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REVIEW

Pretibial lacerations

Kajal Gohil[1]

Parvathi Varma[1]

Geraldine Byford[1]

Karl Walsh[1]

Pratap Dutta[1]

Author details can be found at the end of this article

Correspondence to:
Kajal Gohil;
kajal.gohil2@nhs.net

Abstract

Patients with pretibial lacerations are commonly referred to plastic surgery services for operative intervention. However, the vast majority of cases can be managed conservatively. Through understanding the epidemiology and pathophysiology underlying these injuries to appropriately assessing and managing these patients, this review demonstrates how best to facilitate wound healing and undertake conservative management. A multidisciplinary approach to managing patients with pretibial lacerations is discussed so that clinicians can provide a better quality of life for patients through optimisation and preventing further decline.

Key words: Conservative management; Education; Pretibial lacerations; Preventative medicine; Wound healing

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Introduction

Pretibial lacerations are a common presentation and these patients are frequently referred to the plastic surgery service. They often have a plethora of comorbidities given that they have a mean age of 78±14 years (Glass and Jain, 2014) and, as such, are admitted under the medical team. Medical optimisation is prioritised, so management of pretibial lacerations tends to be delayed. These injuries are often neglected, with mismanagement leading to prolonged hospitalisation and terminal decline (Glass and Jain, 2014). This article summarises the assessment and conservative management of pretibial lacerations, considering different patient factors.

Epidemiology

Occurring mainly in the older population, pretibial lacerations account for 5.2 out of every 1000 emergency department attendances in the UK (Cahill et al, 2015), with an estimated incidence of 40–70 per 100 000 per year (Laing and Tan, 2009). The financial impact of this is significant, as each acute admission is estimated to cost about £3500 (Thomson et al, 2014). Patients with these injuries are often referred to plastic surgery units for an opinion about possible surgical intervention. However, these patients are more likely to have comorbidities which may make an operation more complicated.

A study by Ousey et al (2010) found that the average age of patients presenting to the emergency department with pretibial lacerations is 82 years. The most common comorbidities included a previous stroke (29% of patients), chronic obstructive pulmonary disease (29% of patients) and ischaemic heart disease (25% of patients), with others including diabetes mellitus, active cancer and renal failure (Ousey et al, 2010). Factors thought to predispose a patient to having a pretibial laceration include increasing age, female sex, systemic steroid use, decreased mobility or balance, and poor vision (Hili et al, 2017). Inappropriate management of these injuries can lead to a further decrease in mobility and increased morbidity and mortality. Glass and Jain (2014) highlighted an approximate 10% mortality in the 6-month period following hospital discharge. Cahill et al (2015) showed that up to 6% of patients with pretibial lacerations die within the first month of injury, and 26% within a year, although this was attributed to the premorbid state rather than directly to the injury.

Pathophysiology

Pretibial lacerations frequently occur in older people because they have reduced levels and density of collagen in the skin and reduced dermal thickness. This is more apparent

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in women than men across all ages (Shuster et al, 1975). Collagen density can also be affected by comorbidities. Studies on obese diabetic mice have revealed thinner collagen bundles, decreased collagen fibre density and overall weaker tensile strength, with further research pending on translation to human models. Oxidative stress occurs alongside overexpression of matrix metalloproteinase genes, affecting dermal fragility (Ibuki et al, 2012). The physiological changes to skin integrity are reflected in the friable nature of skin with the ageing process, leading to injury out of proportion to simple mechanisms of trauma. This is also exacerbated by the subcutaneous location of the tibia which causes large skin lacerations with greater propensity for soft tissue losses.

Prescription medications such as anticoagulants can cause haematomas underlying pretibial lacerations. Haematomas cause a pressure effect on surrounding healthy soft tissues and compromise tissue viability because they create an ischaemic environment with the production of free radicals (Singh et al, 2017). Corticosteroid use also reduces skin integrity.

