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Surgical Site Infection Following Cesarean Section: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Introduction: Cesarean section (CS) is one of the most commonly performed surgical procedures in the obstetrics and gynecology department. After urinary tract infection, surgical site infection (SSI) is the most frequent infection found in post cesarean section patients. Optimizing maternal co-morbidities and using evidence-based surgical procedures are both essential for lowering the risk of SSI. This study was carried out to study the prevalence of surgical site infections following cesarean section.

Methods: This was a descriptive observational study in patients who had undergone cesarean sections from Baishak 2079 to Chaitra 2079 at Pokhara Academy of Health Sciences. Following surgery patients were put on regular follow up visits during which signs of infection were noted. Swabs from infected surgical sites were then further sent for microbiological investigations. Data collection was done and were analyzed using SPSS.

Results: Among 315 cases,306 cesarean section cases were included in the study and 9 cases were lost to follow up. In this study post LSCS SSI rate was 12.43%(n=35), of which SSI in elective LSCS was found in 4 cases i.e., 5.06% whereas in emergency LSCS SSI was found in 31 cases i.e., 13.65%. Overall prevalence of SSI was higher in emergency LSCS with obesity being a major risk factor (31.42%). Among culture positive SSI, Staphylococcus (n=11/61.11%) was the most common microorganisms detected followed by Pseudomonas (n=5/27.78%).

Conclusion: Prevalence of surgical site infection in cases of emergency LSCS is high, increasing maternal morbidity. The recognition and correction of associated medical complications in the antenatal period is vital. Staphylococcus being the most common and Pseudomonas the second most commonly isolated organisms.

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INTRODUCTION

Cesarean Section (CS) is one of the most commonly performed surgical procedure in obstetrics and gynecology department.[1]The prevalence of deliveries by cesarean section has increased recently in a view of improving maternal and perinatal outcome. Cesarean section carries 5-20 times increase in maternal infections as compared to vaginal delivery.[2]With the increasing cesarean section rate postpartum infection is also expected to increase. Post operative infection at the surgical site in obstetrics and gynecological procedures are very common in third world countries like Nepal as the state of health of many women is below the optimum level.[33]Some of the risk factors observed for CS wound infections are obesity, diabetes, immunosuppression, chorio-amnionitis, a previous CS, steroids use, improper optimization pre-operatively, lengthy labour and surgery.[4] The SSI following cesarean section causes delayed recovery, prolonged hospitalization, as well as increase in patient morbidity and mortality, thus increasing physical, psychological and economic burden.[2] SSI also defines the index of health care system of any hospital. With the increase in prevalence

of noso-comial infections and multi-drug resistance, a meticulous and periodic surveillance of various hospital acquired infections is necessary to control SSI.[5] This study was hence carried out to study the prevalence and risk factors for surgical site infection following CS.

METHODS

This was a cross-sectional study conducted to assess surgical site infections (SSIs) following Cesarean Section (CS). The study was carried out in the Department of Obstetrics and Gynaecology at Pokhara Academy of Health Sciences (PoAHS) from Baishak 2079 to Chaitra 2079. The study population included all cases who had undergone a CS during the study period. Written informed consent was obtained from all participating women. The study protocol was reviewed and approved by the Institutional Review Board (IRB) with reference number 97/079.

Inclusion Criteria:

1. All cases who underwent CS (both elective and emergency) during the study period.
2. Cases that received both pre-operative and post-operative prophylactic antibiotics.
3. Patients who were willing to participate and commit to follow-up visits.

Exclusion Criteria:

1. Patients referred from other facilities or who had a CS at a different hospital and presented with a pre-existing SSI.
2. Patients who attended a follow-up visit more than 30 days after their CS.
3. Patients with diagnosed psychological illness, neurological deficits, diabetes, or who were immunocompromised.
4. Patients who refused to give informed consent.
5. Patients who were lost to follow-up.

Sample Size Calculation

The sample size was calculated using the formula for a proportion: $N=Z2\times p(1-p)/E2$

- Z = 1.96 (for a 95% confidence interval)
- p = 0.29 (prevalence calculated from a previous study at the same hospital)
- E2 = 0.0025 (margin of error)

The calculated sample size was 315. Based on the local context, this was stratified into 79 elective CS cases (25%) and 236 emergency CS cases (75%).

