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A Comparative Study of Skin Staples with Conventional Sutures for Abdominal Skin Wound Closures

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Abstract **Original Research Article**

Background and Objectives: There are various ways the skin approximation can be done be it by sutures, staplers, glues, sterile tapes all of these have the same purpose of healing but the one which provides the best scar with least wound infection and consumes least time is the one that should be used. So here we have studied 100 patients over a period of 20 months comparing skin sutures with staplers and their outcome with respect to time consumed and percentage of complication was studied. Surgical sutures are conventionally used in skin closure of surgical wounds. Alternative wound closure techniques include staples and adhesive strips. We aimed to evaluate sutures versus staples as methods of surgical wound closure by performing a randomized prospective study. ***Methods:*** A prospective study was conducted between November 2016 to June 2018 over 100 cases, admitted in Basaveshwar Teaching and General Hospital. The patients were randomly selected to either receive staples or sutures for abdominal wound closures. ***Results:*** In this study of 100 cases, 50 patients underwent abdominal wound closure by staples and 50 patients underwent closure by sutures ie nylon. The youngest patient was aged 10 year and the oldest was 80 years old. The commonest region of the surgical wounds in this study was Mcburneys, 23 in staplers and 23 in suture group. The time taken for wound closure using staplers showed statistically significant difference over nylon suture closure. It took the stapler four time less duration to perform wound closure. The appearance of the scar among the staple groups was good in 90% of those who returned for follow up at one month, 10% had average scar. The average cost of using staple was higher than nylon suture. Patient acceptance was better in the staple group with less pain during removal as compared to suture group. There were four complications in the staple group in the form of wound infection and five cases of postoperative wound infection in the suture group. ***Conclusion:*** The present study has demonstrated better cosmetic results and a slightly higher cost with the staples, but saving in closure time that was statistically significant and in agreement with the literature reviewed. The marvel of skin stapling has helped in eliminating the post operative pain and the infection, ensuring a near normal skin appearance. It is strongly believed that when available, use of staples for skin closure allows saving in time, an important factor mainly for closure of large and multiple incision.
Keywords: Skin closures, staples, sutures, wound dehiscence, post operative pain.

INTRODUCTION

The skin is an organ of astonishing complexity. It is a barrier between the human body and external environment and is protective and self repairing .It is strong, elastic, and water- resistant and acts as a sense organ to a number of stimuli. The skin is also the largest organ of the body and also the protective covering.

When the surgeon sutures a clean incision, healing takes place with minimum loss of tissue and without significant bacterial infection with minimal scarring. Accurate tissue approximation is essential for operative repair of defects and execution of defects and execution of safe healing process.

In today's modern world brilliant developments of surgical skills and instrumentation have provided a precise understanding of an operative intervention. Today most surgical procedures are assessed by rigorous scientific methods, and such procedures become reproducible and predictable. Elaborate algorithms are available to calculate the requirement to replace or repair, to lengthen or shorten, to ablate or enhance, to drain or not. However traditional axioms are often contravened. Urgent operations and insertion of foreign bodies are

undertaken when one is confronted with acute sepsis; adhesive and staples are substituted for sutures; balloons challenge the bypass, and lasers, the scalpel. The essence of modern surgeon is now, more than ever before, that quality called Judgement-the ability to know what to use, when to use it, and for how long.

The principle aims of tissue repair of surgical skin incisions are rapid acquisition of strength and minimum tissue damage with minimum inflammation and a good scar. Many factors including the choice of suture materials and its placements influence these aims. But of particular relevance is the accurate opposition of dermal edges; eversion or inversion leads to sub optimal healing [1].

For many years it has been possible to approximate the skin edges using sutures. However, sutures have the disadvantages of consuming more time in applying with a cosmetically inferior scar [2]. The use of automatic stapling device for skin closure has become more popular of late to overcome these disadvantages and is in turn better in terms of wound infection, wound dehiscence, wound strength, pain and cosmesis and hence the present study is undertaken.

Hence this study was undertaken at Mahadevappa Rampure Medical College. Kalaburgi, Karnataka.

Objectives of the study

- To compare skin staples with skin sutures for abdominal wound closures in terms of wound infection, wound dehiscence and wound cosmesis.
- To study the total cost and surgeon's time requirement for suture and staples.
- To compare post operative pain.
- To study the degree of patients acceptance with the two techniques.

