

A COMPARATIVE STUDY BETWEEN ISOAMYL 2 CYANOACRYLATE WITH CONVECTIONAL SUTURECLOSURE FOR ELECTIVE SURGICAL WOUND

¹Dr Nivedita , ²Dr.Mohammed faizul viqhas k , ³Dr.Harshith M G

¹Assistant Professor, Dept. of General Surgery, Gulbarga Institute of Medical Sciences, Kalaburagi

²Senior Resident, Dept. of General Surgery, Gulbarga Institute of Medical Sciences, Kalaburagi

³Senior Resident, Dept. of General Surgery, Hassan Institute of Medical Sciences, Hassan

Corresponding Author: Dr. Harshith M G

Article History: Received: 11.07.2023 Revised: 19.07.2023 Accepted: 26.07.2023

Abstract

Background: Wound healing is a mechanism where body attempts to restore the integrity of injured part, delayed healing results in loss of function / poor cosmetic outcome, so the process of regeneration and tissue repair is sequence of molecular and cellular events occurring to restore the damaged tissue. Over time, researchers have found newer technology for wound closure and one among them are the surgical adhesives.

Materials and Methods: Patients admitted in the wards under the department of General Surgery during a period of one year were the source of data collection after considering inclusion and exclusion criteria. A descriptive comparative study design was used for data collection and the total sample size of our study was 100.

Simple random sampling technique was used to select patients for wound closure, 50 patients underwent wound closure by isoamyl 2 cyanoacrylate and other 50 by conventional suture closure method.

Results: There was no much difference in age distribution, gender distribution and investigations like haemoglobin, bleeding and clotting time, blood urea and s. creatinine between groups. Among conventional suture participants, appearance of secondary infection was higher, the mean time taken for the wound to heal after the procedure was also higher, also they received antibiotic therapy for longer duration and mean RBS was higher when compared to the adhesive glue group and the difference was statistically significant.

Conclusion: Use of isoamyl 2-cyanoacrylate was better compared to conventional suture method as it required less time to heal, lesser antibiotic duration, lesser chance of appearance of secondary infection and also cosmetic appearance was better compared to the use of sutures.

Keywords: isoamyl 2-cyanoacrylate, tissue adhesive, conventional suture closure.

Introduction

Wound healing is a mechanism where the body attempts to restore the integrity of the injured part and delayed healing results in loss of function or poor cosmetic outcome, so the primary aim of the treatment is to achieve healing by primary intention and to reduce the inflammatory and proliferative responses so as to achieve wound closure and better healing.¹ Research done in last two decades has revealed the general steps of wound healing process, proving that it involves a complex network of all cells, tissues, cytokines, chemokines and growth factors of skin participating in wound healing process. It elucidates that skin cells interact with the changing tissue microenvironment and defines the phenotype in every stage of tissue repair, but when cells are dysfunctional the inflammatory process is extended and the integrity of the skin

is not restored resulting in ulcer or pathological fibrosis. The dominant cells involved in all phases of tissue repair are macrophages and they have an essential regulatory role and hence are seen as important therapeutic targeted to control the wound healing process.²The process of regeneration and tissue repair consist of sequence of molecular and cellular events occurring after the onset of tissue lesion to restore the damaged tissue. The sequential remodeling phases occurring through the dynamic processes are the exudative, proliferative and extracellular matrix involving soluble mediators, blood cells and parenchymal cells. The exudative phenomena contributes to development of tissue edema, proliferative stage reduces tissue injury by contracting myofibroblasts and fibroplasia.³ Over the years, researchers have found out that healing the wound with suture in patients with injuries and cuts is faster and also results in occurrence of less scars in such people and hence extensive research is going on to discover mechanisms which are related to wound healing without scarring and every year a new product is being offered to the medical community.⁴ There is availability of a new technology for wound closure and they are the surgical adhesives, Cyanoacrylate provides the patients an option of suture less skin closure and the use of cyanoacrylate is fast catching up and the Cyanoacrylates are safe for the clinical use with no known reports of adverse effects or carcinogenicity and they are solvent free, synthetic adhesives. They are the reactive monomer liquids which polymerize into a film after being initiated by moisture or certain chemicals. Its key property is that, the monomer liquid polymerizes directly on the surface where applied and creates a high quality and very tenacious polymer film, typically fixing within a minute and it achieves full bond strength within 24 hours.⁵ The traditional technique of needle skin suturing using the suture material is used as it is cost effective and in this technique patients experience more pain in the post-operative period and they have to come for suture removal. Even after the healing process, the track marks of suture will remain and the chances of wound infection are also higher with needle skin suturing when compared with closure using adhesive glue. It also increases the risk of acquiring blood borne viral infections like HIV, HBV etc., while cyanoacrylate is easier to use and it also provides flexible, water resistant, sealed skin closure and cosmetically better outcome when compared to needle skin suturing.⁶