Sampling Technique

A convenience sampling method was used, wherein all eligible patients who met the inclusion criteria during the study period were enrolled until the required sample size was met.

Data Collection Technique and Tools

All patients undergoing CS who met the inclusion criteria were enrolled after providing written informed consent. A detailed medical history was taken, and a complete physical examination was performed. Data on various risk factors (e.g., anemia, pre-eclampsia, obesity), indication for CS (maternal, materno-fetal, or fetal), seniority of the operating surgeon, and type of skin closure were recorded.

Pre- and Post-operative Care: All cases were given pre-operative prophylactic antibiotics. Post-operatively, intravenous antibiotics (Inj. Ceftriaxone 1gm iv BD and Inj. Metronidazole 500mg iv TDS) were administered for the first 24 hours unless otherwise indicated. The surgical wound was inspected for soakage during the hospital stay, particularly between 35-60 hours post-operation. If the wound was healthy and without complication, the patient was discharged with oral antibiotics.

Follow-up and SSI Diagnosis: Patients were advised to return to the Obstetrics and Gynaecology Outpatient Department (OPD) for suture removal on day 7 (for primary CS) or day 8 (for repeat CS). At this visit, the wound was examined for any evidence of SSI. Patients were also instructed on the signs of infection and were advised to attend follow-up visits on day 15 and day 30. If a patient did not attend, they were contacted via phone to inquire about signs of wound infection. If SSI was suspected at any follow-up point (days 3, 7, 15, or up to 30 days), a swab was taken from the wound for culture and susceptibility testing before any change in antibiotics. Patients with confirmed SSI were readmitted and managed with intravenous antibiotics and regular wound dressing.

Analysis: The collected data was stored in MS-Excel. Statistical analysis was performed using SPSS 26.0. Descriptive statistics such as mean, median, and percentages were used to summarize the data.

RESULTS

Overall post cesarean section SSI rate was 12.4%(n=35); of which SSI in elective CS was found in 4 out of 79 cases i.e 5.06% whereas in emergency LSCS SSI was found in 31 out of 227 cases i.e 13.65%. Overall prevalence of SSI was more common in emergency CS.

Table 1: CS indication in SSI cases

Indication of CS	Prevalence of SSI in CS			
	Elective	Emergency	Total SSI	Percentage (%)
Fetal distress	0	7	7	20
Previous CS	3	2	5	14.28
Abnormal presentation	1	2	3	8.57
Eclampsia	0	0	0	0.00
CPD	0	3	3	8.57
NPOL/Failed IOL	0	12	12	34.3
Others	0	5	5	14.28
Total	4	31	35	100

In this study surgical site infection was noticed in labour arrest which included non-progress of labour and failed induction(n=12/34.3%) followed by fetal distress(n=7/20%). (Table 1)

Table 2: Risk factors in SSI cases

Risk Factors	Types of CS			
	Elective	Emergency	Total	Percentage (%)
Anemia	1	5	6	17.17
Preeclampsia	0	0	0	0
Obesity	2	9	11	31.42
IVF	0	1	1	2.85
Others	0	1	1	2.85
None	1	15	16	45.71
Total	4	31	35	100

Majority of cases didn't have any risk factors. However, obesity (n=11/31.42 %) followed by anemia(n=6/17.17%) accounted for most of cases. (Table 2)

Table 3: Association between postoperative days and SSI prevalence

Post op days	SSI prevalence			
	Elective	Emergency	Total	Percentage %
3-7	0	6	6	17.14
7-15	3	23	26	74.28
>15	1	2	3	8.58
Total	4	31	35	100

Surgical site infection was detected generally on post operative days 7-15 days (n=26, 74.28%) after being discharged from the hospital. (Table 3)

SSI was found to be highest in CS cases with surgery duration of more than 1 hour(n=2,33.33%). Only 11% cases detected with SSI was completed in less than 1 hour.

