

A comparative study on skin staplers and conventional silk suture for elective abdominal surgeries

¹Dr. Rajaram Meena, Senior Resident, Department of Surgery, Government Medical College, Kota

²Dr. Sitaram Yadav, Senior Resident, Department of Surgery, Sardar Patel Medical College, Bikaner

³Dr. Devi Singh Kchhawa, Senior Resident, Department of Surgery, Sardar Patel Medical College, Bikaner

⁴Dr. Ramesh Suthar, Senior Resident, Department of Surgery, Government Medical College, Kota

⁵Dr. R.S. Meena, Senior Professor, Department of Surgery, Government Medical College, Kota

Corresponding Author: Dr. Rajaram Meena, Senior Resident, Department of Surgery, Government Medical College, Kota

Citation this Article: Dr. Rajaram Meena, Dr. Sitaram Yadav, Dr. Devi Singh Kchhawa, Dr. Ramesh Suthar, Dr. R. S. Meena, “A comparative study on skin staplers and conventional silk suture for elective abdominal surgeries”, IJMSIR- June - 2020, Vol – 5, Issue -3, P. No. 61 – 66.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: One of the lasting reminders of any abdominal surgery, and most noticeable to the patient, is the scar made by the incision. The surgeon must be cautious to take into consideration the underlying pathology, suspicion of malignancy and the underlying comorbid state of the patient. Despite increasing emphasis on evidence-based medicine, there is very little reliable data available about the best method of wound closure.

Objective: To compare between skin staplers and conventional silk suture for elective abdominal skin closure in term of safety, efficacy, and satisfaction.

Material & Method- A comparative cross-sectional study was conducted in tertiary care center located in western part of India. The duration of study was 18 months. All patients came with different etiology and procedure were distributed into two groups. Each group was of 50 patients. In one group incision was closed by stapler and on another group, it was closed by

suture. Written informed consent was obtained from all patients. Data was entered in Microsoft excel and appropriate statistical analysis was done.

Result: In the suture group 23 (46%) and in 22 (44%) patients belong to age group of more than 45 years. Mean value of length of incision in staplers' group was taken 8.25cm and in sutures group was 9.12cm. The mean time required for incision closure by suture method was 16.04 minutes while only mean time of 4.76 minutes required for stapler closure. In suture group, 47 (94%) had pain score between 1-3 and 3(6%) had score between 4 and 5. Similarly 45 (90%) had pain score between 1-3 and 5 (10%) had pain score between 4 and 5. Data related to patient satisfaction in term of cosmetic purpose, 49 (98%) were satisfied and 1(2%) patient was extremely satisfied. In staple group. 46 (92%) patients were satisfied while 5 (10%) patients had neutral version.

Conclusion: The stapler method had many advantages like to administer, less time required, less complication

and lower post-operative pain score but cost if it was relatively high. So advantage of staplers outweighs its cost.

Keywords: Suture, Elective surgery, Stapler, Post-operative Complication, VAS score, Satisfaction

Introduction

Every year several million women/men must undergo surgery. As a result of that they acquire an abdominal scar. Nowadays women/men of all ages place extreme importance on the appearance of the scar in addition to the symptoms of pain, tenderness, and itching. An aesthetically poor scar can have a negative impact on the overall quality of life causing considerable distress, loss of self-esteem and unhappiness.^[1,2] The appearance of the scar is of significant importance and is often the only reminder of surgery.

The outcome of the surgical skin closure is influenced by the indication for the procedure, the location of the surgical site and the associated intra-operative or post-operative complications. The general medical condition of the patient is also of considerable importance. These factors are usually outside the control of the surgeon. The surgeon, however, can choose the technique of closure and the suture material.^[3]

The technique of closure should be quick, easy, cost effective and simple, while maximizing wound cosmesis and patient satisfaction. The technique should be based on evidence and not only on the surgeon's preference and tradition. Any of the methods used should be able to restore the physical integrity and function of the injured tissue. Appropriate and careful selection of suture material is important. Choosing the appropriate materials and adhering to good wound closure technique will ensure optimal wound healing^[4].

