Pattern of pathogens from surgical wound infections in a Nigerian hospital and their antimicrobial susceptibility profiles

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Abstract:

Background: In surgical patients, infection is an important cause of morbidity and mortality. A prospective study to find the pattern of microorganisms responsible for post operative wound infections and their antibiotic susceptibility profile was therefore conducted.

Setting and Methods: Surgical wards in Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Nigeria. Isolation, identification and antimicrobial susceptibility screening of organisms were done employing standard microbiological techniques.

Results: Bacterial pathogens were isolated from all the specimens while the yeast Candida species (spp) was isolated from 12.4%. Staphylococcus aureus was the most frequent organism isolated accounting for 23 (18.3%) of a total of 126 isolates. Other organisms were Pseudomonas aeruginosa and Bacillus spp 11.1% each; Escherichia coli 10.3%; Candida spp 8.7%; Coagulase negative staphylococci 8.7%; Pseudomonas spp 6.3%; Serratia odorifera 4.7%; Bacteroides species 4.0%; Enterococcus spp 3.2%; the remaining isolates were other enterobacteria. Sensitivity of the bacterial isolates to antibiotics varied. In general, resistance to the β-lactam antibiotics was above 98%, whilst more than 70% of isolates were resistant to erythromycin, fusidic acid and thiamycin.

Conclusions: The infections were polymicrobial and multidrug resistant. The quinolones, ciprofloxacin and ofloxacin, should be used as frontline drugs in the management of surgical wound infections at the hospital.

Keywords: surgical wound infections, susceptibility, bacterial pathogens, antibiotics

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Introduction

In spite of the progress in surgery, surgical techniques and antibiotic prophylaxis1-3, postoperative infections remain the commonest postoperative complications and one of the most frequently encountered nosocomial infections worldwide4. The incidence of these infections has been estimated to be 15.45% and 11.32% by the Center for Disease Control and Prevention (CDC) and the Surgical Infection Society in USA2,7. Risk of wound infection varies with the type of surgery and surgical operations have been classified into, clean, clean-contaminated, contaminated and dirty4. A clean wound is an incision through un-infamed tissue in which the wound is primarily closed. In this wound type only closed drainage systems are used and there is no breach in aseptic technique and the viscus is not opened. A clean-contaminated wound is one (that is otherwise clean) created at emergency surgery and in which the un-infamed upper gastrointestinal tract, normal gall bladder and urinary bladder are opened but there is no spillage of contents and there is minimal breach in aseptic technique. Contaminated wounds are traumatic wounds less than 6 hours old and wounds in which the inflated upper gastrointestinal tract and obstructed urinary bladder are opened or spillage of contents occurs. In these wounds there are major breaks

in sterile technique. Dirty wounds are associated with presence of pus and may include intra-peritoneal abscess formation or visceral perforation and traumatic wounds more than 6 hours old8. The choice of treatment for post-surgical infections requires an understanding of the usual infectious flora, available antimicrobial agents and susceptibility patterns of the infecting organisms as these would be helpful in the selection of empiric antimicrobial therapy and also on infection control measures in the health institutions9,10. The investigation of the microbiologic spectrum and antibiotic susceptibility of isolates in surgical wound infections is therefore of increasing importance bearing in mind the increasing antibiotic resistance by microorganisms and the high incidence of surgical infections caused by these resistant organisms11.

Anaerobic bacteriology is expensive and requires special facilities and expertise to perform. It is not readily available in many hospitals in the developing countries. Therefore most studies from developing countries do not incorporate anaerobic bacteriology in the study of surgical wound infection despite the reported significant roles that anaerobes play in such infections12.

In this study we report on the microbiologic spectrum of post operative wound infections in a Nigerian Teaching Hospital and the antimicrobial susceptibility profiles with a view to providing guideline to the clinicians for making rational decision over the choice of antibiotics in the management of surgical site infection.

Materials and Methods

Study centre

The study was conducted at Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria for a period of 2 years from September 2005 to Sept 2007 after appropriate approval were obtained and following standard guidelines. The hospital caters for a wide variety of patients ranging from high to low income level patients. The teaching hospital provides health care services for people from over five different states in the South Western parts of Nigeria: Oyo, Osun, Ondo, Ekiti and Kwara States. During the collection of specimens for the study, hospital activities were disrupted at several points by industrial actions under taken by several staff unions within the hospital, hence a smaller number of surgical operations than expected were carried out in the centre.

