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Risk Factors Analysis and Microbial Etiology of Surgical Site Infections Following Lower Segment Caesarean Section

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Abstract: *Lower segment caesarean section (LSCS) is a common mode of delivery now and surgical site infection is the third most common infectious complication in these patients.* ***Aim & objectives:*** *This study was planned with this background to have a comprehensive approach to SSI following LSCS.* ***Methods:*** *100 consecutive patients undergoing LSCS, irrespective of indication who developed SSI,were studied. A questionnaire was developed to assess the risk factors associated with development of SSI. All patients were followed up from day one of surgery till discharge postoperative day 30.* ***Results:*** *SSI was identified in (70%) out of 100 patients with SSI. In all age groups,Gram-negative bacilli were the commonest finding. The commonest isolate was Klebsiella pneumoniae(28.72%) followed by Pseudomonas aeruginosa(25.53%) and Staphylococcus aureus (17.04%). ESBL (75.6%), Amp C (27%), MBL (8.5%) & MRSA (87.5%).* ***Conclusions:*** *A proper assessment of risk factors that predispose to SSI and their modification may help in reduction of SSI rates. PROM, overcrowding, poor nutrition, lack of hygiene were found to be significant. Hospital infrastructure has to be improved by providing more space to accommodate the overload of patient's with good ventilation of wards and water facilities.*

Keywords: *surgical site infections, LSCS, risk factors, antibiogram*.

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I. Introduction:

Surgical site infection (SSI) is considered as one of the most common healthcare-associated infections, especially in low and middle-income countries[1-3]. However; surgical site infection (SSI) after cesarean section is one of the major infections that can affect patients with a cesarean section (C-section) procedure[4]. Caesarean section (CS) is among the most frequent surgical interventions in women all over the world[5,6]. Despite advances in operative techniques and a better understanding of the pathogenesis of wound infection and wound healing, post operative wound infection (surgical site infections) continue to be a major source of morbidity and mortality for patients undergoing operative procedures. The overall incidence of wound sepsis in India is from 10%-33%. However, the incidence of wound complications in the obstetric population varies with rates ranging from 2.8% to 26.6%[7,8,9].Despite recent surgical parameters and antibiotic prophylaxis, SSI is still standing significantly behind morbidity, mortality and healthcare-associated costs, especially if we know that CS increases the risk of post-partum infections by five to even twenty-fold compared to usual or vaginal delivery[7-9].

Due to the worldwide ongoing rise in the incidence of cesarean deliveries, the number of women with postpartum infection is expected to increase. The SSI following CS causes physical, psychological and financial burden to the lady, her family and community[10-12]. Difficulties to the mother and her family are exaggerated when SSI develops, especially in today's climate of early hospital discharge, which leaves women to stay at home, sometimes with little practical and/ or emotional support[13]. Obstetrical surgery involves some degree of contamination, and is classified as" clean- contaminated" cases, even when the patient has no preoperative signs and symptoms of active infection. So; pregnant women are at risk of infection during delivery, which may be enhanced by the relative immunocompromised state of pregnancy[14]. Risk factors contributing to an increase in SSI post CS are widely variable such as gross contamination of the operative site, prolonged and premature rupture of membranes, prolonged operative time, obstructed labor, obesity, chorioamnionitis, emergency operation and decreased immune status, which are especially common in poor countries where women may be malnourished and chronically anaemic[15-18].

Aims and Objectives

1. To identify the risk factors causing SSI after LSCS which may have an impact on increasing alertness among obstetricians aiming to prevent such a problem.
2. To know the spectrum of the aerobic bacteria causing SSIs after LSCS .
3. To know the antibiotic susceptibility patterns of the isolates.

Materials and methods

- The study was carried out prospectively in Department of Obstetrics &Gynaecology and Department of Microbiology, Rangaraya Medical College, GGH, Kakinada, from November 2014 to November 2016.
- Clearance certificate was obtained from ethical committee in the institution.
- The sample size includes 100 samples of pus were collected from all cases of SSI after LSCS in post operative ward mostly in the form of swabs.

Inclusion criteria:

1) Presence of post operative SSI's.
2) Involves only the skin and subcutaneus tissue.

