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A Study of Comparison between Suture (Nylon) and Staplers in Closure of Skin Incision of Elective Surgical Procedures

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Abstract: ***Background: To get good tissue union and acceptable aesthetic results, the method of skin closure has become extremely important in modern surgical practices. Any method of skin closure acts to hold the skin edges until healing occurs sufficient enough to be self supportive. In this study we will compare and observe the merits and demerits of stapler and nylon suture for skin incision closure. Materials and Methods: This prospective observational study was conducted on 98 patients undergone elective surgical procedures in Rama Medical College, Hospital and Research centre, Kanpur. Patients were randomly divided into two groups A and B with 49 patients in each group. Similar inclusion criteria have been laid down for selection of patients in both groups. In group A patients skin closure was done using stapler and in group B nylon suture material was used to approximate the skin edges. Results: Observations made during the study shows that mean time for incision closure is significantly shorter in stapler (27.2 seconds) compared to suture (172.2 seconds). Incidence of surgical site infection is more with suture group than stapler group. A higher VAS score was observed in stapler group than in suture group. Suboptimal cosmetic appearance was reported in 10.2% cases of stapler group as compared to 24.4% cases of suture group. Cost of stapler used for stapler was higher as compared to suture group. Conclusion: Skin stapler although expensive but speedy with less post operative infections and has better cosmetic outcomes compared to suture material. However, suture is cost effective and has comparably better in terms of post operative pain on incision line.***

Keywords: Stapler, Suture, Wound Healing, Infection, Cosmesis, Elective Procedures

1. Introduction

Skin is a protective barrier of human body to external environment. An ideal skin closure technique is to get back the wound strength as quickly as possible with minimal damage to the tissue and good tissue approximation for good cosmetic appearance of scars. Along with excellent cosmetic scars, the method of skin closure should also be technically easy, less time consuming, painless, without complications and cost effective. Basic fundamentals of skin closure includes that it should be performed without any tension, retain good vascularity and involve minimum tissue damage for adequate healing with minimum wound complications. This can be achieved by obliteration of dead space between the layers or mass closure and without inversion of skin margins. Wound complications are one of the significant sources of morbidity and prolong post operative inpatient stay and also lead to re - admission. In the modern era we have different methods and materials or gadgets for wound closure like sutures, staplers, glues, clips, steri - strips etc. and the existing literature still does not provide enough evidence to say whether staplers or suture material is better over other for closure of skin incision. In view of this we have compared the outcomes of incision closure by nylon suture and closure by skin stapler in terms of speed of incision closure, post operative pain, surgical site infection, cosmetic appearance, cost effectiveness, compliance of patient or surgeon in an elective surgical procedures conducted at Rama medical college, hospital and research centre, Kanpur.

2. Materials and Methods

Before starting the study, ethical clearance was obtained by the institutional ethics committee of Rama Medical College, Hospital and Research Centre to conduct the prospective observational study. Research was conducted in Rama Medical College, Hospital and Research Centre, Kanpur from December 2020 to June 2022. Patients included are admitted in the department of general surgery and department of orthopedic surgeries in which primary skin closure was done, fulfilling the given inclusion criteria. Data was collected and analysed by using semi - structured, predesigned, appropriate statistical analysis using Microsoft excel and software SPSS 25 version. A total of 98 patients were included in the study and randomly divided into two groups: group A (49 patients) in whom skin stapler was used and group B (49 patients) in whom nylon suture was used for closure of skin incision in elective surgical procedures. Various procedures done including open cholecystectomy, appendicectomy, cystolithotomy, hernioplasty, laparotomies, modified radical mastectomy, plating, knee arthroplasty, laminectomy. Most cases were operated in general anaesthesia under all aseptic precautions and with pre and post operative antibiotic coverage according to the surgery done and the choice of operating/ treating/ consultant surgeons. Criteria for selection of patient in both groups A

and B, were kept similar up to maximum. No co - morbiditity, all cases were chosen for elective surgical procedures and were optimized for surgery before operation.

Inclusion criteria

- Patients aged 22 to 50 years in comparative anthropometric assessment (same BMI).
- Undergoing elective general and orthopedic surgeries with primary skin closure.

Exclusion criteria

Emergency surgeries, acute cases surgery, immune - compromised patients, patients with skin infections or co - morbidities like diabetes, anemia, uremia, previous keloid or hypertrophic scar, traumatic wounds, patients more than 50 years of age.

