



Hypoxic Effects of Edema Measured by Transcutaneous Oximetry

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Case Report - 9

Abstract

Chronic venous ulcers are the direct result of venous hypertension due to either valve dysfunction with reflux, venous obstruction or the failure of the calf muscle pump function. This causes the leakage of serous fluid and fibrinogen into the interstitial space. This fibrin buildup around the capillaries may interfere with oxygen transport necessary to maintain the viability of the cells. We are also proposing that the build up of interstitial fluid can reach a level that creates a compartment-like syndrome. This compresses the dermal arterioles and capillaries, thus reducing the blood flow to the cells of the skin. This reduced blood flow may lead to ischemia of these involved areas of skin and may contribute to venous ulcer formation.

Case Study

This is the case of a 70 year old who developed a venous ulcer on the lateral aspect of her right leg. She noted marked swelling for months and was not wearing the compression stocking which had been prescribed to treat prior venous ulcer disease of her opposite leg. Past medical history was significant for diabetes and smoking. Physical exam revealed a large ulcer involving the right lateral posterior leg just above the ankle. The skin of the right leg was very tense due to the marked edema. On prior exam she had palpable pulses in both lower extremities, but they were not palpable at the

time of this exam due to the severe edema. Doppler studies revealed an audible dorsalis pedis in the right foot with an ABI of 0.83. Transcutaneous oximetry revealed local tissue hypoxia of the peri-ulcer skin.

Our impression was that the patient had adequate flow in her larger arteries, but the arterioles and capillaries in the dermis of

Before Treatment - TcpO2 Study



her peri-ulcer skin were being compressed by the compartment-like effect from the marked increased interstitial fluid on the small vessels.

Treatment

We initially treated the ulcer with an enzymatic debriding agent, salt restriction, elevation, and daily dressing changes with compression wraps. Once the debris in the wound was decreased, we added compression therapy with Profore compression wraps.

During Treatment



The patient's edema began to decrease, the skin started to wrinkle and a repeat transcutaneous oximetry was performed.

TcpO2 Study



The follow up study showed an improvement in the oxygenation of the peri-ulcer skin and the ulcer became smaller with the new growth of skin from the periphery. We continued the compression wraps and as the patient became more compliant with elevating her legs and maintaining her salt restriction, all of the edema subsided. A third Transcutaneous Oximetry was performed, which revealed normal oxygenation of the peri-ulcer skin.

During Treatment



As demonstrated in the previous picture, the ulcer has markedly decreased in size due to the continued growth of new skin. We continued the same treatment plan until the ulcer completely healed.

During Treatment



The patient continues to do well and the wound remains healed with continued salt restriction, intermittent elevation, and the use of compression stockings.

Conclusion

As demonstrated in this case, the peri-ulcer skin showed a marked improvement in the pO₂ by transcutaneous oximetry and the ulcer healed with the reduction in pressure from the excessive fluid. We are assuming that this reduction in pO₂ is related to a compartment-like syndrome, causing the compression of the small dermal vessels. We believe that this is a contributing factor in the development of venous ulcers. Further study will be necessary to determine if transcutaneous oximetry will be useful in diagnosing and treating this problem.

About Precision Health Care

Precision Health Care is a comprehensive wound healing and hyperbaric medicine service organization dedicated to the development of state-of-the-art hyperbaric and wound healing centers through partnership and collaboration with our affiliate hospitals.

Community-based and patient-focused, we are driven by this mission philosophy: To provide select hospitals safe, comprehensive, compassionate wound healing and hyperbaric services for patients in need.

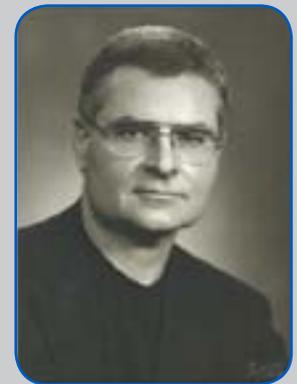
Questions or Comments?

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THE PRIMARY CARE PHYSICIAN SHOULD REFER THE PATIENT FOR ADVANCED WOUND CARE IN A WOUND HEALING CENTER IF THE PATIENT:

- Has a wound that persists for more than 30 days after treatment
- Has a wound and Reynaud's phenomenon
- Has purpura
- Has a wound and hypertension
- Has gangrene or necrotic tissue in a wound
- Has a wound and diabetes