ICU related bacterial infection

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Content

- Bacterial infection in ICU
- Why is it different ??
- Treatment: Antibiotic
- An impressive Case
- Personal sharing
- Conclusion
Bacterial infection in ICU

Though ICUs account for only 8% of hospital beds, 45% of infections in a hospital originate in an ICU.

Clin Infect Dis 1997;24:211-215
Seminars in Respiratory and critical care med
2003,24(1):3-22,
Distribution of major sites of infection in medical ICU’s

Bacteria infection is common in ICU

- Seriously compromised or critically ill patients
- Invasive diagnostic or therapeutic procedures
Bacteria infection is common in ICU

- Patients at the extremes of ages
- Most crowded place
- Prolong hospitalization
- Others: e.g. multiple sites of injury
Common infection in ICU

- Low respiratory tract infection
- Urinary tract infection
- Primary bacteremia
  - Catheter-related infection
- Surgical wound infection
- Gastrointestinal tract infection
Why the infection is Different in ICU?

Pt usually cannot communicate

Inflammation mimics infection

Multiple mechanism of infection
Why the infection is Different in ICU?

Skin integrity – operations, wounds, ulcers, poor perfusion, central lines, drains, tubes, catheters, stomas……

Immunosuppression and immunoparesis
Treatment

• Surgery:
  • Get the pus out! All of it!

• Drug Tx: Antibiotics, Anti-fungal....
  – Empirical Tx
  – Base on microbiology results
  – Points to be considered:
    • Pharmacokinetic
    • Pharmacodynamic
    • Side effect monitoring
    • duration
    • Resistance pattern
THE EARLIEST , THE BETTER
Empirical Treatment

- Diagnosis
- Sources of infection
- Know your Local Pathogens
- Follow local and international guidelines
- Patient allergy record
Empiric to Specific Therapy in VAP

**Early VAP**
Amp/sulb, ceftriaxone, ertapenem, or moxifloxacin (PCN all)

**Late VAP**
Imipenem or mero + vancomycin +/- aminoglycoside or ciprofloxacin

If GPC in clusters on gram stain, history of MRSA, or RF for MRSA, add vancomycin

De-escalation based on quantitative culture
Consider linezolid for documented MRSA pneumonia

Standard duration of therapy 8 days except for *Pseudomonas*
Pharmacokinetics

• Renal adjustment following CrCl
  – CrCl = [(140 - age) x IBW] / (Scr x 72)
    (x 0.85 for females)

• Dose adjustment for hemodialysis

• Dose adjustment for other disease state, e.g. liver failure

• Obesity
rate and extent of an antibiotic’s activity depend on:
- drug concentrations at the site of infection,
- bacterial load
- phase of bacterial growth
- MIC of the pathogen
**Pseudomonas and Fluoroquinolones**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>$C_{\text{max}}$</th>
<th>MIC</th>
<th>$\text{AUC}_{\text{free}}/\text{MIC}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>400 q12</td>
<td>4.1</td>
<td>0.125</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>400 q8</td>
<td>4.1</td>
<td>0.125</td>
<td>184</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 q24</td>
<td>12.1</td>
<td>0.5</td>
<td>152</td>
</tr>
<tr>
<td>Gatifloxacin</td>
<td>400 q12</td>
<td>4.6</td>
<td>1.0</td>
<td>28</td>
</tr>
<tr>
<td>Moxifloxacin</td>
<td>400 q24</td>
<td>4.2</td>
<td>2.0</td>
<td>10</td>
</tr>
</tbody>
</table>

New IDSA and ATS Guidelines recommend Ciprofloxacin 400mg IV q8hr or Levofloxacin 750 mg qd

*Am J Respir Crit Care Med 2005;171:388-416*
High-dose, Short-course
Levofloxacin for CAP

• Attempt to increase AUC:MIC ratio while decreasing overall drug exposure
• Multi-center, randomized, double-blind study comparing 750 mg qd x 5 days vs. 500 mg qd x 10 days in the treatment of CAP
• Found equivalent clinical and microbiological outcomes

Clin Infect Dis 2003;37:752-60
Adverse effects Monitoring

• A/E: e.g: Red man syndrome

• Ototoxicity and nephrotoxicity in aminoglycosides

• Cephalosporin associated with seizure
Duration of treatment

- In UK ICU median duration of antibiotic therapy is 6 days
- Range 0 to 29 days!!!!
- Similar for both community and nosocomial acquired infections.

