Procedures for cleansing, closing and covering acute wounds

If skin layers are not meticulously approximated, the patient may be left with an uneven or irregular scar line, which is cosmetically undesirable. Cross-hatching (when suture marks remain visible across the suture line) and needlepoint scarring may occur, which lead to an unacceptable cosmetic result (Fig 2). The needlepoint scarring can usually be avoided if sutures are removed before the eighth day (Edlich and Reddy, 2001).

Suturing is not an ideal closure method where skin is thin and friable as the suturing causes additional trauma to the area and the skin may tear around the sutures.

Suture removal Sutures are removed once healing has occurred (normally between five and 10 days after injury) and asepsis and correct technique must be observed in order to avoid pulling infected material through the healing wound. Sterile stitch-cutters are available.

Advantages

● Sutured wounds are strong. This tensile strength makes suturing a choice of wound-closure method where tissues are taut (Young, 1997), subjected to movement (for example, over joints) or where patients wish to return to normal activities quickly.

● Misplaced sutures can easily be removed and replaced whereas mistakes can be quickly rectified.

● Superficial, deep and complex wounds can be closed by suturing.

● Sutured wounds are strong. This tensile strength makes suturing the choice of wound-closure method where tissues are taut (Young, 1997), subjected to movement (for example, over joints) or where patients wish to return to normal activities quickly.

Disadvantages Suturing wounds requires considerable skill and is time-consuming. It also requires infiltration of the wound tissues with local anaesthetic, which increases the risk of needlestick injury (Ritchie and Rocke, 1989). There is also the potential that damage can occur to local tissue defences – forceps can crush skin edges and insertion of a needle may initiate an inflammatory response in the tissues (Edlich and Reddy, 2001).

The presence of suture material increases the risk of wound infection. In addition, the suture track provides an entry pathway for bacteria deep into the wound.

The wound must be kept scrupulously clean and dry until initial healing has taken place if further risk of bacterial invasion is to be avoided. This is not an easy option for some patients, for example children, and in some body areas such as the hands.

If sutures are tied too tightly, tissues can become damaged and devitalised, which provides further opportunity for bacterial ingression (Castille, 1998). Sutures tied too loosely will not hold the tissues in adequate apposition and may result in delayed healing and/or in a cosmetically unacceptable scar line.

Key words

Acute wounds
Wound closure
Wound cleansing

Box 1. Principles of wound care

● Tissues must be handled gently

● Caustic solutions that can sterilise skin must never be applied to the wound itself

● All dead and devitalised tissue must be removed – chemically, mechanically or surgically

● All dead space must be eliminated

(Aliyeh et al, 2002)

Box 2. Aims of wound closure

The aim of wound closure is to promote healing (Young, 1997) and this can be achieved by:

● Eliminating any dead space where infection or haematoma may occur;

● Realigning the tissues correctly so that minimal remodelling (the final stage of wound healing) is necessary within the wound (see p50);

● Holding the carefully aligned tissues together under the correct tension (not too tight or too loose) until healing has occurred;

● Avoiding the introduction of infection that will delay the healing process.

(Gottrup, 1999; Castille, 1998)

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Each year it is estimated that as many as three million acute wounds are treated in the UK (Wardrope and Edhouse, 2000). In order to provide optimum care to these patients, nurses need to understand the anatomy of the wounded tissue(s), the physiological processes of wound healing and be able to make informed decisions about the best way to cleanse, close and cover a wound. Marion Richardson outlines the options available for the management of acute wounds.

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Every wound and patient is different so there is no single method for the management of acute wounds. However, there are some guiding principles that can assist in the decision-making process. Most wounds are suitable for primary closure, for example with sutures, while for other wounds closure is either delayed or not attempted (healing by secondary intention). Atiyeh et al (2002) provide a list of the principles of wound care that must always be observed in order to avoid sepsis and to achieve optimal wound healing (Box 1).

Cleansing acute wounds Infection in a wound may disrupt and delay the healing process (Dealey, 1999), so it is important to reduce the risk of contamination by microbes. There are a number of factors to consider:

