Pharmacoeconomic Analysis of Peri-Surgical Antibiotics and Surgical Site Infections in Livingstone General Hospital, Zambia.

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Trinity Medical Students have gone on MOVE electives to Livingstone General Hospital since 2001

Previous students reported extremely limited resources and an apparently high incidence of surgical site infections coupled with what seemed a high level of antibiotic usage. It was felt that this may be an area worthy of investigation to examine whether some simple alterations to current practices may result in significant savings and improved patient outcomes.
Background\Research Environment
-Livingstone General Hospital, Zambia

• 250 bed regional hospital serving 800,000 people
• Staffed by 7-10 doctors (2 consultants), 15-20 clinical officers, 30+ nurses
• Annual Capital Expenditure Budget €12,000
Background/Research Environment
- Hospital Conditions

Laboratory Facilities
No culture and sensitivity
No pathologist
Crude Imaging – Xray/Ultra sound

Wards
25-30 beds per ward
One electrical power point per ward
No curtains around bed/patients brought own bed clothes
Aims of Research

- Peri-Surgical Antibiotics
  What antibiotics are being used?
  Are they appropriate?
  What is the associated cost?

- Surgical Site Infections (SSI)
  What is their incidence?
  What is the associated cost?
  Are there potential benefits to changing the antibiotic prophylaxis used?
Methods
Retrospective study of all surgical patients’ charts from January to July 2006

Total Number = 63
Available Charts = 43
(Excluding those who present for surgical management of an infected wound or those discharged post-op who subsequently represent with a SSI, N=1)

Data Collected
• Type of Surgery
• Antibiotics usage & cost
• Duration of in-patient stay (pre and post op)
• Incidence of SSI
Results

4 Surgical Categories: G.I, Orthopaedic, Gynaecology, Urology

Within each category comparison of

• Antibiotic agent, dose and duration where no SSI was recorded, where an SSI was recorded, and comparison with agents used in SJH Antibiotic Prophylactic policy

• Cost of Antibiotic per dose and comparison with SJH

• Expenditure of Antibiotic Prophylaxis per surgery where no SSI occurs, comparison with SJH and any predicted savings from switching to a dosage regimen equivalent to SJH

• Where SSIs occurred – incidence, associated increased duration of hospital stay and increase in cost of antibiotic treatment.
## Surgical Antibiotic Prophylaxis

<table>
<thead>
<tr>
<th>Surgery</th>
<th>Agents used</th>
<th>Doses (no. of days)</th>
<th>SJH Guide</th>
<th>Doses (no. of doses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal (17)</td>
<td>Benzylpenicillin (14) +/-Gentamycin (9) +/-Metronidazole (6) +doxycyclin(1) +cloxacillin(1) +ciprofloxacin(2) +amoxyccillin(1)</td>
<td>3.6 - 7</td>
<td>•Co-amoxiclav / •Large Bowel Resection Co-amoxiclav Gentamycin Metronidazole 500mg IV</td>
<td>1</td>
</tr>
<tr>
<td>Orthopaedic (8)</td>
<td>Benzylpenicillin(7) Metronidazole(7) Cloxacillin (2)</td>
<td>7</td>
<td>Cefuroxime + Metronidazole</td>
<td>2-3</td>
</tr>
<tr>
<td>Gynaecology (4)</td>
<td>Gentamycin (4) Benzylpenicillin (3) Metronidazole (2)</td>
<td>3 - 5</td>
<td>Co-amoxiclav</td>
<td>1</td>
</tr>
<tr>
<td>Urology (7)</td>
<td>Benzylpenicillin (3) Metronidazole (1) Amoxycillin (1) Cefotaxime (1) Gentamycin (1)</td>
<td>2.5 – 6</td>
<td>None if pre-op urine clear. If culture positive Gentamycin or Cefuroxime</td>
<td>1</td>
</tr>
</tbody>
</table>
Surgical Antibiotic Prophylaxis – Take Home Points

