Improving Outcomes in Brain and Other CNS tumours

Draft Guidance

Contents

Foreword

1. This is the latest guidance document in the *Improving Outcomes in Cancer* series and gives advice on the service arrangements for patients with brain and other CNS tumours. The great majority of patients whose care is covered by this guidance have malignant brain tumours and some of the most important recommended changes largely apply to them. This is a group of patients whose care is currently often fragmented and uncoordinated, and who may face a lengthy period of physical and cognitive decline following their initial treatment, often without access to appropriate support and rehabilitation. I hope that the recommendations in the guidance will be seen as a constructive way of trying to improve this situation.

2. In addition there is guidance on the management of patients with the less common tumours of the CNS, some of whom require access to very specialised services and many of whom would benefit from more consistent care across the country. There are some very specific recommendations in this area.

3. I am very grateful to all the members of the guidance development group, especially the chair, Dr Penny Bridger, and the lead clinician, Dr Sean Elyan, who all gave so much of their time to the development of the guidance. I hope that all their hard work will be rewarded by significant improvements in the way that care is organised and delivered and, eventually, in clinical outcomes for these patients.

4. Dr Fergus Macbeth

5. Note: The title of the guidance uses the term ‘brain and other CNS tumours’. This term is used once in each chapter but thereafter, for the sake of brevity, the term ‘CNS tumours’ is used, unless a specific group of patients is being referred to (e.g. ‘pituitary tumours’ or ‘base of skull tumours’.)

Key recommendations

6. • The care of all patients with brain and other CNS tumours should be coordinated through:

   - a designated lead in every acute trust (see Box 1)
   - a neuroscience brain and other CNS tumours multidisciplinary team (MDT), usually based at a neuroscience centre (see Boxes 2 and 3)
   - a cancer network brain and other CNS tumours multidisciplinary team (MDT). (See Boxes 4 and 5)
   - an appropriate key worker.

7. • Palliative care specialists should be included as members of the neuroscience brain and other CNS tumours MDT and the cancer network brain and other CNS tumours MDT to provide advice on palliative and supportive care and the management of symptoms and to contribute to the patient's management plan.

8. • Cancer networks should set up robust local mechanisms to ensure that every patient with radiology that suggests a diagnosis of CNS tumour is discussed by the neuroscience brain and other CNS tumours MDT without delay. This is to ensure confirmation of the radiological diagnosis and advice on further management, whatever the source of the initial referral for imaging and whether or not it is thought likely that specialist treatment is needed (see section on Presentation and Referral).

9. • Neuropathology and neuroradiology services should be provided to a level that ensures practitioners in these specialties can provide appropriate diagnostic investigations in a timely and efficient manner, can be involved in pre- and post-operative management decisions and intra-operative histopathological diagnosis, reporting to the standards

detailed in the document *Minimum Datasets for CNS Tumours* (Royal College of Pathologists).[1]

10. • There should be ready access to a neurosurgical biopsy or resection service, including image localisation and stereotactic techniques. Pre-operative discussions should take place at the neuroscience brain and other CNS tumours MDT to determine the optimum approach to surgery and the processing of tissue specimens, including intra-operative histological evaluation.

11. • National tumour groups should be established to develop standardised guidelines and protocols for the investigation, management and clinical research of rare CNS tumours.

12. • Healthcare professionals should have face to face communication with patients at critical points in the care pathway to discuss diagnosis, prognosis, treatment options (including no treatment), recurrence and end of life care. Clear, high quality and relevant written information material should be made available to support patients, carers and professionals in this process.

13. • Patients should have ready access to specialist neuropsychology and neuropsychiatry for assessment and management of complex cognitive, emotional and behavioural problems, and to specialist healthcare professionals as appropriate for any other problems they may experience, such as epilepsy, headaches, functional loss, speech and language problems, or visual problems.

14. • There should be rapid access to allied health professional (AHP) assessment and rehabilitation services, including specialist neurorehabilitation, as the patient's condition changes. There should be immediate access to specialist equipment, as necessary.

[1] The Royal College of Pathologists (2004) *Minimum dataset for the histopathological reporting of tumours of the central nervous system*. Available at: www.rcpath.org

15. • Data collection systems should be in place that allow entry of information on all patients with a radiologically or histopathologically confirmed CNS tumour and made available to healthcare professionals. Consideration should be given to a web-based information system that will allow easy data sharing across the service.

16. • The National Cancer Research Institute (NCRI) Clinical Studies Group on brain tumours is encouraged to develop an extended portfolio of trials. Cancer networks will need to demonstrate how they intend to ensure that trials are supported and patient entry into these studies should be actively monitored.

Background

Scope of the document

17. The purpose of this guidance is to describe key aspects of services required to achieve the best outcomes for adult patients with tumours of the brain and central nervous system (CNS). The document predominantly deals with primary tumours although metastases from other primary sites that require complex neurological or neurosurgical interventions are also included. Spinal cord compression due to metastatic tumours and ocular tumours are not included.

18. The guidance covers all aspects of care for this group of patients from diagnosis onwards. The interface between services for adolescents and adults is covered in the recently published NICE guidance *Improving outcomes in children and young people with cancer* [1].

19. This guidance manual is intended to inform the commissioning and provision of cancer services. It is not a clinical guideline and does not include the level of detail required to inform decision-making about specific treatments for individual patients. This background section is intended to inform non-specialist readers about this group of diseases and their management.

CNS tumours: nature

20. Primary CNS tumours are uncommon. The most numerous are brain tumours and are said to account for only 1.6% of cancers in England and Wales [2]. The variety of pathological tumour types is large. Pathologically benign tumours are considered here as well as malignant tumours for three important reasons:

- the severity of their effects due to the enclosed space formed by the cranium (bones of the skull) and the resulting increase in intracranial pressure affecting the brain.

- the vital functions of the organ in which these tumours arise pose a particular challenge for surgical excision.

- some benign brain tumours may undergo malignant transformation.

21. In general CNS tumours have a poor prognosis. Both their anatomical position and pathology play an important role in prognosis and decisions about appropriate treatment.

22. The anatomical location influences symptoms that include physical, cognitive and psychological components. For this reason adults with CNS tumours pose a unique challenge to healthcare professionals; the patient may not be the best person to explain his or her symptoms and cognitive dysfunction may greatly increase the need for psychological, social, and physical support. In view of the poor survival of many patients, even with optimal treatment, an important aspect of improving outcome is through maximising quality of life.

23. The location of these tumours may mean that tissue diagnosis is not possible. As a result, unlike most other tumour groups, the final diagnosis may depend on the results of imaging rather than biopsy.

Incidence prevalence, mortality and survival rates and trends

24. Approximately 6,500 primary tumours of the central nervous system in those aged 15 years and over were registered annually in England and Wales between 1995 and 2000, of which 58% were malignant (Table 1). There is, however, evidence of significant under-registration of intracranial tumours in the United Kingdom, particularly benign tumours. It has been suggested that almost half of intracranial tumours are not recorded by cancer registries [3] [4].

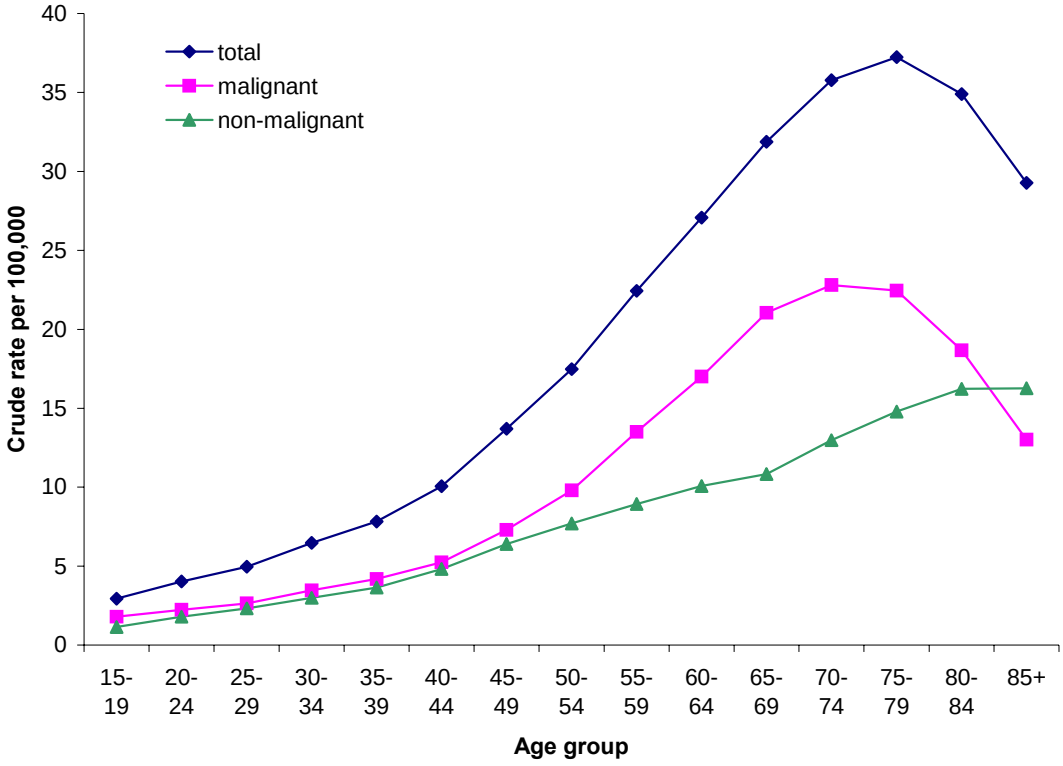


Figure 1 Age related rates per 100,000 population for total primary tumours, subdivided by malignant / non-malignant 1995-2000. Data supplied by the National Cancer Intelligence Centre of the Office for National Statistics and the Wales Cancer Intelligence and Surveillance Unit.

25. The incidence of these tumours rises throughout adulthood (after a peak in childhood) to reach its highest among the 75-79 year age group at 37 registrations per 100,000 persons per year over the above mentioned six year period (Figure 1). Between the ten years 1991-2000 the rate of tumour registration increased by 17%. The rise was particularly marked in older age groups and registrations for these tumours more than doubled among the very elderly in that decade (Table 2). The reasons for this are unclear but may be due to more intensive investigation of neurological deficit in older patients in recent years. As the number of tumours registered in England and Wales has risen, hospital admissions recorded for this group of patients have also increased (Figure 2).

26. It is not known how many primary lymphomas of the CNS are registered in England and Wales each year, as the coding system used

(ICD 10) does not readily distinguish these from primary lymphomas occurring in other sites. They are, however, rare accounting for approximately 2-3% of biopsied CNS tumours [5]. At a national level a substantial number of CNS tumours do not have specific morphology recorded[2], and so reliable data is not available for tumour subtypes defined by their morphology (for example, oligodendroglioma).

27. There are approximately 3,700 deaths per year in England and Wales among those aged 15 years and over where primary tumours of the CNS are given as the underlying cause. The majority of these are due to brain tumours. As with registrations, death rates among the very elderly, those aged over 85 years, attributed to tumours of the CNS have increased substantially in the decade between 1991 (13 per 100,000) and 2000 (26 per 100,000). As with incidence, this may be related to increased investigation (in particular CT and MRI scans) among this age group. Details of the recorded incidence and mortality of CNS tumours for England and Wales are shown in Table 1.

[2] 37% of brain tumours registered for England 1995-2000 had non-specific morphology codes (20% “neoplasm” malignant/benign/uncertain whether benign or malignant; 17% “glioma, malignant”). Data supplied by the National Cancer Intelligence Centre of the Office for National Statistics.

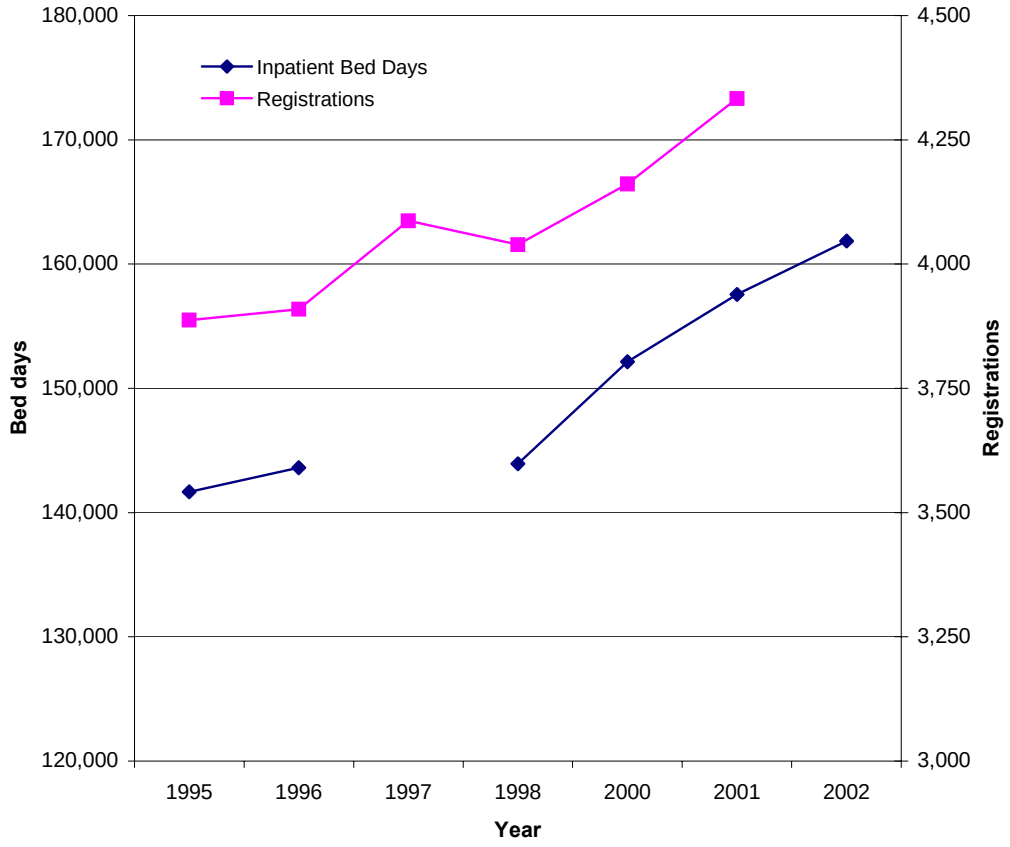


Figure 2 Inpatient bed days and registrations for patients with brain tumours (benign, malignant and uncertain) 1995-2002. Hospital activity data represent any admission for patients with a known diagnosis of this tumour type. Data supplied by the National Cancer Services Analysis Team (HES/PEDW data; year refers to commencement of financial year; incomplete data available for financial year 1997-8), National Cancer Intelligence Centre of the Office for National Statistics and the Wales Cancer Intelligence and Surveillance Unit.

