

A Comparative Study of Indigenous Irrigation Device and Conventional Method of Surgical Wound Care for Prevention of Surgical Site Infection

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Abstract: Introduction: Since wound complications increase the morbidity of patient, the task of every surgeon is to take all possible measures to prevent SSI, especially in cases that are at higher risk for getting infected. Wound seromas, hematomas and surgical site infections are the most common complications. A number of methods have been used by surgeons from time to time to reduce these complications. Use of subcutaneous irrigation device in surgical wounds may be one method to reduce infection rates. Only a few studies are available in the literature regarding the role of subcutaneous irrigation device in the prevention of local wound complications. Aim: The aim of study will be a comparative study of Self Designed irrigation device and other conventional methods of surgical wound care for management and prevention of Skin and soft tissue infection in cases of class 3 and 4 abdominal wounds. Materials and Methods: A prospective study of contaminated surgical wound i.e., class 3 and class 4 abdominal wounds that will be admitted in Subharti Medical College and Hospital, Meerut, during the period from Oct 2018 to Sept 2020. Patients will be assessed for eligibility for the study and those who qualify the inclusion and exclusion criteria will be included in the study. Results: As compared to simple irrigation and no irrigation of the Class 3 and Class 4 abdominal wounds irrigation through the self-designed catheter significantly reduced major complications like discharge from wounds, superficial and deep wound dehiscence and better healed suture lines in follow-up. However, there was no difference in the minor complications like bruising and erythema over the suture line. Conclusion: The study is limited by a small sample size that led to a skewed distribution of some parameters amongst the groups which could have had a bias in the analysis. Additionally, the study is limited to class 3 and class 4 wounds of the abdomen only, where the subcutaneous tissue is significant. The results may be different for other sites in the body. Additional studies for the same are needed.

Keywords: Irrigation Device, Surgical Wound, Surgical Site Infection

1. Introduction

Since wound complications increase the morbidity of patient, the task of every surgeon is to take all possible measures to prevent SSI, especially in cases that are at higher risk for getting infected. Wound management is a basic practice in surgery, especially after emergency abdominal surgeries. Wound seromas, hematomas and surgical site infections are the most common complications. A number of methods have been used by surgeons from time to time to reduce these complications. Use of subcutaneous irrigation device in surgical wounds may be one method to reduce infection rates. The rationale for the use of subcutaneous irrigation device is based on the principle that removal of the collecting serum or debris in subcutaneous plane will result in lower rate of infection and wound complications. Only a few studies are available in the literature regarding the role of subcutaneous irrigation device in the prevention of local wound complications. Abdominal surgeries are routinely performed in general surgical units of our institution and the rate of infection/SSI in Class 3 and class 4 wound remains relatively high with primary closure of the skin despite all the standard infection prevention protocols being followed. When infected the

morbidity, cost of treatment and hospital stay increases. One of the simple and effective way to prevent SSI is to leave the skin open and plan for delayed primary suturing after the wound infection has subsided, however it adds to cost, anxiety and hospital stay and an added second procedure. Primary closure has high rates of infection but it gives better cosmetic outcomes and comfortable hospital stay if not infected. Wound irrigation through catheters with primary closure may be a method to achieve reduced wound infection rates. A Subcutaneous irrigation device may be used to wash this space and reduce Introduction 2 the risk of infection¹. As no such devices were available in the market thus the same was devised from locally available resources keeping the expenditure of the patient in limit. A study is needed to assess that if such a device is created, then would it be able to successfully prevent wound infection in wounds with high likelihood of infection when primarily closed and thereby reduce the overall expenditure of the patient and reduce hospital stay and improve wound related outcome or will it act as a nidus for infection to persist and further increase the incidence of SSI.

Aim

The aim of study will be a comparative study of Self Designed irrigation device and other conventional method of

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surgical wound care for management and prevention of Skin and soft tissue infection in cases of class 3 and 4 abdominal wounds.

2. Materials and Methods

A prospective study of contaminated surgical wound i.e., class 3 and class 4 abdominal wounds that were admitted in Subharti Medical College and Hospital, Meerut, during the period from Oct 2018 to Sept 2020. Patients were assessed for eligibility for the study and those who qualified the inclusion and exclusion criteria were included in the study.

