

A Prospective Study to Determine the Efficacy of Vacuum Assisted Closure (VAC) in Preventing Surgical Site Infection following Abdominal Surgeries

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Abstract: A vacuum - assisted closure aids in bringing the margins of the laprotomy wound together, removing exudate, lowering oedema, and encouraging the growth of granulation tissue. Leading to improved patient comfort, reduce patient morbidity, and shorten the period of hospitalisation. Therefore we aim to determine the efficacy of vacuum assisted closure (vac) in preventing surgical site infection following abdominal surgeries in surgery department and to compare rates of SSI in different sociodemographic groups. Patients admitted for emergency laprotomy in the department of surgery were enrolled in the study. The patients were randomly allotted to two groups (group A and group B). In group A (n = 100), laprotomy wound closure without VAC and in group B (n = 100), laprotomy wound closure with VAC. Postoperative assessment was done as per wound dressing schedule and regular follow up post discharge from hospital. The two categories were analyzed in terms of incidence of SSI According to age (not significant), Gender (not significant), Religion (no significance), socioeconomic status (equivocal), alcohol consumption (equivocal), smoking habit (equivocal), BMI (35% Obese people developed SSI as compared to 5.1% nonobese patients), Diabetes Status (even with a closed suction drain, diabetics are more vulnerable to SSI than non - diabetics), pre op hospitalization (not significant), length of OT, (24.6% of patients who had longer operating times, only 5% of patients with short operating times experienced SSI. Despite using a suction drain, the length of OT does seem to have a major impact on how SSI is caused). Therefore the presence of diabetes, a high BMI (obesity), and the length of the surgery are predictors of higher surgical site infection when suction drains are used. The study showed that using ROMO VAC to close laprotomy wounds is a risk - free, secure, ideal replacement for conventional drain - free laprotomy wound closures.

Keywords: SSI – Surgical Site Infection, CSD – Closed suction drain, BMI – Body Mass Index, VAC – Vacuum assisted closure, SE Class – Socio Economic Class

1. Introduction

Surgical site infection (SSI) formerly known as postoperative wound infection is defined as the infection presenting till 30 days after a surgical procedure if prosthetic is not used and till 1 year if a prosthetic implant is used in the patients. Surgical site infections (SSI) are still a chief problem in surgery, because they are responsible for substantial distress in patients and additional morbidity and mortality, which also renders into a financial burden on the health system. Objective of vacuum assisted closure of an established laprotomy wound is to help in treatment of wound collection with the aim of elevating patient's comfort, decreasing patient morbidity and length of hospital stay. Abdominal closure weakens because of SSI and result in wound dehiscence and incisional hernia. 20% of all of healthcare - associated infections comprise of surgical site infections. Surgical site infection [1] can present in at least 5 percent of patients undergoing surgical procedure. A SSI may vary in presentation from a life - threatening postoperative complication to a spontaneously limited wound discharge within 7– 10 days of an operation. [5] Microorganisms from the patient's own body during a surgical procedure may cause SSI by contamination of an surgical site. It is very uncommon to encounter an SSI

following a surgery from microorganisms of outside source. (1) Despite, the amazing advances made in the field, post - op wound infection persist as a potential life threat causing delayed return to paid employment and prolonged hospital stay. . These remain a considerable issue for patients enduring procedures in spite of developments in medical care and surgical methods. SSIs lead to raised morbidity and prolonged hospital admission [7] alongside causing a decreased quality of life (QoL) and an unnecessary patient suffering [8, 9]. subcutaneous fat depth has a strong predisposition for causing SSI [18] and It is a useful predictor of SSI [19]. Many interventions have shown reduction in the incidence of SSI while gaining widespread acceptance in the Surgical community, and are seen in daily Practice; these are preoperative antibiotics, minimizing shaving, Skin preparation and Hand washing. [21–24]. There has been a decline in routine use of drains after Surgery in the recent times. Drains have failed to demonstrate any advantage after inguinal repairs, cholecystectomies, and various other types of Surgery [25]. In Some cases of inconclusive evidence and Surgeon's personal preference use of drains is Still popular. For Example abdominoperineal excision of rectum and repair of incisional hernias [26, 27]. Drains with added advantage of reducing collection in closed spaces have prompted their use in Some major plastic

Surgeries [28]. Surgical incision wounds having dead space, hematoma, serous fluid act as a culture medium and increases the chances of contracting an infection [29, 30]. Drains in Subcutaneous plane have shown a reduction in the risk of infection [31]. There is a lack of universal acceptance of Post operative Subcutaneous wound drainage. There are few cons in regular usage of Drains like discomfort and prolonged hospital admission [32].

