The integumentary system

15

15.1 Principles of inflammation and wound management

Wounds are an extremely common, and in many cases preventable, presentation to working equine veterinarians. Knowledge of inflammation and the healing process is required for the management of these wounds. In order to minimise the occurrence of wounds in the future, it is important to understand the underlying causes.

Phases of healing

There is overlap between each of the classic phases of healing described. The timing of each process will depend on the size and depth of the wound.

1. Inflammatory phase

This phase begins immediately after injury has occurred.

Haemostasis and formation of a wound matrix: haemorrhaging blood from traumatised vessels flushes the wound; removing debris and micro-organisms. This is followed by vasoconstriction and clot formation (haemostasis). Fibrin within the blood clot forms the provisional wound matrix. Cells involved in tissue regeneration begin to migrate to the site.

The inflammatory process is initiated by activation of the complement pathway within the wound. The early phase of the inflammatory response is characterised by the arrival of neutrophils. A late phase follows (day 3 onwards) with the appearance of monocytes. Phagocytosis of bacteria and degradation of necrotic tissue by neutrophils occurs for 2–5 days. Inflammation can lead to tissue damage if prolonged; this can occur in infected wounds.

There are five clinical signs of acute inflammation: heat, redness (vasodilation), swelling (oedema), loss of function and pain (inflammatory mediators sensitise nerve fibres).

2. Proliferative phase

This phase begins 2–3 days after injury and the duration depends on the size of the original wound.

During the proliferative phase the wound surface is covered with granulation tissue which also helps to fill the cavity. New blood vessels form (angiogenesis) to supply the granulation tissue; the healing wound is highly vascularised and easily traumatised at this stage. Excessive granulation tissue is known as proud flesh (where the tissue protrudes above the surrounding skin), which inhibits skin re-epithelialisation. Re-epithelialisation is initiated from the wound edges; this is preceded by the migration of fibroblasts to the injury site. Fibroblasts synthesise collagen forming the basis of a new matrix of connective tissue. Keratinocytes migrate across the matrix to form the new epithelial layer.

3. Maturation phase

Formation of granulation tissue gradually slows (from 2 to 3 weeks post injury), and the wound becomes stronger with the re-modelling of collagen fibres within the tissue. Angiogenic processes diminish and the blood supply to the wound reduces. Myofibroblasts induce wound contraction.

As there is no potential for the regeneration of hair follicles the scar will remain hairless.

By understanding the process of wound healing the optimal conditions can be created to promote rapid repair of injury. This process is not only complex but fragile, and susceptible to interruption or failure leading to the formation of non-healing chronic wounds. Infection of a wound delays healing; it is essential to spend sufficient time cleaning and preparing wounds for effective healing.

Figures 15.1.1 demonstrate the healing process from the initial trauma with associated haemorrhage and inflammation through to granulation and epithelialisation stages.

Figure 15.1.1 The wound on day 1 (left) and 2 weeks later demonstrating healthy granulation tissue with re-epithelialisation and contraction.

Factors affecting wound healing

What factors affect the prognosis of a healing wound?

When treating a wound or advising the owner on appropriate management it is important to consider whether the following factors are present, and how to alleviate or prevent them.

Infection resulting in a chronic inflammatory state. The tissue fails to progress through the normal stages giving rise to a non-healing wound.

Ischeamia and necrosis Often the result of poor perfusion or substantial tissue trauma as outlined below

Oedema Extracellular water which increases the diffusion distances of oxygen from capillaries

Tissue trauma Trauma to the wound site when the injury occurred, or subsequent trauma, e.g. caused by the vet's over-zealous surgical debridement or the owner's application of toxic substances

Foreign body The presence of foreign material within the wound induces a chronic inflammatory state if the foreign body is too large to be resolved by macrophage phagocytosis.

Corticosteroids These delay wound closure by suppressing the growth factors necessary in the proliferative phase.

Protein deficiency Low albumin results in slower collagen formation.

Poor perfusion Reduced delivery of nutrients, leukocytes, inflammatory cytokines and oxygen to the injury site. This may be the result of damaged local blood vessels, hypovolaemia, severe anaemia, etc.

Stress Induces a physiological (as opposed to iatrogenic) increase in glucocorticoids which has negative effects on pro-inflammatory cytokines and growth factors. This factor is of particular importance for working equids (Christian et al. 2006).

Movement Pressure and movement from harnesses, tack, etc. or movement of the wound as the skin shifts over a joint will slow healing as the wound matrix breaks. New epithelial cells are delicate and a repaired wound has reduced strength even once a scar has formed.

Concurrent disease A chronic debilitating disease can cause immunosuppression and reduced nutrient supply to a healing wound.

Figure 15.1.2 Open wounds over the carpus joint. The fresh blood indicates that this wound has occurred within the last few hours. There is a risk of joint sepsis in wounds directly over joints.

Wound management

When an injury occurs directly over a joint (Figure 15.1.2) it is essential to establish whether a synovial membrane has been breached as, if this has occurred, the result is a septic arthritis (see Section 14.7 Conditions affecting the joints). Once a joint infection is established, a day or so after the inciting cause, the affected animal is likely to be severely lame. At this stage it is difficult to resolve the infection. By determining at the outset whether a joint is involved it may be possible to flush the joint and reduce the likelihood of infection.

Clip and aseptically prepare a large area around the wound to include the skin overlying any local joints. Place a needle into the joint (synoviocentesis) at a site distant to the wound, as described for intra-articular medication in Section 4.1 Drug administration techniques. After collecting joint fluid for cytology, inject 5–10 ml of sterile saline through the needle to pressurise the joint capsule. If this fluid passes out though the wound this confirms damage to the synovial membrane and the joint is likely to be contaminated. Continue to flush the joint with copious (at least 1 litre) sterile fluids, place an egress needle at another site in the joint to improve flow. Following flushing remove the egress needle and inject 2–5 ml of an antibiotic suitable for intra-articular use such as amikacin sulfate (250–500 mg) or gentamicin (1 g).

Figure 15.1.3 Fresh wound on a horse's forelimb.

The Golden Period is a theoretical time frame of 8 hours after which a contaminated wound is described as infected (Figure 15.1.3). Within approximately 8 hours any bacteria present within the wound will adhere to the tissue surface and are unlikely to be removed by wound flushing and debridement. This has implications when determining a wound management protocol (e.g. open wound or closed wound). If more than 8 hours have passed it is preferable to allow a wound to heal by second intention. Suturing an infected wound is likely to lead to slow healing, chronic wound formation and suture breakdown.

Initial medical treatment of acute wounds

Treat with NSAIDs to provide pain relief and minimise swelling. Ensure tetanus cover is provided and, if the equid has not been vaccinated, administer tetanus anti-toxin. Administer a full course of antibiotics to equids with an infected wound. A single dose will have little effect and risks the development of bacterial resistance. If the wound is uncontaminated and sutured within 8 hours of the injury antibiotics may not be required; these cases are rare.

> Most wounds in working equids are unlikely to be suitable for suturing.

Open wound management

Wound types appropriate for open wound management are listed below:

- Dirty or infected wounds (> 8 hours old)
- All puncture wounds
- Maggot-infested wounds
- Chronic wounds
- Saddle and harness wounds
- Wounds with large skin or tissue deficits
- Wounds over joints
- Wounds below the carpus
- Sutured wounds that have broken down

Figure 15.1.4 Shaving around a wound.