Table 4: Type of microorganisms in wound swab culture

Microorganisms	SSI prevalence			
	Elective	Emergency	Total	Percentage (%)
E. coli	0	1	1	5.55
Pseudomonas	0	5	5	27.78
Staphylococcus	2	9	11	61.11
Others (Acinetobacter)	0	1	1	5.55
Total	2	16	18	100.00

The study noticed 18 cases of SSI showed presence of growth of microorganisms in the culture. There was no growth in 17 cases of SSI.Among culture positive SSI, Staphylococcus (n=11,61.11%) was the most common microorganisms detected followed by Pseudomonas(n=5,27.78%). E. coli and Acinetobacter was detected in only 1 case. In both elective and emergency SSI, Staphylococcus aureus was found repeatedly. (Table 4)

DISCUSSION

In regards to prevalence of SSI, our study showed SSI to be 5.06% and 13.6% respectively in elective and emergency CS. Overall prevalence of SSI was more common in emergency CS which was comparable to the study done by Cheong A et al, which showed 50% higher risk of SSI in emergency cases than elective surgery which is 16%[6]Another similar study done by Shrestha et al showed prevalence of SSI to be 12.6% .[7]

Previous CS (34.64%) was the commonest indication of CS in our study, followed by fetal distress (23.52%), labour arrest (15.35%) and others. But in SSI cases labour arrest followed by fetal distress was common indications.A study done by Gupta et al study also showed fetal distress (26.4%) and prior CS (24.1%) were most frequent reasons for undergoing CS which was similar to our study.[2] Likely Bizuayew et al also found that the highest indication for a cesarean section was non-reassurance fetal heart rate (NRFHR) (27.33%), followed by cephalo-pelvic disproportion (CPD) (21.7%).[8]As compared to my study, Jido et al also mentioned the top three reasons for elective CS were prior CS (60.8%), a poor obstetrics history (13.5%), and malpresentations (4.8%). [9]

Majority of cases undergoing elective and emergency CS had no risk factors. However, the most common risk factors favouring development of SSI was obesity(31.42%) followed by anemia (17.17%). In study done by Vijaya et al, the most frequent risk factors for SSI were anemia (26.77%) and preeclampsia (25.19%) followed by obesity. [1]Also a study by Opoien et al found that two significant independent risk factors: operating time > or =38 min and body mass index (BMI) >30.[10]

In our study SSI was generally detected on post operative

days 7-15 days after being discharged from the hospital whereas in 17.14% cases SSI was identified on days 3-7. Another study by Zejnullahu et al revealed that the median time for SSI was the seventh post-operative day whereas prospective study by Alfouzan et al showed the mean time for SSI to be of less than or equal to 15 days.[11,12]Similarly Wloch et al claimed that the average post-cesarean SSI occurrence time was 10 days, but the average SSI occurrence time for organ or space SSIs was 8 days.[13]

Of total SSI detected in this study, the SSI rate was found highest in CS cases with duration of surgery of more than 1 hour(n=2,33.3%). Only 11% of cases completed in less than 1 hour showed SSI. Similarly to my study, the study conducted by Shahane et al and Cheng et al , there was a rise in the proportion of SSI patients where surgery took longer than or equivalent to 2 hours.[5,14] Similar were the results as shown by study by Rubin et al. [15]

In both elective and emergency SSI, Staphylococcus aureus was most common organism seen followed by Pseudomonas and E. coli. Our study was in alignment with studies conducted by Dhar et al, Alfouzan et al and Jido TA et al who showed similar organisms as culprit for SSI[4,9,11].In contrast a study by Vijaya et al found that Kleibsiella species (22.83%) and E. coli (41.7%) were the most frequently isolated organisms in SSI.[1] Simlarly, another study by Gupta et al mentioned that there were 21 (55.3%) gram positive and 17 (44.7%) gram negative bacteria recovered from pus cultures respectively.[2] Thus, it can be concluded that the organisms that cause SSI vary from place to place and from time to time.

Study being conducted in a single centre with modest sample size could be one of few limitations of this study.

CONCLUSIONS

The prevalence of surgical site infection in cases of emergency CS is high compared to elective CS, with obesity and anemia increasing the likelihood of developing SSI thereby increasing maternal morbidity and mortality. Staphylococcus aureus was the most commonly isolated organism, followed by Pseudomonas. The study emphasizes the importance of recognizing and addressing medical complications during the antenatal period to reduce the prevalence of SSI and improve maternal outcomes.

