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# Bacteriology of wound infections in the surgical wards of a Teaching Hospital in Enugu, Nigeria

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**Summary**

During a 24-month period, January 2001 - December 2002, 404 wound swabs from 390 patients made up of 280 from surgical wounds, 92 from ulcers and 32 from other wounds like lacerations and discharging sinuses were studied. The prevalence of bacterial organisms and their antibiotic susceptibility pattern was analyzed, using standard bacteriologic techniques. Two hundred and sixty four organisms (69.8%) were isolated from surgical wounds, 82 (21.7%) from ulcers and 32 (8.5%) from other wounds. Coliforms were the most predominant organisms in surgical wounds (63.5%), while puste in ulcers, proteus species were the most prevalent (37.2%). Multiple microbial infections were common (22.7% and 24.6%) in surgical wounds and ulcers respectively. Antibiotic resistance by the isolates to commonly used antibiotics like Ampicillin, Tetracycline, Cotrimoxazole was high. The isolates were most sensitive to Ciprofloxacin and Ofloxacin. Restriction of the use of broadspectrum antibiotics in the treatment of wound infections should be enforced, while better collaboration between the clinical microbiologist and surgeon should be practiced especially with respect to infective preventive measures.

**Keywords:** *Wound infection, microorganisms, antibiotic resistance*

**Résumé**

De Javier 2001 à Décembre 2002, 404 spécimens des blessures de 390 patients provenaient des 280 de blessures chirurgicales, 92 des ulcères et 32 des blessures des lacérations et décharges des sinus étaient étudiés. Le taux de prévalence des bactéries et leur fréquence de susceptibilité aux antibiotiques étaient analyses utilisant des techniques standard bactériologiques. Deux cent soixante quatre des organismes (69.8%) étaient isoles des blessures chirurgies, 82 (21.7%) des ulcères et 32 (8.5%) d'autres types de blessures. Les Coliformes étaient les organismes les plus prédominant en chirurgie des blessures (63.5%), lorsque les ulcères, l'espèce proteus étaient les plus prévalent (37.2%). Les infections microbiennes multiples étaient communes (22.7% et 24.6%) en chirurgie des blessures et des ulcères respectivement. La résistance aux antibiotiques par les isolats les plus utilisés tel que l'ampicilline, Tétracycline, Cotrimoxazole était élevée. Les isolats étaient plus sensible au Ciprofloxacine et Ofloxacine. La restriction sur l'emploi des antibiotiques de spectre générale dans le traitement des infections des blessures, en plus des collaborations entre les microbiologistes cliniques et les médecins doit être renforcée pour respecter les mesures préventives

## Introduction

Infection of the operative wound is as old a problem, as surgery is an art and surely older than surgery as a science [1]. Nosocomial wound infections in surgical patients is an undesirable complication, which considerably contributes to higher costs and can increase the patient mortality risk [2]. Sepsis is the most frequent single cause of death after surgery or trauma and after 3 days, it causes the overwhelming majority of deaths [3]. In the United states of America, the National Centre for disease control estimates that 325,000 surgical wound infections occur each year [4]. Thus wound infections constitute a big burden on health care in a nation and by also prolonging the duration of hospitalization, increases the financial burden of the patient.

Different organisms have been associated with wound infections [5,6]. Organisms causing wound infections have been investigated in other parts of Nigeria [7,8,9,10,11] but no investigation has been carried out in Enugu, Nigeria. This study reports on the pattern of wound infections in a tertiary care hospital and their antibiotic susceptibility patterns. This will help to guide the establishment of policies for empirical antibiotic treatment and control of antibiotic use.

## Materials and methods

A prospective study of bacteria isolated from infected wounds of patients at the University of Nigeria

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Teaching Hospital (UNTH), Enugu was carried out between January 2001 and December 2002. Both inpatients and outpatients were involved. A total of 404 wound swabs made up from 280 surgical wounds, 92 ulcers and 32 others such as lacerations and sinuses were investigated.

