soft tissue radiation injury

Radiation doses in excess of 40 Gray (4,000 cGy) are more commonly associated with compromised/delayed healing and persistent soft tissue/ integumentary breakdown within a previously irradiated field that has failed conservative and/or surgical management.

The role of hyperbaric oxygen is one of overcoming hypovascular - hypocellular - hypoxic tissue bed and the late-radiation effects. Acute inflammatory responses to ongoing or recently completed radiation therapy need to be differentiated. Relieve the radiotherapy-induced hypoxic/ischemic state by stimulating angiogenesis, thereby overcoming radiation-induced obliterative endarteritis.

Delayed radiation complications are often manifested as non-healing wounds in previously irradiated areas, precipitated by an external insult such as surgery or trauma. It is important to differentiate delayed radiation from acute radiation injuries, which usually resolve within a few weeks from radiation exposure and are treated symptomatically.

# HISTORY and physical Exam

⬜ An initial assessment including a history and physical that clearly substantiates the condition for which HBO is recommended.

⬜ Comprehensive history, **to include type and total radiation dose.** Obtain the radiation portal photographs, where possible

⬜ Past medical records must support history of radiation therapy at the site identified by anatomical location and laterality.

⬜ Prior medical, surgical and/or hyperbaric treatments.

⬜ Date of initial cancer diagnosis

⬜ Name(s) of person(s) who provided previous care:

⬜ Cancer type and specific anatomical location

⬜ Documentation of current cancer status. Rule out cancer re-occurrence or residual tumor.

⬜ History of radiation induced signs or symptoms for:

Radiation Cystitis

* Dysuria
* Decreased stream
* Ulceration
* Frequency
* Hematuria
* Incontinence

Radiation Enteritis

* Intestinal pain
* Stricture
* Stool frequency
* Bleeding
* Constipation
* Ulceration
* Melena
* Weight loss

Radiation Proctitis

* Urgency
* Rectal pain
* Mucosal loss
* Rectal bleeding
* Loss of sphincter control
* Ulceration
* Increased stool frequency
* Stricture

Soft Tissue (skin) Radiation injury

* Non-healing wound on irradiated area with onset at least six months since last radiation exposure
* History of radiation treatment (in excess of 40 Gray or 4,000 cGy) to the region of the documented injury
* Wound that is non-responsive to conservative standard treatment
* Ulceration
* Tissue necrosis or breakdown
* Failed skin graft - prior failure of coverage attempts
* Compromised/failed skin flap - prior failure of coverage attempts

# Physical Exam

⬜ Documentation of Physical Examthat clearly substantiates the condition for which HBO is recommended.

⬜ Documentation of Non-responding lesion, within the previously irradiated field.

⬜ Documentation of radiation therapy at the site identified by anatomical location and laterality.

⬜ Documentation of optimization of nutritional status

* Albumin
* Pre-Albumin

⬜ Documentation of Labs to order or review:

* Complete Blood Count (CBC)
* Erythrocyte Sedimentation Rate (ESR)
* C-reactive protein (CRP)

⬜ Documentation of Wound photographs

⬜ Documentation of Chest x-ray

⬜ Documentation of Electrocardiogram (ECG)

⬜ Documentation of Determine present oncological status

⬜ Documentation of Evaluation of tympanic membranes

⬜ Documentation of Baseline visual acuity assessment

⬜ Documentation of smoking/nicotine cessation

# Risk Assessment

⬜ Risk benefit ratio in favor of offering hyperbaric oxygen therapy.

Example: The patient was informed of the possible risks and complications of hyperbaric oxygen therapy. These include, but are not limited to, fire, barotrauma of the ears, sinuses, and lungs to include air embolism, central nervous system oxygen toxicity resulting in seizure, cataracts, myopia, and exacerbation of congestive heart failure.