Steps in managing open wounds

1. Reduce contamination or infection:

- Protect the wound with moist swabs or sterile lubricant.
- Clip or shave hair from wound edges (Figure 15.1.4).
- Clean the surrounding area with antiseptic. Iodine, if used, should be the colour of weak tea. Strong antiseptics, including spirit or purple spray, result in damage to the delicate epithelial tissue.
- Remove any maggots or foreign bodies from the wound.
- Clean the wound from the centre.
- Flush with large volumes of sterile saline in a 60-ml syringe with an 18G needle.
- With sterile gloves explore the wound to establish which anatomical structures are involved.

'Dilution is the solution to pollution.' A large volume of water, applied under moderate pressure, is an important factor in helping a wound to heal. Owners can continue with this treatment daily. Caution that clean boiled and cooled water must be used for flushing.

2. Debride the wound:

1. Infiltrate a local anaesthetic to the wound edges. It is preferable to use mepivacaine or lidocaine without adrenaline. An alternative is perineural anaesthesia (see Section 14.2 Working equine lameness examination).
2. Use a scalpel blade to debride the edges of the skin by sharp dissection; remove a thin margin of skin rather than just scraping the edge of the wound.
3. Resect devitalised and necrotic tissue (black, dried, crusting).

For grossly contaminated wounds 'wet-to-dry' dressings can be used to lift the necrotic tissue and debris from the wound surface that cannot be removed by cleaning and debridement. Apply wet gauzes to the surface of the wound and bandage. Remove after 24 hours.

3. Protect the wound:

1. Application of a sterile wound lubricant is beneficial to keep the wound surface moist. Antiseptics, antibiotic preparations or medicinal plants are unlikely to create an environment optimal for wound healing. However, honey has been used to treat human wounds and there is evidence that this has positive effects for wound healing (Noori et al. 2011).
2. Corticosteroid creams should not be used in the majority of cases as it slows wound healing. The exception is with proud flesh (see later in this chapter).
3. Keep flies and dirt away with a bandage if possible and ensure harness or padding is not over the top of the wound. A cotton sheet can be used on areas that are hard to bandage such as the withers or neck. Bandaging can also reduce swelling and oedema, in the early stages, and immobilise the affected region. 'Strikethrough', where wound exudate has seeped through the bandage, creates a channel for the migration of micro-organisms. The bandage should be changed at this stage.

Closed wound management (suturing)

Sutured wounds in equids have a high rate of breakdown, even in the absence of the aforementioned factors which delay healing.

A wound may only be sutured if the following conditions can be fulfilled:

1. A fresh wound of less than 8 hours old ('golden period')
2. A clean wound with no gross contamination
3. There will be little tension when the skin edges are brought together.

Principles of suturing wounds

Needle choice Use a cutting needle when suturing the skin and a round-bodied needle when suturing subcutaneous tissues.

Suture material

Absorbable sutures are used when suturing structures below the skin surface.

Subcutaneous tissue Size 2 to 3 metric, absorbable monofilament such as monocryl (poliglecaprone 25) or multifilament such as vicryl (polyglactin 910). Catgut can be used. However, natural suture materials tend to induce an inflammatory reaction and rapidly reduce in tensile strength.

Muscle Size 3 to 5 metric, absorbable monofilament such as maxon (polyglyconate)/PDS (polydioxanone) or multifilament such as vicryl (polyglactin 910). Again, catgut can be used but synthetic suture materials are preferable.

Non-absorbable sutures for the skin itself (will need removing after 10–14 days).

Monofilament is preferable as multifilament sutures may create a channel for microorganisms into the wound.

Size is important – ensure it is not going to pull through (too thin) or affect healing (too thick).

Appositional skin sutures Size 3 to 3.5 metric, non-absorbable monofilament prolene (polypropylene) or ethilon (nylon)

(Suture recommendations from Stashak and Theoret, 2009)

Suture pattern Simple interrupted, cruciate or mattress suture patterns are preferable. It is essential to use the least number of sutures necessary to appose the wound under minimal tension. Sutures are a foreign body and will induce an inflammatory response.

Tension Excessive tension can cause tissue necrosis. Wound edges should just touch; swelling continues for 24 hours following an injury. Tying the throws down over a pair of haemostat forceps will ensure that the sutures are not too tight. Tension sutures may be required to stabilise a wound over a joint. If the wound is under severe tension, mobilisation of skin, using undermining, skin incisions or flaps, has been recommended. These procedures can be technically challenging and can risk wound breakdown, refer to Stashak and Theoret (2009) for detailed instruction.

Intra-wound antibiotics are controversial but have been shown to reduce infection rates. Limit antibiotic delivery into the wound to examples with a poor blood supply. It is important to use water soluble and non-irritant antibiotics.

> If it is unclear whether a wound should be sutured or left open, always ensure cleanliness and leave to heal as an open wound.

Surgical drains

Dead space is the potential space underlying an incompletely closed wound. This space is created as the result of a deficit in the muscle or subcutaneous tissue that has not been closed or where it has not been possible to directly appose tissues. Accumulation of blood or serum within this space will delay healing. A surgical drain placed within the wound allows drainage of the accumulating fluid, and eventually closure of the space. A Penrose drain (soft rubber tube) is most commonly used; the fluid drains along the sides of this tube rather than through the centre. Gauze or bandage in the wound is not recommended as drainage is poor, and this material can act as a 'wick' for infection.

The drain should be placed in the wound and attached by a suture through the skin. Exit the drain through a separate stab incision at the most ventral part of the cavity, below the suture

line, attaching with a second skin suture. Do not exit the drain through the wound or suture line as this will prevent healing. Remove the drain after fluid has stopped leaking from the wound (usually 2–3 days). The drain should not be left in for longer than 3–4 days.

Proud flesh (excessive granulation tissue)

Wounds heal via granulation from the depth and epithelialisation from the edges. Usually these two act in synchrony resulting in a fast healing process.

> Proud flesh occurs when granulation > epithelialisation

This is seen as excessive pink tissue forming a large protruding growth which prevents epithelialisation (Figure 15.1.5). It is common on the distal limb but can occur anywhere.

Figure 15.1.5 Proud flesh on the face of a horse (top) and dorsal coronary band.

How to manage excessive granulation tissue?

1. Using a scalpel blade, trim the excess granulation tissue back to just below the skin surface. Remember granulation tissue has an excellent blood supply, so will bleed profusely. Be careful not to disturb the newly laid epithelium around the edges of the wound.
2. The aim is to encourage epithelialisation so the wound heals. Apply corticosteroid cream to the centre of the wound only, to inhibit further granulation, keeping it away from the delicate edges.
3. Firmly bandage the wound – the pressure will prevent further bleeding (granulation tissue is highly vascular).
4. Apply the corticosteroid cream to the granulation tissue every third day for 3–5 applications after debridement. If exuberant granulation tissue reforms, repeat the process. Do not use other chemicals such as potassium permanganate or copper sulphate.

Prevention of excessive granulation is preferable. The early treatment of wounds is essential; clean wounds thoroughly to prevent infection (Figure 15.1.6). Bandaging and immobilisation will also limit the development of proud flesh.

Figure 15.1.6 This horse became entangled in barbed wire. The wound is infected and excessive granulation tissue is forming.

Diagnosis of skin abnormalities

15.2

A logical and systematic approach is necessary when attempting to diagnose skin disease. Many conditions may present with the same signs even though the inciting cause is different: the signs are not pathognomonic.

History

Outlined below is a skin specific history that can be incorporated into the initial discussions with an owner:

- When and where on the body did the problem start?
- What did the initial lesion looks like?
- Is there any pruritus (itching)?
- Have there been any skin problems before and, if so, has there been a seasonal link?
- Are any in-contact horses, donkeys, mules showing similar signs?
- Has any treatment already been given?
- Have there been any recent changes to management, diet, tack, etc.?

