



## POST LAPAROTOMY SURGICAL SITE INFECTIONS – A TERTIARY CARE CENTER STUDY

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**ABSTRACT** **Introduction:** Surgical site infection is defined as infection occurring within 30 days of a surgical operation, and affecting either the incision or deeper tissues at the operation site. These infections are associated with increased incidence of complications as well as increased cost of treatment.

**Methods:** The objective was to evaluate the incidence and risk factors of surgical site infection among patients undergoing laparotomy. The subjects were patients undergoing laparotomy in the department of General Surgery, Medical College Trivandrum.

**Results:** The incidence of surgical site infection following all laparotomies was 35.3%. Increased incidence of surgical site infection was associated with older age, prolonged surgery, prolonged hospitalisation, hypoalbuminemia, hyperglycemia, drain tubes and past history of laparotomy.

**Conclusions:** A good number of patients develop surgical site infections after laparotomy. Knowledge about the risk factors will help us to understand surgical site infections in a better way and thereby to take appropriate precautionary measures.

**KEYWORDS :** Abdominal surgery; Laparotomy; Surgical site infection;

### Introduction

The intact skin forms the major obstacle to the introduction of infections by bacterial pathogens into internal tissues. Any wound is the result of physical disruption of this barrier. Surgery involves the intentional production of a wound. Surgical site infection (SSI) by definition is an infection occurring within 30 days of a surgical operation (or within one year if an implant is left in place after the procedure). SSI can affect either incision or deep tissues at the operation site. Postoperative SSI is one of the most common problems for patients who undergo operative procedures and is the third most frequently reported nosocomial infection in the hospital setting. Postoperative SSI is associated with increased morbidity, mortality, prolonged hospital stay and increased economic costs for patient care and remain a major headache for surgeons all over the world<sup>1</sup>.

The occurrence of SSI can be brought down to a greater extent by following strict aseptic techniques and optimal preoperative preparation. Appropriate antimicrobial therapy significantly influences the outcome of the patients with SSI. Advances in the investigative modalities and surgical technologies of diseases have led to a significant increase in diverse surgical interventions. In parallel with these advances, the magnitude of SSIs and the number of antibiotic resistant bacterial strains are likely to increase. Therefore a better understanding of the spectrum of pathogens causing SSI as well as their susceptibility pattern will be important for prompt management of patients. With this background, this study was undertaken in an attempt to establish local data on the magnitude and risk factors as well as bacteriological profile of SSI. Having such data would help to establish guidelines for the management of SSIs and contribute to planning of prevention and control of this group of infections. This data can also be adopted by policy makers to lay a basic foundation for further surveillance studies within the country.

### Methods

The study was designed as a hospital level prospective follow up study with a study period of 12 months. Patients aged between 12 and 80 years, undergoing laparotomy - both elective and emergency - in the department of General Surgery, Government Medical College Trivandrum, were selected as the study subjects. Institutional review committee agreement as well as Human Ethics Committee clearance was obtained before the study. Patients with established infection at the site of incision and those who were lost to follow up were excluded from the study. Sample size estimation was done by the formula

$$N = \frac{(Z\alpha\sqrt{2pq} + 2p\sqrt{p(1-q)} + p(1-q))^2}{(p_1 - p_0)^2}$$

$(p_1 - p_0)^2$

Where  $\bar{p} = \frac{p_1 + p_0}{2}$  and  $p_1 = \frac{p_0 Z}{1 + p_0(Z-1)}$ ;  $q = 1 - p$ ;  $q_1 = 1 - p_1$ ;  $q_0 = 1 - p_0$

Substituting the values, sample size was obtained as 51 each for the two groups. Thus total sample size was taken as 102. Consecutive sampling technique was used.

Patients undergoing laparotomy were consecutively assigned to the study after obtaining an informed, written consent. Demographic data, history of illness (elective/emergency) and of any associated illnesses were collected with the help of a structured questionnaire. Clinical examination was done and findings were noted before surgery. Routine investigations were done. Operative findings including type of incision, duration of operation and wound contamination were noted on post operative day 1. Patients were followed up daily till day of discharge for any signs of wound infection. Patient were seen again 2 weeks after discharge and on 30<sup>th</sup> day post laparotomy. Any patient who failed to report on 30<sup>th</sup> day was contacted over phone. Patient was asked to report if any signs or symptoms of wound infection develop. If a clinical diagnosis of wound infection was arrived at, exudates were collected from the depth of the wound and send for pus culture and sensitivity. The data obtained was entered into excel sheets and analyzed using appropriate statistical methods.

