South West Wales Cancer Centre

Department of Radiotherapy: Quality System
Department of Radiotherapy Physics: Quality System

Radiotherapy Clinical Protocol: SCLC - Small Cell Lung Cancer

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Radiotherapy clinical protocol: Small Cell Lung Cancer

Date of change	Index number/Rev No	Details of Change
Oct 2019	RTQW4097/3.0	Multiple changes.
June 2021	RTQW4097/4.0	Updated to iPassport format. Format of 'Radiotherapy Localisation' matched to NSCLC. Clarification of dose constraints, whilst splitting between NSCLC and SCLC protocols. Change in cranial border of Heart delineation
Jan 2026	RTQW4097/5.0	Dose Constraints removed and new reference added QFORM3.166, Responsibility section updated to reference separate document. Documents section also updated.

Objective

This protocol outlines the investigations, staging system, radiotherapy technique and dose, and includes an outline of management including chemotherapy and follow up procedure for patients referred with Small Cell Lung Cancer (SCLC).

Scope

Any patients referred to the South West Wales Cancer Centre requiring radiotherapy for SCLC.

Responsibility

Please see 'Radiotherapy Clinical Protocol Responsibilities' (RTQW4177)

Documentation

Booking and Scheduling Radiotherapy	RTQW1009
Prescribing Radiotherapy	RTQW3007
Oncologist/SpR/Locum IR(ME)R Entitlement form	RTQF3016
Ionising Radiation (Medical Exposure) Regulations 2017 in Radiotherapy and Radiotherapy Physics (Including IR(ME)(A)R 2024	RTQP5001
Procedure for making, amending or cancelling a patient referral to the South West Wales Cancer Centre (SWWCC) for Radiotherapy treatment	RTQP1001
Referral of emergency patients	RTQP1005
Medical exposures and pregnancy	RTQW3018
Common Terminology criteria for adverse events (CTCAE) version 5	

Method

Background

Small cell lung cancer (SCLC) is considered as a systemic disease, which carries a poor prognosis. Only a small minority of patients receive long-term benefit from radical treatment.

The staging system has changed and what was considered "limited disease" in the old system is now specified as "localised disease" i.e. any stage (other than Stage IV) confined to the thorax that can be treated with radical intent. The "Stage IV" disease will replace the "extensive" stage in the old staging system in the current staging system.

A few patients with early stage disease, which are centrally located and can be encompassed within a safe PTV, could be considered for starting with concurrent chemoradiotherapy (cCRT) as an initial treatment.

However, the clinician should make a judgement of any negative impact due to a delay in cCRT arising from the necessary time required to plan the treatment.

The aim for all patients considered suitable for radical treatment is to start treatment as soon as possible, preferably within 7 – 14 days. The timing of the start date for radiotherapy will influence the decision to treat with concurrent chemo-radiotherapy (if start date is within 7 – 14 days) OR neo-adjuvant chemotherapy (maximum 2 cycles) followed by concurrent chemo-radiotherapy

Diagnostic investigations

- All patients should have a CT scan TA (minimum extent).
- Pulmonary function test for all patients being considered for high dose radiotherapy.
- Patients with a known cardiac condition should be considered for ECG/echogram at the discretion of the clinician (e.g. if the patient has active/uncontrolled cardiac problems).
- All other investigations required for pre-chemotherapy assessment i.e. renal and liver function, hearing test etc.

Staging investigations

- Patients potentially suitable for radical option should have staging CT/PET, full lung function, brain imaging, with MRI the preferred modality, if available.
- EBUS/EUS should be considered for appropriate patients.

Any other investigation as indicated e.g. bone scan, MRI liver etc.

