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Original Research Article

Role of Subcutaneous Drains in Reducing the Incidence of Incisional Surgical Site Infections Post Emergency Abdominal Surgery- A Prospective Study of 100 Cases

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ABSTRACT

Aim: To compare the incidence of incisional surgical site infections in post emergency abdominal surgical wounds with subcutaneous drains versus those in who subcutaneous drains are not used.
Methods: A prospective consecutive 6 month interventional study of 100 subjects (50 drain group and 50 no-drain groups).
Results: 32% patients developed surgical site infection post emergency abdominal surgery. In the 'drain' group, 24% patients developed surgical site infection. In the 'no drain' group, 40% patients developed surgical site infection. Though the incidence of surgical site infection in drain group was lower than the no drain group, it was not statistically significant (p value 0.13).
Conclusion: Subcutaneous drains in emergency setting play no role in reducing the incidence of surgical site infections statistically.

Keywords: surgical site infections; emergency surgery; abdominal surgical wounds; subcutaneous drains;

INTRODUCTION

Nosocomial infections are the most common complications observed in surgical patients. Abdominal surgery is associated with the highest rates of infective complications, especially surgical site infections, because opening of the abdominal cavity causes contamination of the operative field with micro-organisms originating from endogenous sources, thus increasing the chance of developing postoperative infective complications. It is reported that without antibiotic prophylaxis, wound infection after colorectal surgery develops in approximately 40% of the patients. [1]

When surgical site infection develops, the wound is drained, cultures are obtained and antibiotics are usually started. These infections occur in abdominal surgery despite all kinds of measures and may induce wound disruption or incisional hernia, because patient discomfort and bad cosmetic result prolong hospital stay and increase cost. [2] The CDC estimates 22% of all healthcare associated infections are SSIs. A CDC estimate suggests 290,000 SSIs occur annually in United States, resulting in upto 10 billion $ medical costs directly or indirectly. Staphylococcus infections including S. aureus are the leading nosocomial pathogens accounting for over 30% isolates. Approximately 8000 patient deaths are associated with these infections. Because of increasing severity and extent of disease caused by multidrug resistant organisms, the prevention and treatment of these diseases has become a crucial part of healthcare. [3] Although use of a subcutaneous continuous drainage system has been suggested to help prevent SSI, the effects of prophylactic subcutaneous drainage are not well studied. The purpose of this study is to evaluate whether the insertion of a subcutaneous drain may contribute to reducing the incidence of surgical site infection resulting in lesser perioperative morbidity and mortality.

MATERIALS AND METHODS

We performed a Prospective consecutive 6 months interventional study of 100 subjects (50 drain group and 50 no-drain group) in Inpatient male and female emergency wards of the Department of General Surgery in a tertiary care centre. Clearance to perform the study was obtained from Institutional Ethical Committee. Over a period of six months, patients undergoing an emergency open abdominal surgery were reviewed for inclusion in the study. Patients with an indication for emergency open abdominal surgery who were above 18 years of age and willing to give consent for the study were included in the study. Patients excluded from the study were patients unwilling to give consent for the study, undergoing organ transplantation, revisional/ re-do surgeries/ re-explorations, surgeries involving prosthesis/implants (meshplasty), patients in immunosuppressive states (patients on steroids, chemotherapy, HIV positive), patients with surgical scar at same site, pregnant patients. Patients were assigned into drain and no-drain groups randomly with software from randomisation.com from a computer generated table of random numbers from the website. As it was an emergency setting, all patients were taken for surgery without any bowel preparation. Shaving was done just prior to surgery. Skin preparation was standardized using Povidone-Iodine scrub and surgical spirit. All patients received single dose inj. Ceftriaxone 1g prior to induction. The fascia and incision closure techniques were standardised. Antimicrobial prophylaxis was also standardized for all patients in drain and no drain group postoperatively. 12 F Tube suction drains (closed system) was inserted by standard stab incision near wound site and placed subcutaneously. Subcutaneous fat thickness was assessed intra-operatively with callipers prior to closure. Skin was closed with staplers. Post-operatively, inspection of wound for purulent discharge /signs of inflammation and inspection of contents of drain were done by attending surgeon till patient got discharged, with follow up for a period of 30 days. In patients with drains, drains were kept in situ till amount was less than 30 ml/ day, for a period no longer than suture removal. Discharge if any, was collected aseptically and sent for culture and sensitivity. Surgical site infection was diagnosed using clinical or microbiological criteria for superficial or deep surgical site infection as defined:

A superficial surgical site infection (SSI) is defined [1] as: Infection occurring within 30 days after the operation and infection involving only skin and subcutaneous tissue of the incision and at least one of the following:

a. Purulent drainage with or without laboratory confirmation, from the superficial incision.

b. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.

c. At least one of the following signs or symptoms of infection: pain or tenderness, localised swelling, redness, or heat.

d. Diagnosis of superficial incisional SSI made by a surgeon or attending physician.

Deep SSI: Infection occurring within 30 days of the operating procedure if no implant is left in place or within one year if the implant is in place and the infection appears to be related to the operating procedure and the infection involves deep soft tissues (fascia and muscle layers) of the incision. In addition it must meet at least one of the following:

a. Purulent discharge from deep incision but not from organ or space component of incision site.

b. A deep incision that spontaneously dehisces or is deliberately opened by the surgeon when the patient gets - fever (>38 degrees), localised pain or tenderness unless the incision is culture negative.

c. Abscess or other evidence of infection involving the deep incision is found on direct examination, reoperation, histopathology or radiological findings.

d. Diagnosis of deep SSI by surgeon or attending physician.

Using above definition, patients were followed up for a period of 30 days or earlier for diagnosis of incisional surgical site infection. Any discharge if present was sent for culture using aseptic techniques. Incidence of surgical site infection in the drain group versus the no-drain group was calculated and statistical tests of significance were applied. The number of patients who developed a surgical site infection was expressed as a percentage of the total. Incidence of surgical site infection was calculated individually in the drain and no-drain group. Statistical significance was calculated using 'Graphpad instat 3' software and applying Chi square test of significance to determine p value. P value <0.05 was taken as statistically significant. Relative risk was calculated similarly.

RESULTS

1. 32% patients developed surgical site infection post emergency abdominal surgery.
2. In the 'drain' group, 24% patients developed surgical site infection.
3. In the 'no drain' group, 40% patients developed surgical site infection.

Though the incidence of surgical site infection in drain group was lower than the no drain group, it was not statistically significant (p value 0.13). The relative risk was 0.67 with CI 0.4 to 1.1 of relative risk. The absolute reduction in risk was 16%. Number needed to treat was 6.25. [Table 1]

4. The drain and no drain groups were assessed for comparability and effect of confounding factors as follows:

- Type of surgery- Clean, Clean-contaminated, Contaminated and Dirty
- Subcutaneous thickness of fat- less than or more than 3 cm
- Type of surgical incision- midline or others

The difference between drain and no drain groups in presence of these compounding factors was not statistically significant (p value > 0.05). Thus, both groups were comparable in terms of these confounding factors known to affect outcome [Table 2].

- Type of surgery: p value >0.05 (not significant).
- Subcutaneous thickness of fat: p value 0.139 (not significant).

- Type of surgical incision: p value 0.192 (not significant).

Table I: Incidence of SSI in drain and no-drain groups

	DRAIN	NO DRAIN	TOTAL	P VALUE	RELATIVE RISK	CI OF RELATIVE RISK
SSI +	12 (24%)	20 (40%)	32 (32%)	0.13	0.67	0.4 TO 1.1
SSI -	38 (76%)	30 (60%)	68 (68%)			
TOTAL	50	50	100			

Abbreviations: SSI= Surgical site infection
CI= Confidence interval

Table II: Comparing variable confounding factors- Type of surgery, subcutaneous fat thickness and type of incision in drain and no-drain group

		Drain	No drain	Chi square value (p value)
Type of surgery based on contamination	Clean	0	0	>0.05
	Clean Contaminated	27	17	
	Contaminated	21	31	
	Dirty	2	2	
	Total	50	50	
Subcutaneous fat thickness	Subcutaneous fat thickness <3cm	36	43	0.139
	Subcutaneous fat thickness >3cm	14	07	
	Total	50	50	
Type of incision	Midline incision	38	44	0.192
	Other incision	12	06	
	Total	50	50	

p value of less than 0.05 is statistically significant and greater than 0.05 is not significant.

