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Original Research Article

A Comparative Study of Stainless Steel Staples Closure of Skin Wound versus Ethilon Closures

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Abstract:

Background: Tissue repair after surgical skin incisions are rapid acquisition of strength, least tissue damage, no inflammation, and an aesthetically acceptable scar. This can be achieved by obliteration of dead space, layered tissue closure, and eversion of skin margins. The perfectness of tissue approximation and type of approximation influences the tissue healing rate, postoperative early and late complication of surgical wound and economic burden of the hospital.

Aims and Objective: A disposable skin stapler was compared with conventional nylon (ethilon) sutures in respect of time taken for wound closure, cosmetic result and ease of application and removal.

Methods and Material: The study was conducted on 100 patients undergoing clean and clean contaminated surgical procedures, divided in 2 groups (A & B), each consisting of 50 cases. Group A selected for Stapler closure, Group B for skin suturing with interrupted ethilon suture (2-0).

Results: The mean length (cm) in stapler group was 9.34±5.62 and in ethilon was 9.36±4.80. Stapler group vs Ethilon Group was also NS as t=0.191 and p=0.9848. In Stapler group, the mean number of staples was 11.88±6.75 and in Ethilon group, the mean number of sutures was 7.8±4.37. Number of sutures compared for stapler group vs ethilon group t=3.5827 and p=0.0005 was extremely significant. The mean time taken (in sec.) per staple was minimum with value of 7.4±1.1 and time taken for one suture of ethilon was 25.0±3.4.

Conclusion: Result of the study indicates that stapler is cosmetically better to ethilon with overall less complication as compared to ethilon.

Keywords: Ethilon, Skin stapler.

Introduction

Any surgical intervention will results in a wound in order to get access to and deal with the underlying pathology. In this situation, the surgeon's task is to minimize the adverse effects of wounds, remove or repair the damaged sutures and harness the process of wound healing to restore function.

Through the age's man sought for methods of binding wounds to promote healing. In olden days spider webs, horsehair, warrior ants etc were used till suture materials were discovered. In this modern era various materials and gadgets for approximation of tissue like a sutures, staples or clips, glues, Steritapes etc. has been used by surgeons but the secret to achieve a good wound healing lies in meticulous tissue dissection followed by selection of suture material, methods of wound closure and post-operative complications. [1] The principle aims of tissue repair after surgical skin incisions are rapid acquisition of strength, least tissue damage, no inflammation, and an aesthetically acceptable scar. This can be achieved by obliteration of dead space, layered tissue closure, and eversion of skin margins. The perfectness of tissue approximation and type of approximation influences the tissue healing rate, postoperative early and late complication of surgical wound and economic burden of the hospital.[2] Ideally, wound closure technique should provide skin apposition till healing occurs, prevent wound infection, provide equal strength throughout the length of the incision, have a good cosmetic result and should be easy and comfortable to use. An ideal wound closure material should be non- allergenic, easy to manufacture and use and cost effective. [3]

Skin stapler closure involves using a special device to insert a series of staples into the skin. This method is quick and easy, and it can be used to close a variety of different types for cosmetic surgery, as it can help to minimize scarring. Ethilon closure involves using a thin thread, called Ethilon, to approximate the incision. This method is more time-consuming than skin stapler closure, but it can be used to close more complex incisions. Ethilon closure is often used for surgeries that involve a lot of tissue manipulation, such as hernia repair or breast surgery.

Methods and Material

The study was carried out on 100 patients who were undergone Clean and Clean contaminated surgical procedure from November 2023 to November 2024 in C.U. Shah medical college and hospital, Surendranagar.

Patients were categorized into two groups:

1. 50 Patients in Group A (Skin closure with Skin Stapler)
2. 50 Patients in Group B (Skin closure with Ethilon 2-0)

A specialized skin stapler device is used to insert a series of metal staples across the incision. The stapler compresses the skin edges and fires a row of staples to hold them in place. Typically it is made up of stainless steel.

