Isolation of Bacterial Contaminants from Operating Theatres in EnNahud city, West Kordofan state - Sudan

ABSTRACT

Background: The prevalence of nosocomial infections has continued to rise due to microbial contamination of the hospital environment. Operating room contamination, on the other hand, is one of the most common and life-threatening sources of nosocomial infections.

Objective: The goal of this research is to isolate and identify bacterial contaminants in operating rooms and equipment in EnNahud, West Kordofan.

Methods: From September to December 2020, 45 samples (from three hospitals) were gathered from various operating theatre locations. All isolated microorganisms were identified using normal microbiological procedures.

Result: Five kinds of bacteria were recovered from the 45 (100%) positive specimens in three hospitals in this study. The number of polluted hospitals is on the rise (100 %). 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%), according to the findings (2.2 %). All of the places where samples were taken were found to be completely contaminated.

Conclusion: The relatively high degree of bacterial contamination in hospital operating rooms highlights the need for ongoing microbiological surveillance

aimed at detecting bacterial contamination levels and their impact on nosocomial infection early.

Keywords:Bacterial contamination, Operating theaters, Equipment, West Kordofan state,EnNahud city, Sudan.

INTRODUCTION

Theatre contamination is one of the most common sources of nosocomial diseases that can be fatal [1]. The prevalence of nosocomial infections has continued to rise due to microbial contamination of the hospital environment, particularly in operating rooms and other specialty units [2]. The operating room is only for the anesthetic and surgical teams and should not be utilized for anything else; nonetheless, it is one of the most dangerous locations in the health-care system. As a result, microbial contamination in the operating theatre poses a significant risk of surgical site infections (SSIs) during clean surgery [3].

SSIs, which are one of the most common causes of nosocomial infections, are a common surgical consequence [4]. Surgical site infection 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 [5]. 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 [6].

Hospitals serve as a reservoir for germs, many of which are antibiotic-resistant. Antimicrobial resistance is a global public health disaster, particularly among bacteria that cause nosocomial infections, which has resulted in increased morbidity, death, rising health-care costs as a result of treatment failure, and longer hospital stays [7]. The rate of nosocomial infections among patients in an institution is a measure of the care's quality and safety. The creation of a surveillance system to track this rate is a critical initial step in identifying local issues and priorities, as well as assessing the efficacy of infection control efforts. Surveillance is an efficient way to reduce the number of hospital-acquired illnesses on its own [8].

The lack of a microbiologically safe environment in the operating room causes a delay in recovery and is linked to SSIs [9]. 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 [10].

Main text

MATERIALS AND METHODS

Design of study:

This is a descriptive cross-sectional study carried out to isolate bacterial contaminants in theatres in West Kordufan in EnNuhud City.The study was carried out during the period from September to December 2020.

Specimen collection

After the sterilization process was completed, samples were taken from the target operating theatre. The choice of culture sites is based on the epidemiology and long-term survival of organisms' features. Different samples were collected from various locations in the operating theatre (operation room bed, trolley, floor, focusing lamp, wall, monitor, ventilator, air-conditioning, Dressing drums, cupboard, door, refrigerator, water wash, and the air) by dipping sterile cotton swabs in normal saline and gently swabbing the equipment of interest. The samples were then transferred to the laboratory for bacteriological examination.

Cultivation of the specimensand interpretation of culture growth

All obtained specimens were inoculated on blood agar and incubated aerobically at 370C for 24 hours under aseptic conditions (near Bunsen burner). Any bacterial colonies that grew significantly on the plates were observed. The bacteria were isolated thoroughly before being identified using colony morphology, Gram staining, and biochemical assays.

Data collection and analysis:

Data was collected using a checklist.Then data were entered, check, and analyzed using Microsoft Excel 2007and SPSS (Statistical Package of Social Science) soft program version 11.5.Proportional data were presented as frequencies and percentages.

RESULTS

The research was carried out in West Kordufan, EnNuhud City, from September to December 2020. A total of 45 swab samples from three hospitals were used in this study. The practical processes were carried out in the West Kordofan University's medical laboratory college's laboratories. The operation room bed, trolley, floor, focusing lamp, wall, monitor, ventilator, air-

conditioning, cabinet, door, operation room table, refrigerator, water wash, and the Air were all sample collection sites in the operating theatre.The sites were chosen based on the organisms' known epidemiology and survival properties. Five species of bacteria were recovered and identified from 45 (100 %) positive specimens in three operating rooms during this study. Staphylococcus aureus was the most commonly isolated bacteria, with 24 (53.3%), pseudomonas 13 (28.8%), Bacillus 6 (13.3%), proteus spp1 (2.2%), and salmonella 1 (2.2%). (Table1). All of the sites where we were collected were 100% contaminated, including the operating room bed 3(100%), trolley 3(100%), floor 3(100%), focusing lamp 3(100%), wall 3(100%), monitor 3(100%), ventilator 3(100%), air condition 3(100%), dressing drums 3(100%), cupboard 3(100%), door 3(100%), operation room table3(100%), refrigerator 3(100%), water wash 3(100%), and water wash 3((Table 2).