MATERIAL AND METHODOLOGY

The choice of wound closure depends on various aspects, it depends on the nature of the wound, site of wound and the choice of surgeons as well. In this study we have compared the two methods of wound closure using conventional suture closure method and use of isoamyl 2 cyanoacrylate for wound closure and also compared the wound infection rates, time taken for wound closure and the cosmetic appearance between the two methods.

Source of data:

The patients admitted in the wards under the department of General Surgery, Navodaya Medical College Hospital and Research Centre during the total period of one year (01.01.2019 to 31.12.2019) were the source of our data collection, after the inclusion and exclusion criteria were considered.

Study design:

A descriptive comparative study design was used for the data collection from the participants.

Sample size and sampling technique:

The wound infection rates on the third day after using isoamyl 2 cyanoacrylate as wound closure method was found out to be 12%.⁶

So, by considering the above value, the sample size (n) for our study was calculated by using the formula $4pq/d^2$.

Inclusion criteria:

1. The cases that has to undergo clean elective surgical procedure and skin closure with 2 octylcyanoacrylate adhesive glue.
2. The patients who are willing to give the written informed consent.
3. The patients who were aged 18 years and above.

Exclusion criteria:

4. Surgical Incisions which require to be closed under tension.
5. Clean contaminated and contaminated surgeries
6. Traumatic wounds
7. Patients who are known cases of diabetes mellitus
8. A known allergy to Cyanoacrylate compound.

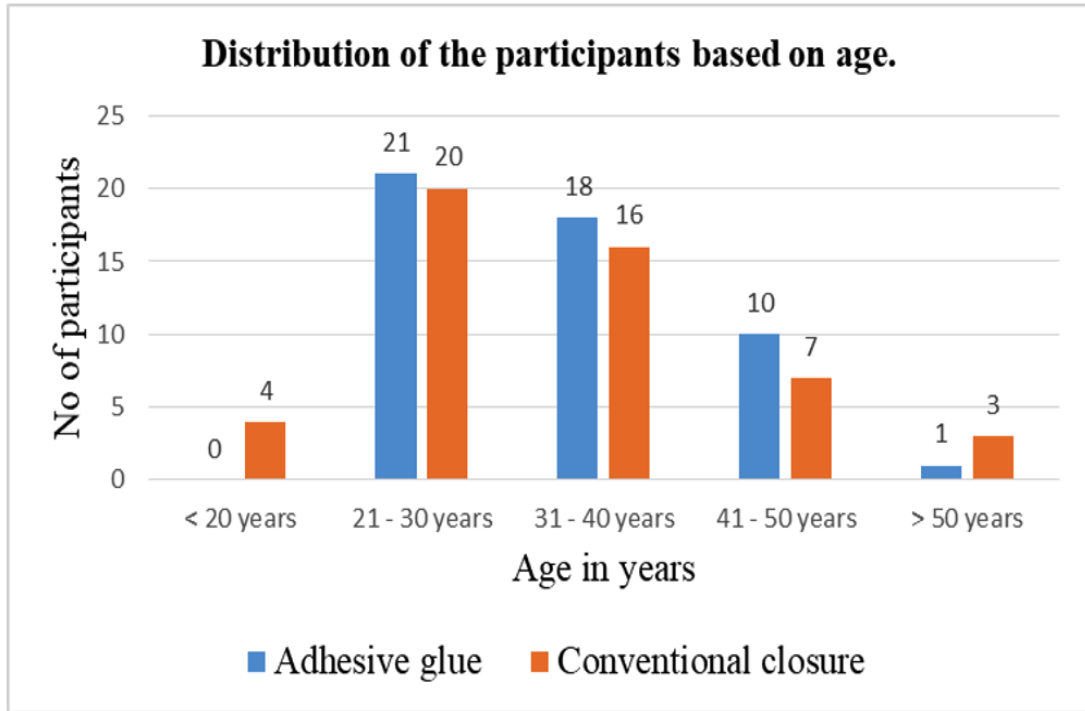
Results

Out of the 100 participants included in our study, all 100 participants had undergone the surgical procedure of appendectomy. Conventional suture with ethylon 3-0 was used as a treatment modality among 50 participants whereas remaining 50 participants received adhesive glue (isoamyl 2 cyano acrylate) as treatment for closure of surgical wound. The findings of our study are presented below.

