

## Original Research Article

# Comparative study of abdominal wound dehiscence in continuous versus interrupted fascial closure after emergency midline laparotomy

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## ABSTRACT

**Background:** Laparotomy wound dehiscence is still a puzzle for most of the surgeons. Mortality associated with dehiscence has been estimated at 10-30%. Patients undergoing emergency laparotomy suffer from one of these comorbid conditions which are detrimental to healing. In this scenario interrupted suturing has been found to give good strength and have less incidence of wound dehiscence. The objective of the study was to compare the incidence of abdominal wound dehiscence in emergency midline laparotomy.

**Methods:** This study was conducted on 300 consecutive patients undergoing emergency midline laparotomy in the Department of Surgery, Government Medical College and Hospital. Methods group-A: closed by suturing the rectus sheath using polydioxanone suture 1-0 (PDS) in continuous layer suturing method. group-B: closed by suturing the rectus sheath using polydioxanone suture 1-0 in interrupted layer suturing method.

**Results:** The mean age in group A was 40.47 years and 37.47 in group B. In Group A 20.1% patients had burst abdomen and 5.4% in group B.

**Conclusions:** Interrupted closure of abdominal wall fascia is better in emergency laparotomy as compared to continuous closure.

**Keywords:** Emergency, Laparotomy, Wound dehiscence

## INTRODUCTION

Laparotomy wound dehiscence is a term used to describe separation of the layers of a wound before complete healing. Laparotomy wound dehiscence is still a puzzle for most of the surgeons. No institute could achieve 0% failure rate despite best efforts. Therefore, there is continuing research to eliminate this complication.<sup>1</sup> Historically, wound dehiscence up to 10% was reported; contemporary series estimates an incidence between 1 and 3%.<sup>2,3</sup> Mortality associated with dehiscence has been estimated at 10-30%.<sup>4</sup> The mean time to wound dehiscence is 8-10 days after operations.<sup>4,5</sup> The problem gets compounded with the high prevalence of diseases

like tuberculosis and typhoid. Patients undergoing emergency laparotomy suffer from one of these comorbid conditions which are detrimental to healing.<sup>6</sup> In this scenario interrupted suturing has been found to give good strength and have less incidence of wound dehiscence.<sup>7</sup>

## METHODS

This study was conducted on 300 consecutive patients undergoing emergency midline laparotomy in the Department of Surgery, Government Medical College and Hospital, Chandigarh from June 2015 to October 2017. Patients for the study were selected from those attending the surgical emergency of Government Medical

College and Hospital, Chandigarh with suspicion of acute abdomen requiring emergency midline laparotomy.

#### **Inclusion criteria**

Inclusion criteria were patients aged 15-75 years, requiring emergency laparotomy; both male and female gender; patients who underwent surgery with midline incisions.

#### **Exclusion criteria**

Exclusion criteria were patients with co-morbid conditions like immuno-compromised patients, patients on cancer chemotherapy, immunotherapy and on long term steroids; patients who died within 7 days after surgery; patients who underwent surgery by grid-iron and transverse abdominal incisions; elective laparotomy; patients who underwent second laparotomy or re-laparotomy.

**Group-A:** Closed by suturing the rectus sheath using polydioxanone suture 1-0 (PDS) in continuous layer suturing method.

**Group-B:** Closed by suturing the rectus sheath using polydioxanone suture 1-0 (PDS) in interrupted layer suturing method.

Details of the study were told to the patient and informed consent was taken. After obtaining consent, the patient underwent a procedure as per the study design and group allocation.

#### **Operative technique**

After resuscitation and preparation patients were taken for laparotomy. In supine position, parts painted and draped. Midline incision given and abdomen opened in layers. The pathology (perforation/obstruction/solid organ injury) was dealt, followed by thorough peritoneal lavage. Abdominal drain placed. Closure was done by either a continuous layer closure or interrupted layer closure as per group allocation.



**Figure 1: Continuous layer closure of rectus sheath.**

#### **Technique of continuous closure**

In group A, rectus sheath was closed using PDS. Each bite was taken 1.5-2 cm from the linea alba edge and successive bites being 1 cm from each other. The edges of the linea alba was gently approximated without strangulation. Wound washed with betadine and saline. Skin closed with polyamide 2-0 cutting needle or skin stapler (Figure 1).