TNM Staging system

Stage Grouping for 8th Edition of the TNM Classification for Lung Cancer

Stage	T	N	M
Occult carcinoma	Tx	N0	M0
0	Tis	N0	M0
IA1	T1a (mi)	N0	M0
	T1a	N0	M0
IA2	T1b	N0	M0
IA3	T1c	N0	M0
IB	T2a	N0	M0
IIA	T2b	N0	M0
IIB	T1a	N1	M0
	T1b	N1	M0
	T1c	N1	M0
	T2a	N1	M0
	T2b	N1	M0
	T3	N0	M0
IIIA	T1a	N2	M0
	T1b	N2	M0
	T1c	N2	M0
	T2a	N2	M0
	T2b	N2	M0
	T3	N1	M0
	T4	N0	M0
	T4	N1	M0
IIIB	T1a	N3	M0
	T1b	N3	M0
	T1c	N3	M0

	T2a	N3	M0
	T2b	N3	M0
	T3	N2	M0
	T4	N2	M0
IIIC	T3	N3	M0
	T4	N3	M0
IVA	Any T	Any N	M1a
	Any T	Any N	M1b
IVB	Any T	Any N	M1c

T – Primary Tumour

Tx		Primary tumour cannot be assessed, or tumour proven by the presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy.
T0		No evidence of primary tumour
Tis		Carcinoma in situ
T1		Tumour 3 cm or less in greatest dimension, surrounded by lung or visceral pleura, without bronchoscopic evidence of invasion more proximal than the lobar bronchus (i.e. not in the main bronchus)[1]
	T1a(mi)	Minimally invasive adenocarcinoma[2]
	T1a	Tumour 1 cm or less in greatest dimension[1]
	T1b	Tumour more than 1 cm but not more than 2 cm in greatest dimension[1]
	T1c	Tumour more than 2 cm but not more than 3 cm in greatest dimension[1].
T2		Tumour more than 3cm but not more than 5 cm; or tumour with any of the following features[3] ▪ Involves main bronchus regardless of distance from the carina, but without involvement of the carina. ▪ Invades visceral pleura. ▪ Associated with atelectasis or obstructive pneumonitis that extends to the hilar region, involving part or the entire lung.
	T2a	Tumour more than 3 cm but not more than 4 cm in greatest dimension
	T2b	Tumour more than 4 cm but not more than 5 cm in greatest dimension
T3		Tumour more than 5 cm but no more than 7 cm in greatest dimension, or directly invades any of the following structures: chest wall (including parietal pleura and superior sulcus tumours), phrenic nerve, parietal pericardium; or associated with separate tumour nodule(s) in the same lobe as the primary.
T4		Tumour more than 7 cm in greatest dimension, or invades any of the following structures: diaphragm, mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, oesophagus, vertebral body, carina; or associated with separate tumour nodule(s) in a different ipsilateral lobe to that of the primary.

N – Regional Lymph Nodes

NX		Regional lymph nodes cannot be assessed.
N0		No regional lymph node metastasis.
N1		Metastasis in ipsilateral peribronchial and/or ipsilateral hilar lymph nodes and intrapulmonary nodes, including involvement by direct extension
N2		Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s).
N3		Metastasis in contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s).

M – Distant Metastases

M0		No distant metastasis
M1		Distant metastasis present.
	M1a	Separate tumour nodule(s) in a contralateral lobe; tumour with pleural or pericardial nodule(s) or malignant pleural or pericardial effusion[4]
	M1b	Single extrathoracic metastasis[5]
	M1c	Multiple extrathoracic metastases in one or several organs

[1] The uncommon superficial spreading tumour of any size with its invasive component limited to the bronchial wall, which may extend proximal to the main bronchus, is also classified as T1a.

[2] Solitary adenocarcinoma, (</=3cm) with a predominately lepidic pattern and </= 5mm invasion in any one focus.

[3] T2 tumours with these features are classified as T2a if ≤4 cm in greatest dimension or if size cannot be determined, and T2b if >4 cm but ≤5 cm in greatest dimension.

[4] Most pleural (pericardial) effusions with lung cancer are due to tumour. In a few patients, however, multiple microscopic examinations of pleural (pericardial) fluid are negative for tumour and the fluid is nonbloody and not an exudate. When these elements and clinical judgment dictate that the effusion is not related to the tumour, the effusion should be excluded as a staging descriptor

[5] This includes involvement of a single distant (nonregional) lymph node.

