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# An In-Depth Analysis of Infectious Morbidity amongst Post Caesarean Section Patients at Royal Commission Hospital (RCH) Jubail. Kingdom of Saudi Arabia (KSA)

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## Abstract

**Introduction:** The Centre for Disease Control and Prevention (CDC) defines a surgical site infection (SSI) as "An infection that occurs after surgery in the part of the body where the surgery took place. Major risk factors are Bacterial vaginosis [6] and chorioamnionitis others include [7-19]: Prolonged labor and prolonged rupture of membranes.

**Setting:** Department of Obstetrics and Gynecology. Royal Commission Hospital Jubail. KSA.

**Duration:** November 2020 - December 2021.

**Methodology:** A descriptive analysis of each patient and presenting features, risk factors, investigations and management was reviewed, all data was tabulated in MS Excel and further analysed.

**Results:** A total of 05 cases of infection were identified in the months of November and December with 03 deep surgical site wound infections. It was found that the risk factors were significant in all the cases along with *E. coli, Klebsiella* and MRSA positive infections. There were additional procedures involved and prolonged hospital stay. Overall, there were no long-term complications.

**Conclusion:** Infectious morbidity following caesarean sections is a cause of deep concern globally, and our set up is not immune from the phenomenon. Despite the presence of risk factors it is notable that severity and the incidence of infections in late November and December 2021, in the three cases was unprecedented and required an audit of all procedures and pathways in order to prevent such occurrences in the future.

***Keywords:*** *In-Depth Analysis; Infectious Morbidity; Post Caesarean Section*

## Introduction

The Center for Disease Control and Prevention (CDC) defines a surgical site infection (SSI) as "An infection that occurs after surgery in the part of the body where the surgery took place". Globally rates of SSIs differ substantially and are higher in less developed countries, compared to more developed countries where advanced hospital infection control services exist and correct implementation of evidence-based guidelines for SSI prevention are functional. According to recently published statistics, approximately 2% to 5% of surgical patients

will develop a SSI, which is up to 300,000 people annually in the United States [1]. In UK the incidence ranges from 1 - 5% [2]. Whereas in a study from Norway it was 8.3% [3]. The incidence in our hospital during year 2020 was 1.4%. A study conducted in 2014 in King Abdul Aziz hospital in Jeddah estimated SSI following caesareans section to be 3.4% [4].

In a review of Maternal-Fetal Medicine Units (MFMU) Network prospective studies of cesarean delivery (n = 70,000 cesareans), the rate of endometritis was 6 percent for primary caesarean deliveries performed before labor and 11 percent of caesarean deliveries performed during labor [5].

## Risk factors

Major risk factors are bacterial vaginosis [6] and chorioamnionitis others include [7-19]:

- Prolonged labor
- Prolonged rupture of membranes
- Multiple cervical examinations
- Internal fetal or uterine monitoring
- Large amount of meconium in amniotic fluid
- Manual removal of the placenta
- Low socioeconomic status
- Maternal diabetes mellitus or severe anemia
- Preterm or post-term birth
- Operative vaginal delivery
- Obesity
- HIV infection
- Colonization with group B S*treptococcus*
- Nasal carriage of *Staphylococcus aureus*
- Heavy vaginal colonization by *E. coli*.

Emergency Caesarean sections or CATEGORY I and II Caesarean sections are a major risk factor for wound complications, even when evidence-based interventions to reduce post caesarean delivery wound complications have been administered. In one study, 28 percent of such patients had a wound complication. Early wound infections (in the first 24 to 48 hours) are usually due to group A or B beta-hemolytic *Streptococcus* and are characterised by high fever and cellulitis. Later infections are more likely to be due to *Staphylococcus epidermidis* or *aureus, Escherichia coli, Proteus mirabilis*, or cervicovaginal flora) [20].

Pre-existing morbidities associated with SSIs include: obesity, smoking, blood transfusion, age, malnutrition, immune incompetence, immunosuppressive therapy, longer preoperative hospitalization, and diabetes mellitus. Factors specifically related to C-sections include:

lack of prenatal care, multiple pregnancies, history of previous C- section, chorioamnionitis, Pre-labor rupture of the fetal membranes, labor dystocia and emergency/labored delivery [21].