A thin thread, known as Ethilon (a brand name for monofilament nylon suture), is used to approximate incision. It's a synthetic, non-absorbable suture material. The surgeon makes small stitches through the skin edges, creating a series of knots to approximate the wound.

Inclusion Criteria

- Elective surgeries with clean or clean-contaminated wounds (e.g., Laparoscopic Cholecystectomy, Hernia repair)
- Incision with minimal tension

Exclusion Criteria

- History of keloid or hypertrophic scarring
- High risk for infection (e.g., diabetes, immunosuppression)
- Allergic to nylon (Ethilon)

Wound was examined on second and third post-operative days and was examined the day before removal of stitches. It was used to assess the amount of pain associated with serous or pus discharge. The verbal response scale had four options for pain: no pain, Mild pain, Moderate pain, severe pain. Staples were removed with the help of specially designed extractor. At 6th week after surgery wound was assessed for width, colour, cross-hatching, hypertrophy and overall result for cosmetic result.

Observation and Result

The wound in both the groups were inspected after removing the dressing for any evidence of serous collection, Infection, gaping, overlapping or any other complication.

Maximum numbers of cases for Stapler group between 31-40 years comprising of 36%. In Ethilon group maximum number was between 21-30 years and 51-60 years i.e. 32%. Male: Female ratio for Group A (Stapler) was 40:10, in Group B (Ethilon) it was 35:15.

Table 1: Showing comparison of mean time taken for wound closure, Stapler vs Ethilon

	Stapler	Ethilon	Z value	P value	Significance
Mean Time taken (Staple vs Ethilon suture)	7.4±1.1	25.0±3.4	35.5	<0.001	Highly significant

The mean time taken to close the wound and mean number of sutures used, the mean time taken per Staple / Ethilon was calculated and is shown in Table 1. Table 1 shows the mean time taken per Staple was minimum with value of 7.4±1.1. Time taken for one suture of Ethilon was 25.0±3.4. The mean time per Staple / Ethilon so calculated was subjected to statistical analysis is presented in Table 1. Stapler group vs Ethilon group was significant (p=<0.001).

Table 2: Showing postoperative skin wound discharge of Stapler group vs Ethilon group

Type of discharge	Stapler (Group A)		Ethilon (Group B)	
	No.	%age	No.	%age
No discharge	45	90%	36	72%
Serous discharge	4	8%	12	24%
Purulent discharge	1	2%	2	4%

It was observed (Table 2) that wound healed without any discharge in Stapler group in 90% cases, 8% cases had serous discharge and no infection was reported in this group and 2% cases got infected. In Ethilon group 72% wound healed without complication and there was serous discharge in 24% cases and 4% cases wound infection was reported.

Type 3: Showing cosmetic result in Stapler and Ethilon groups

Cosmetic appearance		Stapler (Group A)		Ethilon (Group B)		P value
		No.	%age	No.	%age	
Width of Scar	**< 2 mm**	43	86%	46	92%	0.472 NS
	2-3 mm	6	12%	4	8%	
	>3 mm	1	2%	0	0%	
Colour of Scar	**Hypo-pigmentation**	0	0%	12	24%	0.169 NS
	Hyper-pigmentation	4	8%	0	0%	
Hypertrophy	**Mild**	3	6%	0	0%	0.366 NS
	Moderate	0	0%	2	4%	
Cross Hatching	**Absent**	50	100%	40	80%	<0.001 S
	Present	0	0%	10	20%	

S= Significant; NS= Non significant

Table 3 shows width of scar was minimum in Stapler and Ethilon group with 86% and 92% respectively, the wound healed having < 2 mm width. >3 mm width of scar in stapler and ethilon groups were 1% and 0% respectively. The comparison between Stapler group vs Ethilon group proved non-significant with p value 0.472.

