



Original Article

A Comparative Study of Wound Healing After Primary Closure of Subcutaneous Tissue of Abdominal Incisions with Suture Material Versus Negative Suction Drain

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ABSTRACT

Background: Closure of the subcutaneous tissue plane plays an important role in wound healing, and different techniques have been proposed to reduce complications such as seroma, infection, and wound dehiscence.

Materials and Methods: This was a hospital based cross sectional analytical study conducted among Patients undergoing abdominal surgeries at Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Sangli, over a period of 18 months.

Results: In Comparison based on the Surgery, where the incidence was high among the emergency surgeries in which suture closure of subcutaneous tissue is done.

In Comparison according to Nature of the wound, all patients among suture closure of dirty wounds developed complication.

In Comparison of wounds Complication among the two groups, the lower incidence of seroma in the drain group was not statistically significant.

In Comparison based on Wound length in cm, Complication rate is around 42% among suture length of 4-7cm and it is 33% among suture length 8-11cm.

In Comparison of period required for complete wound healing with removal of all sutures, among drain group complete suture removal done within 15 days among around 95% patients.

Conclusion: The study conducted at tertiary care center to observe the results of subcutaneous suture closure group versus NSD conclude incidence of seroma formation, SSI, superficial wound dehiscence was found to be lower among drain group but the difference was not statistically significant. Wound healing is better among the NSD group.

Considering the observations, use of NSD for subcutaneous tissue closure in contaminated, dirty wounds, and in patients with comorbid conditions, reduces postoperative complications and achieves better wound healing.

Keywords: Subcutaneous tissue, abdominal incisions, suture material, negative suction drain.

INTRODUCTION

Abdominal wound closure after an incision could leave a potential dead space in subcutaneous tissue which needs to be closed before closing skin incision. It is important to close this space as the collections (hematoma, seroma) after primary closure is causative element of wound complication⁽¹⁾ There is an increased risk of incisional hernia, delayed wound healing, increased morbidity by the discomfort due to the infection of subcutaneous collection⁽²⁾. There is no ideal method of closing this space and preventing the complications. Negative suction drain (NSD) is routinely used in closing wounds with large dead space. Some studies have confirmed that, in emergency surgeries NSD helps in reducing the complications

⁽³⁾. Closure of skin is directly done in lean patients. In obese patients, where subcutaneous tissue is more subcutaneous plane closure done either with absorbable suture or direct skin closure with deep sutures. Subcutaneous tissue plane closure (STPC) with suture cause good approximation of this plane, decreasing the dead space and ultimately the complications. In this study, we will observe the outcome of STPC done either with suture material or by closure using a NSD in this plane.

MATERIALS AND METHODS

Design:

This study was a hospital based cross sectional analytical study, which was conducted at Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Sangli, over a period of 18 months. After the written and informed consent from the patients, they were taken in this study

Participants:

Total 91 patients operated for abdominal surgeries have been taken in our study. Out of which 44 patients received drain and 47 patients were in suture closure of subcutaneous tissue group.

Patients with hemoglobin (Hb) level less than 11 in females and less than 12 in males were considered anemic in our study. Patients were selected with the following inclusion and exclusion criteria. Inclusion criteria comprise, Patients operated for abdominal surgeries, vertical / Transverse abdominal incisions of more than 4cm size, elective/ Emergency laparotomy wounds, all Patients of age group 20-60 years. Exclusion criteria comprise, inguinal hernia repair.

Study procedure:

After the written and informed consent from the patients, they were taken in this study. Those patients operated with abdominal wound size more than 4 cm size were included in the study. Patients with hemoglobin (Hb) level less than 11 in females and less than 12 in males were considered anemic in our study. All patients with known history of diabetes and those newly diagnosed in present admission have also been included in diabetic group in our study. Patients with albumin levels less than 3.0 taken as hypoproteinemia group. All patients with any previous abdominal surgeries have been grouped under previous surgery. Pre-operative surgical site preparation was done with povidone iodine in all cases. Pre-operative antibiotic prophylaxis given half an hour earlier to incision as per the institutional antibiotic policy. Abdominal wound closure, in laparotomy cases was done either by using closed suction drain or subcutaneous tissue with absorbable suture material in all patients included in the study. The type of closure is made according to the requirement by the patients decided by the operating surgeon. In our study patient group with suture closure of subcutaneous tissue was done with absorbable suture size and material of suture material being decided by the operating surgeon mostly polyglactide was the material used. Different size of drain was used in patients of group with drain closure depending on the length of the incision and thickness of subcutaneous fat decided by the operating surgeon. During immediate post-operative day (POD), these patients were observed from POD 1 for any complications, that include subcutaneous wound gaping, seroma formation, infection. As soon as complications are seen, necessary action has been taken. During post-operative period soaking of dressing was alarming sign of collection in the subcutaneous tissue. Seroma was drained by milking the suture line or by removing one or two skin sutures as required. During post-operative dressing suture line examined for any signs of inflammation. Culture swabs were sent to assess the surgical site infection (SSI) in all cases as needed. In patients with drain placed, drain site infection was also considered under SSI. Antibiotic treatment given as per the culture report. Patients who had subcutaneous wound dehiscence were treated by secondary suturing or left open to heal by secondary intention depending on the size of dehiscence. Removal of drain was done when the collection was less than 5ml or in cases where negative suction was not maintained due to dehiscence of suture line. In our study complete wound healing was considered after removal of all sutures. In cases with wound dehiscence dressing was done and after granulation tissue was found secondary suturing was done. In these cases, complete healing was considered after removal of all sutures including the secondary suturing.

Data analysis:

The data collected during the study period was noted and analyzed using Z - test with the help of statistician.

CLINICAL PHOTOGRAPHS



Image 1: Suture line of a ventral hernia repair closure done with subcutaneous suture.



Image 2: Closure of skin suture done with subcutaneous drain in a case of ventral hernia repair



Image 3: Laprotomy with colostomy skin closure done with a subcutaneous drain



Image 4: Laprotomy with colostomy skin approximation after closure of subcutaneous tissue with suture.



Image 5 : Suture line of open cholecystectomy closure done with subcutaneous drain



Image 6 : healthy healed suture line of the patient in image5



Image 7: suture line of laparotomy patient with superficial wound dehiscence



Image 8 : closure of laparotomy incision with subcutaneous drain.



Fig 9: Operated case of abdominoplasty closure done with subcutaneous drain.



Fig 10: Post operatively gaping of suture line observed.



Image 11: placing NSD in subcutaneous plane in a case of ventral hernia repair



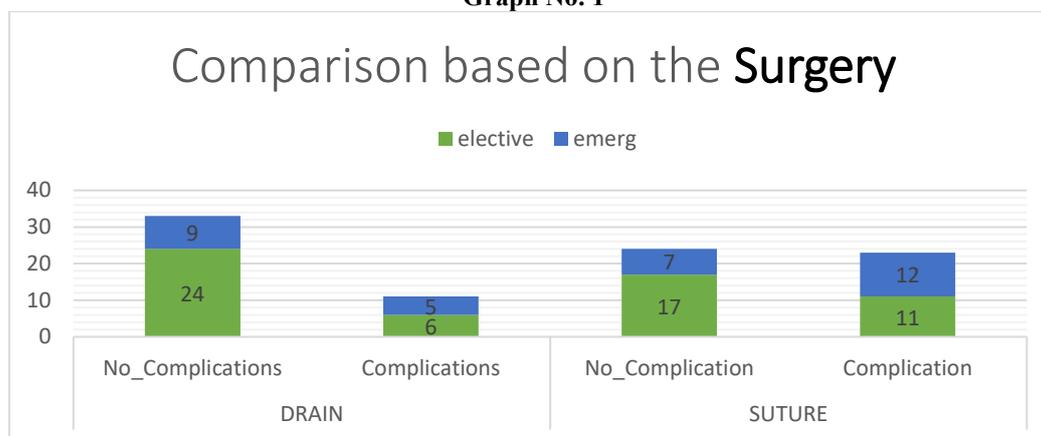
Fig 12: Suture line closed with drain

RESULTS

Table No. 1: Comparison based on the Surgery

DRAIN				SUTURE			
Surgery Type	No Complications	Complications	Grand Total	Surgery Type	No Complication	Complication	Grand Total
Elective	24	6	30	elective	17	11	28
Emergency	9	5	14	emergency	7	12	19
Grand Total	33	11	44	Grand Total	24	23	47

