PRIMARY CRANIAL TUMOURS

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PRIMARY OBJECTIVE AND SCOPE:
This combined document is intended to summarise the rationale, planning and treatment of patients receiving radical and palliative radiotherapy for primary cranial indications.
Responsibilities for the process are described within CD-L2-001

For stereotactic cranial radiotherapy see CD-L3-018.
For palliative radiotherapy for brain metastases see CD-L3-021
For patients requiring whole CNS treatment see CD-L3-002.
For Prophylactic Cranial Irradiation (PCI) for Small Cell Lung Cancer patients see CD-L3-021.

NB. NHS guidelines on proton therapy should be consulted for all patients under 25 years old and if appropriate, these patients should be considered for referral.

For Paediatric patients: the appropriate study protocol or CCLG (Children’s Cancer and Leukaemia Group) guideline or guidance from appropriate CCLG lead (which should be documented in the patient’s record) must always be used and given priority over this document. Please also use the department paediatric protocol in conjunction with this document (RTProt/Paed).

Current paediatric protocols/guidelines are usually available digitally and can be found on the OUH Trust intranet: Paediatric Haematology and Oncology - treatment protocols. In the absence of a Consultant Paediatric Clinical Oncologist please contact the Paediatric Oncology Consultant of the Week for advice via Kamran’s ward (01865 2)34068/9)

For rare tumours please see the BNOS /National Cancer Action Team: www.bnos.org.uk
Rare Brain and CNS Tumours. Guidelines on the diagnosis and management of:

1. Primary CNS and intra-ocular Lymphoma (PCNSL)
2. Optic Pathway Glioma (OPG)
3. Adult Pineal area tumours
4. Adult PNET
# Index

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indications - Radical</td>
</tr>
<tr>
<td>2</td>
<td>Indications - Palliative</td>
</tr>
<tr>
<td>3</td>
<td>Pre-Radiotherapy Investigations</td>
</tr>
<tr>
<td>4</td>
<td>Pre-Treatment</td>
</tr>
<tr>
<td>5</td>
<td>Volume Definition and Physics Planning – Radical</td>
</tr>
<tr>
<td>6</td>
<td>Therapeutic Schema - Radical</td>
</tr>
<tr>
<td>7</td>
<td>Volume Definition and Physics Planning – Palliative</td>
</tr>
<tr>
<td>8</td>
<td>Therapeutic Schema - Palliative</td>
</tr>
<tr>
<td>9</td>
<td>Quality Assurance and Approval Criteria</td>
</tr>
<tr>
<td>10</td>
<td>Treatment</td>
</tr>
<tr>
<td>11</td>
<td>Follow Up</td>
</tr>
<tr>
<td>12</td>
<td>Linked Documentation and Abbreviations/ Acronyms</td>
</tr>
<tr>
<td><strong>APPENDIX 1</strong></td>
<td>WHO Grade</td>
</tr>
<tr>
<td><strong>APPENDIX 2</strong></td>
<td>Document Development Checklist</td>
</tr>
</tbody>
</table>
1. INDICATIONS FOR RADICAL RADIOTHERAPY

WHO grading information is given in appendix 1

Low Grade Glioma (Astrocytoma, Oligodendroglioma, Ependymoma)

- Following evidence of disease progression on imaging
- Persistent symptoms difficult to control medically (e.g. seizures)
- Disease affecting a critical site (e.g. optic chiasm, spinal cord) at outset.
- Generally Ependymoma is treated following initial surgery rather than watch and wait

High Grade Glioma
(Glioblastoma, Anaplastic Astrocytoma, Anaplastic Oligodendroglioma, Anaplastic Ependymoma)

- Post op RT should be considered for all patients.
- Consider Temozolomide +RT for patients with GBM, PS ≤1, Age ≤ 70
- Consider Temozolomide alone (or following 34Gy in 10#) for GBM age >70, meth MGMT positive
- Consider hypofractionated RT (34Gy in 10# or 40Gy in 15#) GBM >70 years meth MGMT negative or unknown, or not for chemo PS 0-1
- Offer adjuvant post RT PCV x 6 chemotherapy for patients with anaplastic oligodendroglioma with 1p19q loss
- Consider BR14 trial for Grade 3 anaplastic astrocytoma or anaplastic oligodendroglioma (trial will include those without 1p19q loss but this is tested as part A of trial).

