Rapidly Fatal Infections

- Infectious diseases are commonly seen in emergency medicine
- A small but important subset of these cases may be rapidly fatal infections

Disclosure

- Dr. Birnbaumer has no financial disclosures

- Identify the patients at risk of having a rapidly fatal infection
- Have minimal diagnostic criteria to identify those at risk of rapid death
- Know the right antibiotics to start and get them going early
- Use aggressive resuscitation protocols
The Big Four
- Meningitis / meningococcemia
- MRSA pneumonia
- Toxic shock syndrome
- Necrotizing fasciitis

A Few Zebras
- The atypical viral pneumonias
  - Avian influenza, MERS
  - Emphysematous pyelonephritis
  - Ascending cholangitis

- Meningitis incidence is decreasing
- Sporadic outbreaks still occur
- Military, universities and colleges
Overall fatality rates for bacterial meningitis are 20-25%, with significant morbidity in survivors.

**Bacterial Meningitis: General**

- Most common organism out of neonatal stage is pneumococcus, then meningococcus, then Listeria.

**Implicated organisms**
- Meningococcus - Any age, often young adults (college, military)
- Streptococcus pneumoniae - Any age
- Listeria monocytogenes - Any age, but neonates and the immunocompromised > 50 years
- Haemophilus influenzae – Children and adults (nonvaccinated)

**Bacterial Meningitis: Presentation**

- Classic presentation
  - Fever, nuchal rigidity, AMS, headache; may also see photophobia, rash, sore throat
- Elderly, very young, immunocompromised more likely to be atypical
## Bacterial Meningitis: Diagnosis

- If high suspicion, treat, THEN diagnose
- CT first if indicated clinically
  - Altered mental status, abnormal neurologic exam, papilledema, history of cancer or immunocompromised; possibly also age > 60 years

## Bacterial Meningitis: Diagnosis

- Lumbar puncture gold standard
  - Low glucose, high WBC with polymorphonuclear cells, positive gram stain is classic
  - Bacterial meningitis cannot be ruled out, however....
    - Negative gram stain
    - WBC as low as 100 WBC/mm³

## Bacterial Meningitis: Diagnosis

- Unless history very clearly suggests nonbacterial cause, antibiotics and admission are advised until culture results are available

## Bacterial Meningitis: Treatment

- Clinical suspicion should prompt treatment; do not delay for diagnostic testing
  - If ALOC, severely ill or CSF WBC > 1000, steroids are indicated
    - Dexamethasone 10 mg IV in adults
    - If possible, give before first antibiotic dose, but do not delay antibiotics for steroid dosing
Bacterial Meningitis:
Treatment

- Antibiotic choice based on patient age
  - Neonate < 1 month
    - Cefotaxime and ampicillin
  - Patient > 1 month
    - Ceftriaxone and vancomycin
  - Adult > 50 yr
    - Ceftriaxone plus vancomycin plus ampicillin

Bacterial Meningitis:
Take Home Points

- Elderly, immunocompromised patients may present atypically
- While CSF findings usually typical, patients may still have bacterial meningitis with lower CSF WBC and negative gram stain
- Antibiotics should be started as soon as possible; do not delay for imaging or diagnostic testing
- Consider steroids in the right patients
- Know the organisms and treatment by age

Toxic Shock Syndrome
General

- Multiorgan system syndrome
- Mortality rates may approach 70%

What do you know about Toxic Shock Syndrome?
Toxic Shock Syndrome

**General**
- Caused by exotoxins produced by Staph aureus and group A strep
  - Cause production of cytokines, tumor necrosis factor, etc
- Leads to capillary leakage and tissue damage of multiple organs

**Risk Factors**
- Staph aureus
  - Tampon use, intravaginal contraceptive devices, nasal packing, postop wound infections
- Group A strep
  - HIV, minor trauma, surgical procedures
- Also seen in diabetics, alcoholics
- Portal of entry unknown in up to 50%

**Presentation**
- Flu-like illness of rapid onset with rash
- Hypotension
- Multi-organ system failure
  - Acute renal failure
  - Coagulopathy
  - Hepatic dysfunction
  - ARDS
  - Rarely myocarditis, perihepatitis, cerebritis
- Rash
  - Typical
    - Diffuse, erythematous, macular rash involving all skin and mucosal surfaces including palms and soles
  - Desquamates later (1-2 weeks)
  - May also be scarlatiniform rash; rarely is bullous or petechial
Toxic Shock Syndrome
CDC Case Definition

- Fever > 38.9°C
- Hypotension
- Desquamation within 1-2 weeks after onset of illness
- Involvement of 3 or more organ systems
- No other pathogen identified

N.B. CDC has case definitions for both Staph and Strep toxic shock syndrome.

