



Comparative Study of Stapled Skin Closure versus Conventional Skin Closure in Elective Surgeries

Authors

Chauhan A¹, Iqbal M², Singhal A³, Niranjana S⁴

¹Associate Professor, ²Senior Resident, ³Senior Resident, ⁴Postgraduate student
Department of Surgery, Gajra Raja Medical College, Gwalior (M.P.) India – 474001

Abstract

Purpose: To compare the merits and demerits of stapled skin closure when compared to conventional sutures skin closure in elective general surgical cases.

Material and Methods: Total of 100 patients (50 in stapler and 50 in suture group) were selected. They underwent closure of skin incision after general surgical procedures (Like open cholecystectomy, appendectomy, modified radical mastectomy, inguinal hernia repair). According to their assigned growth with either nylon (in suture group) or stainless skin staples (in stapler group). Both the groups were compared and analysed for speed of closure, pain on removal, patient comfort, wound related complications and aesthetic outcome i.e. resulting scar.

Results: The mean incision length in suture group was 7.2 ± 1.2 cm while in stapler group was 7.4 ± 1.1 cm which was statistically insignificant. The mean time of closure was 48 seconds in suture group while in stapler group was 295 seconds which was statistically highly significant ($p < 0.001$).

Conclusion: It was concluded that skin staples are better alternative to conventional sutures in general surgical procedure as they lead to faster wound closure with better aesthetic outcome and patient comfort with low wound complication rates.

Introduction

The surgical scar remains the only visible evidence of surgeon's skill and frequently all of his efforts are judged by the appearance of scar.^{1,2}

The requirement of skin wound closure by any method is that it should hold the skin edges in correct apposition for a sufficient length of time to allow healing to take place. The principle aim of tissue repair of surgical skin incisions are rapid acquisition of strength, minimal tissue damage with minimal inflammation & a good scar³.

The most important & necessary step in any surgical procedure is closure of skin⁵. There

should be no movements between the skin edges, no overlapping, and excessive tension on the wound margins must be avoided. Since ancient times various techniques of skin wound closure were used like sutures, staples or adhesive.⁴

For many years, it has been possible to approximate the skin edges using sutures. However, sutures have the disadvantages of consuming more time with cosmetically inferior scar. The use of automatic stapling device for skin closure has become more popular of late, to overcome these disadvantages.

Metallic skin staples are made from stainless steel

and are easy to place. They decrease the skin closure time up to 80% as compared to subcuticular or interrupted skin suturing techniques. Infection rates may be reduced due to stapler because of quick closure and inertness of material.⁹ Braided sutures like silk are more vulnerable for infection.¹⁰

A metaanalysis of Mackeen et al showed that skin stapler is better in terms of wound morbidity in comparison to conventional sutures techniques in caesarean section.⁶ Some other studies also supported the staples use.⁷ In orthopaedic surgeries also, the skin staples may prove equivalent to sutures or sometimes may cause pain and infection.⁸

This prospective study was conducted to compare the results of stapler skin closure versus conventional skin closure in elective surgeries on the basis of time taken for skin closure, cost, wound complications and overall cosmetic results.⁵

Material and Methods

This study was conducted in Department of Surgery, G.R. Medical College and J.A. Group of Hospital, Gwalior during the period of June 2015 to May 2016. Study was conducted on 100 elective cases who underwent surgeries like Open Cholecystectomy, Inguinal hernia repair, Open appendectomy, Modified Radical Mastectomy and various abdominal surgeries. The cases selected were in the age group of 14-56 years both males and females. These 100 cases were alternatively allocated for the described method of skin wound closure i.e. 50 cases for Skin Stapler (Stapler group) and 50 cases for Conventional skin suturing (Suture group). Patients undergoing elective surgery with clean wound were included while patients having lacerated wound with skin loss, HIV and HBsAg positive, skin diseases, bleeding diathesis and patients undergoing emergency surgeries were excluded. Also patients with chronic diseases (COPD, stroke, renal failure, liver disease, neoplastic disorders), malnutrition, history of radio/chemotherapy,

concurrent infections, immunocompromised patients, anaemia (Hb < 10 g/dl) were excluded. Surgical procedures were done by senior consultant and skin closure was done according to group assigned. In suture group, skin was closed with nylon (suture) while in stapler group, skin staplers were used. Skin closure time was noted with stop watch android application. Check dress was done after 48 hours and wounds were inspected, for any gaping, seroma collection, disruption and any infection. Thereafter, the wounds were inspected on weekly basis for 4 weeks.

Each individual data (Group) was assessed in relation to test of significance in particular value. Test of significance between two or more different study group (n>30) applied was paired 't' test.

