

Original Research Article

Evaluation of abdominal wound closure using continuous versus interrupted sutures in patients of perforation peritonitis

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ABSTRACT

Background: The type of wound closure plays a critical role in patients of perforation peritonitis, since many of these patients also have poorly controlled co-morbidities and risk factors for wound dehiscence. Though many studies have evaluated abdominal wound closures in the elective scenario, similar studies in the emergent scenario are rather scarce. Hence, we have dealt with this issue in patients presenting with hollow viscus perforation peritonitis.

Methods: This was a prospective randomized case control single-centre study with 120 patients performed at St. Stephen's Hospital, New Delhi, India between February 2016 and January 2019. These patients were randomized divided into two groups; group A comprising those patients in whom, the abdominal wound was closed with continuous sutures, and group B comprising those in whom it was closed with interrupted sutures. Informed consent was taken from all the patients. A detailed proforma included all parameters. Follow up was conducted at 2, 4, 6 and 12 weeks from the date of surgery. Data analysis was done using S.P.S.S. version 17.

Results: The time taken for continuous suture fascial closure was significantly less than the interrupted technique. There were no significant differences in other parameters, immediately or on follow-up.

Conclusions: The continuous method of abdominal closure was faster than interrupted suturing on account of the use of only two terminal knots, this difference being statistically significant. The outcomes were comparable to other studies that have dealt with this issue in elective surgeries.

Keywords: Abdominal wound closure, Continuous suture technique, Interrupted Suture technique, Laparotomy

INTRODUCTION

Post-operative wound healing depends on several factors, importantly, the general health and co-morbid conditions of the patient, besides the types of suture materials used and the type of wound closure.^{1,2}

The current opinion in the West, is of a mass closure of the abdomen as no significant differences have been noted between the different methods of abdominal fascial closure in terms of wound dehiscence and incisional hernia development.³ Slowly absorbable suture materials are preferred over their non-absorbable counterparts because their use seems to be associated with lesser incidence of suture sinus development and incisional site

pain and they have a similar incidence of wound infection, dehiscence and development of incisional hernia.⁴

In the emergency set-up, the type of wound closure plays a critical role in patients of perforation peritonitis, especially since many of these patients also have pre-operatively detected, and often poorly controlled co-morbidities and risk factors for wound dehiscence.²

The objective of this study was to evaluate the closure of the abdominal fascial wound post midline laparotomy, using continuous versus interrupted sutures, in patients of perforation peritonitis, in terms of wound complications.

Aims and objectives

To compare the immediate, early and late wound-related complications noted in patients of perforation peritonitis, when the abdominal fasciae were closed in a continuous manner versus when they were closed using an interrupted technique. To compare patient satisfaction in either scenario.

METHODS

Study design

It was a prospective randomized case-control single centre study on a total of 120 patients.

Centre for the study

This study was conducted in the Department of Surgery, St. Stephens's Hospital, Tis Hazari, New Delhi, India.

Time frame of the study

The data for this study was prospectively collected between February 2016 and January 2019.

Inclusion criteria

The study included all patients of bowel perforation, who presented with peritonitis. These patients were randomized divided into two groups; group A comprising those patients in whom, the abdominal wound was closed with continuous sutures, and group B comprising those in whom the abdominal wound was closed with interrupted sutures.

Exclusion criteria

The study excluded patients documented to be affected with primary peritonitis, patients aged less than 18 years or greater than 70 years of age, patients with a body mass index either less than 16 or greater than 35, patients with co-morbid conditions detected earlier or at admission-e.g. diabetes mellitus, HIV and other causes of immune-compromise, e.g. chemotherapy, radiotherapy, those with documented chronic liver disease or chronic kidney disease, patients with serum albumin less than 3.5 gm/dl, and pregnant women, irrespective of gestational age.

Sample size

The sample size was calculated using the formula:

$$n = \frac{4pq}{d^2}$$

Where, n=the sample size; 4=constant; p=mean incidence of wound dehiscence noted in previous studies; q=100-p; d=degrees of freedom permitted.

“p” was taken to be 3%, in accordance to a randomized controlled trial conducted by Seiler, Christoph and Bruckner, where the incidence of burst abdomen was noted to be 2-4% in the emergency setting.⁵

“q” was therefore calculated as 100-p = 97.

