

Abdominal wound closure: small bites vs large bites: A study to compare incidence of wound complications

Ashok Kumar, Sumitroj Singh, Aswathy GS

Abstract

Objective: To compare the incidence of wound complications in large bite and small bite suturing techniques in midline laparotomy.

Study design: Prospective randomized controlled trial

Place and duration of study: Government Medical College, Amritsar between January, 2020 and October, 2021.

Material and Methods: The study was conducted on 50 patients who underwent midline laparotomy. Group-A included 25 patients in whom wound closure was done with large bites. Group-B included 25 patients in whom the closure was done with small bites. Follow up was done for 6-months to observe any complications.

Results: No statistically significant difference was observed between the small bite group and large bite group in terms of the demographic variables of the patients like age and sex, type of surgery, wound length, suture length used or the suture length : wound length ratio. In both the groups, it was possible to achieve a ratio of at least 4 in all the patients. No statistically significant difference was observed in terms of duration of hospital stay also. In the small bite group, 28% patients (7 out of 25 patients) and in the large bite group, 52% patients (13 out of 25 patients) developed SSI. In the small bite group, 8% patients (2 out of 25 patients) and in the large bite group, 12% patients (3 out of 25 patients) developed wound dehiscence. In the small bite group, 16% patients (4 out of 25 patients) and in the large bite group, 20% patients (5 out of 25 patients) developed incisional hernia. Although it did not reach statistical significance, it was observed that the incidence of SSI, wound dehiscence and incisional hernia in midline laparotomies can be reduced by implementing the small stitch method.

Conclusion: Small bite technique of wound closure is better for prevention of wound complications in a midline laparotomy.

Keywords: Midline laparotomy, large bite, small bite, surgical site infection, wound dehiscence, incisional hernia.

Introduction:

Recently, minimally invasive techniques are preferred for abdominal surgery. But in major surgeries and in emergency conditions, midline incision is still commonly used. It gives enough access to the abdominal cavity with minimal damage to the neurovascular structures of the abdominal wall. It is quick and can be extended also.¹

The main wound complications after midline laparotomy are surgical site infection (SSI), wound dehiscence and incisional hernia. Incisional hernia is seen as a long term complication in patients who had developed SSI and wound dehiscence. These affect the recovery course of the patients, reduce their quality of life and increase the cost of the health care.²

The rate of SSI in abdominal surgery is around

Received

date: 10th November, 2021

Accepted

date: 7th July, 2022

Government Medical College, Amritsar

A Kumar

S Singh

Aswathy GS

Correspondence:

Dr. Aswathy G S

Junior Resident,

Department of General

Surgery, Government

Medical College, Amritsar.

Girls Hostel, NRI Block,

Government Medical

College Campus, Amritsar,

Punjab, 143001

Aswathy, PRA-

224, Near RIMS,

Government College

Road, Nedumangadu,

Thiruvananthapuram,

Kerala. 695541

Ph No: 8281655136

E mail: aswathynair.93@

gmail.com

15% to 25% depending on the level of contamination.³ Wound dehiscence is observed within 7 to 10 days post-operatively. It occurs in 0.2% to 6% of midline incisions. It is associated with more serious conditions like burst abdomen and mortality in the range of 9% to 50%.⁴

The incidence of incisional hernias about 11% to 20%. Long term studies report that even after mesh repair, there is high recurrence rate (32%) and re-operation rate (11%).⁵

The patient factors responsible for the complications are: increasing age, long standing illness, anemia, high body mass index, cancer, immuno-suppressive conditions and increased intra-abdominal pressure. The surgical factors include the type of incision, suture material used and the method of closure of wound. These can be modified to reduce the incidence of wound complications.⁶

The conventional practice is to place large stitches more than 10 mm from the wound edge and from the previous stitch. The large stitches include more amount of necrotic tissue within and they cut through the soft tissues. Slowly, the stitch gets slacken, wound edges separate and incisional hernia is developed.⁷

Jenkins proposed that the suture length to wound length ratio (SL: WL) for abdominal fascial closure should be atleast 4:1 to prevent wound complications particularly incisional hernia. The incidence of incisional hernia was more when the abdomen is closed with a ratio less than 4:1.⁸

For the surgeon, the closure technique should be easy and quick. At the same time there should not be any tension or ischemia in the wound. Recent studies show that an adequate ratio should be achieved by placing small stitches (5mm from wound edge and from previous bite) in the aponeurosis. The small bite suture technique using continuous slowly absorbable material reduces wound complications. This method is according to the European Hernia Society guidelines.^{9,10}

This study attempted to compare the incidence of wound complications in midline laparotomy wounds which were closed with the large bite technique and the small bite technique.