Courtesy of IASLC

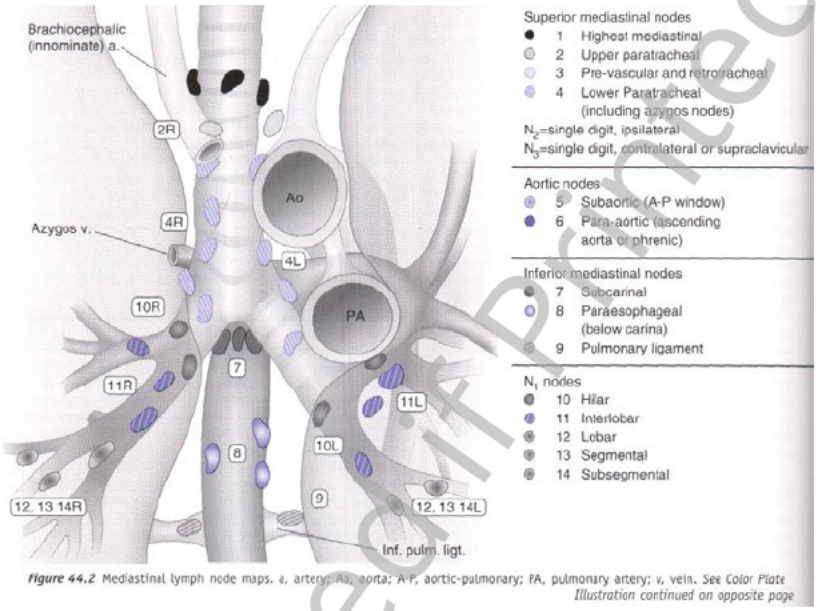
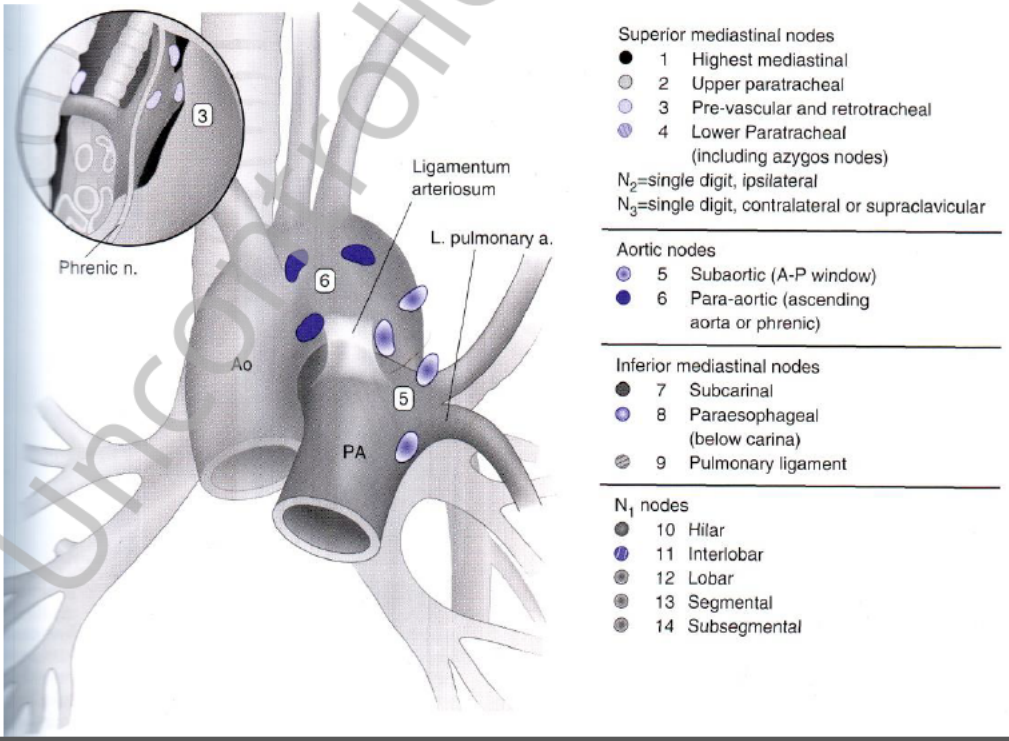


