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Scar management during rehabilitation of burn patients: an occupational therapist's perspective

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Rehabilitation of the burn patient is a long and intensive process that requires a dedicated team approach starting with inpatient care. In the South African setting the role of the occupational therapist (OT) during outpatient rehabilitation is integral to enhancing function and quality of life of the burn survivor. There are no designated burn rehabilitation centres in South Africa. This article describes an OT's perspective as experienced at the Tygerberg Hospital Pressure Therapy Outpatient Department.

Scar management is an essential part of burn rehabilitation and falls within the OT scope of practice. The use of pressure garments is a common treatment modality. However, there is little scientific evidence to prove the effectiveness in isolation of other treatments, e.g.:

- scar massage
- active exercise
- inserts
- silicone gel sheets or
- splinting.

Irrespectively, pressure garments are still used at Tygerberg Hospital due to the subjective and clinical experiences of doctors, therapists and patients that the garments work and assist in attaining a functional outcome.[1, 2]

Why pressure?

The skin in the normal state applies pressure against its underlying layers. When the skin is damaged (e.g. partial or full-thickness burns), the normal pressure of the epidermis exerted on the dermal, or underlying, layer is removed.[3] The lack of pressure causes the tissue to rapidly generate in irregular patterns, resulting in hypertrophic scarring. Pressure garments not only prevent and control scarring but also regress advanced scarring by applying counter (external) pressure[3] which decreases the inflammatory response and the amount of blood in the scar.[4] Pressure garments accelerate scar maturation. They flatten the scar by re-aligning collagen bundles and decreasing the rate of collagen synthesis/lysis.[2] The aim of treatment is to maximise the functional ability of the patient.

Wounds that have been grafted or take longer than 2 weeks to heal, are at high risk of hypertrophic scarring.[5] It is essential that the ward-based therapist ensures early application of pressure as soon as it is safe to do so. Early application of pressure is necessary for optimal outcome.[6] Scar tissue is highly responsive in the early stages, therefore early application is imperative, while the wound is still active and immature.[4]

Tubular bandages

Elasticated tubular bandages (Tubigrip, Tensogrip, Versogrip) can be used to effectively reduce oedema and apply pressure.[2] These bandages can be applied using ring applicators to minimise pain and damage to the newly grafted skin (Figs 1 and 2). Protocols regarding when to start applying pressure vary (3, 5, or 7 days after skin graft) and are determined by the needs of the patient. In order to enhance patient independence when applying the elasticated bandages, large milk tins may be adapted as ring applicators (opened at both ends) to take home on discharge from the unit (Fig. 3). Elasticated tubular bandages can be used for the limbs, as well as the torso (cut into vests), if large sizes are available.

Fig. 1. Application of elasticated tubular bandage using ring applicator.

Fig. 2. Elasticated tubular bandages should also be used to apply pressure to donor areas, which may lead to scarring.

Fig. 3. 'Milk tin' opened on either side, which can be used as a ring applicator. Elasticated tubular bandage measuring tape (below the rings) is used to choose the correct size bandage.

These bandages are used in the interim until the wounds have healed and there are no longer dressings *in situ*. It is also inexpensive and is generally more acceptable to the patient.[2]

Pressure garments

Once wounds are healed, proper custom-made pressure garments can be applied. However, certain factors influence the success of the therapy:

- the patient's intellectual insight and compliance regarding the wear and care of the pressure garment
- the time taken for wounds to heal completely can be prolonged
- clinic staff who are poorly skilled in performing dressings.

The discretion and experience of the therapist is very important in overcoming these problems and crucial in making an assessment.[2,6] Measurements are taken once the patient nears complete wound healing, generally as an outpatient. Garments are therefore manufactured in advance. The therapist, together with the patient, will decide which garment will be most suitable (consider a chin strap instead of a full mask if the patient is claustrophobic; a corset instead of pants for lower abdominal burns).