The history of surgical sutures is more than 2000 years old. It is not clear when mankind learned to use strings

or animal's parts to ligate bleeding vessels or approximate tissues. After a long time various materials and metals were innovated to ligate the incision.^[5-7] Catgut and silk are the main natural materials that were used for suturing products.^[8] Choice of materials used is especially important for adequate healing and aesthetically pleasing affect. Different materials that can be used were surgical clips, sutures, adhesive glue, and tapes. Staples, also called clips, are made of high-quality stainless steel. They are available in regular and wide sizes. Staples are less reactive than other traditional suturing materials. Staples can be applied by minimal skin penetration and few organisms are carried to the lower skin layers. They are removed painlessly by using a specialized set of extractors. The disadvantage of using staple is that the patient must go back in seven days for its removal and they are expensive. There is also on-going research in welding of the wound by laser energy.^[9-16]

The goal of any skin closure technique is to produce skin approximation and adequate healing with minimum wound complications like pain, infection, scarring and keloid formation. Most important to the patient is the pleasing aesthetic affect. Cost of the procedure should also be considered. Closure should serve both functional and aesthetic purposes.^[17] Effective wound closure includes elimination of the dead space by approximating the subcutaneous tissues, minimization of the scar formation by careful epidermal alignment, and avoidance of a depressed scar by precise approximation of the skin edges. Atraumatic handling of the wound combined with avoidance of tight closures and undue tension contribute to excellent results. The wound should be able to withstand the daily tensile forces and be able to heal expeditiously and effectively when it is

most vulnerable.^[18] Wound complications can cause significant morbidity following operations. The risk for complications depends on the indication of the operation and the surgical technique combined with the comorbid problems of the patient. Risk factors for wound complications include diabetes, cardiovascular disease, cancer, immune-suppression, obesity, smoking, previous surgery and length of incision, malnutrition, and prior radiation.^[5, 19, 20]

With this background this study is aimed to compare between skin staplers and conventional silk suture for elective abdominal skin closure in term of safety, efficacy, and satisfaction.

Materials and Methods

A prospective study of was conducted in a surgery department of government tertiary care center located in western region India. The study duration was one and half year starting from May 2016 to November 2017. The Sample size of study for each group was 47 which was rounded off to 50. So overall sample size of study was 100. Patients within age group of 14 to 45 years and who undergoes elective surgeries. The inclusion criteria of study were age group between 14 to 45 years. All other kind of surgeries including emergency surgeries or surgeries if done in immunocompromised patients/ Diabetics must be excluded. All patients came to surgery OPD and subjected for elective abdominal surgeries (open cholecystectomy, appendectomy, Breast cancer, inguinal hernias, epigastric hernia, and umbilical hernia) were recruited in the study after considering inclusion and exclusion criteria. These patients were allocated in both groups based on random number table. Here their OPD number was consider their number. Each group had 50 patients. All patients had routine check-up & specific investigations related to

pathology. Pre anesthetic check-up was done for each and every patient. After the surgical procedure the length of the incision was measured by pre-sterilized scale, wound closure was done by interrupted silk sutures placed at a distance of 1 cm in suture group and in staple group staplers were placed at a distance of 1 cm. Time taken in skin suturing in both the groups was recorded by stop watch. The wound was observed for 7 days and sutures were removed on 10th day post operatively.

Staples were used for the other group. For their application, an assistant exerted the skin edges and the stapler was placed firmly on the skin surface perpendicular to the wound. It was pressed firmly avoiding indenting of the skin. The center mark on the stapler was aligned with the center of the wound margin. The stapler was squeezed, plunging the staple into the skin to form an incomplete rectangle. The depth of the penetration depends on the pressure exerted on the stapler against the skin. To disengage the staple the handle was released.

If the stapler did not automatically release the staple, then the stapler was pulled back. The staples were placed about 1 cm apart. Staples were removed on the 10 postoperatively. The incision was measured at the end of the procedure. Dressings were identical in both groups.

