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Dr. KBC Sogi
Associate Professor of Surgery, Basaveshwara Medical College, Chitradurga, Karnataka, India

Dr. Pradeep Kumar J
Associate Professor of Surgery, P K DAS Institute of Medical Sciences, Vaniamkulam, Palakkad, Kerala, India

Dr. Kailas CT
Assistant Professor of Surgery, J. J. M. Medical College, Davangere, Karnataka, India

Dr. RL Chandrasekhar
Professor & HOD Department of Surgery, J.J.M. Medical College, Davangere, Karnataka, India

Correspondence
Dr. Pradeep Kumar J
Associate Professor of Surgery, P K DAS Institute of Medical Sciences, Vaniamkulam, Palakkad, Kerala, India

Isoamyl-2-cyanoacrylate with subcuticular polyamide suture for skin closure in elective surgical procedures: Comparison of cosmetic outcome

Dr. KBC Sogi, Dr. Pradeep Kumar J, Dr. Kailas CT and Dr. RL Chandrasekhar

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Abstract
The history of wound suturing reflects that of surgery itself. Wound treatment includes the technique of suturing as well as suturing materials. Of the above mentioned two, wound suturing plays a prominent role. Though the technique of suturing to close the dead space, to support and strengthen wounds until healing increases the tensile strength, to approximate skin edges for an aesthetically pleasing and functional result, and to minimize the risks of bleeding and infection, have remained the same. 50 patients (25 in each group) undergoing clean elective surgery with no focus of infection on the body admitted in the department of general surgery. This was a comparative study in which patients were studied in two groups. The mean cosmesis score at the end of one month was 5.92 for the adhesive glue group and 5.68 for the skin suturing group. Compared to the 7th day scores the difference between the two groups is further widened and infers a cosmetically better outcome for the adhesive glue group.

Keywords: Isoamyl-2-cyanoacrylate, subcuticular polyamide suture, cosmetic outcome

Introduction
Care of wound in its simplest form and based on the contemporary knowledge, evolved along with the evolution of mankind. From that time till date, enormous innovative measures and techniques in the management and closure of wounds have evolved [1]

The recorded history of wound closure is as old as that of medicine. The Edwin Smith Surgical Papyrus which was written in Egypt during the seventh century BC, was apparently an historical document when it was written, because it contained material dating back to 2500 to 3000 BC. Wound closure techniques have evolved a great deal from the earliest development of suturing materials. These evolutions have provided us variety of suture materials, absorbable ones, staples, tapes and adhesive compounds [1, 2].

The technique of suturing is thousands of years old. The history of wound suturing reflects that of surgery itself. Wound treatment includes the technique of suturing as well as suturing materials. Of the above mentioned two, wound suturing plays a prominent role. Though the technique of suturing to close the dead space, to support and strengthen wounds until healing increases the tensile strength, to approximate skin edges for an aesthetically pleasing and functional result, and to minimize the risks of bleeding and infection, have remained the same.

Wound treatments, suturing techniques and instruments that were developed in ancient India, Egypt and the Greek and Roman societies, strongly resemble those in our days. Hardly any progress is noted upto the nineteenth century. The Lister started in 1860. In the nineteenth century prototypes of mechanical suturing instruments (staplers) were developed. They were introduced into clinical practice in the early decades of the 20th century. The greatest progress in wound suturing started after World War II with the introduction of advanced semiautomatic stapler machinery and with the manufacture of synthetic non resorbable and resorbable fibres [3, 4]

The history of sutures begins more than 2000 years ago with the first records of eyed needles. The Indian plastic surgeon, Susruta (AD 380-450), described suture material made from flax, hemp and hair[2.] At that time, the jaws of the black ant were used as surgical clips in bowel surgery. In 30 AD, the Roman census again described the use of sutures and clips. In 150 AD Galen described the use of silk and catgut. Before the end of the first millennium, Avicenna described monofilament, with his use of pig bristles in infected wounds. Surgical and suture technique evolved in the late 1800s with the development of sterilization procedures.

The first synthetics were developed in the 1950s and further advancements have led to the creation of various forms. The different types of sutures offer different qualities in terms of handling, knot security, and strength for different purposes [5, 6].

Sutures can be divided into two categories, depending on whether they are composed of natural fibres or synthetic materials. Although natural fiber sutures have been used traditionally and have been largely effective for most surgical situations, the recently developed synthetics may be desirable for, among other reasons, reducing chronic tissue reactivity to foreign organic material [8, 1] This is particularly important when choosing an absorbable suture because, when using catgut, one must contend not only with an initial inflammatory reaction comparable to that of other sutures but also with a renewal of tissue reactivity when the catgut begins to be broken down and absorbed by the tissue [7, 8].

