



**POST-STERILIZATION CONTAMINATION BY HANDLING FORCEPS IN  
KHARTOUM BAHRI TEACHING HOSPITAL ORTHOPEDIC THEATER FROM  
FEBRUARY TO MAY 2016**

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## 1. 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.<sup>[1]</sup> are the most common nosocomial infections<sup>[2]</sup> & in particular are the most popular perioperative complications.<sup>[3]</sup> It lead to adverse patient outcomes, including prolonged hospitalization and death.<sup>[4]</sup> 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.<sup>[3,4]</sup> 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<sup>[5,6,7]</sup> efficacy of material and instruments sterilization.<sup>[5,8,9,10,11,12]</sup> Surgical tools including knives & Surgical power tools, & splash basin my represent a contamination source.<sup>[13,14,15,16,17]</sup> 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.<sup>[18]</sup> The incidence of SSIs it range from 1.4 to 3.3 (2.35).<sup>[19,13,21,22,23]</sup> 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.<sup>[22]</sup> All surgical operations have the potential for contamination, and the equipment used can harbor bacteria.<sup>[24, 25,26,27]</sup> 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.<sup>[24]</sup> 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.<sup>[28,29,30,31,32]</sup> Organisms may be transmitted by direct and indirect contact, by the airborne route, and with water, food and drugs.<sup>[30]</sup> The most common infective organism was *Staphylococcus* species including Methicillin Resistant *Staphylococcus Aureus* (MRSA). *Acinetobacter* species, *Pseudomonas* species, and *Escherichia coli*.<sup>[1,23,33,34,35]</sup>

## 2. OBJECTIVE

**2.1. General objective:** To study post-operative nosocomial surgical site infection associated with

contaminated handling forceps in orthopedic theater of Khartoum Bahri Hospital.

## 2.2 Specific objectives

- 2.1. To isolate the contaminating organisms.
- 2.2. To identify the isolated organisms.
- 2.3. To determine antimicrobial susceptibility of the identified organism
- 2.4. To detect the source of contamination

## 3. MATERIAL AND METHODS

### 3.1. The Study type and design

This study was Quantitative and qualitative analytical hospital based study conducted in in orthopedic theater in 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 operated in Khartoum Bahri Teaching Hospital Theater 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 (Appendix1).

Swabs for culture were collected from patient`s wound and hospital equipment including handling forceps, Forceps Jar, and Instrument.

### 3.3. Inclusion criteria

Patient suffering from orthopedic post-operative surgical site infection whom operated in Khartoum Bahri Teaching Hospital Theater.

For Handling-forceps: Swabs were taken only from handling forceps of orthopedic surgery in orthopedic theater of Khartoum Bahri hospital.

### 3.4. Exclusion criteria

For patient: Patient admitted for any reasons than post-operative wound infection after orthopedic surgery in orthopedic theater of Khartoum Bahri hospital.

For Handling-forceps: Swabs taken from handling forceps of any theater than orthopedic surgery theater of Khartoum Bahri hospital.

### 3.5. Biochemical tests for identification of infecting microorganism.

#### 2.9.1 Microscopic examination

After Gram stain by standard procedure

#### 2.9.2 Culture

The swabs were cluttered on blood agar and MacConkey`s agar by using sterile wire loop.

#### 2.9.3 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.

2.9.4 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.

## 3.6. Data analysis

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

## 3.7. 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.

## RESULT

The study includes 104 samples; 12 from ward admitted patient with surgical site infection & 92 from theater.

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 (4)**. 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%),*Klebsella Pneumoniae* 1(6.7%) and *Enterococcus Faecalis* 1(6.7%). **Table (3)**.

Of the12 patient, 11(91.7%) 5(41.7) are under antibiotics treatment and showed growth; 2 (40%) on Zinoxime, 2 (40%) on metronidazole and only 1 (20%) was used Clavulnic Amoxicillin treatment. 6 (50%) are on daily dressing with Yamidin 10%. There is statistically insignificant association (P.value 0.348, O.R 0.25) between using of yamidine as washing antiseptic and antibiotics with mixed growth isolates.

