CANCERS OF THE CENTRAL NERVOUS SYSTEM

PREFERRED MODEL OF CARE AND CRITERIA FOR REFERENCE CENTRES

Coordinator: Tom Boterberg (radiation oncology, Ghent University Hospital)

Authors : Jean-Francois Baurain (University Hospital St.-Luc Brussels, medical oncology), Tom Boterberg (Ghent University Hospital, radiation oncology), Paul Clement (University Hospital Leuven, medical oncology), Jean-François Daisne (Clinique & Maternité Ste-Elisabeth Namur, radiation oncology), Philippe David (Erasme Hospital Brussels, radiology), Steven De Vleeschouwer (University Hospital Leuven, neurosurgery), Catherine Godfraind (University Hospital St.-Luc Brussels, pathology), Ingeborg Goethals (Ghent University Hospital, nuclear medicine), Martin Lammens (University Hospital Antwerp, pathology), Florence Lefranc (Erasme Hospital Brussels, neurosurgery), Nick Liefhooghe (Groeninge Hospital Kortrijk, radiation oncology), Paul Meijnders (Middelheim Hospital Antwerp, radiation oncology), Micheline Mouchamps (Citadelle Hospital Liège, neurosurgery), Bart Neyns (University Hospital Brussels, medical oncology), Laurette Renard (University Hospital St.-Luc Brussels, radiation oncology), Isabelle Salmon (Université libre de Bruxelles, Hospital Erasme, pathology), Frank Van Calenbergh (University Hospital Leuven, neurosurgery), Ludo Vanopdenbosch (Hospital St.-Jan Brugge, neurology), Frank Weyns (Hospital East Limburg Genk, neurosurgery), Nicolas Whenham (Hospital St.-Pierre Ottignies, medical oncology)

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- **Hospitals with which coordinators and authors of these proposals are affiliated are not de facto considered Reference Centres. Similarly, Belgian hospitals that are not represented in these proposals are not de facto considered Peripheral Centres.**
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- **This addendum only exists in English. No French or Dutch translation was done.**
- **Finally, the report to which this addendum refers has been approved by common assent by the Executive Board.**

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A. Type of cancer

Group 1: ependymoma, medulloblastoma, embryonal tumours of Central Nervous System (CNS), choroid plexus carcinoma, atypical and malignant meningioma, paraganglioma, nerve (sheath) tumours, intradural spinal tumours, skull base tumours

Group 2: astrocytoma (all grades, including glioblastoma), oligodendroglioma, oligo-astrocytoma

B. Short description of the cancer

Although somewhat artificial, the division in two groups tries to take into account both the incidence or need for complex care and all types of treatment that may be required for this disease. The tumours of group 1 are rare to extremely rare with less than 30 cases of each type per year in Belgium. The tumours of group 2 are more frequent, though at an incidence of around 6 per 100 000. Additionally, most of the tumours of group 1 also require multidisciplinary high level care and therefore qualify to be treated in reference centres only. Most of both types of tumours occur in the brain (astrocytoma, oligodendroglioma, oligo-astrocytoma, medulloblastoma, embryonal tumours, choroid plexus carcinoma), some can occur both in the brain and spine (ependymoma, atypical and malignant meningioma). Intradural spinal tumours obviously only occur in and around the spinal cord, paragangliomas and nerve (sheath) tumours can occur at different sites and skull base tumours are a mixture of different types of histopathology, but are all located in or at the base of the skull.

In contrast to other types of cancer, distant metastases almost never develop in these tumours, except for malignant nerve (sheath) tumours. So-called drop metastases along the spinal cord, however, are frequently seen in medulloblastoma, ependymoma and embryonic tumours. The neurological symptoms are mainly dependent on the location where these tumours develop.

Although some tumours of group 1 can be very aggressive at presentation (like metastatic embryonal tumours), when appropriately treated, their prognosis is usually good, in contrast to the high grade gliomas like glioblastoma or anaplastic astrocytoma, which represent the majority of tumours of group 2. There has been some improvement in the treatment results of high grade tumours in the last decennium, but long term survival (i.e. 5 years or longer) is still exceptional and below 5%, especially if one includes all cases and not only trial-eligible patients.

