

## Original Research Article

# A study to evaluate the effects of various abdominal closure techniques on midline laparotomy wounds in a tertiary care hospital in West Bengal

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### ABSTRACT

**Background:** Post-operative complications of wound repair after laparotomy pose a major threat to life as well as to the health economy of a developing nation. Among many other factors, the length of suture used during wound closure has been studied for long. A prospective randomized control study comprising of 104 patients was conducted in the department of surgery of Bankura Sammilani medical college for comparing the incidence of SSI, wound dehiscence and incisional hernia after using short stitch and long stitch for repairing midline laparotomy wounds.

**Methods:** Out of 104 patients enrolled in the study, 51 patients were randomly allocated to short stitch group (suture length: wound length>4:1) and 53 patients were allocated to long stitch group (suture length: wound length=4:1) and both the groups were subsequently followed up for development of the three complications.

**Results:** Data analysis revealed that 11.7 % patients in short stitch group developed SSI whereas 24.5% patients in long stitch group developed SSI. Wound dehiscence occurred in 5.8 % of patients in short stitch group against 15% in long stitch group. 7.8% patients in short stitch group developed incisional hernia against 20.7% patients in long stitch group. In all three situations, p value was significant (<0.05).

**Conclusions:** It is concluded from our study that, the rate of SSI, wound dehiscence and incisional hernia is significantly lower in midline abdominal wounds closed with short stitch length than those closed with long stitch length.

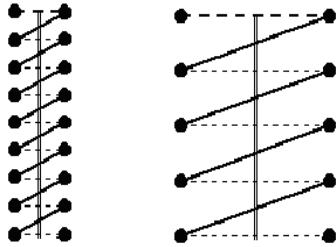
**Keywords:** Laparotomy, Short stitch, Long stitch, Surgical site infection, Wound dehiscence, Incisional hernia

### INTRODUCTION

A midline incision is frequently used in abdominal surgery. It can be rapidly made with minimal damage to muscles, nerves and blood supply. Post-operative wound complications, such as surgical site infection, wound dehiscence and incisional hernia cause patients suffering and costs for the welfare system. Incisional hernia is a frequent complication of abdominal operations which can increase to 38% in specific risk groups.<sup>1-4</sup> Incisional hernia causes pain and discomfort decreasing quality of life.<sup>5</sup> Also, incarceration and strangulation of abdominal

contents can take place, for which emergency surgery is required, thus increasing morbidity and mortality.<sup>6</sup> Prevention of incisional hernia is therefore of paramount importance. Several suturing techniques for abdominal closure after a midline abdominal incision have been studied in the past few decades. Findings from meta-analyses have shown that a running technique with long-lasting monofilament suture material reduces the incidence of incisional hernia compared with interrupted suture techniques.<sup>3,7</sup> Most surgeons use the running closure technique with large tissue bites to close midline incisions.<sup>8</sup> In 2009, a study from Sweden showed that a

running suture technique with small tissue bites, developed by Israelsson, decreased the incidence of incisional hernia compared with a running suture technique with large tissue bites.<sup>9</sup> In this study, small tissue bites were defined as placement of a stitch every 5-8 mm from the wound edge. This promising technique is contradictory to old surgical principles and needs to be thoroughly investigated before it can be widely implemented.<sup>10,11</sup>



To the right an SL to WL ratio of 4 is achieved with large stitches. To achieve the same ratio with small stitches (left) the number of stitches placed in the wound must be increased.

