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A REVIEW ON SURGICAL GLUES

K. Pavankumar*[1], S. Lakshmiprasanna[1], S. N. Priyanka[1], M. L. Sailahari[1], S. L. Anusha[1]

[1*]Department of Pharmaceutics, Santhiram College of Pharmacy, Nandyal, Kurnool District, Andhra Pradesh, India.

ABSTRACT

Wound closure is one amongst the cardinal steps of surgical treatment, and suturing is the most generally used methodology of wound closure. The method of suturing typically prolongs the length of surgery and will increase the patient's risk of anesthesia awareness. it's many disadvantages, together with induced trauma to the tissue, pain, hyperbolic risk of infection and inflammation, delayed healing, and inability to produce an instantaneous seal. Lately, there has been a growing interest in surgical glues as a substitute to suturing. However, surgical glues have their own distinctive disadvantages, which require to be addressed in planning "ideal" surgical glue.

KEYWORDS

Surgical Glue, Hemostat, Sealant and Adhesive.

Author for Correspondence:

Pavankumar K,

Department of Pharmaceutics,

Santhiram College of Pharmacy,

Nandyal, Kurnool District, Andhra Pradesh, India.

Email: pavankumarmph@gmail.com

INTRODUCTION

Surgery (from Greek "hand work") is "the branch of medication that relates to body injuries, deformities, and morbid conditions that need being remedied by operations or instruments". It sometimes involves cutting of tissues and closure of induced or traumatic wounds. The tissues that are closed is static, like skin, or dynamic, like getting cardiac muscle. The setting is dry, like a bone, or wet, like the lumen of a vessel. Historically, surgical wounds are closed with a spread of sutures with completely different sizes, strengths, and compositions. Suturing sometimes achieves its meant goal of approximating the tissue at the wound website till the physiological "seal" is accomplished, but it's disadvantages. The method of passing the needle is traumatic and can cause further

pain. Often, it's to be removed and needs a second procedure. The suture tracts themselves will function passage to secondary infections and necessitate antibiotic treatment, and also the suture material will cause native tissue inflammation and delay healing. Though suturing is effective in approximating the sides of the tissue, it doesn't come through immediate protection of the wound and will be related to prolonged hemorrhage. Lastly, the method of suturing is long and subject the patient to prolonged risk of anaesthesia and increase the price of tending. Therefore, with increasing quality of minimally invasive surgery, that isn't related to massive incisions, and advancement in chemistry, there's a growing want, application, and availableness of surgical glues for various surgical subspecialties. The presently on the market surgical glues, however, have shortcomings: they will be simply washed out underneath dynamic conditions; they will be cyanogenetic to the tissue; some aren't robust enough; they will be tough to reposition when initial application; and a few is destabilized by the presence of blood. There are a spread of surgical glues that have robust points (e.g. perishable, straightforward to handle, strength, suture-free, etc.), however there's no single ideal glue that addresses all shortcomings. William D. Spotnitz provided a helpful system of classifying surgical glues divided into teams and classes. The teams are supported their purpose (hemostats, sealants, and adhesives) and classes supported their useful characteristics and mechanism of action. The purpose of topical hemostats is to accelerate hemostasis by inflicting grume formation and it needs the presence of blood. The sealants stop run of fluid from tissue openings like CSF from CNS, however the fluid doesn't should be blood. The adhesives bond tissue along, like a section wound.

It is notable that some agents will have multiple functions, like a protein sealing material that may act as a haemostat, a sealant, Associate in Nursing and adhesive. a big range of surgical glues functionally rely upon a physiological curdling cascade. 2 of the essential elements of the curdling cascade are coagulase and clotting factor. Within the presence of Ca+2 ions, coagulase cleaves the clotting factor chains. The ensuing clotting factor monomers eventually polymerize and type a protein clot. These steps are freelance of the curdling pathway and may be reproduced by artificial means. The speed of the clot formation will increase with coagulase concentration. The strength of the clot, on the opposite hand, depends on the concentration of clotting factor.

