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Postoperative Wound Infection in Surgical Ward

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Abstract
The principle aim of this study was to determine the incidence of post-operative wound infection and the common pathogens responsible for SSI and their sensitivity to antibiotics, thereby modifying the approach for its management. This was a prospective observational study which consists of 528 patients operated on elective / emergency basis admitted to the hospital. Two samples were collected, one from subcutaneous tissue before wound closure and other from the wound post operatively when infection was suspected. The incidence of post-operative wound infection was 12.12%, patient with age more than 60 years had high incidence (22.58%) compared to younger, high in emergency surgeries (19.38%), more in contaminated and dirty wounds (18.04%) and more in surgeries with longer duration (20.40%). Patients with co-morbid conditions and pre disposing factors had higher incidence of post-operative wound infection. Most common pathogens identified were gram positive's out of which staphylococcus aureus had the highest incidence of 43.75%. Proper pre and post-operative care helps in decreasing the surgical site infection.
Keywords-*Surgical wound, Surgical site infection, Incidence, Pathogens,Antibiotic sensitivity, Contaminated woun*

INTRODUCTION

Infection is the clinical manifestation of the inflammatory reaction incited by invasion and proliferation of microorganisms[1]. Surgical site infection (SSI) places a significant burden on both the patient and health system[2], thus prolongs hospital stay and adds to hospital costs[3]. The understanding of wound infection has come a long way from the days when pus was laudable to the present day where advances in therapeutics, techniques in surgery and maintenance of asepsis have contributed to controlling scourge of surgery which is postoperative infection. Infection was accepted as an inevitable sequel of Surgery a century ago. Although a large number of reports on SSI are available in adult literature[4], reports for children are few, and most are from developed countries with an overall incidence of 2.5–20% [3,5]. Although the total elimination of wound infection is not possible, a reduction in the infection rate to a minimal level could have significant benefits in terms of both patient comfort and medical resources used.

Clear understanding of pathogens and their pathogenicity, advances in the field of asepsis and aseptic technique, the advent of antibiotics and reliable suture materials have furnished the surgical armamentarium in countering infection. Hence a constant awareness of the ever present threat of infection must be a way of life for the entire surgical fraternity.

AIMS

Determining the incidence of post -operative wound infection and thereby modifying the approach for its management. Identifying the common pathogens causing surgical site infection and their sensitivity to antibiotics healing wound infection and prophylaxis in post – operative surgical site infection.

MATERIALS AND METHODS

This is a prospective observational study which consists of 528 patients operated on elective / emergency basis admitted to the hospital; the study was conducted from September 2012 to March 2014 at Mamatha general hospital, Khammam after obtaining clearance from ethical committee. Analytical data obtained was compared and discussed with the data available in the literature.

Inclusion criteria:

1. Patients undergoing elective and emergency surgeries.
2. Patients of all age groups.
3. Patients willing for the study.

Exclusion criteria:

1. Patients with immune compromising diseases (e.g. retroviral disease, tuberculosis etc,).
2. Patients unwilling for the study.

Two samples were collected, one from subcutaneous tissue before wound closure and other from the wound post operatively when infection is suspected. Using sterile technique up to 5 ml of pus was collected from the drainage tube which was transferred to a leak-proof sterile container. When pus is not being discharged, a sterile cotton-wool swab was used to collect the sample from infected site.

RESULTS

In the present study a total of 528 patients were included who underwent surgery on an elective or emergency basis. Among the cases studied 464 patients had wound healing with primary intention and 64 patients had post-operative clinical as well as bacteriological wound sepsis.

These 64 patients were categorized according to their age and sex and the following results were observed:

Age Distribution

Among the 64 patients with SSI, patients between age group 20-29 years were 7.05%, 30-39 years were 10.47%, 40-49 years were 13.79%, 50-59 years were 15.43% and above 60 years were 22.58% as shown in the table-1.

Sex Distribution

Among the 64 infected cases, 25 cases with SSI were males with an incidence of 12.25% and females were 39 with an incidence of 12.03% as shown in the table-2.

Pre disposing Factors

There was increased incidence of Post -operative wound infection in patients with following pre disposing factors – Diabetes Mellitus, Peripheral Vascular Disease, smoker & Alcoholic. As shown in the table-3.

