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RESEARCH ARTICLE

EPIDEMIOLOGY OF SURGICAL SITE INFECTION IN A TERTIARY CARE CENTRE IN NORTH INDIA

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Key words:-
SSI- Surgical Site Infection , SES- Socio Economic Status, CDC- Centers of Disease Control and Prevention, APSIC - Asian Pacific Society of Infection Control, NHSN- National Health Care Safety Network

Abstract

Background and Objective- Surgical site infections are one of the most common cause of nosocomial infections and second most common cause of maternal mortality next to PPH. Surgical site infection being a relatively serious problem in our health institution, there are scanty published reports on the risk factors that are involved in SSIs in our local hospitals necessitatingfurther research to identify the indispensable factors responsible for high infection rate

Methodology- Data were collected prospectively using predefined data collection forms which was developed after review of literature to identify risk factors for SSI. The form included patients' demographic features, potential risk factors for SSI. A surveillance system as suggested by the CDC NHSN criteriawere used for diagnosing SSI. SSI was defined as a wound swab culture confirmed infection at the site of surgery within 30 days after an operation . SSI was defined as per NHSN criteria. Data was collected daily on all study participants after obtaining informed written consent, and followed them until discharge. The post discharge surveillance was done by actual patient visit in majority of patients (81%) or by mobile phones

Results- Increasing age , increasing parity , anemia , hypertension , diabetes and poor nutrition, obesity were found to be independent risk factors for development of SSI .

Conclusion- A proper assessment of identifiable risk factors that predisposes to SSI and their correction may help reduce SSI rates.

Introduction:-

Surgical Site Infections (SSIs), previously called post operative wound infections,are the third most commonly reported nosocomial infection that account for approximately a quarter of all nosocomial infections. (1)

A surgical site infection is defined as an infection which occurs at the incision/operative site (including drains) within 30 days after surgical procedure if no implant is left in place/ within one year if an implant is left in place. The infection must appear related to the surgical procedure.[2]

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SSI In Obstetrics-

SSIs in obstetrics is the second most common cause of maternal mortality next to postpartum hemorrhage [3]. These events are one of the most common nosocomial infections accounting for 14–16% of the inpatient infections [4] and 20–25% of all hospital-acquired infections worldwide [5]. Women undergoing Caesarean deliveries have a 5 to 20-fold greater chance of getting an infection compared with women who give birth vaginally. These SSIs post-Caesarean birth can occur around the surgical incision, in the pelvic organs,and sometimes the uterine wall [6]. In addition, maternal morbidity related to infections post-C/S is eight times higher than post-vaginal delivery [7].

Risk Factors For SSI (APSIC guidelines, 2018) , for prevention of surgical site infection)

Preoperative risk factors (Patient factor)

A. Unmodifiable

1. Increasing age until age 65years
2. Recent radiotherapy and history of skin and soft tissueinfection

B. Modifiable

1. Uncontrolled Diabetes
2. Obesity and malnutrition
3. Current smoking
4. Immunosupresion
5. Preoperative albumin < 3.5 gm/dl
6. Total bilirubin>1.0 mg/dl
7. Preoperative hospital stay of atleast 2 days

Peri-operative risk factors

A. Procedure related

1. Emergency and more complex surgery
2. Higher wound classification
3. Open surgery

B. Facility risk factors

1. Inadequate ventilation
2. Increased operation theatre traffic
3. Inappropriate /Inadequate sterilization of instruments/ equipments.

C. Patient preparation related

1. A preexisting infection
2. Inadequate antiseptic skin preparation
3. Preoperative hair removal
4. Wring antibiotic choice, administration, and/or duration

Intraoperative risk factors

1. Long operation time
2. Blood transfusion
3. Asepsis and surgical technique
4. Hand/forearm antisepsis and gloving techniques
5. Hypoxia
6. Hypothermia
7. Poor glycemic control

Post operative risk factors

1. Hyperglycaemia and Diabetes
2. Post operative wound care
3. Transfusion

Wounds may be classified as clean, potentially contaminated, contaminated, and dirty.

Surgical site infection, on the basis of severity (Bailey and Love's)

Major - Criteria of major SSI are significant quantity of pus, delayed return home and systemic illness.

Minor-Pus or infected serous fluid may be present but should not be associated with excessive discomfort, systemic signs or prolonged hospitalization.

