Common Infections in the Older Adult

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Infections in the Elderly

- Infectious diseases
  - 1/3 of all deaths age 65 years and older

- Early detection more difficult
  - typical signs and symptoms frequently absent
    - fever and leukocytosis

In General...

- Only presenting symptom in an older patient with an infection
  - Change in mental status or decline in function

- Pneumonia deaths
  - 90% over age 65

- Influenza Mortality
  - Primarily in the elderly

- Urinary tract infections
  - Most common cause of bacteremia
Antibiotic-Resistant Bacteria

- Methicillin-resistant Staphylococcus aureus & vancomycin-resistant enterococcus
  - Problem in elderly
  - Exposed to infections at higher rates in hospital and institutional settings
  - Treatment of colonization and active infection is problematic
  - Strict adherence to hygiene practices necessary to prevent spread of resistant organisms

“Usual” Signs...

- Leukocytosis
  - Only 60% with serious infections develop
  - Absence does not rule out an infectious process
- Body temperature response
  - Frail older adults have poorer responses
  - Elevations in body temperature of 1.1°C (2°F) from baseline temperature should be considered febrile response
  - Fevers higher than 38.3°C (101°F)
    - severe, life-threatening infections, with hospitalization considered

Change in Presentation

- Cognitive impairment or change
- Frank delirium in 50%
- Only signs may be
  - Anorexia
  - Functional decline
  - Falls
  - Weight loss
  - Slight increase in respiratory rate
Factors that Increase Mortality

• Comorbid conditions
• Number of invasive procedures performed
• Decreased physiologic reserves

“Age” Risk Factors for Infection

Elderly Risk Factors
Alterations of Natural Barriers

• Eye
  – Decreased tears to flush
  – Diminished blink reflex increases dryness

• Oral cavity
  – Dental caries, periodontal disease
  – Less saliva production
  – Altered tongue performance & aspiration
## Elderly Risk Factors

### Respiratory System:
- Increased chest diameter & rigidity
  - ↓ air exchange, ↑ residual air
- Weakened respiratory muscles & cough
- Decreased cilia action

### Gastrointestinal System
- Delayed esophageal emptying & intestinal mobility
  - increased risk of aspiration
- Decrease or loss of gastric acid production (by 30%)

### Genitourinary System
- Change in kidney function
- Relaxation of female pelvic floor can reduce bladder emptying
- Residual urine or incontinence
Elderly Risk Factors

**GU System**
- BPH & Bladder outlet obstruction
  - Urethral stricture
  - Neurogenic bladder
- Urinary drainage catheters

Elderly Risk Factors

**Skin and Mucosal Surfaces**
- Thinning of epidermal / dermal layers
- Loss of skin elasticity and strength
- Decreased production of sebum (oil & fat)
  - Antifungal and antibacterial properties
- Skin breakdown
  - Chronic diseases such as diabetes

Urinary Tract Infections
Urinary Tract Infection

- Most common infection
  - elderly, noncatheterized: 15% - 50%
  - long-term in-dwelling catheters
    - bacteriuria = 100%
- Clinical manifestations nonspecific
  - “Classic”
    - dysuria, frequency, suprapubic/back pain
  - Most often confusion
- Clean-catch difficult to obtain

Differential Diagnosis

- Pain at onset of urination: Urethritis
- External Dysuria: Vaginitis
- Long, insidious onset: Chlamydia
  - Bacterial Prostatitis in men

Urinary Tract Infection

- Upper
  - Pyelonephritis
- Lower
  - Cystitis
    - Inflamed bladder with pain & burning
    - 30% occult pyelonephritis
- Asymptomatic bacteriuria (ASB)
- Urethral syndrome
  - history of chronic recurrent UTI
  - cultures without conventional bacterial growth
What Complicates UTIs

- Functionally, metabolically, or anatomically abnormal urinary tract
  - Foreign body
    - catheter, stent
  - Obstruction
    - calculi, congenital anomaly, prostatic disease, stricture, tumor
  - Long-term care
  - Diabetes mellitus
  - Menopause

Diagnosis & Treatment

- UA, C&S
- Polymicrobial infections
  - 30%
  - Most often catheter related
- Considered “complicated” UTI in older adult
- Antibiotic length longer
  - 7 days older women
  - 14 days older men

Treatment

- An important caveat
  - Treatment of asymptomatic bacteriuria does not reduce morbidity or mortality
    - Increases development of drug-resistant microorganisms and adverse reactions to antibiotics
  - Asymptomatic bacteriuria or bacteria < 100,000
    - Common in elderly
    - Withhold antibiotics
**Antibiotic Options Complicated UTIs**

