

A COMPARATIVE STUDY BETWEEN CONVENTIONAL SKIN SUTURES, STAPLERS AND ADHESIVE SKIN GLUE FOR ELECTIVE SURGICAL SKIN CLOSURE

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Abstract

Background: To compare the outcome and efficacy of conventional skin sutures, staplers, and adhesive skin glue for surgical skin closure. **Materials and Methods:** Comparative study done in 90 patients in three groups Group A: Patients who had skin closure with conventional skin suturing, Group B: Patients who had skin closure with staplers, Group C: Patients who had skin closure with adhesive skin glue admitted in Govt Namakkal Medical college Hospital, Namakkal from June 2022- June 2023 were included in the study. Necessary data were collected. **Result:** The patients in the three groups were analyzed using ANOVA results were formulated. Compared to Glue, Staplers and Sutures- Glue is better than Staplers and Sutures. Staplers is better than Sutures. Time for closure, post-operative pain, asepsis score and modified Hollander score is the least for glue and highest for sutures ($p < 0.005$, statistically highly significant). **Conclusion:** Skin glue gives the best results in terms of less post-operative pain, wound asepsis, better cosmesis. The concept of tissue glue is a safe, attractive, and effective alternate over other conventional methods of wound closures following elective surgeries.

INTRODUCTION

The last three decades has witnessed the availability of numerous options for skin closure.^[1] In the ancient times, it began with catgut and silk which has now extended to several thousand including knot-less sutures and antibiotic coated sutures.^[2,3] Additionally, the technical acumen of needles and packaging has also improved substantially. Latest methods of closure namely, absorbable staples and topical adhesives are available that help in better outcomes either used alone or in conjunction with the traditional methods. With such a wide array of options available, it is essential to customize the approach and method used for every patient based on the type of wound that is being addressed. A high-quality result can be obtained using an accurate technical execution. Considering the options available, it is mandatory for a surgeon to gain a complete knowledge on the different suture materials available, their biochemical properties and techniques of closure to reach a level of competency to make sound clinical decisions on closure based on profound scientific knowledge.^[4] The operating surgeon carries the onus of making the best choice for any laceration depending on the patient and the characteristics of the wound. For

instance, a laceration in a child has to be addressed differently compared to a 70-year-old man with a host of comorbidities like diabetes, hypertension, thin skin, use of steroids and other cardiovascular issues. Another point of decision making is the site of the laceration in the body. Different parts of the body have different skin types and of varying thickness, elasticity, tendency to scar and the speed of healing.^[5] Also, the need for an aesthetic scar in areas exposed to the outside is an additional requirement. Techniques to avoid suture marks like 'rail road tracks' tends to be more favorable from the patients' perspective.^[6]

Considering all these decision-making points, it is therefore essential for the surgeon to make the best choice. In addition, the responsibility of the surgeon to consider the cost of complication against the choice of suture is equally important. Some of the common complications are pain, infection, wound dehiscence, fistula, reoperations and maybe death at times. Therefore, the choice of a suture must balance all these factors in order to provide the best closure with minimal pain and scarring.^[7]

The following study focused on comparing sutures, tissue adhesives and staplers for wound closure. Tissue adhesives are successful in reducing the wound infection by creating a barrier to the

microorganisms against their entry into the wound. Another factor is the time taken to execute the technique. Sutures take longer (7-10 minutes) while adhesive glues take the shortest time (3 minutes). Aesthetically, glue have an advantage over sutures. Post-operative dressing is essential while using sutures whereas with glue the post-operative wound management cost is minimal.^[5] Additionally, the risk of needle stick injury to the surgeon is absent with glue apart from the low risk of infection to the patient. The scientific reason behind low risk of infection is the obliteration of dead space and complete hemostasis.^[8,9] Though the cost of adhesive is higher, yet considering the loss of working days, both glue and sutures have similar cost-benefit ratio.^[10] The following study is a comparative study on the sutures, tissue adhesives and staplers for wound closure.

