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Refresher course: Arthropathy and other benign conditions

Radiotherapy for non-malignant diseases



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1. Introduction

The concept of radiation therapy for the treatment of benign diseases refers to the use of moderate to high energy ionizing radiation as part of the treatment of non-malignant, but not necessarily harmless, diseases. The usefulness of radiation therapy, based on the anti-inflammatory properties of ionizing radiation, has been long known. Apart from the treatment of intracranial benign tumors, such as meningiomas and neurinomas, the prevention of cardiovascular restenosis or treatment of skeletal degenerative diseases are, without doubt, the main fields of action for radiation therapy in benign conditions. Nonetheless, many other non-cancer entities may benefit from ionizing radiation therapy treatment. Concerns about the development of radiation-induced tumors has been the principal cause of its scant acceptance. Nevertheless, the efficacy this therapy has demonstrated, as well as the quality-of-life improvement among patients, far outweighs the minimum potential risk associated with the therapeutic use of ionizing radiation.

2. Radiobiological considerations

Radiobiological mechanisms underlying radiation therapy effects in benign diseases are not fully understood, different hypotheses have been proposed as an explanation:

Anti-proliferative effect

This mechanism has been used to explain radiation therapy's effect on the prevention of heterotopic ossification following prosthetic replacement or the prevention of keloid or pterygium recurrence following their removal. Recommended doses are typically around 10 Gy.

Anti-inflammatory effect

Low radiation doses (2–6 Gy at 0.5 Gy/fraction) are especially efficient in the initial inflammation process, characterized by the development of vasodilation, edema, and leukocyte infiltration. Vascular endothelial cells play a key role in this process. This mechanism explains the efficacy of low radiation therapy doses in the treatment of synovitis, osteoarthritis, tendonitis, and other processes associated with inflammation of synovial membranes, leukocyte hyperplasia, and lymphocyte infiltration.

Immunomodulatory effect

Radiation therapy's effect on circulating lymphocytes probably plays an important role. This effect of radiation therapy has been proposed for inflammatory conditions such as Grave's ophthalmopathy mainly to a modulatory effect on immune response. Recommended doses are not well established, but doses above 10 Gy are generally administered.

3. Indications

In 2002, the German Working Group on Radiotherapy in Benign Diseases reported a consensus document in the red journal which established potential indications for ionizing radiation therapy under the following conditions:

1. **Acute/chronic inflammatory diseases:** hidradenitis suppurativa, boils, whitlows, and other antibiotic-refractory infections.
2. **Acute/chronic painful degenerative diseases:** tendonitis and bursitis of different joints, calcaneal spurs, etc.
3. **Soft tissue proliferative disorders:** Dupuytren's Disease, Ledderhose's Disease, Peyronie's Disease, Gorham–Stout

Disease, prevention of post-surgical recurrence of pterygium or keloids, etc.

4. **Functional disorders:** Grave's ophthalmopathy, arteriovenous malformations (AVM), age-related macular degeneration, persistent lymphatic fistulae, etc.
5. **Skin conditions:** basalioma, psoriasis resistant to PUVA treatment, etc.
6. **Other conditions:** prophylaxis of heterotopic ossification in hip or other joints following prosthetic replacement, vascular restenosis prophylaxis following dilation and stent implantation, hemangioma, mastocytosis, Kasabach–Merrit syndrome, etc.

4. Generals considerations for the use of radiation therapy in benign diseases

Before conducting any ionizing radiation therapy in non-cancer diseases, a number of considerations should always be borne in mind:

1. Assessing beforehand the consequences of not providing treatment and the natural history of the disease.
2. Determining the risk/benefit ratio for each individual patient, both from radiation therapy and the available alternatives.

3. Considering radiation therapy if conventional treatments have not been effective, if the risks from other treatments are greater than radiation therapy's inherent risk or if the potential implications of not providing treatment are unacceptable.
4. Assessing the long-term risk of using ionizing radiation in terms of the total dose, fractions, organs at risk, presence of comorbidities and the patient's age.
5. Obtaining always the patient's informed consent, and make sure the patient has thoroughly understood the need, purpose and potential risks of the treatment.
6. Selecting as possible the smallest treatment field and the lowest effective dose.
7. Using multiple treatment fields and beam incidences, using appropriate shielding and protection.
8. Planning the treatment using the same criteria for quality and volume definition as used in cancer external beam radiation therapy (ICRU-50, ICRU-62).
9. Setting an appropriate follow up which allows for the assessment of both the treatment response and its efficacy as well as the development of late complications.
10. Always advising the patient to obtain a second opinion and/or treatment options if there is the slightest doubt about the therapy.