Meningioma

- Stereotactic radiotherapy should be considered where possible. See CD-L3-018.
- For incompletely resected disease in critical sites, or recurrent Grade 1 or Grade 2 Meningioma usually following second operation.
- Consider RT for all Grade 3 Meningioma (following complete/partial or no resection)

Pituitary Adenoma

- Stereotactic radiotherapy should be considered where possible. See CD-L3-018.
- Post op residual extra-sellar disease or continued hormone secretion despite surgery / medical therapy.
- Recurrent disease in patients who initially had surgery alone
- Stereotactic radiotherapy / radiosurgery can be considered for relapse >0.3cm from optic chiasm in patients who have undergone surgery and external beam RT (45Gy)

Craniopharyngioma

- Stereotactic radiotherapy should be considered where possible. See CD-L3-018
- Following partial resection or recurrence

Pineal Tumours

- Localised, non-metastatic MNGGCT following induction chemotherapy (See BNOS guidelines)
- Pineocytoma and Intermediate differentiation pineal tumour
Primary CNS Lymphoma (see www.bnos.org.uk for national guidelines and RTProt/ NHLL for detailed local protocol)

- Combined modality post chemotherapy in selected younger patients with complete response
- Residual disease resistant to methotrexate based chemotherapy
- Recurrent disease
- Elderly patients unfit for chemotherapy

(Avoid combining chemo and Radiotherapy in patients > 60 yrs due to high incidence of dementia)

Cranial RT for A.L.L

- Patients with CNS disease at presentation.
- Patients with an isolated CNS relapse on or off treatment who have not previously received radiotherapy.
  or
- Follow relevant clinical trial protocol.
  
- If CSF+ disease, patient to receive Whole CNS treatment following CD-L3-002

Retreatment

Retreating patients with intracranial tumours should be undertaken with caution, and following discussion with Prof Bleddyn Jones. Doses between 36Gy to 54Gy in 1.5-1.8Gy fractions may be considered. Time elapsed since previous treatment should be at least 1 year.

See ‘Retreatment of Central Nervous System Tumours’, Jones, B. and Grant, W., Clinical Oncology, August 2014

2. INDICATIONS FOR PALLIATIVE RADIOTHERAPY

- High grade Glioma not suitable for radical RT as outlined above (conventional or hypofractionated dose) ie all ages PS >=2.
- Primary CNS Lymphoma not suitable for radical RT.
- Other primary brain tumours not suitable for radical RT.

3. PRE-RADIOTHERAPY INVESTIGATIONS

- Pre and post op (where available) imaging (MRI or CT)
- FBC, Biochem all patients. Phenytoin levels in patients receiving this drug. NB Blood tests within 7 days of starting treatment for those receiving Temozolamide.
- Visual Fields within last 6 months for pituitary irradiation.
- Histological confirmation of diagnosis unless exceptional circumstances (for example for palliative radiotherapy where radiological diagnosis is certain and/or surgery is not indicated eg. skull base meningioma).
4. PRE-TREATMENT

Mould Room Process

Requirements
Head only Thermoplastic Mask
S-Frame
Headrest and 2 shims
High or Low Kneefix

METHOD

This thermoplastic mask procedure should be only be undertaken by a radiographer who has the appropriate competency in accordance with OCC-MR-L2-001.

4.1 Once the patient arrives in the Mould Room, they are identified following OCC-RT-L3-019.

4.2 The patient is asked to remove their outer upper body garments completely and to lie down in a supine position. Care must be taken to preserve patient dignity and modesty as much as is possible. Straighten the patient along their whole body, using the sagittal laser.

4.3 The majority of patients should be positioned supine with neck fully flexed. Occasionally it may be appropriate to use a prone shell for posterior lesions. For further guidance see Guidelines for Head and Neck Immobilisation OCC-PT-L4-008.

4.4 Arms are positioned by the sides, with the shoulders as far down (inferiorly) as possible.

4.5 A low knee support is placed in position as appropriate.

4.6 The Thermoplastic immobilisation device is made following MR Tutorial 13. However in addition note must be taken of the following:

- If the patient is anaesthetised, access will have to be cut in the mask prior to placing on the patient.
- The shell material is sticky when heated, so must be kept clear of any anaesthetic tubing or Naso-Gastric tubes.
- The headrest should normally be in position 1 if the tilt board is used, position 2 if without tilt board.

4.7 All the positioning information relevant to the set-up must be recorded on the patient planning details form, OCC-PT-L4-007c.

