI. Cr increased to 3.6 on day 7 with urine microscopy showed + muddy brown casts. A diagnosis of ATN secondary to osteomyelitis from mixed GPC and GNR was made. Vancomycin and cipro was continued. His Cr peaked on day 9 at 4.3. On day 10, his Cr down trended to 3.9 and his Cx grew MSSA (vanc changed to nafcillin) and GNR grew pseudomonas sensitive to cipro (continued). On day 11, his Cr further improved to 3.2 (renal team signed off). As the team was planning to discharge the patient on day 13 to SNF, his AM lab showed Cr increased from 2.5 back to 3.5. What’s the cause of the new AKI?

- A: Pre-renal
- B: Acute tubular necrosis
- C: Acute interstitial nephritis
- D: Post-renal

Case 1 – Continue (ARS)

- 52 y/o male with PMH T2DM, HTN, tobacco use, PVD, and CKD stage 3b with baseline ~Cr 1.9 consulted for AKI. Cr increased to 3.6 on day 7 with urine microscopy showed + muddy brown casts. A diagnosis of ATN secondary to osteomyelitis from mixed GPC and GNR was made. Vancomycin and cipro was continued. His Cr peaked on day 9 at 4.3. On day 10, his Cr down trended to 3.9 and his Cx grew MSSA (vanc changed to nafcillin) and GNR grew pseudomonas sensitive to cipro (continued). On day 11, his Cr further improved to 3.2 (renal team signed off). As the team was planning to discharge the patient on day 13 to SNF, his AM lab showed Cr increased from 2.5 back to 3.5. What’s the cause of the new AKI?

- A: Pre-renal
- B: Acute tubular necrosis
- C: Acute interstitial nephritis
- D: Post-renal
Case 1 – Continue

- New urinary sediment reviewed:

52 y/o male with PMH T2DM, HTN, tobacco use, PVD, and CKD stage 3b with baseline ~Cr 1.9 consulted for AKI. Cr increased to 3.6 on day 7 with urine microscopy showed + muddy brown casts. A diagnosis of ATN secondary to osteomyelitis from mixed GPC and GNR was made. Vancomycin and cipro was continued. His Cr peaked on day 9 at 4.3. On day 10, his Cr down trended to 3.9 and his Cx grew MSSA (vanc changed to nafcillin) and GNR grew pseudomonas sensitive to cipro (continued). On day 11, his Cr further improved to 3.2 (renal team signed off). As the team was planning to discharge the patient on day 13 to SNF, his AM lab showed Cr increased from 2.5 back to 3.5. What’s the cause of the new AKI?

A: Pre-renal
B: Acute tubular necrosis
C: Acute interstitial nephritis
D: Post-renal

Case 1 – AIN

- Clinical suspicion
- Onset s/p potential culprit meds (1-2 weeks with new exposure or few days with repeated exposure)
- Pyuria (50-90%), tubular proteinuria
- Fever, rash (15-50%)
- Eosinophilia

Case 1 - Urine Eosinophil Testing?

- At 1% cutoff, the test does not shift pretest probability of AIN in any direction.
- Even at 5% cutoff, UEs performed poorly in distinguishing AIN from ATN or other kidney diseases.

Perazella Clinical Nephrology 2014

Muriithi CJASN 2013
Case 1 – End

The patient was diagnosed with presumptive AIN secondary to Cipro (The patient had multiple exposures to penicillin like Augmentin prior). Despite stopping cipro, his creatinine continued to increase. He received a renal biopsy which confirmed AIN. Then he was treated with prednisone for a month with Cr eventually settled in the high 2s after 6 months.

Case 1 – My Pearls for AKI NOT ATN

- No major medical events – unexplained Cr rise
- Patients appear well with great/graduate Cr rise
- Positive hematuria and proteinuria (always get an UA before renal consult if possible)
- Pyuria with negative Culture
- Inpatient de novo GN (except for infectious GN) is very rare
- No muddy brown cast ≠ no ATN
- Patients can have AIN without urinary WBCs

Overview

- The pre, post, and "intrinsic" (15 mins)
- **The patient’s Cr bumped (45 mins)**
- Will the patient need dialysis (5 mins)
- Will the patient recover (5 mins)
- Covid-19 and kidney injury (5 mins)

Case 2

- 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib RVR and shortness of breath. On DOA, the patient had CT PE protocol which ruled out PE and PNA. On day 2, she had RHC which showed elevated right (Mean RA ~31 mmHg) and left-sided (PCWP ~33 mmHg) filling pressures with low CO. She was diagnosed with decompensated heart failure and started on IV Lasix but did not make much urine. Her Cr trend:
Case 2 (ARS)

- 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib RVR and shortness of breath. On DOA, she had CT PE protocol which ruled out PE and PNA. On day 2, she had RHC which showed elevated right- (Mean RA ~31 mmHg) and left-sided (PCWP ~33 mmHg) filling pressures with low CO. She was diagnosed with decompensated CHF and started on IV Lasix but only made about 1L of urine. Cr increased from 1.1 to 1.5 to 2 to 2.9. Nephrology was consulted for whether to continue diuresis.

What was the cause of the patient's AKI?

A: Pre-renal
B: Acute tubular necrosis
C: Acute interstitial nephritis
D: Post-renal

Case 2 (ARS with answer)

- 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib RVR and shortness of breath. The patient was s/p CT PE protocol on DOA which ruled out PE and PNA. On day 2, she had RHC which showed elevated right- (Mean RA ~31 mmHg) and left-sided (PCWP ~33 mmHg) filling pressures with low CO. She was diagnosed with decompensated CHF and started on IV Lasix but only made about 1L of urine. Cr increased from 1.1 to 1.5 to 2 to 2.9. Nephrology was consulted for whether to continue diuresis.

What was the cause of the patient’s AKI?

A: Pre-renal
B: Acute tubular necrosis 2/2 contrast nephropathy
C: Acute interstitial nephritis
D: Post-renal

Case 2 (ARS)

- 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib RVR and decompensated heart failure exacerbation. Her hospital course was complicated by contrast nephropathy. Assuming her baseline GFR was normal at 100mL/min and her creatinine peaked at close to 4 and level off. What was her GFR at the arrow point?

A: ~100mL/min
B: ~80mL/min
C: ~50mL/min
D: ~20mL/min

Objectives

- Differentiate scenarios that may not be JUST acute tubular necrosis (ATN)
- Explain the limitation of common lab tests
- Devise a treatment plan for non-oligouric ATN
Case 2 – Assessing Kidney Fx in AKI

• Limitations of serum [Cr]
  • Not helpful when not in steady state
  
  The patient’s kidney function has been the same since day 1 of injury. Clinical implication would be dosing medications with GFR < 10-30mL/min and avoid meds that will accumulate in patients with advanced kidney disease.

Case 2 (ARS with answer)

• 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib, RVR and decompensated heart failure exacerbation. Her hospital course was complicated by contrast nephropathy. Assuming her baseline GFR was normal at 100mL/min and her creatinine peaked at close to 4 and level off. What was her GFR at the arrow point?

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Case 2 (ARS)

• 85 y/o female with PMH of aflutter, T2DM and HTN presenting with Afib, RVR and decompensated heart failure exacerbation. The patient developed contrast nephropathy. Her RHC showed elevated right (Mean RA ~31 mmHg) and left-sided (PCWP ~33 mmHg) filling pressures with low CO. However, creatinine continued to increase with diuresis. Should we continue diuresis?

  A: Yes
  B: No, waitful watching
  C: No, check FeNa
  D: No, check FeUrea
  E: No, give IVF
Case 2 – Lasix vs IVF

- Limitations of FeNa
  - Not helpful when not Oligouric

- Purpose of FeNa: Explain why a patient is oliguric

- If a patient is not oliguric, what does FE Na represent?

- Assuming normal renal function, what would your FE Na be?

Case 2 – Origin of FeNa

**Fractional Excretion of Sodium**

*Exceptions to Its Diagnostic Value*

Stuart Zarich, MD; Leslie S. T. Farg, MD, PhD; Jonathan R. Diamond, MD

- Low FE Na reported in:
  - Oliguric ATN
  - CIN
  - Acute glomerulonephritis
  - Myoglobin-induced AKI
  - HRS
  - Renal allograft rejection
  - AIN

- FE urea better if diuretics involved
- Unclear whether studies included CKD

A Wise Nephrologist Once Told Me:

"Acute tubular necrosis is a solute retention state."

Case 2 (ARS with answer)

- 85 y/o female with PMH of AF, T2DM and HTN presenting with AFib RVR and decompensated heart failure exacerbation. The patient developed contrast nephropathy. Her RHC showed elevated RA (~31 mmHg) and left-sided (PCWP ~33 mmHg) filling pressures with low CO. However, creatinine continued to increase with diuresis. Should we continue diuresis?

A: Yes
B: No, waitful watching
C: No, check FeNa
D: No, check FeUrea
E: No, give IVF
Case 2 – Assessment and Plan

- 85 y/o female with PMH of AFib, T2DM and HTN presenting with Afib RVR and decompensated heart failure exacerbation. The patient developed contrast nephropathy. Her RHC showed volume overload. She was managed with IV Lasix with minimal response and transitioned to inotrope infusion and IV bumex gtt. Her creatinine continued to worsen daily.

- What can a nephrologist do that an internist can’t do now?

Case 2 – Nephrologist = Internist PLUS

- Intensive Insulin Therapy
- Loop Diuretics
- Erythropoietin
- Insulin-like growth factor
- Thyroxine
- Dopamine
- Fenoldopam

Objectives

- Differentiate scenarios that may not be JUST acute tubular necrosis (ATN)
- Explain the limitation of common lab tests
- Devise a treatment plan for non-oligouric ATN

Plan: FEN

1) Solute/Fluid
2) Na
3) K
4) HCO3/AG
5) Ca/Mg/Phos
6) BUN/Nutrition/Uremia
Case 2 – Assessment and Plan

**S:** + SOB, fatigue, poor appetite, +N and small amount of V

**O:** AF, HR 80s, RR 16, BP 90/50, O2 Sat 97% on 4LNC, Wt 72.6 (Adm 71.6), Intake 430mL UOP 800mL

**PE:** JVD to mandible, irregularly irregular, bibasilar crackles, Bilateral 1+ thigh edema, + asterixis

Plan: FEN

- 1) Solute/Fluid
- 2) Na
- 3) K
- 4) HCO3/AG
- 5) Ca/Mg/Phos
- 6) BUN/Nutrition/Uremia

**CHEM PROFILE**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>122</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.9</td>
</tr>
<tr>
<td>Calcium</td>
<td>7.8</td>
</tr>
<tr>
<td>Phosphate</td>
<td>5.2</td>
</tr>
<tr>
<td>Magnesium</td>
<td>2.5</td>
</tr>
<tr>
<td>Hepatitis B Anti</td>
<td>-</td>
</tr>
<tr>
<td>Hepatitis C Anti</td>
<td>-</td>
</tr>
</tbody>
</table>

**Case 2 – Assessment and Plan**

1) Solute/Fluid (Wt ~5Kg + up) – Total solute overload, perfusion pressure OK

- Increase bumex gt and low sodium diet

2) Na (122) – Total water overload

- Fluid restriction to < 1L per day

3) K (4.9) – Total body K adequate

- Monitor for hypokalemia especially if UOP increases

4) HCO3/AG (18/12) – likely NAGMA due to decreased ammoniagenesis and dilutional

- May improve with diuresis

5) Ca/Mg/Phos (7.8/2.5/5.2) – Mild hypoCa from resistance to PTH and decreased 1,25-OH vitamin D and hyperMg/hyperPhos from decreased excretion

- Renal diet to decrease phos intake (not too concerned right now given poor PO intake)

6) BUN/Nutrition/Uremia (79) – Concerning with decreased PO intake, +N/V, + asterixis

- Patient is needing dialysis soon if renal function doesn’t start to recover (hoping for renal recovery by 7-10 days with CIN).

