**A study of surgical site infection-**

**an obstetrical surgical morbidity in a in tertiary level hospital.**

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***Abstract: Background:*** *Surgical site infection (SSI) is amongst the most common sufferings following caesarean section. It contributes to increased morbidity and negative impact on the mental, social and economic condition of patient.* ***Aim:*** *To determine the incidence, risk factors and therefore the bacteriological profile following caesarean section at Umaid Hospital Jodhpur.* ***Methods****: This was a hospital based observational study of 1600 patients who had caesarean section over 3 months duration. Out of which 50 patients developed post caesarean surgical site infection. Wound swabs were collected from these patients ,culture and antibiotic sensitivity were done for aerobic pyogenic organisms.* ***Results:*** *Out of the 1600 participants who had a caesarean section, 50 patients had surgical site infection, giving an incidence of 3.12 per 100 caesarean sections. The common isolates were CONS (coagulase negative staphylococcus aureus) (57%), Staphylococcus aureus (14%), followed by E.coli (17 %), Acinetobacter (7%) and Klebsiella (3%). Common known risk factors present in this study were emergency caesarean section , obesity, rupture of membranes, lack of intra operative antibiotic coverage, previous caesarean section etc. Most isolates were resistant to Ofloxacin and sensitive to Vancomycin , Linezolid and Amikacin .* ***Conclusion:*** *The post-caesarean wound infection rate in our centre was 3.12 of 100 caesarean section. Linezolid , Cefazoline antibiotics were sensitive for commonest isolates from SSIs and may be used prophylactically till the final report of culture and sensitivity is obtained. This may reduce the complications associated with SSI.*

**Keywords:** Caesarean section, Surgical site infection, Wound infections, Antibiotic sensitivity

**Introduction:**

Surgical site infection (SSI) is defined as an infection occurring within 30 days after a surgery and affecting superficial/deep tissues at the operation site1. Surgical site infection (SSI) is one of the most common causes of nosocomial infections, with a reported incidence rate of 2-20%2.Postoperative SSI following caesarean section is related with increased morbidity, mortality, prolonged hospital stay and socio-economic loss to the patient 3.

Among risk factors patient related factors are old age, nutritional status, pre existing infection, co-morbid illness and procedure related factors like poor surgical technique, prolonged duration of surgery, pre operative part preparation, improper aseptic precautions. These factors can influence SSIs significantly4.

In addition to these risk factors, the virulence and the invasive power of the organism involved, physiological state of the wound tissue and the immunological integrity of the host are also the important factors .Surgical site infections delay recovery of patient thus prolong hospital stay or outpatient treatment, may necessitate readmission as well as other morbidities and mortality5.Thus are responsible for significant psychological and economical loss to the society. The rate of surgical site infection after caesarean section range from 3% to 15%.6-8

The causes of surgical site infection following caesarean include following.9-12 Intrinsic factors are age, obesity, underlying medical conditions like diabetes mellitus, hypertension, immunocompromised states like HIV infection, anemia. Extrinsic factors include preoperative parts preparation, type of procedure carried out (emergency/elective), type of anaesthesia (regional/general), type of skin incision given (horizontal/vertical), prophylactic antibiotic coverage, chorioamnionitis, number of vaginal examinations carried out before surgery, duration of operation and environment of the operating room.13-14 Knowledge of risk factors may help to reduce the incidence and severity of surgical site infections.

The CDC 15 describes three levels of surgical site infection; Superficial incisional SSI Infection occurs within 30days after the operation and infection involves only skin or subcutaneous tissue of the incision and at least one of the following:1. Purulent drainage, with or without laboratory confirmation, from the superficial incision. 2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision. 3. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture-negative. 4. Diagnosis of superficial incisional SSI by the surgeon or attending physician. Deep incisional SSI Operation related infection involving deep soft tissues which occurs within 30days after the operation and at least one of the following:1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site. 2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38°C), localized pain, or tenderness, unless site is culture-negative. 3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histo-pathologic or radiologic examination. 4. Diagnosis of a deep incisional SSI by a surgeon or attending physician.