4.8 All parts of the individualised immobilisation equipment for use with a patient must be labelled with the patient’s name and NHS number on as a minimum. Following manufacture and labelling of the immobilisation devices, these can be moved to the CT scanner for the next stage of the process.
CT Planning Scan

- The planning CT will be conducted in the RT department following OCC-PT-L2-001.
- Use IV contrast in absence of contraindication at clinician request following OCC-PT-L3-016. This will be specifically requested on the planning request form (RT 4.4).
- Radical cranial patients will be scanned with ExacTrac CT markers in situ.
- Palliative cranial patients do not require ExacTrac CT markers.
- Virtual CT simulation when part brain is being irradiated.

Requirements

- S-frame, Headrest and 2 Shims
- Head only Thermoplastic Shell
- High or Low Kneefix
- Marking Tape
- Radio-opaque Markers
- Permanent Marker Pen
- Tattooing Equipment

METHOD

Whilst following OCC-PT-L2-001:

4.9 Prepare the couch with the relevant fixation board as specified on the information from mould room.

4.10 Explain the procedure to the patient so that they are fully aware of the procedure.

4.11 Position the patient on the CT couch following the information provided by mould room. Fit immobilisation shell, including an appropriate number of shims to ensure a good fit and document number of shims on set-up sheet (OCC-PT-L4-007c)

4.12 Any concerns regarding mask fit should be discussed with a Mould Room radiographer, Neuro Oncology Advanced Practitioner or pre-treatment Band 7 radiographer.

4.13 Using the LAP laser system ensure that the patient is straight, including the central ridge on the kneefix.

4.14 Use LAP laser system to mark Midline on the patient’s shell using white tape and black pen except where the shell is solid, then mark directly onto the thermoplastic.

4.15 Move the couch into the scanner until the LAP lasers are projected longitudinally over the region of interest or suitably stable point. Mark the intersection of the lasers both anteriorly and laterally using white tape (or directly onto the shell if the lasers project onto solid thermoplastic) and black pen. The anterior and lateral intersection points represent the anterior and lateral reference points.

4.16 Mark the horizontal and lateral laser lines with white tape and black pen on both sides of the shell.

4.17 Place radio-opaque markers on the anterior and lateral reference marks.

4.18 For radical patients only (including 40Gy in 15# or 34Gy 10#), place ExacTrac marker spheres on shell. Ideally 4-6 markers should be placed, taking care to ensure that they are not overlapping one another in any plane. See diagram below for guidance.
4.19 Marker sockets must be drawn around in case they move or fall off. Spheres must be removed after scanning and placed back in their storage container.

4.20 Ensure the lasers run through midplane of the patient in the area to be scanned.

4.21 Zero the couch to the LAP lasers.

4.22 Scan the whole head and neck using the appropriate CT scanner programme, as defined in OCC-PT-L4-006.

4.23 Ensure set-up details are entered and checked in ARIA. Place notes in the contouring basket.
5. VOLUME DEFINITION AND PHYSICS PLANNING – RADICAL CRANIAL RADIOTHERAPY (including hypofractionated RT)

Image Import and Registration
If there are multiple image data-sets required for treatment planning, import images as follows:
1. Primary data set CT Simulation.
2. Diagnostic MRI imaging for target delineation (named first by modality then by date e.g., MRgad_Jun09).

MRI -CT fusion
Diagnostic MRI images will be registered to the planning CT scan following OCC-RT-L3-010. The treating consultant shall review and approve the co-registration.

Outline – see RTProt/ CNS Contouring for details
- Orbit
- Lens
- Optic nerve, optic chiasm and brainstem
- Cochlea
- Pituitary
- Normal brain outside PTV
- Add a margin of 0.2cm to give the Planning Organ at Risk Volume (PRV) (OUH data) for orbit, optic chiasm, brainstem and optic nerves (no margin added for lens, cochlea, pituitary, normal brain outside PTV).
- Consider other adjacent normal tissues as appropriate.

