

# Comparison between Interrupted X Suture and Continuous Suture for Closure of Midline Incision in Emergency Laparotomy : A Randomized Controlled Trial

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## Abstract

**Background:** Wound dehiscence is disruption of any or all of the layers in a wound. At around 7–10 days post operatively leakage of clear sero-sanguinous fluid from the wound is usually the first indicator of burst abdomen. The patient usually feels something ‘giving away’ at this time. It may occur in 3-14.5% cases and is very distressing to the patient. Number of methods of closure of midline laparotomy wound have been introduced in the past to prevent this outcome. The study to compare the result of continuous and interrupted closure of midline emergency laparotomy in respect of burst abdomen.

**Materials and methods:** This randomized controlled trial study was carried out in the Department of Surgery Chittagong Medical College Hospital, Chattogram, duration January 2017 to December 2017. A total of 500 patients were enrolled in this study. Data were collected, statistical analyses were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-23).

**Results:** 250 patients in group A and 250 in B. Surgical wound related post-operative complications were found in 30.4% of the study subjects (n=152). Wound dehiscence was found in 11% subjects, surgical site infection was found in 18.4% subjects and incisional hernia in 1%. All these complications were significantly higher in continuous suture group than interrupted group ( $p < 0.001$ ). Wound dehiscence in 20 subjects, treated with interrupted sutures and in 40 subjects (35 wound dehiscence and 5 incisional hernia) treated with continuous suture. The Relative Risk (RR) of developing wound dehiscence post-operatively was found to be 0.63 (95% CI 0.33 – 0.72) for interrupted suture. This was statistically significant ( $p < 0.05$ ).

**Conclusion:** The interrupted X suture technique is better than continuous suture technique in prevention of burst abdomen in emergency midline laparotomy.

**Key words:** Continuous suture; Emergency laparotomy; Interrupted X suture; Wound dehiscence.

## INTRODUCTION

Most studies in the Indian subcontinent revealed the superiority of interrupted X suturing in emergency settings.<sup>1,2,3</sup> Whereas in West no significant differences.<sup>4, 5, 6</sup> Wound dehiscence is disruption of any or all of the layers in a wound. At around 7–10 days post-operatively, leakage of clear sero-sanguinous fluid from the wound is usually the first indicator of burst abdomen.<sup>7</sup> The patient usually feels something ‘giving away’ at this time. It may occur in 3-14.5% cases and is very distressing to the patient. Number of methods of closure of midline laparotomy wounds have been introduced in the past to prevent this outcome but debate continues regarding the best option.<sup>3</sup>

The method of closure may not be very crucial in elective laparotomy with adequate nutrition and minimal risk factors in the West, but in developing countries where most patients present with prolonged intra-peritoneal sepsis and poor nutrition it is vital for us to ascertain the safest method of closure.<sup>2</sup>

Murtaza et al reported 2.7% incidence of burst abdomen by interrupted X technique.<sup>8</sup> Srivastava et al reported 2.17% of burst abdomen compared to 14% of burst by continuous technique.<sup>1</sup> On the other hand, European hernia society guidelines for abdominal wound closure showed no statistically different.<sup>6</sup> In theory, the interrupted closure allows discharge of contaminated abdominal contents which is associated with less intra-abdominal complications (For example fluid collections and abscess) thereby aiding abdominal fascial healing. Interrupted closure also overcomes the problems faced in continuous sutures like inadequate tension, inadequate distance from cut margins and consecutive bites.

