Incidence of aerobic bacteria and Candida albicans in post-operative wound infections

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The aim of the study was to isolate aerobic bacteria and Candida albicans from post-operative wounds, establish the antimicrobial susceptibility pattern of isolated bacterial agents and proffer ways and means for the prevention of post-operative wound infections. A total of 350 swab specimens from post-operative wounds of consenting patients in Central Hospital, Benin City, were screened for the presence of aerobic pathogens and C. albicans using standard bacteriological methods. The samples were collected using sterile Evepon swab sticks and inoculated onto Blood Agar, MacConkey Agar and Sabouraud Dextrose Agar plates. The 348 specimens (96.4%) yielded pathogens in the following order: Staphylococcus aureus (35.0%), Pseudomonas aeruginosa (26.0%), Escherichia coli (13.0%), C. albicans (9.3%), Klebsiella aerogenes (7.4%), Proteus spp. (7.4%) and Streptococcus spp. (1.9%). The highest infection was seen in the age group 51 years and above, followed by 41 - 50, 21 - 30 and 11 - 20, while 0 - 10 years gave the lowest incidence. A gradual decline in resistance to infection among patients in the age group 51 and above could be responsible for the high prevalence rate (100%) observed in this study. The anti-microbial susceptibility test indicated that there were differences in the sensitivity and resistance patterns of the isolates.

Key words: Aerobes, Candida albicans, post-operative wounds, infections.

INTRODUCTION

Post-operative wound infections occur when the inoculum of contaminating microorganisms is not contained by host defenses, proliferates and produces established infection. The chances of developing an establishing infection after surgery are determined by the pathogenicity of the invading organisms and by the size of bacterial inoculum (Badoe et al., 2000). Wound infection has always been a major complication of surgery (Bailey and Love, 2004). Most post-operative wound infections are hospital acquired (nosocomial infection), vary from one hospital to the other and are associated with increased morbidity and mortality (Okodua, 1996; Kirkland et al., 1999; Nichols, 2001). The establishment of a wound infection requires a microbial inoculum at the surgical site in a susceptible host and factors affecting wound infection include: pre-operative removal of hair, especially with instruments capable of causing skin abrasion, inadequate skin preparation with solutions contaminated with bacteria, immunocompromised hosts and delayed prophylaxis with antibiotics or incorrect choice of antibiotics (Bailey and Love, 2004). Post-operative wound infection delays recovery and often increases length of stay and may produce long lasting sequelae. It requires extra resources for investigations, management and nursing care (Garner, 1985).

In Nigeria and other parts of the world, Staphylococcus aureus, Proteus mirabilis, Pseudomonas aeruginosa, Klebsiella aerogenes, Escherichia coli, Staphylococcus epidermidis, Streptococcus pyogenes and Streptococcus faecalis, Candida albicans and Candida tropicalis have been implicated as etiological agents of infection (Anielski and Barczynski, 2002; Enweani et al., 2003; Kaplan et al., 2003; .Krzeminska – Jaskowiak et al., 2003; Tatfeng
et al., 2002). This study was carried out to determine the bacterial etiology of wound infections in patients in Central Hospital, Benin City, and to proffer ways and means for the prevention of post-operative wound infection.

MATERIALS AND METHODS

A total of 350 wound swabs were collected from patients in surgical, obstetric and gynecology, male surgical and pediatric wards of Central hospital, Benin City, Nigeria, between the months of July and October 2006. All samples were collected with sterile swab sticks (Evepon industries limited, Nigeria). The samples were inoculated on Blood Agar, MacConkey Agar and Sabouraud Dextrose Agar plates, all of which were reconstituted according to the manufacturer’s specification and sterilized at 121°C for 15 min. Smears were made from the swab sticks on clean microscope slides for Gram stain. The bacterial isolates were identified using standard bacteriological procedures, including Gram stain, motility test, microscopic examination, and biochemical tests, as described by Cheesbrough (1984). Colonies growing on Sabouraud Dextrose agar were Gram-stained and viewed microscopically for presence of budding yeast cells and further tested for germ tube formation. The method of Stokes and Ridgway (Stokes and Ridgway, 1987) was used for testing for antimicrobial susceptibility of bacterial isolates, using appropriate control organisms.

RESULTS

Of the 350 specimens examined, 348 (99.4%) were infected and 345 (99.1%) of the infected samples were

![Figure 1. Wound infection rates among age groups.](image1)

![Figure 2. Microbial isolates from infected wounds.](image2)
Table 1. Susceptibility pattern showing number (%) of the different bacterial isolates sensitive to various antimicrobial agents.