- Dialysis indication – uremia *don’t let BUN level lead you around by the nose

**Case 2 – My Pearls for BUN level**

- Elevated BUN states without uremia
  - Excessive protein feeding (ex: transitioning off CVVHD to IHD)
  - GI Bleed
  - High catabolic state (ex: high dose steroid)

- Low BUN states with uremia
  - Malnourished state
Case 2 – One more word about BUN

- BUN is not a true uremic toxin – it is a SURROGATE

<table>
<thead>
<tr>
<th>Subhead Group</th>
<th>Example</th>
<th>Source</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peptide and small protein</td>
<td>Beta-2-microglobulin</td>
<td>Shed from RBCs</td>
<td>Pseudoalbumin because of large size</td>
</tr>
<tr>
<td>Guanidines</td>
<td>Guanidines</td>
<td>Arginine</td>
<td>Increased production in serum</td>
</tr>
<tr>
<td>Phosphates</td>
<td>p-Cresol sulfur</td>
<td>Phenylalanine, tyrosine</td>
<td>Protein bound, produced by gut bacteria</td>
</tr>
<tr>
<td>Nucleotides</td>
<td>Nucleotides</td>
<td>Adenosine, guanine</td>
<td>Large volume of distribution, produced by gut bacteria</td>
</tr>
<tr>
<td>Amino acids</td>
<td>Amino acids</td>
<td>Aspartic acid, glutamic acid</td>
<td>Formation of crystal deposits</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>Glucuronic acid, inositol</td>
<td>Glycolytic intermediates</td>
<td>Reaction with proteins to form advanced glycosylation products</td>
</tr>
</tbody>
</table>

Meyer NEJM 2007

Case 2 – End

- 85 y/o female with PMH of afib, T2DM and HTN presenting with A fib RVR and decompensated heart failure exacerbation. The patient developed contrast nephropathy. After 2 days of high dose bumex gt and inotrope, the patient’s UOP increased to 3L per day with Cr slightly down trending. The next day, despite reducing bumex gt to spot dosing, she made 5L UOP with Cr down to low 3s with resolution of N/V and asterixis.

Case 2 – Reflection

- Did I do anything to help with this case?
  - I diagnosed the patient with contrast nephropathy
  - I reassured the team that despite Cr going up, it was ok to continue diuresis
  - I helped keeping an eye on FEN and got ready to perform dialysis while being hopeful for the potential renal recovery around 7-10 days

Case 2 – My Pearls for CIN Prophylaxis

- IV saline, IV saline, IV saline
- How much?
  - Enough that pt doesn’t develop shortness of breath
  - 100cc/hr x3-6hrs pre and 6-12hrs post
  - NO pre-emptive dialysis
  - NO IV NaHCO3
  - NO mucomyst

Weisbord NEJM 2018, Brar Lancet 2014
90 y/o male with PMH of HFpEF, afib s/p pacemaker, COPD, CKD baseline Cr ~2, T2DM and BPH admitted for worsening cough, shortness of breath and orthopnea. He was diagnosed with CHF exacerbation and diuresed ~2L the first 2 days. Cr on admission was close to baseline, worsened initially and improved back to baseline after diuresis. The AM prior to consultation he went into Afib RVR. The day of consultation his Cr rose from 2 → 2.46. The team consulted us to assist with AKI management specifically regarding whether to give Lasix or IVF.

After his episode of Afib with RVR s/p amiodarone load, the patient developed hypercapnic respiratory failure with pH 7.15, CO2 78, O2 66 → ICU and intubated. Post intubation, the patient developed shock requiring 1L NS bolus followed by initiation of norepinephrine. On exam, the patient's SBP was 110s and HR 70s. Pertinent exam: Afib, rate controlled, + JVD without peripheral edema, decreased BS at bases, and extremities are warm. His TTE showed severe tricuspid regurgitation, LV ejection fraction was estimated to be 45% to 50%. Mechanical ventilation precluded the accurate estimation of right atrial pressure. CXR showed worsening of perihilar opacity which may reflect edema, infection, or acute lung injury, with moderate layering effusions. CT chest non-con showed dependent consolidation throughout the mid to lower lungs suspicious for aspiration, infection, or dependent edema and esophageal pathology that predisposed to aspiration. The patient became +1.5L with only 190mL UOP through the day. Renal was consulted for management of AKI and volume status. We should recommend:

A: Bolus IVF for septic shock
B: Give IV loop diuretics for ATN
C: Start patient on CVVHD

"If you don’t know what to do with the fluid status, consult nephrology."
Case 3 (ARS with answer)

- After his episode of Afib with RVR s/p amiodarone load, the patient developed hypercapnic respiratory failure with pH 7.15, CO2 78, O2 66 → ICU and intubated. Post intubation, the patient developed shock requiring 1L NS bolus followed by initiation of norepi gtt. On exam, the patient’s SBP was 110s and HR 70s. Pertinent exam: Afib, rate controlled, + JVD without peripheral edema, decreased BS at bases, and extremities are warm. His TTE showed severe tricuspid regurgitation. LV ejection fraction was estimated to be 45 to 50%. Mechanical ventilation precluded the accurate estimation of right atrial pressure. CT chest non-con showed dependent consolidation throughout the mid to lower lungs suspicious for aspiration, infection, or dependent edema and esophageal pathology that predisposed to aspiration. The patient became +1.5L with only 190mL UOP through the day. Renal was consulted for management of AKI and volume status. We should recommend:

A: bolus IVF for septic shock
B: Give IV loop diuretics for ATN
C: Start patient on CVVHD

Case 3 – Assessment and Plan

Events: s/p IV diuril+bumex, IV Abx and off pressor with improved oxygenation
S: intubated
O: AF, HR 70s, RR 16, BP 154/76, O2 Sat 98% on 40%FiO2, Wt 73.5 (Adm 81.6), Intake 1.3L UOP 1.7L
PE: JVD elevated, +crackle at bases, no dependent edema, alert following command

Plan: FEN

1) Solute/Fluid – Total solute still up with pulm edema, perfusion pressure fine
Continue IV diuril and bumex
2) Na (149) – Water deficient (WHAT? Should I give diuretics?)
What to do???
3) K (4) – Total body K adequate for now, monitor for hypoK
4) HCO3/AG (22/20) – Met Alkalosis (from diuretics) and Gap acidosis (from ATN)
5) Ca/Mg/Phos (9/2.3/6.2) – HyperPhos from decreased excretion
Renal diet +/- phos binder pending on trend
6) BUN/Nutrition/Uremia (132) – Uremia? Dialysis?
Case 3 – Volume Expansion And Dehydration

<table>
<thead>
<tr>
<th>Day</th>
<th>Total Na (meq)</th>
<th>Total Body Water (L)</th>
<th>Na PO Intake (meq)</th>
<th>Water PO Intake (L)</th>
<th>Urinary Na Output (meq)</th>
<th>Urinary Water Output (L)</th>
<th>Net Na Balance (meq)</th>
<th>Net Water Balance (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5600</td>
<td>40</td>
<td>50</td>
<td>1.2</td>
<td>150</td>
<td>222</td>
<td>420</td>
<td>9.63</td>
</tr>
<tr>
<td>1</td>
<td>6020</td>
<td>43</td>
<td>150</td>
<td>1.2</td>
<td>150</td>
<td>1.5</td>
<td>0</td>
<td>0.13</td>
</tr>
<tr>
<td>2</td>
<td>5920</td>
<td>42.24</td>
<td>100</td>
<td>1</td>
<td>150</td>
<td>0.8</td>
<td>–100</td>
<td>–0.8</td>
</tr>
<tr>
<td>3</td>
<td>5820</td>
<td>15</td>
<td>150</td>
<td>1</td>
<td>100</td>
<td>0.1</td>
<td>–50</td>
<td>–1</td>
</tr>
<tr>
<td>4</td>
<td>5820</td>
<td>7</td>
<td>50</td>
<td>1.5</td>
<td>150</td>
<td>0.5</td>
<td>–100</td>
<td>–0.5</td>
</tr>
<tr>
<td>5</td>
<td>5770</td>
<td>9.63</td>
<td>50</td>
<td>1.5</td>
<td>150</td>
<td>0.8</td>
<td>–100</td>
<td>–2</td>
</tr>
</tbody>
</table>

Case 3 (ARS with answer)

- Patient is hypertensive, + pulm edema and + hypernatremia. How to manage the patient?
  - A: Continue IV diuril and bumex for volume overload
  - B: Waitful watching
  - C: Only give diuril and stop IV bumex to generate hyponatremia
  - D: Continue IV diuril and bumex and give NGT water 500cc q4hr
  - E: Stop IV diuril and bumex and give NGT water 500cc q4hr

Overview

- The pre, post, and “intrinsic” (15 mins)
- The patient’s Cr bumped, what now (45 mins)
- **Will the patient need dialysis (5 mins)**
- Will the patient recover (5 mins)
- Covid-19 and kidney injury (5 mins)

A Wise Nephrologist Once Told Me:

“The rules of A, E, I, O, U are not helpful to a Nephrologist.”
Case 3 – My Pearls for Dialysis Need

- BUN/Nutrition/Uremia (132) – Uremia? Dialysis?
  1) Acidosis, Electrolytes, Overload
     -- oligo-anuria without hope of renal recovery soon
  2) Ingestion
     -- depends on renal function, level, and type of toxin
  3) Uremia
     -- AMS (diagnosis of exclusion)
     -- cardiac rub
     -- poor nutritional intake, N/V

Case 3 – Any Outcome Diff with early HD

The patient received IV bumex and 2.5L FW via NGT. His respiratory status improved leading to successful extubation the next day. The patient’s FEN parameters all started to improve:

- Up to 20% of all admissions
- Independently associated with increased:
  - Inpatient mortality
  - Length of stay
  - Hospital costs
- Rise in serum Cr of $\geq 0.5 \text{ mg/dL}$:
  - 6.5-fold increase in odds of death
  - 3.5-day increase in LOS
  - $7,500$ in excess hospital costs

References:
- Zeng JASN 2014
- Chertow JASN 2005
Overview

- The pre, post, and "intrinsic" (15 mins)
- The patient’s Cr bumped, what now (45 mins)
- Will the patient need dialysis (5 mins)
- Will the patient recover (5 mins)
- Covid-19 and kidney injury (5 mins)

Case 4

- 42 y/o male with PMH of HTN and obesity admitted for progressive encephalopathy, weakness, and fevers diagnosed with West Nile virus-meningoencephalitis. His hospital course was complicated by hypercapnic respiratory failure and septic shock leading to oligo-anuric ATN initiated on continuous veno-venous hemodialysis for acidosis and volume overload. His Cr trend:

- As the patient’s mental status and respiratory status started to improve, his wife asked: “Will he need dialysis for the rest of his life?”

Case 4 -- AKI-D Significance

- 6-7% of ICU patients
- Independently associated with short-term mortality

Case 4 – AKI-D Recovery Probabilities

<table>
<thead>
<tr>
<th>Pre-admission eGFR (mL/min/1.73m²)</th>
<th>Renal Recovery (among survivors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;90</td>
<td>100% (Schiffl NDT 2006)</td>
</tr>
<tr>
<td>30-44</td>
<td>84% (Lo KI 2009)</td>
</tr>
<tr>
<td>15-29</td>
<td>58% (Hsu CJASN 2009)</td>
</tr>
<tr>
<td></td>
<td>37% (Hsu CJASN 2009)</td>
</tr>
</tbody>
</table>

Cerda Lancet 2015; Lo KI 2009; Odutayo JASN 2017; Wallar JASN 2006
• 42 y/o male with PMH of HTN and obesity admitted for progressive encephalopathy, weakness, and fevers diagnosed with West Nile virus-meningoencephalitis \( \rightarrow \) AKI-D. I told the patient’s wife that he has ~80% chance coming off dialysis by 3-6 months after discharged from the hospital.
Case 5 – A Case of Covid-19

- 50 y/o female with PMH of HTN, DM, CKD 4 with nephrotic range proteinuria (last creatinine check 2020 was 2.3) admitted for mechanical fall due to weakness and found to have febrile illness with Covid (+ vaccinated with Janssen). No NSAID or other nephro-toxin exposure. We are consulted for elevated creatinine:

![Graph showing creatinine levels from 8/2020 to 7/2021.]

IHD Start
Covid Sx
Resolved

8/2020
7/2021

Case 5 – A Case of Covid-19

- 50 y/o female with PMH of HTN, DM, CKD 4 admitted for mechanical fall and Covid with ATN. The patient’s creatinine continued to trend up despite supportive care (pt declined remdesivir due to fever and URI symptoms improved by day 2):

![Graph showing progression of creatinine levels with IHD start and resolved.]

