Bacterial Agents of Abdominal Surgical Site Infections in Lagos Nigeria

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SSI-surgical site infections

Abstract

Background: Infection continues to be a major complication of abdominal surgeries with significant increased costs, morbidity and potential mortality. Identifying the agents of abdominal wound infection and instituting appropriate measures will go a long way in reducing this problem.

Objective: A prospective study of the aetiological agents of abdominal wound infections at the Lagos University Teaching Hospital was designed to identify the organisms involved and document their antibiotic sensitivity pattern.

Methods: Swabs of the clinically infected wounds detected in a population of 144 consecutively studied patients were taken and cultured for both aerobic and anaerobic bacteria using standard microbiologic methods. Antibiotic sensitivity pattern was also determined for the aerobic organisms cultured.

Results: 25(17.4%) of the 144 patients studied developed surgical site infections. *Pseudomonas* was the most frequently cultured aerobic organism in 28% (n=7) of the cultures, while *Bacteroides* species was the most common anaerobe isolated. It was found in 64% (n=14) of the infected patients. Over 80% of the organisms demonstrated less than 50% sensitivity to the tested antibiotics.

Conclusion: The study showed that gram negative bacteria and anaerobes are the majors agents of abdominal surgical site infections in Lagos, Nigeria.
Keywords: bacterial agents, abdominal surgical wounds

Introduction
Though the aim of asepsis and antisepsis in surgery is the prevention of infection, sepsis still complicates between 2 to 7% of all surgical procedures\(^1\). The development of wound sepsis following surgery usually results insignificant strain on the surgeon, burden the nursing staff, and increasing morbidity and cost to the patient if not fatal. Surgical operations aim to utilize controlled morbidity to repair and restore normal anatomy and function. The trauma of access however disrupts the normal biologic barrier to infection and increases the risk of sepsis. Reports on microbes responsible for wound infection varies and depends on the surgical site, study population and pattern of local antimicrobial use\(^2\).

The Lagos university teaching hospital is a 753 bedded tertiary center where empiric antibiotic use is usually employed as a first line measure in patients requiring antibiotic use. With recent increasing concerns about health care costs the study of the agents of abdominal wound infection has become highly relevant in our center. The life threatening nature of severe surgical site infection is well known. For the less severe varieties the associated morbidity of SSI related complications and increased financial burden on the patients who survive is highly significant. The patient with SSI is two to eleven times more likely to die than their non infected cohorts\(^3\). More than 75% of all deaths in patients with SSI are attributable to the SSI\(^4\). This is in addition to the over a week of additional post operative hospital stay incurred\(^5\). Repeat admissions following discharge is commoner in patients who developed SSI than non infected cohorts\(^6\). For many of our patients who have to make out of pocket expenses for their health care expenses will benefit from a shorter hospital stay. This can be achieved through a better knowledge of the aetiologic agentsof SSI and appropriate antimicrobial use.

Method
A cross sectional prospective study was designed in which all patients who had abdominal surgeries over a one year period were studied. Swabs were taken from wounds that were clinically infected and immediately placed into Roberston cooked meat broth (for anaerobic cultures). Swabs for aerobic cultures were inoculated into blood and MacConkey agar and incubated at 37\(^{0}\)C. The colonial morphologies of the organisms grown were recorded. A presumptive identification of all isolates was made based on morphology, hemolysis, pigments as well as the primary gram stain appearance. Confirmatory biochemical tests were carried out according to standard microbiological procedures\(^7\). Antibiotic sensitivity was done using standardized disc agar diffusion technique (Kirby Bauer method)\(^8\) and interpreted according to NCCLS standard 1990\(^9\).

Anaerobic cultures were subcultured into freshly prepared 10% blood agar plates enriched with vitamin K and Hemin. The plates were incubated in an oxford anaerobic gar and read after 24 hours at 37\(^{0}\) C. A biologic indicator *Pseudomonas aeruginosa* was inoculated in a Simmond citrate agar. The isolated organisms were later identified with the aid of further biochemical tests\(^10\). All data obtained were analysed in simple tabular form. All patients had preoperative antibiotics, as needed in the course of their treatment.

Results
One hundred and forty four consecutive patients who had surgery for various abdominal conditions were seen. Twenty five of them developed surgical site infections. As evidenced by purulent wound discharge, 10 patients had some degree of wound dehiscence. There were 18 males and 7 females. The ages ranged form 19 years to 56 years. Two patients died during study (both from disseminated intra-abdominal malignancy). All patients were followed up for 6 months and four patients developed incisional hernia during this period.
From the 25 infected wounds, 8 aerobic and 6 anaerobic organisms were cultured. All the aerobic organisms were gram negative. The most frequent aerobe was *Pseudomonas aeruginosa* (7/25 patients) followed by *Enterobacter* spp (5/25), and *Proteus mirabilis* (4/25). Other organisms isolated included *Klebsiella* spp, *E.coli*, *Citrobacter* spp, *Providencia* spp and *Candida albicans*.