Table 1: Distribution of the study participants based on age.

Age	Adhesive glue		Conventional closure	
	Number	Percentage	Number	Percentage
< 20 years	0	0	4	8%
21 - 30 years	21	42%	20	40%
31 - 40 years	18	36%	16	32%
41 - 50 years	10	20%	7	14%
> 50 years	1	2%	3	6%
Total	50	100%	50	100%

Among the participants who received adhesive glue for closure of surgical wound, 42% of the participants belonged to the age group between 21 to 30 years, 36% were in the age group of 31 to 40 years, 20% were in the age group of 41 to 50 years whereas among the participants who received conventional suture closure, 40% of them were in the age group of 21 to 30 years, 32% were in the age of 31 to 40 years and 14% were in the age of 41 to 50 years. Similar trend was observed in both the groups.

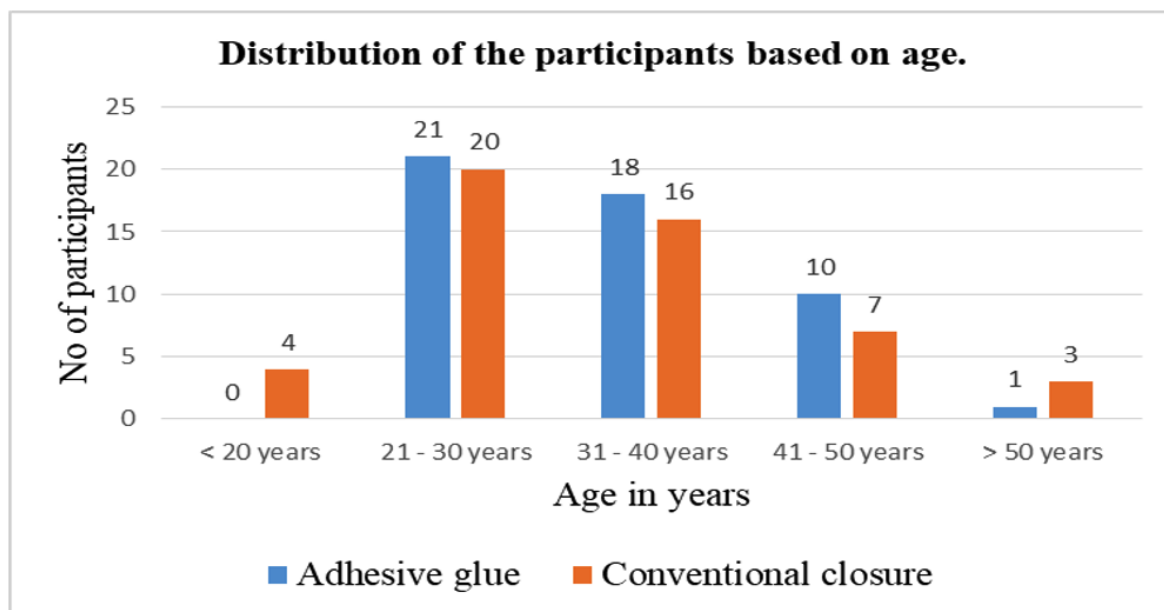


Graph 1: Distribution of the study participants based on age.

Table 2: Distribution of the study participants based on gender.

Gender	Adhesive glue		Conventional closure	
	Number	Percentage	Number	Percentage
Male	23	46%	21	42%
Female	27	54%	29	58%
Total	50	100%	50	100%

More than half of the participants in both the group were females, among the participants who received adhesive glue as treatment 54% of the participants were females while 46% were males whereas in the group receiving convention suture closure 58% of them were females and 42% were males.



Graph 2: Distribution of the study participants based on gender.

Table 3: Distribution of the study participants based on various investigation parameters.

