

CONTEMPORARY RECONSTRUCTION OF A SEVERE NEUROPATHIC FOOT BURN INJURY

TRAITEMENT CONSERVATEUR D'UNE BRÛLURE DE PIEDS DIABÉTIQUES

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SUMMARY. The neuropathic foot in diabetic patients constitutes a special clinical entity that needs particular care and ministration. A burn on such a foot requires special care and attention in order to avoid amputation, especially when the burn is a deep partial or a full-thickness burn. The indication for early excision and coverage of a diabetic foot is taken under consideration in clinical practice. An 80-year-old male diabetic patient with deep partial and full-thickness burns on both his feet after a long hot footbath is presented. Even though feet appearance indicated the need for amputation of both feet, we performed gradual surgical debridement and primary coverage with human skin allografts. Both feet were finally covered with partial thickness skin grafts. Considering age, general condition and severity of the burn injuries, the final results were very satisfactory. We believe that the gamma-radiated allograft is another useful adjunct to the reconstructive armamentarium of the surgeon.

Keywords: burn, diabetic foot, reconstruction, human derived skin allograft

RÉSUMÉ. Les pieds du patient souffrant de neuropathie diabétique nécessitent des soins spécifiques. Le traitement d'une brûlure profonde de tels pieds a pour but d'en éviter l'amputation, l'indication d'excision-greffe précoce étant systématiquement à évoquer. Nous présentant la cas d'une patiente diabétique de 80 ans ayant subi des brûlures profondes des 2 pieds du fait d'un bain trop chaud. Alors même que l'aspect des brûlures laissait craindre la nécessité d'une amputation, nous avons choisi des excisions réitérées avec couverture par allogreffe avant autogreffe dont les résultats, compte tenu de l'âge, de la comorbidité et de la profondeur de la brûlure, sont considérés comme satisfaisants. Les allogreffes irradiées représentent un élément utile dans l'arsenal thérapeutique du chirurgien brûlologue.

Mots-clés : brûlure, pied diabétique, reconstruction, allogreffe

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Introduction

The neuropathic foot in diabetic patients constitutes a special clinical entity that needs particular care and ministration. Patients with diabetes are at increased risk for lower extremity complications, but the risk of burns is not well known.¹

Its aetiology is included in the various clinical manifestations of the neuropathic disorders of diabetes mellitus.

Sensory loss in the lower extremities of diabetic patients may be the cause of unusual accidental foot injuries.²

Diabetic burn patients have a particular epidemiological profile in terms of their age, bodily sites affected by the injury, comorbidities and the timing of presentation to medical facilities.³

Burn wound is a significant cause of diabetic patient admission to the hospital for treatment, representing 10% of these cases.⁴ In one study patients with diabetes represented 18.3% of annual burn admissions to a burn unit, while 27% of them had burns to the feet.⁵ Recent studies have shown that the length of hospital stay of burned diabetic patients was significantly longer than that of burned non-diabetic patients.⁶

A burn on such a foot requires special care and attention in order to avoid amputation, especially when the burn is a deep partial or a full-thickness burn. Once a burn occurs, morbidity and cost to the patient and society are severe.¹ In a report from the Netherlands, they stated that the number of diabetic foot burns is low, but the rate of morbidity is high. A study conducted by Momeni et al.⁷ showed that these patients had higher morbidity compared to other burn patients.

The indication for early excision and coverage of a diabetic foot is taken under consideration in clinical practice.^{5,8} Bone and tendon exposure in diabetic patients requires flap reconstruction to avoid major limb amputation.⁹ For critical and unstable diabetic patients, revascularization and flap reconstruction may not be feasible. Skin grafts can be used in such a situation.⁹ Usually a surgical debridement is proposed at the beginning of the treatment.^{3,5} Wound dressing will be selected according to the intended purpose, which

can be absorptive, debriding, protective, and/or antimicrobial.⁵

Peripheral vascular disease and diabetes, and impaired, poor wound healing capacity¹⁰ leads to the conclusion that early excision must be avoided, as bone and tendon exposure may occur on the dorsal surface of the foot.¹¹ This requires immediate reconstruction and coverage, which may be impossible in some cases, so the danger for bone infection and amputation is dramatically increased.¹²

Case report

An 80-year-old man was admitted to our medical department with deep partial and full-thickness burns on both his feet. The patient's medical history reported diabetes type II, for 16 years, with total sensory loss in the lower extremities due to distal sensorimotor polyneuropathy.

