Use And “Misuse” Of Antibiotics In Neurosurgery
• **CSF infection** in the United States after neurosurgery from 1992 to 2003

• 0.86% to 2.32% *

AIIMS data

- CSF infection from 1994 to 2006 = 2.9 %
  - 1996 = 6.1%
  - 2000 = 1.3%
  - 2006 = 2.3%

*Graph showing trend line depicting the incidence of culture-proven meningitis as a percentage of the total number of procedures performed per year at AIIMS.*
Role of prophylactic antibiotic

- The role of antibiotic prophylaxis*
  - Not to eradicate all the bacteria
  - To control the number of contaminating bacteria below the significant level that cannot cause infection
  - Concentration of antibiotics should be at the maximum at the time of incision

General principles of prophylactic antibiotic

- Directed at the most common organism in the hospital
- Repeat the antibiotic dose at intervals so that bactericidal serum levels are maintained
• Do not continue the antibiotic more than a few hours after the end of the operation.

• Vancomycin should be avoided
# Wound classification

<table>
<thead>
<tr>
<th>Wound class</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clean cases</td>
<td>&lt; 4 hrs</td>
</tr>
<tr>
<td>2. Clean contaminated cases</td>
<td>4- 6 hrs or when there is a breach in sterility</td>
</tr>
</tbody>
</table>
| 3. Contaminated cases           | • >6 hrs  
• All emergency cases  
• Trans-sphenoidal surgery  
• Frontal or mastoid air cells opened  
• Implants  
• Diabetic patients  
• Re-do patients  
• Osteomyelitis |
| 4. Dirty cases                  | • Abscesses  
• Suspected meningitis  
• Penetrating head injuries |
AIIMS antibiotics protocols in the past

- 1994–2000
  - ciprofloxacin + amikacin based

- A comprehensive written antibiotic policy came into being for the first time in 2000.
  - 3 classes

- 2000–2004
  - cefotaxime + netilmicin based

- 2004–2006
  - chloramphenicol + netilmicin based
Class I

- At induction
  - iv cloxacillin 500 mg (12.5 mg/kg) push
  - iv amikacin 500 mg (7.5 mg/kg) push
- Follow through in hospital
  - Repeat iv cloxacillin 6 hrly for 24 hrs
  - Repeat iv amikacin 12 hrly for 24 hrs
- At discharge
  - No a/b
Class II

- Same as class I except that total duration is 48 hrs

- At discharge
  - No a/b
Class III

- Same as class III except
- Add iv metrogyl 500 mg (10 mg/kg) iv at induction and 8 hrly for 48 hrs
- Follow through
  - Oral/ iv cloxacillin 500 mg 6 hrly (day 2-5)
  - Im/iv amikacin 500 mg 12 hrly (day 2-5)
Class IV

- At induction
  - iv ceftriaxone- tazobactum 2 g (40 mg/kg)
  - iv netilimycin 300 mg (5 mg/kg)
  - iv metrogyl 500 mg (10 mg/kg) 30 min infusion

- Follow through in hospital
  - iv. ceftriaxone- tazobactum 2 g (40 mg/kg) 12 hrly for 7 days
  - iv netilimycin 200 mg (7.5 mg/kg/ day) 12 hrly for 7 days
  - iv metrogyl 500 mg (10 mg/kg) 8 hrly for 7 days

- Review at 48 hrs with c/s reports
Only as last resort

- Iv cefoperazone- sulbactum 2 g (40mg/kg) 3 minute push 12 hrly
- Iv vancomycin 500 mg (10 mg/kg) 60 min infusion 6hrly
Controversies
External ventricular drainage

- Controversies-
  - Whether to administer prophylactic antibiotics or not?
  - If yes, for how long?
• Patients getting no prophylactic antibiotics
  • 27%

• Patients getting prophylactic antibiotics
  • 9%

• Periprocedural antibiotics = 4% (4/99)

• Prophylactic antibiotics = 3.8% (8/209)

• No association between the duration and indication of EVD insertion

Current evidence

- Antibiotic prophylaxis indicated
- Only periprocedural (three doses or less, including one well before making the incision) and not prolonged prophylactic
Ventriculoperitoneal shunts

- Rate of infection - 1.5 to 38%*

- Controversy -
  - Is there a role for prophylactic antibiotics
  - If yes, for how long?

• Results from a meta analysis showed that the use of systemic antibiotic prophylaxis for internal shunts was associated with a decrease in shunt infection (odds ratio 0.51)

• Benefit remains uncertain after the first 24 hours

Instrumentation in spinal surgery

- Smaller number of bacteria can cause infection with foreign material*
- Clean surgery with implantation: higher risk for infection
- Infection rate**
  - Instrumented fusion - 6% or more
  - Spinal fusion without instrumentation - 2-3%
  - Disectomy - 1%


Therefore, it is appropriate to increase the duration of prophylactic antibiotics in cases with instrumentation

- Included in class C in our protocol

• Currently available evidence from RCTs does not support prophylactic antibiotic use in patients with BSF, whether there is evidence of CSF leakage or not

• Until more research is completed, the effectiveness of antibiotics in patients with BSF cannot be determined because studies published to date are flawed by biases
Ethical questions
• Antibiotics
  • Costly
  • Involve risks
    • Side effects and drug interactions
    • Resistant organism
Antibiotic resistance

- Moral conflict
  - Doctor’s responsibility to the patient
  - Responsibility to the society/ future patients to prevent resistance
• Can empirical evidence of efficacy alone justify the use of an antibiotic regimen that some consider dangerous?

• What is Malis protocol?
• Is it ethical to conduct antibiotic trials with placebo as control group?
- Proper cleaning, draping technique and surgical discipline among all the staff is the best antibacterial prophylaxis.
- In the preantibiotic era, Harvey Cushing reported only a single mortality, attributable to streptococcal meningitis in a series of 130 tumor operations*

*Cushing H: Concerning the results of operations for brain tumor. JAMA 64:189–195, 1915
Take home message

- Antibiotics usage and resistance needs to be monitored.
- Should be based on objective evidence.
- Protocol based management is helpful.
- Protocols should be routinely revised according to changing sensitivity of organisms
- Proper surgical technique is the ultimate elixir for antibacterial prophylaxis.
Thank You