**Material and methods:** This hospital based observational study was carried out in Department of Obstetrics and Gynecology at a tertiary level mother and child hospital, western Rajasthan India. The study population comprised of patients that had a cesarean section and developed surgical site infections during hospital stay or readmitted after discharge from hospital. The study was conducted over 3 months where 1600 caesarean section were done and patient who developed SSI were included in study after taking their written consent. Structured questionnaires were used to extract data from the patients undergoing caesarean sections. The information includes demographic data, existing chronic disease (such as diabetes mellitus, hypertension), past medical history. For those patients that developed SSI, physical examination was done to determine the diagnosis and type of the surgical site infection. Two swabs were collected from the infection site using aseptic precautions and sent to the hospital laboratory immediately for microscopy, culture and sensitivity. Vaginal swab were also collected and sent for examination. 3 ml of blood sample were collected in plain vial for detection of sepsis markers i.e. CRP and PCT. Culture sensitivity and identification of organism were done according to standard textbooks and CLSI guidelines.16

**Results:**

The study was performed over a period of 3 months. 1600 women had caesarean section out of which 50 women developed Surgical site infection. Result are depicted in tables below.

**Fig1**: Shows that 50 patients out of 1600 participants (3.12%) had surgical site infection following caesarean section.

Figure : A pie chart of percentage of patients with a wound infection after caesarean section

**Table 1**: Depicts the demographic data of patient developing SSI. Majority of patient were of teenage (8.1%), with =/>4 children (4%) and had secondary education (3.3%).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VARIABLE | TOTAL PATIENT | SSI PRESENT (%) | SSI ABSENT (%) | P value |
| **AGE**  <19  20-29  >30 | 49  1277  274 | 04(8.1)  40(3.1)  06(2.1) | 45(91.8)  1237(96.8)  268(97.8) | X2 = 4.9  Df = 2  P = 0.086 |
| **PARITY**  1  2  3  =/>4 | 915  455  132  98 | 36(3.9)  08(1.7)  02(1.5)  04(4.0) | 879(96.0)  447(98.2)  130(98.4)  94(95.9) | X2 = 5.8  Df = 3  P = 0.134 |
| **EDUCATION LEVEL**  ILLETRATE  PRIMARY  SECONDARY | 326  915  359 | 08(2.4)  30(3.2)  12(3.3) | 318(97.5)  885(96.7)  347(96.6) | X2 = 0.612  Df = 2  P = 0.736 |
| **ESTIMATED GESTATIONAL AGE**  <37WEEKS  >37 WEEKS | 160  1440 | 05(3.1)  45(3.1) | 155(96.8)  1395(96.8) | X2 = 0.06  Df = 1  P = 0.811 |
| **BOOKING STATUS**  UNBOOKED  BOOKED | 958  620 | 26(2.7)  24(3.8) | 932(97.2)  596(96.1) | X2 = 1.74  Df = 1  P = 0.224 |

**Table 2:** Shows the risk factors for post-caesarean wound infection. SSI was significantly higher among emergency caesarean section (6%) than the elective caesarean section (0.8%) (p= <0.0001). Also obese women (BMI>30) were having more SSI (4.5%) than BMI <30 (p=0.014). The most common indication of caesarean section developing SSI was Fetal distress (5%) followed by previous LSCS. Rupture of membranes before caesarean section (2.8%) was associated with higher risk of developing surgical site infection than intact membranes (2.2%) .

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RISK FACTOR** | **TOTAL**  **(%)** | **SSI present**  **(%)** | **SSI**  **Absent (%)** | **p VALUE** |
| **BMI**  <30  >30 | 1390  110 | 45(3.2)  05(4.5) | 1345(96.7)  105(95.4) | X2 = 4.72  Df = 1  P = 0.014 |
| **TYPE OF SURGERY**  EMERGENCY  ELECTIVE | 700  900 | 42(6)  08(0.8) | 658(94)  892(99.1) | X2 = 32.31  Df = 1  P = 0.0001 |
| **Indication of C-Sec** |  |  |  |  |
| FD  PREVIOUS 1LSCS  PREV2/PREV3 LSCS  NPOL  PRIMARYBREECH  DTA  CPD  PRE ECLAMPSIA  PLACENTA PREVIA  OTHERS | 300  500  159  168  130  50  37  41  24  191 | 15(5.0)  08(1.6)  03(1.8)  03(1.7)  03(2.3)  03(6.0)  03(8.1)  01(2.4)  01(4.1)  10(5.2) | 285(95)  492(98.4)  156(98.1)  165(98.2)  127(97.6)  47(94.0)  34(91.8)  40(97.5)  23(95.8)  181(94.7) | X2 = 16.77  Df = 9  P = 0.052 |
| **RUPTURED MEMBRANE**    YES  NO | 623  977 | 18(2.8)  22(2.2) | 605(97.1)  955(97.7) | X2 = 0.399  Df = 1  P = 0.264 |
| **PAST ILLNESS**  **DIABETES**  YES  NO | 20  1580 | 05  45 | 15  1535 | X2 = 32.01  Df = 1  P<0.0000001 |

