

Assessment of Antimicrobial Sensitivity of Bacterial Pathogens Isolated from Post-Cesarean Surgical Site Infection of Patients in Al-Elwiyah Maternity Hospital

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Abstract

Background: Cesarean section is the most frequent surgical procedure in obstetrics. Surgical site infection is one of the most common post-cesarean complications. **Objective:** Assessment of sensitivity of common bacterial pathogens in surgical site infection to some of the clinically used antimicrobials. **Patients and methods:** this study was conducted in Al-Elwiyah maternity hospital for the whole year 2016. Sixty in- and outpatients presented complaining of post cesarean surgical site infection signs and symptoms were subjected to wound swab for culture and sensitivity to identify the causative bacteria and evaluate their sensitivity to the commonly used antimicrobials. **Results:** thirty-four out of sixty cultures were contaminated. The main isolated bacterial pathogens were staphylococcus aureus (47%), E. coli (23.5%), pseudomonas aeruginosa (11.7%) and others. Antimicrobial sensitivity of Gram positive bacteria (Staphylococcus aureus) was high for vancomycin (100%), amikacin (93.8%) and tobramycin (87%). Gram negative microbes were susceptible for amikacin (100%), vancomycin (100%) and imipenem (100%). **Conclusions:** The major microbial species isolated from infected post-cesarean SSI were S. aureus, E. coli and P. aeruginosa. Their sensitivity to antimicrobials was variable; vancomycin and amikacin have shown the best effect against all isolated species.

Keywords: antimicrobials, cesarean section, surgical site infection, antimicrobial resistance, microbial sensitivity

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INTRODUCTION

Cesarean section is the most common surgical procedure in obstetrics since about 15% of births accounted by this procedure worldwide.^[1,2] Cesarean section includes a major abdominal incision, it carries a prominent risk of surgical site infection (SSI). The single most important risk factor for postpartum maternal infection is cesarean delivery, and women undergoing cesarean section have a 5-20-fold greater risk of infectious complications when

compared with a vaginal delivery. These complications include fever, wound infection, endometritis, bacteraemia, urinary tract infection and other serious infections.^[3]

A surgical site infection is defined as an infection which occurs at the incision / operative site (including drains) within 30 days after surgical operation). Wound infection occurs in about 2-16% of all Cesarean section deliveries.^[4] In Iraq, a study has shown that from 1670

women delivered with elective or emergency CS, about 2.9% of them expressed the signs and symptoms of PCSSI.^[5] Post-cesarean surgical site infection (PCSSI) increases postpartum maternal morbidity eight-folds compared to vaginal delivery.^[6] Surgical site infection (SSI) is considered to be one of the most common hospital associated infections where it accounts for 14-16% of the total healthcare acquired infections.^[2] PCSSI incidence depends on many factors such as antibiotic prophylaxis, length of labor, duration of membranes rupture, duration of internal monitoring, and number of vaginal examinations.^[7] The major microorganism pathogens associated with PCSSI include both gram positive (e.g. staphylococcal and streptococcal strains) and gram negative pathogens (e.g. E. coli, klibsiella, pseudomonas aueruginosa, Enterobacter,..etc).^[8] Objective: Assessment of the sensitivity of the common bacterial pathogens causing PCSSI to some of the clinically used antimicrobials.

PATIENTS AND METHODS

This cross-sectional study was conducted in Al-Elwiyah maternity hospital for the period from January to December 2016. Sixty in- and outpatients complaining of PCSSI signs and symptoms (fever, surgical wound inflammation and discharge, abdominal pain and tenderness) were subjected to wound swab for culture and sensitivity in order to isolate the causative microorganisms and evaluate their sensitivity to the commonly used antimicrobials. The swabs were taken by the obstetrician researchers.

The antibiotic sensitivity test for the clinical isolates was carried out for the samples of patient against number of antibiotic by using disc diffusion method.^[9] Samples were collected by a standard technique in sterile containers and cultured on blood and MacConkey agar media to know if there is growth of bacteria, then incubated aerobically at 37°C for 24 hours and extended up to 48 hours in cases of G-ve. Identification of isolates was done by standard method depending on observation of colony characteristics and antimicrobial sensitivity test was performed by disc diffusion method using Muller-Hinton agar and choose of antibiotic disks according to type of isolated bacteria. If there is growth of bacteria around antibiotics disc in inhibition zone this means that the bacteria are sensitive to this antibiotic and vice versa if there is no growth.