Normal Tissue tolerance (maximum) doses: <2Gy/fraction
See QUANTEC papers Int. J. Radiation Oncology Biol. Phys., 2010 Vol. 76, No. 3, Supplement,

<table>
<thead>
<tr>
<th>Tissue</th>
<th>&lt;2Gy/fraction</th>
<th>34Gy/10# (α/β=2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optic chiasm</td>
<td>Dmax &lt;54 Gy (&lt;=2Gy#) Radiation induced optic neuropathy (RION) negligible</td>
<td>Dmax=40Gy</td>
</tr>
<tr>
<td></td>
<td>Dmax 54–60 Gy(&lt;=2Gy#) RION incidence 3-7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dmax &gt;60 Gy (&lt;=2Gy#) RION &gt;7–20%</td>
<td></td>
</tr>
<tr>
<td>Orbit</td>
<td>Dmax 50Gy in 2Gy #</td>
<td>Dmax=37Gy</td>
</tr>
<tr>
<td>Lens</td>
<td>Dmax 6Gy (2Gy #) &lt;1% risk cataract,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dmax 10Gy (2Gy#) 50% risk of cataract</td>
<td></td>
</tr>
<tr>
<td>Optic nerve</td>
<td>Dmax 54Gy</td>
<td>Dmax=40Gy</td>
</tr>
<tr>
<td>Brain stem</td>
<td>Dmax 54Gy (2Gy #) if entire brainstem is irradiated. Risk &lt;5%</td>
<td>Dmax=40Gy</td>
</tr>
<tr>
<td></td>
<td>V&gt;54Gy &lt; 10cc Dmax &lt; 59Gy (absolute volume receiving 59Gy &lt;= 10 cm³) risk &lt;5%</td>
<td></td>
</tr>
<tr>
<td>Cochlea</td>
<td>Dmax 45Gy</td>
<td>Dmax=33Gy</td>
</tr>
</tbody>
</table>
Treatment modality and energy
6 MV photons.

Usual field arrangement
Conformal Planning:
- Preferably at least three fields for radical brain treatment
- Reduce irradiation of contra-lateral hemisphere if possible.
- A three-field + beam arrangement reduces permanent hair loss.
- Shielding: Shield optic chiasm, lenses and field outside PTV.
- *Prescribe to ICRU reference point (100%)*

IMRT/RA Planning:
- may be used to achieve optimal dose distribution
- Prescription: 100% to PTV median dose
- 95% of prescription dose should cover PTV but may be compromised in order to meet PRV/OAR dose constraints. The following DVH parameters should satisfy for PTV: \( D_{99\%} \geq 90\%; D_{98\%} \geq 95\% \) (optional constraint); \( D_{95\%} \geq 95\%; D_{50\%} = 100\% \) and \( D_{2\%} \leq 107\% \).
- Refer to *CD-L3-018* for beam arrangements

See above table for PRV/OAR dose constraints.

6. **THERAPEUTIC SCHEMA: Radical Cranial Radiotherapy Prescription, Prescription Point and Target Definition**

Prescription doses for guidance only;
- For Adults, prioritise to relevant NCRI protocol if in existence
- For Paediatrics, see statement on page 1 re using CCLG and local paediatric protocols.
- Trial protocol should be followed for patients on BR14 trial for Grade 3 anaplastic astrocytoma or anaplastic oligodendroglioma without 1p19q loss.

<table>
<thead>
<tr>
<th>Malignant Glioma (Glioblastoma, Anaplastic Astrocytoma, Anaplastic Oligodendroglioma)</th>
<th>60Gy in 30 x2Gy fractions x5/week (GBM)</th>
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<tbody>
<tr>
<td></td>
<td>59.4Gy in 33 x1.8Gy fractions x5/week (Grade 3 or chiasm included in PTV)</td>
</tr>
<tr>
<td></td>
<td>34Gy in 10 x3.4Gy fractions or 40Gy in 15 x2.67Gy fractions x5/week (GBM ≥ 70 y.o. PS ≤ 1 Meth MGMT negative)</td>
</tr>
<tr>
<td></td>
<td>GTV = post op residual enhancing tumour and resection cavity. For grade 3 tumours include all T2 abnormality in the GTV (consider pre-op tumour volume)</td>
</tr>
<tr>
<td></td>
<td>CTV = GTV + 2.0cm including all T2 abnormality /oedema or to anatomical boundary (extend across mid line only if corpus callosum is involved),</td>
</tr>
<tr>
<td></td>
<td>PTV = CTV + 0.5 cm</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Meningioma Grade 1 (non-stereotactic protocol only)</th>
<th>54Gy in 30 x1.8Gy fractions x5/week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GTV = post op residual enhancing tumour and resection cavity. (consider pre-op tumour volume)</td>
</tr>
<tr>
<td></td>
<td>CTV = GTV + 1.0cm (Consider local infiltration into bone.)</td>
</tr>
<tr>
<td></td>
<td>PTV = CTV + 0.5 cm</td>
</tr>
</tbody>
</table>

