

A Comparative Study of Short Term versus Long Term Administration of Prophylactic Antibiotics in Elective Lower Segment Caesarean Section

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ABSTRACT

BACKGROUND

There is an increasing incidence of caesarean section around the world. As caesarean section is associated with infectious complications, frequent and inappropriate use of all newly discovered antimicrobial drugs has led to the development of altered mechanisms and treatment failure or ineffective management of such patients which increase the rate of morbidity and mortality in mothers. Many guidelines and studies recommend single dose antibiotic prophylaxis for women undergoing elective or non-elective caesarean section. The aim of this study was to assess the effectiveness of ceftriaxone as prophylactic antibiotic in elective caesarean section patients.

METHODS

This study was carried out in Indira Gandhi Government Medical College and Hospital, Nagpur from 2017 to 2019. Approval from Institutional Ethics committee was taken prior to commencement of the study. Two hundred patients were included in the study from wards who fulfilled the inclusion criteria. They were divided into two groups, group 1 had hundred patients who received inj. Ceftriaxone as single dose prophylaxis after cord clamping. Group 2 of hundred patients received combination of inj. cefotaxime, metronidazole and gentamicin, which was administered for 2 days IV followed by oral Augmentin for 5 days Postoperatively. The efficacy was measured in terms of febrile morbidity, wound infection, duration of hospital stay, and cost of antibiotic.

RESULTS

Febrile morbidity was significantly less in group 1 compared to group 2. 3% from group 1 and 16% from group 2 had wound discharge and therefore, the difference was statistically significant ($p=0.003$). 2% from group 1 and 9% from group 2 presented with wound dehiscence ($p=0.027$). 74% from group 1 had a shorter hospital stay of ≤ 7 days while 60% from group 2 had longer hospital stay of > 7 days ($p<0.001$). Mean cost of antibiotic in group 1 was INR 98.68/- while that in group 2 was INR 662.68/-. So, the use of short-term antibiotic was cost effective and the difference was statistically significant ($p<0.0001$).

CONCLUSION

Short-term course of prophylactic antibiotic is very safe, cost effective, more convenient and effective in reducing maternal morbidity and post-operative hospital stays when compared to traditional use of combination of metronidazole, cefotaxime and gentamicin in elective low risk caesarean section cases.

KEYWORDS

Caesarean Section, Wound Infection, Antibiotic Prophylaxis

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BACKGROUND

Obstetrics is a wonderful discipline. It gives an insight into the most fundamental biological process leading to human creation. The phenomenon of giving birth is the climax of all those intricate processes. As the most dominant and intelligent species, we humans have designed a way to circumvent difficult labours, in order to avoid resultant mortality and morbidity by formulating an alternate mode of delivery that has been called 'caesarean birth'.

The single most important risk factor for postpartum maternal infection is caesarean section. Bacterial infections around the time of childbirth account for about one tenth of the global burden of maternal death.⁽¹⁾ For most pregnant women, surgical site infections are not life threatening, yet they have important implications on the length of hospital stay, hospital costs and social implications for the parents and the new born⁽²⁾. The most important source of microorganisms responsible for post c-section infection if the membranes are ruptured is the genital tract. Infections are commonly polymicrobial and the pathogens commonly isolated are *E coli*, other gram-negative aerobic rods, group b streptococcus, staphylococcus aureus and coagulase negative staphylococci, enterococcus faecalis, Gardnerella vaginalis, anaerobes and genital mycoplasma. Antibiotic prophylaxis refers to administration of antibiotics before, during or after a diagnostic, therapeutic, or surgical procedure so as to prevent infection. Prophylactic antibiotics decrease the bacterial inoculum burden on the skin and makes the operative site less hospitable to the growth of bacteria.⁽³⁾ The frequent and inappropriate use of all newly discovered antimicrobial drugs has led to the development of altered mechanisms in the pathophysiology of the concerned microbes as a survival technique. This leads to treatment failure or ineffective management of such patients. The Joint Commission developed an antimicrobial stewardship standard for hospitals in January 2017. It was designed to promote appropriate use of antibiotics, improve infection cure rates, reduce antibiotic resistance, and decrease the spread of multidrug resistant organisms.⁽⁴⁾ The Primary Research Question of the present study is 'Is short term antibiotic prophylaxis as effective as long-term prophylaxis in preventing postpartum infection in low risk elective caesarean section.

