

## Prospective Study of Stapler V/S Conventional Closure of Abdominal Surgical Wounds in Elective Cases

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### Abstract

**Objective:** To study the efficacy and effectivity of stapler closure in terms of hospital stay, aesthetic outcomes, patient comfort and complication in comparison to conventional method.

**Study Design:** Prospective study.

**Place and Duration of the Study:** This study was conducted in the Department of General Surgery, M.M. Institute of Medical Science and Research, Maharishi Markandeshwar (Deemed to be University), Mullana, from October 2018 to July 2020.

**Materials and Methods:** After the approval of the Institutional Ethical Committee, a prospective study for comparison between skin sutures and skin staplers in terms of effectiveness and its complications in 60 patients who underwent elective abdominal surgical procedures. The patients included in this study were randomly selected and divided into two groups stapler and suture (each consists of 30 patients). Correlation has been made in terms of time taken for skin closure (min), post-operative pain (VAS), appearance of scar (cosmesis), satisfaction of patients, duration of hospital stay and complication (SSI) between the two groups.

**Results:** Stapler group took less duration in skin closure (min) than suture which is statistically significant ( $p < 0.000$ ). The mean value of post-operative pain (on POD-1) in stapler group was 2.6 while in suture was 5.20. Wound infection was more in suture group with 16% while it is 13% in stapler group. 93% of scar in the staple group was good and 60% in suture group which was statistically significant ( $p$  value  $< 0.002$ ). Level of satisfaction in stapler and suture group was 96% and 83% respectively. There was short duration of hospital stay among stapler group with mean value of  $4.10 \pm 1.40$  and in suture group mean value is  $8.57 \pm 2.19$ .

**Conclusion:** Present study has demonstrated that skin stapler is superior to conventional suture. Stapler are effective and yielding less operating time, post-operative pain, less complication (SSI) and good cosmetic result. The duration of hospital stays is also less in the stapler group than suture group. Patients are more satisfied with stapler during post op period and in follow up.

**Keywords:** Stapler; Sutures; Cosmesis; SSI; Post-Operative Pain; Time for Closure of Wound

### Introduction

Surgical suture is a medical technique used to approximate tissue after any surgical procedure or injury. A basic need for skin closure is good approximation and preventing infection of the wound site. The technique should prevent surgical site infection. Patients expect a

good aesthetic outcome and minimal post-operative wound care and often judge a surgeon skill by appearance of scar [1]. Skin closure from historical time till date has changed along with mankind. For e.g., in India and South America have described that termites being provoked to bite across an approximated wound, after which the bodies are quickly twisted off, leaving behind the clenched jaw of the insect like stapling (Image 1) [2]. Various method of skin closure is available these days like suture, staples, tapes and adhesive compound. The material used for skin closure should be safe, easy, fast, inexpensive, painless, bactericidal and aesthetically appealing scar. The main principal involved in perfect healing of the wound involved preservation of blood supply, minimal tissue damage, approximation of edges without tension, correct suture spacing and proper selection of suture materials [3]. This study is conducted for comparison of skin closure by using skin suture and skin stapler with respect to efficacy, hospital stay, aesthetic outcome and complication (infection).



Image 1:

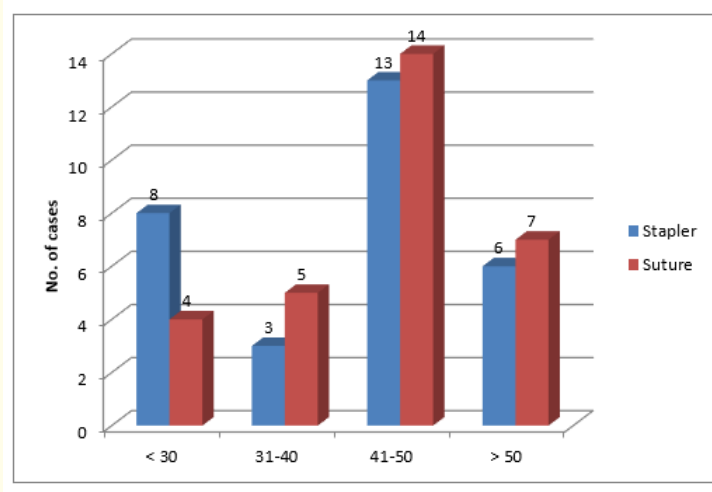


Figure 1: Age distribution.

