

Risk of Post-Operative surgical site contaminations from word environment in in Khartoum Bahri Teaching Hospital orthopedic words from February to May 2016

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I. Introduction

Surgical site infections (SSIs) are defined as infections occurring up to 30 days after surgery (or up to one year after surgery in patients receiving implants) and affecting either the incision or deep tissue at the operation site⁽¹⁾. are the most common nosocomial infections⁽²⁾ & in particular are the most popular perioperative complications⁽³⁾. It lead to adverse patient outcomes, including prolonged hospitalization and death⁽⁴⁾. Strategies to prevent these infections are crucial. Evidence based measures like hand hygiene, treatment of nasal carriage of S. Aureus, surveillance, prophylactic application of antibiotics or hair removal with electric clippers are listed in national and international guidelines^(3,4). A nosocomial infection is determined by plenty of factors, such as a kind of flora and its virulence, hygiene standard, technical terms of work organization in hospital, staff and patient related factors^(5,6,7) efficacy of material and instruments sterilization^(5,8,9,10,11,12). Surgical tools including knives & Surgical power tools, & splash basin may represent a contamination source.^(13,14,15,16,17). Failure to administer the first dose of antimicrobial prophylaxis within the 2-h window of time before incision is associated with 2- to 6-fold increases in rates of surgical site infection⁽¹⁸⁾. The incidence of SSIs it range from 1.4 to 3.3 (2.35)^(19,13,21,22, 23). The incidence of SSIs may be as high as 20%, depending on the surgical procedure (1) in children over 24 months of age who underwent surgical implant procedures and had longer preoperative periods and lengths of hospitalization⁽²²⁾. All surgical operations have the potential for contamination, and the equipment used can harbor bacteria^(24, 25,26,27). These showed rates of contamination of 11.4% for the sucker tips, 14.5% for light handles, 9.4% for skin blades and 3.2% for the inside blades used during surgery; 28.7% of gloves used for preparation were also contaminated. Of the samples taken from the collection bags used during hip arthroplasty, 20% grew bacteria, which represents a significant microbial reservoir. Also, 17% of theatre gowns were contaminated at the end of the operation⁽²⁴⁾. Hospital infections arise by cross infection from other patients and hospital staff, and by transmission of pathogens from items in the hospital environment including hospital bed handsets, children's toys, sinks, door handles, patient files and flowers^(28, 29, 30, 31, 32). Organisms may be transmitted by direct and indirect contact, by the airborne route, and with water, food and drugs⁽³⁰⁾. The most common infective organism was Staphylococcus species including Methicillin Resistant Staphylococcus Aureus (MRSA) Acinetobacter species, Pseudomonas species, and Escherichia coli^(1, 23, 33, 34, 35).

II. Objectives

2.1 General objective

- To study post-operative nosocomial surgical site infection associated with contaminated ward environments in Khartoum bahri hospital orthopedic wards.

2.2 Specific objectives

- To isolate the contaminating organisms.
- To identify the isolated organisms.
- To determine antimicrobial susceptibility of the identified organisms.
- To detect the source of contamination.

III. Material and Methods

3.1 Study type and design

This study was Quantitative and qualitative analytical hospital based study conducted in in orthopedic wards of Khartoum Bahri hospital, Khartoum Bahri locality; Khartoum state from February to May 2016. The study includes all patients suffering from orthopedic post-operative surgical site infection whom admitted in Khartoum Bahri Teaching Hospital post-operative wards during study duration.

3.2 Data collection

The background history covering needed information such as the age, gender and uses of antibiotics were collected through personal interview questionnaire^(Appendix 1). Swabs for culture were collected from patient's wound and hospital equipment including Bed, Curtain, Flour, Instrument (Sterilizer), Kidney Dish, Knob, Light switch, Nurse table, Peg & Wall in surgery ward.

3.3 Inclusion criteria

For patient: Patients with surgical site infection, whom operated in Khartoum Bahri Teaching Hospital orthopedic theater & admitted to post-operative wards during study duration. For ward environed: Swabs were taken only from environment of orthopedic surgery wards in Khartoum Bahri hospital.

3.4 Exclusion criteria

For patient:

- Patient admitted for any reasons other than post-operative wound infection.
- Patient operated outside Khartoum Bahri hospital orthopedic theater.
- Patient admitted in any place other than the orthopedic post-operative ward of Khartoum Bahri hospital

For Swabs: any Swabs with possible contamination from any sources other orthopedic post-operative wards environment.