Nature of operation:

Among the 528 patients operated 332 were on elective basis and 196 were on emergency basis with an SSI incidence of 7.83% and 19.38% respectively with an overall SSI incidence of 12.12%. As shown in table-4

Elective cases

Among the 332 elective cases gastric surgeries were 27 (SSI-3.57%), biliary-28 (SSI-14.28%), appendectomy for chronic appendicitis-92(SSI-4.34%), hernias-136(SSI-6.61%), miscellaneous-49(SSI-12.24%) as shown in the table-5.

Emergency

Among 196 emergency cases that underwent surgery for acute appendicitis were 85(SSI-

17.64%), gastric perforation-38(SSI-25%), duodenal perforation-4(SSI-21.05%), ileal perforation-6(SSI-33.33%), small intestine obstruction-28(SSI-10.71%), large intestine obstruction-5(SSI-60%), meckels diverticulitis-8(SSI-25%), inguinal hernias (obstructed/strangulated)-22(SSI-18.18%) shown in table-6.

Duration of surgery

Among 528 patients who underwent surgery 262 patients had surgery duration ≤1 hour (SSI-5.72%), 70 patients had surgery duration ≤2 hours (SSI-12.85%), and 196 patients had surgery duration ≥3 hours (SSI-20.40%)

Type of Wound

Among 528 patients operated-clean cases were 136 (SSI-4.41%),clean contaminated were 259(SSI-13.12%) and contaminated were 133(SSI-18.04%), as shown I table-7.Percentage of cases infected in contaminated wound is higher than in clean and clean contaminated wounds

Bacteriological Surveillance

Among 64 cases of wound infection, gram negative bacilli were very often responsible for post-operative wound infection than gram positive organisms. As shown in table-8

Antibiotic Sensitivity

ABST was done for different microorganisms and shown in table 9

Table-1: Incidence of post operative infections is directly proportionate to the age of patient

S.No.	Age Group (Years)	Total Cases	Infected Cases	SSI (%)
1	20-29	156	11	7.05
2	30-39	105	11	10.47
3	40-49	87	12	13.79
4	50-59	149	23	15.43
5	>60	31	7	22.58

Table-2: Influence of sex on incidence of SSI's.

S.No	Sex	Total Cases	Infected Case	SSI (%)
1	Male	204	25	12.25
2	Female	324	39	12.03

Table-3: Incidence of infection in patients with pre-disposing factor

S.No.	Predisposing Factors	Total Cases	Infected Cases	SSI (%)
1	Diabetes Mellitus	135	31	22.96
2	Peripheral Vascular Disease	23	1	4.34
3	Smoker	64	19	29.68
4	Alcoholic	78	20	25.64

Table-4: Total surgical procedures with SSI.

S.No.	Surgical Procedure	Total Cases	Infected cases	SSI(%)
1	Elective	332	26	7.83
2	Emergency	196	38	19.38
	Total	528	64	12.12

Table-5: Rate of SSI in elective procedures

S.No.	Surgical Procedure	Total Cases (elective)	Infected cases	SSI (%)
1	Gastric	27	3	3.57
2	Biliary	28	4	14.28
3	Appendectomy	92	4	4.34
4	Hernia	136	9	6.61
5	Miscellaneous	49	6	12.24

Table-6: Rate of infection in emergency procedures.

S.No.	Surgical Procedure	Total Cases (emergency)	Infected Cases	SSI (%) 12.12%
1	Appendicitis	85	15	17.64
2	Gastric Perforation	38	8	25
3	Duodenal Perforation	4	1	21.05
4	Ileal Perforation	6	2	33.33
5	Small Intestine Obstruction	28	3	10.71
6	Large Intestine Obstruction	5	3	60
7	Meckels Diverticulitis	8	2	25
8	Inguinal Obstructed or Strangulated Hernia	22	4	18.18

Table-7: Rate of SSI in different type of wounds

S.No.	Surgical Procedure	Total Cases	Infected cases	SSI (%)
1	Clean	136	6	4.41
2	Clean Contaminated	259	34	13.12
3	Contaminated	133	24	18.04