Primary lesions These include the following:

- Papules Small (< 1 cm) circumscribed solid elevations of the skin with no visible fluid. These often develop into pustules.
- Pustules Small and raised containing purulent material
- Macules Changes to the colour of the skin, neither raised nor depressed
- Wheals (urticaria) Raised skin lesions that are either rounded or flat-topped and often disappear in 24–48 hours
- Nodules Lesions that extend into the dermis or subcutaneous tissue. The term tumour is used for larger nodules.
- Alopecia Loss of hair. This may form part of the pathological process or could be the result of rubbing induced by pruritus.
- Changes in skin colour

Secondary lesions These lesions may develop from primary lesions resulting from external forces such as self-trauma, infections and treatment:

- Excoriations Caused by self-trauma such as the equid biting or rubbing pruritic lesions
- Erosion A break in the skin not penetrating the full thickness of the epidermis
- Ulcer A break in the skin, full thickness and revealing the underlying sub-cutaneous tissue
- Lichenification Thickening of the skin, usually as the result of persistent excoriation
- Scale Flakes or plates of peeling sheets of skin
- Crusts Dried plasma or exudate on the surface of the skin
- Scars Areas of fibrosis that replace normal skin after injury

Further diagnostics

It is frequently necessary to collect an appropriate sample for laboratory examination in order to make a definitive diagnosis of a skin condition.

If a microscope is available, skin brushings and scrapings are easily collected for direct examination. This is often the first stage in a skin disease work-up.

Skin scraping

Skin scrapes are usually carried out if a parasitic skin infection, such as mange, is suspected.

It is important to do a number of scrapes from different areas where the lesions occur. Apply a small amount of paraffin on the scalpel blade. Parting the hair of the animal, scrape the skin carefully, but firmly, to induce redness and slight bleeding. (Mites can burrow deeply under the skin. In the case of Sarcoptes scabei var equi a skin biopsy may be more appropriate.) Examine using a microscope.

Skin brushing

Several skin parasites, such as the Chorioptes mite, live on the skin surface. By brushing over the coat surface onto a large sheet of paper, debris can be collected for examination microscopically.

Fine needle aspirate

A fine needle aspirate (FNA) is a technique used to collect cells from skin lumps or fluid from cavities. In nodules or tumours of an unknown aetiology a diagnosis may be determined by collecting cells from within the mass by FNA and examining microscopically. This procedure can be used to differentiate an abscess, which may need to be drained, from a haematoma, the draining of which would result in further haemorrhage.

Procedure

1. Shave a small area of hair at the most dependent point of the mass.
2. Clean and disinfect the skin.
3. Choosing a small needle, quickly but gently insert it down to the hub.
4. Re-direct the needle or aspirate using a syringe to release fluid or collect cells for microscopic examination.

Cytology

This is a simple, fast diagnostic test that is underused in evaluating skin disease. It is possible to identify the presence of yeasts, fungal hyphae, bacteria, different types of inflammatory cells and even neoplastic cells.

Obtaining the smear

Direct impression smears Useful for moist areas such as the underside of crusts, areas of exudate/discharge or open pustules, vesicles or papules.

Firmly press the glass slide directly onto the skin surface. Stain with Diff-Quik (or alternative histological stain) and examine when dry (see Section 4.4 Blood smears and staining).

Swab smears Useful for dry, superficial areas such as crusts, hairless patches of skin or ear canals. Moisten a cotton-tipped applicator with saline and rub briskly over area to be examined. Roll the cotton tip over the surface of glass slide and examine after staining with Diff-Quik.

Sticky tape preparations Useful for dry areas. Interpretation can be slightly more difficult unless cell types/organisms are present in large numbers. Firmly press sticky tape onto the skin in a number of different areas. Place a few drops Diff-Quik onto glass slide and press tape onto slide, distributing the stain evenly underneath the tape with your fingers.

Biopsy

Nodules and tumours will often require a histological diagnosis to discern the aetiology. Do not conduct a diagnostic test unless it will be used to inform treatment. It is essential that a laboratory facility is available and capable of processing samples before biopsies are collected.

Biopsy Surgical removal of a small sample of the lump for laboratory assessment. This is used as an investigative tool, for example to determine the margins required for a surgical removal or to establish a prognosis for the animal.

Lumpectomy Complete removal of a lump, with the objective of being curative. A specific diagnosis should be obtained prior to complete excision. Only histopatholoical examination can provide a definitive diagnosis. When this is not available lesions should be managed as malignant; remove wide margins around the tumour in order to reduce the likelihood of recurrence. When removing a tumour it is essential that it is removed completely; this also necessitates knowledge of the types of tumours which occur, and whether complete excision is possible given the size and position of the tumour, and its relation to underlying tissues.

What should be considered before attempting to remove a lump?

Is the lump suitable for biopsy/removal? Consider the following:

- What is the most likely cause of the lump?
- Is there evidence of infection/inflammation which could delay the healing process?
- Is the lump in a suitable site which allows for healing? Ensure it is not in a dependent or highly mobile area which would result in wound breakdown.
- Are you able to ensure total excision, if this is the objective?
- Do you have a suitable area in which to carry out the procedure?
- Is there access to a laboratory where analysis of the biopsy can be carried out?

The primary responsibility of a veterinarian is to the animal, regardless of what the owner feels is possible. Consider the goal of the surgery and whether this is achievable.

15.3 Common skin diseases of working equids

For practical diagnostic purposes, it is easier to categorise skin conditions according to the presenting signs rather than aetiological agents. Skin disease is characterised by pruritus, nodules, lumps and bumps or crusting and ulcerative lesions.

Skin diseases characterised by pruritus (itching)

Refer to Section 17.5 for parasitic skin conditions.

Pyoderma

A secondary bacterial infection is common in all skin afflictions, regardless of the primary cause. Many bacteria, for example Staphylococcus species, are commensal organisms. If there is a break in the integrity of the skin surface, such as a wound, these bacteria can easily colonise in the damaged tissue.

Causal organisms

- Staphylococcus spp. (predominant bacteria in pyoderma)
- Corynebacterium spp.
- Dermatophilus congolensis ('rain scald' – see opposite)

Causal factors

Damp skin (warm, wet weather), poor grooming, skin wounds, abrasion and pruritic conditions resulting in excoriation. Pyoderma is very commonly associated with skin contact with tack, rugs or cart equipment, particularly if sweating occurs and the equipment is dirty.

Appearance

- Staphylococcus infection – forms crusts in a circular pattern (similar to ringworm).
- The skin appears wet due to exudate.
- Encrusted papules and pustules are evident.
- In severe cases a deep pyoderma with ulceration develops.
- There are signs of pruritus and discomfort.
- Inflammation – causes redness, swelling and pain. (Staphylococcus lesions are usually very painful.)

Treatment

Clip the affected area and clean with dilute antiseptic. An application of topical anti-bacterial solution may be necessary; in severe or chronic cases systemic antibiotics may be indicated (trimethoprim sulfamethoxazole). If pyoderma is associated with tack or rugs make sure these are removed frequently and kept clean. Un-tacking and allowing air to reach the skin can greatly facilitate healing and reduce the chances of pyoderma recurring.

Consider the human health risks of Staphylococcus infection particularly antibiotic-resistant strains known as MRSA (Methicillin Resistant Staphylococcus Aureus) (Yusada et al. 2000).

Dermatophilosis ('rain scald')

Dermatophilus congolensis (actinomycete bacteria) is spread by carrier animals; pre-disposing factors for infection include moisture and abrasion.