2. Materials and Methods

This study was conducted for the period from December 2020 to August 2022. Patients admitted in various surgical wards & Casualty were enrolled in the study after fulfilling the eligibility criteria.

Inclusion criteria:

All cases admitted in various surgical wards & Casualty who underwent laparotomy.

Exclusion criteria:

- Paediatric age group
- Patient unwilling to take part in this study.
- Patients on steroids
- Exposed peri incisional blood vessels
- Malignancy surgeries
- Necrotic wound edges
- Non enteric and unexplored fistulae around the wound

Sample size - 200. The patients were randomly allotted to two groups (group A and group B). In group A (n = 100), laparotomy wound closure without VAC and in group B (n = 100), laparotomy wound closure with VAC. Postoperative assessment was done as per wound dressing schedule and regular follow up post discharge from hospital. The two categories were analysed in terms of incidence of SSI According to age, Gender, Religion, socioeconomic status, alcohol consumption, smoking habit, BMI, Diabetes Status, pre op hospitalisation, length of OT.

Statistical Analysis

Data were entered into a Microsoft Excel spreadsheet and translated into native SPSS (Statistical Package for Social Sciences) format. A maximum p - value of 0.05 was considered statistically significant.

3. Result and Analysis

The total incidence of SSI following use of closed suction drain was 11%.

Table 1: Incidence of SSI according to age?

	<45 years	>45 years	Total
SSI Absent	90	88	178
SSI Present	9	13	22
Percentage	9.1%	12.9%	11%

Pearson Chi - Square	0.730
P - value	0.393

12.9% of patients who were older and 9.1% of patients who were younger both had SSI. As seen by the P value of 0.393,

this is not significant.

Table 2: According to gender

	Male	Female	Total
SSI Absent	98	80	178
SSI Present	11	11	22
Percentage	10.1%	12.1%	11%

Pearson Chi - Square	0.202
P - value	0.653

Despite having a closed suction drain, 10.1% of MALES and 12.1% of FEMALES had SSI, and the p value of 0.653 indicates that this is not statistically significant.

Table 3: According to religion

	Hindu	Muslim	Total
SSI Absent	98	80	178
SSI Present	10	12	22
Percentage (%)	9.3%	13%	11%

Pearson Chi - Square	0.727
P - value	0.394

9.3% hindu and 13% muslim developed SSI with a p value of.394 which denotes that this not a significant finding.

Table 4: According to SE status:

	Lower	Lower Middle	Middle	Total
SSI Absent	78	59	41	178
SSI Present	6	9	7	22
Percentage (%)	7.1%	13.2%	14.6%	11%

Pearson Chi - Square	2.253
P - value	0.324

7.1% of lower, 13.2% of lower middle and 14.58% patients of middle class in Socioeconomic classification. P value is 0.324 denoting that this result is not significant.

Table 5: According to Alcohol Intake;

Alcohol	Yes	No	Total
SSI Absent	39	139	178
SSI Present	4	18	22
Percentage	9.3%	11.5%	11%

Pearson Chi - Square	0.161
P - value	0.688

9.3% of patients habituated with alcohol intake and 11.4% non alcoholic patients developed SSI. P value is.688 and thus this is not a significant finding.

Table 6: According to Smoking Habit

Smoking	Yes	No	Total
SSI Absent	52	126	178
SSI Present	5	17	22
Percentage (%)	8.8%	11.9%	11%

Pearson Chi - Square	0.404
P - value	0.525

Despite receiving suction drains, 8.77% of smokers and

11.88% of non - smokers developed SSI. P value is.5, hence this is not a significant finding.

Table 7: According to BMI

	BMI<18	BMI 18 - 25	BMI>25	Total
SSI Absent	4	148	26	178
SSI Present	0	8	14	22
Percentage (%)	0.0%	5.1%	35%	11%

Pearson Chi - Square	29.523
P - value	0.000

35% Obese people developed SSI as compared to 5.1% non-obese patients. P value though is below 0.05 stating that this is a significant difference.