## Classification of surgical site infection (SSI)

The criteria for SSI by CDC is an infection which occurs within 30 days after a surgical procedure and is further divided into superficial incisional primary and secondary SSIs, deep incisional primary and secondary SSIs and organ/space SSIs if involving structures deeper than muscle and fascia space [22]. This can be seen in figure 1.

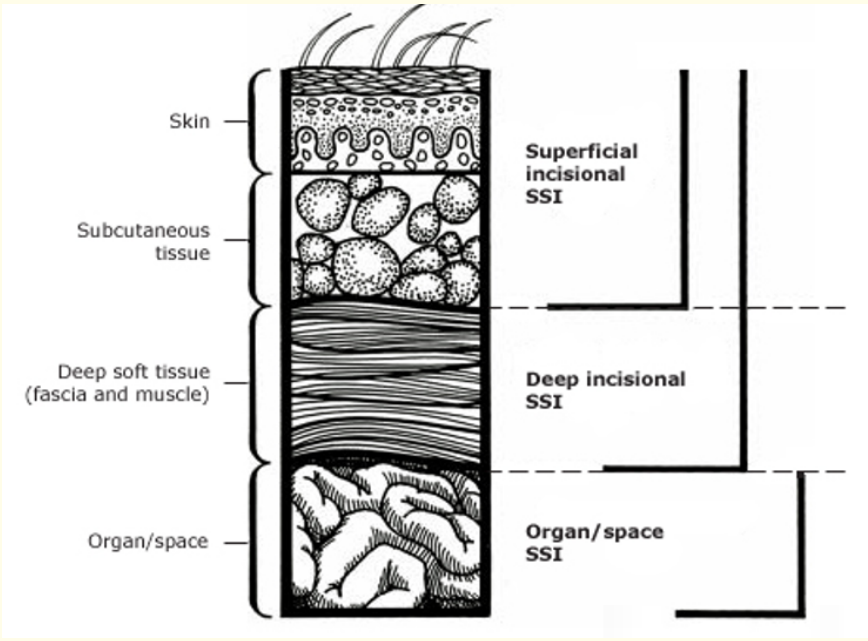



***Figure 1:*** *Cross-section of abdominal wall depicting CDC classifications of surgical site infection.*
*CDC: Centers for Disease Control and Prevention; SSI: Surgical Site Infection.*
*Data from: Mangram AJ, Horan TC, Pearson ML, et al. Guideline for prevention of surgical site infection. In: Infection Control and Hospital Epidemiology, CDC 1999; 20:247. Graphic 80661 Version 5.0 (2021 UpToDate, Inc. and/or its affiliates. All Rights Reserved). Graphic 80661 Version 5.0 (2021 UpToDate, Inc. and/or its affiliates. All Rights Reserved).*

SSI within 30 days of the operative procedure and meeting the CDC/NHSN criteria [22] as follows:

1. A superficial incisional SSI: Must report at least one of the following criteria:
    a. Purulent drainage
    b. Organism isolated
    c. At least one of the following signs and symptoms of infection-pain or tenderness, localised swelling, redness or heat
    d. The superficial incision is opened by a surgeon unless the incision is culture negative

e. The diagnosis is made by a surgeon or attending physician.

2. Deep incisional SSI: Must report at least one of the following criteria:

   a. Purulent drainage

   b. Incision that spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms-fever (> 38°), localised pain or tenderness unless the incision is culture negative; abscess or other evidence of infection involving deep incision found on direct examination, during reoperation or histopathology, or radiological examination

   c. The diagnosis is made by a surgeon or attending physician.

3. Organ/space SSI: Must report one or more of the following criteria:

   a. The patient has an identified organism cultured from endometrial tissue of fluid obtained during the operation.

   b. The diagnosis is made by a surgeon or attending physician based on at least two of the following: fever (≥ 38°C) with no other validated causation, purulent drainage from the uterus, abdominal pain or uterine tenderness.

