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## **A Comparative Study of Suture Vs Stapler in Open Abdominal Surgery**

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### **Abstract**

**Aims and Objectives:** The aim of the study were Comparative study between suture v/s stapler in open abdominal surgery Comparing factors like Surgical site infection; Post operative pain; Post-operative scarring; Wound dehiscence; Cosmetic appearance; Cost effectiveness.

**Materials and Method:** A total of 160 cases were included in this study with prior informed consent.

**Study duration:** The study was carried out over a time period of two years from December 2011 to September 2013.

**Study design:** The present study was prospective, observational, and comparative.

**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 our study, comparison of abdominal skin closure with staples and vertical mattress sutures was done. We found that: 1) Incidence of post operative wound infection was less with skin staples. 2) Skin staples provided better cosmesis than the vertical mattress skin closure. Hence, we conclude that the use of skin staples in low tension incision is easy, associated with low incidence of wound complications, provides good cosmetic outcome and also takes considerably less time for skin closure and thus recommend its use more frequently especially for closure of long and multiple incisions.

**Keywords:** Lipid peroxidation, Antioxidant status, Diet Factors.

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## **1. 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 suture a clean incision, healing takes place with minimum loss of tissue and without significant bacterial infection with minimal scarring, With passage of time and availability of newer methods of skin closure, it has become an art with stress on better cosmetic results.

Any method of skin closure should provide adequate approximation of the tissue to allow wound healing with minimal risk of infection and should produce an acceptable cosmetic result.

The method should be simple, quick to use and cost effective.

Since long the art of suturing is emerging continuously for the betterment of the patient in terms of cosmetic appearance –minimal scar, decreasing the risk of infection better patient compliance thus overall decreasing the morbidity.

We have undertaken a comparative study of 160 cases between suture and stapler in open abdominal surgery to compare the merits and demerits of the techniques.

## **2. Materials and Methods**

The aim of this study is to compare two skin closure techniques – suture and stapler in open abdominal surgeries. A total of 160 cases were included in this study with prior informed consent.

### 2.1 Study duration

The study was carried out over a time period of two years from December 2011 to September 2013.

### 2.2 Study design

The present study was prospective, observational, and comparative.

### 2.3 Patient selection

All those patients who were attending Surgery department (elective and emergency) and underwent open abdominal surgeries.

### 2.4 Closure technique

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

**1) Suture Group:** Skin was approximated with vertical mattress sutures using non-absorbable 2-0 Ethilon at a distance of 1 cm from each other.

**2) Stapled Group:** The staples are used to close the wound and are placed at a distance of 5mm from one another.

## 3. Observation and Results

This comparative study was done over a period of 2 years from December 2011 to September 2013 in our hospital. 160 cases were studied and were randomly divided in two groups each of 80 cases:

Group (A) patients in which Skin closure done with skin stapler

Group (B) patients in which Skin closure done with nonabsorbable suture material. i.e. Polyamide 2-0 (vertical mattress suture)

The results were analyzed from the observations made and are tabulated as follows

### 3.1 Age Distribution

**Table 1: Age Distribution**

Age(years)	A (n=80)		B (n=80)		TOTAL (n=160)	
	No.	%	No.	%	No.	%
0-10	9	11	3	4	12	15
11-20	9	11	7	9	16	20
21-30	14	18	12	15	26	33
31-40	10	13	11	14	21	26
41-50	16	20	13	16	29	36
51-60	12	15	18	23	30	38
>60	10	13	16	20	26	33
<b>TOTAL</b>	<b>80</b>	<b>100</b>	<b>80</b>	<b>100</b>	<b>160</b>	<b>100</b>

The age of the patients in the study varied from less than 10 years to more than 60 years.

The number of patients in age groups between 0-10(A-11%,B-4%),11-20(A-11%,B-9%), 21-30 (A-18%,B-15%),31-40(A-13%,B-14%), 41-50(A-20%,B-16%), 51-60(A-15%,B-23%), >60(A-13%,B-20%).

### 3.2 Sex Distribution

Both skin closure techniques are utilized more frequently in males than in females.

In laparotomy 35 were male (73%) and 13 were female (27%).

In hernia repair 35 were male (76%) and 11 were female (24%).

In appendectomy 7 were male (70%) and 3 were female (30%).

