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Aerobic bacteria isolation from post-caesarean surgical site and their antimicrobial sensitivity pattern in Karbala city, Iraq

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Objectives Surgical site infection represents a noteworthy issue in the surgery field and nosocomial infection, which is associated with expanded healing facility stay, patient suffering, reintervention, increase expenses and use a lot of antibiotic drugs. The latter helps in appearance and spread new strains of bacteria resistant to antibiotics. The contamination of the operating theatre, patients' rooms and the medical and paramedical staff is a major cause of nosocomial infection. The aim of the study is to determine the bacteria isolates from caesarean section wound infections and their antimicrobial susceptibility patterns.

Methods In this study, a cross-sectional survey was guided at the Hospital of Gynecology and Obstetrics and education in the holy city of Karbala-Iraq amid a time of 9 months (February 2014 to October 2014), disease after caesarean section was classified by the purulent. The study included collection 50 swabs from surgical operations patients rooms in the hospital including bed, patient dressing, as well as the nose and hands and the people working in the hospital to determine the sources of the wound infection.

Results A total of 124 wound swabs were collected (75.81%) had given bacteria growth, while the (24.19%) did not give any growth. More than half (57.77%) (mono isolate) while (32.97%) had (two isolations) in addition (9.57%) give more than two bacteria growth. The most commonly isolated bacterial species were *Staphylococcus epidermidis* (31.48%), *Pseudomonas aeruginosa* (18,51%) and *Staphylococcus aureus* (14.81%). And distributed the remaining isolates *Klebsiella pneumonia* (9.25%), *Proteus mirabilis*, *Escherichia coli* (5.55%) for each one. Followed by *Enterococcus faceless*, *Acinetobacter baumannii* and provident state in the rate by (3.7%). The lowest rate (1.85%) where the *Citrobacter youngae*, *Proteus vulgaris*. The results were isolated bacteria from surgical operations, patients' rooms and hospital staff, *S. epidermidis* was the most common isolate (36.5%), *Staphylococcus aureus* 29.25%, *Escherichia coli* 17%, *Enterococcus faeclis* 9.7%, *Pseudomonas aeruginosa* 4.9%, *Proteus mirabilis* 2.4%, All bacterial strains isolated from Surgical site infections (SSI) were submitted to sensitivity testing, results showed various reactions toward different types of antibiotics used in this study.

Conclusions *S. epidermidis* is the most common bacteria isolation from caesarean section wound infections and from hospital environment in Hospital of Gynecology and Obstetrics and education in the holy city of Karbala-Iraq.

Keywords Surgical Site Infections (SSI), caesarean section, bacteria isolation

Introduction

Surgical site infections (SSI) are the most common nosocomial infections in surgical patients. They lead to increased morbidity and mortality and on average double the cost of medical care. Therefore, prevention has become paramount not only to decrease morbidity and mortality, but also to decrease the cost for healthcare. In the last decade, many landmarks studies have been published that decrease the incidence of post-operative surgical site infections.[1]

Post-operative wound infections have been found to pose a major problem in the field of surgery. It may occur as a primary wound infections following surgical operation from sources in the ward or as a secondary wound infection due to some other complications.[2] When death in these surgical patients with nosocomial SSI occurred, 77% of the these deaths were reported as related to the infection and the majority (93%) were serious infections involving organs or spaces accessed during the operation.[3] In fact, most post-operative wound infections are hospital acquired (nosocomial infection) and varies from one hospital to the other.[4] Determinants of infection may be related to the host, microbe, environment, procedure adopted or perioperative antibiotic prophylaxis. Malnutrition and low socioeconomic status further exacerbate the risk of infection in caesarean sections.[5]

Caesarean section carries five to 20-fold increased risk of infection compared to vaginal delivery. Unnecessary caesarean sections should be avoided as they are also associated with an additional potential risk of iatrogenic prematurity. The most common postoperative infections following caesarean section are urinary tract infections, surgical site infections or infections of the pelvic organs.[6]

These costs and the length of hospital stay are undoubtedly lower today for most surgical procedures that are done on an outpatient basis, such as laparoscopic (minimally invasive) operations or those that require only a short postoperative stay. In these cases, most infections are diagnosed and treated in the outpatient clinic or the patient's home. However, major complications such as deep organ, tissue space infections continue to have a grave impact, increasing the duration of hospitalization as much as 20-fold and the cost of hospitalization fivefold.[7] Patients with SSIs had a significantly extended hospital stay, incurred higher costs and increased risk of mortality compared to those without these infections.[8]

Materials and Methods

A cross-sectional study was directed at the Hospital of Gynecology and Obstetrics and education in the holy city of Karbala-Iraq amid a time of nine months (February 2014 to October 2014), An injury, disease after caesarean section was distinguished by purulent release from the entry point with erythematous cellulitis, induration or torment, and verifiable, liquid accumulation noted on ultrasound. Women with stitch

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abscesses, hematomas, or those creating diseases after clinic discharge, were excluded from this study.