## Materials and Methods

An audit of cases of SSI in the department of obstetrics and gynaecology was undertaken due to a sudden rise in cases of atypical presentation pertaining to post caesarean section surgical wound infections.

**Setting:** Department of Obstetrics and gynaecology. Royal Commission Hospital Jubail.

**Duration:** January 2020 - December 2020.

**Methodology:** A descriptive analysis of each patient and presenting features, risk factors, investigations and management was reviewed, all data was tabulated in MS Excel and further analysed.

## Results

### Over all data from January - December 2020

| | | |
|---|---|---|
| 1 | The total number of deliveries | 1243 |
| 2 | Total Number of Caesarean Sections | 347 |
| 3 | Percentage of Caesarean Sections | 12.24 % |
| 4 | Percentage of Infectious Morbidity in Caesarean section Patients | 1.72% |

### November and December 2020

It is important to note that the months of November and December 2020 were analysed due to reports of severe and deep tissue infectious morbidity amongst our caesarean patients. The infection rate was 2.06% and 3.0% for November and December 2020 respectively.

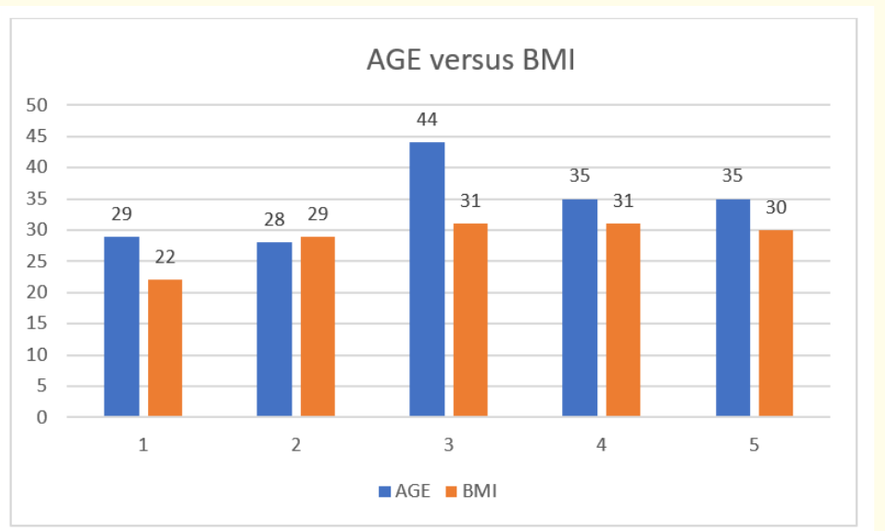
A total of 05 cases of infection were identified in the months of November and December with 03 deep surgical site wound infections. These are described as cases 1-5 and colour coding has been used to identify superficial and deep infections. Superficial infections are represented as blue and deep as Pink or red.

## Patient characteristics

**Age:** Range was 28 - 44 years. Two patients were 28 and 29 years respectively and two at 35 years. One with elective LSCS was 44 years old.

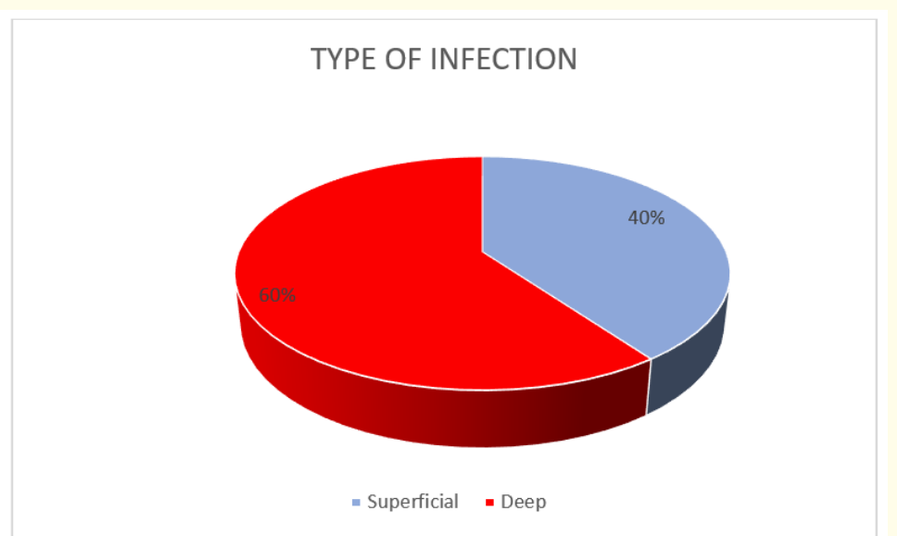
**Parity**: There were 02 Primiparae (40%) and 3 Multigravidae (60%). Amongst the multigravidae there was one grand multipara with previous 05 LSCS.

