Surgical site infection following caesarean section: evaluation of incidence, risk factors and common bacterial pathogens in a tertiary hospital of Bangladesh.

M Sultana[1], SJ Chowdhury[2], S Khanam[3], K Asaduzzaman[4], T Talukdar[5]

Abstract

Background: Caesarean Section (CS) is one of the most commonly performed surgical procedures in obstetrical and gynaecological department. Surgical site infection (SSI) after a caesarean section increases maternal morbidity prolongs hospital stay and medical costs. ***Objective:*** The aim of this study was to find out the incidence and associated risk factors of surgical site infection and common bacterial pathogens among caesarean section cases. ***Method:*** This descriptive type observational study was carried out between January 2018 to June, 2018 at obstetrics and gynaecology department (Unit-II) of Chittagong medical college hospital. A total 673 patients underwent caesarean sections performed on emergency and elective basis both was included in this study. Among 673 patients only 70 patients were suffered from wound infection (SSI). Wound was evaluated for the development of SSI on third day, and fifth post-operative day, and on the day of discharge. ***Results:*** Total of 673 cases was studied. Among them 70 patients was suffering from SSI. Infection rate was 10.4 %. Among the 70 sufferer age was ranging from 15 to 43 years. Average age was 26 years. Most of the patients (32, 38.57%) were suffering from SSI came from poor socio economic group. Educational level of most of the SSI patients (58, 82.86%) was primary or below. Overweight patients (38, 54.28%) are more frequent sufferer in our series. Those who (44, 62.86%) had not attended or infrequently attended for ANC check-up were more frequent sufferer from SSI. Those who had underwent emergency caesarean section (62, 88.57%) were more commonly suffering from SSI. Patients with caesarian sections due to foetal distress in labour (20, 28.57%) were the most common sufferer from SSI followed by CS due to obstructed labour (12, 17.14%). Most common co-morbidity of our series was Anaemia (20, 28.57%) followed by Hypoalbuminaemia (17, 24.28%) and DM (14, 20%) respectively. The most common organism causing SSI in our series was *Escherichia*. coli (19, 25.71%) then *Klebsiella* (15, 21.43%). ***Conclusion:*** Various modifiable risk factors for SSI were observed in this study. Development of SSI is related to multifactorial rather than one factor. Development and strict implementation of protocol by all the health care professionals could be effective to minimize and prevent the infection rate after caesarean section.

Key words: Caesarean section, surgical site infection (SSI), incidence, risk factors etc.

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Introduction

Caesarean section (CS) nowadays is commonly performed surgical procedure in obstetrical practice[1]. Surgical site infections (SSI) are among the most common hospital acquired infections. They make up to 14 – 16% of inpatient infections[2, 3]. Surgical site infection following Caesarean section represents a substantial burden to the health system because of increasing maternal morbidity, hospital stay and medical cost. The rate of wound infection after Caesarean section reported in the recent literature ranges from 3%–16% which depends on the surveillance methods used to identify infections, the patient population and the use of prophylactic antibiotics[4–6]. Global estimates of SSI have varied from 0.5% to 15%[7,8]. Studies in India have consistently shown higher rates ranging from 23-28%[7, 9].But in Bangladesh, the overall prevalence rate of SSI was 14.13% and that the 3 most common pathogens isolated were *Staphylococcus aureus* (41.9%); *Escherichia. coli* (30.8%); and *Enterococcus spp*. (12%)[10].

SSI is the infection at the site of surgical procedure within 30 days of operation but may be within one year if prosthetic or implant surgery is performed[11]. Wound infections can be attributed to a preoperative bacterial load in the tissue at the site of surgery and the diminished integrity of the host's defences[11]. Some of the risk factors observed for Caesarean section wound infections are obesity, diabetes, poor prenatal care, immunosuppressive disorders, chorioamnionitis, a previous Caesarean

1. Dr Munawar Sultana
Assistant Professor (Obs & Gynae)
Chittagong Medical College.
2. Dr Shahnaz Jahan Chowdhury
Junior consultant (Obs & Gynae)
Chittagong Medical College Hospital.
3. Dr Sufia Khanam
Registrar (Obs & Gynae)
Chittagong Medical College Hospital.
4. Dr. Khondakar Asaduzzaman
Associate Professor (Obs & Gynae)
Cox's Bazar Medical College.
5. Dr. Tutul Talukdar
Resident Surgeon.
250 Bed District Sadar Hospital, Cox's Bazar.

