

# Managing Neglected Burn Wound with Exposed Upper Tibia Using Multiple Modalities

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**Background:** Deep burn wound with exposed underlying structures such as muscle or moreover in this case, bone, may increase morbidity in the terms of infection. Therefore careful planning of reconstruction is needed.

**Patient and Method:** We report one case of neglected burn wound with exposed tibia and muscle contracture on bilateral knee joint that was reconstructed in our Plastic Surgery Division of Prof RD Kandou Hospital. Data was taken from medical and surgery record.

**Result:** We managed the muscle contracture of the left knee joint by sedated gradual stretching and splinting. We also utilized hyperbaric treatment in order to maximize granulation process. A medial gastrocnemius muscle flap followed by split thickness skin graft is used to reconstruct the missing tissue at upper tibia, and another split thickness skin graft to cover another wound at opposite upper leg. The result was satisfying without any complication.

**Conclusion:** In managing a neglected burn wound with bone exposed and muscle contracture, it is compulsory to have a careful reconstruction planning. Our objectives are to release the muscle contracture and to provide an adequate coverage to the bone-exposed wound by using many modalities we have.

**Keywords:** Tibial exposed deep burn wound, medial gastrocnemius flap, STSG, muscle contracture, gradual stretching, hyperbaric oxygen therapy

**Latar Belakang:** Luka bakar dalam dimana struktur bawah kulit seperti otot, atau pada kasus ini tulang terpapar, dapat meningkatkan morbiditas terkait dengan infeksi. Oleh sebab itu, perencanaan rekonstruksi yang seksama sangat diperlukan.

**Pasien dan Metode:** Kami melaporkan sebuah kasus luka bakar yang terbengkalai dengan tulang tibia yang terpapar dan kontraktur otot pada kedua sendi lutut yang dilakukan rekonstruksi di Divisi Bedah Plastik RSUP Prof. dr. R. D Kandou. Data diambil dari rekam medis dan operasi.

**Hasil:** Kami menangani kontraktur sendi lutut dengan stretching bertahap dalam sedasi dan splinting. Kami juga menggunakan terapi hiperbarik untuk memaksimalkan proses granulasi. Flap otot gastrocnemius medial dan split thickness skin graft (STSG) digunakan untuk merekonstruksi jaringan yang hilang pada tibia proksimal kiri, dan luka pada tungkai kanan juga ditutup STSG. Hasilnya memuaskan dan tanpa komplikasi.

**Kesimpulan:** Dalam menangani luka bakar dengan tulang terpapar dan otot yang mengalami kontraktur, penting untuk membuat perencanaan rekonstruksi yang seksama. Tujuan kita adalah membebaskan kontraktur otot dan menyediakan jaringan yang adekuat untuk menutup tulang yang terpapar menggunakan beberapa modalitas yang kita miliki.

**Kata Kunci:** Tibial exposed deep burn wound, medial gastrocnemius flap, STSG, muscle contracture, gradual stretching, hyperbaric oxygen therapy

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Managing any open wound with exposed bone, regardless of the cause, is challenging.<sup>1</sup> Burn wounds with an associated exposure of underlying structure such as bone, tendon and

muscles are considered as fourth degree burn. which often require multistage reconstructive procedures.<sup>2,3</sup>

Problems are the high rates of cellulitis, deep vein thrombosis and bacteremia, not to mention prolonged hospital stay and cost.<sup>3</sup>

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## PATIENT AND METHOD

A 20 years old man, came to our emergency department with fourth degree burn wound caused by prolonged contact with heated motorcycle muffler in an accident, exposing his anterior upper third left tibia, and another wound exposing subcutaneous layer on the opposite upper leg. The wound has persisted for 2 months, and was treated with herbal medications. At admittance the wound is malodorous, filled with residues of green leaves, and contained maggots. The knee joint at left leg cannot be fully extended and has been so soon after the injury happened. The patient was very thin and weak (BMI = 16). Disuse atrophy was found in both legs and the patient was unable to walk by himself (Figure 1).

A debridement under general anesthesia was immediately performed at emergency operating theatre. The patient was admitted to the ward and for a week, the patient underwent a total of four sedated gradual knee joint stretching and also wound dressing in order to be able to fully extend his left leg. A long back slab cast was applied after each stretching to maintain the extended position. For the next two weeks, the patient was treated with hyperbaric oxygen therapy to maximize the granulation process. The patient also consumed high calories high protein diet to increase his nutritional status.