Protein energy malnutrition is widely prevalent in Asian population. The problem gets compounded with onset of consuming diseases like tuberculosis, typhoid and cancer. Many patients underwent emergency laparotomy may suffer from one of these co morbid conditions detrimental to healing, in addition perforative peritonitis. At laparotomy profound necrosis of linea rendering it incapable to hold abdominal contents on coughing and sneezing.<sup>1</sup> Most patients need reoperation.<sup>9</sup> When difficulties are encountered while returning abdominal contents Bogota bag application or deep tension sutures are used.<sup>10</sup> Not only is it a common procedure, it is also associated with substantial mortality, reported variably between 11 and 15%.<sup>11, 12</sup> In 2015, The Lancet Commission set a target that by 2030, 80% of the global population should have access to facilities able to safely provide EL within 2 h.<sup>13</sup> Patients often present with complex multi-morbidity which may necessitate higher levels of perioperative care.<sup>11,14</sup> It can be explained by the fact that blunt abdominal trauma tends to occur more in young age<sup>15</sup>. Interrupted closure is commonly performed using no. 1 prolene suture.<sup>16</sup> 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.<sup>17</sup> The midline incision provides a relatively quick and wide access to the abdominal cavity.<sup>18, 19</sup>

**MATERIALS AND METHODS**

This is a randomized controlled trial study was done in 500 emergency laparotomy. Patients were selected by simple random sampling technique. All the patient's were evaluated before surgery. Information was collected from the study population by questionnaire and case record form. Variable were found among all the patients. Prior permission was taken from the Ethical Review Committee (ERC) of Chittagong Medical College Hospital. Keeping compliance with Helsinki Declaration for Medical Research Involving Human Subjects

1964 revised in 2008 and last amended in 2013. The objectives of the study along with its procedure, risk and benefits to be derived from the study was explained to the patients in easily understandable local language and then informed consent was sought from them. It was assured that all records would be kept confidential and would not be disclosed anyway except for the purpose of study. Proper history taking, clinical examination, were performed. Pre-designed data collection sheet was used to document all findings of the study patients.

All patients were evaluated by detail history, examination, routine investigations reports were recorded in predetermined case record form. Informed written consent was obtained from all patients and they were divided in 2 groups randomly according to surgeon's choice. Patients control group (Group A) treated with continuous suture and case group (Group B) treated with interrupted suture. In both groups no. 1 polypropylene suture was used.

All the relevant data were compiled on a master chart first. Data were analyzed with the help of computer based software SPSS-23 (Statistical Package for Social Sciences). Statistical significance was defined as  $p < 0.05$  and confidence interval was set at 95% level. Continuous data were expressed as mean ( $\pm$ SD) and categorical data were expressed as frequency and percentage. Baseline characteristics were compared by either Student's t-test for continuous data or the  $\chi^2$  test (Fisher's exact test when the expected value is  $<5$ ) for categorical data. The proportion of patients in the two groups experiencing per operative complication, post operative pain, surgical site infection and recurrence of hernia were compared using a Chi-square test. Relative risk (RR) and 95% CI for RR was estimated for the outcome variables.

**RESULTS**

**Table 1** Distribution of the respondents according to age (n=500)

Variable (Age in years)	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)
11-20	15 (6%)	12 (4.8%)	27 (5.4%)
21-30	80 (32%)	64 (25.6%)	144 (28.8%)
31-40	55 (22%)	79 (31.6%)	134 (26.8%)
41-50	35 (14%)	45 (18%)	80 (16%)
51-60	35 (14%)	27 (10.8%)	62 (12.4%)
61-70	30 (12%)	23 (9.2%)	53 (10.6%)

Source : Study report 2017.

Age of all the patients were ranging from 15 years to 70 years. Most of the patients were between 21 to 40 years. The difference was not significant ( $p > 0.05$ ). Majority of the patients (28.8%) were aged between 21 to 30 years.

**Table II** Personal habit and co-morbid diseases of the respondents (n=500)

Variable	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)
Smoking	75 (30%)	65 (26%)	140 (28%)
DM	42 (16.8%)	40 (16%)	82 (16.4%)
CKD	10 (4.0%)	11 (4.4%)	21 (4.2%)
Obesity	35 (14%)	45 (18%)	80 (16%)

Subjects were asked for smoking habit, Diabetes Mellitus (DM) and Chronic Kidney Disease (CKD) and were tested for obesity calculating body mass index. Total 28% subjects had smoking habit either regular or irregular. DM was found in 16.4% subjects and CKD was found in 4.2% subjects. Obesity was a finding in 16% subjects. Distribution of these factors was similar across intervention groups.