*Bacteroides* spp was isolated from 14 patients, 9 of which were *B. fragilis* three were *B. assacharolyticus* in 3 and *B. Ovis* in 2 cultures. Other organisms isolated include *Eubacterium* spp, *Actinimycessp*, *Fusobacterium* spp, *Peptostreptococcus* spp and *Propionobacterium* spp. Antibiotic sensitivity pattern of the organisms is shown in the table.

**Table:** Organisms and culture sensitivity

<table>
<thead>
<tr>
<th>Organism</th>
<th>No</th>
<th>%</th>
<th>% sensitivity</th>
<th>caz</th>
<th>cro</th>
<th>cfm</th>
<th>gen</th>
<th>nit</th>
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</thead>
<tbody>
<tr>
<td><em>Bacteroides</em> spp</td>
<td>14</td>
<td>28</td>
<td>Not tested</td>
<td></td>
<td></td>
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<tr>
<td><em>Eubacterium</em> spp</td>
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<td>16</td>
<td>Not tested</td>
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<td></td>
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</tr>
<tr>
<td><em>Actinomycetessp</em></td>
<td>2</td>
<td>16</td>
<td>Not tested</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><em>Fusobacterium</em> spp</td>
<td>2</td>
<td>16</td>
<td>Not tested</td>
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<tr>
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<td>4</td>
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<tr>
<td><em>Peptostreptococcus</em> spp</td>
<td>2</td>
<td>8</td>
<td>Not tested</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No growth</td>
<td>3</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><em>Pseudomonas</em> spp</td>
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<td>28</td>
<td>37.5 12.5 12.5 37.5</td>
<td>R</td>
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<tr>
<td><em>Enterobacter</em> spp</td>
<td>5</td>
<td>20</td>
<td>60 12 R R</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td><em>Proteus</em></td>
<td>4</td>
<td>16</td>
<td>25 75 R R</td>
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<td></td>
<td></td>
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<tr>
<td><em>klesiella</em></td>
<td>3</td>
<td>12</td>
<td>R 33.3 33.3</td>
<td>R</td>
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<tr>
<td><em>Escherichia Coli</em></td>
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<td>50 50 R R</td>
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<tr>
<td><em>Citrobacter</em> spp</td>
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<td>4</td>
<td>R 50 R 50</td>
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<tr>
<td><em>Providencia</em> spp</td>
<td>1</td>
<td>4</td>
<td>50 50 R R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No growth</td>
<td>1</td>
<td>4</td>
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cro-ceftriaxone, cfm-ceftaxime, caz-cefloxidine gen-gentamycin nit-nitrofurantoin R –resistance

**Discussion**

Our findings of a predominance of gram–ve bacilli is similar to those of other workers. In most cases of SSI the organism is usually patients endogenous flora. In abdominal surgeries the opening of the gastrointestinal tract increases the likelihood of coliforms, gram negative bacilli and anaerobes as agents of wound infection which was our finding in this study. These group of organisms tend to be endemic in hospital environment by being easily transferred from object to object, they also tend to be resistant to common antiseptics and are difficult to eradicate in the long term. These group of organisms are increasingly playing a greater role in the many hospital acquired infections.

The study showed that virtually all of the pathogens were resistant to the commonly prescribed antibiotics such as ampicilin cotrimoxaole, streptomycin and tetracycline. The cultured aerobes also demonstrated less than 50% sensitivity to the cephalosporins tested (ceftaxidine, cefuroxime and ceftriaxone) in over 80% of the infected patients. This finding further supports the well known high prevalence of multiple antibiotic resistant nosocomial pathogens in our environment and may reflect the widespread abuse of antibiotics in the general population.

Though limited by the influence of perioperative antimicrobial use and narrow range of antimicrobial sensitivity tested, the high resistance to most antimicrobials found is cause of significant concern, making choice of empiric antibiotic use more difficult.

The predominance of *Bacteroides Fragiilis* as the major anaerobic organism found in infected abdominal wounds (isolated in 69.2% of all patients with wound infection) is similar to that of other workers. This is expected considering the fact that over 75% of the surgeries studied involved the small bowel or colon with their significant high anaerobic bacteria counts.

*Pseudomonas, Enterobacter* and *Bacteroides* seem to be the predominant organisms causing SSI in patients having abdominal surgeries. Majority of the aerobic agents appear to be resistant to...
most of the tested antimicrobials. There is a definite need for more work to be done at our center in this area, to accurately confirm the source of identified pathogens and study the pattern of multidrug resistant pathogens in greater detail.

References