Parameters	Adhesive glue		Conventional closure		t value	p value
	Mean	SD	Mean	SD		
Haemoglobin	13.04	1.41	13.34	1.46	1.0451	0.2985
Bleeding time	2.96	0.41	2.55	0.38	5.1861	0.0001
Clotting time	3.95	0.39	3.85	0.41	1.2496	0.2144
Blood Urea	33.42	5.05	29.86	4.51	3.7179	0.0003
S. Creatinine	0.96	0.21	0.91	0.21	1.1905	0.2367

Among the various investigation parameters included we have analyzed for important five investigations and there was no much difference among the participants between both the groups. Mean and Standard deviation was calculated for each investigation parameter and t test was applied.

Among the participants who received adhesive glue for suture closure, the mean Haemoglobin was 13.04 mg/dl with a SD of 1.41 mg/dl, mean bleeding time was 2.96 minutes with a SD of 0.41 minute, mean clotting time was found to be 3.95 minutes with a SD of 0.39 minute, mean blood urea level was 33.42 mg/dl with a SD of 5.05 mg/dl and mean serum creatinine was 0.96 mg/dl with a SD of 0.21 mg/dl.

Among the participants who received conventional suture closure, the mean haemoglobin was 13.34 mg/dl with a SD of 1.46 mg/dl, mean bleeding time was 2.55 minutes with a SD of 0.38 minute, mean clotting time was found to be 3.85 minutes with a SD of 0.41 minute, mean blood urea level was 29.86 mg/dl with a SD of 4.51 mg/dl and mean serum

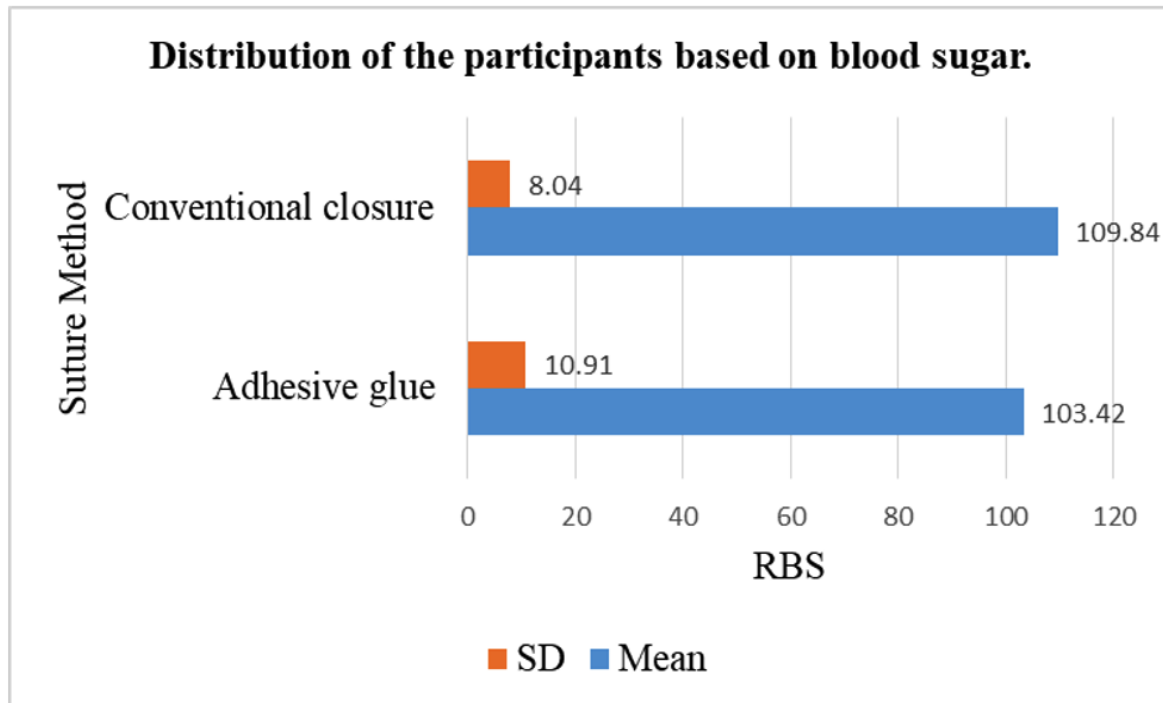
creatinine was 0.91 mg/dl with a SD of 0.21 mg/dl.

Out of the five investigations, only two investigations showed statistically significant difference between the two groups. There was statistically significant difference between the bleeding time of both the groups with a t value of 5.1861 and p value of 0.001. Similarly statistically significant difference was observed between blood urea levels of both the groups with t value of 3.7179 and p value was 0.0003. Both the values were significant at p value less than 0.05 and no other investigation parameter showed any significant difference.

