

Wound Closure Techniques

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Continuing Education Activity

Wound management is an essential part of emergency medicine practice. The clinicians care for wounds ranging from minor and simple lacerations or abrasions to complex wounds. Wound closure techniques have evolved significantly and now range from simple sutures to adhesive compounds, and techniques have also improved. This activity reviews the evaluation and management of wounds and highlights the role of the healthcare team in managing patients with different types of wounds and their respective closure.

Objectives:

- Describe the major wound closure techniques.
- Summarize the three underlying principles of proper suture technique.
- Outline risk factors that may produce less than optimal wound healing.
- Explain the importance of collaboration and communication amongst the interprofessional team to ensure the appropriate selection of candidates for wound closure and its technique.

Access free multiple choice questions on this topic.

Introduction

Wound management is an essential part of emergency medicine practice. The clinicians care for wounds ranging from minor and simple lacerations or abrasions to complex wounds. Wound closure techniques have evolved significantly and now range from simple sutures to adhesive compounds, and techniques have also improved. For injuries that require further management, it is imperative to assess the wound and determine how best to treat it. Multiple techniques can be used for wound closure. These include sutures, staples, and adhesives.[1][2][3]

Staples

For many minor wounds, sutures are the gold-standard method for closure. In a case where you have a linear laceration located on the scalp or extremities, it is a reasonable alternative to use staples. The advantage is that they can be placed quickly. This is immensely useful in situations where there is brisk bleeding and in mass casualty settings where there are multiple wounds to which to attend. They are also widely used to close postoperative incised wounds. Staples are cost-effective, easily placed, require minimal training, and have similar healing times and infection rates as sutures.[4][5][4]

Sutures

In primary wound closure, sutures are the standard of care. There are two types of sutures, absorbable and non-absorbable. Non-absorbable sutures are preferred because they provide great tensile strength, and the body's chemicals will not dissolve them during the natural healing process. Non-absorbable sutures are used primarily to close superficial wounds; whereas, absorbable sutures can be placed in a double layer closure for deeper wounds. In doing so, absorbable sutures help decrease the tension and better approximate the wound edges. This will allow for a lower risk of wound dehiscence and a more aesthetically pleasing outcome. Synthetic sutures tend to have a problem with "memory." That is, they tend to retain the shape of their packaging. This can potentially make it difficult to manipulate the suture during wound closure.

The choice of suture and technique depends on the type of wound, depth, degree of tension, and desired cosmetic results. Simple interrupted sutures have the advantage of more cosmetically appealing results, as the use of separate stitches allows for a better approximation of the skin and fascia. They provide greater tensile strength and have less risk of injuring cutaneous circulation. Also, in the case of an infection, the entire length of sutures would not need to come out.

For rapid hemorrhage control or long wounds with minimal tension, running sutures are the best choice. They can be applied quickly and spread tension along the wound. The disadvantage of running sutures is the risk of dehiscence if part of the suture material ruptures. This would cause the entire length of the suture to unravel.

For a wound that is deeper in nature, a mattress stitch can be placed, providing better strength. The deeper penetration into the skin layers minimizes tension and allowing for better closure at the wound edges. They can be thrown in as temporary stitches are removed after the tension is more evenly distributed across the wound. If there is still tension after wound closure, the mattress stitch can be left in place to decrease the risk of dehiscence. Mattress sutures can be applied as vertical or horizontal subtypes.

Sutures can also be applied with a subcuticular technique. It can be done either as a simple suture or continuous sutures. The skin is not pierced and thus has the ability to produce better aesthetic results. Care should be taken when applying these sutures as to the depth of the wound because they can form a potential cavity beneath the suture line if the wound is deep.

Adhesives

In percutaneous wounds or simple pediatric cases, skin glues are particularly useful as they are quick and relatively painless. Adhesive tapes and skin glues are a useful adjunct to deeper sutures too. They cause minimal wound inflammation, have a lower infection rate than sutures, and are removed easily.[6][7]

Regardless of which wound closure technique the responder chooses, it is important to remember that to achieve a thoroughly healed incision with minimum scarring; one should be mindful of the following:

- Line up the skin edges precisely to ensure minimal scarring.
- Do not pull too hard trying to reduce tension with sutures, as that can lead to further wound breakdown.
- Use skin adhesives and/or glue in conjunction or an adjunct to sutures or staples to strengthen the closure of your wound.

The goals of wound management are to avoid infection, tamponade the bleeding, and provide a better cosmetic outcome.[8][9]

Function

There are four distinct stages of wound healing which are (1) hemostasis, (2) inflammatory phase, (3) proliferative ("rebuilding") phase, and (4) maturation phase. The wound closure or healing occurs through three different methods,

as mentioned below. Regardless of the method used, the wound will heal by going through the above mentioned four phases.

