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EFFICACY OF PROPHYLACTIC SINGLE DOSE THIRD GENERATION CEPHALOSPORIN IN LOW-RISK ELECTIVE CESAREAN SECTION AT R.C.S.M. GOVERNMENT MEDICAL COLLEGE, KOLHAPUR.

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ABSTRACT Cesarean section is associated with increased risk of postoperative infectious morbidity, particularly surgical site infection (SSI) and febrile illness. Appropriate antibiotic prophylaxis helps in reducing postoperative infections while minimizing antimicrobial resistance. The present study aimed to determine the incidence of postoperative SSI and febrile morbidity. To evaluate the efficacy of a single preoperative dose of third-generation cephalosporin. Prospective interventional study among 250 low-risk pregnant women undergoing elective c-section received a single intravenous dose of ceftriaxone 1 g administered 30–60 minutes prior skin incision. Postoperative febrile morbidity was observed in 7.2% patients, while SSI occurred in 4.4% patients. Majority of women (95.6%) had satisfactory postoperative recovery and wound healing. Additional antibiotic therapy was required in only 7.6% patients. Single-dose prophylactic ceftriaxone was effective, safe, and economical in preventing postoperative infectious morbidity in low-risk elective cesarean section patients.

KEYWORDS : Cesarean Section, Antibiotic Prophylaxis, Ceftriaxone, Surgical Site Infection.

INTRODUCTION

Cesarean section is one of the most commonly performed obstetric surgical procedures worldwide and has contributed significantly to reduction in maternal and perinatal morbidity and mortality. Over the past few decades, the global rate of cesarean delivery has increased substantially due to rising institutional deliveries, improved fetal monitoring, repeat cesarean sections, and changing obstetric practices. Despite advances in surgical techniques, anesthesia, aseptic precautions, and perioperative care, postoperative infectious morbidity continues to remain an important complication following cesarean delivery.[1,2]

Postoperative infections following cesarean section include surgical site infection (SSI), febrile morbidity, endometritis, urinary tract infection, wound discharge, wound gaping, and sepsis. Among these, surgical site infection is one of the most common complications and contributes significantly to maternal morbidity, prolonged hospitalization, increased healthcare expenditure, delayed recovery, psychological stress, and excessive antibiotic usage.[3] The incidence of SSI following cesarean section varies widely across different healthcare settings and is influenced by factors such as operative duration, obesity, anemia, prolonged labor, rupture of membranes, diabetes, emergency procedures, and inadequate antibiotic prophylaxis.[4,5]

Antibiotic prophylaxis has therefore become an essential component of cesarean section care. Prophylactic antibiotics significantly reduce postoperative infectious morbidity by decreasing bacterial contamination during surgery. Cephalosporins are among the most commonly used antibiotics for prophylaxis because of their broad-spectrum coverage, good tissue penetration, favorable safety profile, and cost-effectiveness.[6] Third-generation cephalosporins such as ceftriaxone provide effective coverage against gram-positive and gram-negative organisms commonly associated with postoperative wound infections.

Traditionally, multiple-dose postoperative antibiotic regimens were commonly administered following cesarean section. However, prolonged postoperative antibiotic administration increases treatment cost, hospital stay, nursing workload, adverse drug reactions, and emergence of antimicrobial resistance. In recent years, several studies have demonstrated that a single preoperative dose of antibiotic administered before skin incision is equally effective in preventing postoperative infections in low-risk cesarean section patients.[7,8] Rational use of antibiotics is especially important in developing countries like India where increasing antimicrobial resistance has become a major public health concern.

Smaill and Grivell, in a Cochrane review evaluating antibiotic prophylaxis in cesarean section, demonstrated significant reduction in postoperative febrile morbidity, endometritis, and wound infection with prophylactic antibiotic use.[9] Tita et al. also emphasized that administration of prophylactic antibiotics before skin incision significantly reduces postoperative infectious morbidity compared to administration after cord clamping.[10] Similarly, Suwal et al. reported that single-dose prophylactic antibiotic regimens were as effective as multiple-dose regimens in preventing postoperative infections following cesarean section.[11] Indian studies by Sharma et al., Ashraf et al., and Patel et al. have also demonstrated favorable postoperative outcomes with single-dose cephalosporin prophylaxis in elective cesarean sections.[12,13,14]

The World Health Organization (WHO) and the American College of Obstetricians and Gynecologists (ACOG) recommend administration of prophylactic antibiotics within 60 minutes prior to skin incision in cesarean delivery to achieve optimal tissue concentration during surgery.[15,16] These recommendations support rational antibiotic use while minimizing unnecessary postoperative antimicrobial exposure.