**Table III** Clinical features of the respondents (n=500)

Variable	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)
Abdominal pain	226 (90.4%)	223 (89.2%)	449 (89.8%)
Abdominal distension	187 (74.8%)	182 (72.8%)	369 (73.8%)
Vomiting	80 (32%)	65 (26%)	145 (29%)
Fever	60 (24%)	55 (22%)	115 (23%)
Board-like rigidity	120 (48%)	130 (52%)	250 (50%)
Obliterated upper border of liver dullness	65 (26%)	55 (22%)	120 (24%)

Abdominal pain was the most common clinical features in the subjects (89.8%), followed by abdominal distension (73.8%), vomiting (29%) and fever (23%). On examination of the abdomen board-like rigidity was found in 50% subjects and upper border of the liver dullness was obliterated in 24% subjects. The distribution was similar across both intervention group.

**Table IV** Pre-operative diagnosis of the respondents (n=500)

Variables	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)
Perforation	145 (58%)	125 (50%)	270 (54%)
Acute Intestinal Obstruction	64 (25.6%)	90(36%)	154 (30.8%)
Blunt trauma	27 (10.8%)	33 (13.2%)	60 (12%)
Others	12 (4.8%)	2 (0.8%)	16 (3.2%)

Most of the patients were diagnosed pre-operatively as perforation (54%) about 30.8 % were diagnosed as intestinal obstruction. Blunt trauma was suspected in 12% cases.

**Table V** Post-operative diagnosis of the respondents (n=500)

Variables	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)
DU Perforation	103 (41.2%)	120 (48%)	270 (54%)
GU Perforation	84 (33.6%)	66(26.4%)	154 (30.8%)
Ileal perforation	27 (10.8%)	33 (13.2%)	60 (12%)
Obstruction	12 (4.8%)	10 (4%)	22 (4.4%)
Solid organ injury	11(4.4%)	9(3.6%)	20(4%)
Others	13(5.2%)	12(4.8%)	25(4%)

Majority patients were post operatively diagnosed as duodenal ulcer perforation (54%). Gastric ulcer perforation, ileal perforation and obstruction was 30.8%,12% and 4.4% respectively

**Table VI** Surgical wound related post-operative complications of respondents (n=500)

	Interrupted suture group (n=250)	Continuous suture group (n=250)	Total (n=500)	p value*
Post-operative complications	64 (25.6%)	88 (35.2%)	152 (30.4%)	<0.001
Surgical site infection	44 (17.6%)	48 (19.2%)	92 (18.4%)	
Wound dehiscence	20 (8%)	35 (14%)	55 (11%)	
Incisional hernia	0	5 (2%)	5 (1%)	

\* p calculated using  $\chi^2$  test.

Surgical wound related post-operative complications were found in 30.4% of the study subjects (n=152). Wound dehiscence was found in 11% subjects, surgical site infection was found in 18.4% subjects and incisional hernia was found in 1%. All these complications were significantly higher in continuous suture treated group than interrupted suture treated group (p <0.001).

**Table VII** Relative Risk (RR) of wound dehiscence in interrupted suture vs. continuous suture (n=500)

	Wound dehiscence (n=75)	RR	95% CI	p value**
Interrupted suture group	20 (33.3)	0.63	0.33 – 0.72	0.004
Continuous suture group	40 (66.7)			

\* The title rows shows percentage among total subjects and the values within each category shows percentage within category.

\*\* p calculated using  $\chi^2$  test.

