

**Original article**

**Role of subcutaneous closed vacuum drain in preventing surgical site infection in emergency surgery for perforative peritonitis: A randomized control study**

Kumar S<sup>1</sup>, Chatterjee S<sup>2</sup>, Gupta S<sup>3</sup>, Satpathy<sup>4</sup>, Chatterjee S<sup>5</sup>, Ray U<sup>6</sup>

**Abstract:**

**Objective:** The aim of our study was to evaluate whether insertion of a subcutaneous closed suction vacuum drain at incisional surgical site reduces the incidence of surgical site infection (SSI) in post operative cases of exploratory laparotomy for perforative peritonitis. **Methods:** An institutional based randomized control study was performed with two hundred patients each included in the study (with drain) and control (without drain) group. Both groups were statistically similar in terms of various variables and thus comparable. All continuous variables were reported as mean  $\pm$  SD and compared across groups using unpaired t-test. All categorical variables were reports as n (%) compared across groups using Chi-square test for independence of attributes. **Result:** Use of a subcutaneous closed suction vacuum drain results in statistically significant reduction in wound infection (58% vs 16%;  $p < 0.001$ ). The most common organism causing SSI was found to be Escherichia Coli accounting for 62.5% and 62.7% of cases in drain group and control group respectively, followed by Klebsiella (12.5% vs 24.14%). **Conclusion:** Use of a subcutaneous closed suction vacuum drain is effective in reducing SSI in contaminated surgery like that for perforative peritonitis and also leads to reduction in SSI related complications like wound disruption, patient discomfort, bad cosmesis, prolonged hospital stay, antibiotic use and increased cost.

**Keywords:** SSI; perforative peritonitis; subcutaneous closed suction vacuum drain

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**Introduction:**

Surgery for perforative peritonitis is associated with the highest rates of infective complications, especially surgical site infections (SSI). Despite all precautionary measures, SSI develops in most of such cases in view of the contamination of the operative field with microorganisms originating from

endogenous sources.

**Objectives:**

The aim of our study was to evaluate whether the insertion of a subcutaneous closed suction vacuum drain at incisional surgical site reduces the incidence of SSI in post operative cases of exploratory laparotomy for perforative peritonitis.

1. Sanjeev Kumar, Department of Surgical Oncology, Tata Memorial Hospital, Mumbai, India.
2. Souvik Chatterjee, Department of General Surgery, R. G. Kar Medical College and Hospital, Kolkata, India.
3. Shahana Gupta, Department of Surgical Gastroenterology, JIPMER, Puducherry, India.
4. Ayusman Satpathy, Department of Neurosurgery, PGIMER, Chandigarh, India.
5. Shamita Chatterjee, Department of General Surgery, Burdwan Medical College and Hospital, Burdwan, India.
6. Udipta Ray, Department of General Surgery, Medical College and Hospital, Kolkata, India.

**Correspondence to:** Dr. Souvik Chatterjee, 51A, Station Pally, P.O. – Dankuni, Dist. – Hooghly, West Bengal, India. Pin – 712311. E-mail: [dr.souvikchatterjee@gmail.com](mailto:dr.souvikchatterjee@gmail.com). Phone number: +919830455814, +913212237301

**Material and methods:**

An institutional based randomized control study was performed in the Department of Surgery, Medical College, Kolkata, India between January, 2011- December, 2013. Two hundred patients each were included both in study (with drain) and control (without drain) group. Both groups were statistically similar in terms of various variables and thus comparable (Table 1). Various parameters like age, sex, diabetes mellitus, ASA score, duration of symptoms, pre operative Hemoglobin level, serum

albumin level, intraoperative variables like site of perforation, type of surgery, duration of surgery, intraoperative hypotension & its duration and nature and output of drain effluent in the postoperative period were studied. It was evaluated whether the insertion of a subcutaneous closed suction vacuum drain at incisional surgical site reduces the incidence of SSI in post operative cases of exploratory laparotomy for perforative peritonitis. BMI was not taken as a parameter as the correct assessment of this variable was difficult in patients of perforative peritonitis owing to third space loss.

**Table 1: Distribution of various variables under study in both study and control group**

		Drain	Control		
		Mean±SD or n	Mean±SD or n	P value	Significance
<b>Age (years)</b>		39.04±18.69	36.12±16.62	0.411	Not Significant
<b>Sex</b>	<b>Female</b>	80	88	0.685	Not Significant
	<b>Male</b>	120	112		
<b>DM</b>	<b>No</b>	176	172	0.766	Not Significant
	<b>Yes</b>	24	28		
<b>ASA score</b>	<b>&lt;=2</b>	156	148	0.640	Not Significant
	<b>&gt;2</b>	44	52		
<b>Duration of symptoms</b>	<b>&lt;= 6 hrs.</b>	24	24	1.00	Not Significant
	<b>&gt;6 hrs.</b>	176	176		
<b>Pre operative Hb. (%)</b>		11.49±1.91	11.14± 1.53	0.316	Not Significant
<b>Pre operative sr. albumin</b>	<b>&lt;= 3.5 g/dl</b>	104	96	0.689	Not Significant
	<b>&gt;3.5 g/dl</b>	96	104		
<b>Site perforation of</b>	<b>Appendix</b>	48	44	0.982	Not Significant
	<b>Colon</b>	20	24		
	<b>Duodenum</b>	8	8		
	<b>Gastric</b>	60	60		
	<b>Ileal</b>	52	52		
	<b>Jejunal</b>	12	12		
<b>Type of surgery</b>	<b>Appendectomy</b>	48	44	0.931	Not Significant
	<b>Primary repair</b>	100	100		
	<b>R e s e c t i o n Anastamosis</b>	20	28		
	<b>Stoma</b>	32	28		
<b>Duration of surgery</b>	<b>&lt;= 4 hr.</b>	184	176	0.505	Not Significant
	<b>&gt;4hr.</b>	16	24		
<b>Intraoperative hypotension</b>	<b>No</b>	164	172	0.585	Not Significant
	<b>Yes</b>	36	28		