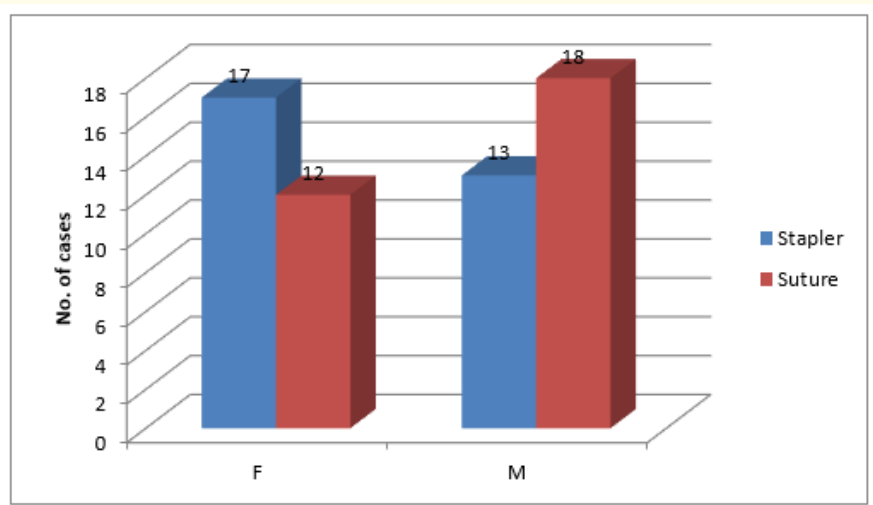


Figure 2: Sex distribution.

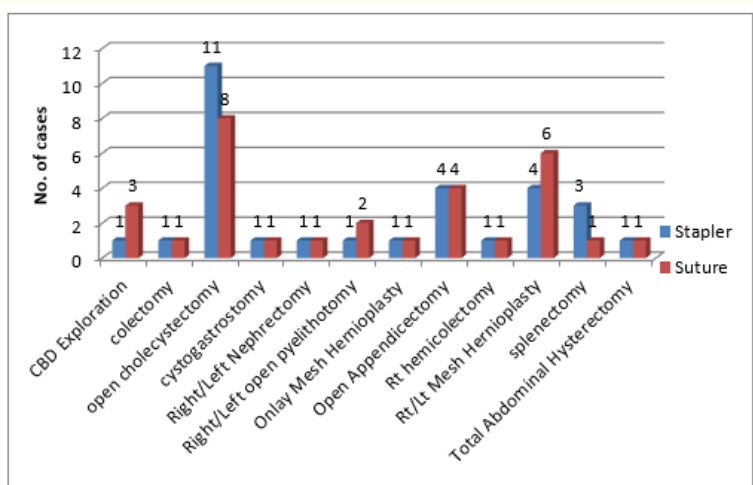


Figure 3: Procedure.

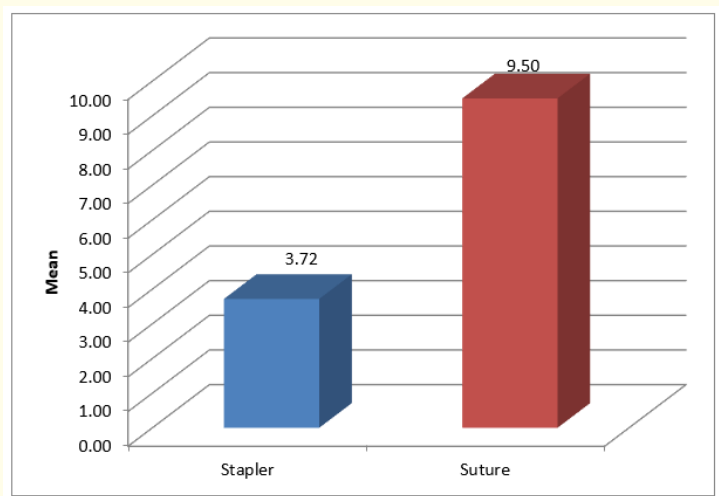


Figure 4: Time taken for skin closure (min).

