Original Research Article

Indian Journal of Obstetrics and Gynecology
Volume 7 Number 2 (Part - II), April - June 2019
DOI: http://dx.doi.org/10.21088/ijog.2321.1636.7219.20

Study of Post LSCS Wound Infections

Parth Ponkshe[1], Anjali Patil[2]

How to cite this article:
Parth Ponkshe, Anjali Patil. Study of Post LSCS Wound Infections. Indian J Obstet Gynecol. 2019;7(2):239-248.

[1]PG Resident, [2]Associate Professor, Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra 415539, India.

Corresponding Author: Anjali Patil, Associate Professor, Department of Obstetrics and Gynecology, Krishna Institute of Medical Sciences, Karad, Maharashtra 415539, India.

E-mail: researchexpert3@gmail.com

Received on 09.03.2019; Accepted on 16.04.2019

Abstract

Background: Caesarean section (CS) wound infections represent a substantial burdento the health system and the prevention ofsuch infections should be a healthcare priority indeveloping countries [3]. The global estimates of surgicalsite infections (SSI) are from 0.5–15% [4]. SSI can beattributed to a perioperative bacterial load in the tissueat the site of surgery and the diminished integrity ofthe host’s defenses [5]. Hence the present study was done at our tertiary care centre to assess wound infection after caesarean delivery.

Materials and methods: A hospital based case control study was conducted with 300 patients to assess the incidence of caesarean wound infections. The patients were prospectively randomized into following two groups of 150 patients each.

Results: 32 (21.3%) patients in Cases Group had hypertension / pre eclampsia while 29 (19.3%) and 23 (15.3%) patients had anemia and diabetes mellitus respectively. 10 (6.7%) patients in Cases Group had hypertension/pre eclampsia while 15 (10%) and 7 (4.7%) patients had anemia and diabetes mellitus respectively. The difference was statistically significant as per Chi-Square test ($p<0.05$).

Conclusions: Obesity, diabetes, prolonged labour with PROM and wound haematoma are the main contributory risk factors responsible for PCS wound infections. The need to reduce SSI is currently receiving considerable attention and requires more research.

Keywords: Cesarean section; Surgicalsite infections; ANC care, Complications.

Introduction

Cesarean section is probably the most common surgical procedure carried out in the field of obstetrics [1]. It is defined as the birth of foetus through abdominal and uterine incision after the period of viability. As medical science has evolved over the recent years there has been a parallel increase in the rate of cesarean section. The cesarean delivery rate is approximately 21.1% for the most developed regions of the globe, 14.3% for the less developed regions, and 2% for the least developed regions [2]. Indication for cesarean delivery have been changing over the last few years as they have become more safer due to improved anesthesia techniques, advent of powerful and effective antibiotics, availability of blood transfusion facilities and improvement in surgical techniques and operative skills and neonatal care. The other factors responsible for rising trend of CS are advancement in antepartum foetal surveillance with the use of Doppler velocimetry, NST, bio-physical profile etc. with identification of at risk fetuses, easy availability of ANC care and identification of high risk mothers, lesser acceptability of VBAC among doctors, adoption of planned CS for mothers who conceive following assisted reproductive techniques, fear of litigation in obstetric practice, adoption of small family norm and cesarean delivery on demand. Caesarean section (CS) wound infections represent a substantial burdento the health system and the prevention ofsuch infections should be a healthcare priority indeveloping countries [3]. The global estimates of surgicalsite infections (SSI) are from 0.5–15% [4]. SSI can be attributed to a perioperative bacterial load in the tissue eat the site of surgery and the diminished integrity of the host's defenses [5]. Some of the risk factors observed for CS wound infections are obesity, diabetes, immunosuppressive disorders, chorioamnionitis, a previous Caesarean delivery, certain medications like steroids, the lack of pre-incision antimicrobial care, lengthy labour and surgery [6,7]. 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 [8,9,10]. Hence the present study was done at our tertiary care centre to assess wound infection after caesarean delivery, to assess the incidence, risk factors / co morbid factors, pathogens (bacteria) causing wound sepsis and analyse the outcome of wound infections after caesarean delivery.

Materials and Methods

A hospital based case control study was conducted with 300 patients to assess the incidence of caesarean wound infections. The patients were prospectively randomized into following two groups of 150 patients each:

Cases Group: Patients who have undergone Caesarean section with surgical site infections (SSI).

Controls Group: Patients who have undergone Caesarean section without any surgical site infections (SSI).

Sample size: 300 patients.

Sample size was calculated using the formula:

$n= [z^2 p(1-p)]/d^2$

Where: Z = table value of alpha error from Standard Normal Distribution table (0.95).

Power (p) = 80%

Precision error of estimation (d) = 3%

150 patients per group will be required to detect a significant difference and hence sample size of 300 patients was selected for the study.

Inclusion criteria

- All women who undergo caesarean delivery.