Appearance

- Small crusty lumps with hair standing up (paintbrush)
- Underlying skin moist and inflamed
- Impression smear of the underside of crusts – 'railroad track' cocci (bacteria joined together in a line)

Distribution

Dorsal surfaces which can become soaked with rain. Also common on the caudal pastern due to hobbles or a muddy environment. Rain scald can also affect other areas: under harness, flanks or face (Figure 15.3.1).

Figure 15.3.1 Dermatophilosis on the face of a donkey.

Treatment

Minimise exposure to wet, muddy environments. Rugs and saddle padding should be removed to avoid contact with sweaty skin. Shave or clip the affected area. Apply dilute antiseptic and leave open to the air to dry. Remove loose scabs and crusting which harbour the bacteria. Burn the removed scabs, as bacteria within this material can infect other horses. Disinfect the grooming kit and minimise grooming until the infection has resolved. Treat with penicillin or trimethoprim sulfamethoxazole for 7 days. Protect lesions on the lower limb by applying a waterproof barrier cream (petroleum jelly or hydrous wool fat). Apply a small amount before the animal begins work and remove afterwards.

Pastern and heel dermatitis ('mud fever')

Pastern dermatitis is not a single disease but a generic skin reaction to a variety of causes. This condition is invariably associated with chronic saturation of the distal limb resulting in a bacterial folliculitis (Staphylococcus infection). Other causes include contact irritation, photosensitisation, mites, fungal infection and immune-mediated inflammation.

Clinical signs

- Inflammation – red skin, hair loss (alopecia), initially around the skin folds of the pastern/heel bulbs
- Exudate – from a mild serous discharge to significant exudation with marked crusting and thick scab formation
- Pain on palpation – cellulitis can develop if a severe infection is present.
- Prolonged cases show chronic skin thickening, persistent hair loss and scarring.

Treatment

Debride the area to remove all scabs and necrotic skin. Soak scabs with warm, dilute disinfectant prior to removal. This is a painful procedure and may require sedation and analgesics. Rest the animal and reduce exposure to wet and muddy conditions. Apply antibiotic cream in severe cases; mild cases will heal with management alone. Severe cases may benefit from a topical steroid application on one or two occasions; repeated steroid application will delay healing. For long-term management the use of barrier creams can be helpful (petroleum jelly). Advise owners to clean and dry the legs of the equid after work.

Dermatophytosis ('ringworm')

This is most common in young or immune-compromised animals and those kept in dirty conditions. Lesions are caused by fungal species that utilise keratin, Trichophyton and Microsporum. Fungal spores can contaminate buildings and tack. The incubation period is 1–4 weeks and the infection spreads slowly amongst a group of equids.

> Ringworm is a zoonotic skin condition; wear gloves when treating affected animals.

Appearance

- Crusting and scaling
- Multifocal, sharply demarcated areas of hair loss, classically a coin-shaped appearance (Figure 15.3.2)
- Initial lesions appearing as raised, swollen lumps (urticaria)
- Variable pruritus

Figure 15.3.2 Clinical appearance of dermatophytosis.

Treatment

Generally equids recover over the course of several months. Affected equids are a source of infection to other animals and humans throughout recovery. If severe, topical antifungals are indicated. Follow the instructions as these medications can be toxic. Wash daily with dilute iodine (10% solution) including the harness and grooming equipment. Systemic antifungals (griseofulvin) require a prolonged treatment period for efficacy, and compliance can be problematic. Griseofulvin should not be used in pregnant mares as the medication is teratogenic. Isolate the affected animal and monitor animals in contact for signs of similar skin lesions.

Insect hypersensitivity ('sweet itch')

Any biting insect can cause this type of hypersensitivity reaction although it is predominantly induced by Culicoides spp. (midges). Most reactions are an immediate hypersensitivity (Type I) but also include a delayed hypersensitivity reaction (Type IV).

Appearance

- Multiple swellings occur over the body; urticarial (Figure 15.3.3).
- Hair loss/rubbed hair especially over the mane/neck and tail base; look for broken hairs.
- Associated pruritus and evidence of excoriation. In chronic cases the skin will be thickened (lichenified).
- Plaques or wheals form in some cases.

Figure 15.3.3 Urticaria on the neck of a horse.

Treatment

In some cases urticaria resolves within 24–48 hours. Steroid treatment will temporarily alleviate the pruritus and skin inflammation. Anti-histamines may help prevent a hypersensitivity reaction, although there is very little evidence for its efficacy in equids. Protect from flies by stabling the affected equid and covering the affected areas. Make owners aware that insect hypersensitivity is likely to be a chronic condition which should be controlled with management appropriate to the feeding habits of the insects involved.

Figure 15.3.4 'Farcy' presentation of glanders.

Skin diseases characterised by nodules, lumps and bumps

Infectious nodular skin conditions

Habronemiasis (Section 9.6 Common eye diseases of working equids and Section 17.5 External parasite species)

Corynebacterium pseudotuberculosis Multiple ventral abscesses

Glanders 'Farcy' presentation (Section 12.7 Bacterial respiratory disease) (Figure 15.3.4)

Sporotrichosis A (rare) zoonotic yeast infection presenting as a nodular or ulcerative skin condition (Crothers et al. 2009)

Epizootic lymphangitis

This is a form of lymphangitis caused by the fungus Histoplasma capsulatum var. farciminosum. This devastating disease is endemic in parts of Africa (with a high prevalence in Ethiopia), Asia and the Middle East and spreads rapidly among equines, particularly younger animals. It is more common in horses than donkeys. Transmission is thought to be through contamination of open wounds and by ticks and biting flies which act as mechanical vectors. Epizootic lymphangitis has been known to affect camels, cattle and even humans.

Clinical signs

The skin form Skin nodules and infected tracts along lymphatic vessels form which are similar to the lesions present in the Farcy form of Glanders (Figures 15.3.5 and 15.3.6).

Lacrimal histoplasmosis is an ocular form of the disease and is the most common form in donkeys. It presents as a granulomatous proliferation of the conjunctival sac that protrudes out of the medial lacrimal puncta. There is swelling, blepharospasm, conjunctivitis and a purulent ocular discharge (Figure 15.3.7).

Obstruction of the nasolacrimal duct causes increased discharge from the eye (Figure 15.3.8).

A pulmonary form of the disease is very rare and occurs after inhalation of the organism.

Diagnosis

Definitive diagnosis is by identification of the characteristic yeast-like cells on stained smears of purulent material. The pus from lanced abscesses has the appearance of honey. The skin form of the disease can look similar to Glanders (Farcy). The mallein test will distinguish the two diseases.

Figure 15.3.5 Cutaneous form of the disease shows an infective nodule/granulomatous lesion with an invasive tract showing spread along the lymphatic vessel.

Figure 15.3.6 Lesions seen on the face and the left forelimb.

Figure 15.3.7 Conjunctival infection and inflammation associated with the lacrimal histoplasmosis.

Figure 15.3.8 Lacrimal histoplasmosis has a similar presentation to Habronema infection.

The ocular form may look clinically similar to lacrimal Habronemiasis; differentiate by histopathology, identification of Habronema larvae or a treatment trial. The 'histofarcin test' was studied for diagnosis of enzootic lymphangitis (Ameni et al. 2006) although this is not commercially available.

Treatment

Various protocols have been trialled, including treatment with sodium iodide or oral potassium iodide. Nodules and abscesses, if in small numbers and distribution, can be treated by lancing and cleaning with iodine based antiseptics. However, the chronic weight loss and debility remains.