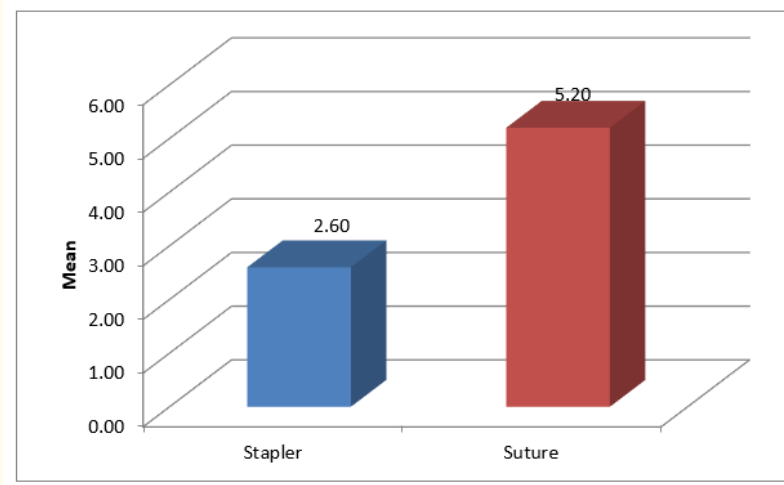


Figure 5: Pain (VAS).

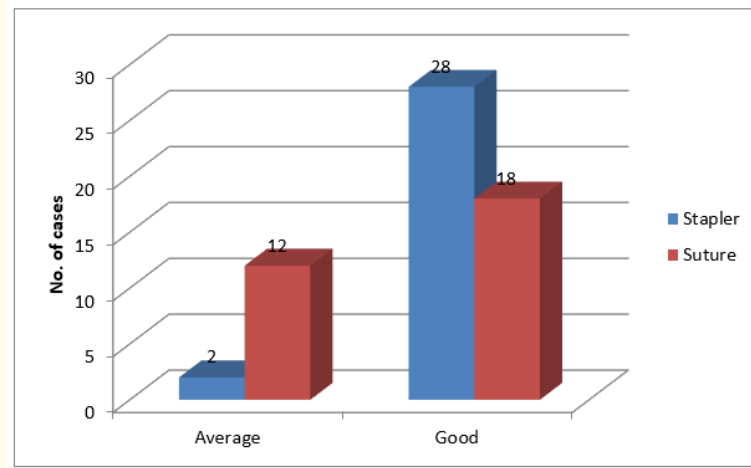


Figure 6: Appearance of scar.

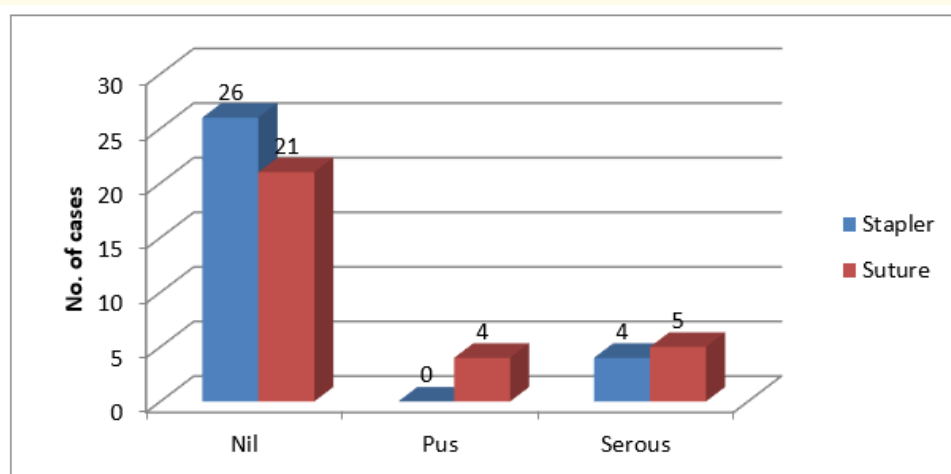


Figure 7: Post-op skin wound complication.