Aim

To compare the outcome and efficacy of conventional skin sutures, staplers and adhesive skin glue for surgical skin closure

MATERIALS AND METHODS

Study Design

Comparative study done in 90 patients in three groups

Group A: Patients who had skin closure with conventional skin suturing

Group B: Patients who had skin closure with staples

Group C: Patients who had skin closure with adhesive skin glue

Study Centre

Govt Namakkal Medical College and Hospital, Namakkal

Inclusion Criteria

- Cases undergoing clean elective surgical procedures and skin closure with conventional skin suturing or staples or adhesive skin glue

Exclusion Criteria

- Critical cases undergoing damage control surgery/ requiring stomas
- Patients who are not able to come for follow-up
- Face, bony prominences, and highly mobile areas are excluded for staplers.
- Mucocutaneous junctions link lips, friction sites like hands and feet are excluded for adhesive glue application.
- History of diabetes mellitus, immunosuppression, malignancy, scars, or keloid formation

Methodology

Patients satisfying inclusion and exclusion criteria were wadmitted and following data were collected

1. Details of participants including disease characteristics.
2. Details of type of intervention.
3. Details of outcomes reported.

Parameters Studied

1. Time taken for skin closure with skin glue, staplers, and suture material.

2. Postoperative wound infection using Asepsis Score for skin glue, staplers, and suture material.
3. Postoperative pain studied with visual analogue scale for skin glue, staplers, and suture material.
4. Wound cosmesis assessed with modified Hollander scale 11 for skin glue, staplers, and suture material.

RESULTS

Age Distribution of the Participants

The mean age of the patients treated with glue is 39.8 years (S.D=13.5 years) ranging between 23-65 years, the mean age of the patients in the staplers group is 42.7 years (S.D=14.7 years) ranging between 16-72 years, the mean age of the patients in the sutures group is 44.4 years (S.D=14.7 years) ranging between 21-72 years.

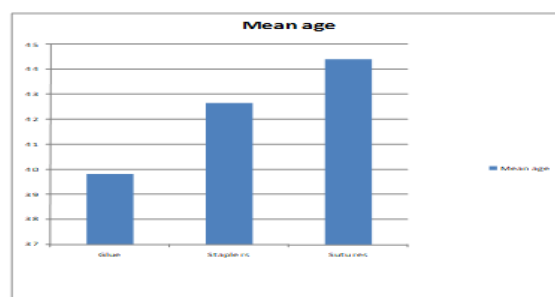


Figure 1: Age distribution of the participants

Gender Distribution of the Participants

- In the overall study, the number of males were more in number (n=55) compared to females (n=35).
- In the group treated with glue; there were 19 males (63%) and 11 females (37%)
- In the group treated with staplers; there were 16 males (53%) and 14 females (47%)
- In the group treated with sutures; there were 20 males (66.7%) and 10 females (33.3%)
- The following table and figure shows the gender distribution of the participants.

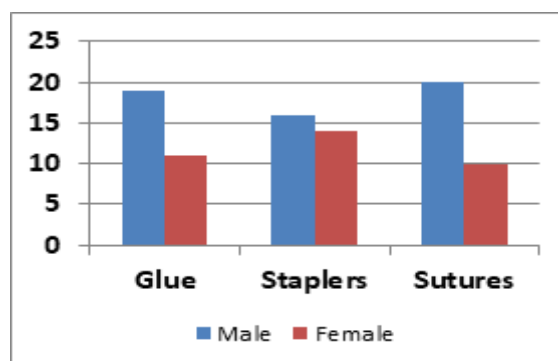


Figure 2: Gender distribution of the participants

Procedure done

The following table and figure show the procedure performed across the three study groups;

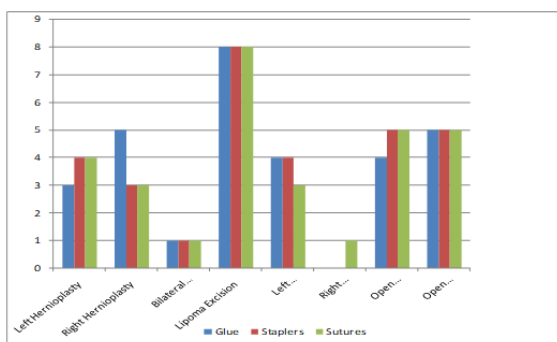


Figure 3: Procedure done across three groups

Study Parameters Comparison

The following section shows the comparison of the study parameters between the three groups;

- time taken for skin closure with skin glue, staplers and suture material,
- postoperative wound infection using Asepsis Score for skin glue, staplers and suture material,
- postoperative pain studied with visual analogue scale for skin glue, staplers and suture material,
- wound cosmesis assessed with modified Hollander scale for skin glue, staplers and suture material.

