

## A COMPARATIVE STUDY OF SKIN STAPLERS WITH SKIN SUTURES IN ABDOMINAL SKIN WOUND CLOSURE IN GASTROINTESTINAL MALIGNANCY – AN INSTITUTIONAL STUDY

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### ABSTRACT

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#### OBJECTIVES

The objectives of this study were to compare the two techniques, skin staplers and conventional sutures in abdominal skin wound closure with respect to the total cost, operative time required, incidence of wound infection, postoperative pain and cosmetic outcome.

#### MATERIALS AND METHODS

The study was conducted on 100 patients undergoing elective surgery for GI malignancies from December 2013 to May 2015 in the Department of General Surgery, Government Medical College, Kozhikode. The patients were randomly assigned to closure by suture or staple.

#### RESULT

The study groups included 50 patients who underwent wound closure by staplers and 50 patients who underwent closure by non-absorbable ethilon sutures. The time taken for wound closure was found to be statistically significant, with staplers requiring five times less duration than conventional sutures. The average cost of using stapler was found to be significantly more expensive than suture. There was no significant difference in post-operative pain between the two groups. The incidence of wound infection was more in stapler group than in suture group although statistically non-significant. The cosmetic outcome with stapler closure was found to be significantly superior to that with sutures.

#### KEYWORDS

Skin staples, sutures, abdominal wound closure, GI malignancies, cosmesis, pain, infection.

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**INTRODUCTION:** Wounds and their management are fundamental to the practice of surgery. Any elective abdominal surgical intervention will invariably result in a skin wound in order to gain access to underlying intra-abdominal pathology. The measures used to close the abdomen may vary from surgeon to surgeon. However, certain basic principles govern all abdominal closures. Ideal wound closure not only provides strength and a barrier to infection, but also leaves behind an inconspicuous scar. The closure should be efficient, performed without any tension, retain good vascularity, involve minimal tissue damage, be comfortable for the patient, and aesthetic. This can be achieved by obliteration of dead space, layered tissue closure, and eversion of skin margins. Precise approximation of skin incisions with wound closure devices is critical for a favourable cosmetic and functional surgical result.

The surgical scar remains the only visible evidence of the surgeon's skill and not infrequently, all of his efforts are judged on its final appearance.

For many years it has been possible to approximate the skin edges using sutures. Historically, there were few surgical options for wound closure. From catgut, silk and cotton, there is now an ever-increasing array of sutures, approximately 5,269 different types, including antibiotic coated and knotless sutures. With the advancement of technology in the field of surgical sciences, we have at our disposal a variety of newer wound closure options apart from the conventional sutures such as staples, adhesive tapes, glues that have changed the practice of surgery in a profound way.

It has become imperative to know which method of wound closure is better for a particular patient and wound. The skin itself varies throughout the body in terms of its thickness, elasticity, speed of healing and tendency to scar. Hence, the prospective study was undertaken with the objective of comparing skin staplers with skin sutures in abdominal skin wound closure with respect to the following characteristics:

- 1) Operative time taken for closure.
- 2) Postoperative wound infection.
- 3) Postoperative pain.

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- 4) Cosmetic outcome.
- 5) Cost effectiveness.

**MATERIALS AND METHODOLOGY:** Before commencing the study, ethical clearance was obtained from the Institutional Ethics Committee for conducting this study. The study was conducted on 100 patients admitted in the Department of General Surgery, Government Medical College, Kozhikode for elective abdominal surgery during the study period of December 2013 to May 2015. The inclusion criteria were patients undergoing elective abdominal surgeries for GI malignancies that required a midline laparotomy incision. Patients with diabetes mellitus and other comorbidities and patients with allergy to suture materials or staples were excluded from the study. The 100 cases were divided randomly into 2 groups of 50 each. Group I consisted of 50 patients in whom the midline laparotomy wound was closed using skin staples and Group II consisted of 50 patients in whom the midline wound was closed with interrupted mattress sutures using non-absorbable 3-0 Ethilon sutures.

Written informed consent was taken from all the patients involved in the study. A detailed history of each patient was obtained and a thorough general physical examination was done. All patients underwent routine blood investigations. The mode of anaesthesia was General Anaesthesia. All patients received one dose of parenteral antibiotics 1 hour prior to applying skin incision and a course of parenteral antibiotic postoperatively. Painting was done with 10% povidone-iodine solution for all cases. All cases were opened using a vertical midline laparotomy incision. For all patients, rectus was closed in the midline using No. 1 loop PDS, thus approximating the wound edges. The wound was then closed by skin staples or skin sutures. Wound was then swiped with Betadine solution and dressed.

Time taken for closure was assessed intraoperatively by the operating surgeon/assisting surgeon. Wound was evaluated for one week to assess for incidence of postoperative infection. Numeric pain score was used for assessing postoperative pain. Subjective quantification of the pain was done. That is, patients were asked to point out in a scale of 1-10 the severity of postoperative pain. The values were then reported as mild, moderate and severe for purpose of feasibility of the study (1-3: mild, 4-7: moderate, 8-10: severe). Evaluation of cosmetic appearance was done after one month of closure during followup. Assessment was done by the clinician and reported as good scar, average scar or bad scar. Cost of suture material and staplers used was calculated.

