

Utilization of Hyperbaric Oxygen Therapy with Vibrio Vulnificus Soft Tissue Infection Preventing Amputation

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Hyperbaric Oxygen (HBO) Benefits

Hyperbaric oxygen therapy (HBOT) involves breathing pure oxygen in a pressurized room or chamber. This therapy has several potential benefits across various medical conditions due to its ability to enhance the body's natural healing processes. Here are some key benefits:

1. Enhanced Wound Healing:

- **Chronic Wounds:** HBOT is effective in treating non-healing wounds, such as diabetic foot ulcers and pressure sores, by improving oxygen delivery to damaged tissues, promoting angiogenesis (formation of new blood vessels), and stimulating collagen production.
- **Surgical Wounds:** It can aid in the healing of surgical wounds, reducing the risk of infections and complications.

2. Treatment of Decompression Sickness:

- HBOT is a primary treatment for decompression sickness (the bends), a condition affecting divers who surface too quickly, by reducing nitrogen bubbles in the blood.

3. Infection Control:

- **Chronic Infections:** It can help treat chronic infections like osteomyelitis (bone infection) by enhancing white blood cell activity and promoting the action of antibiotics.
- **Necrotizing Infections:** HBOT is used to treat severe infections such as necrotizing fasciitis (flesh-eating disease) and gas gangrene by inhibiting the growth of anaerobic bacteria.

4. Radiation Injury:

- HBOT is beneficial for patients with tissue damage caused by radiation therapy (radiation necrosis), helping to repair and regenerate affected tissues, particularly in cancer treatment.

5. Carbon Monoxide Poisoning:

- It is a standard treatment for carbon monoxide poisoning, as HBOT can rapidly displace carbon monoxide from hemoglobin, restoring normal oxygen transport in the blood.

6. Enhancement of Immune Function:

- By increasing oxygen levels, HBOT can enhance the function of white blood cells, thereby improving the body's ability to fight infections and inflammation.

7. Reduction of Inflammation:

- HBOT has anti-inflammatory effects, which can be beneficial in various inflammatory conditions, reducing pain and swelling.

Vibrio Vulnificus

Vibrio Vulnificus (v.vulnificus) is an opportunistic gram-negative bacterial pathogen that is found in warm low-salinity waters. V. vulnificus wounds are increasing in prevalence due to the rise in temperatures of the sea water. According to the CDC, about 150-200 v.vulnificus infections are reported each year. It primarily infects humans through the consumption of raw or undercooked seafood, especially oysters, or through open wounds exposed to contaminated water. Infections can lead to gastrointestinal illness, severe skin and soft tissue infections, or life-threatening septicemia, particularly in individuals with compromised immune systems or chronic liver conditions. About one in five people with this infection will die with fatalities occurring as soon as 48 hours after exposure. Wounds caused by V.vulnificus quickly become necrotic requiring urgent surgical tissue removal or limb amputation. V.vulnificus wound infections are characterized by necrotizing soft tissue infection with or without hemorrhagic bullae.

Case Study

An 85-year-old male presented to the ED at Banner University Medical Center (BUMCP) in Phoenix, AZ, on December 3, 2023, with left leg cellulitis. The infection began while the patient was fly fishing near Cancun, Mexico. Initially suspected to be caused by a spider or insect bite, cultures later confirmed a Vibrio vulnificus infection. Before returning to Arizona, the patient underwent his first surgical debridement in Mexico. Upon assessment at BUMCP, significant swelling and erythema from the foot to the proximal thigh, along with large hemorrhagic bullae, were observed. CT scans raised concerns about a necrotizing soft tissue infection. During hospitalization, the patient received multiple antibiotics and two additional surgical debridement. Post-debridement wounds on the left lower leg measured 20x13x1 cm and 18x4x1 cm. Due to the infection's severity, he faced a high risk of amputation and death. The wound and hyperbaric medicine team was consulted immediately, and hyperbaric oxygen therapy (HBOT) was initiated on December 5, 2023. The patient underwent a total of 60 HBOT sessions at 2.4 ATA, with four treatments while inpatient and the remainder post-discharge. While hospitalized, the patient's wounds were treated with Kerlix soaked in Vashe. After discharge, weekly antimicrobial dressings with multi-layer compression were used, and he completed a 10-day course of oral antibiotics. Weekly wound assessments and debridements were performed, and nine applications of a skin substitute were utilized every 1-2 weeks. By May 10, 2024, the patient was completely healed.

