



## CASE REPORT

# Chronic Wound Formation on an Old Burn Scar after Surgical Incision and Hyperbaric Oxygen Therapy: Case Report

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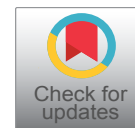
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## Abstract

Chronic wounds fail to progress through the phases of wound healing; inflammation-proliferation-remodelling which are usually the result of persistent infection, malperfusion due to periwound hypoxia, cellular failure, and unrelieved pressure or repetitive trauma. In this report, we present a different rare cause of a chronic wound; a surgical incision on a post-burn scar during the surgery of transurethral resection of the prostate (TUR-P) because of urethral stricture. After six weeks, the surgical incision area was enlarged, and a chronic wound was formed with dimensions of 4\*6 cm and a depth of 1 cm. The patient's wound was disrupted in the proliferation phase of wound healing. Hyperbaric oxygen (HBO) therapy was applied in order to provide a healthy granulation tissue development for a successful graft application by stimulating fibroblasts, providing adequate oxygen for collagen formation and enhanced neoangiogenesis. In the present case, repetitive debridements and negative pressure wound therapy (NPWT) were continued concurrently with HBO therapy. After twenty sessions of HBO therapy, graft application, and one-week immobilization, the wound was fully healed. Interventions on post-burn scars should be avoided as the tissue never regains the properties of uninjured skin. This tissue may have peripheral neuropathy which can lead to non-healing wounds. If the intervention is necessary, it should be done very carefully with minimal damage. The incisions should be deepened through unscarred tissues. The patient should be followed up closely. If the wound healing has delayed, additional appropriate methods should be considered like debridements, NPWT, HBO therapy, and grafts/flaps.

## Keywords

Wound healing, Surgical wound, Hyperbaric oxygenation, Burns

## Introduction

A burn scar may have varying degrees of functional and aesthetic components [1-3]. However chronic wound formation after surgical incision on old burn scar hasn't been reported. In this report, we present hyperbaric oxygen (HBO) therapy application in a case who had a chronic wound development on an old burn scar after performing a 3 cm incision on pubis during the surgery of transurethral resection of the prostate (TUR-P) because of urethral stricture.

## Case Presentation

Our case was a 59-year-old male. He has an old burn scar covering his whole trunk due to flame burn injury at the age of four. He hasn't got any chronic illness or drug use history. He had TUR-P operation on June 8, 2017. During the operation, due to urethral stricture, a 3 cm incision was performed to a post-burn scar on the pubis. Ten days after the surgery, he was re-hospitalized due to an abscess formation and non-healing wound on the incision site. Intravenous antibiother-



**Figure 1:** At the admission to the hyperbaric medicine unit.



**Figure 2:** After graft application.

apy regimen and repetitive debridements were performed. Infection was resolved but incision site didn't heal. Plastic surgery planned negative pressure wound therapy (NPWT) on July 7, 2017, and advised HBO therapy. When the patient was admitted to our hyperbaric medicine unit on July 19, 2017, there was a non-healing wound for about 1.5 month on pubis with dimensions of 4\*6 cm and a depth of 1 cm, fully granulated wound bed without any sign of infection (odor, swelling, erythema, purulent discharge) (Figure 1). Patient's antibiotherapies were ceased. HBO therapy (%100 oxygen at 2.5 atmosphere absolute (ATA) for 120 min) in a multiplace chamber was applied for 20 sessions daily between July 19, 2017, and August 16, 2017. Repetitive debridements and NPWT were continued concurrently with HBO therapy. On August 16, 2017, HBO therapy was ceased for graft application. After graft application and one-week immobilization, the wound was fully healed (Figure 2).

## Discussion

Chronic wounds fail to progress through the phases of wound healing; inflammation-proliferation-remodeling which is usually the result of persistent infection, malperfusion due to periwound hypoxia, cellular failure, and unrelieved pressure or repetitive trauma [4-6]. Di-

abetic foot ulcers (DFU), pressure ulcers, venous stasis ulcers and ulcers of arterial insufficiency are the most common chronic wound etiologies [5,7,8]. In this report, we present HBO therapy application before skin grafting for a different and rare cause of a chronic wound; a surgical incision on a post-burn scar.

