Bacterial Profile and Antimicrobial Susceptibility Pattern of Nosocomial Wound Infection in a Teaching Hospital at Uyo, Akwa Ibom State, Nigeria

***Onwuezobe IA, Offong EI, Moses AE**

Department of Medical Microbiology and Parasitology.
* Corresponding author: ifezobe@yahoo.com, ifeanyionwuezobe@uniuyo.edu.ng

Abstract

Background: *Nosocomial wound infection has been implicated to occur globally. There are various types of wounds some of which may be peculiar to the environment, occupation and social life of the people. Postoperative wound infection is common in hospital and is spread directly from person to person or indirectly from equipment or personal care items. They are a significant burden to patients and public health and also a major cause of increased morbidity in hospitalized patients. The objectives of this study therefore were to determine the bacterial agents and antimicrobial susceptibility pattern of organisms causing nosocomial wound infection as well as to assess the presence of ESBL and MRSA from wound isolates in the University of Uyo Teaching Hospital (UUTH), Uyo.*

Methodology: *A cross sectional study was carried out by collecting wound swab samples from 170 patients in different wards in the hospital.*

Result: *Staphylococcus aureus (28.7%) was mostly isolated whereas, Pseudomonas aeruginosa (22.9%) was the most isolated Gram negative bacterial agent from the wound sites. The antimicrobial susceptibility pattern revealed increased sensitivity of S. aureus to gentamicin (70%), while Pseudomonas aeruginosa was most sensitive to Imipenem (90%). More than 40% of the Staphylococcus aureus were methicillin resistant and among the Gram negative bacterial agents isolated, were extended beta lactamase producers.*

Conclusion: *There is need therefore for routine surveillance and reporting of methicillin resistant Staphylococcus aureus and extended spectrum beta lactamase producers from wound isolates by hospitals in Akwa Ibom state in particular and Nigeria by extension, as part of control measures for nosocomial infection.*

Keywords: Nosocomial, wound infection, bacteria, antibiotic profile

Introduction

Nosocomial infection is an infection occurring in a patient in a hospital or other healthcare facility which the infection was not present on at the time of admission including infection acquired in the hospital after discharge and also occupational infection acquired while working in the hospital.[1]

The more frequent nosocomial infections are that of surgical wounds, urinary tract and lower respiratory tract. A World Health Organization prevalence study and other studies have shown that these infections most commonly occur in intensive care units and in acute surgical and orthopedic wards.[2,3] The Centres for Disease Control and Prevention (CDC) estimate that more than 2 million patients die as a result of these infections.[4] This is of public health concern especially as surgical site infection alone account for about 24% of all nosocomial infections despite the preventive and control measures instituted by some hospital.[2] It is obvious then that infections acquired in the

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hospital is a cause of morbidity and mortality which has added noticeably to economic burden.[5] The control of wound infections has become more challenging due to widespread bacterial resistance to antibiotics especially against infections by common bacterial agents such as *Staphylococcus aureus*, *Pseudomonas aeruginosa,* and *Klebsiella species.*[6]

The record of the causative agents of wound infection in an environment such as ours, where such data is scarce or unavailable, will be helpful in the selection of empiric antimicrobial therapy and impact on the infection control measures by other health institutions as well.[7]

Study objectives

To determine the bacterial agents and antimicrobial susceptibility pattern of organisms causing nosocomial wound infection and to assess the presence of ESBL and MRSA from wound isolates in the University of Uyo Teaching Hospital (UUTH), Uyo.

Methodology

Study Population

The study subjects were patients admitted in various wards and units, in the University of Uyo Teaching Hospital (UUTH), Uyo, Nigeria.

Sample Collection

One hundred and seventy wound samples were collected from patients on admission for up to 72 hours in the hospital. Samples were taken from various wound sites with sterile cotton wool swab sticks soaked in sterile normal saline, and transported to the laboratory immediately for further processing.

Isolation and Identification of Bacterial Organisms

All swab samples were cultured on Blood agar and MacConkey agar and incubated at 37^0C for 18-24hours. Pure colonies were subcultured onto nutrient agar slants and peptone water for biochemical tests which was carried out to identify the isolates using standard procedures.[8]

Antimicrobial Susceptibility Testing

Antimicrobial Susceptibility test was performed using the Kirby-Bauer disk diffusion method following the guidelines of the Clinical Laboratory Standard Institute (CLSL).[9] *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 25923) were used as reference strains. Double disk diffusion synergy test for the detection of extended spectrum Beta-lactamase (ESBL) was also performed.[10]

Data Analysis

Student's T-test was used to analyse the difference between frequency of isolates and types of wound infection and equipment. P value < 0.05 was regarded as statistically significant.

