

**Evaluation of Tissue Adhesive as Alternative To Conventional Closure Methods in Inguinal Hernia Repair****A.R. Bansal, O. P. Saini, M.S. Griwan, Y.R. Karthikeyan**

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**Background:** Goals of wound closure should be achieved with a simple rapid and cost effective. Use of surgical adhesives can simplify skin closure in that certain problems inherent to suture use can be avoided.

**Methods:** To assess effectiveness of tissue adhesive in comparison to subcuticular 3-0 vicryl sutures in closure of inguinal hernia repair with respect to, time required for closure of skin incision, postoperative complications like wound disruption, wound discharge, wound infection and scar cosmesis. The study was carried out on 50 patients of inguinal hernia (either direct or indirect) divided into group A tissue adhesive and group B subcuticular vicryl of 25 each.

**Results:** Mean wound closure time in group A was  $244 \pm 8.20$  whereas mean wound closure time in group B was  $391 \pm 29.72$ . A total of three patients had wound disruption in group A while none of the patients in group B had wound disruption. Wound discharge was present in 6 out of 25 (24%) cases in group A while only 2 out of 25 (8%) cases had wound discharge in group B. This difference in wound discharge was also found to be statistically significant ( $P < 0.001$ ). Wound infection in form of seropurulent discharge was observed in only one (4%) patient of the tissue adhesive group. One out of 20 (5%) cases had poor overall appearance of wound in group A and none of the cases had poor overall appearance of wound in group B. The difference between overall appearances of wound in both the groups when compared statistically was found to be insignificant ( $p > 0.05$ ).

**Conclusion:** In the present study, although tissue adhesive offered a significantly faster closure than a running subcuticular 3-0 vicryl suture, there was no significantly different result in cosmesis.

**Introduction**

Wounds and their management are fundamental to the practice of surgery. Goals of wound closure are tissue approximation with minimal wound infection and postoperative pain resulting in an acceptable cosmesis. These goals should be achieved with a simple rapid and cost effective method<sup>1</sup>. A myriad of closure techniques are available, like sutures, surgical staples, surgical tapes, tissue adhesives etc. The choice of a particular suture material should be based on wound and tissue characteristics, anatomic location and individualized to a particular patient. As an ideal suture is yet to be made understanding the characteristics of various available sutures materials is of prime importance to make an educated selection<sup>1</sup>.

Use of surgical adhesives can simplify skin closure in that certain problem inherent to suture use can be avoided. Application of a tissue adhesive is relatively painless for the patient, and provides an excellent cosmetic outcome. 2-octylcyanoacrylate is the only cyanoacrylate tissue adhesive approved by the U.S. Food and Drug Administration for superficial skin closure<sup>2</sup>. In order to assess if tissue adhesive can be used as an alternative to subcuticular closure in elective surgical incisions; a randomized prospective study was planned to evaluate the efficacy of tissue adhesive (2-octylcyanoacrylate) in patients undergoing elective hernia repair in comparison to subcuticular closure by vicryl 3-0 suture.

The aims of this study were to assess effectiveness of tissue adhesive in comparison to subcuticular 3-0 vicryl sutures in closure of inguinal hernia repair in relation to:

- Time required for closure of skin incision.
- Postoperative complications :
  - Wound disruption
  - Wound discharge
  - Wound Infection
- Scar cosmesis.

### Patients and Methods

The study was carried out on 50 patients of inguinal hernia admitted in surgical ward of Pt. B.D. Sharma Post Graduate Institute of Medical Sciences, Rohtak, with a fully informed and written consent about the procedure and its complications. This study was approved by the institute ethics committee. Excluded from present study were patients aged above 60 years, the obese persons (bmi>30), diabetic patients, malnourished patients and those with malignant disease, chronic pulmonary or obstructive disease.

The patients were divided into two groups alternately, group A and group B by computer generated random sampling.