Objectives

1. To assess the effectiveness of single dose antibiotic prophylaxis with Inj. Ceftriaxone 1 gm IV 30 minutes before skin incision in controlling infections in Caesarean section.
2. To reduce the total requirement of antibiotics in lower segment caesarean section cases in order to reduce the cost of treatment.
3. To compare the effectiveness of ceftriaxone with cefotaxime, metronidazole and gentamicin combination, which was administered for 2 days IV followed by oral Augmentin for 5 days Post-operatively.

METHODS

Present study is prospective comparative observational study conducted in the Department of Obstetrics and Gynaecology, Indira Gandhi government medical college and hospital, Nagpur, from December 2017 to October 2019.

Women admitted to our hospital from 2017-2019 were evaluated. Patients were alternatively categorised into group 1 and group 2. Group 1 received single dose 1 gm injection ceftriaxone after cord clamping, and group 2 received conventional post-operative antibiotic regimen for 7 days i.e. Combination of injection cefotaxime 12 hourly, injection metronidazole 8 hourly and injection gentamicin 80 mg 12 hourly for 2 days, post operatively, followed by oral Augmentin 625 mg 12 hourly till 7th postoperative day.

The intraoperative details like type of anaesthesia, type of skin incision, type of uterine incision, duration of surgery, exteriorization of the uterus done or not was recorded. Information regarding total number of wound infections, urinary tract infections, febrile morbidity post lower segment Caesarean section was obtained. Complete blood count, urinalysis, and urine culture was sent on 2nd post-operative day. In case of a suspected wound infection, wound swab was sent for culture and sensitivity. Patients were treated in the post-operative period as per standardized hospital protocol. The outcome measures in the form of duration of maternal hospital stays, cost of the stay.

Cases of elective lower segment caesarean section were included in the study and cases with hypersensitivity to cephalosporins, Pre-existing infection, Concomitant systemic disease such as uncontrolled diabetes, hypertension, renal or hepatic disease. PROM, any antibiotic treatment 2 weeks prior to surgery, Presence of chorioamnionitis, Malnutrition or Obesity >85 kgs, Immunocompromised state, autoimmune disorder, On Immunosuppressive therapy, Prolonged pre-operative hospitalization, Duration of labour > 6 hrs. and >3 times per-vaginal examination for intra partum cases were excluded from the study.

RESULTS

Total no. of cases included in Group I: 100. Total no. of cases included in Group II: 100. Maximum number of patients belonged to the age group of 21 to 25 years. 88 cases were observed in the same, of which 44 % (n=44) were from group 1 and 44 % (n=44) were from group 2. 34 % (n=68) were from age group of 26-30 years, of which 35% (n=35) were from group 1 and 33% (n=33) were from group 2. 15% were <20 years of age, 7 % (n=7) from group 1 and 8% (n=8) were from group 2. 13.5% belonged to age group of 31-35 years, 13% (n=13) from group 1 and 14% (n=14) were from group 2. Only 1% (n=2) patients were in between age group of 36-40 years, 1% (n=1) were from each group. On analysing the above data, we can infer that the distribution between the two groups according to age was comparable.

Majority of patients were multigravida 81.5% (n=163) in both the groups of which 84% (n=84) were from group 1

and 79% (n=79) were from group 2. On the other hand, 18.50% (n=37) were primigravida, out of which 16% (n=16) were from group 1 and 21% (n=21) were from group 2.

Indication for Caesarean Section	Group 1	Group 2	Total
Bad obstetric history	3%	3%	3.00%
Breech at term	11%	8%	9.50%
Cephalopelvic disproportion	3%	5%	4.00%
Oligohydramnios	5%	9%	7.00%
Oligohydramnios with IUGR	1%	3%	2.00%
Previous LSCS	77%	71%	74.00%
Transverse lie in labour	0%	1%	0.50%
Total	100%	100%	100.00%

Table 1. Distribution with Respect to Indication of Caesarean Section

Wound Discharge	Group 1	Group 2	Total	P Value
No	97 (97.00%)	84 (84.00%)	181 (90.50%)	0.003
Yes	3 (3.00%)	16 (16.00%)	19 (9.50%)	
Total	100 (100.00%)	100 (100.00%)	200 (100.00%)	