Table 4: Distributoin of study participants based on Random blood sugar levels.

RBS	Adhesive glue	Conventional closure	t value	P value
Mean	103.42	109.84	3.3497	0.0011
SD	10.91	8.04		
No of participants	50	50		

None of the participants in both the groups were diabetic and the blood sugar levels were within the normal range. The mean random blood sugar level was 103.42 mg/dl among the participants who received adhesive glue for suture closure with a SD of 10.91 whereas among the participants receiving conventional suture closure the mean RBS was 109.84 mg/dl with a SD of 8.04 and this difference was statistically significant with p value of 0.0011, which was significant at p value less than 0.05.

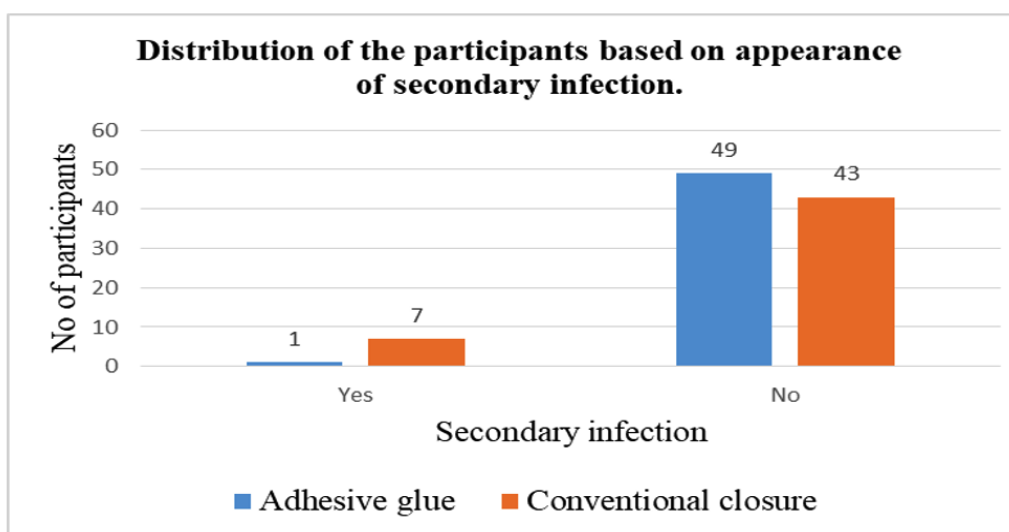


Graph 3: Distribution of study participants based on Random blood sugar levels.

Table 5: Distributoin of study participants based on appearance of secondary infection.

Secondary infection	Adhesive glue		Conventional closure		$\chi^2 = 4.89$ $df = 1$ $p = 0.027$
	Number	Percentage	Number	Percentage	
Yes	1	2%	7	14%	
No	49	98%	43	86%	
Total	50	100%	50	100%	

The appearance of secondary infection was seen more among those participants who received conventional suture closure being 14% when compared to those who received adhesive glue being only 2% and this difference was statistically significant with the chi square value being 4.89 with p value of 0.027 which was significant at p value less than 0.05.



Graph 4: Distribution of study participants based on appearance of secondary infection.

Table 6: Distribution of study participants based on time taken for the suture wound to heal.

Time taken to heal (in days)	Adhesive glue		Conventional closure		$\chi^2 = 21.7$ $df = 2$ $p = 0.00002$
	Number	Percentage	Number	Percentage	
< 7 days	28	56%	6	12%	
7 - 10 days	21	42%	41	82%	
> 10 days	1	2%	3	6%	
Total	50	100%	50	100%	

56% of the participants took seven or less than seven days for the suture wound to heal, 42% of them took 7 to 10 for the wound to heal among those treated with adhesive glue and among the group of participants who were treated with the conventional suture 82% of them took 7 to 10 days for the wound to heal, 12% of them took seven or less than seven days and 6% of them took more than 10 days.

The time taken for the suture wound to heal was lesser among those who were treated with adhesive glue when compared to those who were treated with conventional suture and this was statistically significant with chi square value of 21.7 and p value of 0.00002 which was less than 0.05.

The mean duration of time for the suture wound to heal for those who were treated with adhesive glue was 7.48 days with a SD of 0.61 days and among those who were treated with conventional suture was 8.66 days with a SD of 1.23 days.