- Group A comprised of 25 patients, in whom skin incision was closed by tissue adhesive (2-octylcyanoacrylate).
- Group B comprised of 25 patients, in whom skin incision was closed by subcuticular 3-0 vicryl suture.

On the day of surgery each patient was given pre-anaesthetic medication as advised by anaesthesiologist. All patients were given preoperative antibiotic injection cefotaxime 1gm i.v. at the time of induction of anaesthesia.

Patients in both the groups were operated upon by the same surgeon. A five to seven cm incision was done on the skin above inguinal ligament on the affected side depending upon the size of hernia. After dissection of the spermatic cord, the hernial sac was identified. Repair of hernia was carried by meshplasty. External oblique aponeurosis was closed by prolene 2-0 and subcutaneous suture with catgut was applied in both the groups. Only the manner of skin closure varied.

- In group A, skin incision was closed by using tissue adhesive (2-octylcyanoacrylate) after achieving meticulous hemostasis. Skin edges were closely apposed with forceps after the application of tissue adhesive which prevented skin edge eversion and penetration of tissue adhesive to deeper layers of wound. The tissue adhesive dried almost immediately. Wound dressing was not done after cyanoacrylate polymer dried as the adhesive itself acts as occlusive dressing.
- In group B, subcuticular suture vicryl 3-0 on cutting needle was used for skin closure.

In both the groups the following parameters were evaluated:

- Wound closure time.
- Postoperative complications :
  - Wound disruption.
  - Wound discharge.
  - Wound infection.
- Scar cosmesis

Patients in both the groups were discharged the next day and given routine instructions with regard to wound care. Follow up was done at the end of first week to assess the condition of the wound and six weeks later for cosmesis in both groups of patients. Cosmesis was analyzed by visual analog score in which photographs were taken at six weeks and rated by two surgeons blinded to the method of closure. Each incision was assigned a score ranging from one (poor result) to six (excellent result).

Six considerations were evaluated while assigning the score:

1. Step off border.
2. Contour irregularities.
3. Wound margin separation.
4. Edge inversion.
5. Excessive distortion.
6. Overall appearance.

Each incision received a score of 0 or 1 depending upon the cosmetic deficiencies in the individual wound. All the scores were then summed up and depending upon the score, the incisions were categorized as follows:

- Excellent : if optimal total cosmesis score is 6
- Acceptable : if optimal total cosmesis score is 5
- Unacceptable : if optimal total cosmesis score is  $\leq 4$

In both the groups all observations like wound closure time, postoperative complications (wound discharge, wound infection, wound disruption) and cosmesis were tabulated and statistically analyzed using the standard student 't' test to assess the routine functional utility of tissue adhesive in inguinal hernia incisions.

### Results

Patients in both the groups were operated in elective list. The age varied from 26 years to 60 years in group A and from 20 years to 60 years in group B. Mean age in group A was  $42.35 \pm 19.56$  whereas in group B it was  $41.52 \pm 15.13$  and it was comparable in both the groups. Patients in both the groups were male.

Wound closure time was recorded in both the groups with the help of stopwatch. It was recorded when the surgeon had already applied subcutaneous sutures and was ready for skin closure. Recording was stopped in group A after 3<sup>rd</sup> layer of tissue adhesive was applied while in the group B the same was done after the subcuticular suture had reached the other end of the wound. Wound closure time in inguinal hernia repair in both groups of patient was as follow:

**Table 1.** Wound Closure Time

Group	No. of Patients	Mean time Seconds (Minutes)	Standard Deviation
A	25	244 (4.07)	8.20
B	25	391 (6.52)	29.72

Mean wound closure time in group A was  $244 \pm 8.20$  seconds whereas mean wound closure time in group B was  $391 \pm 29.72$ . A high standard deviation value in group B showed that it took longer to suture the wound than applying tissue adhesive. Mean wound closure time was consistently higher in group B than group A and it was statistically significant ( $p < 0.001$ ).

