

COMPARATIVE EVALUATION OF EFFICACY OF CYANOACRYLATE AND SUTURE MATERIAL IN THE MANAGEMENT OF OPERATIVE SKIN WOUNDS

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ABSTRACT

Objective: Closing wounds are a fundamental aspect of surgery. Both patients and surgeons hope that no scars remain once a wound has healed. This study examined the effectiveness of cyanoacrylate and suture material in closing operational skin wounds in terms of time required for closure of the operative incision and problems associated with it.

Methods: Forty-two individuals who had emergency surgery participated in this comparative analysis. The study evaluated how the identical patient's abdominal incisions were closed on the skin. Relevant surgical information, such as signs of inflammation, discomfort, possible discharge, wound dehiscence, and sinus, was recorded both during and after the operation.

Results: In the adhesive application group, it took 1.5 min (95 s), but it took 4.1 min (248 s) in suturing group for the closure of a <5-cm incision. Of the 32 patients in the adhesive group, 4 (12.5%) showed erythema and warmth, 3 (9.3%) showed discomfort, and 6 (18.7%) showed discharge. All other problems, excluding dehiscence, were less severe in the sticky group.

Conclusion: For patients undergoing emergency laparotomies, cyanoacrylate appears to be a safe and cost-effective alternative to sutures. For a conclusive outcome, a high number of case groups are needed, but the observed results were only on a small number of case groups.

Keywords: Wound, Dehiscence, Suture, Cyanoacrylate.

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INTRODUCTION

Every surgeon creates a surgical wound before beginning an operation and closes the wound afterward. A surgeon's routine always includes wound closure. Sutures are typically used to close the skin after surgery; however, this procedure adds another point of contamination and raises the risk of a foreign body reaction in the delicate subcutaneous tissue [1]. In addition to taking longer during application, this raises the rate of complications. Numerous skin closure techniques, including as stapling and adhesive tapes, have been tried to avoid these issues, but none have been successful.

In 1949, Ardis became the first person in the world to successfully synthesis cyanoacrylates [2]. Cyanoacrylate adhesives were found to have adhesive characteristics by Coover *et al.*, who recommended using them as surgical adhesives [3]. Interest in using cyanoacrylates for numerous surgical procedures has grown since their 1949 discovery [4]. The use of tissue adhesives in general surgery has been seen in procedures involving the abdomen, eyes, kidney, liver, and vascular systems. Every patient would desire a healing technique that left only a small scar.

Tissue adhesives, sticky tapes, and staplers are only a few of the alternatives and techniques for skin closure that is currently accessible, in addition to traditional sutures. Each approach has benefits and drawbacks. Numerous investigations have shown contradictory findings regarding the cyanoacrylate adhesive's efficacy. To examine the effectiveness of cyanoacrylate and suture material in closing surgical skin wounds in terms of time required for closure of the operative incision and complications associated with it, this study was created.

METHODS

Design and study participants

The current prospective comparison study was carried out on 32 patients who underwent emergency surgery at the BRD Medical

College in Gorakhpur's Nehru Chikitsalya. The study took place over the course of about a year. In this study, the same patient served as a control for a midline surgical incision. We were able to control the confounding factor thanks to this study design. In this study, topical adhesive was used to repair the remaining half of the midline incision and an interrupted suture to close the other half. The present study assessed how the same patient's abdominal incisions healed on the skin.

Inclusion criteria

All abdominal surgery patients would be eligible for enrollment in the trial if they gave written informed consent, were in generally good health without severe systemic abnormalities, consented to return on day 14 and on month 2 for follow-up evaluation. All patients who underwent surgery for traumatic blunt or penetrating abdominal injuries, all patients who underwent surgery for non-traumatic gastric and duodenal perforations within 72 h of duration if eligible otherwise, and all patients who underwent laparotomy for intestinal obstruction if eligible otherwise were included in the study.

Exclusion criteria

Patients with peripheral vascular disease, patients with a known history of allergy to cyanoacrylate compound, patients who refused to give consent for the study, patients with non-traumatic (pathological) small bowel perforation, and patients with any type of colorectal perforation were excluded from the study. Other exclusion criteria included patients with immunocompromised states, patients who were malnourished and anemic (Hb 10 g%), patients with immunosuppressive states.

Study tool

A questionnaire was used as a structured research instrument. All patients underwent the necessary clinical examinations, tests, and treatments, and the results were recorded in a pro forma. The study evaluated how the identical patient's abdominal incisions were closed on the skin. Relevant surgical information, such as signs of inflammation,

discomfort, possible discharge, wound dehiscence, sinus, was recorded both during and after the operation.