A digital photograph was also taken for evaluation. Each photograph was evaluated for discharge, keloid formation, any redness and separation of the wound edges. Patients were also asked about pain and cosmesis which was assessed on the VAS scale of 1 to 5. A simple pain scale was used. Where 1 means no pain, 2 means mild pain, 3 means moderate pain, 4 means severe pain and 5 means very severe pain. Similarly, patient satisfaction regarding cosmesis was

assessed on a scale of 1 to 5 where 1 corresponds to extremely satisfied, 2 corresponds to satisfactory, 3 corresponds to neutral, 4 corresponds to not satisfied and 5 corresponds to extremely not satisfied. All patients were called for follow up on 30th day. The informed consent was obtained from all patients before the surgical procedure. This study was approved from institutional ethical committee. All information was recorded on the standard proforma attached. Data was tabulated and entered in Microsoft excel. Analysis was done with the help of SPSS Statistics version 17. Qualitative data was presented in form of frequency and percentage while quantitative data was presented in form of mean and standard deviation. Statistical analysis was performed using the chi-square test or student's t-test as applicable. Statistical significance was defined if the p value was <0.05 .

Results

This study was conducted on 100 patients came in surgery department with various complaints and further selected for different elective surgical procedures. These patients were divided in two groups of 50 patients each. One group was incision was closed with suture and in another group it was managed with staple. In the suture group 7 (14%) patients were between 14 to 24 years, 9 (18%) patients were in the group of 25 to 34 years, 10 (20%) patients were in age group of 35-44 years and 23 (46%) were in the 45 years and above. While in the stapler group, out of total 50 patients 12 (24%) were in age group of 14-24 years, 8 (16%) patients were in 25-34 years, 9 (18%) patients were in age group of 35-44 years and 22 (44%) was in 45 years and above age group. In the suture group 30 patients were male and 20 were females respectively whereas in stapler group, thirty-two patients were male and eighteen were female. The above table shows different

operations in which stapler was used in 12 patients and suture was used in 9 patients of appendectomy, in open cholecystectomy suture was used in 15 patients and staplers was used in 14. In left inguinal hernia 6 patients were in suture group and 3 in stapler group, In Right inguinal hernia 11 patients were in suture group and 15 in stapler group, In B/L inguinal hernia 1 patients were in suture group and 1 in stapler group, In Epigastric hernia 1 patients were in suture group and 3 were in stapler group and Umbilical hernia 3 were in suture group and 1 in stapler group, In right breast cancer 2 patients were in suture group only, and left breast cancer 1 patients were in suture group and 2 in stapler group.

This study showed that 5 cm incision was done in 8 patients out of which 3 patients in staplers' group and 5 patients in sutures group. 8cm of incision was taken in 22 patients out of which them 10 patients had staplers' closure and 12 patients were in sutures group. 10 cm of incision was taken in 19 patients in which 12 were in staplers' group and 7 were in sutures group. The mean value of length of incision in staplers' group was taken 8.25cm and in sutures group was 9.12cm.

The time required for 5 cm incision in suture group was 9.4 minutes and 3 minutes for stapler group. Those patients who had 8 cm incision, time taken for closure by suture was 13.16 minutes while 4.6 minutes were required for stapler closure. In 10 cm length of incision time taken was 19.14 minutes by suture but in stapler it was 5.33 minutes only. So mean time required for incision closure by suture method was 16.04 minutes while only mean time of 4.76 minutes required for stapler closure. Difference between time of closure was statistically significant. Pain score was calculated using VAS scale. In suture group, 47 (94%) had pain score between 1-3 and 3(6%) had score between 4 and 5.