**STATISTICAL ANALYSIS:** The data was collected using a proforma and tabulated in Microsoft Excel spread sheet. Results were analysed using SPSS version 18.0. Quantitative variables were expressed as the mean±standard deviation. Comparison of means was done by student 't' test. Values without mean were compared by Pearson Chi-square test.

**RESULTS:** The study groups included 50 patients who underwent wound closure by staples and 50 patients who underwent closure by suturing.

Age of the patients ranged from 35-99 years for stapled group with a mean age of 58.92 years and 30-80 years for suture group with a mean age of 60.04 years. There were 31 males and 19 females in the stapled group while there were 30 male and 20 females in the suture group.

The study population comprised of patients diagnosed with different types of GI malignancies namely, carcinoma Stomach, carcinoma Rectum, carcinoma Sigmoid Colon, carcinoma GE Junction, carcinoma Oesophagus, carcinoma Pancreas, GIST, Carcinoid tumour.

The various surgeries performed in the study population were Distal Gastrectomy + Gastrojejunostomy + Jejunojejunostomy, Palliative Gastrojejunostomy + Jejunojejunostomy, Total Gastrectomy + Oesophagojejunostomy + Jejunojejunostomy + Feeding jejunostomy, Abdominoperineal Resection, Anterior Resection, Low Anterior Resection, Transhiatal Oesophagectomy + Oesophagogastric anastomosis + Feeding jejunostomy, Distal Oesophagogastric anastomosis + Oesophagojejunostomy + Jejunojejunostomy + Feeding jejunostomy, Sleeve Gastrectomy, Right Hemicolectomy + Ileotransverse anastomosis, Sigmoidectomy + Colorectal anastomosis, Palliative Cholecystojejunostomy + Gastrojejunostomy + Jejunojejunostomy, Left Hemicolectomy, Explorative Laparotomy + biopsy.

**Time Taken for Closure:** Mean time taken for wound closure with stapler application was 104.6 sec, and that with suturing with Ethilon was 546 sec which was found to be strongly statistically significant. Staplers took almost 5 times lesser duration than the time taken by sutures.

	Mean±SD	T value	Sig	Inference
Stapler	104.6±15.74	-22.166	.000	Significant
Suture	546±139.92			

**Table 1: Time taken for closure**

**Cost of Closure Method:** The average cost of stapler was 900 and that of sutures was 174. This was found to be statistically significant. Staplers were significantly more expensive than suture material, about 5 times more expensive.

	Mean±SD	T value	Sig	Inference
Stapler	900±0	82.5	.000	Significant
Suture	174.2±62.2			

**Table 2: Cost of material**

**Wound Infection:** Of the 100 patients, wound infection was found in 6 patients (6%). In the stapler group 4(8%) patients had wound infection and in the suture group 2(4%) patients had wound infection. Although wound infection in stapler group (8%) was double that of suture group (4%), this was not found to be statistically significant (p value=0.4).

	No. of cases of infection	Chi square value	p value	Inference
Stapler	4(8%)	0.709	0.4	Not Significant
Suture	2(4%)			

**Table 3: Incidence of infection**

**Pain Assessment:** In stapler group, 6(12%) patients experienced mild postoperative pain, 29(58%) experienced moderate pain and 15(30%) experienced severe postoperative pain. Whereas in suture group, 5(10%) patients experienced mild postoperative pain, 28(56%) experienced moderate pain and 17(34%) experienced severe postoperative pain. The pain perception by patients was almost similar with both methods of closure. This was not found to be statistically significant.

	Mild pain	Moderate pain	Severe pain	Chi square value	p value	Inference
Stapler	6(12%)	29(58%)	15(30%)	0.233	0.89	Not Significant
Suture	5(10%)	28(56%)	17(34%)			

**Table 4: Post-operative pain**

**Cosmetic Outcome:** In stapler group, 44(88%) patients had a good scar after 1 month, 5(10%) had an average scar and 1(2%) had an ugly scar. Whereas in suture group, 28(56%) patients had a good scar after 1 month, 17(34%) had an average scar and 5(10%) had a bad scar. Therefore, patients in stapler group were found to have a significantly superior scar as compared to the suture group. (p value <0.05)

	Good scar	Average scar	Bad scar	Chi square value	p value	Inference
Stapler	44(88%)	5(10%)	1(2%)	12.768	0.02	Significant
Suture	28(56%)	17(34%)	5(10%)			

**Table 5: Cosmetic outcome**

**DISCUSSION:** The discipline is properly named surgery, which is derived from its earlier name chirurgery which means "hand work". Halstedian teaching emphasised gentle handling of the tissues careful haemostasis to enhance healing to prevent infection. Wound healing is a complex and dynamic process and is influenced by surgical technique. Optimal wound healing; with a minimal scar is the desired result. This process is affected by both local and systemic factors. Method of closure adopted is an important factor.

