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"COMPARATIVE STUDY OF PRIMARY SKIN CLOSURE WITH ADHESIVE SKIN GLUE AND CONVENTIONAL SUTURE MATERIAL IN CLEAN ELECTIVE SURGERY"

BY

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DOING POST GRADUATION IN M.S GENERAL SURGERY

UNDER THE GUIDENCE OF

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is a bonafide research work done by

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in partial fulfillment of the requirement for the degree of

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Date: *Signature of the Candidate*

Place :Kolar *Dr. Anantha Raju G S*

DEDICATED TO,

MY FATHER

LATE DR. SATHYANARAYANA SETTY G.A,

ALL MY TEACHERS ...,

MY MOTHER, MY SISTER..,

MY FIANCÉE, HER FAMILY AND MY ENTIRE FAMILY..,

MY COLLEAGUES..,

LIST OF ABBREVIATION

1) ADP – Adenosine diphosphate

2) C3a - Plasma-activated complements and

3) C5a - Plasma-activated complements

4) DF - Degrees of Freedom

5) ESR – Erythrocyte Sedimentation Rate

6) GAGs – Glycosaminoglycans

7) FGF - Fibroblastic growth factor

8) HIV – Human Immunodeficiency Virus

9) IL-1 - Interleukin-1

10) PDGF - Platelet-derived growth factor

11) PMN - Polymorphonuclear leukocytes

12) RBS – Random Blood Sugar

13) TGF-a - Transforming growth factor alpha

14) TGF-b - Transforming growth factor beta

15) TNF - Tumor necrosis factor

16) VAS - Visual Analog Scale

ABSTRACT

INTRODUCTION

Wound closure techniques have evolved overtime from natural suturing materials to synthetic sutures, absorbable sutures, staples, tapes, and adhesive compounds.

A new technology is surgical adhesives, exemplified by Cyanoacrylate that could provide patients with the option of suture less skin closure[3,4].

AIMS AND OBJECTIVES

(i) To compare the time efficacy between the application of adhesive skin glue and conventional suturing.

(ii) To compare the post operative pain in patients undergoing adhesive glue skin closure and conventional suturing.

(iii) To compare the cosmetic appearance and complications of skin closure by adhesive glue and conventional suturing.

MATERIAL AND METHOD

This is a comparative study in which 100 patients will be studied in two groups, 50 patients in Adhesive glue group and 50 patients in Subcuticular suturing group. Every case in both the groups will be investigated for any acute or chronic infections and malignancy. Informed consent will be taken for the study. Same antibiotic protocol is followed; Injection Cefazolin 1gm single dose given intravenously at the time of anaesthesia.

In both the groups, subcutaneous suturing is done before the closure of skin. Adhesive skin glue is applied in 3 layers over the operated wound in one group of patients, and subcuticular suturing by nylon (ethilon 2-0) is done for the other group.

RESULTS

The wounds were assessed at 3rd, 5th, 7th post-operative days, 1st month and 3rd months post op using ASEPSIS score. Maximum number of complications (such as Seroma, Erythema, Discolouration and Wound dehiscence) were noted in Skin suturing group (16% -8 cases). In Adhesive glue group 8% (4 cases) of complications were observed. The wounds were assessed for Cosmesis on 7th post-operative day using Modified Hollander Cosmesis Scale and in the follow-up of 1st month and 3rd month, the Wound cosmesis was assessed by an independent observer and was scored in Visual Analogue Scale from 0 to 100. Adhesive Glue group had better cosmetic results compared to Subcuticular skin closure group.

CONCLUSION

The results from the present study show that the 2-octylcyanoacrylate adhesive glue skin closure is better than subcuticular skin closure.

The use of adhesive glue takes lesser time for skin closure and results in shorter operative period. It forms a flexible, water resistant sealed skin closure and gives better cosmetic outcome.

The postoperative pain is much less compared to traditional skin suturing techniques. The adhesive glue disappears naturally as incision heals and leaves no mark. It is non-irritant to skin and complications following adhesive glue application are extremely less.

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INTRODUCTION

The history of wound closure is as old as that of medicine. The recorded history of wound closure is found in Edwin Smith Surgical Papyrus, which was written in Egypt dating back to 2500 to 3000 BC [1,2].

Wound closure techniques have evolved overtime from natural suturing materials to synthetic sutures, absorbable sutures, staples, tapes, and adhesive compounds.

A new technology is surgical adhesives, exemplified by Cyanoacrylate that could provide patients with the option of suture less skin closure[3,4]. At present, 2-Octylcyanoacrylate has replaced, 2-Butylcyanoacrylate, as skin adhesive[7]. The polymer 2-octyl cyanoacrylate was formulated to correct some of the deficiencies of the shorter-chain cyanoacrylate derivatives. As an 8-carbon alkyl derivative, this polymer should be less reactive than the shorter chain derivatives[8,9]. The slower degradation of the octyl derivatives may result in lower concentrations of the cyanoacrylate polymer by-products in surrounding tissues, resulting in less inflammation. Additionally, plasticizers are added to produce a more pliable and tissue-compatible product that flexes with the skin and remains inherent for longer periods of time[10]. The 3-dimensional breaking strength of 2-octyl cyanoacrylate is 3 times that of butyl-2 cyanoacrylate. This stronger flexible bond may allow its use on longer incisions.

Traditionally, needle skin suturing with suture material is used because of cost-effectiveness. Nowadays surgeons are looking for faster, comfortable and cosmetically better techniques for skin closure, and 2-

octylcyanoacrylate probably offers these qualities since it is easier to use and provides a flexible, water resistant, sealed skin closure[11]. 2-octylcyanoacrylate provides a needle-free method of wound closure, an important consideration because of blood-borne viruses (e.g., HIV)[12,13]. It requires no bandaging due to its antimicrobial properties. From the patient's view, it gives less pain during post operative period, he or she can even have a shower, needs no suture or staple removal, disappears naturally as incision heals, leaves comparatively very less mark[14].

In traditional skin closure with suture material, patients experience more pain during post operative period, cannot have a shower; have to come for suture removal. Even after healing, there will be track marks of suture. Chances of wound infection are also higher[15, 16, 17].

The history of wound suturing reflects that of surgery itself. In wound treatment, which encloses the technique of suturing as well as suturing materials, wound suturing plays a prominent role. The technique of suturing is thousands of years old. Although suture materials and aspects of the technique have changed, the goals remain the same: closing dead space, supporting and strengthening wounds until healing increases their tensile strength, approximating skin edges for an aesthetically pleasing and functional result, and minimizing the risks of bleeding and infection.

In ancient India, Egypt, Greek and Roman societies, wound treatment as well as suturing techniques and instruments were developed that strongly resemble the ones of the present days. Hardly any progress is made till the nineteenth century. It started with the improvement of catgut by Lister in 1860. In the 19th century prototypes of mechanical

suturing instruments (staplers) were developed[18, 19, 20]. 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.

The history of sutures began more than 2,000 years ago with the first records showing eyed needles. The Indian plastic surgeon, Susruta (AD 380- 450), described suture material made from flax, hemp, and hair. At that time, the jaws of the black ant were used as surgical clips in bowel surgery[21]. In 30 AD, Celsus of Rome again described the use of sutures and clips, and Galen further described the use of silk and catgut in 150 AD. Before the end of the first millennium, Avicenna described usage of monofilament pig bristles in infected wounds[22]. Surgical and suture techniques 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.

Figure – 1 : Adhesive Glue

Figure – 2 : Adhesive Glue Vial

The cyanoacrylates first were synthesized in 1949 by Airdis. Coove et al and they described their adhesive properties and suggested their possible use as surgical adhesives. In the early 1960s, various surgical applications were investigated for these adhesives. Cyanoacrylates can be synthesized by reacting formaldehyde with alkyl cyanoacetate to obtain a prepolymer that, by heating, is depolymerized into a liquid monomer. The monomer then can be modified by altering the alkoxycarbonyl (-COOR) group of the molecule to obtain compounds of different chain lengths[23]. Upon application to living tissues (water or base), the monomer undergoes an exothermic hydroxylation reaction that results in polymerization of the adhesive. The shorter-chain derivatives tend to have a higher degree of tissue toxicity than the longer-chain derivatives[24].

Cyanoacrylates, very simplistically may be defined as solvent free, synthetic adhesives. They are reactive monomer liquids that polymerize into a film when initiated by moisture or certain chemicals. A key

property of cyanoacrylates is that the monomer liquid actually polymerizes directly on the surface where it is applied, creating a high quality and very tenacious polymer film. Cyanoacrylates typically fix within a minute and achieve full bond strength in 24 hours[25, 26].

Figure – 3 : Application of Adhesive Glue

The engineering of sutures with synthetic material along with standardization of traditional materials (eg. catgut, silk) has created superior aesthetic results. Similarly, the creation of natural glues, surgical staples, and tapes as substitute for sutures has supplemented the armamentarium of wound closure techniques. Aesthetic closure is based on knowledge of healing mechanisms.

Choosing the proper materials and wound closure technique ensures optimal healing. 2-Octyl Cyanoacrylate is the latest skin adhesive glue, used for faster skin closure. So it is essential to do a comparative study of the two techniques of skin closures.

2-Octylcyanoacrylate adhesive polymerizes through an exothermic reaction in which a small amount of heat is released. With the proper technique of applying adhesive in multiple thin layers (at least three) onto a dry wound and allowing time for polymerization between applications, heat is released slowly and the sensation of heat or pain experienced by the patient is minimized. If adhesive is applied so that large droplets of liquid are allowed to remain unspread, the patient may experience a sensation of heat or discomfort. Extra caution should be taken to avoid depositing any adhesive in the wound; the adhesive will not seep into the wound since it starts to polymerize instantaneously. A common mistake is to inadvertently deposit the adhesive in the wound by pushing the tip of the vial into the wound and separating the wound edges[27].

