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Clinical Assessment of Several Risk Variables Linked to Surgical Site Infections in a Tertiary Hospital

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Abstract

Background: Surgical site infections (SSI) are the most common nosocomial infection for surgical patients. They have been found to be the primary cause of operation-related adverse events and commonly cause morbidity and mortality among hospital inpatients.

Aims & objectives: The goal of the current study was to investigate different risk variables for surgical site infections at a tertiary hospital.

Material and Methods: The current investigation was a prospective, observational, hospital-based study that included patients of any gender, ages 18 to 70, who had non-traumatic exploratory laparotomies and surgical site infections afterward.

Results: During the study period, 162 patients had surgical site infections (1664 laparotomies), meaning that the incidence of SSI was 6%. The majority of cases (64 %) and age group (28 %) were male. Diabetes (43%) was the most common co-morbidity observed, followed by hypertension (25%) BMI 25–30 kg/m2, dyslipidemia (33%) smoking (28%) and dyslipidemia (45%). 51% of patients had an ASA score of 2, and 53% had surgeries lasting more than two hours. Exploratory laparotomy with appendicectomy and peritoneal lavage had the highest rate of SSI (28%), with open appendicectomy (15%), adhesiolysis/resection anastomosis (11%), and peritoneal lavage coming in second and third, respectively. The majority of wounds (46%) were clean, with clean contaminated wounds (30%), contaminated wounds (16%), and dirty or infected wounds (9%). In the current investigation, the most prevalent SSI was superficial (65%), followed by deep (28%) and organ space (6%). E. Coli was the most frequently isolated organism (20%), followed by Pseudomonas (16%) and Streptococcus (14%). In 66 cases (41%), there was no discernible growth.

Conclusion: Infections at the surgical site are avoidable complications. High-risk factors for surgical site infections were BMI > 25, co-morbidities like diabetes, smoking, dyslipidemia, surgery lasting more than two hours, and appendectomy.

Keywords: Surgical site infection, diabetes, smoking, dyslipidaemia, abdominal surgeries.

Introduction

Surgical site infections (SSI) are the most common nosocomial infection for surgical patients. They have been found to be the primary cause of operation-related adverse events and commonly cause morbidity and mortality among hospital inpatients[1]. Compared to wealthy nations, the rate of SSI is higher in developing nations. In 2019, SSI post-discharge surveillance was conducted for elective clean and clean-contaminated surgical operations; 15% of cases were recorded in low- and middle-income countries. There is a strong correlation between SSI patients and longer hospital stays, slower wound healing, pain, discomfort, permanent impairment, and even death[2-5]. A complex interplay of risk factors, including surgery, patients, microbiological, and environmental variables, contributes to surgical site infections (SSIs).

The vulnerability of any wound to infection is influenced by numerous factors. Pre-existing conditions, the duration of the procedure, the type of wound, and wound contamination are some of these variables. Extreme age differences, cancer, metabolic disorders, malnourishment, immunosuppression, cigarette smoking, distant site infections, emergency procedures, and extended hospital stays prior to surgery are additional risk factors[6,7]. While SSIs continue to present difficulties in the management of healthcare, SSI-related morbidity, mortality, and healthcare costs may be reduced by precisely identifying the factors that may put a given patient at higher risk of infection and by identifying the gaps in the current pool of preventive options. The current study set out to investigate a number of surgical site infection risk factors in a tertiary medical facility[8].

MATERIAL AND METHODS

The current investigation was a prospective, observational, hospital-based study carried out in the general surgery department in Central India. The study lasted for two years. It was approved by the institutional ethical committee to conduct the study. This study included patients who had surgical site infections after non-traumatic exploratory laparotomies performed during the study period. Patients between the ages of 18 and 70 who had exploratory laparotomies without any trauma, experienced surgical site infections after the procedure, and were willing to take part in the current study met the inclusion criteria. Criteria for exclusion: Patients with traumatic reasons undergoing exploratory laparotomies. Patients undergoing immunosuppressive medications, chemotherapy, or radiation therapy. those who previously had skin infections. Patients underwent surgery apart from the hospital.

Patients were informed about the trial in their native tongue, and their signed agreement was obtained before they could participate. The following information was recorded: sociodemographic details, clinical details, prophylactic antibiotic use, blood transfusion, preoperative hospital stay, ASA score, nature of surgery, type of anesthesia, duration of surgery, intraoperative findings, post-operative course, present examination findings, and routine investigations (CBC, blood sugar, wound swab culture and sensitivity, LFT, RFT). These co-morbidities included diabetes, hypertension, bronchial asthma, thyroid disorders, renal disease, and any immunosuppressive disorders. A diagnosis of wound infection was made if any one of the following conditions was met: pus discharge from the wound, serious or nonpurulent discharge from the wound with signs of inflammation, and when the surgeon purposefully opened the wound because of a localized collection.