Exclusion criteria:

1) LSCS done outside.
2) Infection occuring 30 days after operation.

Sample collection:

Two sterile swabs were used for collection of the sample from the wound site. With consent, two swabs were taken from the wound site. One swab was used for direct microscopy. The other was inoculated on Mac Conkey agar and Blood agar and incubated at 37°C for 16-18hrs. The
plates were examined for growth, if any growth was observed on plates it was processed according to standard conventional methods.

Culture:

Smears prepared from specimens were stained by Gram's stain and after observing motility by hanging drop preparation and confirmed that the organisms are Gram negative or Gram positive. The specimens were inoculated on to Nutrient agar, Mac conkey agar, 5% Blood agar, and incubated at 37°c overnight and examined for growth. These were subjected to various biochemical tests for confirmation.

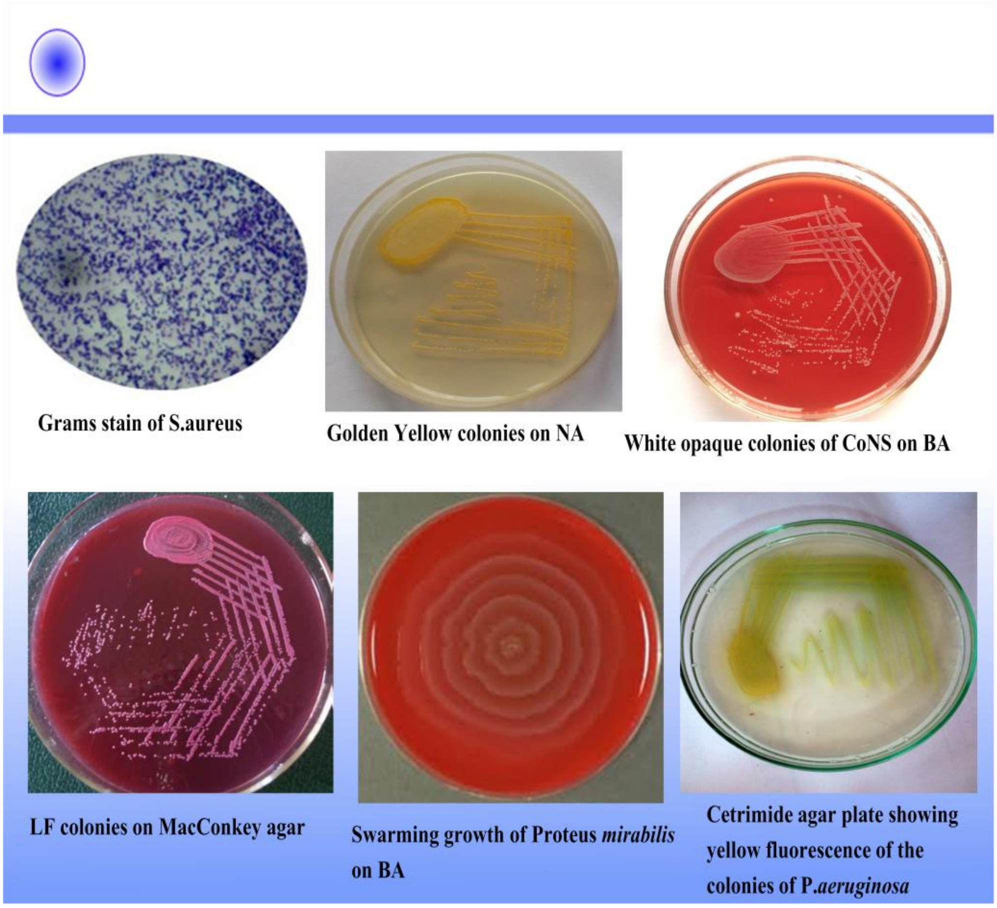
Antibiotic susceptibility testing:

Routine antibiotic susceptibility [RAST] was done by modified Kirby-Bauer's disc diffusion method. The panel of antibiotic discs used were obtained from HIMEDIA.