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Ethical consideration

Ethical approval was obtained from the Ethics and Research Committee of the University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria.

Results

The various types of wound samples were analysed, with the number of samples from post operative wound sites being one of the highest (18.23%) as indicated in table 1. Of the 174 isolates, 99 (56.9%) were from male patients as shown in Table 2. The highest isolates were from the age group 61–70yr, 62 (35.6% while the lowest was from 11 – 20yr age groups (Table 3). The commonest bacterial isolate from wound infection of patients admitted in the hospital was *Staphylococcus aureus* (Table 4). Antibiotic susceptibility profile (Table 5) shows increased susceptibility to Gentamicin 35(70%) and Imipenem 36(90%) by *Staphylococcus aureus* and *Pseudomonas aeroginosa, respectively* when compared with other antibiotics used. *Escherichia coli* (6 (3.4%)) *and Klebsiella* species (2 (1.14%)) were found to be *ESBL* producers while some *Staphylococcus aureus* isolates (22 (44%)) were MRSA.

Table 1: The various types of wound Infection sites

Types of wound	No. of specimen	Percentage
Road traffic accidents	20	11.7
Bruised/cuts	7	4.11
Post-operative	31	18.23
Gun shots	13	7.64
Acid/fire burn	12	7.05
Genital ulcer	8	4.70
Osteomyelitis	8	4.70
Venous/arterial ulcer	2	1.17
Leg cellulites	3	1.76
Wound from abscess	10	5.88
Pin site infection	5	2.94
Malignant melanoma	2	1.17
Others	53	31.17

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Table 2: Frequency of Microbial Isolates of Wound Infection from UUTH by Gender.

Gender (N = 170)	No. of isolates	Percentage
Male	99	56.9
Female	75	43.1
Total	174	100

Table 3: Age Distribution and Isolates from Nosocomial Wound Infection

Age group (years)	Population studied	Frequency of isolates	Percentage
<1-10	12	12	6.9
11-20	7	7	4.0
21-30	14	14	8.0
31-40	28	29	16.7
41-50	15	15	8.6
51-60	16	16	9.2
61-70	59	62	35.6
71 & above	19	19	10.9
Total	170	174	100

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Table 4: Frequency of Bacterial Isolates from Wound Infection

Pathogen	No. Isolated	Percentage
Staphylococcus aureus	50	28.7
Pseudomonas aeruginosa	40	22.9
Esherichia coli	38	21.9
Klebsiella species	26	14.9
Proteus species	20	11.5

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TABLE 5: Antimicrobial Susceptibility Pattern of Isolates

Antimicrobial agent	Disc(µg) content	*S. aureus* (%)			*P. aeruginosa* (%)			*E. coli* (%)			*Proteus* sp. (%)			*Klebsiella* sp. (%)		
		R	I	S	R	I	S	R	I	S	R	I	S	R	I	S
Azithromycin	15	25(50)	9(18)	16(32)	-	-	-	-	-	-	-	-	-	-	-	-
Amoxicillin/clav.	20/10	35(70)	4(62)	11(22)	-	-	-	25(65.7)	1(2.6)	12(31.5)	9(45)	1(5)	8(40)	13(50`)	-	13(50)
Sulphomethazole	23.7	30(60)	4(8)	16(32)	-	-	-	23(60.5)	6(15.7)	9(23.6)	8(40)	1(5)	11(55)	7(26.9)	1(38.4)	18(69.2)
Ciprofloxacin	5	18(36)	6(12)	26(52)	18(45)	5(12.5)	17(42.5)	25(65.8)	1(2.6)	12(31.5)	5(2.5)	1(5)	14(70)	10(38.4)	-	16(80)
Ceftriaxone	30	-	-	-	15(37.5)	9(22.5)	16(40)	19(50)	5(13.2)	14(36.8)	6(30)	5(25)	9(45)	8(30.7)	3(11.5)	15(75)
Cefoxitin	30	31(62)	-	19(38)												
Gentamicin	10	12(24)	2(4)	35(70)	14(35)	6(15)	20(50)	21(55.2)	2(5.3)	15(39.5)	3(15)	2(10)	15(75)	10(38.4)	-	16(61.5)
Imipenem	10	-	-	-	-	4(10)	36(90)	-	-	-	-	-	-	-	-	-
Carbenicillin	5	-	-	-	12(30)	2(5)	18(45)	-	-	-	-	-	-	-	-	-
Ofloxacin	10	-	-	-	8(20)	10(25)	22(55)	15(39.4)	3(7.8)	20(52.6)	5(25)	3(15)	12(60)	3(11.5)	1(3.8)	22(84.6)
Ceftazidime	30	-	-	-	22(55.2)	(5)	16(40)	11(28.9)	6(15.7)	21(55.3)	-	-	-	8(30.7)	4(15.3)	14(53.8)
Cefotaxime	30	-	-	-	22(55)	-	-	17(44.7)	6(15.7)	15(39.4)	-	-	-	11(42.3)	5(19.2)	10(38.4)