Sutures, Stitches, and Staples

Sutures, stitches and staples are used for the identical purpose - to shut wounds or surgical incisions - however they're not the identical. For sutures, doctors use a thread or strand of fabric to perform wound closure. The term "stitches" refers to the surgical treatment or method of closing a wound with sutures. Staples are another material that doctors typically use to create sutures or stitches. Sutures in Surgery: varieties, Materials, Indications, Needles and Sizes

Types of Sutures and Stitches

Sutures is either absorbable or non-absorbable. Absorbable sutures are meant to be attenuated by the body over time and eventually dissolve fully. Some materials wont to create absorbable sutures are derived from animal product that are specially processed. Alternative absorbable sutures are made up of artificial chemical compound materials like polylactic acid (Vicryl), polyglycolic acid (Dexon), polyglyconate (Maxon) and polydioxanone (PDS). Permanent, nonabsorbable sutures are typically most popular as a result of their proof against body chemicals which may otherwise dissolve them too early within the healing method. Non-absorbable sutures are helpful for maintaining semi-permanent tissue wound closure (apposition) and healing. Non-absorbable sutures is made up of nylon, polypropene (prolene), or silk.

Stitches is divided into the subsequent sub-types

Continuous stitch

This can be fast to perform victimisation the identical suture line while not cutting, that helps distribute the stress on the length of the sewed wound.

Simple interrupted stitching

The identical suture line is used quite once to create separate stitches that give a lot of precise closure of the tissue, particularly that of skin and facia.

Mattress stitches

These is placed either vertically or horizontally. Pad stitches go deeper into the skin layers and permit for glorious closure of incision edges whereas minimizing tension.

Sub-cuticular stitch

Victimisation Associate in Nursing absorbable suture, the sew is created at the dermal-epidermal junction to permit for higher closure in order that surgical suture removal makes no sense. This sew may be a convenient technique to shut skin incisions. Staple varieties are classified in line with their material or form. Medical staples are most typically made up of Ti or stainless steel. But they will even be made up of alternative materials like iron, chromium, nickel or plastic. Medical staples is also straight, curved or circular.

Uses of Sutures

Absorbable sutures

Gut sutures

Wont to shut tissue that needs marginal support and heals apace, like that of the rima oris membrane layer, or procedures of superficial blood vessels.

Vicryl sutures

Best for the lower layers of skin, and approximating muscle or adipose tissue.

Maxon and monocryl sutures

Used for sub-cuticular stitches and soft tissue approximation.

PDS

Used for stitches of muscle and facial tissue.

Non-absorbable sutures

Prolene sutures

Utilized in tissue of facia, muscle or blood vessels.

Nylon sutures

Used for closure of skin, surgical incisions or emptying tubes.

Silk sutures

Sometimes wont to tie off blood vessels or intestine segments Staples are typically used as an alternate to sewing to shut skin incisions, in areas that are onerous to sew, or throughout procedures that has to be performed in an exceedingly short time. Circular staples are wont to create end-to-end surgical closures or connections, as in an exceedingly intestine surgical procedure to assist reattach the separated intestine components.

Advantages of each

Stitching with sutures or staples are cosmetically equivalent, and also the alternative of fabric and technique used depends on the Dr. United Nations agency performs the procedure. Generally, staples tend to permit for fast skin closure with marginal wound inflammation, and are easier to get rid of than stitches. Medical staples are removed with a staple remover tool, whereas stitches are removed by cutting the suture next to the knot, then pull the knot out gently till the suture is totally removed. Typically, victimisation staples to shut skin incisions work best with 2 health care professionals, wherever one aligns the skin edges with a extractor whereas the opposite makes the staples. Stitches will typically be done by one health care skilled.

Precautions

Regardless of the closure technique getting used, the subsequent precautions should be thought of to avoid wound breakdown, and to realize a well-healed incision with marginal scarring:

- guarantee skin incision is found on the intrinsic tension lines for marginal scarring
- Maintain smart blood offer to the wound
- Avoid over-tightening the stitches to scale back the stress and forestall any wound breakdown or unwanted scars
- Eversion (alignment) of skin edges for best healing with marginal scarring
- Usage of Steri-Strips, Band-Aids, and skin adhesive materials to strengthen incision throughout and when suture removal

Recovery

As shortly because the wound has well enough to face up to the expected stress or pressure thereon space, the stitches or staples ought to be removed. If stitches are left in situ on the far side that amount, they're going

to possibly leave Associate in nursing unwanted scar.

