Original research article

Skin Closure with Sutures Vs Stapler Vs Steri Strips in Open Surgical Procedures – An Observational Study

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Abstract

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. The aim of this study is to compare two skin closure techniques – suture and stapler in open abdominal surgeries.

Material and Methods: A total of 150 cases were included in this study with prior informed consent. The study was carried out over a time period of two years from December 2011 to September 2013. The present study was prospective, observational, and comparative. This randomized observational study is conducted in the Department of General Surgery, Saveetha medical college hospital, Thandalam. Around 150 patients of age above 18 years fit for hernioplasty are included in the study. Patient who are not fit for general or spinal anaesthesia re-excluded. A detailed history of the patients were taken and physical examination, complete blood analysis and ultrasound of the abdomen will be routinely performed in all the cases. Randomization was done to avoid bias. Each group consists of 50 patients.

Results: The age group of the patients included in the study was above 18 years all the 3 groups. (Mean Age in sutures – 42.84, Mean age in staplers – 48.38, Mean age in Steri-strips – 45.64). Between sex distribution and materials used, there is no statistically significant difference at p >0.5. Between the materials used and suture removal days, 90% (45 cases) of steri-strips removal, 66 % (33 cases) of skin staplers removal and 38 % (19 cases) of sutures removal done on 7^{th}-10^{th} day. Followed by 10% (5 cases) of steri-strips removal, 34 % (17 cases) of skin staplers removal and 40 % (20 cases) of sutures removal done on 11^{th}-14^{th} day. Followed by 0% (0 cases) of steri-strips removal, 0 % (0 cases) of skin staplers removal and 22 % (11 cases) of sutures removal done on more than 14^{th} day. SSI, Post-operative pain, post-operative scarring and post-operative wound dehiscence were statistically significant between the three groups.

Conclusion: We found that incidence of post-operative pain is less with steri-strips followed by skin staplers and skin suture. Incidence of surgical site infections is less with steri-strips followed by skin staplers and skin suture. Incidence of skin closure material removal is less with steri-strips followed by skin staplers and skin suture. Incidence of post-operative scarring is less with steri-strips followed by skin staplers and skin suture. Incidence of post-operative wound dehiscence is less with steri-strips followed by skin staplers and skin

sutures. Skin closed with steri-strips provided better cosmesis than skin closed with skin staplers and skin sutures. Skin closure with steri-strips (adhesive tapes) is cheaper than skin staplers and skin sutures.
Keywords: Wound healing, Surgical tape, Sutures, suture techniques, wound closure techniques

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.[1-3] 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.[4,5]

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.[6,7] We have undertaken a comparative study of 150 cases between suture vs stapler vs steri-stripes (adhesive tapes) in open abdominal surgery (Hernioplasty) to compare the merits and demerits of the techniques. Aim of the study is Randomized observation on types of skin closure with sutures v/s stapler vs steri-strips (adhesive tapes) in all open surgical procedures.

Methodology

The aim of this study is to compare two skin closure techniques – suture and stapler in open abdominal surgeries. A total of 150 cases were included in this study with prior informed consent. The study was carried out over a time period of two years from December 2011 to September 2013. The present study was prospective, observational, and comparative. This randomized observational study is conducted in the Department of General Surgery, Saveetha medical college hospital, Thandalam. Around 150 patients of age above 18 years fit for hernioplasty are included in the study. Patient who are not fit for general or spinal anaesthesia re-excluded. A detailed history of the patients were taken and physical examination, complete blood analysis and ultrasound of the abdomen will be routinely performed in all the cases. Randomization was done to avoid bias. Each group consists of 50 patients. The patients were explained that they cannot choose the method of skin closure technique, which they have to undergo. The patient were explained that there are no risk in all three methods. All the patients were divided into

Group (A) : Patients in which Skin closure done with non-absorbable suture material. i.e. Ethilion 3-0 (vertical mattress suture)

Group (B) : Patients in which Skin closure done with skin stapler

Group (C) : Patients in which the skin closure is done with steri-strips size (adhesive tapes) is ½ inch **2 inch (12mm*** 50 mm) and variable sizes

All those patients who were attending Surgery department (elective and emergency) and underwent open abdominal surgeries. After the subcutaneous fat was sutured with 2-0 Vicryl,

In suture group skin was approximated with vertical mattress sutures using non-absorbable 2-0 Ethilon at a distance of 1 cm from each other. In stapled group the staples are used to close the wound and are placed at a distance of 5mm from one another.