In kidney exposure 11 were male (55%) and 9 were female (45%).

In suprapubic cystolithotomy 12 were male (100%) and 0 were female (0.00%).

In open cholecystectomy 5 were male (42%) and 7 were female (58%)

In open prostatectomy 12 were male (100%)

**Table 2: Sex Distribution**

Gender	Group		Total n=160	
	A(n=80)	B(n=80)	No.	%
<b>Laparotomy</b>				
Male	15	20	35	73
Female	9	4	13	27
<b>Total</b>	<b>24</b>	<b>24</b>	<b>48</b>	<b>100</b>
<b>Hernia repair</b>				
Male	17	18	35	76
Female	6	5	11	24
<b>Total</b>	<b>23</b>	<b>23</b>	<b>46</b>	<b>100</b>
<b>Appendectomy</b>				
Male	4	3	7	70
Female	1	2	3	30
<b>Total</b>	<b>5</b>	<b>5</b>	<b>10</b>	<b>100</b>
<b>Kidney exposure</b>				
Male	7	4	11	55
Female	3	6	9	45
<b>Total</b>	<b>10</b>	<b>10</b>	<b>20</b>	<b>100</b>
<b>Suprapubic cystolithotomy</b>				
Male	6	6	12	100
Female	0	0	0	0
<b>Total</b>	<b>6</b>	<b>6</b>	<b>12</b>	<b>100</b>
<b>Open cholecystectomy</b>				
Male	3	2	5	42
Female	3	4	7	58
<b>Total</b>	<b>6</b>	<b>6</b>	<b>12</b>	<b>100</b>
<b>Open prostatectomy</b>				
Male	6	6	12	100

### 3.3 Operation wise distribution

**Table 3: Operation wise Distribution**

Operation	Number	% [N = 160]
Laparotomy	48	30%
Kidney exposure	20	13%
Hernia repair	46	29%
Open appendectomy	10	6%
Open cholecystectomy	12	8%
SPCL	12	8%
Open prostatectomy	12	8%

In our study laparotomy done in 48 patients (30%), kidney exposure in 20 patients (13%), hernia repair in 46 patients (29%), open appendectomy in 10 patients (6%), open cholecystectomy in 12 patients (8%), SPCL in 12 patients (8%), open prostatectomy in 12 patients (8%).

### 3.4 Stich removal in stapler and suture

**Table 4: Stich Removal in Stapler and suture**

Day	Stapler	% n=80	Suture	% n=80
7-10 <sup>th</sup> Day	72	90	64	80
11-14 <sup>th</sup> Day	8	10	12	15
>14 <sup>th</sup> Day	0	0	4	5

#### Distribution according to Stich removal on various days

With stapler group stitch removal done in 72 patients (90%) within 7-10<sup>th</sup> days, in 8 patients (10%) within 11-14<sup>th</sup> days.

With suture group stitch removal done in 64 patients (80%) within 7-10<sup>th</sup> days, in 12 patients (15%) within 11-14<sup>th</sup> days and in 4 patients (5%) after 14<sup>th</sup> days.

### 3.5 Complication on various post operative days

**Table 5: Complication on various post operative days**

Observation	Group	3 <sup>rd</sup> day		7 <sup>th</sup> day		14 <sup>th</sup> day		30 <sup>th</sup> day	
		N	%	N	%	N	%	N	%
Infection	A	5	6	11	14	8	10	0	0
	B	13	16	22	28	16	20	0	0
Pain	A	5	6	9	11	3	4	0	0
	B	14	18	18	23	10	13	0	0
Scarring	A	-	-	-	-	70	88	68	85
	B	-	-	-	-	58	73	56	70
Dehiscence	A	4	5	7	9	3	4	0	0
	B	12	15	16	20	10	13	0	0

#### 3.5.1 Surgical site infection

**Table 6: Association of infection with stapler and suture**

	Yes	No	Chi square	p value	Inference
<b>3<sup>rd</sup> day</b>					
Stapler	5	75	4	0.04	Significance
Suture	13	67			
<b>7<sup>th</sup> day</b>					
Stapler	11	69	4.61	0.03	Significance
Suture	22	58			
<b>14<sup>th</sup> day</b>					
Stapler	8	72	4.11	0.04	Significance
Suture	16	64			

In patients with stapler on 3<sup>rd</sup> day 5 patients (6%) are having infection, on 7<sup>th</sup> day 11 patients (14%) are having infection, on 14<sup>th</sup> day 8 patients (10%) are having infection and on 30<sup>th</sup> day no patient is having infection.