Designing a garment

All garments are custom-made using a reduction factor specific for the patient, in terms of age and diagnosis, and a pattern is formulated. The overall fit of the garment is determined by subjective evaluation of the therapist; one should be able to slide and fit a finger snugly under the garment, feeling at the seams.[6] Again the importance of a skilled therapist cannot be overemphasised.

Fastenings (zips/velcro and their placement) assist with putting on the garments and ultimately improve patient compliance and independence. Each patient receives at least two sets of garments to ensure that each set can be washed without interrupting the application of pressure. It is recommended that pressure garments be worn at all times, and that they are removed only for bathing and laundering.[4-6] The role of the occupational therapist as an educator to the patient and the family is vital in improving compliance.

Pressure is applied until subjective evaluation determines that the burn scar has matured, i.e. when it is soft, pliable and flat.[6] This time period varies from patient to patient and can be anything from 6 months to 2.5 years. Garments are replaced every 2 - 3 months depending on how well the patient cares for the garment.

The burnt or grafted skin may never look like the normal skin[5] and false hope that the skin will return to normal should be avoided. Skin grafts have the same problems as burns scars, as they form contractures, lose sweat gland function and hair growth, and have altered pigmentation.[5] Patients often ask if the colour of the skin will return to normal; the response is that hypo- and hyperpigmentation varies between individuals. In conjunction with pressure garments, holistic scar management should include active exercise, hard and soft splinting (progressing from static to dynamic) (Figs 4 - 8), inserts, silicone gel sheets, elastomer putty and scar massage. The skilled therapist should be able to identify if and when the patient requires intervention from other health professionals, i.e. physiotherapy, social workers, psychologists and plastic surgeons. Further surgery may be indicated, as well as the use of corticosteroid injections as a second-line therapy for treating hypertrophic scars.[7]

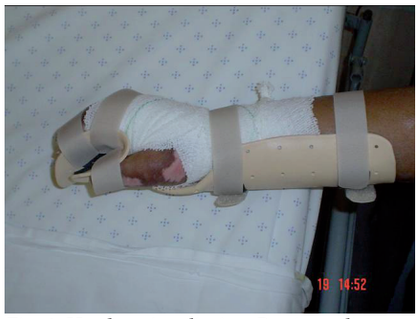
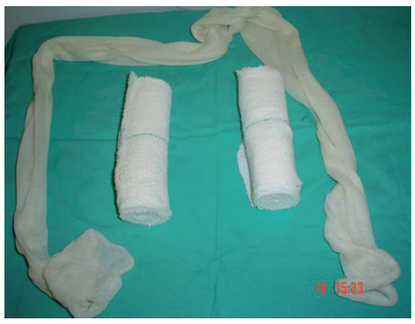
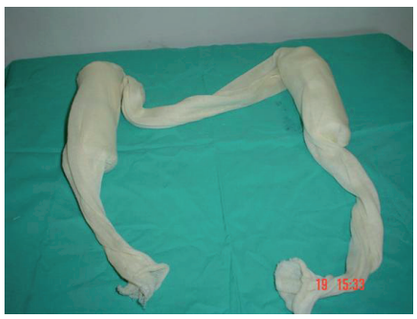


Fig. 4. Hard static splinting. Resting splints should be adjusted to achieve 20 - 300 wrist extension, 900 MP flexion and full IP extension, i.e. z-splint/ intrinsic splint.





Figs 5 and 6. Making a soft axilla sling using two 150 mm bandages and stockinette.

References

1. Giele HP, Liddiard K, Currie K, Wood FM. Direct measurements of cutaneous pressures generated by pressure garments. *Burns* 1997; 23(2): 137-141.
2. Serghiou MA. Scar management: paediatric burn rehabilitation. Powerpoint presentation, Shriners Hospital. mserghiou@shrinenet.org
3. http:www.burnsurvivorsttw.org.Rehabilitation of Burn Scars.
4. http://www.burnsurvivor.com. Pressure Garments – Burn Survivor Resource Centre.
5. http://www.icon.co.za/-firechildren/burntreat.html Burn Treatment
6. Williams F, Knapp, Wallen M. Comparison of the characteristics and features of pressure garments used in the management of burn scars. *Burns* 1998: 24: 329-335.
7. http://www.etrs.org. European Tissue Repair Society: Bulletin 12.1 & 2. Scar evaluation and management: recommendations.