The specimens were gathered aseptically on the principal day when ladies gave clinical confirmation of infection (purulent seepage from incision or drain) before the injury was cleaned with antiseptic. Utilizing sterile cotton wool, swabs were acquired from surgical site without polluting with skin commensals and transported to the research center instantly on Amies transport media.[9]

The sample was streaked on Blood agar, MacConkeys, Nutrient agarand Mannitol salt agar (MSA) agar and incubated for 24–48 h at 37°C. Further identification was done depending on colony morphology, Gram's stain and various biochemical tests for identification and speciation. The organisms were grown on agar plates of specimens were identified by standard laboratory methods including bio-typing and API-20, API-staph. (BioMerieux, France), Antimicrobial susceptibility test was performed on Müller-Hinton agar medium (HIMEDIA, India) using disk-diffusion method according to the direction of the Clinical and Laboratory Standards Institute.[10] Briefly, 1–3 similar colonies of the isolates were inoculated on nutrient broth to prepare inoculums; broths were incubated at 37°C for 4 hrs. Turbidity of broths was standardized at 0.5 McFarland using sterile phosphate buffered saline (pH, 7.2). Bacterial suspensions were inoculated on Mueller–Hinton agar plate (HIMEDIA, India) and antibiotic disks (Oxoid, UK), representing antibiotics commonly prescribed in the study area, were placed on the media. After 18–24 h of incubation, the diameter of each inhibition zone was measured using caliper and interpreted as per the standard. All isolated gram- positive and gram-negative aerobic bacteria were tested against.

Results

This study was conducted for a period of 9 months between February-October 2014. A total of 124 patients with clinically suspected post-operative wound infections (caesarean section) were enrolled in the study shows Gram stain morphology in relation to culture results. The bulk of the Gram-stained smears revealed presence of pus cells. A total of 124 wound swabs were collected (94) out of (124) Among these, 76.81% had bacterial growth while 24.19% had no bacterial growth, Gram stain had no bacterial growth on culture, suggesting the possibility of presence of anaerobic organisms from wound infections or dead bacterial cells Table 1.

Table 2 shows the number of bacterial isolates from culture. Among these 76.81% had bacterial growth within 24 h of incubation. More than half (57.44%) had pure bacterial growth (Mono isolate) while the rest had mixed growth. Most specimens (83%) from clean procedure grew bacterial colonies, of which 72% were mono microbial isolates. In contrast more than half (51.5%) of the specimens from contaminated wound had mixed infections More than half (57.44%) had pure bacterial growth (Mono isolate) while (32.97%) the rest had (Two isolation) in addition (9.57%) give more two bacteria growth.

The three most commonly isolated bacterial species (mono isolation) were *Staphylococcus epidermidis* (31.48%), *Pseudomonas aeruginosa* (18.51%) and *Staphylococcus aureus* (14.81%), and distributed the remaining isolates *Klebsiella pneumonia* (9.25%), *Proteus mirabilis*, *Escherichia coli* (5.55%) for each one. Followed by *Enterococcus faeclis*, *Acinetobacter baumannii* and *Providentia stuartii* in the rate of (3.7%), the lowest rate (1.85%) were the *Citrobacter youngae*, *Proteus vulgaris* (Table 3).

Table 1. **Bacteria growth from sample**

Culturing	No. culture	Rate of culture (%)
Growth	94	75.81
No growth	30	24.19
Total	124	100

Table 2. **Type of isolation bacteria**

Isolation	No. of isolation	Rate of isolation (%)
Mono isolation	54	57.44
Two isolation	31	32.97
Mix isolation	9	9.57

Table 3. **Types of isolated bacteria**

Bacteria	No. of isolation	Rate (%)
Staphylococcus epidermidis	17	31.48
Pseudomonas aeruginosa	10	18.51
Staphylococcus aureus	8	14.81
Klebsiella pneumonia	5	9.25
Proteus mirabilis	3	5.55
Escherichia coli	3	5.55
Enterococcus faeclis	2	3.7
Acinetobacter baumannii	2	3.7
Providentia stuartii	2	3.7
Citrobacter youngae	1	1.85
Proteus vulgaris	1	1.85

Were distributed a Two isolation bacteria from the post caesarean section inaction As in the (Table 4) :