In patients with sutures on 3<sup>rd</sup> day 13 patients (16%) are having infection, on 7<sup>th</sup> day 22 patients (28%) are having infection, on 14<sup>th</sup> day 16 patients (20%) are having infection and on 30<sup>th</sup> day no patient is having infection.

#### 3.5.2 Post operative pain

**Table 7: Association of post operative pain with stapler and suture**

	Yes	No	Chi square	p value	Inference
<b>3<sup>rd</sup> day</b>					
Stapler	5	75	4.83	0.02	Significance
Suture	14	66			
<b>7<sup>th</sup> day</b>					
Stapler	9	71	3.6	0.05	Significance
Suture	18	62			
<b>14<sup>th</sup> day</b>					
Stapler	3	77	4.11	0.04	Significance
Suture	10	70			

In patients with stapler on 3<sup>rd</sup> day 5 patients (6%) are having pain, on 7<sup>th</sup> day 9 patients (11%) are having pain, on 14<sup>th</sup> day 3 patients (4%) are having pain and on 30<sup>th</sup> day no patient is having pain.

In patients with suture on 3<sup>rd</sup> day 14 patients (18%) are having pain, on 7<sup>th</sup> day 18 patients (23%) are having pain, on 14<sup>th</sup> day 10 patients (13%) are having pain and on 30<sup>th</sup> day no patient is having pain.

#### 3.5.3 Post operative Scarring

**Table 8: Association of post operative scarring with stapler and suture**

	Linear scar	Rail road scar	Chi square	p value	Inference
<b>14<sup>th</sup> day</b>					
Stapler	70	10	5.60	0.01	Significance
Suture	58	22			
<b>30<sup>th</sup> day</b>					
Stapler	68	12	5.16	0.02	Significance
Suture	54	26			

In patients with stapler on 14<sup>th</sup> day 70 patients (88%) are having linear scar, 10 patients (12%) are having rail road scar and on 30<sup>th</sup> day 68 patients (85%) are having linear scar, 12 patients (15%) are having rail road scar.

In patients with suture on 14<sup>th</sup> day 58 patients (73%) are having linear scar, 22 patients (27%) are having rail road scar and on 30<sup>th</sup> day 54 patients (68%) are having linear scar, 26 patients (32%) are having rail road scar.

#### 3.5.4 Post operative wound dehiscence

**Table 9: Association of wound dehiscence with stapler and suture**

	Yes	No	Chi square	p value	Inference
<b>3<sup>rd</sup> day</b>					
Stapler	4	76	4.44	0.03	Significance
Suture	12	68			
<b>7<sup>th</sup> day</b>					
Stapler	7	73	4.11	0.04	Significance
Suture	16	64			
<b>14<sup>th</sup> day</b>					
Stapler	3	77	4.1	0.04	Significance
Suture	10	70			

In patients with stapler on 3<sup>rd</sup> day 4 patients (5%) are having dehiscence, on 7<sup>th</sup> day 7 patients (9%) are having dehiscence, on 14<sup>th</sup> day 3 patients (4%) are having dehiscence and on 30<sup>th</sup> day no patient is having dehiscence.

In patients with suture on 3<sup>rd</sup> day 12 patients (15%) are having dehiscence, on 7<sup>th</sup> day 16 patients (20%) are having dehiscence, on 14<sup>th</sup> day 10 patients (13%) are having dehiscence and on 30<sup>th</sup> day no patient is having dehiscence.

### 3.5.5 Comparison of cosmetic look of scar

**Table 10: Comparison of scar**

Appearance	Stapler		Suture	
	n=80	%	n=80	%
Primary Healing	68	85	55	69
Secondary Healing	12	15	25	31
Hypertrophic Scar [on 30 <sup>th</sup> day]	3	4	8	10

In patients with stapler 68 patients (85%) had primary healing, 12 patients (15%) had secondary healing and on 30<sup>th</sup> day 3 patients (4%) had hypertrophic scar.

In patients with suture 55 patients (69%) had primary healing, 25 patients (31%) had secondary healing and on 30<sup>th</sup> day 8 patients (10%) had hypertrophic scar.

