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A Study on Surgical Site Infections in Abdominal surgeries

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Abstract
Background: *Surgical site infection (SSI) is the most commonly reported nosocomial infection. Surgical site infections are responsible for increase in cost, morbidity, and mortality related to surgical operations. Surveillance with information feedback to surgeons and other medical staff has been shown to be an important element in the overall strategy to reduce the numbers of Surgical site infections (SSI). This study aims to study the prevalence of SSI in the Department of Surgery, Andhra medical college, Visakhapatnam*
Aims and objectives of the study: *To determine the incidence and types of surgical site infections (SSIs) following abdominal surgeries*
Materials and Methods: *A retrospective study was undertaken on patients admitted to general surgery units at the, Department of General Surgery, Andhra medical college, King George Hospital, Visakhapatnam. The study period in this super specialty teaching institution was one year. A total of 553elective surgical patients and 314 emergency surgical patients were included in the study.*
Results: *The present study revealed 10.5% prevalence of SSI in department of general surgery, Andhra medical college. Vishakapatnam. Among the 3 types, superficial incision SSI was most prevalent followed by deep incisional SSI and finally by organ/space SSI. The surgical procedure most commonly associated with SSI was exploratory laparotomy. An alarming 19.42% of SSI was associated with emergency surgeries as compared to 7.05% of elective surgeries.*
Conclusion: *The consequences of SSIs greatly impact patients and the healthcare systems. Prevention of SSI requires a multifaceted approach targeting pre-, intra-, and postoperative factors. It is imperative that facilities have open-minded management teams, regulatory agencies and medical associations that want to provide the foundation required to generate a culture of patient safety in our health care systems*
Keywords: *General surgery, Nosocomial infection, SSI, Surgical site infection, Surgery.*

Introduction

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as surgical site infections (SSIs). SSIs are one of the most important causes of healthcare – associated infections (HCAIs), second only to urinary tract infection (UTI) in incidence. SSI develops in at least 5 % of hospitalized patients undergoing an operative procedure in developed countries, raising the costs of healthcare both to the public and the healthcare delivery system. According to are port by the International Nosocomial Infection Control Consortium (INICC), overall more than 1.4 million people

worldwide were suffering from nosocomial infections, and in India alone, the rate was over 25 per cent, with SSI occupying a significant share. The incidence is likely underestimated because of inadequate surveillance and incomplete post-discharge data. Extensive surveys have shown that SSIs are associated with considerable morbidity and it has been reported that over one - third of postoperative deaths arer elated, at least in part, to SSIs. SSI can range from a fairly minor wound discharge with no other complications to a life-threatening condition. Other outcomes include poor scars that are cosmetically unacceptable and cause psychological stress. SSI is, in most scenarios, a preventable HCAI, that can double the length of hospital stay and thereby increase the costs of healthcare, attributable to re-operation, extra nursing care and interventions, and drug treatment costs. There are, in addition, indirect costs due to loss of productivity, patient dissatisfaction and litigation, and reduced quality of life.

Abdominal surgical site infections are among the most common infectious complications in hospitalised patients and are associated with serious consequences for outcomes and costs. They account for up to 14 % of SSIs in studies conducted in developing countries, where there is no organized surveillance system to describe routine nosocomial infections. The present study aims to determine the frequency of surgical site infections in patients undergoing various abdominal surgical procedures and the associated risk factors, the organisms implicated and their sensitivity patterns, and the outcomes observed after treatment among inpatients in the general surgical wards of King George Hospital, Visakhapatnam.

Aims and objectives of the study

Aims and objectives of this study are:

• To determine the incidence and types of surgical site infections (SSIs) following abdominal surgeries

Materials and Methods

A retrospective study was undertaken on patients admitted to general surgery units at the Department of General Surgery, Andhra medical college, King George Hospital, Visakhapatnam. The study period in this super specialty teaching institution was one year. A total of 553elective surgical patients and 314 emergency surgical patients were included in the study.

