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Clinical Study Of Various Risk Factors Associated With Surgical Site Infection At A Tertiary Care Hospital.

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ABSTRACT

Surgical site infections (SSI) are the most common cause of nosocomial infections, frequently causing morbidity and mortality among inpatients of hospitals. They have been shown to be the leading cause of operation related adverse events. The Present study was aimed to study the various risk factors of surgical site infections at a tertiary care hospital. During the study period, among 832 laparotomies, 81 patients had surgical site infections, thus incidence of SSI was 9.6 %. Majority of cases were from 41-50 years age group (28.4 %), male (64.2 %). Common co-morbidities noted were diabetes (43.2). Most patients had ASA score 2(50.62%) and the duration of surgery>2 hours (53.09%). SSI was most common in Exploratory laparotomy with appendicectomy and peritoneal lavage (28.4 %). In the present study, Superficial SSI (65.43 %) was most common, followed by Deep SSI (28.4 %) and Organ space SSI (6.17%). Most common organism isolated was E. coli (19.75%) followed by Pseudomonas (16.05%) and Proteus (13.58%). No growth was detected in 27cases (33.33%). A BMI > 25, co-morbidities such as diabetes, surgery > 2 hours, were few of the high-risk factors associated with surgical site infections. SSI is preventable. Routine microbiological analysis of the infected wound and the study of the sensitivity pattern of the isolated organism is mandatory to prevent SSI.

Keywords: Surgical site infection, diabetes, smoking, culture, antibiogram.

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INTRODUCTION

Surgical site infections (SSI) are one of the most common causes of nosocomial infection, frequently causing morbidity and mortality among inpatients in hospitals and they have been shown to be the leading cause of operation related adverse events [1,2]. These infections usually occur within a month of surgery. The rate of SSI is higher in the developing world than that in developed countries. SSI is associated with contamination of the surgical wound with microbes, duration of the procedure and certain host factors(3). Patients of SSIs are closely linked with increased duration of stay in the hospital, delayed wound healing, and if neglected SSI may even be fatal [4].

Numerous risk factors are involved in SSI with a complex relationship as; type of surgery, health status of the patients, microbial, and environment related factors [5,6]. There are many factors that affect the susceptibility of any wound to infection. These factors include pre-existing illness, duration of the surgery, type of wound, and wound contamination. Other factors are extremes of ages, malignancy, metabolic diseases, malnutrition, immunosuppression, cigarette smoking, remote site of infection, emergency procedures, and long duration of hospitalization [7,8].

As SSI continue to pose challenges in healthcare management, detailed and specific identification of the factors that may place individual patients at greater risk of infection, and identification of the gaps in currently available prevention options could help to minimize morbidity, mortality and healthcare costs associated with SSI.

The Present study was aimed to study various risk factors of surgical site infections at a tertiary care hospital and to identify the bacteriological profile of SSI, as appropriate antibiotic therapy can help in the prevention of SSI.

MATERIAL AND METHODS

The Present study was hospital based, prospective, observational study, conducted on the inpatients in the surgical ward, at government medical college and hospital, Cuddalore between Jan 2023 and Dec 2023. Patients with surgical site infections following non-traumatic exploratory laparotomy during the study period were taken into consideration.

Inclusion criteria: Patients 17-70 years of age, of either gender who underwent non-traumatic exploratory laparotomy and had surgical site infection following laparotomy.

Exclusion criteria

- Patients undergoing exploratory laparotomy for traumatic causes.
- Patients receiving steroids, Chemotherapy/radiotherapy, immunosuppressant drugs
- Patients presenting with pre-existing skin infections.

Study was explained to the patients in local language and written consent was obtained from them. Socio-demographic details, associated co morbidities like diabetes /hypertension /bronchial asthma, thyroid disorders/ renal disease or any immunosuppressive disorders was noted.

Clinical details such as prophylactic antibiotic used, blood transfusion, preoperative hospital stay, nature of surgery, type of anesthesia, duration of surgery, intraoperative findings, and post-operative course were taken. Present examination findings, routine investigations (CBC, blood sugar, LFT, RFT) were noted.

Wound infection was diagnosed if any one of these criteria was fulfilled:

- Serous or non-purulent discharge from the wound,
- Pus discharge from the wound,
- Serous or non-purulent discharge from the wound with the signs of inflammation and when wound was deliberately opened by the surgeon due to the localized collection.