“d” was the degrees of freedom permitted. With an intention of keeping the confidence intervals within 95%, the degrees of freedom was accepted as “5”.

The sample size therefore was as follows:

$$n = \frac{4 \times 3 \times 97}{5^2}$$

$$=47$$

It was therefore observed that the minimum sample size representative of the population was 47 patients. Hence, it was decided to include at least 47 patients in each group.

Randomization

A simple randomization method was followed wherein, the first patient in the study was subjected to continuous closure of the abdomen, the second patient was subjected to interrupted closure, followed by continuous closure in the third and so on, in an alternate manner.

Methodology

All patients presenting with symptoms suggestive of bowel perforation were assessed immediately. After adequate resuscitation, a detailed history was elicited along with a detailed physical, and systemic examination in a suitably private environment.

All the patients suspected clinically to be suffering from bowel perforation peritonitis underwent relevant investigations to confirm the diagnosis as well as ascertain the nature of pathology and fitness to undergo surgery under general anaesthesia.

All patients were started on relevant intravenous antibiotics at admission, along with adequate fluid resuscitation and analgesia.

Exploratory laparotomy was conducted through a midline vertical incision. The measurement of the length of incision was done using a metallic scale kept sterilized in glutaraldehyde solution. The necessary surgical procedure was carried out in accordance to the operative findings. Peritoneal lavage was carried out with warm 0.9% saline, till the returning fluid in the suction tube was clear. Intra-abdominal drain(s) was/were then inserted, if thought necessary by the chief surgeon. Suitable abdominal closure was then carried out, using continuous or interrupted sutures, depending on the group the patient was randomly assigned to.

The wound was dressed after thorough cleaning, with sterile gauze pieces and covered with occlusive adherent bandage. The primary dressing was removed after 48 hours and daily aseptic dressing was done. The wound was examined for signs of infection or dehiscence, prior to each dressing. Swab cultures from the wound were sent for microbiological culture and antibiotic susceptibility studies, on any sign of infection. The patients were put on or changed over to appropriate antibiotics depending upon the culture sensitivity reports, or on clinical signs of infection (fever, tachycardia, raised total leukocyte counts in excess of 12,000/cubic millimeters).

Methods of closure of abdominal wound

GROUP A- Continuous suturing done

Non absorbable number 1 prolene was used in a simple running technique, starting from the inferior margin of the wound. The bites taken were 1 cm from the wound margin with a gap of 1 cm between subsequent sutures, in a non- interlocking manner.

GROUP B Interrupted suturing done

Non absorbable number 1 prolene was used, starting from the inferior margin of the wound. The bites taken were 1 cm from the wound margin with a gap of 1 cm between subsequent sutures, taking six knots per suture tie.

Parameters of evaluation

The following parameters were evaluated: 1) Age distribution of patients. 2) Sex distribution of patients. 3) Diagnoses in all the evaluated patients. 4) Time taken for closure of the abdominal wound (defined as the time taken from the start of abdominal fascial closure till the end, not including the time for dressing). 5) Wound dehiscence (defined as lack of post-operative continuity of the abdominal fasciae with bursting open of the wound or splitting along the line of suturing). 6) Wound infection (defined as the presence of erythema and/or wound dehiscence with the secretion of either putrid foul-smelling fluid or requiring change of or addition of antibiotics or surgical intervention). 7) Length of hospital stay. 8) Patient satisfaction index: The patients were asked to choose their level of satisfaction at the time of discharge in terms of local wound pain and/or discomfort from among the following three categories: a) highly satisfied, b) satisfied, c) unsatisfied.

Follow up of the patients

The patients included in the study were called for review at 2, 4, 6 and 12 weeks after discharge. During these reviews, attention was focused upon the following complications: 1) Wound infection (as defined earlier). 2) Development of suture sinus (defined as an abnormal protrusion of underlying suture material through intact

skin, or through an area of induration with or without superficial ulceration, often requiring surgical intervention, that is, removal of the protruding suture material). 3) Development of incisional hernia (defined as postoperative evidence of fascial dehiscence after complete superficial wound healing, with or without prolapse of intra-abdominal organs enclosed within a thinned out peritoneal sac).

Statistical analysis

All quantitative data was expressed in terms of minimum, maximum, mean and median. Significance of differences in means was calculated using the ANOVA test followed by the application of the post-hoc test if the data was normally distributed and the Kruskal Wallis test otherwise. Significant difference in proportions of qualitative data were calculated by applying the Pearson's Chi-square test and Fischer's exact test. All calculations were done using SPSS version 17.