Finally, malnutrition plays a large role, with vitamins, minerals, carbohydrates, fats and proteins all essential intrinsic factors in wound healing, including the phases of inflammation, proliferation and remodelling. For example, zinc and iron have a role in DNA synthesis, while protein, vitamins A and C have a structural role in collagen synthesis (Harris and Fraser, 2004). Extrinsic factors affecting wound healing include inadequate dietary routine and a mismatch between the increased nutritional requirements and reduced calorie needs in older people because they have less lean body mass (Harris and Fraser, 2004). It is crucial to consider both intrinsic and extrinsic factors to understand the impact that malnutrition plays in wound healing.

Bearing this in mind, it is easy to delineate the pathophysiology underpinning pretibial lacerations. Clinicians should acknowledge and optimise these factors as part of the management of these patients.

Clinical assessment

The clinical assessment in these patients should include a focused history as well as an examination of the wound itself. Salient points to ask about include the mechanism of injury, as well as any precipitating factors leading to the event. It is important to rule out any other concomitant injuries. The rest of the history should include details of relevant comorbidities and medication history, paying particular attention to whether the patient is taking anticoagulants and/or steroids. These patients will be at higher risk of developing a pretibial haematoma and are likely to have fragile skin. Other examples of immunocompromised status, such as diabetes, need to be noted as these patients experience delayed wound healing with associated increased risk of infection. Last, it is vital to ask about social history, including social support, social residence, mobility status and independence with activities of daily living (Hili et al, 2017).

A clinical examination follows and should begin with a general examination following A–E principles, ensuring that life- or limb-threatening injuries are addressed primarily and that the patient is haemodynamically stable. A focused examination of the limb should include its neurovascular status and assessment of the wound. The different components of the wound assessment are described in **Table 1**.

After assessment of the patient and the limb, baseline investigations should be ordered. In older patients with multiple comorbidities, it may be useful to have a baseline set of blood tests, including a clotting profile if they are taking any anticoagulants. Plain X-rays of the injured leg will also be useful (in two views) to exclude fractures or foreign bodies, as well as a microbiology swab of the wound. Clinical photographs should be taken on first presentation as this is useful to monitor progress, classify the laceration and formulate a management plan.

Pretibial lacerations can range from simple linear lacerations and viable flap lacerations (**Figure 1a**) to non-viable flap lacerations with a degree of skin loss of >1% total body surface area with an associated underlying haematoma (**Figure 2a**). Clinical examination helps to clarify whether the laceration can be managed conservatively or requires plastic surgery input for further treatment. **Figure 1a** shows a simple viable flap laceration. Although the flaps are bruised, they are viable and can be managed conservatively with simple dressings

Table 1. Wound assessment summary in the clinical examination
Size and morphology (linear, flap, jagged)
Depth: skin, subcutaneous tissue, muscle, tendon, bone
Around: inflammation, infection, active bleeding, skin quality, oedema
Bed: evidence of necrosis or over-granulation? Any exudate?
Contamination?
Any obvious deformity? This could indicate an underlying fracture
Any skin loss? Presence of haematoma?
Skin edge and flap viability? Dark flap or dusky blue edge means non-viable

Figure 1. a. A simple viable flap laceration affecting the left lower limb. b. Conservative management over a 3-month period demonstrating a healed pretibial laceration.