- TMP/SMX
  - NSAID caution
- Cephalosporin
- Amoxicillin ± clav (Augmentin)
- Gentamicin: IM or IV
- Ampicillin or Amoxicillin
- Levofloxacin or Ciprofloxacin

**Etiology of Uncomplicated UTIs**

**Gram-Negatives**
- Escherichia coli (72%)
- Klebsiella species (6%)
- Proteus species (4%)
- Other (5%)

**Gram-Positives**
- Enterococcus species (5%)
- Other Gram-positive organisms (7%)

**Uncomplicated UTI: 3 day treatment**

- Cephalexin (decrease for renal)
- Fosfomycin trometamol (Monurol) > 18 yrs
  - Clinical efficacy rate 91%
  - 3 grams single dose; safe in pregnancy:
- Doxycycline
- Augmentin
- Bactrim DS
- Nitrofurantoin (Macrodantin) for 7 days
- Use quinolones as last line...
- Pyridium (OTC Uristat, AZO, Cystex, etc)
Creatinine Clearance for Dosing Renally Eliminated Drugs (like Nitrofurantoin & Cephalexin)

• Cockcroft-Gault equation preferred method
  – Drug manufacturers use to determine renal dosing
  – Developed using "average" men...healthy, middle-aged, and about 70 kg

• Tailor approach to get best results

Creatinine clearance (mL/min)

\[(140 - \text{age}) \times \text{wt (kg)} \times (0.85 \text{ for fe}) / (\text{Serum creatinine (mg/dL)} \times 72)\]

• Overweight or obese patients
  – Using IDEAL body weight can underestimate CrCl...but using ACTUAL body weight can overestimate it.
  – BMI ≥ 25 kg/m2, calculate ADJUSTED body weight with this formula:
    • Adjusted body weight = ideal body weight + 0.4 (actual body weight - ideal body weight)

• Or consider using ideal AND actual body weight to calculate a range for CrCl...and select appropriate dose for that CrCl range
• Underweight patients
  – Use actual body weight and actual SCr
  – Don't routinely round up SCr in these patients to compensate for reduced muscle mass. This can underestimate CrCl by up to one-half

• Elderly patients
  – Don't round up SCr, can underestimate CrCl by almost one-third

• Patients with amputations
  – Measure CrCl with 24-hour urine for best accuracy. There are no validated equations for calculating CrCl in these patients

Antibiotic Resistance in UTIs

• E. coli - 75% to 95% of UTIs
  – Antimicrobial resistance
    • Ciprofloxacin: #1 used in US
      – Increased over five-fold from 2000 to 2010
    
    • Bactrim: #2 used in US
      – One in four isolates

Recurrent UTI & Risks

• ≥2 infections in 6 months or ≥3 in 1 year
  – Sexual intercourse
  – History of recurrent UTI
  – Spermicide-coated condom use
  – Recent antimicrobial use
    • Adversely affects vaginal flora
  – New sex partner during past year
  – 1st UTI at or before age 15
Management of Recurrent or Chronic UTI

- Nightly antibiotic use
  - Short term
  - Post sexual intercourse: low-dose prophylaxis
    - Single dose 1 - 2 hrs prior
- Cranberry tablets or Vit C 500mg nightly
- Hormonal therapy
  - Intravaginal estriol cream 0.5 mg estriol
    - Nightly for 2 weeks then 2-3 times week

Old Thoughts....

- No associations are found between history of recurrent UTI and....
  - Pre- and postcoital voiding patterns
  - Frequency of urination
  - Delayed voiding habits
  - Wiping patterns
  - Douching
  - Use of hot tubs
  - Frequent use of pantyhose or tights
  - Body mass index

Clostridium Difficile Disease
C-Diff Disease: Practice & Risk

- 2011:
  - 500,000 infections in US
    - 83,000 experienced at least one recurrence
    - 29,000 died within 30 days of initial diagnosis
- Poor prescribing practices increase risk
  - > 1/2 of all hospitalized patients will get an antibiotic at some point during their hospital stay
    - 30-50% of antibiotics prescribed are unnecessary or incorrect

C difficile Carriage & Transmission

- Adults in hospitals & long-term care facilities
  - 20 to 50 %
- Carrier rate among healthy adults
  - 3 %
- Those with negative admission stool cultures who become infected during hospitalization
  - 20 %
- Even asymptomatic individuals
  - Shed pathogenic organisms
  - Serve as reservoir for environmental contamination to other hospitalized patients
- Highly transmissible
  - Can culture from any surface, including hands, clothing, and stethoscopes of healthcare workers
- Newly exposed patients develop more frequently than colonized patients
- Any antibiotic can predispose to colonization
  - metronidazole and vancomycin
Clinical Presentation
Almost 50% will not have typical symptoms