The wound sample was sent to the microbiology department for culture and sensitivity. If necessary, the antibiotic was modified after the swab culture and sensitivity report was obtained. Follow-up was maintained until the SSI was cleared. SPSS 23.0 was used for data analysis after Microsoft Excel was used for data collection and compilation. Descriptive statistics were used in the statistical analysis.

RESULTS

During the course of the trial, 162 patients experienced surgical site infections (SSI) following 2664 laparotomies; this represents a 6% incidence of SSI. The age group of 41–50 years old accounted for the majority of cases (28%), followed by 51–60 years old (21%). The research patients' average age was 51. Cases by males (64%) exceeded those by females (36%). Diabetes (43%) was the most common co-morbidity observed, followed by hypertension (25%) BMI 25–30 kg/m2, dyslipidemia (33%) smoking (28%) and dyslipidemia (45%). 51% of patients had an ASA score of 2, and 53% had surgeries lasting more than two hours.

Table 1: General Characteristic

Characteristic	No. of patients (n=162)	Percentage
Age group (years) ≤30	24	15%
31-40	28	17%
41-50	46	28%
51-60	34	21%
61-70	30	19%
Gender Male	104	64%
Female	58	36%
Co-morbidities Diabetes	70	43%
BMI >25 kg/m2	68	42%
Dyslipidaemia	54	33%
Smoking	46	28%
Hypertension	42	26%
Chronic obstructive pulmonary disease	34	21%
Coronary artery disease	12	7%
ASA grade I	22	14%
II	82	51%
III or more	58	36%
Duration of operation (Hours) <1 hr	30	19%
1-2 hr	46	28%
>2 hr	86	53%

In this study, exploratory laparotomy with appendicectomy and peritoneal lavage had the highest rate of SSI (28%), which was followed by open appendicectomy (15%), adhesiolysis/resection anastomosis (11%), and peritoneal lavage (11%).

Table 2: Type of Surgery

Surgery	No. of patients (n=162)	Percentage
Appendicectomy and peritoneal lavage	46	28%
Open appendicectomy	24	15%
Adhesiolysis/Resection Anastomosis	18	11%
Peritoneal lavage	18	11%
Hernia repair	16	10%
Ileal repair/ileostomy	12	7%
Exploratory laparotomy with omental patch repair	10	6%
RA repair of sigmoid volvulus	8	5%
Duodenal ulcer perforation repair	4	2%
Liver abscess drainage and peritoneal lavage	4	3%
Repair of intussusception	2	1%

Surgery wounds in SSI patients were classified as clean, clean contaminated, and contaminated; clean wounds accounted for 46% of all wounds, followed by clean contaminated wounds (30%), contaminated wounds (16%), and dirty or infected wounds (9%). In the current investigation, the most prevalent SSI was superficial (65%), followed by deep (28%) and organ space (6%).

Table 3: SSI related characteristics

Characteristic	No. of patients (n=162)	Percentage
Type of wound Clean	74	46%
Clean contaminated	48	30%
Contaminated	26	16%
Dirty or infected	14	9%
Type of SSI	162	
Superficial SSI	106	65%
Deep SSI	46	28%
Organ space SSI	10	6%

E. Coli accounted for 20% of all isolates in the current investigation, with Pseudomonas (16%), Streptococcus (14%), Klebsiella (10%), MRSA (7%), Acinetobacter (5%), Helicobacter (2%), and Providentia (1%), following in order. In 66 cases (41%), there was no discernible growth.

Table 6: Organism isolated

Organism isolated	No. of patients (n=162)	Percentage
No growth	66	41%
E. coli	32	20%
Pseudomonas	26	16%
Streptococcus	22	14%
Klebsiella	16	10%
MRSA	12	7%
Acinetobacter	8	5%
Helicobacter	4	3%
Providentia	2	1%

(polymicrobial infection noted in few cases)

DISCUSSION

The probability of SSI occurrence is influenced by a number of factors, therefore prevention efforts need to take an integrated strategy that involves all stakeholders in pre-, intra-, and postoperative care. There are several multimodal preventative intervention programs that have been developed, based on guidelines, surgical safety checklists, and surgical site care bundles[9-11]. Even with a number of procedural breakthroughs, reducing SSIs to the ideal level is still difficult. The multifactorial nature of SSI development may be attributed to a patient's age, comorbidities, smoking habit, obesity, malnourishment, immunosuppression, cancer, and kind of wound contamination. Primary infections typically manifest five to seven days after surgery and are more dangerous[12-13].

Most superficial superficial infections (SSIs) are mild, affecting mainly the skin and subcutaneous tissue, although they can occasionally become necrotizing infections. An infected surgical wound typically presents as pain, discomfort, warmth, erythema, edema, and pus accumulation.