Similarly 45 (90%) had pain score between 1-3 and 5 (10%) had pain score between 4 and 5. This was not statistically significant. 5 (10%) patients had seroma and 3 (6%) patients had pus discharge in suture group, while there were 5 (10%) patients with seroma and 1 (2%) patients had pus discharge in staple group. This study showed that there was no statistically significant difference in patient satisfaction between the groups silk suture versus staple group ($P=0.76$). Data related to patient satisfaction in term of cosmetic purpose, 49 (98%) were satisfied and 1 (2%) patient was extremely satisfied. In staple group, 46 (92%) patients were satisfied while 5 (10%) patients had neutral version. This difference was statistically not significant. In sutures group the cost of suture was rupees 150/- per silk suture whereas the cost of stapler was rupees 500/- per stapler.

Discussion

A prospective study was conducted in tertiary care center with the objective of comparison suture method of incision closure with staple method. 100 patients with 50 in each group was admitted for elective surgical methods of different kind. Age of patients were range from 14 to 45 years. This study which was performed on a total number of 100 patients from 14 years of age to ≥ 45 years of age. The mean age of suture group was 24.99 ± 14.84 years and in staple group was 24.99 ± 12.5 years. These results denoted that both groups were comparable. The study included all type of surgeries namely appendectomies, cholecystectomy, left and right inguinal hernia, B/L inguinal hernia, epigastric hernia, umbilical hernia repair and right & left breast cancer. In this study mean value of length of incision in staplers' group was taken 8.25cm and in sutures group was 9.12cm. This study showed that closure of wound was almost 3 times faster with

staplers as compared with sutures. There were several other studies which showed that staple is relatively suitable, faster and convenient method as compared to suture group.^[21-24]

In our study according to simple pain scale in the suture group 47 had between 1-3 and 3 patients had a score between 4-5 whereas in staple group 45 patients had a pain scale between 1-3 and 5 patients were between 3-5. Similar finding was observed from other studies done in various part of India. All these studies clearly mentioned that staple method had relatively less pain.^[12,13,25] This study mentioned that 8 patients in suture group had complications while in staple group 6 patients had complications. Other studies also demarcated that wound complication were high in suture group.^[12,26] This was contrasted by finding of clay et al, who concluded that wound separation as well as complications were high in staple group.^[27]

Satisfaction level in relation to cosmetic point of view were high in suture group in which all were satisfied while 5 patients had neutral version in staple group and only 45 patients were satisfied. This finding is concurrent with finding of study of Basha et al.²⁶ Other studies done by Meiring et al²² and Frishman et al¹⁸ concluded that cosmetic was better in suture group and patients were more satisfied with suture method. But when they compared the wound complications, they found no difference in the patient's satisfaction in both groups. Some studies suggested that pain, cosmetic outcome and rate of wound complication is almost similar in suture and staple group, it was a decision of surgeon to choose appropriate method based on current situation and condition of patients.^[9,10,28]

The mean time required for incision closure by suture method was 16.04 minutes while only mean time of 4.76 minutes required for stapler closure. This was

quite large than other study.^[10,12] The cost of suture was rupees 150/- per silk suture whereas the cost of stapler was rupees 500/- per stapler which is almost the triple. The final cost of the stapler was crucial for selecting the method.^[18,22,29] In similar study done by Gatt et al²⁹ concluded from a controlled trial of staples for wound closure that the speed and convenience of the skin staples outweigh the extra cost. One of the important and essential aspect of the patient satisfaction is assessment of pain. Simple factor like overwork and social stress can make considerable difference. Also, the magnitude, cause and management of pain are important.

It is evident from all the studies reviewed that staples are quick to apply. From the surgeon's point of view, it is a quick, easy, and safe method as it also decreases the risk of needle stick injuries. From the management point of view, it decreases theatre time. We must keep in mind the staples are far more expensive and, but sometime availability is free of cost in govt. medical college. Moreover, the best time to remove the staples is at 7-10 days. According to available literature the inflammatory process continues beyond seven days. This is especially important point to note as the skin seems intact within days after the injury, but the tissues underneath is still vulnerable to damage and may not be strong enough to withstand daily tensile forces.

Another point which always be considered is the socioeconomic circumstances of patients. The patients have to come for another visit. Nursing personnel must be present, and they require a special instrument to remove the staples. All these add to the cost and are burdensome to the patient. The major limitation of this study was sample size. Larger sample size could explain a result in a better way.

