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RESEARCH ARTICLE

PROSPECTIVE STUDY OF DIABETES AND DRAIN AS A RISK FACTOR FOR SURGICAL SITE INFECTION

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ABSTRACT

Although SSIs are not associated with a high case-fatality rate, they cause significant morbidity and huge economic burden. In 1992, the US Centers for Disease Control (CDC) revised its definition of 'wound infection', creating the definition 'Surgical Site Infection' (SSI) to prevent confusion between the infection of a surgical incision and the infection of a traumatic wound. So, post-operative wound infection hereafter referred to as Surgical Site. This is a hospital based prospective study. This study was conducted in the General surgery ward of Department of Surgery in a well-equipped tertiary care center. Each patient undergoing surgery both elective and emergency were observed in the ward and carefully assessed each day for signs of surgical site infections till the day of discharge and post operative. Better control of blood sugar in diabetics and if possible opt for elective surgery and even if surgery done in emergency post operative glycemic level optimization is must. Avoid wound drains, if this is not possible, using a closed drainage system and removal of drains as soon as possible may help in control of SSI.

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INTRODUCTION

Post operative wound infection is considered a surgeon's nightmare (Sampson, 1998). This complication, while seemingly infrequent, adds to the morbidity and delays incision healing. Before the mid-19th century, surgical patients commonly developed postoperative purulent discharge from their incisions, followed by overwhelming sepsis, and often death. In 1992, the US Centers for Disease Control (CDC) revised its definition of 'wound infection', creating the definition 'Surgical Site Infection' (SSI) (Horan *et al.*, 1992) to prevent confusion between the infection of a surgical incision and the infection of a traumatic wound. So post-operative wound infection hereafter referred to as Surgical Site Infections (SSIs) are second only to urinary tract infection as the most commonly reported nosocomial infection (Rioux *et al.*, 2007). and accounting for 14% to 16% of all nosocomial infections among hospitalized patients (Emori and Gaynes, 1993). Although SSIs are not associated with a high case-fatality rate, they cause significant morbidity and huge economic burden in the form of prolonged hospital stay, readmission and secondary procedures. Hence a septic surgical wound is considered "a remarkably expensive luxury". The Centers for Disease Control and Prevention (CDC) has classified Surgical site infections (SSI) into superficial or deep, or organ/space SSIs.

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The definitions of surgical site infections:

- **Superficial Incisional SSI**: Infection involves only skin and subcutaneous tissue of the incision.
- **Deep Incisional SSI**: Infection involves deep tissues, such as fascial and muscle layers. This also includes infection involving both superficial and deep incision sites and organ/space SSI draining through incision.
- **Organ/space SSI:** Infection involves any part of the anatomy in organs and spaces other than the incision, which was opened or manipulated during operation.

MATERIALS AND METHODS

This is a hospital based prospective study. This study was conducted in the General surgery ward of Department of Surgery in a well-equipped tertiary care center. The study was approved by the Ethics Committee of the hospital**.** Sample size of 200 patients were selected from among those admitted in surgical wards for planned and emergency surgical procedures in this hospital. Patients operated elsewhere and getting and patients undergoing surgery with SSI of previous operative procedure were excluded. Each patient undergoing surgery both elective and emergency were observed in the ward and carefully assessed each day for signs of surgical site infections till the day of discharge. The patient's parameters noted were:

- General physical examination - pulse, temperature

- Local examination – wound assessed by the CDC (Center for disease control) definitions of surgical site infections (1992) like pain or tenderness, induration, erythema, and local warmth of the wound; fluid or pus exudations from the wound.

Thereafter patients were followed up on an outpatient basis once a week for 30 days from the day of surgery. The discharge from infected wounds were collected using sterile swabs or aspirated by a sterile needle and syringe. The samples were transported to the Department of Microbiology, within 2 hours of collection for culture.

RESULTS

Diabetes and SSI

The presence of diabetes increased the occurrence of wound infections. The percentage of surgical wounds in diabetics getting infected were 13.8% and the non-diabetics were 6.3% which is statistically significant (χ^2 with Yates correction= 4.497, p value 0.0302. Furthermore, a decreased incidence of infections was found in diabetic patients undergoing elective surgery compared to emergency surgery.

