A comparative study of skin closure using staples versus nylon suture in emergency exploratory laparotomy

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INTRODUCTION

“Surgery is the first and is highest ranked division in art of the healing and is pure in itself, perpetual in its applicability, and is working product of heaven and sure of fame on earth” SUSHRUTA (400 B.C.)[1,2]

Background: The goal of suturing is to acquire healing with mild edema, no discharge or any infection, without any wound dehiscence, and with minimal scar formation, after any surgical procedure careful approximation of the tissues will allow good healing by primary intention. Suture thread is made from various materials. The sutures were made from biological materials, such as catgut and silk. These sutures absorbed the body fluids and could be foci of infection. Skin staplers are also used for skin approximation in place of sutures. Objectives: The objectives of the study were to compare skin staples with skin closure in exploratory laparotomy wounds with respect to wound infection, wound dehiscence, wound cosmesis, post-operative pain, and suturing time. Materials and Methods: The present study was carried out in the Department of Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh. This was a double-blinded randomized controlled study. All patients undergoing emergency exploratory laparotomy during the study period and fulfill the inclusion criteria were included in the study. Patients were randomly divided into two groups, Group A (Nylus suturing) and Group B (stapler) and this randomization was done using website www.random.org to make study double blind. A total of 100 patients were included in the study and divided into two groups each containing 50 patients. Post-operative results of the patients at 10 days and 1 month in terms of healing time and complications were assessed. Results: Stapler was superior to nylons suture with respect to wound infection, discharge, cosmesis, post-operative pain, skin closure time, incidence of seroma, and occurrence of lesser complications.

KEY WORDS: Stapler, nylon, laparotomy


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epidermis and dermis only serves to auto-inoculate the wound of the patient, passage for flora to penetrate deep into the subcutaneous tissue and is a potential source of foreign body reaction.[5,8]

The type of suture material for skin closure is also reported to influence post-operative wound complications. Suture thread is made from various materials. The sutures were made from biological materials, such as catgut and silk. These sutures absorbed the body fluids and could be foci of infection.[9]

Most of modern sutures are synthetic, including the absorbable such as polyglycolic acid, polylactic acid, monocril and polydioxanone, as well as the non-absorbable such as nylon, polyester, PVDF, and polypropylene.[10]

Ethilon (Nylus) is a synthetic non-absorbable nylon suture manufactured by surgical suture making company Ethicon in Cornelia, Georgia. It is black in color and is a monofilament suture that is used frequently for soft-tissue approximation and ligation. Even though it is non-absorbable, the knot security decreases over the time (in vivo) and should not be used where permanent approximation of suture is required.[13]

Jenkin’s rule was the first research result in the suturing technique, showing that the then-typical use of a suture length to wound length ratio of 2:1 increased the chance of a burst wound, and suggesting a SL:WL ratio of 4:1 or more in abdominal wounds. In later, study is going on which is suggestive that 6:1 is the optimal ratio in abdominal closure.[11-16]

Skin stapler was used first by Hungarian surgeon Húmér Hültl. Hultl’s prototype stapler of 1908 weighed 8 pounds (3.6 kg) and required 2 h to assemble and load and known as father of stapler. The technology of stapler was further refined in the 1950s in the Soviet Union and allowing for the first commercially produced reusable stapling devices for creation of bowel and vascular anastomosis. The first stapling device sample was brought by Mark M. Ravitch after attending a surgical conference in USSR and introduced for commercial purpose, then Leon C. Hirsch who manufacture surgical staplers under its auto-suture brand in 1964.[5]

The present study was conducted to compare skin closure using staples versus nylon suture in emergency exploratory laparotomy with respect to wound infection, wound dehiscence, wound cosmesis, post-operative pain, and suturing time.

MATERIALS AND METHODS

The present study was carried out in the Department of Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh. This was a double-blinded randomized controlled study.

All patients undergoing emergency exploratory laparotomy during the study period in the Department of Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, and fulfill the inclusion criteria were included in the study. Patients were randomly divided into two groups, Group A (Nylus suturing) and Group B (stapler) and this randomization was done using website www.random.org to make study double blind. A total of 100 patients were included in the study and divided into two groups each containing 50 patients.

Inclusion Criteria

All emergency exploratory laparotomy case and all patients of age 18–60 years were included in the study.

Exclusion Criteria

Patients undergoing elective exploratory laparotomy, patients below 18 years of age and above 60 years, pregnant women, and patients who are not opted for study were excluded from the study.

Procedure

After closing the abdomen, skin was closed using either Nylus suture or stapler.