Cesarean section, though a commonly performed surgical procedure, carries a risk of postoperative infections, especially surgical site infections. To mitigate this risk, antibiotic prophylaxis is routinely employed. Third-generation cephalosporins, known for their broad-spectrum coverage and favorable safety profile, have been considered a suitable choice for prophylaxis. However, limited Indian studies are available evaluating the efficacy of single-dose third-generation cephalosporin prophylaxis specifically among low-risk elective cesarean section patients.

Hence, the present study was undertaken to evaluate the efficacy of a single preoperative dose of third-generation cephalosporin in preventing postoperative infections among low-risk women undergoing elective cesarean section at a tertiary care teaching hospital.

OBJECTIVES

1) To find out incidence of post-operative surgical site infections & febrile illness in low-risk pregnant women undergoing elective caesarean section
2) To study assesses the efficacy of a single preoperative dose of a third-generation cephalosporin in preventing postoperative infections in low-risk pregnant women undergoing elective caesarean section

METHODOLOGY

This prospective interventional study was conducted in the Department of Obstetrics and Gynaecology at R.C.S.M. Government Medical College and C.P.R. Hospital, Kolhapur over a period of one year after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to inclusion in the study.

A total of 250 low-risk pregnant women undergoing elective lower segment cesarean section (LSCS) during the study period were included in the study. Pregnant women aged between 18–45 years undergoing elective cesarean section for indications such as previous LSCS, breech presentation, and twin pregnancy were included. Women with known or suspected cephalosporin hypersensitivity and high-risk pregnancies associated with comorbid conditions such as anemia, diabetes mellitus, hypertension, premature rupture of membranes, prolonged labor, deep transverse arrest, heart disease, retroviral disease, and hepatitis B infection were excluded from the study. Patients unwilling to participate were also excluded.

All participants underwent detailed clinical evaluation and routine preoperative investigations including complete blood count, blood sugar, serum creatinine, thyroid function tests, HIV, HBsAg, and blood grouping. Obstetric history, indication for cesarean section, duration of surgery, intraoperative findings, and postoperative complications were recorded using a predesigned proforma.

All study participants received a single intravenous dose of third-generation cephalosporin (ceftriaxone 1 g) administered 30–60 minutes prior to skin incision as prophylactic antibiotic therapy. Postoperative monitoring included daily assessment for febrile morbidity, surgical site infection, wound discharge, wound gaping, and requirement of additional antibiotic therapy from postoperative day 1 to day 7. Patients were advised to report any symptoms suggestive of infection after discharge. Follow-up evaluation was performed on postoperative day 15 to assess wound healing and identify delayed postoperative complications.

The primary outcome measures were incidence of postoperative surgical site infection and febrile morbidity. Secondary outcome measures included wound complications, duration of hospital stay, requirement of additional antibiotics, and wound healing status at follow-up. Data were entered in Microsoft Excel and analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequency and percentage. Chi-square test was used to determine association between variables, and p value <0.05 was considered statistically significant.

RESULTS

The present study included 250 participants. Majority of the study participants belonged to the age group of 25–29 years (44.8%). Multigravida women constituted 59.2% of the study population, while previous LSCS was the most common indication for elective cesarean section (50.4%).