Data were represented as numbers and percentages. Microbial sensitivity was tabulated according to their Gram stain into Gram positive and gram-negative groups. Then, the main microbial species isolated in this study were studied specifically to assess their sensitivity to each of the selected antimicrobials.

RESULTS

Identification of bacterial species associated with PCSSI: In this study seven bacterial species that are most commonly causing PCSSI were isolated. It was found that 26 cultures were sterile (43.3%). The rest 34(56.7%) cultures were contaminated with different types of pathogenic microorganisms. Table 1 below shows these isolated pathogens.

Table 1: percentage of isolated bacterial species.

Type of microorganism	No. of isolates	Percentage (%)
Staph. aureus	16	47.05
E. coli	8	23.5
Pseudomonas aeruginosa	4	11.7
Klebsiella	3	8.8
Proteus	1	2.9
Acinobacter species	1	2.9
enterobacter species	1	2.9
Total	34	100

Bacterial sensitivity towards the used antimicrobials: The results have revealed both microbial sensitivity and resistance toward different antimicrobial drugs. The sensitivity was variable according to the species of microbes. Since the use of antimicrobial disc was determined according to the type of microorganism, drug antimicrobial effects were studied towards the gram positive and gram-negative bacteria independently. Tables 2 and 3 list the sensitivity patterns in each bacterial group.

The main microbial species sensitivity and resistance toward selected antimicrobials: The sensitivity of the main microbial species isolated in this study (staph. aureus, E. coli and pseudomonas aeruginosa) was assessed for specific antimicrobials independently and found that vancomycin produced the highest sensitivity in all microbial species (100%) followed by amikacin which produced 100% sensitivity in gram negative species and 93 % in staph. aureus. Ceftriaxone and piperacillin sensitivity was 100% in pseudomonas species while in E. coli was far lower (42 and 12% respectively). Sensitivity patterns of the major isolated bacterial species toward some of the used antimicrobials are listed in (Table 4) below.

Table 2: Gram positive bacteria sensitivity and resistance towards the used antimicrobials.

Antimicrobial	No. of antimicrobial use (100%)	sensitivity no. (%)	resistance no. (%)
Amikacin	16	15 (93.8%)	1 (6.2%)
Chloramphenicol	16	13 (81.2 %)	3 (0%)
Ciprofloxacin	16	8 (50%)	8 (50%)
Erythromycin	16	8 (50%)	8 (50%)
Gentamycin	16	13 (81.2 %)	3 (18.8%)
Penicillin	16	1(6.2%)	15 (93.8%)
Tobramycin	16	14 (87.5%)	2 (0%)
Vancomycin	16	16 (100%)	0 (0%)

Table 3: Gram negative bacteria sensitivity and resistance towards the used antimicrobials.

Antimicrobial	No. of antimicrobial use (100%)	Sensitivity no. (%)	Resistance no. (%)
Amikacin	18	18 (100%)	0 (0%)
Aztreonam	18	5 (28 %)	13 (72%)
Cefotaxime	18	9 (50%)	9 (50%)
Ceftriaxone	18	8 (44.4%)	10 (55.6%)
Chloramphenicol	18	8 (44.4%)	10 (55.6%)
Ciprofloxacin	18	12 (66.6%)	6 (33.3%)
Gentamycin	18	13 (72 %)	5 (28 %)
Imipenem	18	18(100%)	0 (0%)
Piperacillin	18	6 (33.3%)	12 (66.6%)
Tobramycin	18	13 (72.0%)	5 (28.0%)
Vancomycin	18	18 (100%)	0 (0%)

Table 4: Microbial species sensitivity percentage toward selected antimicrobials.

Antimicrobial drugs	Bacterial sensitivity percentage		
	<i>Staphylococcus Aureus</i>	<i>E. coli</i>	<i>pseudomonas aeruginosa</i>
Amikacin	93.8%	100 %	100%
Ceftriaxone		42%	100%
Ciprofloxacin	50%	34%	62.5%
Gentamycin	81.2%	75%	75 %
Imipenem		100%	100%
Piperacillin		12%	100%
Tobramycin	100%	50%	50%
Vancomycin	100%	100%	100%

