WM Radiotherapy Clinical Protocol

Haematological Radiotherapy Protocol

Revision history

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1.0	7.5.21	Ratified by EAG Final
2.0	14.4.23	Ratified at the EAG
3.0	14.2.25	Ratified by EAG
4.0	11.9.26	Peer review section added; dose fractionation presented in table format; changes to some dose fractionations; reference to DIBH and boost section clarified
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Approved By

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1. PURPOSE

To provide a standardised l protocol for planning and delivery of external beam radiotherapy for patients with Lymphoma, Solitary Plasmacytoma or Myeloma within the West Midlands. This protocol is aligned with the Royal College of Radiologists (RCR) Dose Fractionation Guidance Version 4, January 2024.

Information & Consent

- Each Patient should be consented with individualised information of planned treatment, individualised risk / benefits and toxicities
- Booking form and consent completed by IR(ME)R practitioner
- Patients should also receive a Local patient information sheet or MacMillan information booklets

Responsibility

- To comply with the Ionising Radiation (Medical Exposure) Regulations 2017 the following roles are defined:
- Referrer & Practitioner: The consultant clinical oncologist is responsible for the care of the patient including correct referral for treatment consent, justification prescription and treatment authorization as defined in departmental protocol but in accordance with this regional protocol.
- Operators: Radiographers, physicists and technologists Consultant clinical Oncologists and other medical staff are responsible for individual tasks associated with the plan production, verification and treatment delivery as per departmental protocols but in accordance with this regional protocol and are undertaken on the auspices of the practitioner.
- It is the responsibility of department management teams to ensure departmental protocols are consistent with this regional protocol and that any disagreement with the content of this protocol is raised through the West Midlands EAG.

2. STAGING

2.1 Ann Arbor Staging Classification for Lymphoma

Stage I	Involvement of a single lymph node region (I); Single extra nodal site (IE)
Stage II	Involvement of 2 or more lymph node regions on the same side of the diaphragm
(II)	Localised involvement of an extra lymphatic organ or site and its regional lymph node(s) with or without involvement of other lymph node regions on the same side of the diaphragm (IIE)
Stage III	Involvement of lymph node regions on both sides of the diaphragm (III), which may be accompanied by localised involvement of extra lymphatic site (IIIE) or spleen (IIIS) or both (IIIES)
Stage IV	Diffuse involvement of one or more extra lymphatic organs with or without associated nodal involvement or distant nodal involvement. Any liver / bone marrow disease
X	Bulk disease>10cm
A	=absence of B symptoms

B =presence of either unexplained fever>38○C; drenching night sweats. Weight loss>10% in the 6 months prior to diagnosis

2.2 Histological Classification

WHO Classification (Full extent is beyond the scope of this document).

Non-Hodgkins Lymphoma (NHL)

- Low Grade / Indolent (e.g. Follicular, MALT)
- High Grade (e.g. Diffuse Large B-Cell Lymphoma; Primary Mediastinal; NK/T Cell Lymphoma)
- Cutaneous T cell; mycosis fungoides

Hodgkin's Lymphoma (HD)

- Classical HD: Nodular Sclerosing; Mixed Cellularity; Lymphocyte Deplete; Lymphocyte Rich
- Lymphocyte Predominant HD (LPHD)

Early-stage HD

Favourable

- Clinical Stage I/II and no risk factors

Unfavourable

- Clinical Stage I/II with one or more of the following risk factors:
    - Large mediastinal mass (>10cm)
    - Extranodal involvement
    - Elevated ESR (>30mm/h for B stage; >50mm/h for A stage)
    - 3 or more lymph node regions involved
    - B symptoms

2.3 Advanced stage HD

Favourable: Clinical Stage III/IV with 0-3 adverse risk factors (listed below)

Unfavourable: Clinical stage III or IV with four or more adverse risk factors

- Albumin level of <4.0 g/dL.
- Haemoglobin level of <10.5 g/dL.
- Male sex.
- Age of ≥45 years.
- Stage IV disease.
- White blood cell (WBC) count of ≥15,000/mm3.
- Absolute lymphocytic count of <600/mm3 or a lymphocyte count that was <8%of the total WBC count.

