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Assessment of Incidence and Risk Factor of Surgical Site Infections among Patients with Intra-Abdominal Surgeries

Chandan Pandurang Wani[1], Sumit Naraniya[2], Ashok Kumar Mehra[3]*

[1]Assistant Professor, Department of Ophthalmology, Government Medical College, Washim, Maharashtra, India
[2]Assistant Professor, Department of Surgery, Pacific Medical College Hospital, Udaipur, Rajasthan, India
[3]Assistant Professor, Department of Biochemistry, RKDF Medical College, Bhopal, Madhya Pradesh, India

***Address for Correspondence:** Dr. Ashok Kumar Mehra, Assistant Professor, Department of Biochemistry, RKDF Medical College, Bhopal, Madhya Pradesh, India
E-mail: drmehra1977@gmail.com

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ABSTRACT

Background: Surgical site infections (SSIs) are common after abdominal procedures, which raises hospitalization expenses and morbidity and death. The purpose of this study was to ascertain the risk variables and incidence rates of SSI following abdominal operations. Finding the risk factors and incidence rates of SSI after abdominal surgeries was the aim of this prospective investigation.

Methods: The present study was a hospital-based, prospective, observational study, conducted in patients 18-70 years of age, of either gender, who underwent non-traumatic abdominal surgeries. SSI incidence rates were calculated and risk factors were estimated. During the study period, patients who had surgical site infections after a non-traumatic exploratory laparotomy were taken into consideration.

Results: A total of 800 patients undergoing laparotomy were enrolled, 152 (19%) patients had surgical site infections. The majority of cases were 46-60 years age group (43.7%), male (61.3%). SSI was most common in exploratory laparotomy with appendicectomy and peritoneal leavage. Risk factors significantly associated with SSI: male gender, emergent surgery, contaminated wound, duration of surgery ≥2 hours, duration of prophylactic antibiotics >24 h, postoperative antibiotics, presence of one or more co-morbidities.

Conclusion: Preventing SSI requires preoperative examination of the identified significant risk factors, intraoperative treatment, and postoperative monitoring.

Key-words: Surgical site infections, CDC guidelines, SSI, Risk factors, Abdominal surgery

INTRODUCTION

Surgical site infection is defined as an infection that may occur within the surgical site at any depth, starting from the skin itself and extending to the deepest cavity that remains after the dissection of an organ occurring within 30 days of the surgery. [1] According to the CDC guidelines, it is separated into three categories: Superficial, Deep space, and Organ space SSIs.

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It is a potential complication associated with any type of surgical procedure. [2] Approximately 2–5% of surgical patients worldwide have experienced surgical site infections, according to epidemiological data. [3]

Nonetheless, the prevalence varies between industrialized and developing nations; more patients from developing countries have been affected than those from industrialized countries. Surgical site infections are a quality problem for health care systems and have an impact on patients' safety, [4] physical and emotional health, [5] length of hospital stay, reoperation, readmission, and increased healthcare costs for both patients and hospitals. [6,7] Compared to other surgical procedures, abdominal surgery has significantly higher rates of SSI; multiple prospective studies have reported a prevalence of 15% to 25%, depending on the degree of

contamination. [8,9] Surgical site infections are linked to high rates of morbidity and mortality, but they can be avoided. Intrinsic, extrinsic, and distinguishing risk factors for surgical site infections exist; these risk factors may be controllable or non-modifiable.

Glycemia, respiratory conditions, smoking, alcoholism, obesity, weakened immune system, albumin, and bilirubin are among the modifiable intrinsic risk factors. Age, recent radiation therapy, and a history of skin and soft tissue infections are among the factors that cannot be changed. [10,11] Procedural risk factors (e.g. emergency and more complex surgeries and wound classification), hospital facility-related risk factors (e.g. inadequate ventilation, increased operating room traffic, and inadequate sterilization of equipment), and intraoperative risk factors (e.g. length of surgery, blood transfusions, maintaining asepsis, surgical hand cleaning and the use of subpar gloves, hypothermia, and poor glycemic control) are examples of extrinsic risk factors [11].