IHD Start
Covid Sx
Resolved

Case 5 – A Case of Covid-19


Case 5 – A Case of Covid-19

- Maybe this is collapsing FSGS:

![Image of collapsing FSGS.]

Werion KI 2020

Shetty JASN 2021
Summary

1) Be on the look out for non-ATN AKI
2) Don’t be afraid to give loop diuretic with creatinine trending up to manage ATN
3) Absolute level of BUN ≠ yes/no uremia
4) Oliguria, ingestion, and uremia are the real indications for RRT
5) For AKI-D, ~80% for GFR ≥45, ~40% for GFR <45 will come off dialysis 3-6 months after discharge
6) Covid-19 likely has some direct kidney injury effect

References

STARRT-AKI Investigators; Canadian Critical Care Trials Group; Australian and New Zealand Intensive Care Society; Clinical Trials Network of Canada; Clinical Trials Network of the United States; Canadian Nephrology Trials Network; Trial Network of Australia and New Zealand; Canadian Critical Care Trials Group Network; MAWED; Multicenter Acute Renal Injury; Adolescent Research Initiative; Renal-Peritoneal Access; Various Investigators; Various Authors. Timing of Initiation of Renal-Replacement Therapy in Acute Kidney Injury. N Engl J Med. 2020 Jul 16;383(3):240-251.


Updates & Controversies in Medical Consultation

Hugo Quinny Cheng, MD
Division of Hospital Medicine
University of California, San Francisco

Updates in Perioperative Medicine

- Perioperative anticoagulation – increasing clarity
- Preoperative echo – useful or overused?
- Postoperative atrial fibrillation – anticoagulation?
- Surgery after COVID-19 – because of course
- Curbside consultation – risks for patient and provider

Managing Perioperative Anticoagulation

A head & neck surgeon asks how to manage anticoagulation in two patients on warfarin who will have major surgery next week.
• One patient has atrial fibrillation due to HTN
• The other has a mechanical aortic valve prosthesis
• Neither has any other relevant comorbidity

“Should we bridge with LMWH while their warfarin is held?”
1. Bridge for AVR only
2. Bridge for AF only
3. Bridge for both
4. Bridge for neither

BRIDGE Trial

Randomized trial of perioperative bridging for AF
• 1884 patients taking warfarin for atrial fibrillation or flutter
• Excluded: mechanical valve, stroke < 12 wks, cardiac & neurologic surgery
• Randomized to bridging with LMWH or placebo when warfarin interrupted for major or minor procedures
• Outcomes: 30-day arterial thromboembolism & bleeding

Douketis JD et al. NEJM, 2015; 373:823-33
**BRIDGE Trial**

<table>
<thead>
<tr>
<th></th>
<th>Bridged</th>
<th>No Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embolic Event</td>
<td>0.3%</td>
<td>0.4%</td>
</tr>
<tr>
<td></td>
<td>Non-inferior</td>
<td></td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>3.2%</td>
<td>1.3%</td>
</tr>
<tr>
<td></td>
<td>NNH = 53</td>
<td></td>
</tr>
<tr>
<td>Minor Bleeding</td>
<td>21%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>NNH = 12</td>
<td></td>
</tr>
</tbody>
</table>

Douketis JD et al. NEJM, 2015; 373:823-33

**PERIOP 2 Trial**

Randomized trial of bridging for AF or mechanical valve
- 1471 patients taking warfarin for atrial fib/flutter, mechanical valve, or both undergoing major or minor procedure
- Excluded mechanical valve patients with: prior stroke/TIA, multiple valves, or Starr-Edwards valve
- All patients received dalteparin prior to surgery
- Randomized to dalteparin or placebo after surgery
  - Therapeutic dose given after low-bleeding risk procedures
  - Prophylactic dose given after high-bleeding risk procedures
- Outcomes: 90-day thromboembolism & bleeding rates

Kovacs MJ et al. BMJ 2021;373:n1205

**PERIOP 2 Trial**

<table>
<thead>
<tr>
<th>90-day Outcome</th>
<th>Bridge</th>
<th>No Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major thromboembolism</td>
<td>1.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Major bleeding</td>
<td>1.3%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

- No significant difference in TE & bleeding risk in all comparisons
- Outcomes similar for patients with AF and mechanical valves
- Only 1 out of the 304 patients with mechanical valve had a TIA

Kovacs MJ et al. BMJ 2021;373:n1205

**Conclusions from BRIDGE & PERIOP 2**

Bridging does not reduce risk of thromboembolism:
- Strong evidence for atrial fibrillation
- Fair evidence for mechanical valves
- Baseline TE risk is low without bridging

Bridging likely increases the bleeding risk:
- Small effect on major bleeds, larger effect on minor bleeds

Caveat:
- Studies had relatively few patients with very high TE risk or bleeding risk
ACC Guideline for AF (2017)

<table>
<thead>
<tr>
<th>Normal Bleeding Risk*</th>
<th>Elevated Bleeding Risk*</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Thrombotic Risk</td>
<td>Bridge</td>
</tr>
<tr>
<td>CHA2DS2-VASc = 7+</td>
<td>Clinical Judgment</td>
</tr>
<tr>
<td>Mod Thrombotic Risk</td>
<td>Clinical Judgment</td>
</tr>
<tr>
<td>CHA2DS2-VASc = 5-6</td>
<td>No Bridge</td>
</tr>
<tr>
<td>Low Thrombotic Risk</td>
<td>No Bridge</td>
</tr>
<tr>
<td>CHA2DS2-VASc = 1-4</td>
<td></td>
</tr>
</tbody>
</table>

* Bleeding risk elevated if major bleed or ICH < 3 months, platelets low or abnormal, aspirin use, supratherapeutic INR, or prior bleeding with bridging or similar surgery

How to PAUSE a DOAC

Perioperative Anticoagulation Use for Surgery Evaluation
- International study of 3007 elective surgery patients taking apixaban, rivaroxaban or dabigatran for atrial fibrillation
- Interrupted & resumed DOAC using standardized protocol
- Considers surgical bleeding risk and (for dabigatran) CrCl
- No bridging was permitted

PAUSE Trial Results
- Average CHADS2 = 2.1 (CHA2DS2-VASc = 3.4)
- Patients having high bleeding risk surgery = 33%

<table>
<thead>
<tr>
<th></th>
<th>Dabigatran</th>
<th>Apixaban</th>
<th>Rivaroxaban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Bleeding</td>
<td>0.9%</td>
<td>1.35%</td>
<td>1.85%</td>
</tr>
<tr>
<td>Arterial Thrombo-</td>
<td>0.6%</td>
<td>0.16%</td>
<td>0.37%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Preoperative Echocardiography

You perform an urgent preoperative evaluation on an 83-y.o. woman with a hip fracture. She has history of mild dementia, remote stroke, diabetes, and hypertension. She reports no dyspnea or angina. Functional capacity unknown, as she is sedentary. Cardiopulmonary exam is normal.

You wonder whether to obtain a transthoracic echo.

1. No, it’s not indicated
2. Yes, it is indicated
3. Yes, because Anesthesia will insist

Preoperative TTE for Urgent Surgery

Japanese national database of 66,620 hip fracture surgery patients:
- 52% underwent preoperative TTE
- Patient having preop TTE were older & sicker
- Patients were matched using propensity score

<table>
<thead>
<tr>
<th></th>
<th>TTE</th>
<th>No TTE</th>
<th>All N.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital Mortality</td>
<td>1.65%</td>
<td>1.74%</td>
<td></td>
</tr>
<tr>
<td>Cardiac Complications</td>
<td>0.39%</td>
<td>0.40%</td>
<td></td>
</tr>
<tr>
<td>ICU Admission</td>
<td>0.46%</td>
<td>0.37%</td>
<td></td>
</tr>
</tbody>
</table>


Guideline Indications for Preop Echo

- Suspect moderate or greater valvular stenosis or regurgitation if no echo in past year or significant clinical change since then (Recommended)
- Heart failure with worsening dyspnea or other change in clinical status (Reasonable)
- Dyspnea of unknown origin (Reasonable)
- Reassessment of LV function in clinically stable patients with previous documented LV dysfunction may be considered if there has been no assessment within 1 year (Not unreasonable)

ACC/AHA Guideline Circulation. 2014;130:2215–2245

Postoperative Atrial Fibrillation

You evaluate a 70-y.o. woman with h/o HTN who develops new postoperative (POAF) atrial fibrillation after total knee arthroplasty. You slow her rate with metoprolol, and she converts back into NSR overnight. Echocardiogram shows normal LV function, normal valves, and mild LAE. Her CHA2DS2-VASc = 3.

Would you recommend long-term anticoagulation?

1. No
2. Yes
3. Let the PCP decide
POAF Predicts Further AF & Stroke

- Observational study of 452 patients with new POAF
- Matched by age, sex, year of surgery, and type of surgery with patient without POAF
- Followed out for 5 years after surgery

<table>
<thead>
<tr>
<th>5-year Event Rate</th>
<th>POAF</th>
<th>No POAF</th>
<th>Adj. HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsequent AF diagnosis</td>
<td>51%</td>
<td>12%</td>
<td>7.9 [4.8-13]</td>
</tr>
<tr>
<td>Stroke or TIA</td>
<td>10.7%</td>
<td>6.0%</td>
<td>2.7 [1.4-5.3]</td>
</tr>
<tr>
<td>All Cause Mortality</td>
<td>46.6%</td>
<td>37.2%</td>
<td>1.7 [1.3-2.1]</td>
</tr>
</tbody>
</table>

Siontis KC et al. JAMA. 2020;324(9):871-878

POAF: Does Anticoagulation Help?

- Retrospective study identified 22,007 patients with new POAF
- Looked at rates of stroke and bleeding based on whether they were prescribed anticoagulation
- Stratified based on CHA2DS2-VASc & HAS-BLED

<table>
<thead>
<tr>
<th>Favors AC</th>
<th>Favors No AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thromboembolic Risk</td>
<td></td>
</tr>
<tr>
<td>Bleeding Risk</td>
<td></td>
</tr>
</tbody>
</table>


Stroke Risk Conclusions

Long-term stroke risk from POAF underappreciated:
- Patients with POAF have 2-fold (adjusted) risk of stroke compared to surgical patients who do not develop AF
- Stroke risk for POAF may be similar to patients with usual, non-surgical NVAF
- Benefits of anticoagulation are unproven

What to do?
- Guidelines recommend treating POAF as regular AF
- Evidence lacking for options: AC? Rhythm monitoring?
You discharge a 50-y.o. obese woman after a 5-day admission for COVID-19 pneumonia. She is now oxygenating well, but still very tired and a little short of breath. On the way out, she says: “I'm scheduled for a gastric bypass in 4 weeks. Can I still have surgery?”

1. Yes, that should be okay
2. Only if your symptoms resolve
3. No...really just don't

Prospective cohort study of surgical cases in Oct 2020:
- 3127 patients (2.2%) had prior COVID-19 infection
- Adjusted mortality for non-infected patients = 1.5%

Higher mortality when surgery performed < 7 weeks after COVID-19 infection:
- Regardless of age, health, urgency/intensity of surgery
- Even if asymptomatic infection (though not as high)
- Even after 7 weeks, mortality higher in patients with ongoing or resolved symptoms compared with asymptomatic cases
- Same pattern observed for postop pulmonary complications

UK Multidisciplinary Consensus Statement
- Surgical planning should consider: severity of infection; ongoing symptoms; comorbid & functional status, before and after SARS-CoV-2 infection; clinical priority and risk of disease progression; and complexity of surgery
- Avoid elective surgery within 10 days of mild/mod infection & 15-20 days of severe infection
- Elective surgery should not be scheduled within 7 weeks of diagnosis, unless outweighed by the risk of delaying
- Delaying surgery beyond 7 weeks should be considered in patients with persistent symptoms

COVIDSurg Collaborative. Anaesthesia 2021, 76, 748–758
El-Boghdady K et al. Anaesthesia 2021, 76, 940–946
Are Curbside Consults Safe?

A surgeon calls you to discuss admission for patient with a suspected infection. Based on this conversation, it doesn’t sound like admission is necessary.

However, you wonder whether you’re liable if you give bad advice on a patient you’re not treating.