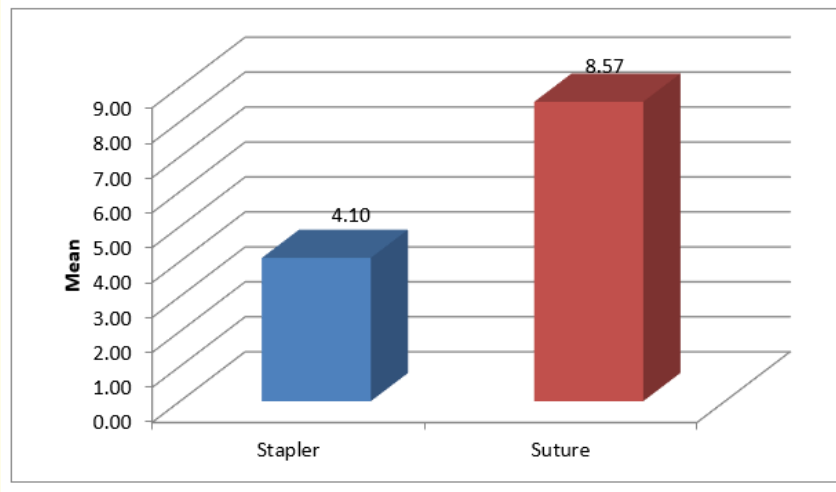


Figure 8: Hospital Stay (days).

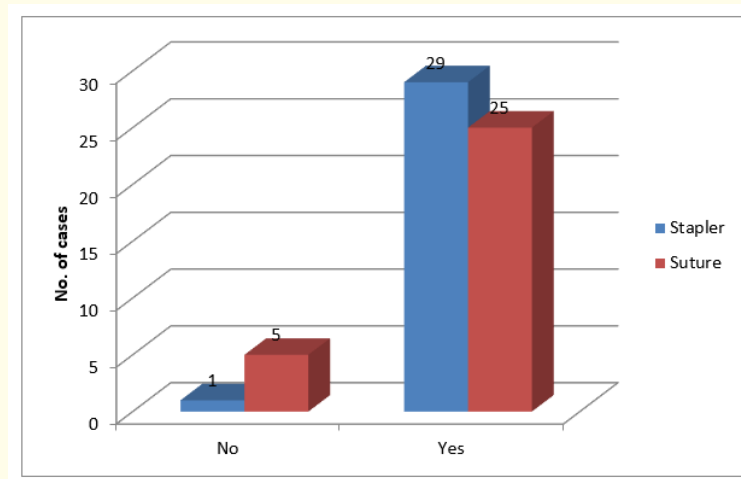


Figure 9: Satisfaction.

### Materials and Methods

The aim of this study is to compare two skin closure techniques – suture and stapler in open abdominal surgeries. A total 60 cases were included in this prior informed consent.

### Study duration

The study was carried out over a time period of two years from October 2018 to September 2020.

### Study design

The present study was prospective, observational, and comparative.

### Patient selection

All those patients who were attending Surgery department OPD and underwent open abdominal surgeries.

### Inclusion criteria

All adult patients of both the sexes, elective abdominal surgery (clean, clean contaminated).

### Exclusion criteria

- Pediatric age.
- Pregnant female.
- Emergency abdominal surgery.

### Closure technique

After the subcutaneous fat was sutured with 2-0 Vicryl.

- Suture Group: Skin was approximated with vertical mattress sutures using non-absorbable 2-0 Ethilon at a distance of 1 cm from each other.
- Stapled Group: The staples are used to close the wound and are placed at a distance of 5mm from one another.

