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Case report

Exposed tibial bone after burns: Flap reconstruction versus dermal substitute

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ABSTRACT

A 44 years old male patient had suffered extensive 3rd degree burns on both legs, undergoing thorough surgical debridement, resulting in both tibias being exposed.

Approximately 5 months after the incident he was referred to the Department of Plastic and Reconstructive Surgery of the University Hospital Gent, Belgium, to undergo flap reconstruction.

Free flap surgery was performed twice on both lower legs but failed on all four occasions.

In between flap surgery, a dermal substitute (Integra®) was applied, attempting to cover the exposed tibias with a layer of soft tissue, but also without success.

In order to promote the development of granulation tissue over the exposed bone, small holes were drilled in both tibias with removal of the outer layer of the anterior cortex causing the bone to bleed and subsequently negative pressure wound therapy (NPWT) was applied.

The limited granulation tissue resulting from this procedure was then covered with a dermal substitute (Glyaderm®), consisting of acellular human dermis with an average thickness of 0.25 mm.

This dermal substitute was combined with a NPWT-dressing, and then served as an extracellular matrix (ECM), guiding the distribution of granulation tissue over the remaining areas of exposed tibial bone.

Four days after initial application of Glyaderm® combined with NPWT both tibias were almost completely covered with a thin coating of soft tissue.

In order to increase the thickness of this soft tissue cover two additional layers of Glyaderm® were applied at intervals of approximately 1 week. One week after the last Glyaderm® application both wounds were autografted.

The combination of an acellular dermal substitute (Glyaderm®) with negative pressure wound therapy and skin grafting proved to be an efficient technique to cover a wider area of exposed tibial bone in a patient who was not a candidate for free flap surgery. An overview is also provided of newer and simpler techniques for coverage of exposed bone that could question the universal plastic surgery paradigm that flap surgery is the only way to cover these defects.

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1. Introduction

In full thickness burns of the lower legs the tibial crest is prone to becoming exposed due to the fact that it is only covered by a relatively thin layer of soft tissue.

Restoration of an adequate soft tissue cover for such defects can present a complex surgical challenge, especially when dealing with wider defects.

Prolonged cortical bone exposure, even without underlying fracture, can result in severe complications such as dehydration and bone necrosis leading to infection, osteomyelitis, possibly sepsis and ultimately even resulting in amputation [1].

As a general rule, whenever bone is exposed after a burn injury to the lower leg, the primary objective, in order to preserve bone viability, must be an early reconstruction of the soft tissue layer, providing the patient with maximal chances for rehabilitation and the opportunity to resume normal life [1–3].

Despite the fact that in recent years there have been several reports on the successful coverage of exposed bone (and tendons) with dermal substitutes, the wide majority of plastic surgeons, and especially those with a wide experience in microsurgery (as in our center), are still convinced that 'flap surgery' is by far the best (if not the only) way to cover these defects.

We hereby present a case that questioned this plastic surgery paradigm. In addition an overview of newer and simpler techniques for coverage of exposed tibial bone is provided as described in present literature.

2. Case report

In April 2011 a 44 years old male patient of African origin sustained extensive 3rd degree burns on both legs due to an accident with a torch setting his pants on fire. In another hospital thorough debridement was performed which resulted in extensive lower leg defects with bony exposure of both tibias. Already at an early stage holes had been drilled into the right tibia hoping this would result in granulation tissue formation.

Several months later, in September 2011, the patient was referred to the Plastic Surgery Department of the University Hospital Gent, Belgium, to provide adequate coverage of the long standing defects (now chronic wounds) of the lower legs with exposed bone (Fig. 1).

In a first surgical procedure, on September 15th, 2011, a free thoracodorsal artery perforator (TAP) flap was used to cover the defect on the left lower leg but despite revision the flap failed and eventually had to be debrided.

Two weeks later, on September 28th, 2011, a contralateral free TAP flap was transferred to cover the defect of the right lower leg but this flap also failed after a few days.

By means of intermediate therapy, NPWT (Exsudex®) was applied at −80 mm Hg. The dressing consisted of polyurethane (PU) foam (Ligasano®) combined with a Hydrofiber® silver dressing (Aquacel® Ag) for antibacterial purposes. NPWT was continued with a twice weekly dressing change schedule until November 23rd. At that moment the wound edges were granulating. On November 23rd, 2011 a dermal substitute (Integra®) was applied on both lower legs of the patient. Prior to Integra® application new holes were drilled in the exposed bone, this time in both tibias. The Integra® was combined with NPWT (Exsudex®). One week after application Integra® was removed due to bacterial overgrowth mainly caused by multiresistent *Pseudomonas aeruginosa* (+++).

To further reduce the bacterial load, intravenous antibiotics were started (Meropenem 1 g, 6x/dy) and the wounds were dressed daily with povidon iodine gel (Iso-betadine® gel) combined with paraffin gauze (Jelonet®) and a dry sterile gauze dressing.

On December 16th 2011, after 17 days of systemic antibiotic treatment which was continued over a total period of 6 weeks, two free gracilis muscle flaps were transferred to both lower leg defects. Both flaps failed again and eventually had to be debrided 10 days later.

After removal of the flaps, additional small holes were drilled in the bone cortex of the exposed tibias and with a chisel the upper layer of the non-vital anterior cortex was removed resulting in bleeding of the cortical bone.

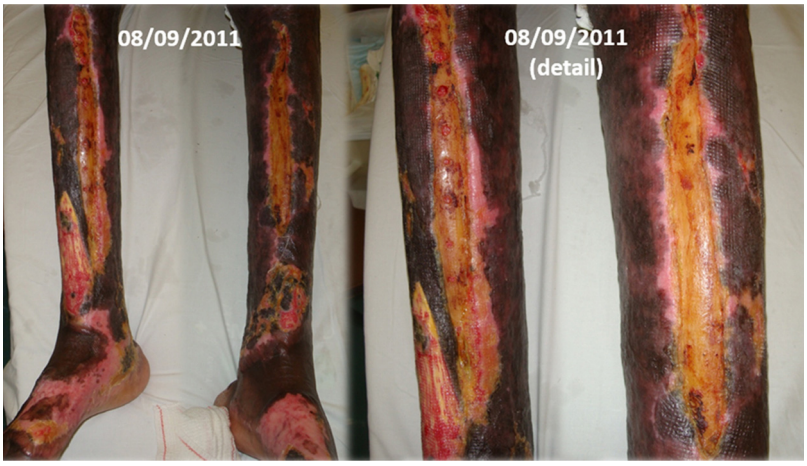

Fig. 1 – Wounds with exposed tibias (08/09/2011).