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Original Research Article

Detection of Bacterial Contaminants from Operating Theatres at Hospitals in Shendi City, Sudan

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Abstract: ***Background*:** Operating room contamination is recognized as one of the most common life-threatening microbial contaminations in hospital environments, especially operating rooms and other specialty units, and is an ever-increasing cause of nosocomial infections. ***Objective:*** The purpose of this study was to isolate and identify bacterial contaminants in Shendi hospital operating room. Between July-September 2021. ***Materials and Methods***: Sixty samples were collected from various locations in the operating room and all isolated bacteria were identified. The study isolated five types of bacteria from the Shendi Hospital operating room. ***Results:*** The results showed that Micrococcus was the most common bacterial contaminant isolated from the operating room. *Leteus* 21 (32.3%) *Staphylococci. Epidermis* 16 (24.6%), *Staphylococci aureus* 11 (16.9%), Bacillus sp. 9 (13.8%), *Bacillus cereus* 8 (12.3%)) and the lowest contaminants were isolated from soil 15 (23%), and focus lamp 5 (7.7%). This study may point to the fact that the Shendi Hospital operating room had bacterial contamination that could lead to postoperative wound infections (SSI). Reasons for contamination may be due to excessive attendance, personnel movement, and ineffective sterilization and disinfection procedures. ***Conclusions:*** Bacterial contamination was highest in operating room beds, followed by carts, floors, and focused lambs. *Micrococcus spp*, *S. epidermidis*, *S. aureus*, and Bacillus species have proven to be the most serious contaminants in the operating room, and are a dangerous cause of hospital-acquired infections, killing patients and hospital staff threatening. This may indicate that the sterilization method is not efficient enough, putting the patient at risk for postoperative infection. Some organisms were resistant to Gentamicin and highly sensitive to Imipenem, Ciprofloxacin, and Ceftriaxone.

Keywords: Operating Room, Nosocomial Infections, Leteus, Shendi, Sudan**.**

INTRODUCTION

Nosocomial infections (also known as nosocomial/acquired infections) are infections that occur while the patient is hospitalized or in other clinical settings that were not present at the time of admission. The hospital environment is a potential reservoir for bacterial pathogens as it houses both patients with a variety of pathogenic organisms and large numbers of susceptible individuals with compromised immune systems. The increasing frequency of bacterial pathogens in the hospital environment is associated with an increasing background of different types of nosocomial infections [1]. Of particular importance for nosocomial infections are bacterial pathogens that survive for long periods in the hospital environment and resist disinfection [1]. Bacterial pathogens isolated from hospital environments are also known to develop resistance to some antimicrobial agents. The emergence of multidrug-resistant bacteria in hospitals has made the treatment of nosocomial infections difficult. Despite advances in modern medicine, nosocomial infections

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still increase the risk of patient morbidity and mortality, in which the hospital environment may play an important role. Therefore, it is important to identify environmental surfaces that are rich in bacteria and may harbor pathogens [1]. Microbial contamination of the hospital environment, especially the operating room, has further increased the prevalence of nosocomial infections. This results in high patient morbidity and mortality [2]. Surgical site infection (SSIs) after caesarean delivery is a common complication that affects 2.5% to 16% of women and is linked to a considerable increase in maternal morbidity, hospital stay, expenses, and psychological stress for new parents [3]. Microbial contamination in the operating room can come from a variety of sources, including frequent movement of the surgical and medical teams, movement within the theatre, a large human population, particularly theatre staff and medical students, theatre gowns, foot wares, wound drainage, and patient transportation. All of these factors contribute to polluting the operating room and, as a result, causing post-operative infection [4]. The lack of a microbiologically safe environment in the operating room causes a delay in recovery and is linked to SSIs [5]. Regular cleaning in accordance with institutionalized infection control measures can reduce the risk of contamination and prevent hospital-acquired infections (HAI), lowering the morbidity and mortality associated with HAI [6].

MATERIALS AND METHODS

Study Design

This was analytical and cross-sectional study.

Study Area

The study was conducted in the Nile State of Shendi Village, Sudan. Shendi is a city in northern Sudan on the eastern bank of the Nile River, 150 km northeast of Khartoum (16°41'N, 33°25'E).

