



Incidence and risk factors for maternal surgical site infection after cesarean section.

Sadia Zaineab¹, Amina Akbar², Mobeen Ikram³, Saira Mahboob⁴, Arshad Mahmood⁵, Abdul Waheed Khan⁶

1. MBBS, FCPS
Assistant Professor Gynecology
Tertiary Care Hospital, Islamabad.
2. MBBS, FCPS
Assistant Professor Gynecology
Tertiary Care Hospital, Islamabad.
3. MBBS, FCPS
Assistant Professor Anesthesia
Secondary Care Hospital, Okara.
4. MBBS, FCPS
Senior Registrar Anesthesia
Tertiary Care Hospital, Karachi.
5. MBBS, MCPS, MSc
Secondary Care Hospital, Thall.
6. MBBS, FCPS
General Surgeon Surgery
Secondary Care Hospital, Thall.

Correspondence Address:

Dr. Saira Mahboob
Department of Anesthesia
PNS Shifa / BUMDC Karachi.
saira.mahboob.md@gmail.com

Article received on:

31/10/2020

Accepted for publication:

20/02/2021

ABSTRACT... Objective: To ascertain the frequency and risk factors for post-operative surgical site infection (SSI) in cesarean section. **Study Design:** Cross-sectional study. **Setting:** Departments of Gynecology & Obstetrics and Anesthesiology, Secondary Care Hospital. **Period:** January to December 2017. **Material & Methods:** After the approval of hospital ethical committee, 337 parturient who underwent cesarean section were included in our study. Outcomes were: frequency and risk factors for post-cesarean wound infection. Data was analyzed by SPSS version 20. Qualitative data presented as frequency and percentage. Chi-square (Fishers test) used to analyze significance. P-value ≤ 0.05 taken as significant. **Results:** A total of 337 patients were included in our final analysis. The frequency of wound infection was 15 (4.4%). The mean age was 27.5 years \pm 5.8 in our study population. There was no difference in age ($p=0.781$), parity ($p=0.898$), antenatal visits ($p=0.319$), referral from doctor ($p=0.205$), anemia ($p=0.731$), nature of surgery (elective or emergency LSCS) ($p=0.548$), severity of anemia ($p=0.962$), blood grouping Rh-factor ($p=0.531$), chorioamnionitis ($p=0.707$), labor ($p=0.955$), premature rupture of membrane ($p=0.427$) and antepartum hemorrhage ($p=0.769$). 11 (3.3%) of the patients with SSI were treated conservatively while 4 (1.2%) required debridement and secondary suturing. None of our patients required referral to tertiary care hospital for treatment of SSI. **Conclusion:** The incidence of SSI after cesarean section was less in our study and we didn't find maternal age, gestational age, previous cesareans delivery, antenatal visits, PROM, labor before LSCS, anemia to be associated with risk of SSI.

Key words: Age, Anemia, Antenatal Visits, Antepartum Hemorrhage, Surgical Site Infection Incidence.

Article Citation: Sadia Zaineab, Amina Akbar, Mobeen Ikram, Saira Mahboob, Arshad Mahmood, Abdul Waheed Khan. Incidence and risk factors for maternal surgical site infection after cesarean section. Professional Med J 2021; 28(10):1495-1500. <https://doi.org/10.29309/TPMJ/2021.28.10.6187>

INTRODUCTION

There is increasing number of cesarean delivery worldwide with a rate of cesarean section is 32.7% in urban areas versus 19.7% in rural areas of Punjab.¹ Other authors have reported lower segment cesarean section (LSCS) rates to be as high as 44%.^{2,3} The rising trend of cesarean section may help to prevent maternal and neonatal deaths from obstetric complication but it may increase the risk of infectious morbidity. Hemorrhage (27.1%) remains one of the leading cause of maternal deaths with sepsis causing 10.7% of maternal mortality worldwide.⁴ A regional study showed that 16.03% of maternal deaths were due to direct pregnancy related infectious causes.⁵ Surgical site infection is defined as infection of skin or underlying subcutaneous tissue within 30 days of