### 3.5.5 Cost Effectiveness in patient prospective

**Table 11: Cost Effectiveness in patient prospective**

	A(Stapler)	%	B(Suture)	%
Cheap	8	10	64	80
Costly	72	90	16	20

In patients with stapler 8 patients (10%) feel it is cheap and 72 patients (90%) feel it is costly. In patients with suture 64 patients (80%) feel it is cheap and 16 patients (20%) feel it is costly.

## 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 its aesthetically pleasing physical appearance. Skin staples are an alternative to regular sutures in offering this advantage.

Sutures are used to facilitate the process of wound healing by:

- 1) Closing dead space within wound
- 2) Supporting wounds until their tensile strength is increased
- 3) Approximating skin edges.

Sutures initiate a foreign body response (i.e. tissue reaction). The initial tissue reaction is attributed to the injury inflicted by the passage of suture and needle and reaction to the suture material itself. The reaction of living tissue to injury or foreign bodies is called inflammation. The

inflammatory response usually peaks between 2 to 7 days after implantation. The longer a suture mass stays in the human body, the more likely it is to produce undesirable tissue reactions.

For the surgeon, a scar may be the only trademark of the surgical procedure performed, as FitzGibbon has stated, "By your scars you will be judged." (Fitz Gibbon, 1968).

In our present study, Regarding post operative surgical site infection on 3rd day infection is three times more in suture (13 patients) then in stapler (5 patients) which was justified by the study of Stillman and colleagues[1].

On the 7th post operative day infection is two times more in suture (22 patients) then in stapler (11 patients) which is correlated with the study of Iavazzo and Gkegkes ID[2].

On the 14th post operative day infection is two times more in suture (16 patients) then in stapler (8 patients) which is correlated with the study of Eldrup[3].

Regarding post operative pain over surgical site, wound pain is more in suture group (3rd day 14 patients, 7th day 18 patients, 14th day 10 patients) then in stapler group (3rd day 5 patients, 7th day 9 patients, 14<sup>th</sup> day 3 patients) which is correlated with the study of Ritchie AJ [4] and with the study of D. Gatt, C. R. Quick [5].

Regarding post operative wound dehiscence, wound dehiscence is less in stapler group (3<sup>rd</sup> day 4 patients, 7th day 7 patients, 14<sup>th</sup> day 3 patients) then suture group (3<sup>rd</sup> day 12 patients, 7<sup>th</sup> day 16 patients, 14<sup>th</sup> day 10 patients) which is correlated with the study of Stillman and colleagues [6] and with the study of Vouloumangu EK[7].

### 4.1 Cosmesis

Scar is observed on 14th and 30th post operative days. On 14th day with stapler (70 patients) are having linear scar then with suture (58 patients) are having linear scar. On 30th day with stapler (68 patients) are having linear scar then with suture (54 patients) are having linear scar. With stapler (68 patients) have primary healing then with suture (55 patients) which is justified with the study of Medina dos Santos [8] and with the study of George TK[9].

### 4.2 Cost factor

The cost of staplers used in this study Sentineal C E 123 is Rs 584 per stapler and reuse is not recommended even after reesterilization.

Ethilon suture cost approximately Rs. 120 and are 6 times cheaper than the disposable skin stapler. This was justified by the study of Kanegaye JT [10].

Our study showed that stapler was fast to take than suture with superior scar formation which was cosmetically more appreciated by patient.

In the present study, wounds closed using sutures showed higher rate of wound complication as compared to wound closed with stapler.

Skin staples have several advantages over conventional sutures. They are quick and easy to use. Cosmetically, they produce good wound eversion and have a minimal cross hatch scar. Skin staples are relatively inert and can be left in situ for a longer period of time without any complications and in addition, patient can take a bath in the early postoperative period.

## 5. 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 our study, comparison of abdominal skin closure with staples and vertical mattress sutures was done. We found that:

- 1) Incidence of post operative wound infection was less with skin staples.
- 2) Skin staples provided better cosmesis than the vertical mattress skin closure.

Hence, we conclude that the use of skin staples in low tension incision is easy, associated with low incidence of wound complications, provides good cosmetic outcome and also takes considerably less time for skin closure and thus recommend its use more frequently especially for closure of long and multiple incisions.

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