After 3 weeks a satisfying granulation was observed and the patient was ready to undergo the final reconstruction procedure (Figure 2). A local flap taken from the medial head of gastrocnemius was used to cover the exposed upper tibia, followed by a split thickness skin graft (STSG) that was harvested from the anterolateral part of the thigh. Another STSG was also performed to cover the defect on the opposite leg. The patient was then observed in the ward for another 2 weeks with the leg back slab still attached before being discharged (Figure 3).

## RESULT

A week after reconstruction procedure, the graft is well taken by the wound. We observed no cellulitis, no thrombosis and fine

vascularization at the graft site, the donor site and their surroundings. The patient was then discharged after 6 weeks of hospital stay, with night leg splints still attached.

Three months later the patient came to our polyclinic. He was able to walk by himself, the graft was fully taken, his nutritional status has improved (recent BMI=19) and he has no complaints (Figure 4). The patient is now a college student.

## DISCUSSION

Our goal here is to manage the wound and contracture so the patient can resume his lower extremities function. In managing open wounds we have to achieve soft tissue coverage for the bone, tendons, and neurovascular structures.<sup>3</sup> The first thing we want to do is to remove necrotized tissue and create a good environment for granulation to occur.<sup>3,4</sup> This can be done by keen debridement that we immediately performed following the patient's admission.

On bilateral legs, there has been a contracture forming a rigid angle on its knee joints. During the first week we change the wound dressing under sedation so that we could gradually stretch the patient's contracted leg with the help of muscle relaxant drugs. We did it in total four times of gradual stretching under sedation to achieve a fully extended leg. After each stretching we applied a long back slab on the affected leg.

In order to maximize wound granulation, we decided to use the hyperbaric therapy. The patient underwent a total 9 times of hyperbaric oxygen therapies in two weeks. The hyperbaric oxygen therapy is a well-accepted adjuvant treatment for non-healing wound, particularly hypoxic wounds.<sup>5-8</sup> It works according to Henry's law of physics, that the increase in the atmospheric pressure magnifies the amount of oxygen dissolved in plasma.<sup>5,6</sup> Oxygen is known essential for intracellular aerobic metabolism, promoting fibroblast proliferation, collagen synthesis, neopithelialization and hence, granulation.<sup>5-8</sup> In accordance to protocol<sup>5,6</sup> our patient was put in a monoplace chamber, inhaling 100% oxygen with a 2.0 ATA pressure for 60 minutes each session. The result was satisfying in which



**Figure 1.** Above Left : Patient at admittance. contracture of the right knee. Above Right : contracture of the left knee. Below : wound on both knee joint



**Figure 2.** The wound bed after hyperbaric treatment with granulation process after two weeks. Left :right leg Right : left leg with upper tibia still exposed.



**Figure 3.** Left : STSG covering right leg wound. Middle : Gastrocnemius muscle flap covering left leg wound. Right : STSG on left leg covering the gastrocnemius muscle flap.



**Figure 4.** Three months after surgery, patient was able to walk by himself.

granulation occurs thoroughly on our patient's both wounds.

After granulation is achieved, we proceed to find adequate soft tissue coverage for the exposed tibia in our patient's left leg. Soft tissue deficit on the proximal third of the tibia can be covered with a gastrocnemius muscle flap.<sup>4,9-11</sup> The gastrocnemius flap is a type 1 (single vascular pedicle) muscle flap, with vascularization comes from the sural branches of popliteal artery.<sup>9,12</sup> Several retrospective studies in Iraq<sup>13</sup>, Egypt<sup>14</sup>, and America<sup>15</sup> have proven that the gastrocnemius muscle flap is indeed a highly reliable flap that could be used safely to cover defects over the upper third of the leg. In this patient we used half anterior part of the medial gastrocnemius head that was rotated anteriorly to cover the exposed upper third tibia. The muscle flap was then covered with STSG taken from the patient's thigh. Another STSG was also applied to the wound on the opposite leg. We chose split thickness skin graft because of the large size of the wound and its greater possibility of take.<sup>16</sup>

## SUMMARY

In managing a neglected burn wound with bone exposed and muscle contracture, it is compulsory to have a detailed and comprehensive reconstruction planning. Our objectives are to release the muscle contracture and to provide an adequate coverage to the bone-exposed wound by using many modalities we have.

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