Antibiotic Prophylaxis for prevention of Surgical Site Infection (SSI)

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What is a Surgical Site Infection (SSI)?

CDC/NHSN definition of SSI: “Infection occurring at the operation site within 30 days of the procedure.”

ref: Horan TC, Am J Inf Cont 2008

Less severe, but harder to reliably diagnose

More severe, but less common
SSI – how much of a problem?

Results: “Surgical-site infection was the leading infection in hospitals ... , strikingly higher than proportions recorded in developed countries.”

Antibiotic prophylaxis for prevention of SSI
The “antibiotic problem”

The problem: mismatch between antibiotic usage and need

The solution: 1) reduce antibiotic usage  
2) align reduced usage with actual need

Antibiotic prophylaxis for prevention of SSI
Need for antibiotics

Antibiotic prophylaxis for prevention of SSI
Surgical antibiotic prophylaxis (AP)

Surgical Antibiotic Prophylaxis (AP) to prevent Surgical Site Infections (SSI)

Huge evidence base to support use of AP
eg. Smaill et al, Cochrane Library, 2010

AP should be
- PRE-operative (0-30 mins before skin incision)
- Single intra-venous dose
- Appropriate to local pathogens
Thika Hospital, Central Province, Kenya
Use of AP in Thika Hospital

From June 2010 to Feb 2011

98% of surgical patients received:

- **Post-operative prescription of 2 or 3 IV agents for 5 to 7 days**
  - Normally Penicillin (79%) + Metronidazole (85%)
  - Also Gentamycin (45%), Ceftriaxone (11%) used.
  - Average of 32 doses of iv antibiotics prescribed

- **First dose given several hours post-op**

- **Normally switched to oral ampicillin+flucloxacillin after 72 hrs.**

→ Similar regime (probably) used in most Government Hospitals in Kenya, though private hospitals better.
Intervention: Hospital AP Policy

Policy Development + Implementation

- Series of seminars (Nov 2010 – Jan 2011) to review evidence and National Guidelines to produce a locally appropriate AP Policy
- “Buy-in” from all senior surgeons and Hospital Director
- Policy implemented from 7th Feb 2011
- Ongoing feedback provided about compliance with policy

Policy Content:

1. All surgical patients to receive PRE-operative AP
2. Drugs used
   - Ampicillin 2g + Metronidazole 500mg for most surgery
   - Ceftriaxone 2g for Orthopaedic surgery
3. No routine post-operative antibiotics should be given
   (for Clean and Clean-Contaminated Surgery)

Antibiotic prophylaxis for prevention of SSI
Why Ampicillin for AP?

Advantages

- **Cheap drug** (approx US$0.50 for dose)
- Non-toxic, generally safe
- $t_{1/2} = 1$ hour
- Reasonable coverage
- Good tissue penetration
- Not otherwise used in TL5H
- On Kenya Essential Medicines List

Concerns

- Possible allergic reactions – but rare
- Ampicillin resistance is common in clinical isolates in Kenya

But

- Prophylaxis is to reduce inoculum rather than treat an infection

Antibiotic prophylaxis for prevention of SSI
ANTIBIOTIC TREATMENT

Infection with single strain of bacteria

Sensitive to antibiotic
ALL bacteria killed

Sensitive

Resistant to antibiotic
No effect of treatment

Resistant
Diverse bacterial contamination

Reduction in bacterial population

ANTIBIOTIC PROPHYLAXIS

Some bacteria killed even if some antibiotic resistance is present

= bacteria resistant to antibiotic
Results of intervention

Monitoring the effects of AP Policy introduction on
1. Use of antibiotics in surgical patients
2. Rate of SSI
3. Pathogens and antibiotic resistance with SSI