Collection of Samples

All consenting general surgical patients with wound infection were used for the study. Specimens were collected using standard collection techniques. Briefly, a sterile non-toxic swab was used to collect a sample from the infected site. The swabs were introduced gently into the wound sites and rotating the swab tips in the wound, taking care to avoid contamination of specimens with commensals from the skin, and then immersed immediately in a MacCartney bottle containing Stuart Transport medium (Merek, Germany). Each sample bottle was labeled carefully and transported to the laboratory immediately for microbiological investigations.

Isolation of organisms

At the laboratory, the swabs were inoculated onto freshly prepared blood agar and Sabouraud Dextrose agar (SDA) (Oxoid, England) plates and incubated aerobically at 37°C for 24-48 hours for the blood agar and 25°C for 3-5 days for SDA. Anaerobic incubation was also done by culturing on fastidious anaerobic blood agar (LAB M, England) plates prepared according to the instruction of the manufacturer and incubated anaerobically in an anaerobic jar supplied with a commercial gas generating kit (BBL Cockleysville, USA) that provided an atmosphere of 1% O2/8% CO2 in accordance to the manufacturers instruction. Incubation was done at 37°C for 3 to 5 days. Distinct well separated colonies growing on such plates were then sub-cultured onto newly prepared blood agar plates as appropriate. Isolates were maintained by cryopreservation using the medium of Gibson and Khway13 and in nutrient agar stab.
Identification of isolates
The characterization of bacterial isolates was based on standard biochemical tests which were performed on the isolates and these include; gram stain, morphological and cultural characteristics of colonies on MacConkey agar, Esoline Methylene Blue agar, Brilliare Green Agar, and Mannitol Salt Agar, haemolysis, catalase production and test for oxidase. Coagulase tests were done for both free and bound coagulase to confirm pathogenic staphylococci.
Coagulase negative staphylococci were characterized as described.
Further tests carried out for gram negative isolates included motility test, nitrate reduction, hydrogen sulphide production, indole production, Methyl isolates included motility test, nitrate reduction, hydro -

Antibiotic resistance testing
Resistance to antibiotics was determined for the staphylococci isolates using the standard disc diffusion method as described.
The test media was Iso Sensitest agar supplemented with whole blood for aerobes and chocolate agar for anaerobes. The antibiotic discs employed included ofloxacin (Ox), chloramphenicol (Chl), cephalothin (CE) all at 30µg, erythromycin (Ery) at 15µg, ciprofloxacin (Cip) and penicillin (PV) at 10µg [Abtek, England]. Also, fusidic acid (FU) (50µg), tobramycin rofloxacin (Cip) and penicillin V (PV) at 10µg [Abtek, lothin (CE) all at 30µg, erythromycin (Ery) at 15µg, cip-

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described. Further tests carried out for gram negative isolates included motility test, nitrate reduction, hydrogen sulphide production, indole production, Methyl isolates included motility test, nitrate reduction, hydrogen sulphide production, indole production, Methyl-

A single pathogen was identified in 56.2% patients, 2, 10.3% and 8.7% of the pathogens respectively. The CoNS isolated included S. epidermidis, Staphylococcus species accounted for 21.2%, 26.9% and 5.8% respectively. Coagulate negative staphylococci were characterized as described.

Results
All the specimens obtained yielded growth of bacteria. A total of 126 isolates were recovered from the 89 samples taken. There were 73.0% dirty surgical wounds which accounted for the remaining isolates. Abdominal wounds were most frequent accounting for 44.9%, followed by leg wounds, 18.0%; chest wall, 9.0% and burns, 9.0%. Correspondingly, abdominal wounds accounted for the majority of the wound pathogens isolated (39.7%) while leg wounds, burns, and chest wall wounds accounted for 17.5%, 10.3% and 8.7% of the pathogens respectively.

The count of aerobic bacteria in the samples was high. Only 8.0% of the isolates were anaerobes and these anaerobes were isolated from 11.7% of the patients. Also, some of the infections were caused by the yeast Candida spp as 12.4% of the patients yielded this pathogen. A single pathogen was identified in 56.2% patients, 2 agents were isolated from 33.7% while 3 agents were isolated from each of the remaining samples. Polymicrobial infections did not follow any specific pattern (Table 2).