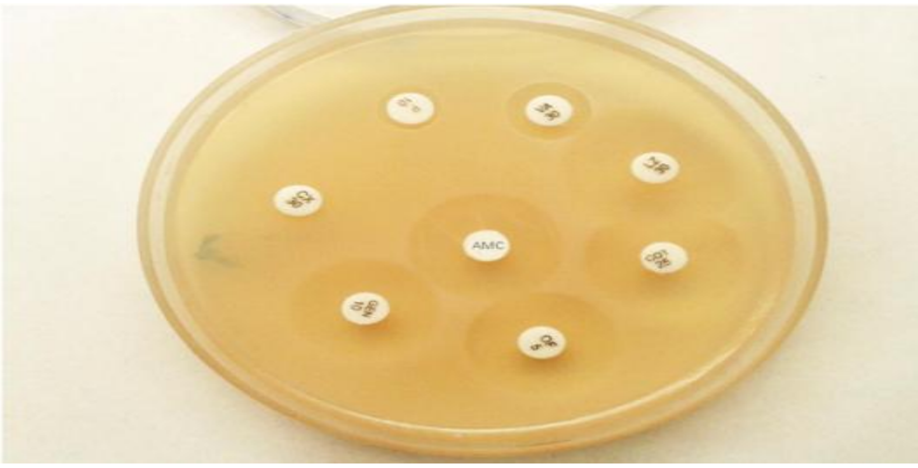
II. Method:

Inoculum for antibiotic susceptibility testing was prepared by emulsifying 4 – 5 similar looking colonies in a test tube containing 1 – 2 ml nutrient broth and incubated for 2-3hours. The turbidity after incubation was matched to 0.5 McFarland standard [Contains 10^8CFU/ml].

After the standardization of the inoculum, a freshly prepared, dried Mueller-Hinton-Agar [MHA] plate was inoculated by pouring the inoculum onto the plate. The inoculum was spread evenly and the excess was poured off the plate. The panel of antibiotic discs were placed on the plate and was incubated aerobically at $35^oC \pm 2^oC$ for 24hours.



- Methicillin resistance by Cefoxitin (30 µg) disc.
- According to CLSI guidelines cefoxitin disc
  ≥22 mm - MSSA
  ≤21 mm - MRSA



III. Results

During this period of study, there were 16,476 deliveries and 6,625 are LSCS giving an incidence of 40.2%. For assessing risk factors for SSI after LSCS a control group of 100 patients with out infection has randomly selected from the patients who underwent LSCS during the study period.The epidemiological and obstetric variables were studied for the patient and control groups. Categorical variables in the two groups were compared by using x2 or fisher exact test. Continuous variables were compared using the student T-test. These tests were two tailed and P<0.05 was considered statically significant.

Distribution of sociodemographic and Obstestrics among the women

Variable	Study group	Control group	P value
Unbooked	37(37%)	27(27%)	>0.05
Booked	63(63%)	73(73%)	>0.05
Maternal age <20	8(8%)	12(12%)	>0.05
20-34	85(5%)	90(90%)	>0.05
>35	7(7%)	2(2%)	>0.05
BMI			
<23	36(36%)	40(40%)	>0.05
23-24	52(52%)	56(56%)	>0.05
>25	12(12%)	4(4%)	<0.05
Type of surgery Elective	20(20%)	20(20%)	>0.05
Emergency	80(80%)	80(80%)	>0.05