**Statistical Methods Used:**

All continuous variables were reported as mean ± SD and compared across groups using unpaired t test. All categorical variables were reports as n(%) compared across groups using Chi-square test for independence of attributes. Alpha level of 5% has been taken and hence any p value < 0.05 has been taken as significant. SPSS software version 16 has been used for the analysis.

**Ethical approval:** This study was approved by ethics committee of Medical College, Kolkata, India.

**Results:**

The average duration for which the drain was kept was 2.92 days (range: 2-8days), SD being 1.61. The total drain output for all subjects was 9240 ml with a mean of 46.2 ml per subject and SD of 52.40, (range:5-237 ml). Overall, average drain output per day was 15.82 ml/day. The drain output was purulent in 6% of patients and serous in 94% of patients. The use of a subcutaneous closed suction vacuum drain resulted in statistically significant reduction in wound infection ( 58% vs. 16%) with a p value of < 0.001.(Table 2 & Figure 1)

**Table 2: SSI in study and control group**

SSI	Group			P Value	Significance
	Drain n (%)	No Drain n (%)	Total n (%)		
No	168(84)	84(42)	252(63)	<0.001	Significant
Yes	32(16)	116(58)	148(37)		
<b>Total</b>	<b>200(100)</b>	<b>200(100)</b>	<b>400(100)</b>		

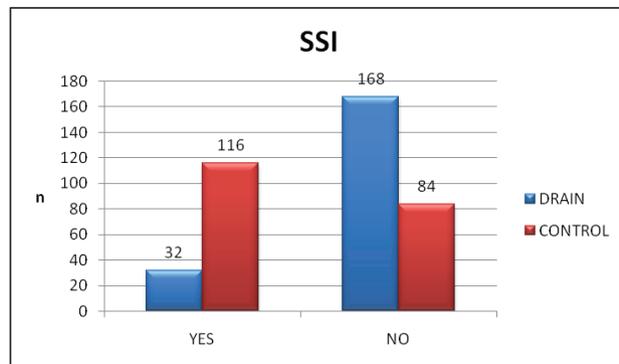


Figure 1: Bar diagram representing data of Table 2

The most common organism causing SSI was found to be Escherichia Coli accounting for 62.5% and 62.7% of cases in drain group and control group respectively, followed by Klebsiella (12.5% vs 24.14%), Staphylococcus aureus(12.5% vs 10.34%) and Candida(12.5% vs 3.45%) (Figure 2). Most of the SSIs in the control group (without drain) was managed by opening the wound up, regular

dressing and antibiotics depending on the culture and sensitivity report. This resulted in increased morbidity, hospital stay, cost and poor cosmesis in these cases. On the other hand, cases with drain who developed SSI, were easily managed without the need of opening the wound resulting in reduction in complications like wound disruption, patient discomfort, bad cosmesis & prolonged hospital stay.

**Discussion:**

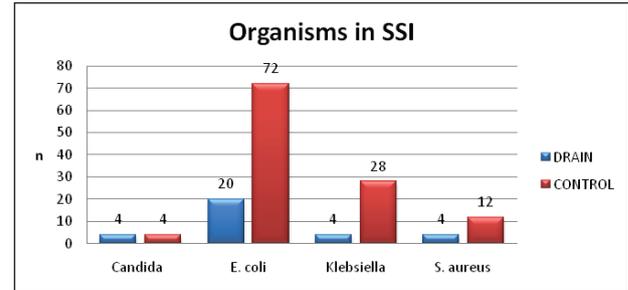


Figure 2: Bar diagram representing organisms causing SSI

SSIs have been reported to be one of the most common causes of nosocomial infections, accounting for 20% to 25% of all nosocomial infections worldwide<sup>1</sup>. They are responsible for the increased morbidity and mortality related to surgical operations as well as increased cost of treatment and continues to be a major problem<sup>2</sup>. Globally, surgical site infection rates have been reported to range from 2.5% to 41.9%<sup>3-9</sup>. In the United States, approximately 2% to 5% of the 16 million patients undergoing surgical procedures each year have postoperative surgical site infections<sup>10</sup>.