All the specimens were inoculated on blood agar (Biotec, UK) and MacConkey Agar (Biotec, UK) and incubated at 37°C for 24 - 48 hours. Colonial morphology of the isolates were observed and Gram stain performed. The isolates were then identified using standard bacteriological techniques(12). Anaerobic cultures were not routinely done. Antibiotic susceptibility tests was done on sensitivity test agar (Biotec, UK) using the disc diffusion method in accordance with the National Committee for Clinical Laboratory standards [13]. *Staphylococcus aureus* (ATTC 29213) and *Escherichia coli* (ATCC 35218) were used as control organisms for the tests. Data were collected on the type of specimen, year, the bacterial isolate, the antibiotic sensitivity pattern, the age and sex.

## Results

A total of 404 wound swabs were collected from 390 patients. Three hundred and seventy eight organisms were isolated. These include 205 (54.2%) from the adult wards (males and females), 84 (22.2%) from the general outpatient clinics, 49 (12.9%) from the accident and emergency unit and 41 (1.8%) from the paediatric wards.

Two hundred and sixty four organisms (69.6%) were isolated from surgical wounds, 82 (21.7%) from ulcers and 32 (8.5%) from other wounds such as lacerations and sinuses (Table 1). Pure growths of the infecting organism were recorded in 79.9%, while 20.1% yielded a mixture of two or more organisms.

**Table I:** Prevalence of bacterial isolates from infected wounds

| Sources of Samples | Number Collected | Number Positive | Percentage Positive |
|---|---|---|---|
| Surgical wounds | 280 | 264 | 69.8% |
| Ulcers | 92 | 82 | 21.7% |
| Other wounds* | 32 | 32 | 8.5% |
| Total | 404 | 378 | 100% |

*Other wounds include lacerations, discharging sinuses

Coliforms and proteus species were the most predominant organisms, accounting for 140 (37.1%) and 117 (30.9%) respectively (Table 2). Coliforms were responsible for 115 (43.5%) of surgical wound infections, followed by Proteus and *Pseudomonas species* 82 (31.1%) and 51 (9.3%) respectively. *Proteus species* accounted for the highest number of isolates from infected ulcer 30 (37.2%) followed by Pseudomonas and Coliforms 21 (26.8%) and 19 (22.1%) respectively.

**Table 2:** Types and frequency of bacterial isolates from infected wounds

| Bacterial species | Surgical wounds No. (%) | Ulcers No. ( %) | Others No. (%) | Total No. (%) |
|---|---|---|---|---|
| Coliforms | 115 (43.5) | 19 (22.1) | 6 (18.9) | 140 (37.1) |
| Proteus | 82 (31.1) | 30 (37.2) | 5 (15.6) | 117 (30.9) |
| *Pseudomonas sp.* | 51 (19.3) | 21 (26.8) | 0 (0) | 72 (19.1) |
| *S. aureus* | 13 (4.9) | 12 (13.9) | 14 (43.8) | 39 (10.3) |
| Enterococcus | 2 (0.8) | 0 | 3 (9.4) | 5 (1.3) |
| Beta-haemolytic Streptococcus | 1 (0.4) | 0 | 2 (6.2) | 3 (0.79) |
| Coagulase negative Staphylococcus | 0 (0) | 0 | 2 (6.2) | 2 (0.52) |
| Total | 264 (100) | 82 (100) | 32 (100) | 378 (100) |

Generally, the isolates were most sensitive to Ofloxacin and Ciprofloxacin (Table3). All the species exhibited marked resistance to commonly used antibiotics like Ampicillin, Tetracycline, Cotrimoxazole and sulphonamides. The coliforms were 99% sensitive to both Ciprofloxacin and Ofloxacin and moderately sensitive to colistin and Gentamycin (61.4% and 60.7% respectively) (Table 3). *Pseudomonas aeruginosa* and proteus species showed appreciable sensitivity to the quinolones, while they both exhibited complete resistance to the commonly used antibiotics, namely Ampicillin, Tetracycline and Co-trimoxazole (Table 3). *Staphylococcus aureus* were most sensitive to Ofloxacin and Ciprofloxacin (92.8% and 92.0% respectively) (Table 3), while they both exhibited very low sensitivity (9.6%) to both Ampicillin and Cotrimoxazole.