Figs 7 and 8. Application of soft axilla sling using a figure-of-8 pattern. The sling must fit snugly under the axillas. It is inexpensive and more acceptable to the patient than a hard aeroplane splint.

The tumescent technique to reduce blood loss in burn surgery

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The tumescent technique is the subdermal or subeschar injection of fluid containing a vasoconstrictor, prior to burn wound surgery, to reduce blood loss. Local anaesthetic can be added to the formula to enhance pain control.

History

The tumescent technique evolved over the past 20 years mainly for use in liposuction.

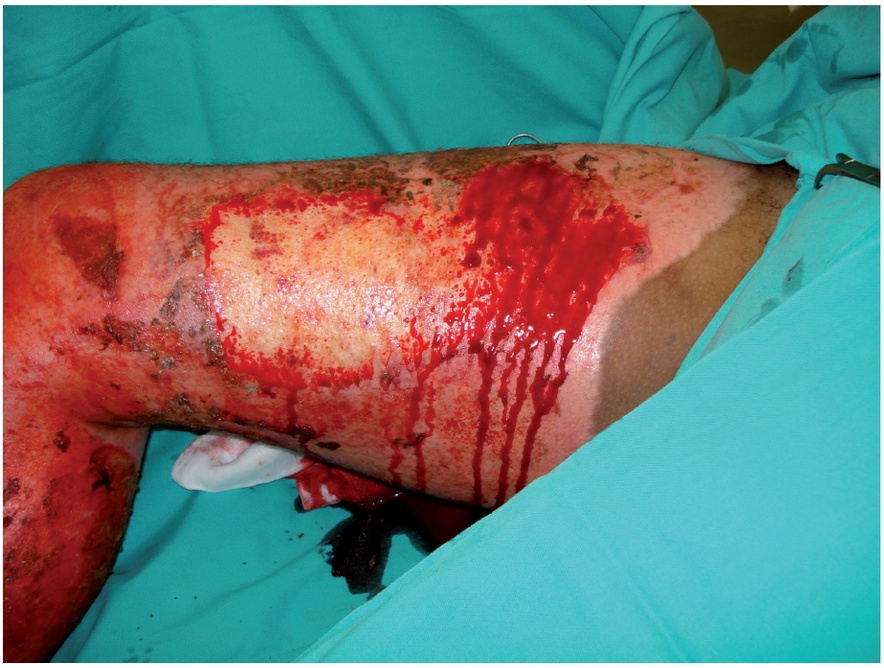

Fig. 1. Burn wound debridement demonstrating decreased bleeding from distal thigh wound area infiltrated with tumescent solution.

Illouz,[1] from France, is credited with creating the technique of blunt tip cannula suction lipectomy, and by 1982 presented a series of 3 000 liposuction cases describing the 'wet technique', where the subcutaneous fat is infiltrated with a fluid solution to cause a hydrotomy effect and enhance the suction of the fat. Local anaesthetic was added to the fluid formula and in 1984 Hetter described the routine addition of dilute adrenaline to the formula to decrease blood loss during liposuction.

The term tumescent derives from the Latin word 'tumidus', which means 'swollen'; Klein in 1987 used the term to describe the technique where the liposuction area is injected with the fluid formula until the skin has a turgid and swollen appearance.

Saline- and adrenaline-soaked swabs applied externally on debrided burn wounds and skin graft donor sites have been used for many years. The subcutaneous infiltration of facial burn wounds with saline and diluted adrenaline to decrease bleeding and to facilitate easier debridement was documented in 1986.

