Ministry of Higher Education and Scientific Research

Missan University College of Nursing

The Microbial Contamination of Operating Theatre: A Study at The Alsader Hospital in Missan City

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وزارة التعليم العالي والبحث العلمي
كلية التمريض
جامعة ميسان

تقييم التلوث الميكروبي في صالات العمليات في مستشفى الصدر التعليمي في محافظة ميسان

بحث تخرج مقدم من قبل الطلبة:
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بحث مقدم الى مجلس كلية التمريض جامعة ميسان كجزء من متطلبات نيل شهادة البكالوريوس في علوم التمريض

اشراف
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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

إِنَّمَا يَخْشَى اللَّهَ مِنْ عِبَادِهِ الْعُلَمَاءُ إِنَّ اللَّهَ عَزِيزٌ غَفُورٌ

فاطر: 28

الإهداء

إليك أيها الشباب العراقي الحر

أهدي هذا الجهد

وثمرة هذا العمل

وإن ضئل

وأخص شباب العلم الطامح

لاسيما هذا المجال الإنساني

لنحمل بالعلم بلدنا

وننير الدرب بفكرنا

لأجيالٍ لاحقة..

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Abstract

Background: Microbial contamination of operating theater (OT) is the most frequent cause of nosocomial infections in patients. **Objectives:** This study aimed to evaluate the incidence of bacterial contamination of operating theatres in Alsader Hospital in Missan City. **Materials and Methods:** The sampling procedures that employed in this study was swabbing. Standard microbiological techniques were used for microbiological culture and identification of microbial pathogens. **Results:** the percentage of contamination with bacterial species is 8.3% which the contaminated species are 74 from the total number of species 882 distributed among the following bacteria: staph.epidermids (21.62%) , klebsilla.ssp (13.51%), bacillus (12.16%), pseudomonas.ssp (5.4%), E.coli (8.1%), enteobacter.ssp (37.83%) and fungal(1.35%). **Conclusions:** These findings emphasize the important role of infection control system to prevent the cross-transmission of nosocomial pathogens to cause contamination and infection in the critically ill patients.

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Chapter one
Introduction

1.1. Introduction:

Operating theatres are one of the most complicated and risky work environments. Microbial contamination in the operating theatres increases the risk factors for developing surgical-site infections (SSI). [Spagnolo et al., 2013]

SSI delays wound healing, prolongs hospitalization, increases morbidity, and the overall costs. Some investigators have observed that there is a relationship between the bacterial air load in the operating theatres and the development of postoperative wound sepsis. [Reichman et al., 2009]

The importance of the estimation of the quantity and types of microorganisms are that these values can be used as an index for the cleanliness of the environment as well as an index of risk concerning human health and a source of hospital-acquired infections. [Jaffal et al., 2011]

Multiple risk factors are responsible for microbial contamination of OT. The contaminating pathogens originate from the OT environment, ventilating systems, cleansing, and sterilization, drainage of the wounds, transportation of patients between areas in the hospital, or from shedding by the OT health-care personnel, use of personal protective equipment by the health-care staff, and patient, or from the patient's skin flora. [Magill et al., 2015]

Multiple reservoirs have been reported as being responsible for hospital contamination, particularly the operating theatre, including unfiltered air, ventilation systems, and antiseptic solutions. [Fridkin et al., 2003]

Medical staff still represent an exogenous contaminant source in operating theatres. and personnel move back and forth between the operating theatre and other parts of

the hospital without changing their gowns or slippers. Moreover, patients are not consistently cleaned or shaved before coming to the operating theatre. All these factors play a role in the contamination of operating theatres and consequent post-operative infections. [Siddiqui & Luby, 2004]

1.2. Problem statement:

Assessment of the microbial contamination in the operating theatre include ground of the room, lights, walls, Anesthesia devices, Sterilization solution and Surgical tools.