In the present case, the post-burn scar is the possible major cause of chronic wound formation. The patient hasn't got any other factors related to delayed wound healing, such as chronic illness, drugs, malnutrition, aging, pressure, edema, repetitive trauma. The infection was resolved after systemic antibiotherapies and repetitive debridements. During a burn injury, the cutaneous nerve fiber network has also been damaged which leads to neuropathy. Although nerve fibers may regenerate, their density frequently is lower [9-12]. Cutaneous innervation has significant roles in repair processes [13,14]. Studies have reported that surgical denervation causes reduced inflammatory cell infiltration, deteriorated wound contraction and delayed re-epithelization [15,16]. Similarly, patients with peripheral neuropathies due to lepromatous leprosy, spinal cord injury or diabetes mellitus may develop chronic wounds [13]. The defective cutaneous innervation may lead to alterations in dermal blood flow similar to DFU pathophysiology and create a hypoxic microenvironment [17]. Although hypoxia stimulates wound healing processes, pathologically increased hypoxia contributes to impaired wound healing and increased wound infection [18,19]. In the present case, damaged cutaneous innervation of the burn scar possibly caused delayed wound healing.

Although the infection resolved, the patient's wound was still disrupted in proliferation phase of wound healing before HBOT application. In order to enhance granulation tissue development, NPWT was applied for 12 days to our patient, however, granulation was still inadequate for proceeding next phase "remodeling" or graft application. As the wound healing process still couldn't progress to next phase, HBO therapy was advised.

HBO therapy is a treatment method in which the patient inhales 100% oxygen intermittently inside a chamber which is pressurized 1.4 atmosphere absolute (ATA) or more [6]. The major rationale of HBO therapy in non-healing wounds is improving tissue oxygenation which also improves the leukocytes' phagocytic capacity, supplies the increased oxygen needs in wound healing process and promotes epithelization. Moreover, HBO therapy also enhances fibroblast replication, collagen production and neoangiogenesis [8]. In the present case, the wound bed was fully granulated after 20 sessions of HBO therapy and prepared for graft application. HBO therapy provided a healthy granulation tissue development by stimulating fibroblasts, providing adequate oxygen for collagen formation and enhanced neoangiogenesis.

On the other hand, the survival of graft application may be enhanced with HBO therapy by improving vascularity. As the grafts lack their own blood supply, the graft survival depends on their recipient bed for initial nutrient diffusion and revascularization. Ultimately, factors that threaten the recipient bed should be treated preoperatively [20]. In a pyoderma gangrenosum case report, authors chose to perform skin grafting after the use of azathioprine and HBO. Authors concluded that the excellent surgical result was also due to the angiogenesis promoted by HBO [21]. Similarly, HBO therapy may contribute the survival of the graft by improving tissue oxygenation and enhancing angiogenesis resulted in better nutrient diffusion through graft in our case.

In conclusion, interventions on post-burn scars should be avoided as the tissue never regains the properties of uninjured skin and this tissue may have peripheral neuropathy which can lead to non-healing wounds. If the intervention is necessary, it should be done very carefully with minimal damage, the incisions should be deepened through unscarred tissues [22]. The patient should be followed up closely in terms of wound healing. If the wound healing has delayed, additional appropriate methods should be considered like different wound dressings, debridements, NPWT, HBO therapy, and grafts/flaps. In the present case, 20 sessions of HBO therapy and 15 sessions of NPWT were applied with repetitive debridements before graft application and the wound healed completely. It should be noted that patients with a delay in wound healing on post-burn scars should be advised to admit a hyperbaric medicine unit. In addition, HBO therapy may be beneficial in the healing of skin grafts in selected wounds by improving the underlying vascularity.

### Conflict of Interest

None.

### Source of Funding

None.

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