Surgery for perforative peritonitis is associated with the highest rates of infective complications, especially surgical site infections, because there is contamination of the operative field with microorganisms originating from endogenous sources, thus increasing the chance of developing postoperative infective complications. These infections occur despite all kinds of measures and may induce wound disruption, patient discomfort, prolong hospital stay, lead to a poor scar and in turn result in increased expenditure<sup>1,11</sup>.

Literature reports cite the incidence of SSI following emergency surgeries for perforative peritonitis between 20-40%<sup>10, 12-14</sup>. There are no studies on usage of subcutaneous closed suction drain in emergency laparotomies for perforative peritonitis

in the literature. However, similar studies using subcutaneous closed suction drain have been done for colorectal surgeries, caesarean delivery and other elective abdominal surgeries<sup>13, 15-21</sup>.

In a study conducted by Ahmet et. al<sup>13</sup> in colorectal surgeries, SSI rate was found to be 13.6%. They found out that insertion of subcutaneous suction drains provided effective drainage of the collection without the need of open drainage. Allaire et al.<sup>15</sup> conducted a prospective randomized study on 79 women undergoing cesarean delivery and found that the use of closed suction drainage in the subcutaneous space may reduce the incidence of wound seroma, infection and gaping.

In a cohort study, Chowdri et al.<sup>16</sup> reported reduction in seroma formation in obese patients undergoing elective cholecystectomy after using subcutaneous drain (8.8% in study group vs. 33.6% in control group). Gallup et al.<sup>17</sup> in their prospective study on 197 patients concluded that use of subcutaneous drains plus prophylactic antibiotics may decrease wound related complication rate when operating on obese gynecologic patients (20% in study group vs. 31% in control group).

Kaya et al.<sup>18</sup> in a randomised clinical trial comprising of 210 patients undergoing elective abdominal surgeries evaluated whether subcutaneous closed-suction drainage affects surgical site infection rate. The SSI rate was found to be comparable with overall rate of 7.7%. SSI rate in drain and non drain group was found to be 5.7% and 9.9% respectively. Though there was a decrease in SSI rate, it was not statistically significant ( $p=0.116$ ).

On the other hand, Hellumset. al.<sup>19</sup> in their metaanalysis suggested that prophylactic use of subcutaneous drainage did not prevent significant wound complications after cesarean delivery. A randomized controlled trial by Baier et al<sup>20</sup> on 200 patients showed that subcutaneous Redon drains do not reduce the incidence of surgical site infections after laparotomy. Al-Inany et al<sup>21</sup> carried out a prospective controlled clinical trial on 118 obese pregnant females with a body mass index  $>32$  undergoing cesarean section which showed no significant benefit in using a subcutaneous drain as a prophylactic measure against wound breakdown.

In our study, it was found that the incidence of SSI in control group without a subcutaneous suction drain was 58% where as it was 16% in the group with such drain. Thus, there was a statistically significant

( $p<0.001$ ) reduction in the incidence of SSI with the usage of subcutaneous closed suction vacuum drain.

For most surgical site infections, the source of pathogens is the endogenous flora of the patient's skin, mucous membranes, or hollow viscera. When the gastrointestinal tract is opened during an operation and is the source of pathogens, gram-negative bacilli (e.g., *E. coli*), gram-positive organisms (e.g., Enterococci), and sometimes anaerobes (e.g., *Bacillus fragilis*) are the typical SSI isolates. Exogenous sources of SSI pathogens include surgical personnel (especially members of the surgical team), the operating room environment (including air), and all tools, instruments, and materials brought to the sterile field during an operation. Exogenous flora are primarily aerobes, especially gram-positive organisms. In the study of Sahu et. al.<sup>22</sup>, most of the wound cultures showed monobacterial growth of which *Escherichia coli* (50%) followed by *Staphylococcus aureus* (20%). Studies by Classenet al.<sup>23</sup> and Giacometti et al.<sup>24</sup> reported monomicrobial and polymicrobial wound infections, respectively. In our study, the commonest source of SSI in perforative peritonitis was endogenous organisms. The most common organism isolated was *E.coli* accounting for 62.5% and 62.7% of cases in drain group and control group respectively, followed by *Klebsiella* (12.5% vs 24.14%), *Staphylococcus aureus* (12.5% vs 10.34%) and *Candida* (12.5% vs 3.45%). In all the cases, infection was monomicrobial.

There are reports in the literature suggesting that placement of drains predisposes the area to infection and prolongs hospital stay<sup>27</sup>. This may be true in clean surgeries having relatively shorter periods of hospital stay. However, it was not found to be true for perforative peritonitis surgery in our study.

Use of subcutaneous drains prevents formation of seroma and hematoma and, also, eliminates the dead-space occurring in obese patients having thick subcutaneous fat tissue<sup>28, 29</sup>. It has been shown that application of negative pressure imparts positive effects on the healing of the wound and formation of granulation tissue resulting in faster wound healing<sup>30</sup>.

### **Conclusion:**

Use of a subcutaneous closed suction vacuum drain results in statistically significant reduction in wound infection (58% vs 16%;  $p < 0.001$ ). It also results in reduction in SSI related complications like wound disruption, patient discomfort, bad cosmesis, prolong hospital stay, antibiotic use and increased cost.

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