Table 1 Registrations and mortality from primary brain and central nervous system tumours in England and Wales, 1995-2000, persons ≥ 15yrs.

	Registrations			Mortality	
	Number per annum	Crude rate per 100,000 ≥ 15	Male:Female ratio (rates)	Number per annum	Crude rate per million ≥ 15
Brain tumours					
Brain					
Malignant	3550	8.54	1.44	2691.2	64.74
Benign / uncertain behaviour	520	1.25	1.04	699.2	16.82
Intracranial meningiomas					
Malignant	54	0.13	0.85	18.0	0.43
Benign / uncertain behaviour	758	1.82	0.46	226.5	5.45
Spinal					
Spinal cord					
Malignant	69	0.17	1.38	21.5	0.52
Benign / uncertain behaviour	56	0.13	1.12	0.8	0.02
Spinal meninges					
Malignant	5	0.01	0.65	0.5	0.01
Benign / uncertain behaviour	60	0.14	0.27	1.2	0.03
Pituitary tumours*					
Malignant	29	0.07	0.99	7.8	0.19
Benign / uncertain behaviour	661	1.59	1.13	31.0	0.75
Cranial nerve					
Malignant	17	0.04	1.27	2.8	0.07
Benign / uncertain behaviour	412	0.99	1.02	17.8	0.43
Pineal					
Malignant	19	0.05	4.29	5.0	0.12
Benign / uncertain behaviour	13	0.03	0.66	1.7	0.04
Other registered as CNS					
Malignant	24	0.06	0.75	9.7	0.23
Benign / uncertain behaviour	215	0.52	0.58	0.5	0.01
Total malignant	3767	9.06	1.42	2748.8	66.13
Total benign / uncertain	2694	6.48	0.79	986.3	23.73
Total	6462	15.54	1.11	3735.2	89.86

Data supplied by the National Cancer Intelligence Centre of the Office for National Statistics and the Wales Cancer Intelligence and Surveillance Unit. Due to ICD coding CNS lymphomas are not distinguished as a separate group. Registrations (ICD 10) and mortality (ICD 9) codes may not match exactly. *Including craniopharyngeal tumours.

Table 2 Primary brain / CNS tumours age specific registration rates per 100,000 persons per year among those 15 years of age and older; selected ages x year (1991-2000).

	15-19	30-34	45-49	55-59	65-69	75-79	85+	All ages
1991	2.7	6.4	14.0	23.1	27.7	31.1	18.4	13.7
1992	3.5	6.9	14.7	22.5	33.1	31.6	20.0	15.1
1993	3.0	7.4	13.6	22.9	32.2	30.1	20.7	14.7
1994	3.4	6.7	13.1	20.9	30.3	35.9	22.6	14.7
1995	2.7	6.9	13.1	23.3	29.7	34.9	23.7	15.2
1996	2.5	6.2	13.6	22.5	32.1	34.3	25.6	15.3
1997	2.8	6.8	14.7	23.9	34.6	37.7	27.9	15.8
1998	2.8	6.1	13.8	20.7	30.8	35.5	28.9	15.4
1999	3.5	5.9	13.2	22.9	32.7	39.0	31.4	15.6
2000	3.2	6.8	13.8	21.3	31.4	41.5	37.3	16.1

Double line indicates transition from ICD 9 to ICD 10, definitions of tumour groups included do not match exactly across this transition. 'All ages' refers to crude rate in those aged 15 and over. Data supplied by the National Cancer Intelligence Centre of the Office for National Statistics and the Wales Cancer Intelligence and Surveillance Unit.

28. Survival of those with malignant brain tumours (ICD10 C70) is poor, and is shown in Table 3. Relative survival has decreased in the last 20 years. The increased incidence in the elderly does not explain the decrease in relative survival, but an increased tendency to investigate severe disability in the elderly and hence diagnose poor prognosis tumours, may be a contributing factor. The EUROCARE-3 study [6], with participating registries from both England and Wales, showed 5-year age standardised relative survival rates similar to those among other participating registries of other countries of Europe although both England and Wales were among the lower range for 1 year survival (table 3).

Table 3 One and five year age standardised relative survival (95% confidence intervals) for adults diagnosed (1990-1994) with malignant brain tumour (ICD-9 191), participating registers for Eurocare study, England Wales and Europe.

	Men		Women	
	One year	Five year	One year	Five year
England	31.7 (30.7 - 32.8)	15.7 (14.9 - 16.7)	34.2 (32.9 - 35.4)	17.9 (16.8 - 19)
Wales	33.8 (30.2 - 37.8)	17.5 (14.3 - 21.4)	33.6 (29.9 - 37.8)	19.7 (16.1 - 24.1)
Europe	37 (35.6 - 38.5)	16.4 (15.2 - 17.6)	39 (37.4 - 40.7)	18.5 (17.1 - 20)

Table 4 One and five year age standardised relative survival (95% confidence intervals) for men and women aged 15-99 diagnosed with malignant brain tumours (ICD-10 C70) in 1991-1995 and 1996-1999, England and Wales.

	Patients diagnosed 1991-95		Patients diagnosed 1996-99		Difference*	
	One-year	Five-year	One-year	Five-year	One-year	Five-year
Men	30.8 (30.0 - 31.7)	13 (12.4 - 13.7)	32.2 (31.3 - 33.2)	12.5 (11.6 - 13.4)	1.4	-0.5
Women	32.2 (31.2 - 33.2)	15.4 (14.5 - 16.2)	32.1 (31.0 - 33.3)	15.3 (14.2 - 16.4)	-0.1	-0.1

* The difference (in percentage points) between the relative survival rates for patients diagnosed in 1991-95 and in 1996-99 [7].

29. As the proportion of elderly in the population increases the incidence of CNS tumours is expected to rise. Based on the Government Actuary's Department figures [8] and the average number of registrations for CNS tumours between 1995 and 2000, Figure 3 demonstrates the predicted registrations of tumours of the CNS up to 2041. The growth in registrations may be greater than predicted if the trend of increased incidence of CNS tumours among elderly people continues.

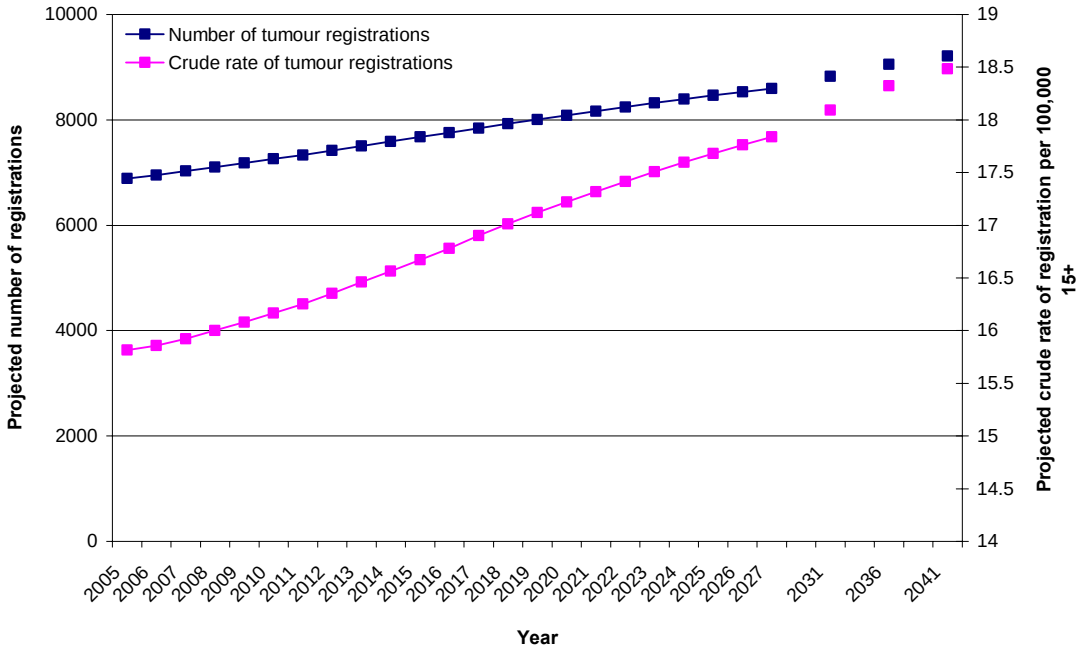


Figure 3 Predicted numbers and crude rates of brain and central nervous system tumour registrations based on age and sex specific rates 1995-2000; age ≥ 15.

Classification of tumours

30. The classification of CNS tumours is complex, and various classifications have been developed since that of Bailey and Cushings in the early 1920s [9]. The World Health Organization (WHO) produced a classification in 1993, most recently updated in 1999 [10]. The use of this classification is now endorsed by professional bodies (Royal College of Pathologists [11]) and the European Network of Cancer Registries [12]. It is also used as part of the United Kingdom National External Quality Assessment Service [13] for laboratory and diagnostic neuropathology. This classification divides CNS tumours into the basic types of tumours of neuroepithelial tissue, including what are often described as gliomas, tumours of the peripheral nerves, tumours of the meninges, lymphomas and haematopoietic neoplasms, tumours of the sellar region, and metastatic tumours. Each type has further subdivisions.

31. The usefulness of this WHO classification in epidemiological terms is limited by the fact that tissue from tumours of the CNS is not always available for analysis. Also, the system used to collect statistics on pathology of CNS tumour registrations at a national level does not conform to this WHO classification.

32. For simplicity and ease of understanding, the guidance classifies tumours into the categories of brain tumours, and rarer tumours, in particular: intradural spinal cord tumours, skull base tumours, pituitary tumours, optic tract gliomas, primary CNS lymphomas, medulloblastomas and pineal tumours.

Aetiology and risk factors

33. The aetiology of tumours of the CNS is largely unknown. The only unequivocally identified causative factors are inherited cancer syndromes and, in rare cases, ionising radiation [14]. Immunosupression, particularly due to the acquired immune deficiency syndrome (AIDS), is a well-recognised cause of cerebral lymphoma [15].

34. The risk of developing CNS tumours is dependent on age and gender (see above), and also shows an inverse social gradient; tumours of the brain are more common among more affluent groups [16], and this is also true for mortality. The reverse trend is evident for brain metastases [17].

35. Geographical variation in CNS tumours is less than for most human neoplasms. Less developed countries have a lower incidence than more developed countries. There is also evidence that in multicultural communities those of African or Asian descent have a lower incidence than those of Caucasian descent. Japan is a developed country with particularly low level of reported tumours although it is not clear if this is related to inadequate registration [18]. There is no consistent regional variation within England and Wales [19].

Familial syndromes with an increased risk of tumours of the CNS

36. There are a number of familial syndromes that give rise to an increased risk of tumours of the CNS, and these are shown in Table 4. These are, in general, autosomal dominant conditions [20], and many have distinctive skin features (phakomatoses). Neurofibromatosis type I is the most common of these syndromes with a prevalence of 1 in 3,000 [21]. Neurofibromatosis type II has an incidence of about 1 in 40,000 [22]. Multiple endocrine neoplasia type I, associated with pituitary tumours, is sometimes included in this group [23].

Table 5 Inheritable syndromes carrying an increased risk for CNS neoplasms.

Syndrome	Gene	Chromosome	Nervous system
Neurofibromatosis type 1	NF1	17q11	Neurofibromas, malignant nerve sheet tumour, optic nerve gliomas, astrocytoma
Neurofibromatosis type 2	NF2	22q12	Bilateral vestibular schwannomas, multiple meningiomas, astrocytomas, glial hamartias
von Hippel-Lindau Syndrome	VHL	3p25	Haemangioblastomas
Tuberous sclerosis	TSC1 TSC 2	9q34 16p13	Subependymal giant cell astrocytoma, cortical tubers
Li-Fraumeni	p53	17p13	Astrocytomas / PNET
Cowden's disease	PTEN	10q23	Dysplatic gangliocytoma of the cerebellum
Turcot's syndrome	APC HMLH1 HPSM2	5q21 3p21 7p22	Medulloblastoma Glioblastoma
Naevoid basal cell carcinoma syndrome (Gorlin's syndrome)	PTCH	9q22	Medulloblastoma

Source: adopted from [24] [25] [26].

Symptoms, diagnosis and treatment

37. CNS tumours can result in a wide range of physical, cognitive and psychological symptoms. The list of differential diagnoses is considerable, and the incidence of many of these alternatives is usually far greater than brain tumours, such that these may be exhaustively explored before the diagnosis of a CNS tumour is considered. Consequently, for some patients and families there is a long delay from first symptoms to reaching a diagnosis causing considerable stress and anxiety [27].