Sodium iodide (NaI) has been used succesfully in Ethiopia where this condition is common (Hadush et al. 2008). Administer 125 ml of 20% NaI solution IV once daily for 3 days. Followed by oral administration of 30 g NaI dissolved in 1 litre of clean tap water for 30 days. Although the study in Ethiopia showed this to be the most successful treatment, owner compliance was low as the cost of NaI exceeded the cost of the horse/donkey. Potassium iodide cannot be administered safely IV. Administer orally; 15 g KI in 1 litre of water, or mixed with feed such as bran, for 30 days. Heragy (2002) reported that topical ocular anti-fungal preparations were effective for the treatment of lacrimal histoplasmosis.

Prevention

- Isolate affected animals and attempt to keep flies from landing on wounds, especially where many animals are housed or there is a known case/outbreak in the area.
- Avoid and minimise wounds whenever possible as these are an entry point for the fungus. Ensure all wounds are protected against flies.
- Vaccine development has been attempted (Zhang et al. 1986) but the vaccines are not commercially available.
- In severe cases, discuss euthanasia with the owner as soon as possible to reduce transmission of the disease to other animals.

Papillomatosis (Warts)

Warts follow infection with papillomavirus and usually affect young equids (under 3 years old).

Appearance

Multiple raised nodules with a 'cauliflower-like' appearance (Figure 15.3.9). These are not usually associated with ulceration or exudation unless secondary infection occurs due to pressure from a harness/saddle.

Treatment

Papillomatosis is self-limiting; the animal mounts an immune response against the virus and the warts disappear over time.

Figure 15.3.9 Papilloma on the nose of a horse.

Neoplasms

Without adequate access to veterinary attention neoplastic lesions may grow to an unmanageable size (Figure 15.3.10) where euthanasia, rather than attempts at surgical or medical treatment, is the most appropriate option.

Definitive diagnosis of skin tumours requires sampling and cytology which is not always possible in the field situation. However, a working diagnosis can be determined through clinical signs, appearance, history and distribution.

Squamous cell carcinoma

The exact aetiology of squamous cell carcinoma (SCC) is unknown. It is thought that exposure to UV radiation is a predisposing factor. SCC is common around the eye (eyelids, third eyelid and medial canthus) and muco-cutaneous junctions such as nostrils, prepuce and vulva.

Appearance

- Mild inflammation and swelling in the early stages
- As the condition progresses the masses become irregular and ulcerated with secondary bacterial infection (Figure 15.3.11).

Figure 15.3.10 Neoplasms in working equids may be presented to a clinician at a late stage in the disease's progression.

Treatment

Surgical excision of squamous cell carcinomas is frequently unsuccessful as this tumour is aggressive. At muco-cutaneous junctions of the eye or penis it is difficult to remove sufficient marginal tissue around the tumour. If the SCC is on the third eyelid, removal is often curative and does not cause any defect to the tear film. The use of BCG vaccine infiltration has been successful (McCalla et al. 1992). Despite being locally aggressive, these tumours do not usually metastasise to other areas.

Figure 15.3.11 A suspected squamous cell carcinoma. Following surgical removal the tumour recurred; obtaining adequate margins in this region is impossible. The tumour resolved when treated with multiple BCG injections (vaccination for TB).

Melanoma

Melanomas are benign or malignant tumours of melanocytes, common in older (> 15 years) grey or white equids. Giemsa staining of a fine needle aspirate will show melanin granules within tumour cells. Melanomas are common in the perineal region and under the tail (Figure 15.3.12).

Appearance

- Firm, nodular pigmented swellings
- Single or multiple
- Slow growing. Some melanomas are more aggressive and metastasise quickly, including to internal organs such as the lungs and the gastro-intestinal tract.

Treatment

Surgical excision may be curative, and is necessary if the mass is interfering with harness or tack. However, there are likely to be metastatic lesions if the tumour is chronic (Valentine 1995), and the prognosis is poor.

Figure 15.3.12 Melanomas under a horse's tail on the underside of the dock – the tail has been raised.

Sarcoids

Sarcoids are common skin tumours and can be problematic to treat; they have a tendency to recur following surgical excision. There is a proposed viral aetiology for the development of sarcoids. Papilloma viruses induce hyper-proliferation of epithelial cells, usually developing into warts. It has been proposed that a bovine papilloma virus, transmitted by

biting flies, infects epithelial cells to induce uncontrolled growth resulting in sarcoids. Despite being benign (they do not metastasise), sarcoids are locally aggressive and can become secondarily infected.

Clinical types include:

Verrucose Crusty and wart-like with alopecia and thickened skin around the lesion. A differential diagnosis is ringworm.

Fibroblastic Ulcerated and very vascular, lesions can have a small or large base (Figure 15.3.13). A differential diagnosis is squamous cell carcinoma.

Occult The initial lesion is a small area of alopecia that develops a crusted surface.

Nodular Encapsulated discrete masses are contained within the dermis/epidermis (Figure 15.3.14 and 15).

Mixed These are very common and are a mixture of the above descriptions.

Figure 15.3.13 A fibroblastic sarcoid.

Distribution

Sarcoids can be found on any part of the body; however, they are common around the head (particularly the verrucose type), eyes, groin, ventral midline and axilla.

> Visual diagnosis is simple and safe. A biopsy can trigger further growth and should be avoided when a sarcoid is suspected.

Figure 15.3.14 A nodular sarcoid.

Treatment

Leave a sarcoid alone if possible. If the lesion is small and interfering with a harness, surgical excision is possible. Lesions frequently recur following surgery, as sarcoids are locally invasive. Some studies indicate a protocol of injections with BCG. There has been a varied success rate, and there is a small risk of anaphylactic shock (Knottenbelt et al. 2000). Sarcoids of the limbs and axilla are more difficult to treat and have a high recurrence rate.

Figure 15.3.15 A nodular, periocular sarcoid.

Lumps and swellings of the skin

Abscesses

> An abscess is an accumulation of white blood cells (predominantly neutrophils) in response either to an infectious process or to a foreign body.

Typically an abscess presents as a hot, swollen, painful area of the skin, and there is sometimes evidence of an injury such as a penetrating wound.

Causes

- Systemic infection (strangles, glanders)
- Penetrating injuries (wire, animal bites)
- Iatrogenic (inappropriate treatment technique) such as an injection site abscess (Figure 15.3.16)
- Continuous abrasion by poorly maintained equipment
- Foreign body (sinus tract)

Figure 15.3.16 Iatrogenic injection site abscesses in the neck (top) and the chest.

Treatment

- Mature an abscess using hot packs.
- Clip or shave the area and clean with antiseptic.
- Lance with a scalpel blade in a vertical line from the centre to the most ventral part.
- Flush out purulent material with large volumes of warm salt water/ iodine.
- Treat as open wound; do not suture.
- Administer tetanus antitoxin (TAT).
- Antibiotics are not a substitute for drainage and irrigation, and are not usually indicated unless there is evidence of systemic infection. Antibiotics will not penetrate a walled-off abscess.
- Flushing to be continued, daily for 5 days, by the owner to ensure drainage continues.

Before lancing it is important to ensure that the swelling is an abscess. Conduct a fine needle aspirate prior to surgery.

Hernias and ruptures

A hernia is a swelling due to mesenteric fat and intestines protruding through a congenital opening in the body wall muscle (umbilical, inguinal).

A rupture is a swelling due to mesenteric fat and intestines protruding through an acquired opening in the body wall muscle (accidents, trauma).

Appearance

- Both hernias and ruptures present as a soft swelling of varying size depending on how much abdominal content has protruded through the opening (Figure 15.3.17).
- Usually there is no heat or pain on palpation.
- Contents can be pushed back (reduced) internally; a 'hernial ring' defect can be palpated in the muscle.
- If intestine is entrapped and strangulated the animal will have signs of colic.