RESULTS

Age

The mean age in group A was 39 years and in group B was 41 years respectively, both ranging from 19 years to 65 years. There was no statistically significant difference in the mean ages in either group ($p=0.53$).

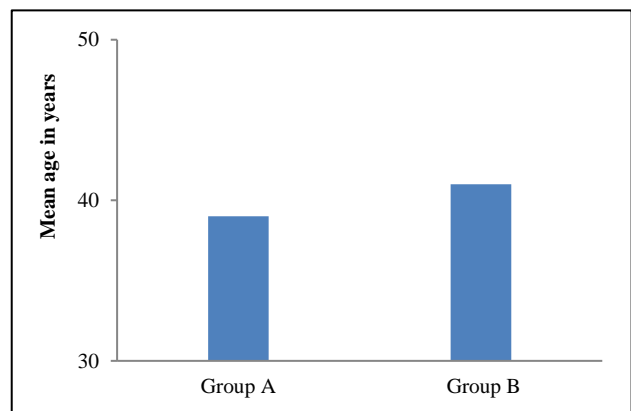


Figure 1: Mean ages in both groups.

Sex

There were more men than women in both the groups, 61.67% in group A and 66.67% in group B, respectively. This was consistent with the higher incidence of hollow viscus perforation peritonitis in men, associated with life-style related risk factors. There were no statistically significant differences in the representation of either sex in either group ($p=0.35$).

Final diagnoses

The commonest diagnosis in both groups together as well as in each group separately, was small bowel perforation.

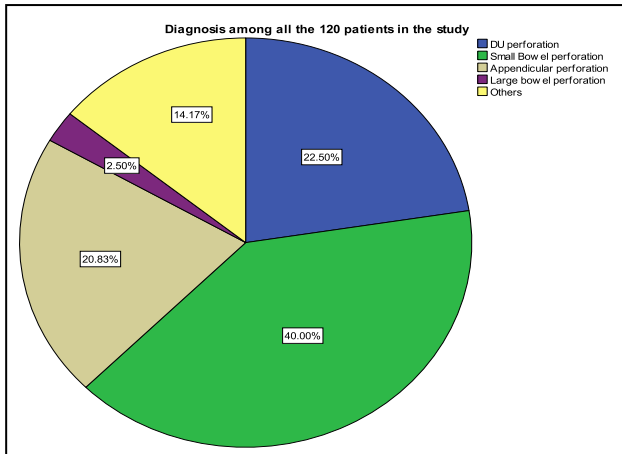


Figure 2: Final diagnoses in both groups together.

Time taken for wound closure

It was noted that there was significant difference in the mean time taken for closure with the continuous suturing technique, when compared with the interrupted technique, in favour of the former ($p=0.00$).

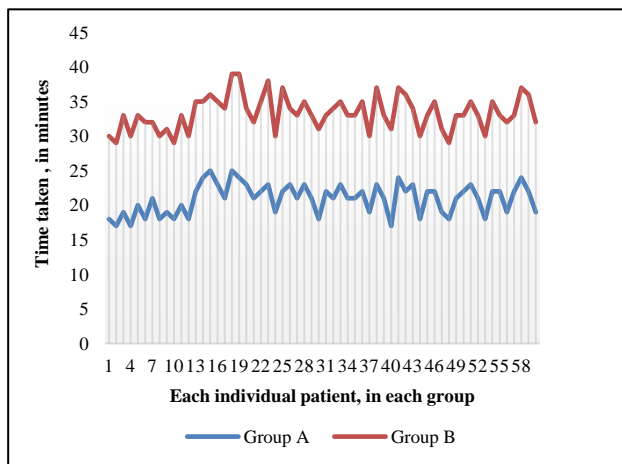


Figure 3: Linear distribution of closure times in minutes, in both groups.

Wound dehiscence

It was noted that 3 patients in group A and 2 patients in group B developed wound dehiscence. All these patients were taken up for re-exploration and repair, as per the findings. The difference was found to be statistically insignificant ($p=0.50$).

Wound infection

It was noted that 12 patients in group A and 14 patients in group B developed wound infection. The difference was found to be statistically insignificant ($p=0.41$) (Figure 5).