#### **Technique of interrupted closure**

In group B, rectus sheath was closed with interrupted suturing using PDS. Each bite was taken 1.5-2 cm from the linea alba and successive interrupted sutures being 2 cm from each other. The edges of the linea alba was gently approximated without strangulation. Wound washed with betadine and saline. Skin closed with polyamide 2-0 cutting needle or skin stapler (Figure 2).



**Figure 2: Interrupted layer closure of rectus sheath.**

#### **Postoperative evaluation**

All patients were examined twice daily for general condition and any postoperative complications, drain output, abdominal distension, serosanguinous discharge, wound gaping and wound dehiscence. All patients were kept nil per oral and on parenteral fluids till their bowel recovered. Broad spectrum antibiotics were given as per protocol and were changed according for culture sensitivity. Daily dressing of the wound was done using betadine solution 5%. In patient who had no wound infection, gaping or wound dehiscence, skin sutures were removed after two weeks.

#### **Follow up**

Regular follow up was done up to 6<sup>th</sup>-10<sup>th</sup> post op days at hospital and then up to 2 weeks. During the follow up, the patients were examined for anaemia, abdominal distension; wound gaping and complete wound dehiscence.

**RESULTS**

**Gender distribution**

There were 80% males and 20% females in Group A while there were 84.7% males and 15.3% females in Group B. These when analysed by the Chi-Square Tests gave a p value of 0.289 which was not significant which showed that both the groups were comparable with respect to the sex distribution of the patients.

**Clinical comorbidities**

In group A, 39 patients had anaemia, 6 patients were diabetic, 51 patients had uraemia and 17 patients had chest infections. In group B, 19 patients were anaemic, 5 were diabetic, 49 had uraemia and 19 patients had chest infections.

**Table 1: Clinical comorbidities of the patients in both groups.**

Group	Anaemia (Hb<10 gm/dl)	Diabetes mellitus	Uraemia (urea>50 mg/dl)	Chest infection
Group A	39	6	51	17
Group B	19	5	49	19
Total	58	11	100	36

**Risk of wound dehiscence**

Out of 300 patients, 37 (12.7%) developed wound dehiscence in postoperative period. Stratified analysis was performed for the significant predictors to better understand the efficacy of the two methods under different conditions.

**Method of suturing**

Out of 300, 150 patients were randomised under the continuous method and 150 under interrupted method. It was seen that 29(20.1%) of 150 patients in continuous group developed burst, while 8(5.4%) of 150 patients in the interrupted group developed wound dehiscence. On analysis Chi-Square Test it showed that variation between the two groups was statistically significant with a p value of <0.001.

**Table 2: Relationship between suturing method and incidence of wound dehiscence.**

Wound dehiscence	Group A (%)	Group B (%)	P value
No	79.9	94.6	<0.001**
Yes	20.1	5.4	

**Cough and wound dehiscence**

Presence of cough at the time of hospital admission and postoperative period was analysed as a predictor in

outcome of burst abdomen. Out of 300 cases, 36 (12%) patients presented with cough. 27.3% cases in group A and 10.9% cases in group B had cough and developed wound dehiscence. On analysis Chi-Square Test it showed that variation between the two groups was statistically significant with a p value of 0.008.

**Table 3: Relationship between cough and wound dehiscence.**

Wound dehiscence	Group A (%)	Group B (%)	P value
Yes	27.3	10.9	0.008
No	72.7	89.1	

**Abdominal distension and wound dehiscence**

Abdominal distension was present in 150 (51.1%) of 291 patients. Out of 150 patients who developed abdominal distension, 33 (22%) patients had abdominal wound dehiscence in postoperative period. 141 patients who did not have abdominal distension, only 4 (2.8%) patients developed abdominal wound dehiscence. On statistical analysis the p value on Fisher's Exact test was <0.001, which was highly significant. It shows that abdominal distension in postoperative period is associated with high rates of abdominal wound dehiscence.