Results

This study included a total of 150 patients. Study included patients with Skin closure after Hernioplasty procedure. After randomization to avoid bias, 50 patients in group A (Skin Sutures), 50 patients in group B (Skin staples), 50 patients in group C (Steri-strips). The age group of the patients included in the study was above 18 years all the 3 groups. (Mean Age in sutures – 42.84, Mean age in staplers – 48.38, Mean age in Steri-strips – 45.64). Between sex distribution and materials used, there is no statistically significant difference at p >0.5. Between the materials used and suture removal days, 90% (45 cases) of steri-strips removal, 66 % (33 cases) of skin staplers removal and 38 % (19 cases) of sutures removal done on 7^{th}-10^{th} day. Followed by 10% (5 cases) of steri-strips removal, 34 % (17 cases) of skin staplers removal and 40 % (20 cases) of sutures removal done on 11^{th}-14^{th} day. Followed by 0% (0 cases) of steri-strips removal, 0 % (0 cases) of skin staplers removal and 22 % (11 cases) of sutures removal done on more than 14^{th} day. SSI, Post-operative pain, post-operative scarring and post-operative wound dehiscence were statistically significant between the three groups (Table 1).

Table 1: Distribution of study variables among the three groups (N=150)

Slno	VARIABLE	SUTURES (n=50)	STAPLERS (n=50)	STERI-STRIPS (n=50)	p
1	**Gender** Male Female	40 (80) 10 (20)	41 (82) 9 (18)	43 (86) 7 (14)	0.722
2	**Suture removal** 7-10th day 11-14^{th} day >14 days	19 (38) 20 (40) 11 (22)	33 (66) 17 (34) 0	45 (90) 5 (10) 0	<0.001
3	**SSI** 3^{rd} day 7^{th} day 14^{th} day	22 (44) 17 (34) 10 (20)	12 (24) 8 (16) 6 (12)	4 (8) 1(2) 0	<0.001
4	**Post-operative pain** 3^{rd} day 7^{th} day 14^{th} day	28 (36) 8 (16) 6 (12)	20 (40) 6 (12) 4 (8)	0 (0) 0 (0) 0 (0)	<0.001
5	**Post-operative scarring** 3^{rd} day 7^{th} day 14^{th} day	22 (44) 17 (34) 9 (18)	18 (36) 8 (16) 4 (8)	0 (0) 1(2) 1(2)	<0.001
6	**Post-operative wound dehiscence** 3^{rd} day 7^{th} day 14^{th} day	14 (28) 8 (16) 4 (8)	6 (12) 4 (8) 2 (4)	0 (0) 0 (0) 1 (2)	<0.001

Table 2: Distribution of cosmetic look of the scar among the study participants (N=150)

Slno	Variable	Sutures	Staplers	Steri-strips
1	Primary healing	46 (92)	0	42 (84)
2	Secondary healing	1 (2)	50 (100)	8 (16)
3	Hypertrophic scar on 30th day	3 (6)	0	0