AIMS AND OBJECTIVES

OBJECTIVES OF THE STUDY:

(i) To compare the time efficacy between the application of adhesive skin glue and conventional suturing.

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REVIEW OF LITERATURE:

ANATOMY OF SKIN:

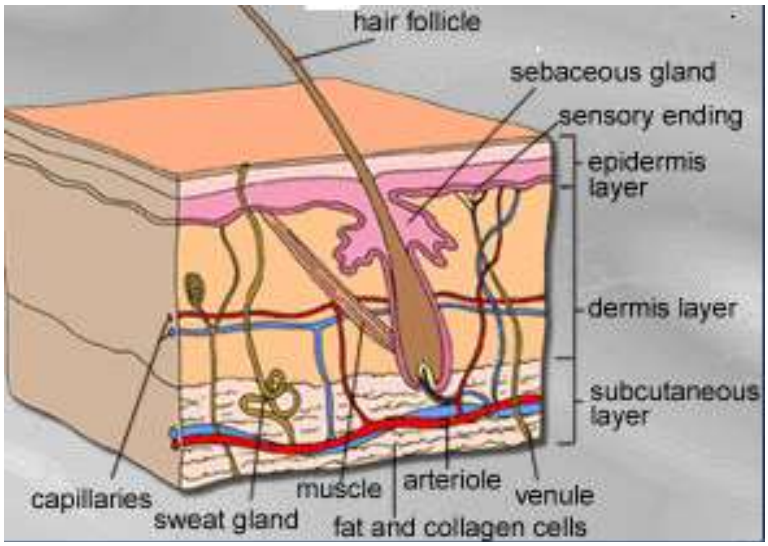

Figure – 4 : Anatomy of Skin

Skin is comprised of three layers[28]

(i) The epidermis (or outermost layer),

(ii) The dermis, and

(iii) The subcutaneous tissue.

Each strata plays a critical role.

Epidermis: Less than a millimeter thick, the epidermis is composed of three types of cells, the most populous of which are the moisture-rich keratinocytes. As these keratinocyte cells migrate up towards the skin surface from the base of the epidermis where they are produced, they lose water, begin to harden, and eventually die. The dead keratinocytes are then integrated into our sebum or surface skin oil and form the outermost protective layer of the epidermis (the stratum corneum)until they are eventually sloughed off and replaced.

In addition to keratinocytes, the epidermis also contains melanocytes, which produce the melanin pigment responsible for skin colour; and langerhans cells, which are part of the immune system, act as a defence against pathogens encountered in the epidermis.

Dermis: Just beneath the epidermis is the dermis, the thickest of the skin's three layers. The primary cells at work here are called fibroblasts. They maintain the dermis network of collagen and elastin proteins, which, in turn, form the structure of the skin and give it its elasticity and resilience. Besides the dermis's nourishing system of tiny capillaries and langerhans- producing lymph nodes, it is also home of the sebaceous glands. These glands generate the protective sebum that travels via tiny hair follicles from the dermis to the epidermis where it lubricates and protects the skin surface.

Subcutaneous Tissue: Composed primarily of adipocyte fat cells, the innermost layer of the skin is the subcutaneous tissue and is largely responsible for providing insulation and padding, as well as housing sweat glands and a system of tiny muscles connected to the hair follicles. Cutaneous vessels ultimately arise from underlying named source vessels. Each source vessel supplies a 3-dimensional vascular territory from bone to skin, termed an angiosome. Adjacent angiosomes have vascular connections via reduced calibre (choke) vessels or similar calibre anastomotic vessels.

The dermis contains horizontally arranged superficial and deep plexuses, which are interconnected via communicating vessels oriented perpendicular to the skin surface. Cutaneous vessels ultimately anastomose with other cutaneous vessels to form a continuous vascular network within the skin[29].

Surgical Wound Classification

Wound Class	Definition	Examples	Reminders
Class I **Clean**	▸ Operative wound clean ▸ Non-traumatic, with no inflammation encountered ▸ No break in technique ▸ Respiratory, gastrointestinal and genitor-urinary tracts not entered ▸ Caesarean Section, elective, no pre-rupture of membranes or trial of labor	▸ Vascular Procedures ▸ Neurological procedures (inflamed II, infected III) ▸ Endocrine procedures ▸ Eye surgery (inflamed II, foreign body III, infected III) ▸ Orthopedic procedures (unless: trauma III, old wound IV, amputation II) ▸ Penile prosthesis ▸ Skin (mastectomy, lumpectomy, lesions, lipoma, cosmetic, I&D IV, old wounds III, inflamed III, infected IV) ▸ Exploratory Lap (no bowel involvement II) Miscellaneous procedures (lymph node excision/Bx unless inflamed III or infected IV, splenectomy, tenckhoff cath unless replacement II)	
Class II **Clean - contaminated**	▸ Operative wound clean-contaminated ▸ Non-traumatic wound with minor break in technique ▸ Gastrointestinal, respiratory or genitor-urinary tracts entered without significant spillage Includes: o Transection of appendix or cholecystic duct in the absence of infected bile or urine o Hysterectomy o Caesarean Section, emergency involving pre-rupture of membranes and / or trial of labor	▸ Thoracic procedures (except mediastinoscopy I, inflammation III, infected IV, foreign body III) ▸ GI procedures (including: laparoscopy, colonoscopy, gastroscopy) (gross spillage III, acute inflammation III, fresh accidental wound III) (itis III, Lithiasis II) ▸ GU procedures (infected III) ▸ Ear surgery (infected III) ▸ Nose/Oropharynx procedures (infected IV) ▸ GYN procedures (Oophorectomy I, inflamed III, infected IV)	▸ Any wound open for drainage II (except total hip / knee) ▸ Removing old implants (wires, pins, etc...) ▸ Re-operation at the same site
Class III **contaminated**	▸ Operative wound contaminated ▸ Fresh traumatic wound from clean source ▸ Operative wound with a major break in technique ▸ Gross spillage from the gastrointestinal tract ▸ Entrance into the genito-urinary or biliary tracts ▸ When infected urine or bile is present ▸ Incision encountering acute non-purulent inflammation.	▸ Inflammation ▸ Gross spillage ▸ Fresh accidental wound	▸ Foreign bodies in a wound (bullets, etc...)
Class IV **Dirty - infected**	▸ Operative wound dirty ▸ Traumatic wound from dirty source ▸ Traumatic wound with delayed treatment ▸ Fecal contamination ▸ Foreign body ▸ Retained devitalized tissue ▸ Operative wound w/ acute bacterial inflammation or perforated viscus ▸ Operative wound where clean tissue is transected to gain access to a collection of pus	▸ Infected ▸ I&D abscess ▸ Wound debridement	
Unclassified	▸ When unable to classify accurately an operative wound		▸ Communicable disease (aids, hepatitis, TB) is not classified the surgical wound is what is being classified

Figure - 5 : Classification of surgical wounds according to risk of infection[30,31]

Wound Healing: Wound healing is a complex and dynamic process with the wound environment changing with the changing health status of the individual. It is a complex series of events that begins at the moment of injury and can continue for months to years. Tremendous advancements have been made in understanding the processes of wound healing. The cell types and the order in which they appear in the wound have been established; many growth factors and their functions have been elucidated.

An incision created by a scalpel, trauma resulting from a bullet, or tissue death caused by myocardial infarction all undergo a similar and predictable reparative process[32].

The 3 categories of wound closure are primary, secondary, and tertiary[33]. Primary healing involves closure of a wound within hours of its creation, for example, repairing a full-thickness surgical incision.

Secondary healing involves no formal wound closure; the wound closes spontaneously by contraction and reepithelialization. Secondary healing results in an inflammatory response that is more intense than with primary wound healing. In addition, a larger quantity of granulomatous tissue is fabricated because of the need for wound closure. Secondary healing results in pronounced contraction of the wounds.

Tertiary wound closure, also known as delayed primary closure, involves initial debridement of the wound for an extended period and then formal closure with suturing or by another mechanism. This type of healing may be desired in the case of contaminated wounds. By the fourth day, phagocytosis of contaminated tissues is well underway, and the processes of epithelization, collagen deposition, and maturation are occurring[34].

Phases of wound healing have been identified and studied at cellular and molecular level.

These 4 distinct phases[35] are,

1. Hemostasis
2. Inflammation,
3. Tissue formation, and
4. Tissue remodelling

Hemostasis:

It depends on an elaborate cascade of growth factors and cellular components interacting in a directed manner to achieve wound closure. The cascade of vasoconstriction and coagulation commences with clotted blood immediately impregnating the wound, leading to haemostasis. Following vasoconstriction, the initial injury leads to the recruitment of inflammatory cells into the wound, platelets adhere to damaged endothelium and discharge adenosine diphosphate (ADP), promoting thrombocyte clumping, which dams the wound. The inflammatory phase is initiated by the release of numerous cytokines by platelets.

Alpha granules liberate platelet-derived growth factor (PDGF), platelet factor IV, and transforming growth factor beta (TGF-b), while vasoactive amines such as histamine and serotonin are released from dense bodies found in thrombocytes. PDGF is chemotactic for fibroblasts and along with TGF-b is a potent modulator of fibroblastic mitosis, leading to prolific collagen fibril construction in later phases.

Fibrinogen is cleaved into fibrin and the framework for completion of the coagulation process is formed. Fibrin provides the structural support for cellular constituents of inflammation. This process starts immediately after the insult, once a clot forms in response to disrupted blood vessels. This scenario entails a complex interaction between local tissue mediators and cells that migrate into the wound.