**BMI**: Ranged for 29 - 31 in four patients and 22 in one Primigravida, with a superficial wound infection. It is notable that in Case number 1 and 2 the Age and BMI are under 30 each respectively whereas in case number 2 - 5 the BMI and age are higher. It must be noted that Case 1 and 2 represented superficial infections whereas Case 3 - 5 had Deep organ space infection However, the total numbers are too small to formulate a statistical corelation.




***Graph 1***

## Type of infection




***Graph 2***

It must be mentioned that case 1 had superficial incisional infection, while case 2 had deep incisional infection. Approximately (40%) were superficial infections and the rest 60% were deep space infections.

### Risk factors and type of infection

It must be noted that not a single patient had diabetes mellitus as a comorbidity in this cluster of patients. However, each case had risk factors described below.

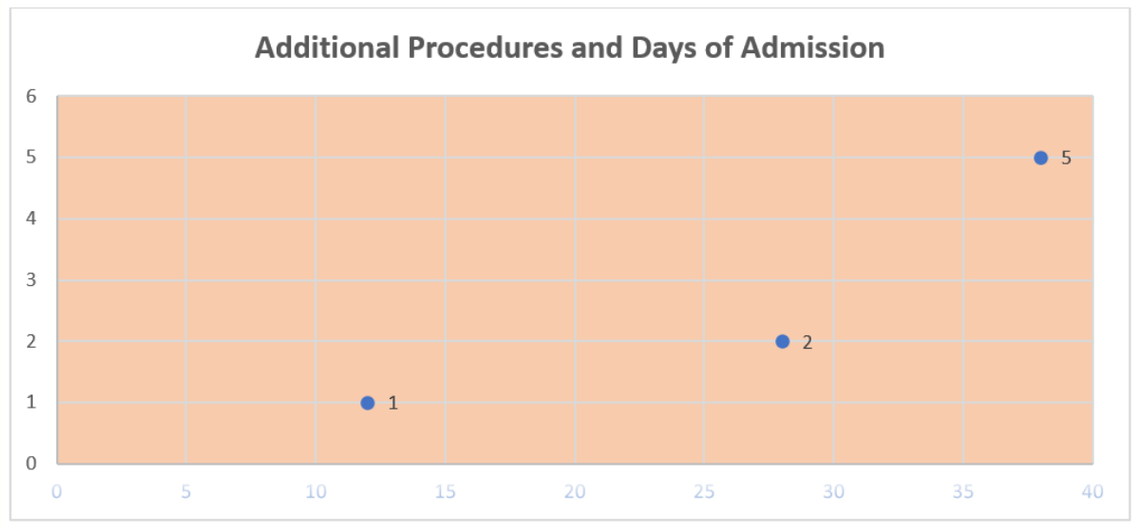
| Case No. | Risk Factors | Type of infection |
|---|---|---|
| 1 | Unbooked, pre term;<br><br>Antepartum urine and HVS cultures showed *Streptococcus agalactiae* - (Group B)<br><br>Previous 3 LSCS in labour | Superficial incisional |
| 2 | Fetal Distress at 09 cm dilatation,<br><br>Labour for more than 24 hours | Superficial (Deep Incisional) |
| 3 | Previous 5CS + maternal age > 44 years (elective LSCS). | Deep Abscesses |
| 4 | IOL for Ruptured Membranes; Anemia, Pre -existing infection with *E. coli*; Congenital Stenosis of ureteral orifice; fibrosed bladder band | Deep Abscesses |
| 5 | PPROM, prolonged labour (GA 31 weeks) | Deep Abscesses |
| | Breech presentation in labor | |
| | Late booking | |
| | Recurrent UTI and vaginitis, perineal herpes in the past | |