The study's participants chose to take part or not. None of the study participants received any financial compensation of any kind. The study's goals were described to the subjects, and they were asked to participate. Subjects were enrolled in the study after providing them with informed consent. Questionnaires were reviewed for accuracy and completeness. The study began after obtaining ethical approval from the ethical committee of the medical college.

Data analysis

The collected data were properly coded and placed into the Microsoft Excel spreadsheet. After that, it was checked for errors. Version 22.0 of IBM SPSS Statistics for Windows was used for the analysis (IBM Corp. Armonk, NY, USA). More variables were created during the data cleaning process to help with potential variable association. The Chi-square test and Fisher's exact test were used to assess categorical data. Since the level of significance for each test was set at 5%, an association was considered significant if p value was <0.05.

RESULTS

Mean time taken for closure of incision <5 cm was 1.5 min (95 s) for adhesive application and 4.1 min (248 s) for suturing. Time taken for closure of incision between 5 and 10 cm (with mean length 6.5 cm) was 2.1 min (130 s) for adhesive application and 5.5 min (330 s) for suturing. Time taken for closure of incision >10 cm was 2.8 min (168 s) for adhesive application and 8.4 min (504 s) for suturing (Table 1).

Of 32 patients in adhesive group, erythema and warmth were noted in 4 (12.5%) patients, tenderness was present in 3 (9.3%) patients, discharge was present in 6 (18.7%) patients, and dehiscence was present in 11 (34.3%) patients, which was statistically significant (p=0.01).

Out of 32 patients in conventional suture group, erythema was noted in 10 (31.2%) patients, warmth in 4 (12.5%) patients, discharge and dehiscence were present in 3 (9.32%) patients, tenderness is present in ten subjects (31.2%) which was statistically significant (p=0.02), and sinus was present in 1% of subjects (Table 2).

DISCUSSION

Both patients and surgeons hope that no scars remain once a wound has healed. The surgeon has the last say over the procedure to employ.

Table 1: Mean time taken for closure of incision by adhesive application and conventional suture

Length of incision (in centimeters)	Mean time taken (in minutes)	
	Adhesive group	Conventional suture group
<5 cm	1.5 min	4.1 min
5-10 cm	2.1 min	5.5 min
>10 cm	2.8 min	8.4 min

The surgeon must assess every case separately and select a closure material that will promote healing and reduce the risk of infection. The objective of wound closure should be to approximate the wound accurately, have simple handling and functioning characteristics, and have minimal infection rates.

Sutures are the classical and conventional method for wound closure. It requires the passage of a foreign substance through tissues; if knotted tightly or left for an extended period of time, it may leave permanent suture lines, and if removed too soon, dehiscence will follow. In addition to this, a sutured wound needs to be dressed for protection. Tissue adhesives were developed as a result of the ongoing search for alternate methods and materials.

Alkyl cyanoacrylates are homologous chemicals that are cyanoacrylate derivatives. The reason why cyanoacrylates have an adhesive quality is because they are liquid monomers that quickly solidify and form strong polymer bonds when they come into contact with water and weak bases.

Methyl-2-cyanoacrylate was the first surgical adhesive product to hit the market, according to the literature. It was a derivative of cyanoacrylate. Later, longer chain derivatives were created, including butyl-2-cyanoacrylate (Histoacryl), isobutyl-2-cyanoacrylate (Bucrylate), and ethyl-2-cyanoacrylate (Krazy glue) [5].

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Dehiscence, on the other hand, belonged closer to the sticky group. It was statistically significant (p=0.01) since it was present in 11 (34.3%) of the patients. Our study included people that had emergency laparotomies; this may be the likely cause.

Bozkurt *et al.* compared the average time required to apply cyanoacrylate to close head and neck incisions to that required to use traditional sutures. For the study, 80 individuals who had head and neck surgeries were included. In one patient group, the skin was closed using the interrupted suture technique, and in the other, cyanoacrylate was used. Age, gender, and wound length differences between the two therapy groups were negligible. In the cyanoacrylate group, the mean wound length was 7.21 cm, while it was 7.22 cm in the suture group. The cyanoacrylate group's mean closure time was 33.69+9.77 s, while the suture group's was 504.38+169.27 s (p 0.001). Both groups reported no complications. Comparing the interrupted suture approach to the administration of cyanoacrylate, the wound closes more quickly [11].