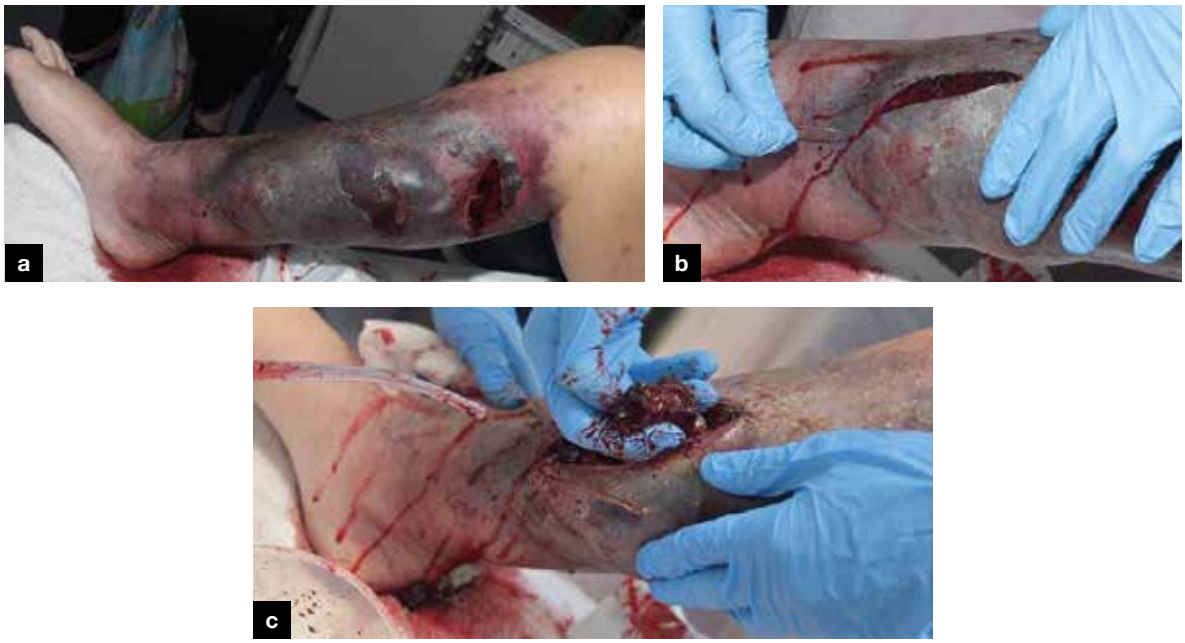

Figure 2. a. Pretibial laceration with necrotic skin and underlying haematoma affecting the right lower limb. b. Small incision is made over the haematoma. c. Evacuation of haematoma.

as first-line treatment (Figure 1b). Figures 2a–c show a series of photos from a patient that presented to the authors' complex wound clinic with a pretibial laceration and underlying haematoma. The necrotic skin was debrided and the haematoma evacuated to assess the degree of skin loss and plan further management. Often patients have several comorbidities and, even with a large haematoma as in Figure 2a, conservative management with dressings might be warranted depending on patient choice and patient factors.

Table 2. Modified Dunkin classification for management of pretibial lacerations

Type	Description	Management
I	Linear laceration without skin loss	Manage conservatively
II	Viable flap laceration	Steri-strip in emergency department Manage conservatively
III	Non-viable flap laceration	A small non-viable flap may be excised and managed conservatively with dressings Larger skin flaps can be primarily excised and skin grafted under local anaesthetic
IV	Skin loss	Manage conservatively if less than 1% total body surface area If the wound fails to heal within 2–3 months, consider a delayed primary skin graft under local anaesthetic
V	Laceration with haematoma	Will often require surgery Evacuate haematoma and skin graft

From Dunkin et al (2003)

There is a variety of classifications proposed for pretibial lacerations. The modified Dunkin classification (Table 2; Lo et al, 2012) provides a useful management guide based on skin viability, total body surface area affected and whether there is an underlying haematoma. However, it should only be used as a reference point and each patient should be treated on an individual basis.

Management

Through referencing the standard operating procedure used at Manchester University NHS Foundation Trust, this article outlines the management of pretibial injuries (Figure 3). The aim of the standard operating procedure is to standardise the management of patients with pretibial injury referred to a tertiary plastic surgery trauma service. A multidisciplinary approach was incorporated when developing the guidelines, using the expertise of consultants in emergency medicine, acute medicine and care of the elderly. The target audience for these guidelines includes plastic surgery departments, complex wound teams, emergency departments, acute medicine/care of the elderly departments, GPs, allied health professionals, district and tissue viability nurses.

Conservative management must begin with thorough wound irrigation with saline or chlorhexidine scrub to remove debris, allow accurate assessment of the wound and reduce the risk of infection (Xu et al, 2009). Devascularised skin and fat can be debrided. Evacuation of haematoma is recommended to remove a potential site for bacterial growth, and prevent overlying skin tension and further necrosis (Hili et al, 2017). Using an area where the skin has already been breached or making a small incision with a scalpel over a haematoma enables evacuation. Caution is required in patients taking anticoagulants as evacuation may precipitate further bleeding. Wound debridement in this manner may require administration of local anaesthetic.