Brain tumours

38. Brain tumours account for the majority of CNS tumours. In this document they are taken to include all primary intracranial tumours apart from rare and unusual tumours considered separately. In particular this group includes malignant and benign tumours of the brain substance itself, many of which arise from the glial or support cells of the brain, for example, glioblastoma multiforme. Glial tumours

(gliomas) may be considered low grade (grade I and II, less aggressive) or high grade (grade III and IV, more aggressive) in accordance with the WHO classification of tumours of the nervous system. It also includes tumours that arise from the tissues around the brain such as tumours of the meninges, and metastases from other primary sites that require complex neurological or neurosurgical interventions.

39. In spite of the variety of brain tumour pathologies, presentation tends to be related either to a) headache with cognitive or behavioural symptoms, b) epilepsy, c) progressive focal neurological deficits, or d) headaches with raised intracranial pressure.

40. Headache accompanied by cognitive, memory or behavioural symptoms is a common presentation and patients are often slow to present because of the wide differential diagnosis.

41. Adult onset epilepsy is a common feature of brain tumours, and may present as either focal or generalised convulsions. It usually presents without other neurological symptoms or signs.

42. Focal neurological deficits may result in a large variety of symptoms depending on the part of the neurological system affected. Gradual onset weakness or sensory loss on one side of the body is common as is difficulty with speech or understanding. Occasionally patients present with unilateral visual field loss.

43. Raised intracranial pressure typically causes headaches, which may be worse in the morning, nausea and vomiting or visual deterioration. More severe raised intracranial pressure may be associated with altered levels of consciousness, and this may be in the form of lethargy or somnolence in the early stages. Swelling of the optic disc (papilloedema) is a sign that may be present when there is raised intracranial pressure.

44. The diagnosis of a possible brain tumour is first indicated following imaging of the brain, that is with either computed tomography or magnetic resonance imaging. The diagnosis is confirmed by surgical biopsy, which allows histopathological classification, though in a few cases biopsy is either not feasible or clinically inappropriate.

45. Management of these tumours depends on their anatomical position and their pathological type. Tumours within the skull, but out-with the brain, such as meningiomas, can often be completely excised with a very good prognosis. Tumours within the brain, such as gliomas, can rarely be completely removed because of the relationship to critical structures and the invasive nature of the tumour. Depending on the type of tumour (for example, high grade glioma) there may be benefit associated with treatment with chemotherapy or radiotherapy. Steroids are often used to reduce intracranial pressure or to try and improve focal signs e.g. weakness on one side. The majority of patients will also require input from a variety of healthcare professionals, including allied health professionals, and those providing psychological help and support for patients and their carers.

Rarer tumours

46. In this document, rarer tumours are those considered to be sufficiently uncommon to warrant specialist input beyond that required for those brain tumours included above.

Spinal tumours

47. Primary tumours of the spinal cord are very uncommon. Patients with these tumours are likely to present with focal neurological symptoms relating to compression or invasion of nerve roots or the spinal cord itself. Pain along a nerve root is a common initial symptom.

48. Tumours around the spinal cord such as meningiomas, and nerve root tumours, often neurofibromas, are more likely to be slow growing. Complete excision may lead to a good prognosis, although their

location may pose technical difficulties. This guidance includes services for nerve root tumours that cause compression of the spinal cord, and chordomas (an uncommon tumour that may occur in the sacral or cervical regions); it does not cover services for spinal cord compression due to tumours. In contrast to tumours around the spinal cord, such as meningiomas, intrinsic tumours of the spinal cord are usually malignant. However, they do not usually expand rapidly and are usually treated by surgery and/or radiotherapy.

Skull base tumours

49. The term “skull base tumour” does not appear in formal classifications of CNS tumours, and does not specify the pathological type. The term refers to multiple tumour types that occur at this anatomical location, for example, acoustic schwannoma (a cranial nerve tumour), some meningiomas, invasive tumours from adjacent sites such as nasal tumours. These tumours may cause specific symptoms due to damage to structures in the region, such as cranial nerves resulting in palsies, difficulty with balance or hearing. Patients with acoustic schwannoma often present with hearing loss on one side (90%), and many experience tinnitus (70%) [28]. The progress of symptoms is highly variable depending on tumour type.

Pituitary tumours

50. Pituitary tumours may be functional and secrete hormones, or non-functional. Larger tumours (>1cm) are usually non-functional [29]. Symptoms may either be the result of hormone secretion or of pressure effects. Pressure on the pituitary gland / hypothalamus may result in hormonal imbalance and pressure on the optic chiasma / optic nerves in visual disturbance. Craniopharyngiomas tumours, more common in children, also arise in the sellar region, and are grouped with pituitary tumours in this guidance.

51. Diagnosis of these tumours is primarily by imaging, although hormonal measurements are also important. Apart from any hormonal treatment

that may be required, the primary management of these tumours is surgical resection, which may be undertaken by either the transsphenoidal or by standard craniotomy approaches [30].

Other rarer tumours

52. Some tumour groupings are very rare. For example in England and Wales there are 0.08 registrations of pineal tumours per 100,000 population per year (that is, 32 registrations). Some rarer tumours have been given particular attention in the guidance due to their specific needs. These include primary central nervous system lymphomas, which has been increasing in incidence globally due to the AIDS epidemic [31]. Immunocompetent patients show treatment response rates of 85%, with 2 and 5 year survivals of 40-70% and 25%-45% respectively. Outlook is much poorer for patients with AIDS, where median survival is 2-6 months [32].

53. Medulloblastoma requires particular attention due to its biological behaviour; in particular its tendency to spread through the neuraxis. Pineal tumours, and in particular germ cell tumours, may be curable with appropriate management. Optic pathway gliomas, which usually present with visual disturbance, may be associated with neurofibromatosis type I, and although usually occurring in children, the controversial nature of their treatment requires specialist input.

NHS services for patients with CNS tumours

54. Services for patients with tumours of the CNS are provided in all healthcare sectors. Primary healthcare teams and local acute hospitals often provide essential services for these patients; however, as these tumours are rare, the role of specialist services is particularly important.

55. The route of care for patients may be complex because catchment areas for neurosurgical units and oncology units often do not coincide and may not match well with the boundaries of cancer networks or strategic health authorities. An analysis was undertaken of the

catchment areas of the 27 neurosurgical units, as mapped by NATCANSAT for this guidance, and the 37 cancer networks covering England and Wales. Only 10 of these units cover areas contained within 1 network, 16 of the other neurosurgical catchment areas cover more than 1 network area[3]. As a result of this incongruity it has been necessary in this guidance to distinguish functions that occur at a cancer network level from those that occur at the neuroscience / neurosurgical unit level.

56. Patients may present to general practitioners, accident and emergency departments, or other acute medical services before being referred on to specialist services.

57. The following description of services is based on a survey of neurosurgical units (with the assistance of the Society of British Neurological Surgeons) and radiotherapy units undertaken to inform this guidance in England and Wales during early 2004.

Neurosurgical services

58. Neurosurgical units are often the first specialist service to which patients with tumours of the CNS are referred. There are 27 units providing neurosurgical services to adults in England and Wales. Most are based within a university hospital (78%), and their self-estimated population ranges from 1 to 3.5 million (average 2.2 million persons). Obtaining information on the total number of new patients with CNS tumours seen by a unit per year is difficult because of the variation in the way data are (or are not) collected by the units; however estimates given varied widely from 63 new patients to 6-700 (median 190).

59. For CNS tumours as a whole there is little evidence of specialisation among neurosurgeons; in virtually all units in England and Wales all neurosurgeons perform surgery on CNS tumours. However, for some subtypes of tumours, in particular pituitary, and acoustic nerve / skull base tumours there is a high level of specialisation with only one or two

[3] For one of the London units the relationship was unclear from the analysis.

surgeons performing procedures in most units. Most neurosurgical units have clinical nurse specialists in neuro-oncology (80%) although the role varies from unit to unit. Often a key function of clinical nurse specialists in neuro-oncology is the coordination of services for patients.

60. Increasingly, multidisciplinary teams (MDTs) are being established for CNS tumours. In the report by the Commission for Health Improvement on NHS cancer care in England and Wales [33], based on visits during 2000/2001, about a third of acute trusts providing services for CNS tumours had defined MDTs. In the survey undertaken for this guidance, 2003/04, 80% of neurosurgical units reported that they had established MDTs. Almost half of units have specific MDTs for pituitary tumours, many have MDTs for base of skull tumours and other specific types of CNS tumours.

61. Specialist clinics for patients with CNS tumours were described in 40% of units. These may be joint clinics with oncologists (22% of units), endocrinologists (19% of units) or otolaryngologists (15% of units). In some cases there were nurse-led tumour clinics, and an epilepsy nurse was also present.

62. The survey showed that allied health professionals were available on-site in all the neuro-oncology units, but in a third of units there was no palliative care consultant or palliative care nurse available on-site.

Oncology and radiotherapy services

63. The survey of the 52 radiotherapy units in England and Wales (92% response rate) found that almost all of these units (94%) undertake CNS tumour work. Although a number are standalone, approximately 40% are located in university / teaching hospitals and 40% in district general hospitals. These units each see between 17 and 350 neuro-oncology patients a year.

64. Oncology / radiotherapy units may provide treatments such as inpatient and outpatient chemotherapy and radical or palliative radiotherapy.

There appears to be variation among units not only in the types of treatment provided [34], but also access to these services. Mean waiting times quoted for a patient with CNS tumour to start radical radiotherapy varied from less than 1 week to 8-12 weeks.

65. All but one unit reported having some degree of specialisation among oncologists for CNS tumours. More than half the units (56%) have clinical nurse specialists in neuro-oncology.

66. Around three quarters of units have access to a MDT either on-site, or at another site, for their patients. Multiple site MDTs exist, where either several units communicate by videoconference, or conclusions are passed on to treating clinicians who may not attend the meetings. In some cases a local expert team is available to provide support in a smaller unit without an MDT.

67. Many allied health professionals are available on-site in all or almost all units. Just under half of units have on-site access to neuropsychological / neuropsychiatric services, and two thirds of units have on-site access to a neurologist with an interest in epilepsy.

Specialist neurorehabilitation units

68. Almost all neurosurgical units (96%) reported having access to a specialist neurorehabilitation unit in England and Wales. Access to specialist neurorehabilitation units was much lower for oncology / radiotherapy units at 60% of units.

Stereotactic radiosurgery

69. Stereotactic radiosurgery is a specialised technique designed to focus high doses of ionising radiation on a tumour, while sparing normal tissue. Much of the stereotactic radiosurgery is undertaken at the national centre in Sheffield. However there are eight centres in total in England and Wales to whom patients are referred by neurosurgical units for stereotactic radiosurgery.

Commissioning services for neuro-oncology

70. All bodies which commission services for adults with CNS tumours within each cancer network should work together to ensure that these services function in a coordinated way. As many neuroscience units cover more than one cancer network area it is important that networks collaborate and pool resources to deliver a full range of services.

References

1. National Institute for Clinical Excellence (2005) *Improving outcomes in children and young people with cancer*. London: National Institute of Clinical Excellence. Available from: www.nice.org.uk.
2. Quinn M, Babb P, Brock A, Kirby L, Jones J (2001) Brain. *Cancer Trends in England and Wales 1950-1999*: *Studies on medical and population subjects No. 66*. London: The Stationary Office, p 34-39.
3. Pobereskin LH, Chadduck JB (2000) Incidence of brain tumours in two English counties: a population based study. *Journal of Neurosurgical Psychiatry* 69: 464-471.
4. Counsell CE, Collie DA, Grant R (1996) Incidence of intracranial tumours in the Lothian region in Scotland: 1989-90. *Journal of Neurology, Neurosurgery and Psychiatry* 61:143-50.
5. Ellison D, Chimelli L, Harding B et al. (2004) *Neuropathology*. 2nd edition. London: Mosby.
6. EUROCARE-3 study. www.eurocare.it
7. Office for National Statistics (2004) *Cancer Survival: England and Wales, 1991-2001, twenty major cancers by age group*. Available from: http://www.statistics.gov.uk/statbase/ssdataset.asp?vlnk=7899 [accessed 24 October 2004].
8. Government Actuary's Department. www.gad.gov.uk
9. Davis FG, Preston-Martin S (1998) Epidemiology. In: Bigner DD, McLendon RE, Bruner JM, editors. *Russell and Rubenstein's Pathology of Tumours of the Nervous System.* 6th edition. Volume 1. New York: Arnold.

10. Kleihues P, Cavenee WK (2000) *Pathology and Genetics of Tumours of the Nervous System.* Lyon: IARC Press.
11. Royal College of Pathologists (2003) *Standards and Minimum Datasets for Recording Common Cancers: Minimum dataset for the histopathological reporting of tumours of the central nervous system.* London: Royal College of Pathologists. Available at: http://www.rcpath.org/resources/pdf/CNSminimumDatasetFINAL04.pdf [accessed 13 October 2004].
12. European Network of Cancer Registries (1998) *Recommendations for Coding Tumours of the Brain and Central Nervous System*. Lyon: ENCR. Available at: http://www.encr.com.fr/ [accessed 13 October 2004].
13. United Kingdom National External Quality Assessment Service (2003) *Neuropathology*. http://www.uknegas.org.uk/Directory/HIST/neurpath.htm [accessed 13 October 2004].
14. International Agency for Research on Cancer (2003) Tumours of the Nervous System. In: Stewart BW, Kleihues P, editors. *World Cancer Report.* Lyon: IARC Press.
15. As reference 10.
16. As reference 2.
17. As reference 4.
18. As reference 14.
19. As reference 2.
20. As reference 10.
21. Friedman JM (1999) Epidemiology of Neurofibromatosis type I. *American Journal of Medical Genetics* 89:1-6.
22. Evans DGR, Sainio M, Baser ME (2000) Neurofibromatosis type 2. *Journal of Medical Genetics* 37:897-904.
23. As reference 5.
24. As reference 10.
25. As reference 5.
26. Pan E, Uyehara-Lock JH, Nicholas MK (2002) Familial brain tumour syndromes. In: Steele GD, Phillips TL, Chabner BA, editors.