Table 2. Distribution with Respect to Presence of Wound Discharge

Wound Dehiscence	Group 1	Group 2	Total	P Value
Full length wound dehiscence	0.00%	7.00%	7 (3.50%)	0.027
No wound dehiscence	98.00%	91.00%	189 (94.50%)	
Partial length wound dehiscence	2.00%	2.00%	4 (2.00%)	
Total	100 (100.00%)	100 (100.00%)	200 (100.00%)	

Table 3. Distribution on the Basis of Presence of Wound Dehiscence

Hospital Stay	Group 1	Group 2	Total	P Value
1) ≤ 7 days	74 (74.00%)	40 (40.00%)	114 (57.00%)	<.0001
2) > 7 days	26 (26.00%)	60 (60.00%)	86 (43.00%)	
Total	100 (100.00%)	100 (100.00%)	200 (100.00%)	

Table 4. Distribution Based on Duration of Hospital Stay

Average Cost (in Rupees)	Group 1	Group 2	Total	P Value
54.00	96 (96.00%)	0 (0.00%)	96 (48.00%)	<.0001
543.00	0 (0.00%)	84 (84.00%)	84 (42.00%)	
1032.00	2 (2.00%)	8 (8.00%)	10 (5.00%)	
1200.00	1 (1.00%)	0 (0.00%)	1 (0.50%)	
1220.00	1 (1.00%)	0 (0.00%)	1 (0.50%)	
1500.00	0 (0.00%)	5 (5.00%)	5 (2.50%)	
1600.00	0 (0.00%)	2 (2.00%)	2 (1.00%)	
1700.00	0 (0.00%)	1 (1.00%)	1 (0.50%)	
Total	100 (100.00%)	100 (100.00%)	200 (100.00%)	

Table 5. Distribution Based on Cost of Antibiotic

On observing the above table, the most common indication for elective caesarean section in both the groups was history of previous LSCS. 77% from group 1 and 71% were from group 2, followed by cases of breech at term (9.50%). Of all the patients who underwent elective LSCS majority of patients that is 98% (n=196), 100% (n=100) in group 1 and 96% (n=96) in group 2 were screened negative for urine culture. Only two patients in group 2 were positive for *E. coli* and 2 patients were positive for *Klebsiella*. These positive patients on urine culture report were given definitive antibiotic therapy according to the sensitivity report. Endometritis was diagnosed with the presence of fever, uterine tenderness with foul smelling discharge irrespective

of culture positivity on cervical vaginal swab report. In group 1, 2 % (n=2) patients presented with endometritis while in group 2, 7% (n=7) patients presented with endometritis and they were given post-operative injectable antibiotics for seven days. Maximal patients were negative for endometritis.

3% (n=3) patients from group 1 and 16% (n=16) patients from group 2 presented with wound discharge. 97% (n=97) patients from group 1 and 84% (n=84) patients from group 2 did not have any wound discharge. The data was observed to be statistically significant (p value = 0.003). as shown in table no 2. For those patients who presented with wound discharge, swabs were sent for culture sensitivity. From group 1, 99 % (n=99) patients and from group 2, 94 % (n=94) patients were negative on culture sensitivity report. 1 % (n=1) patients from group 1 and 3% (n=3) patients from group 2 were positive for *Acinetobacter* growth. From group 2, another 3% (n=3) patients were positive for *E. coli* on culture sensitivity report. These positive patients on culture sensitivity were given definitive therapy. Distribution on the basis of presence of wound dehiscence shown in table no 3.

Women who received prophylactic antibiotic had a shorter duration of stay in hospital, compared to all those women who received multiple doses of antibiotic post operatively as shown in table no 4.

Cost of single dose of injection Ceftriaxone was approximately 54/-, while those patients who received multiple doses of antibiotics had an expenditure of approximately 543/-. Also, those women who experienced wound discharge, wound dehiscence and endometritis required definitive therapy with antibiotic which was pretty expensive. Distribution of women on the basis of cost of antibiotic in both the Groups shown in table 5.

