

# Modern Radiation Therapy for Hodgkin Lymphoma: Field and Dose Guidelines From the International Lymphoma Radiation Oncology Group (ILROG)

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Reference :

# Modern Radiation Therapy for Hodgkin Lymphoma: Field and Dose Guidelines From the International Lymphoma Radiation Oncology Group (ILROG)



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# Introduction

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- Radiation Therapy has been widely used in the management of malignant lymphomas
- Earlier, Radiation Therapy alone was used as the single modality of choice for treatment of lymphomas
- Presently, RT alone can be used to treat some patients of Hodgkin Lymphoma (HL)
- In most of the cases, RT is used in combination with chemotherapy for the treatment of patients with HL

# Introduction

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- The purpose of these guidelines is :
  1. To provide a consensus position on the modern approach to the delivery of radiation therapy (RT) in the treatment of Hodgkin lymphoma (HL)
  2. To outline a new concept of Involved Site Radiation Therapy (ISRT) in which reduced treatment volumes are planned for the effective control of involved sites of disease

# Radiation Therapy as Primary Treatment

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- i. Early-stage lymphocyte-predominant Hodgkin lymphoma (LPHL)
- ii. Selected cases of early-stage classic HL in patients who are not candidates for primary chemotherapy

# Radiation Therapy as Part of a Combined Modality Approach

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- i. Early-stage classic HL
  - After adequate systemic chemotherapy in all age groups
  - RT improves freedom from treatment failure even in patients with negative positron emission tomography (PET) scans and allows treatment with fewer chemotherapy cycles
  
- ii. Advanced-stage disease
  - Localized RT may be used for residual lymphoma after full chemotherapy
  - RT may be an integral part of some regimens for advanced-stage disease

# Volume Definitions for Planning Radiation Therapy for Lymphoma

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- These principles apply whether Involved Site Radiation Therapy (**ISRT**) or Involved Node Radiation Therapy (**INRT**) is applied
- The difference between them is the quality and accuracy of the pre chemotherapy imaging
- Determine the margins needed to allow for uncertainties in the contouring of the CTV

# Volume of interest acquisition

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3-dimensional (3D) simulation study using

- CT simulator
- PET/CT simulator
- Magnetic resonance imaging simulator

Imaging studies should be obtained with the patient in the treatment position and using the planned immobilization devices



# Determination of Gross Tumor Volume

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Pre chemotherapy (or pre surgery) GTV

No chemotherapy or post chemotherapy GTV

# Determination of Clinical Target Volume

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- The CTV **encompasses the original** (before any intervention) **GTV**
- **Normal structures** such as lungs, kidneys, and muscles that were clearly uninvolved **should be excluded from the CTV** based on clinical judgment
- The following points should be considered:
  - Quality and accuracy of imaging
  - Concerns of changes in volume since imaging
  - Spread patterns of the disease
  - Potential subclinical involvement
  - Adjacent organs constraints

# Determination of Clinical Target Volume

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- If separate nodal volumes are involved, they can potentially be encompassed in the same CTV
  
- If the involved nodes are more than 5 cm apart, they can be treated with separate fields using the CTV-to-PTV expansion guidelines

# Determination of Internal Target Volume

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- CTV plus a margin taking into account uncertainties in size, shape, and position of the CTV within the patient
- ITV is mostly relevant when the target is moving, most commonly in the chest and upper abdomen with respiratory movements
- ITV is calculated by :
  - 4D CT simulation
  - Fluoroscopy
  - Estimated by an experienced clinician

# Determination of Internal Target Volume

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In chest or upper abdomen: Margins of 1.5 to 2 cm in the superior-inferior direction

In sites that are unlikely to change shape or position during or between treatments : Outlining the ITV is not required

# Determination of Planning Target Volume

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Volume that takes into account the

- CTV (or ITV, when relevant) and
- accounts for setup uncertainties in patient positioning and alignment of the beams during treatment planning and through all treatment sessions

PTV margins are based on :

- Institutional protocols
- Site of area being treated with the amount of setup uncertainties expected

# Determination of Organs At Risk

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The organs at risk (OARs) are critical normal structures that, if irradiated, could experience significant morbidity and might influence treatment planning or the prescribed dose

They should be outlined on the simulation study

Dose volume histograms (DVH) and normal tissue complication probability (NTCP) should be calculated

# Radiation Therapy Dose Considerations

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## Early-stage classic HL in CR after chemotherapy

Dose to the CTV :

- Determined on the basis of the results of the German Hodgkin Studies HD 10 and 11