Postoperative complications were evaluated in the form of:

- Wound disruption
- Wound discharge
- Wound infection

All the patients were discharged the next day after surgery and advised to come for follow up after one week.

**Wound disruption.** A total of three patients (12%) had wound disruption in group A. One of the three patients in group A had complete wound disruption in the evening of the operative day. Suturing had to be done under local anaesthesia after shifting the patient to emergency operation theater. Rest of the two patients had partial wound disruption & were managed conservatively. None of the patients in group B had any wound disruption. This difference was found to be statistically significant ( $P < 0.001$ ).

**Wound Discharge:** In both the groups wound discharge was observed on 7<sup>th</sup> postoperative day i.e. on first follow-up. None of the patients in either of the groups returned within the follow-up period for complaints of wound discharge. Wound discharge was present in 6 out of 25 (24%) cases in group A while only 2 out of 25 (8%) cases had wound discharge in group B. This difference in wound discharge was also found to be statistically significant ( $P < 0.001$ ).

**Wound Infection:** Although a total of eight patients (six in group A & two in group B) had wound discharge on 7<sup>th</sup> postoperative day but of these wound infection in form of seropurulent discharge was observed in only one (4%) patient of the tissue adhesive group. This patient was managed conservatively by daily antiseptic dressing along with an extended use of oral antibiotics. Wound infection in both the groups when compared statistically was found to be insignificant ( $P>0.05$ ).

**Scar Cosmesis:** In group A, five out of 25 (20%) patients never attended the OPD at sixth week follow-up while three out of 25 (12%) patients in group B were lost in follow-up at the sixth week. Subsequently the wound cosmesis for these patients could not be evaluated. For remaining patients wound cosmesis is as being evident from the table below:

**Table 2.** Wound Cosmesis at 6 Weeks

	Group A	Group B
No. of step-off border	5	1
No. of contour irregularities	2	1
No. of margin separation	1	1
No. of edge inversion	1	0
No. of excessive distortion	1	0
No. of poor overall appearance	1	0
Mean total cosmesis score	5.45	5.86

Five out of 20 (25%) cases had a step-off border of wound in group A (Fig.10) and one out of 22 (4.55%) cases had a step-off border in group B. The difference between step-off border of wound in both the groups when compared statistically was found to be significant ( $p<0.001$ ). As is evident from the above table rest of the observations among the two groups for scar cosmesis were comparable and most of the patients in either of the groups had “acceptable” or “excellent” overall scar cosmesis.

## Discussion

Wound closure has always attracted the attention of surgeons for improvement since ancient time. Surgeons in different era kept on devoting their best to fulfill the need for improvement. Wound closure techniques have evolved from the earliest development of suturing materials to comprise resources that include synthetic sutures, staples, tapes and adhesive compound. Aesthetic closure is based on knowledge of skin anatomy, healing mechanism and closure technique. Choosing the proper materials and wound closure technique ensure optimal healing. The field of tissue adhesive is an area of tremendous interest and research. Topical adhesives have been used quite successfully for minor incisions, thus sparing the patient the need for injection of local anesthesia for traumatic lacerations - a benefit of considerable importance especially for pediatric patients.

Considerable clinical experience exists with 2-octylcyanoacrylate in the management of skin wound in many surgical fields. They have been used on skin, bone, cartilage graft, and middle ear surgery, repair of cerebrospinal fluid leak and repair of corneal ulcer<sup>3</sup>. The present study was planned to confirm or refute whether the tissue adhesive (2-octylcyanoacrylate) is superior to subcuticular vicryl 3-0 suture used for closure of inguinal hernia repair wound specially in terms of wound closure time, postoperative complications (like wound disruption, wound discharge and wound infection) and overall scar cosmesis. In the present study subcutaneous sutures were applied in all the patients irrespective of the method of closing the skin incision. The reason for placing the interrupted subcutaneous sutures in all the patients was to prevent any significant wound separation if the tissue adhesive (2-octylcyanoacrylate) fails. A significant observation noted in the study was a higher wound closure time in beginning of the study in tissue adhesive group but as study progressed this time decreased significantly. The overall results vis-a-vis wound closure

time in the present study showed that the time required for closure of wound in the subcuticular vicryl 3-0 suture group was higher than the tissue adhesive group.

