A Physician's Guide To Problem Wound Management

VOL. 1

Soft Tissue Radionecrosis

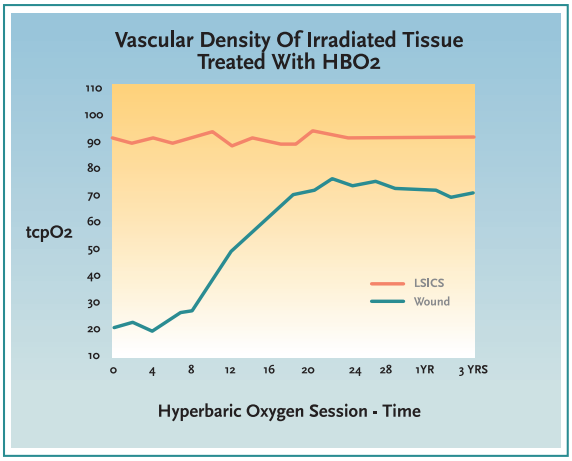
When late radiation injury occurs, tissue undergoes a progressive deterioration characterized by a reduction in the density of small blood vessels and replacement of normal tissue with dense fibrous tissue until there is insufficient oxygen supplied to sustain normal function. Wounds that present in this relatively avascular, hypoxic tissue often fail to heal. Hyperbaric oxygen therapy (HBOT) has been demonstrated to improve oxygenation and stimulate angiogenesis in this damaged tissue, resulting in recovery from delayed radiation tissue injuries and the ability to heal.

The Effects Of Hyperbaric Oxygen

HBOT is the only intervention that has been shown to increase the number of blood vessels in irradiated tissue. This change can be documented using transcutaneous oximetry. Delayed radiation injuries are typically seen after a latent period of six months to several years. The hallmark of delayed radiation injury is endarteritis with tissue hypoxia and secondary fibrosis.

Intermittent hyperbaric oxygenation allows for periods of hypoxia between daily treatments. During these hypoxic periods angiogenesis factor is released from macrophages, which causes capillary budding. New capillaries, however, cannot advance unless they are surrounded by a collagen matrix. Hyperbaric oxygen raises the oxygen tension in tissue sufficiently for collagen formation to take place at greater distances from damaged/functioning capillaries. In addition, this improved oxygen level will improve white cell function, further enhancing the healing process.

A minimum of 20 mmHg partial pressure of oxygen is required for fibroblast proliferation and collagen production to start (irradiated tissue is often far below this level). In normal tissue at atmospheric pressure, this tension of oxygen exists up to 30 microns away from the capillary wall. Under hyperbaric conditions this tension can be maintained up to 280 microns away.



Tissue oxygen levels increase in irradiated tissue with hyperbaric oxygen therapy, returning to 80% of normal at about 20 twenty treatments. These oxygen levels are sustained following cessation of treatment.[4]

This rich collagen matrix allows capillary buds to invade rapidly and form a new advancing vascular system that returns perfusion to within normal limits, thus allowing the irradiated tissue to heal.

A Comprehensive Approach To Wounds

A comprehensive approach to healing includes attention to all of the following essential components:

- *nutritional support*
- *off-loading*
- *treatment of infection, if present*
- *ensuring adequate blood flow*
- *debridement & surgery as needed*
- *appropriate topical wound care*
- *patient education*

Hyperbaric oxygen therapy used as an adjunct to aggressive, comprehensive wound care can often result in healing of these difficult wounds.

References

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