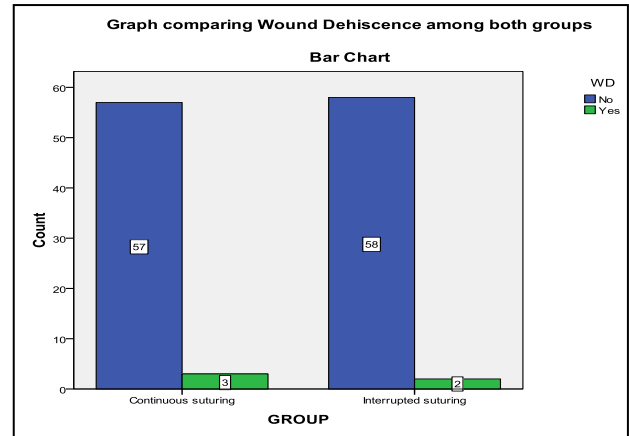


Figure 4: Graph comparing wound dehiscence in both groups.

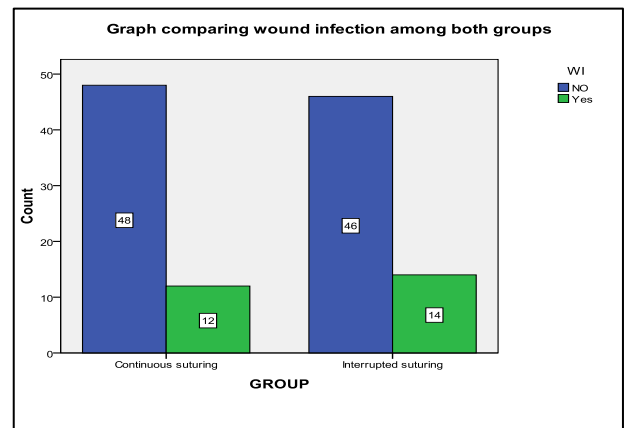


Figure 5: Graph comparing wound infection in both groups.

Length of hospital stay

The maximum period of hospitalization was noted to be 75 days in group A and 45 days in group B. The minimum period of hospitalization was noted to be 5 days in each group. No statistically significant difference was found between the two groups ($p=0.41$).

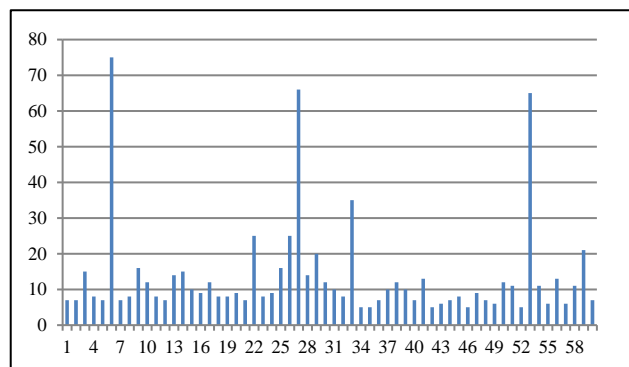


Figure 6: Length of admission period in days, for each patient in group A.

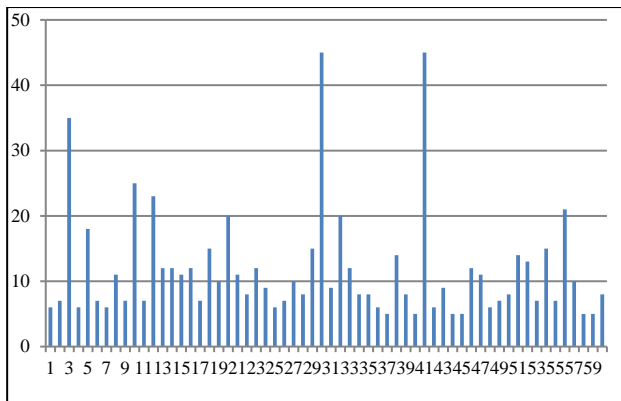


Figure 7: Length of admission period in days, for each patient in group B.

Patient satisfaction index

It was noted that 81.70% patients in group A (n=49) were highly satisfied, as opposed to 85% (n=51) in group B. It was noted that 16.70% patients in group A (n=10) were satisfied, as opposed to 15% (n=9) in group B. It was noted that 1.70% patients in group A (n=1) were not satisfied, as opposed to none (n=0) in group B. It was finally concluded that none of these differences were statistically significant.