Anaesthesia. 2004 Sep;59(9):885-90
# Duration of Therapy for VAP

<table>
<thead>
<tr>
<th>Variable</th>
<th>8 Days (n=197)</th>
<th>15 Days (n=204)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>18.8%</td>
<td>17.2%</td>
</tr>
<tr>
<td>Recurrent infection</td>
<td>28.9%</td>
<td>26%</td>
</tr>
<tr>
<td>Antibiotic free days</td>
<td>13.1 days</td>
<td>8.7 days</td>
</tr>
<tr>
<td>Antimicrobial resistance</td>
<td>42.1%</td>
<td>62.0%</td>
</tr>
<tr>
<td>Recurrence rate among Non-lactose fermenters</td>
<td>40.6%</td>
<td>25.4%</td>
</tr>
</tbody>
</table>

JAMA 2003;290:2588-2598
Antimicrobial resistance

Resistant Strains
Rare

Antimicrobial Exposure

Resistant Strains
Dominant
Acinetobacter bacteremia

Colistin/Polymixin E

• Cationic polypeptide
• Detergent-like disruption of outer cytoplasmic membrane of Gram-negative bacteria
• Used in treatment of highly resistant *Acinetobacter* and *Pseudomonas* when no other options
• Can accumulate in tissues and continue to be released after discontinuing therapy
• Nephrotoxicity (20-30%), neurotoxicity (7%)
A Case

- 55yr old male
- **SH:** retiree
- **CC:**
- Patient was admitted for pneumonia with prostrating high fever and arthralgia. He complained of headache and stiff neck when admitted, and therefore LP was ordered. However, it showed normal results.

- **Allergic Hx:** Penicillin

- **Vital signs**
  - Temp 39
  - RR 24  WBC 1300
A Case

- Day 1
- Fever persists, WBC 13000
- He presented as bacterial pneumonia.
- Chest X ray shows patchy infiltrates
- Amox/ clav was started due to empirical choice, changed to Levofloxacin 500mg daily due to his allergy history
A Case

Day 3
- Culture negative, no improvement
- Step up to piperacillin/tazobactam

Day 4, Day 5, Day 6 ?????????????
- Fever persists
- He developed into severe pneumonia
- X-ray showed increased infiltrates
A Case

- Day 8
- Meet with relative, collected a history of patient in contact with parrot before admission
- May be source of infection
- Started doxycycline 100mg bd
- Found culture of *Chlamydia psittaci*
Personal Sharing

• Multidisciplinary approach
  – Nurses
  – Doctors
  – Physiotherapist
  – Pharmacist
  – Microbiologist

• Infection control
Infection control measures in ICU

- Eliminate risk factors when possible
  - Extubate
  - Remove NG tube
  - Care of catheter sites
  - Proper respiratory care
- Selective decontamination (Controversial measure)
- Control antibiotic use
- Treatment of underlying diseases
Conclusion

- Infectious disease is common in ICU
- Drug treatment remains the mainstay of therapy
- Proper use is of utmost importance
- Multidisciplinary approach proves its effectiveness in critical care
- Pharmacist may take up a role
• Cuthbertson, B; Thompson, M; Sherry, A. Antibiotic-treated infections in intensive care patients in the UK. Anaesthesia. 59(9): 885–890, 2004.
• Fibroproliferative phase of ARDS. Clinical findings and effects of corticosteroids Chest. 1991. 1:1644
References

- Wilson, SJ; Knipe, CJ; Ziegler, MJ. et al. Direct costs of multidrug-resistant Acinetobacter baumannii in the burn unit of a public teaching hospital. American Journal of Infection Control, 32: 342-344, 2004
Thank You