INCIDENCE, RISK FACTORS AND MICROORGANISMS FOR POST CAESAREAN SURGICAL SITE INFECTION IN A TERTIARY CARE CENTRE IN BANGLADESH

MEHZABIN S[1], ELAHI MM[2], BAR D[3], SINHA B[4], AKTER T[5], ALAM MN[6]

Abstract

Background: *Surgical site infection (SSI) is a common complication following caesarean section (C-section) and mainly responsible for increased maternal morbidity and higher treatment costs. This study will determine the incidence and risk factors of surgical site infections following caesarean section in Dhaka Medical College Hospital (DMCH).*

Materials and Methods: *This is a retrospective observational study which was conducted among patients having post caesarean surgical site infections attending post-natal outdoor clinic of DMCH from January, 2019 to December, 2019. Data were collected in structured questionnaire. Culture-based microbiological methods were used to identify causal agents in postoperative wounds.*

Results: *Overall SSI rate following caesarian section was 4.44%.Patient related risk factors were inadequate antenatal check-up, emergency procedures, malnutrition (22.44%), anaemia (21.46%) associated comorbidity (59.46%), history of rupture membrane >12 hours (40.98%) and had history of prolonged labour pain >12 hours (16.10%).Surgery related risk factors were repeated per vaginal examinations by untrained birth attendant (21.95%) & duration of surgery>1 hour (62.93%). The most common organisms responsible for SSI were* Staphylococcus aureus 44*(21.46%) and* Escherichia coli 31*(15.12%). The most sensitive antibiotics were aminoglycosides, cephalosporin & cloxacillin.*

Conclusion: *Most of the risk factors for surgical site infection following caesarean section identified in this study can be modified through intervention. However the microorganisms detected from our patient showed a high degree of resistance for commonly prescribed antimicrobials in our set-up.*

Key words: *Surgical site infection; Microorganisms; Risk factors.*

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Introduction

Caesarean section (CS) is the most common surgical procedure performed on women in both developed and developing countries.Globally, the CS rate is 15%.[1] One of the most common complications associated with caesarean section is Surgical Site Infection (SSI) being diagnosed in 2.5 to 16% of cases.[2] Caesarean section wound infection represents a substantial burden to the health system and prevention of such infections should be a health care priority in developing countries.[3]

Some of the risk factors observed for CS wound infections, specifically those related to patient's factors include: lack of antenatal care, multiple pregnancies, history of previous C-section, chorioamnionitis, prolonged rupture of membrane and history of prolonged labour. Factors related to surgical procedure include: prolonged surgery, lack of pre-incision antimicrobial care & massive blood loss during surgery.[4] Pre-existing morbidities associated with SSI include: obesity, under nutrition, smoking, blood transfusion, diabetes mellitus, hypertension, immunosuppressive therapy, immune incompetence and longer preoperative hospitalization.[5]SSIs are associated with significant morbidity and occasional mortality,

1. Dr. Shahfinaz Mehzabin, Medical officer, Sheikh Hasina National Institute of Burn and Plastic Surgery
2. Dr. Mohmmad Mahbub Elahi, Resident Surgeon, Dhaka Medical College Hospital
3. Dr. Debashish Bar, Registrar, Department of Surgery, Dhaka Medical College Hospital
4. Dr. Banalata Sinha, Senior Consultant, Model Family Planning Clinic, DMCH
5. Dr. Tahmina Akter, Medical Officer, Model Family Planning Clinic, DMCH
6. Dr. Md. Nur Alam, Indoor Medical Officer, Department of Hepatology, Dhaka Medical College, Dhaka

Correspondence: Dr. Shafinaz Mehzabin, Medical Officer, Sheikh Hasina National Institute of Burn and Plastic Surgery, Mob no: 01711206469

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higher rates of patient's dissatisfaction, prolonged hospital stay, often needs readmission and adds 10-20% of extra hospital cost.[6]

Although total elimination of SSI is not possible, the delivery of high quality services with early interventions to reduce wound infections is an important aspect of patient safety measures. Therefore, the aim of this study was to determine the incidence of SSIs in patients undergoing CS at Dhaka Medical College Hospital in Bangladesh, to identify risk factors, common bacterial pathogens and antibiotic sensitivity.

Materials and Methods:

This retrospective observational study was conducted among patients having post caesarean surgical site infections attending post-natal outdoor clinic of Dhaka Medical College Hospital from January, 2019 to December, 2019. The patients who developed SSI after C-section that underwent in the same hospital, diagnosed during their post natal visit, were included in the study irrespective of indications. Patients whose C-section underwent out of DMCH were excluded from the study. Data were collected in structured questionnaire on the variables responsible for the development of SSI following C-section. Discharge was collected from the surgical incision site with sterile cotton swabs. Culture-based microbiological methods were used to identify causal agents in postoperative wounds. Categorical variables were summarized by frequency (percentage).

