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Original Research Article

A comparative study of skin staples and conventional sutures for abdominal skin wound closures

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ABSTRACT

Background: The objectives of the study were to study the operative time, the effect on wound healing, cosmetic results, patients acceptance and total cost with the use of sutures and staples.
Methods: The study was conducted on 100 patients who were undergoing elective surgery from January 2016 to July 2017 in our institute. The patients were randomly selected to receive either suture or staple.
Results: The study group included 50 patients who underwent wound closure by staplers and 50 patients underwent suturing. The commonest region of the surgical wounds was Mc Burneys site. The time taken for wound closure using staplers showed statistically significance difference over closure with suture, it took the stapler 4 times less duration to perform wound closure. The average cost of using stapler was higher than suturing. The appearance of the scar among the staple group was good in 90% of those who returned for follow-up at 1 month, 10% had average scar. The patients acceptance was better in staple group with less pain during removal as compared to suture group. P-value calculated using students unpaired T-test. P<0.0001 which was highly significant.
Conclusions: Staples did not cause excess wound pain and allows saving in time with better cosmetic results.

Keywords: Skin staples, Skin suturing, Conventional sutures

INTRODUCTION

The act of sewing is as old as Homo sapiens. In Susruta Samhitha 600 BC there is mention of suture material made from animal sinews, braided horsehair, leather strips, and vegetable fibers. This text describes in detail triangular, round bodied, curved, and straight needles.[1]

For many years it has been possible to approximate the skin edges using suture however sutures have the disadvantages of consuming more time and applying with a cosmetically inferior scar. The use of automatic stapling device for skin closure has become more popular of late, to overcome these disadvantages.[2]

Most of the devices are disposable and relatively expensive, but their cost is offset by saving operative time and potential increase in range of surgery.[3]

Development of newer techniques of surgical wounds closure which are not associated with contamination i.e. stapling suggest that wound closure with staples is almost three times faster thus time saving.[4]

Skin staples are better alternatives to conventional sutures in head and neck cancer surgery as they offer ten times faster wound closure, cost effectiveness and similar results to sutures in terms of patients comfort,aesthetic outcome and complication rate.[5]

Hence this study was undertaken to study the operative time, the effect on wound healing, cosmetic results, patient's acceptance and total cost with the use of sutures and staples at our institute.

METHODS

Source of data

The present study is a prospective study consists of 100 cases admitted in our hospital, during the study from Jan 2017 to July 2018; Total 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

Inclusion criteria included patients undergoing elective surgery, with clean wounds.

Exclusion criteria

Exclusion criteria were patients having lacerated wounds with skin loss; patients having raised blood sugar, HIV infection, BMI>30.

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.

Statistical analysis was done using SPSS software.

RESULTS

The study groups included 50 patients who underwent wound closure by staplers and 50 patients who underwent the suturing. Among the stapler group, the youngest patient was aged nine year and the oldest was 65 years old, with a median age of 25 years. The suture group has a nine-year old patient as the youngest and 75 year old patient as the oldest. There were 33 males and 17 females in the stapler group while there were 39 male and 11 females in the suture group (Table 1). 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 (Table 2).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 (Table 3). There were no statistically significant differences between the two groups (p>0.001), with respect to patients' age, sex and wound length.

Table 1: Sex distribution.

Parameter (n=100)	Male (n=54)	Female (n=46)	P value
Staplers	23	27	P=0.025 (p>0.001)
Sutures	31	19	P=0.148 (p>0.001)
Total	54	46	

*P<0.001 is significant, but here p>0.001 so it not statistically significant.

The time taken for wound closure using staplers showed statistically highly significant difference over suture closure (p<0.001). It took the stapler five times less duration to perform wound closure. With staplers the average time taken was 11 seconds whereas with suture, the time taken was 45 seconds per centimeter of wound length (Table 4).

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 (Table 5).

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

Table 2: Site of incision.

Parameter (n=100)	Inguinal	Midline	Para Median	Sub Costal	Transverse	Mc Burney's
Staplers	10	07	03	04	03	23
Sutures	11	06	02	06	02	23
Total	21	13	05	10	05	46

Table 3: Classification of wounds.