Materials used

Skin closure by - Staples in group A (49 patients) and suture (nylon) in group B (49 patients).

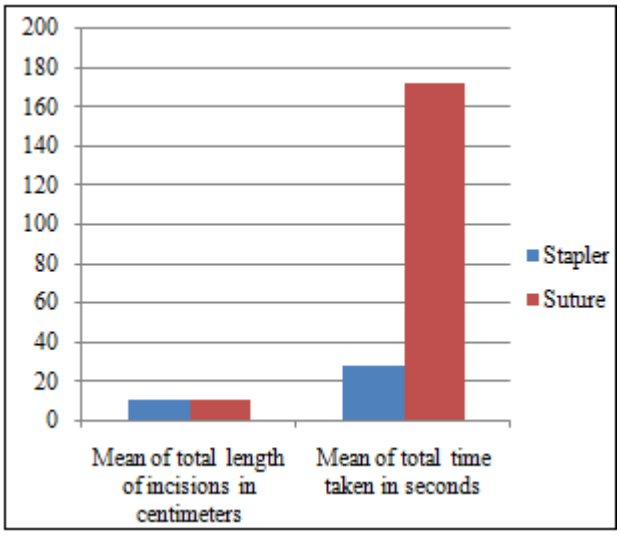
Wound of all patients were evaluated on post operative day 3 and on day 7. Sutures or staplers were removed whichever was applied on 8th day. Wound was further evaluated on post operative day 14, 21, 30 and after 6 months to look for surgical site infection, pain, wound dehiscence, cosmetic satisfaction.

3. Observation and Results

There were 33 males and 16 females in stapled group (A) and 29 males and 20 females in suture group (B). Following observations were made during the study:

1) Comparison of study groups based on mean time required per centimeters length of incision for closure.

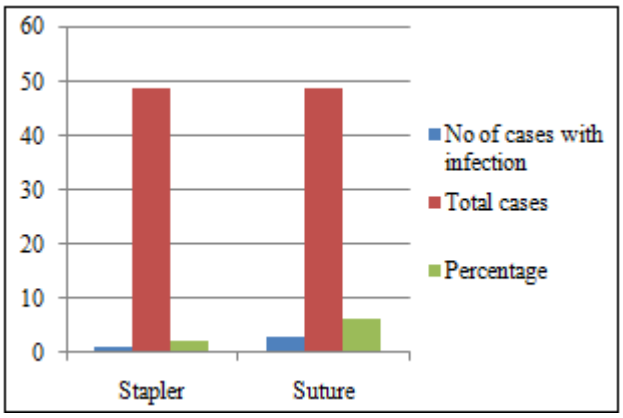
	Stapler	Suture
Total length of incision (Mean)	10.3cms	10.1cms
Total time taken (Mean)	27.2seconds	172.24seconds



Mean time required for closure was significantly less in group A as compared to group B with p value < 0.001.

2) Comparison of study group A and B based on incidence of surgical site infection (Day 3)

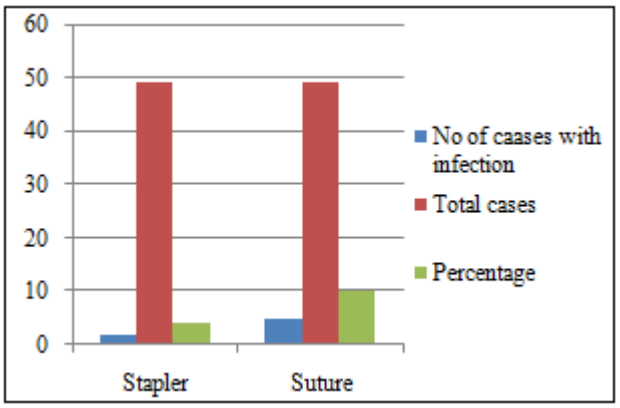
	No. of cases	Total cases	Percentage
Stapler	1	49	2.04%
Suture	3	49	6.12%



Incidence of surgical site infection on day 3 was 2.045 in stapler group as compared to 6.12% in suture group with p valve 0.06.