American Cancer Society Atlas of Clinical Oncology Brain Cancer. London: BC Decker Inc.

27. Grant R (2004) Neurosurgery and Psychiatry. *Journal of Neurology* 75 (suppl III): ii18-ii23.
28. British Association of Otorhinolaryngologists Head and Neck Surgeons (2002) *Clinical Effectiveness Guidelines Acoustic Neuroma (Vestibular Schwannoma) BAO-HNS Document 5*, London: Royal College of Surgeons of England. Available at: http://www.sbns.org.uk/members/society_reports/ceg_acousticneuroma.pdf [accessed 22 October 2004].
29. Chin CT, Dillon WP (2002) Magnetic Resonance Imaging of Central Nervous System Tumours. In: Steele GD, Phillips TL, Chabner BA, editors. *American Cancer Society Atlas of Clinical Oncology Brain Cancer.* London: BC Decker Inc.
30. Thorner MO (1996) Anterior pituitary disorders. In: Weatherall DG, Ledingham JGG, Warrell DA, editors. *Oxford Textbook of Medicine* 3rd edition. Volume 3. Oxford: Oxford University Press.
31. As reference 10.
32. As reference 10.
33. Commission for Health Improvement (2001) NHS Cancer Care in England and Wales, Supporting Data 5, Multidisciplinary Team Working. In: *National Service Framework Assessments No. 1 NHS Cancer Care in England and Wales.* London: The Stationary Office. Available at: http://www.chi.nhs.uk/cancer/data/sd5.pdf [accessed 24 May 2004].
34. Gerrard GE, Prestwich RJ, Franks KN et al. (2003) Neuro-oncology practice in the UK. *Clinical Oncology* 15: 478-484.

Multidisciplinary teams

Background

71. Patients with brain and other CNS tumours have very particular clinical needs which mean that the arrangements for their care need to be structured quite differently from those with the more common cancers. Their healthcare needs are complex because of a number of factors:

- Many patients are severely disabled by their disease
- Many patients have a poor prognosis
- They present through a variety of specialties
- There are significant differences in the care needs of patients with tumours of different histological types and arising in different parts of the CNS
- Many tumour subtypes are extremely rare
- Many patients experience long term progressive cognitive, physical and emotional problems

72. This chapter describes the organisation of care for the majority of patients, those with brain gliomas. Specific specialist care is required for those with spinal cord and other less common tumours and this is described in more detail in the treatment and follow-up sections.

73. Patients present in a variety of different ways. Patients are referred by their general practitioner (GP) to one of a number of specialties including neurology, acute services (such as acute medicine), ophthalmology, endocrinology, radiology or orthopaedics. First line investigations, including imaging, are normally carried out at the local hospital. Radiological imaging (CT or MRI, see section on diagnosis – pathology and radiology) is essential in the diagnosis of these patients

and is the first point at which a suspected diagnosis of a CNS tumour is made which prompts entry into the MDT.

74. The MDT is pivotal in the management of these patients and attendance at the multidisciplinary meetings is essential. They should form part of the timetabled activities of core members.

75. All patients, including those who have had emergency surgery, need to have their clinical history and images reviewed by a specialist neuroscience brain and other CNS tumours MDT, whether or not they go on to have further active treatment.

76. Once the initial treatment (surgery, radiotherapy or chemotherapy) is completed, many patients will have a prolonged period of follow-up, with input from a variety of support services, either to monitor the effects of treatment, or to manage gradual physical or neuropsychological decline. Many of the continuing rehabilitation, supportive and palliative care needs are met by allied health professionals (AHPs) and these services need to be provided as near to the patient's home as possible. During this time all of their aspects of care should be properly assessed and addressed, and immediate access provided to the appropriate services.

77. This guidance, together with the *Manual for cancer services,*[4] has become more rigorous in describing the role of core members of the MDT. It is recognised that in the UK up to 30% of patients handled by individual neurosurgical units may fall into the scope of this guidance. The Society of British Neurosurgeons, currently implementing new manpower and training needs under the process of Modernising Medical Careers, has recognised that training and service demands, will need to develop to achieve the supply of neurosurgeons specialising in CNS tumours.

[4] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

78. To be able to achieve the key recommendations of this guidance, all such specialist neurosurgeons treating CNS tumours must take part in the MDT with at least two as core members.

79. As the management of patients with CNS tumours is often provided in different care settings, it is important that their care is, at all stages, adequately coordinated. This may be best achieved by ensuring that every patient has a clearly identified *Key Worker*[5] who is the identified point of contact for patients and carers, is responsible for ensuring the supportive care needs of the patients and carers are met, and for coordinating care across the patient pathway. This role is discussed later in this section.

80. These patients therefore need a multidisciplinary approach to their care throughout their illness and follow-up, with continuing input from a variety of rehabilitation and support services. The patient pathway must be structured to ensure that access to appropriate services is always safe, easy and equitable. At all stages of the patient pathway, there may be a need to involve members of the AHP and supportive and palliative care services in order to address the patient's problems.

81. Appropriate clinical assessments are essential at three specific times:

    1. when the diagnosis of a CNS tumour is initially suggested by radiological investigations and appropriate onward referral is arranged.

    2. when the diagnosis of CNS tumour is reviewed, usually in conjunction with further radiological and pathological diagnostic tests, and when the initial management plan (as defined in Box 2), which may or may not include neurosurgery and/or adjuvant therapy, is determined.

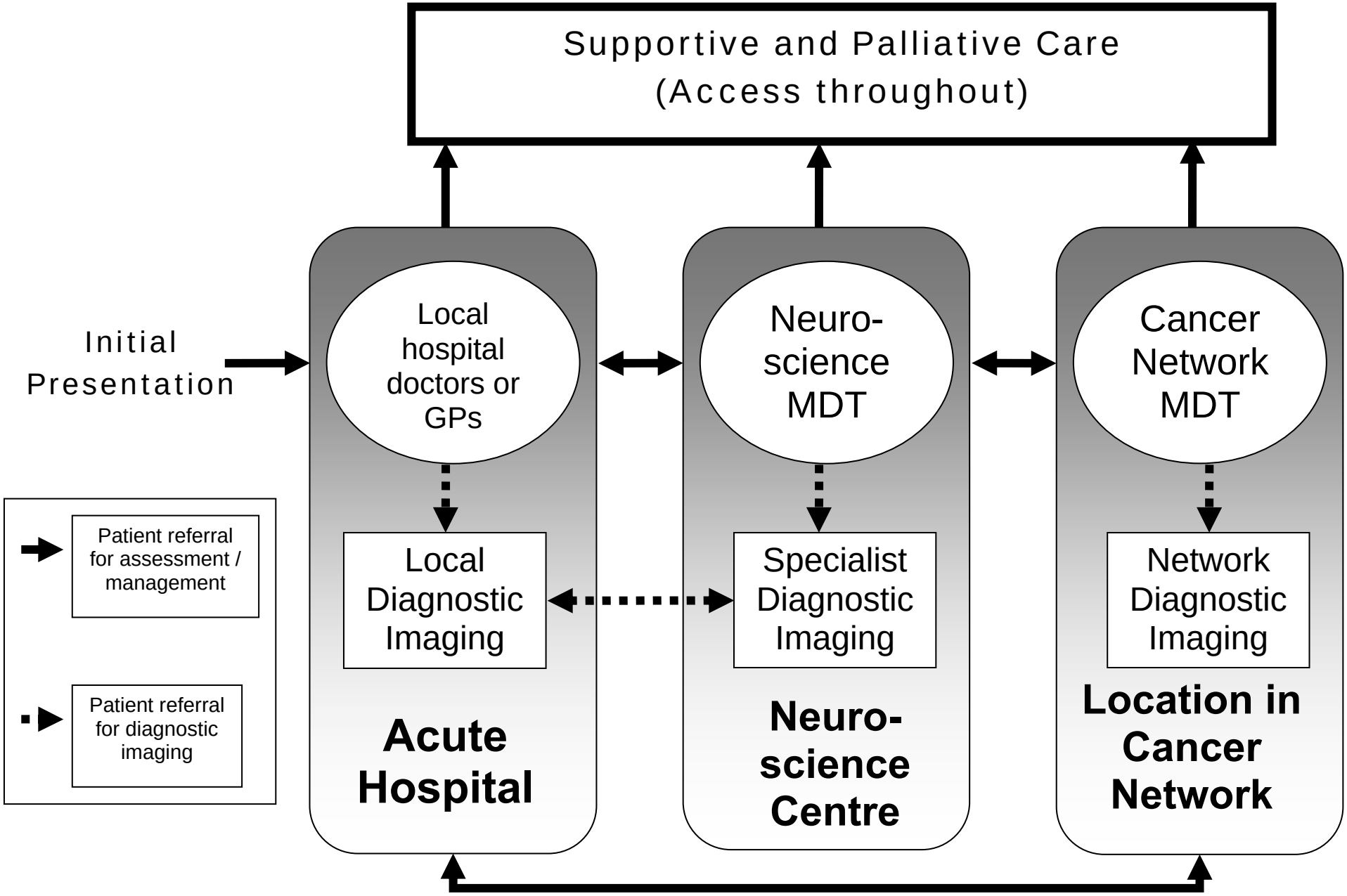
[5] Department of Health (2004) *Manual for cancer services*. *Topic 2A The generic multidisciplinary team*. Available at www.dh.gov.uk

3. when any indicated adjuvant therapy is instigated, and when further clinical review and initial and continuing access to rehabilitation, supportive and palliative care services are arranged.

82. It is possible that some patients may have all their care coordinated and delivered in one location. But, as is clear from the Background section, the population served by neuroscience centres and cancer networks are different in many parts of the country. Where they coincide it should be easier to coordinate the necessary care, but where they differ, very clear arrangements for referral and continuing management are essential to ensure that patients get the most appropriate care.

83. Fundamental to ensuring efficient clinical care when patients are managed by different teams on different sites is good communication. Figure 4 summarises the flow of information through the patient pathway.

Figure 4: Brain and Other CNS Tumours Patient Pathway



A. Recommendations

84. Because of the particular needs of these patients and the complexity of the care that they require, often provided at different locations, the recommended model of multidisciplinary assessment and care is novel and quite different from that for many other tumours.

85. The care of all patients with CNS tumours should be coordinated through

- a **designated lead** in every acute trust (see Box 1)
- a **neuroscience brain and other CNS tumours MDT**, usually based at a neuroscience centre (see Boxes 2 and 3)
- a **cancer network brain and other CNS tumours MDT** (see Boxes 4 and 5)
- an appropriate **key worker**.

86. Where the population served by the neuroscience centre and the cancer network are the same the neuroscience MDT and cancer network MDT may involve many of the same healthcare professionals, but their responsibilities will be distinct (see below). In many places there will, however, need to be separate MDTs with close working relationships (see Background section).

Designated lead

87. In every acute hospital there should be clearly defined mechanisms, coordinated by a designated lead for the Trust (see Box 1), for referring all patients with suspected primary CNS tumours to the neuroscience MDT. These should ensure that clinical summaries for discussion and imaging scans of all patients with suspected primary CNS tumours are sent as soon as possible for review.

Multidisciplinary teams

Designated coordinator

88. Each neuroscience MDT should have a designated coordinator whose responsibilities include obtaining the imaging of patients with CNS tumours from radiology departments in their catchment. In addition the designated coordinator will obtain clinical summaries requested by the neuroscience MDT lead clinician.

MDT lead clinician

89. It is the responsibility of the neuroscience MDT lead clinician to request information about these patients directly from the clinician who arranged the imaging if this is not forthcoming.

Neuroscience brain and other CNS tumours MDT

90. The neuroscience MDT (see Boxes 2 and 3) will review the case history and images and suggest a management plan which will be communicated back to the appropriate consultant. This plan might suggest referral of the patient for neurosurgical or oncological management or continuing care locally.

91. The neuroscience MDT should meet at weekly intervals to review all new cases and advise on their initial management in accordance with national cancer waiting times standards. Patients reviewed and discussed previously should be referred back to the neuroscience MDT by the cancer network MDT for advice on further surgery or specialist interventions on relapse and according to agreed protocols.

92. The neuroscience MDT, in collaboration with the cancer network MDT, should develop, regularly review and audit evidence-based protocols for the management of patients with CNS tumours.

93. Following surgery or a decision by the neuroscience MDT that surgery would be inappropriate, the continuing management and specialist supportive care should be provided according to protocol under the supervision of the cancer network MDT.

94. There may be some frail patients in whom active medical intervention is not considered appropriate. After review of the imaging and clinical summary at the neuroscience MDT these patients will not be seen at the neuroscience centre but referred to the cancer network MDT to arrange appropriate assessment locally by a member of the MDT.

Key worker

95. All patients should have a clearly identified key worker[6] as nominated by the neuroscience or cancer network MDT. The key worker is likely to be the clinical nurse specialist (CNS) or allied health professional (AHP) most closely involved with the patient's care. The key worker role should be transferred to the most appropriate healthcare professionals as the patient's needs change, for example neurosurgeon, neurologist, GP, community nurse, AHP, palliative care team member. The patient and carer should be informed of who their key worker is and how to contact them.

Cancer network brain and other CNS tumours MDT

96. The cancer network MDT (see Boxes 4 and 5) should meet at least monthly to coordinate care for 5 to 15 new patients monthly and monitor the ongoing care of approximately 50-100 follow-up patients.

97. Membership of the cancer network MDT is shown in Box 5.

[6] Department of Health (2004) *Manual for cancer services*. *Topic 2A The generic multidisciplinary team*. Available at www.dh.gov.uk

Box 1 Designated lead.