**Favourable characteristics : 20 Gy in 10 fractions**

**Unfavourable characteristics : 30 Gy in 15 fractions**



# Radiation Therapy Dose Considerations

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## Early-stage LPHL :

30 to 35 Gy in 1.8 to 2 Gy per fraction is the recommended dose to the CTV

No advantage has been shown for higher doses

## Residual lymphoma after chemotherapy :

36 to 40 Gy in 18 to 20 fractions

# Treatment techniques

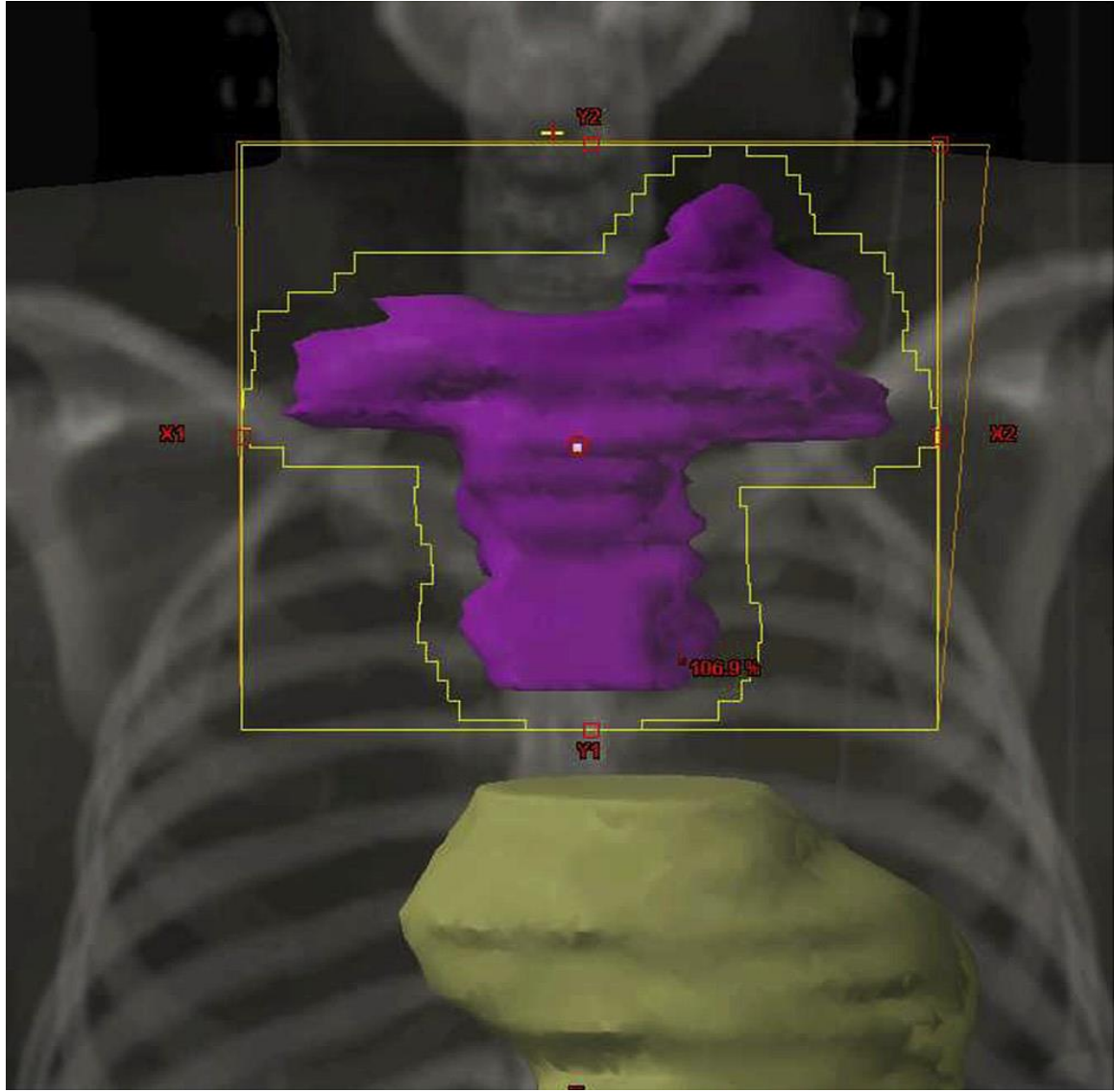
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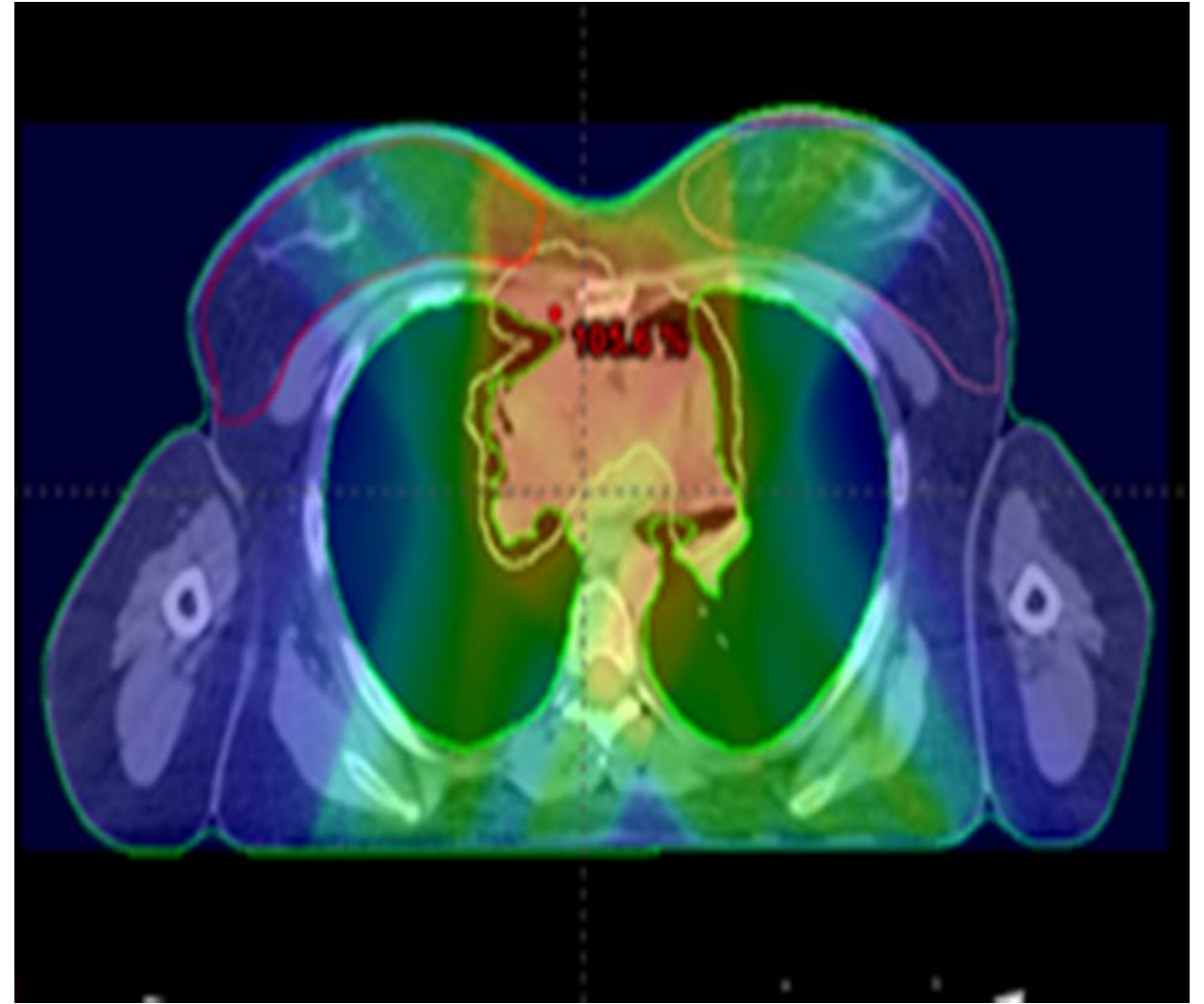
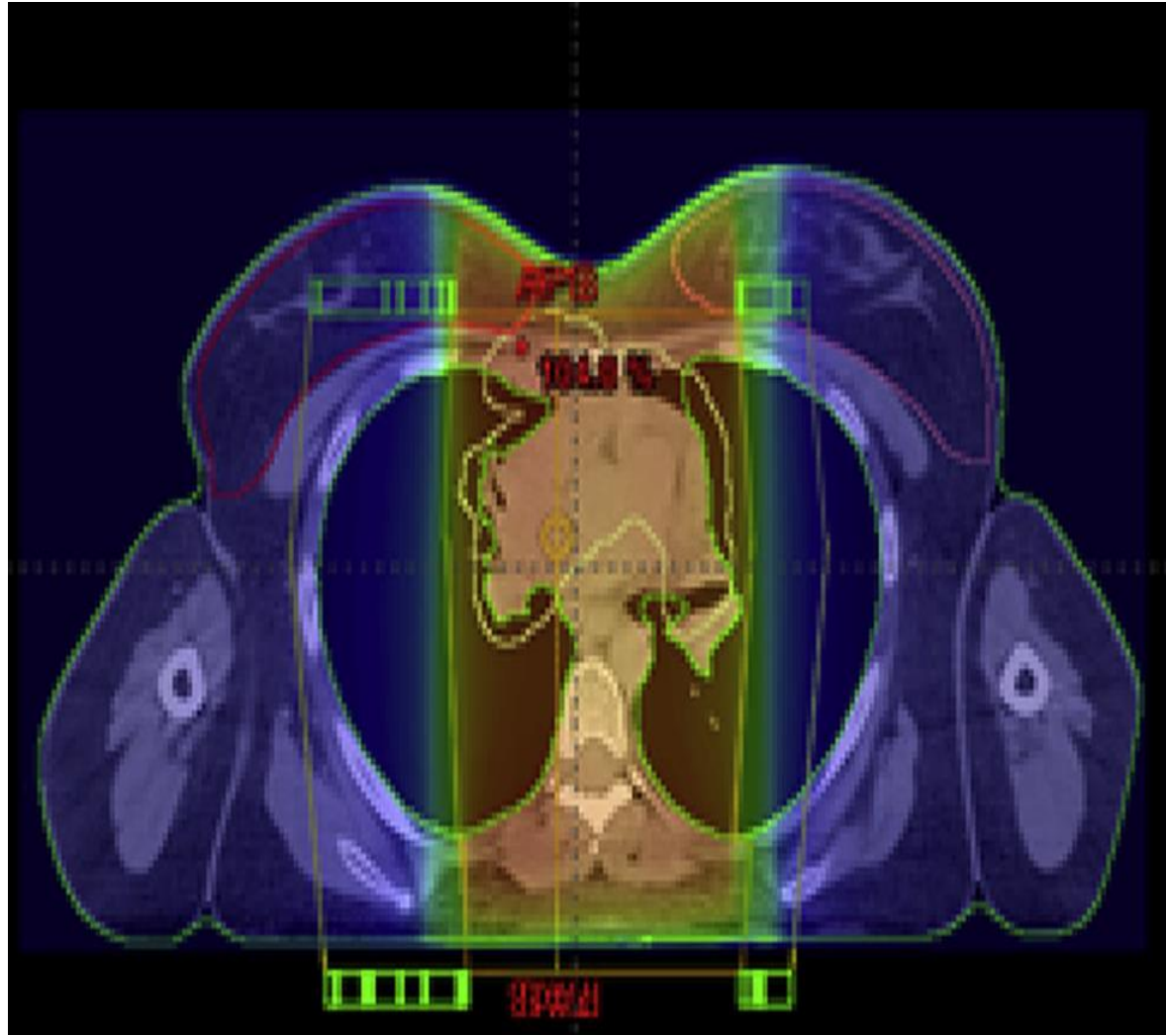
In some situations, **conventional AP-PA techniques** may be preferred