[(Others = abruption, severe oligo, twin pregnancy, bad obstetric history, cord prolapsed) FD=fetal distress, NPOL= non progression of labour, DTA=deep transverse arrest, CPD= cephalopelvic disproportion]

**Fig 2:** Shows number of bacterial isolates from culture. A total of 50 wound swabs were collected from patients developing post caesarean SSI. Among these 28 (56%) had bacterial growth while 22 (44%) showed no growth.

Figure 2 Percentage of culture with growth

Table 3: Shows the frequency of pathogenic bacteria isolates from post-operative wound infection.

|  |  |  |
| --- | --- | --- |
| Type of organism | Pus culture | Vaginal culture |
| **CONS** | 16 | 02 |
| E.coli | 05 | 17 |
| Staph aureus | 04 | 03 |
| Klebsiella | 01 | 05 |
| Acinatobactor | 02 | 00 |

(CONS= coagulase-negative staphylococci , E.coli= Escherichia coli)

Figure3: Frequency of bacterial isolates from post operative wound culture

**Fig 4**: Showstype of wound infection: About 76% were superficial and 24% were deep wound infections

Figure Type of wound infection developing SSI

**Fig 5:** Shows post of management of patient. About 39 patients (78%) were managed by dressing alone while 11( 22%) required resuturing-

Figure5 Post operative management of SSI

**Table 4:** Shows hospital stay of patient after developing SSI.

|  |  |
| --- | --- |
| <5 days | **04** |
| 5-10 days | **21** |
| >10 days | **25** |

**Table 5:** Shows degree of sensitivity of antibiotics. Most of the CONS were highly sensitive to Linezolid (100%) and Amikacin (100%), while highly resistant to Ofloxacin. E coli was highly sensitive to Meropenam (100%), Cefepime (100%), Tobramycin (10 0%)

**The degree of sensitivity and resistance varied significantly.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Antibiotic name** | **CONS** | **E COLI** | **Staphylococcus aureus** |
| **Linezolid** | **100%** | **-** | **100%** |
| **Amikacin** | **100%** | **50%** | **100%** |
| **Cefazoline** | **96.66%** | **-** | **100%** |
| **Vancomycin** | **91.66%** | **-** | **100%** |
| **Ampicillin+sulbactum** | **85.71%** | **-** | **-** |
| **Tobramycin** | **60%** | **100%** | **100%** |
| **Ampicillin** | **50%** | **-** | **-** |
| **Piperacillin** | **0%** | **-** | **-** |
| **Ofloxacin** | **0%** | **0%** | **0%** |
| **Meropenam** | **-** | **100%** | **-** |
| **Cefepime** | **-** | **100%** | **-** |
| **Aztronem** | **-** | **80%** | **-** |
| **Ciprofloxacin** | **-** | **-** | **100%** |
| **Piperacillin +Tazobactam** | **-** | **-** | **100%** |

**DISCUSSION**:

The study gives information about pathogens associated with post-operative wound infections in this hospital and their sensitivity profiles. The incidence of post-caesarean wound infection in present study was 3.12 per 100 caesarean sections. Similarly in another study done by [Charles Obinna Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20CO%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) and [Amarachi Nnaemezie Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20AN%5BAuthor%5D&cauthor=true&cauthor_uid=31198449)2 in 2019 incidence of SSI was found to be 8.5% 17. Another study done by Vikrant negi, Shekhar Pal, Deepak Juyal, Munesh Kumar Sharma, Neelam Shara incidence came out to be 7.8% 18.The possible reason for variation in these studies could be due to differences in the population under study, diversity of indications for caesarean sections performed in different centers.

According to Eritrean EMOH in 2011, female reproductive age group is from 15-45 yr. Similar results were found in our study. Cunningham19 mentioned that many obstetrical complications such as prolonged labour , PIH, and post partum sepsis were commonly observed among teenagers and in reproductive age group. In this study teenagers (<19 years) showed higher percentage of SSI (8.1%)

In present study SSI was observed more among booked women compared to unbooked. This could be due to extended hospital stay, nosocomial , iatrogenic infection due to multiple per vaginal examinations and obstetric interventions in these patient as compared to unbooked patient, who were referred either delivered or operated earliest.

