

Original Research Article

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## Nosocomial Pathogens in Surgical Theatres in Braithwaite Memorial Specialist Hospital, Port Harcourt, Rivers State.

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### Abstract

The study was conducted to ascertain the Nosocomial pathogens involved in surgical theatres; main surgical theatre, casualty ward and modelling theatre of Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt. One Hundred samples were collected from nine different sources; namely surgical scissors, surgery scissors, surgical blades, blood pressure cuff, dressing forceps, towel clamps, speculum, cut scissors and surgical suture. Samples were also collected from sterile sources as control. The organisms isolated from all the theaters were *Staphylococcus aureus*, *Pseudomonas* sp., *Escherichia coli*, *Klebsiella* sp. and *Proteus* sp. giving a total of 106. The number of isolates based on the wards are 34 (32.0%) Main Surgical Ward, 33 (31.2%) Casualty Ward and 39 (36.8%) for Modeling Theater. Statistically there was a significant relationship between main surgical theatre, casualty ward and modeling theatre ( $P = 0.05$ ). In the total heterotrophic count of bacteria isolates, the main surgical theatre recorded  $25.8 \times 10^4$  CFU/ml, the casualty ward recorded  $28.9 \times 10^4$  CFU/ml while the modeling theatre recorded  $26.7 \times 10^4$  CFU/ml. This study has revealed that pathogenic organisms were not found in sterilized surgical instruments. It becomes necessary that surgical equipment must be sterilized before use to avoid transfer of Nosocomial pathogens to patients.

**Keywords:** Nosocomial, Surgical, Pathogens, Contamination, Infections.

### Introduction

The development of potential Nosocomial infection in surgical equipment is a significant problem in hospitals. Nosocomial infection is acquired in the hospital by patients who are admitted for reasons other than infections that first appear 48hrs or more after hospital admission or within 30 days after discharge. Nosocomial infections can result from development and persistence of multidrug resistant (MDR) bacteria,

immune compromised status and mechanical transmission of agents from one patient to another. It is the transmission of organisms through contaminated medical devices such as scissor, forceps, speculum, towel, forceps, electronic thermometers, blood pressure cuffs, respiratory equipment/devices, gloves, catheters, gowns, masks, and white coats. This happens on the skin and nasopharynx of hospital personnel which is possible because of their contact with patient's body<sup>(1)</sup>.

Hospital acquired infections could be in the form of cross-infection, endogenous infection and environmental infection (from an inanimate objects or substances that are contaminated from another human sources<sup>(2)</sup>). A prevalence survey in 2002 was conducted under the auspices of the world Health organization (WHO) in 55 hospitals in 14 countries representing four WHO Regions<sup>(3)</sup>. Nosocomial infections are the most common complications affecting hospitalized patients, with 5% to 10% of patients admitted in hospitals (Burke, 2003). Contamination may occur either by transfer of microorganisms contaminating health worker's hands or direct patient shedding of microorganisms in the immediate environment of surgical theatre<sup>(4)</sup>. Bacteria have been reported as contaminating Microorganisms of surface, communal use of medical equipment and high contact surfaces e.g. telephones, keyboard, medical charts<sup>(5)</sup>. It has been reported that both Gram-positive and Gram-negative bacteria are able to survive up to months on dry inanimate surfaces, with longer persistence under humid and lower temperature conditions.

Surgical theatre also known as an operating theater or operating room is a facility within a hospital where surgical operations are carried out in a state environment.

The aims of the study are to establish the possible presence of known bacteria pathogens on fomites in the operating theatre, to isolate and characterize the types of pathogens associated with surgical instruments, to determine the total heterotrophic count of bacteria and to determine the control/prevention measures in order to make the surgical instrument conducive for patients and the surgical teams.

The most common types of nosocomial infections that could occur in a hospital set up are, surgical wound infection, urinary tract infections, Nosocomial pneumonia, blood stream infections etc.

Surgical site infections (SSIs) are one of the most common types of nosocomial infections in all around the globe.<sup>(6)</sup> Some pathogens involved

in surgical site infections are:- *Acinetobacter* isolates, *E.coli*, *Enterobacter*.

Urinary tract infection (UTI) is the most common hospital acquired infection, accounting for 40% of all hospital acquired infections.

The bacteria responsible arise from the gut flora, either normal (*Escherichia coli*) or acquired in hospital (multi-resistant *Klebsiella*), *Pseudomonas aeruginosa* and *Acinetobacter* sp.<sup>(7)</sup>.

Hospital-acquired pneumonia is the most common life-threatening hospital-acquired infection. Gram – negative organisms that predominate in hospital acquired pneumonia, are *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, and the *Enterobacteriaceae*.