This study concluded that staplers reduce the time of skin closure from that of silk suture. However, stapler cost higher (more than three times in comparison of silk suture) than that of suture. Staplers have good acceptance amongst patients specially in clear elective cases and have a equal rate of seroma formation and pus discharge as compared to silk sutures thereby reducing post-operative morbidity and mortality. This study results clearly remarked that advantage of staplers overweighs its cost but more useful and better means for skin closure in elective cases than silk sutures.

Acknowledgement: Authors were thank full for support provided by different staff of surgery department working round clock without their support this study could not be possible.

References

1. Brown, B.C., et al., the hidden cost of skin scars: quality of life after skin scarring. *J plastReconstrAesthetSurg*, 2008. 61(9): p. 1049-58.
2. Brown, B.C., et al., skin scar preconceptions must be challenged: importance of self -perception in skin scarring. *J plastReconstraesthet Surg*. 63(6): p. 1022-9.
3. Tully, L., et al., Surgical techniques used during caesarean section operations: results of a national survey of practice in the UK. *Eur J ObstetGynecolReprodBiol*, 2002; 102(2):120-6.
4. Meeks, G, R., K.C. Nelson, and R.W. Byars, Wound strength in abdominal incision: a comparison of two continuous mass closure techniques in rats. *Am J Obstet Gynecol*. 1995; 173(6):1676-82.
5. De Vivo, A., et al., Wound length and corticosteroid administration as risk factors for

- surgical-site complications following caesarean section. *Acta ObstetGynecolScand.* 2010; 89(3):355-9.
6. Sartin, J.S., J. Marion Sims, the father of gynecology: hero or villain? *South Med J*, 2004; 97(5): 500-5.
 7. Toombs, J. and K. Clarke, Basic operative techniques., in textbook of small animal surgery, D. Slatter, Editor. 2003, WB Saunders: Philadelphia. P. 199-221.
 8. Mercandetti, M. and A. Cohen. Wound healing: Healing and repair. 2005[cited 2019 January 20]; available from: Emedicine.com.
 9. Obermair, A., et al., Randomized trial of skin closure after laparotomy for gynaecological surgery. *ANZ J Surg*, 2007; 77(6): 460-3.
 10. Gaetner, I., T. Burkhardt, and E. Beinder, Scar appearance of difference skin and subcutaneous tissue closure techniques in caesarean section: a randomized study. *Eur J ObstetGynecolReprodBiol*, 2008; 138(1): 29-33.
 11. Alderdice, F., D. McKenna, and J. dornan, Techniques and materials for skin closure in caesarean section. *Cochrane database of systematic reviews*, 2003(issue 2. Art. No.:CD003577. DOI: 10.1002/14651858.CD003577).
 12. Rousseau, J.A., et al., A randomized study comparing skin closure in caesarean sections: staples vs subcuticular sutures. *Am J ObstetGynecol* 2009; 200(3): 265 e1-4.
 13. Altman, A.D., et al., Pfannenstiel incision closure: a review of current skin closure technique. *J ObstetGynaecol can*, 2009; 31(6): 514-20.
 14. Shen YM, Sun WB, Chen J, Liu SJ, Wang MG. NBCA medical adhesive (n-butyl-2-cyanoacrylate) versus suture for patch fixation in lichtenstein inguinal herniorrhaphy: A randomized controlled trial. *Surgery.* 2012;151(4):550-5.
 15. Lober CW, Fenske NA. Suture materials for closing the skin and subcutaneous tissues. *Aesthetic plast Surg.* 1986;10(4): 245.i
 16. Moy RL, Waldman B, Hein DW. A review of suture and suturing techniques. *J DermatolSurgOncol.* 1992;(9): 785.h
 17. Hollander, J.E.and A.J. Singer, Laceration management. *Ann Emerg Med*, 1999. 34(3): p. 356-67.
 18. Freshman, G.N., T. Schwartz, and J.W. Hogan, closure of pfannelstiel skin incisions. Staples vs. subcuticular suture. *J Reprod Med*, 1997; 42(10): p. 627-30.
 19. Olsen, M.A., et al., Risk factors for surgical site infection after low transverse caesarean section. *Infect control Hosp Epidemiol*, 2008; 29(6): 477-84.
 20. Myles, T.D., J. Gooch, and J. santolaya, Obesity as an independent risk factor for infectious morbidity in patients who undergo caesarean delivery. *ObstetGynecol*, 2002; 100(5 Pt 1): 959-64.
 21. Moy RL, Lee A, Zalka A. commonly used suture materials in skin surgery. *Am Fam Physician.* 1991;44(6):2123-8.
 22. Meiring, L., et al., A comparison of a disposable skin stapler and nylon sutures for wound closure. *S Afr Med J*, 1982; 62(110): 371-2.
 23. Pickford, I.R., et al., Two method of skin closure in abdominal operations: a controlled clinical trial. *Br J Surg*, 1983; 70(4): 226-8.