In the study of Prakash V et al., there was a 25.34% incidence of SSI, consisting of 18.42% deep SSI and 81.58% surface SSI. The most common age group was 41 to 60 years old, and 63.2% of cases were females and laparotomies. The common pathogens were Escherichia coli, Vancomycin, and carbapenem-sensitive Staphylococcus aureus and Klebsiella pneumoniae. A strong correlation was shown between the development of SSI, the usage of povidone iodine alone, the presence of a drain, and the existence of pre-morbid analysis[14-16].

According to Patel S. M. et al., the SSI rate was 16% (32/200). Escherichia coli was the most often isolated organism (35.7%, 10/28). Increased incidence of surgical site infections (SSIs) were linked to pre-operative hospital stays, ASA (American Society of Anesthesiology) scores greater than 2, surgical wound classes, emergency surgeries, and longer surgical times. According to Amrutham R et al., surgical site infections (SSIs) were more common in older adults, men, diabetics, anaemic patients, underweight and overweight people, hypertensive patients, patients who needed blood transfusions, and patients who needed longer hospital stays. Compared to elective procedures, surgical site infections were more common in emergency situations. When it came to surgical site infections, Staphylococcus aureus was the most often isolated pathogen. Surgical site infections were primarily caused by germs resistant to multiple drugs[17,18].

In Amit Agrawal's study, the incidence of SSI was 15.7% (59/375). The SSI rate was 5.7% for elective procedures and 28.6% for emergency surgeries. It was discovered that SSI rose linearly with aging. A longer surgical time, the use of drains, a higher preoperative stay, the presence of a remote site infection, and an increase in the class of wound (dirty > clean) were additional important factors. It was discovered that the most frequent organism causing SSI during abdominal surgeries was E. coli.

Salahuddin M et al. conducted a systematic evaluation of 18 papers and found that the prevalence rate of SSI ranged from 2.8% to 17.8%. Three bacteria that were often reported were E. Coli, Klebsiella pneumonia, and Staphylococcus aureus[18].

There is a higher prevalence of SSIs in emergency surgical procedures compared to procedures in obstetrics and gynecology. Prolonged hospital stays prior to surgery, reduced hemoglobin and serum albumin levels, and coexisting medical diseases including diabetes and hypertension can all be risk factors for the onset of secondary stress injuries. Post-operative patients have an extremely high incidence of SSI, particularly in underdeveloped nations. A systemic study by Korol E et al. found that the median incidence of SSIs ranged from 0.1% to 50.4%, with a median of 3.7%. Tumor-related and transplant procedures had the highest incidence of both S. aureus and overall surgical site infections. 17.0 days was the median time to SSI start; orthopedic and transplant operations had longer time-to-onset[19].

The following risk factors were frequently linked to SSI: advanced age, co-morbidities, risk indices, patient fragility, and difficult surgery. In multivariable analysis, diabetes was taken into account as a risk factor in thirteen studies; of these, 85% revealed a significant connection with SSI, with odds ratios ranging from 1.5 to 24.3. Eleven studies with substantial findings showed a median odds ratio of 2.3, indicating that longer procedures were linked to a higher incidence of SSI. The risk of superficial surgical site infections might be raised by a number of risk factors and peri-operative features. Diabetes mellitus, hypoxemia, hypothermia, leucopenia, smoking, long-term steroid or immunosuppressive drug usage, malnourishment, Staphylococcus aureus-contaminated nares, and inadequate skin cleanliness are significant host factors[19,20].

Operative site shaving, lapses in sterile technique, early or delayed initiation of antimicrobial prophylaxis, insufficient intraoperative antimicrobial prophylaxis dosing, infected or colonized surgical personnel, prolonged hypotension, poor operative room air quality, contaminated operating room instruments or environment, and inadequate wound care following surgery are examples of perioperative and environmental factors. Among healthcare professionals, maintaining good hand hygiene is crucial for breaking the cycle of infection-causing bacteria between patients and lowering healthcare-associated infections (HAI), particularly surgical site infections (SSI). The consequences of SSI will affect patients and healthcare systems more profoundly as its incidence rate rises. A multifaceted strategy is needed to prevent surgical site infections (SSIs), focusing on risk factors connected to patients as well as procedures during the pre-, intra-, and post-operative phases.

CONCLUSION

Infections at the surgical site are avoidable complications. A few high-risk variables for surgical site infections after elective or emergency abdominal procedures included BMI > 25, co-morbidities like diabetes, smoking, dyslipidemia, surgery lasting more than two hours, and appendicectomy. To prevent SSI, preoperative examination, assessment of high-risk variables, intraoperative care, and postoperative monitoring are crucial.

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