The sensitivity & resistance 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)** theater sample **represented by** ninety two swabs **Table(1)** which are 60(65.2%) swabs from the forceps, 30(32.6%) from forceps jar ,2(2.2%) from instrument, from all samples only 22(23.9%) of cultured swabs showed growth, while the remaining 70(76.1%) swab showing no growth. 16(72.7%) of the isolates were gram positive,6(27.3%) were gram negative bacteria.15(68.2%) of the growth were *Coagulase negative Staphylococci*, 1(4.5%) *Staphylococcus Aureus*, 3(13.6%) *Pseudomonas Aergiuinosa*, 1(4.5%) *Acinetobacter Lwoffii*, 1(4.5%) *Bacillus species* and 1(4.5%) *Proteus Mirabilis*.

**Table. (1): Shows frequency of samples, growth gram reaction and organisms from theater rooms.**

		Frequency	Percent
<b>Samples</b>	Forceps	60	65.2
	Forceps Jar	30	32.6
	Instrument	2	2.2
	Total	92	100.0
<b>Growth</b>	No growth	70	76.1
	Growth	22	23.9
	Total	92	100.0
<b>Gram reaction</b>	Gram positive	16	76.1
	Gram negative	6	23.9
	Total	22	100.0
<b>Organism</b>	<i>Co-agulase -ve staphylococci</i>	15	68.2
	<i>Pseudomonas aeruginosa</i>	3	13.6
	<i>Acintobacter</i>	1	4.55
	<i>Bacillus species</i>	1	4.55
	<i>Proteus merablis</i>	1	4.55
	<i>Staphylococcus aureus</i>	1	4.55
	Total	22	100.0

**Table. (2): showed sensitivity and resistant to isolated organisms from theater handling forceps.**

<i>Acintobacter</i>	0	1	0	1	1	0	1	0	0	1	1	0	---	---	---	---	---	---
<i>Bacillus species</i>	0	1	1	0	1	0	0	1	0	1	0	1	1	0	---	---	---	---
<i>Co-agulase-ve staphylococci</i>	5	10	12	3	15	0	5	10	3	12	10	5	8	7	---	---	---	---
<i>Proteus merablis</i>	0	1	0	1	0	1	1	0	1	0	---	---	0	0	---	---	---	---
<i>Pseud. aeruginosa</i>	1	2	1	2	3	0	3	0	3	0	-	-	---	---	---	---	---	---
<i>Staph. aureus</i>	0	1	1	0	1	0	1	0	1	0	0	1	1	0	0	1	0	1
<i>total</i>	6	16	15	7	21	1	11	11	8	14	11	6	10	7				

• **Cef:** Ceftriaxane, **Chl:**Chloramphenicol, **Gen:**Gentamicin, **Nail:**Nalidixic acid , **Pen:**penicillin, **Amp:**ampicillin, **Meth:**Methicillin, **Vanco:**Vancomycin.

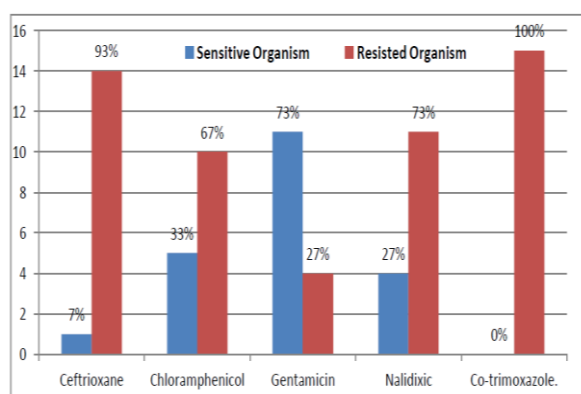
**Table. (3): shows frequencies of site of wound, growth, isolates, Gram reaction, organisms, antibiotic treatment and types of antibiotics in post-operative wound infection patients.**