Brain stem: 54Gy in 30 x1.8Gy fractions x5/week
<table>
<thead>
<tr>
<th>Meningioma Grade 2 or 3 (non-stereotactic protocol only)</th>
<th>59.4Gy in 33 x1.8Gy fractions x5/week or 60Gy in 30x 2Gy fractions x5/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GTV = post op residual enhancing tumour and resection cavity. (consider pre-op tumour volume) If bone is involved, a CT bone window setting is strongly advised. Clearly thickened dural tails and hyperostotic bones should be included whereas non-enhancing but thickened dura does not need to be included</td>
<td></td>
</tr>
<tr>
<td>• CTV = GTV + sub-clinical microscopic tumour which may include the pre-operative tumour bed, peritumoural oedema, hyperostotic bone changes, and dural enhancement or thickening as seen in the CT/MRI at diagnosis. An additional 3-dimensional margin of 1.0 cm along the meninges should be added limited by the patient skin surface. The margin should be reduced to 0.5 cm where this would extend into brain tissue unless there is evidence of invasion when the 1.0 cm margin should be maintained.</td>
<td></td>
</tr>
<tr>
<td>• PTV = CTV + 0.5 cm</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Grade Glioma, Localised Ependymoma (low and high grade anaplastic)</th>
<th>54Gy in 30 x1.8Gy fractions x5/week (Option to use 50Gy in 28#, clinical decision)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GTV = POST-OP tumour volume on T2 for glioma or T1+ contrast for meningioma (consider post and pre op imaging as well)</td>
<td></td>
</tr>
<tr>
<td>• CTV = GTV + 1.0cm or to anatomical boundary (extend across mid line only if corpus callosum is involved),</td>
<td></td>
</tr>
<tr>
<td>• PTV = CTV + 0.5cm</td>
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| Special sites: | 50 - 54Gy in 28 - 30 x1.8Gy fractions x5/week. Optic glioma: 54Gy in 30 x1.8Gy fractions x5/week. |

<table>
<thead>
<tr>
<th>Pituitary Adenoma (non-stereotactic protocol only)</th>
<th>45Gy in 25 x1.8Gy fractions x5/week or 50Gy in 30 x1.67Gy fractions x5/week for large Macroadenomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GTV = POST-OP tumour volume (consider post and pre-op tumour volume imaging as well).</td>
<td></td>
</tr>
<tr>
<td>• CTV = GTV + whole cavernous sinus if involved</td>
<td></td>
</tr>
<tr>
<td>• PTV = CTV + 0.5cm</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Craniopharyngioma (non-stereotactic protocol only)</th>
<th>50Gy in 30 x1.67 Gy fractions x5/week (54Gy in 33 x1.64 Gy fractions x5/week for selected large cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GTV = POST-OP tumour volume (consider post and pre op tumour volume imaging and cystic portion).</td>
<td></td>
</tr>
<tr>
<td>• CTV = GTV</td>
<td></td>
</tr>
<tr>
<td>• PTV = CTV + 0.5cm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Malignant Non-Germinomatous Germ cell tumour (Secreting NGGCT) Pineocytoma and Intermediate differentiation pineal tumour</th>
<th>54Gy in 30 x1.8Gy fractions x5/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>• GTV = visible residual tumour and /or tumour bed</td>
<td></td>
</tr>
<tr>
<td>• CTV = GTV + 1cm</td>
<td></td>
</tr>
<tr>
<td>• PTV = CTV + 0.5cm</td>
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</table>

| Primary CNS Lymphoma | Refer to Lymphoma protocol: RTProt/ NHL Non-Hodgkin Lymphoma |

TVCN Primary Cranial Radiotherapy

Version 6

Issue Date: 23.02.2016

Page 10 of 18

DO NOT PHOTOCOPY
7. VOLUME DEFINITION AND PLANNING – PALLIATIVE CRANIAL RADIOTHERAPY

See OCC-PT-L3-001 Palliative Treatment Planning for guidance on Virtual Simulation or planning on the Acuity Simulator.

**Image Import and Registration**

The consultant may occasionally request diagnostic MRI images to be fused to aid palliative cranial radiotherapy planning.

If there are multiple image data-sets required for treatment planning, import images as follows:

1. Primary data set CT Simulation.
2. Diagnostic MRI imaging for target delineation (named first by modality then by date e.g., MRgad_Jun09).