Table- 1 Baseline Characteristics and Postoperative Outcomes of Study Participants (N=250)

Variable	Category	Number (%)
Age Group (Years)	20–24	68 (27.2%)
	25–29	112 (44.8%)
	30–34	58 (23.2%)
	≥35	12 (4.8%)
Obstetric Characteristics	Primigravida	102 (40.8%)
	Multigravida	148 (59.2%)
Obstetric Characteristics	Previous LSCS	126 (50.4%)
	Breech Presentation	82 (32.8%)
	Twin Pregnancy	42 (16.8%)
Duration of Surgery	<45 mins	72 (28.8%)
	45–60 mins	148 (59.2%)
	>60 mins	30 (12.0%)
Wound Complications	Wound Discharge	8 (3.2%)
	Wound Gaping	3 (1.2%)
	No Complication	239 (95.6%)
Duration of Hospital Stay	4–5 days	225 (90.0%)
	>5 days	25 (10.0%)

Most surgeries (59.2%) were completed within 45–60 minutes. Wound complications were minimal, with 95.6% patients showing no postoperative wound-related complications. Majority of women (90%) had hospital stay ranging between 4–5 days, indicating satisfactory postoperative recovery following single-dose prophylactic ceftriaxone administration.

Postoperative febrile morbidity was observed in 18 patients accounting for 7.2% of the study population, whereas 92.8% women remained afebrile throughout the postoperative period, suggesting good efficacy of single-dose prophylactic ceftriaxone in preventing postoperative infectious complications.

Table 2- Postoperative Outcomes Following Elective Cesarean Section (N=250)

Variable	Category	Number (%)
Surgical Site Infection (SSI)	SSI Present	11 (4.4%)
	SSI Absent	239 (95.6%)
Additional Antibiotic Therapy	Required	19 (7.6%)
	Not Required	231 (92.4%)
Follow-up Findings on Postoperative Day 15	Normal Healing	239 (95.6%)
	Persistent Infection	11 (4.4%)

Postoperative surgical site infection was observed in only 4.4% patients, while majority of women (95.6%) had uneventful postoperative recovery without wound infection. Additional postoperative antibiotic therapy was required in only 7.6% patients, indicating satisfactory infection prevention with single-dose prophylactic ceftriaxone. Follow-up assessment on postoperative day 15 demonstrated normal wound healing in 95.6% patients, further supporting the safety and efficacy of single-dose third-generation cephalosporin prophylaxis in low-risk elective cesarean section patients.

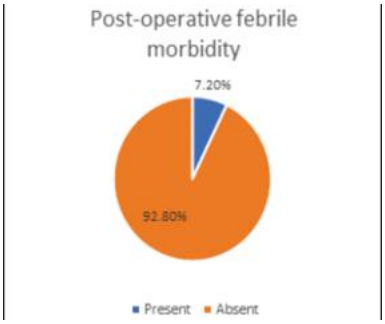

Figure-1 Incidence of Postoperative Febrile morbidity (N=250)

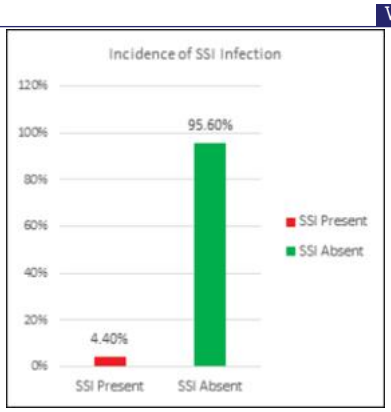

Figure 2 -Incidence of Surgical Site Infection (N=250)

The present study showed that surgical site infection was comparatively more common among women whose duration of surgery exceeded 60 minutes, and the association between prolonged surgery duration and SSI was found to be statistically significant (χ^2=8.42, p=0.014). SSI was more frequently observed among multigravida women and patients with previous LSCS; however, these associations were not statistically significant (p>0.05).