There were four Emergency caesarean sections which were all Category I, four out of five patients had presence of pre-existing infection due to PROM and GBS positive cultures, *E. coli* and *Klebsiella* respectively.

### Duration of hospital admission and additional procedures

Case number 1 and 2 were managed mainly on outpatient basis, therefore are not included in this graph.

Whereas case number 3 - 5 required prolonged admissions and additional procedures.




***Graph 3:*** *Horizontal axis shows days of admission and vertical axis shows number of additional procedures.*

A list of additional procedures is given below.

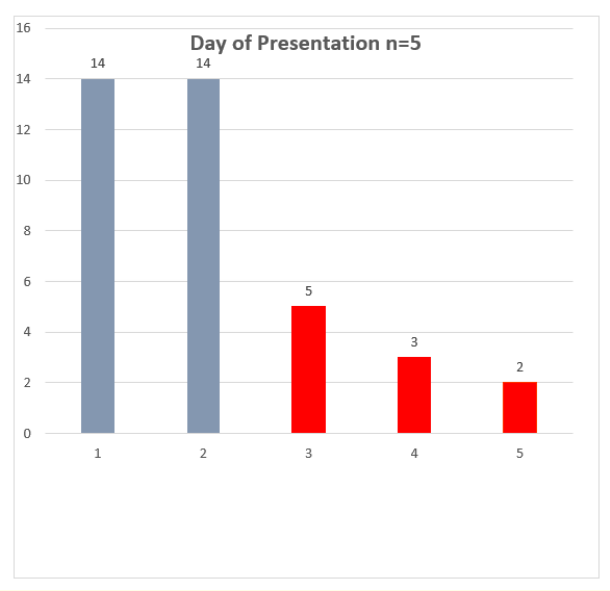
| Case No. | Days of Admission | Additional Procedures | 0rganism | Procedures |
|---|---|---|---|---|
| 1 | 0 | 0 | Normal Flora | Nil |
| 2 | 0 | 0 | MRSA | Hyperbaric dressing |
| 3 | 12 | 1 | Negative culture | Flouroscopic guided Aspiration |
| 4 | 38 | 5 | *E. coli* | Flouroscopic guided Aspiration |
| | | | | Cystoscopy |
| | | | | Retrograde cystography |
| | | | | Retrograde pyelography |
| | | | | Endoscopic insertion of ureteric stent |
| 5 | 28 | 2 | *Klebsiella* | Fluoroscopic guided Aspiration |

## Surgery details

Average operation time was 60 - 70 minutes for the procedures and there were not many intraoperative complications during the surgeries. In addition, none of these patients had excessive blood loss.

| Case number | Dates of Pro-cedure | Operation time | Operation Type | Indication | Surgeon | Infection Type | Microbial |
|---|---|---|---|---|---|---|---|
| 1 | 29/11/2020 | pm | CAT II | Previous 03 LSCS in Labour | Dr. A | Superficial | Normal flora |
| 2 | 14/12/2020 | pm | CAT I (9 cm) | Fetal Distress | Dr B | Superficial | MRSA |
| 3 | 24/12/2020 | am | CAT IV | Previous 5 LSCS | Dr B + Dr C | Deep | Nil |
| 4 | 24/11/2020 | pm | CAT I | Prolonged labour and Fetal distress | Dr A + Dr. D | Deep | *E. coli* |
| 5 | 29/12/2020 | pm | CAT I | PPROM; 31 weeks Breech Presentation | Dr E | Deep | *Klebsiella* |

It is to be noted that deep tissue infections presented as early as Day 02 of LSCS and maximum day 5 of caesarean section. Whereas the superficial infections presented on Day 14 in both cases. This is in congruence with the literature review.