- Diarrhea
- Cramps, fever, malaise, anorexia
- Abdominal pain
- Ileus

- Little to profound leukemoid reactions
- Severe hypoalbuminemia
- Septic shock
- Toxic megacolon

Pathophysiology

- Colonization, alteration of flora, organism growth
- Toxin A
  - Enterotoxin
    - Tissue damage, fluid secretion, inflammation
    - Not necessary for virulence
    - Less potent than B
- Cytotoxin B
  - 1000 times more potent than A
  - Activate release of cytotoxins from monocytes

“Newer” Resistant C Diff

- Anaerobic, gram positive, spore-forming bacillus
- Annually in US > 14,000 die of C. difficile
- Hypervirulent strain (BI/NAP1/027)
  - Cause of outbreaks in facilities since 2001
  - More resistant to antibiotics
  - Associated with more severe disease
  - About 1/3 of US cases
Risk Factors
- Inflammatory bowel disease
- Acid suppressive agents
  - H2-blockers
  - PPIs
- Exposure to antibiotics not seen as frequently
  - BUT includes
    - Cephalosporins, Amoxicillin Clavulanate, Quinolones, Metronidazole, Vancomycin
- Immunosuppression / chemotherapy
- Age >65
- Chronic Renal Failure

Treatment Guidelines

Guidelines: May 2010
- SHEA: Society for Healthcare Epidemiology & IDSA
  - Published Infection Control & Hospital Epidemiology May 2010
- Guideline changes
  - Diagnosis
  - Infection control recommendations
  - Treatment
**Guidelines**

- Testing should be on diarrheal stools only
  - Stool from asymptomatic pts not clinically useful
  - Order a *C. difficile* test if three or more unformed stools within 24 hours
  - “Test of cure” not recommended
- **Polymerase chain reaction (PCR)**
  - Rapid, sensitive, specific
- **Enzyme immunoassay (EIA) testing for A&B**
  - Less sensitive although rapid
- Probiotics NOT recommended to prevent *primary C Diff*

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**Guidelines**

- Avoid antiperistaltic agents
  - Narcotics
  - Imodium, etc
- If stool toxin assay negative, individualize decision to treat anyway
- Start empirical treatment if suspected

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**Guidelines**

- Supportive care
  - Hydration
  - Electrolytes
  - No milk products
  - Skin care
Treatment

Mild to moderate: metronidazole (Flagyl)
– 500 mg TID or 250 mg QID for 10 – 14 days
Severe: Vancomycin oral
• Vancomycin (by mouth)
  – 125mg QID for 10 – 14 days
  • Per rectum if ileus
• Severe, complicated: Vancomycin oral
  – With or without IV metronidazole
  – 500 mg 4 times day AND retention enema:
    500mg / 100ml NS every 6 hrs
  – IV metronidazole: 500mg every 8 hrs

Fidaxomicin

• Can be used as alternative to metronidazole
  or oral vancomycin
• Macrocyclic antibiotic that is bactericidal
  – Metronidazole & vancomycin are bacteriostatic
  – Narrower antimicrobial spectrum leading to less
    disruption of normal colonic anaerobic microflora
• Treatment of initial episode associated with
  lower incidence of recurrent CDI
  than vancomycin (15 % vs 25 %)
• 200 mg twice daily X 10 days
  – With or without food

Recurrent Clostridium difficile infection

• Rates of recurrence
  – After 1st episode
    • 20 %
  – After 1st recurrence
    • 45 %
  – After two or more recurrences
    • 65 %
Recurrence
• First recurrence same regimen
  – By disease severity
    • Mild – moderate
    • Severe
    • Severe complicated
  – Do not use metronidazole beyond first recurrence or for long-term chronic therapy RT cumulative neurotoxicity

Recurrence
• Second or later recurrence
  – Vancomycin taper or pulse only

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Tapering Schedule
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<tr>
<th>Week</th>
<th>Vanco dose</th>
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<tr>
<td>1</td>
<td>125mg qid</td>
</tr>
<tr>
<td>2</td>
<td>125mg bid</td>
</tr>
<tr>
<td>3</td>
<td>125mg daily</td>
</tr>
<tr>
<td>4</td>
<td>125mg every other day</td>
</tr>
<tr>
<td>5 &amp; 6</td>
<td>125mg every 3 days</td>
</tr>
</tbody>
</table>
From the Horse’s Mouth: CDC’s Web Site
After treatment, repeat *C. difficile* testing is not recommended if symptoms have resolved, as patient may remain colonized.