DISCUSSION:

Any hospital's operating rooms should be in a completely sanitary environment. As a result, and obviously, abacterial infection in these operating rooms is extremely harmful to patients and poses a significant risk to healthcare providers. Various microorganisms, primarily bacteria, viruses, fungi, and parasites, are uniquely susceptible to contamination in the accompanying structures of operation theatres. We attempted to isolate bacterial pollutants from the operation room in our research.In this study, the rate of contaminated specimens with bacteria was collected from the operating room bed 3(100%), trolley 3(100%), floor 3(100%), focusing lamp 3(100%), wall 3(100%), monitor 3(100%), ventilator 3(100%), air condition 3(100%), cupboard 3(100%), door 3(100%), operation room table3(100%), refrigerator 3(100%), water wash 3(100%), and air 3(100%). All of these locations have more

patient contact as well as employees that work in the operating room and deal with patients. Staphylococcus aureus 24 (53.3%), pseudomonas 13 (28.8%), Bacillus 6 (13.3%), proteus spp1 (2.2%), and salmonella 1 were the most commonly isolated bacteria (2.2 %).Our findings matched those of Ali SA (2010), who found that Staphylococcus aureus (30.8 %) was the most often isolated bacteria in Sudan [11]. This was in line with a study conducted in India by Kaur and Hans (2007), who found that the most common bacterial contamination in the operating room was Staphylococcus aureus (16%), Coagulase Negative Staphylococcus normal flora, and that the possible contamination source was usually endogenous from patients' normal skin flora or exogenous from surgical staff. Furthermore, the findings contradicted those of an Altom RB, 2013 study conducted in Sudan, which found that Pseudomonas aeruginosa (32.5 %) was the most commonly isolated bacteria [12].Antiseptic solutions were a likely source of contamination for Pseudomonas aeruginosa, which is an opportunistic pathogen that may be found in most damp situations. It also possesses a number of characteristics, including the ability to live and propagate in hospital settings, the acquisition of several virulence determinants, and inherent resistance to routinely used antibiotics and disinfectants. This makes Pseudomonas aeruginosa a prominent nosocomial infection responsible for numerous outbreaks in operating rooms, and the second most common bacteria in our study [13].In this study *Bacillus subtilis* was isolated (13.3 %) which is considered a contaminant. A recent study carried out by Kiranmani and Madhavi, 2016 in operating theatres and intensive care units of a teaching hospital in Telangana in India reported that *Bacillus subtilis* 45% (contaminants) were the most common isolates followed by *Proteus spp (2.2%) and salmonella (2.2%)*were commonly isolated from operating theatre but by low percent**[2]**.

Conclusion:

The rate of bacterial contamination of the target operating theatre in this study was 100%. The most common contaminant species found in the different operating theatres (*S.aureus* and *P. aeruginosa*) had some relation to the kind of operation. This may indicate that sterilization methods are not efficient in our operating theatres and are putting patients at risk of postoperative infections.Implementation of comprehensive infection control programs and surveillance of infections, in hospitals by the infection control committee. Health education of hospital staff, to protect themselves and the patients from the contaminating bacteria, as well as from spreading pathogenic bacteria themselves.

Declaration

Ethics approval and consent to participate

Permission to carry out this study was obtained from the College of Medical Laboratory Science, west Kordufan University and Public Health hospital the Administration.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Limitation

This study was used only conventional culture technique to detect presence or absence of bacterial contamination, in addition the detection of antibiogram may also be valuable which was not don in this study.

List of abbreviations

HAI: hospital-acquired infections.

SSIs: surgical site infections.

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Table-1: Frequency and percentage of isolated organisms.

Isolate	*Frequency*	*Percentage*
S. aureus	24	53.3%
P. aeruginosa	13	28.8%
Bacillus Spp	6	13.3%
Proteus spp	1	2.2%
Salmonellaspp	1	2.2%
Total	**45**	**100%**

Table-2: Frequency of isolated bacteria according to the site of collection.

Site of sample collection	*No*	*Isolated bacteria*
Operation room bed	3(6.6%)	*S. aureus* 2 (8.3%) *P. aeruginosa* 1(7.6%)
Trolley	3(6.6%)	*S. aureus2(8.3%)* *P. aeruginosa* 1(7.6%)
Floor	3(6.6%)	*S. aureus* 2(8.3%) *P. aeruginosa* 1(7.6%)
Focusing lamp	3(6.6%)	*S. aureus* 2(8.3%) *Bacillus spp*1(16.6%)
Wall	3(6.6%)	*S. aureus* 2(8.3%) *P. aeruginosa* 1(7.6%)
Monitor	3(6.6%)	*S. aureus* 2(8.3%) *Salmonella spp*1(100%)
Ventilator	3(6.6%)	*S. aureus* 1(4.2%) *P. aeruginosa*1(7.6%) *Bacillus spp*1(16.6%)
Air condition	3(6.6%)	*S. aureus* 1(4.2%) *P. aeruginosa*1(7.6%) *Bacillus spp*1(16.6%)
Cupboard	3(6.6%)	*S. aureus* 1(4.2%) *P. aeruginosa* 2(15.3%)
Door	3(6.6%)	*S. aureus* 3(12.5%)
Operation room table	3(6.6%)	*S. aureus* 1(4.2%) *P. aeruginosa* 2(15.3%)
Refrigerator	3(6.6%)	*S. aureus2(8.3%)* *Bacillus spp*1(16.6%)
Water wash	3(6.6%)	*S. aureus* 1(4.2%) *P. aeruginosa* 2(15.3%)
Air	3(6.6%)	*S. aureus* (4.2%) *Bacillus spp*2(33.3%)
Dressing drums	3(6.6%)	*S. aureus* 2(8.3%) *Proteus spp*1(100%)
Total	**45(100%)**	