Principles of Radiation Therapy
Treatment with photons, electrons, or protons may all be appropriate, depending upon clinical circumstances.

Advanced radiation therapy technologies such as IMRT, breath hold or respiratory gating, image-guided therapy, or proton therapy may offer significant and clinically relevant advantages in specific instances to spare important organs at risk such as the heart (including coronary arteries and valves), lungs, kidneys, spinal cord, esophagus, bone marrow, breasts, stomach, muscle/soft tissue, and salivary glands and decrease the risk for late, normal tissue damage while still achieving the primary goal of local tumor control. Achieving highly conformal dose distributions is especially important for patients who are being treated with curative intent or who have long life expectancies following therapy.

The demonstration of significant dose-sparing for these organs at risk reflects best clinical practice.

In mediastinal lymphoma, the use of 4D-CT for simulation and the adoption of strategies to deal with respiratory motion such as inspiration breath-hold techniques, and image guided RT during treatment delivery is also important.

Since the advantages of these techniques include tightly conformal doses and steep gradients next to normal tissues, target definition and delineation and treatment delivery verification require careful monitoring to avoid the risk of tumor geographic miss and subsequent decrease in tumor control. Image guidance may be required to provide this assurance.

Randomized studies to test these concepts are unlikely to be done since these techniques are designed to decrease late effects, which take 10+ years to evolve. In light of that, the modalities and techniques that are found to best reduce the doses to the organs at risk (OAR) in a clinically meaningful way without compromising target coverage should be considered.

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**PRINCIPLES OF RADIATION THERAPY**

**Volumes:**

- **Involved-site radiation therapy (ISRT) for nodal disease**
  - ISRT is recommended as the appropriate field for NHL. Planning for ISRT requires modern CT-based simulation and planning capabilities.
  - Incorporating other modern imaging like PET and MRI often enhances treatment volume determination.
  - ISRT targets the site of the originally involved lymph node(s). The volume encompasses the original suspicious volume prior to chemotherapy or surgery. Yet, it spares adjacent uninvolved organs (like lungs, bone, muscle, or kidney) when lymphadenopathy regresses following chemotherapy.
  - The pre-chemotherapy or pre-biopsy gross tumor volume (GTV) provides the basis for determining the clinical target volume (CTV).
  - Concerns for questionable subclinical disease and uncertainties in original imaging accuracy or localization may lead to expansion of the CTV and are determined individually using clinical judgment.
  - For indolent NHL, often treated with RT alone, larger fields should be considered.
  - For example, the CTV definition for treating follicular lymphoma with radiation therapy alone will be greater than that employed for diffuse large B-cell lymphoma with similar disease distribution being treated with combined modality therapy.
  - Possible movement of the target by respiration as determined by 4D-CT or fluoroscopy (internal target volume- ITV) should also influence the final CTV.
  - The planning treatment volume (PTV) is an additional expansion of the CTV that accounts only for setup variations (see ICRU definitions).
  - OAR should be outlined for optimizing treatment plan decisions.
  - The treatment plan is designed using conventional, 3-D conformal, or IMRT techniques using clinical treatment planning considerations of coverage and dose reductions for OAR.

- **ISRT for extranodal disease**
  - Similar principles as for ISRT nodal sites (see above).
  - For most organs and particularly for indolent disease, the whole organ comprises the CTV (eg, stomach, salivary gland, thyroid). For other organs, including orbit, breast, lung, bone, localized skin, and in some cases when RT is consolidation after chemotherapy, partial organ RT may be appropriate.
  - For most NHL subtypes no radiation is required for uninvolved lymph nodes.

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*aSee references on NHODG-D 4 of 4.*

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General Dose Guidelines:
- Localized CLL/SLL: 24–30 Gy
- Follicular lymphoma: 24–30 Gy
- Marginal zone lymphoma:
  - Gastric: 30 Gy
  - Other extranodal sites: 24–30 Gy
  - Nodal MZL: 24–30 Gy
- Early-stage mantle cell lymphoma: 30–36 Gy
- Palliation/local control of SLL, FL, MZL, MCL: 2 Gy x 2 which may be repeated as needed
- DLBCL or PTCL
  - Consolidation after chemotherapy CR: 30–36 Gy
  - Complimentary after PR: 40–50 Gy
  - RT as primary treatment for refractory or non-candidates for chemotherapy: 40–55 Gy
  - In combination with stem cell transplantation: 20–36 Gy, depending on sites of disease and prior RT exposure
- NK-T cell lymphoma
  - RT as primary treatment 50–65 Gy
  - RT in combined modality therapy 45–60 Gy
- Primary cutaneous anaplastic large cell lymphoma: 30–36 Gy
- Primary cutaneous follicle center or marginal zone lymphoma: 24–30 Gy

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PRINCIPLES OF RADIATION THERAPY

REFERENCES


Held G et al., Impact of rituximab and RT on outcome of aggressive B-cell lymphoma and skeletal involvement. JCO 2013;31:4115-4122.


