RADIOThERAPY RECOMMENDATIONS FOR PATIENTS WITH EARLY STAGE HODGKIN’S LYMPHOMA.

INVOLVED NODE RADIATION THERAPY (INRT)

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RATIONALE

Chemotherapy is effective notably for microscopic disease, therefore large fields are no longer necessary. On the other hand, consolidating radiation therapy to involved lymph nodes after a limited number of chemotherapy cycles remains a necessity.

It has been demonstrated in numerous studies that radiotherapy-induced complications are dependent on the irradiated volume and the total radiation dose. (1,2,3,5,6,7)

It is therefore of utmost necessity to decrease the size of radiation fields and to limit radiation doses. The concept of involved field radiotherapy (IFRT) which included the whole lymph node area is replaced by the concept of a field which includes the initially involved lymph node(s).

DEFINITIONS AND RULES

All patients must have pre- and post-chemotherapy cervical and thoracic CT scans (axillary lymph node areas must be clearly visible on thoracic CT scans). Patients must be examined by the radiation oncologist before chemotherapy. Whenever possible, CT scans should be evaluated with the radiologist.

The remission status after chemotherapy should be determined for each initially involved lymph node exclusively using CT scans.

Complete remission (CR) is defined as the complete disappearance of clinically and/or radiologically detectable disease. CRu is defined as at least a 75% decrease in tumor size. A partial response (PR) is at least a 50% decrease in tumor size. Failure is less than a 50% decrease or any increase in tumor size.

RADIATION FIELDS

1) CT simulation is strongly advised when designing INRT fields.
2) It is strongly recommended that pre- and postchemotherapy CT scans be performed, whenever possible, with patients in the treatment position.
3) As a rule, fusion possibilities, allowing the overlapping of the pre- and postchemotherapy CT scans are strongly recommended. However, they must be used with caution owing to many assumptions underlying such techniques.
I) INITIALLY INVOLVED LYMPH NODES IN CR or CRu

A) CERVICAL AND AXILLARY LYMPH NODES

As initially involved lymph nodes are either no longer visible or of normal size or are in CRu, only a CTV should be outlined.

1) **The CTV** is the initial volume of the lymph node(s) before chemotherapy. In other words, the CTV incorporates the initial location and the extent of the disease taking into account the displacement of normal structures** **(see Annex 1).**

   In case of a CRu with a visible lymph node remnant, the lymph node remnant should be included in the CTV.

   As the CTV is expected to be relatively small, blood vessels can be included in the CTV. However, if initially involved lymph nodes were clearly located at a distance from blood vessels, whenever feasible, those blood vessels can be excluded.

2) **The PTV** is the CTV with a margin to take into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

B) MEDIASTINAL AREA

As the mediastinal area is considered to be in complete remission or CRu, only a CTV should be outlined.

1) **The CTV** is the initial volume of the mediastinal mass (in the case of a CRu, the lymph node remnant should be considered as part of the CTV).

   Two main rules should be applied:
   1) Whenever feasible, blood vessels must be avoided
   2) In order to decrease lung toxicity

   A) The length of the CTV is the length of the mediastinal mass or lymph node(s) **before** chemotherapy
   B) The width of the CTV is the width of the mediastinal mass or lymph node(s) **after** chemotherapy
      a) In the case of a CR, the normal mediastinum is contoured and the CTV should not exceed the lateral mediastinal boundaries.
b) In the case of a CRu, the normal mediastinum is contoured and the CTV should not exceed the lateral mediastinal boundaries except where lymph node remnants persist.

2) **The PTV** is the CTV with a margin taking into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

II) INITIALLY INVOLVED LYMPH NODES IN PR (partial remission)

A) CERVICAL AND AXILLARY LYMPH NODES

As initially involved lymph nodes are in partial remission the GTV is the lymph node remnant(s).

a) **The GTV**: as a rule, the GTV should be contoured first and is the lymph node remnant(s).

b) **The CTV** is the initial volume of the lymph node(s) before chemotherapy. In other words, the CTV incorporates the initial location and the extent of the disease and takes into account the displacement of normal structures.