**MRI -CT fusion**

Diagnostic MRI images will be registered to the planning CT scan following OCC-RT-L3-010. The treating consultant shall review and approve the co-registration.

**Normal Tissues to be outlined**

None

**Usual field arrangement**

Whole Brain or part brain – opposed fields.

**Treatment modality and energy**

6MV Photons

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8. THERAPEUTIC SCHEMA: Palliative Cranial Radiotherapy Prescription, Prescription Point and Target Definition

<table>
<thead>
<tr>
<th>High Grade Glioma</th>
<th>30Gy in 6 x5Gy fractions over 2 weeks to 100% (all ages, PS 2-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GTV = contrast enhancing tumour from pre-op imaging</td>
</tr>
<tr>
<td></td>
<td>Field edge = GTV + 3.0cm including T2 abnormality/oedema</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary CNS Lymphoma plus other primary brain tumours not suitable for radical RT</th>
<th>Refer to Lymphoma protocol: RTProt/ NHL Non-Hodgkin Lymphoma</th>
</tr>
</thead>
</table>
9. QUALITY ASSURANCE AND APPROVAL CRITERIA

- Prior to signing off the plan as approved, a thorough review and evaluation shall be performed ensuring plan meets department policy by all members of the interdisciplinary team.
- All radical brain contouring to have second check by appropriately entitled clinician and annotate in patient notes/task pad.
- Physics to perform a plan check as per OCC-PP-L4-510.
- QA of IMRT or RapidArc plan is carried out following OCC-PDS-L3-044 or OCC-PDS-L3-049 respectively.
- Physics to perform a plan check as per OCC-PP-L4-510.
- QA of IMRT or RapidArc plan is carried out following OCC-PDS-L3-044 or OCC-PDS-L3-049 respectively.
- Data entry and checks are carried out following OCC-RT-L2-012
- ExacTrac Patient Data Preparation will be carried out by entitled treatment radiographers ahead of patient treatment following OCC-VI-L3-025

10. TREATMENT

Scheduling and Review on Treatment

All radical cranial patients are treated as category 2 with the exception of medulloblastoma (category 1).

All patients must be scheduled to start their radiotherapy on a Tuesday so that this ties in with the weekly clinic review or as per external protocol.

Patients receiving concurrent radiotherapy will also be dispensed with Temozolomide at clinician review on a Tuesday or as per external protocol. Tablets will be taken on an empty stomach.

All cranial patients must be reviewed weekly by the clinician, Neuro Oncology Clinical Nurse Specialist or Neuro Oncology Advanced Practitioner Radiographer. Steroid dose to be monitored closely during and following radiotherapy; lower slowly if no symptoms of raised intra-cranial pressure.

Patients receiving Temozolomide under the BR14 trial must have radiotherapy at least 1 hour after taking their Temozolomide as per trial protocol. Contact the Neuro Oncology Advanced Practitioner or Research Radiographers if it is not clear which arm of the trial the patient has been randomised to.

Blood Tests on Treatment

- Weekly FBC and U+E and LFT (+/- phenytoin/glucose levels if requested) for those receiving concomitant Temozolomide.
- Patients receiving Temozolomide under the BR14 trial will have weekly blood tests as above. However on weeks 4 and 6 these patients will have FBC, U&E, LFT, Glucose and Urea, Ca, Alk Phos,TP, Cr, GGT, ALT, AST, LDH checked as per trial protocol.

Treatment Verification and Delivery

- Refer to the departmental verification imaging policies (see OCC-VI-L2-001 and OCC-VI-L3-001)
PREPARATION
The patient should remove bulky top clothing; a thin t-shirt type layer is acceptable provided there is no bunching around the neck.

Prepare the treatment couch, including any immobilisation devices, as instructed on the in room monitor.

If the accessory tray is required, attach the accessory mount to the linear accelerator.

Check the patient is straight from the end of the couch.

Treatment will be delivered following OCC-RT-L2-001 Delivery of External Beam Radiotherapy after the patient has been correctly identified following OCC-RT-L3-019 Patient Identification procedure.