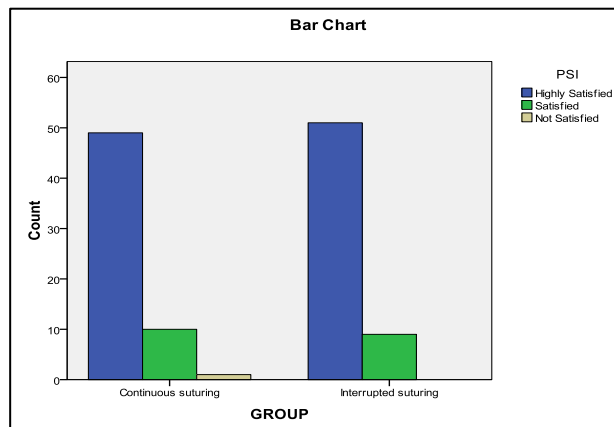


Figure 8: Patient satisfaction index.

Follow-up evaluation

Wound infection at 2 weeks follow up

Wound infection was noted in 21.70% patients in group A (n=13) and 18.30% patients in group B (n=11) at 2 weeks follow up. The difference was not significant statistically (p=0.41).

Wound infection at 4 weeks follow up

Wound infection was noted in 10% patients in both the groups (n=6). There was no difference between the groups.

Wound infection at 6 weeks follow up

Wound infection was noted in 1.70% patients in both the groups (n=1). There was no difference between the groups.

Wound infection at 12 weeks follow up

All patients in both the groups were infection-free at 12 weeks follow up.

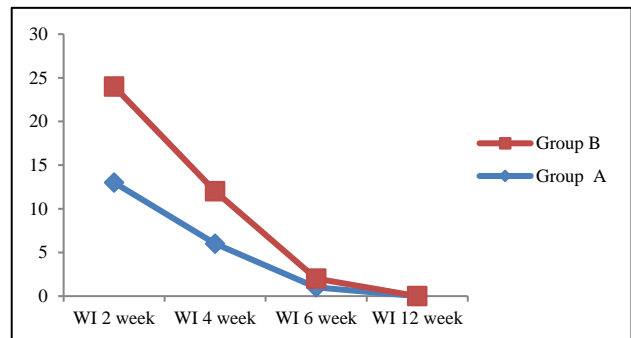


Figure 9: Trend in wound infection at serial follow up.

Suture sinus at 2 weeks follow up

Suture sinus was noted in 5% patients in group A (n=3) and 1.70% patients in group B (n=1). The difference was insignificant statistically (p=0.31).

Suture sinus at 4 weeks follow up

No patients in group A had suture sinus while 5% patients in group B (n=3) had suture sinuses. This difference was statistically insignificant (p=0.12).

Suture sinus at 6 weeks follow up

5% patients in group A (n=3) and 3.30% patients in group B (n=2) had suture sinuses. The difference was insignificant (p=0.50).

Suture sinus at 12 weeks follow up

No patient in either group had suture sinuses at 12 weeks of follow up.

Incisional hernia at 2 weeks follow up

None in group A and 1.70% (n=1) in group B developed incisional hernia by 2 weeks. The difference was insignificant (p=0.50).

Incisional hernia at 4 weeks follow up

None in group A and 3.30% (n=2) in group B developed incisional hernia by 4 weeks. The difference was insignificant (p=0.25).

Incisional hernia at 6 weeks follow up

1.70 % patients in group A (n=1) and 3.30% in group B (n=2) developed incisional hernia by 6 weeks. The difference was still statistically insignificant (p=0.50).

Incisional hernia at 12 weeks follow up

Two patients in each group (3.30%) had developed incisional hernia by 12 weeks of follow up, with no resultant difference in this regard, between the groups.

DISCUSSION

The best method of abdominal closure is accepted to be one that maintains tensile strength throughout the healing process with good tissue approximation, does not promote wound infection or inflammation, is tolerated well by the patient and is technically simple and expedient. The technique used for closure of abdominal fascia is frequently based on non-scientific factors. Owing to difficulties arising from differently designed studies in this regard, literature does not clearly define the ideal or optimal technique to perform closure of abdominal fasciae, especially in the emergency setting.