surgery where the wound was closed primarily. It is diagnosed by a surgeon or physician as purulent discharge from incision; clinical signs and symptoms of infection or isolation of microbial growth on wound tissue culture.⁶ The estimated incidence has been reported to be between 0.41-4.1% of all surgical procedures and as high as 15-25% in contaminated wounds.^{7,8,9} The surgical site infection (SSI) may result in prolonged hospital stay, reduced quality of life, increased cost of health care and higher mortality. A study by Lawson EH et al reported an incidence of 6.2% superficial and 4.7% deep SSI after colectomy. They reported a significantly higher incidence of SSI in patients with obesity, insulin dependent diabetes mellitus, chronic obstructive pulmonary disease and hypertension.¹⁰

LSCS is considered as clean contaminated surgery even if there is no obvious pre-operative discharge, as there is some degree of bacterial contamination during delivery. Parturient are at risk of infection during labor and delivery, as normal flora of the female genital tract can contaminate an otherwise sterile uterus and amniotic fluid. With the routine prophylactic use of antimicrobial, the incidence of post cesarean wound infection has been reduced. The risk of surgical site infection (SSI) may depend on various patient risk factors as well as sterile technique and adequate hemostasis during surgery and post-operative wound care. The incidence of SSI may also be higher in resource limited countries with still developing healthcare system and poor maternal health. Jasim SK reported an incidence of SSI in 6.3% after cesarean section in a Baghdad hospital versus 11.4% SSI in obstetric cases in Ethiopia by Amenu D et al.^{11,12}

Our institute is a peripheral secondary care level hospital that caters for trauma as well as gynecology and obstetrics cases for a wide area of Khyber Pakhtunkhwa. The objective of our study was to ascertain the frequency and risk factors for wound infection, with a target to identify patients at risk of postoperative SSI for the prevention and prompt initiation of treatment.

MATERIAL & METHODS

After the approval of hospital ethical committee (IERC/obs/16/01); this cross sectional-analytical study was conducted at Departments of Gynecology & Obstetrics and Anesthesiology, Secondary level Hospital Thal for a duration of 01 years from 1st January to 31st December 2017. WHO sample size calculator was used to calculate a sample size of 300 parturient. All the pregnant ladies presenting for cesarean delivery for obstetrical reason, aged ≥ 18 years were included in our study. The parturient were assessed by a single classified obstetrician for cesarean section as well as the preoperative preparation. The surgery was also performed by the same obstetrician and patient's data was collected on a predesigned proforma. For the prophylaxis of surgical infection intravenous amoxicillin/clavulanate 1.2g was given pre-operatively and

intravenous amoxicillin/ clavulanate 1.2g with amikacin 80mg were continued 08 hourly for 03 days post-operatively. The patient were discharged and follow up was done in outdoor department by the same obstetrician. The patient who presented with complaints of wound erythema, swelling, discharged and met the diagnostic criteria of SSI was labeled as post cesarean wound infection. As the facility of culture and sensitivity testing were not available at our institute, the patients who were diagnosed with wound infection were treated with intravenous linezolid and metronidazole along with an anti-inflammatory drug serratiopeptidase. Our outcomes were: frequency of wound infection and the risk factors included: age, parity, previous LSCS, antenatal visits, presence of liver disease, nature of surgery, pre-operative suspicion of chorioamnionitis as well as anemia and its severity.

The data was analyzed using SPSS version 20. The qualitative data was presented as frequency and percentage. Chi square (Fischer exact test) used to analyze significance. The quantitative data presented as mean \pm standard deviation. Independent sample T-test was used to calculate association between preoperative leukocytosis and wound infection. P-value ≤ 0.05 taken as significant.

RESULTS

A total of 337 patients were included in our final analysis. The frequency of wound infection was 4.4% (n=15). The mean age was 27.5 years \pm 5.8 in our study population. The correlation between the various risk factors studied is shown in Table-I.