Study Duration

This study was carried out during the period from July to September 2021.

Sample Size

Sixty swabs samples were collected from certain sites in operating theaters including beds, trolleys, floors, and focusing lamps.

Collection of Samples

Cotton-tipped swabs moistened with sterile peptone water were used to swab Different sites in the operating theaters.

Isolation

The swabs were directly inoculated on blood agar and MacConkey's agar near benzene burner. The pairs of inoculated media were incubated aerobically at 35-37C for 24 hours and then examined for bacterial growth.

Identification

The colonies which obtained were purified by sub culturing in MacConkey's agar and blood agar. The both inoculated media were incubated aerobically at 37C for 24 hours and then examined.

Ethical Considerations

This study was performed after written approval from the Department of Microbiology, Department of Medical Laboratory Sciences and approval from the Department of Advanced Research and Scientific Research, Shendi University. Specimen collection and processing were performed after ethical approval by hospital administrators. The benefits and results of this study will be published under confidentiality.

Data Analysis

Data were analyzed by using the statistical package for social sciences (SPSS) computer program Version19.

RESULTS

The study was conducted during the period of July to September 2021 in Shendi hospital. The processes of practical were done in the laboratories of Shendi university college of Medical Laboratory Science. A total of sixteen swab samples were collected from different sites including operation room bed, trollyes, floor, and focusing lamp. The selection of sites was based upon the known epidemiology and survival characteristics of the organism. During this Study five types of bacteria were isolated and identified from the 65 isolated bacteria. The most frequently isolated bacteria were *Micrococcus. leteus* (32.3%) *Staphylococcusepidermidis* (24.6%) *Staphylococcus aureus* (16.9%), *bacillus species* (13.8%) and *Bacilluscereus* (12.3%) (Table 1). The total number of contaminated bacteria were collected from Gynecological surgery 40 (61.5%) and pediatric surgery 25(38.5%) (Table 2). The most contaminated site was operation room bed 25(38.5%), Trolly 20(30.8%), floor 15(23.0%) and focusing lamp 5(7.7%) (Table 3). Antimicrobial susceptibility testing was performed on pathogenic isolated bacteria and the result showed that part of pathogenic organisms isolated from operating theaters are resistant to Gentamicin and highly sensitive to Imipenem, Ciprofloxacin and Ceftrixone respectively (Table 4).

Table-1: The frequency of isolated bacteria from operating theaters

Age group	***Frequency***	***Percent %***
Micrococcus luteus	21	32.3%
S. epidermidis	16	24.6%
S. aureus	11	16.9%
Bacillus species	9	13.8%
Bacillus cereus	8	12.3%
Micrococcus luteus	21	32.3%
Total	**65**	**100.0**

Table-2: The Percentage of contamination rate in each operating theaters

Operating theaters	***No***	***Type of isolated bacteria***
Gynecological surgery	40(61.5%)	*Micrococcusleuteus* 15(37.5%) *Staphylococcusepidermidis* 12(30%) *Staphylococcusaureus* 9(22.5%) *Bacillusspecies* 4(10%)
Pediatric surgery	25(38.5%)	*Bacilluscereus* 8(32%) *Micrococcusleuteus* 6(24%) *Bacillusspecies* 5(20%) *Staphylococcusepidermidis* 4(16%) *Staphylococcusaureus* 2(8%)

Table-3: Frequency of isolated bacteria according to the site of collection

Site of sample	***No***	***Type of isolated bacteria***
Operation room bed	25(38.5%)	*Micrococcusleuteus* 15(60%) *Staphylococcusaureus* 6(24%) *Bacilluscereus* 4(16%)
Trolly	20(30.8%)	*Staphylococcusaureus* 5(25%) *Bacillusspecies* 5(25%) *Bacilluscereus* 4(20%) *Bacillusepidermidis* 4(20%) *Micrococcusleuteus* 2(10%)
Floor	15(23%)	*Staphylococcusepidermidis* 9(60%) *Bacillusspecies* 4(27%) *Micrococcusleuteus* 2(13%)
Focusing lamb	5(7.7%)	*Staphylococcusepidermidis* 3(60%) *Micrococcusleuteus* 2(40%)