Table-8: incidence of individual organism isolated from infected wounds

S.No.	Name of Organism	Infected Case	Percentage of cases infected(%)
1	Staphylococcus aureus	28	43.75
2	Escherichia Coli	14	21.87
3	Klebsiella Species	8	12.5
4	Proteus Species	4	6.25
5	Pseudomonas Aeruginosa	4	6.25
6	Beta haemolytic Streptococci	2	3.12
7	No Pathogen Grown	4	6.25

Table 9: Antibiotic sensitivity test

Name of the organism	Amikacin	Ciprofloxacin	Gentamycin	Cefotaxime	Amoxycillin	Norfloxacin	Cefaxitime	Imipenem	Cephalexin	Vancomycin	Erythromycin
Pseudomonas	+	+	+					+			+
Escherichia Coli	+	+	+			+	+		+		+
Klebsiella	+	+	+		+	+		+			
Proteus	+	+		+	+		+				
Staphylococcus Aureus	+		+	+							
Beta haemolytic Streptococci				+	+			+	+	+	+

DISCUSSION

The surgical Site Infection (SSI) is considered as one of the surgeon‘s nightmare, this complication while seemingly infrequent and almost never lethal, adds morbidity, delays incisional healing and thereby generates large marginal care expenses when measured in aggregate, With an extra hospital stay of 6–14 days[6].

The variability in estimates is consistent with the differences in the characteristics of the hospital populations, the underlying diseases, differences in clinical procedures, the extent of the infection control measures, and in addition the hospital environment.

Influence of age on SSI incidence

Different groups of investigators have reported contradictory results concerning the relationship between increasing age and risk of SSI. In some of the studies, increasing age was associated with an increased risk of development of SSI[7]. However, the factors responsible for the above findings remain controversial. Some investigators have speculated that factors indirectly related to age such as an increased prevalence of co morbid conditions, an increased severity of acute illness, and a decreased host response to bacterial invasion in older patients are the real reasons for older patients appear to have an increased risk of SSI[7-8]. To make matters even more confusing, some investigators have concluded that increasing age was not an independent risk factor for SSI. However, the present study found the increased rate of risk of SSI‘s with every decade increase in the age of the patient population; with rate of 22.58% SSI‘s in the patients above 60 years of age.

Influence of gender on incidence OF SSI

In the present study on 528 patients with 204 males and 324 females the SSI incidence was 12.25% and 12.03% respectively, which showed no significant influence of gender on incidence of SSI. These results are in comparison with others[9].

SSI incidence

The overall infection rate in the present study is l2.12 %.Comparable with various other studies where the incidence ranged from 2.5%-41.9%[10]. This is due to poor nutritional status, inadequate infection controlling measures and inadequate diabetic control. The variability in the incidence accounts for intra operative aseptic precautions, pre-operative co morbidities of the patient, post-operative nutritional status of the patient, post-operative nursing care and hospital environment.

Incidence of SSI in clean, clean contaminated and contaminated surgeries

In the present study surgical site infections were more in case of emergency surgeries when compared to elective surgeries.The high rate of infections in emergency cases may be attributed to the delay in patient reaching the hospital, treated elsewhere initially and most cases brought to the hospital were with established peritonitis and few of them with pre renal uremia. SSI‘s are an important cause of increased hospital stay, and they directly affect the morbidity and risk of mortality of surgical patients, particularly older patients.

Influence of duration of surgery on SSI incidence

In the present study the rate of infection was 5.72% when procedure lasted for one hour or less and 20.40% when procedure lasted for more than 3 hours. The duration of surgery directly influences the rate of surgical site infection, it is considered as an independent predictor for assessment of SSI[11].

SSI incidence after discharge and follow up period

About 54 cases failed to come for follow up after discharge which could mean a minimal increase in rate of infections than the present figure of 12.12%. The global estimates of SSI have varied from 0.5–15% while it differed considerably in Indian set up varying from 2.5% to 41.9%[12].

