ECG Monitoring in the Elderly

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Alternative Title for this Talk

Arrhythmias in the elderly:
A Broken Heart or Just Getting Old

What is old?
What is a ‘normal’ old heart?
What ECG abnormalities increase with age?
What ECG rhythms increase with age?
What are current recommendations for preop ECG’s?
What surgeries are common in the elderly population?
Rhythm devices, anything new?
Biomarkers, what are they, and how might they help?


"Long life is a sign of good health. The aging of the world’s population - in developing and developed countries - is an indicator of improving global health. The world’s elderly population - people 60 years of age and older - is 650 million. By 2050, the ‘greying’ population is forecast to reach 2 billion."

United Nations-

There is no United Nations standard numerical criterion, but the UN agreed cutoff is 60 years to refer to the older population

US Retirement Systems-

The definition of retirement ages is typically 65 years
A society is considered relatively old when the fraction of the population aged 65 and over exceeds 8-10%.
1900- elderly fraction in the US was 4.1%
2000- elderly fraction in the US was 12.6%
2030- projected to increase to 20%

http://longevity-science.org/Population_Aging.htm
Conventionally, “elderly” has been defined as a chronological age of 65 years old or older, while those from 65 through 74 years old are referred to as “early elderly” and those over 75 years old as “late elderly.” However, the evidence on which this definition is based is unknown.
The SA node exhibits automaticity that is determined by sympathetic and parasympathetic influences. Intrinsic automaticity is the heart rate unmodified by neurohumoral factors, and is a spontaneous firing rate of 100-115 beats/min. This intrinsic firing rate decreases with age.

What are the most common ECG Abnormalities

- Abnormalities increase with age
- At least 50% have ECG abnormalities
- LVH
- Increases in PR, QRS, and QT intervals
- Decrease in QRS amplitude
- Left axis deviation in the frontal plane
- Prior MI
- Bundle branch block and Atrial Fibrillation
- Non-specific ST-segment and T-wave changes

Preop ECG Abnormalities - age > 70

- 75% had at least one ECG abnormality
- 76% in patients with a cardiac history
- 71% in patients without cardiac history
- Q-waves - 34%
- Left axis deviation - 19%
- LVH - 7%
- ST-T wave abnormalities - frequent
- Atrial fibrillation - 3.5%
- No ECG abnormality was predictive of a post op event

Atrial Fibrillation

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Preop ECG’s- When are they indicated?
- Age not considered a reason to obtain a preop ECG
- Symptoms determine testing
- ASA Preop Practice Advisory: No added predictive risk value over symptoms
- Centers for Medicare and Medicaid Services do not reimburse for preop ECG’s, or age-based ECG’s
- AHA/ACC Recommendations for a preop ECG
  - Determined by clinical risk factors AND
  - Type of surgery

AHA/ACC Clinical Risk Factors
- Coronary artery disease
- Heart failure
- Diabetes
- Cerebrovascular disease
- Creatinine >2.0 mg/dL

AHA/ACC Recommendations for preop ECG
- Class I: Recommended
  - At least 1 clinical risk factor for vascular surgery
- Class IIa: Reasonable
  - No clinical risk factors and vascular surgery
- Class IIb: May be reasonable
  - At least 1 clinical risk factor and intermediate risk surgery
- Class III: Not indicated
  - Asymptomatic persons for low-risk (out-patient) surgeries

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Preop ECG’s- Significant Arrhythmias
AHA/ACC: Arrhythmias to postpone elective surgery
- High grade block or Mobitz II AV block
- High-grade ≥2 sinus P waves block consecutively in the context of periodic AV conduction
- 3rd degree AV block
- Symptomatic ventricular arrhythmias
- SVT with an uncontrolled ventricular rate
- Symptomatic bradycardia
- Newly recognized VT