Approximate tips are as follows

- Facial stitches sometimes stay in situ for 3 to 5 days
- Extremities stitches are sometimes left in situ for concerning 10 days
- Joint stitches are left in situ for 10 to 14 days
- Back stitches ought to stay in situ for fourteen days
- Abdominal stitches ought to typically be left in situ for seven days

Complications of sutre absorption and stiches

1. Hemorrhage (reactional or secondary hemorrhage).
2. Run particularly in musculature and colonic junction.
3. Diverticular formation.
4. Artificial stitches are painful upon removal of stitches.
5. Probability of microbic contamination is a lot of. Inorder to avoid the facet effects and inconvenience caused by stitches surgical glues are used.

Glues

Glue is employed once the wound is

- Small
- Shallow- solely involving skin
- is approximated in straight lines while not tension in any direction Glue mustn't be used once the wound is
- Deep- involving muscles, tendons and deeper tissues additionally to skin
- Infected
- Open sores with no solid edges
- Jagged edges
- Animal bites Glue ought to ne'er be used on locations wherever it will get damp or has movement because it tends to open up the wound like
- within the mouth
- Wound that is actively haemorrhage
- Natural skin folds like armpits and groins
- Fingers and toes

Obviously there are some blessings of victimisation glue over stitches since gluing up a wound takes less time, less skill, no anesthesia would be required and removal of stitches not needed. Therefore it's very helpful once tiny chil dren have tiny cuts which might be simply taken care of with the glue while not the effort of the anesthesia and stitches. It is additionally utilized in surgical wounds to shut the skin once deeper wounds have already been sewed up like in cesarian, herniation repair, laprotomy incisions. For easy tiny wounds involving solely skin- either glue or stitches offer similar results. In eye injuries, cyanacrylate glue is employed as a short lived live to carry the integrity of the world just in case of tissue layer infections inflicting rupture. But even tinytissu e layer cuts would require sewing with hair skinny sutures. Stitches still stay the gold commonplace therefore it's the alternative if there's any reason to not use glue. to place in stitches may be a a lot of complete job and it'd want some type of anaesthesia- native, regional or general. If the wound is on the face, it'd be higher for a Oculoplastic or Facial cosmetic surgeon to try to to the suturing as they are a lot of expertise in high tension wound repair because it typically happens within the face giving higher cosmesis.

Tissue glues are utilized in surgery on Associate in nursing experimental basis since the mid-1960s; they were formally approved by the U.S. Food and Drug Administration (FDA) for surgical use in 1998. As early as 1964, industrialist Kodak submitted Associate in nursing application to the agency for the employment of cyanoacrylate glues in surgery; the formula was utilized by Dr. Harry Coover throughout the Vietnam War to seal chest wounds or alternative open wounds till the patient may well be taken to a hospital. In addition to wound closure, surgical glues were approved by the agency in 2001 as sealants against bound styles of bacterium, together with staphylococci and pseudomonas. Ideally, wounds ought to be but four cm, not contaminated or infected and have skin edges that aren't underneath tension. Wounds ought

to be closed among twelve hours. Most patients are going to be youngsters with short clean wounds. Dehiscence is slightly higher with skin glues than with sutures, however the cosmetic outcome is comparable and skin glues are painless. The glue utilized in closing wounds is that the same molecule that's normally referred to as super-glue-Cyanacrylate. But it's of medical grade with no impurities that's gift within the regular superglue. This medical grade glue is nicknamed "Liquid stitches" There are bound use cases for each glue and stitches. It's best to let the treating doctor take the decision. Typically one has the selection to settle on either glue or stitches. Repeatedly stitches are the sole modality.