- Hair is a potential source of wound contamination and it is best to remove it before the wound is closed. Eyebrows, which are important and obvious facial features, should be left intact as misalignment is difficult to correct. Hair removal with electric hair clippers has been shown to result in far less infection than removal with a razor (Masterson et al, 1984);
- Foreign bodies (such as dirt, glass and other debris), haematoma and dead or dying tissue are potential foci for infection, so need to be removed from the wound. (Particles of dirt or debris left in a wound will lead to infection. The site, configuration and biomechanical properties of the wound may rule out a particular closure method. The patient’s needs in terms of cosmetic appearance and return to full function may also influence the choice.
- It may be possible to remove adherent and ingrained matter from the wound with high pressure irrigation using a 50ml syringe and a 19-gauge needle. The needle should be held close and perpendicular to the wound and the fluid pushed out as fast as possible to flush out debris from the wound (Edlich and Reddy, 2001). There is a potential risk of contaminated fluid splashing into the nurse’s eyes during this procedure so protective goggles should be worn or other precautions taken to avoid this;
- Devitalised tissue provides an anaerobic medium that enhances the proliferation of bacteria and inhibits phagocytosis, which is an important part of the healing process (Calvin, 1998). Dead and devitalised tissue must be removed before the wound is closed. The aim is to close only clean, healthy tissue and as little tissue as possible should be removed in order to achieve this aim. Again, a number of alternatives are available such as excision of the tissue with a scalpel or sterile scissors, scrubbing the wound with a sterile scrubbing brush or the use of maggots to digest necrotic tissue and bacteria (Root-Bernstein and Root-Bernstein, 1997). Patients will need analgesia during some of these procedures.

Choosing the closure method The aims of wound closure are listed in Box 2. A number of factors need to be considered when choosing the best method of closure. Details on the history of the injury may help to determine the depth of the wound and the likely risk of infection. The site, configuration and biomechanical properties of the wound may rule out a particular closure method. The patient’s needs in terms of cosmetic appearance and return to full function may also influence the choice.

Suturing Suturing has been practiced for at least four thousand years and remains the most common method of wound closure (Edlich and Reddy, 2001) (Fig 1). A broad range of suture materials and needles has been developed over the years to facilitate insertion. A broad range of suture materials and needles has been available. Absorbable sutures, which undergo rapid degradation, are suitable for primary closure, for example with staples in the skin

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anaesthetic is required and patients report that they are comfortable and good cosmetic results are produced.

Application of adhesive strips The strips are applied by apposing the wounded skin edges, either with forceps or with sterile gloved fingers. The adhesive strips are then applied across the wound. It is important that no tension is applied to the strip during application as this may result in shearing or blistering of the skin or loss of adhesion of the strip.

It is usually best to begin the procedure by laying a strip in the centre of the wound and then adding further strips, using light finger pressure along the length of the strip, to bisect the resulting half wounds until closure is complete. Laying the strips about 3mm apart will allow any exudates to escape. Laying strips parallel to the wound and on top of the closure strips (resulting in a train-track appearance) provides additional strength.

Disadvantages Strips do not adhere well to sweaty, oily or hairy areas (Gottrup, 1999) and this precludes their use in some body areas. The presence of tissue oedema may make it difficult to achieve good apposition of the tissue edges. Strips can only be used to close superficial wounds, so deeper layers will need to be sutured first, and they may be difficult to use on complex wounds. Elastic strips may be suitable over some joints but, generally, where skin is taut or subject to joint movement, adhesive strips do not provide optimum closure (Edlich and Reddy, 2001).

Removal of strips Once the wound has healed, strips are easy to remove and many patients will be able to do this for themselves without the need to return to a health care professional. It is important to support the skin during this procedure to avoid tearing or causing a friction burn to the skin.

Tissue adhesive Tissue adhesive (cyanoacrylate adhesive or surgical glue) has been available since the 1950s and has become increasingly popular as a wound-closure method in emergency settings (Fig 3). It achieves good cosmetic results (Farion et al, 2003) and results in low wound complication rates (Applebaum et al, 1993). The glue is supplied in small, single-use ampoules, which should not be resealed or reused, and has been shown on many occasions to be an acceptable alternative to sutures for simple, traumatic lacerations.

The glue is easy to apply from the sterile single-use vial in which it is supplied. The opened vial is squeezed gently to either spread a thin line of adhesive along the length of the clean, dry wound or to ‘spot-weld’ the wound by applying a series of dots along its length. The wound needs to be held together for 30 seconds to allow polymerisation to occur.

Gluing wounds is easy to perfect and the procedure is relatively painless (though polymerisation releases heat, which some patients find uncomfortable). It is quicker than suturing or using adhesive strips and, as no local anaesthetic is needed, there is no danger of needlestick injury. The glue provides a waterproof seal and helps to prevent contamination with dirt and bacteria.

Disadvantages There has been much debate about the cost-effectiveness of this wound-closure method. Balanced against the relatively high cost of the glue itself is the fact that no instrument or local anaesthetic are required.

There are cost savings in terms of nursing time and, also, there is no need for the patient to return for removal of the glue since it will rub off when healing is complete. However, there is a slight increase in the rate of wound dehiscence with tissue adhesive compared with standard wound-closure methods (Farion et al, 2003).