The present study revealed a good cosmetic result as a colour of scar is concerned in stapler in comparison to ethilon. Hyper pigmentation was seen in 4 cases (8%) of stapler group and not seen in ethilon group and hypo pigmentation was seen 12 cases (24%) in ethilon group and not present in stapler group. The comparison between stapler and ethilon proved non-significant with p value 0.169. As regards the appearance of hypertrophic scar (Table 3) it was not present in 47 (94%) cases of Stapler group and 48 cases (96%) of Ethilon group. Mild hypertrophy observed in 3 cases (6%) in Stapler group. In Ethilon group there were 2 cases (4%) in which moderate hypertrophy was seen. The analysis between Stapler vs Ethilon group proved significant with p value 0.366.

Cross hatching (Table 3) was seen in ethilon group in 10 cases (20%) but no cross hatching was seen in Stapler group. The analysis between Stapler vs Ethilon proved significant (0% to 20% with p<0.001).

Type 4: Showing severity of pain during removal of stitching material in Stapler vs Ethilon group

Pain	Stapler (Group A)		Ethilon (Group B)	
	No.	%age	No.	%age
No Pain	30	60%	35	70%
Mild Pain	16	32%	13	26%
Moderate Pain	4	8%	1	2%
Severe Pain	0	0%	1	2%

Table 4 shows that severe pain during removal of Stapler/Ethilon was observed in 1 case (2%) in Ethilon group and none in Stapler group. Moderate pain was observed in 4 cases (8%) in Stapler group while in Ethilon group 1 case (2%) was present. Mild pain was observed in 16 cases (32%) in Stapler group and 13 cases (26%) in Ethilon group. Painless removal of Stapler/ ethilon was observed in 30 cases (60%) cases in Stapler group and 35 cases (70%) in Ethilon group.

Discussion

Victor Fischer, an ingenious designer of surgical instruments, was the inventor of the first surgical stapler that used metal staples. [4] The early experience of Steiche and Ravitch with the original Soviet staplers convinced them of their potential uses in surgery, which provided the stimulus for American designers and manufacturers to create a family of staplers. Although many of the original staplers were developed from the basic principles utilized in the Soviet instruments, the skin stapler was a totally new kind of instrument in conception. This stapler, manufactured in the United States utilized a disposable, preloaded, presterilized magazine that contained 25 staples. A small sterile disposable cylinder containing carbon dioxide provided the driving force for the formation of rectangular skin staples. [5]

Several studies have been conducted to compare the use of staples and nylon sutures on the trunk, head, and neck; these revealed comparable cosmetic results. Advantages of staples include a decreased risk of tissue strangulation and infection, improved wound eversion, and minimal tissue reactivity. Disadvantage include the need for a second operator to evert and re-approximate skin edges during staple placement, greater risk of crosshatch marking, and less precise wound approximation. The cost is usually more than that of suture material. [7]

Both, for the patient and surgeon, the preference of any suture material would be guided by its easy handling, speedy wound closure, low complication rate, better patient comfort and compliance, less cost and good cosmetic result. Various techniques available for closure are interrupted/ continuous wound closure using different kinds of sutures, metallic clips and adhesive tapes. The choice of technique is determined by the nature of the surgery performed i.e. clean, clean contaminated. [6]

In our study, one stapler took 7.4±1.1seconds for insertion and one ethilon suture take 25±3.4 seconds for insertion. It was highly significant between stapler and ethilon group as in Table 3 with p value < 0.001. So a significant reduction in time required for skin closure can be achieved by using the approximate stapler. So a significant reduction in time required for skin closure can be achieved by using the proximate stapler. Our study is in favour with various authors [8,9,10] as far as reduction in time of application of staples is concerned. In the studies by Karbhari with Bhavikatti, and Batra et al comparing staples with prolene sutures and staples with silk suture respectively, the time taken by staples for wound closure was significantly less. [11,12]