1. You’re safe; there’s no duty to treat
2. Put your lawyer on speed-dial
3. What state am I practicing in?

Curbside Consults

Studied 47 requests for curbside advice to hospitalist
- Curbside consultant could ask questions ad lib
- Made recommendations without seeing patient or chart
- Different hospitalist performed formal, in-person evaluation

Questions:
- Did curbside consultant obtain accurate information?
- Did advice and management differ?

Curbside vs. Formal Medicine Consult

Compared to formal consultation, how often did curbside evaluation lead to:

- Incomplete clinical information 34%
- Inaccurate clinical information 28%
- Any difference in management 60%
- Major difference in management 36%

Liability from Curbside Consults

Traditional view:
- Physician-patient relationship ("duty to care") required for malpractice liability
- Purely curbside consultation does not establish treatment relationship – but deeper involvement (chart review, visiting patient, documentation, care coordination) blurs the line

Minnesota & "reasonably foreseeable":
- "duty arises...when the physician provides medical advice and it is foreseeable that the third party will rely on [it]"
Curbside with Caution

Be wary when giving (or requesting) informal advice:
• Only for basic, generic questions
• Avoid in unstable or critically ill patients
• If you’re asking a lot of questions, do a formal consult
• Offer to perform formal consultation; insist on it if “curbsided” again on same patient
• Don’t visit patient, write orders, review chart, or submit bill

Take Home Points

1. Most patients on anticoagulation of atrial fibrillation or mechanical valves don’t require perioperative bridging
2. Echocardiography has a role in preoperative evaluation, but it’s smaller than you might think
3. Postoperative atrial fibrillation predicts future stroke and mortality; benefit vs. risks of anticoagulation uncertain
4. Delay elective surgery at least 7 weeks after COVID-19 diagnosis if possible, even longer if still symptomatic
5. Exercise caution when providing curbside advice

Thank You

Quinny.Cheng@ucsf.edu
Disclosures

- No Conflicts of Interest
- No Financial Disclosures
- Krishan.soni@ucsf.edu

Outline

- **Coronary Artery Disease**
  - Aspirin and prevention of coronary artery disease (CAD)
  - Antiplatelet therapy for secondary prevention
  - Management of combined anticoagulation and antiplatelet agents

- **Heart Failure**
  - Updates in Medical Therapies: ARNI and SGLT2 Inhibitors
  - Treatment of Functional Mitral Regurgitation
  - Putting it all together: Rethinking the algorithm for HF/HFrEF
Acronyms

- ACS: Acute Coronary Syndrome
- BMS: Bare Metal Stent
- CAD: Coronary Artery Disease
- CABG: Coronary Artery Bypass Graft Surgery
- DAPT: Dual Antiplatelet Therapy
- DES: Drug Eluting Stent
- DOAC: Direct Oral Anticoagulant
- HF: Heart Failure
- MR: Mitral Regurgitation
- PCI: Percutaneous Coronary Intervention
- SIHD: Stable Ischemic Heart Disease
- VKA: Vitamin K Antagonist

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Primary Prevention: Aspirin

US task force proposes adults 60 and older should not start daily aspirin to prevent heart disease or stroke
Recent EMR Messages...

Dr. -

I just saw on the TV news tonight that for people over 65 years old that the daily dose of baby aspirin is not necessary and may even be counter productive. They are effective for people in their 40’s.

Should I continue to take my daily dose of baby aspirin?

Please advise. Thank you

Hi Dr. -

I wanted to see if you think it would be reasonable to discontinue Mr. XX aspirin. His MI was remote in 1994 and he continues on rivaroxaban for atrial fibrillation. Would love to hear your thoughts.

Anticoagulation Pharmacist

USPSTF 2021 DRAFT Guidance

Recommendation Summary

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommendation</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults aged 65 or older</td>
<td>The decision is to discontinue low-dose aspirin use for the primary prevention of CVD in adults age 65 or older if they have a 1% or greater 10-year CVD risk, and are willing to take low-dose aspirin daily for at least 10 years.</td>
<td>C</td>
</tr>
</tbody>
</table>

USPSTF 2016 Guidance

Primary Prevention: Aspirin

ARRIVE Trial

Clinical Question:

What is the clinical benefit of 100 mg per day of aspirin in reducing the risk of cardiovascular death, myocardial infarction, unstable angina, stroke, or transient ischemic attack in patients at moderate risk of cardiovascular events without diabetes?

Use of aspirin to reduce risk of initial vascular events in patients at moderate risk of cardiovascular disease (ARRIVE): a randomised, double-blind, placebo-controlled trial

Gaziano JM, Bertoni AG, Cappuccio F, et al., on behalf of the ARRIVE Executive Committee. Use of aspirin to reduce risk of initial vascular events in patients at moderate risk of cardiovascular disease (ARRIVE): a randomised, double-blind, placebo-controlled trial. Lancet 2015 Aug 22
Primary Prevention: Aspirin
ARRIVE Trial

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Aspirin</th>
<th>Placebo</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite Outcome of Cardiovascular Death, Myocardial Infarction, Unstable Angina, Stroke, or TIA</td>
<td>4.3%</td>
<td>4.5%</td>
<td>p = 0.60</td>
</tr>
<tr>
<td>Gastrointestinal Bleeding</td>
<td>0.97%</td>
<td>0.43%</td>
<td>p = 0.0007</td>
</tr>
</tbody>
</table>

Clinical Question:
What is the clinical benefit of 100 mg per day of aspirin in reducing the risk of vascular death, myocardial infarction, or stroke/transient ischemic attack in patients with known diabetes but no history of cardiovascular disease?


Aspirin resulted in a 1.1% absolute risk reduction in major adverse cardiovascular events

Aspirin resulted in a 0.9% absolute increase in major bleeding

NNT: 91
NNH: 111

Primary Prevention: Aspirin
ASCEND Trial

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Aspirin</th>
<th>Placebo</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite Outcome of Cardiovascular Death, Myocardial Infarction, Stroke, or TIA</td>
<td>8.5%</td>
<td>9.6%</td>
<td>p = 0.01</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>4.1%</td>
<td>3.2%</td>
<td>p = 0.003</td>
</tr>
</tbody>
</table>

Clinical Question:
What is the clinical benefit of 100 mg per day of aspirin in reducing the risk of vascular death, myocardial infarction, or stroke/transient ischemic attack in patients with known diabetes but no history of cardiovascular disease?


Aspirin resulted in a 1.1% absolute risk reduction in major adverse cardiovascular events

Aspirin resulted in a 0.9% absolute increase in major bleeding

NNT: 91
NNH: 111
What about cancer?...

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Aspirin</th>
<th>Placebo</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal</td>
<td>2.0%</td>
<td>2.0%</td>
<td>p = 1</td>
</tr>
<tr>
<td>All Cancer</td>
<td>11.6%</td>
<td>11.5%</td>
<td>p = 0.98</td>
</tr>
</tbody>
</table>

No Benefit in Reducing Fatal or Non-Fatal Cancer

An aspirin a day…

Should not routinely be prescribed to patients without prior cardiovascular events due to a lack of clinical benefit and/or increased risk of bleeding that offsets the reduction in cardiovascular events.
Primary Prevention: Aspirin
2019 AHA/ACC Guidelines

4.6. Aspirin Use

<table>
<thead>
<tr>
<th>Recommendations for Aspirin Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Prevention: Aspirin</strong></td>
</tr>
<tr>
<td><strong>2019 AHA/ACC Guidelines</strong></td>
</tr>
</tbody>
</table>

**Coronary Artery Disease**
- Aspirin and prevention of coronary artery disease (CAD)
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- Management of combined anticoagulation and antiplatelet agents

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Antithrombotic therapy in patients with known Coronary Artery Disease (CAD)

**ACC/AHA FOCUSED UPDATE**

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease

**Oral Antiplatelet Agents**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Aspirin</th>
<th>Clopidogrel</th>
<th>Prasugrel</th>
<th>Ticagrelor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS Post PCI Stroke</td>
<td>325 mg</td>
<td>300-600 mg</td>
<td>60 mg</td>
<td>180 mg</td>
</tr>
<tr>
<td>Post PCI</td>
<td>81 mg DAILY</td>
<td>75 mg DAILY</td>
<td>10 mg DAILY</td>
<td>BID</td>
</tr>
<tr>
<td>Class</td>
<td>NSAAD</td>
<td>2nd gen Thienopyridine (PRODRUG)</td>
<td>2nd gen Thienopyridine (PRODRUG)</td>
<td>CTPPT</td>
</tr>
<tr>
<td>Mechanism</td>
<td>IRREVERSIBLE COX-1</td>
<td>IRREVERSIBLE P2Y12</td>
<td>IRREVERSIBLE P2Y12</td>
<td>REVERSIBLE P2Y12</td>
</tr>
<tr>
<td>Peak Effect</td>
<td>1-3 hours</td>
<td>6 hours</td>
<td>4 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td>CYP Metabolism</td>
<td>NA</td>
<td>2C19</td>
<td>2C44</td>
<td>2C19</td>
</tr>
<tr>
<td>FDA Approval</td>
<td>1997</td>
<td>2009</td>
<td>2011</td>
<td>2018</td>
</tr>
<tr>
<td>Generic Approval</td>
<td>+</td>
<td>+</td>
<td>2017</td>
<td>2018</td>
</tr>
</tbody>
</table>
Aspirin dosing in patients with Coronary Artery Disease

- Higher doses of aspirin are associated with bleeding and no increased anti-ischemic benefit
- When used with ticagrelor, aspirin doses of >100 mg are contraindicated

Duration of dual antiplatelet therapy (DAPT)

- Duration of DAPT depends on:
  - Underlying condition
  - Treatment provided

Duration of dual antiplatelet therapy (DAPT) in patients with ACS

ACS = 1 year

Stopping early at 6 months

Duration of dual antiplatelet therapy (DAPT) in patients with SIHD

PCI with Bare Metal Stent (BMS) 1 MONTH
PCI with Drug Eluting Stent (DES) 6 MONTHS

Stopping early at 3 months
**Duration of Antiplatelet Therapy**

**TWILIGHT Trial**

**Clinical Question:**
Can aspirin be safely discontinued from the dual antiplatelet regimen after three months in patients undergoing PCI?

**Regimen:**
- Aspirin 81 + Ticagrelor x 12 months
- OR
  - Aspirin 81 + ticagrelor x 3 months
  - then ticagrelor + placebo x 9 months

**Antiplatelet Therapy Summary**
- When used, dose of Aspirin for all patients with CAD is 81 mg daily
- Duration of DAPT:
  - ACS Patients: 1 YEAR for ALL (with/without stent)
  - SIHD (Stable Ischemic Heart Disease) Patients:
    - Drug Eluting Stent (DES): 6 MONTHS
    - Bare Metal Stent (BMS): 1 MONTH
- Stopping Early:
  - New trials show that shorter durations of aspirin therapy after stenting may be effective and result in lower bleeding risk

<table>
<thead>
<tr>
<th></th>
<th>ASA + Ticagrelor (12 months)</th>
<th>ASA (3 mos) + Ticagrelor (12 months)</th>
<th>HR P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bleeding</td>
<td>7.1%</td>
<td>4.0%</td>
<td>0.56</td>
</tr>
<tr>
<td>Composite</td>
<td>3.9%</td>
<td>3.9%</td>
<td>0.99 P&lt;0.001 (non-inferiority)</td>
</tr>
</tbody>
</table>

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Management of combined anticoagulant and antiplatelet therapy

- Long-term treatment with oral anticoagulants is necessary in patients with:
  - Mechanical heart valves
  - Many with atrial fibrillation

- 20–30% of these patients have concomitant ischemic heart disease that requires PCI with stenting and subsequent antiplatelet therapy.

- The combination of oral anticoagulants and antiplatelets is associated with a high annual risk (4–16%) of fatal and non-fatal bleeding episodes.

What is the indication for triple therapy?