Time for closure

The time for closure in the three groups is;

- For patients treated with glue; mean=3.5 minutes (S.D=0.9 minute) ranging between 2-5 minutes
- For patients treated with staplers; mean=6.13 minutes (S.D=0.7 minute) ranging between 5-8 minutes
- For patients treated with sutures; mean=7.3 minutes (S.D=0.9 minute) ranging between 5-9 minutes

The following table and figure shows the time taken from closure in the three groups;

ANOVA test shows that the three groups differ significantly in the time taken for closure ($p < 0.005$, highly significant). The time taken in the group treated with sutures is high compared to staples and glue. Treating with glue takes the shortest time comparatively. [Table 4]

Post-operative pain score

The post-operative pain score in the three groups is; For patients treated with glue; mean=3.3 (S.D=0.6) ranging between 2-5

For patients treated with staplers; mean=5.8 (S.D=1.1) ranging between 4-8

For patients treated with sutures; mean=7.2 (S.D=1.03) ranging between 4-9

ANOVA test shows that the three groups differ significantly in the post-operative pain score ($p < 0.005$, highly significant). The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest pain score comparatively. [Table 5]

ASEPSIS Score

The ASEPSIS score in the three groups is;

For patients treated with glue; mean=5.1 (S.D=0.7) ranging between 4-7

For patients treated with staplers; mean=6.7 (S.D=0.8) ranging between 5-8

For patients treated with sutures; mean=8.03 (S.D=1.24) ranging between 6-11

ANOVA test shows that the three groups differ significantly in the ASEPSIS score ($p < 0.005$, highly significant). The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest ASEPSIS score comparatively. [Table 6]

Modified Hollander score

The Modified Hollander score in the three groups is;

For patients treated with glue; mean=3.7 (S.D=0.7) ranging between 3-5

For patients treated with staplers; mean=6.2 (S.D=0.5) ranging between 5-7

For patients treated with sutures; mean=7.5 (S.D=0.8) ranging between 6-9

ANOVA test shows that the three groups differ significantly in the modified Hollander score ($p < 0.005$, highly significant). The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest modified Hollander score comparatively. [Table 7]

Final Interpretation

Compared to Glue, Staplers and Sutures; Glue is better than Staplers and Sutures and Staplers is better than Sutures. Time for closure, post-operative pain, asepsis score and modified Hollander score is the least for glue and highest for sutures ($p < 0.005$, statistically highly significant).

Table 1: Age distribution of the participants

AGE (in years)		Mean	Std. Deviation	Minimum	Maximum
	Glue	39.833	13.5165	23.0	65.0
Staplers	42.667	14.7001	16.0	72.0	
Sutures	44.400	14.7241	21.0	72.0	
Total	42.300	14.2887	16.0	72.0	

Table 2: Gender distribution of the participants

		Categories			Total
		Glue	Staplers	Sutures	
SEX	Female	11 (37%)	14 (47%)	10 (33.3%)	35
	Male	19 (63%)	16 (53%)	20 (66.7%)	55
Total		30	30	30	90

Table 3: Procedure done across three groups

Procedure	Categories			Total
	Glue	Staplers	Sutures	
Left Hernioplasty	3	4	4	11
Right Hernioplasty	5	3	3	11
Bilateral Hernioplasty	1	1	1	3
Lipoma Excision	8	8	8	24
Left Trendelenburg Procedure	4	4	3	11
Right Trendelenburg Procedure	0	0	1	1
Open Cholecystectomy	4	5	5	14
Open Appendicectomy	5	5	5	15
Total	30	30	30	90