The elective surgical procedures included, open cholecystectomy, Hernioplasty, gastrojejunostomy, mastectomy, whipples procedure, resecti on anastomosis of bowel, hemorrhoidectomy, fistulectomy, parotidectomy, thyroidectomy. The commonly performed surgeries under emergency conditions were hollow viscus perforation exploratory laparotomy and resection anastomosis of bowel. During the time period of the study, a retrospective chart review was conducted from the hospital database. In this retrospective chart review, existing data that had been recorded for reasons other than research was studied. It was referred as "chart reviews" because the data source was the medical record of the patient. Details that were recorded included the type of surgery by wound class, type and duration of operation, antimicrobial prophylaxis if given, drain used, preoperative and total hospital stay.[4] Each patient's data was assessed from the time of admission till discharge from the hospital and also on follow up visits which extended up to 30days.

Wound infection was diagnosed if any of the following criteria were fulfilled: serous or non-purulent discharge from the wound with signs of inflammation; edema, redness, warmth, raised local temperature, fever >38ºC, tenderness, induration; and wound deliberately opened up by the surgeon due to localized collection (serous/purulent). Stitch abscesses were excluded from the study. SSI thus detected was divided into three categories: superficial incision SSI, deep incision SSI and organ/space SSI.

Results

Of the 100 patients who developed abdominal SSI, 39 had elective procedures and 61 had emergency procedures. Data pertaining to these two groups has been recorded as follows.

A. Patient factors

1. Age and sex: The age and sex distribution of the patients in this study is given in the following tables.

Table - 1: Age distribution

Age group	Elective (*n* = 39)		Emergency (*n* = 61)		Total (*n* = 100)	
	No.	%	No.	%	No.	%
15 – 25 years	06	15	08	13	14	14
26 – 40 years	11	28	18	30	29	29
41 – 60 years	16	41	31	51	47	47
> 60 years	06	15	04	06	10	10

.**Table - 2:** Sex distribution

Sex	No.	%	No.	%	No.	%
Male	30	77	50	82	80	80
Female	09	23	11	18	20	20

The most common age group associated with the development of abdominal SSI was 41 – 60 years, the mean age being 43 years. There was male predominance in the study, for both elective and emergency procedures, as noted above.

Table - 3: Incidence of SSI in various emergency abdominal surgeries

Type of surgical procedure	**No. performed**	**No. infected**	**Percentag e**
Surgery for duodenal ulcer perforation	44	18	41 %
Surgery for acute intestinal obstruction	48	19	40 %
Surgery for hollow viscus perforation (stomach, small and large intestines)	20	8	40 %
Psoas abscess	10	3	30 %
Surgery for obstructed inguinal hernia	5	1	20 %
Open appendicectomy	83	10	12 %
Splenectomy	13	1	8 %
Laparoscopic appendicectomy	23	1	4.3 %
Laparotomy and lavage for haemoperitoneum (various causes)	18	-	0 %
Insertion of flank drains for peritonitis	29	-	0 %
Miscellaneous procedures	16	-	0 %
Exploratory laparotomy (includes ruptured liver abscess)	4	-	0 %
Surgery for obstructed femoral hernia	1	-	0 %

Table - 4: Incidence of SSI in various elective abdominal surgeries

Type of procedure	**No. performe d**	**No. infecte d**	**%**
Open cholecystectomy	12	7	58.3 %
Ilio-inguinal block dissection	4	2	50%
Surgery for carcinoma colon (resections/ colostomy)	15	6	40 %
Abdomino-perineal resection	5	2	40 %
Whipple's procedure	5	1	20 %
Laparotomy and procedure for abdominal TB	8	2	25 %
Reversal of colostomy / ileostomy	17	3	17.6 %
Various exploratory procedures	18	3	16.6 %
Incisional – hernioplasty	32	1	3 %
Laparoscopic cholecystectomy	44	1	2.2 %
Inguinal hernioplasty	175	3	1.7 %