**Figure 1: Closure of wound with short stitch and long stitch.**

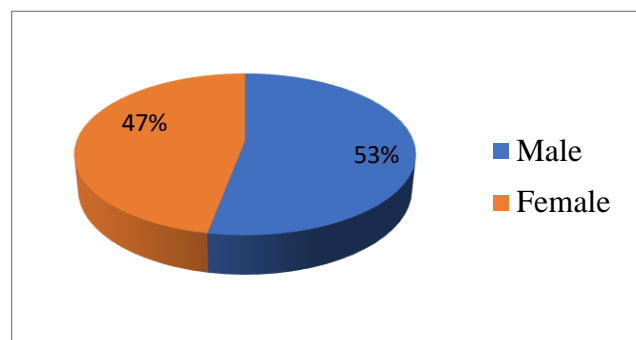
**METHODS**

The study was conducted in the department of general surgery of BSMCH over a time period 18 months from March 2015 to September 2016. 104 patients who underwent laparotomy by midline incision during this time period were enrolled in the study. Patients who were unwilling, age less than 12 years, pregnant women, patients with H/O chronic obstructive pulmonary disease or chronic cough were excluded from the study. Intraoperative exclusion criteria were grossly contaminated abdomen, bacterial peritonitis, intra-abdominal abscess, radiotherapy of abdomen or chemotherapy within 2 weeks before surgery. The study design was a prospective randomized control study. The cases are divided in two groups by random allocation process. The first group undergoing midline abdominal closure with a short stitch length (i.e., placing stitches <10 mm from wound edge) and the second group undergoing midline abdominal closure with a long stitch length (i.e., placing stitches 10mm from wound edge). This means that the first study group has short stitch length with SL:WL>4:1 whereas the second study group has long stitch length with SL:WL 4:1. These patients are to be evaluated in the postoperative period for any wound dehiscence, discharge from wound, fever, pain abdomen or diarrhoea. Regular monitoring of the patient was done clinically and regular dressing of the wound and careful observation of the for any sign of surgical site infection or wound discharge/dehiscence are to be done. Blood examination for Hb%/TLC/DLC/ESR, culture sensitivity of any discharge from wound and ultrasonography of abdomen may be planned in the postoperative period depending on patient’s recovery/response. All patients

were planned for discharge after removal of skin sutures and were followed up in surgical OPD of BSMCH for any wound gaping or development of incisional hernia. The data have been analysed using statistical package for the social sciences (SPSS) for Windows, version 16.0 (SPSS inc; Chicago, IL, USA). Chi square test was applied at 5% significance level.

**RESULTS**

The total study population was 104 patients that underwent laparotomy with midline incision at BSMCH. Out of these 104 cases 49 patients were female (47%) and 55 patients were male (53%). The cases were distributed in two groups randomly depending on the technique of midline closure.



**Figure 2: Sex wise distribution of total sample.**

The study included patients from age of 12 years up to 50 years and above and they were divided into the following groups:

**Table 1: Age wise distribution of study population.**

Age (years)	Number	Percentage (%)
12-20	9	8
20-30	18	17
30-40	29	29
40-50	27	26
>50	21	20

The total study population was divided into two groups and a prospective randomised study was carried out to compare results between the two groups.

In the first group closure was done with short stitch technique i.e., sutures were placed <10 mm from margin of wound and distance between two stitches is also <10 mm, with non-absorbable sutures (polypropylene) and continuous single-layer sutures. The suture length to wound length ratio (SL:WL) is >4:1 (5:1 or 6:1).

In the second group, closure was done with standard long stitch technique i.e., sutures were placed 10mm from wound margin and distance between two sutures is also 10mm, with continuous non absorbable sutures like that

of the first group. The suture length to wound length ratio (SL:WL) here is 4:1.

In the short stitch group 51 patients were allocated randomly and in the long stitch group 53 patients were allocated.

**Table 2: Distribution of cases according to stitch length.**

Case	Number
Study population-short stitch length	51
Study population-long stitch length	53
Total	104

Out of the total 104 patients, 22 (2.1%) had band obstruction, 17 (16.3%) had sigmoid volvulus 15 (14.4%) had gastric carcinoma, 12 (11.5%) had sigmoid cancer, 2 (01.9%) had mid gut volvulus, 15 (14.4%) had obstructed hernia, 9 (08.6%) had carcinoma of ascending colon, 12 (11.5%) had pyloric stenosis.

**Table 3: Case wise distribution of study population.**

Case	Number	Percentage (%)
Band obstruction	22	21.1
Sigmoid volvulus	17	16.3
Gastric CA	15	14.4
Sigmoid CA	12	11.5
Mid gut volvulus	2	01.9
Obstructed hernia	15	14.4
CA ascending colon	9	08.6
Pyloric stenosis	12	11.5
Total	104	100

The patients were followed up in the postoperative period for development of surgical site infection (SSI), wound dehiscence and incisional hernia.

Out of 51 patients in short stitch group 6 patients (11.7%) developed SSI in postoperative period and out of 53 patients in long stitch group 13 patients (24.5%) developed SSI with the p value being 0.005(significant).

**Table 3: Incidence of SSI in short stitch and long stitch group.**

Study population	Surgical site infection		P value
	Yes (%)	No (%)	
Short stitch	6 (11.7)	45 (88.3)	0.005
Long stitch	13 (24.5)	40 (75.5)	(significant)

Out of 51 patients in short stitch group, only 3 patients (5.8%) developed wound dehiscence. On the other hand, out of 53 patients in long stitch group, 8 patients (15%) developed wound dehiscence. p value was calculated to be 0.01 (significant).

**Table 4: Incidence of wound dehiscence in short stitch and long stitch group.**

Study population	Wound dehiscence		P value
	Yes (%)	No (%)	
Short stitch	3 (5.8)	48 (94.2)	0.01
Long stitch	8 (15)	45 (85)	(significant)

Out of 51 patients in short stitch group only 4 patients (7.8%) developed incisional hernia whereas out of 53 patients in long stitch group, 11 patients (20.7%) developed incisional hernia. p value calculated is 0.001 (significant).