Graph No. 1

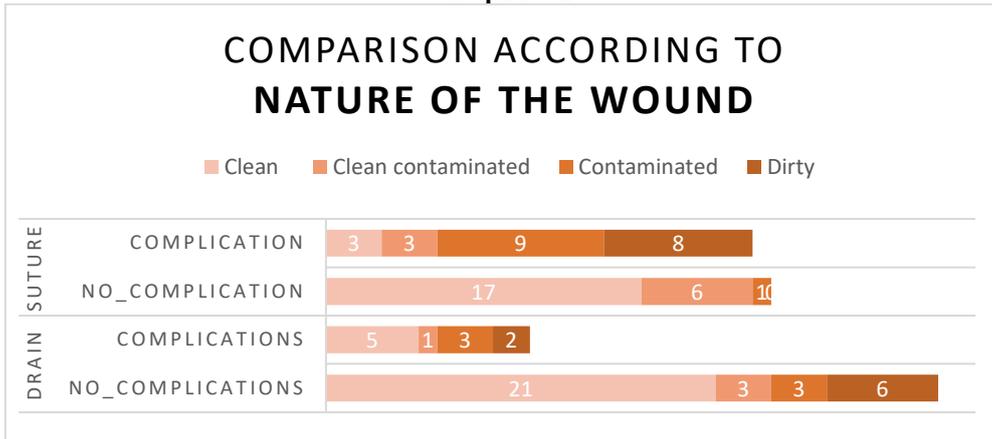


Majority cases were operated electively in our study. Incidence of complication is high among patients operated in emergency than elective operated patients. Drain placement in subcutaneous tissue for closure is preferred during elective surgeries. Whereas in emergencies closure is done using suture material. Overall Incidence of complication is observed to be low among the elective cases in whom drain closure of subcutaneous tissue was done, where the incidence was high among the emergency surgeries in which suture closure of subcutaneous tissue is done.

Table No. 2: Comparison according to Nature of the wound

DRAIN (Percentage)				SUTURE(Percentage)			
Nature of the Wound	No Complication	Complication	Grand Total	Nature of the Wound	No Complication	Complication	Grand Total
Clean	21	5	26	Clean	17	3	20
Clean contaminated	3	1	4	Clean contaminated	6	3	9
Contaminated	3	3	6	Contaminated	1	9	10
Dirty	6	2	8	Dirty	0	8	8
Grand Total	33	11	44	Grand Total	24	23	47

Graph No.2



Among clean cases, in our study most patients had drain closure of subcutaneous tissue. Majority of clean cases in our study were hernioplasty. Due to major subcutaneous tissue dissection drain placement preferred. In clean contaminated and contaminated cases most patients had suture closure of subcutaneous tissue. All patients among suture closure of dirty wounds developed complication.

Table No. 3: Comparison of wounds Complication among the two groups

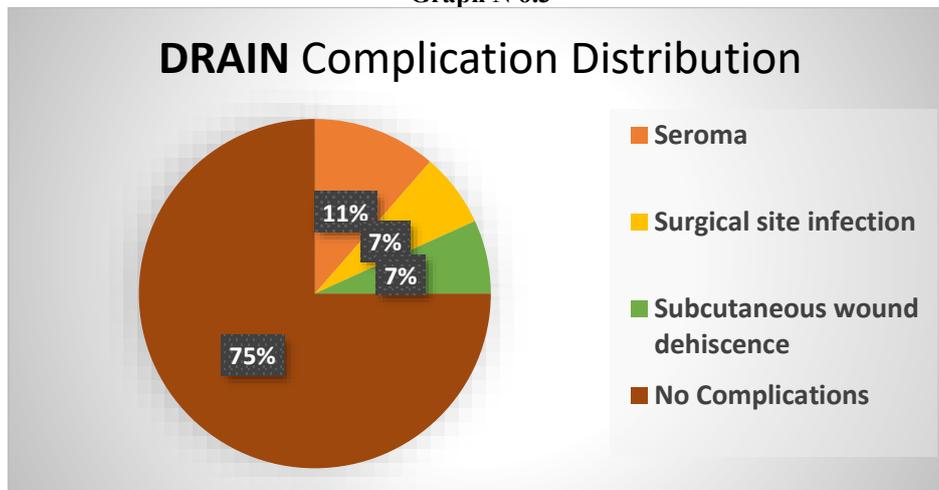
Complications	Drain	Suture
Seroma	5	9
Surgical site infection	3	8
Subcutaneous wound dehiscence	3	6
No Complication	33	24
Total	47	47

