Acute lacerations

Assessment and non-surgical management

CPD

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Background
Given appropriate case selection and capability, many acute lacerations can be managed in the primary care setting. An understanding of the basic pathophysiology, assessment and management principles is essential.

Objective
The aim of this article is to provide a basic framework for assessing and managing simple acute lacerations.

Discussion
The aim of assessment is initially to decide whether the laceration is suitable for office-based treatment, and then whether it requires formal surgical closure with sutures or staples. Two non-surgical techniques for skin closure in amenable wounds are described. A companion article in this issue provides details of surgical closure techniques and wound aftercare.

TRAUMATIC BREACHES of skin integrity are a common reason for presentation in the primary care setting. It is therefore important to be conversant with the assessment and triage principles of simple lacerations, as well as basic management techniques. This article will focus on the process of evaluation of an acute laceration, indications for specialist surgical referral and options for non-surgical treatment. A companion article provides technical details on basic surgical treatment.[1]

The tissue response to a breach of skin integrity is a sequence of overlapping phases (Table 1). Active management as described in this article aims to expedite this process, with the principal aims of haemostasis, cosmesis and minimisation of the risk of infection. While the default management for skin laceration closure is typically suturing, certain wounds may be amenable to less invasive forms of definitive treatment provided the principal aims are met. Assessment is therefore paramount in determining eligibility for non-surgical management.

Assessment

A focused history should include the time and mechanism of injury that led to the laceration. Crush injuries may be associated with external contamination, devitalisation of surrounding tissues and, in some cases, fracture of underlying bone. The mechanism of injury due to a sharp instrument, as well as details of the instrument itself, will give an indication of the likely degree of contamination and involvement of deeper structures. Lacerations due to bites are at high risk of infection and would merit a prolonged course of antibiotic therapy. Enquiry regarding estimated blood loss is especially important in young people, where vital signs in haemorrhage are often initially compensated.

Knowledge of past medical and surgical history is important to foresee possible complications or the need for prophylactic measures. For example, patients with a history of diabetes, vascular disease or steroid use may be at risk of impaired healing. Those who have undergone a lymph node dissection in the drainage basin of the laceration site (eg axillary or inguinal) are recommended to have a subsequent course of antibiotics to prevent major sepsis. Anticoagulants or platelet inhibitors may also pose a problem for haemostasis. A comprehensive social history is essential where there is suspicion of child abuse or domestic violence.

For all but the most trivial of lacerations, pulse and blood pressure should be measured initially to ascertain whether there has been significant blood loss. First aid treatment of an actively bleeding wound is direct pressure with a compressive bandage. A more detailed examination will allow documentation of length, likely depth, and degree of external contamination. Further examination is determined by the location of the wound and anatomical knowledge of underlying structures. For limb lacerations, distal sensation, motor function and vascularity should be tested to exclude nerve, tendon or vascular damage. Potentially penetrating lacerations over the torso necessitate a thorough examination of the chest and abdomen to exclude complications such as pneumothorax or hollow-viscus perforation. It should be borne in mind that penetrating chest wounds below the level of the nipples also carry a risk of intra-peritoneal involvement.

Indications for referral of acute lacerations are shown in Box 1. Ultimately, the need for referral should be informed by the capacity of the individual practitioner to provide the appropriate standard of care in his/her practice setting.

Management

The ideal management for most acute lacerations is immediate (primary) closure with meticulous approximation of wound edges. Traditional teaching advises against closure of lacerations older than 6–8 hours, largely because of concerns about increased bacterial load in the wound.[2,3] However, a recent Cochrane review yielded no high-quality evidence for or against a so-called 'golden period' for wound closure.[4] Therefore, the age of the wound per se should not inform the decision to primarily close or not, provided certain preparatory steps are undertaken:

- Tetanus prophylaxis should be considered for susceptible wounds, such as bites or those exposed to soil or other external contaminants. If any doubt exists regarding immunisation history, the patient should receive tetanus-containing vaccine and tetanus immunoglobulin.[5]
- Personal protective equipment – consisting of gloves, gown or apron, and goggles – is recommended for the treatment of open wounds to protect the patient and the practitioner. No evidence currently exists to suggest the superiority of sterile technique over clean surgical technique.
- Local anaesthesia is advised if significant tissue manipulation is required to approximate healthy skin edges, even if the wound is to be closed by non-surgical means. This can usually be done before skin antisepsis. Local anaesthetic can be infiltrated via the skin breach itself, in the dermal and subcutaneous layers, to a radius of 1–1.5 cm from the wound. This will adequately numb sensory nerve endings to enable potentially painful tissue handling. With appropriate expertise, regional nerve blocks are also a useful option for lacerations on extremities to avoid further tissue distortion. Maximum doses, onset times and duration of local anaesthetic agents should be considered (Table 2). Those incorporating adrenaline should be avoided on digits. In selected cases, there may be a case for 'pre-medication' with a topical local anaesthetic agent such as an anaesthetic cream, although the product information advises against using these on open wounds.[6]
- For wounds potentially contaminated with particulate matter or bacteria, wound irrigation is most commonly effected with sterile normal saline, either gently applied with soaked gauze swabs or under pressure via syringe.

Table 1. Biological phases of wound healing

1. Haemostasis	• Injured blood vessels constrict to minimise haemorrhage. • Platelet plugs form to seal breaches in the vessels. • Platelet plugs are stabilised by coagulation, whereby fibrin strands bind platelets together.
2. Inflammation	• Damaged blood vessels leak white cells, growth factors, nutrients and enzymes, which serve to prevent bacterial infection and promote proliferation of repair cells. • Resulting transudate causes tissue swelling.
3. Proliferation	• Fibroblasts are activated and migrate into the wound defect, laying down collagen and extracellular matrix. • Some differentiate into myofibroblasts that draw the wound edges together in a process known as wound contraction. • Angiogenesis occurs, whereby new blood vessels grow into the developing granulation tissue to keep it well oxygenated. • Epithelial cells proliferate from the edges inwards to resurface the granulating wound.
4. Maturation	• The cells of the proliferative phase are removed by apoptosis. • The collagen that has been laid down remodels from type III to type I, and becomes aligned with the skin's natural lines of tension. • Cross-linking of collagen fibres leads to a reduction in the volume of scar tissue, giving the wound additional strength, although a completely healed wound will only regain about 80% of the strength of the uninjured tissue.

Box 1. Indications for referral

- Suspected injury to underlying structures: nerves, tendons, named blood vessels, viscera, bones, joints
- Significant contamination or devitalisation of tissues
- Significant tissue loss or inability to primarily close wound edges
- Cosmetic considerations
- Unsuitability for local anaesthesia: large wound, need for extensive exploration or debridement, patient with needle phobia, children, combative patient, etc

There is no consensus on the additional benefit of active agents such as hydrogen peroxide or povidone iodine; at worst, they may be locally toxic to tissues and impair healing.[7] A Cochrane review has shown that irrigation with tap water alone is equally safe and effective.[8]

- Following preliminary cleansing, formal skin antisepsis is usually undertaken to reduce the load of ambient skin flora. Suitable antiseptic solutions are chlorhexidine gluconate or povidone-iodine, usually combined with alcohol. Swabbing should commence at a radius of 5–10 cm from the wound and move towards it. Care should be taken when swabbing in proximity to eyes and mucosal surfaces. The prepared surface can be left to air dry before manipulating the wound edges themselves.
- Where foreign matter (eg ground-in dirt) in the wound cannot be removed by irrigation alone, this should be sharply excised with scissors or scalpel. The same applies to ragged or obviously devascularised wound edges, which should be debrided back to healthy, bleeding tissue.

Certain acute lacerations may be amenable to so-called needle-free or non-surgical techniques that do not necessitate further trauma to normal skin edges, such as by suture needles or staples.

