
Assessment and Management of the Burn Wound

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Summary

Burn injuries still carry a high risk of morbidity and mortality. Central to this is control of sepsis by the use of good antimicrobial agents and the treatment of large burns in specialised burn centres, where the skills and expertise of the team enable early excision and skin grafting of such injuries. The introduction of new skin substitutes – which enable the dead tissue, a great culture medium for bacteria, to be removed and the raw areas to be covered – has helped considerably. Such procedures have been made possible by a team approach to the treatment of burn patients, particularly with respect to the control of sepsis.

Basic to any assessment of the depth of a burn wound is the anatomy of the skin. Normally, the skin regenerates from the papillae towards the surface, but if the papillae are lost it can regenerate only from the hair follicles and sweat glands. In a very superficial partial-thickness burn some of the papillae may be intact. However, in a deep partial-thickness burn papillae may be lost and skin can must regenerate from around the hair follicles and sweat ducts. If the burn progresses deeper the hair follicles may be lost, meaning the burn wound can regenerate only from around the sweat ducts. However, if infection supervenes, the burn wound – if not already involving full-thickness loss from the injury itself – can easily be converted to full-thickness loss, with no elements of the skin remaining. Such a burn wound can heal only from the edges and, if it is larger than 3 cm, this will take a very long time, with skin grafting required. Since capillaries are based just below the papillae, in superficial partial-thickness burns they are irritated and vasodilation occurs, meaning the wound is red and will blanch on pressure. This area also contains the nerve endings and these are irritated too, making the wound very painful. If the burn goes deeper the blood vessels may be damaged and extravasation of blood occurs such that the area appears red but does not blanch on pressure. As the wound deepens, nerve endings are destroyed

and the wound may cause no pain. In partial-thickness burns, hair, if present, may be adherent and as the wound deepens it will drop out on touching. Again, in partial-thickness burns touch and pin-prick sensations may be intact, but with a full-thickness burn they are lost. These factors allow one to estimate the depth of the wound. With full-thickness burns (Figure 1) there may be a dead, leathery eschar with no touch sensation, and any hairs present will fall out. In deep partial-thickness burns (Figure 2) the wounds are painful, hair, if present, may be adherent, and touch and pin-prick are retained. If red, the wounds will blanch on pressure. The presence of blisters nearly always indicates a deep partial-thickness burn unless massive heat was involved, in which case the subcutaneous fat can boil; however, that type of blister has a completely different appearance and the patient history will make the clinical picture clear.

With burns there is a considerable amount of dead tissue and this can readily become the focus of infection, leading to sepsis and possibly deepening of the wound. These days it is unusual to lose a patient in the initial shock phase and resuscitation is generally very well carried out. With shock control, the next big risk to the patient is sepsis and every effort will be made to avoid this. Today, most deaths from burn injuries, apart from very massive burns, involve inhalation injuries and complications following this, combined with a large surface area of burn.

In burns, estimation of body surface area (BSA) is necessary, as this is involved in all the resuscitation formulae; further, it helps give a good estimate of the patient's prognosis. For adults, BSA is usually estimated using the 'Rule of Nines'; that is, 9 per cent for each upper limb, 18 per cent for the front of the trunk, 18 per cent for the back of the trunk, 18 per cent

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Figure 1. Full-thickness burn – note the hard, leathery eschar.



for each lower leg, head and neck, and 9 per cent and 1 per cent respectively for genitalia and perineum. With children, the Lund & Browder Chart – in which the age of the child is taken into consideration – is used instead to estimate the area of burn. Generally, the palm of the hand and the fingers are regarded as 1 per cent of body surface area.