Figure 15.3.17. Examples of abdominal and inguinal hernias/ruptures.

Treatment

Hernias may be sub-clinical if small. If a rupture is suspected, bandaging may help to retain intestines within the abdomen while the defect heals. Surgical repair of ruptures and large hernias cannot be recommended in field conditions as there is high risk of wound breakdown and peritonitis. Small umbilical hernias may be repaired in foals. An imbricating suture pattern is used to draw one muscle layer over the top of the other. It is essential that hernias and ruptures are differentiated from an abscess prior to attempts to drain the latter.

Haematoma

A blunt trauma (fall/kick) ruptures small blood vessels under the skin, causing subcutaneous bleeding. This blood clots forming a lump over the next few days which eventually fibroses and shrinks to a small hard mass.

Appearance

- Sudden-onset swelling following a history of trauma (Figure 15.3.18)
- Heat and pain on palpation
- Blood/blood-tinged serum on aspiration
- In chronic stages the lump becomes small and hard with no fluid.

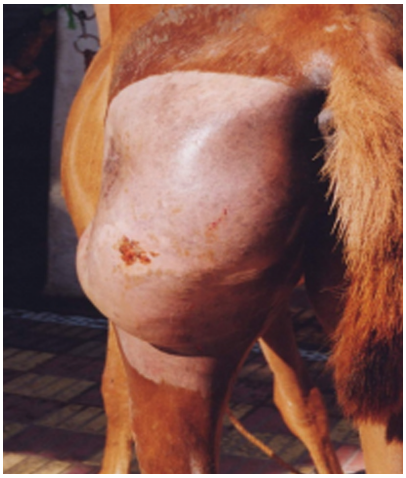

Figure 15.3.18 Haematoma on the hindquarter of a horse.

Treatment

NSAIDs reduce pain and swelling in the initial stages following trauma. Cold therapy with hosing, buckets of water or rags soaked in water can help to reduce the inflammation in

the acute stages. Haematomas tend to resolve gradually. Surgical drainage is not recommended as haemorrhage is likely to continue. Antibiotics are not usually necessary.

Seroma

A seroma (pocket of serous fluid) often develops after suturing a wound or surgery, particularly if dead space has been left under the suture line. Seromas present as a fluid-filled mass in the vicinity of a surgical incision or site of trauma. Aspiration of fluid produces a clear, serous exudate (Figure 15.3.19).

Treatment

Remove one or two ventral sutures and allow to drain, or take out all sutures and allow to heal as an open wound. Drainage of a closed seroma is not worthwhile as the fluid will continue to accumulate. When suturing a wound ensure that the dead space is closed down by using a multi-layered closure.

Oedema

Oedema is a subcutaneous, interstitial accumulation of fluid. Distribution depends on the underlying cause although it is seen most often in dependent areas such as the ventral abdomen/chest, sheath and lower limbs (Figure 15.3.20). Generally, the swelling is diffuse and an indentation is left when the oedema is pressed (pitting). A fine needle aspirate is unlikely to yield fluid.

Causes

- Localised circulatory disturbances
- Lower-limb swelling due to standing for long periods
- Poor venous circulation and lymphatic drainage
- Unsuitable bandaging methods
- Major circulatory disturbances such as heart failure
- Hypo-proteinaemia as the result of liver disease, parasitism or malnutrition
- Inflammation of vessels which increases permeability to fluid

Figure 15.3.19 Severe swelling of the scrotum (top); aspiration of blood-tinged serous fluid.

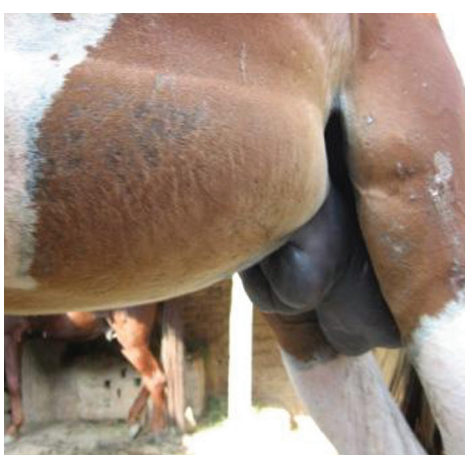

Figure 15.3.20 Ventral oedema in the horse.

Treatment

Walking the animal will help to resolve localised distal limb oedema. Cold therapy can reduce any inflammation. Generalised oedema will require a thorough clinical examination for signs of underlying systemic disease or other causes of low blood protein. Drainage is not recommended.

Cellulitis

Cellulitis is an inflammation of the subcutaneous tissue, often associated with infection.

Recommended protocol for treatment of cellulitis

- If microbial culture is available, a swab or aspirate of the fluid should be collected.
- The recommended first-line treatment is procaine penicillin 22,000 IU/kg IM BID and gentamicin 6.6 mg/kg IV SID. At least 3 consecutive days of treatment is required. Penicillin alone may be ineffective in 60% of cellulitis cases (Haggett and Wilson 2008, Fjordbakk et al. 2008).
- Initiate pain relief therapy to prevent laminitis in the contra-lateral limb.
- The animal should not work throughout the duration of treatment. Hand walking may be beneficial.
- Prognosis is guarded and recurrences are common.

Skin diseases characterised by crusting and ulcerative lesions

Sunburn and photosensitisation

Sunburn is primary direct damage to the epidermis by intense ultraviolet light. Damage tends to be to non-pigmented skin which is more sensitive to the harmful rays.

Photosensitisation is the over-reaction to normal levels of sunlight as the result of photodynamic agents accumulating in the skin for two main reasons:

- Ingestion of plants containing photodynamic agents which are directly absorbed and circulate in the blood
- Failure of the liver to detoxify phylloerythin a by-product of chlorophyll

Figure 15.3.21 Sunburn on a horse's face following over-exposure to sunlight.

Appearance

Cases of sunburn present as vesicle formation and blistering, followed by rapid crusting, commonly on the muzzle and around the eyes (Figure 15.3.21). The appearance of photosensitisation is often more severe and includes erythema (redness), oedema (swelling), pain, vesicle (blister) formation leading to serum exudation, ulceration and, in severe cases, skin sloughing.

Management

- Avoid sun exposure (bring into the shade) and cover sensitive areas with mask/rug.
- Apply high-factor sunscreen, or a similar barrier cream, and provide analgesia.
- Treat secondary bacterial infections. Topical creams can be soothing and antibacterial (cold sulphadiazine cream). Emollient creams containing aloe vera will soothe the skin.

In cases of photosensitisation, in addition to the above, remove inciting cause if due to plant toxicity. In cases of severe liver disease there is a poor prognosis and any treatment is only supportive. Discuss euthanasia with the owner.

The long-term prevention of wounds 15.4

Knowledge and recognition of the underlying causes and good owner communication is essential for the prevention of wounds.

Consider the root causes of wounds. In working equids chronic wounds are frequently the result of a poorly fitting harness (Burn et al. 2008), inappropriate materials used for tack (Figure 15.4.1) and a poor state of repair of equipment. Equids working in developing countries will be harnessed or saddled for several hours each day and equipment-related injuries are commonly reported (Pritchard et al. 2005).