The 2 intervention Groups were

Group1: - Conventional wound closure

Group2: - Self Designed Catheter introduction

The Allocated Intervention Group techniques for subcutaneous space management was as follows: **GROUP 1:** - No additional steps other than standard steps. That is after rectus closure in midline, the skin was closed directly and no intervention was done for the subcutaneous space.

Group 2: The Self Designed irrigation catheter was introduced intraoperatively inside the subcutaneous tissue through a separate incision at the inferior end of the wound and placed along the length of the wound in the subcutaneous space on either one side of the midline after rectus closure and was fixed to the skin. (Fig 1)



Figure 1: Indigenous irrigation device in subcutaneous space

This catheter was used for irrigation purpose. After this the skin was closed as described above. Post operatively the irrigation with 60-100 ml normal saline through a 20ml Syringe was started on 3rd day and was done on every alternate day till day 7 or till there is no purulent discharge. Catheter was removed when the purulent discharge was no more. (Fig:2)



Figure 2: Irrigation method through indigenous device.

Method of making the tube

A 8 Fr feeding tube was taken and multiple fenestrations at 0.5 cm distance till 20 cm mark were made with the help of 21- gauge needle. (FIG-3,4) The closed end already had large eyes and this end was sealed with ETO machine so that the irrigation could be done with some amount of pressure thereby ensuring that the irrigation fluid comes out with some amount of force. This catheter was sterilized with ethylene oxide and was stored for later use in the Operating Room. (FIG-5)



Figure 3: Material used in making of tube

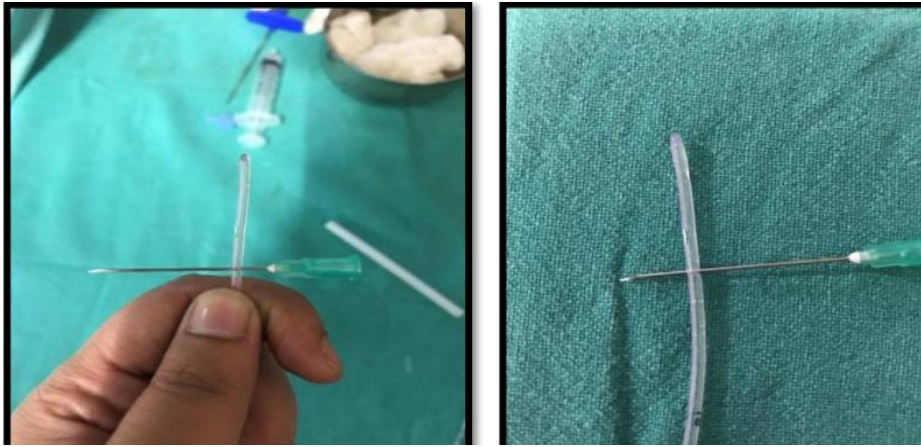


Figure 4: Methods of making multiple fenestrations in the tube by 21 G Needle



Figure 5: Final product after sterilization

3. Results

As compared to simple irrigation and no irrigation of the Class 3 and Class 4 abdominal wounds irrigation through the self-designed catheter significantly reduced major complications like discharge from wounds, superficial and deep wound dehiscence and better healed suture lines in follow-up. However, there was no difference in the minor complications like bruising and erythema over the suture line.

In our prospective study, which was conducted in the department of General Surgery at Subharti Medical College, Meerut from the period of October 2018 to September 2020. Surgical site wound care plays a vital role in post-operative management and prevention of skin & soft tissue infection. We studied various methods of wound irrigation, a especially Self-Designed irrigation catheter and compared it to simple irrigation and no irrigation as the control group.

In Group 1: - that is conventional wound closure without any sort of irrigation for wounds at high risk of SSI i.e., class 3 and class 4 wounds was made to act as a control group.

In Group 2: - After rectus closure and irrigation of the subcutaneous space with approximately 50 ml normal saline, we inserted an irrigation catheter at the depth of the wound in the subcutaneous space such that when the irrigation was done the flow from the catheter would be released in the subcutaneous space with some pressure and thus act as micro-debridement. No such catheter was available in the market.