MATERIAL

Cyanoacrylate glues are acquainted with to most of the folks among the sort of such compounds as Krazy Glue or Superglue, used as unit adhesives to bond nonporous materials, along with metals. These glues are used in criminal investigations to develop latent fingerprints on swish surfaces like glass or plastics. directions for the utilization of cyanoacrylate industrial glues forever contain warnings regarding their capability to bond with skin; it's this characteristic that crystal rectifier to their use in surgery. The formula of cyanoacrylate approved for medical use is 2-octyl cyanoacrylate; its trade names embody Dermabond, Band-Aid Liquid bandage, and Soothe-N-Seal. Dermabond
has several advantages: quick application, good cos metic results, strength, and suppleness. It in addition has several drawbacks: it'll alone be used
to shut the uppermost layers of skin, as a result of it causes inflammation to animal tissue tissues. It cannot be used close to the eyes or mouth, on hairy parts of the body, or to shut wounds with jagged or torn edges. The Dr. ought to use animal tissue sutures to draw the perimeters of a deep wound on before applying the surgical glue to the surface of the skin. Last, a little proportion of patients are allergic to cyanoacrylate and develop a rash.

TECHNIQUE

Dermabond comes in Associate in Nursing applier that resembles a pen with a thicker barrel. It contains a bottle that snaps open among the barrel once the doctor removes the cap. The adhesive itself is tinted purple and comes out through a porous tip regarding the scale of a rubber once a black button on the aspect of the barrel is pushed. The doctor or nurse holds the perimeters of the wound on whereas applying a layer of Dermabond to the wound with the tip of the applier. Once fifteen seconds, the first layer is dry and conjointly the doctor can apply the second layer of adhesive. Once regarding 45 seconds to a second, the closure is complete. It reaches its full strength regarding three minutes once the second layer has been applied. The patient does not should cowl the Dermabond with a bandage. It's safe to urge the closure wet among the course of ancient bathing or showering, tho' patients are sometimes instructed to not soak the wound. Dermabond does not ought to be removed like staples or non-absorbable stitches; it wears off the skin in 5-10 days, that's generally enough time for the upper layer of skin to heal. Some other materials used for preparation of surgical glues are as follows: Porcine gelatin, bovine scleroprotein, change regenerated polysaccharide, and saccharide spheres these compounds work by making a mechanical barrier and a surface to prevent hemorrhage or accelerate curdling. Hence, they act as hemostats. They're comparatively safe and straightforward to use. However, swelling and infection are drawbacks. Removal of the glue is suggested when achieving haemostasis to attenuate facet effects.

Bovine coagulase, pooled human coagulase, and recombinant coagulase

These compounds basically offer focused levels of coagulase for speedy conversion of coagulation factor to a protein clot. They act as hemostats and may be effective in stopping each native and diffuse hemorrhage. They're comparatively simple to use, however the facet effects embrace protein formation (bovine) which will cause coagulopathy. Infective agent or particle malady could doubtless be related

to pooled human plasma. Hypersensitivity to rodent or snake macromolecule are attainable for recombinant merchandise. Additional significantly, intravascular use of those merchandise is counter-indicated.

Summary of functions, strengths, and drawbacks of current surgical glues

Fibrin sealing material

Fibrin sealing material is that the most versatile substance. It's approved by the bureau as a surgical instrument, sealant, and adhesive. The utilization of protein was 1strecognized in 1909. The primary business protein sealing material became obtainable in Europe in 1972, and also the bureau approved it within the us in 1998. Human plasma-derived protein sealants are currently commercially obtainable.

Fibrin sealants are primarily comprised of coagulation factor and coagulase. They reproduce the cardinal steps of the physical action cascade. On condition that they provide each coagulase and coagulation factor, they are doing not depend upon active hurt for the supply of coagulation factor. The concentration of every part varies between completely different makers. The protein sealants are simplest once applied to a dry surface. The potential facet effects embrace infective agent or protein formation, hypersensitivity, and swelling. The protein sealants are passionate about associate intact action system.