Umbilical herniorrhaphy / plasty	15	1	6.6 %
Secondary suturing for burst abdomen	15	2	13.3
Lavage for pyoperitoneum	13	2	15.4
Loop Ileostomy / colostomy for benign causes	10	0	0 %
Miscellaneous procedures	75	0	0 %
Gastrojejunostomy(for CDUD and corrosive injuries)	23	2	8.7%
Repair of ventral / femoral / lumbar hernia	26	0	0 %
Curative / palliative surgery for carcinoma stomach	21	0	0 %

Surgery for rectal prolapsed	9	0	0 %
Longitudinal pancreaticojejunostomy	4	1	25 %
Mesenteric / omental cyst excision	3	0	0 %
Triple bypass	4	0	0 %

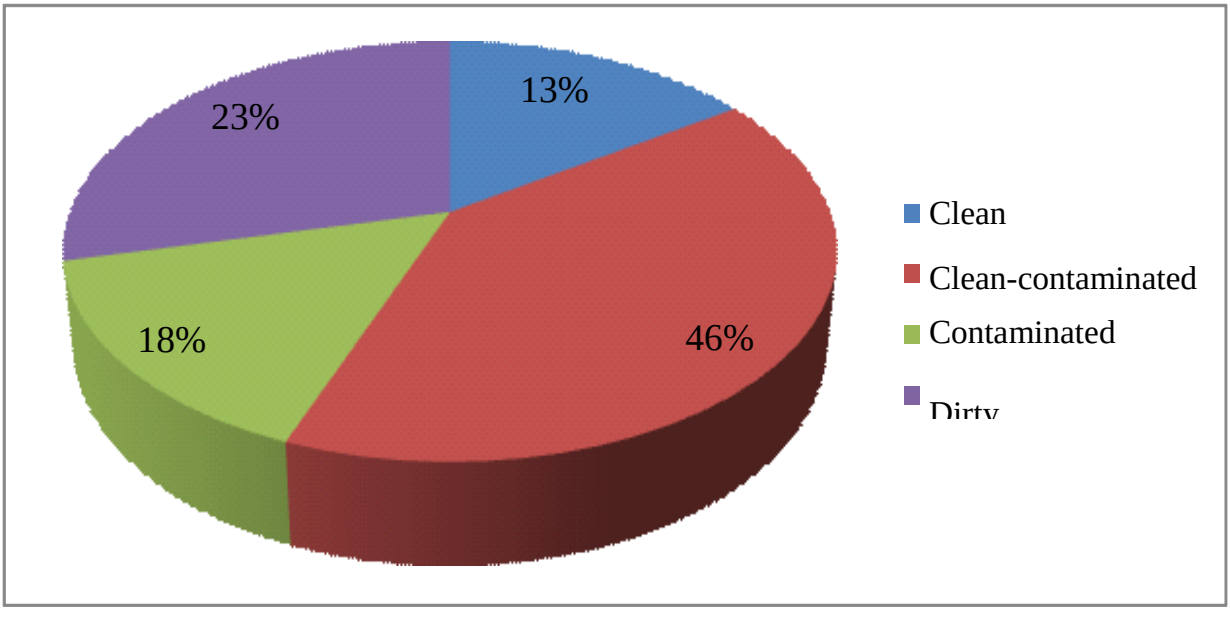
The following observations were made with regard to the incidence of SSI

- SSI rate for total open abdominal surgeries - 98 / 8000 = 11.3 %.
- SSI rate for laparoscopic surgeries - 2 / 67 = 3 %.
- SSI rate for elective abdominal surgeries - 39 / 553 = 7.05 %.
- SSI rate for emergency abdominal surgeries - 61 / 314 = 19.42 %.

