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Evaluation of risk factors in wound dehiscence following caesarean section in sir salimullah medical college & Mitford hospital

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Abstract
Context: The caesarean section rate is at rising trend. The prevalence of caesarean section currently in SSMC&MH is 49.72% (Statistics 2018). Wound dehiscence rate is quite high. The risk factors contributing to wound dehiscence in not known. There are limited numbers of studies in this field and literature available is also scanty. The present study attempts to determine the prevalence of different risk factors associated with surgical wound dehiscence in post Caesarean Section patients. Thus, this study is attempted.
Objectives: To evaluate the different risk factors contributing to wound dehiscence following Caesarean section in Sir Salimullah Medical College & Mitford Hospital.
Results: This study was a case control study enrolling 100 female patients in total who underwent caesarean section and 50 patients in each of case and control groups. The mean age was 25.20 (±1.83) years. Most of the patients (76) were Muslim. The mean weight was 68 (±2.43) kg, mean height was 150.02 (±4.32) cm, and mean BMI was 32.30 (±1.83) for all patients. BMI was 34.56 (±2.34) kg/m2, which was much greater than 31.78 (±2.11) kg/m2 in case groups. The difference was statistically significant (p=0.043). Most of the patients came from urban (40). Most of the patients were primi-para (52). Among the patients, 22 had history of prior Caesarean section. None had HIV serology positive. Anemia was the most common medical disorder present in 32 patients followed by hypertension (12) and diabetes (11). Most of the patients (56) had irregular antenatal visits, among them 36 were cases and 20 were in control groups. Regularity of antenatal visits was associated with development of wound dehiscence (p=0.043). Prior Caesarean section was also associated with development of wound dehiscence (p=0.033). Those who had prior Caesarean section had 1.5 (1.1-2.7) times higher odd of developing wound dehiscence. Intrapartum steroid use was also associated with development of wound dehiscence (p=0.027). Those who had history of intrapartum steroid use had 2.7 (2.0-4.9) times higher odd of developing wound dehiscence. In our study, commonest recorded indications for CS were: previous CS (28), fetal distress (18), cephalo-pelvic disproportion (12), prolonged obstructed labor (9). The most common organism was S. aureus (15) followed by *Klebsiella pneumoniae* (11) and then E. coli (9) and *Pseudomonas aeruginosa*(3).
Conclusion: Increased BMI, irregularity of antenatal visits, prior Caesarean section, intrapartum steroid use were the risk factors associated with development of wound dehiscence.

Keywords: Caesarean section, wound dehiscence, risk factors, BMI, antenatal visits, steroid use, infection

Introduction
Lower Uterine Caesarean Section (LUCS) is amongst the most common surgeries performed in both developed and developing countries.1 In a community based survey conducted between 2005 and 2012, spanning three countries (Bangladesh, India, Nepal), assessing 45,327 live births, it was found that the proportion of private and charitable facility births delivered by Caesarean section was 73% in Bangladesh, 30% in rural Nepal, 18% in urban India and 5% in rural India [1]. Moreover, according to the latest data from 150 countries, between 1990 and 2014 the global average Caesarean Section (CS) rate has increased 12.4% (from 6.7% to 19.1%) with an average annual rate of increase of 4.4% [2]. As a result, the Caesarean Section and its related complications are of great importance for any country and health care delivery system. Multiple factors are responsible for declining trial of labor after Cesarean (TOLAC) by most patients, causing repeat Cesarean Section (CS) to hold the greatest proportion of total number of Cesarean sections [3].