In assessing the burn wound in the burns unit, it is necessary also to estimate the time it will take to heal, even if the wound is a deep partial-thickness burn. As a general rule, if a burn takes longer than 2 weeks to heal it will raise up to hypertrophic scars and so is usually skin-grafted to give better functional and cosmetic results. This is not to say that one waits 2 weeks before skin-grafting –the sooner tissue is excised the less chance there is for sepsis to occur and the result for the patient is better. Considerable clinical experience is necessary in deciding whether to skin-graft a burn early, as for a scald in a young child, or wait 2 weeks and see if the area heals.

Control of Sepsis

With skin-grafting, early excision is now carried out in all major burns units, to lessen both hospital stay and the risk of sepsis.

Figure 2. Deep partial-thickness burn – it should heal in less than 14 days.



It has been made possible by our ability to control the potential for sepsis in such patients via meticulous wound care and good anti-microbial agents. Obviously, with a very large burn it is not always possible to excise and skin-graft the area at the first theatre session and, unless skin cover is available, not desirable to excise the area and leave it open. Indeed, there may not be enough of the patient's own skin to cover the area and this is

where homografts and new skin substitutes like Biobrane™, Integra™ and Dermagraft-TC™ (all from Smith & Nephew) come into their own (their use is rarely necessary for smaller burns).

Tetanus

Following a burn, all patients are at risk of developing tetanus, although this is now uncommon due to the high immunisation rate; however, the trend lately is not to have children immunised and this must be borne in mind. Tetanus prophylaxis must be maintained as the disease can be devastating if it does occur.

Superficial Partial-thickness Burns

Such burns generally heal well, with no real problems. However, they can become infected. They are often dressed with tulle gras – petroleum jelly-impregnated gauze. This method is quite satisfactory and soothing for very superficial burns. A further development of this method is the use of Bactigras, chlorhexidine-impregnated tulle gras, which releases chlorhexidine over 5-6 days and, as such, can be left *in situ* for that length of time to provide local antiseptic action. Superficial partial-thickness burns can also be treated with a hydrocolloid and a wide range of these is available today. Such burns can also be treated well with transparent adherent substances such as Opsite™ (Smith & Nephew) or Tegaderm™ (3M). However, if there is a risk of infection, the gold standard remains Silvazine™ (Smith & Nephew), silver sulfadiazine cream with chlorhexidine diglucanate added. It has been used in Australia for more than 25 years and recent studies show that even multiply-resistant organisms remain sensitive to it. Where there is a risk of infection, burns should be cleaned daily with chlorhexidine and Silvazine applied. Other dressings can be left on longer (up to several days) but, if the patient becomes sick or develops a fever, the wound must be inspected.

Deep Partial-thickness Burns

Again, for such burns the gold standard treatment is use of Silvazine, with daily bathing of the wound. However, hydrocolloids and Bactigras may be reasonable alternatives if the burn does not seem too deep. The dressing regime used will also depend on whether surgery is contemplated. If it is, the wound is best treated with Silvazine, for the lowest possible bacterial count when the procedure is actually carried out. Occlusive dressings not inspected regularly put the patient at risk – sepsis

may develop beneath them and this should be borne in mind, since toxic shock syndrome can occur in these patients.

Full-thickness Burns

Silvazine is mandatory for such burns, unless the patient has an allergy to silver sulfadiazine. When such is the case, a possible alternative is povidone iodine solutions and surgery as soon as possible. In patients with full-thickness burns, control of sepsis by the use of Silvazine allows earlier excision and skin-grafting at the burn area. Prior to the control of bacteria with a good topical agent, burn wounds excised early could lead to sepsis. Skin-grafting usually involves the use of a split skin-graft but for massive full-thickness burns other modalities – for instance, cultured skin, cultured skin suspension, Allograft™ and skin substitutes such as Biobrane, Integra and Dermagraft-TC – should be considered. Split skin, when taken, can be applied as a sheet for the best cosmetic result; however, if there is a bleed behind the graft part of it may be lost. This can be overcome by mesh-grafting using a 1½:1 mesh, which process puts small holes in the skin so that any serous discharge and/or bleeding can leak through. Thus, no graft is lost and the cosmetic result is reasonable, although a mesh pattern often remains visible. Wider meshes give a poor cosmetic result but can be used as a layered graft covered by Biobrane or Allograft. The latter is usually meshed ½:1, again to allow any serous discharge or blood to leak to the exterior. When Allograft is rejected or Biobrane removed, the area beneath generally heals on the patient's own widely meshed skin.