Nosocomial blood stream infections is a serious health problem and are associated to high.

The most common modes of transmission of surgical site infections include, contact transmission, endogenous infection and exogenous infections.

Hand Hygiene and use of hand gloves are the most important measures that can be taken to prevent infection. Hand hygiene is a general term that include hand washing with plain or antimicrobial soap and water.

## Materials and Methods

### Study area

The project was carried out in Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt, Rivers State which is a five star hospital owned by the Rivers State government.

Port Harcourt is a cosmopolitan city and the hub of oil and gas in Nigeria with a population of over 5 million made up of farmers, civil servants, traders, expatriates, etc.

### Sample collection

Hundred samples were collected from three different wards namely main surgical theatre ward, modeling theatre and casualty ward by using a sterile wet swab stick to swab the surgical scissor, surgical blade, speculums, towel clamps, blood pressure cuff, dressing forceps, cut scissor, surgery scissor and surgical suture. Samples were also collected from sterile sources.

### Enumeration of bacteria isolates

The swabbed samples were shaken in 9ml of sterile normal saline and diluted in one Tenth stepwise up to  $10^{-4}$  dilution.

From  $10^{-4}$  dilution of each sample, an aliquot (0.1ml) was transferred onto freshly prepared Blood Agar, Nutrient Agar, MacConkey Agar and spread evenly. The inoculated plates were incubated aerobically and anaerobically at  $37^{\circ}\text{C}$  for 24-48 hours after which the plates were

examined for growth, counted and biochemical test done to identify the organisms.

### Results

The number of isolates based on the wards are 34 (32.0%) Main Surgical Ward, 33 (31.2%) Casualty Ward and 39 (36.8%) for Modeling. From the main surgical theatre, the number of *Staphylococcus aureus* isolated were 6(30%), *Pseudomonas sp.* 7(31.8%), *E. coli* 8(36.4%), *Klebsiella sp.* 7(31.8%) and *Proteus sp.* 6(30%). In casualty ward the number of *Staphylococcus aureus* isolated were 6(30%), *Pseudomonas sp.* 8(36.4%), *E.coli* 5(22.7%), *Klebsiella sp.* 8(36.4%) and *Proteus sp.* 6(30%). In modeling theatre the number of isolates were *Staphylococcus aureus* 8(40%), *Pseudomonas sp.* 7(31.8%), *E.coli* 9(40%), *Klebsiella sp.* 7(31.8%) and *Proteus sp.* 8(40%) giving a total of 34(32.0%) isolates for main surgical theatre, 33(31.2%) bacteria isolates for casualty and 39(36.8%) for modeling theatre as shown in Figure 1.

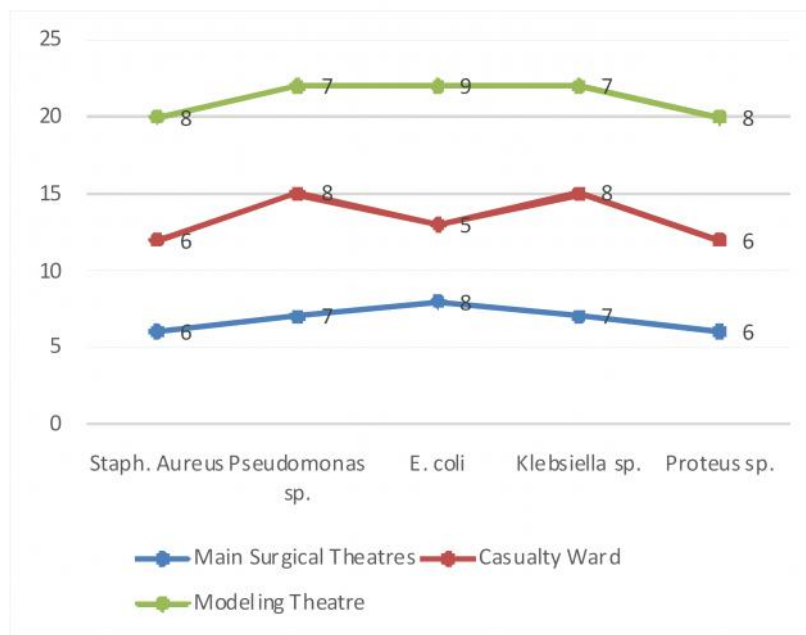


Figure 1: Distribution of Isolated

The mean total heterotrophic bacteria count for surgical scissors is  $1.76 \times 10^4$  CFU/ml, surgery scissors is  $1.76 \times 10^4$  CFU/ml, surgical blades is  $1.64 \times 10^4$  CFU/ml, blood pressure  $1.74 \times 10^4$  CFU/ml, dressing forceps  $1.94 \times 10^4$  CFU/ml,

towel clamps  $2.10 \times 10^4$  CFU/ml, Speculum  $1.92 \times 10^4$  CFU/ml, cut scissors  $1.80 \times 10^4$  CFU/ml surgical suture  $1.82 \times 10^4$  CFU/ml as shown in table 1.