Nylus Suturing

Nylus 2.0 reverse cutting suture was used.

- Suture was loaded in needle holder by placing the needle in the tip of the holder, two-thirds of the distance from the tip to the thread
- Entry and exit of suture were done on either side of the wound. Suture should lie perpendicularly across the wound with equal depth and distance from the wound edge
- Skin was gently lifted with the forceps and skin surface was pierced with the needle perpendicular (90 degrees) to the skin
- Skin was sutured in an interrupted horizontal mattress type
- Suturing was done in ratio of 4:1 suture length to wound length
- To secure the knot, squaring of knot was done also called surgeon’s knot
- Then, suture was cut leaving 5-6 mm in length, which help in identifying the knot in future.

Stapling

Disposable steel skin stapler was used.

- Skin margin was approximated with eversion using either Adson forceps (forceps with teeth) or the thumb and forefinger
- Stapler was placed firmly on the skin surface without indenting the skin
- Center mark on the stapler was aligned with the center of the wound margin
- Stapler handle was squeezed to eject the staple into the skin
- Staples were placed about 0.5–1 cm apart
- Staples were placed to allow for proper apposition of the wound edges.

Post-operative Period

Same broad-spectrum antibiotics (ceftriaxone + sulbactam) and analgesics (diclofenac) were given to the patient of both groups for 7 days. First dressing was done on post-operative day 2 with...
Betadine solution. Daily dressing was done in case of infected wound whereas alternate day dressing was done in clean wound. Skin sutures were removed on the 10th post-operative day in both the groups but in some cases where wound was infected, few sutures or staples were removed before 10 days also.

**Follow-up**

It was done to see the scar integrity and cosmesis, within 1 month of surgery.

Visual analog pain score – Post-operative pain was measured using the visual analog scale, which consists of a line, usually 100 mm long, whose ends are labeled as the extremes (“no pain” and “pain as bad as it could be”). The patient is asked to put a mark on the line indicating his/her pain intensity.[5]

Cosmetic scores (1-10)

To be evaluated by
- a. Subjective satisfaction score
- b. Wound satisfaction score
- c. 10-point photographic series questionnaire
- d. 21-point body image cosmetic score
- e. Modified Hollander incision attribute satisfaction score
- f. 8- and 12-item short-form health survey.

**OBSERVATION AND RESULTS**

The present study was conducted in the Department of Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, with the objective to compare skin closure using staples versus nylon suture in emergency exploratory laparotomy. A total of 50 patients were included in each group.

Table 1 and Figure 1 show the distribution of age between the groups. More than one-third of patients of both nylon (48%) and stapler (44%) were between 18 and 30 years. The mean age of patients of nylon and stapler group was 35.70 ± 14.63 and 34.32 ± 10.54 years, respectively. There was no significant ($P > 0.05$) difference in age between the groups showing comparability between the groups in terms of age.

Table 2 and Figure 2 show the comparison of diagnosis between the groups. More than half of patients of both nylon (54%) and stapler (70%) groups had intestinal perforation. There was no significant ($P > 0.05$) difference in diagnosis between the groups showing comparability between the groups in terms of age.

Table 3 and Figure 3 show the comparison of average time for skin closure between the groups. The average time for skin closure was significantly ($P = 0.0001$) higher among patients of nylon group (29.92 ± 1.46 min) than stapler group (6.10 ± 1.46 min).

In both the groups, all the patients had undergone midline incision.

Table 4 and Figure 4 show the comparison of no. of staple/stitch between the groups. The no. of staple/stitch was insignificantly ($P > 0.05$) lower among patients of nylon group (16.86 ± 5.36)
than stapler group (17.26 ± 5.31). All patients had undergone exploratory laparotomy with midline incision of average length of 15 cm.

Table 5 and Figure 5 show the comparison of complications of wound between the groups. Irregular margin complication was among 34% of patients of nylon group and in 2% of patients of stapler group. There was significant ($P = 0.0001$) difference in complications between the groups.

**DISCUSSION**

The mean age of patients included in our study for nylon and stapler group was 35.70 ± 14.63 and 34.32 ± 10.54 years, respectively. There was no significant ($P > 0.05$) difference in age between the groups showing comparability between the groups in terms of age. More than half of patients of both nylon (80%) and stapler (66%) groups were male. There was no significant ($P > 0.05$) difference in gender between the groups having comparison. Similar to this study, Sundresh et al. (2018)[17] found that both the groups (staples and sutures) were found to be similar in characteristics such as age, sex, and education with $P$-value of more than 0.05.