- Recent ACS (<1 year)
- Recent PCI (<6 months)
- Chronic ischemic heart disease
- Stroke
- Peripheral vascular disease

- Need to balance risk of thrombotic / ischemic events with bleeding

- Use risk scores to help assess:
  - CHADS2/VASC for stroke risk in AF
  - HAS-BLED for bleeding risk

Multiple medical options for therapy

<table>
<thead>
<tr>
<th>Dual Antiplatelet (DAPT)</th>
<th>Oral Anticoagulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>Coumadin</td>
</tr>
<tr>
<td>P2Y12 Inhibitors</td>
<td>Dabigatran</td>
</tr>
<tr>
<td>Clopidogrel</td>
<td>Rivaroxaban</td>
</tr>
<tr>
<td>Ticagrel</td>
<td>Apixaban</td>
</tr>
<tr>
<td>Prasugrel</td>
<td>Edoxaban</td>
</tr>
</tbody>
</table>

- What is the safety and efficacy of each medication?
- What combinations offer the greatest reduction in ischemic / thrombotic events?
- Which combinations have the lowest bleeding risk?

Four recent trials:
- WOEST (2013)
- PIONEER AF (2016)
- RE DUAL PCI (2017)
- AUGUSTUS (2019)
Triple therapy associated with higher bleeding without thrombotic protection

**WOEST**
- Coumadin + Clopidogrel: 19% bleeding, 11% thrombosis
- Coumadin + Clopidogrel + Aspirin: 44% bleeding, 18% thrombosis

**PIONEER AF PCI**
- Rivaroxaban 15 mg Daily + P2Y12: 17% bleeding, 6.5% thrombosis
- Rivaroxaban 2.5 mg BID + Aspirin: 18% bleeding, 5.6% thrombosis
- Coumadin + P2Y12 + Aspirin: 27% bleeding, 6.0% thrombosis

**RE DUAL PCI**
- Dabigatran 110 mg BID + P2Y12: 15% bleeding, 13% thrombosis
- Dabigatran 150 mg BID + P2Y12: 20% bleeding, 13% thrombosis
- Coumadin + P2Y12 + Aspirin: 28% bleeding, 14% thrombosis

**Clinical Question:**
What is the safest and most effective medical regimen for patients with atrial fibrillation and chronic coronary artery disease (angiography with no intervention or PCI/CABG > 1 year prior)?

**Preferred options in United States**

**Long Term Anticoag and Antiplatelet**
**AFIRE Trial**

<table>
<thead>
<tr>
<th></th>
<th>Rivaroxaban</th>
<th>Placebo</th>
<th>Antiplatelet</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite Outcome of Stroke, Embolism, Myocardial Infarction, Unstable Angina requiring revascularization, or Death</td>
<td>4.14%</td>
<td>5.75%</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>1.62%</td>
<td>2.76%</td>
<td></td>
<td>0.01</td>
</tr>
</tbody>
</table>
All this evidence now incorporated into the 2020 ACC Expert Consensus Pathway

**Bottom Line** regarding triple therapy

- **Anticoagulant**
  - DOAC strongly preferred over Coumadin if the patient is a candidate
  - DOACs should not be used for patients with:
    - Mechanical heart valves
    - Atrial fibrillation and mitral stenosis
- **P₂Y₁₂**
  - Clopidogrel preferred over other P₂Y₁₂ agents
- **Aspirin**
  - Little need for triple therapy, can usually drop aspirin in favor of DOAC + P₂Y₁₂ alone
- **Long Term**
  - Drop BOTH antiplatelet agents (oral anticoagulation alone)

**The Role for Aspirin in 2021**

<table>
<thead>
<tr>
<th>Not on Anticoagulation</th>
<th>Primary Prevention</th>
<th>Recent PCI / Acute Coronary Syndrome</th>
<th>Chronic Coronary Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Antiplatelet</td>
<td></td>
<td>Dual Antiplatelet (P₂Y₁₂ + Aspirin)</td>
<td>Single Antiplatelet (Aspirin)</td>
</tr>
<tr>
<td>Concurrent Anticoagulation</td>
<td></td>
<td>DOAC + Single Antiplatelet (P₂Y₁₂)</td>
<td>AC Alone (DOAC)</td>
</tr>
<tr>
<td>AC Alone (DOAC)</td>
<td>3-12 months</td>
<td>3-12 months</td>
<td>6-12 months</td>
</tr>
</tbody>
</table>
Doc, Should I still take my aspirin?

<table>
<thead>
<tr>
<th>Primary Prevention</th>
<th>Aspirin?</th>
<th>Therapy in 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Routinely</td>
<td>Aspirin?</td>
<td>Therapy in 2021</td>
</tr>
<tr>
<td>After Acute Coronary Syndrome (ACS)</td>
<td>As short as 3 months</td>
<td>P2Y12 for 1 Year</td>
</tr>
<tr>
<td>• Recent MI / PCI &lt; 1 year</td>
<td>Aspirin 3-12 mos</td>
<td></td>
</tr>
<tr>
<td>ACS + Atrial fibrillation</td>
<td>NO</td>
<td>DOAC indefinitely</td>
</tr>
<tr>
<td>Chronic Coronary Disease</td>
<td>YES</td>
<td>Aspirin Alone</td>
</tr>
<tr>
<td>• MI &gt;1 year / PCI &gt;6 mos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Coronary Disease and Atrial Fibrillation</td>
<td>NO</td>
<td>DOAC Alone</td>
</tr>
</tbody>
</table>

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Management of Heart Failure in 2021

- Medical Therapy
  - Beta Blockers
  - ACE Inhibitors/ARBs
  - Mineralocorticoid Receptor Antagonists
  - Angiotensin Receptor / Neprilysin Inhibitor (ARNI)
  - Sodium Glucose co-transporter 2 Inhibitors (SGLT2)

- Intracardiac Devices
  - Implantable Cardiac Defibrillators
  - Cardiac Resynchronization Therapy
  - Pulmonary Artery Pressure sensors

- Management of Valve Disease (particularly functional mitral regurgitation)
  - Surgical Therapies
  - Percutaneous Interventional Therapies
ARNI Mechanism
Angiotensin Receptor / Neprilysin Inhibitor (ARNI) = Sucabitril/Valsartan

ARNI in heart failure with reduced EF

- Clinical Question: Does sucabitril/valsartan improve the risks of death or rehospitalization compared to enalapril in patients with heart failure?

Patients on ARNI had significantly reduced rates of death and hospitalization for heart failure.

- Double Blind, Randomized
  - 8442 Patients
  - Class II, III, IV HF
  - EF <= 40%
  - All on baseline therapy

Primary Outcome: composite of death or hospitalization for HF.

Stopped early at 27 months
ARNI group had more angioedema and hypotension.

ARNI added to HF guidelines in 2016
Current recommendation for ARNI use

Indications for Use of an ARNI
- HFrEF (EF <40%)
- NYHA class III-IV HF
- Administered in conjunction with a background of GDMT for HF in place of an ACEI or ARB

<table>
<thead>
<tr>
<th>ARNIs</th>
<th>Starting Dose</th>
<th>Target Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacubitril/valsartan</td>
<td>24/26 mg-49/51 mg twice daily</td>
<td>97/103 mg twice daily</td>
</tr>
</tbody>
</table>

SGLT2 Mechanism
Sodium Glucose Co-Transporter 2 Inhibitor

Clinical findings:
- Plasma glucose
- Body weight
- Blood pressure
- Plasma uric acid
- Glomerular hyperfiltration

SGLT2 Pleotropic Effects
SGLT2 in heart failure with reduced EF

• **Clinical Question:** Does empagliflozin (SGLT2i) improve the risks of death or rehospitalization compared in patients with heart failure with reduced EF?

Patients on Empagliflozin had significantly reduced rates of death and hospitalization for heart failure.


Double Blind, Randomized
• 3730 Patients
• Class II, III, IV HF
• EF <= 40%
• All on baseline therapy

Primary Outcome: composite of death or hospitalization for HF.
Median follow up: 16 months
Findings occurred in patients with and without diabetes

SGLT2 in heart failure with reduced EF

Patients also had a lower rate of decline in GFR

Clinical Data for SGLT2i

Heart failure with reduced EF

Reproduced with permission from: Gulsin GS, et al. Heart 2021;0:1–6. doi:10.1136/heartjnl-2021-319185
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Functional mitral regurgitation

Dilation of a failing left ventricle can result in significant mitral regurgitation (MR).

MR increases left atrial pressures and can result in heart failure symptoms

If MR does not resolve with medical management of HF, additional therapies may be warranted.
Percutaneous mitral valve repair

Clinical Question: Do patients who have heart failure with reduced EF and symptomatic moderate to severe mitral regurgitation benefit from transcatheter mitral valve repair in addition to guideline directed medical therapy?


Randomized controlled trial
- 614 patients
- 78 sites US and Canada
- HF symptomatic mod-sev MR
- All on maximum therapy

Primary Efficacy Outcome: Hospitalization for HF within 24 mos
Primary Safety Outcome: Freedom from complications at 12 mos

Percutaneous mitral valve repair

Patients who underwent mitral repair had a significant decline in hospitalization for heart failure.


46.1%
29.1%

Percutaneous mitral valve repair

Patients who underwent mitral repair had a significant decline in death with low procedural complication rate.

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---

**Treatment Algorithm**

- [Flowchart for treatment algorithm]

---

2020 ACC Focused Update

- [Flowchart for intervention for symptomatic secondary MR]

---

Maddox et al, 2021 Update to 2017 ECDP for Optimization of Heart Failure Treatment: Answers to 10 Pivotal Issues About Heart Failure With Reduced Ejection Fraction
Steps in managing HF with reduced EF

1. Start ACEi/ARB/ARNI (ARNI preferred)
2. Start guideline directed beta blocker
3. Use diuretic as needed for volume overload
4. Updtrate (1) and (2) as tolerated every 2 weeks with monitoring
5. Start aldosterone antagonist if eGFR > 30 ml/min/1.73m and K < 5.0 meq/dL
6. Start SGLT2 inhibitor if eGFR > 20 ml/min/1.73m
7. Repeat transthoracic echocardiogram in 2-3 months
8. Refer for ICD/CRT therapies if EF remains low and patient qualifies
9. Refer to valve center for consideration of valve therapy if significant mitral regurgitation

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Take Home Points

**Coronary Artery Disease**
- Aspirin should not routinely be prescribed to patients without prior cardiovascular events
- When used for treating CAD, dose of Aspirin is **81 mg daily**
- Duration of DAPT:
  - ACS Patients: **1 YEAR for ALL** (with/without stent)
  - SIHD (Stable Ischemic Heart Disease) Patients: Drug Eluting Stent (DES): **6 MONTHS**
    - Bare Metal Stent (BMS): **1 MONTH**
- For patients requiring anticoagulation and antiplatelet therapies
  - Ensure there is an indication for both
  - DOACs are preferred over coumadin
  - Clopidogrel preferred over other P2Y12 agents
  - Aspirin can usually be omitted from the regimen

**Heart Failure**
- For your patients with heart failure and reduced EF:
  - ARNI confer a benefit for mortality and reduced hospitalizations
  - SGLT2 Inhibitors benefit patients with and without DM
  - Severe functional mitral regurgitation that has not responded to optimal medical therapy can be treated with transcatheter valve repair to reduce death and heart failure rehospitalization
Before we start, let’s check in to be sure everybody is feeling OK...

Talk Roadmap

- A few thoughts on the current state of the pandemic and the problems it has exposed in our politics and society
- A few tech innovations that were accelerated by Covid
  - Telemedicine, dashboards
  - Plus a few that might have hit the tipping point, but didn’t
- Entering the post-EHR era: why and what that means
- The future of healthcare’s digital transformation

Disclosures

- Dr. Wachter serves on the board of directors of The Doctors Company (malpractice insurer) and on the scientific advisory boards of Teladoc (telemedicine provider), Amino (help employers choose healthcare providers), Curai (AI-enabled urgent care), EarlySense (bed-covering that measures vital signs), Commure (interoperability platform), and Notable (digital process automation). He also advises the San Francisco 49ers football team and SCOR (life insurance company) on Covid-19. He holds the Benioff Chair in Hospital Medicine from Marc and Lynne Benioff.
America’s Unique Response

“Aspects of America’s identity may need rethinking after COVID-19. Many of the country’s values have seemed to work against it during the pandemic. Its individualism, exceptionalism, and tendency to equate doing whatever you want with an act of resistance meant that when it came time to save lives and stay indoors (and wearing masks & getting vaccinated), some people flocked to bars and clubs (and didn’t & didn’t). Having internalized years of anti-terrorism messaging following 9/11, Americans resolved to not live in fear. But SARS-CoV-2 has no interest in their terror, only their cells.”