Primary intention healing is when the wound edges are brought and kept together by sutures or staples. The healing occurs with wound epithelization and connective tissue deposition. This allows for lower infection rates. In the case of wound healing by secondary intention, the wounds heal by leaving them open and allowing for granulation tissue to form contraction of the wound edges and eventual epithelialization. Typically, this is seen with chronic wounds. These take longer to heal due to the volume of tissue needed to fill the defect. Healing by secondary intention puts the patient at risk for more infections as there is no epidermal barrier. The third one is healing by tertiary intention, also known as delayed primary closure, which involves delayed closure of a wound after a period of time, varying in different cases, for which the wound has been left open. These wounds are grossly contaminated but do not have significant tissue loss, and can potentially be closed after the wound is thoroughly explored, irrigated, debrided, and observed for 3 to 7 days before surgical closure or skin grafting.

In the process of wound healing, nutrition, lifestyle, medications, and infections all play a significant role. Active children and adults who exercise regularly tend to have better circulation and heal quicker due to better oxygenation and nourishment provided to the wound. Also, smoking limits the oxygen-carrying capacity of the blood and has been linked to forming clots, all of which can inhibit the wound healing process. Medications such as steroids, blood thinners, or antineoplastic agents tend to prolong healing as well.

Issues of Concern

Wound closure is not a painless event, and some anesthesia should be provided. For small wounds, lidocaine with epinephrine will suffice. The addition of epinephrine not only causes vasoconstriction and limits blood loss but also increases the duration of the anesthetic. An additional benefit of epinephrine is that it delays the absorption of anesthetic agents, thus allowing for a larger dose of the particular agent to be administered. However, it is vital not to inject epinephrine around the ears, the tip of the nose, penis, and distal phalanges. Otherwise, tissue necrosis can occur. Bupivacaine is a longer-acting anesthetic agent and can be used in cases requiring anesthesia for a longer period of time due to its long half-life. The clinician must know about the safe dosage of these agents.

- Lidocaine: 4 mg/kg to 4.5 mg/kg
- Lidocaine with epinephrine: 7 mg/kg
- Bupivacaine (with or without epinephrine) (adults only): 175 mg in a single dose or a maximum of 400 mg per 24 hours

It is also important to know when not to close the wound. Some wounds best heal by secondary intention. When the wound is dirty, or there is significant tissue loss, wound closure should be delayed. The immediate closure of animal and human bites is not recommended, and these wounds should be left open as this can lead to florid infection.[10]
[11]

Clinical Significance

Anyone who closes wounds should understand sutures. Unfortunately, no suture is ideal for every wound, and in most cases, several types of sutures are required to close the wound adequately. Today there are natural, synthetic, absorbable, non-absorbable, multifilament, and monofilament sutures available. Synthetic sutures are preferred around the face as they cause a limited reaction, and inflammation is minimized. Absorbable sutures are used in areas where there is no need for extensive support, and the wound heals faster, and these are also used in internal layers. Non-absorbable sutures are used when one wants continued mechanical support. Monofilaments are less susceptible to infection but can be traumatized by surgical instruments. The multifilaments can sustain infections, but they are prone to tangles.

Proper suture technique should incorporate three major principles, including proper distribution of tension to the deeper layers, atraumatic handling of tissues, and eversion of wound margins.

Other Issues

Complications can arise in this procedure as in any other procedure. Immediate complications may involve a hematoma formation due to poor hemostatic control. Human bites and some animal bites, particularly felines, have a very high chance of getting infecting early on. Antibiotics are imperative for such bite wounds, and these should be thoroughly cleansed. Late complications may involve scar formation due to improper technique. An unfortunate outcome in some people may be hypertrophic scars and keloid formation. Wound necrosis may also ensue in rare cases.

Enhancing Healthcare Team Outcomes

Multiple members of the interprofessional healthcare team should know when to close wounds and when to leave them open. This includes surgeons, other clinicians, including PAs and NPs, nurses, and surgical assistants. Premature closure of infected or contaminated wounds usually leads to prolonged hospitalization and higher healthcare costs. There are many wound closure techniques, and it is important to be familiar with them, as all of them have certain indications and contraindications. Once a wound is closed, the patient must be monitored to ensure that healing occurs without complications.[12][13] With interprofessional team approaches to wound closure, the patient stands a better chance for a positive outcome with less risk of infection and other adverse events.

Nursing, Allied Health, and Interprofessional Team Monitoring

Generally, post-closure assessment includes:

- Assess for presence, type, and amount of exudate:
 - Serous, serosanguineous, sanguineous, or purulent
 - Minimal, light, moderate, or heavy
- Assess surrounding skin tissue
- Assess wound margins for tunneling, rolled, undermining, fibrotic changes, and if unattached
- Evaluate for signs and symptoms of infect - warm, pain, odor, delayed healing
- Assess pain

Document finding and report unexpected findings to the healthcare team.

Review Questions

- Access free multiple choice questions on this topic.
- Comment on this article.

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