The most common presentation of SSI in obstetrical patients in our hospital is fever and discharge from stitchline

Complications of Surgical site infection-

1. Wound dehiscence/ seperationof layers/burst abdomen
2. Necrotizing fascitis
3. Abscess of adnexa& peritonitis
4. Parametrialphlegmon
5. Intensiveparametrial cellulitis of fascia with area of induration of ligaments-– a phlegmon ,within leaves of broad
6. Fever persist >72 hrs after iv antibiotics

Surgical site infection is preventable in majority of the cases if proper assessment and appropriate measures are brought by the operating surgeon, nursing staffs, patients and others in the perioperative period

Surgical site infection being a relatively serious problem in our health institution, there are scanty published reports on the risk factors that are involved in SSIs in our local hospitals necessitatingfurther research to identify the indispensable factors responsible for high infection rate following lower segment caesarean section (LSCS) . So, these study findings will play a vital role to decrease the infection rate and thereby reduce the morbidity and mortality. Further, validation of the recommendations of this study in operative field will reduce the rate of surgical site infections in our country and thereby will improve cosmesis of wound and make the results of operations better as a whole.

Methodology:-

Study Design-

Prospective observational study.

This study was carried out in Swaroop Rani Nehru Hospital and Kamla Nehru Hospital, attached to Motilal Nehru Medical college, government Medical college, Prayagraj Uttar Pradesh.

Inclusion Criteria

Patients undergoing lower segment caesarean section (LSCS) in Swaroop Rani Hospital and Kamla Nehru Hospital.

Exclusion Criteria

1. Uncontrolled Diabetes Mellitus(hyperglycemic coma, DKA)
2.Immunocompromised state like HIV positive patients, patients on steroids, jaundice of pregnancy
3.Patients admitted after LSCS in different set up
4.Patients with pre- existing sepsis

Demographic Factors Associated With Surgical Site Infection

Demographic features were explored and grouped as - age group, parity, socioeconomic status, BMI , hypertensive disorders and blood sugar (diabetic status),

Surgical preparation

All procedures followed the same protocol. Proper part preparation was done using betadine scrub solution , 70% alcohol , betadine solution in all the patients, 1 shot of pre operative antibiotic was given half an hour before surgery . In post operativeperiod all patients were given IV antibiotic for 3 days . First dressing of surgical wound was done 72 h after surgery followed by on day 8 .

Identification of SSI was done according to CDC 2019 criteria –

1. Purulent drainage with or without laboratory confirmation from the incision site .
2. Organism isolated from an aseptically obtained culture of fluid or tissue from the incision site.
3. Sign and symptoms of infection – pain , tenderness, localized swelling or heat .

Data were collected prospectively using predefined data collection forms which was developed after review of literature to identify risk factors for SSI. The form included patients demographic features, potential risk factors for

SSI, wound swab culture and antibiotic. A surveillance system as suggested by the CDC NHSN criteriawere used for diagnosing SSI. Data was collected daily on all study participants after obtaining informed written consent, and followed them until discharge.

SPSS software V25 was used for structural analysis of data. Test applied were chi square test.

Incidence OF SSI

56 patients out of 659 patients were identified with SSI. Thus incidence rate was 8.48%.

Risk Factors For SSI

Age

Table 1:- SSI In Patients Of Different Age Group.

AGE (Years)	SSI	NO SSI	TOTAL
≤20	5 (7.04%)	66	71
21-30	32 (7.1%)	427	459
≥31	19 (14.7%)	110	129
TOTAL	56	603	659

Out of 659 patients , 71 were of age less than or equal to 20 years, 459 were between 21 to 30 years, and 129 were of more than 30 years. Youngest patient was of age 18 years and eldest was of 38 years. SSI among>30 years age group was 14.7% whereas SSI among ≤20years age was 7.04 %. The difference in SSI of these age groups were statistically significant. (p=0.018)

Table 2:- SSI In Patients Of Different Parity Group.

PARITY	SSI	NO SSI	TOTAL
Primi	11 (5.95%)	174	185
P2-4	30 (7.92%)	349	379
Grandmultipara	15 (15.79%)	80	95
TOTAL	56	603	659

Out of 659 patients,185 were primi para, 379 were multipara and 95 were grand multipara. SSI was noted in 5.95% primi patients, 7.92% multipara patients and 15.8% grandmultipara patients. The parity of women made statistically difference (P value= 0.016) in causing SSI.

Table 3:- SSI In Obese Patients.