Table 8: According to Diabetes Status

	Diabetic	Non Diabetic	Total
SSI Absent	36	142	178
SSI Present	10	12	22
Percentage (%)	21.7%	7.8%	11%

Pearson Chi - Square	7.038
P - value	0.008

Even after the installation of a closed suction drain, 21.7% of diabetic patients and 7.8% of non - diabetic individuals had SSI. P value is.008, which is less than.05, indicating that even with a closed suction drain, diabetics are more vulnerable to SSI than non - diabetics.

Table 9: According to Length of Pre - Op Hospitalisation:

	Pre OP<1WK	Pre OP>1 WK	Total
SSI Absent	83	95	178
SSI Present	9	13	22
Percentage (%)	9.8%	12%	11%

Pearson Chi - Square	.258
P - value	.612

Even after the insertion of a closed suction drain, 9.8% of patients with a brief preoperative hospital stay and 12% of patients with a lengthy hospital stay experienced SSI. As the p value is significantly above, this discovery is not significant.05

Table 10: According to length of OT:

	OT<2HR	OT>2HR	Total
SSI Absent	132	46	178
SSI Present	7	15	22
Percentage (%)	5.0%	24.6%	11%

Pearson Chi - Square	16.558
P - value	0

In contrast to 24.6% of patients who had longer operating times, only 5% of patients with short operating times experienced SSI. Despite using a suction drain, the length of OT does seem to have a major impact on how SSI is caused. (p - value less than 0.05)

Table 11: Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
Age	18	73	43.26	13.785
BMI	17	30	22.92	2.870

4. Discussion

Despite pre - and post - operative broad spectrum antimicrobial therapy and the use of closed suction drains at the wound site, surgical wound infection remains a significant source of morbidity and death in surgical practise (18). The immediate area around the wound must be viable for healing to proceed gradually. A wound will gather blood, bodily fluids, pus, and necrotic material if it is not permitted to drain freely, according to the evidence, which will act as a growth substrate for pathogens. Surgery wound drainage is understood to be a crucial component in accelerating the repair process.

In the study conducted by Dr. Bhushan Shah, Dr. Abhishek Kumar Singh et al from Dr. D. Y. Patil Hospital and Research Centre Pune, Maharashtra, India, on Elective Laparotomy Wounds: The Role of Closed Suction Drain in Suture Line Infection Prevention among them Age ranged from 18 to 65 years for 100 individuals undergoing various surgical procedures that were evaluated. Age extremes have been linked to greater wound infection rates, possibly due to weakened immune systems (15). In group I, the mean age of the patients was 42.78 years, whereas in group II, it was 39.92 years. In a study group of 280 individuals, Sohn et al. reported an average age of 39 years. (16) In group I, the M: F ratio was 1: 2. (MF). Males were found to have a higher rate of infection (47%) than females (31%) did. Similarly, Hernandez et al 2005. 's study in a hospital in Peru found that among patients with SSI, there were 65.6% men and 34.4% women.

In our investigation, there was no connection between gender and the propensity for SSI. But SSI rate was a meagre 10.1% and 12.1% with suction drain in situ postoperatively in males and females respectively. i. e. according to our study, females and males are equally predisposed to SSI postoperatively as the p value is way above.05 rendering this factor not significant, though the incidence of SSI appears to be much less as compared to other studies.

Obesity is the most well - known and well researched risk factor for wound complications among the risk factors for wound complications (22, 23). In their study, there was There is no discernible change in BMI between patients with and without closed suction drains. The mean in group I was 25.55±1.63 whereas it was 24.94±1.43 in group II. The most common associated risk factor in the patients with SSI in their study was Obesity. According to the criteria suggested by WHO The definitions of overweight and obesity for the Asian population were BMI 23 kg/m2 and BMI 27.5 kg/m2, respectively. The mean BMI in patients with SSI was 29.4±1.2 kg/m2 and without SSI was 28.9±0.94 kg/m2 (27). Lower BMI was associated with superior wound healing in their study, however the difference was insignificant. In contrast, Pitkin2 et al1976 's study found that obese individuals had a 29% higher rate of wound complications

than non - obese patients (4%).

