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Pattern of Bacteriological Profile of Wound Infections in Caesarean Section and their Anti Biogram; A Study from a Tertiary Care Women and Children Hospital, Puducherry, India

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A B S T R A C T

Wound infection was the common consequence after cesarean section (CS) in pregnant women. High cost burden, longer duration of hospital stay, dissatisfaction of patient, morbidity, and mortality of the pregnant women are the common consequences of surgical site of wound infection. The aim of the present study is to determine the pattern of bacterial pathogens in wounds of Caesarean section in a tertiary care maternity and children hospital and to identify the antibiogram pattern of the bacterial isolates in wound infections of Caesarean section. This is a hospital based retrospective study conducted in the Department of Microbiology in Rajiv Gandhi Government Women and Children Hospital Puducherry, a tertiary care hospital totally 309 wound swabs collected from patients. Out of 309 samples 247 samples were positive for bacterial isolates showing positivity rate of 79.9%. In this study, Staphylococcus aureus (33.6%) was the predominant pathogen isolated which is frequent cause of surgical site infections (n=83). Most common Gram negative bacterial isolates (66.4%) causing wound infection in the present study was *Escherichia coli* (32.7%) followed by *Klebsiella* species (19%), *Pseudomonas* (11%), *Proteus* (1.6%), *Acinetobacter* (0.4%), *Providencia* (0.4%). Regarding antibiogram of *Staphyloccocus aureus*, Amikacin, cefaperazone sulbactum, meropenam, linezolid, vancomycin, gentamycin, cotrimoxazole were highly sensitive. This present study gives an insight of the type of bacterial isolates causing wound infections in caesarean sections and their antibiogram. This will help the clinicians to plan for Empirical therapy.

Introduction

It is estimated that 21.1% of women give birth by Caesarean section worldwide (Bharatam *et al.,* 2015). Around 80% to 90% of women with previous cesarean delivery (CD) are delivered by elective repeat CD (ERCD) in subsequent pregnancy (Betran *et al.,* 2021). With this increasing rate of caesarean delivery, chances of complications also rise. In Bhutan, the rate of cesarean section (CS) is around 18.7% (Dorji *et al.,* 2021). The most common indications for CS are previous CS, fetal distress, prolonged labor, and failed induction (Wagner and Bédard, 2006). Complications of caesarean delivery can be immediate and late with commonest complication being postpartum hemorrhage, sepsis, and wound infection (Endalafer *et al.,* 2011). Surgical site infection is one of the most common problems who undergo caesarean sections inspite of improved infection control practices. It is the most frequently reported nosocomial infections (Messele *et al.,* 2009). Surgical site infections (SSIs) which

account 17% of all health care-associated infections are the second most common HAIs next to urinary tract infections (Rice, 2006).

It leads to increase in treatment cost, length of hospital stay, morbidity and mortality. Knowledge of the causative agents of wound infection has proven to be helpful in the selection of appropriate antimicrobial therapy. Necessary infection control can be undertaken to reduce the infection rates in health institutions (Misic *et al.,* 2014).

The emergence of antibiotic resistance give threats to public health worldwide. Moreover multi drug resistant Gram Negative bacterial isolates are increasingly reported due to irrational use of antibiotics (Iredell *et al.,* 2016). Common organisms causing surgical site infections are *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas*, Candida species (Sway *et al.,* 2019). Therefore, the present study is aimed to evaluate the important causative agents of wound infections and their antibiotic susceptibility pattern. Also this study will help us to identify the burden of bacterial infections in Caesarean wound infections. The data on antibiogram will facilitate to plan effective empirical treatment in wound infections of Caesarean sections. The aim of the present study is to determine the pattern of bacterial pathogens in wounds of Caesarean section in a tertiary care maternity and children hospital and to identify the antibiogram pattern of the bacterial isolates in wound infections of Caesarean section.

Materials and Methods

This is a hospital based retrospective study conducted in the Department of Microbiology in Rajiv Gandhi Government Women and Children Hospital Puducherry, a tertiary care hospital and totally 309 wound swabs collected from patients. Data was collected from the laboratory records from January 2022 to April 2023. Results of all pus culture and wound swabs sent from the wounds of Caesarean section were taken for analysis.

Kirby-Bauer disc diffusion method was used for antimicrobial susceptibility testing. 0.5 McFarland standard suspension from the bacterial isolates was taken as standard for antimicrobial susceptibility testing. Sensitivity pattern was reported as sensitive, intermediate, resistant as per Clinical Laboratory Standards Institute guidelines. (Gelaw *et al.,* 2013)

Cefoxitin disc method was used for screening MRSA. (Giacometti *et al.,* 2000)

Statistical Analysis

The proportion of total culture positive, individual bacterial infections and anti-biogram profile will be expressed as percentage.