DISCUSSION

Despite the World Health Organization's guidelines that Caesarean section rates should be no greater than 15%, in the developed world Caesarean rates are have already crossed 20%. With increasing Caesarean delivery rates, post-Caesarean delivery infections are likely to become an increasing health and economic burden and their prevention remains a public health priority.⁽⁵⁾ Hospital acquired infections caused by multidrug resistant strains are rampant in India. *Staphylococcus* is the most common organism causing nosocomial infections followed by *Pseudomonas*, *Streptococcus* and *Escherichia coli*. The incidence of Methicillin resistant *Staphylococcus aureus* in India ranges from 30-70% and it continues to be a major threat.⁽⁶⁾

According to NICE guidelines, 2004: Women having a Caesarean section should be offered prophylactic antibiotics, such as a single dose of first-generation cephalosporin or ampicillin, to reduce the risk of postoperative infections (such as endometritis, urinary tract infection and wound infection), which occur in about 8% of women who have had a CS.⁽⁷⁾

According to ACOG antibiotic prophylaxis is recommended for all caesarean deliveries and such

prophylaxis should be administered 60 minutes before the start of the caesarean delivery.⁽⁸⁾

According to FOGSI 2018 antibiotics should be given either shortly before or at the time of bacterial inoculation. First or second-generation cephalosporin's (single dose of cefazolin 1 or 2 g single dose intravenously) have emerged as the drugs of choice for the vast majority of operative procedures because of their broad antimicrobial spectrum and low incidence of allergy and side effects.

Therefore, in the present study we administered injection Ceftriaxone 1 gm IV after cord clamping in controlling infections in Caesarean section.

Presence of febrile morbidity in studies has been proven to be statistically significant in studies conducted by S H Huam et al,⁽⁹⁾ Subha Sivagami et al,⁽¹⁰⁾ Apurba Mandal et al⁽¹¹⁾ and Prathima et al where injectable antibiotic had been given prophylactically. The findings of our study concur with the above studies with statistical significance. Most common cause of febrile morbidity has been urinary tract infection and surgical site wound infection.

Study	Febrile Morbidity	Urinary Tract Infection	Presence of Endometritis	Duration of Hospital Stay
S H Huam et al	<0.05	NS	NS	<0.005
Subha Sivagami et al	<0.001	<0.001		
Surabhi Aggarwal et al ⁽¹²⁾	1.00	0.31	0.49	>0.05
Shagufta Shaheen et al ⁽¹³⁾	1	NS	-	-
Bhattachan K et al ⁽¹⁴⁾	0.617	1	-	1
Shivamurthy H M et al ⁽¹⁵⁾	<0.05	NS	NS	-
Apurba Mandal et al	0.002	-	0.0007	0.0001
Prathima et al ⁽¹⁶⁾	0.457	0.103	-	-
Present study	0.036	0.130	0.17	<0.0001

Table 6. p values of Studies with Respect to Parameters Under Study

Multiple per vaginal examinations, prolonged urinary catheterisation, failure to maintain aseptic precautions during catheterisation, bladder trauma and occult bacteriuria are risk factors for development of postoperative urinary tract infections. In the study conducted by S H Huam et al, Shagufta Shaheen et al, Surabhi Aggarwal et al, Bhattachan K et al, Shivamurthy H M et al and Prathima et al presence of urinary tract infection in both the groups were comparable. In maximal studies we see that the data has been insignificant as shown in above table. In post-operative period presence of fever, foul smelling discharge, uterine tenderness is suggestive of endometritis, irrespective of status of culture on cervical vaginal swab. In the study conducted by Apurba et al, Endometritis was found in 3.26% of the patients in the pre-incision group as compared to 19.35% of the patients in the control group showing statistically significant difference ($P=0.0007$). In the study conducted by Surabhi et al, Endometritis presenting as purulent lochia with uterine tenderness was present in 1 patient in the study group ($P>0.05$). In present study, 2 women from group 1 presented with endometritis and were given seven days course of triple IV antibiotics. Seven women from group 2 presented with endometritis and they received definitive therapy other than the routine

administration of antibiotics, costing more with potential risk of development of drug resistance.

As per Shagufta Shaheen et al Hospital stay was almost the same in both groups. In the study conducted by Bhattachan K et al, the mean duration of hospital stay was 4.40 and 4.42 days for group 1 and 2 respectively ($p= 1.00$). The findings of our study were comparable to the findings of study conducted by S H Huam et al and Apurba Mandal et al and was statistically significant.