Data collection is ongoing...
1. Use of antibiotics for AP in Thika Hospital

AP used in Clean and Clean-Contaminated Operations

% given PRE-op AP  % given POST-op antibiotics

AP Policy introduced Feb 2011
1. Use of antibiotics for AP in Thika Hospital

Timing of pre-op AP, relative to skin incision

- Within 10 mins: 40%
- 10-20 mins before: 30%
- 20-30 mins before: 10%
- 30-60 mins before: 5%
- Outside of 60 min "window": 1.7%
- Data not available: 5%
2. Rate of SSI

<table>
<thead>
<tr>
<th>Type of Surgical Site Infection (Clinical Diagnosis)</th>
<th>Post-operative abx ONLY (&quot;old&quot; regime)</th>
<th>Pre-operative AP +/- post-op abx (&quot;new&quot; regime)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any SSI (%)</td>
<td>77 (7.1%)</td>
<td>71 (5.4%)</td>
</tr>
<tr>
<td>SSI reported by phone only (%)</td>
<td>32 (2.9%)</td>
<td>30 (2.3%)</td>
</tr>
<tr>
<td>Superficial SSI (%)</td>
<td>32 (2.9%)</td>
<td>30 (2.3%)</td>
</tr>
<tr>
<td>Deep SSI (%)</td>
<td>10 (0.9%)</td>
<td>7 (0.5%)</td>
</tr>
<tr>
<td>Organ-Space SSI (%)</td>
<td>3 (0.3%)</td>
<td>4 (0.3%)</td>
</tr>
<tr>
<td>All Operations (%)†</td>
<td>1,094 (100%)</td>
<td>1,304 (100%)*</td>
</tr>
</tbody>
</table>

† = for CLEAN and CLEAN-CONTAMINATED surgery only
* = 36 operations since 7th Feb which were not documented to get AP excluded

Antibiotic prophylaxis for prevention of SSI
3. Antibiotic resistance in SSI cases

Isolates “before” Policy change (n=120)

- Pseudomonas aeruginosa: 3%
- Klebsiella pneumoniae: 1%
- Enterococcus spp: 2%
- Acinetobacter baumanii: 2%
- E. coli: 7%
- S. aureus: 5%
- No growth: 24%
- No sample obtained: 42%

Isolates “after” Policy change (n=117)

- Pseudomonas aeruginosa: 4%
- Proteus mirabilis: 4%
- Klebsiella pneumoniae: 4%
- S. aureus: 10%
- E. coli: 8%
- CoNS: 3%
- No growth: 18%
- No sample obtained: 39%
3. Antibiotic resistance in SSI isolates

<table>
<thead>
<tr>
<th>Drug</th>
<th>Species tested against</th>
<th>BEFORE AP Policy</th>
<th>AFTER AP Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Sensitive</td>
<td>% Sensitive</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>E.coli, Proteus spp., Enterococci, K.pneumo</td>
<td>23% (3/13)</td>
<td>19% (4/21)</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>E.coli, Proteus spp., Staph spp., E.cloacae, Acinetobacter</td>
<td>52% (11/21)</td>
<td>66% (16/24)</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>E.coli, Proteus spp. E.cloacae, K. Pneumo</td>
<td>45% (5/11)</td>
<td>53% (9/17)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>E.coli, Proteus spp., Pseudomonas spp., Staph spp. E.cloacae</td>
<td>78% (18/23)</td>
<td>73% (19/26)</td>
</tr>
</tbody>
</table>
Summary of results

1. Policy introduction has “rationalised” antibiotic use and reduced overall antibiotic consumption
   but
   - Development of AP Policy took many months
   - Implementation of AP Policy was “challenging”

2. Possibly small reduction in SSI rate

3. No major impact on pathogens or drug resistance
Could this approach be applied elsewhere?
Fig. 1. Change of use of systemic antibiotics (DDD/100 bed-days) at the department of vascular surgery following interventions, 2007-2009

(2) official order on the implementation of PABP was issued (Oct 2008);
(3) changes in the list of drug prescriptions for registration of the first pre-operative antibiotic dose was introduced (Oct 2008);
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