Topical skin adhesives

Originally used in veterinary practice, topical skin adhesives (TSAs) were approved for humans more than 20 years ago and offer an alternative for closure of traumatic skin lacerations. They use the reaction between cyanoacrylate and formaldehyde to form a liquid adhesive. Benefits include a needle-free technique, painlessness,[9] faster repair time,[9,10] reduced resource requirements (including consumables and sedation in paediatric populations), a water-resistant covering and no need for suture removal.[11] Cosmetic outcomes and infection rates have shown equivalence to sutures.[12–15] Disadvantages include a slightly increased rate of dehiscence (4% in comparison to 2% with sutures)[9,10,16] and allergic reactions.

The success of TSAs for lacerations is contingent on wound selection. The properties of TSAs restrict their use to 15–20% of all wounds and are described in Box 2.[10] In the authors' experience, cases most suitable are children with small wounds (eg <4 cm), facial or scalp lacerations fitting the stated criteria, and wounds amenable to adhesive strips (discussed later in this article) but with a need for more durable wound edge adhesion.

After careful selection, the wound should be cleaned as usual. The wound edges then need to be approximated (longitudinal tension at either end often helps). The adhesive should be applied to fully opposed skin edges to form a bridge across the wound, as direct application to subcutaneous tissues may lead to an inflammatory reaction and impaired healing.[17] A variety of TSAs exist, and knowing how to activate the polymerisation process and getting used to viscosity and flow will minimise unwanted spread and adhesion in locations such as around the eye. Once the polymerisation process is activated, TSA is applied to the wound and 5–10 mm either side. A wait time of 10–15 seconds should be allowed before applying another coat. Three coats are required to provide the equivalent strength of 4.0 nylon after 2.5 minutes.[10] The wound can be left exposed once dry, or covered if there is risk of the patient picking at it. Antibiotic ointments should not be used in conjunction with cyanoacrylate glues as they inhibit setting and can in fact be used to facilitate glue removal if adjustments are required.[18] The glue will peel off in 5–8 days, and an antibiotic ointment or petroleum jelly can help facilitate removal.

Adhesive strips

Adhesive strips may occasionally be used for minor tension-free skin breaks. However, their application as a sole wound closure agent is limited because of the need for persistent adhesion in most cases. They are more commonly useful in achieving initial wound edge approximation to be followed by definitive fixation with a TSA.[19]

Delayed primary and secondary closure

For some acute lacerations, immediate definitive (primary) closure may not be indicated or feasible. Tiny skin breaks in cosmetically inconsequential areas may be treated by secondary closure, whereby non-adhesive dressings are periodically applied to facilitate natural healing by contraction and re-epithelialisation.[20]

A heavily contaminated wound, or one where devascularised areas have yet to declare, can be managed by delayed primary closure. This involves dressing the open wound as above and re-examining it 2–3 days later to ascertain feasibility of definitive closure.

Table 2. Specifications of commonly used local anaesthetic agents

Anaesthetic	Maximum dose	Maximum volume (mL)	Onset (minutes)	Duration (hours)
Lignocaine 1%	5 mg/kg	35	<2	0.5–1
Lignocaine 1% with adrenaline	7 mg/kg	49	<2	2–6
Bupivacaine 0.25%	175 mg	70	2–10	2–4
Bupivacaine 0.25% with adrenaline	225 mg	90	2–10	3–7

Box 2. Indications for topical skin adhesives

- Good wound approximation
- Minimal or no tension
- Clean
- Dry/haemostatic
- Non-mucosal
- Patient with phobia of needles (eg children)

Key points

- Acute breaches of skin integrity heal by a process of inflammation, contraction and re-epithelialisation.
- This process can be expedited, with optimal cosmetic outcomes, by direct closure where feasible.
- Assessment of acute wounds is necessary to determine the suitability for treatment in the general practice setting.
- Assessment will also define those wounds amenable to direct closure by non-surgical means such as TSAs and adhesive strips.

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