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Stapler Suturing Vs Conventional Suturing -A Comparitive Study on the Outcome of Wound Closure in Abdominal Skin Incisions

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Abstract :
Introduction:
Tissue repair following skin incisions should be with good strength with least tissue damage and less inflammation with aesthetically acceptable scar. So we compared the conventional and stapler suturing in terms of the above parameters.
Materials &Methods:
100 sequentially admitted patients were divided into 2 groups and one underwent stapler suturing and the other underwent conventional suturing. We measured the length of the incision sutured per minute, pain score, scar type, expenses and wound infections.
Results:
The mean age of people is 44.56 ± 14.9 years with males 62% and Females 38%. The complication rates between two groups are stapler group 4% and
conventional group 17%. The number of centimeters covered per minute in
stapler method 4.2 ± 0.9 cm and conventional suturing method 1.9 ±1 cm. Pain scoring using Visual Analog Scale for stapler method 0.46 ± 5.7 conventional suturing method 1.38 ± 5.6. Regarding the cost effectiveness, there is only a marginal difference with both methods.
Conclusion:
The incidence of Wound infection, pain score, time taken for suturing are lesser in stapler group compared to Conventional group.
Cost wise the Conventional type of suturing is cheaper than the Stapler method.
Key words: *Wound healing, skin stapler, conventional skin suturing*

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I. Introduction

The Principal aims of tissue repair after surgical skin incisions are rapid acquisition of strength, least tissue damage, no inflammation and an aesthetically acceptable scar. Conventional suture techniques have the disadvantage of consuming more time as well as an outcome of a cosmetically inferior scar. Staplers were originally performed to address the perceived problem of patency i.e, security against leaks of blood or bowel contents in anastomoses in particular. More recent studies have shown that Stapler suturing are quicker to perform.

II. Aims And Objectives

To compare the outcome of Stapler suturing and conventional suturing in abdominal skin wound closure .To Compare the efficacy / efficiency of suturing techniques between Stapler and Conventional suturing in Linear abdominal incisions and wound closure.

The following factors are taken into account before comparing both the suturing techniques

1. Time taken for suturing
2. Post operative wound infection
3. Pain scoring during suture removal in the post operative period
4. Cost effectiveness

III. Materials And Methods

Data consists of primary data collected by the principal investigator directly from the patients who were admitted in the Government Medical College and hospital.It was a Comparative & Observational Study, for a period of one year ,from July 2015-June 2016 and the sample size was100.

3.1 INCLUSION CRITERIA:

All patients getting admitted to the Department of general surgery and requiring laparotomies in both elective and emergency settings.
Surgeries in which Linear abdominal skin incisions are performed, either horizontal or vertical.
Length of the skin incision >10 cms.
All patients in the age group between 15-60 yrs willing for participation in the study after obtaining informed consent.

3.2 EXCLUSION CRITERIA :

Psychiatric patients
On table deaths
Immuno compromised states like TB, HIV
Patients having uncontrolled Diabetes
Patients who refused to cooperate for the entire study period
Pregnant women

3.3 MATERIALS USED:

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

3.4 METHODS

In our study around 100 patients satisfying the above inclusion and exclusion criteria were selected, of which they were divided into 2 groups in a random manner . All the Odd numbers underwent stapler suturing and all the even numbers underwent wound closure by conventional suturing methods (50 patients will undergo wound closure by stapler and another 50 patients will undergo closure by 1-0 or 2-0 ethilon suture material in a conventional mattress suturing) The length of the incision sutured by staple per minute was calculated for each patient and recorded . In a similar fashion the length of the skin incision sutured by 1-0 or 2-0 ethilon in a minute was also recorded for every patient. Each patient was followed up for 30 days after the procedure .A wound was considered to be infected if any discharge or distinct redness were present. Any wound infection, in both the groups were recorded subsequently. Abnormal delay in wound healing was also considered in both the groups and recorded A visual analog scoring system was used. A pain scoring chart was given to each patient at the end of his/her study, when he/ she was declared fit for discharge during suture removal and recorded.