BMI	SSI	NO SSI	TOTAL
≥30 (OBESE)	13(13.26%)	85	98
<30 (NON OBESE)	43(7.6%)	518	561
TOTAL	56	603	659

Patients were divided according to BMI and grouped as Obese and Non Obese. Out of 659 patients,98 patients were obese. 13(13.26%) obese patients developed SSI. SSI among obese patients was 1.84 times than that of non obese patients. The difference in the SSI of these 2 groups was statistically significant (p=0.035)

Table 5:- SSI Among Patients Belonging To Different Socioeconomic Status.

SOCIOECONOMIC STATUS (SES)	SSI	NO SSI	TOTAL
LOWER	30 (10.33%)	263	293
MIDDLE	22 (7.88%)	257	279
UPPER	4 (4.12%)	83	87
TOTAL	56	603	659

Above table shows distribution of SSI amongs patients belonging to different socioeconomic status according to modified kuppuswami scale. Majority patients belonged to low SES i.e. 293 while 279 patients were from Middle SES and 87 patients belonged to upper SES. Although ,SSI was found to be higher among Low SES i.e. (10.3%) than in upper SES (4.12%) but differences between these three groups were statistically insignificant. (p >0.05) reflecting that socioeconomic status is not an independant factor for develoment of SSI .

Many of patients who came to the Labour room emergency were referred from peripheral PHC,CHC and District Hospitals of nearby districts. Many of them had different comorbidities including severe anaemia, hypertensive disorders of pregnancy (included Eclampsia, Severe Pre eclampsia, Gestational hypertension) and Chronic hypertension, seizure disorders of pregnancy, jaundice in pregnancy. SSI were compared among these groups to evaluate association of these risk facors to SSI

Table 6:- SSI Among Anaemic Patients.

Pre Operative Hb (gm%)	SSI	NO SSI	TOTAL
<7	15 (13.76%)	94	109
>7	41 (7.45%)	509	550
TOTAL	56	603	659

On the basis of pre operative haemoglobin status, these 659 patients who underwent LSCS, were divided into two groups of severely anaemic (<7gm%) and not severely anaemic(>7gm%). SSI was compared among these two groups. SSI among severely anaemic patients was 2 times than that among non severely anaemic group (OR=1.98)

There was statistically significant difference (p=0.0168) in rate of SSI between these two groups.

Table 7:- SSI Among Patients With Hypertensive Disorders.

HYPERTENSIVE DISORDER	SSI	NO SSI	TOTAL
YES	21 (12.4%)	148	169
NO	35(7.1%)	455	490
TOTAL	56	603	659

Among 659 patients, 169 had hypertensive disorders of pregnancy (including Eclampsia, severe pre eclampsia, gestational hypertension) and Chronic hypertension. SSI among hypertensive patients was 1.84 times than that of normotensive group (OR= 1.84). 12.4% of hypertensive patients developed SSI while 7.1% of normotensive group patients developed SSI.
The difference between these two groups was statistically significant (p= 0.033).

Table 9:- SSI Among Patients Among Patients With Different Albumin Values N=659

Pre operativeALBUMIN (g/dl)	SSI	NO SSI	TOTAL
<3.5	27 (11. 11%)	216	243
>3.5	29(6.97%)	387	416
TOTAL	56	603	659

Above table shows the division of patients according to their pre operative albumin .Among 659 patients . Majority patients(416) had Pre operative serum albumin values >3.5gm/dl whereas 243 patients had Pre operativeS.Albumin values <3.5gm/dl . SSI was compared among these two groups. SSI among patients with low albumin was 1.7 times than that among patients with normal serum albumin group (OR=1.66)

The difference between SSI in these two groups was statistically significant (p=0.03)(CI-95%)

Table 10:- SSI Among Patients Among Diabetic Patients. n=659

DIABETIC STATUS	SSI	NO SSI	Total
YES	10(16.67%)	50	60
NO	46 (7.68%)	553	599
TOTAL	56	603	659

Above table shows distribution of patients according to blood sugar levels. Patients were divided as Diabetic (included GDM, pregestational DM) and non diabetic . SSI was compared among these two groups. SSI among diabetic patients was 2.4 times than that among non diabetic group (OR=2.4)

The difference in rate of SSI between these two groups was statistically significant (p=0.017). showing diabetes as independant risk factor for development of SSI