Table 4: Type of surgical wound and incidence of abdominal SSI

	Total (*n* = 100)		Elective (*n* = 39)		Emergency (*n* = 61)	
	No.	%	No.	%	No.	%
Clean	13	13	8	20.5	5	8.2
Clean – Contaminated	46	46	24	61.5	22	36
Contaminated	18	18	3	7.7	15	24.6
Dirty-infected	23	23	4	10.2	19	31.14

Pie diagram showing the incidence of SSI with relation to the type of wound



Discussion

Surgical site infection (SSI) is a common complication following abdominal surgery and is the third most frequent health-care associated infection, accounting for serious consequences in terms of morbidity and increased health-care costs. Various risk factors have been identified, pertaining to patient characteristics and aspects of perioperative management.

Timely recognition of SSI and appropriate management can hasten post-operative recovery and prevent the development of adverse outcomes like burst abdomen and incisional hernia or even death. The present study was undertaken on 100 patients who developed SSI following either elective or emergency abdominal surgery in 867 patients, admitted to the IV surgical unit, King George Hospital, Visakhapatnam, over a period of 24 months, from august 2014 to august 2016.

Incidence and types of SSI following various procedures, the risk factors for SSI, the causative organisms and their sensitivity patterns and the outcomes of treatment were studied.

The overall incidence of SSI for all surgeries performed in the IV surgical unit during the study period was 10.53 %.28 Different studies from various parts of India have shown rates ranging from 6.09 to 38.7 %, with the majority of studies having a rate of 14 – 17 %, hence the rate of SSI for all surgeries in the present study was slightly lower than that seen in most other hospitals in India. This was probably due to adherence to a uniform protocol for antibiotic prophylaxis and post-operative wound care in our unit. The incidence of SSI in abdominal surgeries in this study was 11.53 %.

The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals, nutritional status, illiteracy and late presentation. The most common age group developing SSI was 41 – 60 years, with the mean age being 43 years for both males and females.

Most studies in literature show an increase in the incidence of SSI with increasing age, probably reflecting the deteriorating immune status and development of co-morbidities as age advances.

Males accounted for 80 % of the cases in this study. Hence, this was a male preponderant study with no specific statistical significance attributed to gender. 61 % of the patients belonged to the low socioeconomic group, who were more likely tobe malnourished and practice inadequate or improper health care, predisposing them to infections.

Among the patient-related risk factors observed in this study, smoking was seen in 67% and the most common co-morbidity was anaemia, seen in 36 % of the patientsmal nutrition. Studies have long since established the increased risk of infection attributable to smoking and anaemia, Malignancy was the most common cause for immunosuppression, seen in 17 % of the cases.

Perioperative blood transfusions, especially multiple, also contribute to an increase in post-operative infections by altering the immune response of the individual.30 Incidence of SSI increases with an increase of the ASA score, but in the present study, 53 % of the patients had an ASA score of II, which was probably due to the fact that most of the patients with ASA score III or IV were either not taken up for surgery or belonged to the group of clean wound type.

Of the 100 patients studied, 39 underwent elective abdominal surgeries (39 %) and 61 underwent emergency abdominal surgeries (61 %). The incidence for SSI was 7.05 % for elective abdominal surgeries and 19.42 % for emergency abdominal surgeries, which shows that emergency abdominal surgeries were statistically far more likely to develop SSI than elective procedures.

The high rates of infection in emergency surgeries can be attributed to delayed presentation, inadequate pre-operative preparation, the underlying conditions which predisposed to the emergency surgery and the greater frequency of contaminated or dirty wounds in emergency surgeries. 61.5 % of elective and 36 % of emergency procedures were classified by the CDC wound classification system as clean-

contaminated. These cases accounted for 46 % of SSI in this study.

This may be due to the fact that a high proportion of elective surgeries is occupied by clean-contaminated cases. Open cholecystectomy (58.3 %) and surgery for duodenal ulcer perforation (41 %) were the most common elective and emergency abdominal surgeries complicated by SSI respectively.