Correlation with Age Group

Average age of patients of Group 1 and group 2 were 40.84 and 36.87 years respectively. The difference was statistically significant in group 1 & 2, and this shows that the randomization was not proper and there could be a bias in the results due to difference in the age groups of these groups.

Correlation with Diabetes

In a review done by *Ekmektzoglou et al*², it was reported that diabetes mellitus has a negative impact on wound healing. GROUP 1 (no irrigation) and GROUP 2 (irrigation with indigenous catheter): - There was significant difference seen between these groups with P Value of (0.0074).

Correlation with Hypertension

In our study, 30% of patients of both groups were hypertensive, and the P-value obtained was not statistically significant (>0.05). A study done by *Ahmed et al*³ states that wound healing of hypertensive patients requires approximately two days longer to dry than those of normotensive patients. There was no statistically significant difference between group 1 & 2. This shows that the distribution of hypertensive patients was similar and the groups were well matched for this parameter.

Correlation with Body Mass Index

Several studies postulate the mechanisms by which obesity increases wound complications. Potential factors include the intrinsic tenuous anatomic properties and poor vascularity of adipose tissue^{4,5}. In GROUP 1 with GROUP 2 (no irrigation and irrigation with indigenous catheter): P Value of 0.0387 and 0.0331 was seen in obese, overweight and underweight patients respectively, which is significant. Better results were seen with irrigation than without irrigation as it helped in less infection in surgical site and

early wound healing. It was seen that when irrigating with indigenous catheter it gave more satisfactory results in obese patients.

Correlation with Smoking

It is hypothesized that post-operative healing complication occurs significantly more often in smokers compared with non-smokers and in former smokers compared with those who never smoked in a meta-analysis conducted by *Sorensen et al.*⁶ GROUP 1(no irrigation) and GROUP 2(irrigation with indigenous catheter) :P Value was 0.0064 which is statistically significant.

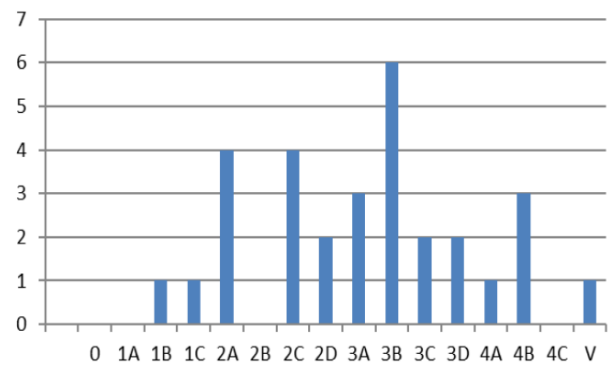
Correlation with Southampton Wound Score

In our study normal wound healing i.e. (SCORE 1) was seen in six patients (20%) of group 2 and it was not seen in any patient of other groups. In Group 1 and 3(3.3%) showed minimum bruising around the suture line (surgical site) and in group 2 four patients out of thirty patients with (13.3%) developed mild erythema on 5TH postoperative day. In Group1 there was highest incidence of non- purulent discharge. Patient had large volume non purulent discharge along the wound (soakage of 2 dressings in one day) and least in Group 2 patients with soakage of one dressing in a day.

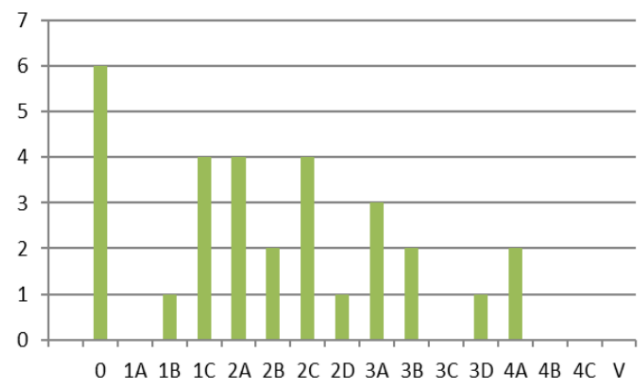
In Group 1, one out of thirty (3.3%) and Group 2 with 6.7% i.e. two out of thirty patients had pus discharge at single suture site (surgical site) i.e. less than 2cm in surface area. In Group1, three in thirty patients (10%) and in Group 2 with 0% had purulent pus discharge along the wound (>2cm).

