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Original Research Article

A Hospital-Based Assessment of the Efficacy of Skin Suture versus Skin Stapler in Abdominal Surgeries: A Comparative Study

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Abstract

Aim: The aim of the present study was to assess the efficacy between skin suture versus skin stapler in abdominal surgeries.

Methods: The present study was conducted on 80 patients, who presented to the in-patient Department of General Surgery, Government Medical College, Bettiah, Bihar, India for one year. A total of 80 patients were categorized into 2 groups i.e., group A which was conventional suture group and group B which was staple groups with 40 cases in each group. In group A, wound closure was done with Prolene 2-0 cutting body (Lotus) using interrupted sutures. While in group B, wound closure was done with Covidien stapler.

Results: The mean age among staples group was 36.54 years and among sutures group was 34.66 years. Majority of the patients belonged to the age group 30-40 years followed by 40-50 years. In the present study, out of 80 patients, 42 (52.5%) were male and 38 (47.5%) were female. In the present study, out of 80 cases, the commonest type of incision for surgical wound creation was McBurney's incision: 16 in staplers and 18 in suture group. Midline incision was given in 11 cases in staplers and 14 cases in suture group, inguinal incision was given in 8 cases in staplers and 5 cases in suture group, sub- costal incision was given in 2 cases in each group, and paramedian incision was given in 2 cases in staplers and 1 in suture group. We observed that in staples group, 4 cases presented with clear discharge with grade (III) and 3 cases with purulent discharge with grade (IV) whereas in suture group, clear discharge with grade (III) was seen in 8 cases and purulent discharge with grade (IV) in 6 cases, rest of the cases healed normally or by with mild bruising. Pain while removal of staples or sutures is tabulated by using pain score with <2 and >2 in both the groups. In staples group, pain score was <2 in 90% of patients and in sutures group, it was 10%.

Conclusion: The results indicated that skin closure by stapler can be preferred over conventional skin suture as it is easy to apply, easy application and easy to remove with less pain on removal ,easy on pockets of the patients and aesthetically acceptable.

Keywords: Abdominal surgery, Skin stapler, Suturing

Introduction

"Scar" is a surgeon's signature. [1] Tissue approximation is a fundamental requirement for skin closure. A surgeon should aim for a successful tissue reunion and a functional and aesthetically pleasing scar. Wound closure techniques have progressed from the earliest innovations in suturing materials to more sophisticated tools like skin staplers, skin glue, and sticky tapes. Based on the effectiveness of modern suturing techniques, patients may experience fewer post-operative pains and wound infections, better cosmetic results, and shorter hospital stays. The history of suturing extends back to the Masai of East Africa would insert acacia thorns around the edges of a laceration before plaiting plant fiber to connect them and close the wound. [2]

Accurate tissue approximation is essential for operative repair of defects and execution of defects and execution of safe healing process. Aside from gentle handling of tissues and careful dissection, the approximation must be achieved without tension and without compromising the integrity of the blood supply which is essential for healing process. The perfectness of tissue approximation and type of approximation influences the tissue healing rate, postoperative early and late complication of surgical wound and economic burden of the hospital. Though the age's man sought for methods of binding wounds to promote healing. The early experience of Steichen and Ravitch [3] with the original Soviet staplers convinced them of their potential uses in surgery, which provided the stimulus for American designers and manufacturers to create a family of staplers. Although many of the original staplers were developed from the basic principles utilized in the Soviet instruments, the skin stapler was a totally new kind of instrument in conception. This stapler, manufactured in the United States utilized a disposable, preloaded, presterilized magazine that contained 25 staples. A small sterile disposable cylinder containing carbon dioxide provided the driving force for the formation of rectangular skin staples. Steichen and Ravitch [3] reported that this instrument saved considerable time during the operative procedure. The first major change in the design of this skin stapler was to replace the carbon dioxide cartridge with a mechanical power source, a movable handle. By compressing the movable handle against a fixed handle, the surgeon generated sufficient force to form the rectangular staple. [4]

Through preservation of blood supply ,minimal tissue damage ,approximation of edges without tension ,correct suture spacing and suture bites with proper selection of suture material the surgeon can achieve perfect healing . Achieving rapid strength ,least tissue damage ,no inflammation and cosmetically acceptable scar are the principal aims of tissue repair after surgical skin incision which can be obtained by obliteration of dead space ,layered tissue closure and eversion of skin margins. Type B of approximation and perfect tissue approximation influences the tissue healing rate, post-operative early and late complication of surgical wound and economic burden of hospital. [5] Staplers were originally developed to address the perceived problem of patency i.e security against leaks of blood and bowel contents in anastomoses. But now basic goals of skin wound closure can be achieved by both staplers and sutures. The main aim is to re approximate the skin by creating watertight, tension free, non-inverted apposition of edges that promote rapid healing and aesthetically acceptable scar. While comparing these two methods of wound closure, multiple studies has produced conflicting results regarding the economics, efficacy, rate of complication and cosmetic outcomes. [6]

The aim of the present study was to assess the efficacy between skin suture versus skin stapler in abdominal surgery in Bihar region.