In the study, it was found that 45 cases (90%) in staple group healed without complication as compared to 36 cases (72%) in ethilon group. 1 case (2%) got infected in group where stapler was used and in ethilon group, 2 cases (4%) got infected. 4 cases (8%) in Stapler group developed serous collection whereas 12 cases (24%) in ethilon group developed serous discharge. Skin Staples, which are metallic and hence do not provide an environment conducive to bacterial growth also do not penetrate subsequently in the relatively avascular subcutaneous tissue plane. Ritechie and Rocke found no difference in rate of wound infection between the nylon suture and staple group. [8] In the study by Smith et al, the wound infection was significantly greater after staple use in orthopedic procedures. [13] The cosmetic result was better with skin staples as the staples come in contact with skin only at the points of skin penetration leaving pinpoint marks as compared to transverse marks across the wound left by conventional sutures. Lubowski D and Hunt D demonstrated that cosmetic results in vertical wounds were almost equal for staples and sutures. [14] Stokley and Elson showed increased complication rate with staple use when compared to vertical nylon mattress suture though there was similar cosmetic appearance of the scar in uncomplicated cases. [15]

In present study showed width of scar was minimum (i.e. less than 2 mm width) in maximum number of cases in ethilon group (92% cases) as compared to the stapler group (86% cases). Colour of the scar proved best in ethilon as compared to stapler group. Hypopigmentation was less in staplers group as compared to ethilon group with p value of 0.169 (non-significant). As regards the appearance of the scar (Table 3) it was normal in ethilon group (96%) and stapler group (94%). Hypertrophy is more in stapler group (mild 6% and moderate 0%) as compared to ethilon group (mild 0% and moderate 4%). The comparison between staple group vs ethilon proved (non-significant) with p value 0.366.

Cross hatching (Table 3) was more in ethilon group (20%) and no cross hatching was seen in stapler group (0%). Eaton observed superior cosmetic results with staples if removed between 48-72 hrs. [16] As regards pain during removal of staples/sutures, pain was observed more in ethilon group (Mild pain in 26%, Moderate pain in 2%, Severe pain in 2% and no pain in 70%) than in stapler group (Mild pain in 32%, Moderate pain in 8%, Severe pain in 0% and no pain in 60%). Gatt observed that painful removal of staples were a bit more in staple group as compared to polypropylene and polyglactin. Harvey and Logan did not find any significant difference in pain scores at day 2 or on suture removal. [17] The pain during suture removal can be attributed to the fact that the staple is removed by pulling, leading to a dragging skin sensation. [18]

The cost of wound repair per wound was significantly higher in ethilon than staplers. Skin stapling was found suitable for use in busy accidents and emergency department because of simplicity, quickness and safety despite being expensive. [19] Singh HR, Chowdary CR and Reddy MR found that cost effectiveness of staples increases with wound length, especially in larger wound incisions of >10 cm, as two suture materials are required for closure of larger wounds which costs Rs.480 whereas a single stapler is sufficient for the closure which costs Rs.300.[7] Orlinsky in their study showed that the average total cost per case was $17.69 (with suture kit) and $ 7.84 (without suture kit) for stapler group compared with $ 21.58 for suture group ($p<0.001$) for each. They concluded that stapling is less costly than suturing and that advantage appears to increase as laceration length increases. [20]

Conclusion

At the end of study we observed and concluded that skin closure by stapler can be preferred over conventional skin suture as it is easy to apply, cost effective, required less time for application, easy to remove with less pain on removal, and also provide better cosmetic results.

Also the ugly cross hatching of scar by ethilon is avoidable with use of stapler. From the p value it is concluded that staplers are effective in terms of lower incidence of complication rate at the probability of 0.005.Compliance for surgeon and patient is also good for staplers. Therefore, it is concluded that staples are best suited, as trauma to the tissue is minimum and can be used in elective clean and clean contaminated surgically incised wound and it also saves time more so in emergencies.

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