Having no absolute contraindication to hyperbaric oxygen therapy, the patient will be offered hyperbaric oxygen therapy. 2.5 ATA for 90 minutes with two inter-current ten minute air breaks (used in the case of mandibular osteoradionecrosis) OR 2.0 ATA for 90 minutes in cases of soft tissue injury. Thirty treatments will initially be provided on a once daily basis Monday through Friday. Thereafter, a re-evaluation of the patient’s clinical progress will be in order to determine if additional treatments may be required.

**References:**

Mize J, Hamm T, Orr S, Song E, (2019). "Soft Tissue Radiation Injury". In Worth E, (Eds.) , WoundReference. Available from: https://woundreference.com/app/topic?id=soft-tissue-radiation-injury. Retrieved on 5/14/19.

# Indication for Hyperbaric Oxygen (HBO) Therapy

"Delayed effects of radiation are a complication of modern radiotherapy that can be well treated with hyperbaric oxygen therapy. Some examples of delayed radiation effects include soft tissue radionecrosis, osteoradionecrosis, radiation cystitis, radiation proctitis, and laryngeal chondroradionecrosis. The basic pathophysiology of delayed radiation tissue damage is endarteritis with resultant tissue hypoxia and secondary fibrosis.

Delayed radiation complications are often manifest as non-healing wounds located in previous irradiated areas and are precipitated by an additional insult such as surgery or trauma within the field of radiation. Hyperbaric oxygen has been shown to induce neovascularization and increase cellularity in irradiated and other hypoxic tissues. The success with randomized controlled studies in patients with mandibular osteoradionecrosis has led to successful use of hyperbaric oxygen in other body areas affected by radiation. Dental extractions or other surgical procedures are fraught with high complication rates when performed in heavily irradiated tissues without the benefit of preoperative hyperbaric oxygen therapy."

# IMpression

1. Soft tissue Radionecrosis Code First: Group 1 - Late Effects Radiation See ICD10 Crosswalk
2. Group 2 - Anatomical Specific Radiation Codes - See ICD10 Crosswalk

# Plan

**Example Statement supporting the role of hyperbaric oxygen therapy:**

Mechanisms by which HBO has been shown to be beneficial include the following:

1. Enhanced fibroblast proliferation – cell proliferation responds to increased tissue levels of oxygen in a dose-dependent fashion.
2. Collagen maturation – adequate oxygen is provided as a substrate for hydroxylative processes resulting in collagen fibril cross-linking. This collagen scaffolding supports the fragile advancing capillary buds.
3. Relieve the radiotherapy-induced hypoxic/ischemic state by stimulating angiogenesis, thereby overcoming radiation-induced obliterative endarteritis.
4. 2.0 ATA, Oxygen for 90 minutes, Once daily (M-F)
5. Reassessment after 30 treatments.
6. Thorough re-evaluation should be made at least every 30 days for documentation of response to therapy.
   1. Thereafter, a re-evaluation of the patient’s clinical progress to determine if additional treatments may be required.
7. Treatment Threshold: 20 – 40 treatments; In rare cases 60 treatments
8. Do not exceed 60 without external peer review

# \* Additional Consideration

* For patients with refractory radiation proctitis with a history of radiation treatment terminating at least 6 months prior to onset of signs and symptoms, we recommend HBO as an adjunctive therapy to improve healing responses (as demonstrated by SOMA-Lent scores)
* For patients who need reconstructive soft tissue surgery or flaps into a previously irradiated area in the head or neck, we recommend HBO therapy to prevent postoperative wound dehiscence
* For patients with hemorrhagic radiation cystitis with a history of radiation treatment terminating at least 6 months prior to onset of signs and symptoms, we suggest HBO as an adjunctive therapy to resolve bleedingReference

# References

Mize J, Hamm T, Orr S, Song E, (2019). "Soft Tissue Radiation Injury". In Worth E, (Eds.) , WoundReference. Available from: https://woundreference.com/app/topic?id=soft-tissue-radiation-injury. Retrieved on 5/14/19.