Method

The most common tumescent technique is the subdermal or subeschar infiltration of the burn wound debridement site as well as skin graft donor site with a solution formula of 1 mg (1:1 000) adrenaline added to 1 litre of saline. This will dilute the adrenaline to 1:1 million.

The surgery sites are infiltrated with the fluid formula by means of a 18 G spinal needle attached to a 20 ml syringe until the tissue has a smooth, firm, slightly swollen appearance. More rapid infiltration of large operative areas can be obtained by attatching the spinal needle to a pressurised vaculiter drip set. The thigh burn wound demonstrated in Fig. 1 needed 60 ml of fluid infiltration.

Warm (37^0 C) saline should be used. Wide, even infiltration of the soft tissue should be done, including extension under the peripheral wound edges, where bleeding from normal skin is often excessive. Lignocaine can be added to the formula, but should not exceed the recommended safe dosage of 6 - 8 mg/kg.

It is important to wait 10 minutes before surgery commences to obtain a good vasoconstrictor effect. This is usually not a problem if multiple regions need infiltration.

Tangential debridement should be stopped once clean dermis or healthy yellow fat is reached. Decreased bleeding with this technique means that burn wound depth can be overestimated.

Final haemostasis with electrocautery can be done and, if needed, wound areas can be covered with swabs soaked in the fluid formula. Bleeding areas can also be re-infiltrated with the fluid formula.

Results

Numerous studies have confirmed the beneficial effect of the tumescent technique. Cartotto *et al.*[2] demonstrated a decrease from 211 ml down to 123 ml in blood loss per percentage of body surface surgery. Futhermore, the intraoperative transfusion requirements were reduced from 3.3 units to 0.1 units of blood. Robertson *et al.* demonstrated a decrease of more than 50% in blood loss and Hussain *et al.* a decrease of 39%.[3,4]

Studies have confirmed that the low dose of adrenaline does not cause acute cardiovascular side-effects.[5] Postoperative wound re-bleeding has not been reported to be a problem. Good skin graft take and wound healing have been reported.

Discussion

Blood loss during tangential debridement and skin graft harvesting is of major concern during burn surgery. Numerous techniques are used for blood conservation. These include the use of limb tourniquets, the use of topical applied swabs soaked in adrenaline solution or application of thrombin spray. Debridement with laser, and more recently the use of the Versajet, enables debridement to be carried out at specific depths with less bleeding.

Several published articles demonstrate on average a 30 - 50% reduction of blood loss with the tumescent technique. Advantages include the decreased bleeding from the debridement and donor sites. Debridement and harvesting from the tumescent surface is easier, especially in difficult areas such as the face. The marked reduction in blood transfusion is of importance in South Africa with its high HIV prevalence rate. Adding local anaesthetic to the tumescent solution decreases pain and is especially beneficial in paediatric burn surgery. The technique is easy to use and no expensive equipment is needed.

There are few disadvantages of the technique. Although some transient increases in heart rate and blood pressure have been described, no significant cardiac arrhythmias due to the diluted adrenaline have been noted. The only, but obvious, problem when starting to use the technique is that the surgeon should be careful not to over-resect in burn wound depth.

Conclusion

The tumescent technique is the subdermal or eschar injection of a solution containing diluted adrenaline and saline, prior to burn wound debridement and skin grafting. Local anaesthetic can be added to enhance pain relief. The technique is easy to use and can significantly reduce blood loss and the need for transfusion during burn surgery.