Wound swab was sent to microbiology department of Govt. Cuddalore medical college for culture and sensitivity. Treatment was done based on the results of antibiotic sensitivity testing. The samples

collected from the patients with SSI were subjected to a direct smear examination and then Grams staining was done to identify the organism. Inoculation of the specimen was made onto nutrient agar, blood agar and MacConkey agar plates. The plates were incubated at 37C for 24 hours. Identification of the organism was made by the standard diagnostic methods and biochemical reactions. The antibiotic sensitivity pattern of the isolated organism was studied by the Kirby-Bauer disc diffusion method using Mueller Hinton agar. The patients were reviewed till the wound was clean. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

RESULTS

During the study period, among 832 laparotomies, 81patients had surgical site infections. Thus the incidence of SSI was 9.6%.

Majority cases were from 41-50 years age group (28.4 %), followed by 51-60 years age group (20.99 %). Mean age of study patients was 50.4 ± 8.24. Male (64.2 %) outnumbered female (35.8 %) cases.

Common co-morbidities noted were diabetes (43.21%) followed by BMI 25-30kg/m^2(41.98%), dyslipidaemia (33.33%), smoking (28.4%) and hypertension (25.03%).

Most patients had ASA score 2 (50.62 %) and duration of surgery >2 hours (53.09 %).

Table 1: General Characteristic

Characteristic	No. of patients (n=81)	Percentage
Age group (years)		
≤30	12	14.81%
31-40	14	17.28%
41-50	23	28.40%
51-60	17	20.99%
61-70	15	18.52%
Gender		
Male	52	64.20%
Female	29	35.80%
Comorbidity		
Diabetes	35	43.21%
BMI>25kg/m^2	34	41.98%
Dyslipidemia	27	33.33%
Smoking	23	28.40%
Hypertension	21	25.93%
Chronic obstructive pulmonary disease	17	20.99%

Table 2: Type Of Surgery

Surgery	No. of patients (n=81)	Percentage
Appendectomy and peritoneal lavage	23	28.40%
Open appendectomy	12	14.81%
Adhesionolysis/ Resection Anastomosis	9	11.11%
Peritoneal lavage	9	11.11%
Hernia repair	8	9.88%
Ileal repair/ileostomy	6	7.41%
Exploratory laparotomy with omental patch repair	5	6.17%
Repair of sigmoid volvulus	4	4.94%
Duodenal ulcer perforation repair	2	2.47%
Liver abscess drainage and peritoneal lavage	2	2.47%
Repair of intussusception	1	1.23%

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Table 3: SSI Related Characteristics

Type of wound	No. of patients	Percentage
Clean	37	45.68%
Clean contaminated	24	29.63%
Contaminated	13	16.05%
Dirty or infected	7	8.64%
Superficial SSI	58	65.43%
Deep SSI	23	28.40%

Table :3 In SSI patients, surgical wounds were labelled as clean, clean contaminated and contaminated.

Majority of wounds were Clean (45.68 %) followed by Clean contaminated (29.63 %), Contaminated (16.05 %) and Dirty or infected (8.64 %).

In present study, Superficial SSI (65.43 %) was most common followed by Deep SSI (28.4 %) and Organ space SSI (6.17%).

Table 4: Organism Isolated

Organism isolated	No. of patients (n=81)	Percentage
No growth	27	33.33%
E. coli	16	19.75%
Pseudomonas	13	16.05%
Proteus	11	13.58%
Klebsiella	8	9.88%
Staphylococcus	6	7.41%

Table :4 In present study, most common organism isolated was E. coli (19.75 %) followed by Pseudomonas (16.05 %), Proteus (13.58 %), Klebsiella (9.88 %]. No growth was noted in 27 cases (33.33 %).

DISCUSSION

There are various factors contributing to the risk of SSI occurrence and preventive measures require an integrative approach that focuses through the pre-operative, intra and postoperative care involving all the stakeholders. Numerous multimodal preventive intervention programs based on guidelines, surgical site care bundles, and surgical safety checklists have been established. Despite several advancements in procedures, the optimal reduction of SSIs remains a challenge [8, 9]. The development of SSI is multifactorial, and it may be related to patient's risk factors such as age, comorbidities, smoking habit, obesity, malnutrition, immunosuppression, malignancies, and the class of contamination of the wound [10].

Primary infections are usually more serious, appearing within five to seven days of surgery. Majority of SSIs are uncomplicated involving only skin and subcutaneous tissue but sometimes can progress to necrotizing infections. The usual presentation of infected surgical wound can be characterized by pain, tenderness, warmth, erythema swelling and pus formation [11].