In other situations, more **conformal techniques** such as IMRT, arc therapy, or tomotherapy may offer significantly better sparing of critical normal structures

**Recommendations as to which technique to use in the individual case cannot be made**

Careful consideration must be given to choosing the technique to offer the minimum risk of significant late toxicity for that patient with adequate coverage of the targets





# Involved Site Radiation Therapy in Early-Stage HL

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The concept of ISRT was developed on the basis of the INRT concept

ISRT accommodates cases in which **optimal pre chemotherapy imaging is not available**

It is not possible to reduce the CTV to the same extent as with INRT because the pre chemotherapy GTV information may not be optimal

In ISRT, clinical judgment in conjunction with the best available imaging is used to contour a larger CTV that will accommodate the uncertainties in defining the pre chemotherapy GTV

# Involved Site Radiation Therapy in Early-Stage HL

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If pre chemotherapy imaging is available, but image fusion with the post chemotherapy planning CT scan is not possible

To contour the pre chemotherapy target volume on the planning CT scan

Allowance should be made for the uncertainty of the contouring and differences in positioning by including a larger volume in the CTV

# Involved Site Radiation Therapy in Early-Stage HL

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If no pre chemotherapy imaging is available

To gather description of :

- The pre chemotherapy physical examination of the patient
- The location of scars and scar tissue on the post chemotherapy planning CT scan
- The patient's and the family's recollections of the location of the presenting lymph node(s)