3. INDICATIONS AND INTENT

3.1 Radical intent

Five Clinical Groups where radiotherapy may be indicated in Lymphoma.

1. Early-stage indolent non-Hodgkin lymphoma (NHL) and nodular lymphocyte-predominant HL (NLPHL) treated with RT alone: The CTV includes all evident sites plus an adequate volume to encompass potential adjacent subclinical disease.
2. ESHL and diffuse large B-cell lymphoma (DLBCL) after limited systemic therapy: Systemic therapy is highly likely to control subclinical disease, so the CTV may be strictly limited to disease sites evident at diagnosis (which are at highest risk of residual microscopic disease).
3. Primary extranodal lymphoma: The CTV is usually the entire involved organ (with some exceptions) because extranodal lymphomas often display an infiltrating or multifocal pattern.
4. Advanced stage HL or aggressive NHL after a full course (typically 6 cycles) of systemic therapy: The CTV includes any residual GTV plus a subset of disease sites at elevated risk of harbouring subclinical disease after systemic therapy.
5. Relapsed lymphoma undergoing salvage therapy with or without transplantation: The CTV includes some or all relapse sites and selected sites of prior disease involvement

- Following short course chemotherapy
- As single modality therapy e.g. localized stage I Lymphocyte Predominant HD;
- Consolidation following chemotherapy
- Chemotherapy refractory disease
- Solitary plasmacytoma of bone
    - Isolated bony lesion
    - Multiple myeloma not confirmed
- Solitary extramedullary plasmacytoma
    - Isolated lesion
    - No evidence of multiple myeloma

3.2 Palliative Intent

- Relapsed Hodgkin's disease
- Relapsed/ refractory high grade NHL
- Advanced low grade NHL
- Multiple myeloma, palliative Radiotherapy, simple technique.
    - Bone pain
    - Pathological fracture, post op
    - MSCC, +/- surgical intervention
- Splenomegaly, myelofibrosis / massive spleen

3.3 Total Body and Total Nodal Irradiation

Total Body Irradiation (photons) UHB Only: Refer to local protocols

- Relapsed or refractory leukaemia or NHL

Total Skin Electrons UHCW Only: Refer to local protocols

- Mycosis fungoides
  - Palliative local radiotherapy for extensive skin disease failed other local skin Radiotherapy +/- systemic therapy.
  - As conditioning radiotherapy ahead of intensive treatment, including Total Nodal Irradiation (TNI) a and allogenic Bone Marrow Transplant (BMT) at UHB

4. TIMING

Radical:

Radiotherapy to start 4 weeks from time of decision to treat. Following chemotherapy recommended starts at maximum within 3 months of completing chemotherapy (e.g. patient factors) but ideally to start4 weeks following completion.

Lymphoma falls into Category 2 patients

5. ESSENTIAL INVESTIGATIONS AND INFORMATION REQUIRED PRIOR TO DECISION TO TREAT FOR EBRT

The following investigations should have been performed with results available before planning commences:

- Clinical history
- Discussion at MDT meeting.
- Baseline clinical examination and Performance Status
- Histology
- FBC, U+E's, biochemical profile, LDH
- Bone marrow evaluation
- Results of staging investigations: CT and or FDG PET-CT. In some instances MRI may be of value e.g. Primary CNS lymphoma; disease in head and neck region
- For patients receiving radiotherapy after chemotherapy, PET-CT / CT scans before and after treatment are used to determine the involved sites and residual disease. PET-CT pre and post chemotherapy is advised for ISRT (Involved Site Radiotherapy).