The results obtained are discussed in detail in the following section:

Time taken for closure

The mean time taken for abdominal fascial closure in group A was 12.37 min (11-15 minutes) while in group B, it was 20.93 min (17-25 minutes). This difference was noted to be statistically significant (p=0.00). This difference in time could be attributed to the increased number of knots to be tied in the interrupted technique. Richards et al did not record the exact closure time in their study, but it was recorded as between 20-25 minutes for the continuous group while it was between 40-45 minutes for the interrupted group.²⁵ Stone et al, in their retrospective study, suggested that anaesthesia duration and the operative time could be reduced by the use of the continuous suture closure technique, although even they did not note the exact time difference.³³ In a prospective randomized study by Mc Neil et al, continuous suture closure of abdominal fasciae was accomplished in significantly less time (21±8 minutes) than interrupted closure (43±19 minutes), including the time for skin closure.³⁴ Hence, no discrepancy was noted in the current study, as compared to other similar trials.

Wound dehiscence

This was noted in 5% patients in group A (n=3) and 3.30% patients in group B (n=2). The difference was insignificant statistically (p= 0.50). Indian authors have reported burst abdomen rates of 10-30% in the emergency set-up.³⁶⁻³⁸ Higher proportions of wound dehiscence were noted in patients who were relatively

more malnourished. There was increased incidence of wound infection associated with dehiscence.

Wound infection

It was noted that 12 patients in group A (20%) and 14 patients in group B (23.33%) developed wound infection. The difference between the groups was found to be statistically insignificant (p=0.41). Wound infection in most elective surgery trials is limited to 3-10%. Gislason et al noted higher incidence of wound infection (14%) in the emergency set up.³⁹ No significant difference was noted in the incidence of wound infection, between continuous (10%) and interrupted (11%) closure by Sahlin et al.⁴⁰ A higher incidence of wound infection in the current study, as compared to other trials, could be attributed to the nature of faeculent contamination and the delay from onset of symptoms to presentation at the hospital.

At 2 week follow up, 21.70% patients in group A (n=13) and 18.30% in group B (n=11) were noted to have wound infection. There was no significant difference between the groups at 2 weeks, in terms of wound infection (p=0.41).

At 4 weeks, 10% patients (n=6) in each group developed wound infection.

At 6 week follow up, 1.70% (n=1) patient in each group had persistent wound infection.

No wound infection persisted till the 12-week follow up deadline.

This was attributed to effective dressing and meticulous wound care, followed by secondary suturing, where indicated.

Length of stay in the hospital

The mean duration of hospitalization was 13.45 days in group A, with a maximum duration of 75 days. The mean duration in group B was 11.7 days, with a maximum period of 45 days. The minimum period of hospital admission was 5 days in each group. There was no significant difference between the groups in this regard (p=0.41). Richards et al reported a mean admission period of 11.3 days in the continuous suturing group of patients and 17.5 days in the interrupted suturing group.²⁵ This difference was also not found to be statistically significant.

Incisional hernia

At 2 weeks follow up, one patient in group B (1.70%) and none in group A had developed an incisional hernia. The difference was insignificant (p=0.50). By 4 weeks, another patient in Group B had developed incisional hernia (total n=2, 3.30%). None in group A had

developed incisional hernia at this time. The difference, however, was still not significant ($p=0.25$). By 6 weeks, one patient in group A had developed an incisional hernia while no new patient had done so in group B. The difference was still insignificant ($p=0.50$). By 12 weeks, another patient had developed incisional hernia in group A while no new patient had done so in group B. Hence, at 12 weeks follow up, both groups had 2 patients each with incisional hernia, with a prevalence of 3.33% in each group. Hence, with regards to incisional hernia, no technique was superior to the other, given the limitation of the relatively short duration of follow up.

Limitations of the study were relatively small, though statistically representative sample size. Study representative of only the emergency setting. Relatively short duration of follow up, with regards to development of delayed complications, like incisional herniae.

CONCLUSION

The continuous method of abdominal fascial closure was faster when compared to interrupted suturing on account of the use of only two terminal knots, this difference being statistically significant. Both techniques of wound closure behaved similarly, in all other parameters used in this study. This study hopes to draw parallels with others that have evaluated the same issues in the elective surgery scenario. We hope to establish the fact that even in the emergency scenario, despite the higher incidence of postoperative wound dehiscence, both techniques of fascial closure are equally acceptable, and the continuous method may be preferred in those where a damage control mode is followed, to save time.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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