***Graph 4***

## Features of clinical presentation

| Cases | Presenting Features/Symptoms | Other features |
|---|---|---|
| 1 | Superficial wound sinuses 02 | No pain, No fever |
| 2 | Superficial wound dehiscence | No Pain no fever |
| 3 | Fever no rigors or chills<br>Diagnosed to have Fluid collection in the pelvis | No wound induration; no Pus or oozing |
| 4 | Difficulty breathing Shoulder tip pain and Diarrhea | Pain and discomfort; wound dehiscence |
| 5 | Fever and Pain intraabdominal collection | Infection |

## Laboratory findings

| Case No. | Hemoglobin Preoperative | Hemoglobin Postoperative | CRP at pre-sentation | CRP peak during infection | CRP on resolution | WBC at Pre-sentation | WBC at Resolution |
|---|---|---|---|---|---|---|---|
| 1 | 12 | 11.9 | 39.8 | - | - | 8.7 | - |
| 2 | 13 | 11.5 | 56.7 | - | 5.62 | 15.9 | 8.22 |
| 3 | 11.90 | 10.90 | 144 | 200 | 4.27 | 16 | 7 |
| 4 | 9.2 | 8.5 | 325 | 333 | 11.7 | 9.81 | |
| 5 | 11.4 | 8.3 | 129 | 268 | 9.4 | | |

### Antibiotic therapy

| Case No. | Antibiotics & Therapy | Culture Findings + (Antibiotic rationale) |
|---|---|---|
| 1 | Daily dressing with topical fucidin cream | Normal Flora (Empirical) |
| 2 | Augmantin 1 gm Q12 hrs for 7 days | Empirical upon Presentation in ER |
| | Metronidazole 500 mg Q 8hrs | |
| | Changed antibiotics to clindamycin 300 mg Q 8 hours | MRSA (Upon Culture) Therapeutic |
| 3 | Tazocin 3375 mg Q6 hours | Presentation of fever and Fluid |
| | ON 07 /01/2021. Fluoroscopic guided Aspiration was done and antibiotic was changed to | Septic Screen Negative |
| | Meropenem 1 gm q 8 hrly | Empirical |
| | PT was discharged on oral metronidazole 500 mg Q 8hrs and ciprofloxacin 500 mg Q 12 hrs | Empirical |
| 4 | On day 26/11/2020 start on cefuroxime 500 mg Q12 hrs PO | |
| | On day 27/11/2020 start on ceftriaxone 2000 mg OD IV | ID consultation (empirical) |
| | On day 29/11/2020 start on meropenem 1000 mg Q8 hrs till date 20/12/20 | *E. coli* * Therapeutic) |
| | On day 29/12/2020 fluoroscopic guided aspiration was done and | |
| | Daily wound hyperbaric dressing | |
| | Cyctoscopy RT side DJ stent | |
| | PT was discharged on cefuroxime 500 mg PO Q12hrs | |
| 5 | On day 30/12 augmantin D/C | Prophylactic |
| | PT started on ampicillin 1 gm IV Q 6 hrs | |
| | And gentamycin 80 mg IV Q 8 hrs + metronidazole | Fever |
| | On day 31/12 ampicillin and gentamycin D/C | |
| | PT was started on imipenem 500 mg Q6hrs IV + metronidazole | *Klebsiella* isolated upon all tissue and blood cultures (Therapeutic) |
| | On 08/01/21 US guided aspiration performed | |

### Important findings

### Pre-operative preparation

### Chlorhexidine showers + Hair removal

All elective admissions scheduled for surgery are provided preoperative showers, therefore in this series, only one patient received a pre-operative shower in the maternity ward.

As a routine preoperative area is cleaned with 3 mm Clippers and not shaved.

The patients are provided a clean set of clothes in all cases.