Other Treatment Approaches
- Cholestyramine resin (1 - 4gm daily to BID)
- Saccharomyces cerevisiae – Brewer’s Yeast
- IgG infusion at dose of 200 to 300mg/kg
- Stool Transplant

Stool Transplant
- Over 50% of patients would rather have this than medication therapy
  - No contraindications
- Some research: 90% cure rate
- “Prepared” feces by NGT or enema
  - Usually family member, can be any donor
  - 30 - 50 g fresh stool (6-24hrs old)
    - Blended with NS for a total of 500ml
Stool Donor Screening

- Ova and parasites
- Stool culture and sensitivity test
  - Generally includes: Salmonella, Shigella, Escherichia coli, Yersinia enterocolitica, and Campylobacter
- Clostridium difficile toxins A and B
- Some additionally screen for cryptosporidium antigen and Giardia antigen

Stool Donor Exclusions

- HIV
- Hepatitis B or C
  - or known exposure within previous year
- High-risk sexual behaviors
- Illicit drug use
- Tattoo or body piercing within previous 6 months
- Recently incarcerated
- Traveled to world areas with endemic
- Chronic constipation
- Chronic diarrhea
- Inflammatory or irritable bowel disease/syndrome
- History of GI malignancy or known GI polyposis
- Anything that would affect intestinal microbiota
  - Antibiotics in preceding 3 months
  - Currently receiving major immuno-suppressive medications or systemic antineoplastic agent

Recurrence: Oral Probiotics

- Saccharomyces boulardii, 500 mg BID for 4 weeks
  plus Vancomycin

- Lactobacillus GG (Lactinex), 1-g packet 4 times a day for 14 days
  after Vancomycin
Other Thoughts

- Incontinence: securely “Depended” so as to prevent environmental contamination

- Antibiotics, antidiarrheal agents used sparingly
  - May lengthen duration, cause complications

- Fluid replacement, preferably with oral fluids
  - No apple juice or milk products

- Temporarily eliminate milk products as damage to mucosa may lead to temporary lactose intolerance

Environmental Survival & Contamination

- Vegetative form survives 15 minutes on dry surfaces in room air
  - Remains viable up to 6 hours on moist surfaces

- Spores: Highly resistant
  - Drying, heat, chemical & physical agents
  - Can exist for 5 months on hard surfaces

- One study found spores
  - 49% of rooms occupied with CDI
  - 29% in rooms of asymptomatic carriers

Environmental cleaning for *C. difficile*

- Use of sporucidal disinfectants for cleaning patient care area and bathroom
  - Daily
  - Focus on high touch areas and commode

- Household bleach in 1:10 dilution
  - Prepared fresh daily
  - Wipe off prevents residue leading to skin irritation
  - Needs contact time of 10 minutes
Recommended Hand Hygiene Measures for C-Diff

- Wash hands with soap and water after caring for known patients with CDiff
- Continue to use alcohol cleaning in routine hand hygiene when caring for other patients

*Handwashing is significantly more effective in removing C. difficile from hands than using an alcohol based gel*

Pneumonia

Pneumonia in the Elderly

- Hospitalization
  - 60% of those over 65 yr
  - 3rd most common reason for hospitalization
    - Mortality rate: 10 – 25%
- Classic symptoms rare
- Nonrespiratory symptoms
  - Weakness
  - Confusion
  - Decline in functional capacity: Increased falls
  - Delirium
A Hundred Years Ago, They Knew!

Sir William Osler

‘In old age, pneumonia may be latent, coming on without chill, the cough and expectoration are slight, the physical signs ill-defined and changeable, and the constitutional symptoms out of all proportion. Importantly, fever may be absent”

Diagnosis

- Routine labs little value
- CXR may be too early
  - May need CT
- Treat what you hear?
- Review history
  - CVA
  - COPD / Asthma / cigarette use
  - Dysphagia
  - End-stage dementia
  - Dentures or dental condition
- “Double sickness”: virus to bacterial

“Typical” vs “Atypical” PNA

- Typical pneumonia
  - Consolidation on CXR
    - S. pneumoniae, H. influenza, S. aureus, enteric gram negative bacteria

- Atypical pneumonia
  - Patchy interstitial pattern on CXR
    - Mycoplasma, Legionella, Chlamydia pneumonia
    - Sputum gram stain usually negative
### Typical vs. Atypical Pneumonia