Toxic Shock Syndrome
Workup

- CMP
- CBC
- Blood cultures
- Cultures from other appropriate sources
- Liver panel
- Imaging as indicated

Toxic Shock Syndrome
Treatment

- Treatment should be started with initial suspicion of the syndrome
- Sepsis management with fluids (may need many liters) and pressure support as needed
- Source control – may need surgical debridement if indicated (especially cases of group A strep)

Toxic Shock Syndrome
Treatment

- Antibiotics
  - Vancomycin or linezolid PLUS clindamycin (possibly decreases toxin production)
  - Add a beta-lactam if strep is suspected

N.B. Antibiotics may not alter course of cases caused by Staph but still should be started as soon as possible.
Toxic Shock Syndrome

**Treatment**
- IV Ig appears to have little effect on outcome
- Steroids may decrease duration and severity of symptoms but do not affect outcome
- Neither treatment is recommended for routine treatment

**Take Home Points**
- Source unknown in up to 50%
- Clinical clues: SIRS with rash and multi-organ system failure
- Treat with clindamycin to decrease toxin production, plus vancomycin or linezolid; add beta-lactam if strep source suspected
- Remember source control
- Aggressive resuscitation may be necessary

MRSA Necrotizing Pneumonia

**General**
- CA-MRSA incidence very high
- CA-MRSA pneumonia now may account for up to 5% of all community-acquired pneumonias
- Causes a necrotizing pneumonia with mortality rates of 30-75%

**General**
- Produces a cytotoxin that causes leukocyte destruction and tissue necrosis (PVL toxin)
- Significant concern is post-influenza superinfection with CA-MRSA
MRSA Necrotizing Pneumonia

Presentation
- Initial presentation often appears like typical community-acquired pneumonia
- Clinical clues to CA-MRSA pneumonia
  - Rapid progression
  - Severe symptoms
  - Recent viral illness
  - Lack of comorbidities

MRSA Necrotizing Pneumonia

Treatment
- Aggressive supportive care
  - Sepsis treatment, with IV fluids and pressure support
  - Ventilatory support as indicated
  - IV vancomycin mainstay, but if suspect CA-MRSA pneumonia, consult infectious disease specialist
  - Linezolid – bacteriostatic, may be indicated

MRSA Necrotizing Pneumonia

Take Home Points
- Suspect it in patients with recent viral illness and rapidly progressive pneumonia
- High mortality rate; aggressive resuscitative care, ventilator support often necessary
- IV vancomycin indicated; may also use linezolid, consider consulting infectious disease specialist

Necrotizing Fasciitis

General
- Incidence rising
  - Immunocompromised patients living longer
  - Diabetes, cancer, alcoholism, transplant patients, HIV positive patients, neutropenia, vascular disease
- Usually middle-aged adults
- Usually begins as cellulitis, then progresses to deeper tissues
Necrotizing Fasciitis

General

- Organisms
  - Often polymicrobial, may be synergistic
  - Note: MRSA necrotizing fasciitis more indolent
- Mortality usually ranges from 15-65%, but rate can reach as high as 80%
- Morbidity is high in survivors

Presentation

- Diagnostic clues
  - Pain out of proportion to exam
  - Rapid spread
  - Bullous changes, especially if hemorrhagic
  - If area is painless, suggests very serious and late infection
  - Crepitance, cyanotic areas, extensive edema also highly concerning

Diagnosis

- If necrotizing fasciitis is suspected...
  - ASAP
    - Get antibiotics on board
    - Call a surgeon
    - Do not delay antibiotics or consultation for imaging studies or labs

Imaging

- Plain films: Good PPV if gas present, but poor NPV if gas NOT present
Necrotizing Fasciitis

**Imaging**
- CT is imaging study of choice
  - No tissue enhancement with IV contrast suggests necrosis
  - Surgeons often use CT to guide surgical approach
- MRI excellent imaging choice, but often not available
- Ultrasound may have a role, but use still being delineated

**Lab Studies**
- Often not helpful
- Low sodium (< 130 mEq/L), high WBC (> 16K) may be often seen, but nonspecific

**Treatment**
- Antibiotics ASAP
  - Cover gram positive cocci, gram negative rods and clostridia
  - Examples
    - Carbopenem plus clindamycin
    - Vancomycin plus an aminoglycoside plus clindamycin
  - Note: Clindamycin may decrease release of Toxin A from clostridia
Necrotizing Fasciitis
Treatment

- Sepsis resuscitation – fluids and shock management

Necrotizing Fasciitis
Treatment

- Surgery ASAP
  - Less than 3 hours optimal, definitely within 12 hours
  - Mortality increases with increasing delay

Necrotizing Fasciitis
Take Home Points

- Pain out of proportion is a clinical clue
- If area in anesthetic, suggests infection is severe
- Rapid spread, bullous changes, crepitance suggest severe infection
- Antibiotics and surgeon ASAP; imaging secondary
Viral Pneumonias

- SARS, avian influenza, MERS
- Viral pneumonias with high mortality rates
- Global surveillance crucial to monitoring activity and spread
- Infection control measures crucial to limiting spread
  - Airborne precautions, negative pressure ventilation rooms

Viral Pneumonias

- Practitioners needs to be aware of disease activity and how to recognize potential cases
- No proven treatment for most of these infections, but measures to consider
  - Aggressive resuscitation
  - Intubation as needed
  - Antivirals (limited benefit, but no other options available)
Severe Viral Pneumonias
Take Home Points

- Infection control measures vital to minimize spread of infection
- Awareness of infection activity and patient presentation useful to identify cases
- Aggressive supportive care with airway management as indicated

Rapidly Fatal Infections

Key Points

- Identify the patients at risk of having a rapidly fatal infection
- Have minimal diagnostic criteria to identify those at risk of rapid death
- Know the right antibiotics to start and get them going early
- Use aggressive resuscitation protocols

Thank You For Your Attention!!