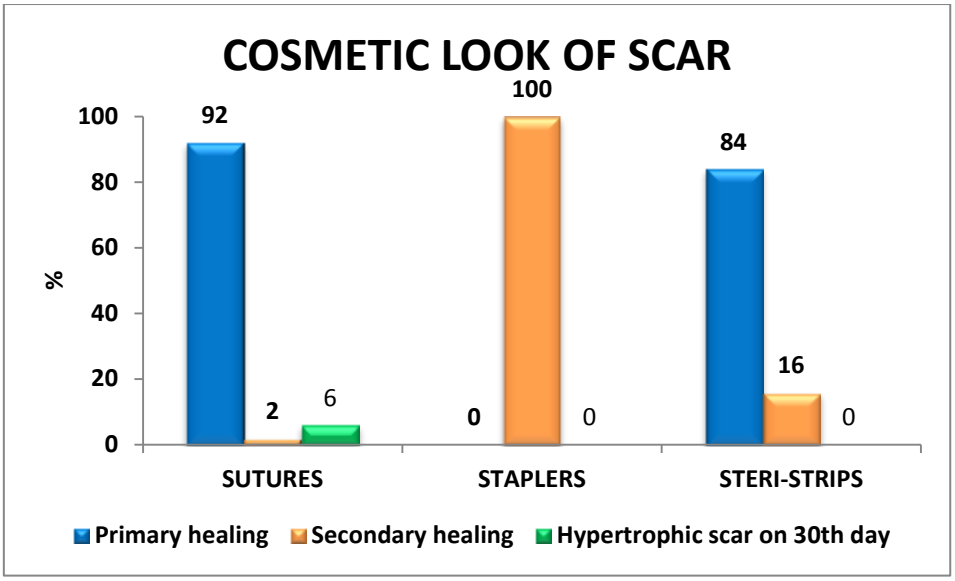

Figure 1: Distribution of cosmetic look of the scar among the study participants (N=150)

According to this crosstab between the materials used and cosmetic look of scar, 84% (42 cases) of steri-strips, 0 % (0 cases) of skin staplers and 92 % (46 cases) of sutures healed by primary healing. Followed by 16% (8 cases) of steri-strips, 100 % (50 cases) of skin staplers and 2 % (1 cases) of sutures healed by secondary healing . Followed by 0% (0 cases) of steri-strips, 0 % (0 cases) of skin staplers and 6 % (3 cases) of sutures healed by hypertrophic scar on 30th day. There is statistically significant difference among the groups at p<0.001 (Table 2, Figure 1).

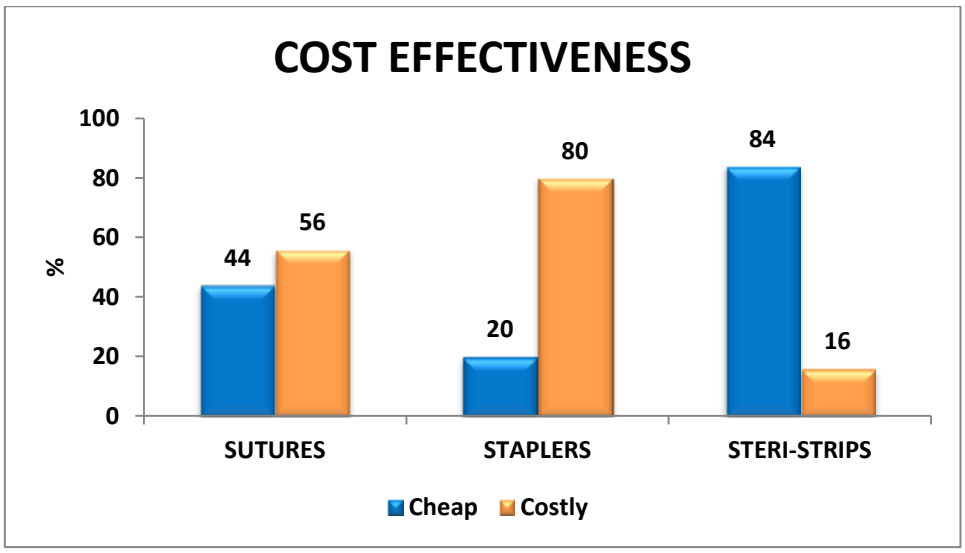

Figure 2: Distribution of cost effectiveness among the study participants (N=150)

Between the materials used and cost effectiveness. Patients outlook on materials considered to be CHEAP - 84% (42 cases) of steri-strips, 20%(10 cases) of skin staplers and 44% (22 cases) of sutures. Patients outlook on materials considered to be COSTLY - 16% (8 cases) of steri-strips, 80 % (40 cases) of skin staplers and 56 % (28 cases) of sutures. There is statistically significant difference among the groups at $p<0.001$ (Figure 2).