Correspondence :
Dr. Munawar Sultana
e-mail : munawarlinaa@gmail.com

delivery, certain medications like steroids and the lack of pre-incision antimicrobial care, excessive blood loss during labour, delivery, or surgery and prolong labour and surgery[13]. Any infection of the abdominal wound complicating Caesarean section should be minimised through strict preventative measures, such as antisepsis, preoperative preparation, a reduction in the duration of surgery, a reduction in blood loss, the use of absorbable sutures and avoiding cross-infection. Many studies have proved that antimicrobial prophylaxis is effective in reducing the incidence of postoperative wound infections as it reduces the risk of resident bacteria overcoming the immune system in the immediate postoperative period[14] .

Incidence of SSI following CS is not known in our hospital (CMCH) and paucity of information regarding incidence in Bangladesh is also seen in literature. Whereas, the delivery of high-quality services with early interventions to reduce wound infections is an important aspect of patient safety measures[15] .

Objective

Aim of this study was to find out the incidence and associated risk factors of surgical site infection and to identify common bacterial pathogens causing SSI following caesarean section.

Materials And Methods

This descriptive type observational study was carried out between January 2018 to June, 2018 at obstetrics and gynaecology department (Unit-II) of Chittagong medical college hospital (CMCH). A total 673 patients underwent caesarean sections performed on emergency and elective basis both was included in this study. Among 673 patients only 70 patients were suffered from wound infection (SSI) diagnosed during post-caesarean hospital stay and / during an emergency department visit or inpatient rehospitalisation within 30 days of operation were taken.

All CS were performed according to established protocol of CMCH. The abdomen and perineum were cleaned by 10% povidone iodine solution prior to incision. All women were received inj. Ceftriaxone 1 gram IV preoperatively. The uterus and fascia closed by delayed absorbable polyglycolic acid in a continuous fashion. Skin closed by delayed absorbable suture or non absorbable suture material by subcuticular or interrupted suture.

Wound observation was done for the development of SSI on third, fifth post operative day and on the day of discharge. All the suspected surgical sites were evaluated irrespective of the day of operation until complete recovery. Post C/S wound infection diagnosed by wound appearance, the presence of common infection symptoms, and presence of certain organism.

Data were collected by using a standardized data sheet which included age, parity, and indication of CS, types of CS (emergency or elective), type of infection, organism in culture, BMI, anaemia, glycaemic status and other co morbidities.

Collected data were checked for completeness and compared in terms of presence of surgical site infection and study variables. All collected data were compiled, analysed, calculated and presented in different tables and figures.

Results

A total 673 patients underwent caesarean sections performed on emergency and elective basis both was included in this study. Among 673 patients only 70 patients were suffered from wound infection (SSI) diagnosed during post-caesarean hospital stay and / during an emergency department visit or inpatient rehospitalisation within 30 days of operation were taken. So, infection rate was 10.4 %. Demographic characteristics of women suffering from SSI following caesarean section are given below.

Age:

Among the 70 sufferer age was ranging from 15 to 43 years. Average age was 26 years

Table I: Distribution according to age (n=70)

Age range (years)	No of patients	Percentage (%)
15- 25	42	**60.00**
>25-35	22	**31.43**
>35	06	8.57

The highest incidence (91.43%) was observed in age group of 15 to 35 years and most (42, 60%) of them belongs to the age groups of 15-25 years .

Parity:

Out of total 70 patients who were suffering from SSI, 32 (45.7%) were primi and 38 (54.3%) cases were multi-para (Figure- 1**).**

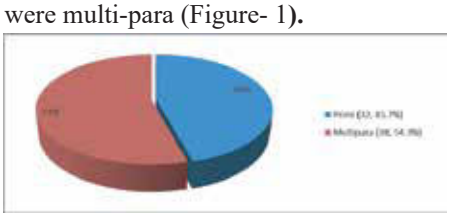

Figure-1: Distribution according to Parity (n=70)

Socio economic status:

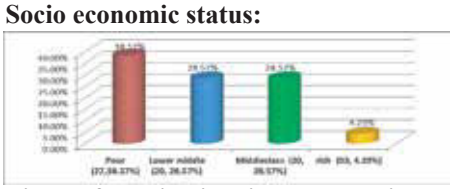

Figure-2: Distribution according to Socio economic status (n- 70)

Most of the patients (27, 38.57%) were suffering

from SSI came from poor socio economic group and rich patients (3, 4.29%) were less sufferer.

Educational qualification:

Table-II : Distribution according to educational qualification (n=70)

Educational qualification	No of patient	Percentage (%)
Primary or below	**58**	**82.86%**
Secondary level	**10**	**14.28%**
Above secondary	**02**	**02.86%**

Educational level of most of the SSI patients (58, 82.86%) was primary or below. But rate was decrease with the improvements of educational level.