### Study procedure

After getting institutional review board clearance, a hospital based prospective study was conducted in patients undergoing abdominal surgeries in Department of General Surgery, M.M. Institute of Medical Science and Research, Maharishi Markandeshwar (Deemed to be University), Mullana. 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. Patients were grouped into two categories- suture and staplers group based on the technique of wound closure. On the 3<sup>rd</sup> (Image 2) and 7<sup>th</sup> postoperative day (Image 3), the wound was evaluated using ASPESIS wound grading system (Image 4). The wounds were evaluated at 1 month follow up and rated for cosmesis by a senior surgeon (Image 5).



Image 2: POD- 3.



**Image 3:** Post op 7 (suture and staple).

Criterion	Description	Points
<b>A</b> Additional treatment	Antibiotics	10
	Drainage of pus under local anaesthetics	5
	Debridement of wound (General anaesthetics)	10
<b>S</b> Serous discharge	Daily	0-5
<b>E</b> Erythema	Daily	0-5
<b>P</b> Purulent exudates	Daily	0-10
<b>S</b> Separation of deep tissues	Daily	0-10
<b>I</b> Isolation of bacteria		10
<b>S</b> Stay in hospital prolonged over 14 days		5

**Image 4:** Asepsis.



**Image 5:** After one month (suture and staple).

**Observation and Results**

This study included total of 60 cases that underwent various surgical procedures at various site, various type of incision from the period of October 2018 to September 2020. Out of these 60 cases 30 cases underwent skin closure by sutures (Ethilon 2-0 R/C) and 30 patients underwent skin closure by skin staplers.

**Age**

Reveals maximum number of cases in both the group were between 41 - 50 yrs. Mean age among suture group was 44.47 and that of stapler group was 43.30. This difference was found to be not statistically significant at p value = 0.718.

		Material used staple/ suture		Total	Chi-square value	p-value
		Staple	Suture			
Age group	< 30	8	4	12	1.947	0.583
	31-40	3	5	8		
	41-50	13	14	27		
	> 50	6	7	13		
Total		30	30	60		

*Table 1: Age.*

**Sex distribution**

Table 2 shows sex distribution in which out of 29 females, 17 patients wound was closed with staples and 12 patients wound was closed with suture and out of 31 males, 13 patients wound was closed with staples and 18 patient wound was closed with suture. P value 0.196 which is statistically insignificant.

		Material used staple/ suture		Total	Chi-square value	p-value
		Staple	Suture			
Sex	F	17	12	29	1.669	0.196
	M	13	18	31		
Total		30	30	60		

*Table 2: Sex distribution.*

**Procedure and site of incision**

According to table 3, most common procedure in both the group is open cholecystectomy 26% in suture group and stapler group 36% followed by hernioplasty 20% in suture group and 13% in stapler group. Most common incision was Kocher incision 38% followed by inguinal incision 16% over the study group.



		Material used staple/suture		Total
		Staple	Suture	
Procedure	CBD Exploration	1	3	4
	colectomy	1	1	2
	open cholecystectomy	11	8	19
	cystogastrostomy	1	1	2
	Left Nephrectomy	1	1	2
	Left open pyelithotomy	1	2	3
	Onlay Mesh Hernioplasty	1	1	2
	Open Appendicectomy	4	4	8
	Rt hemicolectomy	1	1	2
	Rt Mesh Hernioplasty	4	6	10
	splenectomy	3	1	4
	Total Abdominal Hysterectomy	1	1	2
Total		30	30	60

Table 3: Procedure and site of incision.

**Time taken for closure**

Mean time for suture closure was 3.72 minutes with a standard deviation 2.18 and for stapler closure was 9.50 minutes with a standard deviation 3.43. This difference statistically significant with t value -7.787 and a p value of 0.000.

	Staple		Suture		t	p-value
	Mean	SD	Mean	SD		
Time to close the wound in min	3.72	2.18	9.50	3.43	-7.787	0.000

Table 4: Time taken for closure.

**Pain**

Mean visual analogue score among suture closure was 2.60 with an SD of 0.7 and among stapler closure was 5.20 with an SD 0.66. This difference was found to be statistically significant with p value = 0.000.