Ed Yong, The Atlantic, March 25, 2020

Where Are We Now?

- Clear that Delta is a completely different virus – all prior assumptions about the virus/vaccines need to be reassessed
- Levels of immunity that we thought would be sufficient to create herd immunity are not enough to beat back Delta
- Boosters clearly needed in highest risk groups – others still debatable
- Society’s tolerance of the unvaccinated has waned, to near-zero
- Thus enthusiasm for mandates and other sharp-elbow tactics
- “Back to normal?” now impossible to predict given need to reach >85% immune for herd immunity, low vaccine rates, and waning immunity from vaccine and infection

What Will the End Game Be?

Covid-19 and the Digital Transformation of Healthcare
“I joined Mayo on January 1, 2020… and I was handed the 2030 [digital transformation] plan. Do you know that in 2020, we finished the 2030 plan?…. Covid accelerated 10 years into 10 months.”

John Halamka, MD
President, Mayo Clinic Platform
on “In the Bubble” podcast, 4/28/21

The Fundamental Question About Telemedicine/Virtual Visits

- Is it simply a visit replacement?
  - Fine if so: convenient for patients, maybe for providers
  - Opens up new non-geographically-determined care options
  - Potentially good for patients, but new competitive threat for health systems
- Or does it pave the way for true virtual care – the real game-changer
  - Patients no longer coming into office to get BP, weight, glucose checks, etc. means new dependence on digital data streams
  - Measures less episodic; more semi-continuous
  - The trillion-dollar question: how will we manage these new data flows?

Patient 112’s sugar is high again: the algorithm bumped the insulin but let’s get the coach involved

Patient 13’s weight is up and O2 sat is worse. I’ll lock the salt shaker and the fridge

Patient 42 has irregular HR and is short of breath. Let’s do a televisit ASAP

The Care Traffic Controllers
Dashboards

Finally (!)… taking all that data and delivering usable, real-time information in visually attractive and actionable form to managers and clinicians.
How About AI and Interoperability?

While one might have anticipated the pandemic would be a moment for AI to shine, I can’t identify a true game-changing AI application.

The pandemic exposed our lack of digital connectedness; in 2020-21, we still found ourselves faxing spreadsheets.

Health IT Needs Its Golden Spike
Maybe the Stupidest Thing I Ever Said to a Mentee

“What will you do after we’ve implemented our EHR?”

Digital Health Investments Accelerating

(Re) Enter the Digital Giants….

Apple Struggles in Push to Make Healthcare Its Greatest Legacy

Why Health IT May Finally Be Entering a New (Post-EHR) Phase

Winners in EHR derby: healthcare-specific companies, good at collecting data & moving it around

They were ready when healthcare went digital

Not expert in consumer-facing tools, user interface, data visualization, learning from data, communication,…

Now entering the post-EHR era, facilitated by value pressures, more interoperability, labor shortages and the overwhelming problem of the in-box, AI, digital companies maturing,… and the obvious limitations of what EHRs can offer

Healthcare organizations are going to need to remake themselves to thrive in this era
Managing the Post-EHR Era: UCSF's New Digital Org Chart

"Traditional" Digital Arm
• Solving core clinical and business problems
• Focused on EHR and related tools

Digital Solutions Shop
• Solving big, hairy problems
• Longer time horizon w/o single/simple solution
• Use of diverse tools

Integration

Several Easy Predictions, and a Hard One

- Health IT will, ultimately, transform and disrupt health and healthcare
- Covid has shortened the timeline for this by several years
- The new system will be less institution-focused, less geographically determined, more patient-centric, and deliver higher quality, less expensive, and more equitable care
- The winners will be any one of these four parties:
  - Existing healthcare organizations that thoughtfully embrace transformation
  - EHR vendors that innovate and open their architecture
  - Digital giants that are able to maintain a focus on health (lower probability)
  - New companies (start-ups) that skillfully address important use-cases
- The hard thing to predict: when?

"In theory there is no difference between theory and practice. In practice there is."
- Yogi Berra (maybe)
Neurological Emergencies

S. Andrew Josephson MD
Carmen Castro Franceschi and Gladyne K. Mitchell Neurohospitalist Distinguished Professor
Chair, Department of Neurology
Founder, Neurohospitalist Program
University of California, San Francisco

The speaker has no disclosures.

Case #1

- A 67F is hospitalized with a community-acquired pneumonia. On Day#3 she is feeling much better awaiting discharge when her nurse finds her unresponsive with rhythmic shaking of all limbs.
- PMHx: COPD
- Meds: Ceftriaxone, NKDA
- SH: 100pk yr hx tobacco, no hx EtOH
- FH: No neurologic disease

Case #1

- You are called to the bedside and after 3 minutes, these movements have not stopped. Options for your next course of action are….
  A. Continue to wait for the spell to subside
  B. Administer IV Diazepam
  C. Administer IV Lorazepam
  D. Administer IV Fosphenytoin

Case #1

- Following Lorazepam 2mg IV x 3 (2 minutes apart), the patient is still having these movements (now 7 minutes). What is your next course of action?
Status Epilepticus

- Changing definition and time window
- Incidence: 100,000 to 150,000 per year nationally
- Contributes to 55,000 deaths per year nationally
- 12 to 30 percent of epilepsy first presents as status
- Generalized convulsive status most dangerous

Status Epilepticus Algorithm: Real World

1. Lorazepam 2mg IV q2 minutes up to 6-8mg or Midazolam 10mg IM*
2. Fosphenytoin 18-20mg/kg (Dilantin Equivalents) IV**
3. General Anesthesia with continuous EEG
   a. IV Midazolam gtt
   b. IV Propofol gtt

Recent Large Trial

Rossetti AO Lancet Neurol, 2011

IM Midazolam: RAMPART

- Out of hospital non-inferiority trial
  - 4 mg lorazepam IV vs. 10 mg midazolam IM
    (the latter using a novel autoinjector)
- Primary outcome: absence of sz at time of ED arrival without the need for rescue therapy

Which to Choose After Benzos: ESETT Trial

- After benzos, if still; seizing randomize to:
  - IV Fosphenytoin, Valproate, or Levetiracetam
- Primary outcome was cessation of status and improvement in mental state at 60 min


Seizure Management: Once the Spell Stops

- Key Question:
  1st seizure or known epilepsy

Seizure Management: First Seizure

- Careful history of the spell: before (including recent events), during, after
- Determine all meds patient is on
- Careful neuro exam looking for focal signs
  - Focal exam= Partial seizure= Focal lesion

Seizure Management: First Seizure

- Work-up for provokers
  - Head trauma?
  - Utox, EtOH history and possible level
  - CBC, Lytes, Ca/Mg/Phos, BUN/Cr, LFTs
  - CT (usually with contrast)
  - Very low threshold to LP
- Needs outpatient work up including: EEG, MRI, and neurologic consultation
Seizure Management: Known Epilepsy

- 1. Non-compliance
  - Determine AEDs including doses
  - Send levels of AEDs if possible
  - Med-Med interactions
- 2. Infection
  - CXR, urine, blood cx, consider LP

Best to curbside primary neurologist regarding any medication changes to current regimen

Case #2

- A 50 year-old man is brought in to the ED by his girlfriend with several days of paranoia and unusually aggressive behavior.
- General physical exam is normal. Neurologic examination shows a disoriented man threatening the staff
- Labs: Lytes, CBC, BUN/Cr, LFTs, Utox all nl
- CT head negative, CXR negative, U/A negative

What is the next test you would like to order?

A. MRI Brain
B. LP
C. Blood Cultures
D. Urinary Porphyrins
E. EEG

Lumbar Puncture

- Opening Pressure 19 cm H₂O
- 18 WBCs (94% Lymphocytes)
- CSF Protein 58
- CSF Glucose 70
- Gram stain negative

Empiric treatment begun
**HSV-1 Meningoencephalitis**

- Diagnosis
  - CSF lymphocytic pleocytosis (can be normal)
  - EEG (can be normal)
  - MRI (can be normal)
  - CSF HSV PCR
- If suspected, start IV acyclovir 10-15mg/kg q 8 hours

**Meningitis Treatment by the Neurologist**

- Perform LP immediately after imaging if any CSF infection suspected
- Empiric Bacterial Treatment
  - Vanco 1 gram IV q6-8 hrs
  - CTX 2 grams IV q12 hrs
  - Amp 2 grams IV q4 hrs (if immunosup., >60)
  - Dexamethasone 10mg IV q6

**Treatable Causes of a Lymphocytic Pleocytosis**

- **Viral**
  - Acute HIV
  - HSV, VZV
  - CMV
- **Bacterial**
  - Syphilis
  - Lyme
  - Leptospirosis

**Treatable Causes of a Lymphocytic Pleocytosis**

- **Fungal**
- **TB**
- **Neoplastic**
- Incompletely treated bacterial meningitis
- **Parameningeal Focus**
Case #3

- A 63yo man comes to the ED with 3 days of inability to walk. The patient reports a 2 week history of tingling in his hands and feet while also stating that he has been stumbling while walking for five days.

Case #3

- Exam
  - General exam nl with stable vitals
  - Mental status, cranial nerves normal
  - Motor exam with mild-moderate symmetric weakness prox>distal in the upper ext., distal>prox in the LEs
  - Sensory exam completely normal
  - Reflexes 2+ throughout except 0 ankles, plantar response flexor bilaterally

Case #3: Additional Tests

- FVC/MIF: 1.2L, -30
- Lumbar Puncture: Opening pressure normal, 2 WBC, Zero RBC, Protein 102, Glucose normal

Guillain Barre Syndrome: Key Points

- Clinically must think in the setting of paresthesias and weakness
  - Normal sensory exam, weakness not always ascending
  - Areflexia the rule, but not early in the disease
  - High protein with no cells on LP the rule, but not early in the disease
- EMG/NCS for diagnosis
  - Axonal and Demyelinating forms
- Antecedent illness or infection only 30%
- Other Variants: Miller Fisher variant w/ GQ1b Ab
Guillain Barre Syndrome: Key Points

- What will kill the patient
  - Respiratory Failure: Intubate for less than 20cc/kg
  - Frequent MIF/FVC
  - ICU or stepdown care always
  - DVT/PE: SQ heparin
  - Autonomic instability: cardiac (telemetry), ileus
- Treatment
  - IVIg or Pheresis, NOT steroids
  - The earlier the better

Case #4

- A 40 yo man comes to the ED with increasing weakness and dyspnea. The patient states that he has a history of myasthenia gravis diagnosed at an OSH two weeks ago but “things are going downhill.” He is on Mestinon (pyridostigmine) 60mg PO q4hrs and Prednisone 60mg PO qd. MIF is −10, FVC 250cc

Myasthenic Crisis

- True crisis vs. cholinergic crisis
- Triggers
  - Infection, surgery, initial steroids
- Management
  - Usually stop all anti-cholinesterase meds
  - Pheresis or IVIg
  - ICU, intubation, DVT/PE prophylaxis

Myasthenia Gravis: Key Points

- Two types of myasthenia
  - Young F>M
  - Old M=F
- Diagnosis
  - Antibodies (90% in generalized myasthenia)
  - EMG with repetitive stimulation
Myasthenia Gravis: Key Points

- Management
  - Pyridostigmine (Mestinon)
  - Immunosuppression
    - Prednisone first then Imuran/CellCept/Cytoxan
    - What about the Thymus?

Case #5

- A 32M comes to the emergency room with the “worst headache of his life” for 8 hours
- Non contrast CT is normal

Which of these historical points is most useful to differentiate SAH from benign headache syndromes?

A. Associated nausea/vomiting
B. Associated photophobia
C. Severity of pain
D. Peak time to maximal pain
E. Pain location

SAH Diagnosis

- CT sensitivity greatest early
- LP sensitivity greatest late
  - What do you look for?
  - Xanthrochromia?
  - Blood that fails to clear?

First 6-8 Hours
6-8hrs to 1-2 weeks
SAH Treatment

• Urgent Blood Pressure Management
• Etiology
  – 1. Aneurysm
    • Need to secure with clipping or coiling ASAP
      – ISAT trial (Lancet 2005)
  – 2. Trauma

Case #6

• A 65 year-old man with a history of DM, HTN presents with 1 day of imbalance and severe vertigo
• Examination shows R>L severe ataxia of the limbs with inability to walk due to imbalance. Power is normal throughout.