IV. Biochemical tests For identification of infecting microorganism.

4.1 Microscopic examination: After Gram stain by standard procedure

4.2 Culture: The swabs were cluttered on blood agar and MacConkey's agar by using sterile wire loop.

4.3 Biochemical tests: The following tests will be ran in order to identify the type of the causative organisms: Catalase test, Coagulase test, fermentation of Mannitol, Oxidase test, Indole test, citrate test, Urease test, Kligler iron agar and motility test.

4.4 Sensitivity test (antimicrobial activity of reference drugs):- The disk diffusion susceptibility testing was used in the study by using Muller-Hinton agar using Kurby and Bauer method.

V. Data analysis

frequencies and Chi square test were computerize calculated by statistical package for social science (SPSS) program 21.

VI. Ethical consideration

The ethical considerations and conformity to individuals in this study were considered by using documented agreement within the questionnaire and signed by the patient.

VII. The result

The study includes 34 samples; 12 from ward admitted patient with surgical site infection. & 22 from ward environments (table, beds sheets etc).

The 12 patient are all male with age ranges 22-80 years (mean52.92). The distribution of the infected surgical sites are 9 in lower limbs whereas in rest 3(25%) in the trunk **Table (1)**. There is no statistically association between site of wound and mix isolate (P.value 0.255)(O.R0.556).Wound swab culture result in 11 (91.7%) specimen showed growth with 36.4% (4 specimens) were mix growth. The total number of isolated microorganism were 15;*proteus mirabilis* 4(26.7%), *pseudomonas aeruginosa* 4(26.7%), *Escherichia coli*3(20%), *Enterobacter species* 2(13.2%),*Klebsellapneumoniae* 1(6.7%) and *Enterococcus faecalis* 1(6.7%). **Table (2)**.

Of the12 patient, 11(91.7%) were under antibiotics treatment and showed growth; 2 (18.2%) on zinoxime, 2 (18.2%) on metronidazole and only 1 (9.11) was used clavulnic Amoxicillin treatment & 6 (54.5%) are on daily dressing with yamidin 10%.

The sensitivity &resistence of isolated microorganism to antibiotic are represented in **figure (1)** with gentamycine is the most sensitive drug to the isolates followed by Chloramphenicol while only 7% are sensitive to Ceftriaxone (one of the commonest drug used in hospital) coming the second as mostly resisted drugs after Co-trimoxazole. The efficacy of drugs in treating isolated microorganism is represented in **figure (2 to 6)**

Table (3) shows frequencies of site of sample, growth gram reaction and organism in ward batches:

The 22 ward environment sample were collected from different site in ward includes; bed 2(9.1%),flour 1(4.5),curtain 4(18.2%) ,instruments sterilizer3(13.6%),kidney dish 2(9.1%), light switch 2(9.1%),nurse table 1(4.5%) , knob 2(9.1%),peg 4(18.2%) and wall 1(4.5%). After preparation 2(9.1%) shows no growth whereas 20(90.9%) swabsshow significant growth with; 14 specimens (63.6%) are gram positive cocci; 3(13.6%) are gram negative rod & 3(13.6%) are gram negative bacilli of *Bacillusspecies*.

The gram positive cocci are 5(35.7%) *Staphyococcus aureus*& 9(64.3%) *Coagulase negative Staphaphylococcus*. While the gram negative rod are; 1(33.3%) is *P.aeruginosa* , 1(33.3%) is *klebsellapneumoniae* , 1(33.3%) is *Enterobacter species*.

Table (4) shows frequencies of antimicrobial of sensitivity and isolates *Bacillusspecies* were species were sensitive to chloramphenicol, gentamicin ,nalidixic acid and Co-trimoxazole.and resist to Ceftriaxone ,Penicillin ,Ampicillin and Vancomycin,9(100%) organisms of *Coagulase negative Staphaphylococcus* were resistant to Ceftriaxane, Co-trimoxazole, penicillin and ampicillin,3(33.3%) were resistant to chloramphenicol whereas 6(66.6%) sensitive to it,9 (100%) *Coagulase negative staphaphylococci*were sensitive to gentamicin .1(100%) *Enterobacter* was sensitive to chloramphenicol , gentamicin and resistant to ceftriaxane,nalidixic acid and co-trimoxazole. *Klebsellapneumoniae* was sensitive to gentamycin and resistant to ceftriaxane, chloramphenicol ,nalidixic acid and co-trimoxazole. *P.aeruginosa*was also sensitive to gentamicin and resistant to other antibiotics .5(100%) of *S.aureus* isolated were resistant to ceftriaxane, chloramphenicol and ampicillin, 1(20%) was sensitive to methicillin and vancomycin.