1.3. Objectives of the study:

This study aims to determine the types of pathogens that cause microbial pollution, and rates of microbial contamination in the operating rooms, reducing the incidence of infection after surgery prevent or at least alleviate the causes of contamination to maintain a high level of cleanliness and safety for both patients and health worker.

1.4. Important of the study

Hospital infections are, even today, one of the main problems of public health. [Magill et al., 2014]

Much importance was given, in recent years, to the contamination of the hospital environment in the onset of these infections. One of the most controversial and debated issues is the qualitative and quantitative role of the environment in the process of patient contamination, in particular the role of adjacent surfaces and furniture. It is known that these surfaces act as reservoirs for microorganisms,

increasing the risk of cross-contamination through direct and/or indirect contact with the patient. [Weber et al., 2013]

Recent studies have focused on the role of hospital environment sanitation processes, establishing a correlation between microbiological contamination of surfaces in direct contact with the patient and Healthcare Associated Infections (HCAI). [Dancer et al., 2009]

The spread of microorganisms is undoubtedly related to the presence of the patients themselves, the latter being the first source of contamination of the environment and especially of all those sites that are closely associated with them, such as the bed, the bedside table, the power supply carriage etc., which are frequently touched ("high-touch surfaces") and easily contaminated. [Huslage et al., 2013]

For many infections of the surgical site, in addition to the patient's endogenous flora, the main source of infection is the contamination of the surgical site with desquamative cells. [Pasquarella et al., 2007]

1.5. Definition of terms:

1.5.1. Microbial contamination:

Theoretical Definition: the non-intended or accidental introduction of infectious material like bacteria, or their toxins and by-products. [Ghiglione et al., 2015]

Operational Definition: the presence of living microorganisms in a specified environment.

1.5.2. Operating theater:

Theoretical Definition: the entire area in which surgical operations are performed and materials are prepared and stored for surgery. [U.S. Army Medical Department Center, 2015]

Operational Definition: is a facility within a hospital where surgical operations are carried out in an aseptic environment.

Chapter two

Literature view

2.1: Microbial contamination health effects:

Microbial contamination of hospital environment, especially the operating theatre had continued to increase prevalence of nosocomial infection [Bhalla et al., 2007]

With resultant effect of high morbidity and mortality rate among patient on admission for post-operative surgery, those in intensive care units with multi-drug resistant strain like methicillin-resistant Staphylococcus aureus (MRSA) and difficulty in infection control. [Zerr et al., 2005]

The clinical implication of bacterial contamination in operating theatre and specialized care units, and overall effect in infection control in hospital setting is enormous on both the patient and the caring medical team. [Okon et al., 2012]

2.2: Source of microbial contamination:

Source of microbial contamination is diverse, from surgical/medical team, movement within the units, theatre gown, foot wares, gloves and hands, drainage of the wounds, transportation of patients and collection bags. The impact of these sources on the degree of bacterial contamination differs, depending on the numbers of bacterial pathogens involved. [Mora, 2001]

2.3. Previous studies:

2.3.1: In 2014 at Erbil city a study by Dlovan M. F. Jalal shows the contamination in the operating theatre of Erbil hospitals, the result was that 48.3% yielded positive microbial growth. The most common isolates were Gram-positive bacteria (83.1%), of which Staphylococcus aureus accounted for 78.6% of bacterial pathogens isolated, followed by Streptococci (33.3%) and Enterococci (28.6%). Whereas lower

rate of Gram-negative bacterial contamination (16.9%) was observed, including Escherichia coli (19%) and each of Pseudomonas aeruginosa and Proteus (4.8%). Air contamination with Aspergillus (19%) and Molds (14.3%) was observed, respectively. The highest rate of microbial contamination was observed in OT rooms (35.6%) where 50% of environmental hygiene practice was detected using infection control practice audit tool. [Dlovan, 2019]