TSE patients UHCW only:

- Referral from Combined Specialist Cutaneous Clinic, UHB

6. DOSE and FRACTIONATION

Histological Classification	Indication	Dose / Fractionation
Classical Hodgkin Lymphoma	Favourable Early Stage after 2 cycles ABVD	20Gy / 10#
	Unfavourable Early Stage after 4 cycles ABVD	30Gy / 15#
	Complete response, post chemo	30Gy / 15#
	may be considered in certain instances e.g. chemotherapy refractory disease.	36Gy - 40Gy / 18-20#
LPHD (Lymphocyte predominant)	Early stage, sole therapy (dependent on bulk and site)	30-35Gy / 15-20#
High Grade NHL	Complete response, post chemo	30Gy / 15#
	NK/ T cell Lymphoma of nose requires higher doses	45-50Gy / 25#
	Primary CNS Lymphoma. Post chemotherapy	36Gy/20# Ph1 + 9Gy/5# Ph2 boost residual volume (Combined 45Gy/25#)
	Poor performance status, partial response post chemo	30.6Gy in 17#[1]
	may be considered in certain instances e.g. chemotherapy refractory disease.	36Gy - 40Gy / 18-20#
Low Grade NHL	Standard dose	24Gy / 12#
	At consultant request	30Gy / 15#
Solitary plasmacytoma / Solitary extramedullary plasmacytoma	Standard dose	45Gy / 25#
	At consultant request	40Gy / 20# 50Gy / 25#
Palliative	Indolent lymphoma	24Gy / 12#
	Advanced follicular lymphoma	Wide field 4Gy / 2#
	Intermediate/High Grade	8Gy / 1# or 8Gy / 2# or 20Gy-30Gy / 5-10#
Multiple Myeloma		30Gy / 10# or 20Gy / 5# or 8Gy / 1#

[1] Recommendations for Radiotherapy Technique and Dose in Extra-nodal Lymphoma, *PJ Hoskin et al, Clinical Oncology 28 (2016) 62-68*

Histological Classification	Indication	Dose / Fractionation
Spleen	For discussion with referring Haematologist's: (may require prophylactic antibiotics)	0.5 – 1.0Gy per fraction, once or twice per week for max of 6weeks
Mycosis Fungoides	Plaque / patch disease (SXR / electrons). Technique dependent on depth of lesion. Electron fields, bolus.	8Gy / 2#
	Tumour nodules. electrons or planned photon beam arrangement; bolus. Low dose; amenable to retreat if required.	12Gy / 3#
TSE		12Gy / 8# over 2 weeks, 4 fractions each week
		24Gy / 16# over 4 weeks
		30Gy / 20# over 5 weeks

For daily fractionation unless otherwise indicated.

Classical Hodgkin Lymphoma

- Favourable Early Stage after 2 cycles ABVD : 20Gy / 10 fractions over 2 weeks
- Unfavourable Early Stage after 4 cycles ABVD: 30Gy / 15 fractions
- Complete response, post chemo 30 Gy in 15#
- 35-40Gy / 18-20 fractions may be considered in certain instances e.g. chemotherapy refractory disease.

LPHD (Lymphocyte predominant)

- Early stage, sole therapy: 30-35Gy / 15-20 fractions (dependent on bulk and site)

High Grade NHL

- Complete response, post chemo 30 Gy in 15#
- NK/ T cell Lymphoma of nose requires higher doses of at least 45-50Gy/25#
- Primary CNS Lymphoma. Post chemotherapy 36Gy in 20 fractions, with boosting of residual volume (9Gy in 5 fractions) to overall dose of 45Gy in 25 fractions
- Poor performance status, partial response post chemo 30.6Gy in 17#s[2]
- 36-40Gy in 18-20# may be considered in certain instances e.g. chemotherapy refractory

Low Grade NHL

- Standard dose: 24Gy in 12#. (30Gy in 15# at Consultant request).

[2] Recommendations for Radiotherapy Technique and Dose in Extra-nodal Lymphoma, *PJ Hoskin et al, Clinical Oncology 28 (2016) 62-68*

Solitary plasmacytoma

- Standard dose – 45Gy in 25#. (May use 40 – 50Gy in 20 – 25# at Consultant request).