Table (1) Frequencies of site of wound, growth, isolates, Gram reaction, organisms, antibiotic treatment and types of antibiotics in post operative wound infection patients.

		Frequency	Percent
Site of wound	Limbs	9	75.0
	Trunk	3	25.0
	Total	12	100%
Growth	Growth	11	91.7
	No growth	1	8.3
Isolates	One organism	8	66.7
	Mix growth	4	33.3
	Total	12	100%
Gram reaction	Gram negative	10	90.9
	Gram positive	1	9.1
	Total	11	
Organism	<i>Proteus merablis</i>	4	26.7
	<i>Pseudomonas aeruginosa</i>	4	26.7
	<i>Escherichia coli</i>	3	20.0
	<i>Enterobacter</i>	2	13.3
	<i>Klebsiellapneumoniae</i>	1	6.7
	<i>Enterococcus fecalis</i>	1	6.7
	Total	15	100%
Antibiotic treatment	Yes	11	91.7
	No	1	8.3
	Total	12	100%
Type of antibiotic	Yamidin	6	18.2
	Zinoxime	2	9.1
	Metronadizole	2	18.2
	Aoxicillin	1	54.5
	Total	11	100%

Table (2) Frequencies of organisms and mix infection in patients with post operative wound infection.

Organisms	Frequency	Percent
<i>Enterobacter</i>	2	18.2
<i>Proteus merablis</i>	2	18.2
<i>Escherichia coli</i>	1	9.1
<i>Klebsiella pneumonia</i>	1	9.1
<i>Proteus merablis and Escherichia coli</i>	1	9.1
<i>Pseudomonas aeruginosa</i>	1	9.1
<i>Pseudomonas aeruginosa and Enterococcus fecalis</i>	1	9.1
<i>Pseudomonas aeruginosa and Escherichia coli</i>	1	9.1
<i>Pseudomonas aeruginosa and Proteus merablis</i>	1	9.1
Total	11	100.0

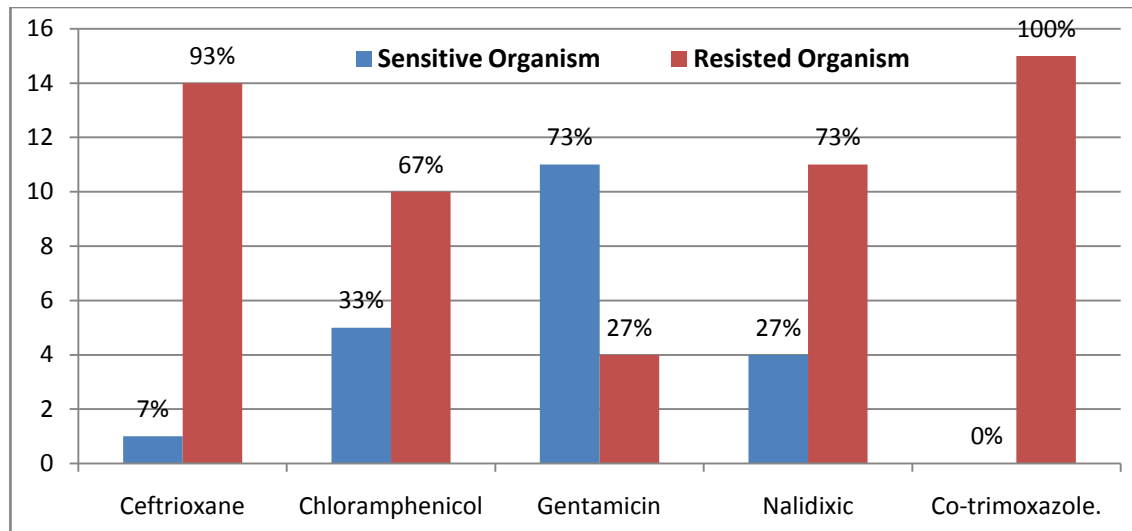


Figure (1); Sensitivity and resistant of isolated micro-organisms to selected drugs.