Glue is not generally suitable over joints and areas of high tension as the adhesive can break and it is not useful where frequent washing is necessary as it peels off. It is not usually considered as a management option for extensive or complex wounds.

In the emergency setting, it is uncommon to repair deep tissue layers using adhesive and this restricts the use of this closure method to superficial wound layers. It is possible to remove and reapply the glue if a mistake is made, but it is preferable not to do so and the assistance of another person to approximate the skin edges may be necessary.

Staples Skin staples have been available for many years and are supplied in disposable, single-use sterile packs. To insert staples, the stapler is placed over the carefully apposed edges of a cleaned wound – if possible with the edges slightly everted. The handle is squeezed to release the staple into the wound. Excessive pressure on the skin should be avoided as it may cause a poor cosmetic result and may make staple removal difficult. Staples are placed at intervals along the length of the wound (Fig 4). Once healing is achieved, the staples are removed with a special remover tool. Patient comfort and cosmetic results are similar to those achieved in sutured wounds.

Stapling is a quick method of wound closure and offers a low level of tissue reactivity and better resistance to infection than use of sutures (Edlich and Reddy, 2001).

Stapling can be performed without local anaesthetic.

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and this reduces the risk of needlestick injury. Ritchie and Rocke (1989) believe this makes it safer for the user and so they advocate its use on these grounds. However, some patients may not tolerate stapling without the use of local anaesthetic.

Several studies report the usefulness of stapling as a wound-closure method for simple scalp wounds in children (Khan et al, 2002; Kanegaye et al, 1997).

**Disadvantages** Staples are more expensive than sutures, particularly when local anaesthetic is used and when removal costs are considered. MacGregor et al (1989) suggest that this is outweighed by the simplicity of the method and safety factors. However, McClelland and Nellis (1997) noted that the cost was enough to restrict the use of staples within their A&E department to wounds where there was a risk of needlestick injury (such as with confused, agitated or violent patients).

Skill is required to insert staples and failing to align tissue edges correctly can cause scar deformity. Staples will only close superficial skin layers; sutures may be necessary to approximate deeper tissues within a wound.

**Hair ties (hair apposition technique)**

This method of wound closure is only suitable for scalp wounds. Tying hair from either side of a wound is cheap, effective, and less painful and distressing than suturing (Davies, 1988). No foreign material is introduced to the wound, no local anaesthetic is required and the method is fast and not painful. If the knot is insecure it can be secured with tissue adhesive or a skin-adhesive spray. It is not necessary for the patient to return for removal of the ties, so saving time and money.

However, the method is only suitable for superficial scalp wounds where the hair is at least 3cm long.

**Secondary dressings** After closure most wounds require a dressing, which serves a number of functions:

- Protection of the wound surface and closures;
- Provision of a barrier against dirt and bacteria;
- Absorption of wound exudates;
- Promotion of the healing process by providing warmth and moisture.

Different dressings are available for a range of wounds. Wounds heal better in a warm, moist environment (Collier, 1996) as this encourages regeneration of the tissues. Gas permeable films and membrane dressings provide this moist environment and some warmth but should not be used on infected wounds or where there is a large amount of exudate (Holt, 2000).

Where deeper dermal layers are involved, occlusive hydrocolloid dressings are recommended as these not only provide a warm, moist environment and encourage granulation but will also absorb exudates and can be left undisturbed for several days.

Removal of dressings should be avoided for as long as possible because it disrupts the healing tissues. Once again, these dressings are not suitable for infected wounds (Holt, 2000).

Where heavy exudates are produced or are expected from a wound, alginate or foam dressings are the option of choice. Dry gauze dressings are not recommended as they could shed fibres into the wound, which may allow bacterial infiltration (Dealey, 1999). They provide no moisture and little warmth may cause the wound to dehydrate. A huge variety of dressing options is available and readers are referred to a more detailed text, such as Dealey (1999), for more information.

**Care after wound closure** Once the wound has been cleansed, closed and covered, it is important to make a clear nursing record stating precisely what cleansing and closure methods were used. Number, type and gauge of any sutures used should be documented as should all the advice given to the patient about how to continue the care of his or her wound.

The patient should be told when and where to return for removal of sutures or staples, or how and when to remove other forms of wound closure. It is always advisable to inform patients of the signs of infection and where to go if they are concerned about their wound.

**Conclusion** Many factors affect the choice of closure method for a particular wound. An understanding of the principles and available methods of wound closure will lead to the right choice being made that will provide the optimum conditions needed for the patient’s body to heal itself and permanently close the wound.