Table 4: Time for closure

	Group	Mean	Std. Deviation	Minimum	Maximum	ANOVA Test
TIME FOR CLOSURE (in minutes)	Glue	3.5517	.94816	2.00	5.00	P<0.005 Highly Significant
	Staplers	6.1333	.73030	5.00	8.00	
	Sutures	7.3333	.95893	5.00	9.00	
	Total	5.6966	1.80532	2.00	9.00	

Table 5: Post-operative pain score

	Group	Mean	Std. Deviation	Minimum	Maximum	ANOVA Test
POST OPERATIVE PAIN SCORE	Glue	3.300	.6513	2.0	4.0	P<0.005 Highly Significant
	Staplers	5.833	1.0854	4.0	8.0	
	Sutures	7.200	1.0306	4.0	9.0	
	Total	5.444	1.8730	2.0	9.0	

Table 6: ASEPSIS Score

	Group	Mean	Std. Deviation	Minimum	Maximum	ANOVA Test
ASEPSIS SCORE	Glue	5.100	.7589	4.0	7.0	P<0.005 Highly Significant
	Staplers	6.767	.8172	5.0	8.0	
	Sutures	8.033	1.2452	6.0	11.0	
	Total	6.633	1.5394	4.0	11.0	

Table 7: Modified Hollander Score

	Group	Mean	Std. Deviation	Minimum	Maximum	ANOVA Test
MODIFIED HOLLANDER SCALE	Glue	3.700	.7022	3.0	5.0	P<0.005 Highly Significant
	Staplers	6.167	.5307	5.0	7.0	
	Sutures	7.533	.8996	6.0	9.0	
	Total	5.800	1.7495	3.0	9.0	

DISCUSSION

A prospective comparative study was done to compare patients who had skin closure with conventional skin suturing with patients who had skin closure with staples and with adhesive skin glue.^[12,13] The following four parameters were studied; time taken for skin closure with skin glue, staplers and suture material, postoperative wound infection using Asepsis Score for skin glue, staplers and suture material, postoperative pain studied with visual analogue scale for skin glue, staplers and suture material and wound cosmesis assessed with modified Hollander scale for skin glue, staplers and suture material.

The mean age of the patients treated with glue is 39.8 years (S.D=13.5 years) ranging between 23-65 years, the mean age of the patients in the staplers group is 42.7 years (S.D=14.7 years) ranging between 16-72 years, the mean age of the patients in the sutures group is 44.4 years (S.D=14.7 years) ranging between 21-72 years.

In the overall study, the number of males were more in number (n=55) compared to females (n=35). In the group treated with glue; there were 19 males (63%)

and 11 females (37%), In the group treated with staplers; there were 16 males (53%) and 14 females (47%), In the group treated with sutures; there were 20 males (66.7%) and 10 females (33.3%).

The time for closure in the three groups is; for patients treated with glue; mean=3.5 minutes (S.D=0.9 minute) ranging between 2-5 minutes; For patients treated with staplers; mean=6.13 minutes (S.D=0.7 minute) ranging between 5-8 minutes; For patients treated with sutures; mean=7.3 minutes (S.D=0.9 minute) ranging between 5-9 minutes. ANOVA test shows that the three groups differ significantly in the time taken for closure (p<0.005, highly significant). The time taken in the group treated with sutures is high compared to staples and glue. Treating with glue takes the shortest time comparatively.

The post-operative pain score in the three groups is; for patients treated with glue; mean=3.3 (S.D=0.6) ranging between 2-5; For patients treated with staplers; mean=5.8 (S.D=1.1) ranging between 4-8; For patients treated with sutures; mean=7.2 (S.D=1.03) ranging between 4-9. ANOVA test shows that the three groups differ significantly in the post-operative pain score (p<0.005, highly significant).

The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest pain score comparatively.

The ASEPSIS score in the three groups is; For patients treated with glue; mean=5.1 (S.D=0.7) ranging between 4-7; For patients treated with staplers; mean=6.7 (S.D=0.8) ranging between 5-8; For patients treated with sutures; mean=8.03 (S.D=1.24) ranging between 6-11. ANOVA test shows that the three groups differ significantly in the ASEPSIS score ($p<0.005$, highly significant). The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest ASEPSIS score comparatively.