Seroma was observed in 14 patients included in our study. Out of which, 9 patients had subcutaneous tissue closed with suture material and 5 patients had drain in the subcutaneous tissue. The lower incidence of seroma in the drain group was not statistically significant.

Incidence of SSI was found in 11 patients in our study. Among the patients who had suture closure of the subcutaneous tissue 8 patients had SSI, whereas among the drain closure group 3 patients had SSI.

Superficial gaping was observed in 9 patients out of 91 patients in our study. Out of 44 patients with drain closure 3 patients had wound dehiscence and 6 among 47 patients with suture closure of subcutaneous tissue had superficial wound gaping.

Graph N o.3



Graph No. 3

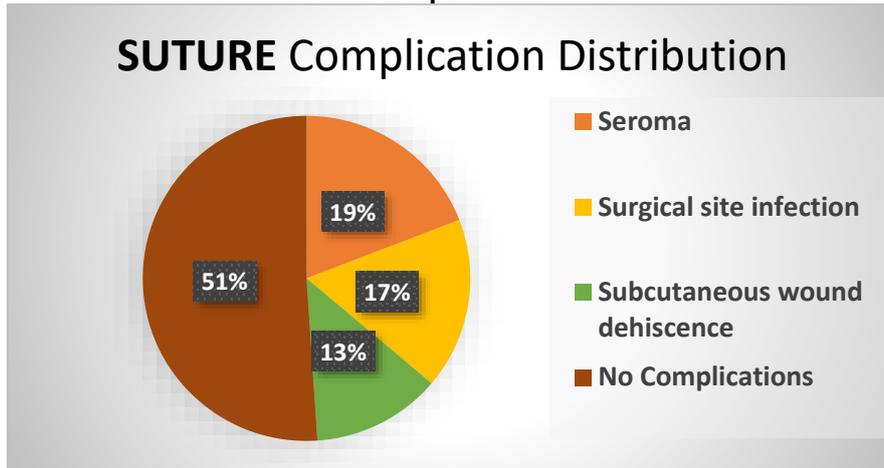
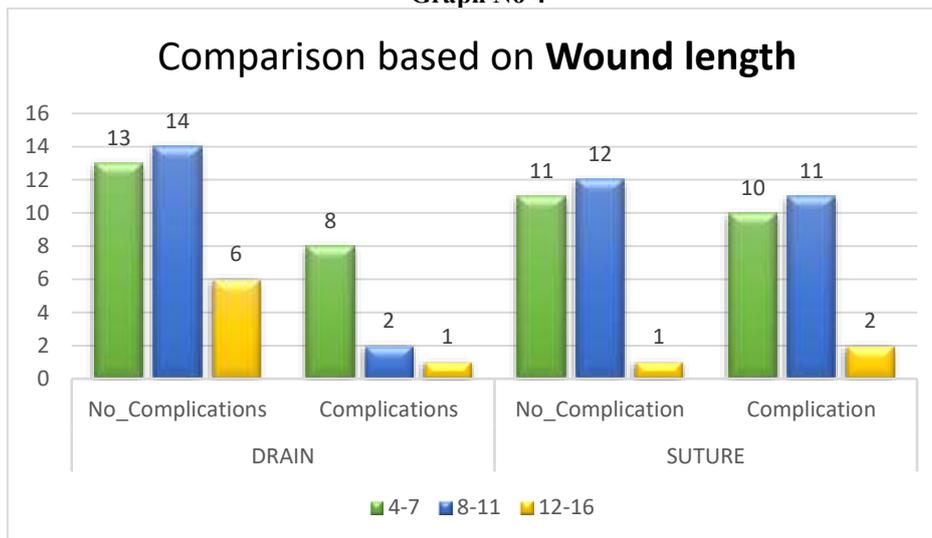


