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Original Research Article

Skin stapler versus sutures in abdominal wound closure

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ABSTRACT

Background: Wound closure is as important as any other action performed by the surgeon. 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.
Methods: Out of the 120 participants, 60 underwent skin closure with Stainless steel skin staples and the remaining 60 with non-absorbable Polyamide mattress sutures randomly. They all received one mandatory dose of pre-operative parenteral antibiotic 1 hour prior to the incision. On the 3rd postoperative day, the wound was evaluated for inflammation, infection and wound gape. Participants were re-evaluated for infection/gape/inflammation during follow-up on 7th day. The wounds were evaluated at 1 months follow up which were rated for cosmesis by Visual Analogue Score. The data was coded and entered in Microsoft excel and then analysed using statistical software SSPS.
Results: Study population consisted of 79 males (65.8%) and 41 females (34.2%). Mean age of the study population was 49.35 with an SD 16.739. Wound infection was found to be higher in stapler group (30%) when compared to conventional suture group (11.7%)which was found to be statistically significant with chi-square value 6.114 and p value 0.013. Mean time for closure was significantly shorter in stapler group 4.55 minutes, when compared to suture group (11.22 minutes). Better cosmetic outcome was observed in conventional suture group.
Conclusions: Preventing wound infection, especially in abdominal wounds, is of importance as it may lead to wound gaping. Incidence of post-operative wound infection was more with skin staples. Cosmesis is essential and important aspect in this day and age. A cosmetic scar not only gives satisfaction to the patient but also mental ease to the surgeon. Conventional sutures provided better cosmetic result when compared with skin staplers.

Keywords: Stainless steel staples, Skin staples, Wound healing, Wound infection

INTRODUCTION

The suturing of any incision or wound needs to take into consideration the site and tissues involved and the technique for closure should be chosen accordingly. Therefore, the correct choice of suture technique and suture material is vital, but will never compensate for inadequate operative technique, and for any wound to heal well, there must be a good blood supply and no tension on the closure.[1] The selection of the proper incision, suture material, and closure technique is very important to assist the patient's own repair mechanism and restore normal anatomic relationships after surgery. Attention to these details also prevents such complications as dehiscence and infection, assuring a good cosmetic result.[2]

Surgical site infections (SSIs) are infections of the tissues, organs, or spaces exposed by surgeons during performance of an invasive procedure. SSIs are classified into incisional and organ/space infections, and the former are further sub-classified into superficial (limited to skin and subcutaneous tissue) and deep incisional

categories.[3,4] Surgical site infections (SSIs) are serious operative complications that occur in approximately 2% of surgical procedures and account for some 20% of health care-associated infections.[5]

The type of suture material for skin closure is also reported to influence postoperative wound complications. However, other studies have failed to demonstrate significant differences between different types of suture material. 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. The aim of the study was to compare the incidence of post-operative wound infection between skin staples and conventional sutures in abdominal skin closures and to compare the cosmetic outcome of stapled closure with conventional sutures.

METHODS

Present study was prospective observational study, carried out in the Department of General Surgery, Medical College Hospital, Kottayam. Duration of the study 6 months

Sample Size: In a study conducted by Chandrashekar N et al, comparing skin sutures and skin staples in abdominal surgical wound closure, proportion of wound infection among staple group was found to be 38.09% and among suture group was 16%.[6]

Using this data, minimum sample size required for the study is calculated using the formula

$n = (Z\alpha+Z\beta)^2\{P1(1-P1) + P2(1-P2)\}/(P1-P2)^2$

where,
$Z\alpha$ = Z value of α error at 5% = 1.96
$Z\beta$ = Z value of β error with 80% power = 0.84
P1 = Proportion of infection among staple group = 38.09%
P2 = Proportion of infection among suture group= 16%

$n = (1.96+0.84)^2\{0.3809(1-0.3809) + 0.16(1-0.16)\}/(03809-016)^2$

= 59.48
= 60

Minimum sample size for this study is 60 subjects in each group. A total of 120 patients.

Inclusion criteria

All patients undergoing abdominal surgeries.

Exclusion criteria

Patients having skin loss.