Mepitel, a soft silicone non-adherent dressing, is commonly used by nurse specialists for optimal wound coverage. Other alternatives are Jelonet, silver-based or hydrocolloid dressings. Hydrogels are moist dressings that are useful for treating haematomas or necrotic skin edges, as they promote autolytic debridement of non-viable soft tissues (Hili et al, 2017). Mobilisation and leg elevation allows reduction of oedema, which can delay wound healing. Wound closure should be performed for clean wounds, using Steri-strips to approximate wound edges without tension, with space between strips to allow drainage of exudate and blood. Suturing is not advised as this causes skin necrosis and delayed wound healing (Sutton and Pritty, 1985). There is insufficient evidence to support the use of prophylactic antibiotics (Lo et al, 2012).

Broadly speaking, patients with large necrotic skin flaps, large areas of skin loss, major haematoma, failed conservative management after 2–3 months, gross contamination or

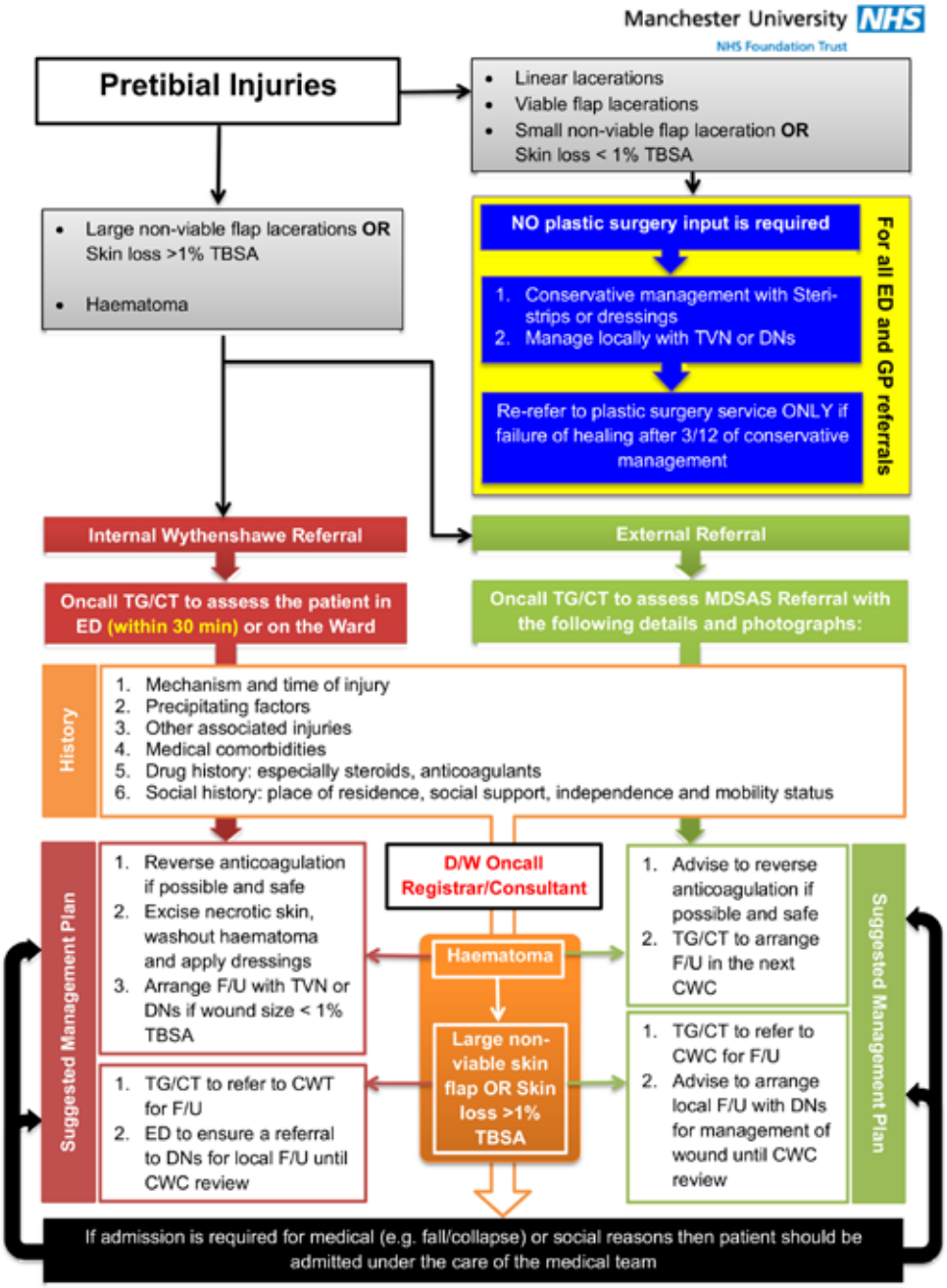

Figure 3. Pretibial injuries standard operating procedure, Manchester University NHS Foundation Trust. CWC = complex wound clinic; CWT = complex wound team; DNs = district nurse; ED = emergency department; F/U = follow up; MDSAS = referral system accessible on the Internet for various NHS specialities; TBSA = total body surface area; TG/CT = trust grade/core trainee; TVN = tissue viability nurse.

infection and large wounds >1% total body surface area can be considered for operative management (ie excision and grafting). Grafting is equally successful under local or general anaesthetic (Lo et al, 2012).

It is important to be aware of potential complications of conservatively managed pretibial lacerations such as wound infection, delayed healing, skin necrosis, decline in mobility, morbidity and mortality (Hili et al, 2017). Although Figure 3 does not explicitly address management in the presence of infection (pain, cellulitis, change in exudate, pus-like discharge) clinical judgement should be used regarding starting systemic antibiotic therapy, with guidance from wound swab sensitivities. If the infection is severe or the patient is septic, intravenous therapy and surgical intervention should be considered. Gram-positive

cover yields first-line empirical antibiotic therapy (flucloxacillin or clarithromycin) for infected pretibial lacerations because *Staphylococcus aureus* is a common pathogen, although local trust guidelines should be followed.