3) Comparison of incidence of cases of surgical site infection (Day 14)

	No. of cases	Total cases	Percentage
Stapler	2	49	4.08%
Suture	5	49	10.2%

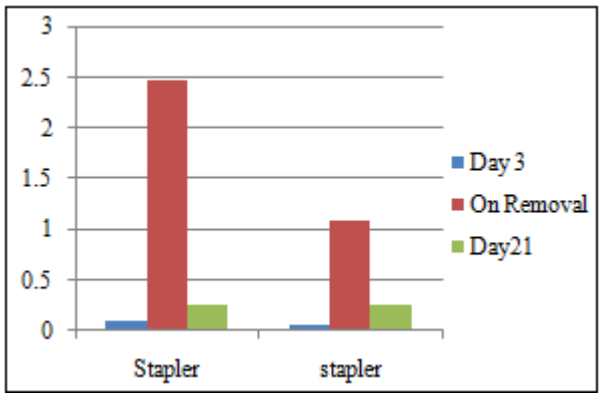


Incidence of surgical site infection in group A is less when compared to group B and p value 0.12.

None of cases had wound site infection on post operative day 30th in any of the group.

4) Comparison of group A and group B based on post operative pain.

	Group	Mean	S. D.	P value
Day 3	A	0.10	0.63	0.64
	B	0.06	0.22	
On removal	A	2.48	3.10	0.02
	B	1.10	1.85	
Day 21	A	0.25	1.10	1.00
	B	0.25	1.13	



Mean VAS (VISUAL ANALOGUE SCORE) was compared between group A (stapler) and group B (suture) at day 3 with p value 0.64. on day of removal of either stapler or suture whichever was applied higher VAS was reported in group A (stapler) than in group B (suture) with p value 0.02. No any difference in VAS score calculation on post operative day 21.

5) Comparison of cosmetic appearance of scar in group A and group B.

	Excellent	Suboptimal	Total	Percentage
Stapler	44	5	49	10.2%
Suture	37	12	49	24.4%

Suboptimal cosmetic scar appearance was reported in stapled group A (10.2%) when compared to suture group B (24.4%) P value 0.02.

4. Discussion

Wound closure is as important as any other action performed by the surgeon. And apart from the need for producing a healthy and strong scar, it is the surgeon's responsibility to ensure excellent asthetic physical appearance of wound, less skin closure time with minimal tissue loss results in less infection rate and good cosmetic appearance appearance of scar. Skin staples are an alternative to regular sutures in offering this advantage. This study was done compare the suture and stapler and to highlight the points in favour of each group.

Skin Closure Time

In present study average time taken for closure of suture was significantly less in stapler group (mean – 27.27) compared to suture group (mean –172.24). P - value is <0.0001. In a study by Pandove et al. [1] the mean time was for the Stapler group was 90.62 ± 54.04 seconds and in the Silk group mean time was 175.38 ± 89.49 seconds and in Ethilon group, the mean time was 191.76 ± 102.58 seconds.

Varghese et al. [2] in their study also observed the mean time for closure to be significantly shorter in stapler group (4.55 minutes) as compared to suture group (11.22 minutes).

Similarly in another study; Kochar et al. [3] observed the average time taken to close a wound in group 'Suture' as 92.8 sec and in group 'Stapler' as 30.3 sec (p<0.01).

Assadi et al. also observed operative time to be longer with suture closure (4.68±0.67 versus 1.03±0.07 minute, P<0.001) [4].

Ranabaldo and Rowe - Jones study compared the sutures with staples and sub cuticular sutures in 48 patients undergoing laparotomy and concluded that the difference in time was significant. [5] Thus our results were consistent with our findings of less time taken time (27.2seconds) staple closure.

Post Operative Pain

Mean VAS Score was comparable between the group at Day 3 (0.1 vs 0.05: stapler vs suture; p - 0.64). However, a higher VAS score was reported in stapler group patients at the day of suture/ staple removal. No difference was noted at the end of 1 month between two groups. Ranaboldo C et al. [5] in their study observed similar results with wound pain and requirements for analgesia being significantly lower in the suture group as compared to stapler group. In present study post operative pain is more in stapler group as compared to suture group with p - value of<0.05.

In the study by Stockley and Elson [6] higher proportion of patients reported considerable pain with removal of staples compared with the proportion who did so with removal of sutures.