Table 4. **Bacteria isolates from culture two isolation culture**

Bacteria	No. isolation	Rate (%)
Pseudomonas aeruginosa + Staphylococcus epidermidis	6	18.75
Klebsiella pneumoniae + Staphylococcus aureus	5	15.62
Pseudomonas aeruginosa + Staphylococcus aureus	4	12.5
Enterococcus faeclis + Staphylococcus epidermidis	3	9.38
Enterococcus faeclis + Escherichia coli	3	9.38
Klebsiella pneumoniae + Staphylococcus epidermidis	3	9.38
Escherichia coli + Staphylococcus epidermidis	2	6.25
Staphylococcus aureus + Staphylococcus epidermidis	2	6.25
Proteus vulgaris + Escherichia coli	1	3.13
Proteus mirabilis + Staphylococcus epidermidis	1	3.13
Staphylococcus aureus + Escherichia coli	1	3.13
Staphylococcus aureus + Enterococcus faecalis	1	3.13

While distributed as Mix isolation bacteria from the post caesarean section intaction As in the (Table 5):

Table 5. **Bacteria isolates from mix isolation culture**

Bacteria	No. of isolation	Rate (%)
Pseudomonas aeruginosa + Staphylococcus aureus + Staphylococcus epidermidis	2	22.22
Staphylococcus epidermidis + Staphylococcus aureus + Escherichia coli	2	22.22
Staphylococcus epidermidis + Klebsiella pneumoniae + Escherichia coli	1	11.11
Enterococcus faeclis + Staphylococcus epidermidis + Escherichia coli	1	11.11
Enterococcus faeclis + Staphylococcus aureus + Staphylococcus epidermidis	1	11.11
Klebsiella pneumoniae + Pseudomonas aeruginosa + Enterococcus faeclis	1	11.11
Staphylococcus epidermidis + Staphylococcus aureus + Proteus mirabilis	1	11.11

As for the sources of infection for wounds after surgical operations (caesarean section), the study showed the contamination of surgical operations, patients rooms in the hospital including bed, patient dressing, as well as the nose and hands and the management of patients and people working in the hospital. *S. epidermidis* was the most common isolate (36.5%), followed by, *Staphylococcus aureus* 29.25%, *Escherichia coli* 17%, *E. faeclis* 9.7%, *P. aeruginosa* 4.9%, *Proteus mirabilis* 2.4%.

Table 6. **Bacteria isolated from surgical operations, patients rooms in the hospital including bed, bed, patient dressing**

Bacterial isolates	No. of isolation	Rateb (%)
Staphylococcus epidermidis	15	36.5
Staphylococcus aureus	12	29.25
Escherichia coli	7	17
Enterococcus faeclis	4	9.7
Pseudomonas aeruginosa	2	4.9
Proteus mirabilis	1	2.4
Total	50	
positive cultures	41	

Table 7. **Antimicrobial resistance pattern of isolated bacteria**

Antibiotics	Gram positive bacteria (%)	Gram negative bacteria (%)
Ampicillin	66	85
Amoxycillin/Clavulanic acid	71	83
Ceftriaxone	45	77
Gentamycin	47	55
Cefotaxime	38	85
Ciprofloxacin	44	42

Discussion

In this study, *S. pidermidis* (31.48%) was the predominant organism isolated from the surgical sites followed by *P. aeruginosa* (18.51%), *Staphylococcus aureus* (14.81%), *Klebsiella pneumonia* (9.25%), *Proteus mirabilis*, *Escherichia coli* (5.55%), *E. coli*, *Acinetobacter baumannii*, *providentia stuartii* (3.7%), *Citrobacter youngae, Proteus vulgaris* (1.85%). The rate of surgical site infection after cesarean section run from 3% to 15%, contingent upon the reconnaissance techniques used to distinguish diseases, the patient populace, and the utilization of antibiotic prophylaxis.[11,12]

The data of the current study is consistent with a previously reported result. *S. pidermidis* is the main cause of postoperative infection (cardiovascular) and is also part of the natural plant. Normal flora for the skin, and its extensions such as hair and mucous membranes.[13] In these cases, the contaminate source is usually endogenously from normal skin flora of patients or exogenously from surgical staff, especially as *S. epidermidis* was the main infectious agent in the fracture operating theatre.[14] In another study, the most common bacteria causing SSI is *Staphylococcus aureus* followed by *P. aeruginosa*, *E. coli* and *Klebsiella*. Gram negative bacteria are more common than Gram positive bacteria.[15] The gram positive *Staphylococcus aureus* could be due to its commensal nature in skin, also a common carrier in hands and nares of healthcare workers. *Pseudomonas* is also a highly resistant and hardier organism having the capabilities to grow even in hospital disinfectants. *E. coli* and *Klebsiella* are commensals in GIT. Many studies have reported *Staphylococcus aureus* as the commonest isolate from the postoperative wound infection.[16]