### Pre and post-operative antibiotics

It was noted that all these patients received the standard preoperative care, and pre-incision injection of antibiotics was given to all patients. The table below shows the given antibiotics.

| Case | Pre Operative | Post Operative | Rationale |
|---|---|---|---|
| 1 | Ampicillin | Ampicillin 2 gm 6hrs for 48hrs | GBS positive |
| 2 | Cefazolin 2 gm | Nil | Routine |
| 3 | Cefazolin 2 gm | Nil | Routine |
| 4 | Cefazolin 2 gm | Cefazolin 1g for 3 doses | CAT I LSCS |
| 5 | Ampicillin IV | Augmantin IV for 48 hrs | Pre-existing infection (PPROM) |
| | Azithromycin 1000 mg PO | Metronidazole IV for 48 hrs | |
| | | | |

In case number 1 the patient had a history of Group B *Streptococcus* infection and in Case number 5 patient had PPROM more than 30 hours, therefore ampicillin and Azithromycin were given:

1. It has been noticed that the surgical drapes used for covering the patients are not the standard drapes for Caesarean section, in addition, the overall quality of these drapes is also not up to the mark, better quality drapes are available in the market and the OR team representative has been requested to look into this matter.

2. A possible link between the dates of surgical procedures, the occurrence of infection and the December holiday season is not a farfetched idea to look into the matters pertaining to sterilization and staff holidays.

3. All the patients had risk factors that have been identified in the table above.

## Discussion

It can be seen that 4 out of 5 patients had emergency caesarean sections which were unscheduled. Amongst those 03 were Category I caesarean sections, which is a risk factor for increased infectious morbidity. Two patients had repeat caesarean sections which is another known risk factor for infectious morbidity. Case number 4 had congenital stenosis of the ureteric orifice and this predisposed her to develop severe *E. coli* infection. Case number 5 was immunocompromised during this pregnancy as she had history of recurrent urinary infections in the past in addition to an attack of Herpes genitalis infection. It is important to note that this patient had positive cultures for *Klebsiella* in all septic work up, in blood, placenta, urine and uterine surface swabs.

A case report published in British Medical Journal described aa 24-year-old woman with severe pelvic abscess formation 2 weeks after a secondary caesarean section. The isolated pathogens were a mixture of *Gardnerella vaginalis, Mycoplasma hominis* and *Ureaplasma urealyticum*. After initial resistance to systemic antibiotic treatment, she underwent radiologically-guided drainage of the abscesses, whereon she had a continuous recovery [24]. Likewise in our series, in case number three, no pathogen could be isolated possibly due to early initiation of antibiotics, however, the recovery was miraculous after aspiration of 4 ml of pus. The improvement of all three patients with the fluoroscopic aspiration of fluid was speedy following the intervention.

## Recommendations

1. It has been mentioned in literature to adopt a surgical bundle [23] as described below to prevent SSI. An example of such a bundle is given below:

Surgical Bundle:

- Intravenous cefazolin 2g and azithromycin 500 mg administration before skin incision in emergency LSCS.
- 2% chlorhexidine gluconate with 70% isopropyl alcohol skin preparation
- Use of clippers instead of razor
- Vaginal cleansing by 10% povidone-iodine Intraoperative processes.
- Placental removal by umbilical cord traction.
- Suture closure of subcutaneous tissue if wound thickness greater than 2 cm.
- Suture skin closure with 4-0 poliglecaprone

**Postoperative processes**

- Dressing removal between 24 and 48h
- Daily use of 2% chlorhexidine gluconate shower on Day 7.

Even though most features of the above measures are being used in our current practice. For future, after discussion, a similar bundle can be adopted in order to ensure that every step is standardized.

2. An urgent call to provide better quality drapes for caesarean section cases is recommended.
3. Early detection of postoperative infection.
4. In addition, a follow up study of implementation of recommendations and interventions must be undertaken each year, in addition to regular audits of severe morbidity.

## Conclusion

Infectious morbidity following caesarean sections is a cause of deep concern globally, and our set up is not immune from the phenomenon. Despite the presence of risk factors it is notable that severity and the incidence of infections in late November and December 2021, in the three cases was unprecedented and required an audit of all procedures and pathways in order to prevent such incidences in the future.

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