MATERIALS AND METHODS

Source of data

The present study is a prospective study consists of 100 cases admitted in Basaweshwar Teaching and General Hospital, attached to Mahadevappa Rampure Medical College, Gulbarga during the study from November 2016 to June 2018 (including sampling procedures, if any) 100 cases for the purpose of the study were selected randomly to receive either staples or conventional sutures for abdominal skin wound closures.

Inclusion Criteria

- Patients undergoing elective surgery, with clean wounds.

Exclusion Criteria

The following will be excluded from the study

- Lacerated wound with skin loss
- Patients with infected wounds.
- Incisions which require to be closed under tension
- Patients with diabetes mellitis.

Materials used

- Sterile disposable skin stapler in which each stapler contains 35 stainless steel staples 6.9mm *3.6mm.
- Non absorbable suture material like 1-0 or 2-0 ethilon material 3. Betadine solution 6% 4. Dressings with sterile gauze and plasters.

Data Collected

- During operation – from operating surgeon
- From patients – postoperatively
- From pharmacy / pharmaceutical companies supply sutures and staplers.

Investigations

- Complete haemogram
- Urine routine
- Other relevant specific investigations

Bleeding time, clotting time, platelet count, USG abdomen whenever necessary.

The methods of skin closure for each case was determined after repair of the deeper layers, by the next sequence number from a randomization. The process of closure was timed in minutes, the length of the wound was measured and the number of staples or number of suture packs used was recorded. Staples or sutures were placed approximately 1.3 cm apart.

Staples were removed with a device that painlessly opened them sideways, while sutures were removed in the conventional way. Wound closures were generally removed at ten days and the ease or difficulty of removal was recorded. Pain attributable to the skin closure was assessed as either present or absent at each stage. The cosmetic appearance was assessed 'blind' at thirty days.

RESULTS

This study was conducted in the Department of Surgery, Basaweshwar Teaching And General Hospital, Karnataka. Between Nov 2016 to June 2018. The study groups included 50 patients who underwent wound closure by staplers and 50 patients who underwent the nylon suturing. Among the stapler group, the youngest patient was aged nine year and the oldest was 80 years old, with a median age of 25 years. The suture group has a 11 year old patient as the youngest and 75 year old patient as the oldest. There were 35 males and 15 females in the stapler group while there were 32 male and 18 females in the suture group. The commonest region of the surgical wounds in this study was Mcburneys, 23 in staplers and 23 in suture group, The regional distribution of surgical wounds in the suture group was mid line 06, Mcburney's 23, subcostal 06,

transverse 02, paramedian 02 and inguinal 11.The regional distribution of surgical wounds in the staples group was mid line 07, Mcburney's 23, subcostal 04, transverse 03, paramedian 03 and inguinal 10 among the stapler group, there were 33 patients whose wound length belonged to group A (<5 cm), 07 in group B (5-10 cm) and 10 patient in group C (>10 cm). Among the suture group, there were 34, 08 and 08 patients in groups A, B and C. There were no statistically significant differences between the two groups, with respect to patients' age, sex and wound length.

The time taken for wound closure using staplers showed statistically significant difference over nylon suture closure. It took the stapler five times less duration to perform wound closure. With staplers the average time taken was 14 seconds whereas with nylon suture, the time taken was 65 seconds per centimeter of wound length. The difference between the two techniques was most striking in the group C wounds, which were longer than 10 cm. Among group A wounds also there was a statistically significant difference between the stapler and suture groups. The average time taken for application of stapler in group C wound was 60 seconds whereas for the suture group, it was 240 seconds.

Subjective quantification of the pain during suture removal showed that most of the patients registered score of 5 and 6. Among the stapler group of patients most of the patients registered score of 1.

The cost of the procedure with stapler depended on the length of the wound. For group A wound, the average cost was Rs. 60 for group B it was Rs. 120 and for group C it was Rs. 300. The cost of nylon suture was Rs.188 (2 metric length) for majority of the cases. In 04 cases, which required more than 2 metric length of nylon due to bigger wounds, the cost was higher (Rs260.00).

The appearance of the scar among the staple groups was good in 90% of those who returned for follow up at one month, 10% had average scar, with widening or hypertrophy of the scar with itching. The cosmetic appearance of the scar was good in 80% of the cases in the suture group, with 10% with average and 10% poor scars. The average saving of just over three minutes in closing a 15cm wound with staples could be extrapolated to a gain of 15-20 minutes on an average operating list. Apart from the more efficient use of theatre time, the psychological effect of rapid wound closure at the end of a long operation on surgeon and theatre staff was very evident during this trial. Continuous sutures save some time but have been shown to take two minutes longer than staples over 15 cms.