Exclusion criteria

- Those women who do not give consent for the study.

Methodology

A case control study for a period of 24 months to determine the incidence of post-Caesarean (PCS) SSI. Controls were randomly selected cases, in the same time period, who have undergone CS without any SSI. Wound infections were defined as inflammation or sepsis with or without positive bacterial cultures. With SSI, there may be fever, redness, swelling and/or pain in the area around the incision site. The Centers for Disease Control and Prevention (CDC) state that SSI should be suspected within 30 days of a surgical procedure if at least one of the following symptoms are present: localised swelling, with or without purulent discharge from the wound, pain or tenderness, redness, malodour or fever. All patients with wound infections underwent swab cultures in accordance with hospital policy and all cases of suspected SSI had swabs taken prior to the commencement of antibiotics. Both culture-positive and -negative cases were included in the study. Where the culture was positive, an antibiotic sensitivity tests of the organism was carried out using standard microbiology techniques. The wound swabs of the culture-negative cases yielded no organism growth of any kind after 24 hours of incubation. The cases and controls were reviewed in detail with respect to the type of CS, the characteristics of the antecedent labour, the duration of the rupture of membranes and other associated risk factors. The organisms isolated from the incision sites were investigated and antibiotic sensitivity was measured. Data collected included details of the wound infections, any organisms grown in the cultures, the drug sensitivity of those organisms as well as the risk factors contributing to infections, like obesity, premature rupture of the membranes (PROM), prolonged labour and comorbid medical conditions like diabetes, hypertension and anaemia.

Statistical Analysis

After data collection, data entry was done in MS Excel 2010. Data analysis was done with the help of SPSS ver. 20. Quantitative data was presented with the help of Mean, Standard deviation, Median and IQR, comparison among study group was done with the help of Unpaired T test or Mann-Whitney test as per results of Normality test. Qualitative data was presented with the help of Frequency and Percentage table, association among study group was assessed with the help of Chi-Square test. p value less than 0.05 was taken as significant level. Results were graphically represented when deemed necessary.

Results

Distribution of patients according to Age

Majority of the patients (46.8%) in Cases Group were in the age group of 21-25 years followed by 26.7% in the age group of 18-20 years, 21.2% in the age group of 26-30 years and 5.3% in the age group of >30 years. The mean age in Cases Group was 23.07 ± 3.56 years. Majority of the patients (50.7%) in Controls Group were in the age group of 21-25 years followed by 24% in the age group of 26-30 years, 17.3% in the age group of 18-20 years and 8% in the age group of >30 years. The mean age in Cases Group was 23.79 ± 3.83 years. There was no significant difference between the groups as per Student t-test (p>0.05) (Table 1).

Distribution of patients according to Parity

Fifty (50) (33.3%) patients in Cases Group were Primigravida while 100 (66.7%) were multigravida - 57 (38%) patients with previous C-Section and 43 (28.7%) patients without previous C-Section. 55 (36.7%) patients in Controls Group were Primigravida while 95 (63.3%) were multigravida - 35 (23.3%) patients with previous C-Section and 60 (40%) patients without previous C-Section. The difference was statistically not significant as per Chi-Square test (p>0.05) (Table 2).

Distribution of patients according to Booking Status

Ninety (90) (60%) and 60 (40%) patients in Cases Group were booked and unbooked cases respectively while 132 (88%) and 18 (12%) patients in Controls Group were booked and unbooked cases respectively. The difference was statistically significant as per Chi-Square test (p<0.05).

Distribution of patients according to Comorbidities

Thiry two (32) (21.3%) patients in Cases Group had hypertension / pre eclampsia while 29 (19.3%) and 23 (15.3%) patients had anemia and diabetes mellitus respectively. 10 (6.7%) patients in Cases Group had hypertension / pre eclampsia while 15 (10%) and 7 (4.7%) patients had anemia and diabetes mellitus respectively. The difference was statistically significant as per Chi-Square test (p<0.05).

Table 1: Distribution of patients according to Age

Age (years)	Cases Group		Controls Group		p Value
	N	%	N	%	
18-20	40	26.7%	26	17.3%	>0.05
21-25	70	46.8%	76	50.7%	
26-30	32	21.2%	36	24%	
>30	8	5.3%	12	8%	
Total	150	100%	150	100%	
Mean ± SD	23.07 ± 3.55		23.79 ± 3.82		

Table 2: Distribution of patients according to Parity

Parity		Cases Group		Controls Group		p Value
		N	%	N	%	
Primigravida		50	33.3%	55	36.7%	>0.05
Multigravida	Previous C-Section	57	38%	35	23.3%	
	Without Previous C-Section	43	28.7%	60	40%	
Booking Status	Booked	90	60%	132	88%	<0.05
	Unbooked	60	40%	18	12%	
Total		150	100%	150	100%	