Staples were removed using a stapler removal tool while ethilon sutures were removed in a conventional way. The cosmetic appearance was also assessed but not included in our study. Finally the expenses of stapler suturing and conventional ethilon mattress suturing was compared on a standard skin incision length basis.

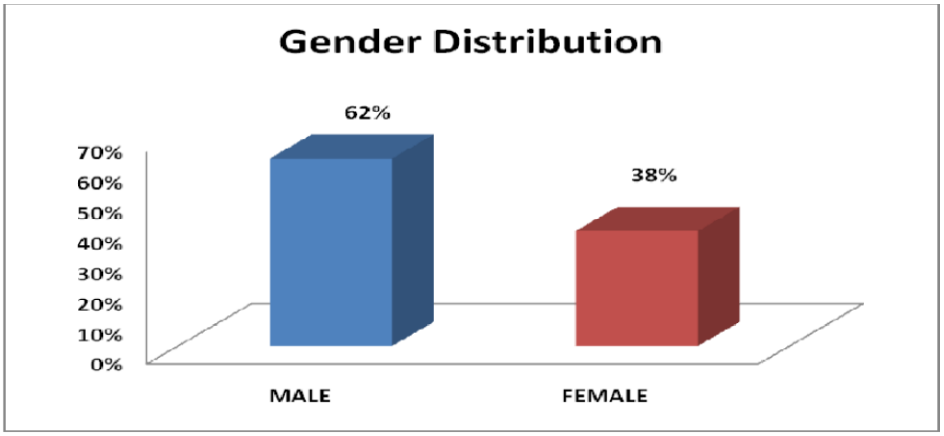
IV. Observation And Results

4.1 Mean age of the study

AGE	Mean±SD
AGE(n=100)	44.56±14.9
Staplermethod(n=50)	43.08±13.7
Conventionalmethod(n=50)	46.04±16.0

4.2 Gender Distribution of the study

Gender	Frequency	Percent(%)
Male	62	62.0
Female	38	38.0
Total	100	100.0



Studymethods	Male(%)	Female(%)
Staplermethod(n=50)	34(68%)	16(32%)
Conventionalmethod(n=50)	28(56%)	22(44%)

The above chart shows the percentage wise distribution of the sexes in both the conventional method of suturing and the stapler method. Since the study was conducted in a random fashion, and the study is not sex specific.

4.3 Mean incision length in the study

PARAMETER	Mean±SD
Incisionlength(totalstudygroup)(n=100)	15.53±2.1
Staplermethod(n=50)	15.58±1.9
Conventionalmethod(n=50)	15.48±2.4

4.4 Mean Time taken in the study

PARAMETER	Mean±SD
Timetaken(n=100)	6.50±3.3
Staplermethod(n=50)	4.01±1.6
Conventionalmethod(n=50)	8.99±2.7

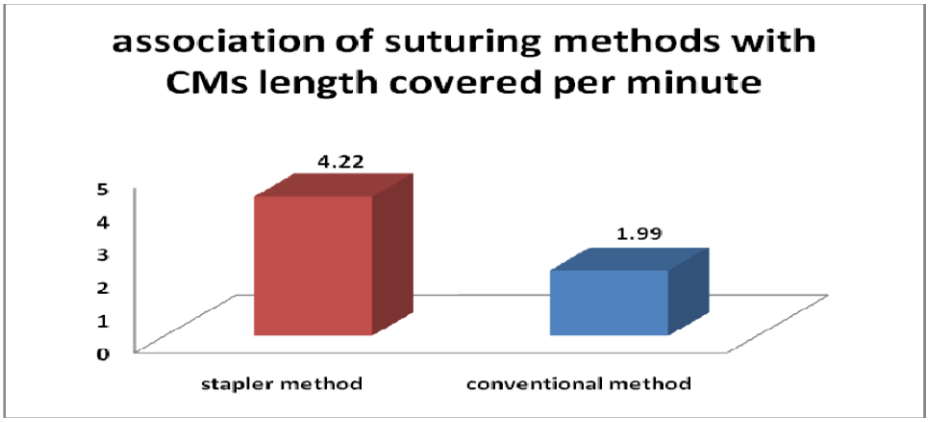
4.5 CMs covered per minute in the study

PARAMETER	Mean±SD
Time taken(n=100)	3.10±1.4
Stapler method(n=50)	4.22±0.9
Conventional method(n=50)	1.99±1.0