It is important to highlight that operative management is not a 'quick fix' for pretibial lacerations. Clinicians must consider the impact that surgery has on frail older patients. These cases are often postponed, and repeat nil-by-mouth, bedbound state and exposure to nosocomial infections contribute negatively to a patient's performance status and can also affect the recovery period. Crawford and Gipson (1977) demonstrated the success of non-operative management in severe lacerations in a series of 48 patients. More recently, Lo et al (2012) and Seppälä et al (2021) support a preference for conservative management, avoiding admission if possible and ensuring continued mobilisation for better quality of life.

Singh et al (2017) noted that patients managed surgically have a shorter length of stay than patients managed conservatively who need a multidisciplinary team and a social care package. It has been proposed that tertiary care for surgical intervention should be restricted to patients with Dunkin type III lacerations or higher, with minimal delay to theatre and a reduced hospital stay with discharge planning in advance. For conservative management, district nurses have a valuable role for managing patients with Dunkin type I lacerations and district general hospitals can be beneficial in treating patients with Dunkin type II pretibial lacerations.

Prevention is also an important factor of management as summarised by Hili et al (2017), separating measures by patient factors (emollient, long protective clothing, bandage application) and environmental factors (adequate lighting, risk assessment of surroundings (furniture placement), padding sharp edges).

By following the management pathway outlined in Figure 3, a multidisciplinary approach can be used in the safe management of pretibial lacerations.

Conclusions

Pretibial lacerations are increasingly common presentations given the demographic profile of society and the population presenting to secondary care. Before consideration of surgical intervention, one must acknowledge the effects of pathophysiology and underlying comorbidities. With diligent clinical assessment and optimisation of precipitating factors, clinicians can conservatively manage most pretibial lacerations promptly to reduce the duration of hospital admission and provide a better quality of life for patients. In addition, if surgical management is considered, expediting time to theatre can result in a positive outcome with reduced length of stay, fewer complications and better financial status for services.

Author details

[1]Burns and Plastic Surgery Department, Manchester University NHS Foundation Trust, Wythenshawe Hospital, Manchester, UK

Conflicts of interest

The authors declare that there are no conflicts of interest.