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]

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

FIG. 1 (a)

FIG. 1 (b)

FIG. 1 (c)

FIG. 1 (d)

FIG. 2 (a)

FIG. 2 (b)

FIG. 2 (c)

FIG. 2 (d)

FIG. 3 (a)

FIG. 3 (b)

Discussion

A) Post-operative pain

On 3RD Day

According to this crosstab between the materials used and post-operative pain. Patients having post-operative pain on 3rd day - 0% (0 cases) of steri-strips, 20 % (10 cases) of skin

staplers and 28% (14 cases) of sutures . Patients without post-operative pain on 3rd day - 100% (50 cases) of steri-strips, 80 % (40 cases) of skin staplers and 72 % (36 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 7TH Day

According to this crosstab between the materials used and post-operative pain. Patients having post-operative pain on 7th day - 0% (0 cases) of steri-strips, 12 % (6 cases) of skin staplers and 16% (8 cases) of sutures. Patients without post-operative pain on 7th day - 100% (50 cases) of steri-strips, 88 % (44 cases) of skin staplers and 84% (42 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 14TH Day

According to this crosstab between the materials used and post-operative pain. Patients having post-operative pain on 14th day - 0% (0 cases) of steri-strips, 8 % (4 cases) of skin staplers and 12% (6 cases) of sutures. Patients without post-operative pain on 14th day - 100% (50 cases) of steri-strips, 92 % (46 cases) of skin staplers and 88 % (44 cases) of sutures. There is statistically significant difference among the groups at **p<0.05**

According to our study and results obtained from other study post operative pain is less in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.[11,12]

B) Surgical site infections

On 3RD Day

According to this crosstab between the materials used and surgical site infections. Patients having SSI on 3rd day - 8% (4 cases) of steri-strips, 24 % (12 cases) of skin staplers and 44% (22 cases) of sutures. Patients without SSI on 3rd day - 92% (46 cases) of steri-strips removal, 76 % (38 cases) of skin staplers removal and 56 % (28 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 7TH Day

According to this crosstab between the materials used and surgical site infections. Patients having SSI on 7th day - 2% (1 cases) of steri-strips, 16 % (8 cases) of skin staplers and 34% (17 cases) of sutures. Patients without SSI on 7th day - 98% (49 cases) of steri-strips, 84 % (42 cases) of skin staplers and 66 % (33 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 14TH Day

According to this crosstab between the materials used and surgical site infections. Patients having SSI on 14th day - 0% (0 cases) of steri-strips, 12 % (6 cases) of skin staplers and 20% (10 cases) of sutures. Patients without SSI on 14th day - 100% (50 cases) of steri-strips, 88 % (44 cases) of skin staplers and 80 % (40 cases) of sutures. There is statistically significant difference among the groups at **p<0.01**

According to our study and results obtained surgical site infections is less in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.

C) Material removal duration

According to this crosstab between the materials used and material removal days, 90% (45 cases) of steri-strips removal, 66 % (33 cases) of skin staplers removal and 38 % (19 cases) of sutures removal done on 7th-10th day. Followed by 10% (5 cases) of steri-strips removal, 34 % (17 cases) of skin staplers removal and 40 % (20 cases) of sutures removal done on 11th-14th day. Followed by 0% (0 cases) of steri-strips removal, 0 % (0 cases) of skin staplers

removal and 22 % (11 cases) of sutures removal done on more than 14th day. There is statistically significant difference among the groups at **p<0.001**

According to our study and results obtained from other study, material removal duration is less in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.[11]

D) Post-operative scarring

On 3RD Day

According to this crosstab between the materials used and post-operative scarring. Patients having post-operative scarring on 3rd day – 0% (0 cases) of steri-strips, 36 % (18 cases) of skin staplers and 44% (22 cases) of sutures. Patients without post-operative scarring on 3rd day - 100% (50 cases) of steri-strips, 64 % (32 cases) of skin staplers and 56 % (28 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 7TH Day