Multimodal strategies to reduce SSIs take place in many contexts under the guidance of multiple clinicians. For SSI reduction initiatives to be successful, significant adherence to these risk-reduction techniques is essential. This prospective study aimed to determine the SSI incidence rates and risk factors after abdominal surgeries.

MATERIALS AND METHODS

Place of the study- The current investigation was a prospective, observational, hospital-based study that was carried out in a tertiary care hospital in India in the general surgery department. During the study period, patients who had surgical site infections after non-traumatic exploratory laparotomy were taken into consideration.

Exclusion criteria

- Patients undergoing exploratory laparotomy for traumatic causes
- Patients receiving steroids, Chemo/radiotherapy, immunosuppressant drugs
- Patients presenting with pre-existing skin infections
- Patients operated outside the hospital
- Patients who provided consent for the study

Inclusion criteria

- Patients 18-70 years of age, of either gender
- Patients underwent non-traumatic exploratory laparotomy
- Patients developed surgical site infections following surgery
- Patients who provided consent for the study

Research design- Patients were given written consent to participate in the trial after being informed about it in the local tongue. Sociodemographic information, co-morbidities such as diabetes, hypertension, bronchial asthma, thyroid, renal, or immunosuppressive conditions, clinical information, blood transfusions, prophylactic antibiotic use, preoperative hospitalisation, ASA score, type of surgery, anaesthesia type, length of surgery, intraoperative findings, post-operative course, and current examination results were recorded. Serous or nonpurulent discharge from the wound, 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 the localised collection were all criteria that were used to diagnose wound infection.

Statistical Analysis- Microsoft Excel was used to compile the data, while SPSS 23.0 was used for analysis. The study employed descriptive statistics, presenting discrete data as frequency and percentage and continuous data as mean±standard deviation. The threshold for significance was $p<0.05$.

RESULTS

During the study period, 800 abdominal surgeries were performed. The majority of cases were from the 46-60 years age group (43.7%), followed by the 31-45 years age group (27.5 %). The mean age of study patients was 53.6±7.24. Male (61.3%) outnumbered female (38.1%) cases. Most of them (51.8%) had normal BMI. 56.8% resided in urban areas and 46.2% had middle socio-economic class. Most patients had ASA score II (50%) and 42.5% secondary education (Table 1).

The incidence of surgical site infection in this study was 19% (152/800), with most cases occurring within the first two weeks postoperatively and varying in severity from mild superficial infections to more serious deep or organ-space infections requiring intervention (Fig. 1).

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Table 1: General Characteristics of study participants

Patients Characteristic		Number (%)
Age of patients	18-30 year	60 (7.5%)
	31-45 year	220 (27.5%)
	46-60 year	350 (43.7%)
	>60 year	170 (21.3%)
Gender	Male	490 (61.3%)
	Female	310 (38.7%)
BMI (kg/m^2)	Underweight	45 (5.6%)
	Normal weight	415 (51.8%)
	Obese	340 (42.6%)
Residence	Rural	345 (43.2%)
	Urban	455 (56.8%)
Socio-economic class	Lower	304 (38%)
	Middle	369 (46.2%)
	Upper	127 (15.8%)
ASA grade	I	120 (15%)
	II	400 (50%)
	III or more	280 (35%)
Educational status	Illiterate	125 (15.6%)
	Primary school	260 (32.5%)
	Secondary school	340 (42.5%)
	Graduate	75 (9.4%)