### Results

Both elective (51 patients) and emergency (51 patients) were included in the study. In the study, 36 out of 102 patients developed SSI. 29.4% of patients undergoing elective surgery and 41.2% of patients undergoing emergency surgery developed SSI. The most common age group affected was 60 – 70 years : 66.7%. SSI was present in 33.8% of males and 38.2% females. 57.1% of alcoholics developed SSI. 53.1% of patients with a history of previous surgery had SSI while only 27.1% of patients without previous surgical history had SSI. 22 patients with hypoalbuminemia developed SSI (46.8%), while only 25.5% patients with normal albumin had SSI. Majority of patients had a BMI on the higher side (25 – 29.9). 50% of patients with a BMI < 18.5 had SSI.

41.9% of patients with co morbidities developed SSI, while only 32.4% patients without co morbidity had SSI. Most common co morbidity associated was diabetes mellitus. 34.4% of patients with recent hospitalisation had SSI while 35.7% of patients with no recent hospitalisation history had SSI. 32.6% of patients with anaemia had SSI and 37.3% of patients with normal haemoglobin had SSI. 50% of patients with hyperglycaemia had SSI while only 31.3% with a normal blood sugar developed SSI. 50% had SSI when they required more than 5 days hospitalisation. 40% had SSI when operated within 24 hours. Lowest rate of SSI was among those operated between days 3 – 5 of admission (5.9%).

50% of patients with an incision above umbilicus had SSI. Only 10.3%

of patients with a below umbilicus incision had SSI. No patients with surgery lasting less than an hour developed SSI while 66.7% of patients with surgery lasting for 3 to 5 hours & 62.5% of patients with surgery lasting more than 5 hours developed SSI. Highest incidence of SSI was seen with dirty surgeries (88.9%) and lowest with clean contaminated surgeries (23.4%). 43.4% of surgeries where drain was kept were associated with SSI while only 11.5% with no drain developed SSI.

Majority of SSI occurred within 10 days of surgery (91.7%). Majority of patients presented with erythema and discharge (63.9%). 19.5% of patients presented with discharge alone. Incidence of SSI in age group > 60 years (66.7%) was more than that in those < 60 years (28.6%). Age more than 60 years was a statistically significant risk factor (p value 0.002). Emergency surgeries have a higher incidence of SSI (41.2%) compared to elective ones (29.4%). However no statistically significant association was found (p value 0.214). Patients with a prior history of surgery had a higher incidence (53.1%) of SSI compared to those without (27.1%). This was statistically significant (p value 0.011), with a 3 times more risk (Odds ratio 3.042). Patients with hypoalbuminemia had a higher incidence (46.8%) of SSI compared to those with normal albumin (25.5%). This was significant (p value 0.024), with a two times risk (Odds ratio 2.577). Incidence of SSI in patients with hyperglycemia was 50% compared to 31.3% in those with normal sugar. Statistically, this was significant.

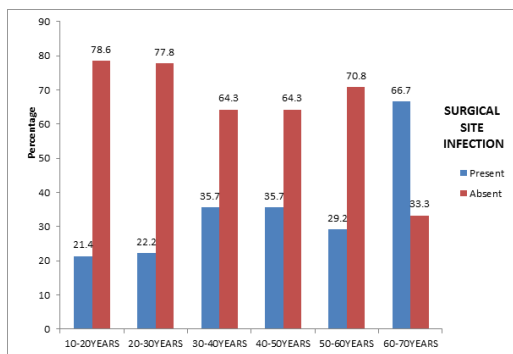


Chart 1. Relation between age and SSI

50% of patients who underwent surgery after 5 days developed SSI compared to 29.7% in those undergoing surgery within 5 days. This association was statistically significant (p value 0.056). Surgery lasting more than 3 hours was associated with higher incidence (65.2%) and it was found to be statistically significant (p value 0.001), with a five times more risk (Odds ratio 5.179). Surgeries in which a drain was kept had a higher incidence (43.4%) than those in which no drain was involved (11.5). Drain was a statistically significant risk factor (p value 0.003) with a five times more risk (Odds ratio 5.884). Clean contaminated surgeries had a lower rate of SSI (23.3%) compared to dirty or contaminated surgeries (55.3%). This was statistically significant (p value 0.003). Most common organism isolated in our study was *Staphylococcus aureus* (36.4%), followed by *Escherichia coli*, *Pseudomonas* and *Klebsiella*. Backward conditional binary logistic regression revealed that age > 60, previous surgery, duration of surgery (>3 hours) are significant risk factors for development of SSI and nature of surgery (clean contaminated) is a significant protective factor.