A number of prospective randomized controlled trial have been conducted for comparing the tissue adhesive versus subcuticular suture for wound closure of lacerations and surgical incisions. In these studies it was observed that wound closure time was shorter in tissue adhesive group than subcuticular group. Another prospective randomized controlled trial carried out by Ong et al to compare two method of wound closure in herniotomy patients using either tissue adhesive or subcuticular monocril suture noted that wound closure time was equal in both the groups<sup>4</sup>. Mean wound closure time of both the groups in the present series as compared to other studies as given in Table 3.

Table 3. Comparison of mean wound closure time of present study with other studies

Authors	Tissue Adhesive Group Seconds (Minutes)	Subcuticular Sutures Group Seconds (Minutes)
Quinn et al (1997) <sup>5</sup>	216(3.6)	744(12.4)
Burn TB (1998) <sup>6</sup>	174(2.9)	348(5.8)
Switzer EF (2003) <sup>7</sup>	155(2.58)	286(4.77)
Sebesta MJ (2003) <sup>8</sup>	222(3.7)	840(14)
Present Series	244(4.07)	391(6.52)

An even greater difference in closure time would be expected in a study of long wounds because an increase in wound length would not substantially increase the time for applying tissue adhesive but it would increase the time for subcuticular suture. The study of long wounds by Maw et al found an approximately 10 fold greater mean closure time for sutures versus tissue adhesive<sup>9</sup>.

Tissue adhesive is an effective barrier against microbial penetration also. United States Food and Drug Administration (US FDA) approved 2-octylcyanoacrylate in January 2001 for use as a barrier against common bacterial microbes including staphylococci, pseudomonas and E.coli. Tissue adhesive has been offered as a "safe and effective means of sutureless wound closure" in facial plastic surgery with insignificant tissue toxicity and may actually assist in reducing the surgical site infections<sup>10,11,12</sup>.

In the present study known complications of standard wound closure like wound disruption was observed only in the beginning of the present study in the tissue adhesive group while partial wound disruption occurred in another two patients and thereafter no wound disruption was witnessed as the study progressed further. Learning curve of the surgeon for the use of tissue adhesive might be the possible explanation. Various studies conducted on the use of tissue adhesive (2-octylcyanoacrylate) concluded that the only complication of tissue adhesive is a small increased risk of wound disruption with no statistical difference in cosmesis<sup>7,13</sup>. Postoperative complications in the present study are in harmony with the studies conducted by Singer et al<sup>13</sup>; Switzer et al<sup>7</sup> and at variance with Maw et al<sup>9</sup>; Ferlise et al<sup>14</sup> and Sebesta et al<sup>8</sup>.

The ideal method of closure of surgical incision would be time saving without complication and also with an optimal cosmetic outcome. Cosmetic outcome is the ultimate parameter by which we measure the quality of surgical incision repair. A number of prospective randomized controlled trials have been done for comparison of cosmetic outcome between tissue adhesive and subcuticular suture. Most of the studies have

shown good cosmetic outcome with less wound closure time. In the present study mean total cosmesis score was 5.45 in tissue adhesive group and in subcuticular suture group was 5.86. In this study no significant difference was observed in cosmesis between tissue adhesive group and subcuticular suture group ( $P>0.05$ ). Similar result were observed by Quinn et al<sup>5</sup>, Singer et al<sup>13</sup>, Ong et al<sup>4</sup>, Switzer et al<sup>7</sup> and Blondeel et al<sup>15</sup>.

The present study demonstrated that tissue adhesive when used for closure of skin incision in a common surgical procedure like inguinal hernia yielded almost similar cosmetic results along with a faster method of wound closure when compared to suturing. But the same tissue adhesive is also associated with a significantly increased complication rate than does the use of subcuticular sutures though the number of wound complications was more in the beginning of the study when the surgeon was not well versed with the technique.