Materials and Methods

The present study was conducted on 80 patients, who presented to the in-patient Department of General Surgery, Government Medical College, Bettiah, Bihar, India for one year. A total of 80 patients were categorized into 2 groups i.e., group A which was conventional suture group and group B which was staple groups with 40 cases in each group. In group A, wound closure was done with Prolene 2-0 cutting body (Lotus) using interrupted sutures. While in group B, wound closure was done with Covidien stapler.

Inclusion criteria

- Patients undergoing abdominal surgeries with clean and clean contaminated wounds.
- Patients undergoing both elective as well as emergency surgeries.
- Patients willing to participate in the study.

Exclusion criteria

- Immunocompromised patients like malignancies, AIDS and uremia.
- Contaminated and dirty wounds.
- Patients unwilling to participate in the study.

All patients were randomized into 2 groups on the basis of chit system, which is given to patient before surgery and based on that patient sequentially divided into two groups i.e. group A: conventional suture group and group B skin stapler group. Each group contains twenty-five patients respectively.

All investigations and surgical procedures were carried out with proper informed written consent as appropriately. Following selection of subjects and after obtaining informed consent about proposed study, data was collected from: 1) operating surgeon after operation regarding time taken for surgery, ease of surgery and surgical procedure done, 2) patients post operatively regarding pain, cosmetic outcome, pain at suture or stapler removal, regarding wound infection etc., 3) follow up of patients in outpatient department after hospitalization.

The data regarding patient profile, diagnosis, investigations, and surgical procedures were collected in a proforma and tabulated to a master chart using Microsoft Excel sheet.

Statistical analysis

Unpaired t test was used for analysis of continuous data. Pearson's $\chi 2$ test was used for analysis of categorical data. Differences were considered statistically significant if $p<0.05$. IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA) software program was used for statistical calculations.

Results

Table 1: Demographic data and Type of incision

Age group (in years)	Staples (n=40) N%	Sutures (n=40) N %
<20	4 (10)	6 (15)
20-30	10 (25)	4 (10)
30-40	12 (30)	14 (35)
40-50	8 (20)	10 (25)
50-60	6 (15)	6 (15)
Sex		
Male	24 (60)	18 (45)
Female	16 (40)	22 (55)
Incision		

Midline	12 (30)	14 (35)
Inguinal	8 (20)	5 (12.5)
Subcostal	2 (5)	2 (5)
McBurney's	16 (40)	18 (45)
Paramedian	2 (5)	1 (2.5)

The mean age among staples group was 36.54 years and among sutures group was 34.66 years. Majority of the patients belonged to the age group 30-40 years followed by 40-50 years. In the present study, out of 80 patients, 42 (52.5%) were male and 38 (47.5%) were female. In the present study, out of 80 cases, the commonest type of incision for surgical wound creation was McBurney's incision: 16 in staplers and 18 in suture group. Midline incision was given in 11 cases in staplers and 14 cases in suture group, inguinal incision was given in 8 cases in staplers and 5 cases in suture group, sub-costal incision was given in 2 cases in each group, and paramedian incision was given in 2 cases in staplers and 1 in suture group.

Table 2: Classification based on length of wounds

Group	Group A<5 cm	Group B 5- 10 cm	Group C >10 cm	Total (%)
Stapels	18	12	10	40 (100)
Suture	19	10	11	40 (100)

Wounds are classified based on the length of incision as group A, <5 cm with 18 cases in staples and 19 cases in sutures group: group B, 5-10 cm with 12 cases in staples and 10 cases in sutures group and group C, >10 cm with 10 cases in staples and 11 cases in sutures group.

Table 3: Time required for closure and Cosmetic outcome

Time required for wound closure (minutes)	Staples (n=40)	Sutures (n=40)
<5	40 (100%)	0
5-10	0	22
10-15	0	6
>15	0	12
Type of scar/ Cosmetic outcome		
SBSE>3	30 (75%)	26 (65%)
SBSE<3	10 (25%)	14 (35%)

Time required for skin closure was classified as <5 minutes, 5-10 minutes, 10-15 minutes and >15 minutes. In staples group, time required for skin closure was <5 min in all the cases whereas in sutures group, no case completed skin closure in <5 minutes, 22 cases in 5-10 minutes, 6 cases in 10-15 minutes and 12 cases in >15 minutes. Stony brooks scar evaluation system (SBSE) was used in this present study and we observed that, in staples group, SBSE score >3 was seen in 75% of cases and in sutures group, SBSE >3 was seen in 65% of cases.

Table 4: Post-operative complications and Pain score during removal of staples/sutures

Complications	Staples (n=50)	Sutures (n=50)
Clear discharge	4 (10%)	8 (20%)
Purulent discharge	3 (7.5%)	6 (15%)
Pain score		
<2	36 (90%)	10 (25%)
>2	4 (10%)	30 (75%)

Southampton wound assessment scale was used for post- operative complications in this study. We observed that in staples group, 4 cases presented with clear discharge with grade (III) and 3 cases with purulent discharge with grade (IV) whereas in suture group, clear discharge with grade (III) was seen in 8 cases and purulent discharge with grade (IV) in 6 cases, rest of the cases healed normally or by with mild bruising. Pain while removal of staples or sutures is tabulated by using pain score with <2 and >2 in both the groups. In staples group, pain score was <2 in 90% of patients and in sutures group, it was 10%.