Polyethylene glycol (peg) compound

This is an artificial material and may be used as a moderately sturdy sealing material. It easy and is simplest once applied to a dry surface. polymerisation takes roughly one minute. a serious disadvantage is critical swelling.

Albumin and glutaraldehyde

This is a bovine albumen cross-linked with glutaraldehyde. It will be used each as a powerful sealing material associated as an adhesive. It's user friendly, however there are many attainable facet effects, together with tissue death and adhesive embolism.

Cyanoacrylate

This is an artificial product and is employed as a powerful adhesive. It's restricted to external use solely. Therefore, it shouldn't be applied to deeper skin layers and incorporates a restricted price as a sole technique of closing the skin. This product is quickly obtainable and is user friendly. The individual merchandise during this class have variable viscousness which will be useful to the MD. However, care ought to be taken to avoid associate unintended application of this adhesive to associate causeless space. Cyanoacrylate will be related to foreign body reaction and a sensation of heat.

Lysine-derived ester adhesive

This adhesive acts to bond along tissue layers, thereby reducing dead house. This can be significantly relevant when sure surgical procedures like tummy tuck. A recent study incontestable a faded rate of seroma formation and fluid emptying following tummy tuck once the adhesive is employed. This adhesive is perishable and over time is absorbed by the body through chemical reaction.

Hydrophobic light-activated adhesive (HLAA)

This adhesive is predicated on polyglycerol sebacate salt (PGSA). It's a thick gel that's applied to a tissue then cross-linked among seconds by ultraviolet radiation. The ensuing bond is robust however versatile. Hence, it sustains beneath high and flowing blood. It will doubtless be wont to seal defects within the heart and arteries, but so far, the testing has been restricted to animal models.

DISCUSSION

With an exaggerated awareness of advantages of quick post-operative recovery and cost- effectiveness of surgical procedures, the role of surgical glue becomes progressively} more relevant. Presently, there are a myriad of surgical glues. However, they need limitations to their safety and usefulness. A perfect surgical glue should be safe, useful below dynamic or wet conditions, perishable, self-sufficing, flexible, quick drying, easy, resist high pressures, and cheap. Repairing an injury to a vessel or an organ once traumatic internal injury, particularly involving the respiratory organ, is usually done by sutures, stapling devices or thermocautery with specialised surgical instruments. Time is the essence as patients will chop-chop lose

giant amounts of blood, predisposing them to shock, that places organs in danger for viability as time goes on. MeTro gel applied to respiratory organ tissue to seal injury (The University of Sydney).

Bleeding within the lungs is problematic because of continual movement related to inflation and deflation. Whereas sealants are explored as potential solutions to stem hemorrhage and repair open wounds, none are able to perform well as a results of problems associated with tissue compatibility, strength and mechanical properties. on the far side this, outflow of air from a surgically repaired respiratory organ injury usually needs a chest tube to be placed, that keeps a patient within the hospital for variety of extra days. Now, one analysis cluster might have solved the matter with development of a replacement tissue glue derived from proteins naturally gift within the human body-offering hope that in the future this approach can be utilised as AN intraoperative tool, on the tract, furthermore as in emergency departments. Referred to as "MeTro", (methacryloyl-substituted tropoelastin), it's a supermolecule derived from the elastic fibers that frame human tissue.