The CTV should be contoured taking into account all of this information, making generous allowance for the many uncertainties in the process

# Involved Node Radiation Therapy in Early-Stage Classic HL

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- The concept of INRT for early-stage classic HL was developed and implemented by the EORTC
- Reduces the treated volume to a minimum, but to be safe limit
- Optimal imaging both before and after chemotherapy is needed

PET/CT is the most accurate imaging method for determining disease extent in HL, and thus **up-front PET/CT is mandatory for INRT design**



# Involved Node Radiation Therapy in Early-Stage Classic HL

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The **pre chemotherapy PET/CT scan** should be acquired with the patient in the treatment position and using the same breathing instructions that will be used later for RT

After the completion of chemotherapy, a **response assessment using PET/CT** or contrast-enhanced CT should be performed

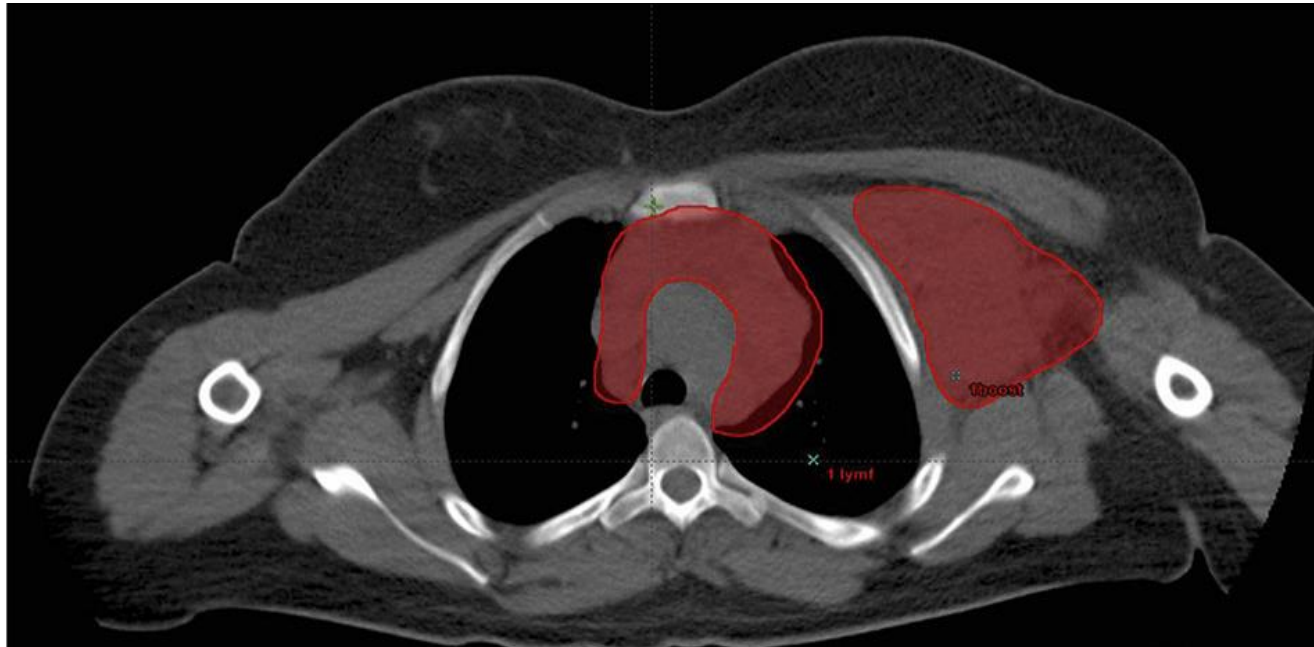
**INRT should be commenced 3 to 4 week after the completion of chemotherapy**

# Involved Node Radiation Therapy in Early-Stage Classic HL

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The contouring process is as follows:

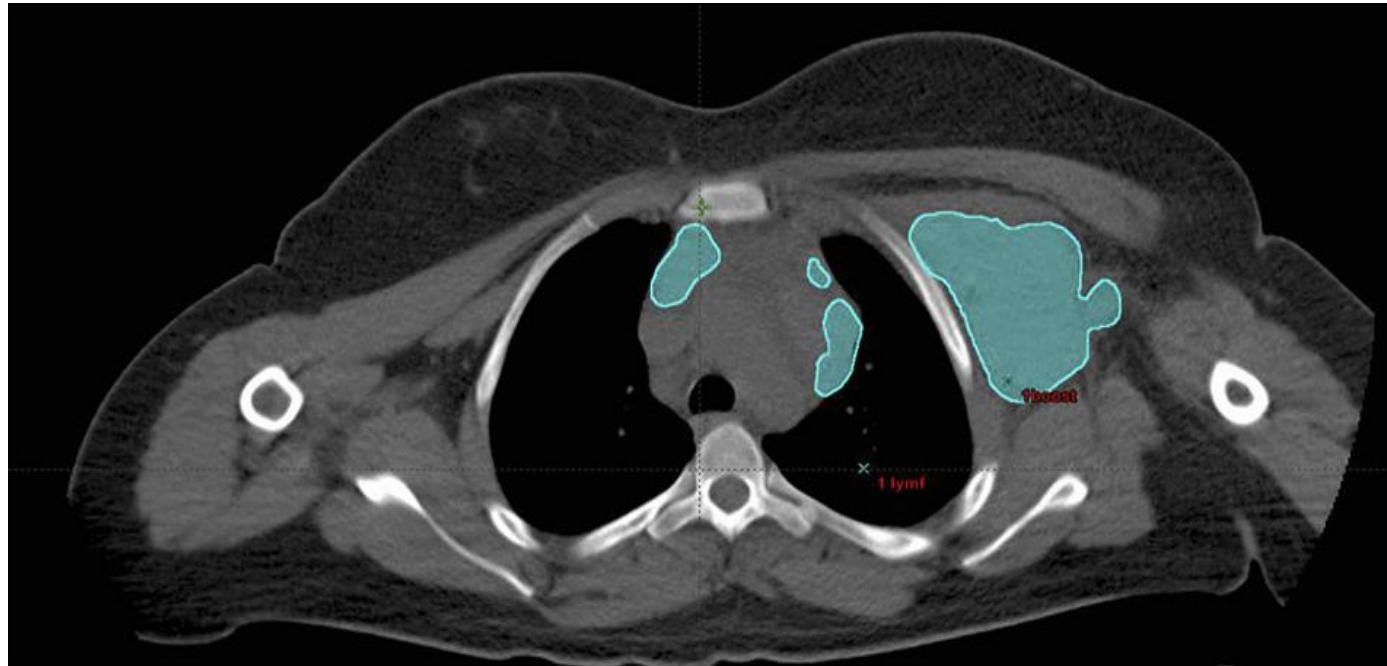
1. The CT images of the pre chemotherapy PET/CT are used to delineate the initially involved lymphoma volume, the **GTV-CT** as determined by morphology on CT