Study procedure

After getting institutional review board clearance, a hospital based observational study was conducted in patients undergoing abdominal surgeries in Department of General Surgery, Government Medical College, Kottayam. Informed consent was obtained from the patients willing to participate in the study. A detailed history of each patient was obtained starting with history of presenting symptoms and any co-existing, co-morbid conditions like, DM, HTN were ruled out. A thorough general physical examination was done. Preoperatively all patients underwent following investigations: complete blood count, urine examination, blood sugar, blood urea. serum creatinine, liver function test, chest x-ray, electrocardiogram. Shaving of the abdomen was done prior to Surgery. Patients were grouped into two categories- suture and staplers group based on the technique of wound closure. Age group matching of the cases was done in both categories of closure technique. On the 3rd and 7th postoperative day, the wound was evaluated using Southampton wound grading system. The wounds were evaluated at 1 month follow up and rated for cosmesis on Visual Analogue Score by a senior surgeon. Data thus collected was coded and entered in Microsoft excel and analyzed using statistical software SPSS.

RESULTS

Age

Mean age of the study population was 49.35 with a standard deviation of 16.739. Minimum age: 18 years; maximum age: 80 years, range: 62. Mean age among suture group was 48.05 and that of stapler group was 50.65. This difference was found to be not statistically significant at P value= 0. 397. Hence, the study group was comparable in terms of age.

Gender

79 patients were male, 41 patients were female.Majority of the study population were males (65.8%). Two study groups were comparable in terms of gender distribution. (P value= 0.083)

Closure technique

60 patients underwent suturing for wound closure whereas 60 patients underwent stapler closure

Type of wound closure and outcome

Among the Suture group, 7 out of the 60 had wound infection whereas in stapler group 18 out of the 60 had wound infection. 11.7% among conventional suture group developed wound infection where as 30% among stapler group developed infection and this difference

wasfound to be statistically significant with a chi square value of 6.114 and p value 0.013.

Table 1: Distribution of study population based on type of incision and type of wound closure.

Closure technique					Total
			Suture	Stapler	
Type of incision	Midline laparotomy incision	Count	54	60	114
		% within SUR	47.4%	52.6%	100.0%
		% within CLOSRE	90.0%	100.0%	95.0%
	Subcostal incision	Count	6	0	6
		% within SUR	100.0%	0%	100.0%
		% within CLOSRE	10.0%	0%	5.0%
Total		Count	60	60	120
		% within SUR	50.0%	50.0%	100.0%
		% within CLOSRE	100.0%	100.0%	100.0%

Table 2: Study population based on type of wound closure and outcome.

Outcome					Total
			Normal healing	Wound infection	
Closure	Suture	Count	53	7	60
		% within CLOSRE	88.3%	11.7%	100.0%
		% within outcome	55.8%	28.0%	50.0%
	Stapler	Count	42	18	60
		% within CLOSRE	70.0%	30.0%	100.0%
		% within outcome	44.2%	72.0%	50.0%
Total		Count	95	25	120
		% within CLOSRE	79.2%	20.8%	100.0%
		% within outcome	100.0%	100.0%	100.0%

Table 3: Distribution of study population based on type of wound closure and wound infection grade.

Southampton grading							Total
			Normal healing	Normal healing with mild bruising/erythema	Erythema+other signs inflamation	Pus	
Closure type	Suture	Count	53	2	1	4	60
		% within CLOSRE	88.3%	3.3%	1.7%	6.7%	100.0%
		% within INSPD3	55.8%	28.6%	25.0%	28.6%	50.0%
	Stapler	Count	42	5	3	10	60
		% within CLOSRE	70.0%	8.3%	5.0%	16.7%	100.0%
		% within INSPD3	44.2%	71.4%	75.0%	71.4%	50.0%
Total		Count	95	7	4	14	120
		% within CLOSRE	79.2%	5.8%	3.3%	11.7%	100.0%
		% within INSPD3	100.0%	100.0%	100.0%	100.0%	100.0%

Type of wound closure and wound infection

Among the suture group 88.3% showed normal healing, 3.3% showed normal healing with mild bruising/erythema, 1.7% showed Erythema+other signs of inflammation and 6.7 % developed pus at the site where as among the stapler group 70% showed normal healing, 8.3% showed normal healing with mild

bruising/erythema, 5 % showed Erythema+other signs of inflammation and 16.7 % developed pus at the site.

Diabetic status and wound infection

Out of the 120 patients, 90 had no diabetes mellitus and in them 16 patients had wound infection. 30 patients had diabetes and were on treatment. Out of the 30, 9 patients had post-operative wound infection.