The choice of absorbable and nonabsorbable suture materials further divides the range of sutures available. The decision of whether to use absorbable or non-absorbable sutures depends upon a number of factors, including the rate at which the wounded tissue is likely to heal, the amount of stress and strain to which the wound site will be subjected over the course of healing, the potential for growth of the wound, and the question of whether the sutures need to be only temporary aids to healing or a means of permanent mechanical support [9].

Sutures are further classified as either monofilament or multifilament. Multifilament sutures can be either twisted or braided. In general monofilament sutures are advantageous because the multiple strands of multifilament sutures provide an environment for potential infection. Multifilament sutures, particularly in their braided form, also tend to be more vulnerable to shearing forces and thus are more susceptible to breakage [8, 3] Monofilament sutures, although less

susceptible to shear, can be damaged and weakened by the crimp of the forceps or other instruments and thus require careful surgical handling [8].

Tissue adhesives (A product made from synthetic material) and glues (A product made from naturally occurring material) in surgical practice fall into 3 categories: Biological[1] natural compound like fibrin, gelatin based, those of fibrin based glues function by reproducing the latter stage of normal clotting cascade leading to the formation of stable fibrin clot. These glues are used largely as haemostatic agents for bleeding surface and vascular Anastomosis. There is a wide range of fibrin product variety but in essence they fall into 2 types, two component fibrin and cryoprecipitate based glues, the composition of the two component type is basically the same, despite several different product proprietary names, the many different preparation vary in the source of the fibrinogen (usually human), the thrombin (usually bovine) [9-11]

Gelatin based glues provide alternative resorbable biological glues that have greater bonding strength than fibrin based glue, GRFG (gelatin & resorcinol & formaldehyde & gluataradehyde) was the first generation. The second generations of gelatin hydrogel glues are much less toxic as the formaldehyde has been substituted with other cross linking agents. Fibrin adhesives can be created from autologous sources of pooled blood. They are typically used for haemostasis and can seal tissues while they do not have adequate tensile strength to close skin. Commercial preparation such as tisseel and hemaseel are food and drug administration approved. Gelatin based glues are photo chemically activated surgical tissue 'bonding for soldering' technology involves using photo reactive gelatins and a water soluble dysfunctional macromer *polyethylene glycol diacrylate: PEGDA). Photoreactive groups e.g., fluorescein sodium salt, eosin Y, and rose Bengal) are incorporated in the gelatins, which are then suspended in a saline solution containing PEGDA forming a viscous. This forms an adhesive hydrogel within 1 minute when irradiated with the appropriate light. The resulting gel is tightly adherent to soft tissues such as the liver. Experimentally this photo curative gelatin glue has been used to seal effectively arteriotomies in canine abdominal or thoracic aortas. This glue has great potential application in laparoscopic surgery, as the percutaneous delivery of the glue followed by in situ photogelation will result in prompt, safe and effective hemostasis [10].

Methodology

50 patients (25 in each group) undergoing clean elective surgery with no focus of infection on the body admitted in the department of general surgery. This was a comparative study in which patients were studied in two groups. One group comprised of incision closure with subcuticular 3-0 polyamide suture material and the other group comprised of closure with 2 - octylcyanoacrylate adhesive glue. For all patients, subcutaneous sutures were applied to relieve tension, close dead space and appose wound edges, and then the wound was closed by subcuticular stitches using polyamide 3-0 or using Isoamyl-2-cyanoacrylate. The adhesive was applied in a single layer while keeping the two ends of the incised wound stretched using forceps. This will approximate the two edges of the incised wound. In each patient of both the groups, detailed history was taken and routine investigations like hemoglobin, total count, differential count, ESR, Blood sugar, bleeding time and clotting time were done. In appropriate cases care was taken to rule out any acute or chronic infection or malignancy through relevant investigations. Preoperative preparation of the patient was done on the previous evening of surgery. Same antibiotic protocol was followed in every case. In all the recruited patients Inj Cefrtiaxone 2gm IV was started one hour before surgery and repeated with 1gm IV at 8 hrs and 24 hrs post operatively.

Results

The patients in both the groups were randomly selected. There were 19 female and 31 male patients in the present study. In the adhesive glue group there were 15 male and 10 female patients. Subcuticular skin suturing group comprised of 16 male and 09 female patients.

