

## N-Butyl Cyanoacrylate (Enbucrilate) V/S Conventional Sutures in Closure of Superficial Surgical Wounds

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### Abstract

**Background:** Sutures, staples and adhesive tapes are the traditional methods of wound closure, whilst tissue adhesives have entered clinical practice more recently. Tissue adhesives offer the advantages of no risk of needle stick injury and no requirement to remove sutures later.

**Objectives:** To determine the relative effects of various tissue adhesives and conventional skin closure techniques on the healing of surgical wounds.

**Materials & Methods:** Screening of only eligible RCT studies and data extraction were conducted independently and in triplicate whilst assessment of the methodological quality of the trials were conducted independently and in duplicate. Results were expressed as random effects models using mean difference for continuous outcomes and relative risks with 95% confidence intervals for dichotomous outcomes. Heterogeneity was investigated including both clinical and methodological factors.

**Results:** 60 cases of inguinal hernia and recurrent appendicitis skin closure were studied to compare the results of cyanoacrylate glue and subcuticular sutures with 2-0 prolene as closure technique. Mean age was 15-30 years. The average time taken ( $p=0.0001$ ) and average hospital stay ( $p=0.0000$ ). Was statistically significant and better in the glue group. The cosmetic outcome ( $P$  value= $0.522$ ), wound complications, difference of the Hollander Wound Evaluation Scale ( $p=1.9479$ ) Were statistically not significant.

**Conclusion:** Tissue adhesive has got a distinct advantage over sutures. Time taken for closure is low, antibacterial property of tissue adhesive decreases the incidence of wound infection. Hospital stay is decreased and thus cost effective. Needle stick injuries to the surgeon, hematoma formation in the wound edges is reduced and long-term follow up shows cosmetically better scars than sutures.

**Keywords:** Cyanoacrylate glue; Tissue adhesives; Subcuticular sutures; Hollander wound evaluation score; Low tension skin incisions; Cosmesis.

### Introduction

Precise approximation of skin incisions and lacerations with wound closure devices is critical for a favourable cosmetic and functional surgical result. Principles of wound closure focus on relieving tension on the wound and bringing the skin edges together in an everted orientation.<sup>1,2</sup> Application of sutures requires passage of a foreign material through the skin, which is usually left in place for 5 to 10 days. If sutures are tied too tight or left in too long, they may leave permanent suture tracts.<sup>3</sup> If sutures are removed before adequate healing, the lack of wound tensile strength may result in wound dehiscence or a widened scar. Although suture removal usually causes minimal discomfort, the procedure is often associated with increased patient anxiety. Additionally, suture removal in sensitive areas of the face, such as the nose, eyelids, and lips, can result in significant discomfort.

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New technology in surgical adhesives may provide the option of sutureless skin closure. Properties of the ideal adhesive would be: Safe for topical application, Easy to apply, Polymerize rapidly, Support the approximated skin edges and maintain the skin edge eversion necessary for maximum wound healing and acceptable cosmesis eliminate the need for suture removal. The development of such technology is very useful for a variety of surgical applications, including plastic surgery.<sup>4</sup>

Over the years, cyanoacrylates have been used for skin closure, fixation of implants, tissue adhesion, and embolization of blood vessels.<sup>5</sup> Derivatives of cyanoacrylate have been available as a surgical tissue adhesives for many years. Despite their availability, cyanoacrylate adhesives have failed to gain widespread popularity due, in part to their suboptimal handling and application characteristics, variable outcomes, and the histotoxicity associated with their use.<sup>6,7</sup> The main aim of this study was to analyze the difference between skin closure with N-butyl-2-cyanoacrylate glue and subcuticular sutures with respect to Cosmesis, Time taken, Wound complications and Cost effectiveness

## Materials and Methods

The present study was carried out at Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka where 60 patients with inguinal hernia and recurrent appendicitis underwent mesh plasty and interval appendectomy respectively over a period of 1 year.

A total of 30 cases each were studied for skin closure with either subcuticular sutures or n-butyl-2-cyanoacrylate glue. All these patients were allotted to either group according to random number table. The total sample size was 60. All patients undergoing open inguinal hernia repair, or interval appendectomy, those aged between 15 and 65 years were included. Patients with DM, jaundice, anaemia and Patients on chronic immunosuppressive therapy were excluded.

Preoperatively all patients underwent following investigations, namely Complete Blood Count, urine examination, Blood sugar, blood urea, serum creatinine and Chest x- ray, ElectroCardioGraphy, (wherever needed). All cases were elective cases and the mode of anaesthesia was spinal anaesthesia.