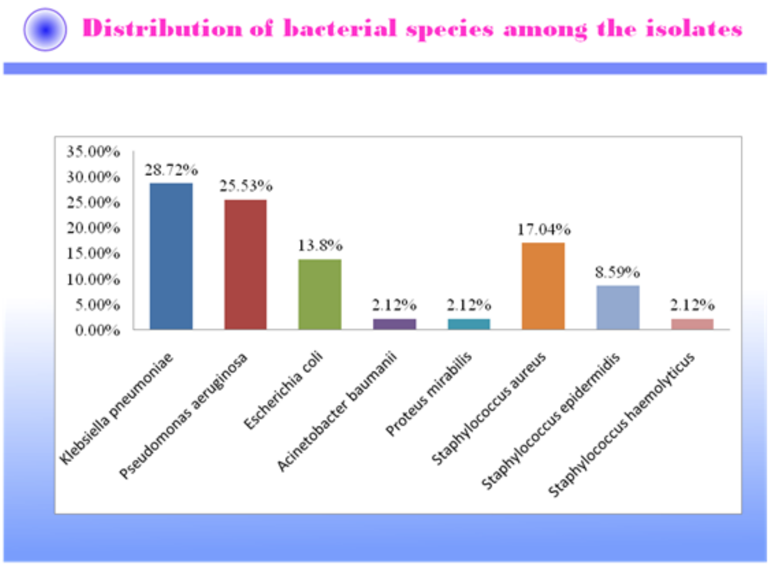
Obstetrics Variables

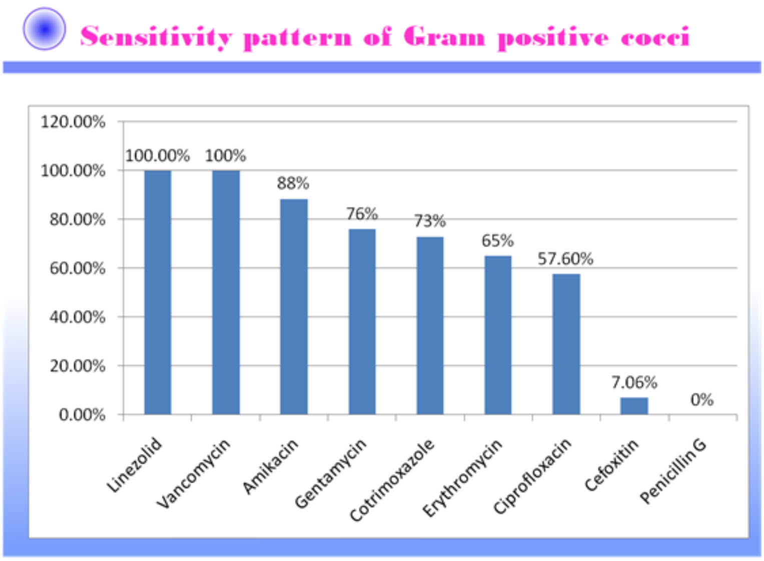
Variables	Cases	control	P value
Anaemia	26	12	<0.05
previous scar	32	28	>0.05
Prolonged rupture of membranes	26	14	<0.05
Prolonged labor	38	12	<0.05
Multiple vaginal examinations	42	27	<0.05
Prolonged operation time	47	24	<0.05

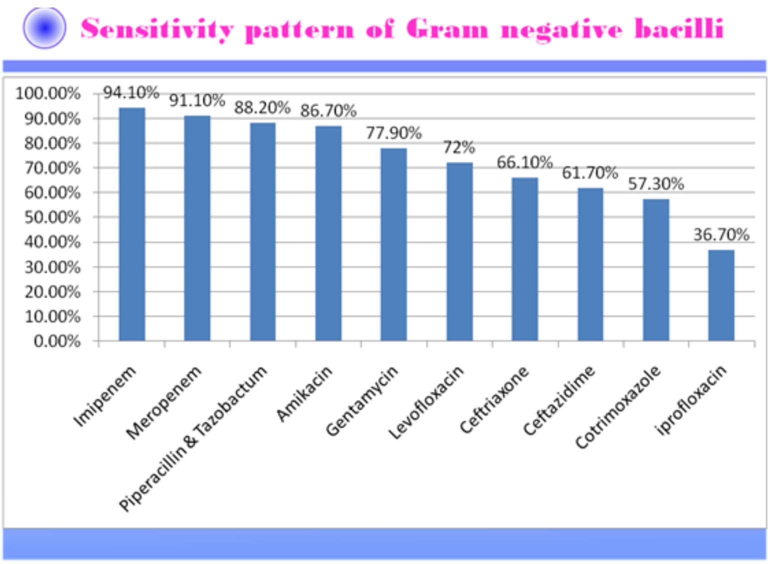
Type of Surgery vs Culture isolations

Category	Type of surgery	No. of cases	Culture positives	Culture negatives
Obstestrics	Emergency	80 (80%)	70 (87.5%)	10 (12.5%)
	Elective	20 (20%)	12 (60%)	8 (40%)
	Total	100 (100%)	85 (85%)	15 (15%)

Statistical analysis were calculated in Obstetrics (Emergency & Elective surgeries)
Chisquare
x2 = 7.977
p value <0.05
There is difference between infection rates in cases among emergency & elective surgeries in post Obstetric ward which is statistically significant.