Key points

- Pretibial lacerations are common and the majority can be managed conservatively.
- Minor pretibial lacerations should be managed by emergency departments and followed up in the community. Plastic surgery referrals are usually not indicated but input can be provided later if conservative management has failed.
- Patients with isolated pretibial lacerations should not be routinely admitted to hospital. If admission is required for medical or social reasons then the patient should be admitted under the care of the medical team.
- When considering safe management options, it is important to acknowledge wound healing factors including potential complications, patient comorbidities and quality of life, especially mobility status.

References

Cahill KC, Gilleard O, Weir A, Cubison TC. The epidemiology and mortality of pretibial lacerations. J Plast Reconstr Aesthet Surg. 2015;68(5):724–728. https://doi.org/10.1016/j.bjps.2015.01.011

Crawford BS, Gipson M. The conservative management of pretibial lacerations in elderly patients. Br J Plast Surg. 1977;30(2):174–176. https://doi.org/10.1016/0007-1226(77)90019-4

Dunkin CS, Elfleet D, Ling C, Brown TP. A step-by-step guide to classifying and managing pretibial injuries. J Wound Care. 2003;12(3):109–111. https://doi.org/10.12968/jowc.2003.12.3.26473

Glass GE, Jain A. Pretibial lacerations: experience from a lower limb trauma centre and systematic review. J Plast Reconstr Aesthet Surg. 2014;67(12):1694–1702. https://doi.org/10.1016/j.bjps.2014.08.001

Harris CL, Fraser C. Malnutrition in the institutionalized elderly: the effects on wound healing. Ostomy Wound Manage. 2004;50(10):54–63

Hili S, Wong KY, Stephens P. Pretibial lacerations. Br J Hosp Med. 2017;78(11):C162–C166. https://doi.org/10.12968/hmed.2017.78.11.C162

Ibuki A, Akase T, Nagase T et al. Skin fragility in obese diabetic mice: possible involvement of elevated oxidative stress and upregulation of matrix metalloproteinases. Exp Dermatol. 2012;21(3):178–183. https://doi.org/10.1111/j.1600-0625.2011.01409.x

Laing R, Tan ST. Pretibial injury: prevention is possible and preferable. N Z Med J. 2009;122(1291):114–116

Lo S, Hallan MJ, Smith S et al. The tertiary management of pretibial lacerations. J Plast Reconstr Aesthet Surg. 2012;65(9):1143–1150. https://doi.org/10.1016/j.bjps.2011.12.036

Ousey K, Gillibrand WP, McClelland H. An investigation into the incidence, causes, progression and treatment of pre- tibial lacerations in the elderly. 2010. https://eprints.hud.ac.uk/id/eprint/9066/1/OuseyInvestigation.pdf (accessed 15 December 2022)

Seppälä T, Grünthal V, Koljonen V. Pretibial lacerations among elderly patients: a province-wide study from Kymenlaakso, Finland, 2015-2019. J Plast Reconstr Aesthet Surg. 2021;74(9):2244-2250. https://doi.org/10.1016/j.bjps.2020.12.107

Shuster S, Black MM, McVitie E. The influence of age and sex on skin thickness, skin collagen and density. Br J Dermatol. 1975;93(6):639–643. https://doi.org/10.1111/j.1365-2133.1975.tb05113.x

Singh P, Khatib M, Elfaki A et al. The management of pretibial lacerations. Annals. 2017;99(8):637–640. https://doi.org/10.1308/rcsann.2017.0137

Sutton R, Pritty P. Use of sutures or adhesive tapes for primary closure of pretibial lacerations. BMJ. 1985;290(6482):1627. https://doi.org/10.1136/bmj.290.6482.1627

Thomson WL, Pujol-Nicolas A, Tahir A et al. A kick in the shins: the financial impact of uncontrolled warfarin use in pre-tibial haematomas. Injury. 2014;45(1):250–252. https://doi.org/10.1016/j.injury.2012.07.007

Xu X, Lau K, Taira BR et al. The current management of skin tears. Am J Emerg Med. 2009;27(6):729–733. https://doi.org/10.1016/j.ajem.2008.05.015