Table- 3 Factors associated with Surgical Site Infection (N=250)

	SSI Present (n=11)	SSI Absent (n=239)	χ^2	P-value
Duration of Surgery				
<45 min	1(9.0%)	71(29.7%)	8.42	0.01
45-60 min	5(45.5%)	143(59.8%)		
>60 min	5(45.5%)	25(10.5%)		
Gravida				
Primi	3(27.2%)	99(41.4%)	1.02	0.31
Multi	8(72.8%)	140(58.6%)		
Previous LSCS				
Yes	8(72.8%)	118(49.4%)	3.24	0.07
No	3(27.2%)	121(50.6%)		
Hemoglobin level				
<10 g/dL	4(36.3%)	28(11.7%)	7.96	0.05
≥10 g/dL	7(63.7%)	211(88.3%)		
Hospital stays				
4-5 days	2(18.2%)	223(93.3%)	52.8	0.01
>5 days	9(81.8%)	16(6.7%)		
Febrile morbidity				
Present	8(72.8%)	10(4.2%)	74.6	0.01
Absent	3(27.2%)	229(95.8%)		

A statistically significant association was observed between low hemoglobin levels (<10 g/dL) and SSI (χ^2=7.96, p=0.005), indicating that anemia may predispose to postoperative wound infection due to impaired tissue healing and reduced immunity. Similarly, patients with prolonged hospital stay of more than 5 days had significantly higher incidence of SSI compared to those discharged within 4–5 days (χ^2=52.84, p=0.001).

Postoperative febrile morbidity also showed a highly significant association with SSI (χ^2=74.6, p=0.001), suggesting that postoperative fever may serve as an important clinical indicator of wound infection. Overall, prolonged surgery duration, anemia, prolonged hospitalization, and febrile morbidity were identified as significant factors associated with surgical site infection in the present study.

The low incidence of surgical site infection (4.4%) observed in the present study indicates that a single preoperative dose of third-generation cephalosporin was effective in preventing postoperative infections in low-risk women undergoing elective cesarean section. Majority of patients (95.6%) had uneventful postoperative recovery, while only 7.6% required additional antibiotic therapy. These findings support the safety and efficacy of single-dose prophylactic ceftriaxone in elective LSCS patients.

DISCUSSION

Cesarean section is one of the most commonly performed obstetric surgical procedures worldwide. Despite advances in surgical techniques and aseptic precautions, postoperative infectious morbidity remains an important cause of maternal morbidity following cesarean delivery. Surgical site infection (SSI), febrile morbidity, wound complications, and prolonged hospitalization contribute significantly to increased healthcare costs, delayed recovery, and excessive antibiotic usage. Antibiotic prophylaxis has therefore become an essential component of cesarean section care. However, irrational and prolonged postoperative antibiotic administration contributes to antimicrobial resistance and unnecessary healthcare expenditure. Hence, the present study was conducted to evaluate the efficacy of a single preoperative dose of third-generation cephalosporin in preventing postoperative infections among low-risk women undergoing elective cesarean section.

In the present study, majority of women belonged to the age group of 25–29 years (44.8%) with a mean age of 27.6 ± 3.8 years. Similar findings were reported by Suwal et al.[11] and Sharma et al.[12] where most cesarean deliveries occurred among women in the active reproductive age group. Multigravida women constituted 59.2% of the study population and previous LSCS was the most common indication for elective cesarean section accounting for 50.4% cases. Comparable observations were reported by Ahmed et al.[8] and Gupta et al.[5] indicating that repeat cesarean section remains a major contributor to rising cesarean rates.

In the present study, majority of surgeries (59.2%) were completed within 45–60 minutes and the mean duration of surgery was 51.4 ± 8.2 minutes. Prolonged duration of surgery is a recognized risk factor for postoperative wound infection due to increased tissue exposure and operative manipulation. A statistically significant association was observed between duration of surgery and SSI (χ^2=8.42, p=0.014), with higher infection rates among surgeries lasting more than 60 minutes. Similar findings were reported by Olsen et al.[3] and Patel et al.[14] who identified prolonged operative duration as an independent predictor of postoperative wound infection.

The major finding of the present study was the low incidence of postoperative infectious morbidity following single-dose prophylactic ceftriaxone administration. Postoperative febrile morbidity was observed in only 7.2% patients, while surgical site infection occurred in 4.4% patients. Majority of women (95.6%) had uneventful postoperative recovery without wound infection. These findings strongly support the efficacy of single-dose third-generation cephalosporin prophylaxis in low-risk elective cesarean section patients.