Inflammatory phase:

Within the first 6-8 hours, the next phase of the healing process is underway, with polymorphonuclear leukocytes (PMNs) engorging the wound. TGF-b facilitates PMN migration from surrounding blood vessels where they extrude themselves from these vessels. These cells "cleanse" the wound, clearing it of debris. The PMNs attain their maximal numbers in 24-48 hours and commence their departure by 72 hours. Other chemotactic agents are released, including fibroblastic growth factor (FGF), transforming growth factors (TGF-b and TGF-a), PDGF and plasma-activated complements C3a and C5a (anaphylactic toxins). They are sequestered by macrophages or interred within the scab or eschar.

As the process continues, monocytes also exude from the vessels. These are termed macrophages. The macrophages continue the cleansing process and manufacture various growth factors during days 3-4. The macrophages orchestrate the multiplication of endothelial cells with the sprouting of new blood vessels, the duplication of smooth muscle cells, and the creation of the milieu created by the fibroblast. Many factors influencing the wound healing process are secreted by macrophages. These include TGFs, cytokines and interleukin-1 (IL-1), tumor necrosis factor (TNF) and PDGF.

The inflammatory phase occurs in the first few days as inflammatory cells migrate into the wound. Migration of epithelial cells has been shown to occur within the first 12-24 hours, but further new tissue formation occurs over the next 10-14 days.

Granulation Phase:

This phase consists of different sub phases. These sub phases do not happen in discrete time frames but constitute an overall and ongoing process. The sub phases are fibroplasia, matrix deposition, angiogenesis and re-epithelialization.

In days 5-7, fibroblasts have migrated into the wound, laying down new collagen of the subtypes I and III. Early in normal wound healing, type III collagen predominates but is later replaced by type I collagen.

Tropocollagen is the precursor of all collagen types and is transformed within the cell's rough endoplasmic reticulum, where proline and lysine are hydroxylated. Disulfide bonds are established, allowing 3 tropocollagen strands to form a triple left-handed triple helix, termed procollagen. As the procollagen is secreted into the extracellular space, peptidases in the cell wall cleave terminal peptide chains, creating true collagen fibrils. The wound is suffused with GAGs and fibronectin produced by fibroblasts. These GAGs include heparan sulfate, hyaluronic acid, chondroitin sulfate, and keratan sulfate. Proteoglycans are GAGs that are bonded covalently to a protein core and contribute to matrix deposition[36,37].

Angiogenesis is the product of parent vessel offshoots. The formation of new vasculature requires extracellular matrix and basement membrane degradation followed by migration, mitosis, and maturation of endothelial cells. Basic FGF and vascular endothelial growth factor are believed to modulate angiogenesis.

Re-epithelization occurs with the migration of cells from the periphery of the wound and adnexal structures. This process commences with the spreading of cells within 24 hours. Division of peripheral cells occurs in hours 48-72, resulting in a thin epithelial cell layer, which bridges the wound. Epidermal growth factors are believed to play a key role in this aspect of wound healing.

Epithelialization and neovascularization result from the increase in cellular activity. Stromal elements in the form of extracellular matrix materials are secreted and organized. This new tissue, called granulation tissue, depends on specific growth factors for further organization to occur in the completion of the healing process. This physiologic process occurs over several weeks to months in a healthy individual.

Remodelling Phase:

Finally, tissue remodelling, in which wound contraction and tensile strength is achieved, occurs in the next 6-12 months. After the third week, the wound undergoes constant alterations, known as remodelling, which can last for years after the initial injury occurred. Collagen is degraded and deposited in an equilibrium producing fashion, resulting in no change in the amount of collagen present in the wound. The collagen deposition in normal wound healing reaches a peak by the third week after the wound is created. Contraction of the wound is an ongoing

process resulting in part from the proliferation of the specialized fibroblasts termed myofibroblasts, which resemble contractile smooth muscle cells. Wound contraction occurs to a greater extent with secondary healing than with primary healing. Systemic illness and local factors can affect wound healing[38].

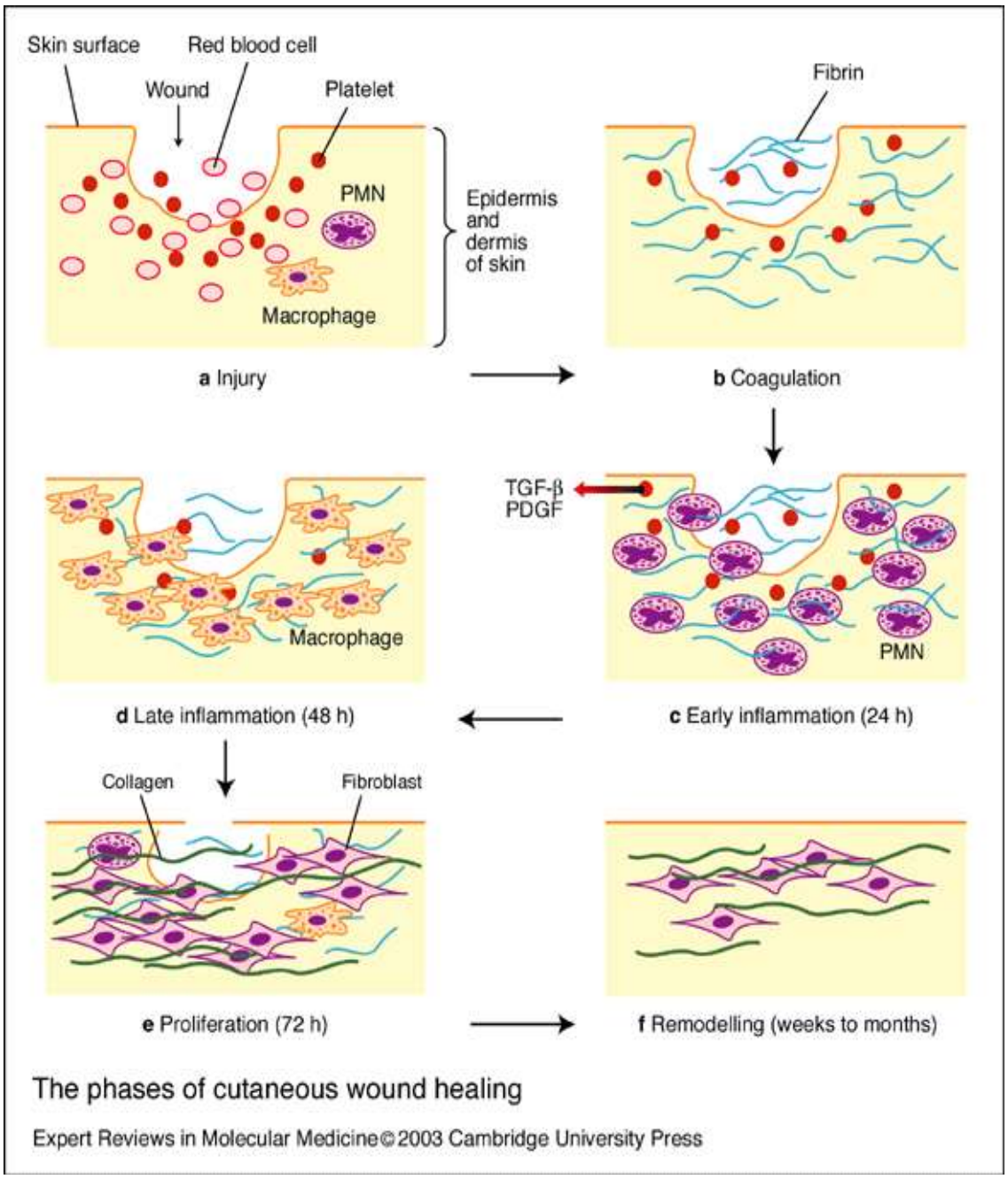

Figure – 6 : Phases of Wound Healing[39]

Suture	Type	Raw material	Tensile strength retention	Mass absorption rate	Contra-indications	Frequent uses
Poliglecaprone	Absorbable monofilment	Copolymer of glycolide and caprolactone	21 days	90–120 days	Should not be used in neural tissue, cardiovascular, microsurgery, ophthalmology (except strabismus) or where extended support is required.	Subcuticular skin suturing, ligation, gastrointestinal, muscle.
Silk	Non-absorbable braided	Natural protein fibre of raw silk spun by silk worm	Loses most or all in about one year	Usually cannot be found after about two years	Should not be used for placement of vascular prostheses or artificial heart valves.	Most body tissues for ligation and suturing; general surgery; ophthalmology.
Polyester	Non-absorbable braided	Man-made	Indefinite	Non-absorbable; remains encapsulated in body tissues	None	Cardio-vascular; general surgery; retention.
Braided polyamide	Non-absorbable braided	Polyamide polymer	Loses 15–20% per year	Degrades at a rate of about 15-20% per year	None	Most body tissues for ligating and suturing; general closure; neurosurgery.
Monofilament polyamide	Non-absorbable monofilment	Polyamide polymer	Loses 15–20% per year	Degrades at a rate of about 15-20% per year	None	Skin closure; retention; plastic surgery, ophthalmology.
Polypropylene	Non-absorbable monofilment	Polymer of propylene	Indefinite	Non-absorbable; remains encapsulated in body tissues	None	General; plastic; cardiovascular; skin closure, ophthalmology.

Figure – 7 : Types of Suture Materials[40,41,42]

Silk

Silk was first widely used as a suture material in the 1890s. It is a braided material formed from the protein fibres produced by silkworm larvae. Although silk is considered a non absorbable material, it is gradually degraded in tissue over 2 years. Silk has excellent handling and knot-tying properties and is the standard to which all other suture materials are compared. Its knot security is high, tensile strength low, and tissue reactivity high. Suture removal can be difficult and painful because the braided material becomes infiltrated with cells and encrusted with debris while the sutures are implanted in the skin[43].