Comparison of Pre-Existing Risk Factors between groups

Eighteen (18) (12%) patients in Cases Group had BMI >35 while Premature rupture of membranes (PROM)> 6 hrs and Artificial Rupture of Membranes (ARM) was noted in 27 (18%) and 23 (15.3%) patients respectively. The number of Per Vaginal (PV) examinations in 56 (37.3%) patients was <4 while it was ≥4 in 94 (62.7%) patients. 4 (2.7%) patients in Cases Group had BMI >35 while Premature rupture of membranes (PROM) >6 hrs and Artificial Rupture of Membranes (ARM) was noted in 9 (6%) and 15 (10%) patients respectively. The number of Per Vaginal (PV) examinations in 27 (18%) patients was <4 while it was ≥ 4 in 123 (82%) patients. The difference in BMI >35, PROM >6 hrs and Number of PV examinations parameters was statistically significant as per Chi-Square test (p<0.05) (Table 3).

Comparison of Operating Characteristics between groups

Fifty six (56) (37.3%) patients in Cases Group delivered in Labour room OT while 94 (62.7%) patients delivered in Major OT. 42 (28%) patients in Controls Group delivered in Labour room OT while 108 (72%) patients delivered in Major OT. The difference was statistically not significant as per Chi-Square test (p>0.05). 27 (18%) and 21 (14%) patients in Cases Group and Controls Group respectively required post-operative antibiotic. The difference was statistically not significant as per Chi-Square test (p>0.05).

In Cases Group, Vicryl was used as suture material used for skin suturing in 52 (34.7%) patients while Monocryl and Ethilon was used as suture materials in 38 (25.3%) and 60 (40%) patients respectively. In Controls Group, Vicryl was used as suture material used for skin suturing in 58 (38%)

Table 3: Distribution of patients according to Comorbidities and Pre-Existing Risk Factors

Comorbidities		Cases Group		Controls Group		p Value
		N	%	N	%	
Hypertension / Pre eclampsia	Yes	32	21.3%	10	6.7%	<0.05
	No	118	78.7%	140	93.3%	
Anemia	Yes	29	19.3%	15	10%	<0.05
	No	121	80.7%	135	90%	
Diabetes Mellitus	Yes	23	15.3%	7	4.7%	<0.05
	No	127	84.7%	143	95.3%	
BMI >35	Yes	18	12%	4	2.7%	<0.05
	No	132	88%	146	97.3%	
PROM >6hrs	Yes	27	18%	9	6%	<0.05
	No	123	82%	141	94%	
ARM	Yes	23	15.3%	15	10%	>0.05
	No	127	84.7%	135	90%	
Number of PV examinations	<4	56	37.3%	27	18%	<0.05
	≥4	94	62.7%	123	82%	

BMI – Body Mass Index; PROM - Premature rupture of membranes; ARM - Artificial Rupture of Membranes; PV – Per Vaginal

Table 4: Comparison of Operating Characteristics between groups

Parameters		Cases Group		Controls Group		p Value
		N	%	N	%	
Operation Theatre	Labour room OT	56	37.3%	42	28%	>0.05
	Major OT	94	62.7%	108	72%	
Post Op Antibiotic	Yes	27	18%	21	14%	>0.05
	No	123	82%	129	86%	
Suture Material used for skin suturing	Vicryl	52	34.7%	58	38.6%	>0.05
	Monocryl	38	25.3%	40	26.7%	
	Ethilon	60	40%	52	34.7%	
Suture material used for rectus sheath closure	Vicryl no 1	118	78.7%	105	70%	>0.05
	Prolene no 1	32	21.3%	45	30%	
Suture material used for fat closure	Vicryl no 1	67	44.7%	60	40%	>0.05
	Vicryl no 2-0	53	35.3%	62	41.3%	
	Monocryl no 2-0	30	20%	28	18.7%	

patients while Monocryl and Ethilon was used as suture materials in 40 (26%) and 52 (34%) patients respectively. The difference was statistically not significant as per Chi-Square test (p>0.05).

In Cases Group, Vicryl no 1 was used as suture material for rectus sheath closure in 118 (78.7%) patients while Prolene no 1 was used as suture material in 32 (21.3%) patients. In Controls Group, Vicryl no 1 was used as suture material for rectus sheath closure in 105 (70%) patients while Prolene no 1 was used as suture material in 45 (30%) patients. The difference was statistically not significant as per Chi-Square test (p>0.05).

In Cases Group, Vicryl no 1 was used as suture material for fat closure in 67 (44.7%) patients while Vicryl no 2-0 and Monocryl no 2-0 was used as suture materials in 53 (35.3%) and 30 (20%) patients respectively. In Controls Group, Vicryl no 1 was used as suture material for fat closure in 60 (40%) patients while Vicryl no 2-0 and Monocryl no 2-0 was used as suture materials in 62 (41%) and 28 (18%) patients respectively. The difference was statistically not significant as per Chi-Square test (p>0.05) (Table 4).