Material and Methods:

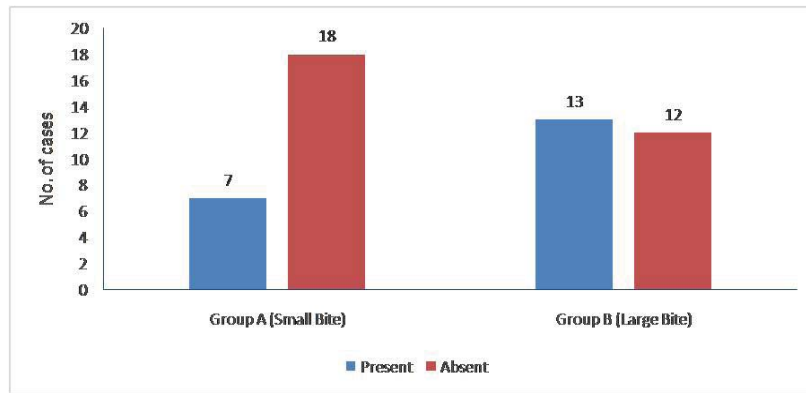
The present study was conducted in the Department of General Surgery, Government Medical College, Amritsar on 50 patients undergoing midline laparotomy (both elective and emergency cases included) during the period from January 2020 till October 2021. The patients were randomly allocated into group A and B. Group A had 25-patients in whom midline wound closure was done with large bites. Group-B had 25-patients in whom closure was done with small bites. The inclusion criteria were the patients who underwent midline laparotomy (both emergency and elective basis) and those patients who provided a valid written informed consent. The exclusion criteria were those who had a history of incisional hernia, Surgical Site Infection or wound dehiscence in the past, those who had a previous history of midline abdominal incision, those who underwent laparotomy where incision was not given in the midline and pregnancy.

Midline abdominal closure was done using PDS II 2-0 Round Body (needle 36mm, length 70cm, synthetic, slowly absorbable, loop, monofilament) suture (Ethicon, Somerville, NJ, USA). Continuous suture technique was used and the stitches were placed in the aponeurosis only. The closure started at one end of the incision. An anchoring knot was done just proximal to the incision. In group-A, the suture was done taking 1cm bite from the wound edge and 1cm inter-suture distance and is advanced to the other end of the incision. A standard self-locking knot with at least 6 throws was performed at the end. Remaining suture was cut at the knot. The length of saved sutures was measured and subtracted from 70 which gave the amount of the suture used (Suture length). Length of the incision was measured using a sterile scale (Wound Length). This same technique was repeated in group-B with 0.5cm bite from the wound edge and 0.5cm inter-suture distance. A Suture Length: Wound

Table 1: Occurrence of surgical site infection

Group	Occurrence of surgical site infection (SSI)				Total	
	Present		Absent			
	No.	%	No.	%		
Group A (Small Bite)	7	28.00	18	72.00	25	100.00
Group B (Large Bite)	13	52.00	12	48.00	25	100.00
Total	20	40.00	30	60.00	50	100.00

$\chi^2: 3.00; p=0.082$

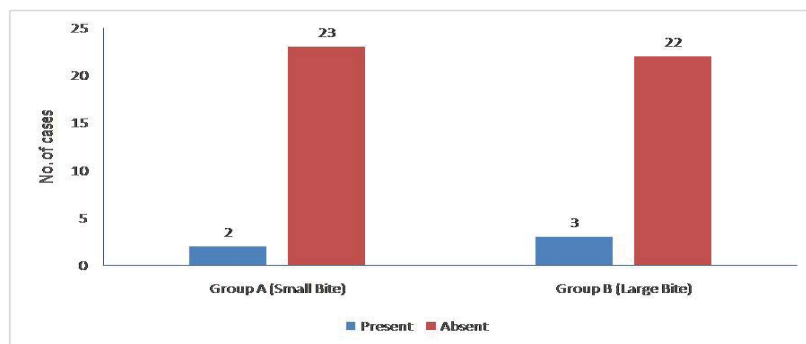


Graph 1: Occurrence of surgical site infection

Table 2: Occurrence of wound dehiscence

Group	Occurrence of wound dehiscence				Total	
	Present		Absent			
	No.	%	No.	%		
Group A (Small Bite)	2	8.00	23	92.00	25	100.00
Group B (Large Bite)	3	12.00	22	88.00	25	100.00
Total	5	10.00	45	90.00	50	100.00

$\chi^2: 0.222; p=0.637$



Graph 2: Occurrence of wound dehiscence

Length ratio of at least 4 was maintained in all cases.