Hypertension and wound infection

Out of the 120 patients, 94 had no hypertension and in them 21 patients had wound infection. 26 patients had diabetes and were on treatment. Out of the 26, 4 patients had post-operative wound infection.

Technique of closure and mean time of closure

Mean time for suture closure was 11.22 minutes with an SD of 2.108 and for stapler closure was 4.55 minutes with an SD of 1.016. This difference was found to be statistically significant with a t value of 22.069 and a P value of <0.001

Type of closure technique and Visual Analogue Score

Mean visual analogue score among suture closure wound was 74.97 with an SD of 4.555 and among stapler closure wound was 38.34 with an SD of 16. 057.This difference was found to be statistically significant on applying Mann- Whitney U test, with P value of <0.001.

Table 4: Distribution of study population based on type of closure technique and mean time for closure.

	CLOSRE	N	Mean time (minutes)	Standard deviation	T	P value
Time	Suture	60	11.22	2.108	22.069	<0.001
	Stapler	60	4.55	1.016		

Table 5: Table showing distribution of study population based on Visual analogue score and type of wound closure.

	CLOSRE	N	Mean score	Standard deviation	Mean rank	Mann-Whitney U	P value
Type of closure	Suture	60	74.97	4.555	82.66	470.500	<0.001
	Stapler	60	65.15	16.057	38.34		
	Total	120					

DISCUSSION

Type of closure technique and incidence of wound infection

The present study shows a statistically significant 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, showed that Staple closure was associated with a twofold higher risk of wound infection or separation compared with subcuticular suture closure.[7] A multicentric study among 1080 patients conducted by Tsujinaka T et al, showed no significant difference in wound infection between the two groups.[8]

Type of closure technique: Mean time for closure and cosmetic appearance

Present study showed a significantly shorter time for stapler closure and a better cosmetic appearance for conventional suture closure. Kanagaye JT et al, at the Children's hospital, Los Angles, USA, following a study, revealed that staple closure was safe, rapid and cost effective. Staples were six times faster than the standard sutures with no observed complication rate. Removal was less painful and the scar was cosmetically acceptable.[9]

Eldrup et al, analysed 137 patients undergoing abdominal or thoracic surgery, and concluded that the main advantage of using staples was the time saved, as closure with mechanical sutures took one third of the time required for the conventional method. On the other hand, closure with staples resulted in the major disadvantages of additional expense, as the cost was forty-seven times higher than that of the suture with Dermalon.[10]

Meiring et al, reported slightly better cosmetic results in a group of 40 patients undergoing laparotomy with an 80% in time saving. They also concluded that the final cost of the stapler was crucial for selecting the method.[11]

Harvey and Logan studied a group of 20 patients undergoing surgery for varicose veins in both lower limbs, using a different method of skin closure in each leg. They reported a saving of 66.6% in closure time and a similar cosmetic result. They considered the use of staples a valid method for selecting patients with a large number of wounds; however, the additional cost would not be justified for small sutures.[12]

Ranabaldo and Rowe-Jones compared sutures with staples and subcuticular suture in 48 patients undergoing laparotomy and concluded that the difference in time was significant. Nevertheless, the cost was five times greater with staples; hence, the use of subcuticular sutures was preferred.[13]

Medina dos Santos LR et al, in their study of 20 consecutive patients concluded that the use of skin staplers speeds up closure by 80%, with a better cosmetic result, and does not increase the incidence of complications, although the slightly higher cost was involved.[14]

Basha et al, determined that staples were associated with increased risk of wound infection. Wound complications led to a decrease in patient satisfaction, however it was not statistically significant to associate staples with decreased satisfaction.[15] Cromi et al, found there were equivalent cosmetic outcome amongst closure methods.[16]

CONCLUSION

Several methods of skin closure are available to close the skin incisions in place of sutures like staples, clips, steristrips and glue adhesives. Wound infection is a great hazard in abdominal skin closure as it can lead to disastrous complications. Cosmesis is essential and important aspect in this day of modern surgical practice. A cosmetic scar gives satisfaction to the patient and also to the surgeon. Preventing wound infection is necessary as it may lead not only to an ugly scar but also occurrence and recurrence of hernia.

In the present study, skin staplers versus sutures in abdominal wound closure, we found that incidence of post-operative wound infection was more with skin staples, sutures provided better cosmesis than skin staples and skin staplers saves operative time as compared to sutures. Hence, we conclude that Sutures are associated with low incidence of wound complications, provides good cosmetic outcome but takes considerably more time for skin closure.

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