Consequently, the number of women who undergo multiple CS, eventually increases despite the increased risk of associated morbidities [4]. The ever-increasing rate of Caesarean Section predicts a simultaneous increase in Caesarean Section related complications, such as, surgical wound dehiscence (SWD) [5]. Surgical wound dehiscence (SWD) is defined as the rupture or splitting open of a previously closed surgical incision site, may be either superficial or deep [6]. Despite the increased knowledge of wound healing process before and after surgery and the development of preoperative care and suture materials, wound dehiscence may increase the length of hospital stay, increase patient inconvenience and rates of re-operation. In addition, wound dehiscence after abdominal surgery is associated with mortality rates of 10-44% [7-9]. Factors responsible for wound dehiscence after Caesarean section can be patient-related or surgically related. Patient-related factors responsible for wound dehiscence after caesarean section include high body mass index at term, [10-12] corticosteroid use, [12] low number of antenatal visits, [13] chorioamnionitis, [11, 14] preeclampsia, [14] foetal macrosomia,14 prolonged rupture of membranes, [13, 15] and prolonged labour [10]. Surgically-related factors responsible for dehiscence include emergency procedures, [10, 15] haemorrhage, [10, 15] increased duration of caesarean section, [13] induction of labour [11] and absence of antibiotic prophylaxis [11, 13, 16].

Materials and Methods

Study design

The study is a case control study.

Place of study

Department of Obstetrics & Gynaecology, SSMC & Mitford Hospital.

Study population

Pregnant subjects of any religion or ethnicity, above the age of 18 years, undergoing Caesarean Section, admitted in Department of Obstetrics and Gynecology, Sir Salimullah Medical College & Mitford Hospital will be taken as the population from which sample will be taken.

Sample size and statistical basis of it

For a case control study, following formula is used for determination of total number of subjects (case and control equal in number).

Using the above formula sample size should be 126. Due to time and monetary constraints, this study will be done on 100 patients. So, the total sample size for this study will be N=100, cases 50 and controls 50.

Inclusion Criteria

Case

1. pregnant subjects of any religion or ethnicity, above the age of 18 years, undergoing Caesarean Section, admitted in Department of Obstetrics and Gynecology, Sir Salimullah Medical College & Mitford Hospital will be taken as the population from which sample will be taken.
2. Patients meeting the above criteria and later developing surgical wound dehiscence (SWD) within 30 days of Caesarean Section (CS).

Controls

1. Patients meeting the no. 1 inclusion criterion but without meeting no.
2. Inclusion criterion.

Exclusion Criteria

1. Patient not interested in participating in the study.
2. Evidence of burst abdomen.
3. History of trauma to the wound site

Data analysis

After collection of information, these data will be checked, verified for consistency and edited for finalized result. After editing and coding, the coded data will directly enter into the computer by using SPSS version 23 (IBM Corporation Inc., USA). Data cleaning validation and analysis will be performed using the SPSS and MS Excel version 2016 (Microsoft Corporation, USA) the result will be presented in tables in proportion. A “P” value < 0.05 were considered statistically significant.

Results

This study was a case control study enrolling 100 female patients in total who underwent caesarian section and 50 patients in each of case and control groups. Baseline characteristics of the patients are shown in Table 1.

Table 1: Baseline characteristics

Factors	Total	Case	Control	P value	OR (95%CI)
Age (in years):	25.20 (±1.83)	26.45 (±1.90)	25.20 (±1.87)	0.987	
Religion					
Muslim	76	40	36		
Hindu	23	12	11	0.879	
Christian	1	1	0		
Weighting:	68 (±2.43)	74.56 (±2.34)	62.78 (±2.11)	0.041	
Height (incm):	150.02 (±4.32)	145.67 (±4.23)	155.98 (±4.11)	0.781	
BMI (kg/m^2):	32.30 (±1.83)	34.30 (±1.84)	30.00 (±1.89)	0.043	
Location of household					
Village	34	18	16		
Sub-urban	26	14	12	0.987	
Urban	40	22	18		
Parity:					
Primipara	52	27	25		
1-3	44	23	21	0.896	
≥4	4	2	2		
Prior Caesarean Section	22	12	10	0.789	
Medical disorders					
Hypertension	12	7	5		
Skin infection	7	3	4		
Diabetes	11	6	5	0.987	
Asthma	10	5	5		
Anemia (<10 mg/dl)	32	17	15		

Table 1 shows that the mean age was 25.20 (±1.83) years. Most of the patients (76) were Muslim. The mean weight was 68 (±2.43) kg, mean height was 150.02 (±4.32) cm, and mean BMI was 32.30 (±1.83) for all patients. BMI was 34.56 (±2.34) kg/m2, which was much greater than 31.78 (±2.11) kg/m2 in case groups. The difference was statistically significant (p=0.043). Most of the patients came from urban (40). Most of the patients were primi-para (52). Among the patients, 22 had history of prior Caesarean section. None had HIV serology positive. Anemia was the most common medical disorder present in 32 patients followed by hypertension (12) and diabetes (11).