Ethical clearance was obtained from the Ethical Committee of NMCHRC, Raichur for the conduction of this study.

The participants were grouped as subcuticular

and glue group. For the subcuticular group, Skin approximated with 2-0 prolene continuous subcuticular sutures with proper anchoring of the suture at the two ends of the incision. For the glue group, After closing subcutaneous layer, proper haemostasis of the wound was achieved. The two skin edges were approximated with the help of forceps or skin hooks. Following this, the glue applicator was pressed and glue applied topically over the wound edges extending 5-10 mm beyond the incision. Initial layer application acted as a barrier, which minimized any heat dissipation to the tissues. There was a delay of 10-30 sec between the two application to prevent pooling of the glue. The wound edges were held together for 60-90 sec to allow the glue to polymerize thus taking care that glue did not enter the wound.

The time required for skin closure was recorded using a stopwatch. For the subcuticular group, betadine ointment was applied and a packed dressing given. For the glue group a simple dry gauze dressing was given as the glue formed a watertight seal itself.

Patients were evaluated post operatively on the 4th postoperative day for evidence of inflammation, infection and wound gape. Patients they were usually discharged after suture removal on 7-8th day for subcuticular group while the glue group patients were discharged after 4-5 days after the first wound evaluation.

Inflammation was defined as excessive redness and tenderness of incision site with induration. Infection was defined as any persistence of superficial cellulitis or induration with sero sanguineous or pus discharge from wound site lasting beyond 7th postoperative day. The total hospital stay was noted. Patients were evaluated for infection, wound gape and inflammation during follow-up on 15 days, 1 month and 3 months.

At the 3 month follow-up, the wounds were evaluated according to the HOLLANDER WOUND EVALUATION SCALE (HWES) by an independent surgeon who was blinded to the method of closure. The wound score addressed 6 clinical variables namely Absence of step off borders, Contour irregularities, Wound margin separation greater than 2 mm, Excessive distortion, Edge inversion and Overall cosmetic appearance. Each of these categories was graded on 0 or 1 patient scale. A total cosmetic score was derived by addition of scores of the 6 variables. A score of 6 was considered optimal, while 5 or less was suboptimal. The percentage of wounds from each group that attained optimal cosmesis was compared.

“Similarly” with “Additionally” the wounds

were photographed at 3 months follow up which were rated for cosmesis on a previously validated cosmesis VISUAL ANALOGUE SCORE which has been demonstrated to be reliable and valid outcome measure of cosmesis. The cosmetic VAS is a 100-mm line with worst scar at 0 and best scar at 100. Photographs were rated by senior surgeon unaware to which method was used to close the wound. Using the line as a continuous entity the surgeon marked the patient's scar on line. The score was then measured in millimetre from 0 to 100. The mean VAS for each group was calculated. Statistical evaluation was done. Using the student T test and Chi-square test the P value was calculated. P<0.05 was considered significant.

**Results**

A total of 60 cases satisfying the selection criteria were included in the study which was carried out at Navodaya Medical College Hospital and Research Centre, Raichur, Karnataka.

The age of the patients ranged from 15-65 years [Graph.1]. Their proportional age is shown in following table. Majority of patients were in the age group (15-30) =21 patients. In this series of 60 patients, 52 were males and 8 were females.

Table.1 illustrates case distribution. A total of 28(47%) patients had indirect hernia and 10(17%) had direct hernia while 22(36%) patients had recurrent appendicitis. Among the 38 cases of inguinal hernias, 22(58%) patients had (R) sided hernia while 16 (42%) had (L) sided hernia.

In both the subcuticular and glue groups, 19 patients underwent surgery for hernia and 11 patients underwent interval appendectomy each.

An average time [Graph.2] of 168 sec was taken for closure of incision with glue. An average time of 259 sec was taken for closure of incision with subcuticular suture. The difference between the two groups in closure time was statically significant. (p=0.0001).

Table 2 and graph 3 illustrates the wound complications. In the glue group a total of 5 (16%) patients had some kind of postoperative complications. These included mild to moderate wound inflammation 5 (16%) patients, 2 (6%) patients of this group had pus discharge on the 7th postoperative day (i.e., wound infection). In the subcuticular group total of 7 (23%) patients developed postoperative complications out of which all had wound inflammation of these 7 patients 3

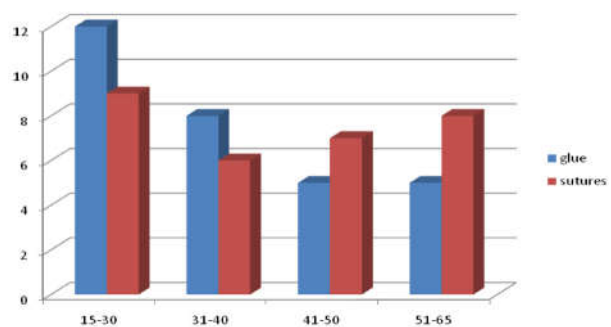
(10%) patients developed wound infection and had pus 8th post operative day. One patient had wound gaping. The prevalence of wound infection though more common in subcuticular group was not statistically significant (p=0.522).