Therefore 2 PTVs should be outlined

1) **The initial PTV** (or PTV1) is the CTV including the GTV (i.e. initial tumor mass and lymph node remnant(s)) with a margin to take into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

2) **The boost PTV** (or PTV2) is the GTV with a margin to take into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

B) MEDIASTINAL AREA

As initially involved lymph node(s) or the tumor mass is (are) in partial remission, a GTV should be contoured.

a) **The GTV**: as a rule, the GTV should be contoured first and is the lymph node remnant(s) or the remaining mass alone.
b) **The CTV** is the initial volume of the mediastinal mass.

Two main rules should be applied:

Whenever feasible, **blood vessels** must be avoided

In order to decrease **lung toxicity**

A) **The length of the CTV** is the length of the mediastinal mass or lymph node(s) **before** chemotherapy

B) **The width of the CTV** is the width of the mediastinal mass or lymph node(s) **after** chemotherapy

The normal mediastinum is contoured and the CTV should not exceed the lateral mediastinal boundaries except where lymph node or mass remnant(s) persist(s).

Therefore 2 PTVs should be outlined:

1) **The initial PTV** (or PTV1) is the CTV including the GTV (i.e. initial tumor mass and the lymph node remnant(s) with a margin to take into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

2) **The boost PTV** (or PTV2) is the GTV alone with a margin to take into account organ movement and set-up variations. In most situations, a 1 cm isotropic margin is considered adequate.

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**TREATMENT AND DOSE PRESCRIPTION**

**GENERAL RULES**

The dose should be specified according to ICRU 50/62 recommendations (4). The PTV must receive a dose comprised between 95% and 107%. In other words, the PTV must be included in the 95% isodose.

If the initially involved lymph nodes are more than 5 cm apart, then separate fields should be devised. Otherwise involved lymph nodes should be included in the same radiation field.

**Radiation** should be delivered using anterior-posterior fields, 3D-conformal radiotherapy or intensity modulated radiotherapy. The choice of the technique will be left to the discretion of the physician.

Radiation treatments will be delivered using 5 fractions of 2 Gy per week.
Portal imaging of all fields should be performed consecutively, within the first two days of treatment and once a week thereafter.

An early retrospective quality assurance program should be set up in large cancer centers and should involve all local treating facilities.

**RADIATION DOSE FOR PATIENTS IN COMPLETE REMISSION or CRu**

The PTV must receive 30 Gy. If a conventional treatment is used with anterior and posterior fields, the size of the field should be at least 5 x 5 cm.

**RADIATION DOSE FOR PATIENTS IN PARTIAL REMISSION**

The PTV1 or initial PTV must receive 30 Gy. If a conventional treatment is used with anterior and posterior fields, the size of the field should be at least 5 x 5 cm.

PTV2 or the boost PTV must receive an additional dose of 6 Gy.

**DEFINITIONS OF MINOR AND MAJOR DEVIATIONS**

**MAJOR DEVIATIONS**

Less than 90% of the prescribed dose delivered to the PTV (e.g. 30 Gy x 90% = 27 Gy).

The 90% isodose inside the PTV (e.g. 30 Gy x 90% = 27 Gy).

Incorrect assessment of the CTV or GTV resulting in poor coverage of the initial tumor mass.

More than 2 incorrect portals (which potentially leads to 4 Gy (2 fractions) incorrectly delivered to the PTV (e.g. 30 Gy – 4 Gy = 26 Gy)

Overall treatment time exceeding the normal overall treatment time by more than 10%. (Normal overall treatment times: up to 14 days for 20 Gy; 21 days for 30 Gy and 26 days for 36 Gy.)

**MINOR DEVIATIONS**
All above items which are between major DEVIATIONS and properly implemented treatment rules.

QUALITY ASSURANCE PROGRAM

Early retrospective quality assurance meetings should be held in designated cancer centers. These meetings will mostly be conducted through videoconferences using new and relatively inexpensive available videoconferencing software. Local meetings with all involved physicians could also be organized but would be more costly to implement.
ANNEX 1

Example
On a prechemo CT scan, a huge lymph node takes up room and insodoing displaces the proximate neck muscles.

On the postchemo CT scan, the initial volume (CTV or GTV) will automatically encompass such muscles because the lymph node would have shrunk to its normal size and neck muscles have returned to their normal position.

In such cases, GTV or CTV contouring will have to be slightly altered to avoid irradiating muscles unnecessarily. Contouring will only include the space between muscles where the involved lymph node was initially located.
REFERENCES