Wound dehiscence was present in 20 subjects who were treated with interrupted sutures and in 40 subjects (35 wound dehiscence and 5 incisional hernia) who were treated with continuous suture. The Relative Risk (RR) of developing wound dehiscence post-operatively was found to be 0.63 (95% CI 0.33 – 0.72) for interrupted suture. This was statistically significant ( $p < 0.05$ ).

## DISCUSSION

Worldwide a large number of emergency laparotomy is undertaken daily. In UK incidence of emergency laparotomy was estimated to be 1 in 1000.<sup>12</sup> Although no such data is available in Bangladesh but it can be speculated that the number will be higher as the population is much higher in Bangladesh.

There are studies reporting a lower rate of incisional hernia with lateral paramedian incisions than with midline incisions but also studies that have failed to detect any difference.<sup>17,20,21,22</sup> Opening and closing a paramedian incision is time consuming and later re-entry may be difficult.<sup>17, 20, 23</sup>

For procedures in the lower abdomen muscle splitting incisions as the gridiron incision and the Pfannenstiel incision are alternatives often held to be associated with a low rate of wound complications.<sup>24</sup> The rate of wound dehiscence is similar, however, with Pfannenstiel and midline incisions.<sup>25</sup>

A meta-analysis of 23 trials comparing continuous suture with interrupted suture in the closure of abdominal wound found, the interrupted technique was better in the non-absorbable suture.

Mean age of the subjects studied was  $39.03 \pm 14.11$  years. Majority of the patients were of younger age: 28.8% and 26.8% subjects were aged between 21 to 30 years, and 31 to 40 years respectively. and blunt abdominal trauma requiring emergency laparotomy were also included in this study.

The healing of a midline incision follows the general principles of wound healing. Smoking, diabetes, chronic kidney disease and obesity are important factors which affect wound healing. In this study 28% subjects were smokers, 16.4% had diabetes, 4.2% had CKD and 16% patients had obesity.

Among 500 subjects, surgical wound related post-operative complications were found in 30.4% ( $n=152$ ). Various post-operative complications can arise after emergency laparotomy involving any system of the body. Study in UK found that post-operative complications can arise in as many as 18.5% of subjects.

All these complications were significantly higher in continuous suture than interrupted suture group ( $p < 0.001$ ). Wound infection found in 19.2% controls and 17.6% cases and wound dehiscence found in 14% control and 8% cases. In contrast to the findings of this study, in a similar study done in India, Kumar et al found a higher proportion of wound infection in interrupted suture group (38%) than continuous suture group (32%).<sup>3</sup> On the other hand the same study found higher percentage of wound dehiscence (20%) in the former than the latter group (4%).

The Relative Risk (RR) of developing wound dehiscence post-operatively was found to be low for subjects in whom the midline abdominal incision was closed with interrupted suture (RR 0.63, 95% CI 0.33 – 0.72,  $p < 0.05$ ). In Kumar et al. the reported RR for interrupted suture is 0.127 ( $p < 0.05$ ).<sup>3</sup> Agarwal et al conducted a RCT for comparison of interrupted X vs. conventional continuous closure in surgical (both elective and emergency) and gynecological cases.<sup>2</sup> They reported a RR of burst to be 0.044 for interrupted closure. All of these findings imply that interrupted wound closure had far lower risk of developing wound dehiscence (Burst abdomen).

As mentioned in the beginning of discussion a meta-analysis showed the superiority interrupted suture in comparison to continuous suture for surgical wound closure. The finding of this study has endorsed that report in case of emergency midline incision.

## CONCLUSION

The optimal strategy for abdominal wall closure has been an issue of ongoing debate. Significantly lower post-operative complications are seen in interrupted X suture group which eventually results in reduced incidence of burst abdomen. Therefore, the interrupted X suture technique is better than continuous suture technique in prevention of burst abdomen in emergency midline laparotomy.

## RECOMMENDATIONS

Interrupted X suture techniques should be used in all emergency laparotomy cases where midline incision is given.

## DISCLOSURE

All the authors declared no competing interest.

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