Most of the patients of glue group were discharged on postoperative day 4 after 1st wound evaluation. The average hospital stay in the glue group was 4.7 days and 7.4 days in the subcuticular suture group. The difference of the hospital stay between the two groups was statistically significant.

Cosmetic evaluation [Table.3] and [Graph.5] of the post operative scar was done at 3-month follow up. 12 patients were lost to follow up. Average VAS of patients in glue group at the 90-day follow up was 74.35. Average VAS of patients in subcuticular group was 72.36. Although the VAS in glue group was more than that of subcuticular group, it was not statistically significant (p=0.4930). The groups were compared with the HOLLANDER WOUND EVALUATION SCALE (HWES). In the glue group, 17 (74%) patients had an optimal score of 6% while 6(26%) patients had ≤ 5. In the subcuticular group, 14(56%) had a score of 6, while 11 (44%) had a score of ≤5. Even though there is a difference between the 2 groups, it is not statistically significant (p=1.9479).

**Table 1:** Case Distribution.

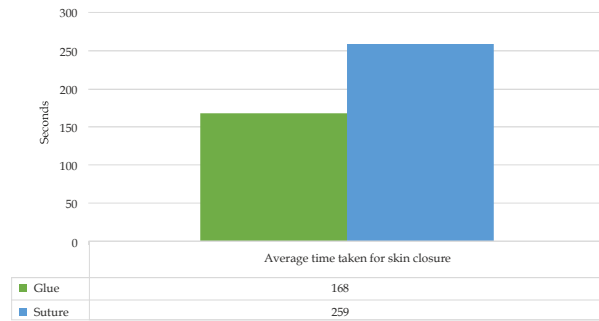
Surgery	Glue	Suture	Total
Direct Inguinal Hernia	05(50%)	05(50%)	10
Indirect Inguinal Hernia	14(50%)	14(50%)	28
Recurrent Appendicitis	11(50%)	11(50%)	22
Surgical Procedure	-	-	-
Meshplasty	19(63%)	19(63%)	38
Interval Appendectomy	11(37%)	11(37%)	22



**Graph 1:** Age Distribution:

**Table 2:** Wound Complications:

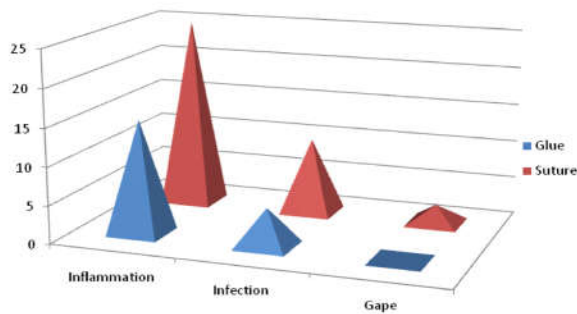
Complications	Glue	Suture	Total
Inflammation	5 (16%)	7 (23%)	12
Infection	2 (6%)	3 (10%)	8
Gape	-	1	1



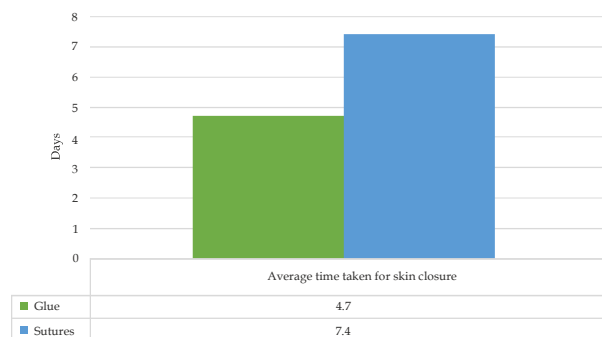
Graph 2: Average Time Taken For Skin Closure.