The **designated lead** will coordinate care at a trust level for all the hospitals within that trust. It is likely to be the role of the trust cancer lead clinician at the hospital or delegated to an appropriate consultant colleague. S/he is NOT clinically responsible for the individual patients, but will ensure that mechanisms are in place for the following:

- The receipt and management / processing of GP referrals of patients with suspected CNS tumours.
- The direct referral of patients to the neuroscience MDT.
- Radiology department(s) make imaging scans and reports concerning suspected CNS tumours available to the neuroscience MDT.
- Timely communication between hospital clinicians, the neuroscience MDT and the cancer network MDT where these exist as separate teams.
- Implementing actions within the Trust arising from audits relevant to this component of the patient pathway.

Box 2 Neuroscience brain and other CNS tumours MDT – responsibilities.

The neuroscience MDT is the team responsible for the diagnosis and initial management (both surgical and non-surgical aspects of care) of most adult patients with CNS tumours. Membership of this group is summarised in Box 3 and responsibilities include the following:

- To establish a diagnosis for the optimal clinical management of the patient.

- To develop management plans for patients with CNS tumours at first presentation, to include initial supportive care needs, diagnostic and surgical interventions, non-surgical oncology interventions, treatment of symptoms, and follow-up.

- Nominate and record a key worker to act as point of contact for patients and carers. This individual will normally be the nurse or allied healthcare professional most involved in the patient's care at any phase of their disease.

- To inform the diagnostic clinician / team at the local referring hospital of the management plan (see communication below).

- To inform the cancer network MDT of the management plan (usually via a representative who is a member of the neuroscience MDT and also in writing).

- To review and advise on patients referred back from the cancer network MDT on disease progression or relapse.

- To develop MDT protocols, in collaboration with the cancer network MDT, to define appropriate follow-up imaging requirements for patients

with CNS tumours.

- To implement the national management protocols for CNS lymphoma, medulloblastoma, pineal tumours and optic gliomas (see section on Treatment and follow-up – primary CNS lymphoma, medulloblastoma, pineal tumours and optic gliomas).

- To act as an educational resource for local service providers.

- To organise regular site-specific group meetings to review pathways of care and protocols.

- To develop and maintain evidence-based local management protocols covering all aspects of the patient pathway.

- To introduce and maintain systems for data entry across the area of service provision including links to cancer registries.

- To audit practice at local, cancer network and supra network levels against national standards of care.

- To facilitate the entry of patients into appropriate NCRN and local clinical trials.

- Liaise with the cancer network MDT.

Box 3 Membership of the neuroscience brain and other CNS tumours MDT. Appropriate cross cover should be available for all MDT members	
Neurosurgeon(s)	Specialist neurosurgeon who spends at least 50% of their clinical programmed activities in neuro-oncological surgery and are regularly involved in dedicated speciality clinics caring for these patients.
Clinical Nurse Specialist(s)	A nurse with specialist knowledge of CNS tumours and skills in communication as defined by the Manual of Cancer Services.[7]
Neuropathologist(s)	An accredited pathologist who is registered as a neuropathologist or histopathologist, has specialist expertise in neuro-oncology, and takes part in the national External Quality Assurance (EQA) scheme for neuropathology organised by the British Neuropathological Society.
Neuroradiologist(s)	A consultant radiologist in a substantive post with at least 50% of clinical programmed activities spent in the practice of neuroradiology.
Oncologist(s)	A clinical oncologist with a special interest in tumours of the CNS.
Palliative care:	A healthcare professional (normally a member of the specialist palliative care team) with experience and expertise on the provision of palliative care services for CNS tumour patients.
Specialist AHP(s):	Representative(s) of the allied health professionals, including, occupational therapy (OT), physiotherapy, speech therapy, dietetics and others as appropriate who have knowledge and experience of dealing with this

[7] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

	patient group with responsibility for education and liaison with other local specialist AHPs.
Coordinator(s)	An administrative post responsible for coordinating patient registration with the neuroscience MDT and data collection.
Others as required (extended MDT members)	Representatives from ward nursing, community palliative nursing, consultant neurologist, epilepsy nurse specialist, psychology, neuropsychologists.

Box 4 The cancer network brain and other CNS tumours MDT – responsibilities.

The cancer network MDT is the coordinating team for the non-surgical management of most adult patients with CNS tumours. Membership of this group is summarised in Box 5 and responsibilities include the following:

- Implement the non-surgical aspects of the management plan produced by the neuroscience MDT.

- Nominate and record a key worker to act as point of contact for patients and carers. This individual will normally be the nurse or allied healthcare professional most involved in the patient's care at any phase of their disease.

- Ensure that there are systems in place for the continuous assessment of patients' and carers' needs, and provide or ensure provision of appropriate support.

- Re-refer patients to the neuroscience MDT where appropriate as defined in local protocols.

- Involve the local referring hospital or community services in continuing and supportive care where appropriate, providing specialist advice to local healthcare professionals when needed.

- To develop MDT protocols, in collaboration with the neuroscience MDT, to define appropriate follow-up imaging requirements for patients with CNS tumours.

- Inform the local referring hospital and GP of the current management plans.

- Act as an educational resource for local service providers.
- Participate in regular site-specific group meetings to review pathways of care and protocols.
- Maintain data entry across the area of service provision.
- Audit practice against national standards of care.
- Facilitate the entry of patients into appropriate NCRN and local clinical trials.
- Liaise with the neuroscience MDT.

Box 5 Membership of the cancer network brain and other CNS tumours MDT. Appropriate cross cover should be available for all MDT members	
Oncologist(s)	A clinical oncologist with a special interest in tumours of the CNS and designated neuro-oncologist for the cancer network.
Clinical Nurse Specialist(s)	A nurse with specialist knowledge of CNS tumours and skills in communication as defined by the Manual of Cancer Services.[8]
Palliative care	A healthcare professional (normally a member of the specialist palliative care team) with experience and expertise on the provision of palliative care services for CNS tumour patients.
Radiologist(s)	A radiologist with a specialist interest in CNS imaging.
Radiographer(s)	A therapy radiographer with a special interest in patients with CNS tumours who has dedicated time allocated to participate in the local MDT.
Specialist AHP(s)	Representative(s) of the allied health professionals, including occupational therapy (OT), physiotherapy, speech therapy, dietetics and others as appropriate who have knowledge and experience of dealing with this patient group, with responsibility for education and liaison with other local specialist AHPs, who participate in MDT meetings.
Coordinator(s)	An administrative post coordinating the MDT meeting and collecting/collating and recording appropriate information through clinicians, radiology and the neuroscience and

[8] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

	cancer network MDTs.
Others as required (extended MDT members)	Representatives from ward nursing, community palliative nursing, consultant neurologist, epilepsy nurse specialist, psychology, neuropsychologists.

Communication between MDTs

98. Good communication is essential for the smooth and effective provision of services. Communication episodes and expected timescales are summarised as follows:

Box 6 Communication framework.	
Communication episode	**Expected Timescale**
The logging of patients with a possible diagnosis of CNS tumour onto neuroscience MDT data base	Within 1 week of imaging report date
The clinical summary received from the diagnosing clinician to the neuroscience MDT	Within 2 working days of the imaging report
The written summary of the management plan produced by the neuroscience MDT sent back to the referring clinician, cancer network MDT and GP	Within 1 working day of the MDT
Informing the patient or carer of diagnosis and management plan	Within 1 working day of MDT for inpatients Within 5 working days for outpatients
Referral to the supportive care services and palliative care team where appropriate	Within 1 working day of the decision
Referral to the cancer network MDT for further management	Within 2 working days of discharge from neurosurgical care
Informing the patient and carer who is the key worker	Within 1 working day of appointment
Referral back to the neuroscience MDT for further management	Within 1 working day of decision

B. Anticipated benefits

99. The establishment of neuroscience MDTs, the appointment of a designated lead clinician at each trust and the development of clear mechanisms for review of imaging and referral of patients will increase the speed of referral and ensure that all patients are discussed at a specialist MDT, whether or not they need specialist intervention.

100. Having a fully staffed neuroscience MDT that meets regularly and discusses all relevant patients will improve diagnostic accuracy, as well as the speed and quality of management decisions.

101. Having a fully staffed cancer network MDT will ensure that the ongoing treatment, care and support for patients is properly coordinated and that the patients' needs are regularly assessed.

C. Evidence

102. The management of patients with CNS tumours requires a range of disciplines (see diagnosis, treatment, rehabilitation and palliative care sections) and the survey carried out to inform the guidance revealed that many neurosurgical units have established MDTs. Evidence for the optimal configuration of the MDT for CNS tumours, however, is limited to expert opinion and consensus based guidelines.

103. There is limited evidence to support MDTs for the management of patients with other types of cancer; in a review conducted for the NHS Executive *Improving outcomes in breast cancer*, multidisciplinary breast cancer teams were more likely to provide appropriate diagnosis and treatment.

D. Measurement

Structure

- Designated lead clinician and access to national teams.

- Neuroscience MDTs established, and cancer network MDTs established where circumstances make the existence of this MDT necessary.
- Support staff in place for every MDT.
- Rapid and effective communication systems between local hospitals and the neuroscience MDT to the time standards identified, see above.
- Establishment of internet based database for central data collection.

Process

- Numbers of neurosurgeons, neuropathologists, pituitary surgeons and neuroradiologists.
- Referral patterns for CNS tumours.
- Current information and audit of diagnosis and treatment.
- Protocols in place and whether they are agreed across the pathway.
- Relationship between different specialties involved in diagnosis and/or management of patients with CNS tumours, for example, ophthalmology.
- Staffing and configuration of existing MDTs.
- Evidence that every patient with a diagnosis of CNS tumours are registered with the neuroscience MDT.
- Evidence that a clinical summary is sent to the neuroscience MDT for all patients with a radiological diagnosis of CNS tumour.
- Audit agreed and reviewed over whole network.

Outcome

- All patients with a presumptive diagnosis of CNS tumour are reviewed by the neuroscience MDT.

- Evidence that MDTs audit individual clinicians' actions against MDT decisions.
- Record of each member's attendance at MDT meetings.
- Record of business carried out (including patients discussed and decisions made) at MDT meetings.
- Logging of patients with imaging suspicious of brain tumour.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Presentation and referral

104. This section primarily refers to the services for patients with primary brain tumours. This is partly because these constitute the largest proportion of patients with CNS tumours, but also because aspects of services for those with other CNS tumours are dealt with in specific sections later on in the guidance. However the organisational arrangements that are recommended will also be relevant to many patients with other CNS tumours.

105. The symptoms associated with brain tumours include headaches, seizures; changes of mental, psychological or mood states, unilateral deafness and progressive neurological deficit. All these are common in general practice. On average, a general practitioner may expect to see more than 30 new presentations of headache or migraine and two new presentations of seizures in a year, but only one patient with a primary brain tumour in seven years. (*NICE Referral guidelines for suspected cancer)*[9].

106. The aim of the referral process is to ensure early access to imaging for people most likely to have brain tumours. The more disabled a patient with brain tumour is at presentation the worse the prognosis and so early diagnosis is important. This does however pose a dilemma in that diagnostic services are limited and referrals need to be prioritised. The combination of new neurological symptoms with new neurological signs is more suggestive of pathology than symptoms alone. The combination of new neurological symptoms in any patient with a past history of cancer is suggestive of metastatic disease and needs to be referred back as a priority to the original team treating the patient.

107. The NICE clinical guidelines for general practitioners *Referral guidelines for suspected cancer* make specific recommendations for the referral of patients with suspected CNS tumours. Implementation of these guidelines should help professionals and agencies providing first

[9] National Institute for Clinical Excellence *Referral guidelines for suspected cancer*. Available at www.nice.org.uk.

contact care to identify those adult patients more likely to have a malignant diagnosis. Such professionals and agencies include general practitioners, nurse practitioners, ophthalmic practitioners, out-of-hours services, NHS Direct and clinicians in accident and emergency departments. The advice for managing children and adolescents with these conditions has been addressed separately in the NICE guidance *Improving outcomes in children and young people with cancer*.[10]

108. It is very important that there are explicit local arrangements whereby general practitioners can access appropriate advice or diagnostic tests.

109. Many patients who are eventually diagnosed with a primary brain tumour will have been referred for investigation of problems not initially thought to have a malignant cause or be admitted as an emergency with an acute neurological problem such as epilepsy and stroke. Hospital staff who care for these patients need to be aware of how they access the appropriate advice.

A. Recommendations

110. Primary care trusts / local health boards should ensure appropriate training is provided for implementation of the NICE clinical guidelines on *Referral guidelines for suspected cancer* as they apply to CNS tumours. This provision should include the new forms of primary care contact such as NHS Direct, walk-in centres, nurse practitioners and health visitors, and the use of relevant IT links. The contents of the guidelines should be incorporated into electronic decision support systems / algorithms used in such settings.

111. Cancer networks should ensure that the trust lead clinician has set up clear and well publicised mechanisms for the receipt and management / processing of GP referrals of patients with suspected primary brain tumours. There should be similar mechanisms for the management of internal referrals.

[10] National Institute for Clinical Excellence. *Improving outcomes in children and young people with cancer*. Available at www.nice.org.uk.

112. Where a brain tumour is identified on requests for imaging from general practitioners, the trust lead clinician should ensure that the general practitioner is informed quickly and arranges early referral through local arrangements.

113. Cancer networks should set up robust local mechanisms to ensure that every patient with radiology that suggests a diagnosis of a primary CNS tumour is discussed by the neuroscience MDT without delay. This is to ensure confirmation of the radiological diagnosis and advice on further management, whatever the source of the initial referral for imaging and whether or not it is thought likely that specialist treatment is needed.

114. Radiological images sent to the neuroscience MDT should be supplemented by clinical information provided either by the consultant responsible for the patient's care or by a member of the MDT who has seen the patient.