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CONFLICT OF INTEREST

None

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REFERENCES

1. Vijaya K, Padmaja A, Poreddy A, Vivekanand N. ISSN 2347-954X (Print) Surgical Site Wound Infection in Emergency and Elective LSCS-A Comparative Study [Internet]. Vol. 3, Scholars Journal of Applied Medical Sciences (SJAMS. 2015. Available from: www.saspublisher.com
2. Gupta S, Manchanda V, Sachdev P, Kumar Saini R, Joy M. Study of prevalence and risk factors of surgical site infections in lower segment caesarean section cases of tertiary care hospital of north India. Indian J Med Microbiol. 2021 Jan 1;39(1):1–5. DOI: 10.1016/j.ijmmb.2020.11.005
3. Kishwar N, Hayat N, Ayoub S, Ali S. SURGICAL SITE INFECTIONS AMONG PATIENTS UNDERGOING ELECTIVE VERSUS EMERGENCY CAESAREAN SECTION. Vol. 30. DOI: 10.9790/1959-1002033841
4. Dhar H, Al-Busaidi I, Rathi B, Nimre EA, Sachdeva V, Hamdi I. عمان حورلاجا الم دعب ةدلاولا رصيقلا ةي في ىفشتسم ةلاحإ ييميلقإ، ناايمإ نوييلا اهبيف،رنم ا،افيدصاصا اماهلإ ييدمح رد ةسا يعدوع ارصاناه راهد، ا ميهاربإ ييديعصوبلا، انواهبو او،ييثار A Study of Post-Caesarean Section Wound Infections in a Regional Referral Hospital, Oman. Vol. 14. 2014. PMID: 24790744
5. Shahane V. Surgical site infections: A one year prospective study in a tertiary care center. Vol. 6, International Journal of Health Sciences. 2012. DOI: 10.12816/0005976
6. Cheong A, Gandhi A, Zainun T, Mat T, Anderson C, Ahmed N, et al. Surgical Site Infection (SSI): Emergency vs Elective Surgery, A Prospective Cohort Study Surgical intervention in sub-arachnoid cyst with severe neurological manifestations View project Recurrent Liver Embryonal Sarcoma View project Inclusion and Exclusion criteria Surgical Site Infection (SSI): Emergency vs Elective Surgery, A Prospective Cohort Study [Internet]. 2020. Available from: https://www.researchgate.net/publication/343318257
7. prevalence and Risk Factors of Surgical Site Infection Following Cesarean Section at Dhulikhel Hospital. DOI: 10.3126/kumj.v12i2.13656
8. Bizuayew H, Abebe H, Mullu G, Bewuket L, Tsega D, Alemye T. Post-cesarean section surgical site infection and associated factors in East Gojjam zone primary hospitals, Amhara region, North West Ethiopia, 2020. PLoS One. 2021 Dec 1;16(12 December). DOI: 10.1371/journal.pone.0261951
9. Jido T, Garba I. Surgical-site infection following cesarean section in Kano, Nigeria. Ann Med Health Sci Res. 2012;2(1):33. PMID: 23209988
10. Opøien HK, Valbø A, Grinde-Andersen A, Walberg M. Post-cesarean surgical site infections according to CDC standards: Rates and risk factors. A prospective cohort study. Acta Obstet Gynecol Scand. 2007;86(9):1097–102. DOI: 10.1080/00016340701515225
11. Alfouzan W, Al Fadhli M, Abdo N, Alali W, Dhar R. Surgical site infection following cesarean section in a general hospital in Kuwait: trends and risk factors. Epidemiol Infect. 2019 Oct 10;147:e287. DOI: 10.1017/S0950268819001675
12. Zejnullahu VA, Zejnullahu VA, Isjanovska R, Sejfija Z. Surgical site infections after cesarean sections at the University Clinical Center of Kosovo: Rates, microbiological profile and risk factors. BMC Infect Dis. 2019 Aug 28;19(1). DOI: 10.1186/s12879-019-4383-7
13. Wloch C, Wilson J, Lamagni T, Harrington P, Charlett A, Sheridan E. Risk factors for surgical site infection following caesarean section in England: Results from a multicentre cohort study. BJOG. 2012 Oct;119(11):1324–33. DOI: 10.1186/s12879-019-4383-7
14. Cheng K, Li J, Kong Q, Wang C, Ye N, Xia G. Risk factors for surgical site infection in a teaching hospital: A prospective study of 1,138 patients. Patient Prefer Adherence. 2007 Aug 14;9:1171–7. DOI: 10.2147/PPA.S86153
15. Rubin RH. Surgical wound infection: Epidemiology, pathogenesis, diagnosis and management. Vol. 6, BMC Infectious Diseases. 2006. DOI: https://doi.org/10.1186/1471-2334-6-171