According to this crosstab between the materials used and post-operative scarring. Patients having post-operative scarring on 7th day – 2% (1 cases) of steri-strips, 16 % (8 cases) of skin staplers and 34% (17 cases) of sutures . Patients without post-operative scarring on 7th day - 98% (49 cases) of steri-strips, 84 % (42 cases) of skin staplers and 66 % (33 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 14TH Day

According to this crosstab between the materials used and post-operative scarring. Patients having post-operative scarring on 14th day – 2% (1 cases) of steri-strips, 8 % (4 cases) of skin staplers and 18 % (9 cases) of sutures . Patients without post-operative scarring on 14th day - 98% (49 cases) of steri-strips, 92 % (46 cases) of skin staplers and 82 % (41 cases) of sutures. There is statistically significant difference among the groups at **p<0.05**

According to our study and results obtained from other study post-operative scarring is less in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.[12]

E) Post-operative wound dehiscence

On 3RD Day

According to this crosstab between the materials used and post-operative wound dehiscence Patients having post-operative wound dehiscence on 3rd day – 0% (0 cases) of steri-strips, 12 % (6 cases) of skin staplers and 28% (14 cases) of sutures . Patients without post-operative wound dehiscence on 3rd day - 100% (50 cases) of steri-strips, 88 % (44 cases) of skin staplers and 72 % (36 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

On 7TH Day

According to this crosstab between the materials used and post-operative wound dehiscence Patients having post-operative wound dehiscence on 7th day – 0% (0 cases) of steri-strips, 8 % (4 cases) of skin staplers and 16% (8 cases) of sutures . Patients without post-operative wound dehiscence on 3rd day - 100% (50 cases) of steri-strips, 92 % (46 cases) of skin staplers and 84 % (42 cases) of sutures. There is statistically significant difference among the groups at **p<0.01**

On 14TH Day

According to this crosstab between the materials used and post-operative wound dehiscence Patients having post-operative wound dehiscence on 14th day – 2% (1 cases) of steri-strips, 4 % (2 cases) of skin staplers and 8% (4 cases) of sutures . Patients without post-operative wound dehiscence on 14th day - 98% (49 cases) of steri-strips, 96 % (48 cases) of skin staplers and 92 % (46 cases) of sutures. There is statistically significant difference among the groups at **p>0.05**

According to our study and results obtained from other study post-operative wound dehiscence is less in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.[13]

F) Cosmetic look of the scar

According to this crosstab between the materials used and cosmetic look of scar, 84% (42 cases) of steri-strips, 0 % (0 cases) of skin staplers and 92 % (46 cases) of sutures healed by primary healing. Followed by 16% (8 cases) of steri-strips, 100 % (50 cases) of skin staplers and 2 % (1 cases) of sutures healed by secondary healing . Followed by 0% (0 cases) of steri-strips, 0 % (0 cases) of skin staplers and 6 % (3 cases) of sutures healed by hypertrophic scar on 30th day. There is statistically significant difference among the groups at **p<0.001**

According to our study and results obtained from other study cosmetic look of the scar is good in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.[14]

G) Cost factor

According to this crosstab between the materials used and cost effectiveness. Patients outlook on materials considered to be CHEAP - 84% (42 cases) of steri-strips, 20% (10 cases) of skin staplers and 44% (22 cases) of sutures. Patients outlook on materials considered to be COSTLY - 16% (8 cases) of steri-strips, 80 % (40 cases) of skin staplers and 56 % (28 cases) of sutures. There is statistically significant difference among the groups at **p<0.001**

According to our study and results obtained from other study, cost factor is cheaper in patients using Steri-Strips (adhesive tapes) followed by skin staples and skin sutures which is proved statistically.

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, the best part is that we are comparing all the 3 skin closure parameters in an open hernioplasty.