Figure 44.2 Mediastinal lymph node maps. a, artery; Ao, aorta; A-P, aortic-pulmonary; PA, pulmonary artery; v, vein. *See Color Plate*

Illustration continued on opposite page



Diagrams from Textbook of Respiratory Medicine; Murray and Nadel; 4th Edition 2005 ISBN 0-7216-0327-0

Indications for radiotherapy

Radical Intent

Concurrent chemo-radiotherapy (cCRT)

Patients with small volume disease, which can safely be encompassed in a PTV, should be considered for cCRT aiming to start treatment within 7 – 14 days.

Recommended practice for patients with small volume disease should be to start cCRT with Cycle 1. However, they may commence chemotherapy alone to avoid any delay in starting treatment. The radiotherapy treatment should align with Cycle 2.

All other patients should be started on standard chemotherapy with Etoposide and Platinum (usually Carboplatin but Cisplatin should be considered for young and fit patients) and scheduled for a CT scan to assess the response to chemotherapy treatment after completion of 2 cycles of chemotherapy; and additionally booked for a planning CT scan and concurrent chemo-radiotherapy. Please note the chemotherapy regimen recommended in the concurrent situation is Cisplatin with Etoposide. The concurrent radiotherapy commences with the 3rd cycle of chemotherapy as a practical option rather than starting with the 2nd cycle.

Sequential (high dose) radiotherapy

Radical radiotherapy can be given following completion of induction chemotherapy with Etoposide and Platinum chemotherapy (number of cycles can vary from 4 to 6 depending on the response) in PS 2 patients or when disease was considered too bulky for concurrent treatment. The patient is assessed clinically and with an up-to-date CT scan to ascertain the suitability for thoracic radiotherapy and prophylactic cranial irradiation (PCI). It is recommended to scan after 2 cycles, 4 cycles and 6 cycles to see suitable timing for chest RT depending on response.

Prophylactic Cranial Irradiation (PCI)

PCI should be considered for fit patients with thoracic only disease (early stage I and II) and in some patients with distant metastatic disease (old extensive staging) who have achieved a complete or good partial response to chemotherapy.

PCI is **not** to be delivered if the patient is undergoing chemotherapy; patients scheduled for concurrent chemo-radiotherapy are to be scheduled for PCI after completion of the planned chemotherapy cycles. Radiotherapy to commence 3 – 4 weeks after completion of chemotherapy.

Contra-indications include a performance status of 3 or 4; any pre-existing mental impairment/condition e.g. any neurological condition including dementia, h/o, CVA, TIA, Parkinson's disease.

Radiotherapy intent

The intent of radiotherapy will be radical in patients who are suitable to receive concurrent chemo-radiotherapy or high dose sequential radiotherapy. However, patients (with limited disease) should be warned about the poor long-term outcome even though 30 – 40% will achieve a complete remission at 2 years.

All patients who receive cCRT should be considered for a total of 4 – 6 cycles chemotherapy.

The WHO dyspnoea score is to be used to assess the status of breathing initially, and the dyspnoea grading under CTCAE recorded at on-treatment review and subsequent follow up assessments.

If patient is potentially suitable for radical treatment they should be listed for discussion in the radical lung planning meeting

MRC Dyspnoea score

Grade 1 - Only get breathless on strenuous exercise.

Grade 2 - Get breathless when hurrying on the level or up a hill.

Grade 3 - Walk slower than people of the same age on the level, or up a slight hill.

Grade 4 - Stop for breath after walking 100 yards, or after a few minutes on the level.