Distribution of patients according to Duration of Hospital Stay

Majority of the patients (84%) in Cases Group had hospital stay of >14 days followed by 8-14 days (9.3%) and ≤7 days (6.7%) while majority of the patients (54%) in Controls Group had hospital stay of 8-14 days followed by ≤7 days (46%). The difference was statistically significant as per Chi-Square test (p<0.05) (Table 5).

Distribution of patients in Cases Group according to Type of Surgical Site Infections

48 (32%) patients in Cases Group had superficial infections while 102 (68%) patients had deep infections (Graph 1).

Distribution of patients in Cases Group according to Management of Post-op Wound Infections

The wound infections in 54 (36%) patients were managed by conservative methods while 96 (64%) patients were managed surgically (Table 6 and Graph 2).

Distribution of patients in Cases Group according to Type of Surgical Site Infection (SSI) Diagnosis

The diagnosis of Surgical Site Infection (SSI) in 48 (32%) patients was prior to getting discharged from hospital while the diagnosis of SSI in 102 (68%) patients was after getting discharged from hospital (Graph 3).

Table 5: Distribution of patients according to Duration of Hospital Stay

Duration	Cases Group		Controls Group		p Value
	N	%	N	%	
≤7 days	10	6.7%	69	46%	<0.05
8 – 14 days	14	9.3%	81	54%	
>14 days	126	84%	0	-	
Total	150	100%	150	100%	
Mean ± SD	17.98 ± 5.84		7.32 ± 0.97		

Table 6: Distribution of patients in Cases Group according to Organisms causing wound Infections

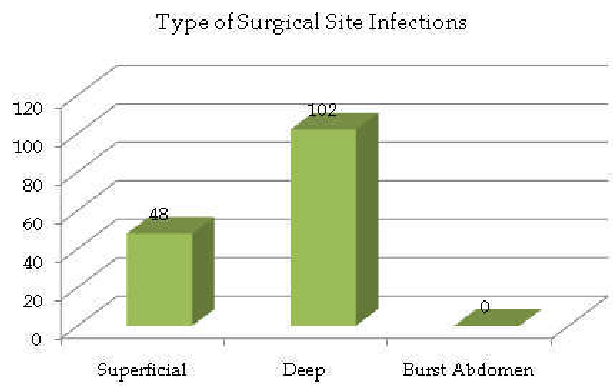
Organisms	N	%
Gram Positive (n=30)		
Staph Aureus	27	18%
Streptococci	3	2%
Gram Negative (n=47)		
E.coli	24	16%
P.aeruginosa	11	7.3%
Klebsiella	8	5.3%
Proteus spp	3	2%
Acinetobacter	1	0.7%
Other (n=73)		
No Growth	33	22%
Mixed Growth	33	22%
Mycoplasma	4	2.7%
Cornynebacteria	3	2%
Total	150	100%

Association of Time of Surgical Site Infection (SSI) Diagnosis and Method of Management

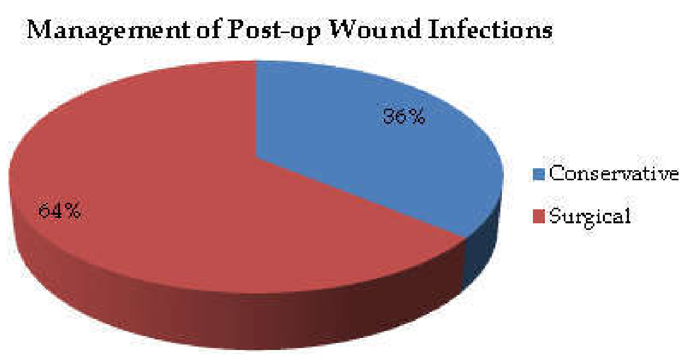
Twenty one (21) (14%) patients with SSI that was diagnosed prior to getting discharged from hospital were treated conservatively while 27 (18%) patients were treated surgically. 33 (22%) patients with SSI that was diagnosed after getting discharged from hospital were treated conservatively while 69 (46%) patients were treated surgically. There was no significant association of time of SSI diagnosis and method of management as per Chi-Square test ($p>0.05$).

Distribution of patients in Cases Group according to Prescribed Antibiotics

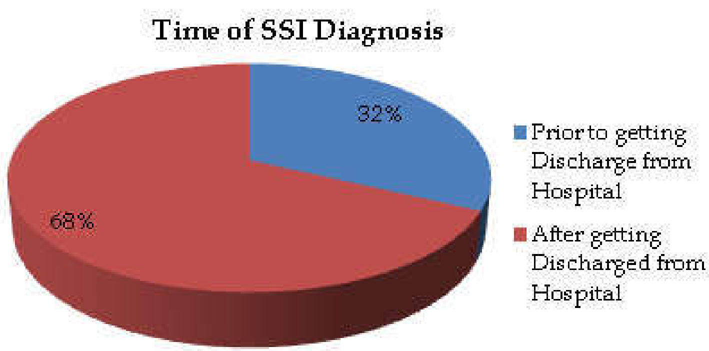
The most prescribed antibiotics was Levofloxacin + Ornidazole (44%) followed by Amikacin (36%), Ciprofloxacin (32%), Gentamycin (26%), Amoxicillin + Clavulunic acid (24%), Cephalosporins (12%), Erythromycin (8%), Clindamycin (4%) and Meropenem (1.3%) (Graph 4).