METHOD
1. Where applicable, ExacTrac IR marker spheres must be attached to the ExacTrac sockets on the patient’s shell before it is fitted to the patient – gloves must be worn to protect the infra-red coating on the marker spheres.
2. Position the patient as per the instructions on the in-room monitor ensuring they are straight and level.
3. Fit the patient’s shell and attach to the fixation system, verifying the fit of the shell.
4. Align reference marks to lasers and perform movements to the isocentre in the x, y and z dimensions, or carry out ExacTrac pre-positioning if appropriate as per OCC-VI-L3-021.
5. Set all parameters required for first treatment field as specified on the in-room monitor.
6. Verify treatment field F.S.D corresponds to that given on the protocol.
7. Verification imaging must be taken in line with current protocols (OCC-VI-L2-001).
   If the patient is being treated on Varian 5, ExacTrac imaging and correction should be carried out by entitled staff as per OCC-VI-L3-021 with tolerances and work flow as per OCC-VI-L3-02p.
8. Position InViDos diodes (if required) according to OCC-RT-L2-003.
9. Eye TLD’s are not routinely required but may be requested by the clinician and should be positioned accordingly (at beginning of treatment course) as per OCC-TLD-L3-010.
10. Treatment is delivered following OCC-RT-L2-001.
11. Treat the remaining field(s) by repeating steps 1.5 to 1.10.

Tolerances and Problems
If the shell fits badly, after hair loss or reduction in swelling, an adjustment to the original shell may be required. In either case a new CT plan may be required. Guidance should be sought from the Neuro Oncology Advanced Practitioner.

11. FOLLOW UP

Patients will be followed up at outpatient clinic at their local regional hospital. Timeframe specified by consultant or as required for adjuvant chemotherapy regimens. Follow up MRI to be scheduled around 8 -12 weeks post-radiotherapy.
LINKED DOCUMENTATION

CD-L2-001 Responsibilities for the Patient Pathway for Combined Disease Site Specific Protocols
CD-L3-002 Whole CNS Combined Protocol
CD-L3-018 Stereotactic Cranial Irradiation Protocol
CD-L3-021 Cranial Irradiation for Palliative Whole Brain for Metastases and Prophylactic Whole Brain for SCLC
OCC-CL-L2-001 Justification for Exposures Related to Therapeutic Radiation
OCC-CL-L2-003 Patient consent
ICRU 50
ICRU 62
OCC-EB-L4-004 Radical Brain Radiotherapy Treatment Delivery Competency
OCC-MR-L2-001 Mould Room Process
OCC-PDS-L3-044 IMRT patient plan QA
OCC-PDS-L3-049 RapidArc Patient plan QA
OCC-PP-L2-001 Planning Management and Responsibilities
OCC-PP-L2-002 Flow of Treatment Planning Information
OCC-PP-L4-510 IMRT Plan Check
OCC-PT-L2-001 Planning of External Beam radiotherapy – CT Scanner
OCC-PT-L2-002 Planning Radiotherapy – Acuity Simulator
OCC-PT-L3-001 Palliative Treatment Planning
OCC-PT-L3-016 Intravenous Injection of Non-Ionic Contrast Media by Radiographers for CT Planning Investigations
OCC-PT-L4-006 Radical Planning Scan
OCC-PT-L4-007c Head and Neck/ Brain Set-Up Information – S frame and Laminate board
OCC-PT-L4-008 Guidelines for Head and Neck Immobilisation
OCC-RT-L2-001 Delivery of External Beam Radiotherapy
OCC-RT-L2-003 Use of In-Vivo Dosimetry
OCC-RT-L2-012 Data Procedure for Linear Accelerator Treatments
OCC-RT-L3-010 Radiotherapy Image Fusion Work Instruction
OCC-RT-L3-019 Patient Identification Procedure
OCC-TLD-L3-010 TLD Dosimetry, instructions for radiographers
OCC-VI-L2-001 Operator Led, Practitioner Directed Verification Imaging
OCC-VI-L3-001 Verification Imaging Tolerances and Frequency of Imaging
OCC-VI-L3-021 ExacTrac Imaging using Body Markers
OCC-VI-L3-025 ExacTrac Patient Data Preparation
MR Tutorial 13 Making a Zentec Thermoplastic Shell
Pregnancy Policy
RT 4.4 Radiotherapy Planning Request form
RTProt/ CNS Contouring Normal Tissue Contouring for CNS Tumours
RTProt/NHLL Non Hodgkin Lymphoma
RTProt/ Paed Paediatric Radiotherapy Excluding Whole CNS
Abbreviations and Acronyms