Looking at the table below, it has been observed that wound sepsis can present in many forms like wound discharge, wound abscess and wound dehiscence. With respect to every parameter, it was seen that the findings of our study were comparable to the findings of the study conducted by S H Huam et al, Armin Witt et al, Subha Sivagami et al and Apurba Mandal et al. In the study performed by Subha Sivagami et al. Culture and sensitivity of pus from wound showed the growth of staphylococcus aureus in Ceftriaxone group in 1.8% and 8.2% in Ampicillin/Gentamicin group. While in our study 1% was positive for Acinetobacter from group 1, 3% were positive for Acinetobacter and 3% were positive for *E. coli* from long term antibiotic dosage group.

Sl. No.	Study	Group 1	Group 2	P Value
1.	S H Huam et al	Wound induration Wound discharge Wound dehiscence	2 2 9	<0.01
2.	Subha Sivagami et al	Wound infection	1.8 8.2	<0.001
3.	Shagufta Shaheen et al	Wound hematoma Superficial wound infection Deep wound infection	1 4 2	1 1 0.49
4.	Surabhi Aggarwal et al	Wound infection	6 7	0.74
5.	Bhattachan K et al	Wound infection	1 0	1
6.	Apurba Mandal et al	Surgical site infection Wound dehiscence	9 1	25 2
7.	Prathima et al	Minor wound infection Moderate wound infection	2 1	4 2
8.	Present study	Wound abscess Wound discharge	1 3	0 16

Table 7. Distribution Showing Presence of Wound Sepsis in Various Studies

As stated by Surabhi et al The cost of three dose regimen was just two third of the seven-day regimen with no difference in the cost of the hospital stay. The approximate cost of three doses of ampicillin were 120 INR in comparison 180 INR for the seven-day regimen. Shorter regimen is judicious way of use of antibiotics and decreases the workload of the paramedical staff as well. The mean cost of antibiotic in this study group conducted by Bhattachan K et al in Nepalese rupees 90.12 when compared to 722.48 rupees in the control group. This meant that single dose regimen costs one eighth of the multiple dose regimen, which is statistically significant ($p= 0.0001$). In our study cost of single dose of antibiotic was Rs. 54/- compared to multiple dose regimen which costs them Rs. 543/-. Mean cost of antibiotic in group 1 was 98.68/- while that in group 2 was 662.68/-. Therefore, the p value (<0.0001) was statistically significant and was comparable to above mentioned studies.

Therefore, we inferred that Febrile morbidity was significantly less in group 1 compared to group 2. 7% in

group 1 and 20% in group 2 showed signs of febrile morbidity. 2% patients from group 2 were urine culture positive for *E. coli* and 2% were positive for *Klebsiella* while 100% patients were urine culture negative from group 1. 2% patients from group 1 and 7% patients from group 2 presented with endometritis. 3% from group 1 and 16% from group 2 presented with wound discharge and therefore, the finding was statistically significant ($p=0.003$). 1% from group 1 and 3% from group 2 were culture positive for *Acinetobacter* on wound swab and 3% from group 2 were positive for *E. coli*. Maximum patients that is 99% from group 1 and 94% from group 2 were negative on wound swab culture sensitivity report. In this study, 2% from group 1 and 9% from group 2 presented with wound dehiscence and this finding was statistically significant ($p=0.027$). 74% from group 1 had a shorter hospital stay of ≤ 7 days while 60% from group 2 had longer hospital stay of > 7 days which was found to be statistically significant ($p<0.001$). Mean cost of antibiotic in group 1 was 98.68/- while that in group 2 was 662.68/- which was cost-effective and statistically significant ($p<0.0001$).

CONCLUSIONS

Present study concludes that short-term course of prophylactic antibiotic is very safe, cost effective, more convenient and effective in reducing maternal morbidity and post-operative hospital stay when compared to traditional use of combination of metronidazole, cefotaxime and gentamicin in elective low risk caesarean section cases. Also, shortening the duration of therapy reduces the medical cost and prevents the microorganism resistance. Therefore, there is a need for change in our practice and for development of an institutional protocol with emphasis on short term course of antibiotic prophylaxis in elective low risk caesarean section cases.

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