HBO Therapy for Soft Tissue Radionecrosis

By: Felix A. Pesa, MD Sunday, June 12, 2011

While there are several structures and organs that can be affected by soft tissue radionecrosis (i.e. skin, breast, gastrointestinal, genitourinary, gynecologic), in this article we will be addressing the effects of HBOT on radiation-induced damage to the skin.

Soft tissue radionecrosis results from damage done to non-osseous tissues by ionizing radiation administered during radiation therapy for cancer. The introduction of radiation therapy made the cure of some solid tumors a reality. Radiation therapy is an effective treatment for a number of malignancies, but it is not free from adverse effects. While cancer specialists would irradiate only cancer cells if they could, healthy cells are unavoidably affected.

Once the patient is exposed to the radiation beam, tissue damage can begin. The layer of endothelium supplying the irradiated area starts to proliferate, resulting in proliferative endarteritis with fibrosis. This proliferation continues to interfere with the normal processes of supplying blood to irradiated tissues. In irradiated tissues, ischemia and necrosis frequently occur. The tissues become hypoxic, hypovascular and hypocellular. The tissue begins to show ischemic changes, which eventually may become necrotic. These ischemic tissues can survive without adequate blood supply for a long time, until a traumatic or infectious incident leads to extensive tissue death. There is no spontaneous resolution from the vasculitis and inflammation progresses after the completion of radiotherapy. ***Only HBOT has been shown to induce angiogenesis and restore capillary density with oxygen values to 80% of normal.***

Soft tissue radionecrosis generally develops quite slowly. There are very few tissue changes that arise during the first six to twelve months after radiation. Ulcerations occur most frequently during the chronic clinical period (second to fifth year following radiation therapy) due to chronic deterioration of the microvasculature, resulting in hypoperfusion and tissue hypoxia. Such developments trigger an increase in tissue fibrosis while lowering resistance to complicating factors and comorbidities that stress the compromised tissue. These ulcerations heal with great difficulty or not at all, which makes managing irradiation sequelae difficult.

Clinical features of radiation-induced tissue injury may include erythema, itching, alterations in skin pigmentation, excoriation and the appearance of a thermal burn. Wounds may develop abruptly or as a result of trauma or infection to the area of irradiation and become resistant to the processes of normal wound healing. The level of tissue injury depends on several factors including type and energy of radiation, total radiation dose, number of radiation fractions and dose per fraction, and susceptibility of irradiated tissues.

The treatment of soft tissue radionecrosis with hyperbaric oxygen therapy (HBOT) has drastically changed the way we can treat this disease. The effect of hyperbaric oxygen therapy on radiated tissues is one of capillary angiogenesis. Because a consistent cause of radiation injury is vascular obliteration and stromal fibrosis, the known impact of HBOT is stimulating angiogenesis. The impact of hyperbaric oxygen in terms of its beneficial effects is likely to involve several mechanisms in irradiated tissue: 1) HBOT stimulates angiogenesis thusly improving tissue oxygenation, 2) HBOT reduces fibrosis, 3) HBOT induces collagen synthesis, which provides a matrix for the development of the new blood vessels, and 4) HBOT is likely to mobilize and stimulate an increase in stem cells within irradiated tissues.

Healing post radiation wounds requires a multi-disciplinary and comprehensive approach to wound healing including nutritional support, optimization of the wound healing through wound debridement, appropriate dressing selection and infection control, and pain management as the effects of these wounds may be debilitating.

The use and benefits of hyperbaric oxygen therapy in regard to soft tissue radionecrosis is well documented in the medical literature. As stated above and repeated for emphasis here: **to date HBOT is the only therapy that reverses the effects of radiation induced tissue damage.**

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