Discussion

In our study it was noted that the use of isoamyl 2-cyanoacrylate was better than the use of conventional suture method and also the cosmetic appearance was better with the use of isoamyl 2-cyanoacrylate tissue adhesive. Many studies have shown similar results which have proven that the use of isoamyl 2-cyanoacrylate tissue adhesive was better than the use of many other methods of wound closure like the conventional suture method or the use of staples. In our study it was seen that there was no much age wise distribution between the two groups who received isoamyl 2-cyanoacrylate tissue adhesive and conventional suture method. The mean age of the participants among the participants who received tissue adhesive was 32.9 years and among the participants who received conventional suture method was 33.28 years whereas in a similar study conducted in Coimbatore the mean age was 32.92 years and 32.56 years respectively.⁵ When it comes to gender distribution in our study it was seen that the participants who had received adhesive glue as treatment, 46% were males and the rest 54% were females and among the participants who had received conventional suture as treatment, 42% were males and the rest 58% were females, whereas in a similar study conducted in Coimbatore 60% were males and 40% were females among the participants who had received adhesive glue as treatment and 64% were males and 36% were females among those who had received conventional suture as a treatment group which showed slight difference.⁵ The sociodemographic differences like the age distribution and the gender distribution along with some investigation parameters like the haemoglobin, bleeding time, clotting time, blood urea levels and the serum creatinine levels showed very minimal or nil effects on the treatment outcome among the participants irrespective of the treatment choice and they had no role to play in the cosmetic outcome or the appearance of the secondary infection post closure of the surgical wound. Wound infection is one of the common complication that can be noticed after the closure of the surgical wound and the appearance of the secondary infection or complication depends on various factors. In our study it was seen that the appearance of the secondary infection among the participants who had received adhesive glue as treatment was about 2% whereas among the participants who had received conventional suture as treatment was 14% while in a similar study conducted in Davanagere on elective surgical closure methods it was seen that in both the choice of treatment the appearance of the complication rate was 4%, which was contradictory to our findings.⁶ In a similar study done in Mumbai it was seen that the wound infection rate was 4% among the participants who received adhesive glue and 8% among the participants who received suture method and the results were similar to our findings.⁸ In a study conducted in Hyderabad on use of cyanoacrylate as an alternate suture closure method, they stated that none of the participants developed wound infection among those who received adhesive glue where as 10% of them had developed wound infection among those who had received conventional suture method and their findings were similar to our study.⁷ Whereas in a similar study conducted in Bangalore on use of cyanoacrylate in paediatric lacerations they found out that there was no appearance of any wound infection among the participants in both groups.⁹ Few of the article have mentioned that the appearance of the wound infection rates was associated with the presence of co-morbidities like diabetes etc., but in our study none of the participants were having diabetes and any other such considerations of the presence of the co-morbidities were not taken into account. When it comes to the time taken for the wound to heal, in our study it was found out that the mean time required for the wound to heal was lesser among the participants who had received adhesive glue when compared to the participants who had received conventional suture method, the mean time required for the participants getting treated with the adhesive glue was 7.48 days and in the other group was 8.66 days. Similar findings was seen in a study conducted in Gujarat which showed us that the mean time required for the application of adhesive glue was lesser among those with the adhesive

glue treatment when compared to the suture method.¹⁰ Another study also showed similar results indicating that the time required for the application of the adhesive glue and also the time taken for the surgical wound to heal post application of the adhesive glue was lesser compared to those receiving suture method.¹¹ Similar trend was noticed among the participants receiving adhesive glue as wound closure technique compared to conventional suture method conducted in Japan.¹² In a review article on closure of cutaneous wound closure materials, they have mentioned that the application of adhesive glue reduces the time spent in operation room.¹³ A Hyderabad study showed us that the time taken for the wound to close with the use of adhesive glue was almost half when compared to the use of conventional suture method.⁷ A retrospective study conducted in China showed contradictory results compared to our study indicating that the duration of hospital stay was more among the participants who had received adhesive glue as treatment rather than the application of haemoclip.¹⁴ When it comes to cosmetic appearance our study showed us that the cosmetic appearance was better with the use of adhesive glue when compared to the use of conventional suture method and had early better results with the use of adhesive glue and similar results were seen in most of the studies. A study conducted in Coimbatore showed us that the cosmetic appearance was better with the use of adhesive glue when compared with the use of sub-cuticular suturing but the difference was not statistically significant.⁵ Study conducted in Madras Medical College, Chennai also opined that cosmetic appearance was better with the application of the adhesive glue compared to the application of the conventional sutures but was not statistically significant.¹⁵ A Gujarat study showed us that among those participants who had received adhesive glue 80% of the wounds had good cosmetic outcome and only 3.3% had poor outcome whereas with the use of conventional suture only 6.7% of them had good cosmetic outcome and 16.7% of them had poor outcome indicating similar results with comparison to our article.¹⁰ A Bangalore study indicated that the cosmetic appearance with the use of adhesive glue was better even after five months of the use when compared to other methods like the use of staples and suture method.¹¹ A study conducted in Dental college and hospital in Mumbai showed us that the cosmetic appearance was better with the application of adhesive glue which was quite similar to the findings of our study.⁹