Some significant elements that can impact the rate of consequent contamination are surgical techniques, skin arrangements, timing and technique for wound conclusion and antibiotic prophylaxis after specific types of surgery. The major classification of operative wounds in light of level of microbial contamination are clean injury, clean contaminated injury, sullied wound and filthy or contaminated injury.[17]

Caesarean section conveys 5–20 crease expanded danger of infection contrasted with vaginal delivery. Unnecessary caesarean sections ought to be avoided as they are likewise connected with an extra potential danger of iatrogenic rashness. The most widely recognized postoperative diseases taking after cesarean segment are urinary tract infections, surgical site infections or diseases of the pelvic organs.[18]

The results of bacterial isolation also observed the presence of two types of bacteria, or more in the wards of wounds where the positive bacteria and negative to the color of Karam and this was agreed with what he confirmed.[19]

The various microbes are found in multiple polymericbial communities and are usually at the edges of wounds and usually include positive and negative Gram-positive bacteria. Synergy occurs when a group of bacteria causes pathogenic lesions that cannot be caused by each individual germ. This study showed that the Gram-negative bacteria causing the most frequent wounds are intestinal germs, *P. aeruginosa*, and this is confirmed by the results of the researchers.[20] They indicated the presence of *E. coli* bacteria with *C. youngae* in the wounds of wounds. This study showed that the most frequent gastrointestinal bacteria in postoperative wounds were *E. coli*, which is consistent with.[21]

The study also found that *E. faecalis*, *S. epidermidis*, were the causes of wound incisions, and this is what the researchers found.[20] It is known that microorganisms have many ways in which they can gain access to the wound by direct contact with the methods of transmission of pollutants from equipment and hands of the team, air diffusion or through self-contamination in the transfer of contaminants from the patient's skin or gastrointestinal tract.[22]

The present study showed that the presence of *P. mirabilis* in the wound cavities is higher than *P. vulgaris*. This result is consistent with which confirmed that *P. mirabilis* is responsible for 90–70% of human infections. *P. vulgaris* is responsible for 88–15% of cases of rheumatism as a result of burns and wounds, causing tissue death and infection.[23] The result of isolation also showed the presence of *C. youngae*, a natural plant found in the human intestines naturally. The opportunistic bacteria, which cause inflammation of the wounds and abscesses.[24]

This study has shown that the bacteria isolated from the operating theaters, patient rooms, tools, hands and noses of workers and patients and their discharge are the same that caused contamination of wounds after operations; because the sources of contamination are internal sources Endogenous or contamination of the wound from the same patient or external sources Exogenous, The infection of the operating theaters and the lobbies, or direct contact with the infected germs of the wounds.[25] where the bacteria can be transmitted from the wound of a patient in the hospital to another, and bacteria may be able to enter the wound during the change of dressings, the patient should not remain in hospital for a long time.[26] In these cases the taint source is typically endogenously from ordinary skin flora of patients or exogenously from surgical staff, particularly as *S. epidermidis* was the main irresistible specialist in the crack operating theater, which is similar to a previously reported result by[27] followed by, *Staphylococcus aureus*, *E. coli*, *E. faeclis*, *P. aeruginosa*, *Proteus mirabilis*. The outcomes show that 3 components should be considered. In the first place, some bacterial strains for example, *S. aureus*, *S. epidermidis*, *E. coli* and *P. aeruginosa* have a more propensity to bring about sullying, particularly in operating room, so broad disease control practices are important to counteract or contain these pathogens, the social level of approaching patients mirrors the individual patient hazard and careful consideration regarding the theater operating condition is critical.[28]

Conclusion

There was predominance bacteria from contamination wound after caesarean section were *S. epidermidis* Followed by *P. aeruginosa* and *Staphylococcus aureus*. while *S. epidermidis* was the most common bacteria isolate from surgical operations, patients' rooms and people working in the hospital.

Recommendation

Cautious thoughtfulness regarding the theater working condition is vital, particularly to keep away from airborne transmission of microorganisms and transmitted to the water supply and nourishment; surgical ability and theater teach are basic segments against surgical sepsis. Perform routine culture whenever SSIs is suspected; use antimicrobial sensitivity test results to guide choice of antibiotics. Conduct large study to to isolate large number of isolates including anaerobic bacteria, establish the magnitude of SSIs due to antimicrobial resistant pathogens and identifying relevant gene responsible for antibiotics resistance. Establish continuous surveillance to monitor antimicrobial susceptibility pattern of the common isolates found in SSI.

The patient should be prepared for operation and fitting skin antiseptic should be used on the operation sites; the patient should also be considered for preoperative antibiotic prophylaxis. Bowel preparation, if appropriate, should be carried out.

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