Nylon

Introduced in 1940, nylon was the first synthetic suture available, and it is the most commonly used nonabsorbable material in dermatologic surgery. It is available in both monofilamentous and multifilamentous forms. Nylon has a high tensile strength, and, although it is classified as nonabsorbable, it loses tensile strength when buried in tissue. Multifilamentous forms retain no tensile strength after being in tissue for 6 months, whereas monofilamentous forms retain as much as two thirds of their original strength after 11 years. Monofilament nylon is stiff; therefore, handling and tying are difficult and knot security is low. The suture also may cut easily through thin tissue[44].

Multifilamentous forms have better handling properties but greater tissue reactivity. Monofilament nylon is relatively inexpensive and available as black, green, or clear. Although its greatest use is as a percutaneous suture, because of its low tissue reactivity, nylon (clear) can be used as a buried suture in situations in which prolonged dermal support is necessary[45].

Polypropylene

Polypropylene (Prolene; Ethicon) is a monofilament synthetic suture that was introduced in 1962. Its tensile strength is lower than that of the other synthetic nonabsorbable sutures. Its handling, tying, and knot security are poor as a result of its stiff nature and high memory. An additional throw is needed for adequate knot security. A method to improve security is the use of thermocautery to fuse the knots or transform the ends into small beads. Tissue reactivity is extremely low for polypropylene, and, unlike nylon, gradual absorption does not occur if it is buried in tissue. As a result, polypropylene is an excellent choice for a buried suture for longterm dermal support[46].

It is a plastic suture that accommodates tissue swelling; therefore, the likelihood of it cutting through the tissue and causing crosshatching is less than that of other materials, easily slides through tissue; this characteristic makes it the suture of choice for a running subcuticular closure.

Cyanoacrylate

Cyanoacrylate (Dermabond) is applied in a thin layer over the entire wound and extending 5-10 mm beyond the wound edge. The formation of the bond produces heat that the patient can feel. Once the layer is dried (10-30 seconds), a second layer is applied. Three to 4 layers are necessary. No additional bandaging is required, and the patient is advised to not perform wound care at home. By 7-14 days, most of the adhesive sloughs with the epidermis, and the remainder may be removed with soap and water or petroleum jelly[47].

Dermabond is quick and easy to apply; only one tenth to one fourth of the time required for suture placement is needed. It provides an antimicrobial and waterproof coating, but repeated washing removes the adhesive in a few days. The cosmetic outcome generally is good, and no postoperative visit is required for its removal.

MATERIALS AND METHODS:

Source of data:

Patients undergoing clean elective surgery with no focus of infection admitted in the department of General Surgery in Sri.R.L.Jalappa hospital and Research centre and attached hospitals, Kolar from December 2010 to December 2012.

Method of collection of data:

This is a comparative study in which 100 patients will be studied in two groups, 50 patients in Adhesive glue group and 50 patients in Subcuticular suturing group. Every case in both the groups will be investigated for any acute or chronic infections and malignancy. Informed consent will be taken for the study. Same antibiotic protocol is followed; Injection Cefazolin 1gm single dose given intravenously at the time of anaesthesia.

In both the groups, subcutaneous suturing is done before the closure of skin. Adhesive skin glue is applied in 3 layers over the operated wound in one group of patients, and subcuticular suturing by nylon (ethilon 2-0) is done for the other group.

Figure – 8 : Method of application of skin adhesive glue.

Figure – 9 : Method of subcuticular closure

In both the groups, the time taken for skin closure is noted and, the post-operative pain is assessed at 24hours, 72hours, 7th day, 1st month and 3rd month using Visual Analogue Scale[48,49,50] of 0 to 100, as rated by patients themselves.

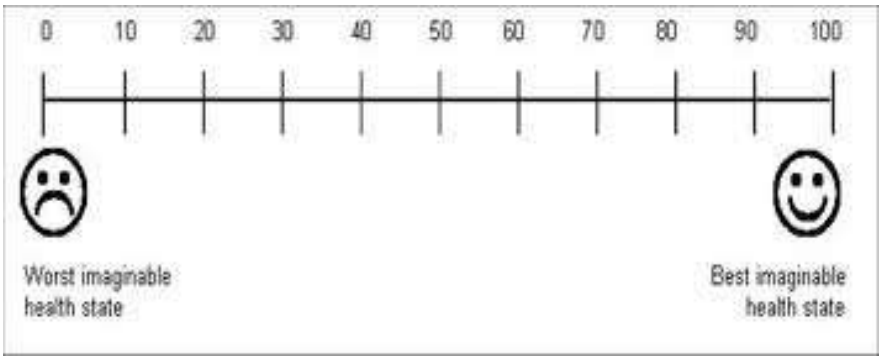

Figure – 10 : Visual Analogue Score

The outcome of wound is assessed at 3rd, 5th, 7th post-operative days and 1st month using ASEPSIS[51, 52] score.

ASEPSIS wound score

	Proportion of wound affected					
Wound characteristic	0	<20	20-39	40-59	60-79	>80
Serous exudate	0	1	2	3	4	5
Erythema	0	1	2	3	4	5
Purulent exudate	0	2	4	6	6	10
Separation of deep tissues	0	2	4	6	6	10

Points are scored for daily wound inspection.

Criterion	Points
Additional treatment:	
Antibiotics	10
Drainage of pus under local anaesthesia	5
Debridement of wound (general anaesthesia)	10
Serous discharge*	daily 0-5
Erythema*	daily 0-5
Purulent exudate*	daily 0-10
Separation of deep tissues*	daily 0-10
Isolation of bacteria	10
Stay as inpatient prolonged over 14 days	5

* Given score only on five of seven days. Highest weekly score used

Category of infection: total score 0-10 = satisfactory healing; 11-20 = disturbance of healing; 20-30 = minor wound infection; 31-40 = moderate wound infection; >40 = severe wound infection.

Figure – 11 : ASEPSIS wound score

Any complications, if present are also observed in both the groups. On the follow-up at 1st month and 3rd month, the Wound cosmesis is assessed by ward nurse, who has been trained on commenting on wound cosmesis using Visual Analog Scale of 0 to 100.

Inclusion criteria:

Cases undergoing clean elective surgical procedure with length of incision less than 8cms and under same antibiotic coverage.

Exclusion criteria:

(i) Cases not undergoing primary closure.

(ii) Surgeries where stomas are necessary.

(iii) Patients with systemic diseases and those not giving consent for 2-octylcyanoacrylate skin closure.

(iv) Surgeries involving excision of malignant tumours.

(v) Patients not coming for follow-up on or after 7th post operative days.

(vi) Surgeries across mucocutaneous junctions like lips, oral cavity, eyes etc. where adhesive glue is contraindicated.

RESULTS

The present study is done to compare the efficacy between Subcuticular skin suturing and Adhesive glue skin closure in clean elective surgeries. A total of 100 patients were recruited in the study from December 2010 to December 2012. All were clean elective surgery cases. The patients were randomly included in either Subcuticular Skin Suturing group or Adhesive Glue group. None of the patients experienced hypersensitivity reaction and toxicity to Cyanoacrylate glue.

AGE AND GENDER:

Table – 1 shows there were 68 males and 32 females in the present study.

	Frequency	**Percentage**
Males	68	68
Females	32	32

Table – 1 : Gender distribution of the study population

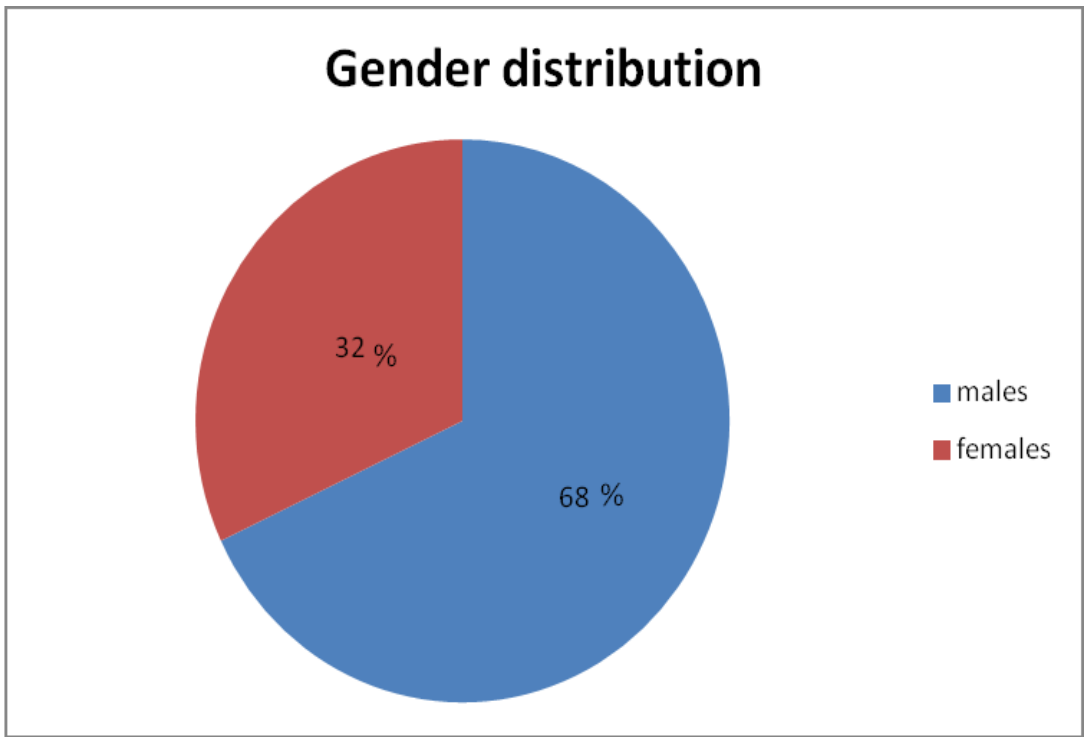

Chart – 1

The above chart demonstrates percentage of gender distribution of 68% males and 32% of females in our study.

