

# BACTERIAL PATHOGENS ASSOCIATED WITH WOUND INFECTIONS AT THE UNIVERSITY OF MAIDUGURI TEACHING HOSPITAL, MAIDUGURI, NIGERIA

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**Background:** Wound infection is a significant health problem in many parts of the world especially, Africa. It complicates the recovery of the patient, increases trauma care, prolongs hospital stay and has economic consequences on the patient. It also undermines the cost-effectiveness of wound management objectives in health settings.

**Objective:** The study aims at investigating bacterial pathogens associated with wound infections at the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria.

**Methods:** Each of the 165 various wound specimens included in the study were streaked on blood and MacConkey agar plates, incubated aerobically at 37°C for 24 hours and colonies were identified and characterized using conventional methods.

**Result:** Out of the 165 wound samples cultured and examined bacteriologically, 98.8% were positive for bacterial growth. Pure culture was obtained in 139 (84.2%), mixed growth of two organisms in 24 (14.5%) and 2 (1.2%) were negative for isolate. The most prevalent (57%) of gram positive organisms was *Staphylococcus aureus* and of the gram negative organisms, *Proteus spp* (16.4%). Twenty (83.3%) out of 24 polymicrobial infections were between *Staphylococcus aureus* and other organisms and 4 (16.7%) were among gram negative organisms.

**Conclusion:** It is hoped that reports of this type will create greater awareness in the selection of prophylactics and suitable antibiotic therapy for prompt healing of wounds and reduction of emergence of resistant strains.

**Key words:** Wound, bacteria, infections.

## Introduction

Despite the technological advances in surgery and wound management, wound infection has remained one of the most common health problems in many parts of the world, especially Africa<sup>1,2</sup>. Wound is considered infected when the integrity and protective function of the skin is breached and microorganisms colonize and multiply in the exposed subcutaneous tissue<sup>3</sup>. Wounds may be infected by indigenous aerobic flora of the patient or exogenous flora acquired from the hospital<sup>4,5,6</sup>. However, anaerobic bacteria also sometimes play an important causative role<sup>7,8,9</sup>.

The importance of wound infection in human and economic terms is enormous; it complicates illness, causes anxiety, increases patient discomfort and can lead to death<sup>10,11</sup>. Infection of surgical sites is one of the most common hospital-acquired infections and is an important cause of morbidity and mortality. The delay in recovery and subsequent increased length of hospital stay have financial consequences on the patient<sup>12,13</sup>.

The management of wound infections has become more challenging due to widespread bacterial resistance to

antibiotics and a greater incidence of infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA) and several gram-negative rods<sup>14</sup>.

Recognition of potential bacterial pathogens of wound is an essential guide to selecting suitable antimicrobial therapy that will aid in the prompt healing of wounds<sup>15,16</sup>. This study was therefore carried out to investigate the bacterial pathogens associated with wound infections at the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria.

## Materials and Methods

This study included wound specimens from 165 patients (112 males, 53 females; ages 1 to 82 years) sent to bacteriology laboratory for microbiological evaluations, between the periods of October 2004 and December 2005. The wounds sampled included abscesses, burns, postoperative wounds, boils, whitlow, trauma wounds, systemic ulcers and swellings of unspecified aetiology.

Each wound swab was immediately applied to freshly prepared blood and MacConkey agar plates

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streaked, and incubated aerobically at 37°C for 24 hours. Characterization of bacterial isolates was based on conventional microbiological methods including Gram stain, morphological and cultural characteristics on nutrient, mannitol salt and Eosin-Methylene Blue (EMB) agar<sup>17</sup>. Other tests included carbohydrate fermentation tests, citrate utilization, indole production, methyl red, and Voges proskauer test and observation of haemolysis on blood agar.

## Results

Out of the 196 bacterial isolates recovered from 165 infected wounds (averaging 1.2 isolates per specimen), positive growth was observed in 98.8% of cultures. Single microorganism was present in 139 (84.2%) cultures, mixed growth of two organisms in 24 (14.5%) cultures and no bacteria were obtained in 2 (1.2%) cultures.