Solitary extramedullary plasmacytoma

- 45Gy in 25# (range 40Gy min to 50Gy max)

Palliative

- Indolent lymphoma, 24Gy in 12#.
- Advanced follicular lymphoma – Wide field 4 Gy in 2#
- Intermediate/High Grade, 8Gy single #; 8GY in2#, 20 – 30Gy in 5-10 #

Spleen

- For discussion with referring Haematologist's: 0.5 – 1.0Gy per fraction, once or twice per week for max of 6weeks (may require prophylactic antibiotics)

Multiple Myeloma.

30Gy in 10#
20Gy in 5#
8Gy in 1#

Mycosis Fungoides.

- Plaque / patch disease (SXR / electrons). 8Gy in 2; technique dependent on depth of lesion. Electron fields, bolus.
- Tumour nodules. 12Gy in 3, electrons or planned photon beam arrangement; bolus. Low dose; amenable to retreat if required.

Total Skin electron (TSE),

12Gy in 8# over 2 weeks, 4 fractions each week
24Gy in 16# over 4 weeks
30Gy in 20# over 5 weeks

7. SCANNING TECHNIQUES

- All patients are 3-D planned using data from a CT planning scan.
- Mediastinal lymphoma - 4D planning scans and DIBH are permitted, in order to encompass all the movement with respiration
- Maximum 3mm slice thickness taken through the region of interest.
- Patients to be planned and treated in the supine position.
- Chin extended for neck and SCF sites.
- Clinician to indicate appropriate neck position for head sites.
- Appropriate immobilization for the site being treated is required.

- Head and neck regions should be treated in a customised immobilisation shell and mould care cushion.
- Patients will be scanned using the most clinically appropriate patient set-upIV contrast is recommended to improve localisation of nodal chains.
- Mycosis fungoides – clinical mark up; physics in attendance.

8. RADIOTHERAPY TECHNIQUES

3D conformal or IMRT planning using CT data with field arrangements appropriate for site to be treated. Parallel opposed pair may be suitable or many sites.

Butterfly VMAT technique should be used for radical treatment of mediastinal lymphoma in

- HL as combined modality treatment or consolidation at the end of chemotherapy for PET positive disease
- Primary mediastinal B cell lymphoma
- High grade NHL with bulky mediastinal disease at diagnosis.

9. TARGET DEFINITION. FIELD /VOLUME

Preferred technique using ISRT (involved site radiotherapy) to limit volume of normal tissue irradiated. See NCRI atlas and guidelines for outlining CTV and defining PTV using pre-chemotherapy tumour volumes.

Where ISRT not able to be delivered, proceed to IFRT as below.

Involved field CTV (IF-CTV) will include the anatomical nodal region affected by lymphoma defined by the clinician as that which should be treated by radiotherapy.

IF-CTV outlined to include the involved nodal region, margins of any tumour mass (primary or residual) in all dimensions and the contigual nodal regions.

For patients who have had prior chemotherapy, the post chemotherapy volume is used in all directions except cranio-caudal direction where the pre-chemotherapy volume is used

Involved nodal regions are described with summary as follows:

- Neck - ipsilateral neck (mastoid – SSN) including SCF.
- Mediastinum – Top of thyroid cartilage, bilateral SCF to 5cms below lower extent of disease.
- Mediastinum + Hilum – as for mediastinum but include bilateral hilar nodes, inferior border = bottom of T10.
- SCF – include ipsilateral neck. If mediastinum involved pre-chemo extend inferiorly as per mediastinum node region.
- Axilla – include ipsilateral lower neck, SCF and infra clavicular fossa. (Top of thyroid cartilage – axillary fold)
- Inguinal – ipsilateral femoral, inguinal and external iliac node region; from bifurcation of common iliacs to Sartorius muscle (at approx. inferior border of lesser trochanter)

- External iliac - ipsilateral inguinal, external iliac, internal iliac, obturator and common iliac node regions (from aortic bifurcation to inferior border of superior pubic ramus)
- Femoral – ipsilateral femoral and inguinal nodes; sup border = where external iliac becomes most superficial; inf border = sartorius muscle.
- Para-aortics – bottom of T10 – aortic biurfication

Maxillary antrum
CTV = whole ipsilateral antrum. If disease extends beyond it CTV = pre-chemotherapy GTV + 10mm

Waldeyer's ring (WR)
Conventionally lymphoma in any part would be treated with inclusion of all sites of the WR in the radiotherapy field and risks a dry mouth.