**Table 3:** Comparison of average time for skin closure between the groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Average time for skin closure in minutes (mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon</td>
<td>29.92±1.46</td>
</tr>
<tr>
<td>Stapler</td>
<td>6.10±1.46</td>
</tr>
<tr>
<td>$P$-value$^1$</td>
<td>0.0001*</td>
</tr>
</tbody>
</table>

Unpaired $t$-test, *significant

**Table 4:** Comparison of no. of staple/stitch between the groups

<table>
<thead>
<tr>
<th>Groups</th>
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</tr>
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<tr>
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</tr>
<tr>
<td>Stapler</td>
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</tr>
<tr>
<td>$p$-value$^1$</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Unpaired $t$-test

**Table 5:** Comparison of complications of wound between the groups

<table>
<thead>
<tr>
<th>Complications of wound</th>
<th>Nylon ($n=50$)</th>
<th>Stapler ($n=50$)</th>
<th>$P$-value$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Irregular margin</td>
<td>17 34.0</td>
<td>1 2.0</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Overlapping border</td>
<td>10 20.0</td>
<td>1 2.0</td>
<td></td>
</tr>
<tr>
<td>Seroma</td>
<td>6 12.0</td>
<td>1 2.0</td>
<td></td>
</tr>
<tr>
<td>Discharge from wound</td>
<td>3 6.0</td>
<td>1 2.0</td>
<td></td>
</tr>
<tr>
<td>SSI</td>
<td>4 8.0</td>
<td>2 4.0</td>
<td></td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>3 6.0</td>
<td>4 8.0</td>
<td></td>
</tr>
<tr>
<td>No complication</td>
<td>7 14.0</td>
<td>40 80.0</td>
<td></td>
</tr>
</tbody>
</table>

$^1$Chi-square test, *significant

**Figure 3:** Comparison of average time for skin closure between the groups

**Figure 4:** Comparison of no. of staple/stitch between the groups

**Figure 5:** Comparison of complications between the groups
In this study, more than half of patients of both nylon (62%) and stapler (82%) groups had intestinal perforation, intestinal obstruction, and others which included appendicular perforation, Meckel’s diverticulum, and ruptured liver abscess along with intestinal perforation and intestinal obstruction.

In the present study, the average time for skin closure was significantly \((P = 0.0001)\) higher among patients of nylon group \((29.92 \pm 1.46 \text{ min})\) than stapler group \((6.10 \pm 1.46 \text{ min})\).

Karthikeyan et al. (2018) showed that time taken for skin closure in stapler method was \(4.01 \pm 1.6 \text{ min}\) and conventional suturing method was \(8.99 \pm 2.7 \text{ min}\). Similar to the present study, Sundresh et al. (2018) found that the mean time for wound closure was lesser when staples were used compared to the sutures, \(5.52 \pm 1.11 \text{ min}\) and \(9.92 \pm 2.37 \text{ min}\), respectively, with significant difference \((P < 0.05)\). In the present study, the no. of stitches was insignificantly \((P > 0.05)\) lower among patients of nylon group \((16.86 \pm 5.36)\) than staples in stapler group \((17.26 \pm 5.31)\). All patients had undergone exploratory laparotomy with midline incision of average length of \(15 \text{ cm}\).

In this study, two cartridges of stapler and two nylon sutures were used among majority of patients. There was no significant \((P > 0.05)\) difference in quantity of stapler/suture between the groups.

In this study, wound complication was among 34% of patients of nylon group and in 2% of patients of stapler group. There was significant \((P = 0.0001)\) association of complications between the groups, Karthikeyan et al. (2018) found that the complication rates between stapler and conventional suture groups were 4% and 17%, respectively, Sundresh et al. (2018) reported that wound infection was present in 36% of cases in the staples group and in 74% in cases of suture group with significant association \((P < 0.05)\). Wound complication occurred in 12% and 16% of the cases in staple and suture group, respectively. Although wound complication occurred lesser in staples group, the difference was not statistically significant.

**CONCLUSION**

The conclusion of our study is that wound infection/discharge, cosmesis, post-operative pain, time consumed for skin closure, incidence of seroma, etc., were less with staplers. Hence, skin staplers are more superior than nylon sutures and it is believed that the advantages of speed and convenience of skin staples are much economical and the disposable instruments can be reused until empty.

**REFERENCES**

17. Sundresh NJ, Devagi M, Gopikrishna D. Comparison between sutures and staplers-which is better for laparotomy wound closure. JMSCR 2018;6:156.