

Original article:

Role of small tissue bites in prevention of Surgical Site Infection and Incisional Hernia in midline incision Prospective observation study

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Abstract:

Background: Midline incision is the most common incision performed in emergency setting as it gives excellent exposure to all the quadrants of abdomen. Midline incisions have advantage of rapid and wide access to the abdominal cavity with minimal damage to muscles, nerves and the vascular supply of the abdominal wall. Extensions, when required, can easily be made superiorly or inferiorly, providing access to the whole abdominal cavity, including the retro-peritoneum. The techniques and sutures used for abdominal fascial closure following elective midline laparotomy differ among surgeons and among centers worldwide. Faulty techniques and/or suture materials used may lead to a wide range of complications, like surgical site infections, wound dehiscence and incisional hernia, some with devastating outcomes.

Aims: The aim of this study is to assess the outcome of midline abdominal wound closure using small tissue bites versus large tissue bites with reference to surgical site infection and incisional hernia.

Materials and methods: A total of 100 cases were enrolled and studied who underwent midline laparotomy in the elective as well as emergency settings over a time period of two years. In 50 patients midline incisions were closed with large tissue bites placed at least 10 mm from the wound edge and 10 mm apart and in another 50 patients small tissue bites were used placed 5-7 mm from the wound edge and 5-7 mm apart and included only the aponeurosis in the stitches without peritoneum.

Results: In all, 100 patients, 50 patients were allocated to long tissue bites and another 50 patients to small tissue bites. 15 patients out of 50 patients (30%) in large tissue bites group and 10 patients (20%) in small tissue bites developed surgical site infection. Only 2 (4%) case out of the 50 administered with small stitch showed signs of hernia, 6 cases (12%) from the other group that were administered with a larger stitch had incisional hernia.

Conclusion: A total of 100 patients who underwent abdominal surgery through midline incision were divided into two groups. In 50 patients midline wound was closed using large tissue bites and in other 50 patients, small tissue bites was used to close midline incision including only aponeurosis. The research findings show that the small stitch length between 5 to 7mm depending on the wound site is the ideal stitch length to close a midline incision. However, there was no statistical deference seen in both groups with reference to surgical site infection. Small stitches may be useful to prevent the development of incisional hernia.

Long term follow up is crucial for patients who undergo midline laparotomy to assess the occurrence of incisional hernia. Although operating time was not studied in this study, it was observed that operative time is more in small tissue bites

Key words: Surgical site infection, Small tissue bites, Incisional hernia

INTRODUCTION

The choice of incision is mainly dependent on the area that needs to be exposed, the elective or emergency nature of the operation and the surgeon's personal preference. Midline incision is the most common incision performed in emergency setting as it gives excellent exposure to all the quadrants of abdomen. The midline incision implies a vertical incision through skin, subcutaneous fat, linea alba and peritoneum. Most of the fibres, crossing the linea alba in a medio-caudal and medio-proximal direction, are cut transversely. Midline incisions have advantage of rapid and wide access to the abdominal cavity with minimal damage to muscles, nerves and the vascular supply of the abdominal wall. The incision can be made quickly taking seven minutes on an average [1,2,3,4]. Extensions, when required, can easily be made superiorly or inferiorly, providing access to the whole abdominal cavity, including the retroperitoneum. The occurrence of post-operative wound site complications like wound site infection, wound dehiscence and incisional hernia depends on both patient and surgical factors like age, diabetes mellitus, malignancy, wound infection, malnutrition, obesity, previous laparotomies and use of corticosteroids. Of these, surgical technique is of special interest, since it is the only factor that can be controlled directly by the surgeon.

According to the Jenkins it is recommended that incisions should be closed with a suture length (SL) to wound length (WL) ratio (the ratio of the length of the suture used through the length of the wound) of at least 4. When the SL to WL ratio is less than 4, the risk of wound site complications is 3 times higher [5,6,7]. The ratio depends on the size of each stitch and the stitch interval. Thus, a ratio of at least 4 can be achieved with many small stitches placed at close intervals or by incorporating a larger amount of tissue into stitches placed at greater intervals [8].