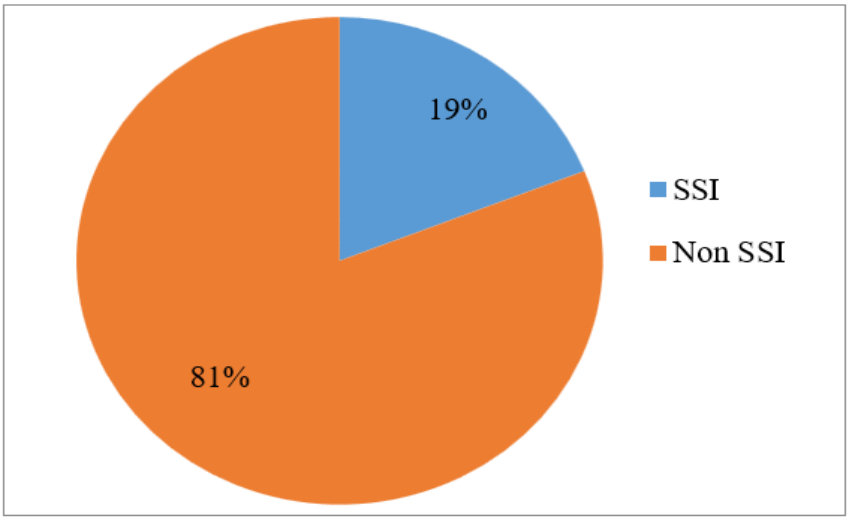

Fig. 1: Incidence of surgical site infections

In the present study, SSI was most common in appendicectomy (39%), exploratory laparotomy (16%), and peritoneal lavage (12%) (Fig. 2), with a higher incidence observed in emergency procedures compared to elective surgeries.

Male gender, emergent surgery, contaminated wounds, duration of surgery ≥2 hours, duration of prophylactic antibiotics >24 hours, postoperative antibiotics, and presence of one or more co-morbidities were found to have a statistically significant association with the occurrence of SSIs (Table 2).

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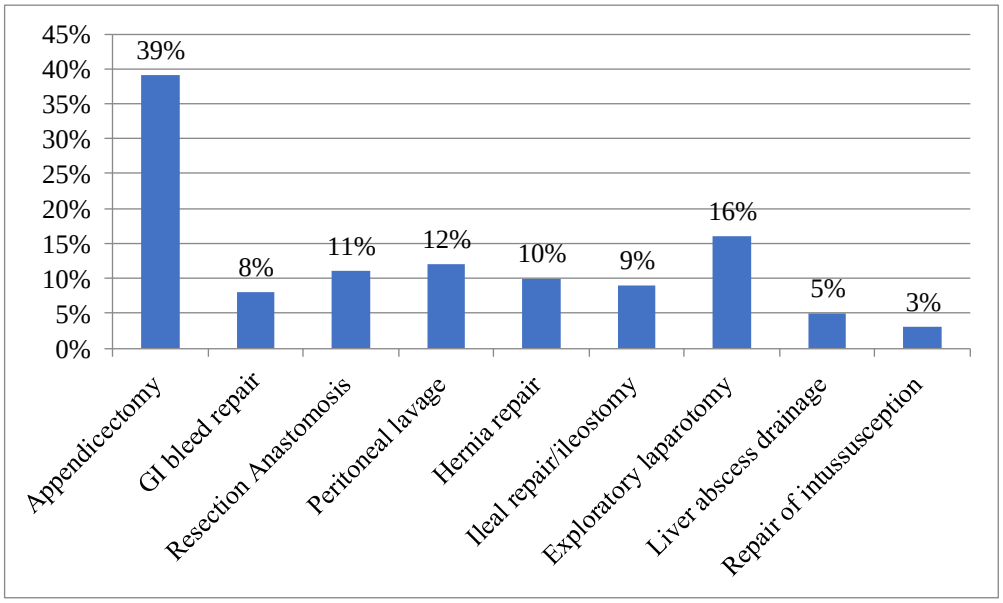

Fig. 2: Type of Surgery performed among study subjects

Table 2: Factors associated with surgical site infections

Variables		SSI	No SSI	p-value
Age of patients	<60 year	119 (78.3%)	511 (78.9%)	0.877
	>60 year	33 (21.7%)	137 (21.1%)	
Gender	Male	105 (69.1%)	385 (59.4%)	0.027
	Female	47 (30.9%)	263 (40.6%)	
Smoking	Yes	149 (98%)	639 (98.6%)	0.593
	No	3 (2%)	9 (1.4%)	
Alcohol consumption	Yes	136 (89.5%)	603 (93.1%)	0.134
	No	16 (10.5%)	45 (6.9%)	
Type of surgery	Elective	24 (15.8%)	245 (37.8%)	<0.001
	Emergency	128 (84.2%)	403 (62.2%)	
Duration of surgery	<2 hours	84 (55.3%)	506 (78.1%)	<0.001
	>2 hours	68 (44.7%)	142 (21.9%)	
Comorbidity	Yes	45 (29.6%)	112 (17.3%)	0.005
	No	107 (70.4%)	536 (82.7%)	
Type of wound	Clean or clean contaminated	70 (46.1%)	615 (94.9%)	<0.001
	Contaminated	82 (53.9%)	33 (5.1%)	
Use of antibiotic post-surgery	Yes	67 (44.1%)	70 (10.8%)	<0.001
	No	85 (55.9%)	578 (89.2%)	
Duration of antibiotic prophylactic	< 24 hours	10 (6.6%)	159 (24.5%)	<0.001
	> 24 hours	142 (93.4%)	489 (75.5%)	