Table No. 4: Comparison based on Wound length in cm

DRAIN				SUTURE			
Length of the wound (cm)	No Complication	Complication	Grand Total	Length of the wound (cm)	No Complication	Complication	Grand Total
4-7	13	8	21	4-7	11	10	21
8-11	14	2	16	8-11	12	11	23
12-16	6	1	7	12-16	1	2	3
Grand Total	33	11	44	Grand Total	24	23	47

Graph No 4

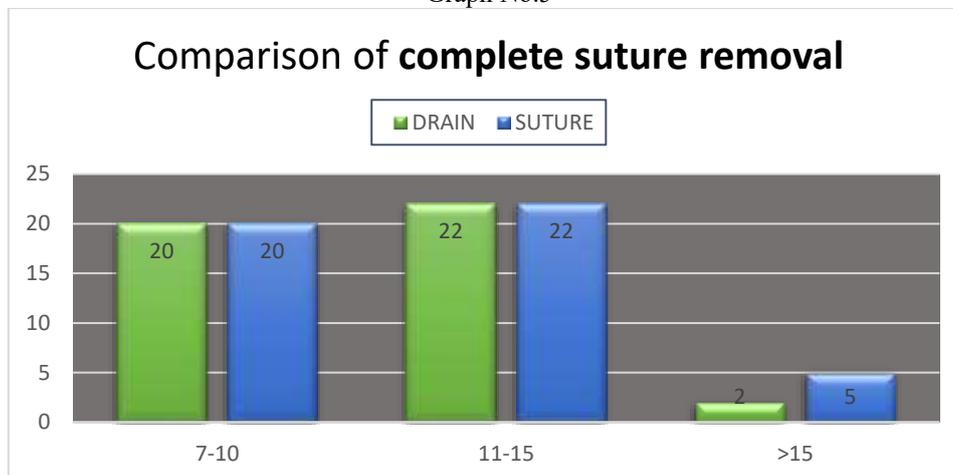


Suture length of majority patients in our study is between 4-7 cm. majority of patients with suture length 8-11cm had subcutaneous tissue closure done with suture material. Complication rate is around 42% among suture length of 4-7cm and it is 33% among suture length 8-11cm.

Table No. 5: Comparison of period required for complete wound healing with removal of all sutures

Post-Operative Days	DRAIN	SUTURE
7-10	20	20
11-15	22	22
>15	2	5
Grand Total	44	47

Graph No.5



Majority patients in our study had suture removal done between 11-15 days' postoperative period. Among suture closure of subcutaneous tissue group less than 90% patients had complete suture removal done before 15 days' postoperative period. Among drain group complete suture removal done within 15 days among around 95% patients.

DISCUSSION

Junaid et al⁽⁴⁾ in their research to find role of negative suction subcutaneous drains in contaminated abdominal surgeries found incidence of SSI to be 15.3% among drain group and 30% among patients with no drain. The decrease in incidence of SSI among the drain group was found to be statistically significant ($P=0.002$). They concluded that drain was effective in preventing SSI. Khan et al⁽⁵⁾ showed incidence of SSI to be 12% among patients with drain closure of subcutaneous tissue and 30% among patients with suture closure. The difference was found to be significant reduction of SSI among drain group.

In our study the incidence of SSI was total 12% among all cases. On comparing drain and suture group incidence of SSI was found 6% in drain group and 17% in suture group. There is low incidence of SSI among the drain group. But this difference was found not significant statistically.

Junaid et al in their research to find role of negative suction subcutaneous drains in contaminated abdominal surgeries found incidence of seroma was 14.7% among drain group and 50% among patients with no drain. The decrease in incidence of seroma among the drain group was found to be statistically significant ($P<0.001$). Khan et al showed incidence of seroma to be 16% among patients with drain closure of subcutaneous tissue and 42% among patients with suture closure. It was found that there was significant reduction of seroma among drain group.