**Alk Phos**  Alkaline Phosphatase

**ALL**  Acute Lymphoblastic Leukaemia

**ALT**  Alanine Aminotransferase

**AST**  Aspartate Aminotransferase

**Biochem**  Biochemistry

**BNOS**  British Neuro Oncology Society

**Ca**  Calcium

**CCLG**  Children’s Cancer and Leukaemia Group

**cm**  centimetre

**Cr**  Creatinine

**CSF**  Cerebro Spinal Fluid

**CNS**  Central Nervous System

**CT**  Computed Tomography

**CTV**  Clinical Target Volume

**FBC**  Full Blood Count

**GBM**  Glioblastoma Multiforme

**GGT**  Gamma-glutamyl Transpeptidase

**GTV**  Gross Tumour Volume

**Gy**  Gray

**IV**  Intra Venous

**LAP**  Laser Anatomical Positioning

**LDH**  Lactic Acid Dehydrogenase

**LFT**  Liver Function Tests

**MGMT**  Methylguanine Methyltransferase

**MNGGCT**  Malignant Non-Germinomatous Germ Cell Tumour

**MRI**  Magnetic Resonance Imaging

**MV**  Megavoltage

**NCRI**  National Cancer Research Institute

**OUH**  Oxford University Hospitals

**PCI**  Prophylactic Cranial Irradiation

**PNET**  Primitive Neuro Ectodermal Tumours

**PS**  Performance Status

**PTV**  Planning Target Volume

**RION**  Radiation Induced Optic Neuropathy

**RT**  Radiotherapy

**TP**  Total Protein

**U+E**  Urea and Electrolytes

**WHO**  World Health Organisation

**y.o.**  Years Old

<  less than

≤  less than or equal to

>  greater than

≥  greater than or equal to

#  fractions
### Appendix 1

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<th>WHO Grade</th>
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### Appendix 2: Document Development Checklist

This checklist is to accompany all newly written or reviewed clinical procedural documents. In order to enable approval, the following criterion is considered to ensure compliance with set standards for document development. Should some elements not be fulfilled, the document author may be asked to make necessary changes prior to resubmission for approval.

<table>
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<tr>
<th>Title of Document Being Reviewed: Radiotherapy Protocol: Primary Cranial Tumours</th>
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<th>Question</th>
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<tbody>
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<td>Is the document title clear and unambiguous?</td>
<td>Yes</td>
</tr>
<tr>
<td>Is the document correctly and consistently defined as a Policy, Procedure, Protocol, Guideline or Strategy?</td>
<td>Yes</td>
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**Rationale**

Are the reasons for the development of the document stated? Yes

**Document Development Process**

<table>
<thead>
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<td>Consistent with RT Dept quality system documentation</td>
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<tr>
<td>Do all pages have appropriate branding and header and footer content?</td>
<td>Yes</td>
</tr>
<tr>
<td>Have contributors to the development of the document been identified?</td>
<td>Yes</td>
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<tr>
<td>Is there evidence that relevant expertise has been used in developing the document?</td>
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<tr>
<td>Have links to national guidance and/or CQC Standards been identified?</td>
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<td>If the document relates to or has implications for medications, has advice and approval be sought from the relevant medicines committee?</td>
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**Evidence**

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<tr>
<td>Are links to other associated OUH procedural documents or information sources included?</td>
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**Content**

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**Dissemination and Implementation**

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<td>Are there processes detailed for monitoring the implementation and effectiveness?</td>
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<td>Have any training needs been identified and planned for?</td>
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**Additional Information**

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<tr>
<td>Does the document have a review date?</td>
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**Approval & Responsibility**

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<td>Does the document identify the relevant committee or group who will</td>
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<tr>
<td>approve it?</td>
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<td>Is the lead Director correctly identified?</td>
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**Comments**

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**Clinical Policy Group or Delegated Group for Approval:**

If the Clinical Policy Group (CPG) or delegated group for approval is happy to recommend this document for ratification, enter group details below. The Document will then be forwarded to the relevant committee for final ratification prior to publication.

**Name of Committee:** Locally approved document (see page 1)

**Date of Meeting:**

**Final Committee Ratification**

<table>
<thead>
<tr>
<th>Name of Committee</th>
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Once this checklist is completed, please return it electronically in Word or .doc format to the Clinical Governance Unit using the email policies@ouh.nhs.uk.

This checklist should accompany the document awaiting approval and be included in appendices.

Once the submitted document has received full approval and ratification, the Clinical Governance Unit will subsequently ensure publication via the OUH intranet.

Clinical Procedural Document Checklist Jan 2014 Version 2.0