Table 2: Gestational age in weeks

Factors	Total	Case	Control	P Value OR (95%CI)
Gestational age in weeks				
<36	50	25	25	0.099
36−40	40	22	18	
>40	10	6	4	

Table 2 shows the length of gestational period in the respondents. Out of 100 respondents, most of the respondents (50, total and 25 in each of the case and the control group) had experienced a gestational period of< 36 weeks. To find out the association between length of gestational period and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 7.218, p = 0.099. Odd's ratio could not be determined.

Table 3: Antenatal check-ups of the participants

Factors	Total	Case	Control	P value	OR(95%CI)
Antenatal check up				0.043	N/A
Regular(>4)	40	15	25		
Irregular(1−3)	56	36	20		
No	4	4	0		

Table 3 shows the regularity of antenatal checkups in the respondents. Out of 100 respondents, most of the respondents (56 in total, 36 cases and 20 controls) had irregular antenatal check-ups. To find out the association between regularity of antenatal checkups and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 6.218, p = 0.0043. Odd's ratio could not be determined.

Table 4: Types of Caesarean section

Factors	Total	Case	Control	P value	OR (95% CI)
Types of caesarean section					
Elective	46	23	23	0.793	
Emergency	54	28	26		

Table 4 shows the types of Caesarean section in the respondents. Out of 100 respondents, most of the respondents (54 in total, 28 cases and 26 controls) had emergency Caesarean sections. To find out the association between types of Caesarean sections and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 0.218, p = 0.793. Odd's ratio was not determined.

Table 5: History of prior Caesarean section

Factors	Total	Case	Control	P Value	OR (95%CI)
Prior Caesarean Section	60	40	20	0.004	1.5(1.1-2.7)
No history of prior Caesarean section	40	10	30		

Table 5 shows the history of prioir Caesarean section in the respondents. Out of 100 respondents, most of the respondents (60 in total, 40 cases and 20 controls) had emergency Caesarean sections. To find out the association between types of Caesarean sections and development of wound dehiscence, a Pearson's chi square test was performed, and the association was significant, χ^2 (4, N = 100) = 16.667, p = 0.0043. Those who had history of prior Caesarean section 1.5 times higher odds (95% CI: 1.1-2.7) of developing wound dehiscence.

Table 10: Induction of labour

Factors	Total	Case	Control	P value	OR (95% CI)
Induction of labour	46	24	22	0.657	

Table 12 shows the history of induction of labor in the respondents. Out of 100 respondents, many of the respondents (46 in total, 24 cases and 22 controls) had induction of labor. To find out the association between history of induction of labor and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 0.134, p = 0.657

Table 11: Hypoproteinemia

Factors	Total	Case	Control	P value	OR (95% CI)
Hypoproteinemia, Serum Albumin Level (mg/dl)	22	12	10	0.978	

Table 13 shows the hypoproteinemia in the respondents. Out of 100 respondents, many of the respondents (22 in total, 12 cases and 10 controls) had induction of labor. To find out the association between hypoproteinemia and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 0.234, p = 0.978.

Table 12: Anemia (Hb< 10 g/dl) level in cases and controls

Factors	Total	Case	Control	P Value OR (95%CI)
Haemoglobin leveling/dl				0.989
<10	56	29	27	
>10	44	22	22	

Table 14 shows the anemia in the respondents. Out of 100 respondents, many of the respondents (56 in total, 29 cases and 27 controls) had induction of labor. To find out the association between anemia and development of wound dehiscence, a Pearson's chi square test was performed, and the association was not significant, χ^2 (4, N = 100) = 0.214, p = 0.989.

Table 15 shows the outcomes of the respondents. Out of 100 respondents,

Table 13: Outcome among the cases and controls

Factors	Total	Case	Control	P Value OR (95%CI)
2. Outcome				
Improved	100	50	50	
Death	0	0	0	

everyone improved, and nobody died. So, no association of outcome (in terms of death or improved) was not present with development of wound dehiscence.