B. Anticipated benefits

115. Prompt identification of patients whose symptoms are likely to be due to a primary CNS tumour and subsequent rapid referral to a neurologist or appropriate imaging services will minimise delays in diagnosis. This will reduce the level of anxiety for patients and carers.

116. Explicit systems for managing patients with radiological imaging showing a possible primary CNS tumour should reduce the time taken to review by the neuroscience MDT and to the start of appropriate management. Overall diagnostic accuracy will also be increased.

C. Evidence

117. A review of the evidence on factors influencing delays in referral and diagnosis in the NICE guidelines *Referral guidelines for suspected cancer* showed that there was insufficient evidence to make statements on the reasons for delay between the onset of symptoms and referral from primary to secondary care.

118. Evidence from observational and qualitative studies identified both patient / carer and physician factors that contribute to diagnostic delays.

119. The evidence confirms that early symptoms of CNS tumours mimic common and self-limiting conditions in adults.

120. There is a low volume of observational study evidence on the effect of delays in diagnosis on outcomes such as survival. One retrospective, population-based study from a UK Cancer Registry observed that in patients with CNS tumours, planning radical treatment in patients with good prognosis took longer than planning palliative treatment in patients with poor prognosis. In patients with high grade glioma, survival was significantly shorter for patients treated within a month of referral, which was attributed to the observation that patients with more urgent symptoms and poorer prognosis necessitated urgent referral and treatment.

D. Measurements

121. The following should be subject to regular audit.

Structure

- Evidence of a designated lead clinician in every acute trust.
- Evidence that fully staffed MDTs are established in appropriate neurosciences centres and in each cancer network.
- Local protocols for referring patients to the neuroscience and cancer network MDT, and for image and information transfer.

Process

- Staff attendance at MDT meetings.
- Time between first presentation to the GP with possible symptoms of primary CNS tumour and referral by GP to secondary care or to neuroradiologist for imaging (GP delay).

- Time between GP referral and first image suggestive of a CNS tumour (hospital + imaging delay).
- Time between request for brain imaging and brain imaging (imaging delay).
- Time between imaging and referral to the neuroscience MDT (MDT referral delay).
- Time between imaging and pathological diagnosis (surgical delay).
- Time between GP referral and first surgical treatment (i.e. first treatment e.g. steroids + biopsy or steroids + resection). (Cancer Audit Standard A [surgical]).
- Time between neuroscience MDT and appropriate feedback to referrers and to GP (neuroscience MDT communication delay).
- Time between surgery (pathological diagnosis) to start of radiotherapy (radiotherapy delay).
- Time between GP referral and first radiotherapy treatment (Cancer Audit Standard B [radiotherapy]).

Outcome

- Survival.
- Quality of life.
- Patient and carer satisfaction.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Diagnosis – radiology and pathology

Background

122. Establishing an accurate diagnosis to inform management decisions is a key element in the care pathway for patients with brain and other CNS tumours. This usually involves neuroradiological imaging and histopathological evaluation following biopsy or tumour resection. Other laboratory tests, such as for germ cell tumour markers, occasionally have a role in specific situations. Molecular analysis will increasingly be used alongside histopathological evaluation to characterise CNS tumours, providing information about prognosis and therapeutic response, and thereby facilitating patient stratification.

123. Timely access to the neuroscience brain and other CNS tumours MDT, defined in the MDT section, is required to discuss potential diagnoses and to ensure that patients are actively considered for the full range of investigations and treatments.

124. Neuroradiological imaging is central to the diagnostic process because this is when the diagnosis of a tumour is raised or confirmed. Radiology departments are in a unique position to identify the majority of patients with potential CNS tumours. Delays may occur because of competing demands on imaging services. Despite an increase in equipment during the past few years there is still unmet need, partly due to difficulties in funding and recruiting staff. Even if these are resolved, there will continue to be a significant number of patients who present with advanced disease as an emergency.

125. Because magnetic resonance imaging (MRI) may remain a limited resource, many patients will have computerised tomography (CT) as their primary investigation. A normal CT scan read by a neuroradiologist, or radiologist experienced in CNS imaging, should reliably exclude a tumour in the majority of cases. However, CT may miss early tumours, for example in the temporal lobes. Some patients

will have an MRI scan as an initial investigation or in addition to CT at the local hospital before referral to the neuroscience MDT. The neuroscience MDT may require an additional MRI to obtain a more definitive diagnosis, discriminate between areas of infarction and tumour, and assist in planning for surgery and radiotherapy.

126. Many other imaging techniques, including MR Spectroscopy, diffusion and perfusion imaging, single photon emission computed tomography (SPECT) and positron emission tomography (PET) may help to identify foci of high grade tumour prior to surgery and thereby improve the accuracy of histopathological evaluation. Diffusion tensor analysis and MR spectroscopy may be able to distinguish between primary and secondary tumours and may also show that the lesion is more extensive than was defined on conventional MRI.

127. These newer techniques also have the potential to identify specific biopsy sites, aid the planning of surgery, and provide additional information that will inform pre-operative discussions between surgeon and patient about prognosis, but they cannot replace neurosurgical biopsy and histopathological assessment in making the definitive diagnosis. Currently, neuroradiological imaging has a high sensitivity for identifying a brain tumour, but not for determining the type or grade of tumour, and it may be difficult to distinguish tumour from ischaemic or inflammatory lesions. Thus, histopathological classification of a CNS tumour is regarded as a pre-requisite to effective patient management. Rarely, a diagnosis can be achieved by cytological examination of the cerebrospinal fluid.

128. Tissue for histopathology can be obtained either by biopsy or tumour resection. The decision about which surgical procedure to undertake is based on a presumptive diagnosis made on the neuroradiological imaging features. Potential procedures include: stereotactically guided biopsy, neuroradiologically guided needle biopsy, neuroradiologically guided open biopsy (usually in the form of an operation to remove the

tumour), endoscopic biopsy and electrophysiologically guided resection.

129. There should be pre-operative discussion between the neurosurgeon, neuropathologist and neuroradiologist regarding the optimum approach to surgery and the processing of tissue specimens, including intraoperative histopathological evaluation.

130. Intraoperative histopathological evaluation by a specialist pathologist is particularly valuable during needle biopsy and helps to ensure that sufficient and appropriate tissue is obtained for diagnostic purposes. It can also provide information that will influence the course of the operation.

131. The neuroscience MDT meeting (see section on Presentation and Referral) provides a setting in which the histopathological findings are compared with clinical disease features and the results of neuroimaging. The participating neuropathologist might be in a position to issue a definitive diagnosis before the meeting, or to use information provided at this time to direct further tests or to inform a definitive (final) report. The final neuropathology report is regarded as the definitive distillation of information from the histopathological evaluation process informed by discussions held at the neuroscience MDT meeting. Patient management decisions should be made on the basis of the final report which should form part of the patient's record. The process for disseminating the final report should be agreed locally.

132. Recent translational research on high grade gliomas has begun to define novel molecular diagnostic tests with clinicopathological utility, such as the association between a profile of loss on chromosomes 1p and 19q and chemosensitivity among anaplastic oligodendrogliomas. Further developments in the use of molecular tests alongside histopathological assessment are to be expected in future.

133. Even with the benefit of modern histopathological techniques, precise classification of a CNS tumour is not always feasible. In such cases,

management decisions are helped by discussion of the clinical, radiological and histopathological disease features at the neuroscience MDT meeting.

A. Recommendations

134. All acute trusts should have adequate CT and MR imaging facilities so that outpatient investigations of patients with suspected CNS tumours meet cancer waiting time national targets[11] [12].

135. An electronic image transfer system should be in place to ensure timely image transfer between the local hospital and neuroscience MDT (see section on Presentation and Referral). A function of the MDT meeting should be to determine whether or not further imaging is necessary prior to surgery.

136. When initial CT imaging is not diagnostic there should be rapid access to adequate MRI resources.

137. There should be ready access to a neurosurgical biopsy or resection service, including image localisation and stereotactic techniques. Pre-operative discussions should take place at the neuroscience MDT to determine the optimum approach to surgery and the processing of tissue specimens, including intra-operative histological evaluation.

138. Neuropathology and neuroradiology services should be provided to a level that ensures practitioners in these specialties can provide appropriate diagnostic investigations in a timely and efficient manner, can be involved in pre- and post-operative management decisions and intra-operative histopathological diagnosis, reporting to the standards detailed in the document *Minimum Datasets for CNS Tumours* (Royal College of Pathologists).[13]

[11] Department of Health (2000) *The NHS plan*. Available at www.dh.gov.uk
[12] Welsh Assembly Government (2005) *Welsh health circular 2005 (027).* Available at www.wales.nhs.uk
[13] The Royal College of Pathologists (2004) *Minimum dataset for the histopathological reporting of tumours of the central nervous system*. Available at www.rcpath.org

139. Molecular diagnostic tests will become increasingly important as supplementary investigations to the neuropathological assessment of CNS tumours, informing diagnosis, prognosis and therapeutic decisions. The evaluation, development and implementation of these tests should be supported by Trusts and clinicians.

140. There is a need for improved biological research into CNS tumours, and tumour biopsy material, when processed optimally at the time of operation, should be stored for future scientific research with appropriate consent, as well as for diagnostic purposes.

B. Anticipated benefits

141. Better access to modern diagnostic radiological, neuropathological and neurosurgical services for CNS tumour patients will improve the speed and accuracy of diagnosis.

142. Improvements in the nature and scope of radiological, neuropathological and molecular diagnostic tests will result in better informed clinical management decisions and the ability to offer patients, and their relatives, clearer information about the specific diagnosis and prognosis.

C. Evidence

143. There is consistent evidence that MRI is more sensitive than CT in the detection of CNS tumours and gives better definition of tumour extent. Observational studies suggest the specificity of MRI for tumour histology is not sufficient to allow it to replace biopsy.

144. Individual case series highlight the potential usefulness of new diagnostic imaging technologies, such as MR spectroscopy, diffusion and perfusion imaging, SPECT and PET in the management of CNS tumours. Meta-analysis of such studies, however, is problematic due to small sample sizes, non-standardised techniques and differences in study populations.

145. Two evidence-based technology appraisals of MR spectroscopy for the evaluation of brain tumours reported that there was insufficient high quality evidence to conclude that MR spectroscopy could replace biopsy in the diagnosis of brain tumours.

146. There is consensus supporting the usefulness of PET in distinguishing between brain tumour and radiation necrosis. An evidence-based technology appraisal estimated the sensitivity of PET in this context as between 76% to 83%, with specificity from 50% to 62%. The review also estimated the sensitivity of PET for distinguishing high grade from low grade gliomas, as ranging from 69% to 100%, with specificity from 57% to 100%. In the absence of studies directly comparing the accuracy of PET with conventional MR for distinguishing low and high grade gliomas, however, it is difficult to estimate whether the addition of PET would improve the preoperative evaluation of tumour grade.

147. There is a lack of prospective research designed to compare biopsy techniques; with evidence limited to case series describing the morbidity and mortality associated with biopsy. These studies suggest that the risks for additional permanent morbidity from stereotactic or image directed biopsy are about 4%, with a less than 0.4% risk of death. These figures relate to centres carrying out large numbers of biopsies, however, where more difficult cases may be referred.

148. Two systematic reviews have compared the outcomes of adults with malignant gliomas following surgical resection or biopsy. Both were unable to draw firm conclusions, as only one small randomised controlled trial was identified. Observational case series report improved median survival in patients undergoing resection; these studies are prone to selection bias, however, as patients with better prognosis are more likely to undergo resection.

149. Consistent evidence supports the usefulness of intraoperative neuropathology to confirm the adequacy of biopsy specimens. A UK case series described how the diagnostic rate for stereotactic CT-

guided biopsy of intracranial lesions was improved from 87% to 94% by the introduction intraoperative cytopathology. Two UK audits both showed increased diagnostic yield following stereotactic biopsy if an intra-operative histological procedure was done to confirm that sufficient tissue had been obtained for diagnostic purposes.

150. Four observational studies examined the accuracy of the intraoperative histopathological and cytopathological diagnosis of CNS tumours. Agreement between intraoperative diagnosis based on frozen sections and the definitive diagnosis was seen in between 87 and 90% of cases. When intraoperative diagnosis was based on both histopathological and cytopathological techniques, accuracy was slightly higher, with 91 to 94% concordance.

151. Observational studies suggest that characteristic cytogenetic changes in anaplastic oligodendrogliomas are predictive of chemosensitivity and prognosis, and useful in differential diagnosis. A recent trial identified a potential role for molecular diagnostic testing in predicting the response of patients with glioblastoma to temozolimide.

D. Measurement

Structure

- Access to appropriate imaging equipment for neuroscience MDTs.
- Sessional time for neuroradiologists, neuropathologists to attend neuroscience MDT meetings.
- Provision of adequate resources and staff or demonstrable contingency plans to cope with the estimated demand for biopsy and resectional surgery to reduce the risk of cancellation and waiting times for diagnostic / therapeutic surgery to recommended levels.

Process

Audit of:

- waiting times for neuroimaging and biopsy / resection
- proportion of patients with potential CNS tumours identified to the MDT meeting via a referral from the responsible clinician
- percentage of patients being identified to the MDT meeting by review of the imaging reports that identify a potential tumour
- frequency of obtaining a definitive histopathological diagnosis
- turnaround times for neuropathology reports
- number of patients with advanced disease presenting as emergencies.

Outcome

- Morbidity and mortality associated with biopsy procedures.
- Patient and carer satisfaction.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Treatment and follow-up - brain tumours

Introduction

152. This section covers healthcare services for the more common brain tumours:
153. Low grade gliomas
154. High grade gliomas
155. Meningiomas
156. Metastases

Treatment

157. There is a wide variety of treatments available for these tumours. Choice between the various options crucially depends on the diagnosis made, either by histopathological evaluation of specimens from biopsy or resection, or by review of the radiological imaging.