	Staple		Suture		t	p-value
	Mean	SD	Mean	SD		
pain (VAS)	2.60	0.77	5.20	0.66	-14.001	0.000

Table 5: Pain (on POD- 1).

**Appearance of scar**

In patients with stapler 28 patients (93%) had good appearance of scar, 2 patients (6%) had average appearance of scar. In suture group 18 patients (60%) had good appearance of scar, 12 patients (40%) had average appearance of scar.

		Material used staple/suture		Total	Chi-square value	p-value
		Staple	Suture			
Appearance	Average	2	12	14	9.317	0.002
	Good	28	18	46		
Total		30	30	60		

Table 6: Appearance of scar.

**Post op wound complication**

It was observed that wound healed without any discharge is 86.6% stapler group (26 patients) and 70% suture group (21 patients). Nil pus discharge from the stapler group and there were 13% pus discharge from suture group (4 cases). Serous discharge encountered in 13% of patients in stapler group (4 cases) and 16% of patients in suture group (5 cases). On comparing both the group p value is 0.098 which is insignificant.

		Material used staple/suture		Total	Chi-square value	p-value
		Staple	Suture			
Complication Wound Infection	Nil	26	21	47	4.643	0.098
	Pus	0	4	4		
	Serous	4	5	9		
Total		30	30	60		

Table 7: Post op wound complication.

**Hospital stay (days)**

It was observed that, the duration of hospital stay in both the group. In stapler group mean value of hospital stay is 4.10 with SD 1.40 and in suture group mean value is 8.57 with SD 2.19. On comparing both the group p value = 0.000. Therefore, it is highly significant.

	Staple		Suture		t	p-value
	Mean	SD	Mean	SD		
Hospital Stay(days)	4.10	1.40	8.57	2.19	-9.409	0.000

Table 8: Hospital stay.

**Satisfaction**

Among the stapler group and suture group the level of satisfaction was 96% and 83% respectively. Lowest level of satisfaction was observed in suture group. The analysis between stapler and suture group is statistically insignificant with p value 0.085.

		Material used staple/ suture		Total	Chi-square value	p-value
		Staple	Suture			
Satisfaction	No	1	5	6	2.963	0.085
	Yes	29	25	54		
Total		30	30	60		

Table 9: Satisfaction.

**Discussion**

Wound closure is important step for producing healthy and strong scar and also gives aesthetically pleasing look. Materials used will initiate tissue reaction (foreign body response). Inflammatory process peak within 2 days and further leads to re-epithelisation of tissue with good wound healing.

**Time for closure of skin wound**

In this study, time taken for closure of skin wound in stapler group (3.72 ± 2.18) minutes and in suture group (9.50 ± 3.43) minutes with p value 0.000. This result is comparable with study done by Fobin Varghese., *et al*, in which time for closure of skin wound was significantly shorter in stapler group (4.55 minutes), when compared to suture group (11.22 minutes) [4]. Abdul basit., *et al* concluded that it takes 87.28 ± 17.20 versus 251.07 ± 28.61 seconds for staplers and suture group respectively with p value <0.001 [5].

Similarly, a study conducted by Jahan K., *et al* reported that time for skin closure in stapler group was 1.22 ± 0.15 minutes and in suture group 5.46 ± 0.97 minutes with p value < 0.001 [6].

**Pain**

In this study, the pain was recorded on Visual Analog Scoring on the post- operative day 1. In staple mean value is 2.60 ± 0.77, while in suture mean value is 5.20 ± 0.66 with p value = 0.000. Parameshwara., *et al* also mentioned similarity that on immediate post-op day score were higher with usage of sutures as compared to staplers in both elective and emergency cases. In elective cases, those skin wound closed with suture 58% patient had pain on an average score of more than 3, which was when compared with stapler closure 18.6% patient who had pain on post-operative day [7].

This study is similar to study done by Vamseedharan Muthukumar., *et al*, which showed pain score of sutures group 6.014 ± 0.203 and staplers group 4.260 ± 0.2128 with significant p Value (< 0.0001) [8].