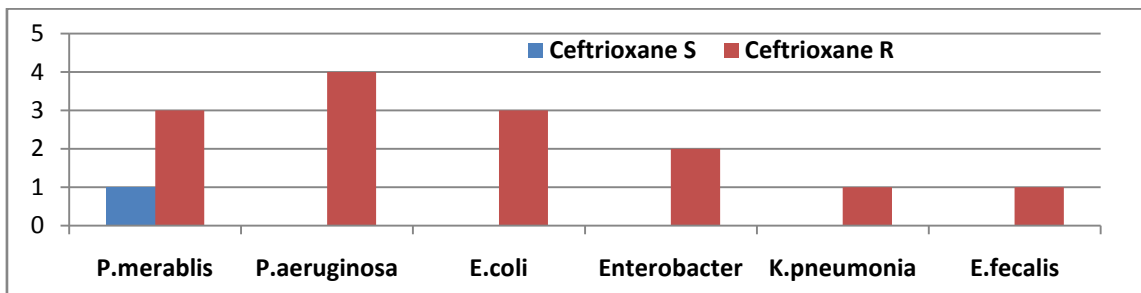


Figure (2) Ceftriaxone Efficacy

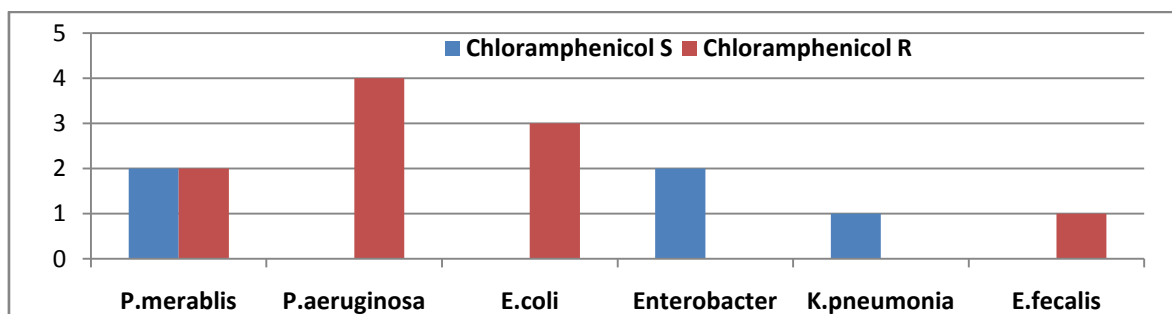


Figure (3) Chloramphenicol Efficacy

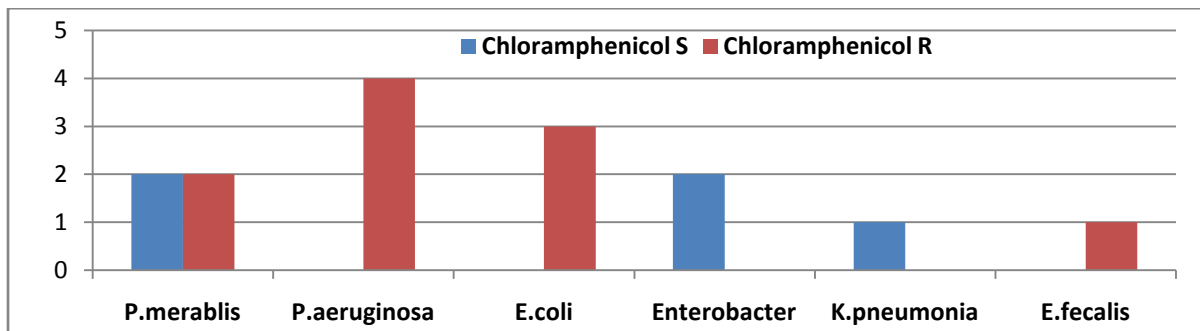


Figure (4) Gentamycine Efficacy

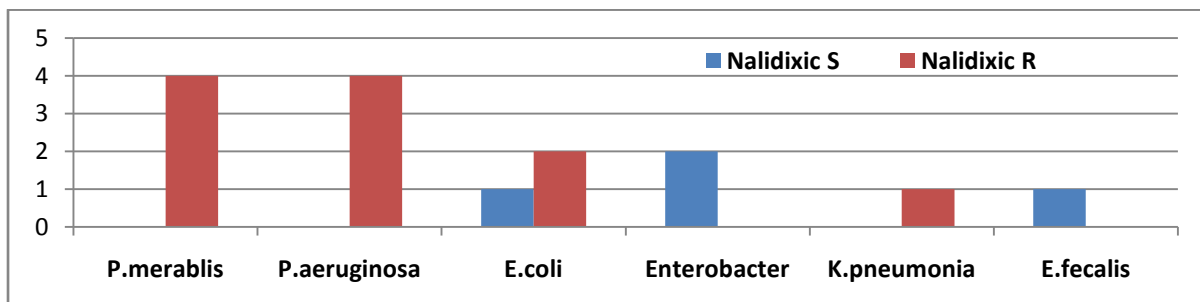


Figure (5) NalidixicAcide Efficacy

Table (3); Shows frequencies of swabs sites, growths, Gram reactions and organisms in ward environments.