Implications

This study will help us to identify the burden of bacterial infections in Caesarean wound infections. The data on anti-biogram will facilitate to plan effective empirical treatment in wound infections of Caesarean sections.

Results and Discussion

Total wound swab samples received in the laboratory during the study period was 309. Out of 309 samples 247 samples were positive for bacterial isolates showing positivity rate of 79.9%.

Microbial profile

In this study, *Staphylococcus aureus* (33.6%) was the predominant pathogen isolated which is frequent cause of surgical site infections (n=83).

Most common Gram negative bacterial isolates (66.4%) causing wound infection in the present study was *Escherichia coli* (32.7%) followed by *Klebsiella* species (19%), *Pseudomonas* (11%), *Proteus* (1.6%), *Acinetobacter* (0.4%), *Providencia* (0.4%).

Acinetobacter was the least common isolated pathogen (0.4%) which was similar to a study by Abhishek Kumar Jain *et al.,* (2022)

Surgical site infection is the third most common type of nosocomial infection that accounts for 14-16% (Dhote and Nagdeo, 2018). Caesarean section has higher risk of postpartum infection than vaginal deliveries (Agboeze *et al.*, 2013).

So it is necessary to identify common pathogens causing surgical site infection in caesarean sections and their antibiogram pattern to have an insight to start empirical therapy.

In the present study the predominant pathogen isolated was *Staphylococcus aureus* (n=83) %. Many studies shows the predominant pathogen causing surgical site infection is *Staphylococcus aureus* (Jido and Garba, 2012). A study by Jain *et al.*, (2022) also showed staphylococcus predominance in post caesarean wound infection. (Kumar Jain *et al.*, 2022)

Common gram negative pathogens isolated were *Escherichia coli*, *Klebsiella Pseudomonas* (Schmitz *et al.*, 1999). The common pathogens isolated in this study were *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* which is similar to the previous study. Least common isolated pathogen was Acinetobacter which is similar to the study by Altaf Bandy *et al.*, (2022).

Regarding antibiogram of *Staphyloccocus aureus*, Amikacin, cefaperazone sulbactum, meropenam, linezolid, vancomycin, gentamycin, cotrimoxazole were highly sensitive. A study done by Thakur *et al.*, (2021) in a tertiary care centre Cattishgarh (India) showed similar pattern. (Thakur *et al.*, 2021)

98.79 % isolates of *Staphyloccocus aureus* were MSSA. In the present study shows low prevalence of MRSA and the isolate was 100 % sensitive to Vancomycin, Linezolid which was similar to a study by Thakur *et al.*, (2021) in which sensitivity pattern was studied in post caesarean wound infections. (Gordana Bogdanović *et al.*, 2022) Cefoxitin disc method was used for screening of MRSA. Low prevalence of MRSA may to due to strict hand hygiene and proper infection control practices followed in this hospital. Moreover caesarean section wounds comes under class 1(clean wounds).This may be also a reason for low prevalence.

Escherichia coli were highly sensitive to amikacin (100%), cefaperazone sulbactum (100%), meropenam (96%), gentamycin (91%), piperacillin tazobactum (87%), ciprofloxacin (85%), levofloxacin (85%) and least sensitive to Cefelexin and Cefuroxime. Similar sensitivity pattern was observed in a study by Gordana Bogdanović *et al.*, (2022).

Klebsiella species showed higher sensitive to Amikacin (100%), ciprofloxacin (93.7%), cefaperazone sulbactum (100%), meropenam (95.8%), ofloxacin (95.8%), Levofloxacin (93.7), piperacillin tazobactum (72.9%), cotrimoxazole (75%) and showed least sensitive to cefelexin (18.7%), cefuroxime (2.08%).

Pseudomonas species were highly sensitive to amikacin (100%), ciprofloxacin (100%), levofloxacin (100%) meropenam (100%), ofloxacin (100%), cefaperazone sulbactum (96%), gentamycin (89%) and all isolates were resistant to cotrimoxazole, cefalexin and cefuroxime which is similar to a study by Garba and Lusa (2012) where 90% of isolates were resistant to co trimoxazole (Garba and Lusa, 2012).

Proteus species were highly sensitive to amikacin (100%), cefaperazone sulbactum (100%), meropenam (100%), gentamycin (100%), piperacillin tazobactum (100%), ciprofloxacin (75%), levofloxacin (100%), ofloxacin (100%). In a study by Mordi *et al.*, (2009) on incidence of *Proteus* species in wound infections and their sensitivity pattern showed similar sensitivity pattern. (Tsai *et al.*, 2007). In the present study tetracyclines and erythromycin sensitivity is not done as compared to that study.