References

1. Illouz Y-G. History and current concepts of lipoplasty. *Clin Plast Surg* 1996; 23(4): 721-730.
2. Cartotto R, Musgrave MA, Beveridge M *et al.* Minimising bloodloss in burn surgery. *J Trauma* 2000; 49(6): 1034-1039.
3. Robertson RD, Bond P, Wallace B, *et al.* The tumescent technique to significantly reduce blood loss during burn surgery. *Burns* 2001; 27(8): 835-838.
4. Hussain S, Ofodile FA.Tumescent technique for burnwound debridement: a cost effective method of reducing transfusion requirements. *J Coll Phys Surg Pak* 2006; 16(3): 227-228.
5. Cartotto R, Kadikar N, Musgrave MA, *et al.* What are the cardiovascular effects of subcutaneous and topical epinephrine for hemostasis during burn surgery? *J Burn Care Rehabil* 2003; 24(5): 297-305.

HIV and burns

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Antiretroviral treatment (ART) has increased life expectancy and the quality of life of many patients infected with the human immunodeficiency virus (HIV). As patients live longer many are admitted with conditions not related to HIV infection, for example trauma and burns. Practitioners are challenged by decisions regarding the management of immunocompetent burns patients. There are no randomised trials and no consensus guidelines for the management of HIV and burns.

In 1998 Rose *et al.*[1] reviewed the literature dealing with complications of surgery in HIV-infected patients. They found that the literature is largely descriptive, retrospective and inconsistent. The writers concluded that the ultimate outcome of surgery in HIV-infected patients is probably dependent upon many independent variables and not just on the underlying viral infection or disease stage. Edge *et al.*,[2] in a South African study, found that HIV status did not alter the outcome of treatment after moderate to severe burns as long as the stigmata of AIDS are not present. In a study by James *et al.*[3] in Malawi, it was found that mortality was higher among HIV-positive individuals. Length of hospital stay, the need for blood transfusions, antibiotics and intravenous fluid administration were not affected. There was also no difference in skin graft take. In contrast Mzezewa *et al.*[4] found impaired graft survival after split skin grafting of burn wounds and prolonged hospital stay in patients with HIV. In another study Sjoberg *et al.*[5] found no difference in the mortality rate or the length of hospitalisation between patient groups with or without HIV. The number of CD4+ T-lymphocytes was lower in burn patients compared with healthy volunteers. HIV-infected burn patients had lower CD4+ T-lymphocyte counts than non-HIV-infected patients. Patients with clinical signs of sepsis had lower CD4+ counts compared with patients without sepsis. The authors concluded that burn injury, HIV infection and sepsis independently result in immunosuppression. Finally, in a recent large study on 31 338 adult burn patients, Thombs *et al.*[6] found that patients with acute burn injury with pre-burn medical conditions are at greater risk for mortality and require longer hospital stays prior to discharge. In particular patients with HIV/AIDS, metastatic cancer, renal disease, and liver disease are at very high risk for mortality compared with patients without those diseases who have similar burn injuries. It can be concluded that HIV status is a serious complication in burns, but it does not preclude treatment.

This article addresses some of the issues based on clinical observations made in a burn centre. Should patients on ART continue treatment after thermal injury? In contrast, should burns patients not on treatment start ART? All these questions will be answered in the future after specific trials have been conducted. However, in the meantime we will discuss the guidelines used in the Johnson and Johnson Burns Centre.

Events surrounding burns

Detailed information regarding the event should be available, since this information will influence early diagnosis and treatment. Thermal injury may occur as a result of accidents or suicide attempts. Most self-inflicted burn patients are young women, recently diagnosed with HIV infection or on ART, with poor quality of life. For unintentional thermal injury the patterns of injury between uninfected patients and HIV patients are similar. Patients are usually undiagnosed at the time of admission, but if there is unexpected morbidity such as nosocomial pneumonia, widespread sepsis or recurrent skin graft failure, an HIV test is done after informed consent has been obtained. HIV-positive patients are entitled to specialised care, including burn care.

HIV testing of burn patients

HIV testing and disclosure should be performed according to legal procedures and established legal guidelines and ethical recommendations. Patients should be counselled in the usual way. Testing of intubated and ventilated patients should be deferred until the patient is able to give informed consent. In the majority of these patients knowing the HIV status will not contribute to their acute management.