**Table 4: Relationship between abdominal distension and wound dehiscence.**

Technique	Abdominal distension	Wound dehiscence (%)		P value
		No	Yes	
Group A	No	94.9	5.1	<0.001**
	Yes	69.4	30.6	
Group B	No	98.8	1.2	0.022*
	Yes	89.2	10.8	

**Table 5: Logistic regression analysis.**

	Standard error (S.E.)	P value	Odds ratio
Technique	0.440	0.005	3.398
Cough	0.531	0.340	1.659
Abdominal distension	0.556	0.001	7.705
Urea	0.006	0.87	1.010
Constant	0.655	0.000	0.009

**Logistic regression analysis**

Logistic regression analysis was applied for the factors which were significant for the development of wound dehiscence and we found that the suture technique and abdominal distension were highly significant. Wound gaping though was highly significant but as patient without wound gaping had no wound dehiscence. So wound gaping was not included in regression analysis.

## DISCUSSION

Abdominal wound dehiscence is defined as postoperative wound separation that involves all the layers of the abdomen wall. The abdominal wound dehiscence is associated with morbidity of up to 40% and up to 18% mortality in malnourished and elderly patients.<sup>6</sup> In these patients burst abdomen represent an additional final insult to their already stressed physiology. In emergency cases, Indian authors have reported 10-30% of burst abdomen.<sup>7</sup> Most of the wound dehiscence in our study occurred from 5<sup>th</sup> to 10<sup>th</sup> postoperative day. This duration is within the period as quoted by similar studies.<sup>8,9</sup> Anielski et al, reported average time of 6.5 days and Madsen et al, reported the sixth postoperative day.<sup>10</sup> A variety of abdominal wound closure techniques have evolved over years, however wound dehiscence is a serious complication. The ideal technique and ideal suture material for abdominal wall closure have long been a matter of debate.<sup>11</sup>

In our study 300 patients were enrolled. Majority of patients were male in both the groups and this is comparable to other studies.<sup>12-14</sup> All patients underwent emergency midline laparotomy and a total of 37(12.7%) patients had abdominal wound dehiscence, out of which 20.1% of 150 patients in continuous group developed wound dehiscence, while 5.4% of 150 patients in the interrupted group developed wound dehiscence. Peter et al, compared continuous versus interrupted technique for closing abdominal incisions. 571 patients were enrolled in this study and they were randomized between the two closure methods. In this study, the patients who underwent midline incisions, the dehiscence rate was 2% (5/244) for the continuous group versus 0.9% (2/229) for the interrupted group. This difference was not statistically significant.<sup>12</sup> McNeil et al, compared continuous absorbable No.2 coated polyglycolic acid suture (Dexon-Plus) versus interrupted non absorbable No.28 stainless steel wire suture. They enrolled 105 patients for midline fascial closure following gastric surgery and did not found any significant difference in the wound complication rate between two closure methods (7/54 for wire and 8/51 for polyglycolic acid).<sup>13</sup> Trimbos et al, conducted a randomized study, comparing interrupted versus continuous suture technique. All patients underwent midline laparotomies in the study. Early evaluation of study resulted in no difference between the continuous and interrupted suture groups with respect to wound infection (3% versus 1%), superficial wound dehiscence (2% versus 4%) and deep wound dehiscence (0.6% versus 0%).<sup>7</sup> Weiland, Bay and Del Sordi from their meta-analysis study in 1998 suggested that continuous closure with non-absorbable suture should be used to close most abdominal wounds; but however, if infection or distension is anticipated, interrupted absorbable sutures are preferred.<sup>14</sup> In 2004, Srivastava et al, conducted a study on abdominal wound dehiscence following emergency laparotomies in Indian setup. They compared continuous versus interrupted suturing method

in midline laparotomy wounds. A total of two hundred and ten patients were included in this study, 100 patient in emergency and 110 in elective group. Out of 100 from emergency group, 54 patients were randomized into continuous group and 46 into interrupted group. Burst abdomen occurred in 1/46 (2.17%) in interrupted group and 8/54 (14.8%) in continuous group. The relative risk of burst abdomen was 0.15 (p= 0.028). So they concluded that the risk of burst abdomen in emergency group is less with interrupted-X- method of closure.<sup>15</sup> Gupta et al, conducted a meta-analysis of 23 trials in 2008 and they compared the interrupted versus continuous closure in abdominal wound repair. In this meta-analysis, 23 studies were included, with a total of 10,900 patients. The result of meta-analysis says that the interrupted method of closure was associated with significantly less dehiscence as compared with continuous method. The interrupted technique was also found to be better in non-absorbable suture, vertical incision and mass closure subgroups. So they concluded that interrupted laparotomy wound closure reduces the odds of dehiscence by half compared with continuous wound closure.<sup>16</sup> In 2012, Agrawal et al, did a randomized controlled trial and concluded that intraperitoneal sepsis, cough, uraemia, wound infection and necrosis of linea alba are significant predictors of burst. In presence of these symptoms, the risk of abdominal wound dehiscence can be reduced to less than one third by using interrupted sutures. Continuous closure gives good results in elective settings.<sup>17</sup> Comparison of wound dehiscence between the two techniques in earlier studies and our study is given in Table 10.