### Conclusion

Goals of wound closure are tissue approximation, minimizing wound infection, acceptable cosmesis and minimizing postoperative pain. It may be suggested that each surgeon has his or her own preference for wound closure and it is not the purpose of study to alter it. In the present study, although tissue adhesive offers a significantly faster closure than a running subcuticular 3-0 vicryl suture and without a significantly different result in cosmesis but it is also associated with a significantly higher rate of wound complications (wound disruption and wound discharge). For this reason we conclude that tissue adhesive (2-octylcyanoacrylate) should not be used as an acceptable alternative to subcuticular 3-0 vicryl suture closure for long and deep incisions like that in inguinal hernia; though a still longer study may be needed to elucidate or refute this observation.

### References

1. Zinner MJ, Anshley SW, editors. Maingot's abdominal operations. 11<sup>th</sup> ed. New York : McGraw Hill; 2007. p. 88.
2. Galli SKD, Constantinides M. Wound closure technique (Emedicine online). 2009 Jan 6 (cited 2009, 15 Jan. 10): available from url:<http://www.emedicine.com/ent/topic35.htm>.
3. Quinn JV, Drzewiecki A, Li MM. A randomized, controlled trial comparing a tissue adhesive with suturing in the repair of pediatric fascial lacerations. *Ann Emerg Med* 1993; 22 : 1130-5.
4. Ong CC, Jacobsen AS, Joseph VT. Comparing wound closure using tissue glue versus subcuticular suture for pediatric surgical incision : A prospective, randomized trial. *Pediatr Surg Int* 2002; 18 : 553-5.
5. Quinn J, Well G, Sutcliffe T et al. A randomized trial comparing octylcyanoacrylate tissue adhesive and sutures in the management of lacerations. *JAMA* 1997; 277(19): 1527-30.
6. Burn TB, Robinson BS, Smith RJ. A new tissue adhesive for laceration repair in children. *J Pediatr* 1998; 1067-70.
7. Switzer EF, Dinsmore RC, North JH. Subcuticular closure versus dermabond : A prospective randomized trial. *The Am Surgeon* 2003; 69: 434-6.
8. Sebesta MJ, Bishoff JT. Octylcyanoacrylate in skin closure in laparoscopy. *Journal of Endourology* 2003; 17(10): 899-903.
9. Maw JL, Quinn JV, Well GA et al. A prospective comparison of octylcyanoacrylate tissue adhesive and sutures for closure of head and neck incisions. *J Otolaryngol* 1997; 26 : 26-30.
10. Schwade ND. Wound adhesives, 2-octyl-cyanoacrylate (Emedicine online). 2008 Sep. 17 (cited 2008 Dec. 18) : Available from URL : <http://www.emedicine.com/ent/topic375.htm>.
11. Johnson CD, Sonenshein. Sutureless wound closure with histoacryl – a personal experience. *Am J Cosmet Surg* 1991; 8: 83.
12. Eiferman RA, Synder JW. Antibacterial effect of cyanoacrylate glue. *Arch Ophthalmol* 1983; 101: 958.

13. Singer AJ, Hollander JE, Valentine SM et al. Prospective randomized controlled trial of tissue adhesive (2-octylcyanoacrylate) vs standard wound closure techniques for laceration repair. Stony Brook octylcyanoacrylate study group. Acad Emerg Med 1998; 5: 94-9.
14. Ferlise VJ, Ankem MK, Barone JG. Use of cyanoacrylate tissue adhesive under a diaper. BJU Int 2001; 87: 672-3.
15. Blondeel PN, Murphy JW, Debross D et al. Closure of long surgical incisions with a new formulation of 2-octyl-cyanoacrylate tissue adhesive versus commercially available methods. Am J Surg 2004; 188: 307-12.