We found that incidence of post-operative pain is less with steri-strips followed by skin staplers and skin suture. Incidence of surgical site infections is less with steri-strips followed by skin staplers and skin suture. Incidence of skin closure material removal is less with steri-strips followed by skin staplers and skin suture. Incidence of post-operative scarring is less with steri-strips followed by skin staplers and skin suture. Incidence of post-operative wound dehiscence is less with steri-strips followed by skin staplers and skin sutures. Skin closed

with steri-strips provided better cosmesis than skin closed with skin staplers and skin sutures. Skin closure with steri-strips (adhesive tapes) is cheaper than skin staplers and skin sutures.

Hence, we conclude that the use of Steri-Strips (Adhesive tapes) 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 when compared to skin staplers and skin sutures, thus we recommend its use more frequently especially for closure of long and multiple incisions for all standards of people for better out come after surgeries.

References

1. Stillman RM, Bella FJ, Seligman SJ, Skin Wound Closure: The effect of various wound closure methods on susceptibility to infection. Arch Surgery, 1980; 115:674-680.
2. Iavazzo C, Gkegkes ID, Vouloumangu EK, Mamais I, Peppas G, Falagas ME. Randomized controlled trial for suture vs. stapler for management of surgical wounds.Am Surg. 2011 Sep; 77(9):1206-21.
3. Eldrup Randomized controlled trial compared stapler with conventional skin closure.
4. Ritchie AJ et al carried out a prospective double blind randomized study comparing staples versus sutures in the closure of scalp wound and found that stapling was significantly faster and less painful.
5. Stockley I, ElsoEldrup J, Wied U, Andersen B. Randomised trial comparing Proximate stapler with conventional skin closure. ActaChir Scand. 1981; 147(7): 501–502.
6. Stillman RM, Bella FJ, Seligman SJ, Skin Wound Closure: The effect of various wound closure methods on susceptibility to infection. Arch Surgery, 1980; 115:674-679.
7. Iavazzo C, Gkegkes ID, Vouloumangu EK, Mamais I, Peppas G, Falagas ME. Randomized controlled trial for suture vs. stapler for management of surgical wounds.Am Surg. 2011 Sep; 77(9):1206-21.
8. Medina dos Santos LR, Freitas CAF, Hojaji FC et al. Prospective study using skin staplers in head and neck surgery. AM J Surg. 1995; 170-451-452.
9. George TK, Simpson DC. Skin wound closure with staples in the Accident and Emergency Department. J R CollSurgEdinb1985; 30:54.
10. Kanegaye JT, Vance CW, Chan L, Schonfeld N. Comparison of skin stapling devices and standard sutures for pediatric scalp lacerations: a randomized study of cost and time benefits. J Pediatr1997; 130:808.
11. Switzer EF, Dinsmore RC, North Jr JH. Subcuticular closure versus Dermabond: a prospective randomized trial. Am Surg 2003; 69: 434–6.
12. Nahas FX, Solia D, Ferreira LM, Novo NF. The use of tissue adhesive for skin closure in body contouring surgery. Aesthetic PlastSurg 2004; 28: 165–9.
13. Stillman RM, Bella FJ, Seligman SJ, Skin Wound Closure: The effect of various wound closure methods on susceptibility to infection. Arch Surgery, 1980; 115:674- 9. Singer AJ, Quinn JV, Clark RE, Hollander JE. Closure of lacerations and incisions with octylcyanoacrylate: a multicenter randomized trial. Surgery 2002; 131: 270-6. 680
14. Arun Kumar Gupta, Kulwant Singh Ded, AbhishekGupta. A Comparative Study OfSutureless Techniques For Closure of Surgical Skin Incisions- Tissue Adhesive Glue (2-Octyl Cyanoacrylate) V/S Skin Staplers. An Open Access, Online International Journal
15. Iavazzo C, Gkegkes ID, Vouloumangu EK, Mamais I, Peppas G, Falagas ME. Randomized controlled trial for suture vs. stapler for management of surgical wounds. Am Surg. 2011 Sep; 77(9):1206-21.