4.6 Association of suturing methods with cms length covered per minute inthe study

PARAMETER	Mean±SD	Pvalue
Stapler method(n=50)	4.22±0.9	.000*
Conventional method(n=50)	1.99±1.0	

shows the association of suturing methods with CMs length covered per minute in the study by using independent 't'test . Mean length in cms /minute was less in using stapler method when compared with conventional method and is Statistically significant (P<0.05)

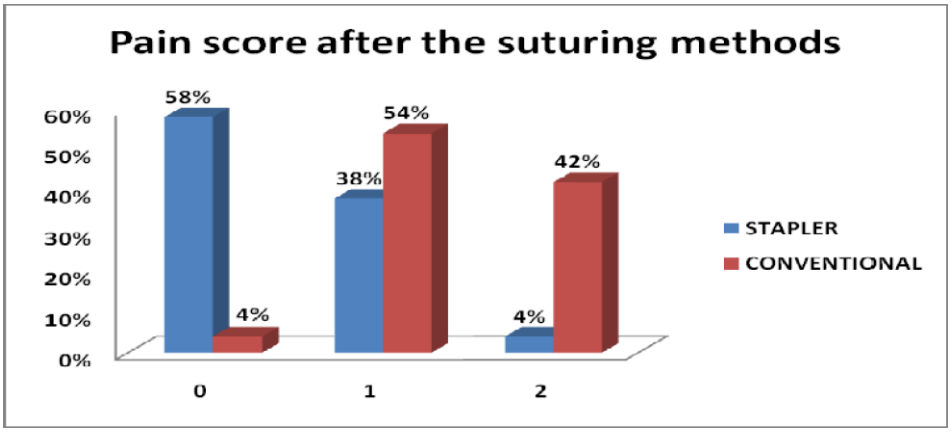


The mean time taken for closing an average skin incision length of 15.5 cm was 4 mins with a standard deviation of 1.6 mins, whereas the mean time for closing an average skin incision length of 15.5 cm was 8.9 mins with a standard deviation of 2.7 minutes.

The number of centimeters covered per minute in each method was also taken into account (Table 13 & 14).In one minute the mean incision length closed for the Stapler method was 4.2 cm with a SD of 0.9 cm whereas in the Conventional suture method it was 1.9 cm with a SD of 1 cm, which shows that the Stapler is almost 2.5 times faster than the conventional suturing method

4.7 Pain score after the suturing methods in the study

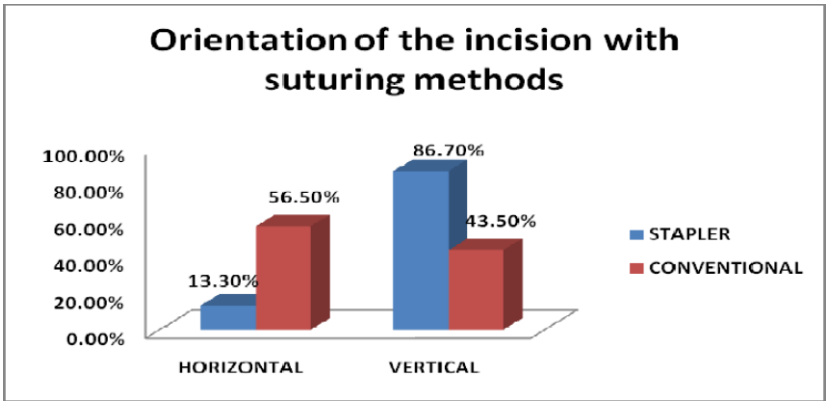
Suturingtype	0	1	2
Staplermethod	29(58%)	19(38%)	2(4%)
Conventionalmethod	2(4%)	27(54%)	21(42%)



The pain scoring was done based on a Visual Analog scale , where the patient was made to select a particular value of Increasing intensity in a 10 point scale at the end of his/her study when the patient was fit for discharge after suture removal.

