Surgical Site Infections in Elective Abdominal Surgery and their Prevention in a Tertiary Care Centre of Rohilkhand Region

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ABSTRACT

INTRODUCTION

Infections that occur in a postsurgical wound are referred to as Surgical Site Infections (SSIs) which results in patient discomfort, prolonged hospital stay and increased cost. The present study was planned to determine the risk factors and incidence of abdominal surgical site infections and to formulate measures to prevent them.

Material and Methods: A prospective, open label clinical study of 24 months duration was conducted on 100 admitted cases in the post graduate Department of Surgery, Rohilkhand Medical College, Bareilly to determine the incidence and risk factors associated with the abdominal surgical site infections in elective abdominal surgery.

Results: The incidence of surgical site infection was 7% in present study. Open surgery have a significantly higher risk of SSI (4/30; 13.3%) as compared to other procedures (3/70; 4.3%) (RR=3.09). Laparoscopic procedures have been reported to have minimal SSI rate. Smoking was found to be significantly associated with a higher risk of SSI (RR=9.37). Significant association of time lag between shaving and surgery with SSI (RR=2.67). Relative risk of SSI (3.4) in patients above 50 years of age and ASA Grade>II. In majority of cases (85.71%) SSI was recorded on third post-operative day.

Conclusion: Open procedures, Smoking, Pre-op Hospital stay >1 day and ASA grade>II were found to be significantly associated with SSI. Mean duration of hospital stay of SSI patients was longer.

Key words: Surgical Site Infection, Infection in Elective Abdominal Surgery, SSI, Surgical Site Infection

CDC Definition of Surgical Site Infection

(US Center for Disease Control and Prevention)

• Superficial incisional, affecting the skin and subcutaneous tissue
• Deep incisional, affecting the fascial and muscle layers.
• Organ or space infection, which involves any part of the anatomy other than the incision that is opened or manipulated during the surgical procedure.

Material and Methods

The present prospective study was conducted in the post graduate Department of Surgery, Rohilkhand Medical College, Bareilly, from September 2014 to August 2016. Ethical clearance was obtained before the start of study.

Inclusion criteria

• All the patients undergoing elective abdominal surgery
were included.

**Exclusion criteria**
- Patients presenting with pre-existing skin infections were excluded.
- Patients operated outside the hospital were excluded.
- Emergency abdominal surgeries were excluded.

**Antibiotic selection**
Third generation Cefalosporins and Metronidazole were used for all the patients and were changed according to CDC Guidelines.

**Pre-operative preparation**
Shaving of the operative area was done over operating table before surgery. All patients were advised to take shower on the day of surgery with soap. All patients received Injection Ceftriaxone 1 gram and Injection Metronidazole 500 milligram intravenous one hour before the incision. CDC Guidelines were followed if changes were required.

**Operative protocol**
The operative area was cleaned with spirit and painted with 5% povidone iodine. The principles of surgery were followed in all cases such as minimum tissue handling and maintenance of adequate hemostasis. Drains were used whenever necessary. Skin closure with suture material or skin staples was done. Neosporin ointment was used for local application and wound was covered with adhesive dressing.

**Post operative care**
Injectable Cefalosporins (3rd generation) and Metronidazole were continued in the post-operative period for 48 hours. Then the patient received oral antibiotics till stitch removal. For the patients with surgical site infection, the plan of antibiotic coverage changed according to culture and sensitivity report. The wound was inspected for any evidence of infection starting from 48 hours after surgery day till 8th post-operative day. Patients were followed up till discharge. The criteria for SSI were based on CDC’s definition of SSI. For the patient who satisfied any of the criteria for SSI, wound swab was sent to the clinical microbiology laboratory for Gram stain and routine culture methods. No culture was obtained for anaerobes, viruses or fungi.

The patients were studied only for superficial incisional SSI. The wounds were further classified into clean, clean contaminated, contaminated and dirty, based on above criteria. The incidence rate was calculated for each wound separately.

The standardized set of criteria developed by CDC National Nosocomial Infection Surveillance System for Superficial incisional SSI was used.

**RESULTS**
The present study was carried out with an aim to determine the incidence of abdominal surgical site infections in elective abdominal surgery and to assess the risk factors associated with the abdominal surgical site infections in elective abdominal surgery in order to formulate measures to prevent post-operative wound infection after elective abdominal surgery.

For this purpose a total of 100 patients falling in sampling frame were included in the assessment and were subsequently monitored for development of surgical site infection during their hospital stay.

Out of 100 patients SSI was noted in 7 cases (n=7). There was no significant gender variation as 4 male and 3 females patients developed SSI. The incidence of SSI was found to be significantly higher in elderly as 3 patients above 60 years of age developed SSI (figure-1). There was considerable variation among procedures performed with Laparoscopic procedures having no SSI to nephrolithotomy in which 3 developed SSI. The incidence of SSI was significantly higher in obese patients (n=5) who required regular antiseptic dressings for prolonged periods. Only 1 out of 7 patients was a non-smoker, rest all (n=6) were chronic smokers with more than 10 years of smoking history. We observed that patients who stayed for more than 2 days preoperatively in the hospital developed more SSI (n=6). Patients who were categorised to be in ASA grade 2 had high incidence of SSI (n=6). Patients who had an operative time of more than 1 hour (n=5) had more incidence as compared to those who required less than 1 hour (figure-2).