Descriptive and inferential statistical analysis has been carried out in the present study. The results were analysed by using SPSS version 18 (IBM Corporation, SPSS Inc., Chicago, IL, USA). Results on continuous measurements were presented on Mean±SD (Min-Max). Significance was assessed at 5% level of significance. Normality of the data was assessed using Kolmogorov Smirnov test. Mann-Whitney U test and Chi-square test with Yate's correction was used to find the significance difference of study parameters between the groups.

Table-1: **Classification of wounds**

Wound	Staplers N(%)	Sutures N(%)	P value
A (1 to 5 cm)	33(66)	34(68)	0.85
B (5 to 10 cm)	07(14)	08(16)	
C (10 to 15 cm)	10(20)	08(16)	
TOTAL	50(100)	50(100)	

Inference: There is no significant difference between the groups for wound classification.

Table-2: **Age distribution**

	Staplers Mean±sd	Sutures Mean±sd	P value
Mean Age	41.36± 21.09	36.26±17.18	0.24

Inference: There is no significant difference between the groups for age distribution i.e both the groups are homogeneous.

Table-3: Gender distribution

Gender	Staplers N (%)	Sutures N (%)	P value
Males	35(70)	32(64)	0.52
Females	15(30)	18(36)	
Total	50(100)	50(100)	

Inference: There is no significant difference between the groups for gender distribution i.e both the groups are homogeneous.

Table-5: **Region of incision**

Region of Incision	Staplers N (%)	Sutures N (%)	P value
LIH	05(10)	05(10)	0.99
M	07(14)	06(12)	
MC	23(46)	23(46)	
P	03(6)	02(4)	
RIH	05(10)	06(12)	
Sub costal	04(8)	06(12)	
Transverse	03(6)	02(4)	
TOTAL	50(100)	50(100)	

Inference: There is no statistically significant difference between the groups for region of incision.

Table-6: **Comparison of other parameters between the groups**

	Staplers Mean SD	Sutures Mean SD	P value
Length(cms)	6.84±4.00	6.82±3.89	0.811
No. of staplers used	7.72±4.54	6.94±4.12	0.037*
Time (secs)	14.84±9.24	66.24±38.33	0.001*
Cost (Rs)	94.12±59.58	192.80±34.94	0.001*

Inference: There is statistically significant difference between the groups for all the parameters except length

Table-7: **Comparison of mean closure time in various studies Comparison of mean closure time**

	Staplers (Mean closure time)	Sutures (Mean closure time)
Medina dos Santos *et al*., [5]	5 Min	25 min
CT Ranabaldo *et al*., [6]	147 sec	224 sec
T Kanagaye *et al*., [3]	65 sec	397 sec

Table-8: **Appearance at 1 week**

Appearance at 1 week	Staplers N (%)	Sutures N (%)	P value
Erythema	01(2)	02(4)	0.43
Good	48(96)	43(86)	
Serous discharge	01(2)	05(10)	
Total	50(100)	50(100)	

Inference: There is no significant difference between the groups.

Table-9: **Appearance at 1 month**

Appearance at 1 month	Staplers N (%)	Sutures N (%)	P value
Good	45(90)	41(82)	0.05
Average	04(8)	01(2)	
Poor	01(2)	09(18)	
Total	50(100)	50(100)	

Inference: There is no significant difference between the groups.

Table-10: **Complications**

Complications	Staplers N (%)	Sutures N (%)	P value
Infected	04(8)	07(14)	0.52
Nil	46(92)	43(86)	
Total	50(100)	50(100)	

Inference: There is no significant difference between the groups

Table 11- Assessment of wound the assessment of wound was done in both the groups at 1 week and at 1 month in the following format

Appearance	Present	Absent	1 week	1 month
Step up of borders	0	1		
Contour irregularities / puckering	0	1		
Wound margins seperation	0	1		
Good overall appearance	0	1		
Total score	0	4		

Table-12: Wound appearance scoring

Wound Appearance Scoring	Staplers N(%)	Sutures N(%)	P value
1	02(4)	05(10)	0.89
2	01(2)	02(4)	
3	02(4)	01(2)	
4	45(90)	42(84)	
Total	50(100)	50(100)	
Mean SD	3.80±0.67	3.60±0.97	