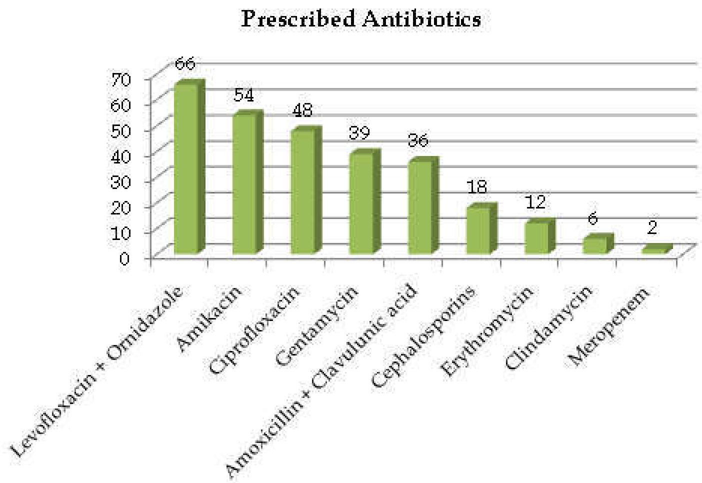
Graph 1: Distribution of patients in Cases Group according to Type of Surgical Site Infections



Graph 2: Distribution of patients in Cases Group according to Management of Post-op Wound Infections



Graph 3: Distribution of patients in Cases Group according to Time of SSI Diagnosis



Graph 4: Distribution of patients in Cases Group according to Prescribed Antibiotics

Discussion

A hospital based case control study was conducted with 300 patients to assess the incidence of caesarean wound infections. The patients were prospectively randomized into following two groups of 150 patients each:

Developing SSI is a traumatic experience [11]. Smyth ET et al. [12] reported SSI to be the third most common type of nosocomial infection, accounting for 14–16%. CS surgery has a 5–20 times higher risk of postpartum infection as compared to vaginal deliveries, mainly with regards to wound infections, endometritis, pelvic peritonitis or pelvic abscesses [11]. Wound infection sares till regarded as the most common nosocomial infections in patients undergoing surgery. Staphylococcus is the most common cause of nosocomial infections and is often the cause of postsurgical wound infections; the Gram-positivecocci are often found living on the skin and in the nose.

To avoid any infections from Staphylococcus bacteria, it is important to implement regular hand-washing and ensure that wounds are kept covered with clean, dry bandages until they are fully healed. Shittu AO et al. [13] recommended collaboration with a microbiologist and wound-care practitioners, and patient education onpersonal hygiene to help control wound infections.

In the present study, majority of the patients (46.8%) in Cases Group were in the age group of 21-25 years followed by 26.7% in the age group of 18-20 years, 21.2% in the age group of 26-30 years and 5.3% in the age group of >30 years. The mean age in Cases Group was 23.07 ± 3.56 years. Majority of the patients (50.7%) in Controls Group were in the age group of 21-25 years followed by 24% in the age group of 26-30 years, 17.3% in the age group of 18-20 years and 8% in the age group of >30 years. The mean age in Cases Group was 23.79 ± 3.83 years. There was no significant difference between the groups as per Student t-test (p>0.05). This is similar to the studies of Sangavi R et al. [14].

In our study, 50 (33.3%) patients in Cases Group were Primigravida while 100 (66.7%) were multigravida - 57 (38%) patients with previous C-Section and 43 (28.7%) patients without previous C-Section. 55 (36.7%) patients in Controls Group were Primigravida while 95 (63.3%) were multigravida - 35 (23.3%) patients with previous C-Section and 60 (40%) patients without previous C-Section. The difference was statistically not significant as per Chi-Square test (p>0.05).

Ninety (90) (60%) and 60 (40%) patients in Cases Group were booked and unbooked cases respectively while 132 (88%) and 18 (12%) patients in Controls Group were booked and unbooked cases respectively. The difference was statistically significant as per Chi-Square test (p<0.05). 32 (21.3%) patients in Cases Group had hypertension/pre eclampsia while 29 (19.3%) and 23 (15.3%) patients had anemia and diabetes mellitus respectively. 10 (6.7%) patients in Cases Group had hypertension/pre eclampsia while 15 (10%) and 7 (4.7%) patients had anemia and diabetes mellitus respectively. The difference was statistically significant as per Chi-Square test (p<0.05).