		Frequency	Percent
Swabs Site	Bed	2	9.1%
	Curtain	4	18.2%
	Flour	1	4.5%
	Instrument (Sterilizer)	3	13.6%
	Kidney Dish	2	9.1%
	Knob	2	9.1%
	Light switch	2	9.1%
	Nurse table	1	4.5%
	Peg	4	18.2%
	Wall	1	4.5%
	Total	22	100%
Growth	Growth	20	90.9%
	No growth	2	9.1%
	Total	22	100%
Gram reaction	G-ve rod	3	13.6%
	G+vebac	3	13.6%
	G+vecoci	14	63.6%
	Total	22	100%
Organism	<i>Staphylococcus aureus</i>	5	25%
	<i>Pseudomonas aeruginosa</i>	1	5%
	<i>Klebsiellapneumoniae</i>	1	5%
	<i>Enterobacter</i>	1	5%
	<i>Co-agulase -ve staphylococci</i>	9	45%
	<i>Bacillus spp</i>	3	15%
	Total	20	100%

Table (4) Sensitivity and resistant to isolated organisms in ward batch.

Organisms	Ceftriaxone		Chloramphenicol		Gentamicin		Nalidixic acid		Co-trimoxazole		Penicillin		Ampicillin		Methicillin		Vancomycin	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
<i>Bacillus spp</i>	3	0	0	3	0	3	0	3	0	3	3	0	3	0	--	--	3	0
<i>Co-agulase -ve Staph.</i>	9	0	3	6	0	9	--	--	9	0	9	0	9	0	--	--	0	9
<i>Enterobacter</i>	1	0	0	1	1	0	1	0	1	0	--	--	--	--	--	--	--	--
<i>Klebsiella pneumonia</i>	1	0	1	0	0	1	1	0	1	0	--	--	--	--	--	--	--	--
<i>Pseud. aeruginosa</i>	1	0	1	0	0	1	1	0	1	0	--	--	--	--	--	--	--	--
<i>Staph. aureus</i>	5	0	0	5	0	5	5	0	5	0	5	0	0	5	1	4	1	4

VIII. Discussion

In spite of the increasing use of prophylactic antibiotics in most surgeries, ⁽³⁶⁾ infections still remain a real risk and constitute a substantial burden of disease for both the patient and health care services. ⁽³⁵⁾. The infected wounds isolated microorganisms were all gram negative with 36.4% (4 specimens) of specimen shows mix growth & no gram positive microorganism isolated. The most frequently isolated microorganism were **proteus mirabilis** & **pseudomonas aeruginosa** in equal frequency of 4(26.7%), followed by **Escherichia coli** 3(20%), Gentamicin is the most sensitive drug to the isolates (73%) followed by Chloramphenicol (67%) while Ceftriaxone showed 93% resistance.

The sample taken from ward environment shows growth in 90.9% of them (20 swabs) while only 9.1 % shows no growth (2 swabs) with gram positive represent 77.2 % (17).The most commonly isolated micro organism is Staphylococci 70 % (14) with Co-agulase -ve staphylococci represent 45% from the total isolate. Most of the isolate is sensitive to gentamicin 95% (19), while all wards isolate are resistant to ceftriaxone (one of the commonly used drugs)

IX. Conclusion and Recommendations

9.1 Conclusion

- There was resisto-typing combatibility between the *Pseudomonasaeruginosa* isolated from the ward and patient's wound.
- *Pseudomonasaeruginosa* and *Proteus species* were multi-drug resistant.
- Gentamicin was effective antibiotic & ceftriaxone is resisted by most organisms.

9.2 Recommendations

Based on our results and previous data regarding nosocomial infections, we recommended:

- 9.2.1 Regular use of antiseptic like color in cleaning of ward.
- 9.2.2 Use of disposable bed sheets.
- 9.2.3 Patient with Infected wound should have separate ward & dressing instrument.
- 9.2.4 Each infected patient should treated by team included surgeon, microbiologist, & clinical pharmacologist.
- 9.2.5 Gentamicin should be one of the empirical drug before organism specific drug according to culture & sensitivity result.
- 9.2.6 Gentamicin loaded saline for intraoperative wash of the surgical site should be further assessed.

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