2.3.2. In 2018 at Uganda a study by Matinyi et al., A total of 14 different organisms were isolated with Pseudomonas spp. [23.9%]; Bacillus spp. [17.5%] and Aspergillus spp. [15.8%] being the most common contaminants, respectively. Other isolates included Enterococcus spp., Rhizopus spp. and Coagulate Negative Staphylococcus isolates especially from settle plates. [Matinyi et al., 2018]

Chapter three
Methodology

3.1. Materials:

3.1.1 Swab: is a tuft of sterilized cottonwool rapped round a wire and enclosed in a sterile glass tube used for obtaining a sample. [Marcovitch, 2005]

3.1.2 Cultural medium: A growth medium or culture medium is a solid, liquid, or semi-solid designed to support the growth of a population of microorganisms or cells via the process of cell proliferation. [Madigan & Martinko, 2005]

The cultural medium used in the research are the following:

3.1.2.1 Blood Agar: an enriched base medium to which defibrinated mammalian blood (5%) has been added. [Buxton, 2005]

3.1.2.2 MacConkey agar: is Selective agar for Non-fastidious Gram-negative organisms. [Smith, 2019]

3.1.3. The Vitek 2 Compact system: is uses a fluorogenic methodology for organism identification and a turbidimetric method for susceptibility testing using a 64 well card that is barcoded with information on card type, expiration date, lot number and unique card identification number. Test kits available include ID-GN (gram negative identification), ID-GP (gram positive identification). [Office of Pesticide Programs Microbiology Laboratory, 2016]

3.2. Method:

The study was carried out in the operation theatre of the teaching hospital in Iraq over a period of 4 months (December 2020- March 2021). The hospital routine for sterilization of the operating theatre consisted of high-level disinfection every morning by “quaternary ammonium compound liquid” and surfactant (1%) for floor, lights, walls, also IPC231 and cold sterilant for Anesthesia devices Surgical tools.

Samples were collected in the empty theatre directly after sterilization every Monday morning using cotton-tipped swaps and cultured in blood and MacConkey agar then kept in incubator for 24 hours.

After 24 hours they start to differentiate between microbes as following:

1. any growth on MacConkey agar consider as gram negative because MacConkey agar is Selective agar for Gram-negative bacteria.

2. any growth on blood agar consider as gram positive because blood agar is a selective medium for gram-positive bacteria

3. using Test kits available of Vitek 2 Compact Identification and Susceptibility Testing, Test kits available include ID-GN (gram negative identification), ID-GP (gram positive identification) and it will show the name of microorganism.

Chapter four

Result

4.1. Result

This chapter presents the findings of the data analysis systematically in tables and these correspond with the objectives of the study as follows:

The result of the current study shows that the percentage of contamination with bacterial species is 8.3% which the contaminated species are 74 from the total number of species 882. [Table 4.1]

The contaminated species percentage distributed among the following bacteria: staph.epidermids (21.62%) , klebsilla.ssp (13.51%), bacillus (12.16%), pseudomonas.ssp (5.4%), E.coli (8.1%), enteobacter.ssp (37.83%) and fungal(1.35%). [Table 4.2]