## Discussion

The most important bacterial pathogens in infected wounds in this study were Coliforms, *Proteus species*, *Pseudomonas species* and *Staphylococcus*

**Table 3:** Percentage sensitivity of the isolates

| Antibiotic | *Coliform* No. tested (percentage sensitive) | *Proteus species* No. tested (percentage sensitive) | *Pseudomonas species* No. tested (percentage sensitive) | *S. aureus* No. tested (percentage sensitive) |
|---|---|---|---|---|
| Tetracycline | 140(18.6) | 117(0) | 72(0) | 39(69.2) |
| Co-trimoxazole | 140(2.8) | 117(0) | 72(0) | 31(9.6) |
| Ampicillin | 140(13.7) | 117(0) | 72(0) | 31(9.6) |
| Ciprofloxacin | 110(99) | 99(91.7) | 66(91.7) | 28(92) |
| Ofloxacin | 110(99) | 101(82.2) | 66(81.8) | 28(92.8) |
| Gentamycin | 140(60.7) | 100(15) | 72(66.7) | 39(84.6) |
| Colistin | 140(61.4) | 100(8) | 72(72.2) | 39(51.3) |
| Carbenicillin | - | - | 72(54.1) | - |
| Tobramycin | - | - | 71(53.5) | - |
| Erythromycin | - | - | - | 39(76.9) |
| Cloxacillin | - | - | - | 39(71.8) |

*- means not tested.*

*aureus*. This is similar to reports from other centres both in Nigeria and other parts of the world [14-19]. The least common organisms were streptococci 1.3%, enterococci 0.79% and coagulase negative staphylococci 0.52%.

Generally, Gram-negative organisms were far more predominant than Gram-positive with prevalence rates of 87.1%. Reports from other centres in Nigeria [18,20] also confirmed the predominance of Gram-negative bacilli in wound infections. Others [10,18,19] however, found *Staphylococcus aureus* to be more predominant. The difference may be due to the type of services rendered by the different hospitals, with varying rates of use of antibiotics and the extent to which infective preventive measures particularly prophylaxis are practiced. A shift from Gram positive to Gram negative bacterial aetiology has been demonstrated [21] and this was attributed to the widespread and intensive use of antibiotics as well as the new and complex surgical operations and procedures now performed. Such a shift cannot be confirmed in the present study, since no previous study has been carried out.

There was also a difference in the relative frequency of isolated organisms in the different types of wound infections. Coliforms accounted for 43.5% of isolates from surgical wounds, followed by *Proteus sp.* (31.1%), while *Proteus species* predominated in infected ulcers (37.2%) followed by *Pseudomonas species* (26.8%). This contrasts with the study by others [17] where *Staphylococcus aureus* predominated in surgical wounds and *Pseudomonas species* in ulcers. Coliforms have been reported to abound around the groins of even normal individuals [22]. Their high incidence in this study could be an indication of poor aseptic techniques.

There was a marked resistance by the isolates to the commonly used antibiotics, as was also observed by many others [10,17,19]. The isolates were most sensitive to the quinolones - Ciprofloxacin and Ofloxacin. Their high cost is however a serious disadvantage in a community where a high percentage of the populace cannot afford them. Most of the isolates, except proteus spp. showed moderate sensitivity to Gentamicin, which can be considered in situations where the cost of the quinolones is a problem. Also a combination of gentamicin and metronidazole could be used for empiric therapy and surgical prophylaxis.

The high prevalence of resistance of the isolates to Ampicillin, Cotrimoxazole, Tetracycline may be due to the abuse and misuse of these drugs. The drugs are easily available in chemist shops without doctor's prescription. Published information on the types and antibiotic susceptibility of bacteria isolated in this community is not regularly available, thus leading to a tendency to prescribe antibiotics for prophylaxis and therapy indiscriminately. Moreover, the use of broadspectrum antibiotics in the treatments of wound infections must be avoided.

To slow the development of antibiotic resistance, infective prevention measures, particularly antibiotic prophylaxis should be re-valuated.

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