DISCUSSION

Preventative efforts necessitate an integrative approach that focuses on pre-, intra-, and postoperative care encompassing all stakeholders, as multiple factors contribute to the risk of SSI incidence. Many multimodal preventative intervention programs have been developed based on surgical safety checklists, surgical site care bundles, and guidelines. The ideal decrease of SSIs is still a difficulty, even with several procedural developments. Age, comorbidities, smoking, obesity,

malnutrition, immunosuppression, cancer, and the kind of wound contamination are some of the risk factors that may contribute to the multifactorial development of SSI.

The incidence of SSI in this study was 19%, which was comparable with the many other studies performed by Patel *et al.* [12] Agrawal *et al.* [13] and Laloto *et al.* [14] reported incidence of SSIs was 16%, 15.7% and 19.1% respectively. Our findings were higher than a prospective follow-up study conducted to determine the incidence of SSI in India (5%). [15] As expected in various studies, heterogeneity was high because of patient baseline characteristics, study design and characteristics, data collection methods, differences in definitions and measures, statistical methods, and large sample sizes.

The incidence of SSI was also higher in low- and middle-income nations, this could be caused by several factors, including inadequate supplies and equipment to maintain strict aseptic conditions, patients' poor hygiene, the rise in bacterial flora colonisation of the skin, patients' delayed arrival at the healthcare system, which results in contaminated wounds, and overburdened emergency services as a result of population growth. [16]

In the present study majority of the patients were 46-60 years age group, predominantly males, in agreement with Marzoug *et al.* [17] and Tripathi *et al.* [18] Patients who developed SSI resided in rural areas, had higher BMI, low socio-economic status and lower education level in the current research, our results were similar with the Papadopoulos *et al.* [19]

We have reported that the co-morbidities were significantly associated with SSI. The most common comorbidities included diabetic mellitus, hypoxemia, hypothermia, leucopenia, COPD, immunosuppression and malnutrition, our findings concordance with the Wagh *et al.* [20]

Emergent surgery, open surgery, significant blood loss, prolonged hospital stays, prolonged duration of surgery ≥2h, duration of prophylactic antibiotics >24 h, postoperative antibiotics, presence of co-morbidities and Contaminated wound was the common risk factors significantly associated with the SSI occurrence, constant findings were reported by Gillespie *et al.* [21] Li *et al.* [22] and Hashim *et al.* [23]

CONCLUSIONS

We have determined that there was a comparatively high prevalence of surgical site infection in the study environment. Surgical site infections were linked to contaminated wound classes, longer surgical times, co-morbidity, and an ASA score of at least II, intraoperative blood loss, prolonged postoperative hospital stays, postoperative antibiotic prescription, open surgical approach and emergency surgeries. To prevent SSI, preoperative examination, assessment of high-risk variables, intraoperative care, and postoperative monitoring are crucial.

CONTRIBUTION OF AUTHORS

Research concept- Sumit Naraniya, Ashok Kumar Mehra
Research design- Chandan Pandurang Wani, Sumit Naraniya
Supervision- Sumit Naraniya, Ashok Kumar Mehra
Materials- Chandan Pandurang Wani, Sumit Naraniya
Data collection- Chandan Pandurang Wani, Sumit Naraniya
Data analysis and Interpretation- Ashok Kumar Mehra
Literature search- Sumit Naraniya, Ashok Kumar Mehra
Writing article- Sumit Naraniya, Ashok Kumar Mehra
Critical review- Chandan Pandurang Wani, Sumit Naraniya
Article editing- Chandan Pandurang Wani, Sumit Naraniya
Final approval- Ashok Kumar Mehra

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