24. Lubowski, D. and D. Hunt, Abdominal wound closure comparing the proximate stapler with sutures. Aust NZJ Surg, 1985; 55(4): 405-6.
25. Ranaboldo, C.J. and D.C. Rowe-Jones, closure of laparotomy wound skin staples vesus sutures. Br J Surg, 1992. 79(11): 1172-3.
26. Basha, S.L., et al., Randomized controlled trial of wound complication rates of subcuticular suture vs staples for skin closure at caesarean delivery. Am J ObstetGyanecol. 2010; 203(3):285 el-8.
27. Clay, F.S., C.A. Walsh, and S.R. Walsh, staples vs subcuticular sutures for skin closure at caesarean delivery: a metaanalysis of randomized controlled trial. Am J Obstet Gynecol. 2011; 204(5): 378-83.
28. Cromi, A., et al., Cosmetic outcomes of various skin closure methods following caesarean delivery: a randomized trial. Am J Obstet Gynecol. 2010; 203(1): 36 el-8.
29. Gatt, D., C.R. Quick, and M.S. Owen-Smith, staples for wound closure: a controlled trial. Ann R Coll SurgEngl, 1985; 67(5):318-20.

Legends Figure

Table 1:- Showing distribution of different variable among two group

Variable		Suture group	Staple group
Age group (in years)	12-24	07 (14%)	12 (24%)
	26-34	09 (20%)	08 (16%)
	35-44	10 (20%)	09 (18%)
	≥ 45	23 (46%)	22 (44%)
Age distributio n		24.99±14.84	24.99±12.5
Sex	Male	30 (60%)	32 (64%)
	Female	20 (40%)	18 (36%)
Type of	Appendecto	10 (20%)	11 (22%)

Surgery/ Procedure	my		
Open Cholecystectomy		15 (30%)	14 (28%)
Left Inguinal Hernia		6 (12%)	3 (6%)
Right Inguinal Hernia		11 (22%)	15 (30%)
B/L Inguinal Hernia		1 (2%)	1 (2%)
Epigastric Hernia		1 (2%)	3 (6%)
Umbilical Hernia		3 (6%)	1 (2%)
Right Breast Cancer		2 (4%)	0
Left Breast Cancer		1 (2%)	2 (4%)

Table 2: Table showed post-operative measures of different variable

		Suture group	Staple Group	P value
Length of Scar (in cm)		9.12 ± 3.70	8.25 ± 3.32	< 0.001
Time taken for skin closure (in minutes)		16.04 ± 6.12	4.76 ± 2.81	< 0.001
Complication	Seroma	5 (10%)	5 (10%)	1.000
	Pus discharge	3 (6%)	1 (2%)	0.47
Vas score	1-3	47	45	0.0138
	4-5	3	5	0.295
Satisfaction score	Extremely Satisfied	1	0	0.315
	Satisfied	49	46	0.169
	Neutral	0	4	0.041

Figure 1: Graphical presentation Scar length between suture and Staple group