In this study, gram negative isolates were sensitive to aminoglycosides, fluroquinolones, carbapenems and penicillin with beta lactamase inhibitors.

Table.1 List of organisms isolated in numbers

Organisms	No. of isolates
E.coli	81
Klebsiella pneumoniae	48
S. aureus	83
Pseudomonas	29
Proteus	4
Acinetobacter	1
Providencia	1
	247

Table.2 Details of samples screened

Total pus samples screened	**309**
No. of positive culture	247
Positivity rate	79.9

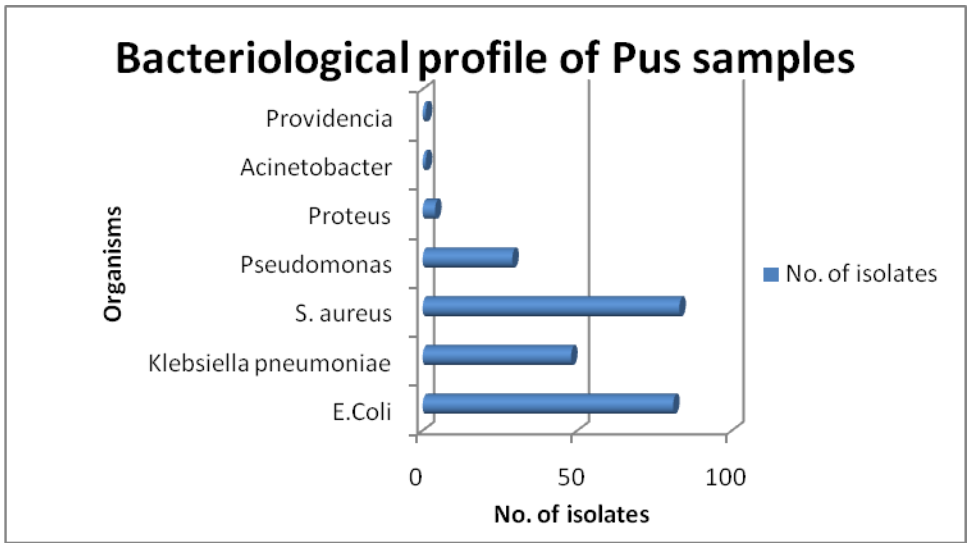
Table.3 Susceptibility pattern of gram negative bacterial isolates

List of Antibiotics	*E.coli* (n-81)	*Klebsiella pneumoniae* (n= 48)	*Pseudomonas* (n = 29)	*Proteus* (n= 4)	Acinetobacter (n=1)	Providencia (n= 1)
Amikacin	100	100	100	100	100	100
Ciprofloxacin	82.71	93.75	100	75	100	100
Cefoperozone sulbactum	100	100	96.55	100	100	100
Co trimoxazole	76.54	75	0	50	100	0
Cefotaxime	58.02	58.33	24.13	75	100	100
Gentamycin	91.35	91.66	89.65	100	100	100
Levofloxacin	85.18	93.75	100	100	100	100
Meropenam	96.29	95.83	100	100	100	100
Ofloxacin	81.48	95.83	100	100	100	100
Piperacillin tazobactum	87.65	72.91	79.31	100	100	0
Cefalexin	3.7	18.75	0	100	0	0
Cefuroxime	3.7	2.08	0	75	0	0

Table.4 Susceptibility pattern of *Staphylococcus aureus*

Antibiotics	*S. aureus* (n=83)
Amikacin	100
Ciprofloxacin	49.39
Cefoperozone sulbactum	100
Co trimoxazole	79.51
Cefotaxime	68.67
Gentamycin	84.33
Levofloxacin	57.83
Meropenam	98.79
Ofloxacin	37.34
Piperacillin tazobactum	49.39
Cefalexin	71.08
Cefuroxime	62.65
Linezolid	98.79
Vancomycin	100
Cefoxitin	98.79

Fig.1 Distribution of bacterial isolates from wound swab



Gram positive isolate (*S.aureus*) was highly sensitive to aminoglycosides, penicillin with beta lactamase inhibitors, Linezolid, Vancomycin.

High sensitivity to aminoglysodes, fluoroquinolones, carbapenams, penicillin with beta lactamase inhibitors may be due to limited use of these antibiotics in this hospital. So while planning empirical therapy for wound infections, aminoglycosides and penicillin with beta lactamase inhibitors may be considered for effective treatment.

This present study gives an insight of the type of bacterial isolates causing wound infections in

caesarean sections and their antibiogram. This will help the clinicians to plan for Empirical therapy.

Conflicts of Interest

Institutional ethical committee clearance was got and the authors report that there is no conflicts of interest in this work.

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