C. Model of care pathway suggested for adult patients with brain tumours

	Model of care pathway	Preferred model
1.	Model 1: Reference Centres exclusively (from diagnosis to follow-up). Once there is a suspicion of the brain cancer or the brain cancer has been diagnosed, the patient should be referred to a Reference Centre. A network with other Reference centres or with specific experts working in other centres is encouraged.	
2.	Model 2: Shared care between Reference Centres and peripheral hospitals. Part of the care pathway is performed in the Reference Centre and for another part of the care pathway the patient is referred (back) to the peripheral centre.	X

D. Phase(s) of the clinical pathway for which Reference Centres are required

Phase of the Clinical Pathway	Reference Centre	Peripheral Centre
1. MOC	**Group 1 and 2**	
2a. Diagnostic confirmation (AP)	**Group 1 and difficult or unclear cases from group 2**	**Group 2**
2b. Diagnostic confirmation (anatomical imaging)		**Group 1 and 2**
2c. Diagnostic confirmation (functional and metabolic imaging)	**Group 1 and 2**	
3. Comprehensive AP diagnosis, including molecular pathology and genetics	**Group 1 and 2**	
4. Therapeutic modalities		
• Surgery	**Group 1 and cases from group 2 requiring special expertise due to location of tumour**	**Group 2**
• Radiotherapy	**Group 1 and difficult cases from group 2**	**Group 2**
• Chemotherapy	**Group 1, clinical trials for group 1 and 2**	**Group 2**
5. Follow-up	**Difficult cases from group 1 and 2, patients in clinical trials**	**Group 1 and 2**
6. Medical genetics counselling	**Specific tumours from group 1**	

Multidisciplinary Oncological Consult: Reference Centre

All newly diagnosed patients with a (suspected) tumour of group 1 or 2 are to be discussed at the MOC. The initial MOC can take place at a Peripheral Centre, but has to be confirmed or advised by a second opinion MOC at a Reference Centre and may need to take place after initial surgery in some cases. The MOC at the Reference Centre should take place at least once a week and involve all disciplines that are needed to come to a final diagnostic and/or treatment plan: pathology, neuro-radiology, nuclear medicine, oncology, radiation oncology, neurosurgery, neurology, all with sufficient expertise in diagnosis and therapy of brain and nerve tumours. The physician in charge of the patient, if not one of the before mentioned, equally has to attend the MOC meeting. It is indispensable that all are present at the same time, although teleconference techniques may not require the physical presence of each. The presence of the general practitioner and other specialists involved in the diagnosis and treatment of the tumours in group 1 and 2, like medical geneticists, is highly recommended.

Diagnostic confirmation: Reference Centre

The techniques mentioned require specific expertise and equipment of which availability is limited to Reference Centres, allowing enough expertise and cost-effectiveness.

1. Complexity and new approaches: functional imaging (functional MRI, tractography), metabolic imaging (PET-scan with specific tracers) to allow image-guided biopsy
2. Facilities and equipment required: dedicated MRI, PET-scan
3. Professional expertise required both to perform the diagnostic procedure and to interpret the results: dedicated neuro-radiologists and nuclear medicine specialists

Comprehensive AP diagnosis: Reference Laboratory

The techniques mentioned require specific expertise and equipment of which availability is limited to Reference Centres, allowing enough expertise and cost-effectiveness. The requirements for AP reference laboratories are described in more detail in the model developed by the separate pathology group of this rare tumours project (see synthesis).

1. Complexity and new approaches: immunohistochemistry with rarely used antibodies, molecular pathology, genetic analysis
2. Facilities and equipment required, use of new technology to predict a tumour's aggressiveness or its response to certain forms of therapy, as well as to identify genetic abnormalities in some tumours: dedicated immunohistochemistry equipment, genetic analysis including FISH, chromosomal analysis, genetic sequencing or any other innovative technique
3. Expertise required both to perform the cell or tissue sampling and to interpret the results: dedicated neuropathologists, geneticists, molecular pathologists. Easy access to a dedicated neuro-radiologist is also highly recommended since for accurate diagnosis of some tumours, confrontation between radiology and pathology is mandatory.