Following the principles for nodal lymphoma the following is considered:
CTV = pre-chemo GTV + 10mm, except 15mm cranio-caudally.
If multiple contiguous sites affected, follow margins above. If other areas within the WR also suspicious, treat the whole ring.

Orbit
Conjunctival tumours:
Electrons or superficial X-rays with corneal shielding. Some form of eye fixation recommended.
CTV = GTV+5mm. GTV=whole conjunctiva also option as difference in volume minimal.
Lachrymal gland: CTV = entire gland, no margin.
Orbit:
Most will be marginal zone or diffuse large B-cell lymphomas.
CTV=whole orbit, constrained to bone. Particularly localised tumours may have a partial orbit treated.

Brain
High Grade lymphoma
Phase 1 CTV = whole brain from frontal, parietal and occipital lobes down to the C1-C2 junction. The IELSG PCNSL trial treats whole brain.
Post-chemotherapy to 36Gy and boosting the phase 2 residual volume (if clear target) with 1-2cm margin to 45Gy. Alternative 30.6Gy in 17#

Low grade lymphoma
Localised irradiation may be used. CTV = GTV+10 mm expansion constrained to bony and lobular anatomy. Shield the eye after 30Gy.
Palliative elderly patients consider 30Gy / 15 fractions

Parotid
CTV = entire ipsilateral gland.
Extra-capsular spread pre-chemotherapy: GTV = pre-chemotherapy volume; CTV = GTV+10 mm expansion
Bone conventionally whole bone irradiated after chemotherapy but not necessary in many cases.

MRI is used to define pre-chemotherapy volume = GTV. CTV = 15 mm cranio-caudally along the bone marrow cavity and 10 mm in all other directions.

Bone

Conventionally whole bone irradiated after chemotherapy but not necessary in many cases.
MRI is used to define pre-chemotherapy volume = GTV. CTV = 15 mm Cranio-caudally along the bone marrow cavity and 10 mm in all other directions.

Skin

Low grade lymphoma:

GTV=pre-chemotherapy volume.
CTV=GTV with a 10 mm expansion.

Complete excision biopsy will not require radiotherapy. If positive excision margin, treat as above with the scar as GTV.
Localised low grades may be treated using superficial techniques.
Diffuse large B-cell lymphoma: more aggressive on leg than upper body.
Outlining is same as for low-grade lymphoma but to a different dose.
T-Cell lymphoma: Outlining is same as for low-grade lymphoma but to a different dose.
Mycosis Fungoides: consider Total Skin Electrons (TSE) @UHCW
Palliative treatment: residual disease post-chemotherapy=GTV. CTV=same as for low grades.
For multiple sites radiotherapy will be given to up to 4 sites.

Stomach

CTV = whole stomach.

Patient preparation recommended e.g. fasting from midnight the day before. Treat earlier rather than later in the day.

Testis

CTV= whole sac. Electrons to be used wherever possible setting the testis in wax block for irradiation. Wax below scrotum to absorb secondary/reflected electrons.

Lung

Most will be MALT lymphoma.

GTV=pre-chemotherapy volume.
CTV=GTV+10mm expansion.

Breast

CTV =whole breast. Small, low-grade lesion may be treated with partial breast irradiation CTV = GTV + 10mm, constrained to tissue planes.

Other organs

e.g. thyroid, prostate and bladder CTV outlining is as for parotid.

PTV – Planning target volume

CTV is expanded in 3D to create the PTV to account for organ motion and set-up error. These are to be defined individually for each disease site and treatment centre. For guidance typical margins are as follows.