Inference: There is no significant difference between the groups

Table-13: Table showing groups vs cost Groups Vs Cost

Groups	Staples	Sutures
A (WL-up to 5cm)	Rs. 60.90	Rs.180.50
B (WL – 5 to 10 cms)	Rs. 120	Rs. 180.50
C (WL > 10 cms)	Rs. 204.30	Rs. 260.00

Linear verbal analog pain score

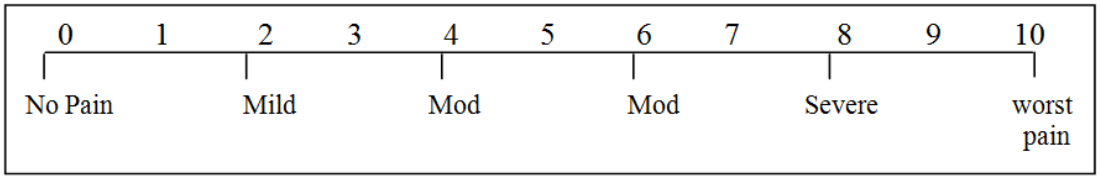

Table-14: Pain scoring

Pain scoring	Staplers N (%)	Sutures N (%)	P value
1	45(90)	-	<0.001
2	03(6)	-	
3	01(2)	-	
4	-	40(80)	
5	-	03(6)	
6	01(2)	07(14)	
Total	50(100)	50(100)	
Mean sd	1.22±0.84	4.34±0.72	

Inference: There is statistically significant difference between the groups for pain scoring

Fig-1: Inguinal incision

Fig-2: Subcostal incision staples used

Fig-3: Mc Burney's Incision

Fig-4: Mid Line

Fig-5: Staples Removal

Fig-6: Scar after removal of staples

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 its aesthetically pleasing physical appearance. Skin staples are an alternative to regular sutures in offering this advantage. The present study has helped to highlight the benefits of skin stapler.

There was a general consensus regarding the time saved by using staple for wound closure. All the reviewed articles echoed the fact that stapling of wound was quicker and time saving when compared to conventional wound/skin closure methods [3].

The mean time saving of 80% was possible with stapling devices and was 2.7 times faster than conventional methods [4].

In the present study, there was no significant difference between the results of application of staplers or sutures at various anatomic regions. The commonest region of the surgical wounds in this study was Mcburney's, 23 in staplers and 23 in suture group,. The scar appearance was good in 90% of the patients who were available for follow up, which is similar to other studies. Medina dos Santos *et al*., have compared the cosmetic results of staplers with noncontinuous nylon sutures [5]. They have observed that the wounds closed with staplers were cosmetically superior in 80% of the cases. There are no studies available in the literature comparing the results of application staplers to various anatomic regions. Though Ranaboldo and Rowe-Jones have compared the results of stapler with subcuticular

absorbable sutures for laparotomy wounds and divided them into lower and upper abdominal regions, no mention was made by them regarding the appearance of the scar at various sites [6]. There was no significant benefit of staplers over subcuticular sutures in their study.

In the present study, the time taken to complete wound closure was significantly less with the use of staplers as compared to sutures. The average time required to approximate one centimeter of wound was 14 seconds with the stapler whereas with silk suture, it was 65 seconds, more than five times longer.

In the study by Ranaboldo *et al*., the rate of wound closure was 8 seconds/cm with stapler and 12.7 seconds/cm with sutures[6]. In our study, for a four-centimeter wound, the time taken with stapler was about 60 seconds whereas a similar wound required 3 minute with suture. Thus, there was a saving of 120 seconds or two and a quarter minutes. This is comparable with several other studies. Kanagaye observed that staplers were six times faster than standard sutures [3]. Eldrup *et al*., analyzed 137 patients and concluded that mechanical sutures took one third of the time taken by conventional sutures [4]. Meiring *et al*., have recorded that there was 80% time saving, whereas Harvey and Logan have reported 66.6% time saving with the use of staplers [7] Medina dos Santos et al found in a prospective trial that the mean skin closure time with staple was 5 minutes and 25 minutes with nylon suture [5].

The other important factor in favor of stapler is pain which the patient experiences in the immediate post op or during the removal of suture or stapler. This study has shown that patient with wound closed by stapler had considerably less pain in the immediate post op and during removal and the need for post op analgesia was less in this group of patients.