Discussion:-

In our study, 56 of the 659 caesarean patients developed SSI i.e. incidence accounting to 8.5%, which is comparable to **9.58% as reported by Savitachandra et al(2020) [8] ,** 9% reported by **PriyankaDahiya et al in 2016[9]**and 10.35% reported by **AshokNaphade** et al (2017)significantly lower than 18.66% reported by Shrestha et al[11]

ShaliniMahanaVelecha reported SSI of 7.3 % in dept of Obs and Gynae ESI-PGIMSR Mumbai .
In the total 659 cesarean section done, 56 developed SSI (8.5%) in which Hypertension75% was the dominant comorbidity associated, followed by anaemia in 26.7% and diabetes mellitus in 17.8% .Anemia acts through hypo-oxegenation of the tissueswhich directly affects the wound healing, as well as predisposes the wound to new post-operative infection. Pre-operative anemia is thus an important risk factor for predicting SSI's and has been proved by several other studies. In my study, Anaemia was present in 15 out of 56 SSI cases (26.79%) which was lower than 38.6% as reported by Savita Chandra et al **[8]** and much lesser than one reported by PriyankaDahiya.et al which was 66.66%.**[9]**Anemic women are more prone to SSI due to frequent association with other co-morbidities. Preoperative anemia as an important predictor of infection has been proved by several other studies as well.It diminishes resistance to infection and is also associated with puerperal sepsis.

Hypertension was present in 21 out of 56 SSI cases (37.5%).which was higher than 29.3% as that of PriyankaDahiya et al.**[9].**Patients with hypertensive disorder of pregnancy have been shown 1.84 times higher risk for SSI which is less than 2.9 times reported by Ashish Pathak[10] et al i.e.(OR 1.84) in this study. Pregnancy induced hypertension has positive association with increased risk of SSIs as it is associated with low vitality and thus predisposes to infection.

Well known morbidities with diabetes mellitus as a risk factor for SSI, the higher blood sugar in the diabetics impairs the function of the white blood corpuscles which are central to the role of the immune system. Diabetics also have less collagen production which also slows wound healing; further they have slower blood circulation so delivery of nutrients to the site of wound healing is slower. [8]. Diabetes(GDM+ pregestational DM) was present in 16.67% of SSI which was higher than 11.6% reported by Savita Chandra et al[8]. and Odds of Diabetes in pregnancy in my study was 2.4 which was lower than Ashish pathat et al who reported it 5.6.

Obesity was found to be a risk factor for SSI. Inthis study, 13.26% patients were obese with BMI more than 30 which was comparable to 11.8% reported by Ashish et al[10] and much lower than 61.1% reported by Savita Chandra et al[8]. Ibrahim et alalso observed that excess weight/obesity was a risk factor for wound infections.Thus, a preventive approach to reduce SSI would be, to enhance effort to increase the general awareness of life style health issues and the benefits of maintaining an optimal weight and health.

Preoperative hypoalbuminemia is an independent risk factor for postoperative complications. S. albumin was low(<3.5gm/dl) in 48% SSI cases which is comparable to 45% as reported by KanakeswarBhuyan et al [12]. Preoperative serum albumin level is an independent predictor of surgical outcome in acute abdomen.

53% of patients having SSI were from low SES which is comparable to 62% as reported by PriyankaDahiya et al[9] supported even by Oslen et al. This may be linked to poor hygiene and nutrition. However SES was not found to be independent risk factor for development of SSI in this study .

This study shows the magnitude of SSI in caesarean section was highest in age group more than 30 years (that was 19 out of 56 patients with SSI - 33.9%) which was comparable to 22.2% highest among the age group that was more than 35yrs seen with TeshagerMamo et al (13).

In our study , SSI was seen maximum in obstetric patients with parity more than 4 that is 26.8% (that 15 out of 56 patients with SSI)which was comparable to 27.8% as reported by TeshagerMamo et al (13).

Conclusion:-

A proper assessment of identifiable risk factors that predisposes to SSI and their correction may help reduce SSI rates. Awareness programmes aimed for family planning, adequate ANC visits from early pregnancy for early identification of high risk pregnancies complicated by diabetes ,anemia , poor nutrition status and obesity could be identified and taken care in advance to prevent morbidities during delivery.New programmes and current schemes

should work hand in hand with women of rural areas including anganwadi and ASHA workers to reach every corner and strengthen the pillar of healthcare system. Frequent antimicrobial audit and qualitative research could give an insight into the current antibiotic prescription practices and the factors governing the same.

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