DISCUSSION

Surgical site infection is one of the most serious infectious complications of surgery. The occurrence is associated with a high incidence of re-operation, a long duration of hospitalization, and a large increase in the cost. In addition, patient discomfort and the inconvenience of caring for a healing open wound at home make the prevention of this complication a high priority. [4] It is generally thought that the incidence of SSI is related to amount of bacterium of the wound, formation of hematoma, pool of effusion, potential subcutaneous dead space, disturbance of the local circulation, and the amount of bacterium in the surgical organ. [5]

A subcutaneous drain might reduce the amount of bacterium around the wound and remove residual effusion and blood from the wound that could serve as a medium for bacterial growth. Many studies from India at different places have shown the SSI rate to vary from 6.09% to 38.7% [6,7,8] The incidence of SSI in our study was 32%. This is explained by the fact that our study focused on purely emergency surgeries, which are known to be more prone to developing SSIs. The infection rate in Indian hospitals is found to be higher than that in other countries; for instance in the USA, it is 2.8% and it is 2-5% in European countries. [6] The higher infection rate in Indian hospitals may be due to the poor set up of our hospitals and also due to the lack of attention towards the basic infection control measures. In a study by Satyanarayan et al, [9] the infection rate was more with emergency surgery (25.2%) when compared to elective surgery (7.6%). The high rates of infection in emergency surgeries can be attributed to inadequate pre-operative preparation, the underlying conditions which predisposed to the emergency surgery and the more frequency of contaminated or dirty wounds in emergency surgeries. [6]

In our study, insertion of subcutaneous drain had a better outcome in terms of SSI, where the drain group scored 24% and no drain group scored 40%. However this difference was not statistically significant.

A study by Baier PK et al [10] also revealed no difference in incidence of SSI post laparotomy by using subcutaneous Redon drains. A study by Kaya E. et al [11] revealed the overall incisional SSI rate was comparable between the drain (5.7%) and no-drain (9.9%) groups.

Surgical site infections pose a major preventable economic burden to the healthcare system. A retrospective review of reported surgical site infection (SSI) rates in Europe was undertaken to obtain an estimated scale of the problem and the associated economic burden. According to the study, SSIs contribute greatly to the economic costs of surgical procedures - estimated range: 1.47-19.1 billion Euro dollars. [12] In a study by Walter Webber et al. [13] the mean additional postoperative length of hospital stay was 16.8 days (95% CI, 13-20.6 days); and the mean additional in-hospital duration of antibiotic therapy was 7.4 days (95% CI, 5.1-9.6 days). The study by Bhatia et al [14] found that 50% of patients with SSI needed a change in antibiotics. The increase in cost of treatment was 3.8% among patients with mild SSI, 14.7% for moderate infections, and 29.4% among patients with severe infections. The study by Suchitra et al [15] estimated the additional cost incurred by patients who develop a SSI. The total expense (including hospital and medicine bills) by patients with SSI was significantly higher compared to patients without SSIs (29,000 vs 16,000 rupees, $p<0.001$).

In our study, subcutaneous drains cause an absolute reduction in risk for SSIs by 16%. The number needed to treat is 6.25, which means one in six patients in whom a subcutaneous drain is inserted will benefit from the drain. However, there was no statistically significant reduction following their use. In a transitional economy like India, even a small reduction in SSI by introduction of a simple cost-effective subcutaneous drain will go a long way in reducing the economic burden of SSI on healthcare. These drains are cheap, simple to insert, don’t require any special skills or technique, are not known to cause any harm to the patient and easy to remove. Though their effectiveness in preventing SSI is still a matter of debate, their use may be propagated at least in emergency setting where degree of contamination is high. However more studies are required to study the role of subcutaneous drains in emergency abdominal surgeries.

SUMMARY AND CONCLUSIONS

Surgical site infections are the most common nosocomial infections and pose a major economic burden to healthcare. Multitude of factors contribute to development of surgical site infections which can be based on surgical contamination, patient preparation, co-morbid conditions, asepsis in operating room and post-operative care and surveillance. Surgical site infections are preventable. Incidence of surgical site infections in emergency setting is high in tertiary care centres. Subcutaneous drains in emergency setting play no role in reducing the incidence of surgical site infections statistically. More studies are required to study the role of subcutaneous drains in emergency abdominal surgeries.

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