Debasis, *et al*, compared post-operative pain score in the suture and stapler group at 0 hrs, 12 hrs, 24 hrs, 36 hrs, 48 hrs, 72 hrs and 7<sup>th</sup> day. At 0 hrs, the mean post-operative pain score doesn't differ significantly [9].

### Post op wound infection

In this study, it was observed that wound healed without any discharge is 86.6% stapler cases and 70% suture cases. There was nil pus discharge from the staple group and there were 13% pus discharge from suture group. Serous discharge encountered in 13% of patients in stapler group and 16% of patients in suture group. Similarly, Vamseedharan muthukumar, *et al* conducted an overall analysis of the SSI scores between two type of skin closure and reported as, staple closure showed  $1.237 \pm 0.115$  SSI in post-operative period and suture closure showed  $1.722 \pm 0.1044$  SSI in post-operative period [8]. Imamura K., *et al* also emphasized superficial SSI occurred in 25 out of 199 in suture group and for 27 out of 202 in stapler group and the result came superficial SSI doesn't differ significantly amongst the suture and stapler group [10].

Pickford IR., *et al*, conducted a prospective controlled clinical trial in 341 abdominal operation and compared the infection rate after two method of skin closure. 182 patients had skin closure by monofilament nylon and 159 patients had skin closure by steel clips. The overall infection rate in the suture group was 17% compared to 6.3% in those closed by clips (p value < 0.01) [11]. Eldup J., *et al*, conducted study among 137 patients, there was no difference found with regards to wound infection [12].

### Scar

In this study, the appearance of the scar (cosmetic) 93% of the stapler wound had good appearance and 60% of suture wound had good appearance. 6% and 40% of patient had average appearance of scar in stapler and suture group respectively with significant p value.

Sagar S Kathare., *et al*, in their study also had similar results, during the follow up, 90% cases had good appearance of scar in sample group and 60% cases of suture group had good scar appearance [13]. Similarly, S. Shaqikh., *et al* compared the scar cosmesis in both the group of stapler and suture after one month, which showed suture group had  $4.69 \pm 3.49$  and  $2.60 \pm 2.76$  in stapler group with p value significant [14].

According to Parameshwara., *et al*, in elective cases cosmetic results were better with stapler group [7].

Sagar Gupta., *et al*, conducted a study and observed the scar appearance on 14<sup>th</sup> day and 30<sup>th</sup> day post-operatively. On 14<sup>th</sup> day with staples (70 patients) had linear scar then with suture (58 patients) had linear scar. On 30<sup>th</sup> day with staples (68 patients had linear scar) and in the staplers (54 patients) had linear scar [15].

### Patient's satisfaction

In this study, among the stapler group and suture group the level of satisfaction was 96% and 83% respectively with insignificant P value but still satisfaction is more in stapler group. Similarly, Sagar S Kathare., *et al*, compared and concluded that, patient compliance was better in stapler group than suture [13]. Methodius G Tuuli., *et al*, on comparing the two group, patient satisfaction was equivalent in both the groups of patients [16].

### Length of hospital stay

In this study, the duration of hospital stay in both the group were compared and showed that, in stapler group mean value of hospital stay was  $4.10 \pm 1.40$  and in suture group mean value was  $8.57 \pm 2.19$  with p value = 0.000 which is highly significant. These results are comparable with study done by Ananda B.B., *et al*, that patient in stapler group required least number of hospitals stay followed by suture group with p value of 0.006 proving strongly significant [17].

Basha, *et al*, on their study showed there is no significant difference between two groups in the length of hospital stay [18].

### Conclusion

The result of this study illustrated the fact that, the staplers are superior to sutures. Stapler is simple to perform, consumes significantly less time in skin closure and gives best result in terms of less post-operative pain, wound infection and in length of hospital stay. Now a days cosmesis being essential and important aspect after surgery. A cosmetic scar not only gives satisfaction to the patient but also improve the mental ease to the surgeon. By using stapler during skin closure has let to have better cosmetic result (appearance and width of scar). Therefore, it is better to use stapler in all elective abdominal surgery.

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