Table 14: Indications for Caesarean section

Indications for CS	Total	Case	Control
Previous CS with scar tenderness	28	14	14
Foetal distress	18	10	8
Prolonged labour	9	5	4
Malpresentation	12	5	7

In our study, commonest recorded indications for CS were: previous CS (28), fetal distress (18), cephalo-pelvic disproportion (12), prolonged obstructed labor (9).

Table 15: Organism isolated from wound swab

Organisms isolated from wound swab	Total	Case	Control
Staphy Loccous Aureus	15	13	2
Klebsiella pneumonia	11	10	1
Escherichia Coli	9	8	1
Pseudomonas aeruginosa	3	3	0

Table 17 shows that the most common organism was S. aureus (15) followed by *Klebsiella pneumonia*e (11) and then E. coli (9) and *Pseudomonas aeruginosa* (3).

Discussion

In our study mean BMI was 32.30 (±1.83) for all patients. BMI was 74.56 (±2.34) kg/m 2, which was much greater than 62.78 (±2.11) kg/m2 in case groups. The difference was statistically significant (p=0.043). Conner *et al.* performed a retrospective cohort study of consecutive cesarean deliveries at a tertiary care facility from 2004-2008 and they found of the 2444 women with complete follow up data, 266 (10.9%) developed a wound complication [17]. They found that compared to non-obese women (6.6%), increasing BMI was associated with an increased risk of wound complications: BMI 30.0-39.9, 9.2%, aOR 1.4 [95% CI 0.99-2.0]; BMI 40.0-49.9, 16.8%, aOR 2.6 [95% CI 1.7-3.8]; BMI ≥50, 22.9%, aOR 3.0 [95% CI 1.9-4.9]. Increasing BMI was also associated with increased rates of midline vertical incision, longer operative time, higher EBL, and lower rates of subcuticular skin closure [17]. Smid *et al.* found in a secondary cohort analysis of a Maternal-Fetal Medicine Unit Cesarean Registry [18]. They stratified the exposure, maternal body mass index (BMI) at delivery, as not obese (BMI < 30), obese (BMI 30-45), and extremely obese (BMI > 45). Their primary outcome was wound complication composite of wound infection, endometritis, wound opening, seroma/hematoma, and hospital readmission. Their secondary outcomes included infection composite (wound infection and endometritis) and each individual outcome included in the primary composite. They performed unadjusted and multivariable logistic regression analyses. They included 38,229 women who underwent cesarean; 39% were not obese, 55% were obese, and 6% were extremely obese. In their cohort, 40% of women underwent repeat cesarean and 57% underwent cesarean after labor [18]. Extremely obese women had increased risk for any wound complication (14%, adjusted odds ratio [AOR], 1.65; 95% confidence interval [CI], 1.44- 1.89), endometritis (8.3%, AOR, 1.26; 95% CI, 1.07-1.49), wound infection (2.0%, AOR, 3.77; 95% CI, 2.60-5.46), wound opening (0.8%, AOR, 5.47; 95% CI, 2.79-10.71), and wound infection-related hospital readmission (3.6%, AOR, 2.97; 95% CI, 2.26-3.91) compared with non-obese women. Obese women had increased risk for any wound complication (9.6%, AOR, 1.14; 95% CI, 1.06-1.23) and post caesarean infection (7.7%, AOR, 1.12; 95% CI, 1.03-1.22) but not other outcomes [18]. Stamillo *et al.* found in another cohort analysis of 585 patients that extremely obese patients had a twofold to fourfold increase in postoperative complications, including the primary infectious outcome (18.8%, adjusted OR 2.7, CI 1.2-6.1), wound infection (18.8%, adjusted OR 3.4, CI 1.4-8.0), and emergency department visit (23.1%, adjusted OR 2.2, CI 1.03-4.9) [19].