Influence of pre disposing factors on SSI incidence

a) Diabetes

The contribution of diabetes to SSI risk is controversial, because the independent contribution of diabetes to SSI risk has not typically been assessed after controlling for potential confounding factors. Recent preliminary findings from a study of patients who underwent coronary artery bypass graft showed a significant relationship between increasing levels of HgA1c and SSI rates[13]. Also,

increased glucose levels (>200 mg/dL) in the immediate postoperative period (≤48 hours) were associated with increased SSI risk[15]. More studies are needed to assess the efficacy of perioperative blood glucose control as a prevention measure for post-operative wound infections. In the present study among 528 patients operated 135 patients were known diabetics with controlled or poorly controlled blood sugar levels pre or post operatively, out of which 31 patients had post-operative wound infection at the rate of 22.96 % , this signifies the association of poorly controlled diabetes with post-operative SSI.

b) Smoking

In the present study 64 patients among 528 patients studied were active smokers, among the 64 patients operated 19 patients had post-operative surgical site infection at a rate of 29.68%, thus nicotine abuse eventfully has a significant role to play in the outcome of surgery. According to data from the NNIS system, the distribution of pathogens isolated from Nicotine use delays primary wound healing and may increase the risk of SSI. In a large prospective study, current cigarette smoking was an independent risk factor for sternal and/or mediastinal SSI following cardiac surgery[15]. Other studies have corroborated cigarette smoking as an important SSI risk factor[16-17].

Incidence of common pathogens resulting in SSI

In the present study gram positive organisms dominated among the isolated pathogenic organisms, with staphylococcus aureus and no pathogens were isolated in about 6.25% among infected patients. In a recent study by McGarry et. al., older patients with *Staphylococcus aureus* SSI's had a 3- fold increase in mortality, longer post-operative hospital stays, and higher hospital charges than did younger patients[18]. The risk of SSI is considered elevated when the level of contamination exceeds organisms per gram of tissue, although lower doses may be required if foreign material such as sutures is present.

Strategies for SSI prevention

Strategies for the prevention of SSIs are based both on reducing the risk of bacterial contamination and on improving the patient's defences against infection.

This requires a bundle approach, with attention to multiple patient-related and procedure-related risk factors. Several studies in a variety of clinical settings have shown that such approaches can produce significant reduction in SSI rates during follow-up periods of up to two years[19].

Complications

Without a note on complications no study is complete.

All the 64 cases had wound gaping (Superficial or deep). Out of 64 cases 25% healed by secondary intention, other patients needed resuturing.

Burst abdomen resulted in two cases; one case of advanced carcinoma of stomach for which palliative anterior gastrojejunostomy with jejunojejunostomy was done, the other case was duodenal perforation.

Incisional hernia developed in 3 patients one in the Mc Bumey's incision through which an appendectomy was done another in the upper midline scar where a gastric perforation closure done, another case of ileal perforation brought in a state of advanced peritonitis and shock opened through midline incision.

Patients who developed surgical site infection are up to 60% more likely to spend time in an intensive care unit, 5 times more likely to be readmitted to the hospital and 2 times more likely to die than are patients without surgical site infection. Health care costs are substantially increased for patients who develop SSI[20].

CONCLUSION

- This study comprised of 528 patients admitted to the hospital on elective / emergency basis out of which 64 patients had post-operative wound infection.
- The incidence of post-operative wound infection in this study was 12.12%. In this study patient with age more than 60 years had an incidence of 22.58% which was considerably high compared to younger age groups in the study.

- Most of the post-operative wound infections in this study were reported in procedures done on emergency basis with an incidence of 19.38%.
- The incidence of SSI was more in contaminated and dirty wounds with an incidence of 18.04%.
- This study showed the risk of post-operative wound infection is more in surgeries with longer duration, surgeries lasting duration of 3 hours or more had an SSI incidence of 20.40%.
- Patients with co-morbid conditions and pre disposing factors had higher incidence of post-operative wound infection.
- Most common pathogens identified were gram positive's out of which staphylococcus aureus had the highest incidence of 43.75%.
- Surgical site infection (SSI) continues to be the most common complication following surgical procedures. These infections are the biological summation of several factors; Prevention of surgical site infection can be achieved by several methods. Better preoperative preparation of the surgical site and sound infection control practice while performing operations and adherence to principles of prophylactic antibiotic therapy helps in decreasing the SSI.Enhanced oxygen delivery, better core body temperature control and glycemic control in the surgical patients are new areas that have the potential to even further reduce the rate of surgical site infection. Although surgical site infections cannot be completely eliminated, a reduction in the infection rate to a minimal level would have significant benefits by reducing post-operative morbidity and mortality and wastage of health care resources.

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