		Frequency	Percent
<b>Site of wound</b>	Limbs	9	75.0
	Trunk	3	25.0
	Total	12	100%
<b>Growth</b>	Growth	11	91.7
	No growth	1	8.3
<b>Isolates</b>	One organism	7	63.6
	Mix growth	4	36.4
	Total	11	100%
<b>Gram reaction</b>	Gram negative	10	90.9
	Gram positive and negative	1	9.1
	Total		
<b>Organism</b>	<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>Klebsiella pneumoniae</i>	1	6.7
	<i>Enterococcus fecalis</i>	1	6.7
	Total	15	100%
<b>Antibiotic treatment</b>	Yes	5	41.7
	No	1	8.3
	Total	6	100%
<b>Type of antibiotic</b>	Zinoxime	2	9.1
	metronadizole	2	18.2

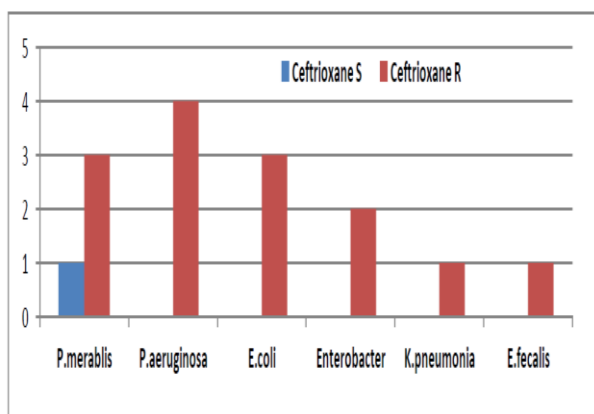
	Aoxicillin	1	54.5
	Total	5	100%
<b>Dressing</b>	Yamidin	6	50%

**Table. (4): Shows 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 infected wound isolated micro-organisms to selected drugs.**



**Figure. (2): Ceftriaxone Efficacy.**

#### 4. 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 grams 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%), Gentamycin is the most sensitive drug to the isolates (73%) followed by Chloramphenicol (67%) while Ceftriaxone showed 93% resistance.

Cultured swabs from forceps, forceps jar & surgical instrument showed growth from only 22(23.9%) of them, while the remaining 70(76.1%) swab showing no growth. Gram positive is the most frequent isolates, represents 16(72.7%) while only 6(27.3%) were gram negative. With ceftriaxone is most sensitive drug to isolate 16(72.7%) followed by co-trimoxazole 14(63.6) then Nalidixic acid 11(50%). Coagulase negative *Staphylococci* is the most frequent isolate 15(68.2%) followed by *Pseudomonas aeruginosa* 3(13.6%) both of them show 100% resistance to Gentamycin & 66.7 % sensitivity to Ceftriaxone.

In comparison we found the wound isolate are mainly gram negative (100%) while gram positive is dominate the instrument isolate (72.7%). The most frequently isolated microorganism from wound are **proteus mirabilis** & **pseudomonas aeruginosa**, they are isolated from instrument culture but they are looked different as the former are highly sensitive to gentamycin & Chloramphenicol while the later are highly resistant to them telling that they are not the same microorganism.

#### 5. CONCLUSION

In conclusion study showed 23.9% instrument contamination but none of isolated instrument micro-organism is present in wound isolate which refutes the theory of microorganism transmission via instruments handling forceps. Gentamycin is found to be a good drug that is killing most of wound isolate but surprisly is not suitable to instrument isolate calling for need to assess the efficacy of adding gentamycin to the fluid used for intra-operative surgical site wash.

## 6. RECOMMENDATION

### 7.1. No contamination is present with using handling forceps for moving sterilized instrument if stick to the basic of sterilization.

7.2. Surveillance system for early detection of infected wound & source of infection.

7.3. Ward dressing with yamidine is not sufficient for infected wound & standard theatre debridement is the appropriate.

7.4. Appropriate antibiotic selection.

7.5. Wash with or without gentamycine need further evaluation.

7.6. Good antiseptic at ward, with daily change of bed sheets.

7.7. Periodic review of working staff & word environment for possible contamination.

7.8. Need to assess efficacy of gentamycine loaded saline in reducing surgical site infection.

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