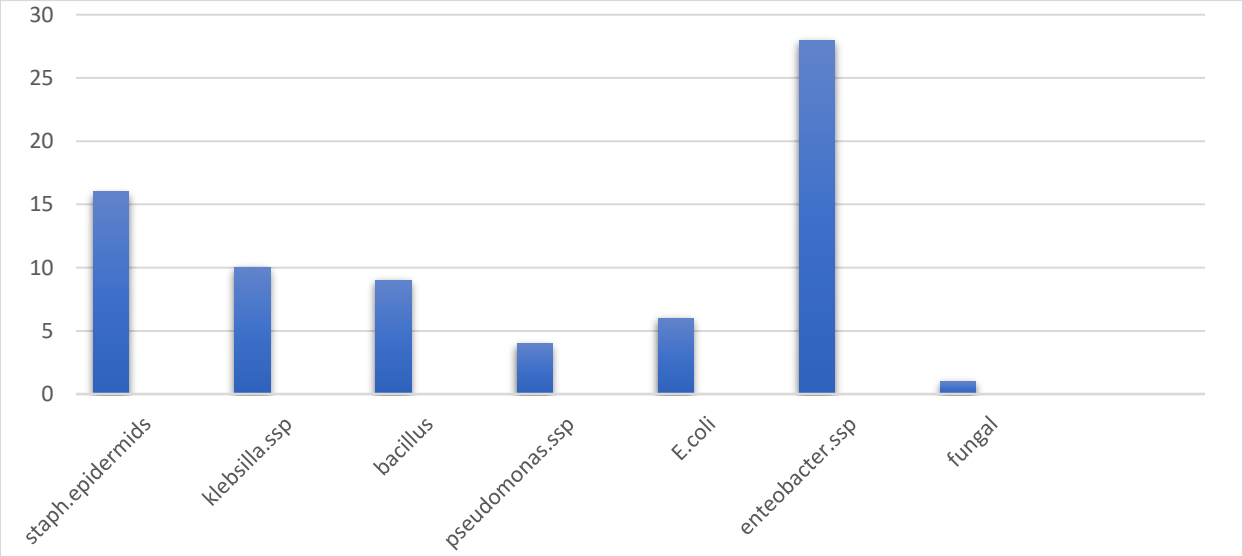
4.1. Bacteria isolated as a proportion of total number of positive cultures:

Total culture	Positive culture	Bacteria isolated	proportion of total number of positive cultures
882	74	staph.epidermids , klebsilla.ssp , bacillus, pseudomonas.ssp , E.coli , enteobacter.ssp and fungal.	8.3%

staph.epidermids = Staphylococcus epidermidis , klebsilla.ssp = Klebsiella species, pseudomonas.ssp = pseudomonas species, E.coli = Escherichia coli , enteobacter.ssp = enteobacter species,

4.2: Distribution of microorganism contamination

n	*Name of microorganism*	*Frequency*	*Percentage*
1.	staph.epidermids	16	21.62%
2.	klebsilla.ssp	10	13.51%
3.	bacillus	9	12.16%
4.	pseudomonas.ssp	4	5.4%
5.	E. coli	5	8.1%
6.	enteobacter.ssp	28	37.83%
7.	fungal	1	1.35%



Chapter five

Discussion

In this study, We observed the percentage of microbial contamination in the operating theatres of Al-Sadr Teaching Hospital and the highest contamination rate was for: enteobacter.ssp (37.83%), followed by staph.epidermids (21.62%), klebsilla.ssp (13.51%) and bacillus (12.16%). Also E. coli (8.1%), pseudomonas.ssp (5.4%) and the lowest microbial contamination rate was fungal (1.35%). The percentage of contamination with bacterial species is 8.3% which the contaminated species are 74 from the total number of species 882.

Our study was, compared with other studies, including an Iraqi study conducted in same hospital and operating theatre in 2020. The number of samples was 688 and the positive results for the bacterial culture where 56 bacterial contamination rate was 8%, distributed as follow: staph. Auruas, staph. Epidermids, enterobacter.Spp, bacillas, pseudomonas.Spp, klebsiella , E. coli.