**Table 5: Incidence of incisional hernia in short stitch and long stitch group.**

Study population	Incisional hernia		P value
	Yes (%)	No (%)	
Short stitch	4 (7.8)	47 (92.2)	0.001
Long stitch	11 (20.7)	42 (79.3)	(significant)

## DISCUSSION

As a result of the anatomy, it is possible to perform a midline incision with minimal damage to muscles, nerves and vascular supply of the abdominal wall as these structures do not cross the midline. The midline incision provides a relatively quick and wide access to the abdominal cavity and therefore often used in major surgery and for emergency procedures. In our study we have only included cases with midline incision repair.<sup>3</sup>

The healing of midline incision follows the general principles of tissue healing and is divided in three phases. Wound healing is similar in all tissues but the time needed for its completion differs. Wound healing consists of three phases: immediate inflammatory phase followed by proliferative phase and long-term maturation phase. The maturation phase may continue for more than 12 months. It is characterised by cross-linking and remodelling of collagen fibres. Up to the second postoperative month there is a rapid gain in wound strength, there after strength progressively increases, but at a slower pace. After 1 month 40-60% of normal wound strength can be expected, after 2 months 60-80 % and after one year 60-90%.

Surgical site infection (SSI), wound dehiscence and incisional hernia are three major wound complications that are frequently encountered and pose a considerable burden on health economy. In this study we have evaluated and compared the two study groups for these three parameters. Total study population consisted of 104 patients admitted in the surgery ward of BSMCH, who underwent laparotomy with midline incision. Out of these 104 patients, 49 (47%) were female and 55 (53%) were male and were randomly allocated to first (short stitch) or second group (long stitch). Age wise distribution of cases show that majority of patients belonged to the age group

of 30-40 years (29%) while least belonged to the age group of 12-20 years (8%).

According to Berard, wounds may be divided into three classes: clean, contaminated and dirty, with an increasing risk for SSI, based on the degree of microbial contamination.<sup>4</sup> Only infections occurring within 30 days after surgery are classified as SSI. In our study, 11.7% patients in short stitch group developed SSI while 24.5% patients in long stitch group developed SSI. This shows that incidence of SSI was significantly lower in short stitch group than in the long stitch group with a p value of 0.005. This result is in congruence with study of Millbourn et al.<sup>9</sup> In 2012 Millbourn et al conducted a randomised control prospective study comprising of 737 patients out of which 356 were allocated in short stitch group and 381 patients were allocated in long stitch group. SSI developed in 5.2% patients of short stitch group and 10.2% patients of long stitch group (p=0.02).

Wound dehiscence is a complete disruption of the wound with evisceration of abdominal content demanding emergent reoperation. It usually occurs within the first 10 days when the integrity of the wound is entirely dependent on the suture and the suture holding capacity of the tissues. Wound dehiscence is reported to occur in up to 4% of midline incision and is associated with mortality rates of up to 35%. Our study showed that wound dehiscence occurred in 3 (5.8%) patients in short stitch group whereas 8 (15%) patients in long stitch group developed wound dehiscence. The difference was significant as the p value was 0.01 (significant).

Suturing with an SL to WL ratio above 4 has in clinical trials reduced the risk of incisional hernia. In these studies, the lowest rate of incisional hernia and SSI was seen with a ratio within the range of 4 to 5. Overweight is commonly identified as a risk factor for wound complications but as larger stitches are used in overweight patients and when the ratio is over 5 it might be the large stitch rather than the high ratio or the overweight per se that constitutes the risk. There are very few other studies investigating the effect of high SL to WL ratios, but there are experimental and clinical studies contradicting the results of a poorer outcome with a ratio over 5.



**Figure 3: Wound closed with short stitch (SL:WL>4).**



**Figure 4: Wound closed with long stitch (SL:WL=4:1).**

In our study, out of 51 patients in short stitch group 4 patients (7.8%) developed incisional hernia in follow up an out of 53 patients in long stitch group 11 (20.7%) developed incisional hernia with the p value being 0.001 (significant).

The etiologic mechanisms for the development of wound dehiscence and incisional hernia are similar and so are the identified risk factors. In 2012, Ramhorst et al conducted a prospective study which showed that smoking, old age, diabetes mellitus, malignant disease is associated with an increased risk of dehiscence and incisional hernia.<sup>5</sup> Separation of wound edges leading to an incisional hernia may be a result of an incomplete early wound dehiscence. A raised risk of incisional hernia is seen after multiple operations through the same scar and after wound dehiscence.

In 2013, Karegoudar et al conducted a study, conducted a study which showed SSI occurred in 24% patients of short stitch group and 52% patients of long stitch group (p value=0.04 S).<sup>12</sup> However the data on incisional hernia development in the post-operative period did not comply with our study. In their study, incisional hernia occurred in 16% patients of short stitch group compared to 36% patients of long stitch group (p value=0.19 NS).

## CONCLUSION

It is concluded from our study that concerning midline abdominal incisions closed with a single-layer continuous technique, the rate of surgical site infection, wound dehiscence and incisional hernia is lower with short stitches compared with long stitches. However further studies are still required in this field keeping in mind the many compounding factors like type of suture material used, suture technique used and patient's comorbidities.

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