Obesity:

Table-III : Distribution according to BMI (n=70)

Obesity	No of patient	Percentage (%)
Underweight (BMI <18.5)	**03**	**04.28**
Normal weight (BMI 18.5-24.9)	**28**	**40.00**
Overweight (BMI 25.0-29.9)	**38**	**54.28**
Obese (BMI 30.0 and above)	**01**	**01.43**

Overweight patients (38, 54.28%) are more frequent sufferer of SSI in our series.

Antenatal care (ANC):

Table-IV : Distribution according to Antenatal care (n=70)

Those who (44, 62.86%) had not attended or infrequently attended for ANC check-up were more frequent sufferer from SSI.

Antenatal care (ANC)	No of patient	Percentage (%)
No / Irregular visit	**44**	**62.86**
Regular visit	**26**	**37.14**

Home trial for normal vaginal delivery:

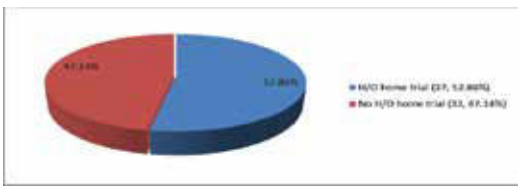

Figure-3: Distribution according to H/O home trial (n- 70)

Home trial group (37, 52.86%) are little more sufferer of SSI than those who have no history of home trial for normal vaginal delivery.

Types of caesarean section (CS):

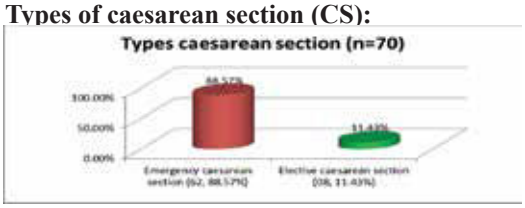

Figure-3: Distribution according to Types of caesarean section (n- 70)

So, those who had underwent emergency caesarean section (62, 88.57%) were more commonly suffering from SSI.

Indication of Caesarean Section (CS):

Table-V : Distribution according to Indication of Caesarean Section (n=70)

Indication of Caesarean Section	No of patient	Percentage (%)
Foetal distress in labour	**20**	**28.57**
Obstructed labour	**12**	**17.14**
Malpresentation	**10**	**14.28**
Post maturity	**07**	**10.00**
Eclampsia	**05**	**07.14**
P/H/O CS with labour pain	**05**	**07.14**
Elective CS	**08**	**11.43**
Chorioamnionitis	**03**	**04.28**

Patients with caesarian sections due to foetal distress in labour (20, 28.57%) were the most common sufferer from SSI and CS due to obstructed labour (12, 17.14%) were next frequent sufferer.

Co-morbid diseases:

Table-VI : Distribution according to Co-morbid diseases (n=70)

Co-morbid diseases	No of patient	Percentage (%)
Anaemia	**20**	**28.57**
Hypoalbuminaemia	**17**	**24.28**
Hypergycaemia (DM)	**14**	**20.00**
Pulmonary disease (Asthma, COPD)	**05**	**07.14**
No known comorbid disease	**12**	**17.14**

Most common co-morbidity of our series was Anaemia (20, 28.57%). Next most common co-morbidity was Hypoalbuminaemia (17, 24.28%) and DM (14, 20%).

Types of organism in culture:

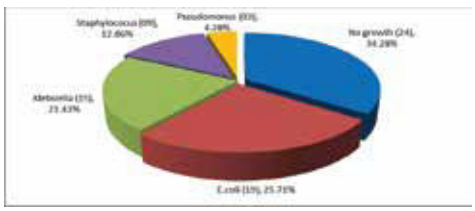

Figure-4: Distribution according to Types of organism in culture (n- 70)

E.coli (19, 25.71%) was the most common organism causing SSI. Second most common organism was *Klebsiella* (15, 21.43%).

Discussion

Surgical site infections constitute a global health problem both in economic and human term. Multiplicity of factors influence is responsible for SSI following caesarean section. This could related with the patient age, parity, socioeconomic status, educational status, personal hygiene, ANC, attempts for home delivery, obesity, other co-morbidity, indication of surgery and types of surgery (emergency or elective), surgeons experience, operating room environment etc. In the present study, some of the risk factors were

evaluated to establish their association or influence on SSI rate in this locality.

Surgical site infection following caesarean section found a little higher rate in this study, which comprises 10.4 %. Comparing to other studies conducted in different parts of the world, the SSI following CS was found to be lower in other studies: US study 5%,[16] Oman 2.66%,[17] Norway 8.3 %,[18] and UK 9.6%.[19] Similar rates were found in other studies conducted in UK 11.2% , Ethiopia 11.4%.and Nepal 12.6% [20,21,22] However, higher rate (16%) was found in studies conducted in US and India (24.2%) before interventon.[23,24]

In our study among the 70 sufferer age was ranging from 15 to 43 years. Average age was 26 years. The highest incidence (91.43%) was observed in age group of 15 to 35 years and most (42, 60%) of them belongs to the age groups of 11-25 years (Table-l).