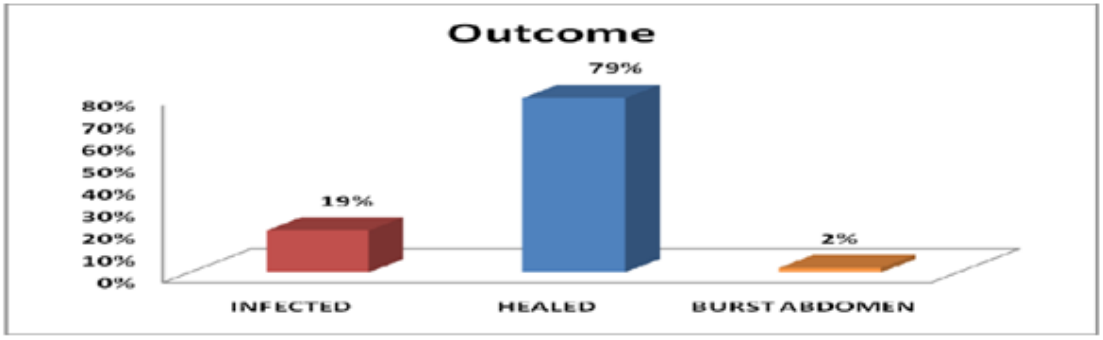
4.8 Orientation of the incision with suturing methods in the study

Suturing type	Stapler method	Conventional method
Horizontal	2(13.3%)	13(86.7%)
Vertical	48(56.5%)	37(43.5%)



4.9 Outcome in the study

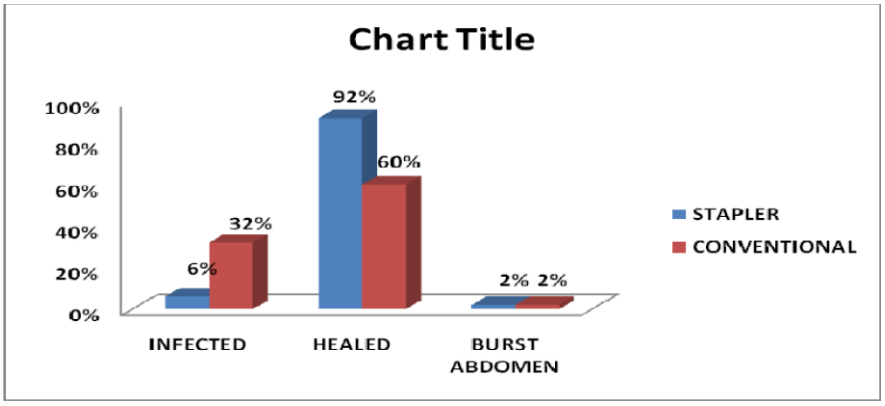
Outcome	Frequency	Percent(%)
Infected	19	19.0
Healed	79	79.0
Burst Abdomen	2	2.0
Total	100	100.0



Out of the 100 patients taken up for study , 79 patients ended up without any complications post operatively . Of the remaining 21 , Two of them subsequently developed burst abdomen and 19 of them got their wounds infected.

4.10 Association of infections with suture methods

SutureMethods	Infected	Healed	Burstabdomen	PValue
Staplermethod	3(6%)	46(92%)	1(2%)	.004*
Conventioal method	16(32%)	33(60%)	1(2%)	



Association of infections with suture methods using Chi-square method. Occurence of infection is less while using stapler method when compared with conventional method and is Statisticallysignificant (P<0.05).

4.11Association of pain score with Suturing Methods

SutureMethods	Mean±SD	PValue
Stapler method	.46±.57	.000*
Conventional method	1.38±.56	

Association of pain score with Suturing Methods using Mann Whitney test. Mean pain score was less in using stapler method when compared with conventional method and is Statistically significant (P<0.05).