Therapeutic modalities: Hospital with a program in oncology or Reference Centre according to the group of tumours and therapeutic modality (see table)

1. Complexity and expertise required: as described in table
2. Facilities and equipment required: as described below
3. Para-medical expertise required: clinical nurse specialists, dieticians, physiotherapists, psychologists, dedicated neuropsychologists both for neurocognitive testing as for psychosocial rehabilitation

Follow-up: Hospital with a program in oncology or Reference Centre according to the group of tumours and specific situation (see table)

1. Complexity: in most cases, follow-up can be done at a Peripheral Centre. In case of doubt about the evolution on imaging or suspicion of relapse, the patient should be discussed again at the MOC at the Reference Centre.
2. Facilities and equipment required: similar to those described at diagnosis
3. Medical expertise required: in case of suspicion of progression or relapse, similar to the situation at diagnosis

4. Para-medical expertise required: clinical nurse specialists, dieticians, physiotherapists, psychologists, dedicated neuropsychologists both for neurocognitive testing as for psychosocial rehabilitation

E. General and specific criteria for Reference Centres

Human Resources and dedicated team

- Specialized medical staff: in a reference centre, for every involved medical specialty, at least one specialist should focus on brain tumours and should be identifiable as an expert in brain tumours for that specific medical specialty. This expert should take the responsibility for all brain tumour issues related to his/her specialty including clinical, scientific and educational activities, quality issues and quality assurance and all patient centred aspects. This expert should be present at the MOC.
- There should be at least 2 neurosurgeons who spend at least 50% of their activities in neuro-oncological surgery and are regularly involved in dedicated specialty clinics caring for brain and nerve tumour patients.
- The neuro-radiologist(s) should spend at least 50% of his activities in the practice of neuro-radiology.
- The neuro-pathologist(s) should be an accredited pathologist who has specialist expertise in neuro-oncology, and takes part in the national Quality Assurance programme.
- The neurologist(s) should have expertise in neuro-oncology, epilepsy, neuro-rehabilitation and care of patients with neurological consequences of a CNS tumour and/or of its treatment.
- There should be at least 3 FTE radiation oncologists, of whom at least 1 has specific expertise in treating brain and nerve tumours. The radiotherapy centre should fulfil the national requirements regarding number of radiographers and medical physicists.
- There should be at least 3 FTE medical oncologists, of whom at least 1 has specific expertise in treating brain and nerve tumours.
- In addition to the medical specialties described above that participate to the MOC, at least one of each of the following should be available: anaesthesiologists, intensive care specialists, pain clinic specialists, medical geneticists, rehabilitation specialists, palliative care specialists. They should all have expertise in treating brain tumour patients and spend a specified time for the care of CNS tumour patients.
- The paramedical members of the multidisciplinary management group include: clinical nurse specialists, dieticians, physiotherapists, psychologists, dedicated neuropsychologists both for neurocognitive testing as for psychosocial rehabilitation, ward nursing, speech and language therapists, palliative care nurses, occupational therapists, community palliative nursing, data management nurses, a MOC coordinator/secretary. All should have specialist knowledge of CNS tumours and spend a specified time for the care of CNS tumour patients.
- The multidisciplinary management (including all medical and paramedical specialties) should be adequately described: procedures for MOC, description of specialists involved in the MOC, necessary audiovisual facilities to discuss diagnostic and examination results during a MOC session, documentation of discussion process and results.

Required facilities and equipment

- Surgery: all equipment and facilities (intra-operative monitoring etc.) for major neurosurgery and related anaesthesiology infrastructure. Surgery has to be performed in a single, one campus located facility
- Dedicated intensive care unit, allowing clustering of neurosurgery patients
- Dedicated neurosurgical ward, allowing clustering of neurosurgery patients
- Radiotherapy: at least 2 linear accelerators with on board imaging, CT-simulation, appropriate immobilisation devices, IMRT, access to MRI and nuclear imaging for fusion, dedicated stereotactic radiosurgery equipment and treatment planning software. Radiotherapy should be restricted to one site. The centre should take part in the national quality assurance programme.
- Chemotherapy: sufficient equipment to allow in and outpatient treatment as well as clinical trials.
- Interventional radiology and all imaging modalities: as described above
- Reference laboratory for pathology: as described above
- Fully integrated electronic medical file