Aerobic gram positive organisms accounted for 41.3% of the total number of organisms. S. aureus constituted 44.2% of the gram positive pathogenic, coagulase negative staphylococci (CoNS), Bacillus spp and Enterococcus species accounted for 21.2%, 26.9% and 5.8% respectively. The CoNS isolated included S. epidermidis, S. saprophyticus and S. xylosus. Overall, S. aureus, CoNS, Bacillus spp and Enterococcus spp accounted for 18.3%, 8.7%, 11.1% and 2.4% of the total isolates respectively, Aerobic gram negative organisms accounted for 42.1% of the total isolates and Pseudomonas aeruginosa and Escherichia coli constituted 26.4% and 24.5% of the gram negative pathogens respectively. The remaining aerobic gram negative isolates are of the family Enterobacteriaceae (Table 1).

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<th>TABLE 1. Bacteria and Fungal Isolates Recovered From Surgical Wound Infections</th>
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Sensitivity of the isolates to different antibiotics varied and most isolates were multidrug resistant. In general, resistance to the β-lactam antibiotics was above 98% except for cephalotax which showed a resistance of 91.5%. More than 70% of isolates were resistant to erythromycin, fusidic acid and trimethoprim. Only two of the five Bacteriodes spp tested was sensitive to metronidazole (result not shown). The staphylococcal pathogens were 100% sensitive to all the fluoroquinolones tested but the CoNS had a low resistance to ciprofloxacin (result not shown). The staphylococcal pathogens were 100% sensitive to the β-lactams (penicillin and cephalosporin), the macrolides (e.g. erythromycin, trimethoprim), the fluoroquinolones (e.g. ofloxacin, ciprofloxacin), chloramphenicol and fusidic acid. The choices depends on their availability and usages of low quality antimicrobials. Antibiotics were screened based on their chemical groups which reflect their modes of action, activities and mechanisms of resistance. These groups include; the β-lactams (penicillin and cephalosporin), β-lactamase susceptible or stable), the macrolides (e.g. erythromycin, trimethoprim), the fluoroquinolones (e.g. ofloxacin, ciprofloxacin), chloramphenicol and fusidic acid. The choices depends on their availability and use at the hospital.

Ciprofloxacin has been identified as the most potent drug available for the treatment of P. aeruginosa infection7. Our results showed that about 40% of the Pseudomonas species and 20% of the enterobacteria already demonstrated resistance to ciprofloxacin. However, in comparison with other antibiotics screened, our results showed that P. aeruginosa and other Pseudomonas spp isolated in this study demonstrated the lowest rate of resistance to ciprofloxacin. Similarly, although at a lower rate, reduced resistance of P. aeruginosa to ciprofloxacin has been reported in Jamaica in Latin America (19.6%) in Ibiror in Nigeria (24.7%), in India (26.22%) and in Kualar Lumpur (11.3%)28. It is to be noted however that, these observations under score the need for urgent steps to arrest the increasing incidence of resistance to the fluoroquinolines in this environment.

The results of this study indicated that Bacteroides isolates demonstrated high sensitivity to chloramphenicol, tobramycin, trimethoprim, metronidazole and the quinolones (ciprofloxacin and ofloxacin) being about 60% sensitive, whereas resistance to the β-lactam antibiotics (Penicillin V, Piperacillin, cephalothin and cephalodrox) were very high. These results are contrary to that obtained for anaerobes isolated from oro-facial infections in an earlier study which reported good activities of the later agents against the anaerobes1. The reduced antibiotic susceptibility profile of all these pathogens suggested their importance for hospital ac-
quired infections. In addition to this observation, although peri-operative prophylaxis has been shown to decrease the incidence of wound infection, the susceptibility data obtained in this study also suggested that most of the antibiotics used in this study would have very limited usefulness for the prophylaxis or the empirical treatment of these infections. Our findings support the reported increasing trends of antibiotic resistance worldwide.

A regular surveillance should be carried out to monitor the susceptibility of these pathogens and choose appropriate regimens both for prophylaxis and treatment of surgical wound infections. There is a need to develop a viable antibiotic policy and draft guidelines to prevent or reduce indiscriminate use of antibiotics, and preserve their effectiveness for better patient management.

Continuous dialogue between the microbiology department and the surgeons is strongly advised in keeping with preventing and controlling surgical wound infections at minimal cost. This will encourage rational use of antimicrobial agents – special references to bacteria isolated from surgical infections and its susceptibility to antimicrobial agents – special references to bacteria isolated between April 2003 and March 2004.

References
5.  Ashby E, Haddad FS, O’Donnell E, Wilson AP. How will surgical site infection be measured to ensure “high quality care for all”?