Antibiotic Coverage was often inconsistent and incomplete

- Gastrointestinal: 11/17 incomplete, 2/17 excessive
- Orthopaedic: 6/8 incomplete
- Gynaecology: 3/4 incomplete
- Urology: 3/7 incomplete

Duration of Prophylaxis: 2.5 – 8 days
Mean: 4.25 days
<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Cost per dose in Zambia compared with Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzylpenicillin</td>
<td>62%</td>
</tr>
<tr>
<td>Gentamycin</td>
<td>154%</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>9%</td>
</tr>
<tr>
<td>Amoxycillin</td>
<td>62%</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>86%</td>
</tr>
</tbody>
</table>
## Expenditure of Antibiotic Prophylaxis per surgery where no SSI occurs, comparison with SJH and any predicted savings from switching to a dosage regimen equivalent to SJH

<table>
<thead>
<tr>
<th>Surgery</th>
<th>Mean Expenditure per Surgery Zambia</th>
<th>Mean expenditure per surgery SJH</th>
<th>Predicted cost of switching to dosing regimen as per SJH</th>
<th>Predicted saving per surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal</td>
<td>€23.17</td>
<td>€6.23</td>
<td>€2.17</td>
<td>€21.00</td>
</tr>
<tr>
<td>Orthopaedic</td>
<td>€12.89</td>
<td>€14.89-€47.67</td>
<td>€1.31 - €3.93</td>
<td>€8.96 – €11.58</td>
</tr>
<tr>
<td>Gynaecologic</td>
<td>€17.89</td>
<td>€3.84</td>
<td>€1.60</td>
<td>€16.29</td>
</tr>
<tr>
<td>Urology</td>
<td>€6.29</td>
<td>€8.73</td>
<td>€0.86</td>
<td>€5.43</td>
</tr>
</tbody>
</table>
Expenditure on peri-surgical antibiotics in Zambia is greater than Ireland in absolute terms (range 72% - 466%)

This is due to primarily to the use of prophylaxis which extends to several days in duration.

Significant savings can be made from switching to a single dose regimen equivalent to SJH
Surgical Site Infections

Total Number: 10/43 – 23%

Per Surgery:  
  Gastrointestinal  3/17  
  Orthopaedic  4/8  
  Gynaecological  0/4  
  Urological  3/7
Surgical Site Infections and Duration of In-patient Stay (days)

No Surgical Site Infection
  Mean Pre-op stay  4.8
  Mean Post-op stay  5.2

Surgical Site Infection
  Mean Pre-op stay  11.6
  Mean Post-op stay  15.7
Increased cost per patient with Surgical Site Infections

Cost per Night  €10.96
Mean Cost of Treating SSI  €16.76

Mean increased cost per SSI

€131.84
Results – Extrapolation of Data per year

Antibiotic Prophylaxis

No clinical benefit of extending prophylactic administration beyond the completion of surgery

- Saving in files examined: €420
- Savings over a year (all surgeries): €1,000 (8% of capital budget)

Surgical Site Infections

- Cost of all SSI examined: €1,320
- Cost per year (all surgeries): €3,300 (27% of capital budget)
In the Literature

• Surgical Site Infections in African Countries range from 16% - 38%

• Mortality Rates for SSI in Africa is unpublished

• Extension of Antibiotic Administration beyond the completion of surgery is without evidence

• The use of multiple post operative doses increases the incidence of antibiotic resistant bacteria in SSI that occur
Sources of Error/Simplifications

• 43 of 63 files studied
• Without culture and sensitivity calculation based only on empirical treatment strategies
• SSI multifactorial in nature
Application of Research?
Conclusion

Even in areas of limited resources simple research and audit can produce useful data.

Small changes in day to day policy have potential to lead to significant savings without compromising patient care.
References


7. Archibald LK, Reller LB. Clinical Microbiology in Developing Countries. Emerging Infecton Diseases. 2001 2:302-305


Thank You