**Table 6: Various studies and comparison of two closure methods with wound dehiscence.**

Study	Continuous layer closure (%)	Interrupted layer closure (%)
Peter et al <sup>12</sup>	2	0.9
Mc Neil et al <sup>13</sup>	12.96	15.68
Trimbos <sup>7</sup>	0.6	0
Srivastava et al <sup>15</sup>	14.8	2.17
Present study	20.1	5.4

However, clinical trials from Indian centres report less number of dehiscence with interrupted fascial closure. This may be because in India patients undergoing emergency laparotomy have poor clinical profile at the time of presentation. At laparotomy, it is observed that profound necrosis of the aponeurotic layers has already occurred. Such necrotic linea alba does not hold sutures well which cut out with a bout of coughing or sneezing.

Chronic lung disease and postoperative pulmonary complications are important systemic factors that may increase the intra-abdominal pressure postoperatively through coughing during the early recovering days. Presence of cough at the time of hospital admission and postoperative period was analysed as a predictor in outcome of burst abdomen.



In our study, out of 300 cases, 27.3% in continuous group and 10.9% in interrupted group had wound dehiscence in patient with cough. On analysis Chi-Square Test it showed that variation between the two groups was statistically significant with a p value of 0.008.

In a study by Makela et al, the wound dehiscence in patients with chronic lung disease (12 of 48 [25%] versus 4 of 48 [8%], respectively;  $p=0.026$ ).<sup>18</sup> In study by Agrawal et al, out of 17 (4.88%) cases who presented with cough preoperatively, 5 (29.41%) went on to develop burst abdomen. Of those, not having preoperative cough, 24 (7.25%) developed burst.  $RR_{\text{cough}}=0$  (4.05); 95% CI 1.76–9.31; two-sided Fisher's exact  $p=0.0086$ . So cough is a significant risk factor for postoperative wound dehiscence.

Abdominal distension was present in 150(51.1%) of 291 patients. 30.6% patients with abdominal distension in continuous group and 10.8% in interrupted group had wound dehiscence. On statistical analysis the p value on Fisher's Exact test was  $<0.001$ , which was highly significant. It shows that abdominal distension in postoperative period is associated with high rates of abdominal wound dehiscence. Various studies also support the association of postoperative abdominal distension and wound dehiscence.

Wound infection and wound gaping is very common after emergency laparotomy. In our study surgical site infection and wound gaping was present in 127(43.6%) of patients. Out of 127, 37(29.1%) patients developed wound dehiscence in postoperative period. On statistical analysis the p value on Chi-Square Test was 0.000. Thus surgical site infection was a highly significant predictor of wound dehiscence. Various studies have observed varied incidence of wound gaping in abdominal closure techniques. In McNeil study incidence of wound gaping was 4% and 2%, 10% and 11% for Sahlin et al, 2% and 13% for Shukla et al, and 1% and 3% for Trimbo et al, in continuous and interrupted group respectively.<sup>19</sup> Graham DJ et al, pointed in their paper "The association of intraabdominal infection and abdominal wound dehiscence" that intra-abdominal infection and colonic surgery were a leading cause of wound dehiscence.<sup>20</sup>

A logistic regression analysis was performed for all the risk factors for development of wound dehiscence and suture technique and postoperative abdominal distension were significantly associated with development of wound dehiscence.

## CONCLUSION

All patients with generalised peritonitis in emergency setting need special attention regarding the wound closure. Wound dehiscence depends on multiple factors. In emergency setting interrupted closure is superior to continuous closure technique for abdominal wound closure. Method of suturing, cough, uraemia, abdominal

distension and wound infection followed by wound gaping are significant predictors of burst abdomen. On regression analysis, abdominal distension and suture technique is significantly associated with wound dehiscence.

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