<table>
<thead>
<tr>
<th></th>
<th>Typical</th>
<th>Atypical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset</strong></td>
<td>Abrupt</td>
<td>Slow / Variable</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Fever, rigors, pleurisy, cough, purulent sputum</td>
<td>Mild fever, dry cough, mucoid sputum</td>
</tr>
<tr>
<td><strong>Physical Examination</strong></td>
<td>Consolidation</td>
<td>Crackles</td>
</tr>
<tr>
<td><strong>WBC</strong></td>
<td>High</td>
<td>Variable / Normal</td>
</tr>
<tr>
<td><strong>CXR</strong></td>
<td>Lobar, Segmental</td>
<td>Interstitial</td>
</tr>
<tr>
<td><strong>Pathogens</strong></td>
<td>S. pneumonia, H. influenza</td>
<td>Mycoplasma, Chlamydia</td>
</tr>
</tbody>
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### Antibiotic Therapy: ATS & IDSA

**Look for New Recommendations**

**Fall 2015**

- No comorbidities or antibiotic use past 3 mth and No macrolide-resistant strains
  - Azithromycin
    - 500 mg daily for three days
  - Clarithromycin
    - 500 mg twice daily for five days or afebrile for 48 - 72 hrs
    - Clarithromycin XL
      - Two 500 mg tablets (1000 mg per dose) once daily for five days or afebrile for 48 - 72 hrs
  - Doxycycline
    - 100 mg twice a day for 7 to 10 days

### Guidelines from ATS & IDSA

Cardiopulmonary disease or modifying factor

β-lactam + macrolide or doxycycline
Considerations

- Newer macrolides
  - H. influenzae, smokers or P450 interactions
  - Higher cost
  - Erythromycin if tolerated & possible
- Trimethoprim-sulfamethoxazole (Bactrim, Septra)
  - Good spectrum of activity
    - S. pneumoniae, H. influenzae and M. catarrhalis
    - No activity against atypical pathogens
    - Emerging resistance
- Respiratory Fluoroquinolone
  - Broad spectrum of activity including atypicals
  - Indiscriminate use increasing resistance

Pneumonia Prevention

- Influenza vaccine
  - Staff, frequent visitors & volunteers annually
- Pneumococcal vaccine for chronic illnesses
  - New recommendations
- Good oral care
  - Removes pathogenic bacteria & improves swallowing reflex

Pneumococcal Vaccination Recommendations in 2015 Adult Immunization Schedule: Footnotes

- Adults age ≥65y: PCV13 and PPV23
  - General
    - When indicated, only one dose PCV13 for adults
    - No additional PPV23 needed if one received at age ≥65y
    - Administer PCV13 before PPV23 (not at same visit)
    - Administer vaccine if history unknown
  - Pneumococcal vaccine intervals for adults
    - PPV23 → ≥1 yr → PCV13
    - PCV13 → 6–12 mos → PPV23  if age ≥65y
      ≥8 wks → PPV23  if age 19–64 immunocompromised, asplenia, CSF leaks, cochlear implants
    - PPV23 → ≥5 yrs → PPV23
- 3 footnotes condensed to 1 footnote
  - Change from vaccine-focused to patient-focused recommendations
How To Keep ‘Em Healthy

• Immunizations
  – Influenza
  – Pneumonia

• Care & control of chronic illnesses

• Cough into sleeve & avoid touching eyes, mouth

• Avoid shopping during prime time

• In an “ill” household
  – Use simple things like bleach
  – Prevent dehydration & fatigue

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**Pneumococcal Vaccination Recommendations in 2015 Adult Immunization Schedule: Footnotes (2)**

**Adults 26+ years**
- Have not received PCV13 or PPSV23, or unknown history
- Have not received PCV13 but received PPSV23 at ≥65 yrs
- Have received PCV13 but received ≥1 PPSV23 at ≥65 yrs
- Have received PCV13 but not PPSV23 at ≥65 yrs
- Have received PCV13 and ≥1 PPSV23 at ≥65 yrs
  
**Adults 19–64yrs immunocompromised, asplenia**
- Have not received PCV13 or PPSV23, or unknown history
- Have not received PCV13 but received ≥2 doses PPSV23
- Have received PCV13 but not PPSV23
- Have received PCV13 and 1 dose PPSV23

**Adults 19–64 years**
- Chronic health conditions
- Smoke cigarettes or reside in long-term facilities
- ≥12 mos after PCV13
- ≥11 mos after PCV13
- ≥6 mos after PCV13
- ≥4 mos after PCV13

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