In our study there was 15% incidence of seroma among all the patients. During the comparison among the two groups the incidence was found to be 11% in the drain group and 19% in suture closure group. The overall incidence of seroma was low among the drain group. Subcutaneous collection is drained through NSD in the drain group. Among these patients the cause of formation of seroma could be faulty drain. The difference in incidence of seroma was found not statistically significant.

Junaid et al in their research to find role of negative suction subcutaneous drains in contaminated abdominal surgeries found incidence of subcutaneous wound dehiscence was 12% among drain group and 45.3% in patients with no drain. The decrease in incidence of wound dehiscence among the drain group was found to be statistically significant ($P<0.001$). Khan et al showed incidence of wound dehiscence to be 14% in patients with drain closure of subcutaneous tissue and 42% among patients with suture closure. It was found that there was significant lower incidence of wound dehiscence among drain group.

In this study there was 9% wound dehiscence among all the patients. During the comparison among the two groups the incidence was found to be 6% in the drain group and 12% in suture closure group. The overall incidence of wound

dehiscence was low among the drain group. Wound dehiscence causes failure of the suction and the drain. The difference in incidence of wound dehiscence was found statistically not significant.

Some studies have been done in knowing the role of subcutaneous drain in specific group of population like obese patients or patients with high subcutaneous fat thickness.

Fujii et al.⁽⁶⁾ in their study used subcutaneous drain for preventing SSI among patients who are at high risk to develop infection of incision following colorectal surgery. Observations noted includes 27.8% of incidence of SSI in all patients included in the study. Incidence of SSI was 38.6% and 14.3% in groups without and with drain respectively. The difference in incidence was statistically found significant and so infers that subcutaneous drain usage has effect in preventing SSI in patient with thick subcutaneous fat.

Chowdri et al.⁽⁷⁾ study conducted for two and half year among obese patients operated for elective open cholecystectomy. Patients were randomized for subcutaneous closure with drain or suture. Observations found complication rate to be 4% in drain group and 19 % in suture group. Infection was reported 8% in suture group and 0% among drain group. Wound dehiscence reported 4% and 15% among drain and suture group accordingly. No seroma was noted in drain group whereas it's 8% among suture group. Recommended routine uses of drain among obese patients undergoing elective abdominal surgeries.

In our study patients were grouped and analyzed based on their BMI as underweight, normal, overweight, obese. Our observation found the incidence of complications 33% among obese patients. 25 % among the drain group and 60% among the suture closure group. There is an overall decrease in incidence of complications in obese patients by usage of drain but the difference is not statistically significant ($p=0.14$) and require further study to confirm the significance. Among the overweight patient's complication rate found to be 33% among which 40% in drain and 66% in suture group. There is no significant difference between the two group ($p=0.07$)

Jun watanabe et al.⁽⁸⁾ studied 240 patients for over 2 year. 112 patients were treated with subcutaneous drain and no drain among others. Overall SSI rate was 8.7%, which was observed to be 4.5 among subcutaneous drain group and 12.8% in the control group. Overall incidence of SSI was significantly reduced ($P=0.025$) in subcutaneous drain group as compared to control group. Results conclude that use of subcutaneous drain is beneficial in preventing SSI in patients undergoing colorectal surgery.

Gupta p et al.⁽⁹⁾ in their study of subcutaneous wound drain efficacy in reducing SSI in emergency laparotomies. Study duration was 30 days which included 50 patients in drain group and 50 in non-drain group. Overall infection rate was found to be 37%. 24% in drain group and 50% in no drain group were the respective infection rates noted. The decrease in incidence of SSI was found statistically significant and so the use of drain was found to be beneficial in reducing SSI in emergency setting

Kavya et al.⁽¹⁰⁾ in their Randomised Control Trial (RCT) included 210 patients operated for elective abdominal surgeries to evaluate the effect of subcutaneous closed suction drainage on SSI rate. Overall SSI rate was 7.7%. It was found to be 5.7% and 9.9% among drain and no drain group accordingly. There was decrease in incidence of SSI among the drain group but that was found not significant statistically and so concludes that NSD in subcutaneous tissue was not effective in preventing SSI among elective abdominal surgeries.