Post-operatively patients were observed for any complications throughout the hospital stay, and then at 1 month, 2 months, 4 months and

6 months both clinically and with ultrasonography. The complications studied were surgical site infection, wound dehiscence and incisional hernia.

Surgical site infection was defined as purulent discharge from the wound, irrespective of the presence of positive bacteriological cultures. Surgical wound dehiscence was the separation of the margins of a closed surgical incision that has been made in skin, with or without exposure or protrusion of underlying tissue, organs or implants. The definition of incisional hernia by the European Hernia Society was used. Any abdominal wall gap with or without bulge in the area of a post-operative scar perceptible or palpable by clinical examination or imaging. Patients were examined in both supine position and standing. If there was a wound edge separation of 12mm or more as detected by ultrasound abdomen, then it was also considered as incisional hernia. The duration of hospital stay was also recorded.

IBM SPSS statistics version. 21.0 software (IBM Corporation, Armonk, NY, USA) was used for data analysis. The numerical variables were stated as mean \pm standard deviation (SD) values for non-normal distribution. Independent samples t-test was used to determine the differences between groups of continuous variables. Correlations between variables were examined with chi square test. A p-value of <0.05 was accepted as statistically significant.

Approval for the study was granted by the Faculty of Medical Sciences, Baba Farid University of Health Sciences (Letter No: BFUHS/2K21p-TH/5597 dated 28/04/2021).

Results:

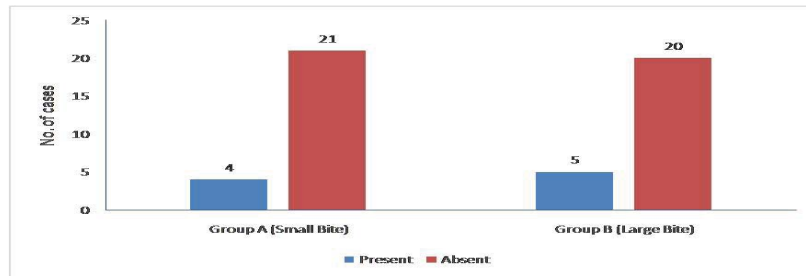
The mean age of the Group A was 41.96 years with standard deviation of 14.63 years and that of group-B was 38.52 years with standard deviation of 13.56 years. No statistically significant difference was found in the age distribution between the two groups (p value= 0.393).

Group-A had 19 males and 6 females. Group-

Table 3: Occurrence of incisional hernia

Group	Occurrence of incisional hernia				Total	
	Present		Absent			
	No.	%	No.	%		
Group A (Small Bite)	4	16.00	21	84.00	25	100.00
Group B (Large Bite)	5	20.00	20	80.00	25	100.00
Total	9	18.00	41	82.00	50	100.00

$X^2: 0.136; p=0.712$



Graph 3: Occurrence of incisional hernia

B had 20 males and 5 females. There was no statistically significant difference in gender distribution between the two groups (chi square=0.117;p value= 0.733).

A total of 12 elective cases and 13 emergency cases were included in group-A and 11 elective cases and 14 emergency cases were included in group-B. No statistically significant difference was found between the 2 groups (chi square =0.081; p value=0.777).

The mean wound length in group-A was 17.96cm with standard deviation of 2.59cm and in group-B it was 18.08cm with standard deviation of 2.216cm. There was no statistically significant difference between the two groups. (p value= 0.861)

The mean suture length in the group-A was 73.88cm with standard deviation of 10.69cm and that of group-B was 73.48cm with standard deviation of 8.71cm. No statistically significant difference was observed between the groups in terms of suture length (p value= 0.885).

The mean SL:WL ratio in the group-A was 4.114 with standard deviation of 0.130. The mean SL:WL ratio in the group-B was 4.066 with standard deviation of 0.068. No statistical-

ly significant difference was observed between the groups in terms of SL:WL ratio (p value= 0.135).