Table - 2	Male	%	Female	%	Total
Adhesive glue	36	72	14	28	50
Subcuticular closure	32	64	18	36	50
	68		32		100

Table – 2 : Sex distribution

Table - 2 shows the sex distribution in each group. There were 36 males out of 50 cases in adhesive glue group, which constitutes 72% of total number of cases and there were 14 females out of 50 cases in adhesive glue group, which constitutes of 28% of total. In suturing group there were 32 males out of 50 cases, which constitutes of 64% of total and there were 18 female cases out of 50 cases, which constitutes of 36% of total.

The graph depicts the gender distribution in each group.

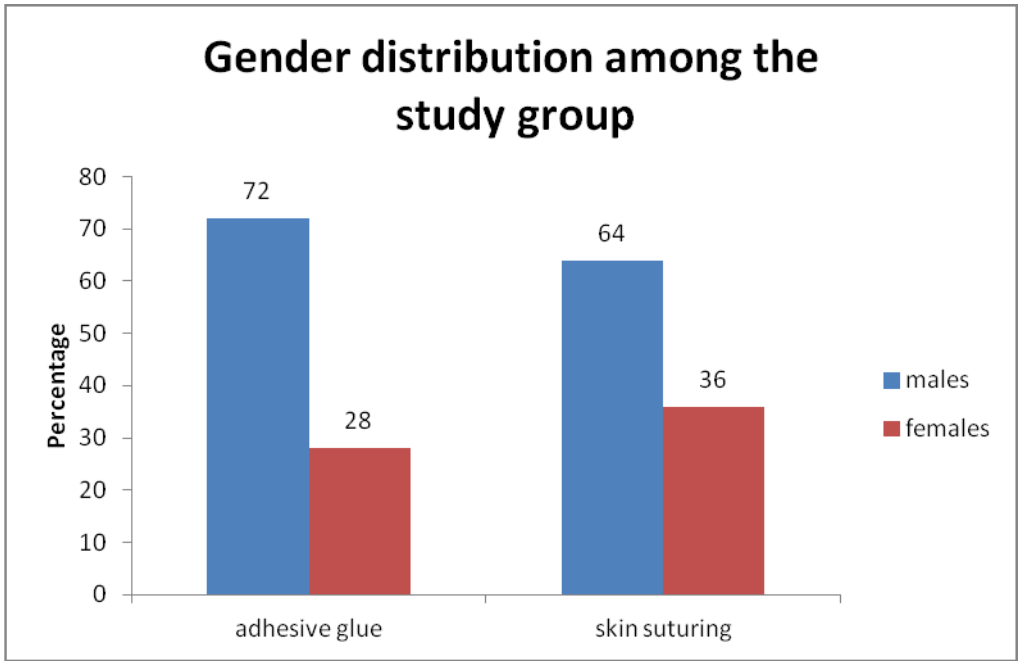

Chart – 2

Mean age distribution among the study group			(All having t value are independent t test)			
	N	**Mean**	**Std.Dev**	**t value**	**p value**	**degree of freedom**
Adhesive glue	50	38.3	19.9	-0.6	0.547	97
Sub cuticular closure	50	40.7	20.1			

Table - 3 : Mean age distribution

It is observed from Table - 3, mean age ± SD of the age for Adhesive Glue group was 38.3±19.9 years and that for Skin Suturing group was 40.7±20.1 years. Nevertheless, this marginal difference in the age between the two categories is statistically not significant (p>0.547).

Table - 3 can be depicted graphically as follows.

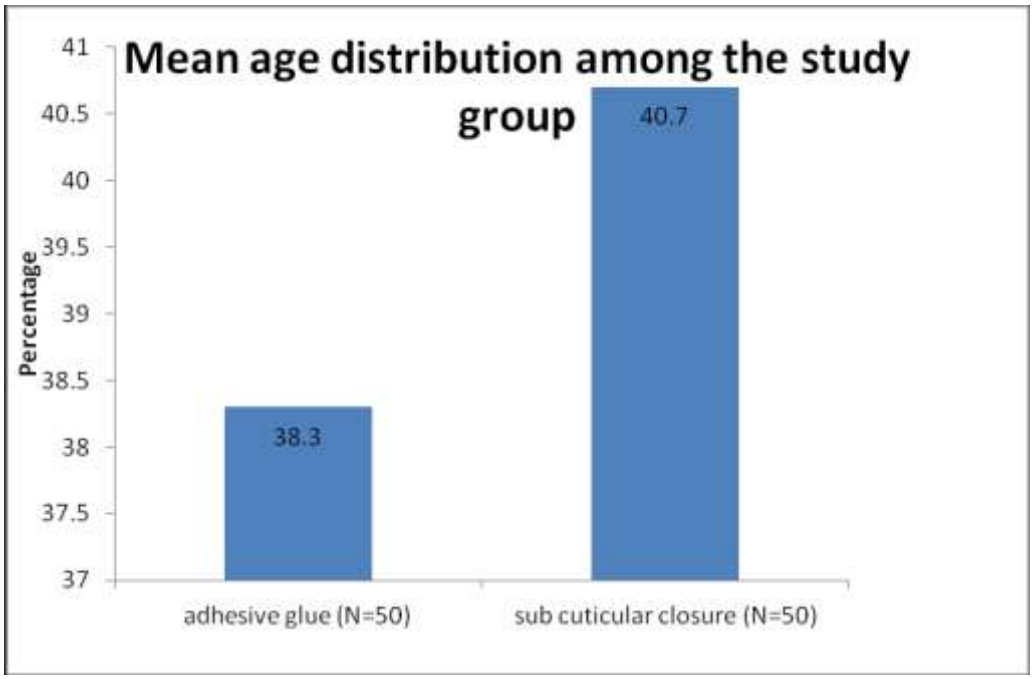

Chart – 3

NATURE OF SURGERIES:

The diagnosis and nature of surgeries were variable in each case in each group. The Table - 4 shows the surgeries done in each group. All cases were clean elective surgeries.

Distribution of surgeries according to the type of material used.	Adhesive glue	Sub-cuticular	Total
Enucleation of fibroadenoma	2	1	3
Excision (fibroadenoma,lipoma, ganglion, sebacious cyst, dermoid cyst)	10	12	22
Hernioplasty (incisional hernia, inguinal hernia, epigastric hernia)	28	24	52
Herniorrhaphy	2	0	2
Herniotomy (congenital hydrocele and hernia)	5	6	11
Mayo's repair (umbilical hernia)	1	1	2
Mesh repair (incisional hernia)	0	3	3
Orchidopexy (undescended testis)	1	2	3
Sub-fascial ligation (varicose veins)	0	1	1
Trendelenburg operation (varicose veins)	0	1	1

Table-4 : Distribution of surgeries according to the type of material used

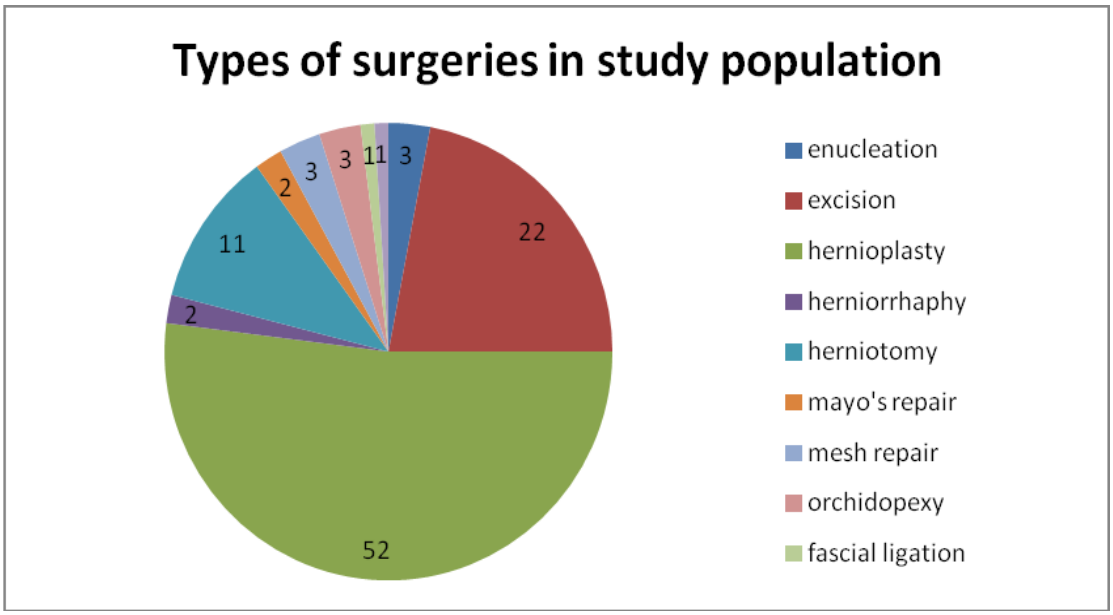

Chart – 4

TIME TAKEN FOR SKIN CLOSURE:

Comparison of mean time taken (sec) for skin closure	N	Mean	Std Dev	t value	p value	Degree of freedom
Adhesive glue	50	97.3	47.1	-24.65	<0.001	85
Subcuticular	50	392.3	70.3			

Table – 5 : Comparison of mean time taken (sec) for skin closure

The time taken for skin closure is measured using a stopwatch and entered in unit of seconds.

Table-5 shows the Mean Time Taken for skin closure and it is observed that mean time taken for skin closure in adhesive glue is 97.3seconds ±47.1 and that of subcuticular suturing is 392.3seconds±70.3.

This difference is of great significance with p value of <.001 confidence.