For analysis of the cost factor, the wounds were divided into three groups depending on the length (less than 5 cm, 5cm to 10cm and more than 10 cm) and were named groups A, B and C respectively. The average cost of using skin stapler for group A wound was Rs.60, for group B it was Rs.120 and for group C it was Rs.204.30. The cost of stapler use in general was significantly higher as compared to nylon sutures, which had a cost of only Rs 150 per wound on average. This difference in cost has been well document by earlier studies as well. Ranaboldo has concluded after studying 48 patients that, the cost of stapler use is five times higher than sutures [6]. However, in the present study, on comparing the cost of using stapler in group A wounds alone showed no major difference. The benefit of time saved in this group alone (60 seconds with staplers versus 240 seconds with sutures) was significant enough to outweigh the minor cost difference. The cosmetic appearance of the wound was also better with use of staplers.

Finally a meta-analysis comparing the use of staples verses suture for surgical procedures went to support staples theoretically as it reduced the operative time and reduction in the operative time has the potential to reduce tissue handling and associated tissue injury. Hence has the potential to improve the patient outcome [8].

To summarize, considerable alteration has taken place from the conventional skin suture technique and switch over to the new era of cosmoses, in the form of skin stapling to achieve a near virgin scar less skin.

According to the study conducted by Tuuli Mehodinn G [9], Rampersad Roxane M, Toby O Smith, Debbie Sexton [10], the risk of developing a wound infection was four times greater after staple closure than suture closure.

CONCLUSIONS

- Staples did not cause excessive wound pain. Local staple removal was unnecessary to allow drainage of moderately infected wounds
- The use of staples to close skin incision in abdominal wound closures also improves the perception of cosmetic appearance of scar to the patient and significantly reduces the level of discomfort and adds to the comfort of patient by reducing the pain experienced by the patient.
- The results of this study could improve the understanding of importance of method of skin closure in reduction of surgical site infection, pain and cosmetic improvement in the appearance of post-operative scar.
- Staplers are convenient to use, easily available and show less post operative complications with better healing than compared to conventional sutures.
- Staplers were well liked by operators and resulted in a substantial and worthwhile saving in time for wound closure especially on a busy operative day.
- Stapled skin closure is not as uneconomic as previously believe

REFERENCES

1. Gatt D, Quick CR, Owen-Smith MS. Staples for wound closure: a controlled trial. Annals of the Royal College of Surgeons of England. 1985 Sep;67(5):318.
2. Singer AJ, Hollander JE, Quinn JV. Evaluation and management of traumatic lacerations. New England Journal of Medicine. 1997 Oct 16;337(16):1142-8.
3. Kanegaye JT, Vance CW, Chan L, Schonfeld N. Comparison of skin stapling devices and standard sutures for pediatric scalp lacerations: a

randomized study of cost and time benefits. The Journal of pediatrics. 1997 May 1;130(5):808-13.
4. Eldrup J, Wied U, Andersen B. Randomised trial comparing Proximate stapler with conventional skin closure. Acta Chirurgica Scandinavica. 1981;147(7):501-2.
5. dos Santos LR, Freitas CA, Hojaij FC, Araújo Filho VJ, Cernea CR, Branda LG, Ferraz AR. Prospective study using skin staplers in head and neck surgery. The American journal of surgery. 1995 Nov 1;170(5):451-2.
6. Ranaboldo CJ, Rowe-Jones DC. Closure of Iaparotomy wounds: skin staples versus sutures. British Journal of Surgery. 1992;79(11):1172-3.
7. Meiring L, Cilliers K, Barry R, Nel CJ. A comparison of a disposable skin stapler and nylon sutures for wound closure. South African medical journal= Suid-Afrikaanse tydskrif vir geneeskunde. 1982 Sep;62(11):371-2.
8. Hemming K, Pinkney T, Futaba K, Pennant M, Morton DG, Lilford RJ. A systematic review of systematic reviews and panoramic meta-analysis: staples versus sutures for surgical procedures. PloS one. 2013 Oct 7;8(10):e75132.
9. Tuuli MG, Rampersad RM, Carbone JF, Stamilio D, Macones GA, Odibo AO. Staples compared with subcuticular suture for skin closure after cesarean delivery: a systematic review and meta-analysis. Obstetrics & Gynecology. 2011 Mar 1;117(3):682-90.
10. Smith TO, Sexton D, Mann C, Donell S. Sutures versus staples for skin closure in orthopaedic surgery: meta-analysis. Bmj. 2010 Mar 17;340:c1199.