The patient described how 15 days before, he had a footbath with warm water as a self-treatment for his feet for half an hour. His 78-year-old wife regulated the water temperature, as usual for these everyday footbaths. But on that day, by mistake, the water was very hot. Afterwards, day by day, they noticed that his feet became black and started smelling without understanding the reason. On admission we realized that he was suffering from severe painless deep partial and full thickness feet burn injuries, due to sensory loss (*Fig. 1*).

Our question in this special case was whether to perform an early debridement and coverage or not, as is our common practice with foot burn injuries but not diabetic ones.

The feet appearance indicated the need to amputate both feet.

We decided to wait, offering the usual conservative therapy: bed rest, tight glucose control, administration of antibiotics and local antiseptics. Little by little a cautious and gradual surgical debridement was performed.

After 40 days and total debridement of the burn injuries, a not healthy granulation tissue appeared without exposed tendons (*Fig. 2*).



Fig. 1 - Diabetic feet with burn injuries

Firstly we covered the wounds with gamma irradiated fenestrated human skin allografts. These grafts, derived from donated human cadaveric skin tissue, were irradiated and stored at room temperature. They act as a protective dressing, as they decrease the amount of fluid and protein loss and the bacterial burden, in this way promoting wound healing. They consist of two layers, epidermis and dermis maintained together (*Fig. 2*).