The graph depicts the mean time of skin closure.

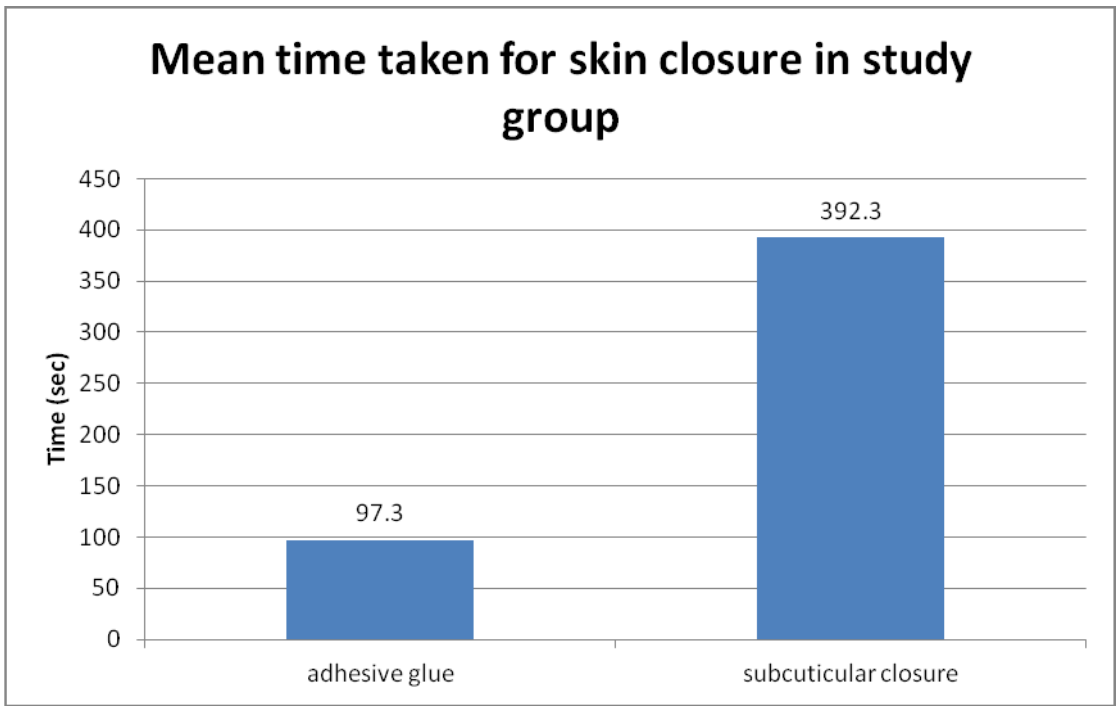

Chart – 5

POST OPERATIVE PAIN SCORE:

The Post-operative pain is measured in both the groups using Visual Analog Scale by patients themselves. Visual Analog Scale (VAS) is calibrated from 0 to 100. 0 is marked for being no pain and 100 being sense of worst pain. The pain score is observed at 24hours, 72hours, 7th day, 1month and 3months.

The Post operative Pain Visual Analog Scores at various intervals:

The Post operative Pain Visual Analogue Score at 24 hours after surgery is as follows; mean in Adhesive glue Post operative Pain Visual Analogue Score is 28.7±8.85 and that of Subcuticular suturing is 37.8±6.07. This difference is of great significance with p value of <.0001 confidence.

The Post operative Pain Visual Analogue Score at 72 hours after surgery: The mean in Adhesive glue Post operative Pain Visual Analogue Score is17.2±6.56 and that of Subcuticular suturing is 24.7±8.42. This difference is of great significance with p value of <.0001 confidence.

The Post operative Pain Visual Analogue Score at 7th day after surgery: The mean in Adhesive glue Post operative Pain Visual Analogue Score is 12.2±4.97 and that of Subcuticular suturing is 14±10.3. This difference is of less significance with p value of 0.268 confidence.

The Post operative Pain Visual Analogue Score at 1month after surgery: The mean in Adhesive glue Post Operative Pain Visual Analogue Score is 2.6±3.53 and that of Subcuticular suturing is 5.8±3.55. This difference is of great significance with p value of <.0001 confidence.

The Post operative Pain Visual Analogue Score at 3 months after surgery: The mean in Adhesive glue Post operative Pain Visual Analogue Score is 0.6±1.64 and that of Subcuticular suturing is 0.7±2.26. This difference is of less significance as p value is 0.801 confidence.

Time		N	Mean	Std Dev	t value	p value	degree of freedom
24hrs							
	Adhesive glue	50	28.7	8.85	-5.99	<0.001	86
	Subcuticular closure	50	37.8	6.07			
72 hrs							
	Adhesive glue	50	17.2	6.56	-4.97	<0.001	92
	Subcuticular closure	50	24.7	8.42			
7 days							
	Adhesive glue	50	12.2	4.97	-1.12	0.268	70
	Subcuticular closure	50	14	10.3			
1 month							
	Adhesive glue	50	2.6	3.53	-4.52	<0.001	97
	Subcuticular closure	50	5.8	3.55			
3 month							
	Adhesive glue	50	0.6	1.64	-0.25	0.801	89
	Subcuticular closure	50	0.7	2.26			

Table – 6 : Comparison of Post Operative Pain - VAS Score

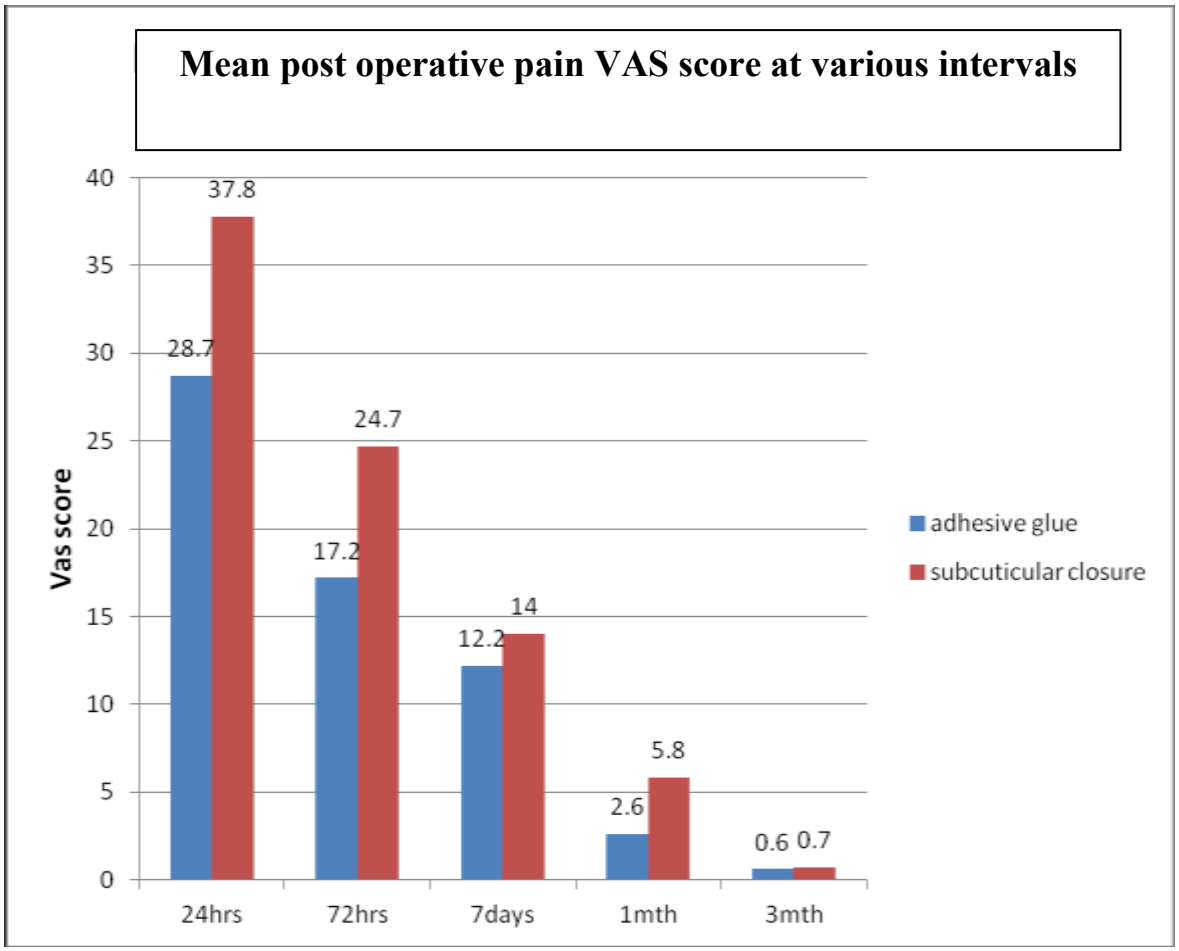

Chart – 6

WOUND ASEPSIS SCORE:

The outcome of wound is assessed at 3rd, 5th, 7th post-operative days and 1 month postoperatively using ASEPSIS score. Wound is scored from 0 to 10, according to the proportion of wound involved and presence of serous collection, erythematous changes, purulent exudates, and separation of deep tissues. Table - 7 shows the ASEPSIS Score on 3rd day, 5th day, 7th day and 1st month in both groups.

Wound asepsis	N	Mean	Std dev	max	degree of freedom	t value	p value
3rd day							
Adhesive glue	50	10.6	2.18	20	66	-1.67	0.099
Sub cuticular closure	50	11.9	5.04	30			
5th day							
Adhesive glue	50	1.18	4.27	20	62	-1.58	0.12
Sub cuticular closure	50	3.9	11.4	60			
7th day							
Adhesive glue	50	0.5	2.53	15	54	-1.75	0.085
Sub cuticular closure	50	3.3	11	60			
1st month							
Adhesive glue	50	0.2	1.41	10	73	-1.38	0.173
Sub cuticular closure	50	0.8	2.74	10			

Table – 7 : Wound asepsis score

Figure - 12 : Sub-cuticular closure causing erythema

At 3rd day, the Asepsis Score is maximum of 30 in Subuticular suturing group and maximum of 20 in Adhesive glue group. The outcome is good with Adhesive glue group.