It was observed in the present study that 18 (12%) patients in Cases Group had BMI>35 while

Premature rupture of membranes (PROM) >6 hrs and Artificial Rupture of Membranes (ARM) was noted in 27 (18%) and 23 (15.3%) patients respectively. The number of Per Vaginal (PV) examinations in 56 (37.3%) patients was <4 while it was ≥4 in 94 (62.7%) patients. 4 (2.7%) patients in Cases Group had BMI >35 while Premature rupture of membranes (PROM) >6 hrs and Artificial Rupture of Membranes (ARM) was noted in 9 (6%) and 15 (10%) patients respectively. The number of Per Vaginal (PV) examinations in 27 (18%) patients was <4 while it was ≥4 in 123 (82%) patients. The difference in BMI >35, PROM >6 hrs and Number of PV examinations parameters was statistically significant as per Chi-Square test (p<0.05). This is comparable to the studies of Dahiya P et al. [15] and Dhar H et al. [16].

Dhar H et al. [16] showed that those women who already had more than six children were 1.4 times more likely to contract a wound infection compared to those women who were delivering for the first time or had only one child. However, the association between wound infections and parity was not significant (p = 0.077). Women with diabetes were three times more likely to develop wound infections and the association between diabetes and wound infections was significant (p = 0.001). It was observed in our study that 56 (37.3%) patients in Cases Group delivered in Labour room OT while 94 (62.7%) patients delivered in Major OT. 42 (28%) patients in Controls Group delivered in Labour room OT while 108 (72%) patients delivered in Major OT. The difference was statistically not significant as per Chi-Square test (p>0.05). 27 (18%) and 21 (14%) patients in Cases Group and Controls Group respectively required post-operative antibiotic. The difference was statistically not significant as per Chi-Square test (p>0.05).

In our study, majority of the patients (84%) in Cases Group had hospital stay of >14 days followed by 8-14 days (9.3%) and ≤ 7 days (6.7%) while majority of the patients (54%) in Controls Group had hospital stay of 8-14 days followed by ≤ 7 days (46%). The difference was statistically significant as per Chi-Square test (p<0.05). 48 (32%) patients in Cases Group had superficial infections while 102 (68%) patients had deep infections. This is concordant to the study of Dahiya P et al. [15].

The wound infections in 54 (36%) patients of our study were managed by conservative methods while 96 (64%) patients were managed surgically. These findings were consistent with the studies of Dhar H et al. [16] and Satyanarayan V et al. [17]. Dhar H et al. [16] retrospective cross-sectional study reported higher infection rate was noted in emergency (119, 1.50%) in comparison with elective (92, 1.16%) CS procedures.

Satyanarayan V et al. [17] study on surgical site infections in abdominal surgeries reported rates of wound infections as high as 25.2% in emergency CS compared to 7.6% in elective cases. An independent risk factor for SSI is the development of subcutaneous wound haematomas. This suggests lapses in complete haemostasis during the wound closure as a haematoma may provide a medium forbacterial growth. The meticulous closure of potential spaces and good haemostatic techniques would reduce the frequency of haematomas leading to wound infections. Postoperative wound haematomais the strongest independent risk factor for SSI. Obesity is a major and rapidly growing health problem. The incidence of infections in patients who are obese with a BMI of 30 or more is higher than that of the general population. This is due to the poor penetration of antibiotics into the skin because of the avascularity of adipose tissue. Moreover, obesity places greater mechanical stress on the wound and thus delays healing [18].

Wloch C et al. [19] study on risk factors for surgical site infection following caesarean section observed that being overweight with a BMI >35 was a major risk factor for infection compared with cases who had a BMI 18.5–25 (OR 3.7, 95% confidence interval [CI] 2.6–5.2). Vertical incisions, which have to be used forover weight or obese patients, are more likely to lead to complications than the typical transverse incisions [20]. Women should be encouraged to eat healthily, have awell-balanced diet and take adequate exercise to avoid the risks of SSI associated with obesity.

In our study, the diagnosis of Surgical Site Infection (SSI) in 48 (32%) patients was prior to getting discharged from hospital while the diagnosis of SSI in 102 (68%) patients was after getting discharged from hospital. This is in concordance to the studies of Dahiya P et al. [15], Devjani D [21] and Johnson A et al. [22].

It was observed in our study that 21 (14%) patients with SSI that was diagnosed prior to getting discharged from hospital were treated conservatively while 27 (18%) patients were treated surgically. 33 (22%) patients with SSI that was diagnosed after getting discharged from hospital were treated conservatively while 69 (46%) patients were treated surgically. There was no significant association of time of SSI diagnosis and method of management as per Chi-Square test (p>0.05). Dhar H et al. [16] and Jasim HH et al. [23] noted similar observations in their studies.