Table 1: Mean age distribution among study groups

Group	No. of Patients	Mean Age	Std. Deviation	Min Age	Max Age
Adhesive Glue	25	32.92 Yrs	19.38	4	70
Subcuticular Skin Suturing	25	32.56 Yrs	16.40	27	65

The mean age in the adhesive glue group was 32.92yrs ± 19.3. The mean age in the subcuticular suture group was 32.56yrs ± 16.4. The above data can be graphically represented as follows.

Wound cosmesis score Wounds of patients in both the groups were assessed for cosmesis on 7th day, 1st month and 3rd month using Modified Hollander Cosmesis Scale which has 6 clinical

variables as step off borders, edge inversion, contour irregularities, excess inflammation, wound margin separation and good overall appearance. A total cosmetic score was derived by adding the scores of the variables. A score of 1 is given to each variable if not present in the wound. So a score of 6 was considered as optimal while 5 or less as suboptimal. Any complications if present were observed in both the groups.

Table 2: Comparison of post-operative wound cosmesis score

Time Days / Months	Type of material used	No	Mean	Std. Deviation	Min Score	Max Score	t Value	p Value
7th Day	Adhesive glue	25	5.84	0.4725	4	6	1.0955	0.3
	Subcuticular Skin suturing	25	5.68	0.5567	4	6		
1 Month	Adhesive glue	25	5.92	0.27676	5	6	1.6134	0.1
	Subcuticular Skin suturing	25	5.68	0.6903	4	6		
3 Month	Adhesive glue	25	6.00	0	6	6	1	0.36
	Subcuticular Skin suturing	25	5.92	0.27676	5	6		

It is observed that the cosmesis score on 7th day in both the groups is spread between a minimum of 4 and a maximum of 6. The Mean score for Adhesive glue group was 5.84 and the same for skin suturing group was 5.68 which is marginally less than the adhesive glue group. It is found that the values are statstically insignificant with a p value of 0.3.

The mean cosmesis score at the end of one month was 5.92 for the adhesive glue group and 5.68 for the skin suturing group. Compared to the 7th day scores the difference between the two groups is further widened and infers a cosmetically better outcome for the adhesive glue group. But again even this difference is not statistically significant with a p value of 0.1.

At the end of 3 months the mean cosmesis scores of adhesive glue group 6.00 and subcuticular skin suture 5.92(P=0.36).

Discussion

In the present study the mean age for skin suturing group was 32.9 years and the same for adhesive glue group was 32.5 years. This difference can be attributed to the process of random recruitment of patients to the groups. Further important age related diseases which interfere with wound healing like diabetes mellitus and malignancies were kept out of the study group.

In a study conducted by matin S.F. [12] in which 50 patient's wounds were closed with 2 – octylcyanoacrylate and 42 patients were closed with skin suturing, the mean age for glue closure was 52.5 years and the same for skin suturing was 51 years.

In the present study the sex ratio M: F of the entire study population was 1.63:1. The sex ratios M: F for adhesive glue group was 1.5:1 and the same for the skin suturing group was 1.76:1. The sex ratio in Matin. S.F.'s [12] study was very close to the ratio of the present study. Anyway the sex ratio is not thought to have any effect on the results as all the patients were randomly selected healthy adults.

Patients in both the groups were assessed for the cosmetic outcome of the wound on the 7th post-operative day, at the end of 1st month and at the end of 3rd month using Modified Hollander Cosmesis scale. Modified Hollander cosmesis scale has six variables and the absence of each variable in the wound gets 1 score. A score of 6 is considered optimal and a score of 5 and below is considered sub optimal.

On the 7th Post-operative day the mean cosmetic score for the adhesive glue group was 5.84 and the same for the suturing group was 5.68(P=0.3). This numerical difference is in favor of Adhesive glue but this difference was statistically not significant. At the end of one month the mean cosmetic score for the Adhesive glue group was 5.92 and the same for the suturing group was 5.68(P=0.1). As compared to the 7th day mean values there is further numerical widening of the 1st month mean cosmetic scores. At the end of 3 months the mean cosmesis scores for the two groups were very close, as close as 6 for the Adhesive glue group and 5.96(P=0.36) for the skin suturing group. At this stage even the numerical difference between the mean scores is not pleasing and can be ignored and concluded as similar outcome. In a study conducted by Jallali N. *et al*. [13] showed no significant difference in cosmesis. Adam J. Singer [14] *et al*. also concluded that there was no statistically significant difference in the cosmetic outcome between the two groups.

Conclusion

Octylcyanoacrylate provides an effective and reliable means of skin closure and yields similar cosmetic results as with subcuticular skin sutures.

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