Discussion

In this modern era broadly speaking the materials or gadgets for approximation of tissues are the sutures, staples or clips, glues, steritapes etc., the secret to achieve a good wound healing lies in meticulous tissue dissection selection of suture material, methods of wound closure and post-operative complications. The key principles involved to achieve perfect healing are preservation of blood supply, minimal tissue damage, approximation of edges without tension, correct Suture spacing and suture bites with proper selection of suture materials. The principle aims of tissue repair of surgical skin incisions are rapid acquisition of strength and minimum tissue damage, with minimum inflammation and a good scar. Many factors including the choice of suture materials and its placement influence these and of particular relevance are the accurate co-optation of dermal edges; eversion or inversion leads to sub optimal healing.

The mean age among staples group was 36.54 years and among sutures group was 34.66 years. Majority of the patients belonged to the age group 30-40 years followed by 40-50 years. In Chavan et al study, the youngest patient was aged 2 years and the oldest was 62 years, with a median age of 30 years in staple group; while in the suture group youngest patient was aged 3 years and the oldest was 75 years of age. [7] In Naireen et al study, age of the patients ranged from 35-99 years for stapled group, with a mean age of 58.92 years and 30-80 years for suture group, with a mean age of 60.04 years. [8] In the present study, out of 80 patients, 42 (52.5%) were male and 38 (47.5%) were female.

In the present study, out of 80 cases, the commonest type of incision for surgical wound creation was McBurney's incision: 16 in staplers and 18 in suture group. Midline incision was given in 11 cases in staplers and 14 cases in suture group, inguinal incision was given in 8 cases in staplers and 5 cases in suture group, sub-costal incision was given in 2 cases in each group, and paramedian incision was given in 2 cases in staplers and 1 in suture group. In Chavan et al study the commonest incision was inguinal, 22 cases in staplers and 20 in suture group. [7]

Time required for skin closure was classified as <5 minutes, 5-10 minutes, 10-15 minutes and >15 minutes. In staples group, time required for skin closure was <5 min in all the cases whereas in sutures group, no case completed skin closure in <5 minutes, 22 cases in 5-10 minutes, 6 cases in 10-15 minutes and 12 cases in >15 minutes. Stony brooks scar evaluation system (SBSE) was used in this present study and we observed that, in staples group, SBSE score >3 was seen in 75% of cases and in sutures group, SBSE >3 was seen in 65% of cases. Stockley and Elson (1987) compared the results of closure with staple and nylon sutures found a higher incidence of inflammation, discomfort on removal and spreading of the healing scar with staples. The only advantage of staples was speed of wound closure. [9] Ranabaldo and Rowe-Jones (1992) compared staple with subcuticular sutures in 48 patients undergoing

laparotomy and concluded that the difference in time was significant, nevertheless, the cost was five times greater with staples. [10] Luiz R Medina dos Santos et al (1995) in their study of 20 patients concluded that the use of skin staplers speed up closure by 80%, with better cosmetic results. [11] John T Kanagaye, Cheryl W Vance, Linda Chan, and Nancy Schonfeld (1997) at the Children hospital, Los Angeles, USA, reported that staple closure was safe, rapid and cost effective and resulted in a cosmetically acceptable scar. [12]

We observed that in staples group, 4 cases presented with clear discharge with grade (III) and 3 cases with purulent discharge with grade (IV) whereas in suture group, clear discharge with grade (III) was seen in 8 cases and purulent discharge with grade (IV) in 6 cases, rest of the cases healed normally or by with mild bruising. Pain while removal of staples or sutures is tabulated by using pain score with <2 and >2 in both the groups. In staples group, pain score was <2 in 90% of patients and in sutures group, it was 10%. Karbhari et al [13] in their study found that pain was significantly less during staple removal between both groups with $p<0.0001$ and they were also same in studies done by dos Santos et al. [11] Study by MacGregor FB et al. in 1989, Scotand [14] said that the meantime for stapler repair is 18.6 sec & for suture is 124 sec and the cost of repair and the complication rate were almost same. Patient compliance with stapler is good than sutures & no local anesthesia applied for stapling. Orlinsky Metal in 1995, USA [15] studies stated that the average speed of stapling is 8.3 seconds per cm wound for staplers & 63.2 seconds per cm wound for sutures.

Conclusion

The results indicated that skin closure by stapler can be preferred over conventional skin suture as it is easy to apply, easy application and easy to remove with less pain on removal ,easy on pockets of the patients and aesthetically acceptable. However, the basic skin closure technique should be known to every surgeon as staplers are not available everywhere. We conclude that skin staplers can be used in elective clean and clean contaminated surgically incised wound over abdomen. But further studies with large sample size and multicenter study is required to establish the role of staplers in skin approximation.

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