But in comparison with other studies which have shown increased SSI rates among older patients.[1,25-27] This difference is probably due to early marriage, early child birth, lower socioeconomic and educational status, reluctant to receive ANC are may be responsible factors.

In the present study, obesity (BMI 25.0) has been found to signifcantly influence the presence of SSI. Similar results were found by Ashby et al[28], Xue et al[29]. Obesity is a well-studied risk factor for SSI development. The pathophysiology involves increased amount of avascular subcutaneous adipose tissue, requirement for larger skin incisions, defective defense mechanism and poor penetrative power of antibiotics in avascular subcutaneous tissue.[1]

Those who (44, 62.86%) had not attended or infrequently attended for ANC check-up were more frequent sufferer from SSI. Similar scenario was seen in the study of Amenu D et al.[21] in Ethiopia. Those who had no ANC follow up, mostly came from rural area and were presented with prolonged rupture of membranes, underwent emergency surgeries and ultimately more frequent sufferer from SSI. This is probably due to lack of knowledge regarding pregnancy, hygiene, nutrition, child birth.

Regarding co-morbidity, 28.57% of SSI patients were suffering from anaemia and 24.28% from Hypoalbuminaemia. Wound infection are strongly linked in literature as documented by Zaman F.[30] and Dunne JR et al.[31] In our study 20% SSI patient suffering from diabetes. According to National Academy of Science of India report diabetes mellitus was considered as a significant pre-disposing factor for SSI.[32] Other workers including Yang K et al[33] Ibtesam K Aff et al[34] concluded that the rate of SSI has an independent association with hyperglycemia. Among diabetics deranged blood sugar levels result in neutrophil dysfunction and subsequent delayed wound healing resulting in increased SSI rate.[35] Wound healing is impaired due to uncontrolled hyperglycemia and low hemoglobin level leading to increased rate of SSI.

In our study, home trial group (37, 52.86%) are little more sufferer than those who have no history of home trial for normal vaginal delivery. This may be due to repeated vaginal examination without proper antiseptic precaution, attending hospital with prolong labour with PROM and underwent emergency caesarean delivery. These all predispose to SSI.

SSI rate was increased in emergency surgical procedure probably owing to insuffcient time for patient's preoperative preparation and severity of indication leading to that emergency procedure.[36]

In our study, those who had underwent emergency caesarean section (62, 88.57%) were more commonly suffering from SSI. Similarly Akhter F et al[1] also found that increased incidence of SSI among emergency caesarean section. This causation is likely due to lack of time for necessary infection preventive measures and PROM before surgery.[16]

Patients with caesarian sections due to foetal distress in labour (20, 28.57%) were the most common sufferer from SSI and CS due to obstructed labour (12, 17.14%) were next frequent sufferer. This findings may be due to increase incidence of emergency caesarin section for the foetal distress and obstructed labour, As emergency surgical procedure one of the predisposing factors of SSI due to lack of time for necessary infection preventive measures.

In this study 65.72 % wound infections revealed growth of microorganism and 34.28% yielded no growth of organism even with the presence of other signs of surgical site infection. This may be due to presence of anaerobic bacteria, prior use of antibiotics which inhibited the growth of any bacteria in vitro culture. In our study, the most predominant isolated organism was *Escherichia coli* (25.71%) followed by *Klebsiella* (21.43%) and *Streptococcus* (12.86%). In the study of M Nur-e-elahi et al[37] in Bangladesh the most predominant isolated organism was *Escherichia coli* (43%) followed by *Staphylococcus aureus* (33%) and *Pseudomonas aeruginosa* (11%). But in the study of T. Giridhar et al[7] most common organism was *Staphylococcus aureus (23%).*

Limitations

This study has certain limitations e.g. being conducted in a single hospital setting, smaller

sample size and case finding methodology. Moreover, patients were followed for only up to 30 days postoperatively.

Conclusion

SSI continues to be the most common and significant post-operative complication following caesarean section that may leads to postoperative morbidity and mortality. A thorough assessment of risk factors that predispose to SSI and their prevention may help in reduction of SSI rates. Hence it is recommended that all the aforementioned factors must be taken into account before conducting any surgical procedure. Prevention of these infections should be a clinical and public health responsibility.

Recommendation

In this study, important contributory factors leading to post caesarean SSI were identified. Hence, reminding the hospital staff that there is a need to take necessary solid measures in order to reduce infection rate and to implement preventive strategies for high risk individuals. Such measures include good glycemic control in patients with diabetes, maintenance of haemoglobin levels to prevent anaemia, preoperative skin antisepsis, use of sterile dressings and routine use of prophylactic antibiotics.

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