DISCUSSION

Bacterial species associated with PCSSI: The microbial pathogens found in this study were similar to the pathogens identified in other studies conducted in different regions of the world.^[4] *Staphylococcus aureus* showed the higher percentage in our study (47 %) followed by *E. coli* (23.5%) and *Pseudomonas aeruginosa* (11.7%) and *Klebsiella* (8.8%). The lowest percentage was for *Proteus*, *Acinobacter* and *Enterobacter* species (2.9%) each. In an Iraqi study 100 PCSSI wound swab cultures revealed the following microbes; *Staphylococcus aureus* (62.4%), *Pseudomonas aeruginosa* (18%), *E. coli* (9.5%) and *Proteus* species (6.4%).^[10] In a cohort study included 14 hospitals in UK it was found that *Staphylococcus aureus* comes at the top of the causative pathogenic microorganism (40.4%). Enterobacteriaceae (*E. coli*, *Proteus*, *Klebsiella* and others) isolated in 13% of cultures, while *Enterobacter* and *Pseudomonas sp.* appeared in 3.9 and 2% respectively.^[11] Another study revealed that in 31.8% *Staphylococcus aureus* was grown, while 13.6% of cultures produced *E. coli*, 6.8% *Pseudomonas* species.^[12]

Bacterial sensitivity towards the used antimicrobials: The highest sensitivity of the gram-positive bacteria (*Staph. aureus*) was against vancomycin (100%) followed by amikacin (93.8%), tobramycin (87.5%), both gentamycin and chloramphenicol (81.2%). *Staphylococcus aureus* bacteria have shown more resistance (50%) toward both ciprofloxacin and erythromycin. while the lowest sensitivity was toward penicillin (6.2%). *Staphylococcus aureus* has long been recognized as an important pathogen in human disease and is the most common cause of nosocomial infections.^[13] Many factors may have contributed to such level of resistance, including misuse of antibiotics by health professionals, unskilled practitioners and lay persons.^[14] *Staphylococcus aureus* is naturally susceptible to virtually every antibiotic that has ever been developed. Resistance is often acquired by horizontal transfer to genes from outside sources, although chromosomal mutation and antibiotic selection are also important.^[15]

Regarding antimicrobial sensitivity of gram negative microorganisms, it was found that amikacin, imipenem and vancomycin were the best (100%). Gentamycin and tobramycin have caused the same antimicrobial sensitivity percentage (72%) followed by ciprofloxacin (66.6%) and third generation cephalosporins cefotaxime (50%) and ceftriaxone (44.4%). Chloramphenicol has

shown (44.4%) and the least piperacillin (33.3%) and aztreonam (28%).

Specific microbial sensitivity toward selected antimicrobials: The major microbial species isolated in this study (*Staphylococcus aureus*, *E. coli* and *P. aeruginosa*) were studied specifically to assess their sensitivity to each of the selected antimicrobials. In this study *Staphylococcus aureus* bacteria has shown an intermediate sensitivity toward ciprofloxacin (50%) and a high sensitivity toward aminoglycosides. In comparison with a Nigerian study, *Staphylococcus aureus* bacteria has shown a low sensitivity toward ciprofloxacin (21.4%) and aminoglycosides in 14.3% of cultures.^[12] This difference can be explained by the continuously changing microbial resistance that is directly related to the rate of antimicrobial prescription in clinical practice for such infections.^[16] In another study conducted in India, staphylococcal sensitivity toward vancomycin was 100% which is the same result found in this study, chloramphenicol 33.3% highly differ from our result (88%) and this high sensitivity may be due to the non-routinely usage of chloramphenicol for such infection in Iraq. Gentamycin 75% compared to 81% in this study.^[17] In an Iraqi study, it was found that Staphylococcal resistance towards gentamycin was 18.88% (81.12% were susceptible).^[18] In another study, low sensitivity was observed toward penicillin (17.8%) and gentamycin (12.3%), while high sensitivity was observed toward vancomycin (95.9%).

High staphylococcal sensitivity against chloramphenicol in Iraq may be due to infrequent prescription of this antibiotic in clinical practice. It has shown that pattern of sensitivity in the gram-negative organisms were mostly towards third generation cephalosporins agents ceftriaxone and cefotaxime (100%) in *Pseudomonas* species Which is compatible with our results (for ceftriaxone 100%), but highly differ in *E. coli* which was shown 42% sensitivity in our study toward ceftriaxone and 100% sensitivity in the Nigerian study.^[12]

Indian study revealed that *E. coli* sensitivity against amikacin was 85.7% compared to 100% in this study, imipenem 100% which is equal to our result. There was some difference in *E. coli* sensitivity against ciprofloxacin 87.5% our result 34%, ceftriaxone 79.8%.^[17] The wide difference in microbial sensitivity is mostly related to the difference in microbial resistance which mostly affected by antimicrobial prescription patterns.^[16] **Conclusions:** The major microbial species isolated from infected post-cesarean surgical site

infection were *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*. Their sensitivity to antimicrobials was variable; vancomycin and amikacin have shown the best effect against all isolated species.

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