Results:

During the study period 7461 C-section were done in DMCH. Among them 331 cases (4.44%) developed surgical site infection. Among these 331 cases, 205 cases (study population) were diagnosed during their postnatal visits and 53 of them needed readmission. Remaining 126 cases were diagnosed during their hospital stay. Total 179 cases (2.4%) needed secondary sutures. Out of these 205 cases who attended post natal outdoor clinic, 184 (89.75%) had undergone emergency caesarean whereas 21 (10.25%) had elective procedure. The age of the patients of this study ranged from 16-40 years, majority of them (33.17%) were between 21 to 25 years of age.

Table I

Indications for caesarean sections. (N= 205)

Indications	Number	Percentage
Previous CS	81	39.51
Fetal distress	64	31.21
Prolonged labour	15	07.31
Obstructed labour	16	07.81
Failed induction	13	06.34
Antepartum haemorrhage	27	13.17
Medical disorders	21	10.24
PROM with chorioamnionitis	05	02.44
Malpresentation	09	04.39
Cephalo pelvic disproportion	17	08.29
Severe oligohydramnios	06	02.92
Mother's request	04	01.95

Table II

Patient related risk factors for post caesarean SSI.

Characteristics	Number	Percentage
Parity		
1	109	53.17
2	55	26.83
>2	41	20
Gestational age in weeks		
Preterm (<37 weeks)	36	17.56
Term (37-42 weeks)	157	76.59
Post term (>42 weeks)	12	5.85
Antenatal check up		
Regular (4 or more)	43	20.98
Irregular (1-3)	144	70.24
No check up	18	8.78
Nutritional status (BMI)		
Underweight (<18.5)	24	11.71
Normal weight (18.5-24.9)	159	77.56
Overweight (>24.9)	22	10.73
Medical disorders		
Hypertension	53	25.85
Diabetes	33	16.10
Infection present elsewhere	8	3.90
Asthma	5	2.44
Anemia (Hb level <10gm/dl)	44	21.46

Most of the patient related risk factors (Table II) were primiparous (53.17%), term gestations (76.59%), malnutrition including both under nutrition (11.71%) and over nutrition (10.73%), having anaemia (21.46%) that is haemoglobin level <60%, associated comorbidity (59.46%) like Diabetes mellitus, HTN, Preeclampsia, infections in other site & asthma. Few women had more than one medical disorders simultaneously. Among all SSIs 70.24% had inadequate &8.78% had no antenatal check-up.

Surgery related risk factors for the development of SSI are repeated per vaginal examinations done by untrained birth attendant (21.95%), history of ruptured membrane >12 hours (40.98%), history of prolonged labour pain >12 hours (16.10%), patients operated for repeat caesarean section or fetal indications, surgery time >1 hour (62.93%) and patients having drain tube in situ (21.46%). Emergency procedures were 184 (89.75%) which were more likely to develop SSI as compared to elective caesarean 21 (10.25%).

The majority of SSI cases yielded growth of *Staphylococcus aureus (44, 21.46%)* followed by *Escherichia coli* (31, 15.12%) [Table IV]. Polymicrobial infections were found in 7 (3.41%) cases. The main organisms found to be grown together were: *klebsiella* and *E. coli, Klebsiella* and *S. aureus, Klebsiella* and *Proteus, E. coli* and *Proteus; and E. coli* and coagulase negative *S. aureus*. There were 74 (36.10%) cases where the culture did not yield any organisms probably due to the use of broad spectrum antibiotics prior to the wound swab. Other organisms that were isolated were *Acinetobacter 14(6.83%), Pseudomonas 13(6.34%), Proteus 8(3.9%) and Klebsiella 7(3.41%).*

Table III

Labour and surgery related risk factors for post caesarean SSI.

Labour and surgery related factors	Number	Percentage (%)
Duration of ruptured membranes in hours	119	58.05
<12 hours	35	17.07
>12 hours	84	40.98
Intact membrane	86	41.95
Number of vaginal examinations		
d”3	160	78.05
>3	45	21.95
Duration of labour in hours		
<12 hours	103	50.24
>12 hours	33	16.10
Nolabour pain	69	33.66
Intervention by untrained dai		
intervention	43	20.98
No intervention	162	79.02
Duration of surgery		
<1 hour	76	37.07
>1 hour	129	62.93
Use of drain		
Yes	44	21.46
No	161	78.54
Blood transfusion needed during/after surgery		
1 unit	29	14.15
>1 unit	27	13.17
Not needed	149	72.68
Types of caesarean section		
emergency	184	89.75
elective	21	10.25

Table IV

Organisms causing wound infection following C-Section among study group.