Table 1 shows the distribution of bacterial isolates recovered from the wound samples. Seven bacterial species were identified. *Staphylococcus aureus* 94 (57.0%) occurred most frequently, followed by *Proteus spp* 27 (16.4%), *Pseudomonas aeruginosa* 25 (15.2%), *Escherichia coli* 24 (14.5%), *Klebsiella spp* 21 (12.7%), Coliforms 3 (1.8%) and  $\alpha$ -haemolytic Streptococcus 2 (1.2%). TABLE 1

Table 2 contains data on polymicrobial infections in which 20 (83.3%) out of 24 polymicrobial cultures were attributed to mixtures of *Staphylococcus aureus* and other organisms while each of the remaining 4 (16.7%) was a mixture of gram-negative organisms (*Pseudomonas aeruginosa* and *Escherichia coli*). TABLE 2

**Table 1:** Prevalence of bacterial isolates recovered from the wound samples

Bacterial organism	Prevalence	
	Number isolated	%
<i>Staphylococcus aureus</i>	94	57.0
<i>Proteus spp</i>	27	16.4
<i>Pseudomonas aeruginosa</i>	25	15.2
<i>Escherichia coli</i>	24	14.5
<i>Klebsiella spp</i>	21	12.7
Coliforms	3	1.8
$\alpha$ -haemolytic streptococcus	2	1.2
<b>Total</b>	<b>196</b>	<b>100</b>

**Table 2:** Prevalence of polymicrobial organisms in wound samples

Bacterial organism	Prevalence	
	Number isolated	%
<i>Staphylococcus aureus</i> and <i>E. coli</i>	4	16.7
<i>Staphylococcus aureus</i> and <i>Proteus spp</i>	8	33.3
<i>Staphylococcus aureus</i> and <i>Pseudomonas</i>	2	8.3
<i>Staphylococcus aureus</i> and <i>Klebsiella spp</i>	6	25.0
<i>Pseudomonas aeruginosa</i> and <i>E. coli</i>	41	16.7
<b>Total</b>	<b>24</b>	<b>100</b>

## Discussion

This study has shown that *Staphylococcus aureus* was the most prevalent single agents of wound infections in this health institution (57.0% of cases). This is similar to reports in developing countries<sup>8,12</sup>. Previous microbiological evaluations have recorded *Staphylococcus aureus* as the single cause of 25-69% of cutaneous abscesses<sup>9,18,19,20</sup>. The events leading to infection depend on an array of factors that may be environmental or patient related. The postulated sequence of events leading to infection is initiated by *Staphylococcus aureus* nasal carriage, which is then disseminated by the hands to other sites in the body where infection can occur through broken skin surfaces<sup>21</sup>. The isolation of Streptococcus in two (1.2%) cases of chronic wound infections in this study is in agreement with the observation of Falanga *et al.*<sup>11</sup>, who reportedly isolated  $\alpha$ -haemolytic streptococcus and anaerobes from chronic ulcers that had no signs of clinical infection suggestive of critical colonization. The development of an infection is influenced largely by the virulence of the organism and immunological status of the patients<sup>22</sup>.

The emergence of *Proteus spp* (27.0%) and *Pseudomonas aeruginosa* (25.0%) as the most important gram negative organisms in this study suggests that the isolates could be strains that have been selected in the hospital community for high infectivity and drug resistance. Antibiotic resistance has become a serious problem in recent years particularly with the rise of epidemic strains of methicillin-resistance *Staphylococcus aureus* (MRSA).

It is an issue of concern that there is no adequate water supply for various health facilities in Nigeria; otherwise simple hygienic practices like washing hands with soap and water and wearing of gloves by wound care practitioners can drastically reduce the spread of potential pathogens and risk of infection by resistance bacteria.

Wound infection is important not only in terms of increased trauma to patient but also because of its burden on

hospital cost and the increasing demand for cost-effective management within the healthcare system.

The high frequency and variety of microorganisms recorded in this study supports the need to obtain culture materials from infected wounds for microbiological evaluations and antibiotic susceptibility testing before the commencement of therapeutic regimen<sup>15,16</sup>. This will

facilitate successful wound management, encourage rational use of antibiotics and curtail the spread of drug resistant bacteria.

It is hoped that the result of this study will assist wound care practitioners in the choice of prophylactic and suitable antimicrobial agents that would prevent wound complications, increase healing rates and reduce the risk of cross-infection in health systems in this region.

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