Laboratory investigations

CD4 T-lymphocyte counts continue to be an indicator of the susceptibility of patients to HIV-related opportunistic infections. Unfortunately, burns, like other trauma events, can lower CD4 counts and interpretation becomes difficult. However, a CD4 count of less than 50 cells/µl in burn patients usually has diagnostic significance. After the acute phase a rising count would be expected, especially after wound cover. A failure to see an improvement in the CD4 count, with absence of infection, is an indication of immune incompetence. Burn patients with CD4 counts of more than 200 cells/µl who develop pneumonia or oral thrush are at risk of having another infection or skin graft failure compared with patients with the same CD4 counts who do not have one of these complications.

Should burn patients on ART continue treatment?

This question needs to be answered for critically ill patients with severe burns. In minor burns there is no problem, even in pregnant women, as long as the patient can take the medication orally. Most antiretroviral agents are only available as oral tablets and suspensions, except zidovudine and enfuvirtide, which are available in parenteral form. Severely burned patients can develop gastric immotility, be on continuous feeding, and have nasogastric suctioning or gastric alkalinisation for stress ulcer prevention. Many drugs used in the burns ICU can interact with ART. All these conditions can contribute to a reduction in drug absorption and produce a suboptimal drug level and resistance. Thus, in most situations of severe burn injury, the best strategy is to stop all ART. Treatment can safely be restarted as soon as the patient is able to take oral agents without the risks described above. Before ART is discontinued, it is advisable to consult with an HIV specialist on how best to do this.

Should burn patients start ART?

Patients who did not receive ART before admission should not start treatment in the ICU, due to the problems described above. This is particularly due to the risk of immune reconstitution syndrome, which could result in clinical worsening of an already critical condition. Once patients recover from the acute condition and have started wound cover (skin grafting) it is

advisable to involve an HIV specialist. Some patients can start ART before discharge; anecdotally, many patients appear to improve in this situation. This is particularly important for long-stay patients who risk contracting opportunistic infections. These decisions will be made as for any non-burn HIV patient. Some HIV-infected patients lose skin grafts after weeks; the mechanism is unkown. The recommendation from this unit is to start ART.

Conclusion

Antiretroviral therapy has changed the long-term prognosis and life expectancy of patients with HIV infection. Many patients are admitted with conditions not related to HIV, for instance burn injuries. Initiation of antiretroviral therapy should be deferred in burn patients admitted to the ICU. Patients can safely continue ART once the wounds are covered and no risk of drug interactions and malabsorption exists. However, antiretroviral therapy should be considered when a prolonged hospital stay is expected in patients with CD4 counts below 200 cells/µl.

References

1. Rose DN, Collins M, Kleban R. Complications in surgery in HIV-infected patients (Editorial review). *AIDS* 1998; 12(17): 2243-2251.
2. Edge JM, Van der Merwe AE, Pieper CH, Pouic P. Clinical outcome of HIV positive patients with moderate to severe burns. *Burns* 2001; 27: 111-114.
3. James J, Hofland HW, Borgstein ES, Kumiponjera D, Komolafe OO, Zijlstra EE. The. prevalence of HIV among burn patients in a burns unit in Malawi and its influence on outcome. *Burns* 2002; 29: 55-60.
4. Mzezewa S, Jonsson K, Sibanda E, Aberg M, Salemark L. HIV infection reduces skin graft survival in burn injuries: a prospective study. *Br J Plast Surg* 2003; 56(8) : 740-745.
5. Sjoberg T, Mzezewa S, Jonsson K, Salemark L. Immune response in burn patients in relation to HIV infection and sepsis. *Burn* 2004; 30(7): 670-674.
6. Thombs BD, Singh VA, Halonenen J, Diallo A, Milner SM. The effects of preexisting medical comorbidities on mortality and length of hospital stay in acute burn injury: evidence from a national sample of 31 338 adult patients.