Conclusion

Out of the 100 study participants, 50 of them received isoamyl 2-cyanoacrylate tissue adhesive for the closure of surgical wound and the remaining 50 of them received conventional suture. There was no much difference in the age distribution and gender distribution among the participants in both the groups. Even the values of various investigation parameters like haemoglobin, bleeding time, clotting time, blood urea and serum creatinine were similar between the groups.

References

1. Bailey & Love's Short practice of Surgery, 27th edition, 2018, 24-30, 84-9.
2. Luis Canedo-Dorantes and Mara Canedo-Ayala, Skin Acute Wound healing: A Comprehensive Review, International journal of inflammation, Volume 2nd June 2019, pdf.
3. Gonzalez AC, Costa TG, Andrade ZA, Medrado ARAP. Wound healing - A literature review. *An Bras Dermatol.* 2016; 91(5):614-20, pdf.
4. Esmailian M, Azizkhani R, Jangjoo A, Nasr M, Nemati S. Comparison of Wound Tape and Suture Wounds on Traumatic Wounds' Scar. *Adv Biomed Res* 2018; 7: 49, pdf.
5. Dhotre M, Chetan SV. A comparative study of isoamyl-2-cyanoacrylate (Novocryl) with subcuticular polyamide suture for surgical wound closure. *J.Evid.BasedMed.Healthc.* 2018; 5(29), 2184-2192, pdf.
6. Dr. KBC Sogi, Dr. Harish Patel BN, Dr. Kailas CT and Dr. RL Chandrasekhar. Wound

infection rate between isoamyl-2-cyanoacrylate and subcuticular polyamide suture for skin closure in elective surgical procedures. *International Journal of Surgery Science* 2019; 3(1): 214-217, pdf.

7. Vaaka PH, Patlolla BR, Donga SK, Ganapathi AK, Kurapati V. Cyanoacrylate: An alternative to silk sutures: A comparative clinical study. *J NTR Univ Health Sci* 2018; 7: 108-14.
8. Deolekar S, Thakur BA, Bairolia K. Comparison of conventional suturing and tissue adhesive (2-octyl cyanoacrylate) for port site skin closure in laparoscopic surgeries. *Int Surg J* 2017; 4: 204-8
9. 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: 49-54
10. Manza JT, Maisuria RS, Chaudhari DR, Dave DN, Gajra YB. 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.
11. Ananda BB, Vikram J, Ramesh BS, Khan HM. A comparative study between conventional skin sutures, staples adhesive skin glue for surgical skin closure. *Int Surg J* 2019; 6, 1-8
12. Muneharu Ando, et al,. Surgical site infection in spinal surgery: a comparative study between 2-octyl-cyanoacrylate and staples for wound closure. *Eur Spine J* (2014) 23: 854–862.
13. Luluah Al-Mubarak, Mohammed Al-Haddab. Cutaneous Wound Closure Materials: An Overview and Update. *Journal of Cutaneous and Aesthetic Surgery - Oct-Dec 2013, Volume 6, Issue 4*
14. Yu Jiang, Julong Hu, Ping Li, Wen Jiang, Wenyan Liang and Hongshan Wei. A Retrospective Analysis of Cyanoacrylate Injection versus Hemoclip Placement for Bleeding Dieulafoy's Lesion in Duodenum. *Gastroenterology Research and Practice, Volume 2018, 1-5*
15. Swaminathan SP, Jebasingh AV, Annadurai A, Mannan M. A study on comparison of conventional suturing and tissue adhesive (2-octyl cyanoacrylate) for skin closure in inguinal hernia surgeries. *Int Surg J* 2019; 6: 188-92