Distribution of bacterial species among the isolates
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
28.72%
25.53%
13.8%
2.12%
2.12%
17.04%
8.59%
2.12%
Klebsiella pneumoniae
Pseudomonas aeruginosa
Escherichia coli
Acinetobacter baumanii
Proteus mirabilis
Staphylococcus aureus
Staphylococcus epidermidis
Staphylococcus haemolyticus


Sensitivity pattern of Gram positive cocci
120.00%
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
100.00%
100%
88%
76%
73%
65%
57.60%
7.06%
0%
Linezolid
Vancomycin
Amikacin
Gentamycin
Cotrimoxazole
Erythromycin
Ciprofloxacin
Cefoxitin
Penicillin G


Sensitivity pattern of Gram negative bacilli
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
94.10%
91.10%
88.20%
86.70%
77.90%
72%
66.10%
61.70%
57.30%
36.70%
Imipenem
Meropenem
Piperacillin & Tazobactum
Amikacin
Gentamycin
Levofloxacin
Ceftriaxone
Ceftazidime
Cotrimoxazole
iprofloxacin

IV. Discussion

Surgical site infections constitute a global health problem both in economic and human term. Multiple factors influence SSI rate in clinical practice.Being a tertiary care hospital most of the patients come to hospital with obstetric complications prone for emergency surgeries compared to elective procedures.Multiple factors which include environmental contamination, standard of hygiene maintained in hospitals especially in developing countries contribute for reporting high number of Gram negative pathogens.Prolonged rupture of fetal membrane, prolonged operative time and BMI > 25 were identified as independent risk factors for caesarean wound infection in this study.The antibiogram of Gram positive cocci shows high resistant to penicillin G may be as result of injudicious use of these drugs in the study population leading to high selection pressure of resistant bacteria. All staphylococcal isolates showing zone of <21mm to cefoxitin 30μg disk are identified as MRSA.The high percentage of MRSA isolates in present study indicates most of the strains were from hospital environment. Staphylococci are well known for their survival for longer periods in the places like wards, corridors, inanimate objects, thus causing nosocomial infections.The antibiogram of Gram negative bacilli, there was drastic reduction in sensitivity to 3rd generation cephalosporins compared to aminoglycosides. This can be explained because of overuse of cephalosporins in recent years leading to emergence of resistant strains.Resistance to third generation Cephalosporins might be transferred to the

recipient strain along with resistance to Gentamicin or non βlactam antibiotics.A review has reported that hands of health care workers & patients can play a role in transfer of Gram negative bacteria during cross infection. Most subjects seeking medical aid in this Government set up belong to low socio economic group and especially during the antenatal period with complications pay less attention to good hygienic practices. Similarly overcrowding of patients in obstetric ward and labour rooms due to increase admissions, limited manpower, not following good barrier methods all contribute to surgical site infections. It highlights the facts that with the use of standardized protocol and good practice, it is possible to reduce cesarean wound infection from higher rates.

V. Conclusion

Anemia(28%),Prolonged rupture of membranes(26%),BMI>25(12%), prolonged operative time (47%) were identified as independent risk factors in this study. Effort should be geared towards the prevention of prolonged rupture of fetal membranes , reduction of prolonged operation time, by the use of potent antibiotics, early intervention and use of good surgical technique. In obese women improved surgical technique and use of non absorbable sutures may suffice.Predominant isolates were Klebsiella *pneumoniae* (28.72%), Pseudomonas *aeruginosa* (25.53%) & Staphylococcus *aureus* (17.04%). Analysis of antibiogram revealed presence of more resistant strains & as such, **Antibiotic policy** has to be made mandatory in all hospitals. **Infection control committee** to be formed in all hospitals to reduce SSIs. Potency of the disinfectant to be monitored & introducing new sterilization techniques like Bacillocid Rassant & Virkon to bring down SSIs.Measures to improve infrastructure of hospital regarding increasing the no. of staff, bed spacing, ventilation to prevent cross infections.

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