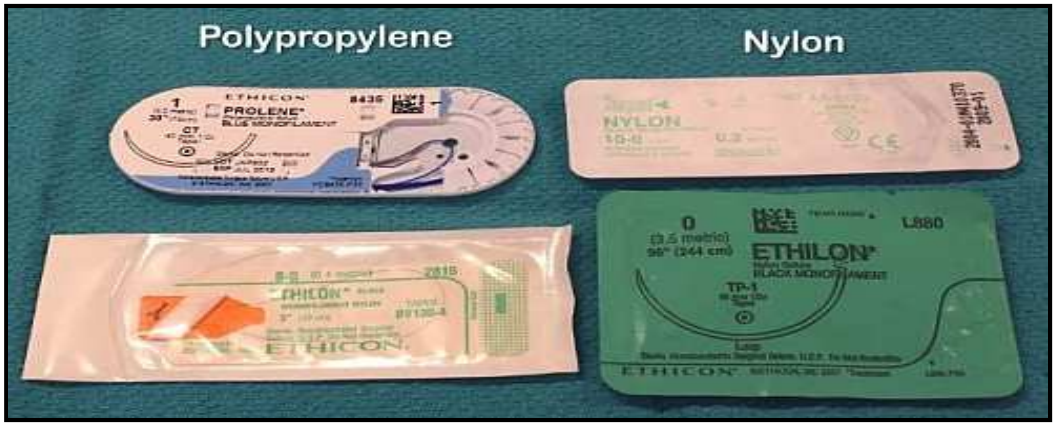
"A sensible surgical sealing material has to have a mixture of characteristics: It has to be elastic, adhesive, non-toxic and biocompatible. The researchers have used railway line in trials involving rats and pigs, with success exploitation the compound to seal surgical incisions in blood vessels. once researchers applied the glue to a wound and so placed it below light, the injuries sealed in sixty seconds, while not rupture or unseaworthy round the space of injury. The glue was effective in protection wounds while not busy with the natural motion of the lungs (inflation and deflation) or the skin once its application, in keeping with the findings of the study.

The researchers found that that the railway line sealing material wasn't ototoxic to the animals during which it absolutely was tested, and was naturally absorbed as its elements were degraded. And compared to sealants already on the market, the investigators noted that the sealing material was stronger and was a lot of immune to wound separation or breakdown. Railway line gel additionally represents an answer for not solely tissue regeneration however repair, effectively healing and protection incisions at the identical time. The researchers hope to start testing the gel in clinical trials in humans within the close to future, whereas investigation different applications in additional fresh developed, however untested versions of the compound.

Applications

- The implications for such railway line gel are various and embody roles within the OR and emergency department with wounds involving in depth hemorrhage, furthermore as on the battlefield--potentially saving lives and reducing the requirement for blood transfusions.
- Two -Octyl cyanoacrylate (Dermabond, Ethicon, Inc., Somerville NJ), a compound typically named as a "superglue" for the skin that has become wide utilized in emergency departments and within the OR for closing external traumatic and surgical wounds, is sort of distinct from the naturally derived railway line gel.
- Dermabond possesses important strength and naturally dissolves in 7-10 days, it's not naturally derived from human tissue, and can't be used on tissue layer surfaces or junctions like lips or within the mouth or within the body on internal organs.

Glue #	Function	Strengths	Drawbacks
1	Act as hemostats	Safe and easy to use	Can cause swelling and infections
2	Perform similar to hemostats	Safe and easy to apply	Antibody formation, plausible coagulopathy, and allergic reactions
3	Hemostat-like*via* fibrin clot	Easy to apply and more effective than 1 and 2	Similar to 1 and 2. Swelling, allergic reactions and infections
4	Hemostat, sealant, and adhesive	Very versatile, FDA approved, commercially available, and effective	Potential side effects are viral or prion disease, antibody formation, allergic reactions, and swelling
5	Moderately strong sealant	User friendly, low-cost, and biodegradable	Can cause significant swelling and not very effective on wet surfaces
6	Strong sealant and adhesive	User friendly and strong glue	Side effects are tissue necrosis and adhesive embolism
7	Strong adhesive	Readily available, easy to use, and instant bond	Limited to external use only and can cause foreign body reaction
8	Adhesive	Biodegradable, reduce dead space, and absorbed by the body	Increase surgical time for a few minutes. Not yet approved for sale or marketing in the USA.
9	Adhesive, used to seal defects in the heart and arteries	Strong and flexible, activated by UV light.	Promising adhesive. However, only animal models have been studied








Application of surgical Glue **After application of surgical Glue**

SUMMARY AND CONCLUSION

- Skin glues are a secure and effective methodology to shut selected wounds.
- They are in addition economical and facilitate stop infection.
- Careful wound alternative and apply of the technique produce wound closure with skin glue acceptable in up to twenty of wounds.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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