



## RESEARCH ARTICLE

## PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF BACTERIA CAUSING POSTOPERATIVE WOUND INFECTIONS IN PORT-SUDAN

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## ABSTRACT

**Background** Postoperative nosocomial infections remain a major problem in health care facilities, If not prevented it will lead to an extended length of stay, high excess of cost and high morbidity and mortality.

**Aim:** The aim of this study was to determine the prevalence of aerobic and anaerobic nosocomial bacteria among patients with postoperative wound infections and their antimicrobial susceptibility pattern.

**Method:** This is a cross sectional study, 112 wound swabs were collected from patients who had developed postoperative wound infection. Conventional microbiological techniques were used for isolation and identification of bacteria. Antimicrobial susceptibility testing was performed to all pathogenic isolates using Kirby-Bauer disc diffusion method according to the CLSI guidelines 2009.

**The Results:** The isolated bacteria were *Staphylococcus aureus* 19.6%, *Pseudomonas aeruginosa* 16.1%, *Escherichia coli* 15.2%, *Klebsiella pneumoniae* 9.8%, *Proteus mirabilis* 5.4%, and *Enterococcus faecalis* 2.7%.

**Conclusion:** Highest prevalence rate of nosocomial postoperative wound infections in this study may be due to poor antibiotic selection for prophylaxis during and after surgery and increased level of contamination in most parts of the hospitals.

**Keywords:** Antibiotics, Bacteria, Nosocomial, Postoperative, Sudan, Surgery, Wound infection

## INTRODUCTION:

Postoperative wound infection is an infection in the tissues of the incision and operative area<sup>(1)</sup>. Infections are considered nosocomial if they first appear 48 hours or more after hospital admission or within 30 days after discharge. Nosocomial infections are transmitted due to the fact that hospitals house large numbers of people who are sick and whose immune systems are often in a weakened state. Increased use of outpatient treatment means that people who are hospitalized are more ill and have more weakened immune systems than may have been true in the past. Moreover, some medical procedures bypass the body's natural protective barriers. Since medical staff moves from patient to patient, the staffs themselves serve as a means for spreading pathogen<sup>(2)</sup>. Thorough hand washing and use of alcohol rubs by all medical personnel before and after each patient contact is one of the most effective ways to combat nosocomial infections<sup>(3)</sup>

In the United States, it has been estimated that 1:10 hospital patient acquires a nosocomial infection, or 2 million patients a year. Estimate of the annual cost range from \$4.5 billion to \$11 billion and up. Nosocomial infections contributed to 88,000 deaths in the U.S. in 1995.

One third of nosocomial infections are considered preventable<sup>(4)</sup>.

The most common nosocomial infections are of the urinary tract, surgical site and various pneumonias<sup>(5)</sup>. Surgical sites infection (SSI) have a significant impact on patients, increasing length of hospital stay, contributing to an overuse of antibiotics and increased associated cost, and contributed increased mortality. They have been responsible for the increase in cost, morbidity and mortality related to surgical operation and continues to be a major problem even in the hospital with the most modern facilities and standard protocols of preoperative preparation and antibiotic prophylaxis<sup>(7)</sup>. Surgical site infection rate has varied from low of 2.5% to a high of 41.9%<sup>(8)</sup>.

A wide variety of aerobic and anaerobic species of bacteria may be present in SSI either singly or in combination, in infections of wounds, are generally associated with the production of pus and the bacteria involved are said to be "pyogenic" (pus producing)<sup>(9)</sup>.

The objective of this study was to determine the prevalence of aerobic and anaerobic nosocomial bacteria among patients with postoperative wound infections and

their antimicrobial susceptibility pattern in, Port-Sudan hospital - Eastern Sudan.

#### MATERIALS AND METHODS:

This is a cross sectional study performed between June and September 2013. Patients are hospitalized during the study at Seaports hospital. This study was approved by the Ministry of health, ethical committee board of Red Sea State and an informed consent was obtained from each patient or their relatives before collecting the demographic and clinical data.

All collected swabs received from patients hospitalized from June to September 2013 were processed for isolation and identification of bacterial pathogens according to the standard microbiological techniques<sup>(10)</sup>. A total of 112 postoperative wound swabs were collected aseptically with a sterile cotton wool swab from clinically suspected infected wounds from different wards. Gram stain preparations were made from all swabs. Samples were

inoculated onto 5% sheep blood agar, MacConkey agar. The plates were incubated at 37°C for 18 - 24 hours. The cultures were read after 24 hours but extended to 48 hours if there was no bacterial growth after 24 hours. Isolated organisms presented to Gram stain and biochemical tests for identification. Identification was carried out according to the standard biochemical tests. Antimicrobial susceptibility testing was performed on Muller-Hinton agar using Kirby-Bauer disc diffusion method according to the CLSI guidelines. Standard stains of *Pseudomonas aeruginosa* (ATCC 27853), *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 25923) were used as controls<sup>(10)</sup>.

#### RESULTS:

Demographic characteristics for patients are listed in (Table 1). The age arranges between 16 and 71 years and the mean age is 43 years, females were 41 (36.6%) and males were 71 (63.4%).