Group (n=100)	A (1 to 5 cms)	B (5 to 10 cms)	C (>10 cms)
Staplers	33	07	10
Sutures	34	08	08
Total	67	15	18

P value is <0.001 statistically highly significant.

Table 4:Time factor.

Time Factor		
Time	**Staplers**	**Sutures**
Sec/cm	11	45

P<0.0001 is statistically highly significant.

Table 5: Comparison of mean closure time.

	Staplers (mean closure time)	Sutures (mean closure time)
Medina dos Santos et al[7]	5 min	25 min
Ranabaldo et al[8]	147 sec	224 sec
Kanagaye et al[9]	65 sec	397 sec

Table 6: Linear verbal analog pain score.[42]

	Staplers	Sutures
Ranaboldo et al[8]	4.79	3.9
Pain while removal (scale 10)	1	6

Table 7: Groups vs. cost.

Groups	Staples	Sutures	P-value
A (WL- up to 5 cm)	Rs. 60.90	Rs. 88.50	*P<0.0001 Highly significant
B (WL – 5 to 10 cms)	Rs. 90.80	Rs. 88.50	
C (WL >10 cms)	Rs. 300.00	Rs. 177.00	

*p<0.001 is statistically significant.

Table 8: Patients acceptance.

	Staplers	Sutures
Scars (good)	90%	60%

The cost of the procedure with stapler depended on the length of the wound. For group A wound, the average cost was Rs.59.85, for group B it was Rs. 89.70 and for group C it was Rs. 300. The cost of suture was Rs.88.50 (2 metric length) for majority of the cases. In 04 cases, which required more than 2 metric length of due to bigger wounds, the cost was higher (Rs.177.00) (Table 7).

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 60% of the cases in the suture group, with 30% with average and 10% poor scars (Table 8). 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 cm.

DISCUSSION

The principle aims of tissue repair of surgical skin incision are, rapid acquisition of strength and minimum tissue damage with minimum inflammation and a good scar. Many factors including the choice of suture material and its placement influence these aims.[6]

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.[7] 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.[8] 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 11 seconds with the stapler whereas with silk suture, it was 45 seconds, more than four 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.[8] In our study, for a four-centimeter wound, the time taken with stapler was about 45 seconds whereas a similar wound required 3 minute with suture. Thus, there was a saving of 135 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.[9] Eldrup et al analyzed 137 patients and concluded that mechanical sutures took one third of the time taken by conventional sutures.[10] 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.[11,12] 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.[7]

For analysis of the cost factor, the wounds were divided into three groups depending on the length (less than 5 cm, 5 cm to 10 cm 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.71, for group B it was Rs.91 and for group C it was Rs.300. The cost of stapler use in general was significantly higher as compared to prolene sutures, which had a cost of only Rs.88.50 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.[8] 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.

Medina dos Santos in their study found that the cost difference between conventional sutures and staplers was only slight.[7] Orlinsky et al studied the cost related to both equipment and personnel time in a general emergency setting and found staplers to be more time and cost efficient in repairs performed by physicians' assistance.[13] In a study by Kanagaye et al, the authors studied, additional factors that influence the cost such as, consumable in the operation theater and the physician time expended etc, and concluded that the overall cost of stapling is less than that of suturing.[9] However, in the present study, analysis of these additional costs were not included. If these were to be also included, the cost of performing stapling should have come down further. In the present study, three complications were encountered in the staple group in the form of wound infection. No other complications were seen. In the suture group, there were four cases with postoperative wound infection and one of which had partial wound dehiscence. These results are significantly less when compared with other studied. Kanagaye et al, in their study of 45 pediatric cases observed no complications in the staple group.[9]

According to the study conducted by Tuuli Mehodinn et al the risk of developing a wound infection was four times greater after staple closure than suture closure.[14,15]

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

CONCLUSION

Stapling is more convenient, time saving and cost effective, routine staple removal is less painful compared to suture removal, so Staplers were well liked by operators and resulted in a substantial and worthwhile saving in time for wound closure.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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