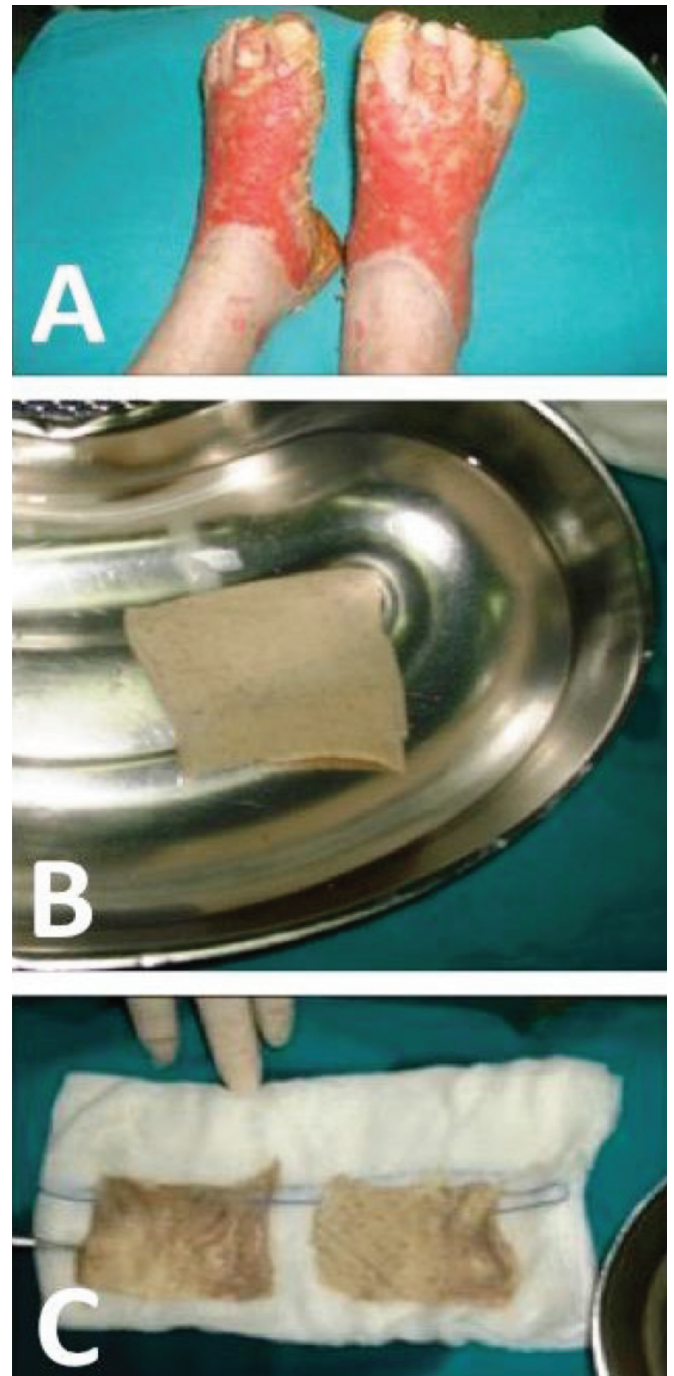


Fig. 2 - The human derived skin allografts

During the first post-op day we left the wound without bandages, according to guidelines in the literature. The fenestration permitted the drainage of the wound exudates (*Fig. 3*).

We noticed a successful attachment of the grafts even from the first post-op day, with complete graft revascularisation later on. Day by day we observed a gradual rejection of the graft's borders as the normal reepithelialisation of the

wound progressed towards the wound centre (*Fig. 3*).

After the 4th post-op day the patient was discharged from our clinic and he returned to the hospital once a week on an outpatient basis, for one month. At this stage the patient returned to his ordinary life (walking, foot bathing, shoe wearing, etc.).

Fifty days later, all allografts were rejected, leaving all remaining non-reepithelialised surfaces covered by a healthy granulation tissue. These deficits were finally covered with fenestrated skin autografts (*Fig. 3*).



Fig. 3 - Burn surfaces grafted with human derived skin allografts

Discussion

It is widely known that patients with diabetes mellitus are at an increased risk for lower extremity wound complications, but the risk of burns is not well documented.¹ Diabetic patients generally seek medical care for foot burns with a delay of 1-3 days.⁷ The majority of lower extremity burns result from intentional exposure to sources of heat without recognition of the risk of burns.¹ In our report injury mechanism was the same, while the patient exhibited the same behavior, seeking help 15 days after exposure to the source of heat.

We implemented key aspects⁵ of treating diabetic foot burns, such as optimizing glycaemic control and wound management and providing a discharge plan.

Surgical debridement of necrotic or infected tissue may be necessary as an initial step to preparing wound bed and achieving wound care.^{5,8} Our question in this special case was whether to perform an early debride-

ment and coverage or not. We performed a cautious and gradual surgical debridement instead of a surgical debridement.

Generally, partial- thickness burns that show no signs of healing after 2 to 3 weeks can be treated with skin grafting.⁸ In our case the injury was deep partial and full thickness burn so it required flap reconstruction with skin grafting. Burns on the feet of diabetic patients may be predisposed to infection. Early wound closure prevents the sequelae of infection, gangrene and amputation.

When the patient needs a bilateral foot reconstruction, after a major burn injury, there may be a limited availability of normal unscarred donor sites.¹³ In our report we covered the wounds with gamma irradiated human fenestrated skin allografts. These grafts derived from donated human cadaveric skin tissue.

A variety of novel therapeutic approaches have been proposed in the treatment of diabetic burn injuries.³ The goal of any method of reconstruction should be the restoration of function with a reasonable aesthetic appearance.^{14,15}

In our case aesthetic appearance and functionality were very good and the patient returned to his normal life 4 weeks after admission.

Results and conclusions

Considering the age, general condition and severity of the burn injuries, the final results were very satisfactory (*Fig. 4*). Today the patient walks normally, respecting all practical guidelines for the prevention of diabetic



Fig. 4 - Early and final results

foot, without any problem. The quality of the skin in the burned areas is very good in terms of elasticity, endurance, cosmetic appearance and acceptance.

The gamma-radiated allograft is another promising

solution for the reconstruction of complex wounds, bearing in mind the poorer outcomes of all possible methods for patients with diabetes.

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