Which of the following most reliably distinguishes central from peripheral vertigo?

A. Severe vomiting
B. Inability to walk
C. Inability to sit upright without falling to one side
D. Presence of nystagmus
E. Slurred speech

Case #6 (con’t)

• Patient discharged from the ED
• BIBA 24 hours later after respiratory arrest at home, now in coma
Emergent ICP Management

Step 1: Head of bed to 30 degrees
Step 2: Hyperventilation
  - Cerebral vasoconstriction with decreased P\(_{\text{aCO}_2}\)
  - Onset rapid
  - Lasts only 1-2 hours as buffering occurs
Step 3: Mannitol 1 gram/kg IV (50-100g)
  - Removes brain water
  - Tolerance develops, must follow serum osms
Step 4: Barbiturates (bolus then infusion)
Consider ventriculostomy if indicated!

Emergent CPP Management

Cerebral Perfusion Pressure (CPP)

CPP = MAP - ICP

Cerebellar Ischemic Stroke

- Maximal swelling: 3-5 days
- Decompression indicated if patient decompenses
- Will only see on MRI
- “Malignant Meniere’s”
Sinus pauses (and vagotonic AV block are common and usually benign)

- Sleep study?

When do you consider a pacemaker for sinus node disease?

- SYMPTOMS
  - Presyncope or syncope with a sinus pause > 3 seconds
    - NOTE: not JUST a sinus pause > 3 seconds
  - This does include post-conversion pauses
    - An AF ablation MAY be sufficient in those cases
  - Chronotropic incompetence
    - Need to ambulate the patient
    - May require an exercise treadmill test
    - More of a quality of life issue than a safety issue

Ms. Jones has a Pacemaker

- Do I need to have the pacemaker checked?
  - Pacemaker in place is not itself an indication for a pacemaker interrogation
    - Pacemaker interrogations drain battery
  - Can assess:
    - If the leads are working
    - Timing of various tachyarrhythmias

Ms. Jones has a Pacemaker

- The device site looks red and maybe is infected?
  - DON'T STICK A NEEDLE IN IT!
  - Device infections are a big deal
  - Can be hard to eradicate infections without removing WHOLE DEVICE
  - Chronic leads adhere to the great vessels and the heart
  - Extraction tools work well, but still high risk
  - Bacteremia plus pacemaker (or ICD) should be considered possible endocarditis
    - Low threshold to get ID and EP involved
Atrial Fibrillation

• NOACs are now DOACs (no longer novel)
• We generally UNDER-ANTICOAGULATE

In the Spirit of trying to Enhance Appropriate Anticoagulation in AF

• “Your patient never calls you in the middle of the night to thank you for not having a stroke.”
In the Spirit of trying to Enhance Appropriate Anticoagulation in AF

- “Your patient never calls you in the middle of the night to thank you for not having a stroke.”

How is This Relevant to Hospital Medicine?

- That patient who develops atrial fibrillation in the setting of cellulitis or pneumonia
  - ASSUME YOU WERE LUCKY TO CATCH IT BECAUSE THE PATIENT WAS BEING MONITORED
  - ANTICOAGULATE UNLESS THERE IS A COMPELLING REASON NOT TO
    - Examples:
      - CHADSVASC of 0 or perhaps 1
      - History of hemorrhagic stroke

Gialdini et al. JAMA 2014
Multiple studies have now shown:
- Heightened risk of dementia with AF
- Dementia/cognitive decline risk mitigated by anticoagulation
What about the other most commonly consumed beverage in the world?
### Coffee Consumption and Incident Tachyarrhythmias

**Reported Behavior, Mendelian Randomization, and Their Interactions**

**UK Biobank (n=386,258)**

**Cumulative Incidence of Any Arrhythmia**

**Kim EJ et al. JAMA Intern Med 2021**

- Caffeinated could reduce AF via:
  - Anti-inflammatory effects
  - Anti-vagal effects
  - Caffeine may prolong LA effective refractory periods

---

### Atrial Fibrillation Ablation

- Success in 60-90%
- Overall risks (4-6%): 1-5
  - Risk of death or permanent disability <1%
- A great option for symptomatic patients
- An ELECTIVE PROCEDURE

---

### Table 2. Polygenic Score of Caffeine Metabolism and Risk of Incident Arrhythmia

<table>
<thead>
<tr>
<th>Arrhythmia</th>
<th>Hazard Ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any arrhythmia</td>
<td>1.04 (0.99-1.09)</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Atrial fibrillation or flutter</td>
<td>1.26 (1.09-1.45)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Supraventricular tachycardia</td>
<td>1.32 (1.08-1.62)</td>
<td>&lt;.05</td>
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<tr>
<td>Ventricular tachycardia</td>
<td>1.26 (0.96-1.64)</td>
<td>.14</td>
</tr>
<tr>
<td>Premature atrial complexes</td>
<td>1.36 (0.99-1.84)</td>
<td>.10</td>
</tr>
<tr>
<td>Premature ventricular complexes</td>
<td>1.36 (0.99-1.84)</td>
<td>.10</td>
</tr>
</tbody>
</table>

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**1. Circulation 2003;108:2355-60**
**2. JACC 2003;42:185-197**
**3. JACC 2004;43:2044-53**
**4. JAMA 2005;293:2634-40**
Atrial Fibrillation Ablation

- CLASS 1 INDICATIONS:
  - Selected patients with symptomatic paroxysmal AF refractory or intolerant to at least one class I or III antiarrhythmic drug when a rhythm control strategy is desired
- CLASS III: Don’t do it to get a patient off anticoagulation

Atrioesophageal Fistula

- Presents 1-3 weeks AFTER ablation
  - Fever
  - TIA or other embolic phenomena
  - Chest pain
  - Odynophagia (but not necessarily)
  - Leukocytosis
  - Hematemesis (more rare)

Atrioesophageal Fistula

- High mortality
- Get electrophysiology involved
- Get CT surgery involved
- Diagnose with CT with intravenous and water soluble GI contrast
- DO NOT DO EGD WITH INSUFLATION
- If test negative, may need to look again
- In some cases with high suspicion, take to OR directly even with negative tests

STAF (n=200): no difference in composite endpoint of death and thromboembolic events
PIAF (n=252): No difference in symptomatic improvement
HOT CAFÉ (n=205): No difference in composite death, thromboembolic events, hemorrhage
Why ever consider rhythm control?

- Unlikely to include symptomatic patients in those studies
  - Rationale for rhythm control is primarily symptoms
- Warfarin was stopped when sinus apparent
- Evidence that those in sinus lived longer

JAMA 2019 Intention to treat

Effect of Catheter Ablation vs Antiarrhythmic Drug Therapy on Mortality, Stroke, Bleeding, and Cardiac Arrest Among Patients With Atrial Fibrillation

The CABANA Randomized Clinical Trial

<table>
<thead>
<tr>
<th>History of composite heart failure</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>60/384 (50.6%)</td>
<td>72/656 (56%)</td>
<td></td>
</tr>
<tr>
<td>21/274 (7.7%)</td>
<td>20/263 (7.7%)</td>
<td></td>
</tr>
</tbody>
</table>

JAMA 2019 Intention to treat

The NEW ENGLAND JOURNAL OF MEDICINE

February 1, 2019

Catheter Ablation for Atrial Fibrillation with Heart Failure

Nerio F. Njavroski, M.D., Johannes Brachtman, M.D., Dietrich Antzemy, M.D., Jürgen Todeler, M.D., Lucien Baruma, M.D., Luiz Jastmuk, M.D., Befa Mphasha, M.D., Ifigny Khokhar, M.D., Frank W. Gnad, M.D., Jürgen Vomberg, M.D., and Dietmar Bauers, M.D., for the CASTLE-AF Investigators
• 2,789 patients with recent AF and CV comorbidities (median 36 days) randomized to rate v rhythm control followed median 5.1 years
• ANTICOAGULATION CONTINUED EVEN IF IN SINUS
Atrial FLUTTER

- Anticoagulation=AF
- Often difficult to rate control
  - “Decremental conduction” of the AV node
- Hard to suppress with drugs
- Easy to ablate

N=>32,000 atrial flutter patients in California over 5 years

Supraventricular Tachycardias
Supraventricular Tachycardias

Adenosine
- Metabolized by red blood cells and endothelium
- Give 6 mg IV with 20 cc flush
- Repeat with 12 mg IV X 2
- How do I know if I’ve given enough?

75% reduction in ED visits among those undergoing catheter ablation (p=0.003).

Avoiding Left Ventricular Dyssynchrony
- Left bundle branch block may lead to heart failure

RV Pacing Causes Left Ventricular Dyssynchrony
- We try to avoid RV pacing
- NEED to avoid RV pacing with low EF
RV Pacing Causes Left Ventricular Dyssynchrony

• We try to avoid RV pacing
• NEED to avoid RV pacing with low EF
  – Change mode to only pace in the atrium if AV conduction is intact
  – Upgrade or place a Biventricular pacemaker
  – Conduction system pacing (pacing the His or left bundle branch) is gaining in popularity

Another Cause of Left Ventricular Dyssynchrony: PVCs

• Suppression or elimination of PVCs in those with reduced EF can improve (sometimes completely) systolic dysfunction

Another Cause of Left Ventricular Dyssynchrony: PVCs

• Frequent PVCs (>5%) with low EF → refer to EP
• Symptomatic PVCs → refer to EP
• Frequent PVCs (>5%) asymptomatic and normal EF, annual echos, consider referral cardiology
Conclusions

Pacemaker for SYMPTOMATIC sinus problems

Generally leave pacemakers alone

...BUT if they are pacing in the RV all the time and have any reduced EF, let EP know!

Conclusions

Anticoagulation generally GOOD

Exercise GOOD

Alcohol BAD

Caffeine/ Coffee probably OK

Rhythm control probably PREFERRED

Conclusions

Low threshold to refer to EP

Usually fine to do upon discharge

Referral to PMD is not the same

Conclusions

SVT

Atrial flutter

Frequent PVCs

Thank You

greg.marcus@ucsf.edu
@gregorymmarcus

Join the Study https://www.health-eheartstudy.org/
Among 359, 315 AF patients in the NCDR PINNACLE registry, 27% of all patients with CHA₂DS₂-VASc of 0 were prescribed an anticoagulant.
**Bridging**

- OK to just start warfarin without heparin
- Pharmacokinetics of NOACs can be considered similar to lovenox
- On warfarin:
  - Low risk: can hold for a week
  - For NOACs, should be gone in 2 days
  - High risk (mechanical valve, prior stroke, higher CHA2DS2-VASc), can consider unfractionated or low molecular weight heparin for warfarin
  - Continue (as is done in many EP procedures)

**What is the first thing I need to do?**

- RATE CONTROL
  - If unstable → DC shock
- Your favorite beta-blocker or calcium channel blocker
- When BP goes down:
  - Consider MORE AV nodal blockage
  - Consider Dig
  - Consider amiodarone
  - Consider esmolol
  - Consider cardioversion

**Drug** | **Dose reduction** | **Other idiosyncracies**
---|---|---
Dabigatran=Pradaxa | CrCl 15-30 ml/min | Dyspepsia ~11% (acid core)
Rivaroxaban=Xarelto | CrCl 15-50 ml/min | pK maybe really 2x day drug
Apixaban=Eliquis | 2 out of 3: Creatinine > 1.5, age >80, weight <60 kg | Might be used in hemodialysis
Edoxaban=Savaysa | CrCl 15-50 ml/min | Contraindicated if CrCl > 95 ml/min Drug interactions (verapamil and dronedarone increases)
Novel Anticoagulants

- Reversibility?