The SSI rate observed in the present study (4.4%) is comparable with several Indian and international studies. Suwal et al.[11] reported SSI rates of 3.8% with single-dose prophylaxis and concluded that multiple-dose regimens did not provide additional benefit. Ashraf et al.[13] and Sharma et al.[12] also demonstrated low postoperative infection rates with single-dose cephalosporin prophylaxis in elective cesarean sections. Similarly, Smaill and Grivell[9] in their Cochrane review showed that prophylactic antibiotics significantly reduce postoperative infectious morbidity following cesarean delivery.

The low SSI rate observed in the present study may be attributed to appropriate timing of antibiotic administration, strict aseptic precautions, shorter operative duration, and

inclusion of only low-risk women. Ceftriaxone, a third-generation cephalosporin with broad-spectrum antimicrobial coverage and good tissue penetration, provides effective prophylaxis against common pathogens associated with postoperative wound infection. WHO recommendations and ACOG guidelines also advocate administration of prophylactic antibiotics within 60 minutes before skin incision to achieve optimal tissue concentration during surgery.[6,15]

Among postoperative wound complications, wound discharge was observed in 3.2% patients while wound gaping occurred in only 1.2% cases. Majority of patients (95.6%) had no wound-related complications. Similar findings were reported by Kaur et al.[16] and Chelmow et al.[17] Reduced wound complication rates indicate satisfactory infection prevention with single-dose prophylactic antibiotic administration.

An important observation in the present study was the lower requirement of additional postoperative antibiotics. Only 7.6% patients required further antibiotic therapy, whereas 92.4% recovered without additional antimicrobial treatment. Similar observations were reported by Suwal et al.[11] and Sharma et al.[12] Rational single-dose prophylaxis therefore represents an effective antimicrobial stewardship strategy by reducing unnecessary antibiotic exposure, healthcare costs, and emergence of antimicrobial resistance.

The present study also evaluated factors associated with surgical site infection. Although higher SSI rates were observed among multigravida women and patients with previous LSCS, the associations were not statistically significant. However, low hemoglobin levels (<10 g/dL) showed statistically significant association with SSI ($\chi^2=7.96$, $p=0.005$). Similar findings were reported by Killian et al.[4] and Singh et al.[18] Maternal anemia impairs tissue oxygenation and wound healing, thereby increasing susceptibility to postoperative infection.

Hospital stay of more than 5 days also showed highly significant association with SSI ($\chi^2=52.84$, $p=0.001$). Women with postoperative wound infection required prolonged hospitalization for wound care and intravenous antibiotics. Similar findings were reported by Olsen et al.[3] and Gupta et al.[5] Postoperative febrile morbidity also showed highly significant association with SSI ($\chi^2=74.6$, $p=0.001$), indicating that postoperative fever may serve as an important early clinical indicator of wound infection.

At postoperative day 15 follow-up, normal wound healing was observed in 95.6% patients while persistent infection was present in only 4.4% women. These findings further support the effectiveness of single-dose ceftriaxone prophylaxis in elective cesarean section patients.

Strengths of the study were the present study was a prospective study conducted in low-risk elective cesarean section patients using a standardized single-dose ceftriaxone prophylaxis protocol. Uniform perioperative management and postoperative follow-up up to day 15 helped in accurate assessment of postoperative infectious morbidity and wound healing outcomes. The study also highlights the importance of rational antibiotic use and antimicrobial stewardship in obstetric practice.

Limitations include the study was conducted at a single tertiary care center and included only low-risk elective cesarean section patients, limiting generalizability of the findings. Absence of a comparison group receiving multidose antibiotic prophylaxis and lack of microbiological culture analysis were additional limitations of the study.

CONCLUSION

The incidence of surgical site infection was on a lower side and febrile morbidity was low, with majority of patients showing satisfactory postoperative recovery and wound healing. Requirement of additional postoperative antibiotics was minimal, supporting the efficacy, safety, and cost-effectiveness of single-dose prophylactic ceftriaxone with no major morbidity like wound dehiscence or burse abdomen. The study findings also support rational antibiotic use and antimicrobial stewardship in elective cesarean section practice which acts as one of the important tools to prevent antibiotic resistance in the future.

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