Table 3: Cosmetic Evaluation:

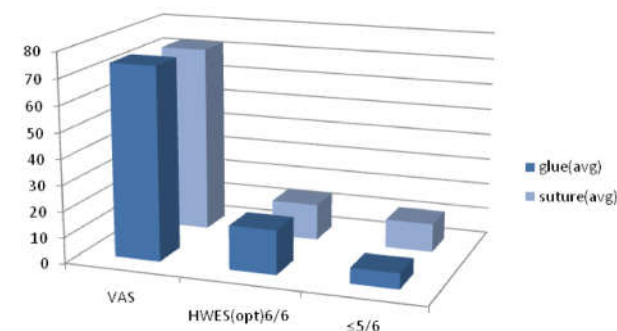
cosmetic outcome	glue (avg.)	suture (avg.)	p value
vas	74.35	72.36	0.4980
hwes (optimal) 6/6	17	14	1.94752
≤5/6	6	11	—



Graph 3: Wound Complications:



Graph 4: Duration Of Hospital Stay:



Graph 5: Cosmetic Evaluation:

## Discussion

LORD MOYNIHAM has said “never judge a surgeon unless you have seen him close the wound”. “I dressed the wound and god healed them” is the famous saying of Ambrose Pare (1510-1590). It could mean, “I suture the wounds and god heals them”. It is usually every surgeon’s desire to close with an optimal cosmetic scar. Proper healing of incisions / wounds so as to restore the structural integrity and strength of the wound has always been the most important factor. With the advent of modern surgical technology and improvement in surgical skills, use of newer and higher antibiotics, maintaining high level of surgical asepsis, there is a decrease in the incidence of wound complications. The onus is now upon obtaining a good cosmetic scar. There are many factors, which affect the cosmetic outcome of scars. Amongst the local factors, surgical skill and type of materials used to close the incisions is of much importance. Traditionally low-tension skin incisions like groin incisions have been closed by subcuticular sutures (continuous) with absorbable (polydioxone) or non-absorbable materials. (Polypropylene / nylon).<sup>15</sup>

The advantage that the absorbable suture material has over the non-absorbable material is the avoidance of suture removal, which may be slightly painful for patient. But problem associated with it, is that this material is not easy to insert in the subcuticular region as compared to polypropylene.<sup>15</sup> Again it is lies at the discretion of the surgeon as to what suture material to be used. The problem associated with suturing of the wound is stitch abscess, Injury to the blood vessels in the skin resulting in hematoma and needle stick injuries to the surgeon. Other alternative for skin closure is cyanoacrylate glue. Numerous clinical reports have shown that N-butyl cyanoacrylate can be used as successful alternative to sutures for topical skin closure of low-tension incisions. M TORUMI et. al.<sup>52</sup> (1998) took 55 seconds for closure of lacerations with glue and 235 seconds sutures with difference being significant (p value<0.0001). C.C.P ORY et. al. (2002) did not find any time difference between skin closure of paediatric herniotomies with glue and subcuticular sutures P=0.18. This may be because the herniotomy incision was small in length. THOMAS B BRUNS conducted a trial for closure of lacerations in children’s emergency department in 1995 and concluded that there was significant time difference between glue application and suturing with glue needing lesser time for closure. wound complications - Wound complications include

Inflammation, wound infection and Wound gape. Superficial inflammation is the presence of redness and tenderness of the incision site. inflammation was present in 5(16%) patient in glue group and 7(23%) in subcuticular group and the difference was statistically insignificant. Infection of wound is presence of sero sanguinous discharge or frank pus incision site which was present in 2(6%) in glue group and 3(10%) in subcuticular group.

It is known that cyanoacrylate glue has antibacterial properties J. QUINN et. al. has shown the antibacterial property of glue in a contaminated wound model. The exact mechanism of antibacterial property is not known, but it is likely to be a cell wall mechanism because the sensitivity is are restricted to gram positive organisms. Gram negative organisms are relatively less affected. All these patients with wound infection were treated conservatively, Cyanoacrylate glue causes mild histotoxicity to the vascularized tissue.<sup>6,20</sup> this histotoxicity may be the cause of mild inflammation seen in patients in glue group. This may be due to leakage of glue within the tissue. M.TORUIMI et. al. (1998) did not find any evidence of gaping in both groups of glue and sutures for laceration repair. AMIEL et. al. (1996) found that post operative complications following glue usage is paediatric hernitomies as follows: Inflammation in 5.5%, wound dehiscence in 1.1% and wound infection in 1.9%.

Hospital stay was the glue scar tensile strength is worst on the 1st to 4th postoperative day. On 7th day it is almost equal to suture wound strength.<sup>4,7</sup> In the suture group, the patients were kept in hospital until suture removal till the 7<sup>th</sup> postoperative day and then discharged which increased the cost factor.