Classification of AV Block
Degree of Block
- Partial (less than 1:1 conduction)
  - First-degree AV block
  - Second-degree AV block
    - Types I (Wenckebach) and Type II
  - Complete AV block (no conduction at all)
    - Third-degree AV block

Location of Block
- Nodal- At the level of the AV node
  - Second-degree Type I (Wenckebach) AV block
- Infranodal
  - Second-degree Type II AV block
  - Third-degree (complete) AV block
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**ECG and Heart Transplants**
- Beebe et al. presented two patients, 4 and 8 years after cardiac transplantation, reversed with neostigmine 5mg and glycopyrrolate 1mg after outpatient non-cardiac surgery resulting in asystole.
- Casta et al. report cardiac arrest after NMB (neo/glyco) reversal 1 month following heart transplant in a 20-month-old.

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**ECG and Heart Transplants**
- Directing acting beta agonists, as well as atropine and epinephrine should be available
- No muscle relaxants, if possible, otherwise, use a short acting muscle relaxant to minimize the need for reversal
- Consider glycopyrrolate or epinephrine first, then neostigmine
- Where is sugammadex?
- Internal or external pacing should be available

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**ECG and Heart Transplants**
- The transplanted heart initially has no sympathetic, parasympathetic, or sensory innervation.
- Loss of vagal tone results in higher than normal resting heart rate (90-100 bpm).
- The donor sinus node pacing mechanisms and coronary autoregulation remain intact.
- Two p waves may be observed if enough atrial tissue remains for the surgical anastomosis with the new donor heart.
- Reinnervation of the transplanted heart is unpredictable.

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**Trends in Hospital Volume and Operative Mortality for High-Risk Surgery**
- all patients from 65 to 99 years of age who underwent one of the following eight cancer and cardiovascular operations from 1999 through 2008

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**ECG and Heart Transplants**
- Millions have pacemakers, many hundred thousands ICDs
- Patients have Pacemaker/ICD cards
- Companies have 24-hr phone lines with humans
- Batteries won’t run out during surgery
- Devices should be checked after surgery to ensure they are still functioning as intended; that they were not inadvertently altered during electro-cautery activation
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Pacemakers & ICDs–

- ICD devices should be deactivated for surgery involving unipolar electrical interference
- When an ICD is deactivated, backup defibrillation must be immediately available
- CVP placement is not contraindicated, but deserves special consideration in a patient with a pacemaker or an ICD, as there is potential lead wire dislocation or infection

Pacemakers & ICDs– What does the magnet do?

- Converts “regular” pacemakers to the asynchronous (fixed-rate) mode
- Deactivates ICD sensing, and subsequent therapy, for atrial and ventricular tachycardias (VT, VF, SVT)
- Can cause R-on-T induced arrhythmias

Cautery Pacemaker Inhibition

Magnet Converts Pacemaker to Asynchronous Mode

Cautery activated

Magnet activated

Electrocautery Induced Pacemaker Reprogramming

Cautery activation

Lead MCLs

Lead MCLs
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Paced rhythm with “R on T” Arrhythmia

What the magnet does NOT do?

- Magnets have NO effect on devices that are patient-activated for termination of atrial fibrillation
- Magnets will NOT turn off the pacing function
- Cautery may permanently reprogram the pacemaker/ICD whether or not a magnet is kept over the generator
- Magnets might produce an effect if the device is NOT a pacemaker or an ICD

Cardiac Safety Biomarkers

- The Role of Cardiac Biomarkers in Prediction of Outcome in Atrial Fibrillation Patients Undergoing Catheter Ablation
- QT as a Safety Biomarker in Drug Development

http://clinicaltrials.gov/ct2/show/NCT01148914

To assess if levels of inflammatory biomarkers serve as independent predictors for drug or procedure outcome

http://www.nature.com/clpt/journal/v86/n1/full/clpt200970a.html

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References- preop ECGs

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**References - specific surgery**


**References - guidelines & advisories**


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**References - biomarkers**