<table>
<thead>
<tr>
<th>Organisms</th>
<th>No of isolates</th>
<th>CMX</th>
<th>AUG</th>
<th>CFX</th>
<th>CFL</th>
<th>AMP</th>
<th>GN</th>
<th>FX</th>
<th>CFF</th>
<th>ERY</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>19</td>
<td>8 (42.1)</td>
<td>15 (79.0)</td>
<td>3 (15.8)</td>
<td>9 (47.4)</td>
<td>9 (47.4)</td>
<td>12 (63.2)</td>
<td>10 (52.6)</td>
<td>3 (15.8)</td>
<td>12 (63.2)</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>14</td>
<td>2 (14.3)</td>
<td>8 (57.1)</td>
<td>5 (35.7)</td>
<td>2 (14.3)</td>
<td>3 (21.4)</td>
<td>10 (71.4)</td>
<td>1 (7.1)</td>
<td>4 (28.5)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>7</td>
<td>5 (71.4)</td>
<td>7 (100)</td>
<td>6 (85.7)</td>
<td>5 (71.4)</td>
<td>7 (100)</td>
<td>4 (57.1)</td>
<td>3 (42.9)</td>
<td>6 (85.7)</td>
<td>1 (14.3)</td>
</tr>
<tr>
<td><em>Klebsiella aerogenes</em></td>
<td>4</td>
<td>1 (25)</td>
<td>2 (50)</td>
<td>2 (50)</td>
<td>1 (25)</td>
<td>3 (75)</td>
<td>4 (100)</td>
<td>2 (50)</td>
<td>2 (50)</td>
<td>1 (25)</td>
</tr>
<tr>
<td><em>Proteus spp.</em></td>
<td>4</td>
<td>2 (50)</td>
<td>2 (50)</td>
<td>1 (25)</td>
<td>3 (75)</td>
<td>1 (25)</td>
<td>2 (50)</td>
<td>1 (25)</td>
<td>2 (50)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><em>Streptococcus spp.</em></td>
<td>1</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (100)</td>
<td>1 (100)</td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>1 (100)</td>
<td>1 (100)</td>
</tr>
</tbody>
</table>

Key: CMX = Cotrimoxazole. AMP = Ampicillin. CMY = Clindamycin. GN = Gentamicin. AUG = Augmentin. FX = Floxapen. CFX = Ciprofloxacin. CPX = Cephalexin. OFL = Ofloxacin. ERY = Erythromycin

infected with pure bacterial isolates and mixed pathogens, while 3 (0.9%) were infected with pure fungal isolates. Figure 1 shows the age distribution of post-operative wound infection.

The highest overall infection rate was in the age range 11 - 30 years and above, while the lowest was in the age range 0 - 10 years.

Figure 2 shows the different pathogens isolated. A total of 49 bacterial and 5 fungal species were isolated. Of the 345 samples infected with bacteria, some of them had mixed growth, hence the increase in number of pathogens to 54. Table 1 shows the antibiotic susceptibility pattern of the bacterial isolates.

DISCUSSION

The predominant bacterial isolates recovered in this study included *S. aureus* (35.0%), *P. aeruginosa* (26.0%), *E. coli* (13.0%), *Proteus* spp. (7.4%), *K. aerogenes* (7.4%), *Streptococcus* spp. (1.9%) and one fungal isolate *C. albicans* (9.3%).

The relative high number of Enterobacteriaceae isolated in this study points to the fact that the presence of enteric organisms in the wounds at operation probably resulted to subsequent sepsis. Gorbath and Barlet (1974) reported similar findings. The findings therefore infer that enteric organisms are important determinants of healing in surgical wounds.

The high incidence of Gram-negative organisms, especially *P. aeruginosa*, *E. coli*, *K. aerogenes* and *Proteus* spp., confirms the observation that most wound infections arising from abdominal procedures are presently acquired from the patient's own faecal flora. Bhattacharyya and Kosloski (1990), Okodua (1996) and Donald (1984) also reported similar findings.

The high isolation of *S. aureus* (35.0%) agrees with the findings of earlier work carried out by Enweani et al. (2003). The predominance of *S. aureus* is, however, not surprising as it forms the bulk of the normal flora of the skin and nails (Junet et al., 2004).

Although the individual immune status of subjects used for this study was not ascertained at any time during this study, the age ranges in which there were high rates of infected wounds may be due to a decline in immunological competence among people in such age groups. This is, however, at variance with the work of Olagoke (2004).

The in vitro antimicrobial sensitivity studies showed that organisms react differently to various antibiotics, as demonstrated by their sensitivity patterns (Table 1). None of the isolates scored less than 50% sensitivity to Augmentin and Gentamicin. It is likely that these antibiotics may not have been misused or because the organisms may not have been frequently exposed to the antibiotics in this locality.

It is of utmost importance that surgeons, and other medical personnel involved in patient’s care, need be reminded of the need to enforce aseptic measures in order to prevent post-operative wound infections.

REFERENCES


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