Another study in Nigeria by Emmanuel 1,800 samples were processed. The following bacterial pathogens were isolated; Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus spp., E. faecalis, Coagulase negative staph and Salmonella choleraesius. The rate of contamination was 25%. [Nwankwo, 2012]

Our study also compared to a study in Ethiopia by Tesfaye et al., 2015. the isolation of coagulase negative Staphylococci 53.5%, S. aureus 33.1%, P. aerugionosa 10.2%, Bacillus Spp. 1.6%, and E. coli 1.6%. [Tesfaye et al., 2015]

Chapter six

Conclusion

&

Recommendations

6.1. Conclusions:

This study reveals that the moderate percentage of bacterial contamination found in the general operating theaters of the target hospitals, both in the pre-operation and post-operation stages, is a serious problem. The data are especially significant because the contaminations were, identified in areas that should be clean and always contain a minimal number of microbes for the safety of the patients and the health workers. The levels of contamination observed in this study carry a high risk for the development of post-operative surgical site infections. These results demonstrate the need for revising the cleansing and scrubbing procedures in our general operating theaters in public and in private hospitals to prevent or at least alleviate the causes of contamination and to maintain a high level of cleanliness and safety for both patients and health workers.

6.2. Recommendations:

- Keep all doors to the operating room closed, except as needed for the passage of equipment, personnel, and the patients.
- Store some sutures and extra instruments in the operating room to decrease the need for people to enter and leave the operating room during a case
- Keep to a minimum the number of people allowed to enter the operating room, especially after an operation has started
- Keep the operating room uncluttered and easy to clean
- Between cases, clean and disinfect the table and instrument surfaces
- At the end of each day, clean the operating room: start at the top and continue to the floor, including all furniture, overhead equipment, and lights; use a liquid disinfectant at a dilution recommended by the manufacturer

- Sterilize all surgical instruments and supplies after use and store them protected and ready for the next use
- Finally, we recommend future studies to investigate the prevalence of anaerobic and fastidious-growing bacteria and other microbial contaminants, such as fungi, in our hospital operating theaters and to expand the study to include other items, such as air samples.

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Appendix

الخلاصة بالعربي:

المقدمة: التلوث الجرثومي لغرفة العمليات (OT) هو السبب الأكثر شيوعا لعدوى المستشفيات في المرضى.

الأهداف: هدفت هذه الدراسة إلى تقييم نسبة التلوث الجرثومي بغرف العمليات في مستشفى الصدر بمدينة ميسان.

منهجية البحث: كانت إجراءات أخذ العينات المستخدمة في هذه الدراسة هي المسح. تم استخدام تقنيات ميكروبيولوجية قياسية للزراعة الميكروبيولوجية وتحديد مسببات الأمراض الميكروبية.

النتائج: بلغت نسبة التلوث بالأنواع البكتيرية 8.3٪ والأنواع الملوثة 74 من مجموع الأنواع 882 موزعة على البكتيريا التالية: العُنقودية البَشْرَوية(٪21.62) ، كليبسيلا(٪13.51) ، العُصَيّات (12.16) ٪ (، الزائفة الزنجارية٪5.4) ، بكتريا قولونية (8.1٪) ، إنتيوباكتير (37.83٪) ، فطريات (1.35٪).

الاستنتاجات: تؤكد هذه النتائج على الدور المهم لنظام مكافحة العدوى في منع انتقال مسببات الأمراض في المستشفيات للتلوث والعدوى في المرضى المصابين بأمراض خطيرة.

إقرار المشرفون

نحن الموقعين ادناه المشرفون على البحث الموسوم (التلوث البكتيري في صالة العمليات في مستشفى الصدر بمحافظة ميسان) وقد تم من قبل الطلاب :

1. مريم فالح حسن
2. تقى علي حسن
3. بيان جميل عبود

وقد تم اجراء البحث تحت اشرافنا

المشرفون:

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NO:

التاريخ: ١١ / ١ / ٢٠٢١
Date:

الى /مستشفى الشهيد الصدر التعليمي

م/ تسهيل مهمة

تحية طيبة

يرجى التفضل بالسماح للطلبة المدرجة اسمائهم في ادناه للمرحلة الرابعة في كليتنا بالدخول الى مستشفاكم وذلك لغرض اكمال بحث التخرج.

مع التقدير ...

الاسماء:

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أ.م. د. رشيد رحيم حتيت
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/ ١ / ٢٠٢١

نسخة منه الى////
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