Results and Discussion

100 patients in this study were alternatively assigned for the different methods of skin wound closure in equal numbers in 2 groups- one is stapler group and other is suture group. This distribution of patients undergoing various surgeries for different methods of skin closure groups are as shown in table given below:

Table 1: Patient allotment for various method used for skin closure

Operation	Stapler	Nylon	Total
Cholecystectomy	13	13	26
Appendectomy	8	8	16
Modified Radical Mastectomy	7	8	15
Inguinal Hernioplasty	12	11	23
Other abdominal Surgeries	10	10	20
Total	50	50	100

In this study, the two groups were well matched for age and sex. The mean age of patients was 36.6 year in staple group, 35.2 in Nylon suture group and these differences were statistically not significant. (P>0.05). Out of 100 patients included in this study, 54 patients were male and rest 46 were female as depicted in Table 1. The difference observed was statistically not significant (p>0.05). In this study, the mean length of skin wound in two groups was approximately same for same type of procedure. Similarly, number of suture

fragments or staples used per wound was also approximately same in two groups for same type of procedure. A mean of 7.66 staple were needed to close each wound as compared to 7.86 suture fragments in nylon suture group for same type of procedure. This difference was statistically not significant ($P>0.05$).

Table 2: Length and no. of suture fragments or staple comparison

	Staple Group (n=50)	Nylon Suture Group (n= 50)	Significance
Length (7-8.5 cm)	7.55	7.50	$P>0.05$
No. of suture fragments or staple (7-9 cm)	7.66	7.86	$P>0.05$

Table 3: Gender distribution in both groups

	Staple Group (n=50)	Nylon Suture Group (n= 50)	Significance
Male	27	27	$P>0.05$
Female	23	23	$P>0.05$

In this study, the mean time taken for skin wound closure in staple group was 48 seconds, compared to 295 seconds in nylon suture group for same type of procedure. This difference between staple and suture group was statistically significant ($p<0.001$).

Time saving up to 84% is possible while using stapler for skin wound closure in comparison to suture and is statistically highly significant.

In this study, the difference was observed related to wound healing and complications between two groups, i.e. 62% of wounds in suture group healed without any wound complications where as in staple group 92% of wounds healed without any complications and this difference between suture and staple group were found statically significant ($P<0.01$).

In this study, serous collections were observed in 3 cases (6%) of staple group, where as in suture group none of the cases showed serous collection. One case was of cholecystectomy which resulted in partial wound gap, second case was of appendectomy, third case was of right side Modified radical mastectomy. Serous collection was mild, only one case of appendectomy subsequently developed skin gaping.

In this study, total of 13 cases in suture group were found to have wound overlapping and there was not much effect on wound healing, except for a broader resultant scar. No skin edge overlapping was observed in stapled group.

There was partial wound gap in one case of the staple group as a result of serous collection. This wound was allowed to heal by secondary intention. In a total of 3 cases, where wound gap was observed in suture group, all were due to wound infection resulting in partial wound gap. These wounds were allowed to heal by secondary intention.

There was no wound infection observed in stapled group compared to 3 cases in suture group.

Table 4: Skin wound complications

	Staple Group (n=50)	Nylon Suture Group (n=50)
Healed without complication	46(92%)	31(62%)
Serous collection	3(6%)	0
Soundly healed with skin edge overlapping	0	13(26%)
Wound gaping	1(2%)	3(6%)
Infection	0	3(6%)

In this study, patients of stapler group experienced less pain and discomfort related to its removal, compared to Nylon suture group, as it was removed with a specially designed staple extractor. More pain was observed on VAS in Nylon suture removal which was statistically significant ($P<0.01$).

In this study the cosmetic result was assessed after 4 weeks. In this series, scar of 76% cases were graded as good scar in stapled group compared to 42% cases in sutured group which was found statistically significant ($p<0.01$). Staples results in eversion of wound margin, thus leading to resultant scar being thin hairline, as there is no cross-overlapping. Stapler also impart even tension throughout the wound and as it is made up of stainless steel imparts less tissue reaction, so less chance of wound related complication and resultant scar is good compared to conventional suturing.

In 50% cases, scar was graded as fair scar in

sutured group compared to 22% in stapled group. This difference was statistically significant ($P<0.01$). Higher number of fair scar in sutured group is due to higher number of cases with skin overlapping, uneven tissue tension throughout wound margin, resulting in little wider scar.

In one case, scar was graded as bad scar in staple group because of wide and hyperpigmented scar as a result of wound healing by secondary intention.

A total of 4 cases (8%) scar was graded as bad scar in sutured group which resulted in wider scar secondary to wound infection, as these wound were allowed to heal by secondary intention. The comparison of bad scar between staple and suture group was not statistically significant ($P>0.05$).

In this study, there was little difference observed between the cost per wound between stapled and nylon sutured wound, staple being slightly cheaper form per wound and this difference was found statistically significant ($P<0.01$).

Similarly, this study also shows no correlation between staple and suture group with age or sex, and is statistically not significant.

We also found in this study, that use of skin stapler speed up wound closure, hence finding that our study is in liaison with some other studies.^{14,15}

It was also possible to save upto 84% of time with stapler because of ease of application and easy handling of staples in comparison to sutures. Stapling may be up to seven times quicker than suturing.^{14,15}

Eldrup et al.¹¹ in 1981 showed that skin staplers are superior in terms of speed in elective breast and abdominal surgeries.