Grade 5 - Too breathless to leave the house.

Radiotherapy immobilisation

To maintain the accuracy of patient positioning, radical patients are treated supine with arms immobilised using a commercially available thorax support. Lower abdomen and extremities are immobilised using a commercially available patient positioning device.

Radiotherapy localisation

3D CT with contrast is the standard modality (see RTQW2018: Planning-CT scans), but 4D can be used at the discretion of the treating Clinician (see RTQW2019: 4DCT scans) to account for individual tumour motion.

Gross Tumour Volume (GTV) is delineated to include all known disease to the primary tumour and lymph nodes including the immediate nodal stations (if acceptable volume). In patients achieving a complete response following initial chemotherapy a GTV cannot be defined except in patients who are still left with residual tumour.

Clinical Tumour Volume (CTV) is grown by adding a 0.5cm margin to the GTV. In patients with no GTV, the initial diagnostic scans are used to identify the previously involved nodal stations only. The decision on including the primary tumour depends on the location and size of the tumour e.g. if the primary tumour is contiguous or close to the nodal areas and can safely be encompassed in the PTV. Elective uninvolved nodal regions is not advised

Planning Target Volume (PTV) is formed by adding a 0.8cm margin, in the AP/PA/Right/Left direction and a 1.0cm margin added in the Sup/Inf direction, to the CTV.

In summary, with 3DCT, the target volume margins are as follows:

CTV	GTV + 0.5cm
PTV	CTV + 0.8cm (1.0cm sup/inf)

With 4DCT planning, a motion adapted 4D-GTV is contoured using one of the 2 following techniques. First, the GTV is delineated on the contrast-enhanced CT as described above and the structure copied and re-named. The GTV is then adjusted on each phase of the 4D dataset and the contour expanded to account for

motion. NB the structure should NOT be made smaller unless to correct for an error. Alternatively, a combined GTV Exhale (defined on the maximum exhale 4D-CT dataset) and GTV Inhale (defined on the maximum inhale 4D-CT dataset) is created. Whichever technique is used the target volume should be visually confirmed on all respiratory phases on axial, coronal and sagittal views, by playing a cine-movie of the datasets representing different phases of the respiratory cycle to ensure all areas of disease are encompassed.

The motion adapted 4D-GTV should be expanded by 0.5cm to create the CTV. The CTV should then be expanded by 0.7cm axially and 0.9cm sup/inf to create the PTV.

In summary, with 4DCT, the target volume margins are as follows:

CTV	4D-GTV + 0.5cm
PTV	CTV + 0.7cm (0.9cm sup/inf)

When planned, the ideal dose distribution of PTV should be –5%, +7% of prescribed dose, and is prescribed as per ICRU 83 (**target median dose = prescription ± 2% for lung**) as inverse planned, as per 'Prescribing Radiotherapy' (RTQW3007).

PTV coverage by the 95% isodose may not be possible where the target volume is surrounded by air in which circumstance coverage by the 90% isodose is clinically acceptable. 6MV photons will be utilised.

Planning technique (VMAT arc/s) is described within 'Lung Treatment Planning WI' (QWORK3.144).

Radical Radiotherapy: Technique and dose

Concurrent chemo-radiotherapy (cCRT).

For patients with a good performance status (0/1), no significant co-morbidities and adequate lung and renal function.

4500 cGy in 30 twice-daily fractions, 10 fractions a week (excluding weekends); **At least 6 hour gap between fractions.**

Alternative fractionations include

6000 cGy in 30 fractions, 5 fractions a week **Or** 6600cGy in 33 fractions, 5 fractions a week

5500 cGy in 20 fraction, 5 fractions a week

6 MV photons. Any justification for using 10MV photons should be recorded in Mosaiq

FULL DETAILS OF CONCURRENT CHEMOTHERAPY SCHEDULES CAN BE FOUND ON CHEMOCARE

Radiotherapy

Radiotherapy alone: For patients with a good performance status and adequate lung function but co-morbidity precludes chemotherapy or previous poor tolerance to chemotherapy or declining chemotherapy.