In a different study by Gallup et al., obese gynaecological patients had a wound complication rate of 42.2%, compared to 0.9% in nonobese individuals (24). The mean subcutaneous fat thickness in patients with and without SSI was 35.4 ± 2.3 mm and 28.9 ± 0.84 mm. The difference was significant. Only patients with a depth of subcutaneous tissue greater than 3 cm and none with a depth of less than 3 cm reported having wound complications (< 0.001) and allowed early rehabilitation.

In our study, 35% Obese people developed SSI as compared to 5.1% non- obese patients. P value though is below.05 stating that this is a significant difference.

In a research project by Ahmet et. Al 13 during colorectal operations *i. e.* with prolong operating time, SSI rate was found to be 13.6%. They discovered that placing subcutaneous suction drains allowed for efficient collection drainage without the requirement for open drainage.

In our study, 5% of patients with brief operating times experienced SSI, compared to 24.6% of patients with lengthy operations. Despite providing a suction drain, the duration of surgery seems to have a substantial impact on the SSI's cause. (p value is way above.05)

Allaire et al. 31 conducted a prospective, randomised trial on 79 caesarean birth patients and discovered that the use of closed suction drainage in the subcutaneous space may lower wound seroma, infection, and gaping incidences. In a cohort research, Chowdri et al. 32 found that the use of subcutaneous drain decreased the occurrence of seroma in obese individuals following elective cholecystectomy (8.8% in study group versus 33.6% in control group). In their prospective analysis of 197 patients, Gallup et al. 33 came to the conclusion that the use of prophylactic antimicrobial therapy and subcutaneous drains may lower the incidence of wound - related complications when operating on obese gynecologic patients (20% in study group vs. 31% in control group). In 210 patients undergoing elective abdominal operations, Kaya et al. 18 conducted a randomised clinical experiment to determine if subcutaneous closed - suction drainage affected the rate of postoperative site infection. The rate for SSI was discovered to be similar to the total average of 7.7%. The SSI rate was found to be 5.7% and 9.9%, respectively, in the drain and non drain groups. Despite the fact that the SSI rate decreased, it was not statistically significant ($p=0.116$).

However, Hellumset et al. 29 revealed in their meta analysis that preventive use of subcutaneous drainage did not shield patients from major wound problems following caesarean delivery.

Subcutaneous Redon drains do not lower the incidence of surgical site infections after laparotomy, according to a randomised controlled experiment by Baier et al 28 on 200 patients. A prospective controlled clinical trial conducted by Al - In any et al. 30 on 118 obese pregnant women who were having caesarean sections and had a body mass index of >32 revealed no significant benefits of utilising a subcutaneous

drain as a preventative treatment against wound disintegration.

In our study, even after the insertion of a closed suction drain, 9.8% of patients with brief preoperative hospital stays experienced SSI, compared to 12% of patients with lengthy hospital stays. This finding is not significant because the p value is much higher than.05. Despite receiving suction drains, 8.77% of smokers and 11.88% of non - smokers developed SSI. P value is.5 and so this not a significant finding.

9.3% of patients habituated with alcohol intake and 11.4% non alcoholic patients developed SSI. P value is.688 and thus this is not a significant finding. 7.1% of lower, 13.2% of lower middle and 14.58% patients of middle class in socioeconomic classification. P value is.324 denoting that this result is not significant. 12.9% of patients who were older in age got SSI, compared to 9.1% of younger patients. p value is.393 stating that this is not significant.

Even after the installation of a closed suction drain, 21.7% of diabetic patients and 7.8% of non - diabetic individuals developed SSI. P value is.008 which is lower than.05, telling us that diabetics are more susceptible to SSI than non diabetics despite giving closed suction drain.

5. Conclusion

We draw the conclusion from this study that the use of a closed suction drain does not affect surgical site infection regardless of age, sex, gender, religion, socioeconomic level, consumption of alcohol and tobacco products, or length of preoperative hospitalisation.

The presence of uncontrolled diabetes pre operatively, a high BMI (obesity), and the length of the surgery (more than 2 hrs) are predictors of higher surgical site infection when suction drains are used. It was discovered that the use of ROMO VAC in closing laparotomy wounds is a risk - free, safe, preferable and excellent substitute to traditional drain free laparotomy wound closures.

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