Low grade glioma (WHO grade I and 2)

158. The natural history of low grade glioma (LGG) and neuronally based tumours is variable, and the histopathological characteristics of the tumour are the most important determinant of outcome. Imaging is not reliable for determining the grade of a glioma and up to 40% of LGG diagnosed on imaging are found to have high grade features on histopathological evaluation of biopsy material. All patients need to have a confirmed histopathological diagnosis unless the neuroscience brain and other CNS tumours MDT decides that performing a biopsy would be too high a risk for the patient or is otherwise inappropriate.

159. Local protocols agreed by the neuroscience and cancer network brain and other CNS tumours MDTs are required to define those patients managed by watchful waiting or early surgical intervention. The EORTC criteria will help identify those at increased risk of rapid deterioration who may benefit by early intervention. Similarly local protocols that define those patients requiring radiotherapy should be in place.

160. The exact role of chemotherapy is uncertain and the research evidence is not strong and the results of recent trials are awaited.

161. Follow-up imaging requirements should be decided by the neuroscience MDT in collaboration with the cancer network MDT and defined by MDT protocol.

High grade glioma (WHO grade 3 and 4)

162. High grade glioma (HGG) includes glioblastoma, anaplastic astrocytomas and anaplastic oligodendrogliomas. These are usually associated with a poor prognosis, although some patients with anaplastic oligodendrogliomas and anaplastic astrocytomas may have a better outcome than others. Among the important prognostic factors are age, performance status and co-morbidity, tumour type and grade and presence or absence of seizures

Initial treatment

163. The main aims of treatment and follow-up are to increase survival while maximising the patients' functional capability and quality of life, and to ensure ready and timely access to appropriate supportive care for patients and carers.

164. The first management decision is to identify whether the patient

- needs urgent surgical intervention (for example, emergency decompression or shunt insertion for hydrocephalus)
- needs elective surgery to decide the management plan within protocols and guidelines agreed by the MDT
- is fit for any intervention.

165. The current waiting time targets (in both Wales and England) from GP referral to first definitive treatment is two months, and from diagnosis

("the definition to treat date") to first definitive treatment is one month[14] [15]. It is important to emphasise that these targets also apply to patients with CNS tumours, although there may be some patients with rapidly growing tumours and pressing symptoms who will need treatment much more quickly.

166. There are some patients in whom tumour growth is very rapid. They may deteriorate very quickly with or without surgical intervention.

167. Radical radiotherapy may be considered following confirmed histopathological diagnosis. In exceptional circumstances where the neuroscience MDT considers that any surgical intervention would put the patient at an unacceptable risk, radical radiotherapy may be given in the absence of histology.

168. Adjuvant chemotherapy has been shown to have a small but significant survival advantage and may be considered in some patients after careful discussion according to local protocol.

169. The use of concomitant chemoradiotherapy and intraoperative chemotherapy implants has recently been assessed in clinical trials. A NICE technology appraisal is anticipated and the results of this work should be incorporated into clinical protocols.

170. High grade gliomas encompass the brain tumours for which novel molecular diagnostic tests have clinicopathological utility. Chemosensitivity among anaplastic oligodendrogliomas is strongly associated with a profile of loss of chromosomes 1p and 19q, and response to temozolomide among glioblastomas is associated with the hypermethylation status of the *MGMT* gene promoter. The development of molecular tests for these and future biological markers that can be used alongside histopathological evaluation has resource implications.

[14] Department of Health (2000) *The NHS plan*. Available at www.dh.gov.uk
[15] Welsh Assembly Government (2005) *Welsh health circular 2005 (027).* Available at www.wales.nhs.uk

171. New service developments would require additional resources.

Treatment at relapse

172. Treatment with chemotherapy may be considered in some patients. NICE guidelines[16] recommend that nitrosourea-based chemotherapy be considered following first relapse of HGG in patients who have had surgery and radiotherapy. Temozolomide may then be considered following failure of nitrosourea-based chemotherapy. Implantable intra-tumoural chemotherapy may be useful in some patients at the time of first surgery or at relapse. A NICE health technology assessment is anticipated and the results of this work should be incorporated into clinical protocols. Survival is very poor in elderly, frail patients with co-morbidities. They tolerate active intervention poorly and are generally managed with corticosteroids and supportive care only. However its role and that of newer chemotherapy and cell cycle active agents remain uncertain and need to be the subject of clinical trials.

Meningioma

173. Meningiomas are tumours arising from the meninges. They most commonly arise in the skull vault and are usually low grade (WHO grade 1) with an indolent, benign course. The commonest presenting symptom is focal or generalised epilepsy. The wider use of CNS imaging has led to an increase in the incidental discovery of meningiomas.

174. Management depends on signs, symptoms, the patient's fitness, the tumour site and size. Small, incidental meningiomas can be safely managed conservatively although there is a lack of consensus as to the optimum follow-up periods. Skull base meningiomas are considered in the section on treatment and follow-up – pituitary, spinal cord and skull base tumours.

[16] National Institute for Clinical Excellence (2001) *Guidance on the use of temozolomide for the treatment of recurrent malignant glioma (brain cancer).* Technology Appraisal Guidance No.23. Available at www.nice.org.uk

175. Resection may be appropriate for patients with skull vault meningiomas. It can prevent further disease progression and the associated deterioration in neurological function although recurrence may occur.

176. Radiotherapy may be considered following histopathological confirmation of the diagnosis in patients with the following features:

- a WHO histopathological grade 2/3 tumour
- invasion by tumour of adjacent brain or extensive invasion of other tissues
- a second or subsequent relapse
- a contraindication to surgery

177. Stereotactic radiotherapy and radiosurgery may be useful in selected patients although the value of these approaches is still uncertain.

178. There is no clearly established role for chemotherapy, hormonal therapy and radiolabelled treatments in the management of these patients.

Metastases

179. Metastases in the brain occur in 20-40% of patients with other primary cancers. Brain metastases are usually associated with a poor prognosis.

180. The great majority of patients require appropriate palliative management which may include radiotherapy, chemotherapy or hormone therapy depending on the site of the primary tumour. There are however a small group of patients who require consideration by a specialist neuro-oncology team:

- those presenting with cerebral metastases as the first sign of malignant disease where surgery is required to clarify the diagnosis

- where imaging findings are in doubt following neuroradiological assessment

- those presenting with solitary metastases, who are otherwise fit, with a prognosis that warrants considering neurosurgical intervention.

181. Complete surgical excision should be considered in patients with single metastases where the risk of unacceptable complications is low.

182. Post operative radiotherapy following the resection of solitary metastases may reduce the likelihood of intracranial relapse in appropriately selected patients.

183. Stereotactic radiotherapy can be considered as an alternative to surgery in small lesions (<3 cm) when the histopathological diagnosis is known. Occasionally it may be considered in patients with more than one lesion. The role of further treatment with radiotherapy to the brain following stereotactic radiotherapy is uncertain although may prevent intracranial relapse.

Follow-up

184. There are difficulties in defining the most appropriate methods and frequency of follow-up patients with brain tumours. The follow up required varies between tumour types and will involve a combined approach to symptom management and disease surveillance. The main reasons for clinical assessment and imaging follow-up are to:

- manage any continuing problems, such as epilepsy, resulting from the disease or initial treatment

- diagnose recurrence when symptoms change and refer for appropriate management

- provide access to appropriate information, support and rehabilitation

- provide symptomatic and palliative care

- provide information to patients on new treatments and opportunities to participate in research studies.

185. Imaging is an integral part of follow-up for patients with brain tumours. There is uncertainty about the value and frequency of follow-up imaging. Ideally it should be reserved for patients in whom the result of the scan is going to alter management. The frequency of scans should then be determined by the MDT. The role of the newer imaging techniques such as PET and SPECT is uncertain.

186. In the case of slow growing low grade glioma patients and benign meningioma patients, locally agreed protocols for follow-up should be in place. It is important to identify a key worker (see section on MDTs) who is the point of contact for the GP, patients and carers.

A. Recommendations

187. The neuroscience MDT should ensure that there are explicit and widely known mechanisms for the urgent management of patients developing acute problems that might require neurosurgical intervention.

188. The neuroscience MDT (Boxes 2 and 3) should be adequately resourced to ensure that all patients start their definitive treatment without delay.

189. Members of the neuroscience MDT are responsible for implementing the surgical aspects of the management plan and adjuvant therapy based on neuropathological diagnosis. All other care including chemotherapy, radiotherapy and coordination of supportive care is the responsibility of the cancer network MDT (Boxes 4 and 5).

190. The cancer network MDT and the neuroscience MDT should develop locally agreed guidelines for follow-up. There should be robust mechanisms in place to ensure that GPs and community palliative care teams are able to communicate efficiently with the specialist teams as the need arises. Patients and carers should be given clear information

as to how and whom to contact if they are concerned about their condition.

191. After initial treatment, patients should have follow-up as close to home as possible by a member of either the neuroscience MDT or cancer network MDT in a multidisciplinary outpatient clinic setting.

192. Patients should have ready access to specialist neuropsychology and neuropsychiatry for assessment and management of complex cognitive, emotional and behavioural problems, and to specialist healthcare professionals as appropriate for any other problems they may experience such as epilepsy, headaches, functional loss, speech and language problems, or visual problems.

193. The neuroscience MDT should advise on the management of patients presenting with brain metastases where biopsy is required to clarify the diagnosis, where there is doubt about the imaging findings following neuroradiological assessment or where neurosurgical intervention is considered appropriate.

194. Stereotactic radiotherapy should be available as an alternative to surgery in patients with a single, or occasionally two, small metastases (<3 cm) when the histopathological diagnosis is known.

195. Novel treatments currently under evaluation should not generally be used outside the context of a clinical trial/research setting.

B. Anticipated benefits

196. Patients will have faster access to the most appropriate specialist care, whatever the diagnosis. They will also have better access to trained health professionals for support, rehabilitation and management of specific problems such as epilepsy.

197. Follow-up will be provided in the most appropriate place, balancing the needs for geographical convenience and specialist expertise.

C. Evidence

Low grade gliomas

198. The data supporting the recommendations for surgery are lacking and constitute expert opinion based on retrospective studies, however there is an association between extent of resection (where this can be done safely) and prolonged survival. There is observational evidence that radiotherapy improves survival in LGG. There is a single RCT indicating that early radiotherapy delays local relapse compared with radiotherapy at clinical or radiological progression, but does not extend survival. Early radiotherapy is associated with a higher risk of late radiation damage compared with delayed radiation therapy.

High grade gliomas

199. The data supporting the recommendations for surgery are lacking and constitute expert opinion based or retrospective studies and one underpowered randomised study, however there is an association between extent of resection (where this can be done safely) and prolonged survival.

200. Radiotherapy has been shown to prolong survival in patients with HGG in four randomised, controlled trials and one well conducted systematic review.

201. In radiotherapy for patients with malignant glioma, evidence to support the use of a focal margin to spare as much normal brain tissue as possible, is provided by one randomised controlled trial. This study compared whole brain radiotherapy with low dose brain radiotherapy plus a boost local to the tumour and found no significant survival difference between groups.

202. Dose escalation beyond 60 Gy has not been shown to be beneficial and neither brachytherapy nor stereotactic boost, have been shown to confer benefit. A well conducted systematic review found that seven of eight randomized studies of hyperfractionated versus conventionally

fractionated radiotherapy demonstrated no significant survival benefit of hyperfractionated radiotherapy.

203. Chemotherapy in an adjuvant setting has been the subject of a recent, high quality meta-analysis that has demonstrated a 2 month median survival advantage for chemotherapy plus radiotherapy compared with radiotherapy alone (hazard ratio of 0.85; 95% CI 0.78-0.91; p=0.00004) and a 5% increase in 2 year survivors.

204. A recent, well conducted, randomised, controlled trial demonstrated benefit from concurrent and adjuvant chemotherapy with temozolomide and radiotherapy, compared with radiotherapy alone, in improving median survival by 2.5 months (hazard ratio of 0.63; 95%CI 0.52-0.75; p<0.001) and a 16% increase in patients surviving at 2 years.

205. Local chemotherapy using implanted wafers has been studied in a randomised, controlled trial, which demonstrated a median 2.3 month survival benefit following polymer slow release chemotherapy (Gliadel), compared with placebo, for patients with newly diagnosed or relapsed glioblastoma.

206. There are numerous case reports of palliative chemotherapy although the optimum regime is not yet established.

207. Anaplastic oligodendrogliomas are more frequently responsive to chemotherapy than astrocytomas. Observational study evidence suggests that in patients with oligodendroglioma, demonstration of 1p 19q LOH not only predicts response to chemotherapy, but also survival.

Meningiomas

208. No randomised controlled trials to guide the management of these tumours were identified. Evidence from case series describes the population, and can be used to suggest a safe population for watch and wait and to indicate the safety of surgery.

209. The role of radiotherapy has been explored in a number of case series but none are randomised or have sufficient follow-up to draw conclusions.

Metastases

210. A systematic review and an evidence-based guideline compared surgical resection and whole brain radiotherapy (WBRT) to WBRT alone in selected patients with a single brain metastasis. No significant difference in overall survival was noted in a meta-analysis of three RCTs. Improved functionally- independent survival was seen in patients receiving surgical resection and WBRT in the single RCT that included this outcome.

211. One of the reviews considered the issue of stereotactic biopsy of presumed solitary brain metastases before initiation of treatment and identified two primary studies. In one study of patients with a known systemic malignancy and a CT scan reported as being consistent with a single brain metastasis, 11% of cases were diagnosed as either primary brain tumours or non-neoplastic lesions following biopsy. The authors concluded that all patients should undergo biopsy. A second study, however, reported the rate of MRI misdiagnosis in patients undergoing surgical resection of presumed solitary brain metastases as 2%.