Table-4: Antimicrobial susceptibility test for bacteria isolated from operating theater

Isolate	**CN**	**IPM**	**CRO**	**CIP**
Micrococcus luteus	90%	100%	95%	90%
Staphylococcus epidermidis	62.5%	100%	75%	100%
S. aureus	72.7%	100%	100%	100%
Bacillus species	77.8%	100%	100%	100%
Bacillus cereus	75%	100%	62.5%	100%

DISCUSSION

This study isolates bacterial contaminants from the operating room. The total number of contaminated bacteria in swab specimens taken from gynecological surgeries was 40 (61.5%) and 25 (38.5%) from pediatric surgeries. The most contaminated locations in the operating room were operating tables 25 (38.5%), followed by trolleys 20 (30.8%), floors 15 (23.0%), and light collectors 5 (7.7%). All of these locations have increased patient contact with staff working in the operating room and caring for patients. In this study, *Micrococcus luteus* (32.3%) was the most frequently isolated, followed by *Staphylococcus epidermidis* (24.6%), *Staphylococcus aureus* (16.9%), *Bacillus species* (13.8%) and *Bacillus cereus* (12.3%). Similar studies has reported different rate, such as study conducted by Babbiker M. Tahe and his colleagues in West Kordofan State in EnNahud City-Sudan, which founded: The most prevalent bacterial pollutants identified from operation theaters were *Staphylococcus aureus* 24 (53.3%), *Pseudomonas aeruginosa* 13 (28.8%), *Bacillus spp* 6 (13.3%), *Proteus spp* 1(2.2%), and *Salmonella spp 1* (2.2%) [7]. Also a recent study carried out by Hassan and Maab in Operating Theater of Wad Medani Teaching Hospital, Gezira State, Sudan (2020) The study result is the frequency of bacterial

contamination in operating theater was 38.0%, the most common isolated pathogen was *Staphylococcus aureus*, followed by *Escherichia coli* and *Pseudomonas aeruginosa*. The *S. aureus, E.coli* and *P. aeruginosa* were detected at the percentage 57.9%, 21.05% and 21.05% respectively [8]. A recent study by Ensayef in (2009) reported in Baghdad that the most common bacterial contaminants in operating rooms in 2002 were coliforms as Gram-negative bacteria and *Staphylococcus epidermidis* as the predominant Gram-positive bacteria. The prevalence of *S. epidermidis* was 8.3% and that of coliforms was 62.5% [9]. The results were not those of Sepherhri and her co-workers in (2009) reported that in Iran: the main contamination was *S. epidermidis*, accounting for approximately 77% of bacterial contamination, followed by *S. aureus* at 12.5% and *Klebsiella* at 2.1%. In this study, Bacillus sp. and Micrococcus spp. isolated and not reported in previous studies. The discrepancy between the results obtained in our study and previous results was unknown but may be due to the sample size used by previous researchers. Also, personal hygiene, safety, cleaning methods, patient social level, surgical ventilation, sterilization methods, surgical techniques, and availability of antimicrobial prophylaxis. Antimicrobial susceptibility testing was performed on the isolated pathogenic bacteria, and as a result, some of the pathogenic organisms isolated from the operating room were resistant to Gentamicin, Imipenem, Ciprofloxacin, and Ceftriaxone. Each was shown to be highly sensitive to on.

CONCLUSION

Bacterial contamination was highest in operating room beds, followed by carts, floors, and focused lambs. Micrococcusspp, *S. epidermidis*, *S. aureus*, and Bacillus species have proven to be the most serious contaminants in the operating room, and are a dangerous cause of nosocomial infections, which can kill patients and hospital staff threatening. This may indicate that the sterilization method is not efficient enough, putting the patient at risk for post- operative infection. Some organisms were resistant to Gentamicin and highly sensitive to Imipenem, Ciprofloxacin, and Ceftriaxone.

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CONFLICT OF INTEREST

The author has declared that no competing interests exist.

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