Table 1: Demographic and clinical data

Characteristics	No.	%
<b>Age in years</b>		
0 – 19	07	06.3
20 – 39	31	27.7
40 – 59	54	48.2
60 – 79	20	17.8
<b>Gender</b>		
Male	71	63.4
Female	41	36.6
<b>Purulent discharge</b>		
Yes	77	68.8
No	35	31.2
<b>Redness and hotness</b>		
Yes	112	
No	0	100
<b>Total</b>	<b>112</b>	<b>100</b>

Pus swabs from 112 post-operative wound infections were analyzed in this study and processed for culture and sensitivity. As listed in (Table 2) pathogenic bacteria were obtained from 77 (68.8%) pus swabs. The predominant isolates were gram-negative bacteria. The most frequently

isolated organisms were *Staphylococcus aureus* 22 (19.6%) followed by *Pseudomonas aeruginosa* 18 (16.1%), *Escherichia coli* 17 (15.2%), *Klebsiella pneumoniae* 11 (9.8%), *Proteus mirabilis* 6 (5.4%) and *Enterococcus faecalis* 3 (2.7%).

Table 2: postoperative wound infections isolates

Isolates	No.	%
<i>Staphylococcus aureus</i>	22	19.6%
<i>Pseudomonas aeruginosa</i>	18	16.1%
<i>Escherichia coli</i>	17	15.2%
<i>Klebsiella pneumoniae</i>	11	09.8%
<i>Proteus mirabilis</i>	6	05.4%
<i>Enterococcus faecalis</i>	3	02.7%
No Bacterial growth	35	31.2%
<b>Total</b>	<b>112</b>	<b>100</b>

Antibiotic susceptibility testing was performed on the resistant strains gram-negative and gram-positive bacteria isolated from patients with postoperative wound to antibiotics respectively. infections. Table (3) and Table (4) show the percentage of

Table 3: Percentage (%) of antibiotic resistance of Gram-negative isolates

	AMP	CT	CH	TE	CP	AK	CF	GM	MER
<i>P. aeruginosa</i> (18 strains)	83	56	50	89	33	56	56	28	17
<i>E. coli</i> (17 strains)	89	47	30	72	18	24	59	36	18
<i>K. pneumoniae</i> (11 strains)	91	9	9	73	27	72	55	18	9
<i>P. mirabilis</i> (06 strains)	83	17	33	83	33	33	33	17	0

Table 4: Percentage (%) of antibiotic resistance of Gram-positive isolates

	AMP	CO	TE	CP	RF	GM	ERT	CLD	AMO
<i>S. aureus</i> (22 strains)	59	59	18	73	41	50	50	59	50
<i>E. faecalis</i> (03 strains)	67	33	33	33	0	33	67	67	33

AMP	Ampicillin	CT	Co-trimexazole	CH	Chloramphenicol	TE	Tetracycline
CIP	Ciprofloxacin	AK	Amikacin	CF	Cefotaxim	GM	Gentamicin
MER	Meropenem	RF	Refampine	ERT	Erythromycin	CLD	Clindamycin
AMO	Amoxyclav						

## DISCUSSION:

The analysis of the demographic variables of the patients included in this study revealed that; the number of males operated on being the majority. This may be partially explained by the fact that the majority of patients were from an emergency department.

Among 112 post-operative wound swab 77 (68.8%) show aerobic bacterial growth and no anaerobic bacteria was isolated. The predominant bacterial isolates recovered in our study included *S. aureus* 22 (19.6%) followed by *P. aeruginosa* 18 (16.1%), *E. coli* 17 (15.2 %) and *K.*

*pneumoniae* 11 (9.8%). Many studies have reported that *S. aureus* was the commonest isolate from postoperative wound infections<sup>(11)</sup>. In the present study, predominance of *S. aureus* in surgical site infections is consistent with reports from other studies and is however not surprising as it forms the bulk of the normal flora of skin and nails<sup>(12)</sup>. The high incidence of gram-negative organisms in the postoperative wound infections can be attributed to be acquired from patient's normal endogenous micro flora<sup>(13)</sup>. A number of studies in literature indicate a gradual increase in the emergence of antibiotic resistant microorganisms in surgical patients special interest *S.*

*aureus* surgical site infection is mainly due to its predominant role in hospital cross infection and emergence of virulent and antibiotic resistant strains<sup>(14)</sup>.

The susceptibility patterns of the 77 bacterial strains to several antimicrobial agents showed that more than 83% of the Enterobacteriaceae and *Pseudomonas* tested were resistant to Ampicillin and a less than 18% were resistant to Meropenem. Also most of these isolates were highly resistant (72% and more) to Tetracycline.

Meropenem, Gentamicin, and Ciprofloxacin were found to be more potent antimicrobials against Enterobacteriaceae and *Pseudomonas* because more than two third of isolated strains were susceptible. The majority of *Pseudomonas aeruginosa* strains were multi-drugs resistant because they were resistant to more than 4 antibiotics used, while *Proteus mirabilis* strains were always sensitive to majority of antibiotics used.

In this study, *S. aureus* was the most common cause of surgical wound infections. Fifty percent and more of these strains were resistant to Ampicillin, Co-trimoxazole, Erythromycin, Clindamycin, Gentamicin, and Ciprofloxacin, while they were more susceptible to Refampine and Tetracyclin.

Enterococci strains were only isolated from 3 patients. All of these 3 isolates were susceptible Refampine, while 2 isolates were resistant to Ampicillin, Erythromycin and Clindamycin.

#### CONCLUSION:

The high prevalence rate of nosocomial postoperative wound infections in the current study was estimated due to poor antibiotic selection for prophylaxis during and after surgery. Moreover, the levels of contamination in the most part of the hospital were above the normal.

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