Total of 58 patients operated elective abdominal surgeries and 33 cases operated in emergency were included in our study. Among elective surgeries 30 patients received drain closure while the rest had suture closure of subcutaneous tissue. In the emergency group there were 19 and 14 patients with suture closure and drain closure accordingly.

In Elective cases in our study overall incidence of complication was found 29%. Which is 20% among the drain group and 39% among the suture group. The decrease in incidence when analysed was found not significant statistically ($P=0.416$). In emergency operated cases incidence of complication was found 51%. 63% complication rate was found in suture group and 35% among the drain group. There was decrease in incidence of complication among drain group in emergency which was found not significant statistically ($p=0.171$).

In our study we observed that use of drain has no significant effect in reducing incidence of complication either in elective surgery or emergency.

CONCLUSION

The study conducted at tertiary care center to observe the results of subcutaneous suture closure group versus NSD conclude incidence of seroma formation, SSI, superficial wound dehiscence was found to be lower among drain group but the difference was not statistically significant. Wound healing is better among the NSD group Considering the observations,

use of NSD for subcutaneous tissue closure in contaminated, dirty wounds, and in patients with comorbid conditions, reduces postoperative complications and achieves better wound healing.

REFERENCES

1. Hyunsuk Suh, , A-Young Lee, , Eun Jung Park, and Joon Pio Hong. Negative pressure wound therapy on closed surgical wounds with dead space animal study using a swine model. *Annals of Plastic Surgery* 2016; 76(6): 717-722.
2. Murray, B.W., Cipher, D.J., Pham, T. and Anthony, T. The Impact of Surgical Site Infection on the Development of Incisional Hernia and Small Bowel Obstruction in Colorectal Surgery. *The American Journal of Surgery* 2011; 202(5):558-560. Available on <http://dx.doi.org/10.1016/j.amjsurg.2011.06.014> viewed on 20.09.2018.
3. Sumi, Y., Kimihiro Yamashita, Kiyonori Kanemitsu, Shingo Kanaji, Masashi Yamamoto, Tatsuya Imanishi *et al.* Effects of Subcutaneous Closed Suction Drain for the Prevention of Incisional SSI in Patients with Colorectal Perforation. *Surgical Science* 2014, 5 (3), 122-127. Available on <http://dx.doi.org/10.4236/ss.2014.53022> viewed on 20.09.2018
4. Junaid S, Brown DJ, Redstone JS, Scarpinato VM, Chatterji S, Gupta S, Effect of subcutaneous drain placement, *International journal of surgery*,2012;24(7);78-85
5. Khan A, Fazal Qadir Parray, Mushtaq Ahmad Gagloo, Complication with use of subcutaneous drain, *Bangladesh journal of surgery*,2002;15(3);58-62.
6. Takaaki Fujii, Yuichi Tabe, Reina Yajima, Satoru, Yamaguchi, Soichi, Tsutsumi *et al* Effects of subcutaneous drain for the prevention of incisional SSI in high-risk patients undergoing colorectal surgery, *International journal of colorectal disease*, 2011 Sep;26(9):1151-5
7. Chowdri Nisar Ahmad, Syed Asrar Ahmed qadri, Fazal Qadir Parray, Mushtaq Ahmad Gagloo, Role of subcutaneous drain in obese patients undergoing elective cholecystectomy: A cohort study,*international journal of surgery*,7(5),404-407
8. Jun wattanabi, , Mitsuyoshi Ota, Makoto Kawamoto, Yago Akikazu, Yusuke Suwa, Hirokazu Suwa *et al* A randomized controlled trial of subcutaneous closed-suction Blake drains for the prevention of incisional surgical site infection after colorectal surgery, *international journal of colorectal disease*, 2017 Mar;32(3):391-398.
9. Gupta Poonam, Rajesh kumar, Role of subcutaneous suction drain in reducing surgical site infection in emergency laparotomies, *international surgery journal*, Aug 4(8),2717-2720.
10. Kaya E, Paksoy E, Ozturk E, Sigirli D, Bilgel H. Subcutaneous closed-suction drainage does not affect surgical site infection rate following elective abdominal operations: a prospective randomized clinical trial. *ActaChir Belg.* 2010 ; 110(4):457-62.