Table 1. Distribution of SSI among diabetics and non-diabetics

		No of cases	No. of SSI	% of infection
Diabetic	Elective	46	6	13.04
	Emergency	12	4	33.3
Non-diabetic	Elective	88	2	2.27
	Emergency	54	7	12.9

95% C.I.-0.7797 to 1.001 (using approximation of Katz), odd's ratio-0.3248
Relative risk-0.8836

Drain and SSI

Presence of drain increases the chance of infections in patient undergoing surgical procedure. In our study drain is kept in 122 patient, in whom 18 cases developed sign of SSI (14.75%) as compared to 1 case out of 78 developed SSI(1.2%).Using Fischer's exact test p value is 0.0009 extremely significant and chi-square statistics with Yates correction=8.538

Table 2. Distribution of cases with drain and rate of SSI

Drain	No. of cases	No. of SSI	%
Present	122	18	14.75
Absent	78	01	01.2
Total	200	19	09.5

Drain and no. of cases

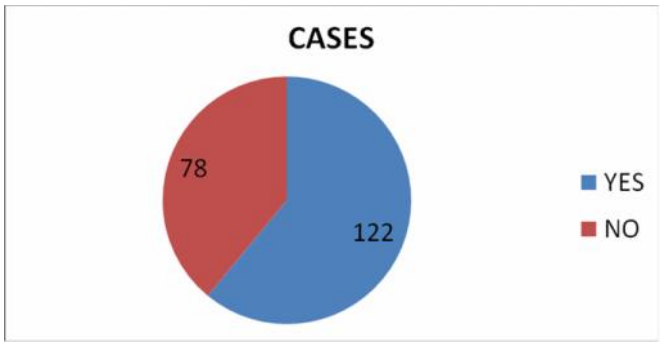

Fig. 1. Showing no. of cases with drain

Duration of drain and SSI

Infection rate increases with increasing duration of drain. In our study, 11 patient developed SSI in whom drain is kept for more than 7 days (64.7%) and patient in whom duration of drain is less than 7 days have SSI (14.2%). Using chi-square test for independence, data is significantly associated.

Table 3. Duration of drain and SSI

Duration of drain	Total cases	SSI	%
1-3 days	56	0	0
4-7 days	49	7	14.3
>7 days	17	11	64.7

Chi-square test for independence=66.187, p value is 0.0001

Graph relating duration of drain and SSI

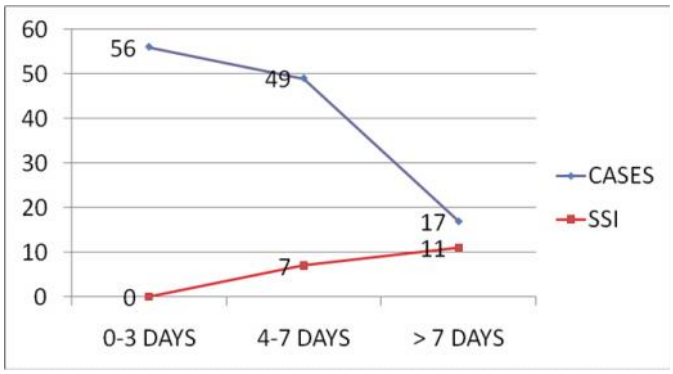

Fig. 2. Relating duration of drain and SSI

DISCUSSION

Diabetes and SSI

In our study diabetics had a higher incidence of SSI than the non-diabetics Odds ratio is 0.3248. Fasting blood sugar levels was the only biochemical parameter significantly associated with the risk of SSI and has been demonstrated in several studies. In a study by Malone *et al.*, 2002 in Maryland hospital showed a higher percentage of SSI in diabetics than in non-diabetics. Logistic regression analysis demonstrated that patients with diabetes mellitus were at a 1.5-fold increased risk for SSI. In a case control study in Mexico by Compte *et al.*, 2000 also demonstrated that the relative risk of SSI's in diabetics is 2.5 times than the non-DM patients. Karim *et al.*, 2000, 3000 surgical wounds for 10 days postoperatively and confirmed that diabetes mellitus was an independent risk factor for SSI in general surgical patients (*P*_ 0.005). With strong evidence supporting the role of diabetes in the development of SSI, measures to decrease SSI should be considered. Preoperative control of blood glucose levels may eliminate the increased risk associated with diabetes, as suggested by Zerr *et al.* 1997. These investigators studied 1585 diabetic patients in a cohort of 8910 patients who underwent cardiac surgery over a 6-year period. They found that infected diabetic patients had higher mean blood glucose levels over the first 2 postoperative days (*P* _ 0.003). Institution of a new protocol of postoperative continuous intravenous insulin infusion to maintain a blood glucose level 200 mg/dl resulted in a decrease in postoperative blood glucose levels with a concomitant significant decrease in the incidence of SSI (*p*_ 0.02). These results suggest that glycemic control in diabetic patients postoperatively may have a significant impact on SSI. The contribution of diabetes to SSI