- Head and Neck: 5 – 10mm
- Mediastinum: 10mm transversely and 15mm cranio-caudally
- All other sites: 10mm

10. CRITICAL STRUCTURES /OAR

DVH constraints for OAR:

Brain stem

If whole organ irradiated, Dmax < 54Gy to any part of the volume.

If partial volume D1-10cm3 < or = 59Gy

Breast

Minimise volume inside PTV, particularly in young women < or = 30 years.

Mean dose< or = 2Gy

Cochlea

Mean dose < or = 45Gy

Coronary artery

Minimise volume inside treatment field and keep doses as low as possible without compromising on PTV coverage

Heart

Mean dose < 26Gy;
V30 <46%, V42 < 20%

Kidney

Single kidney irradiated: V15 65-70%
Both kidneys irradiated: V15 20-25% for each kidney; mean dose < 18 Gy
Partial kidney irradiation (all constraints are for combined kidneys):

Mean doses < 18Gy, V28 <20%; V23 <30%; V20 <32%; V12 <55%.

If mean dose to one kidney>18Gy, V6 for remaining kidney <30%

Lens

Maximum dose of 6Gy to any part of the volume, unless compromising PTV coverage

Liver

Mean dose < 32Gy;
V40 of 30-35%
D100 of 20Gy, D66 of 28Gy, D33 of 38Gy

Lung (whole)

V20 < or = 30%. Mean lung dose (MLD) < or = 20Gy

Oesophagus

Mean dose < 34 Gy, V35 < 50%

Optic Chiasm & Optic nerve

Maximum dose of 55Gy to any part of the volume

Ovary

Maximum dose of 10Gy to any part of the volume outside the PTV.

If inside the PTV discuss individual case with clinician

Parotid

Bilateral irradiation: mean dose <25 Gy

Unilateral irradiation: mean dose <20Gy to the contra-lateral parotid

Small bowel

For individual loops V15 < 120cm3

For whole peritoneal cavity V45 <195cm3

Spinal cord

Dependent on length of field. D max < or =50Gy to any part of the volume.

For neck + mediastinum field D max < or = 42Gy

Testis

Maximum dose of 2Gy to any part of the volume

Thyroid

D100<45 Gy

Total skin electrons: UHCW only

See UHCW protocol TSE using the Stanford Technique, RTW09.01.92

11. PEER REVIEW

Peer review should be undertaken in line with the West Midlands regional guidance agreed in December 2025 which identifies which cases should be subject (as a minimum) to peer review. Please refer to the West Midlands Peer Review guidance (December 2025).

12. PRE-TREATMENT / TREATMENT VERIFICATION

Dependant on site treated and technique

For IMRT daily CBCT may be required

For conformal volumes 1# -3# and then weekly will be suitable

See Local site-specific imaging documents

13. ON TREATMENT REVIEW

- Clinical review and monitoring of blood tests to be conducted as indicated
- Dietician involvement may be required
- After completion of treatment arrangements should be made for patients to be seen in the outpatient clinic for clinical review.
- After completion of treatment consideration must be given to the review of breast tissue in young female patients, those who underwent mediastinal RT should be put on early breast screening via BARD (Breast screening After RT Database).

14. END OF TREATMENT LETTER

- On completion of treatment a summary of the radiotherapy dose administered and toxicities experienced are documented
- In addition, the expected acute and late side effects are detailed with recommended treatments

15. REFERENCES

a) RCR Radiotherapy dose fractionation, 4th Edition 2024
b) ILROG (International Lymphoma for Radiation oncology Group) guidelines for Radiation Therapy for Solitary Plasmacytoma and Multiple Myeloma.
c) Radiation Therapy for Solitary Plasmacytoma and Multiple Myeloma: Guidelines From the International Lymphoma Radiation Oncology Group; Int J Radiat Oncol Biol Phys, Vol 101, no 4, pp794-808, 2018.