**Table 1 Heterotrophic Counts According To Wards**

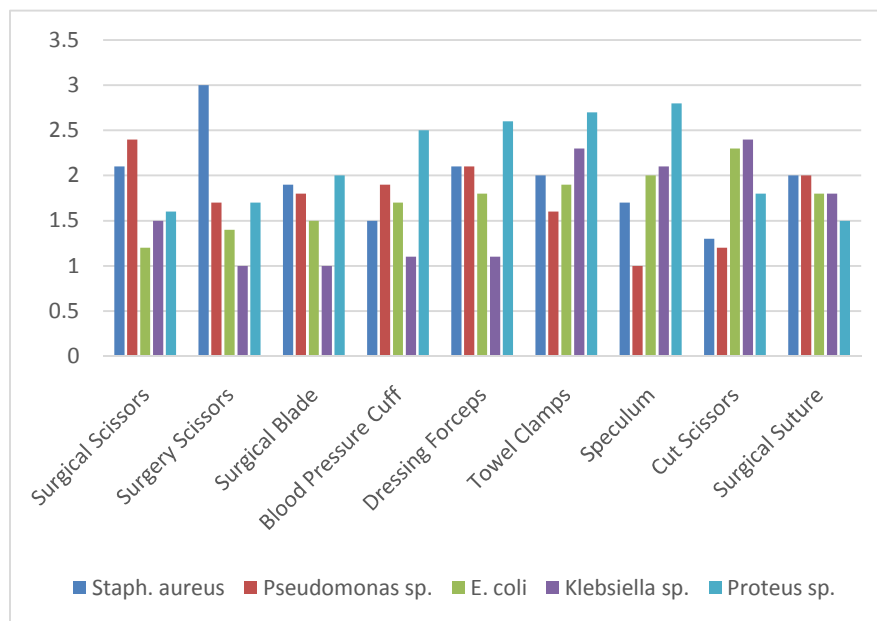
Theatres	<i>Staphylococcus aureus</i>	<i>Pseudomonas</i> sp.	<i>E.coli</i>	<i>Klebsiella</i> sp.	<i>Proteus</i> sp.	Total
<b>Main Surgical theater</b>	7.0 x 10 <sup>4</sup> CFU/ml	5.9 x 10 <sup>4</sup> CFU/ml	4.1 x 10 <sup>4</sup> CFU/ml	3.5 x 10 <sup>4</sup> CFU/ml	5.3 x 10 <sup>4</sup> CFU/ml	25.8 x 10 <sup>4</sup> CFU/ml
<b>Casualty Ward</b>	5.6 x 10 <sup>4</sup> CFU/ml	5.6 x 10 <sup>4</sup> CFU/ml	5.4 x 10 <sup>4</sup> CFU/ml	4.5 x 10 <sup>4</sup> CFU/ml	7.8 x 10 <sup>4</sup> CFU/ml	28.9 x 10 <sup>4</sup> CFU/ml
<b>Modelling Theatre</b>	5.0 x 10 <sup>4</sup> CFU/ml	4.2 x 10 <sup>4</sup> CFU/ml	6.1 x 10 <sup>4</sup> CFU/ml	6.1 x 10 <sup>4</sup> CFU/ml	6.1 x 10 <sup>4</sup> CFU/ml	26.7 x 10 <sup>4</sup> CFU/ml
<b>Total</b>	17.6 x 10 <sup>4</sup> CFU/ml	15.7 x 10 <sup>4</sup> CFU/ml	15.6 x 10 <sup>4</sup> CFU/ml	13.3 x 10 <sup>4</sup> CFU/ml	19.2 x 10 <sup>4</sup> CFU/ml	81.4 CFU/ml

**KEY:CFU – Colony Forming Unit**

The total heterotrophic counts of organisms in the main surgical theatre is 25.8 x 10<sup>4</sup> CFU/ml, casualty ward, 28.9 x 10<sup>4</sup> CFU/ml while in modelling theatre, 26.7 x 10<sup>4</sup> CFU/ml as shown in figure 2.

isolated, in Surgical Blade 17 were isolated, in Blood Pressure 16 were isolated, in Dressing Forceps 18 were isolated, in Towel Clamps 11 were isolated, in Speculum 17 were isolated, in Cut Scissors 13 were isolated, in Surgical Suture 16 were isolated as shown in table 2.