129 (38.3%) were gravida 2-4 in non-SSI group versus 6 (1.8%) in SSI group; followed by 101 (30%) primigravida in non-SSI versus 5(1.5%) in SSI; whereas 92 (27.3%) were grand multiparida in non-SSI versus 4 (1.2%) in SSI group. The difference in parity was statistically insignificant, p value 0.898. Similarly, grand multiparty (previous ≥ 4 children) was not an independent risk factor for post-operative surgical site infection, p value 0.690, Odds Ratio 0.80 (0.26 to 2.4). There was no statistical difference in frequency of wound infection in patient in regards to nature of surgery

(elective or emergency LSCS); $p=0.548$ OR 0.732 (0.09-5.01); as shown in Figure-1.

The mean hemoglobin in non-infected cases was $11.7 \text{ g/dL} \pm 1.3$ versus $12.1 \text{ g/dL} \pm 2.0$ in patients with wound infection, $p= 0.227$. There was no statistical difference between severity of anemia and wound infection, p -value 0.962; as shown in Figure-2.

There was no difference in the frequency of SSI in regards to blood grouping Rh-factor. 91 (27%) patients without SSI had A positive blood group versus 3 (0.1%) in patients with SSI had B positive, p value 0.531. 296 (87.8%) were Rh-positive in patients without SSI versus 12 (3.6%) in patients with SSI, p value 0.107; OR 0.351 (0.09-1.32). Most of our patients were managed in post-operative ward in either group, 291 (86.4%) in non SSI versus 12 (3.6%) in patients with SSI, p value 0.250. The incidence of chorioamnionitis was 3 (0.9%). There was difference in frequency of post-operative SSI in patient with or without chorioamnionitis, labor, premature rupture of membrane and antepartum hemorrhage is shown

in Table-II.

11 (3.3%) of the patients with SSI were treated conservatively while 4 (1.2%) required debridement and secondary suturing. None of our patients required referral to tertiary care hospital for treatment of SSI. There was found to be no association between indication for LSCS and frequency of SSI, p value 0.505, as shown in Figure-3.

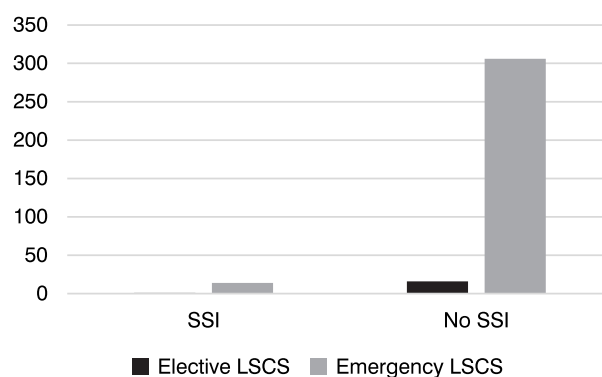


Figure-1. The frequency of SSI with nature of LSCS.

Variable		Wound Infection		P-Value	Odds Ratio
		No	Yes		
Age	Mean	27.5 years	27.1 years	0.781	NA
	\pm SD	± 5.8	± 5.89		
Obstetric history	Primigravida	101 (30%)	4 (1.2%)	0.898	NA
	2-4	129 (38.3%)	6 (1.8%)		
	Grand multiparida	92 (27.3%)	5 (1.5%)		
Antenatal Visits	Yes	64 (19%)	1 (0.3%)	0.319	3.473 (0.448-26.9)
	No	258 (76.6%)	14 (4.2%)		
Referral from Doctor	Yes	184 (54.6%)	9 (2.7%)	0.205	3.4 (0.44-26.9)
	No	138 (40.9%)	6 (1.8%)		
Anti-HCV positive	Yes	8 (2.4%)	-	0.537	0.954 (0.932- 0.977)
	No	314 (93.2%)	15 (4.5%)		
HBsAg Positive	Yes	8 (2.4%)	1 (0.3%)	0.326	2.80 (0.328 - 23.98)
	No	314 (93.2%)	14 (4.2%)		
Anemia	Yes	94 (27.9%)	5 (1.5%)	0.731	1.213 (0.404-3.4)
	No	228 (67.7%)	10 (3.0%)		

Table-I. Correlation of various risk factors with wound infection.