Incidence of SSI for both these surgeries was far higher than any noted in literature. This was probably due to the associated co-morbidities that rendered patients unfit for laparoscopic cholecystectomy and the late presentation of patients with duodenal ulcer perforation in these parts, which converts a contaminated wound to a dirty wound, thus increasing the risk of SSI.

The incidence of SSI was lower following laparoscopic surgery (3 %) compared to open surgery (11.3 %), with the rates slightly higher than those observed in literature. duration of surgery exceeds 2 hours, although the type of surgery may vary. The observation of increase in SSI rates with the presence of drains was consistent with that observed in literature.

Wound irrigation was regularly practised for wounds with a greater risk of contamination, which theoretically reduces the risk of SSI. Antibiotic prophylaxis was received by all the cases studied, which has consistently proven to reduce SSI rates in various studies world-wide.31 The most critical factors in the prevention of postoperative infections, the sound judgement and proper technique of the surgeon and surgical team, were difficult to quantify in this study. Majority of the patients in this study did not develop systemic signs of inflammation like fever or elevated cell counts.

The most common organism implicated in this study was *E.coli*, while the most common organism causing abdominal SSI consistently observed in literature was *Pseudomonas aeruginosa*.

The Gram-negative organisms implicated were found to be most sensitive to the aminoglycosides Amikacin or Gentamicin, followed by third generation cephalosporins and penicillins with or without beta-lactamase inhibitors, macrolides like Roxithromycin, quinolones like ofloxacin and to tetracycline and doxycycline. Drug resistance to the regularly prescribed empiric antibiotics, Ciprofloxacin and Cefotaxime was encountered during initial as well as persistent infection, reflecting the need to re-analyse and design a new empiric antibiotic regimen effective against the resident flora of the hospital.

The mean pre-operative stay for elective surgeries was 8.3 days, which could have contributed to the development of SSI.32 This prolonged stay was necessary in some cases to improve the nutritional status and general condition of the patient to achieve fitness for anaesthesia and surgery. Post-operative stay was often prolonged once SSI developed for both emergency and elective surgeries, as patients hailing from far-away places preferred to stay at the hospital for dressing of the wound. Some of these patients required re-operation for reasons other than wound dehiscence, which resulted in a prolonged post-operative stay.

Superficial incisional infections were the most common in all the three studies. While most of the risk factors for SSI described in literature have been found to be significant in all these studies, an increased number of patients with SSI were also found to have smoking, anaemia, malignancy and transfusion of blood products as additional risk factors in the present study.

While there were no deaths in this study that could directly be attributed to sepsis following SSI, there have also been remarkably few adverse outcomes like burst abdomen and incisional hernia. This is most probably due to the fact that a majority of the infections were superficial incisional at the time of diagnosis and have been adequately controlled by timely intervention and institution of the appropriate antibiotic as suggested by the sensitivity pattern, before they could worsen and cause deep incisional and organ / space infections

Conclusion

The following conclusions were drawn from the present study:

1) The incidence of SSIs following abdominal surgeries was 11.53 %.
2) It is slightly higher than the overall incidence of SSI for all surgeries (10.53 %).
3) Emergency abdominal surgeries were statistically more likely to develop SSI than elective abdominal surgeries.
4) A large share of abdominal SSIs was occupied by surgeries with clean contaminated wounds, which is similar to other studies. It reflects the higher proportion of such cases in abdominal surgery.
5) Anaemia was the most common co-morbidity encountered.
6) Smoking, increased hospital stay and perioperative blood transfusions were the most common risk factors identified.
7) The most common organism implicated in the development of abdominal SSI was *E.coli*, which is different from that noted in literature.
8) Signs of systemic inflammation may be masked by the prolonged use ofantibiotics.
9) Most were superficial incisional infections, which, as they were recognized early and managed appropriately, did not progress to deeper and more serious infections.
10) Increased awareness among hospital staff with regard to infection control and strict adherence to the aseptic precautions is the need of the hour.

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