Group 1 with one patient (3.3%) and Group 2 with 0% presented with wound infection requiring aspiration or wound exploration. Patients have highest incidence of purulent discharge which took almost 2 weeks to reduce in volume and inpatients with Self Designed indigenous catheter in situ it was noted in only two out of thirty patients which reduced in volume in one week only There were more signs of inflammation like erythema around the surgical site than other groups but it was found that incidence of seroma and hematoma formation was less in patients with Self Designed indigenous catheter in situ and patients who developed discharge were irrigated with normal saline till the purulent discharge wasnot noted. Because of less infective debris, incidence of wound dehiscence was also least in this group. Intervention was done in a greater number of patients without subcutaneous indigenous catheter than those with subcutaneous indigenous catheter. Thus, it significantly decreased the duration of hospital stay and expenses of patients.

Comparison of Group 1 and Group 2 (i.e., no irrigation and use of irrigation catheter) was done to see the role of irrigation through the catheter as compared to no irrigation. The P value was significant and it suggests that the self-designed irrigationcatheter could effectively decrease the discharge from the wound and help in normal wound healing when compared to no irrigation.(Graph 1,2)



Graph 1: Distribution of patients as per Southampton score in Group 1



Graph 2: Distribution of patients as per Southampton score in Group 3

Correlation with discharge from surgical site

Among the study population, thirty patients in ninety (33.3%) of the cases developed discharge from the surgical site and sixty patients (66.7%) of the patients did not had any discharge from surgical site.Comparison of Group 1 and Group 2 (i.e., no irrigation and use of irrigation catheter) was done to see the role of irrigation through the catheter as compared to no irrigation. The P value (0.0315) was significant and it suggests that the self-designed irrigation catheter could effectively reduce purulent wound discharge when compared to no irrigation.

Correlation with Superficial Wound Dehiscence

Comparison of Group 1 and Group 2(i.e., no irrigation and use of irrigation catheter) was done to see the role of irrigation through the catheter as compared to no irrigation. The P value (0.0421) was significant and it suggests that the self-designed irrigation catheter could effectively reduce superficial wound dehiscence when compared to no irrigation.

Correlation with Deep Wound Dehiscence

Comparison of Group 1 and Group2 (i.e., no irrigation and use of irrigation catheter) was done to see the role of irrigation through the catheter as compared to no irrigation. The P value (0.0001) was significant and it suggests that the self-designed irrigation catheter could effectively reduce deep wound dehiscence when compared to no irrigation.

Correlation with Suture Line

Comparison of Group 1 and Group 2 (i.e., no irrigation and use of irrigation catheter) was done to see the role of

irrigation through the catheter as compared to no irrigation. The P value (0.0463) was significant and it suggests that the self-designed irrigation catheter could effectively help in formation of healed suture line when compared to no irrigation

4. Conclusion

Patients undergoing emergency laparotomy often develop local wound complications. These complications were effectively reduced in our study with the use of our self-designed subcutaneous catheter that worked by letting out the collections in the wound because of the intermittent irrigation done with normal saline. As compared to simple irrigation and no irrigation of the Class 3 and Class 4 abdominal wounds irrigation through the self-designed catheter significantly reduced major complications like discharge from wounds, superficial and deep wound dehiscence and better healed suture lines in follow-up.

However, there was no difference in the minor complications like bruising and erythema over the suture line. The study is limited by a small sample size that led to a skewed distribution of some parameters amongst the groups which could have had a bias in the analysis. Additionally, the study is limited to class 3 and class 4 wounds of the abdomen only, where the subcutaneous tissue is significant. The results may be different for other sites in the body. Additional studies for the same are needed. Pressure studies with different sized apertures of catheter eyes may be done to find out the ideal catheter design for wound irrigations. Different amounts of irrigation fluid and agents for irrigation may also be studied. We recommend the use of our self-designed catheter in all Class 3 and class 4 abdominal wounds if primary closure is being planned.

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