An incisional hernia is one that develops in the scar of a surgical incision. It may be small and insignificant, or it may bulge through the wound to become a large, unsightly, and uncomfortable hernia. Intra-abdominal organs such as omentum, bowel or bladder may protrude through the fascial defect, covered by a peritoneal sac and intact skin [9]. Many incisional hernias are asymptomatic. However, incisional hernias can also be an important source of morbidity. Apart from discomfort and pain, incisional hernia may lead to serious conditions such as incarceration (6-15%) or strangulation of bowel (2%) [10,11]. If not promptly reduced, these conditions can be fatal.

The rate of incisional hernia, one year after operation, is reported to range from 9% to more than 20% [12]. Surgical site infection, which occurs in up to 16% of patients after major surgery, is a risk factor for the development of incisional hernia [13].

AIMS AND OBJECTIVES

To compare the outcome of midline abdominal wound closure after using small tissue bites versus large tissue bites with reference to:

- Surgical site infection
- Incisional hernia

Materials and methods

Study design

Hospital-based descriptive prospective study.

Study area:

The study was conducted in the department of General Surgery Government Medical College Srinagar.

Study population:

Patients admitted in general surgical and allied specialities who underwent midline laparotomy in elective as well as emergency settings.

Study sample:

Our study consisted of 100 consecutive patients undergoing abdominal surgery through a midline incision.

Inclusion criteria:

All patients ≥ 18 years of age who undergoes abdominal surgery through midline incision in the emergency as well as in elective settings.

Exclusion criteria:

1. Patients with a previous midline incision.
2. A pre-existing abdominal wall hernia.
3. Patients with hypoproteinemia , anaemia,diabetes or COPD.

RESULTS

The present prospective study was conducted in the Department of Surgery, Government Medical College Srinagar in a time period of three years. The study population consisted of 100 consecutive patients undergoing abdominal surgery through a midline incision, fulfilling the inclusion criteria. The following observations were made:

DEMOGRAPHIC CHARACTERISTICS

In our study of 100 patients, mean age in the large tissue bites group was 47.43 years with standard deviation of 18.49 and the mean age in the small tissue bites group was 48.09 years with standard deviation of 18.26. Mean age between the two groups was comparable. No significant statistical differences were found in the age distribution between the two groups (p value 1.0) as shown in table 1.

Age (in years)	Large tissue bites	Small tissue bites
19-29	29	26
30-39	6	11
40-49	7	4
50 – 59	7	8

>60	1	1
Total	50	50

Ratio of suture length to wound length

Mean suture length to wound length ratio in large tissue bites group was 4.84 and in small tissue bites group was 5.18. Ratio of suture to wound length was found to be statistically significant in the study groups with p value of 0.001 as depicted in table 2:

SL:WL Ratio	Large tissue bites	Small tissue bites	p value
4:1 – <5:1	38	21	
5:1 – 6:1	12	29	
Total	50	50	0.001
	S.D=18.3	S.D=5.6	

Surgical site infections

15 patients out of 50 patients in large tissue bites group and 10 patients out of 50 in small tissue bites developed surgical site infection. The difference was found to be statistically insignificant with p value of 0.355 as depicted in table 3

SSI	Large tissue bites	Small tissue bites	p value
Present	15	10	
Absent	35	40	
Total	50	50	0.355
	Mean=25 S.D=14.14	Mean=25 S.D=21.2	

Type of surgery

The type of surgeries in both the study groups was comparable with statistically insignificant p value (0.367) as depicted in table 4:

Table 4: Type of surgery			
Type of surgery	Large tissue bites	Small tissue bites	p value
Elective	16	11	
Emergency	34	39	
Total	50	50	0.367

Incisional Hernia

6 patients out of 50 patients in large tissue bites group and 2 patients in small tissue bites developed incisional hernia. The difference was found to be statistically insignificant with p value of 0.268 as depicted in table 5:

Table 5: Incidence of Incision hernia		
Stitch type	Incisional hernia present	Incisional hernia absent
Large tissue bite	6	44
Small tissue bite	2	48

P value is 0.268

DISCUSSION

Earlier surgeons chose the abdomen closure technique based on teaching, recommendation or personal experience. Dudley suggested the benefit from large tissue bites and thick sutures for safe abdominal closure.[14] Jenkins was probably the first to recommend a specific suture length(SL):wound length(WL) ratio on the basis of clinical studies and mathematical calculations. Jenkins gave a mathematical analysis to support this ratio derived from consideration of layered wound closure.[15] The aim of our study was to compare the outcome of midline abdominal wound closure after using small tissue bites versus large tissue bites with reference to surgical site infection and incisional hernia.

Age distribution

Mean age in the large tissue bites group was 47.43 years and the mean age in the small tissue bites group was 48.09 years (Table 1). Mean age between the two groups was comparable. No significant statistical differences were found in the age distribution between the two groups (p value of 1).

In a similar study done by **Milbourn et al**[16] from 2001 to 2006, the difference between the mean age of their long stitch length group (64 years) and short stitch length group (65 years) was statistically insignificant (p value 0.30). In our study, the mean age was less than the study done by **Milbourn et al** due to more number of peptic and duodenal perforation cases in young age group secondary to *Helicobacter pylori* infestation and may be due to smoking, over the counter NSAID use and stress in our setting.

Ratio of suture length to wound length

Mean suture length to wound length ratio in large tissue bites group was 4.84 and in small tissue bites group was 5.18 (Table 2). Ratio of suture to wound length was found to be statistically significant in the study groups with p value of 0.001. In no case was a suture length to wound length ratio less than 4. No case required a suture length more than 6 times the wound length.

In study done by **Milbourn et al**, [16] in long stitch length group, mean suture length to wound length ratio was 6.4 whereas in short stitch length group, suture length to wound length ratio was 5.7. This difference was significant statistically (p value 0.001).

Surgical site infection (SSI)

15 patients out of 50 patients (30%) in large tissue bites group and 10 patients (20%) out of 50 patients in small tissue bites developed surgical site infection (Table 3). The difference was found to be statistically insignificant with p value of 0.355. Most of the patients who developed surgical site infections in our study had undergone emergency surgery secondary to generalized peritonitis.

In study done by **Milbourn et al**, [16] 10.2% patients in long stitch length group and 5.2% patients in short stitch length group had surgical site infection.

Type of surgery

The types of surgeries in both the study groups were comparable with statistically insignificant p value (0.367) (Table 4). Previous studies had not studied this variable. Type of surgery was not found to affect the outcome with respect to surgical site infection and incisional hernia in this study.

Incisional Hernia:

While only 2 (4%) case out of the 50 administered with small stitch showed signs of hernia, 6 cases (12%) from the other group that were administered with a larger stitch had hernia (Table 5). The study conducted by **Daniel Millbourn**[16] also revealed that only 5.6% of his massive sample size administered with small stitch length had hernia while 18% of the cases administered with larger stitch showed visible signs of incisional hernia. This again reinforces the advantage of using small stitches to close mid-line incision for minimal occurrence of hernia.

CONCLUSION

A total of 100 patients who underwent abdominal surgery through midline incision were divided into two groups. In 50 patients midline wound was closed using large tissue bites and in other 50 patients, small tissue bites was used to close midline incision including only aponeurosis. The research findings show that the small stitch length between 5 to 7mm depending on the wound site is the ideal stitch length to close a midline incision. However, there was no statistical deference seen in both groups with reference to surgical site infection. Small stitches may be useful to prevent the development of incisional hernia. Long term follow up is crucial for patients who undergo midline

laparotomy to assess the occurrence of incisional hernia. Although operating time was not studied in this study, it was observed that operative time is more in small tissue bites.

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