has been demonstrated in various studies. Trick *et al.*, 2000 demonstrated that a preoperative glucose level of 200mg in diabetic patients was an independent risk factor (OR 4.4, *P* _ 0.01) for radial artery harvest site infections after coronary artery bypass graft surgery (CABG. Karim *et al.* 2000 studied 3000 surgical wounds for 10 days postoperatively and confirmed that diabetes mellitus was an independent risk factor for SSI in general surgical patients (*P* _0.005). In a study by Malone et al., 2002 patients with diabetes were approximately 1.5 times more likely to develop SSI, demonstrating that in non-cardiac surgical patients, diabetes mellitus was a significant independent risk factor. Increased glucose levels (>200mg/dl) in the immediate post op period (<48hrs) were associated with increased SSI risk (Terranova, 1991). Hence tight control of blood glucose levels in the peri-operative period may lead to better SSI outcomes in diabetic and non-diabetic patients.

Drain and SSI

Drains placed in incisions probably cause more infections than they prevent. Sealing of the wound by epithelialization is prevented and the drain becomes a conduit, holding open a portal for invasion of the wound by pathogens colonizing the skin. Several studies of drains placed into clean or clean-contaminated incisions show that the rate of SSI is not reduced (Al-Inany *et al.,* 2012; Magann *et al.,* 2002), in fact, the rate is increased (Siegman-Igra *et al.,* 1993; Noyes *et al.,* 1998; Vilar-Compote *et al.,* 2002; Manian, 2003). In our observation, the post-operative drain were 12 times more likely to develop SSI compared to those without the drain. While the proportion of those with post-operative drain acquiring SSI was 14.75% (18/122), it was 1.2% (1/77) among those without the drain (C.I=1.740 to 102.04). Further, the infection rate increases with the increasing duration of the drain as studied by other workers on SSIs. Considering that drains pose a risk and accomplish little, they should rarely be used and removed as soon as possible (Barie, 2002). Under no circumstances should prolonged antibiotic prophylaxis be administered to "cover" indwelling drains.

Drain and Durations

Early observational studies suggested that surgical drains contributed to the development of SSIs (Cruse and Foord, 1980 & 1973). The work of Magee *et al.,* 1976 suggested that the drains may also potentiate the risk of infection by acting as a foreign body and suppressing local tissue defenses. Simchen *et al.,* 1984 prospectively evaluated 1,487 patients who had undergone hernia operations. Among 14 variables analyzed using multivariate analysis, the use of drains was found to significantly increase the risk of infection (odds ratio 4.1; p <.001). Lidwell (1961) also found drains to be a risk factor when he applied regression analysis to data collected on SSIs. In contrast, neither the study by Claesson and Holmlund (Claesson *et al.,* 1988) nor the study by Mishriki *et al.,* (1990) both of which used multivariate analysis methodology, was able to incriminate drains as a risk factor for SSIs. Several prospective, randomized trials have also been published (Lubowski and Hunt, 1987; Shaffer *et al.,* 1987; Shaffer *et al.,* 1988; Monson *et al.,* 1991). Three studies found no difference in infection rates when drains were used. A task force of experts from the Society for Hospital Epidemiology of America (SHEA), the Association of Practitioners in Infection Control (APIC), the CDC, and the Surgical Infection Society (SIS) concluded, after review of the evidence, that the use of drains was only a possible contributor to SSIs.

Conclusion

Better control of blood sugar in diabetics is must to reduce the incidence of SSI. Avoiding wound drains or using a closed drainage system and early removal of drains may limit the Surgical site infections.

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