# Involved Node Radiation Therapy in Early-Stage Classic HL

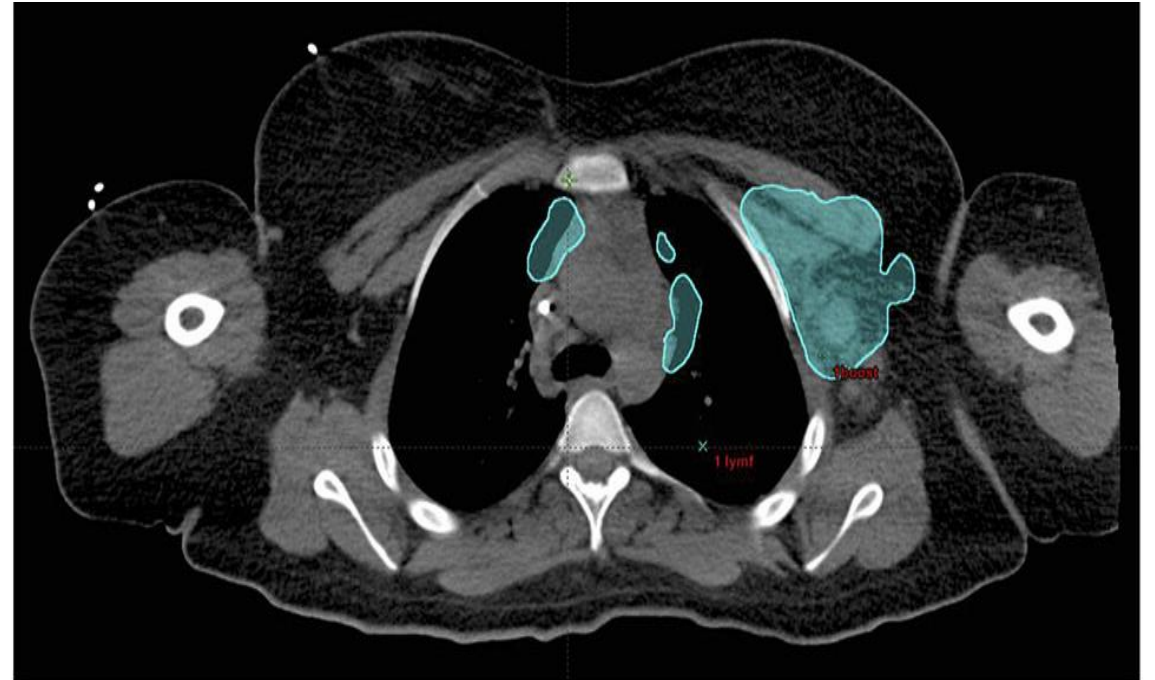
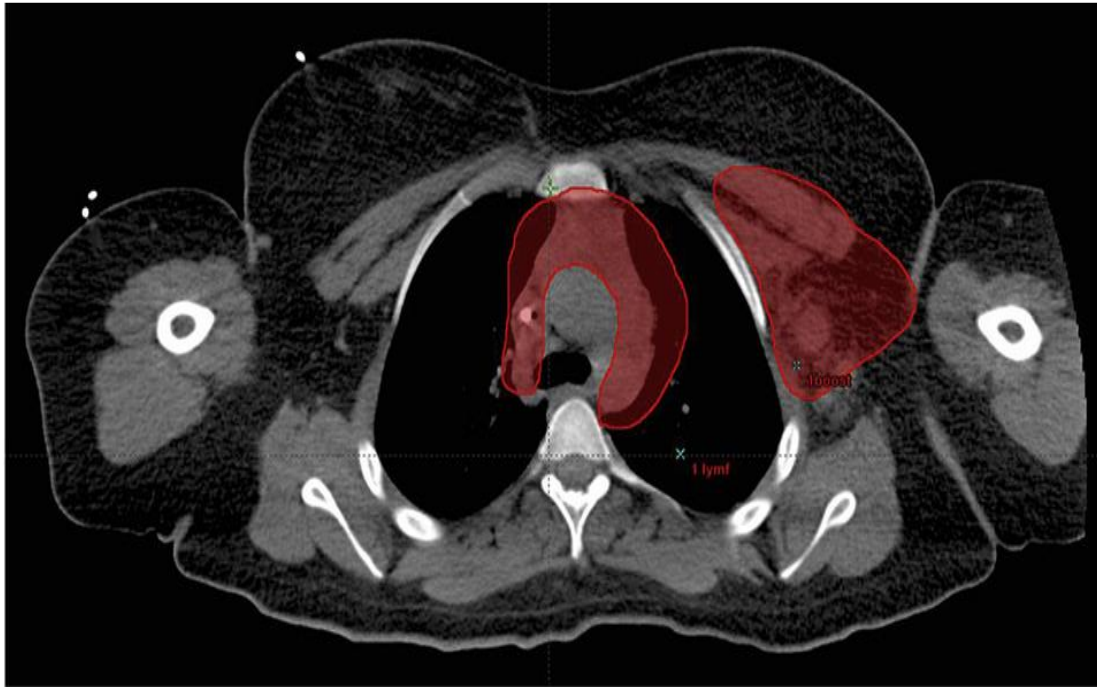
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2. The PET images of the pre chemotherapy PET/CT are used to delineate the initially involved lymphoma volume, the **GTV-PET** as determined by FDG uptake