Alderdice et al. [7] in a systematic review of methods of skin closure in caesarean section reported that use of absorbable sub - cuticular sutures resulted in less postoperative pain than staples. Frishman G et al. [8] and Ian Stockley et al. [6] have also observed that Pain in removal of stapler was more as compared to suture removal. Kathare S et al. [9] reported mean VAS at the time of removal to be significantly higher in stapler group as compared to suture group (4.79 vs 3.9; p<0.05).

However, Aabakke AJ et al. [10] and Abdus et al. [11] in their studies observed no significant differences in pain scores at any time between the study groups.

The results of present study were consistent with results of previous done studies for post operative pain in stapler group more than suture group.

Surgical Site Infection

Incidence of Surgical site Infection at Day 3 post operation was 2.04% in stapler group as compared to 6.12%in suture group with p – value 0.06, not significant.

Incidence of surgical site infection at day 14 post operation was 4.08% in stapler group as compared to 10.2% in suture group, with p - value 0.12, not significant.

On day 30th post operation, all the cases with surgical site infections were resolved in both groups. Varghese et al. [12] in their study observed a significantly higher incidence of wound infection among stapler group as compared to conventional sutures (30% and 11.7% respectively).

A study conducted by Tuuli MG et al. [13] also showed that Staple closure was associated with a twofold higher risk of

wound infection or separation compared with sub - cuticular suture closure. Chandra shekhar N et al. [14] in their study observed that staplers are associated with higher rates of wound infections and dehiscence, especially in emergency cases.

A multi centric study among 1080 patients conducted by Tsujinaka T et al. [15], showed no significant difference in wound infection between the two groups. Also, comparable rates of wound infection were observed in the studies by Varghese et al. [12] and Kochar et al. [3].

Smith T et al. [16] in a meta - analysis observed that the risk of developing a wound infection was four times greater after staple closure than suture closure.

In present study, the results were not consistent in with previous study findings. The infection cases are less with stapler group as compared to suture group. The difference was however statistically non - significant.

Cosmetic Scar Appearance
All the patients included in the both study groups were followed up at 1 month and 3 month after operation for evaluation of the scar. A senior surgeon was consulted, who was blinded to the method of closure, to evaluate the scar. Wound cosmesis score was calculated and compared. Sub - optimal cosmetic appearance was reported in 10.2% cases of stapler group compared to 24.45 cases of suture group with p - value of 0.02.

Batra J et al. [17] in a similar study reported similar results of staplers as compared to sutures in terms of patient comfort and aesthetic outcome.

Kathare S et al. [9] observed that cosmetic appearance of the scar was good in 60% of the cases in the suture group, with 30% with average and 10% poor scars while in stapler group, cosmetic appearance of the scar was good in 90% of the cases and average in 10% of the cases. Basit A et al. [18] also observed no difference between the study groups regarding scar cosmesis. However, S Shaikh et al. [20] and Karthikeyan S et al. [21] in their studies observed that Staples produced better scars than sutures.

Thus to summarize, present study revealed that stapler technique has a shorter operating time but is associated with significantly more pain and less incidence of surgical site infection. The achieved cosmetic effects was also compared and stapler group has better scar appearance than suture group.

Cost Effectiveness:
The associated equipment cost is six times greater with use of staples than with suture group.

Compliance of Patient and Surgeon
Staplers are more handy and quick to use for skin closure as compared to the sutures which are difficult to handle, knotting is not uniform so is the depth of the tissue taken in the suture. Hence, the compliance of the stapler with surgeon is found more as compared to the suture. Also, the removal of stapler is more easy but painful as compared to suture.

5. Conclusion

Wound infection is a great hazard in skin incision closure as it can lead to complications and affect the mortality and morbidity of the patient, stay in hospital and financial burden. The observations made in the present study shows that mean for closure of incision (in seconds) was significantly less in stapler group (27.2) compared to suture group (172.24). Criteria for application of stapler and suture is keeping the distance between two consecutive staplers or sutures is 1cm unless otherwise contraindicated. Keeping all the parameters same as far as possible we compared the infection rate in stapler method is certainly less as compared to suture. In objective method for assessment of pain, we found in comparative study that stapler use is more associated with post operative pain as compared to sutures. Cosmetic results are good and more acceptable with staplers as compared to sutures. Cost evaluation for application of staplers for skin incision closure is approximately six times more compared to sutures material and in our socio - economic status this single factor is hampering the use of stapler in every patient. Further study is needed to compare the other available resources for skin closure like steri - strips, clips, glue adhesives.

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