In our study, most of the patients (56) had irregular antenatal visits, among them 36 were cases and 20 were in control groups. Regularity of antenatal visits was associated with development of wound dehiscence (p=0.043). Jama *et al.* found that in retrospective case controlled study of 107 patients with wound infection after lower segment caesarean section (LSCS) undertaken between January 1998 and December 2007. The control group comprised of 340 patients selected randomly from among those who had LSCS during the study period with no wound infection. The overall wound infection rate in the study was 4.2% among 2 541 lower transverse CS. The independent risk factors identified for wound infection were, obesity, duration of labor >12 hours, and no antenatal care. Patients' age and parity, diabetes mellitus, premature rupture of membranes (PROM) >8 hours and elective vs. emergency surgery was not found to be significantly associated with wound infection. Conclusion: The independent risk factors could be incorporated into the policies for surveillance and prevention of wound infection. Antibiotic prophylaxis may be utilized in high risk patients such as PROM, obese patients and prolonged labor [20].

In our study, prior Caesarean section was also associated with development of wound dehiscence (p=0.033). Those who had prior Caesarean section had 1.5 (1.1-2.7) times higher odd of developing wound dehiscence. Bashiri *et al.* found in a rertrospective cohort study from computerized database identifying patients with recurrent CDs in the index pregnancy (1988- 2002). Of 7,833 women with at least 1 previous CD and a CD in the index pregnancy, 81 (1.03%) had uterine scar dehiscence. This finding was associated with nonprogress of labor during the first stage, number of previous CDs, parity, preterm delivery and low Apgar scores at 5 minutes. For patients with only 1 previous CD, failure to progress during the first stage of labor and lower parity were associated with uterine scar dehiscence. The numbers of previous CDs, gravidity and placenta previa rate were significantly higher in the group with dehiscence who delivered preterm [21]. They concluded that preterm delivery, nonprogress of labor during the first stage and number of previous CDs were found to be independent risk factors for uterine scar dehiscence. In contrast, parity had a protective effect against dehiscence [21]. In our study, commonest recorded indications for CS were: previous CS (28), fetal distress (18), cephalo-pelvic disproportion (12), prolonged obstructed labor (9). Our findings are almost identical to those found by Aminu *et al.*, who reported that in rural the commonest recorded indications for CS were: previous CS (29.4%), fetal distress (15.7%), cephalo-pelvic disproportion (10.2%), prolonged obstructed labor (8.3%) and post-term dates (7.0%) [22]. Jido and Garba found in their study that the most common indication for CS was obstructed labor/failure to progress (86, 17.7%) of the patients, of these 13 (15.1%) had wound infection. Sixty seven (13.8%) patients had severe pre-eclampsia/eclampsia, while only 3 (4.5%) had SSI. The indication in 48 (9.9%) was abnormal lie/breech presentation.

All but 11 (22.9%) presented in labor and had emergency CS. Seven (14.7%) of these patients had hand and/or cord prolapse. Eight (16.7%) patients in this group had wound infection [23].

In our study, the most common organism was S. aureus (15) followed by *Klebsiella pneumonia*e (11) and then E. coli (9) and *Pseudomonas aeruginosa* (3). Njoku and Njoku found similar findings as they reported that the most common organisms were S. aureus 22 (37.3%), *Klebsiella pneumonia*e 16 (27.1%), E. coli 13 (22.0%), *Pseudomonas aeruginosa* 3 (5.1%), Klebsiella oxytoca 3 (5.1%) and Bacteroides 2 (3.4%) [24]. Jido and Garba reported that in their study, of the 44 cases with SSI, 32 (72.7%) had wound swab cultures done, 3 (6.8%) yielded no growth. In 14 (31.8%) Staphylococcus aureus was grown, while 13.6% produced E. coli, 6.8% Pseudomonas spp. and 2.3% each for Salmonella and *Morganella morganii* [23].

Limitation of the present study

This study has some limitations, which could not be avoided. First of all, monetary and time constraints did not allow enough number of cases to be recruited as sample. Secondly, this study was done only in SSMC & Mitford Hospital, Dhaka, which is a tertiary level hospital, and may not represent the actual condition of whole Bangladesh.

Conclusion

Increased BMI, irregularity of antenatal visits, prior Caesarean section, intrapartum steroid use, staple wound closure were the risk factors associated with development of wound dehiscence.

Recommendations

Further study should be undertaken to find out more associations

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