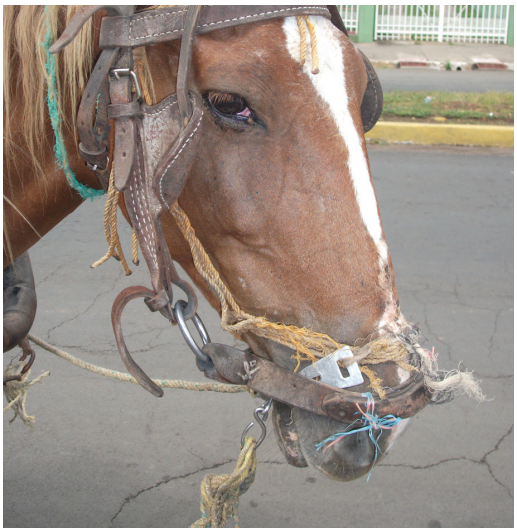

Figure 15.4.1 Nose band lesions caused by inappropriate materials such as chains or wire.

Lip lesions

In a study (Shah et al. 2010) in Pakistan, 70% of 512 working equids surveyed had lip lesions (Figure 15.4.2). These lesions are painful, reduce feed and water consumption and result in weight loss. To reduce such lesions it has been shown that involvement of the whole community, not just the equine owners, is needed (Shah et al. 2010). Advice may be provided to bit-makers on proper bit selection, fit and maintenance. Owners can be advised on cleaning and removing the bit when the animal is eating, drinking and not working, as well as maintaining the other parts of the harness. A study by Nawaz et al. (2006) showed that lip lesions in working equids in Pakistan were affected by the bit, bridle, cart and by owner behaviour and attitude, as well as by animal physiology. The highest risk factor for lip lesions was a jointed bit, with a straight-bar bit least likely to cause damage.

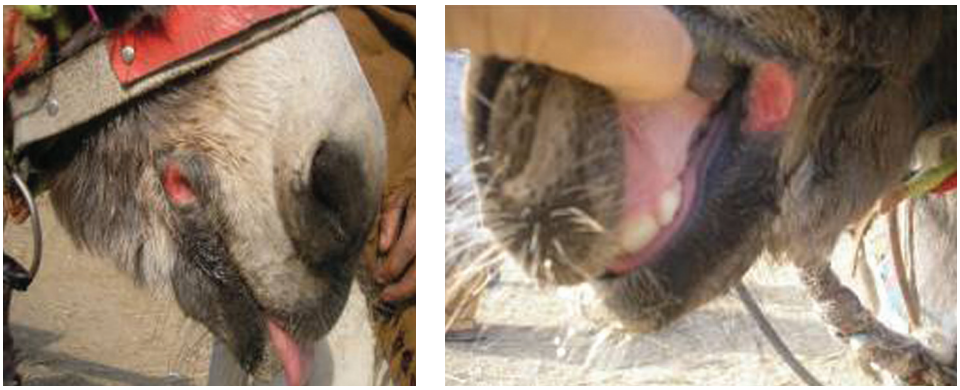

Figure 15.4.2 Harness-related lip lesions in working equids.

Tail-base lesions

Tail-base lesions are generally located underneath the tail, between the tail base and the rectum (Figure 15.4.3), and are thought to be caused by rump/crupper straps used to stop the saddle from slipping forward. A study by Burn et al. (2008) in Jordan found 73% of the 86 donkeys surveyed had tail-base lesions. The most severe lesions were associated with more padded straps used under the tail, and by those that were not clean; cotton straps were associated with more severe lesions than synthetic straps.

Figure 15.4.3 Harness-related tail-base lesions in working equids.

Body lesions

Withers wounds (Figure 15.4.4) have been reported as present in 52% of working equids carrying pack saddles in the brick kilns of Delhi, India (Aravindan et al. 2006). Early signs of pain and hair loss prior to lesion development were identified and can be used as indicators for owners to adopt preventive measures.

Figure 15.4.4 Harness-related body lesions in working equids. Withers lesions caused by pack saddles and hindleg lesions caused by poorly fitted breaching straps.

Prevention

Many of these lesions can be prevented by increasing owner awareness of the impact, and devising local solutions to such problems. For example, soft 'doughnuts' can be made from cloth, to raise the harness above the withers, or chain nose bands can be replaced by a softer material. This involves working with owners and harness makers.

Owners: Encourage owners to be aware that a better-fitting and well-maintained harness results in fewer injuries and debilities for working equids.
Harness makers: Increase the skill of using local materials and techniques to make well-fitting harnesses, and the ability to repair them affordably for owners.

Deliberate mutilations are frequently conducted in some regions and are often the result of misguided beliefs (described in brackets for each mutilation). In these situations treat the wounds and provide guidance to owners on evidence-based strategies to deal with the problems that are of concern (see Section 2.4 Firing and nostril slitting). Examples of mutilations and the regions where these procedures are commonly carried out are outlined:

Gum cutting or firing West Africa, India and Latin America (to 'treat' lampas, swelling of the hard palate, Figure 15.4.5) (see Section 11.4 Conditions of the mouth and oesophagus)

Nostril slitting East Africa, India and Pakistan (to 'improve' breathing) (Figure 15.4.6)

Ear removal/cutting India and East Africa (to 'prevent' tetanus and for identification) (Figure 15.4.6)

Setonism Threading wire or thread through the skin (often creating a chronic infected wound) (Figure 15.4.7)

Figure 15.4.5 This horse in Senegal had lampas (inflammation of the roof of the mouth) which the owner has attempted to treat by inserting a hot rod into the mouth. The horse is struggling to eat and drink as the result of severe inflammation.

Firing Widely practised ('treatment' of many disorders) (Figure 15.4.8)

Tail mutilations Widespread (improved cleanliness)

Figure 15.4.6 Ear cutting (above) and nostril slitting (below).

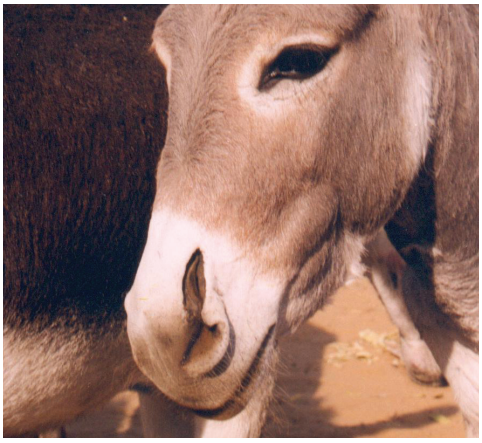

Figure 15.4.7 An example of setonism in which thread or wire is stitched into the skin.

Figure 15.4.8 An example of firing; the skin is burnt using a red-hot iron.

Bandaging

15.5

Developing an appropriate bandaging technique is vital to the management of wounds and injuries in equids.

Bandages are important for:

- controlling and reducing swelling and oedema (reducing dead space to prevent seroma formation)
- controlling haemorrhage
- protecting open wounds from contamination, flies and further trauma
- providing a favourable environment for wound healing, i.e. holding wound edges together and immobilising the area
- providing stability to injuries (e.g. tendon injuries/fractures)
- immobilising and supporting the limb to make the patient more comfortable – a useful adjunct to analgesia for pain control
- protecting a wound against harm by the patient.

However, if done incorrectly, bandaging can cause a huge amount of damage. Complications include:

Infection If a bandage is left on too long and/or becomes very dirty, bacteria can spread through the bandage and contaminate the wound.

Pressure sores A bandage applied with uneven pressure, or a bandage that slips, will cause constriction. This may result in localised areas of tissue damage.

Pressure necrosis If the bandage is put on too tightly it impedes blood supply to the area which can result in sloughing of large patches of skin and tissue.

It is essential that bandages are applied correctly and that the bandaging is well maintained. It is often necessary for an owner to replace the bandage. Provide clear, precise instructions including a demonstration of bandage application.

Materials

There are normally three layers to a bandage (Table 15.5.1); the first directly covers the wound, the second offers padding/support (the thickness of this varies, depending on the amount of support required) and the final layer holds the bandage in place and offers some protection from the environment.