Procedure

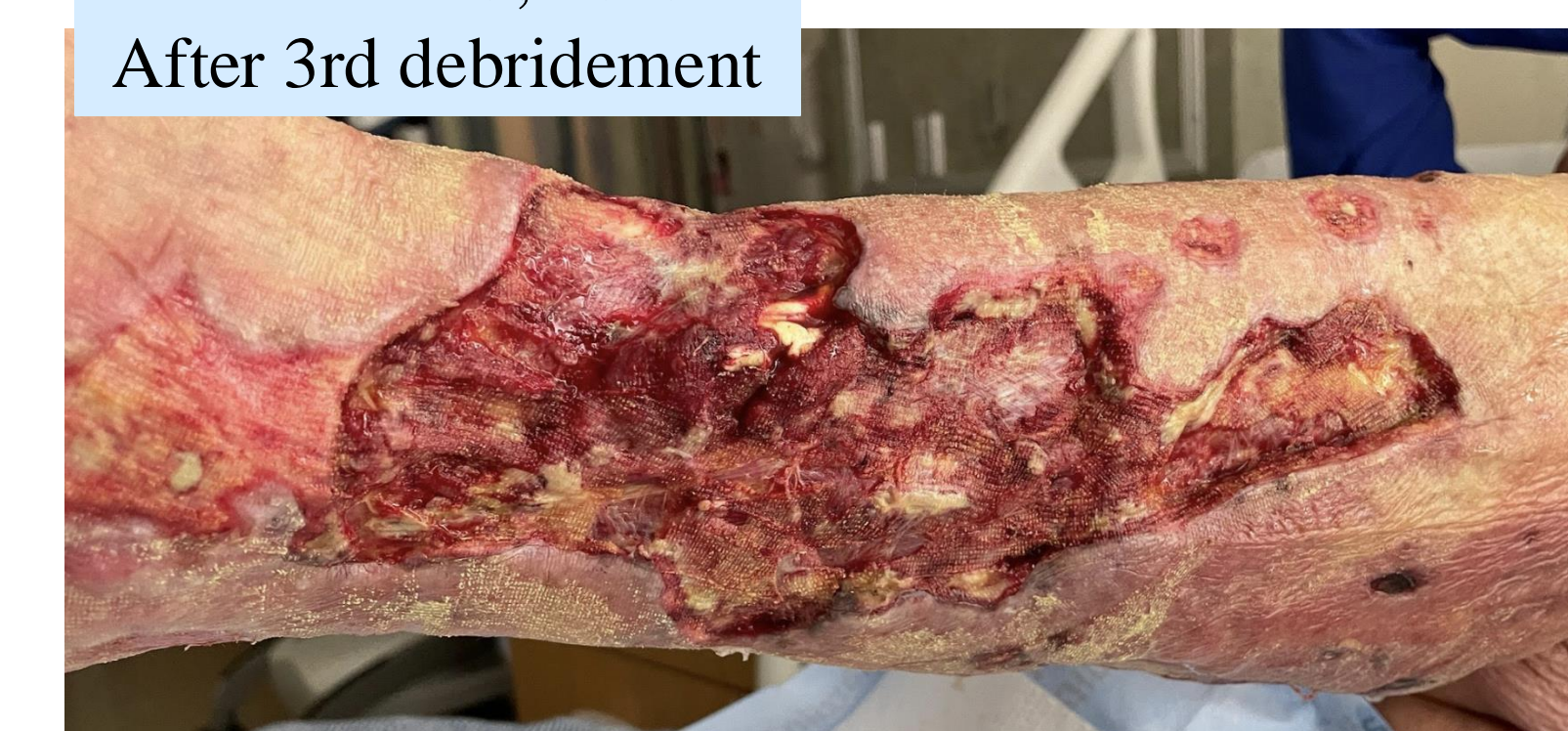
November 28, 2023
Before first debridement



December 3, 2023
After 2nd debridement



December 5, 2023
After 3rd debridement



January 17, 2024
1 week post tissue application



April 17, 2024
After 5/10 biological application



Results

May 10, 2024
100% epithelization



May 17, 2024
1 week post epithelization follow-up



Discussion

The patient required multiple surgical debridements and IV antibiotics to quickly control the extent of the infection. The patient was left with large full thickness wounds to the left lower leg down to muscle and tendon. He was at high risk for amputation and death. Hyperbaric oxygen therapy was utilized to assist with infection management as well as to decrease inflammation, and promote angiogenesis to stimulate wound healing. Early initiation of hyperbaric oxygen therapy as well as a comprehensive multi-disciplinary approach to this patient's care prevented the patient from amputation or death. The patient was able to fully heal without need for skin grafting.

Acknowledgements

<https://english.elpais.com/science-tech/2023-09-06/us-warns-of-deadly-bacteria-in-warming-waters-near-gulf-of-mexico-and-east-coast.html>
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