Dhar H et al. [16] retrospective cross-sectional study reported cases diagnosed with wound infections during their hospital stay accounted for 62 (29.38%) patients. The remaining 149 (70.61%) patients were readmitted 6–10 days after discharge, with evidence of wound induration and soakage, either with or without fever. The most common gram positive organism in the present study was Staph Aureus (18%) followed by Streptococci (2%). The most common gram negative organism was E.coli (16%) followed by P. Aeruginosa (7.3%), Klebsiella (5.3%), Proteus spp (2%) and Acinetobacter (0.7%). There was no growth observed in 33 (22%) patients while mixed growth was observed in 33 (22%) patients. Mycoplasma and Cornynebacteria was noted in 2.7% and 2% patients respectively. This is consistent with the studies of Dahiya P et al. [15], Dhar H et al. [16] and Sangavi R et al. [14].

Dahiya P et al. [15] prospective observational study assessing the the incidence of SSI after cesarean section at first referral units and identifying micro-organisms and risk factors reported most ofthe organisms were gram negative (56.53%) most common organism isolated was E.coli (25.93%) followed by coagulase negative Staphylococcus epidermidis (22.2%). The most prescribed antibiotics in our study was Levofloxacin + Ornidazole (44%) followed by Amikacin (36%), Ciprofloxacin (32%), Gentamycin (26%), Amoxicillin + Clavulunic acid (24%), Cephalosporins (12%), Erythromycin (8%), Clindamycin (4%) and Meropenem (1.3%). Similar observations were noted in the studies of Sangavi R et al. [14], Dahiya P et al. [15] and Dhar H et al. [16].

Sangavi R et al. [14] retrospective study determining the incidence of SSI in patients undergoing a LSCS and identifying risk factors, common bacterial pathogens and antibiotic sensitivity reported 15 cases which were found to be affected by E.coli were found to be sensitive for Pipercillin+Tozabactum, Imeprenem and Gentamycin. Staphylococcus aureus infection occurred in 12 cases. Absence of growth was seen in 5 cases.

The frequency of CS wound infections can beprevented by educational programmes designed toraise public and clinical awareness. Modifiable risk factors like BMI and associated comorbid medical problems, such as diabetes and hypertension, should be closely monitored and controlled in the pre pregnancy period. Standards of personal hygiene, suchas bathing every day, are culture-dependent and may also differ according to the individual patient. Women opting for a CS for non-medical reasons should beinformed about the risks of SSI as a complication [4,8].

Measures should be taken in the pre-, intra- and postoperative phases to reduce the risk of infection. In the preoperative phase, certain measures can be beneficial—for example, bathing on the day of the surgery, avoiding the unnecessary shaving of hair, the use of electric clippers, the proper sterilisation of instruments, antibiotic prophylaxis and patient specific theatre-wear. Additionally, hand-washing, the antiseptic preparation of the surgical site and the use of appropriate staff theatre-wear should been couraged. Intraoperative infection prevention canbe aided by one of the latest practices world wide which is the use of monofilament sutures. The use of subcuticular sutures buried in the wound is also very unlikely to cause infection [24].

Nevertheless, despite all of these precautions, surgical wound infections may occur in the operating theatre when the tissues are exposed. Postoperative wound infection can be greatly reduced and controlled by rigorous surgical techniques. Furthermore, covering surgical incisions with aninteractive dressing able to absorb exudates, placed so as to ease pain and to ensure that they remain inplace for a minimum of 48 hours after the operation, is another practice to avoid wound infections [8]. A satisfactory surveillance system is essential inall hospitals to reduce the rate of sepsis, with reliable feed back to clinicians [25].

Conclusion

Obesity, diabetes, prolonged labour with PROM and wound haematoma are the main contributory risk factors responsible for PCS wound infections. The need to reduce SSI is currently receiving considerable attention and requires more research. Reducing the rate of SSI will help to reduce the unnecessary morbidity and associated socioeconomic consequences for the patient and her family. Recommendations include addressing modifiable risks factors in the preconception period, ensuringa sterile environment, aseptic surgeries, meticulous haemostatic techniques and the use of antimicrobial prophylaxis to reduce the incidence of infection. Assessment of risk factors should be done before surgery to determine the incidence and risk of SSI. Modification of these risk factors can reduce the chances of SSI. Discipline of the operation theatre should be strictly followed.

Moreover, SSI is associated with a maternal mortality rate of up to 3%. With the global increase in cesarean section rate, it is expected that the occurrence of SSI will increase in parallel, hence its clinical significance. Given its substantial implications, recognizing the consequences and developing strategies to diagnose, prevent, and treat SSI are essential for reducing postcesarean morbidity and mortality. Optimization of maternal comorbidities, appropriate antibiotic prophylaxis, and evidence-based surgical techniques are some of the practices proven to be effective in reducing the incidence of SSI.