Only 1 patient presented with mild discharge on postoperative day 1 rest all (n=6) were diagnosed to have SSI on day 3. Based on the pus culture report the commonest isolated organism was *Staphylococcus aureus* followed by *Pseudomonas, Staphylococcus epidermidis*, and *E. coli*. All patients who developed SSI required more post-operative hospital stay (>4 days) (table-1, figure-3).

<table>
<thead>
<tr>
<th>SN</th>
<th>Pathogen</th>
<th>No. of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>E. coli</td>
<td>1</td>
<td>14.29</td>
</tr>
<tr>
<td>2.</td>
<td>Staphylococcus aureus</td>
<td>3</td>
<td>42.86</td>
</tr>
<tr>
<td>3.</td>
<td>Pseudomonas</td>
<td>2</td>
<td>28.57</td>
</tr>
<tr>
<td>4.</td>
<td>Staphylococcus epidermidis</td>
<td>1</td>
<td>14.29</td>
</tr>
</tbody>
</table>

**Table-1:** Distribution of SSI Cases according to Pathogen isolated (n=7)

**Figure-1:** SSI in a patient on day 5
Surgical site infection is one of the most intriguing post-surgical complications that have the capability to revert back the outcome of a surgery. It has great financial consequences too. Surgical site infection is one of the biggest reasons for increased hospital stay and substantial cost overflows. It is a strong predictor of treatment success and failure in different types of surgical procedures.

In present study we made an attempt to determine the incidence of abdominal surgical site infections in cases of elective abdominal surgery and to assess the risk factors associated with the abdominal surgical site infections in elective abdominal surgery procedures.

The incidence of surgical site infection was 7% in present study. For different studies exclusively reporting the SSI in elective surgeries, the infection rate varies from 4.7% to 20%. Among, studies from India, surgical site infection rate varies from 5% to 28%. There was only one study that reported a phenomenally high SSI rate of 20% in elective abdominal surgeries.

In present study, open procedures (open cholecystectomy, open cystolithotomy, open prostectomy) showed to have a significantly higher risk of SSI (4/30; 13.3%) as compared to other procedures (3/70; 4.3%) (RR=3.09). Among other procedures, in 27 laparoscopic procedures, no case of infection was reported. Laparoscopic procedures have been reported to have minimal SSI rate. In different case series reviewed by us, the series showing minimal infection rate had included laparoscopic procedures only (Tang et al.30).

Laparoscopic procedures owing to being minimal invasive expose a lesser surgical site and thus the vulnerable area for infection is relatively smaller and hence the infection rate is lower. In another study by Hübner et al. (2011) too, the protective effect of laparoscopic surgery was reported vehemently. In present study, smoking was found to be significantly associated with a higher risk of SSI (RR=9.37). Smoking has always been cited as a contributory factor towards risk of surgical site infections. In present study, surgical site infection was found to be significantly associated with a longer duration of pre-operative hospital stay. Pre-operative hospital stay makes the patient exposed to risk of various nosocomial infections. A number of other reports have also reported preoperative hospital stay to be a determinant of rate of SSI and findings of present study endorsed this finding. In different studies reviewed by us, Razavi et al. also suggested that reduction of preoperative hospital stay might play a role in reducing the SSI rate.
(2016) also voiced a similar opinion.

In present study, SSI occurrence was recorded on day 3 after surgery in majority of cases (85.71%) and in all except one (85.71%), the wound was clean.

In present study, among SSI cases, Staphylococcus aureus was the most common isolate (42.86%) followed by Pseudomonas (28.57%). There was 1 (14.29%) case each with E. coli and Staphylococcus epidermidis respectively. The microbial profile of SSI reported in different studies has shown a variance. Sahu et al. (2009) and Kakati et al. (2013) in their study found E. coli to be most common isolate followed by Staphylococcus aureus. However, Maheshwari et al. (2013) similar to our study found S. aureus to be the most common isolate.

The difference in pathogen types might be attributable to changed environment in different studies.

Thus, the focus of attention for reduction of SSI in elective abdominal procedure shifts to the quality of post-operative care, hospital environment and factors other than those studied in the present study. Given the limited number of cases included in this study, further studies on a larger sample size are recommended.

CONCLUSION

The present study was carried out with an aim to assess the incidence of surgical site infection among patients undergoing abdominal surgery and to assess various risk factors associated with surgical site infection. The incidence of surgical site infection was 7% in present study. Open surgery have a significantly higher risk of SSI as compared to other procedures. Laparoscopic procedures have been reported to have minimal SSI rate. Smoking was found to be significantly associated with a higher risk of SSI. Significant association of time lag between shaving and surgery and SSI. Relative risk of SSI (3.4) in patients above 50 years of age and ASA Grade>II. In majority of cases (85.71%) SSI was recorded on third post operative day. Staphylococcus aureus was the most common isolate (42.86%) followed by Pseudomonas (28.57%), E. coli.

Therefore, Open procedures, Smoking, Pre-op Hospital stay >1 day and ASA grade>II were found to be significantly associated with SSI resulting in Mean duration of hospital stay of SSI patients was longer.

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