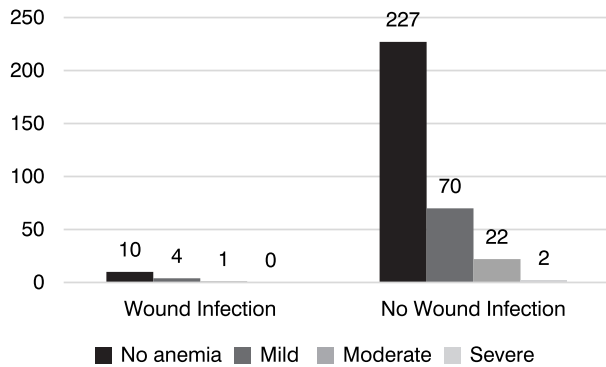


Figure-2. Correlation between severity of anemia and wound infection.

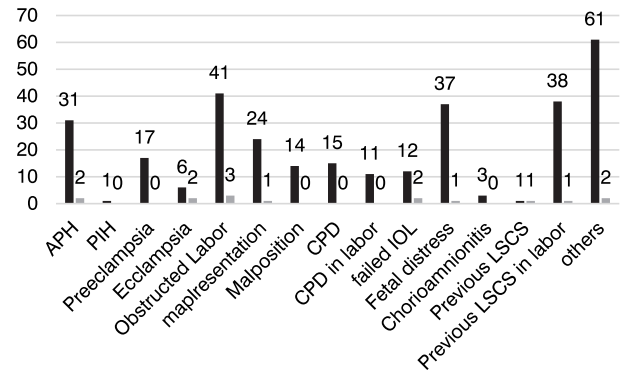


Figure-3. Association of indication of LSCS with SSI.

Variable		Wound Infection		P-Value
		Yes	No	
Chorio-amnionitis	Yes	-	3 (0.9%)	0.707
	No	15 (4.5%)	319 (94.7%)	
Laboring patient	Yes	8 (2.4%)	174 (51.6%)	0.955
	No	4 (1.2%)	99 (29.4%)	
Antepartum hemorrhage	Yes	1 (0.3%)	49 (14.5%)	0.769
	No	11 (3.3%)	225 (66.7%)	
Premature rupture of membrane	Yes	2 (0.6%)	15 (4.5%)	0.427
	No	10 (3%)	258 (76.6%)	

Table-II. Correlation between chorioamnionitis, premature rupture of membrane and antepartum hemorrhage with postoperative SSI.

DISCUSSION

The incidence of post cesarean wound infection was reported to be 4.4% in our study and we were not able to identify any risk factor with significant correlation with SSI. Various studies have shown association of SSI with lower socioeconomic status, obesity, presence of maternal diabetes mellitus, hypertension, renal disease, smoking, prolonged operative time, increased blood loss, surgeon inexperience, wound hematoma.^{11,14,15,16} According to the authors' knowledge, limited studies are published on the risk factors of post cesarean SSI in Pakistani population. Ambreen A et al. reported a much higher incidence of SSI in 10.6%, whereas Iqbal R et al. reported 13.82% of patient undergoing LSCS developed SSI, despite antibiotic prophylaxis.^{17,18} However, both studies didn't go into details of the risk factors for wound infections.