References

1. Kausar R, Yasmeen L. Elective cesarean section. short antibiotic prophylaxis Vs prolonged antibiotic therapy. Professional med J. 2010;17(2):304-307.
2. Betran AP, Merialdi M, Lauer JA et al. Rates of caesarean section: analysis of global, regional and national estimates. PaediatrPerinatEpidemiol. 2007; 21(2):98-113.
3. Nwankwo EO, Ibeh I, Enabulele OI. Incidence and risk factors of surgical site infection in a tertiary health institution in Kano, northwestern Nigeria. Int J Infect Control. 2012;8:1−6.
4. Arabashahi KS, Koohpayezade J. Investigation of risk factors for surgical wound infection among teaching hospital in Tehran. Int Wound J. 2006; 3:59−62.
5. Yohannes Y, Mengesha Y, Tewelde Y. Timing, choice and duration of perioperative prophylactic antibiotic use in surgery. A teaching hospital based experience from Eritrea, in 2009. J Eritrean Med Assoc. 2009;4:65−7.
6. Amenu D, Belachew T, Araya F. Surgical site infection rate and risk factors among obstetric cases of Jimma University specialized hospital, southwest Ethiopia. Ethiop J Health Sci. 2011;21:91−100.
7. Gong SP, Guo HX, Zhou HZ et al. Morbidity and risk factors for surgical site infection following cesarean section in Guangdong Province, China. J ObstetGynaecol Res. 2012;38:509–15.
8. National Institute of Health and Clinical Excellence. Clinical Guideline 74. Surgical site infection: Prevention and treatment of surgical site infection. From: www.nice.org.uk/nicemedia/ pdf/ CG74NICE Guideline.pdf Accessed. Mar 2014.
9. Scottish Intercollegiate Guidelines Network. National Clinical Guideline 104. Antibiotic prophylaxis in surgery. From: www. sign.ac.uk/ pdf/sign104.pdf Accessed. Mar 2014.
10. Young BC, Hacker MR, Dodge LE et al. Timing of antibiotic administration and infectious morbidity following cesarean delivery. Incorporating policy change into workflow. Arch Gynecol Obstet. 2012; 285:1219−24.
11. Gregson H. Reducing surgical site infection following caesarean section. Nurs Stand. 2011; 25:35−40.
12. Smyth ET, Emmerson AM. Surgical site infection surveillance. J Hosp Infect. 2000;45:173−84.
13. Shittu AO, Kolawole DO, Oyedepo EAR. A study of wound infections in two health institutions in Ile-Ife, Nigeria. Afr J Biomed Res. 2002;5:97–102.
14. Sangavi R, KS. Assessment of incidence of post-operative wound infection in women undergoing caesarean section: a retrospective study. Int J ReprodContraceptObstet Gynecol. 2018;7(6):2328-32.
15. Dahiya P, Gupta V, Pundir S et al. Study of Incidence and Risk Factors for Surgical Site Infection after Cesarean Section at First Referral Unit. International Journal of Contemporary Medical Research. 2016; 3(4):1102-1104.
16. Dhar H, Al-Busaidi I, Rathi B et al. A Study of Post-Caesarean Section Wound Infections in a Regional Referral Hospital, Oman. Sultan Qaboos Univ Med J. 2014;14(2):e211–e217.
17. Satyanarayana V, Prashanth HV, Basavaraj Bet al. Study of surgical site infections in abdominal surgeries. J ClinDiagn Res. 2011;5:935−39.
18. Vuolo JC. Assessment and management of surgical wounds in clinical practice. Nurs Stand. 2006; 20:46−58.
19. Wloch C, Wilson J, Lamagni T et al. Risk factors for surgical site infection following caesarean section in England: results from a multicentre cohort study. BJOG. 2012;119(11):1324–33.
20. Wall PD, Deucy EE, GlantzJC et al. Vertical skin incisions and wound complications in the obese parturient. ObstetGynecol. 2003;102:952−6.
21. Devjani D. Risk factors analysis and microbial etiology of surgical site infections following lower segment cesarean section. Int J Antibiotics. 2013, Article ID 283025:1-6.
22. Johnson A, Young D, Reilly J. cesarean section surgical site infection surveillance. Infect Control HospEpidemiol. 2008;29:477-84.
23. Jasim HH, Syed Sulaiman SA, Khan AH et al. Incidence and Risk Factors of Surgical Site Infection Among Patients Undergoing Cesarean Section. Clinical Medicine Insights: Therapeutics. 2017;9:1-7.
24. Gould D. Caesarean section, surgical site infection and wound management. Nurs Stand 2007; 21:57−62.
25. Chadli M, Rtabi N, Alkandry S et al. Incidence of surgical wound infections: A prospective study in the Rabat Mohamed-V Military Hospital, Morocco. Med Mal Infect. 2005;35:218−22.