The act of sewing is as old as Homo sapiens. The earliest wound closure can be found in the Edwin Smith papyrus, the oldest surgical attempt at medical record known to man, written in Egypt around 3000 to 2500 BC. As early as 5000-3000 BC eyed needles were used to pass suture material through surgical wounds. In Sushruta samhita 600 BC, there is mention of suture material made from animal sinews, braided horsehair, leather strips, and vegetable fibres.

Suture technology and suture sterilisation has kept its pace of advancement along with the latest techniques in surgery and provided the surgical fraternity with a wide range of sutures in different sizes swaged to needles as fine as 30 microns. Surgical stapling was developed in 1908 by Humer Hultl in Australia. The original instrument was massive by today's standards. Modifications performed by Von Petz provided a lighter and simpler device, and in 1934 Fredrick of Ulm designed an instrument that resembled the modern linear stapler. The next major advances came from Russia after World War II. In 1958, Ravich, who, through research and development, refined the instruments to their current state and wide spread use today.<sup>1,2,3</sup>

In the present study, 100 patients underwent midline laparotomy wound closure. Out of the 100, 50 underwent closure of skin with skin staples while the remaining 50 patients had their skin closed with non-absorbable 3-0 Ethilon sutures. The comparison of these two groups were done in relation to:

1. Time taken for closure.
2. Cost factor.
3. Postoperative wound infection.
4. Postoperative pain.
5. Cosmetic outcome.

**Time Factor:** Staplers significantly reduce the operative time. According to our study, staplers took almost 1/5<sup>th</sup> of the time taken by conventional skin sutures, thus saving surgeon's time.

Ranaboldo et al reported that the rate of wound closure was 8 seconds/cm with stapler and 12.7 seconds/cm with sutures.<sup>4</sup>

Kanagaye et al observed that staplers were six times faster than standard sutures.<sup>5</sup>

Eldrup et al concluded that stapler took one third of the time taken by conventional sutures.<sup>6</sup>

Meiring et al have recorded that there was 80% time saving,<sup>7</sup> whereas Harvey and Logan have reported 66.6% time saving with the use of staplers.<sup>8</sup>

Medina dos Santos et al found in a prospective trial that the mean skin closure time with stapler was 5 minutes and 25 minutes with nylon suture.<sup>9</sup>

**Cost Factor:** In our study, we found that disposable skin staplers were significantly more expensive than sutures.

Orlinsky et al did a cost analysis of stapling versus suturing for skin closure and concluded that stapling is less costly than suturing and that the advantage appears to increase as wound length increases.<sup>10</sup>

**Wound Infection:** Although the number of patients with wound infection in stapler group was double that of suture group, this was not found to be statistically significant.

Eldrup et al recorded no difference in incidence of wound infection between stapler closure and conventional suture closure.<sup>6</sup>

Chunder et al found that patients who had staples were at 6.93 times higher risk of wound infection ( $p=0.014$ ) than those who had sutures in closure of caesarean section wound.<sup>11</sup>

**Postoperative Pain:** In our study, the postoperative pain perception in terms of severity of pain was similar in the two groups. There was no statistical significance found.

Selvadurai et al showed no difference in pain response between the two groups.<sup>12</sup>

**Cosmesis:** In our study, 88% of stapler group patients had a good scar while 56% of suture group had good scar. This was found to be statistically significant.

Meiring et al showed that the cosmetic result of staples is as good as if not better than that with nylon sutures.<sup>7</sup>

Lubowski D et al compared stapled and sutured abdominal wound closure which resulted in almost equal cosmetic scores for vertical wounds.<sup>13</sup>

Medina dos Santos et al observed that the wounds closed with staplers were cosmetically superior in 80% of the cases.<sup>9</sup>

Selvadurai et al, conducted a randomised trial to compare the results of neck wound closure using metal (Michel) clips or subcuticular suture and found no difference in cosmetic results.<sup>1</sup>

**CONCLUSION:** Skin, the largest organ of the body, is the most important natural barrier to infection. Any insult to skin in the form of a surgical incision carries risk of infection. Therefore, wound closure is as important to a surgeon as is the rest of the surgery. Although the skill and technique of the surgeon are important, so is the choice of wound closure methods. Furthermore, in this modern era, cosmesis carries a great deal of importance and a cosmetic scar not only gives satisfaction to the patient but also to the surgeon.

In this study, we compared the closure of abdominal skin wound using skin staples and sutures. We found that

- Skin staples significantly shortened the operative time.
- Staples were found to be considerably more expensive.
- Incidence of postoperative wound infection was less with sutures.
- Skin staples provided better cosmesis than the sutured skin closure.
- No difference in pain perception between the two methods.

Hence, from our current study, we conclude that skin staples, although expensive, considerably reduce operative time and provide better cosmetic outcome without any increase in wound complications.

**Ethical Approval:** The study was approved by the Institutional Ethics Committee.

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