At 5th day, the Asepsis Score is maximum of 60 in Subcuticular suturing group and maximum of 20 in Adhesive glue group. The outcome is good with Adhesive glue group.

At 7th day, the Asepsis Score is maximum of 60 in Subcuticular suturing group and maximum of 15 in Adhesive glue group. The outcome is good with Adhesive Glue group.

At 1st month, the Asepsis Score is maximum of 10 in Subcuticular suturing group and maximum of 10 in Adhesive glue group. The outcome is same in both the groups.

WOUND COMPLICATIONS:

Complications	adhesive glue	Sub cuticular closure	Total
Erythema	1	5	6
Seroma	1	1	2
Wound gaping	1	2	3
Discolouration	1	0	1
	4	8	12

Table – 8 : Wound complications

The overall complication rates in both the groups were shown in Table - 8 and maximum number of complications are noted in Subcuticular suturing group.

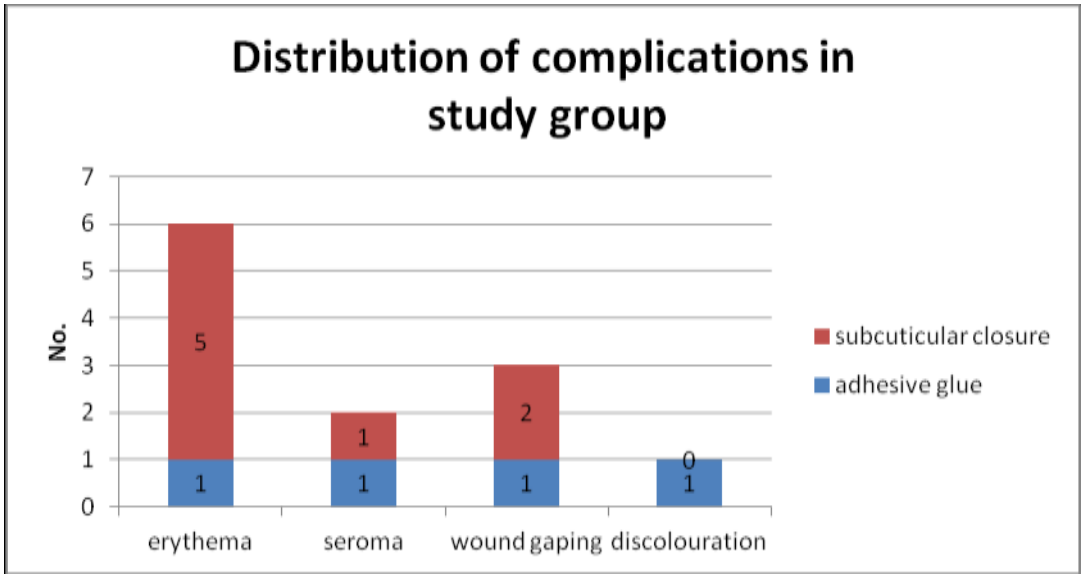

Chart – 7

WOUND COSMESIS SCORE:

Patients in both the groups were followed up at 7 days, 1st month, and 3rd month and the wound is assessed for Cosmesis on 7th post-operative day using Modified Hollander Cosmesis Scale[53] 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 variables. A score of 1 is given to each variable if not present in the wound, so a score of 5 and 6 was considered as optimal while less than 5 as sub-optimal. Any complications/infections, if present are also observed in both the groups. On the 1st month and 3rd month Wound Cosmesis is assessed by independent observer and wound scoring is done using Visual Analog Scale of 0 to 100.

Table-9 shows the comparison of wound Cosmesis between Adhesive glue group and Subcuticular suturing group.

comparison of post operative wound cosmesis score	N	Mean	Std dev	degree of freedom	t value	p value
7th day						
Adhesive glue	50	4.86	0.72	91	1.77	0.08
Sub cuticular closure	50	4.56	0.95			
1st month						
Adhesive glue	50	77.3	9.32	89	1.07	0.29
Sub cuticular closure	50	74.9	12.9			
3rd month						
Adhesive glue	50	80.3	9.06	97	0.58	0.562
Sub cuticular closure	50	79.2	9.81			

Table - 9 : Comparison of post operative wound cosmesis score

Wound Cosmesis Score is assessed at 7th post-operative day using Modified Hollander Cosmesis Scale. Subcuticular suturing group has a maximum score of 6 in 5 patients and a minimum of 2 in 3 patients, with a mean of 4.56 on the scale. In Adhesive glue group maximum score is 6 in 6 patients and minimum is 2 in 1 patient with a mean of 4.86 on the scale. These early results are more in favour of Adhesive glue.

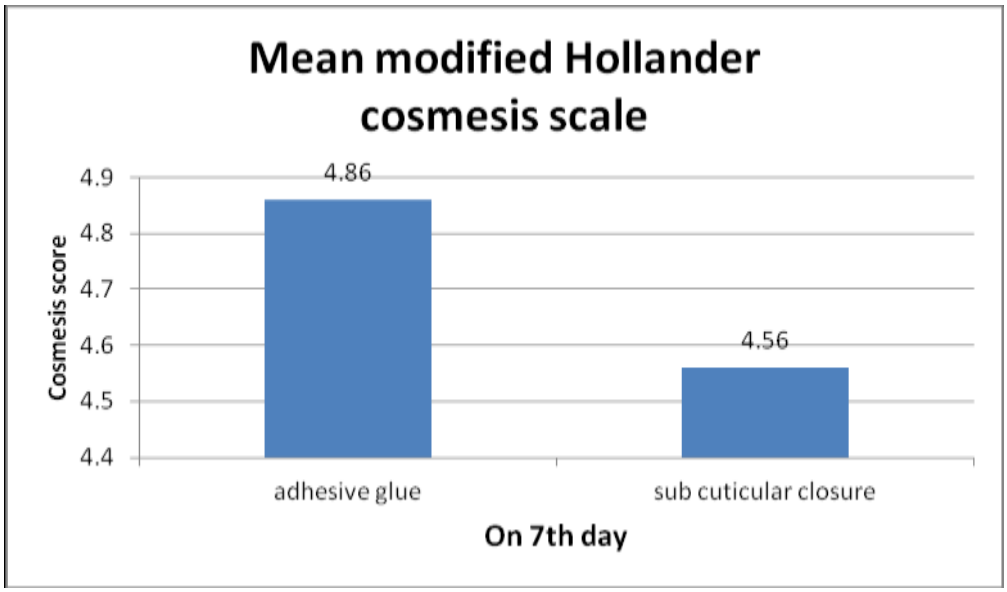

Chart – 8

Further, in the follow-up of 1st month, 3rd month, and 6th month, the Wound Cosmesis is assessed by an independent observer and was scored in a Visual Analogue Scale from 0 to 100.

Wound Cosmesis Score at 1st month: Subcuticular suturing group has a minimum score of 40 and maximum of 95 with a mean of 74.9±12.9. In Adhesive glue group, maximum score is 95 and minimum is 45 with a mean of 77.3±9.32. Results are in favour of Adhesive glue.

Wound Cosmesis Score at 3rd month: Subcuticular suturing group has a minimum score of 50 and maximum score of 95 with a mean of 79.2±9.81. In Adhesive glue group, maximum score is 95 and minimum score is 50 with a mean of 80.3±9.06. Results are again in favour of Adhesive glue.

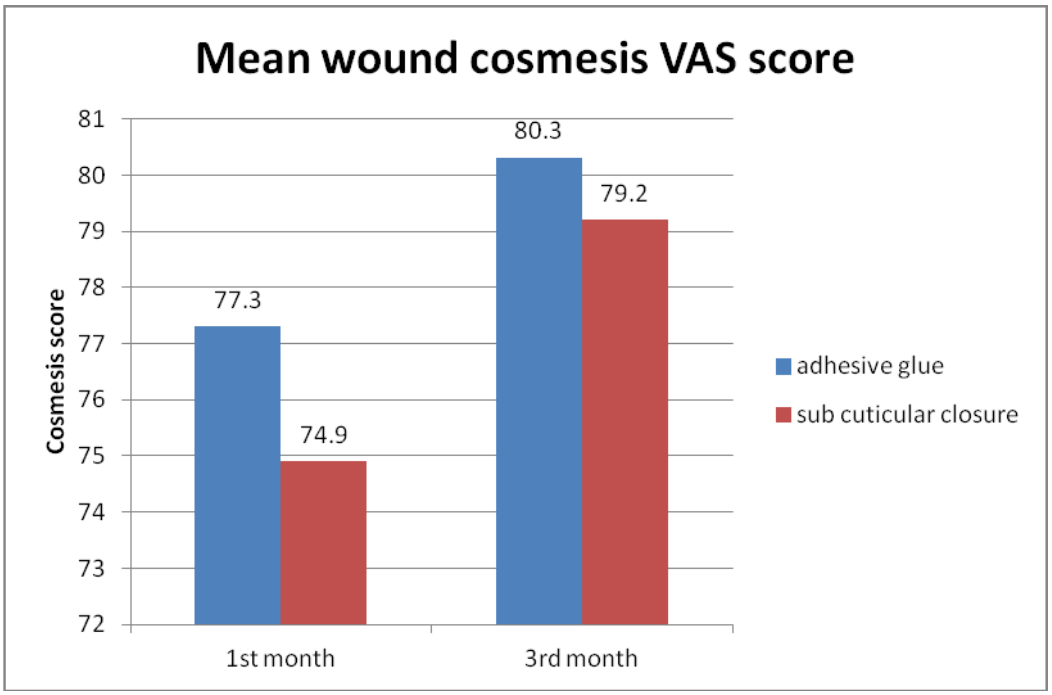

Chart – 9

Figure – 13 : Skin Closure with Subcuticular Suturing

Figure – 14 : Adhesive Glue Skin Closure at 1 month

Figure – 15 : Adhesive Glue Skin Closure at 3rd month

DISCUSSION:

Age:

In a study conducted by Matin.S.F[54], 50 patients' wounds were closed with Octylcyanoacrylate, and 42 patients' wounds with Subcuticular suturing. In Octylcyanoacrylate skin closure group, mean age was 52.5years and that of Subcuticular skin Suturing group it was 51.24 years. In the present study, the mean age in Adhesive glue group is 38.3±19.9 years and in Subcuticular suturing group it is 40.7±20.1years. Nevertheless, this marginal difference in the age between the two categories are statistically not significant ($p>0.547$) as patients are randomly selected.