The mean duration of hospital stay of the group-A was 10.92 days with standard deviation of 4.3 days. The mean duration of hospital stay of the group-B was 9.44 days with standard deviation of 3.72 days. No statistically significant difference was observed between the groups in terms of hospital stay (p value= 0.199).

Discussion:

The age and gender distribution were similar in the study groups. The type of surgery, the mean wound length, the mean suture length were also similar in both the groups.

In the study by Albertsmeier et al,¹¹ 3.73% patients in small stitch group and 5.72% patients in large stitch group developed SSI. Hassan et al¹² reported an incidence of 30% in large stitch group and 20% in small stitch group. de Vries et al¹³ reported SSI of 28% in large stitch group compared with a 17% in the small stitch group. So, there was a correlation between the use of small stiches and reduced incidence of surgical site infection.

In the present study, in the small bite group, 28% developed SSI. In the large bite group, 52% developed SSI.

The results of the present study can be compared to that of the study by Chanamolu et al.¹⁴ where, the occurrence of SSI in the small stitch group was 20% and in the large stitch group, it was 43%.

Hassan et al reported occurrence of wound dehiscence in 8% patients in the small bite group and 16% patients in the large stitch group. Chanamolu et al reported a slightly higher occurrence- 13% in small stitch group and 30% in large stitch group. Albertseimer et al reported a much lower rate- 1.40% in the small stitch group and 4.76% in the large stitch group.¹¹ The difference might be due to the difference in study population and definitions used in those studies.

In the present study, 2 patients out of 25 (8%) in the small bite group and 3 patients out of 25 (12%) in the large bite group developed wound dehiscence.

In the study by Deerenberg et al,¹⁵ 21% patients in large stitch group and 13% patients in small stitch group developed incisional hernia. de Vries et al showed 27% incidence of incisional hernia in large stitch group against a 10% incidence in small stitch group. Millbourn et al.¹⁶ reported incidence of 18% incisional hernia in large stitch group. But in small stitch group, incidence was only 5.6%. Chanamololu et al showed and incidence of 3% in small stitch group and 10% in large stitch group in the present study, 16% in the small bite group and 20% in the large bite group developed incisional hernia.

In the present study, since the duration of follow up is short, ultrasonography has also been used for diagnosis of incisional hernia in addition to clinical examination for early diagnosis.

Duration of hospital stay is also an indicator of the post-operative complications and cost effectiveness. But a prolonged hospital stay does not always point to operative morbidities. It may be because of underlying septicemia, nutritional factors or any systemic complications unrelated to surgery. In the study by Deerenberg et al the mean duration of hospital stay was 14 and 15 days in small stitch and large stitch group respectively. In the study by de Vries et al it was 8.2 days in the small stitch group and 9.4 days in the large stitch group.¹³

In the present study, the mean hospital stay was 10.92 ± 4.3 days in small bite group and in large bite group it was 9.44 ± 3.72 days.

The results of the present study were in accordance with the experimental studies conducted by Cengiz et al that the small tissue bites reduced the presence of viable tissue inside the stitch. So there was less chance of ischemia and wound complications.^{17,18}

It was the studies conducted by Israelsson et al²⁰ which has attempted to propose a standard tech-

nique of closure. However, even now the technique of incision and closure methods largely remain as the choice of the individual surgeon.^{19,20}

Several limitations did exist for our study. The sample size was small. The patients were not randomized for other factors like comorbidities, immuno suppressive state, BMI, smoking, hypo-proteinemia etc. as done in other studies. This study included both emergency and elective cases where as most other studies had taken the elective cases only into consideration. The duration of follow up was also short. The rate of complications observed in this study was found to be higher than that of the other studies especially SSI. This may be because of the class of wound during surgery, poor personal hygiene and the definitions used for the complications. The literature in this particular area is very limited and the topic has got a very less focus in our country.

Conclusion:

From the present study, it may be concluded that the use of small bite closure technique is superior to the large bite technique in preventing both short term and long term wound complications.

Ethical approval: Approval for the study was granted by the Faculty of Medical Sciences, Baba Farid University of Health Sciences (Letter No: BFUHS/2K21p-TH/5597 dated 28/04/2021).

Conflict of interest: None

Funding source: None

Role and contribution of authors:

Ashok Kumar, project development, data collection and processing, data analysis and interpretation, literature search, manuscript writing, critical reviews.

Sumitoj Singh, project development, data analysis and interpretation, literature search, manuscript writing, critical reviews.