With massive burns it is not always possible to excise the burn completely in the first operating session, due to factors such as blood loss or the position of the wounds necessitating much movement in the theatre. The stamina of the surgeon must also be considered, since this very difficult surgery involves a great deal of skill and knowledge. If possible, the burn is excised in one session; however, serial excisions may be necessary to try and remove the dead tissue as soon as possible. On initial assessment of the patient, a timetable for this needs to be determined as fully as possible, to give the best cosmetic and functional result.

Antibiotic Cover

Generally there is no need to use antibiotics when the patient is admitted. An exception to this is electrical burns or those

that are grossly contaminated, in which cases it is reasonable to give penicillin as a prophylaxis against gas gangrene. However, despite the bacteria count initially being low, it will rise. Then, when operating to excise dead tissue, the bacteria are disturbed such that bacteraemia may well occur. Accordingly, it is usual to cover the operation with an appropriate antibiotic given an hour before the excision and perhaps 4 hours afterwards. It is not necessary to continue the antibiotic longer, as this usually controls the transient bacteraemia well. Obviously, if the patient remains septic and has septicemia it will be necessary to continue the antibiotics. There should be a strict policy in the burns unit to restrict the use of antibiotics as much as possible, being guided by the culture and sensitivity of each patient and also any knowledge of bacteria present in the unit. As stated, burn patients are at high risk of infection and may well develop a cross-infection from others, despite strict barrier nursing.

Physiotherapy and Occupational Therapy

The physiotherapist and occupational therapist must be involved with such patients from the start, rather than waiting to be asked. Not only should there be physiotherapy for the chest, to help prevent pneumonia, but the limbs must also – where possible – be put through both active and passive ranges of movement, particularly if the patient is on a ventilator, with splinting arranged as necessary to prevent contractures. Adequate early splinting has made contractures a thing of the past, although the axilla and neck still pose problems. Deformity of the hands should be preventable through splinting at night and active movements in the daytime.

Nutrition

Patients with severe burns experience a huge rise in basal metabolic rate and thus have huge requirements for proteins, calories and vitamins. Hence, a skilled dietitian is involved in their treatment right from the start, with nasogastric or nasojejunal feeding instituted when the patient is admitted. Parenteral feeding does put such patients at risk for sepsis but, with early enteral feeding, translocation of bacteria from the gut can be prevented to a large extent, since the patient's nutritional state is maintained. This will play a large part in preventing infection while facilitating rapid wound healing and taking of the graft.

Social Workers

Burn patients suffer enormous physical and emotional stress, while their families will suffer great emotional stress. Support from social workers, psychiatrists and psychologists is therefore essential, to ease the burden on patients and help them cooperate with their treatment regime, leading to better functional and cosmetic results.

With massive burns, despite the best treatment the patient may not survive so, again, the support of these health-care professionals is essential, to prepare the patient – and his or her relatives in particular – for such an event.

Conclusion

Burns treatment has progressed dramatically in the last 30 years. Adequate resuscitation, and control of sepsis with antimicrobial agents, have allowed early excision and skin-grafting of even a massively burned patient. Temporary skin covers such as those mentioned have played a large part in the survival and functioning of such patients. It is now possible to totally excise the injury of a massively burned person and cover the area rapidly with a skin substitute, such that his or her well-being is much improved, healing more rapid and return to the home environment facilitated. Control of infection is the main factor here, combined with a multidisciplinary team approach and the advent of highly specialised burn centres to not only treat more severe burns but also advise on burn treatment in remote areas.

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