> Announcement of FDA approval 10/16/15

> "Let’s just cardiovert back to sinus rhythm so we don’t need to worry about anticoagulation.”
I decide to go with

- Cardioversion can reduce left atrial appendage function
  - Even from AF to sinus
- The pericardioversion period is a particularly pro-thrombotic time
  - Regardless of mode: DC/electrical, pharmacologic, spontaneous

Prior to cardioversion: 1, 2

- Can exclude preexisting thrombus by TEE
- Can anticoagulate (therapeutic/for at least 3 weeks) prior to cardioversion

1. JACC 2006;48:e149-246
2. Chest 2004;126:429S-456

During and after cardioversion: 1, 2

- Anticoagulation for at least 4 weeks
- Applies even to those who would otherwise not require anticoagulation

Epidemiology

- AF is the most common sustained arrhythmia in adults
- Affects ~4% of everyone over age 60 and ~10% of everyone over age 80
- The age-adjusted incidence is increasing 1

1. Miyasaka Y. Circulation 2006;114:119-125
Oncologic Emergencies in Hospital Medicine
Sam Brondfield, MD, MAEd

Disclosures
• Consulting fees:
  • Gemini Health
  • IDEO
  • American Physician Institute
  • Blackstone
  • PAI Pharmaceuticals
• Honorarium:
  • Doximity

Learning Objective
Describe inpatient management of solid tumor oncologic emergencies.

Outline
• Five cases of oncologic emergencies (4 old, 1 new)
• Review of key take-aways
Overview

Solid Tumor Oncologic Emergencies

- Metabolic
- Structural
- Treatment-Related

Case 1

A 60-year-old man is diagnosed with metastatic small cell lung cancer, including an 8 cm hilar lung mass, mediastinal lymphadenopathy, and diffuse bone lesions. He is admitted for expedited workup. Baseline labs, including chemistries, are normal. Oncology administers inpatient carboplatin/etoposide. You ponder the risk of tumor lysis syndrome.

Which of these lab abnormalities is consistent with the pathophysiology of TLS?

- A) Elevated calcium
- B) Low potassium
- C) Low phosphorus
- D) Elevated uric acid

Tumor lysis syndrome

Cancer cell lysis

Chemo (or spontaneous)

K

Phos

DNA

Cytokines

Blood

- K
- Phos
- Ca
- UA
- BP

N Engl J Med 2011;364:1844-54
Tumor lysis syndrome

Cairo-Bishop Criteria for laboratory TLS (2 of 4)

<table>
<thead>
<tr>
<th>Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>≥6.0 mEq/L</td>
</tr>
<tr>
<td>Calcium</td>
<td>≤7.0 mg/dL</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>≥4.5 mg/dL</td>
</tr>
<tr>
<td>Uric acid</td>
<td>≥8.0 mg/dL</td>
</tr>
</tbody>
</table>

Or 25% change from baseline

Clinical TLS

Laboratory TLS plus one of:

- Cr >1.5x ULN (or >1.2-1.3)
- Arrhythmia
- Seizure

Element Value

Potassium ≥6.0 mEq/L
Calcium ≤7.0 mg/dL
Phosphorus ≥4.5 mg/dL
Uric acid ≥8.0 mg/dL

Case Wrap-Up

- Develops TLS 24 hrs after chemotherapy
- Fluids, allopurinol, rasburicase given
- Labs improve, discharged once normalized
- Admitted for cycle 2 of chemotherapy for TLS monitoring
- No recurrence, further cycles given as outpatient

Tumor lysis syndrome: Your role

Admit patient with cancer

Most solid tumors

Recognize and treat rare cases of TLS

Bulky SCLC or GCT

Fluids: Allopurinol + Rasburicase

Electrolyte correction

Tumor lysis syndrome

- Step 1: Risk stratification
  - Bulky small cell lung cancer and bulky germ cell tumors = intermediate risk
  - Other solid tumors mostly low risk
  - Check baseline TLS labs

- Step 2: Interventions

<table>
<thead>
<tr>
<th>Risk of Clinical TLS</th>
<th>Low</th>
<th>Intermediate</th>
<th>High</th>
<th>Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluids</td>
<td>Fluids with chemotherapy</td>
<td>4-6L/day; 150-200 cc/hr UOP</td>
<td>4-6L/day; 150-200 cc/hr UOP</td>
<td>4-6L/day; 150-200 cc/hr UOP</td>
</tr>
<tr>
<td>Allopurinol*</td>
<td>Not needed</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Rasburicase</td>
<td>Not needed</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lab monitoring</td>
<td>Daily</td>
<td>q8-12 hrs</td>
<td>q4-8 hrs</td>
<td>q4-6 hrs</td>
</tr>
</tbody>
</table>

*Requires renal dosing if renal impairment present.
Case 2

A 58-year-old woman with metastatic non-small cell lung cancer received carboplatin/paclitaxel and is admitted 12 days later with fever and chills. Temperature is 38.5. There are no focal infectious symptoms or signs. WBC is 1.0 and ANC is 200. CXR is normal. Cultures are drawn. She has no central line.

What empiric therapy would you start?

A) Vancomycin and piperacillin-tazobactam
B) Cefepime
C) Ceftriaxone and azithromycin
D) Levofloxacin

Neutropenic fever

- Definition: 38.3 x1 or 38.0 over 1 hour with ANC <500 (or "close")
- Primary risk factor is type of chemotherapy
- Infectious source identified in minority of cases
- Most cases are bacterial (translocation of gut flora)
- Gram negatives, S. aureus, and enterococci cause severe illness
- S. epidermidis is a common pathogen
- Anaerobes are infrequent causes of neutropenic fever

Neutropenic fever: Treatment

- Cultures ➔ timely antibiotics ➔ sign/symptom-directed workup
- Empiric therapy: cefepime, pip-tazo, meropenem, (cipro/amox-clav)
  - Vanc if unstable or suspect for gram+
  - Do not broaden for persistent fever alone
- Target infection if found
- If not, continue empiric regimen until ANC >500
- G-CSF generally not recommended
- Some VERY stable patients may be treated as outpatient
Case Wrap-Up

- Cefepime started
- Fevers resolve within 72 hours
- No organism identified
- On hospital day 5, feels well, ANC 600
- Discharged without antibiotics
- G-CSF given with next cycle of chemotherapy

Neutropenic fever: Your role

- Admit (usually)
- Cultures and antibiotics
- Find and treat standard infections
- If no infection found, continue empiric therapy until ANC > 500
- If condition not improving after 3-4 days, consult ID

Case 3

A 73 year-old previously healthy non-binary person with a 40 pack-year smoking history presents with confusion. Calcium is 16.0 and renal function is normal. CT reveals a 6 cm hilar lung mass with multiple liver lesions. No bone lesions are present. Head imaging is normal.

What is the most likely cancer and mechanism of hypercalcemia in this case?

A) Parathyroid carcinoma secreting PTH
B) Lung adenocarcinoma with occult lytic bone metastases
C) Squamous cell lung cancer secreting PTHrP
D) Lymphoma causing elevated 1,25-dihydroxyvitamin D3
Hypercalcemia of malignancy

- Most common cause of hypercalcemia in hospitalized patients
- Most common causes: breast, lung, renal, myeloma
- Workup: PTHrP, vit D, imaging, +/- SPEP
- Indications to treat: Ca>14 (albumin corrected), symptoms, or fast rise

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTHrP</td>
<td>80%</td>
</tr>
<tr>
<td>Osteolytic lesions</td>
<td>20%</td>
</tr>
<tr>
<td>1,25-dihydroxyvitamin D</td>
<td>Rare</td>
</tr>
<tr>
<td>PTH</td>
<td>Very rare</td>
</tr>
</tbody>
</table>

Case Wrap-Up

- PTHrP elevated
- Fluids, calcitonin, and zoledronate given
- Calcium improves, mental status follows
- Liver biopsy shows squamous cell carcinoma
- Discharged with outpatient oncology appointment

Hypercalcemia of malignancy: Management

- Diuretics (only if volume overload)
- Isotonic fluid 200-300 cc/hr (Cr<4.5 cc/hr UOP)
- Prednisone (symptoms only)
- Dialysis (last resort)
- Calcitonin 4-8 IU/kg q12 hrs x 48 hrs
- Zoledronate 4 mg IV x1 (Cr>4.5)
- Prednisone (lymphoma only)
- Denosumab (Cr>4.5)

Hypercalcemia of malignancy: Your role

- Triage based on severity (level, pace, symptoms)
- PTH, PTHrP +/- SPEP/SFLC imaging
- Isotonic fluid Calcium Zoledronate
Case 4
A 65 year-old woman with newly diagnosed triple-negative breast cancer with diffuse spine metastases not yet on treatment presents to the ED with two weeks of progressive back pain, 24 hours of bilateral leg weakness, and urinary incontinence. MRI shows a T10 lesion causing cord compression. Performance status is otherwise excellent.

What is the next step in management?
- A) Glucocorticoids
- B) Urgent radiation
- C) Surgical resection
- D) Urgent systemic cancer therapy

Neoplastic epidural spinal cord compression
- Back pain may precede neurologic changes by weeks
- Thoracic spine most common site
- Obtain whole spine imaging (MRI)
- 10 mg IV dexamethasone x1, then 4q6 IV or PO
  - Caution if lymphoma on dtx
- Surgery vs XRT depends on severity, radiosensitivity, and prognosis
  - Radiosensitive: lymphoma, myeloma, testicular seminoma

Case Wrap-Up
- Dexamethasone started
- Laminectomy and fusion performed
- Steroids tapered over four weeks, recovers well
- Sees oncology to start systemic therapy
Neoplastic epidural spinal cord compression: Your role

MRI total spine w/ contrast → Chem dux 10 mg IV, then 4 mg PO q6 hrs, pain control → Call neurosurgery and radiation oncology

Case 5

A 60 year-old man with metastatic melanoma and no other comorbidities who started ipilimumab and nivolumab 3 months ago presents with subacute progressive dyspnea. CT shows shrinkage in all metastatic lesions and new diffuse ground glass opacities in both lungs. He is afebrile. Hypoxemia progresses rapidly requiring intubation. Exam shows diffuse inspiratory crackles and flat JVP. Pulmonology performs BAL with results pending. Broad-spectrum antibiotics are started.

What is the next step in management?

A) Switch to oral ipilimumab/nivolumab
B) Start oral prednisone
C) Start IV methylprednisolone
D) Start IVIG and infliximab

Brief Overview of Immune-Related Adverse Events (IRAEs)

- IRAE = inflammatory side effect
- Occur weeks to months after initiation of checkpoint inhibitor
- Variable severity
- Can affect any organ system
- Some are "emergencies" (prompt attention to avoid bad outcome)
Severe IRAE Treatment Approaches

- Rule out other causes (e.g. BAL)
- Consult organ-specific specialist
- For most severe IRAEs, IV steroids are first step
- Additional immunosuppression if no improvement in 48 hrs

Case Wrap-Up

- IV methylprednisolone 2 mg/kg started
- Infectious workup returns negative
- Oxygen requirement decreases
- Steroids tapered over 6 weeks as outpatient
- Immunotherapy discontinued permanently

Severe IRAE: Your role

Rule out other causes (infection) → Consult organ-specific specialist → IV steroids typically first-line

Review of key take-aways
Tumor lysis syndrome: Your role

Admit patient with cancer

- Most solid tumors
- Bulky SCLC or GCT

- Recognize and treat rare cases of TLS

- Flush: Allopurinol +/- Rehydration
- Electrolyte correction

Neutropenic fever: Your role

Admit (usually)

- Cultures and antibiotics

- Find and treat standard infections

- If no infection found, continue empiric therapy until ANC > 500

If condition not improving after 3-5 days:
- ID consult

Hypercalcemia of malignancy: Your role

Triage based on severity (level, pace, symptoms)

- PTH/PITP +/- SPEP/SFLC

- Isotonic fluid
- Calcitonin
- Zoledronate

Neoplastic epidural spinal cord compression: Your role

MRI total spine with contrast

- Give dex 10 mg IV, then 6 mg QD q6 hrs, pain control

- Call neurosurgery and radiation oncology
Severe IRAE: Your role

Rule out other causes (infection) → Consult organ-specific specialist → IV steroids typically first line

Thanks!

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UCSF Management of the Hospitalized Patient
October 2021

Year in Review
Brad Sharpe, MD
Brad Monash, MD

The Year in Review will highlight key articles from the last year in the field of hospital medicine, from September 2020 to September 2021. Articles were selected based on article quality and ability to impact and change practice. We will not be presenting articles related to COVID.

The articles will be presented in an interactive case-based format as we will follow a few patients through their hospital stay.

In order to avoid duplicating articles of other speakers, we are in the final stages of selecting the articles and a version of the slides will be posted ahead of the conference.