Aswathy GS, data collection and processing, literature search, manuscript writing.

References:

1. Hempel S, Kalauch A, Oehme F, Wolk S, Welsch T, Weitz J et al. Wound complications after primary and repeated midline, transverse and modified Makuuchi incision: A single-center experience in 696 patients. *Medicine*. 2021;100(20).
2. Israelsson LA, Wimo A. Cost minimisation analysis of change in closure technique of midline incisions. *Euro J Surg*. 2000;166(8):642-6.
3. Azoury SC, Farrow N, Hu Q, Soares K, Hicks C, Azar F, Rodriguez-Unda N et al. Postoperative abdominal wound infection-epidemiology, risk factors, identification, and management. *Chron Wound Care Manage Res*. 2015;2:137-48.
4. Aksamija G, Mulabdic A, Rasic I, Aksamija L. Evaluation of risk factors of surgical wound dehiscence in adults after laparotomy. *Med Arch*. 2016;70(5):369-72.
5. Meijer EJ, Timmermans L, Jeekel J, Lange JF, Muysoms FE. The principles of abdominal wound closure. *Acta ChirBelg* 2013;113:239-44.
6. Sanders RJ, DiClementi D, Ireland K. Principles of abdominal wound closure: I. Animal studies. *Arch Surg*. 1977;112(10):1184-7.
7. Harlaar JJ, Deerenberg EB, Dwarkasing RS, Kamperman AM, Kleinrensink GJ, Jeekel J et al. Development of incisional herniation after midline laparotomy. *BJS open*. 2017;1(1):18-23.
8. Jenkins TP. The burst abdominal wound: a mechanical approach. *J Br Surg*. 1976;63(11):873-6.
9. Jensen TK, Gögenur I, Tolstrup MB. Standardized Surgical Primary Repair for Burst Abdomen Reduces the Risk of Fascial Redehiscence. *Ann Surg*. 2021 Dec 1;274(6)
10. López-Cano M, García-Alamino JM, Antoniou SA, Bennet D, Dietz UA, Ferreira F et al. EHS clinical guidelines on the management of the abdominal wall in the context of the open or burst abdomen. *Hernia*. 2018;22(6):921-939.
11. Albertsmeier M, Hofmann A, Baumann P, Riedl S, Reisensohn C, Kewer JL et al. Effects of the short-stitch technique for midline abdominal closure: short-term results from the randomised-controlled ESTOIH trial. *Hernia*. 2021:1-9.
12. Hassan Y, Hassan NU, Gilkar IA, Irshad I, Bashir Y, Hussain A, Shah SM. An Observational Study of Midline Abdominal Wound Closure Using Small Tissue Bites versus Large Tissue Bites with Reference to Surgical Site Infections and Wound Dehiscence. *Surg Sci*. 2018;9(11):399-406.
13. de Vries HS, Verhaak T, Van Boxtel TH, Van Den Heuvel W, Teixeira MB et al. Implementation of the small bites closure of abdominal midline incisions in clinical practice is correlated with a reduction in surgical site infections. *Hernia*. 2020;24(4):839-43.
14. Kumar CD, Rao TV, Kishore NB. Effect of Stitch Length on the Rate of Postoperative Wound Complications in Midline Incisions. *J Den Med Sci. (IOSR-JDMS)*. 2016;15(5):37-48.
15. Deerenberg EB, Harlaar JJ, Steyerberg EW, Lont HE, van Doorn HC, Heisterkamp J et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. *Lancet*. 2015;386(10000):1254-60.
16. Millbourn D. Closure of midline abdominal incisions with small stitches. Studies on wound complications and health economy [Doctoral Thesis]. Umeå (Sweden): Umeå University; 2012.
17. Cengiz Y, Blomquist P, Israelsson LA. Small tissue bites and wound strength: an experimental study. *Arch Surg*. 2001;136(3):272-5.
18. Cengiz Y, Gislason H, Svanes K, Israelsson LA. Mass closure technique: an experimental study on separation of wound edge. *Eur J Surg*. 2001;167(1):60-63.
19. Israelsson LA, Millbourn D. Prevention of incisional hernias: how to close a midline incision. *Surg Clin North Am*. 2013;93(5):1027-40.
20. Israelsson LA, Jonsson T. Incisional hernia after midline laparotomy: a prospective study. *Eur J Surg*. 1996;162(2):125-9.