The incidence of SSI in study by Prakash V et al [12] was 25.34% with 81.58% superficial SSI and 18.42% deep SSI. Laparotomy was the common procedure and 63.2%of cases were females and 41-60 years was the most common age group. Staphylococcus aureus, Klebsiella pneumoniae and Escherichia coli were the common pathogens and were sensitive to carbapenems, vancomycin and linezolid. Significant association was observed with presence of pre-morbid analysis, presence of drain, use of povidone iodine alone and development of SSI.

Patel S M et al [13] noted that, SSI rate was 16% (32/200).The most common organism isolated was Escherichia coli (35.7%,10/28).Increase in pre-operative hospital stay, ASA (American Society of Anesthesiology) score > 2, increase in surgical wound class, emergency surgeries done under compromised

sterile techniques, longer duration of surgery were associated with increased SSI rates.

Amrutham R et al [14]. noted that surgical site infections (SSIs)were most commonly found among males, diabetics, patients who are anaemic, and patients with longer hospital stay. Surgical Site Infections were higher in emergency cases than elective surgeries [15] because sterilization standards cannot be followed strictly when the surgery is performed in an emergency situation. Staphylococcus aureus was the most common organism isolated from surgical site infections.

In study by Amit Agrawal et al [15], SSI incidence was 15.7 % (59/375). In elective surgeries, the SSI rate was 5.7% and in emergency surgeries, it was 28.6%. It was found that SSI increased with increasing age linearly. Other significant factors involved were increasing class of wound (dirty > clean wound class), increased preoperative stay, presence of remote site infection, increased duration of surgery and use of drains. E. coli was found to be the most common organism causing SSI in abdominal operations.

In a systematic review, Salahuddin M [16] observed that occurrence rate of SSI ranges from 2%to17.8%. Microorganisms commonly reported were Staphylococcus aureus, Klebsiella pneumonia, and E.Coli. High incidence of SSI was noted among emergency surgical procedures and lower among elective procedures. Longer preoperative duration of stays in hospital, decreased Hb and serum albumin level, comorbid conditions such as diabetes, hypertension are potential risk factors for the development of SSI. The occurrence rate of SSI among post-operative patients is very high, especially in developing countries. Koro l E et al [17]. conducted a systemic review and noted that median SSI incidence was 3.7%, ranging from 0.1% to50.4% .Incidence of overall SSI and S.aureus was the commonly isolated organism. Median time until SSI onset was 17.0 days, Risk factors consistently identified as associated with SSI included co-morbidities, advanced age and surgery complexity.

Thirteen studies considered diabetes as a risk factor in multivariable analysis; 85% found a significant association with SSI, with odds ratios ranging from 1.5-24.3. Long duration of surgeries were associated with increased risk of SSI, with a median odds ratio of 2.3 across 11 studies reporting significant results.

Multiple risk factors and per-operative characteristics can increase the likelihood of superficial surgical site infections. Important host factors include diabetes mellitus, hypoxemia, nicotine, long term use of steroids or immunosuppressive agents, malnutrition, nares contaminated with Staphylococcus aureus and poor skin hygiene [18].

Per-operative/environmental factors are operative site shaving, lacunae in operative sterile technique, delayed initiation of antimicrobial prophylaxis, inadequate intra-operative dosing of antibiotics, infected or colonized surgical personnel, prolonged hypotension, poor operative room air quality, contaminated instrument and poor wound care postoperatively [18, 19]. Correctly performed hand hygiene among health care workers (HCWs) is the most important action to interrupt the chain of transmission of pathogenic microorganisms between patients and therefore reducing HAI, including SSI [20].

Identification of the bacteria infecting the wound and proper management with the appropriate antibiotic is very much needed to prevent SSI.

With rising incidence rate of SSI, its end results will have a greater impact on patients as well as on healthcare systems. Prevention of SSI requires multipronged approach targeting both patient related and procedure related risk factors in pre-operative, intra-operative, and post-operative period.

CONCLUSION

Surgical site infection is a preventable morbidity. BMI > 25, co-morbidities such as diabetes, smoking, dyslipidaemia, surgery>2hours, appendicectomy were few high-risk factors noted for surgical site infections following abdominal surgeries. Pre-operative assessment, evaluation of high-risk factors, intraoperative care, management with appropriate antibiotics and postoperative monitoring is important to prevent SSI.

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