Patient centred care

- A reference centre should offer emergency management (including emergency surgical procedures, imaging and pathological diagnosis) 24/24 h and 7/7 d. A Reference Centre should be able to offer a new non-urgent patient a consultation for intake within one week after referral.
- Continuity of care: care should be covered 7 days a week by specialised staff. Agreements concerning the continuity of care should be written.
- Any centre not being able to offer emergency management and/or continuity of care should make arrangements with a Reference or Peripheral Centre to refer brain tumour patients at any time.
- It is important that patients are supported from diagnosis through the entire pathway with appropriate neuro-rehabilitation support. Rehabilitation care pathways provide a model for this support and cover the acute, community and primary care settings. There should be appropriate assessment of patients' rehabilitative needs across the pathway and the provider must ensure that high quality neuro-rehabilitation is provided.
- Support services for the patient include: identification of a care coordinator/clinical nurse specialist, support for patient's information, link with patient's associations, specific website for patients / professionals, ...
- The general practitioner should be involved as much as possible.
- Supportive and palliative care: patients who require palliative care will be referred to a palliative care team in the hospital and the team will be involved early to liaise directly with the community palliative services. Specialist palliative care advice should be available on a 24 hour, seven days a week basis.
- National and international networking with other Reference Centres with appropriate arrangements for referrals within Belgium and from/to other EU countries if applicable is highly recommended.
- Shared care: formal links with other hospitals, specialists and general practitioners should be made, considering E-Health solutions e.g. shared case management systems, expert systems for tele-expertise and shared repository of cases.

- Organisation of collaborations to assure the continuity of care between childhood, adolescence and adulthood, as some brain tumour patients may be treated as a child, but will need continued follow-up as an adult.

Minimal volume of patients

There are no evidence-based data on a minimal volume of patients treated which may influence quality of care for brain tumours. At least for surgery it is not possible to define a sharp threshold in mortality outcome. Using the Nationwide Inpatient Sample hospital discharge database for the years 1988 to 2000, which represented 20% of inpatient admissions to non-federal U.S. hospitals, investigators found that large-volume hospitals had lower in-hospital mortality rates after craniotomies for primary brain tumors (odds ratio [OR] = 0.75 for a tenfold higher caseload; 95% confidence interval [CI], 0.62–0.90). Centres with 5 or less procedures per year have a mortality rate of 4.5%, while this is 1% in centres treating 42 patients per year. Moreover, not only the surgical volume is important, ICU expertise is equally important and volume figures should always be linked to quality and quality assurance.

Based on these figures, the group suggests a minimum number of around 40 patients per year to be treated in Reference Centres

Quality Assurance

- Exhaustive and reliable information sent to Cancer Registry
- Development of clinical guidelines for diagnosis and management with regular updates
- Compliance with existing guidelines and documentation of deviations from guidelines
- Involvement in quality initiatives (e.g. benchmarking, audits)
- Annual activity report ensuring transparency detailing the number of new patients / type of cancer per year; diagnostic, treatment and outcome data; specific protocols for reporting and recording complications
- Capacity to propose quality indicators (structure, process, outcome)

Research and other scientific activities

- Involvement in national and international clinical studies (RCTs, cohort studies, translational studies) in the primary management of CNS tumour patients and at relapse.
- Publications in peer-reviewed journals and grants obtained for scientific and/or clinical research projects by at least three of the members of the reference centre are highly recommended.
- Link with a tumour bank

Educational activities: Teaching and dissemination of expertise

- Involvement in training and continuous education programs with at least the organisation of an annual or preferably more frequently training or educational programme for medical specialists in training, medical specialists, general practitioners, nurses, supportive disciplines together or for a more specified audience, but always with emphasis on a multidisciplinary approach.
- Organisation of and/or communications at national and international scientific congresses by at least three of the members of the reference centre are highly recommended.

Additional comments

The current management of brain tumours in Belgium may be quite different from the model that is proposed here. Implementation of this model is not possible as of tomorrow. A transition period of 3 to 5 years seems reasonable to allow adapting the organisation of care to deal with brain tumours according to this model. It is equally important that after this period, the model is re-evaluated and necessary adaptations are discussed again. Reference centres (or rather reference networks) will need to arrange themselves according to the requirements mentioned above. Peripheral centres will need to set up collaborations with reference centres to offer the patients efficient and dedicated care in a reasonable time frame. Finally, in order to increase the chances that this model can be successfully implemented, it is highly recommended that some incentive or other form of facilitation is created to encourage referral and collaboration between peripheral and reference centres and/or between different sites of reference networks.

The training programme of some specialties will need to be adapted to increase the familiarity with brain tumours and their management in order to form dedicated brain tumour specialists. It is beyond the scope of this project to define the criteria for this. Finally, this model will also have financial implications. Especially, for pathology and radiology, it seems mandatory to compensate the additional workload and deployment of personnel and equipment, which is currently not reimbursed, or only to a very limited extent. The same is true for the quality assurance programme described in E.5. which is hardly possible with the current financial and human resources.