Sequential Radiotherapy: For patients who are not fit for concurrent chemoradiotherapy

CT planned conformal radiotherapy.

5500 cGy in 20 fractions, 5 fractions a week.

4000 cGy in 15 fractions, 5 fractions a week - for patients not fit for 5500cGy in 20 fractions

Chemo-radiotherapy regime (4500 cGy in 30 #s, twice-daily # over 3 weeks)

Starting at cycle 3 of CTX	Week 1	Week 2	Week 3
Cisplatin 75 mg/ m^2 IV	x		
Etoposide 100 mg/ m^2 IV	x		
Twice-daily Radiotherapy 150 cGy per fraction.			

OR (6000 cGy in 30 #s, 5 # a week over 6 weeks/6600cGy in 33 fractions, 5 fractions a week)

Starting at cycle 3 of CTX	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Cisplatin 75 mg/m^2 IV	x			x		
Etoposide 100 mg/m^2 IV	x			x		
Daily Radiotherapy 200 cGy per fraction.						

Other medication

- The chemotherapy regimen is used with the standard pre-medication, hydration and post medication as per protocol.
- GCSF is recommended if clinically indicated – e.g. neutropenic sepsis or prolonged Neutropenia.
- Use of steroids should be carefully monitored, and prescription of Proton Pump Inhibitor is recommended.
- Treatment of oesophagitis depends on the severity. Mild Oesophagitis is treated with pain control using soluble paracetamol, codeine, antacid/oxetacaine, gaviscon and raspberry mucilage. Mild to moderate Oesophagitis requires Oromorph, with dietary advice, and should be seen by the dietician. Severe Oesophagitis, some grade 3 and some grade 4, may require hospital admission with IV hydration and parenteral nutrition.
- Radiation pneumonitis is treated with steroids, and a troublesome cough may require strong cough suppressants such as opioids.

Prophylactic cranial irradiation (PCI)

Patient supine in a custom shell. Parallel-opposed fields covering whole cranium localised on Prosoma using a CT study.

2500 cGy Midplane Dose in 10 #s, 5 # a week

Palliative Intent

Palliative radiotherapy indications:

Thoracic radiotherapy to be considered post chemotherapy in patients with advanced or metastatic disease

For symptom control (haemoptysis, obstruction etc.) or in cases with poor performance status.

Single fraction or short fraction schedules are recommended but high dose palliative radiotherapy should be considered for patients with good PS.

PCI can be considered in good PS patients with advanced or metastatic disease who have a good response to chemotherapy

Avoid giving RT concurrent with immunotherapy (such as Atezolizumab in stage IV disease)

Dose and fractionation (Thorax)	Dose and fractionation (Brain)
800 – 1000 cGy in 1# or 2000 cGy in 5 fractions, 5 fractions a week (PS ≥2 or travelling long distance). 3000 cGy in 10 fractions, 5 fractions a week (PS < 2). For PS 0/1 3900 cGy in 13 fractions, 5 fractions a week with planned volume or 4000 cGy in 15 fractions with planned volume, 5 fractions a week 6 MV photons. Record any justification for using 10MV photons	For patients with brain metastases who did not have PCI. 2000 cGy Midplane Dose in 5 #s, 5 # a week or 3000 cGy Midplane Dose in 10 #s, 5 # a week. Use 6 MV photons only

Organs at risk

Radiotherapy Physics Technologists will routinely outline anatomical structures as indicated in the 'Lung Treatment Planning WI' (QWORK3.144). Where Dose Volume Histogram (DVH) information for other anatomical structures is required, the anatomical structure(s) will be outlined by the Consultant Clinical Oncologists or nominated Specialist/Speciality Registrars. It is the Consultant Clinical Oncologist's responsibility to review outlined OARs (amending if deemed necessary) when delineating.

- ***Spinal cord*** - The spinal canal (bony limits) should be contoured, before growing a 0.3cm PRV, to be used for dose reporting.