Layer	What this layer provides	Materials that can be used
Primary layer – wound dressing	This directly covers the wound. Apply aseptically after the wound has been thoroughly cleaned and debrided. This dressing should be non-stick (unless additional debridement is required) so that delicate granulation tissue is not disturbed. Absorbent – so any wound exudation is drawn away from the wound surface (to avoid wound maceration/inflammation) Semi-occlusive – to allow oxygen to reach the wound Non-stick	Purpose made dressings These have a shiny, non-stick surface, that goes against the wound, and a matt, cotton surface that faces away from the wound. Cotton gauze/cotton wool Avoid using cotton wool as it sticks to wounds. Adding a layer of petroleum jelly will reduce this; however it will also reduce the amount of oxygen that can reach the wound. Absorbent dressing Some thicker dressings are specially designed to absorb more wound exudate.
Padding layer	This provides padding and support. The amount of support provided depends on the number of padding layers applied. A Robert Jones bandage can have 10 layers or more and should be at least three times the diameter of the leg. The padding layer should be clean, absorbent and soft. Apply padding evenly and reasonably tightly. If more than one layer is applied use a weave bandage or crepe bandage between each layer.	Cotton wool This is available in most countries and is inexpensive. Disposable nappies Although expensive these are very absorbent and can be useful in fresh large wounds which are discharging excessively. Towels and cloths Although absorbent these tend to stick but can be useful if there is no alternative. These materials can be washed so are reusable.
Outer layer	The final protective layer secures the other bandages. This needs to be durable and strong as well as non-absorbent and waterproof. Care must be taken that this layer is applied with the correct tension. Too little tension and the bandage will slip, resulting in pressure rubs. Too much and this will injure the skin and deeper structures, resulting in pressure sores and pressure necrosis.	Elasticated cohesive dressing This is very useful and easy to apply although it can be expensive. Adhesive dressings Elasticated adhesive dressings can also be useful especially around the top and bottom of bandages. A cotton bandage or strips of cotton (e.g. cut from cloth) Cloth can be useful as it is readily available and affordable.

Table 15.5.1 The purpose and potential materials for different layers of a bandage.

Location

Different parts of the body will require different types of bandaging materials and techniques. Table 15.5.2 describes the more common areas which may require bandaging and important aspects of application and care.

Types of bandage	Notes
Foot bandage	This includes the foot only and finishes around the pastern/coronet (Figure 15.5.1). This technique is commonly used for applying poultices to treat foot abscesses: Clean the foot thoroughly, and dry before bandaging, to prevent the development of thrush. It can be useful to put a stable bandage on the distal part of the limb above the foot bandage to keep it in place. Apply a padding layer over the foot and coronet/pastern, to alleviate pressure and rubbing on the coronet. Cover the entire foot with duct tape or other impermeable material to avoid wicking of faeces/urine/dirt. Change the bandage regularly, ideally daily.
Lower limb bandage	This extends from the coronary band to just proximal to the hock/carpus (Figure 15.5.2). The amount of padding depends on the amount of support needed. For superficial wounds very little support is required, one layer is sufficient. For more severe injuries to bone/tendon a half limb Robert Jones may be required. (See Section 14.6 Common conditions affecting the bones of working equids.)
Full limb bandage	Full limb bandages are difficult to apply and maintain, and require regular veterinary attention and re-checking. The amount of bandaging material becomes expensive. Protect pressure points, such as the caudal aspect of the carpus (accessory carpal bone) and the point of the hock, either by reducing the padding over these points or applying the bandage in a figure-of-eight configuration.
Splints	A splint can be applied over the top of a bandage to offer additional support to the leg (see Section 14.6). Splints are most commonly used to stabilise fractures. There are very few fractures that are amenable to treatment in the working equid context. Consider the prognosis and welfare implications before fracture treatment is offered. Fit a splint snugly to the bandage with elastic tape.
Pressure bandage	A pressure bandage is a useful way of applying pressure consistently for a long enough period to control haemorrhage. A bandage can be applied quite tightly. Leave the bandage in place for at least a couple of hours, after which gently remove the bandage without dislodging the clot. A second bandage can then be applied to protect the wound and allow for healing. Monitor for signs of continued haemorrhage such as 'strike through' (blood seeping through the bandage). A pressure bandage should not be left on for a long period of time (maximum 6–8 hours). A bandage soaked in blood is detrimental to wound healing, and a tight bandage may cause skin necrosis.
Head bandage	The head and face can be covered with a roll of 6-inch orthopaedic stockinet. Holes are trimmed in the stockinet over the eyes and to accommodate the ears. If a tubular bandage is not available, ensure that any dressing applied is light and does not impose any restriction on head, neck and jaw movements.
Trunk bandages	These bandages are not frequently applied but may be required to protect a trunk laceration. A light bandage covered with an elasticated cohesive layer is ideal (Figure 15.5.3).

Table 15.5.2 Different types of bandages for equids.

Bandage maintenance

A wound cannot be easily assessed without first removing any applied bandaging. Good monitoring of the animal and the bandage is essential to avoid complications and it is crucial the owner knows and understands what to look out for.

Lameness Check the comfort of the animal at least once daily. If the lameness worsens, this could indicate wound/injury deterioration.

Strike through This is when wound exudate/haemorrhage soaks through the bandage. It indicates that all the bandage layers are saturated. Change the bandage without delay and re-check the wound.

Bandage slips If the bandage slips, replace it without delay as pressure sores and skin necrosis can develop rapidly.

Dirt Keep the bandage as clean and dry as possible.

Regular changes Change bandages regularly; the frequency depends on the location and injury. Ideally, foot bandages and wounds that are discharging copious exudate are changed daily. A bandage should not be left on for more than 5 days.

Figure 15.5.1 A foot bandage.

Figure 15.5.2 A bandaged hock and lower limb.

Figure 15.5.3 A light thoracic bandage.

Case study – Wound management

15.6

Location Senegal

Attending veterinarian Francois-Xavier Laleye

History

A 3-year-old cart horse presented with a chronic history of a withers wound from a poorly fitted harness. It also had a 5-day history of wounds on the stifle and scrotum as the result of whipping with a riding crop. The horse was reluctant to move while it was being trained to pull the cart. The owner had treated the wounds with motor oil, local plant remedies and blue methyl alcohol.

Figure 15.6.1 The wither wound at presentation with heavy contamination.

Clinical findings

The withers wound was purulent, infected and 10 cm deep. The area surrounding the wound was painful and the horse was 4/5 lame. The wound was contaminated with motor oil, plant fragments and sand (Figure 15.6.1). Other wounds were observed between the front limbs, inside the thighs, scrotum, sheath and cranial aspect of the hind leg.

Treatment

All wounds were clipped and cleaned with dilute povidone-iodine. Shea butter was applied to the wounds twice a day until the lesions had healed. IM procaine penicillin 20,000IU was prescribed daily for 5 days. Anti-tetanus serum was given. Strict rest for one month was advised. A discussion took place with the owner regarding proper treatment of the horse in future (no beating and appropriate harnessing).

Figure 15.6.2 One month later the wither lesion had healed.

Outcome

One month later the lesions had healed (Figure 15.6.2).

Discussion

Young animals should be trained to pull a cart by someone with expertise in this area. Advice on simple first aid techniques can easily be imparted to owners to avoid the use of unsuitable treatments such as motor oil. The use of shea butter in this case is interesting as this is a locally available resource. Application of a sterile wound lubricant is beneficial to keep the wound surface moist; however, ensure that topical wound treatments do not delay wound healing.

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