Key

R = Resistant

I = Intermediate

S = Sensitive

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Table 6: Frequency of ESBL and MRSA isolates from wound sites

Isolates	No. of org. Tested	No. positive (%)
ESBL producers	*E. coli* (38)	6 (3.4%)
	Klebsiella (26)	2 (1.14%)
MRSA	*S. aureus (50)*	22 (44%)

Discussion

Nosocomial infection has been known globally to be the cause of resistance to antibiotics which may result to increase morbidity and mortality in patients.[11] In this study, a total of 170 wound samples were processed out of which 18.2% were postoperative wounds, while 11.7% were from road traffic accidents, 7.05% from acid/fire burn wounds, and 7.64% were from gunshots wounds among others. The various wound types revealed by this study, may be connected to the occupation and social life of the people in Uyo. For this same reason, they differ from the pattern of wound types seen in studies done in other parts of the world.[12]

Although there was no significant difference in both sexes as observed in other studies [13, 14], wound Infections were seen more in male patients (56.9%) than in females probably due to the fact that males are involved more in accident prone occupation and social life[15]. This notwithstanding, there were higher numbers of bacterial isolates from wounds of female patients (43.1%) than males. However, there were no deducible reasons for this from this study.

Noticeably too, are the higher numbers of older patients, 61-70 years (35.6%), admitted in the hospital with wound infection when compared to lower admissions recorded for the younger age groups, 31-40years (16.7%). This may be so because of the more prevalence of wound infections in the older age group as a result of reduced immunity which leads to longer period of healing and longer stay in the hospital when compared with the younger age group with probably better immunity and consequently shorter hospital admissions.

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As revealed by this study, *Staphylococcus aureus* (28.7%) was the most common bacterial agent isolated from wound infections in this hospital and this compares favourably with result of studies carried out in Uganda.[16, 17]

The majority of the pathogens causing nosocomial wound infection were of the Gram negative class especially the Enterobacteriaceae which was also the case in some studies carried out in other parts of the world.[11]

The antibiotic susceptibility test for the bacterial isolates shows that *Staphylococcus aureus* is more sensitive to Gentamicin (70%) when compared to ciprofloxacin (52%). This may due to unrestricted use of antibiotics usually sold without valid prescription over the counter in Nigeria.

For probably the same reason, *Staphylococcus aureus* isolates showed increased resistance to amoxycillin/clavulanic acid (70%), an anti-beta lactamase agent which is expected to show more sensitivity to the bacterial agent. However, the study also showed that more than 40% of the *Staphylococcus aureus* isolated from wounds were methicillin resistant which is implicated in nosocomial antibiotic resistance.[17]

There was a higher susceptibility of *Pseudomonas aeruginosa* to imipenem (90%) when compared to records from other studies which had 76.9% and 88% respectively.[18, 19] This may be attributed to the fact that this drug is not only expensive, but is not readily available and hence not abused.[20] The increasing prevalence (12.5%) of extended spectrum beta-lactamase (ESBL) producers by *E. coli* and *Klebsiella* species was also noticed in this study and is comparable to reports elsewhere.[21, 22]

Conclusions

Nosocomial wound infection may occur in all hospitals admitting patients, therefore routine surveillance should be put in place where it is yet to be done. This study showed that 40% of *Staphylococcus aureus* isolated from wound of patients admitted in the hospital were methicillin resistant. This calls for routine check of methicillin resistant *Staphylococcus* and Extended Spectrum Beta-lactamase producers from wound isolates by all tertiary hospitals in Akwa Ibom state in particular and Nigeria by extension, especially where equipment and manpower are available, as a measure towards the control of nosocomial infection.

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