- ***Heart+A_Pulm*** - The whole heart should be contoured to include the pericardium, with the major blood vessels (superior to the organ) and the inferior vena cava (towards the inferior extent) excluded. The superior extent is the cranial aspect of the pulmonary artery, as visualised on coronal images (as per ADSCaN trial guidance).
- ***Normal lung*** - The PTV and field arrangement should be chosen to produce the lowest possible lung dose. Both lungs should be contoured as one structure using the pulmonary window. The GTV, liver, trachea/ipsilateral bronchus should be excluded from this structure. This is locally named 'R_Lungs'.
- ***Oesophagus*** - The entire oesophagus (mucosa, submucosa and all muscular layers out to the fatty adventitia) should be contoured as a solid organ from the lower border of the cricoid cartilage to the gastro-oesophageal junction.
- ***Brachial plexus*** - For upper lobe tumours, the major trunks of the brachial plexus should be contoured using the subclavian and axillary vessels as a surrogate for identifying the location of the brachial plexus. This neurovascular complex will be contoured starting proximally at C7 and following along the route of the subclavian artery ending after the neurovascular structures cross the 2nd rib. PRV is generated for Brachial Plexus with a 0.3cm isotropic margin.

If doses exceed the specified limits, a justification must always be recorded on the MOSAIQ notes – see tables of dose limitations below.

Dose Constraints

Please see 'Dose Constraints: LUNG (SCLC)' (QFORM3.166)

Treatment verification

Either Cone Beam CT (CBCT) or Electronic Portal Imaging (EPI) methods of verification may be carried out.

CBCT is the preferred method of IGRT for Physic led pathway patients. ProSoma-led Palliative cases and clinically marked patients generally receive 2D EPI Verification.

Details of the 2D EPI verification protocol are outlined in RTQW4009. CBCT Verification details are outlined in RTQW4130, RTQW4139.

Patients in radiotherapy trials will be imaged according to trial protocol; it is the responsibility of the Clinical Oncologist acting as Principal Investigator to check that any trial imaging requirements meet with the departmental imaging strategy. Any additional imaging dose required for the trial is to be justified (in the IR(ME)R sense.

Chemotherapy

Chemotherapy regimens for concurrent chemo-radiotherapy are available on ChemoCare, including dose modifications. Any delaying or changing chemotherapy during radiotherapy are to be authorised by a Lung Lead Consultant Clinical Oncologist.

Patient care

- It is recommended that patients undergoing radical radiotherapy start on a Monday to avoid lengthening overall treatment

- All patients receiving concurrent chemo-radiotherapy are to be scheduled for weekly FBC, LFT, U&E weight and review by either oncologist or review radiographer. The oncologist will review prior to each chemotherapy cycle
  Palliative patients receiving 5 or more fractions should be reviewed at least once during treatment.
- Patient symptoms such as pain, dyspnoea or any other toxicity of treatment should be recorded in Mosaiq.
- Check pre-radiotherapy Hb, should ideally be maintained to at least 100g/l th oughout treatment.
- Oesophagitis – treated according to severity.
- Patients should be warned about a dry cough, if troublesome, short course of steroids might be helpful.

During each review, the clinician should make a best clinical judgement with regard to continuing or stopping the treatment if the patient experiences severe side effects, after consultation with patient. **Dose modifications or delay to concurrent chemo-radiotherapy must be authorised by a Lung Lead Consultant Clinical Oncologist.**

Follow up arrangements

- Once treatment is completed radiotherapy team should inform Consultant secretary who will arrange appropriate FU
- Post treatment baseline CT scan is recommended at 3 months post treatment.
- Further follow up appointments will be 3-monthly for 1 year, and 4-6-monthly during 2nd and 3rd year, and annually thereafter.
- CXR, CT scan during follow up is requested at the discretion of the clinicians or MDT.

It is recommended to repeat the CT scan at the 1st anniversary of the completion of cCRT and annually thereafter.

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