Sex ratio:

It is observed from the present study that the sex ratio (Male: Female ratio) in Adhesive glue group is 1:0.38 and that in Subcuticular suturing group it is 1:0.56, whereas the respective values in Matin.S.F study were 1:0.85 and 1:0.7824. It may be seen here that the male to female ratio in the present study is much lower in both Adhesive glue group and Subcuticular suturing group compared to Matin.S.F. study. The difference in sex population was not thought to have any effect on the results, as all the patients were randomly selected healthy individuals.

Time taken for skin closure:

In one of the first published studies evaluating Octylcyanoarylate, Quin.J. et al[55]., performed a prospective randomized controlled trial comparing Octylcyanoarylate and sutures. One hundred and thirty patients were enrolled. Use of the skin adhesive was found to be significantly faster in this setting (220seconds versus 744seconds; $p < 0.001$). In Matin.S.F. study, the mean time taken for skin closure in Adhesive glue group is faster than Subcuticular suturing group (150 seconds versus 360 seconds). In the present study, the mean time taken for skin closure in Adhesive Glue is much faster than Subcuticular suturing Group (97.3seconds versus 392.3 seconds) which is of great significance with $p<.0001$.

Post-operative pain:

In both the groups, the post-operative pain is assessed at 24hours, 72hours, 7th day, 1 month and 3 months using Visual Analogue Scale of 0 to 100, as rated by patients' themselves. The present study shows significant less postoperative pain in Adhesive glue group. The earlier studies by Zempsky.W.T., et al.[56], Arunachalam.P, et al.[57], and Quinn.J.,et al., have compared the post-operative pain using Visual Analogue Scale of 0 to 100 and have shown less post-operative pain in Adhesive glue group. In the present study there is significant less pain in Adhesive glue group up to first 72 hours following surgery.

Wound ASEPSIS score:

The outcome of wounds is assessed at 3rd, 5th, 7th post-operative days, 1 month and 3 months post op using ASEPSIS score. Maximum number of complications are noted in Subcuticular suturing group (16% - 8 cases). In Adhesive glue group 8% (4 cases) of the patients developed complications. Seroma developed in 1 patient, Discolouration was seen in 1 patient, Erythema was found in 1 patient and 1 patient had Wound dehiscence. In Subcuticular suturing group, 1 patient developed seroma, Erythema formed in 5 patients and 2 cases of wound dehiscence were observed. Earlier published studies by Singer.A.J., et al.[58], shows that the infection rates at the end of 1week after surgery were similar and fewer cases of erythema were seen in Adhesive glue group. But Wound dehiscence rate is 1.6% in Adhesive glue group and 0.9% in Suturing group. In the present study wound dehiscence is seen in 2% (1 case) in Adhesive glue group and 4% (2cases) in Subcuticular suturing group. Toriumi.D.M., et al.[59], in their study, evaluated the wound at 1st week and hdidn't observe any complications. Our complications are in the initial part of the study in Adhesive glue group wherein excess of glue is used in the wound which led to seroma formation and wound separation.

Wound cosmesis score:

Patients in both the groups were followed up at 7th day, 1st month, and 3rd month. The wound is assessed for cosmesis on 7th post-operative day using Modified Hollander Cosmesis Scale. Further, in the follow-up of 1st month and 3rd month, the Wound cosmesis is assessed by an independent observer and was scored in a Visual Analogue Scale from 0 to 100.

The study conducted by Toriumi.D.M., et al., observed wounds on 7th day using Modified Hollander Cosmesis Scale and later by Visual Analog Scale and revealed the equivalent results with Modified Hollander Cosmesis Scale. In a study done by Jallali.N. et al.[60], they compared the wound with Modified Hollander Cosmesis Scale and later by Visual Analog Scale which showed no significant difference in cosmesis with both the scores. In the present study, the early results on 7th day is in favour of Adhesive glue group and later follow up at 1st month and 3rd month shows less significant difference between both the groups.

Thus, comparing the criteria of Time taken for Skin closure, the Post operative pain, the Cosmetic appearance between Adhesive glue group and Subcuticlar suturing group in the present study with earlier studies prove that Adhesive glue, Octylcyanoacrylate skin closure is significantly better than the subcuticular skin closure.

CONCLUSION:

The results from the present study show that the 2-octylcyanoacrylate adhesive glue skin closure is better than subcuticular skin closure. The concept of a surgical tissue adhesive for superficial skin closure is an attractive alternative to the use of sutures. The use of adhesive glue takes lesser time for skin closure and results in shorter operative period. It forms a flexible, water resistant sealed skin closure and gives better cosmetic outcome.

Application of adhesive glue needs no bandaging and allows the patient to have shower anytime after surgery. The postoperative pain is much less compared to traditional skin suturing techniques. The adhesive glue disappears naturally as incision heals and leaves no mark. It is non-irritant to skin and complications following adhesive glue application are extremely less.

Therefore it can be concluded that 2- Octylcyanoacrylate can be used safely in surgical skin closure in clean elective surgeries.

SUMMARY:

The present study is conducted on One hundred patients and compared the efficacy of Skin closure with Adhesive glue and Subcuticular skin suturing in clean elective surgeries in the department of General surgery in R. L. Jalappa Hospital and Research Centre and attached teaching hospitals, Kolar, Karnataka, India.

Patients were randomly divided into two groups of fifty patients each, irrespective of their age and sex. Detailed history was taken and relevant investigations were done to rule out any focus of infection or malignancy. Patients with co morbid medical conditions, patients undergoing contaminated or emergency surgeries were excluded from the study. The nature of operation and site of incision were variable. In Subcuticular skin closure group wound is closed with 2-0 ethilon and in Adhesive glue group wound is closed with 2-Octyl cyanoacrylate.

In the Present Study, the mean time taken for skin closure in Adhesive glue is much faster than Subcuticular Suturing Group. There is significantly less pain in Adhesive glue group at 72 hours following surgery and 7th post op day.

The wounds were assessed at 3^{rd}, 5^{th}, 7^{th} post-operative days, 1^{st} month and 3^{rd} months post op using ASEPSIS score. Maximum number of complications (such as Seroma, Erythema, Discolouration and Wound

dehiscence) were noted in Skin suturing group (16% -8 cases). In Adhesive glue group 8% (4 cases) of complications were observed. The wounds were assessed for Cosmesis on 7th post-operative day using Modified Hollander Cosmesis Scale and in the follow-up of 1st month and 3rd month, the Wound cosmesis was assessed by an independent observer and was scored in Visual Analogue Scale from 0 to 100. Adhesive Glue group had better cosmetic results compared to Subcuticular skin closure group.

Thus, the concept of a surgical tissue adhesive for superficial skin closure is an attractive alternative to the use of sutures. Octylcyanoacrylate gives faster, comfortable and easier skin closure making it an effective and reliable skin closure glue in clean elective surgeries.

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Annexure : I

COMPARATIVE STUDY OF PRIMARY SKIN CLOSURE WITH ADHESIVE SKIN GLUE AND CONVENTIONAL SUTURE MATERIAL IN CLEAN ELECTIVE SURGERY. PROFORMA

Name:

Age:

Sex:

I. P. No.

Date of Admission:

Date of Surgery:

Date of Discharge:

Chief Complaints:

Past history:

Routine Investigations:

Hb%:

PCV:

Total count:

Urine Routine:

DIAGNOSIS:

SURGERY:

DATE:

NAME OF THE PROCEDURE:

TYPE OF ANTIBIOTIC:

SKIN CLOSURE:

TYPE OF MATERIAL USED:

TIME TAKEN FOR SKIN CLOSURE:

POST OPERATIVE PERIOD (1-7Days):

PAIN SCORE:

24 Hrs:

72 Hrs:

After 7 Days:

WOUND ASEPSIS SCORE:

3rd Day:

5th Day:

7th Day:

WOUND COSMESIS SCORE:

(Modified Hollander Cosmesis Scale)

7th Day:

FOLLOW-UP:

AT 1 MONTH:

PAIN SCORE:

WOUND ASEPSIS SCORE

WOUND COSMESIS SCORE:

AT 3 MONTHS:

PAIN SCORE:

WOUND ASEPSIS SCORE:

WOUND COSMESIS SCORE:

Annexure : II

ABBREVIATIONS USED IN MASTER CHART

Sl. No	:	Serial number
HOSP. No.	:	Hospital number
M	:	Male
F	:	Female
P	:	Visual analog score for pain
Wa	:	Wound ASEPSIS Score
SUB-CUT	:	Subcuticular Closure
ADH-GLU	:	Adhesive Glue Closure
Sec	:	Section
m	:	Minutes
h	:	Hour
d	:	days