4.12 COST EFFECTIVENES

The mean incision length in our study is 15.53 cm , for the Stapler method being 15.58 cm and the conventional suture method being 15.48 cm. The cost of a single stapler device containing 35 staples is Rs.825, whereas the cost of the Ethilon suture material is Rs.130 for a length of 70 cm. Therefore for an average incision length of 15.5 cm , with an inter suture spacing of 1cm approximately 2 Ethilon suture materials was used up, the total cost being Rs.360,whereas for an average length of 15.5 cm , with an inter suture spacing of 0.5 cm, about 30-31 staples were used approximately, with 3-4 staples remaining in the device. The difference between using Conventional sutures and staples was approximately 465 Rupees and considering the Fact that Staples can be reused after placing in CIDEX solutions in emergency set up like trauma wards , there is only a marginal Cost benefit in favor of conventional suturing methods.

V. Discussion

There is evidence that the Stapler method causes considerably less damage to wound defenses when compared even with the least reactive non absorbable suture materials. PubMed, Scopus, and Cochrane Central Register of Controlled Trials for randomized controlled trials were searched that compared sutures with staples for surgical wound closure. Twenty studies (involving a total of 2111 patients) were included. Five studies referred to obstetrics/gynecological operations, seven to general surgery, four to emergency care treatment, three to head/neck operations,and one to vascular surgery. Regarding the time needed for wound closure, staples were superior to sutures; the mean difference observed between the sutures and staples groups was 5.56 minutes per wound (95% confidence intervals [CI], 0.05 to 11.07). Wound infections were significantly fewer in the staples group compared with the sutures group(s) (12 studies, 1529 patients; odds ratio, 2.06; 95% CI, 1.20 to 3.51). In five studies, the use of staples was associated with significantly more pain compared with sutures. The majority of studies with available relevant data reported nonsignificant differences regarding the cosmetic result and patient's satisfaction. Medina dos Santos et. al., have compared the cosmetic results of staplers with non continuous nylon sutures and reported that Nylon suture should not be used in suturization when permanent retention of tensile is required. They have also observed that Stapler's closure causes considerably less damage to wound defenses than closure with least reactive non absorbable suture. Standard suturing causes significantly more necrosis than stapling in myocutaneous flaps In Susruta samhitha 600 BC there is mention of suture material made from animal sinews, braided horsehair, leather strips, and vegetable fibers.Surgical stapling was developed in 1908 by Hulti Humer in Australia. The original instrument was massive by today's standards weighing 7.5 pounds. Modifications performed by Von Petz provided a lighter and simpler device, and in 1934 Fredrick of Ulm designed an instrument that resembled the modern linear stapler. The next major advances came from Russia after World War II. In 1958, Ravich, who, through research and development, refined the

instruments to their current state and wide spread use today **.** 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. Regarding abdominal surgery, five randomized controlled trials dating from 1981 to 1992, assessed the outcome of staples versus sutures for skin closure on superficial surgical site infection, pain, operation time, and cosmetic outcome. Three of the trials compared interrupted mattress sutures to staples and two compared intracutaneous sutures versus staples including a comparison of different suture materials.While in the Pickford trial the infection rate was significantly lower in favor of staples (6.3% vs. 17%), no significant difference could be demonstrated in the trials of Eldrupand Gatt. The two trials comparing intracutaneous sutures to staples showed no significant difference regarding the incidence of superficial surgical site infection. Moreover, the suture material was proven to be of no impact[22]. All trials, which additionally considered the cosmetic outcome[19,20,21] and closure time, revealed no significant difference for the cosmetic outcome but a significant reduction of the closure time. However, data addressing postoperative pain were conflicting. Two trials demonstrated a significant reduction of postoperative pain in favor of staples, whilst one trial showed no difference.

VI. Conclusion

The incidence of Wound infection is Lesser in Using Staples when compared to the Conventional Suturing method ,using non absorbable 1-0 Ethilon material There is a significant Time difference ,with an Obvious advantage favoring the Stapler method over the Conventional suturing method while closing abdominal skin incisions especially in Emergency settings.

Most of the patients were happy in whom the Stapler method of Abdominal wound closure was done with a few minor exceptions.Overall the mean Pain score was less in the stapler method when compared to the Conventional method

Cost wise the Conventional type of suturing method is more efficacious when compared to the Stapler method, but however only a marginal benefit is given to the Conventional type of suturing considering the time and the Skill of the surgeon.

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