In our study, we found that 92% stapled wounds healed without any complication compared to 62% in suture group, which was quite significant ($P<0.01$). This is due to inherent property of stapler as, it imparts everting closure of wound margins, so no cross overlapping, imparts even tissue tension throughout the wound, and is practically inert to tissue as it is made up of stainless steel. Because of these properties, less chance of inflammation and infection and most of

wounds were healed without any significant complications.

In this study, patients of stapler group experienced less pain and discomfort related to its removal compared to Nylon suture group, as it was removed with a specially designed staple extractor. More pain was observed on VAS in Nylon suture removal which was statistically significant ($P<0.01$). Some studies have shown that staples are more painful in early period and during removal of stitches,^{12,13} but we did not notice any of such events in our study.

In our study, cosmetic results were better with skin staplers compared to suture group, up to 76% of scar was graded as good scar compared to 43.3% in suture group and this was found statistically significant ($P<0.01$) which is supported by the above studies. The metal hooks leave only pinpoint mark where they penetrate the skin compared to transverse mark across the wound left by conventional sutures (cross hatching). Because of the everting property of stapler and even tension throughout the wound exerted by stapler the scar is usually like thin hairline without any cross overlapping.

In our study, there was little difference observed between the cost per wound closure between stapled and nylon sutured wound, staple being slightly cheaper form per wound and this difference was found statistically significant ($P<0.01$).

Conclusion

With this study, we concluded that stapler helps to speed up wound closure as compared to conventional suture. Time is saved with the use of stapler up to 84% as compared to time required with conventional suture. Also, use of stapler is relatively cheaper and economic. 92% of stapled wound healed without any complications as compared to 62% of sutured wounds. Stapled patients experienced less pain and discomfort related to its removal. Also, cosmetic results were better obtained with use of stapler as 76% of scars were graded as good scar.

References

1. Earley M.: Wounds, tissue repair and Scar: Williams NC, Bulstrode CJK, O'Connell PR.(Eds.) Bailey & Love Short Practice of Surgery.26th Ed. Boca Raton: CRC Press 2013; p.24-5.
2. Cotran R, Kumar, V, Collins T. Robbins pathological basis of disease.9th ed. Philadelphia, W.B. Saunders 2014; p114-126.
3. Leong M, Phillips LG.: Wound healing: Townsend Jr CM, Beauchamp RD, Evers BM, Mattox KL(Eds.) Sabiston text book of surgery.19th ed. Philadelphia: WB Saunders 2012; p.167-8.
4. Barbul A, Efron DT, Kavalukas SL.: Wound healing: Brunicardi FC, Anderson DK, Dunn DL, Hunter JG, Matthew JB, Pollock RE(Eds.) Schwartz principles of surgery 10th ed. New York: McGraw Hill 2010; p.241-44.
5. Halsted WS.: Ligature and suture material the employment of fine silk in preference to catgut and the advantages of transfixion of tissues and vessels in control of hemorrhage also an account of the introduction of gloves, gutta-percha tissue and silver foil. JAMA 1913;60(15): p.1119-26.
6. Mackeen AD, Schuster M, Berghella V. Suture versus staplers for skin closure after caesarean: A metaanalysis. Am J Obstet Gynecol 2015;212(5):621/e-10.
7. Slade Shantz JA, Vernon J, Morshed S, Leiter J, Stranges G. Sutures versus staples for wound closure in orthopaedic surgery: a pilot randomized controlled trial. Patient Saf Surg. 2013;7(1):6.
8. Smith TO, Sextan D, Mann C, Donell S. Sutures versus staples for skin closure in orthopaedic surgery. metaanalysis. BMJ 2010;340:c1199.
9. Oswal S, Borle R, Bholra N, Jadhav A, Surana S, Oswal R. Surgical staples: A superior alternative to sutures for skin closure after neck dissection- A Single Blinded Prospective Randomized Clinical Study. J Oral Maxillofac Surg. 2017;75(12):2707e1-e6.
10. Merritt K, Hitchins VM, Neale AR. Tissue colonization from implantable biomaterials with low numbers of bacteria. J Biomed Mater Res. 1999;44(3):261-65.
11. Eldrup J, Wied U, Anderson B. Randomised trial comparing Proximate stapler with conventional skin closure. Acta Chir Scand 1981;147(7):501-2.
12. Lavazzo C, Gkegkes ID, Vouloumanou EK, Mamais I, Peppas G, Falagas ME. Sutures versus staplers for management of surgical wounds: A meta-analysis of randomized controlled trials. Am Surg. 2011;77(9):1206-21.
13. Khan AA, Majeed S, Shahzadi M, Hussain SM, Ali MZ, Siddique K. Polypropylene suture versus skin staples for securing mesh in Lichtenstein inguinal hernioplasty. J Coll Physic & Surg Pak. 2014;24(2):88-90.
14. Rousseau JA, Girard K, Turcot-Lemay L, Thomas N. A randomized study comparing skin closure in caesarean sections: Staples vs subcuticular sutures. Am J Obstet Gynecol. 2009;200(3):265e1-4.
15. O'Neill JK, Robinson P, Giddins GE. Staplers for intraoperative skin retraction in hand surgery. Journal of Hand and Microsurgery. 2014;6(2):100-101.