of 1.44% (118 out of 8180) of SSI after cesarean section at a women hospital in Brazil. They also reported that number of prenatal visits (6.6 ± 3.6 vs 7.19 ± 3.1); level of hemoglobin (11.3 ± 1.6 g/dL vs 11.7 ± 1.1 g/dL); premature rupture of membranes (27 vs 21); gestational age (38.2 ± 3.4 vs 38.3 ± 2.9); diabetes mellitus (4 vs 7); hypertension (14 vs 15); cigarette smoking (12 vs 7) were comparable between patients with or without SSI; all p values > 0.05. These finding correlate with the results of our study. However, they reported that emergency surgery was a significant risk factor for SSI (63 vs 43); p value=0.001, relative risk 3.30 (1.63-6.67).¹⁹ We didn't study smoking, BMI, hypertension or diabetes as risk factors, as these have been repeated been proven to be significantly associated with SSI. We reported that emergency LSCS was not a risk factor for SSI, which doesn't correlate with other authors' findings. This may be due to the fact that all the cesarean section in study population were

Farret TCL et al. reported a much lower incidence

performed by a single, classified obstetrician and risk of bias by surgical skill / techniques can not ruled out in our study.

Dhar H et al. reported an incidence of 2.66% (211) of post cesarean section infections with positive bacteriology in 164 (77.7%) cases. They report that parity ($p=0.077$) did not correlate with wound infection which correlates with our findings. However, they reported diabetes mellitus ($p=0.001$); premature rupture of membrane (PROM) ≥ 6 hours ($p < 0.001$); anemia ($p=0.035$); Hypertension/ pre-eclampsia ($p=0.007$) and body mass index > 35 ($p=0.018$) as independent risk factors for SSI. We did not study, the presence of diabetes / hypertension as risk factors. The increased risk of SSI in anemia found in their study does not correlate with our findings. In addition, they had a slightly lower incidence of anemia 59 (27%) in their population versus 99 (29.3%) in our study. Both studies also differ in the findings that we didn't find any correlation between severity of anemia and SSI. There was also a difference in study designs, ours was a cross-sectional analytical study whereas theirs was a retrospective, case-control study.²⁰ Assawapalangool S et al. have reported a slightly higher SSI rate of 5.9% (293) with anemia (Relative risk 2.19; 1.57-3.04); preterm (RR21.08;10.23-43.41); ≥ 5 pelvic examinations during labor (RR 4.16; 2.89-5.99) and foul smelling discharge (RR 21.08; 10.23-43.41) as independent risk factor for post cesarean SSI.

Our study had certain limitations. As the follow up was by self-reporting to gynecology & obstetrics department, so we may have missed a few cases of SSI that may have reported to other hospitals.

CONCLUSION

The incidence of SSI after cesarean section was less in our study and we didn't find maternal age, gestational age, previous cesareans delivery, antenatal visits, PROM, labor before LSCS, anemia to be associated with risk of SSI.






Copyright© 20 Feb, 2021.