Cosmetic outcome was evaluated on 2 scales namely Visual analogue score (VAS) and Hollander wound evaluation scale (HWES). Visual analogue scale is more reliable than Hollander wound evaluation scale. The HWES has less ability to discern small differences in cosmetic outcome than visual analogue score wound evaluation method. The VAS obtained by analysis of the 3-month post operative photographs revealed comparable cosmetic results between the 2 groups. It is also been proved that 3-month follow up evaluation provides good measure of long term cosmetic outcome. [QUINN et. al. 1998]<sup>53</sup> Similarly, HWES evaluation also showed comparable results with no significant difference between the two groups (p=1.9479). The finding in this study is similar to other studies in literature. C.C.P ORY et. al. (2002) concluded that tissue glue is easy and safe, with no complications and results equality good cosmesis.

HAROLD K. SIMON et. al. found that cyanoacrylate is an ideal alternative to conventional suturing for the cutaneous closure of low tension lacerations in children with long term cosmetic outcome comparable to conventional sutures. KENG et. al. (1988)<sup>43</sup> found that glued wounds had consistently better cosmesis mean score (4.7) than sutures (4) (p<0.05) at 4 weeks follow up for groin incisions.

## Conclusion

Tissue adhesive (n- butyl- 2 -cyanoacrylate) has got a distinct advantage over sutures. Time taken for closure is low, Antibacterial property of tissue adhesive decreases the incidence of wound infection., Hospital stay is decreased and thus cost effective, Needle stick injuries to the surgeon , hematoma formation in the wound edges is reduced and Long - term follow up shows cosmetically better scan than sutures.

Hence we conclude that use of glue in low tension incisions is easy, time saving, with good cosmetic outcome, low incidence of complications and equally cost effective as sutures and thus recommend its use in surgical practice.

## Credits

The study was conducted at NMC HRC, Raichur, Karnataka, where the first author was an employee during the period of study. There is no conflict of interest involved.

## References

1. Borges A.F. Elective incision and scar revision. Boston little,Brown,1973.
2. Davidson T.M. "Subcutaneous suture placement", Laryngoscope,1987,97:50.
3. Reiter, D. "Materials and Methods for wound closure", Otolaryngology clinics North America, 1995,285:1069.
4. Kamer.F.M.et.al."Histoacryl:Itsuseinaneesthetic facial plastic surgery", Arch otolaryngology head and neck surgery,1989,115:193.
5. VintersH.V,Lundie,et.al."Longtermpathological follow-up of cerebral arterio venous malformation treated by embolisation",Emergency journal med. 1994, 614:477.
6. Toruimi.D.M. et. al. "Histotoxicity of cyanoacrylate tissue adhesive. A comparative study",Arch Otolaryngol Head and Neck surgery,1990,116:546.
7. M.T.Toruimi et. al. "use of octyl 2 cyanoacrylate for skin closure of facial laceration",Plastic reconstructive surgery,1998 102(6):2209-2219.

8. D.J.Leaper et. al. "Subcuticular skin closure after inguinal surgery", Journal of Royal College Surgeons,1985,30(4):234-236.
9. W.E.G.Thomas "Sutures,Ligature materials and staples Basic Surgical Techniques",Surgery 2002:97-99.
10. C.C.P.Ory et. al. "Comparing wound closure using tissue glue Vs Subcuticular suture for pediatric surgical incisions. A prospective randomized trial" Pediatric Surg.Int.2002:553-555.
11. Quinn J.V. et. al. "Octylcyanoacrylate tissue adhesive Vs Suture wound repair in a contaminated wound model", Surgery 97, 122:69-72.
12. Holander J.E, Singer A.J "Application of tissue adhesive,Rapid attainment of proficiency-Story book of octyl cyanoacrylate study group",Academy Emergency Medicine 1998, 5:1012-17.
13. Singer A.J., Quinn J.V., "Prospective ,randomized controlled trial of tissue adhesive versus standard wound closure techniques for laceration repairs" Acad.Emerg.Med.1998,5: 94-99.
14. Harold K. Simon et. al. " Long term appearance of laceration repaired using a tissue adhesive",Pediatrics 99(97).
15. King T.M. et. al. "A clinical trial of T.A (Histoacryl) in skin closure of groin wounds" Medical Journal Malaysia 89(2): 122-8.
16. Dikkabder J.G., Singer A.J "Application of tissue adhesive :rapid attainment of proficiency"Acad.Emerg.Med.1998,1012-17.