Another study from Gujarat comprised 60 open inguinal hernia cases that had undergone surgery. In open inguinal hernias, comparisons between cyanoacrylate tissue adhesive and traditional skin suturing

Table 2: Complications associated with adhesive and sutures application

Complications	Adhesive group (n=32)		Conventional suture group (n=32)		Test of significance*
	Number	Percentage	Number	Percentage	
Erythema	3	12.5	10	31.2	p=0.02
Warmth	1	12.5	4	12.5	p=0.04
Tenderness	3	9.3	10	31.2	p=0.02
Discharge	3	9.32	6	18.7	p=0.28
Dehiscence	11	34.3	3	9.32	p=0.01
Sinus	0	0	1	3.1	p=0.31

*Chi-square test and Fisher's exact test

were done. The time needed to apply cyanoacrylate glue intraoperatively was shorter than the time needed to suture the wound. Cyanoacrylate glue wound closure was reported to have a lower incidence of wound infection than suturing. Using cyanoacrylate adhesive, the incision healed with a single linear scar that is more esthetically pleasing than a suture scar. When cyanoacrylate glue is used instead of sutures, wound dehiscence occurs more frequently [12].

CONCLUSION

Based on the results of this study, it can be said that for patients undergoing emergency laparotomy incisions, cyanoacrylate appears to be a comparably safer and more affordable alternative to suture. To arrive at a conclusive outcome, however, a significant number of study samples are needed as the observed effects are on a tiny sample size.

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AUTHORS' CONTRIBUTIONS

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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REFERENCES

- Nagpal BM, Kumar G, Nagi GS, Singh P. Sutureless closure of operative skin wounds. *Med J Armed Forces India* 2004;60:131-3. doi: 10.1016/S0377-1237(04)80102-3, PMID 27407605.
- Pawar AA, Joshi MA, Gadhire M, Shotriya R, Phad B, Singh J. Prospective randomized comparative study of skin adhesive glue (2-methyl-2-cyanopropionate or cyanoacrylate) versus conventional skin suturing by suture material/skin stapler in clean surgical cases. *Int Surg J* 2017;5:168-73. doi: 10.18203/2349-2902.isj20175889.
- Devrukhkar VN, Hegde RJ, Khare SS, Saraf TA. Evaluation of isoamyl 2-cyanoacrylate tissue adhesive in management of pediatric lacerations: An alternative to suturing. *Ann Maxillofac Surg* 2015;5: . doi: 10.4103/2231-0746.161059, PMID 26389034.
- Amer MI, Ahmed ME, Hassan DA. Hysteroscopic tubal occlusion using iso-amyl-2-cyanoacrylate in patients with hydrosalpinx. *J Obstet Gynaecol Res* 2018;44:2174-80. doi: 10.1111/jog.13769, PMID 30058273.
- Borie E, Rosas E, Kuramochi G, Etcheberry S, Olate S, Weber B. Oral applications of cyanoacrylate adhesives: A literature review. *Biomed Res Int* 2019;2019:8217602. doi: 10.1155/2019/8217602, PMID 31008113.
- Chow A, Marshall H, Zacharakis E, Paraskeva P, Purkayastha S. Use of tissue glue for surgical incision closure: A systematic review and meta-analysis of randomized controlled trials. *J Am Coll Surg* 2010;211:114-25.
- Gennari R, Rotmensz N, Ballardini B, Scevola S, Perego E, Zanini V, *et al.* A prospective, randomized, controlled clinical trial of tissue adhesive (2-octylcyanoacrylate) versus standard wound closure in breast surgery. *Surgery* 2004;136:593-9. doi: 10.1016/j.surg.2004.02.015, PMID 15349107.
- Snizek PJ, Walling HW, DeBloom JR, Messingham MJ, Vanbeek MJ, Kreiter CD, *et al.* A randomized controlled trial of high-viscosity 2-octyl cyanoacrylate tissue adhesive versus sutures in repairing facial wounds following Mohs micrographic surgery. *Dermatol Surg* 2007;33:966-71. doi: 10.1111/j.1524-4725.2007.33199.x, PMID 17661940.
- Raju GS, Naik SA. Comparative study of primary skin closure with adhesive skin glue and conventional suture material in clean elective surgery. *Int J Intg Sci* 2016;3:384-90.
- Shivamurthy DM, Singh S, Reddy S. Comparison of octyl-2-cyanoacrylate and conventional sutures in facial skin closure. *Natl J Maxillofac Surg* 2010;1:15-9. doi: 10.4103/0975-5950.69151, PMID 22442543.
- Bozkurt MK, Saydam L. The use of cyanoacrylates for wound closure in head and neck surgery. *Eur Arch Otorhinolaryngol* 2008;265:331-5. doi: 10.1007/s00405-007-0454-2, PMID 17899144.
- Manza JT, Maisuria RS, Chaudhari DR, Dave DN, Gajra YB, Patel DP. Comparative study between cyanoacrylate tissue adhesive versus skin sutures in closure of wound in 60 operated cases of open inguinal hernia. *Int Surg J* 2018;5:1908-13. doi: 10.18203/2349-2902.isj20181608.