REFERENCES

1. Abbas F, Din RA, Sadiq M. **prevalence and determinants of caesarean delivery in Punjab Pakistan.** EMHJ. 2018; 24(11); 1058-65.
2. Baig JR, Jamal MM, Ashfaq T. **A two year analysis of cesarean delivery at CMH Hyderabad.** PAFMJ. 2016 Feb 29; 66(1):25-9.
3. Un Nisa Q, Raza F, Shams R, Gul R. **Frequency and Indications of Cesarean Section in a Tertiary Care Hospital of Peshawar, Khyber Pakhtunkhwa, Pakistan.** Journal of Rehman Medical Institute. 2016; 2(1):27-34.
4. Say L, Chou D, Gemmill A, Tuncalp O, Moller AB, Daniels J et al. **Global causes of maternal death: A WHO systemic analysis.** Lancet Global Health. 2014; 2(6):e323-33. doi: 10.1016/S2214-109X(14)70227-X. Epub 2014 May 5.
5. Halder A, Vijayselvi R and Jose R. **Changing perspective of infectious causes of maternal mortality.** J Turk Ger Gynecol assoc. 2015; 16(4):208-13.
6. Singh R, Singla P, Chaudhry U. **Surgical site Infections: classification, risk factors, pathogenesis and preventive management.** International Journal of Pharma Research NA Health Sciences. 2014; 293):302-14.
7. Azoury S, Farrow N, Hu Q, Soares K, Hicks C, Azar F, et al. **Postoperative abdominal wound infection-epidemiology, risk factors , identification, and management.** Dovepress. 2015; 2:137-48.
8. Kaoutzanis C, Gupta Varun, Winocour J, Shack B, Grotting JC, Higdon K. **Incidence and risk factors for major surgical site infections in Aesthetics surgery: Analysis of 129,007 Patients.** Aesthetic Surgey Journal. 2017; 37(1):88-9. <https://doi.org/10.1093/asj/sjw100>.
9. Lemaigen A, Brigand G, Ghodhbane W, Alkhoder S, Lolom I, Belorgey S, et al. **Sternal wound infection after cardiac surgery: Incidence and risk factors according to clinical presentation.** Clinical Microbiology and Infectio. 2015; 21(7):674.e11-674.e18.
11. Lawson EH, Hall BL, Ko CY. **Risk factors for superficial vs deep/organ-space surgical site infection Implications for Quality Improvement Initiatives.** JAMA Surg. 2013; 148(9):849-58. doi:10.1001/jamasurg.2013.2925.

12. Jasim SK. **Post cesarean section surgical site infection; Incidence and Risk factors.** International Journal of Science and Research (IJSR). 2017; 6(7):1864-8.
13. Amenu D, Belachew T and Araya F. **Surgical site Infection rate and Risk factors among obstetric cases of Jilma University Specialized Hospital, Southwest Ethiopia.** Ethiop J Health Sci. 2011; 21(2):91-100. PMID: PMC3275863.
14. Saeed KBM, Greene RA, Cocoran P and O'Neill SM. **Incidence of surgical site infection following caesarean section: A systemic review and meta-analysis protocol.** BMJ Open. 2017;7(1):e013037.
15. Vijayan CP, Mohndas S and Nath AG. **Surgical site infection following cesarean section in a teaching hospital.** International Journal of Scientific study. 2016; 3(12):97-101
16. Osler MA, Butler AM, Willers DM, Devkota P, Gross GA, Fraser VJ. **Risk factors for surgical site infection after low transverse cesarean section.** Infect Control Hosp Epidemiol. 2008; 29(6):477-86. doi: 10.1086/587810.
17. Ezechi Oc, edet A, Akinlade H, Gab-Okafor CV and Hebertson E. **Incidence and risk factors for cesarean wound infection in Lagos Nigeria.** BMC Res Notes. 2009; 22(2):186.
18. Anwer A, Tehseen F and Anwer A. **Prophylaxis antibiotics use in cesarean section.** Ann King Edward med Uni. 2001; 7(4):271-3.
19. Iqbal R, intsar A, Khurshid S, Manzoor T and Shehbaz S. **Single dose antibiotic prophylaxis in emergency caesarean section.** Pak J Med health sci. 2012; 6(1):77-80.
20. Farret TCF, dale J, Monteiro VS, Riche CVW and Antonello VS. **Risk factors for surgical site infection following cesarean section in a Brazilian Women's Hospital: A case-control study.** The Brazilian Journal of Infectious Diseases. 2015;19(2):113-7
21. Dhar H, Al-Busaidi I, Rathi B, Nimre EA, Sachdeva V and Hamdi I. **A study of post caesarean section wound infections in a Regional Referral Hospital, Oman.** Sultan Qaboos Univ Med J. 2014; 14(2):e211-e217. PMID: PMC3997538.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Sadia Zaineb	Concept, Conduct literature review.	
2	Amina Akbar	Literature review.	
3	Mobeen Ikram	Conduct, Proof reading.	
4	Saira Mahboob	Statis, Manuscript editing.	
5	Arshad Mahmood	Conduct, Literature review.	
6	Abdul Waheed Khan	Literature review.	