Gram positive organisms	n(%)	*Gram negative* organisms	n(%)	Others	n(%)
S. aureus	44(21.46)	*E. coli*	31(15.12)	No growth	74(36.10)
MRSA	5(2.44)	*Acinetobacter*	14(6.83)	Mixed growth (polymicrobial organisms)	7(3.41)
a-H *streptococci*	1(0.49)	*Pseudomonas*	13(6.34)		
b-H *streptococci*	1(0.49)	*Proteus*	8(3.9)		
		Klebsiella	7(3.41)		

Table V

Antibiotics prescribed for post caesarean wound infections according to culture sensitivity (N= 205)

Antibiotic	N	%
Penicillin, amoxicillin, ampicillin and co-amoxiclav	32	15.61
Cloxacillin	33	16.10
Cephalosporin	41	20
Aminoglycoside (gentamicin)	48	23.41
Meropenem	22	10.73
Fusidic acid	14	6.83
Linezolid	14	6.83
Colistin	1	0.49

The aminoglycoside constituted the most sensitive antibiotic and was used whenever indicated by the culture sensitivity [Table V]. Cephalosporin was frequently used as it was the second most sensitive antibiotic of choice. Other groups of drugs showing sensitivity in culture were: cloxacillin (33, 16.10%), penicillin(32, 15.61%), meropenem (22, 10.73%), fusidic acid(14, 6.83%), linezolid(14, 6.83%) and colistin(1, 0.49%). Antibiotics like meropenem, imipenem were used for the *Enterobactericeae* which were highly resistant to cephalosporin.

Discussion:

This study evaluated the rate of SSI after CS, determined risk factors for development of SSI and identified the common bacteriological profile in the study population. The rate of CS wound infections was 4.9% in the current study which was comparable to rates of 2.8% reported by *Mahet al*[7] &*Mathew et al*[8]and similar low rates of 2.8% and 2-5% in the USA and certain European countries.[9] High incidence rate upto 48% is noted in low resource settings in developing countries. These demonstrate that the overall SSI rate differs widely depending upon study sample, preexisting diseases, use of antibiotics as well as reliable methods for SSI documentation and reporting.

The development of SSI is multifactorial and various risk factors have been found for post caesarean SSI. In our study one of the patient related factors is young maternal age (78.05%) occurred in women less than 30 years, this is in accordance with other studies.[10]Most of the patients of this study had inadequate(70.24%) or no(8.78%) antenatal check up which is consistent with another study done by *Killian et al*[11] in New York in 2001. This is the single most important factor where intervention is mostly effective by good prenatal care and thus preventing most of the risk factors like anemia, hypertension, uncontrolled diabetes, prolonged rupture of membrane and we can avoid many emergency C-sections.

Hypertensive disorders in pregnancy which is linked with chronic alteration in peripheral blood supply have been found to be a risk factor for SSI.[12]The incidence of infections in patients with diabetes was significantly higher (33, 16.10%) in this study as uncontrolled blood glucose level increase the infection rate and

impairs wound healing as it enables the leukocytes to control the harmful proliferation of bacteria. Both obesity and under nutrition have been associated with increased risk of SSI.[13]

Prolonged rupture of membranes (>12 hours), prolonged labour and frequent vaginal examinations (>3) are established risk factors of SSI.[14]Loss of protective cervical mucus plug and barrier effect of fetal membranes and amniotic fluid after rupture of membranes are thought to be the main cause. Frequent vaginal examinations increases the risk of introduction of infection.

Emergency CS(89.75%) were more likely to develop SSI as compared to elective CS(10.25%) due to inadequate preparation time and associated other risk factors. Another risk factor is longer operation time which leads to extensive tissue trauma, desiccation and maceration of wound edges, increase number of bacteria, decreased temperature and hypovolaemia.[15]

In bacteriological study, microorganisms were identified in 63.9% cases. *Staphylococcus aureus*was the most common organism (21.46%). Other organisms were *Escherichia coli (15.12%), Acinetobactersp (6.83%), Pseudomonas sp(6.34%), Proteus sp(3.9%) and Klebsiellasp (3.41%).* Polymicrobial infections were found in 7(3.41%) cases. In a study done in 2007 by Anguzu JR[16]in Uganda, microorganisms were identified in 58.5% cases and the most common organism was *Staphylococcus aureus*(45.1%). Most organisms of our study were sensitive to aminoglycosides, cephalosporin & cloxacillin. Three cases (one proteus, two pseudomonas) were resistant to all antibiotics. This finding is a real threat to both patients and doctors.

Limitations of the study:

1. It was a retrospective study.
2. This study was done on the patients who came on post natal visits being referred from different areas of the country. As all the patients might not come for post natal check up in this outdoor, many SSI might not come to our data and the real incidence of SSI may be more than our study.

Conclusions:

The need to reduce SSI is currently receiving considerable attention and requires more research. Identifying modifiable risk factors in antenatal period, properly managing patients with co-morbidities, ensuring sterile environment, aseptic surgeries, use of antimicrobial prophylaxis and reducing surgery time can decrease further SSI rates. Each hospital authority should ensure standard of infection control and steps should be taken to improve further.

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