The Modified Hollander score in the three groups is; For patients treated with glue; mean=3.7 (S.D=0.7) ranging between 3-5; For patients treated with staplers; mean=6.2 (S.D=0.5) ranging between 5-7; For patients treated with sutures; mean=7.5 (S.D=0.8) ranging between 6-9. ANOVA test shows that the three groups differ significantly in the modified Hollander score ($p<0.005$, highly significant). The score in the group treated with sutures is high compared to staples and glue. Treating with glue gives the lowest modified Hollander score comparatively.

Compared to Glue, Staplers and Sutures; Glue is better than Staplers and Sutures and Staplers is better than Sutures. Time for closure, post-operative pain, asepsis score and modified Hollander score is the least for glue and highest for sutures ($p<0.005$, statistically highly significant).

CONCLUSION

The present study is done to compare the skin closure technique with adhesive skin glue, staplers and skin suturing material. The concept of adhesive skin glue is superior to staplers and skin suturing due to following properties^{14,15}; Faster, comfortable, and cosmetically better. Time taken for skin closure is shorter which in turn reduces operating time. It forms water tight barrier and allows the patient to take

shower at any time. Stitches need not be removed. Reduced postoperative pain. It disappears naturally as incision heals and leaves no mark. It is non-irritant and can be safely applied. Therefore, it is concluded that cyanoacrylate skin glue can be used in surgical skin closure in clean elective surgeries.

REFERENCES

1. George Broughton, I. I., Janis, J. E., & Attinger, C. E. (2006). Wound healing: an overview. *Plastic and reconstructive surgery*, 117(7S), 1e-S.
2. Mackenzie, D. (1973). The history of sutures. *Medical history*, 17(2), 158-168.
3. Moy, R. L., Waldman, B., & Hein, D. W. (1992). A review of sutures and suturing techniques. *The Journal of dermatologic surgery and oncology*, 18(9), 785-795.
4. Kolarsick, P. A., Kolarsick, M. A., & Goodwin, C. (2011). Anatomy and physiology of the skin. *Journal of the Dermatology Nurses' Association*, 3(4), 203-213.
5. McGrath, J. A., Eady, R. A. J., & Pope, F. M. (2004). Anatomy and organization of human skin. *Rook's textbook of dermatology*, 1, 3-2.
6. Shaw TJ, Martin P. Wound repair at a glance. *J Cell Sci*. 2009;122:3209-3213.
7. Thomas Hess, Cathy BSN, RN, CWOCN Checklist for Factors Affecting Wound Healing, *Advances in Skin & Wound Care*: April 2011 - Volume 24 - Issue 4 - p 192 doi: 10.1097/01.ASW.0000396300.04173.ec
8. Smyth, E. T. M., & Emmerson, A. M. (2000). Surgical site infection surveillance. *Journal of Hospital Infection*, 45(3), 173-184.
9. Cheadle, W. G. (2006). Risk factors for surgical site infection. *Surgical infections*, 7(S1), s7-s11.
10. Jones Jr, K. C., Himel, H. N., Towler, M. A., Thacker, J. G., & Edlich, R. F. (1993). New advances in automatic disposable rotating cartridge skin staplers. *Burns*, 19(2), 159-165.
11. Douglas DM, Forrester JC, Ogilvie RR. Physical characteristics of collagen in the later stages of wound healing. *Br J Surg*. 1969 Mar;56(3):219-22.
12. Materials of wound closure. April 12, 2005. Available at: www.emedicine.com.
13. Margaret Terhune, MD, Private Practice, Richmond Dermatology and Laser Specialists. Materials for wound closure. Updated: Nov 10, 2009.
14. Hochberg J, Meyer KM, Marion MD. Suture choice and other methods of skin closure. *Surg Clin*. 2009 Jun 1;89(3):627-41.
15. Lloyd JD, Marque III MJ, Kacprowicz RF. Closure techniques. *Emergency Med Clin North Am*. 2007 Feb 1;25(1):73-81.