# Involved Node Radiation Therapy in Early-Stage Classic HL

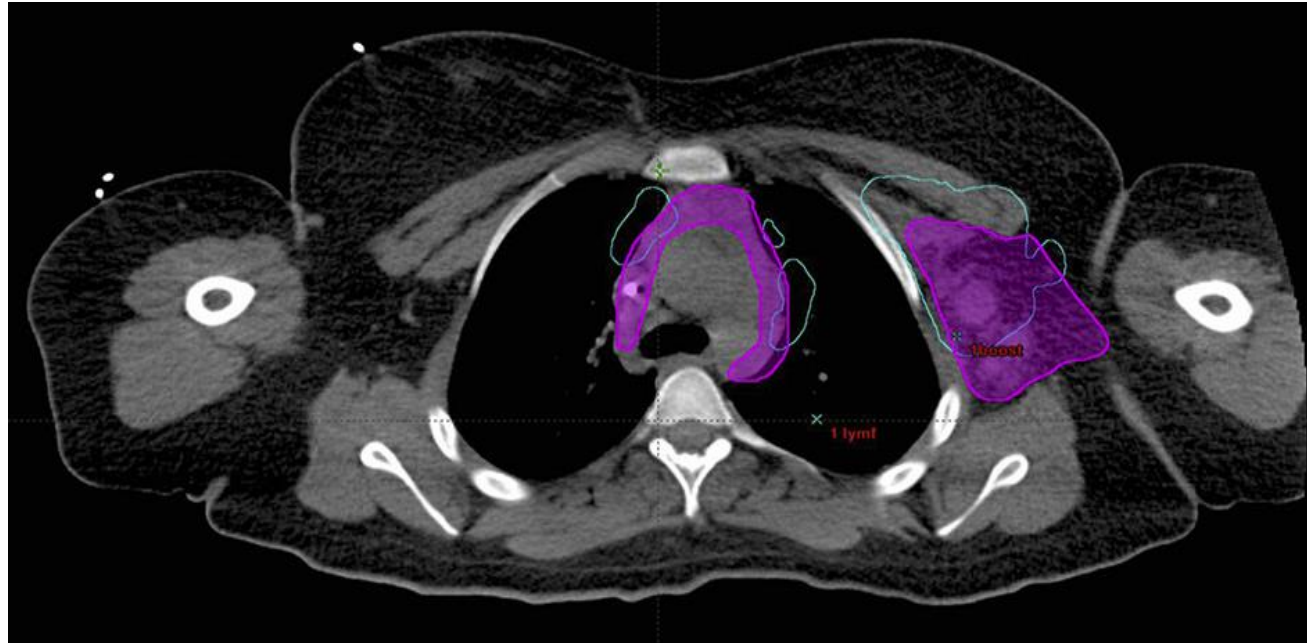
3. The pre chemotherapy PET/CT is fused with the post chemotherapy planning CT scan, and the **GTV-CT** and **GTV-PET** are imported to the planning CT images



# Involved Node Radiation Therapy in Early-Stage Classic HL

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4. The **post chemotherapy tissue volume**, which contained the initially involved lymphoma tissue, is contoured using information from both pre chemotherapy PET and pre chemotherapy CT, taking into account tumor shrinkage and other anatomic changes.



# Involved Node Radiation Therapy in Early-Stage Classic HL

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## The CTV

- Encompasses all of the initial lymphoma volume
- Still respecting normal structures that were never involved by lymphoma, such as lungs, chest wall, muscles, and mediastinal normal structures

# Irradiation of Residual Mass After Full Chemotherapy for Advanced Disease

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Advanced disease (classic HL and LPHL)

- Many centres treat patients with chemotherapy alone (especially in the absence of bulky disease)
- Only if a CR is not achieved will RT is used

Target in this situation is the **residual mass (GTV) after chemotherapy**

# Irradiation of Early-Stage LPHL

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When RT is used as the only treatment modality, the CTV must be designed to encompass suspected subclinical disease

No advantage has been demonstrated with EFRT as opposed to more limited treatment fields

CTV should incorporate the **GTV** and include as a **minimum adjacent lymph nodes in that site** and a generous **margin dictated by the clinical situation**



# Larger Field RT

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Role of larger field RT is now **limited essentially to salvage treatment** in patients in whom chemotherapy is unsuccessful and who are unable to embark on more intensive salvage treatment schedules

Usually addressed on a case-to-case basis and it is not feasible to produce guidelines

No data to support the use of extended fields that can cause toxicity and compromise the safety of subsequent therapy such as stem cell transplantation

# Refractory and Relapsed HL

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## **Salvage RT**

- Important role in local control for patients who have primary refractory disease dominated by a local site
- Important for patients who experience relapse after achieving a CR with initial therapy

RT should also be considered as a salvage option in the setting of ASCT failure, after relapse, or after progression

# Refractory and Relapsed HL

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Salvage RT yields high response rates and high local control rates in refractory and relapsed HL and in relapses after ASCT

Systemic failures remain the commonest problem in this setting, underlining the need for improved systemic therapy in combination with salvage RT

# Conclusion

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- Modern RT for HL is a highly individualized treatment restricted to limited treatment volumes
- Modern imaging and RT techniques should be used to limit the amount of normal tissue being irradiated, thus minimizing the risk of long-term complications

# Conclusion

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- The newly defined fields of ISRT represent a significant reduction in the volume included in the previously used IFRT
- Radiation oncologists treating HL should be involved as part of the multidisciplinary team in the initial management plan and attempt to introduce imaging procedures up front before the initiation of chemotherapy
- Integrated multidisciplinary approach will enable the optimal outcome for patients with HL