Sutureless closure of Operative Skin Wounds

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Abstract

Good tissue union and cosmetically acceptable scar is vital for ideal surgical practice. Since their discovery in 1949, cyanoacrylate compounds have evoked interest as being the ideal “tissue glue”. Several different forms of this compound have been developed in order to eliminate tissue toxicity. In this article, we have described a technique of sutureless closure of operative skin wounds and compared it to closure of skin with silk. Inter-group comparison was carried out with respect to the time required for closure, rate of infection, cosmesis and patient acceptance. N-butyl 2-cyanoacrylate was used for sutureless skin closure in 100 patients and compared with skin closure with sutures. The time taken to close the wounds with cyanoacrylate was found to be significantly less, the cosmetic outcome better and patient acceptability higher than when sutures were used.

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Key Words : N-butyl 2-cyanoacrylate; Skin closure

Introduction

In modern times, with the advent of elective surgery, more energy has been directed at achieving an efficient and uncomplicated healing of the deliberately inflicted wound. “Never judge the surgeon until you have seen him closing the wound” is a saying attributed to Lord Moynihan. The surgical scar remains the only visible evidence of the surgeon’s skill and not infrequently, all of his efforts are judged on its final appearance. Advances in anaesthesia and surgery have not been paralleled by advances in wound care, which is an integral part of any surgical procedure. The method of skin closure generally used in surgery is with sutures which provide an extra source of contamination and are a potential source of foreign body reaction in the susceptible subcutaneous tissue [1]. This increases the complication rate besides being time consuming during application. To overcome these shortcomings, various methods of skin closure have been tried which include stapling and adhesive tapes, but none have been found to be effective.

Cyanoacrylates were first synthesized by Ardis in 1949 [2]. Cyanoacrylate derivatives are one of the series of homologous compounds known as alkyl cyanoacrylates. The adhesive property of cyanoacrylates is due to the fact that in monomer form the cyanoacrylates are liquids and upon contact with weak bases and water they quickly form a strong polymer bond and solidify. Coover et al [3] discovered the adhesive properties of cyanoacrylate adhesives and suggested their use as surgical adhesives. Methyl-2-cyanoacrylate (Eastman 910 monomer) was the first

cyanoacrylate derivative packaged and marketed as a surgical adhesive. Longer chain derivatives such as ethyl-2-cyanoacrylate (Krazy glue), isobutyl-2-cyanoacrylate (Bucrylate) and butyl-2-cyanoacrylate (Histoacryl) have subsequently been developed.

In this study, the aim was to compare the efficacy of cyanoacrylate and suture material in closure of operative skin wounds in terms of (i) the effectiveness of cyanoacrylate in closing operative skin wounds, (ii) comparison with efficacy of sutures in closing operative skin wounds in similar patient groups, (iii) advantages or disadvantages of use of cyanoacrylates in comparison to sutures in closure of such wounds and (iv) to compare the cosmetic result.

Material and Methods

The study was conducted over a two year period from April 1999 to March 2001. The study consisted of 100 patients, all of whom underwent elective surgical procedures barring 4 paediatric cases on whom the glue was applied for closure of facial lacerations after meticulous debridement and haemostasis in the emergency department. Table 1 gives the list of operative procedures undertaken. This group of patients was designated as group I. An age and sex matched control group was designated group II in whom the skin after operative procedures was closed with interrupted silk sutures.

Inclusion and exclusion criteria

Procedure wise sex distribution is given in Fig 1. Patients from the age group of one to 80 years were included in this study. All patients underwent elective surgery except 4 paediatric cases in whom closure of facial lacerations was done in emergency department. The wounds varied from 2 to 18 cm in length. Other factors influencing wound healing like

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Fig. 1 : Case profile

nutritional factors (anaemia, vitamin deficiencies, malnutrition) and other illnesses (jaundice, malignancy, uraemia) were taken into account while evaluating the results. The exclusion criteria consisted of wounds crossing muco-cutaneous junctions or joints and infected wounds.

Procedure of closing wounds

In group I, after achieving absolute haemostasis the wound was cleaned with a solution of povidone iodine and subcutaneous interrupted sutures were applied in all cases with chromic catgut of 2-0 or 3-0 size. After the above step the ends of the skin incision were held together by skin hooks or artery forceps. The assistant achieved approximation of the wound edges manually by holding the skin edges together by fingers or forceps. The glue was applied directly over the edges in droplet form taking care not to apply the glue between the wound edges. The flim of glue extended to at least 5 mm on either side of the healthy skin around the wound area. The wound was held together till it was dry to allow complete polymerization of the glue as was evident when the film of glue opacified. Time was measured from start of skin closure till its completion. Clean and dry dressing was applied to the wound and removed the next day. The glue was allowed to scale off gradually and only in some cases had to be removed with acetone. Postoperative antibiotics were given according to the requirement of the case. The wound was examined on 3rd and 7th postoperative day for evidence of infection viz. erythema surrounding the edges of the wound, pain or serous and seropurulent discharge from the wound. Resultant scar, for assessment of cosmetic outcome, was seen at 2 weeks, 4 weeks and 6 months. In control group (group II), all wounds were closed using 3-0 silk percutaneous interrupted sutures by the standard technique.