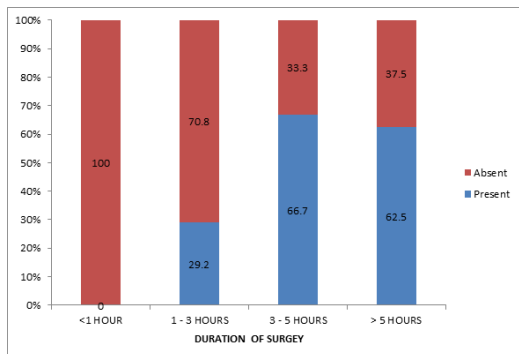


Chart 2. Relation between duration of surgery and SSI

**Discussion**

This was a Prospective study of 102 patients who underwent laparotomy. Incidence of SSI in our study population was 35.3. The incidence of SSI in this study is comparable with other studies available in the literature<sup>2,5</sup>. It was found that patients undergoing emergency surgery had more incidence of SSI. In similar studies<sup>3,6</sup>, significant association was not seen between type of surgery and SSI. Higher rates of infection in emergency surgeries can be partly explained by inadequate pre operative preparation, the underlying conditions which predisposed to emergency surgery and the more likelihood of contaminated or dirty wounds in emergency setting.

The rate of SSI in our study is higher compared to European and American standards<sup>7</sup>. The higher infection rate in Indian hospitals may be due to the poor infrastructure of our hospitals and due to the lack of stringent infection control measures. Similar studies in other parts of India also revealed a higher rate of SSI<sup>8</sup>. Patients with age more than 60 had more chance of developing SSI than those under 60 years. This was in concordance with the studies conducted by Gosain et al<sup>9</sup>. As the duration of surgery increases, the chance of SSI is also higher. Similar study showed that operative time = 240 minutes was associated with increased complications<sup>10</sup>.

Several community studies<sup>11,12</sup> have found a relationship between a low serum albumin level and an increased risk of death. In the hospital setting serum albumin level was related to in-hospital mortality length of stay<sup>13</sup> and nosocomial infection. 50% of patients needing preoperative hospitalisation more than 5 days developed SSI. Other authors<sup>10,14</sup> also had similar results. This could be explained by the increased chance of colonisation by nosocomial strains with longer hospital stay and indirectly it reflects the severity of disease and underlying co morbidities which require longer workup. The use of drains has contributed significantly as a risk factor in causing SSI in this study. This could be attributed to the nature of operation warranting the drainage, or the drain itself which might act as entry portal for infections.

Abdominal SSI was noted most commonly within ten days in our study, similar results being obtained in another study by Shahane et al<sup>15</sup>. Most common organism isolated in our study was *Staphylococcus aureus*, followed by *E. coli*, *Pseudomonas* and *Klebsiella*. Other studies have also implicated *Staphylococcus aureus* the predominant cause of postoperative wound infections<sup>16,17</sup>. Most cases of SSI, the causative organism is usually patient's endogenous flora which are coliforms, gram negative bacilli. This group of organisms tends to be resistant to common antiseptics, endemic in hospitals and are difficult to eradicate in the long term.

As in this study, several studies have found that clean contaminated surgeries had a significantly lower rate of infection compared to contaminated and dirty surgeries<sup>15,18</sup>. This is an expected observation as SSI increases with degree of contamination. Hyperglycaemia may decrease the immune status thus significantly increasing the risk of SSI<sup>14,15,19</sup>. Our study revealed that 53.1% patients with a history of previous abdominal surgery had surgical site infection while only 27.1% of patients with a virgin abdomen had surgical site infection. As in our study, studies by Haridas et al<sup>20</sup> also showed that previous operation was significantly associated with SSI.

**Conclusions**

Surgical site infections continue to be a significant cause of postoperative morbidity. They are a common post operative complication particularly after laparotomy and can significantly add to the patient morbidity. The occurrence of SSI can be reduced to a great extent only by strict aseptic techniques and good preoperative preparation. The information reported in this study will definitely be useful in understanding SSI in a better way and thus, enable us to take necessary precautions.

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