The distribution of isolated organisms in Surgical Scissors totaled 13, Surgery Scissors, 16 were



**Figure 2: Distribution of Heterotrophic Bacteria Count**

**TABLE 2** Shows the Distribution of isolated organisms according to sample sites.

<b>Bacteria</b>	Surgical Scissors (%)	Surgery Scissors (%)	Surgical Blade (%)	Blood Pressure Cuff (%)	Dressing Forceps (%)	Towel Clamps (%)	Speculum (%)	Cut Scissors (%)	Surgical Suture (%)
<i>Staphylococcus aureus</i>	5(38.4)	5(31.2)	4(23.5)	6(37.5)	5(27.8)	4(36.4)	5(29.4)	3(23.1)	5(31.2)
<i>Pseudomonas</i> sp.	3(23.1)	3(18.8)	5(29.4)	4(25)	7(38.9)	2(18.2)	5(29.4)	2(15.3)	-(0)
<i>E.coli</i>	2(15.4)	3(18.8)	- (0)	3(18.8)	3(16.7)	3(27.2)	2 (11.8)	3(23.1)	4(25.0)
<i>Klebsiella</i> sp.	3(23.1)	3(18.8)	2(11.8)	2(12.5)	2(11.0)	2(18.2)	3(17.6)	4(30.8)	3(18.0)
<i>Proteus</i> sp.	-(0)	2(12.5)	6(35.3)	1(6.2)	1(5.6)	-(0)	2(11.8)	1(7.7)	4(25.0)
<b>Total</b>	<b>13 (100)</b>	<b>16(100)</b>	<b>17 (100)</b>	<b>16 (100)</b>	<b>18 (100)</b>	<b>11(100)</b>	<b>17 (100)</b>	<b>13(100)</b>	<b>16 (100)</b>

## Discussion

From the study, the presence of pathogenic organisms were found on the surfaces of unsterilized equipment used in the theatre, such equipment include: surgical scissors, dressing forceps, blood pressure cuff, towel clamp, surgical suture, cut scissors, speculum, surgical blade, surgery scissors which were mainly found in main surgical theatre, casualty ward theatre and modeling theatre.

These organisms that were found on these equipment are domiciled in the theatre and can be agent of transfer of nosocomial pathogen.

Studies have also shown that organisms like *Escherichia coli*, *Pseudomonas* sp., *Proteus* sp., *Staph. aureus*, *Klebsiella* sp., which are potential pathogens can be transmitted from surfaces of unsterilized instrument to medical personnel and patients in the theatres. These occur when instruments are used unknowingly by personnel on patients or when these pathogens are not adequately removed by routine room cleaning, sterilization and disinfecting surgical surfaces and medical devices. This agrees with the study conducted by<sup>(8)</sup>.

Similarly, the presence of pathogenic organisms were not found on the surface of sterilized medical instruments as stated above. This of course should be encouraged at all times by the staff that work in the theatre.

The highest mean heterotrophic count was from modeling and casualty theatres. *Proteus* shows the highest percentage of the isolated organisms in the theatre wards and it can be caused by cross infections in hospitals. *Pseudomonas* is a recalcitrant organism and it can cause wound and Otitis media, and skin infections especially at burn sites.

*Staphylococcus aureus* is a common cause of skin infections such as abscesses, respiratory infections such as sinusitis and food poisoning. *Klebsiella* sp. has the lowest percentage of the isolated organisms in the theatre wards.

*E.coli* is the chief organisms implicated in urinary tract infection (U.T.I) and as such should be avoided by all means as discovered by Robert and Jonathan (2005).

All these organisms are potential pathogens within the hospital environment. It should also be pointed out that microorganisms that cause bloodstream infection are implicated in this study. According to<sup>(9)</sup> nosocomial blood stream infections is a serious health problem and are associated to high morbidity and mortality, which results in increasing healthcare cost.

*Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Proteus* sp., are organisms discovered by<sup>(10)</sup> as the being responsible for causing surgical sites infection and each one can on their own be implicated in hospital setting.



*Proteus* sp., and *Escherichia* sp., discovered in this study were responsible for postoperative infection.

### Conclusion

Surgical site infections are most common nosocomial infection accounting for 38% of nosocomial infection and as such all surgical instruments used in hospital theatres should be sterilized, because if unsterilized instruments are used, the surgical teams may be introducing pathogens intopatients which might cause harm to the patients, even more to themselves.

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