SSI was more common in educated women as compared to uneducated in study done by [Charles Obinna Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20CO%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) and [Amarachi Nnaemezie Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20AN%5BAuthor%5D&cauthor=true&cauthor_uid=31198449)17 .However in this study SSI was more common in educated women. This may be due to the reason that educated women were booked and were admitted for extended duration in the ward and had frequent obstetric examinations by various strata of healthcare services.

Generally patients undergoing emergency Caesarean section are at higher risk of infections. In this study elective surgeries developing SSI were 6% while 0.8% were emergencies. This is probably due to antibiotic prophylaxis given in elective surgeries reducing the risk of post operative SSI. Similar results were found in Study done by [Charles Obinna Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20CO%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) and [Amarachi Nnaemezie Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20AN%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) with more no. of emergency caesarean sections as compared to elective developing SSI 17

Most common indication of caesarean section developing SSI in our study was fetal distress (5%) followed by prev LSCS . Study done by Tsehaynesh Aslake Wendmagegn et al 2018 also showed Fetal distress to be the most common indication20 In our study 76 % wound infection were superficial while 24% were deep wounds . While a study done by Ghirmay etal in 2015 showed superficial incidence as 25% and deep 75% 21

In this study out of 50 patients developing SSI, 28 patients (56%) had microbial culture growth where Gram positive cocci (*Staphylococcus aureus and CONS* ) was isolated in 72% cases, followed by *E.coli* (17%), *Acinetobacter sp*. (7%) and *Klebsiella sp*. (3%). Similar results were found in other studies done by [Charles Obinna Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20CO%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) and [Amarachi Nnaemezie Njoku](https://www.ncbi.nlm.nih.gov/pubmed/?term=Njoku%20AN%5BAuthor%5D&cauthor=true&cauthor_uid=31198449) where *Staphylococcus aureus* was most common organism associated with SSI17.

In this study vaginal swab of patient developing surgical site infection was also sent, where *E.coli* (62%) was most common following *Klebsiella*(18%). The results were not found to be significant as *Ecoli* is natural commensal of vagina. Blood sample for CRP(C-reactive protein ) and PCT(procalcitonin) were also collected but results were not significant as out of 50 patient developing Surgical site infection, 45 (90%) were CRP positive and PCT was in normal range in all 50 patient.

In this study, CONS isolates were sensitive to Amikacin, Linezolid, Cefazoline and Vancomycin (table 9). Another study done by Njoku et.al reported CONS to be sensitive to Amikacin and Imipenem, and resistant to Cephalosporins, Amoxicillin/Clavulanate, Gentamicin and Meropenem, and Fluoroquinolones.17 In spite of availability of antibiotics SSI are still responsible for much morbidity and socio economic loss for both patient as well as health care systems. Reduction in SSI while minimizing antibiotic resistance still remains a challenge for many health care institutions.

Secondary resuturing rate was less at our centre (22% underwent resuturing while 78% of cases were managed on conservative basis i.e. dressing alone ) which shows that proper aseptic precautions were taken while managing these patients and secondary resuturing rate was less

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SURGICAL SITE WOUND INFECTION

**CONCLUSION :**

* The incidence of SSI in this study was 3.12 per 100 caesarean sections.
* Presence of wound sepsis was associated with longer duration of hospital stay which further lead to economic loss to the patient.

**RECOMMENDATIONS:**

* Hand hygiene and Infection prevention practice by health care providers to be followed in order to reduce the risk of wound sepsis.
* To evaluate and improve pre and post operative care, there is need of continuous training and supervision of infection control practices.
* Intra operative antibiotics can be given to all patient scheduled for any obstetric intervention and caesarean section whether emergency / elective. Every institute should follow their antibiotic use protocols.
* If a patient is diabetic, frequent and regular blood sugar monitoring along with low glycemic index diet and appropriate exercise.
* A vigilent infection control committee should be established which should monitor SSI through surveillance studies with feedback data to healthcare workers, labour room, operation theatre and post operative staff and residents and surgeons has been shown to be an important component of strategies to reduce risk of SSI to minimum acceptable level.

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