Result

A total of 100 patients were designated as group I and matched with a similar control group designated as group II. The age range of the patients was between one year and 80 years. In group I, of the total 100 patients, 74 were males and 26 females and the ratio was 1:3. Of the 100 patients whose wounds were closed with tissue adhesive (n-butyl 2-cyanoacrylate), results were found to be satisfactory. Compared to the suturing of skin, the glue was found to be easier and quicker to use. The mean time taken in the closure of various wounds is shown in Table 2. After proper statistical

analysis, the difference in the mean time taken in the closure of the wounds between group I and II was found to be significant.

All wounds were inspected daily for any evidence of wound infection. This was assessed by the presence of any erythema, serous or serosanguinous or frankly purulent discharge from the wound. The incidence of wound infection/dehiscence was also significantly lower in group I. The incidence of dehiscence in group I was 4% (4 out of 100 cases). The incidence of infection was 3% (3/100) as compared to 5% in case of group II. The incidence of infection is shown in Table 3. The incidence of infection in group I as compared to group II was not statistically significant ($p > 0.05$).

In most cases of cyanoacrylate closure the glue came off spontaneously after a period of 7-10 days. In 13 cases the glue did not come off and was removed by wiping with acetone solution after a period of 7 days. The cosmetic results

Table 1

Distribution of cases

Procedure	Number
Cholecystectomy	10
Appendicectomy	14
Thyroidectomy	6
Pyelolithotomy	6
Inguinal herniorrhaphy	31
Facial lacerations	4
Umbilical/Paraumbilical hernias	4
Prostatectomy	1
Herniotomy	10
Varicocoelectomy	3
Cervical rib excision	1
Orchidopexy	2
Ureterolithotomy	8
Total	100

Table 2

Time distribution of wound closure

Site of incision	Length of incision (cms)	T 1 (seconds)	T 2 (seconds)
Right subcostal	8-12	92+10.00	302+16.90
McBurney's	4-6	36+6.24	184+18.0
Suprasternal transverse	10-12	100+12.0	308+18.2
Lumbar	14-18	140+28	402+22.6
Inguinal	5-6	62+19.69	268+8.2
Midline	6-12	92+6.2	280+18
Infra-umbilical transverse	8	62+0	306+0

T1 - Mean time taken in skin closure in group I + SD

T2 - Mean time taken in skin closure in group II + SD

Table 3

Incidence of wound infection

Type of closure	No of cases	Wound infection	Percentage
Group I	100	3	3
Group II	10	5	5

achieved by closure with cyanoacrylate glue in group I were much better compared to conventional suture closure in group II. The scar seen at 15 and 30 days in the follow up visit of the patients was thin and supple. The patients were further followed for six months and the scars were cosmetically highly satisfactory at the end of this period. There was no cross hatching mark in group I. In group II there were gross cross hatching marks due to subtle inflammatory response hampering the cosmesis.

Patient acceptance was noteworthy in case of closure with cyanoacrylate glue. They reacted favourably to having their wound closed by the non suture technique. Pain and discomfort at the site of incision at rest and while routine activity like walking, sitting and lying down was considerably less as judged by the verbal response of the patients. All patients were spared of the fear and pain of suture removal. No skin reaction to the glue was noted in any case.

Discussion

Despite all advances in medical science, man continues his search for the ideal suture material. That suture closure of the wound results in increased incidence of infection in the wound was a fact recognized as early as 4000 years ago and its better cosmetic results were recognized by Ambrose Pare in the 16th century [4].

Cyanoacrylate adhesives are by no means new to the medical profession. They were first described in 1949 by Ardis [2] but their use in clinical setting was first described by Coover et al [3]. Short alkyl chain cyanoacrylates-methyl cyanoacrylates-were associated with tissue toxicity and the longer chain n-2 butyl cyanoacrylates are better alternatives in that respect. Heiss et al [5] reported that the tensile strength of skin approximated with conventional sutures is inferior to that bonded with cyanoacrylate tissue adhesives.

Cyanoacrylate tissue adhesives have been extensively used in the closure of extremity wounds in paediatric emergency department [6,7]. Cyanoacrylate tissue adhesive was found to be an effective alternative replacing skin sutures on virtually all facial lacerations and was also employed in low-skin tension wound management in children. They found in their study that closing surgical wounds with cyanoacrylates takes significantly less time, had a lesser rate of infection and better cosmetic results with better acceptance by patients due to lesser pain and discomfort during routine activity in the postoperative period [8].

There are varying reports regarding the antibacterial properties of cyanoacrylate glue. The glue has bacteriostatic effect against Gram positive bacteria while no activity has been reported against Gram negative bacteria [9]. There have been no reports of any carcinogenic effects.

In this study, it has been observed that the efficacy of cyanoacrylate glues in the closure of surgical wounds is comparable to the previously quoted studies. Comparison with suture closure of incised surgical wounds shows cyanoacrylate glue to be much superior in all aspects. The time taken in closure of variously sized wounds is much less compared to conventional closure technique. The cosmetic results are much better in that the scar is thin and there is no cross hatching. There is also a lower incidence of infection, owing to the antibacterial properties of the glue.

The closure with tissue adhesive of operative wounds is indicated in all primary wound closures and especially so in lacerated wounds in the paediatric age group after meticulous debridement and haemostasis in emergency department. However, the method is not recommended for closure of moist surfaces.

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