212. An RCT comparing WBRT plus stereotactic radiosurgery boost with WBRT alone in patients with one to three brain metastases, found no significant difference in the median overall survival or performance status of the two treatment groups. In patients with a single metastasis however, a stereotactic radiosurgery boost was associated with improved median overall survival on univariate analysis, and this benefit approached significance on multivariate analysis.

213. Evidence comparing surgical resection with stereotactic radiosurgery for patients with a solitary brain metastasis was limited to a retrospective case series. The study did not observe an overall survival

difference between the treatment groups, but noted improved local control in patients treated using stereotactic radiosurgery.

214. It remains uncertain whether WBRT is really necessary after resection of a single brain metastasis. While this may reduce likelihood of further brain metastases, it is also associated with radiation related CNS toxicity.

215. An evidence-based guideline comparing WBRT with supportive care alone in patients with multiple brain metastases identified a single RCT. Median survival was 14 weeks in the WBRT compared to 10 weeks in the supportive care group (p value not stated) with similar improvements in performance status seen in both groups. Patients in both groups received oral corticosteroids.

Hospital case volume and patient outcome

216. Consistent observational evidence suggests a positive relationship between hospital case volume and perioperative outcome following neurosurgery. A large population-based American study noted postoperative mortality following craniotomy for CNS tumour resection was significantly lower in high case volume hospitals, and for high case volume surgeons. Similar findings were reported in a study of mortality in patients undergoing craniotomy for tumour in 33 American acute care hospitals and in a population-based study of craniotomy for the resection of metastatic brain tumours. A positive case volume and patient outcome relationship was reported in a study of mortality and morbidity following surgical removal of primary brain tumours in a Russian study, although case mix adjustment was not made in this study. Two American studies reported that perioperative mortality after surgery for cerebral aneurysm was significantly lower in higher volume hospitals and for higher volume surgeons.

217. Evidence, reviewed for example in NICE guidelines *Improving outcomes in colorectal cancer*, suggests that for complex or high risk cancer surgery outcomes are better in higher volume hospitals.

Place of care

218. A report by Northern and Yorkshire Cancer Registry compared the survival of patients with CNS tumours (HGG, LGG or meningioma) treated at 3 specialist neurosurgical centres with those managed elsewhere, in the period 1986 to 1994. Although in a simple comparison survival was better for those treated in neurosurgical units, patients with very poor prognosis tended not to be referred for neurosurgery. When patient age and treatment factors were adjusted for there was no significant difference in survival between those referred to the neurosurgical units and those treated elsewhere.

219. The Glioma Outcomes Project examined patterns of care and survival in 565 American patients with malignant glioma. In a case mix adjusted analysis, patients treated in academic institutions did not have improved survival compared to those treated elsewhere. In a univariate comparison, survival was better for those treated in academic centres and the authors concluded that the survival difference reflected the increased use of chemotherapy, radiotherapy at academic centres and the younger age of patients referred to such institutions.

Sub-specialization in neurosurgery

220. A Scottish observational study compared the survival of a series of 168 patients with malignant glioma treated by a specialist surgical neuro-oncologist with 68 treated by non-specialist neurosurgeons. No survival difference was seen in a case mix adjusted comparison.

221. A small retrospective audit of surgery for intracranial aneurysm in a UK neurosurgery department noted that there was less morbidity and mortality and better patient performance status after neurovascular sub-specialisation was established in the unit.

222. An American observational study analysed the correlation between neurosurgical subspecialisation and outcome using data from three clinical trials which included 485 children with medulloblastomas /

primitive neuro-ectodermal tumours and 247 children with malignant gliomas. Paediatric neurosurgeons were more likely than general neurosurgeons to resect more than 90% of the tumour. No difference in the complication rates of the paediatric and general neurosurgeons was observed, and survival data were not reported.

223. Evidence for neurosurgical sub-specialisation in the treatment of pituitary and skull base tumours is presented in the next section.

D. Measurement

Structure

- Evidence for the establishment of adequately resourced MDTs.
- Provision of staff and resources to provide an adequate neurosurgical service, including emergency procedures.
- Access to stereotactic radiotherapy equipment.

Process

- Time intervals from diagnosis to start of definitive treatment, (31 days) especially for HGG patients, in whom the total time from GP referral to definitive treatment should be well within the 62 day target.
- Number of operations carried out per annum by specialist neurosurgeons and number of new referrals for treatment by clinical oncologists.
- The proportions of patients having surgery, radiotherapy and chemotherapy.
- Entry of patients into clinical trials.
- Delays to start of radiotherapy.

Outcome

- Neurosurgical complication rates.

- One and five year survival rates.
- Quality of life for patients.
- Patient and carer satisfaction.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Treatment and follow-up - pituitary, spinal cord and skull base tumours

Background

224. This section covers the care of those patients with brain and other CNS tumours that would benefit from the advice and management of specialist MDTs (different from the neurosciences brain and other CNS tumours MDT as defined in the MDT section). These include pituitary, spinal and skull base tumours. These MDTs are defined by the specialist expertise required to manage the patients and will be detailed in the individual sections that follow.

225. These patients present in a variety of ways and, as with other CNS tumour patients, the diagnosis will normally first be indicated by imaging. The designated lead in every trust (see Box 1) will be responsible for ensuring clear pathways are in place to refer patients directly to the appropriate specialist MDT for these patients.

226. There is current controversy regarding the manpower requirements for many pituitary tumours. Work is currently underway at a national level to help define this. The service configuration will depend on local circumstances and in some cases there will be overlap in the membership between the pituitary MDT and the neurosciences MDT. However all patients should benefit from assessment by the specialist membership of the pituitary MDT.

227. For spinal and skull base tumours the specialist teams are likely to relate to more that one neuroscience centre. This will be determined by the access to specialist healthcare professionals and services. There will need to be clear pathways of referral to these very specialist teams.

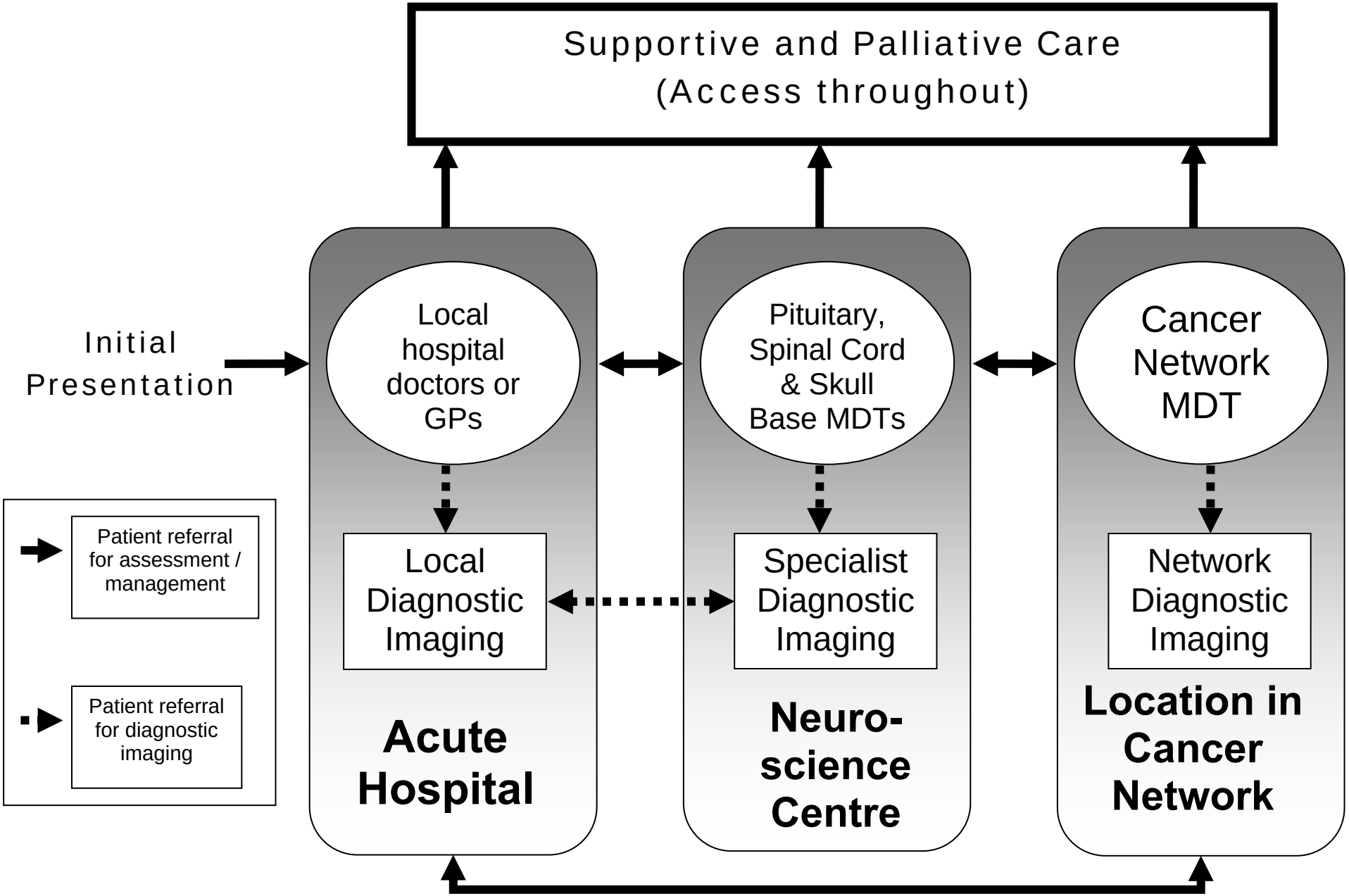
228. The general responsibilities of these specialist MDTs are described in Box 7.

229. For all patients with pituitary, spinal and skull base tumours the cancer network MDT will be the focus of non-surgical treatment and follow-up

unless there are particular treatments and techniques that require a specialist referral. These pathways will need to be defined by protocol determined by the specialist MDT.

230. Fundamental to ensuring efficient clinical care when patients are managed by different teams on different sites is good communication. Figure 5 summarises the flow of information through the patient pathway.

Figure 5: Brain and Other CNS Tumours Patient Pathway



A. Recommendations - general

231. Patients with pituitary, spinal or skull base tumours should have their management plan decided by a dedicated specialist MDT.

232. The relationship between these specialist MDTs and the neurosciences MDT should be clearly defined by local protocols.

233. All patients should have specialist follow-up as defined by the relevant MDT.

Box 7 Pituitary, spinal and skull base MDTs – responsibilities

The pituitary, spinal and skull base MDTs are the teams responsible for the diagnosis and initial management plan (both surgical and non-surgical aspects of care) of most adult patients with these tumours. Membership of these is summarised in boxes 8, 9 and 10 and responsibilities include the following:

- To establish as complete a diagnosis as possible for the optimal clinical management of the patient.
- To develop management plans at first presentation, to include initial supportive care needs, diagnostic and surgical interventions, non-surgical oncology interventions, treatment of symptoms and follow-up.
- To inform the diagnostic clinician/team at the local referring hospital of the management plan.
- To inform the cancer network MDT of the management plan.
- To review and advise on patients referred back for disease progression or relapse.
- To develop MDT protocols, in collaboration with the neuroscience MDT and the cancer network MDTs, to define appropriate follow-up imaging

requirements for patients.

- To act as an educational resource for local service providers.
- To organise regular site-specific group meetings to review pathways of care and protocols.
- Nominate and record a key worker to act as point of contact for patients and carers. This individual will normally be the nurse or allied healthcare professional most involved in the patient's care at any phase of their disease.
- To develop and maintain evidence-based local management protocols covering all aspects of the patient pathway.
- To introduce and maintain systems for data entry across the area of service provision including links to cancer registries.
- To audit practice at local, cancer network and supra network levels against national standards of care.
- To facilitate the entry of patients into appropriate NCRN and local clinical trials.
- Liaise with the cancer network MDT.

Pituitary and pituitary related tumours

Background

234. The majority of pituitary tumours (95%) are adenomas. The remainder include craniopharyngiomas, Rathke's cleft cysts and meningiomas as these involve similar clinical problems, surgical management and personnel.

235. The initial diagnosis may be suspected or confirmed by neurologists, physicians, ophthalmologists or gynaecologists who then have no further involvement in patients' management. Patients usually present with headache, visual disturbance, endocrine dysfunction or by the incidental identification in a CT scan in patients who are asymptomatic.

236. The following principles of care apply:

- Patients with pituitary tumours may require prolonged periods in the care of an endocrinologist who specialises in pituitary dysfunction.
- All patients will benefit at presentation from specialist multidisciplinary team (Box 8) discussion to formulate a management plan.
- MRI is the preferred investigation for patients with potential pituitary or para-sellar tumours. In patients with Cushing's syndrome, specialist interventional radiology experience may be needed.
- The majority of patients require surgery. This is usually carried out by either an ENT surgeon or neurosurgeon.
- The surgical workload for these tumours will decrease in the next few years as new endocrinological treatments become available.
- Histopathological assessment of these tumours requires particular expertise and access to electron microscopy and possibly a second opinion from specialists nationwide.
- Post operative radiotherapy may be required.
- Radiosurgery techniques may help in the management of patients with residual tumours that continue to secret hormones. Otherwise, radiosurgery should be the subject of research studies.
- The follow-up of patients who have been treated for pituitary tumours may require the following:
    - regular assessment by an endocrinologist

- regular assessment of the visual fields by a neuro-ophthalmologist
- MRI imaging.

- Most patients with pituitary tumours will not need palliative and supportive care, although there should be ready access to these services when required.

A. Recommendations - Pituitary

237. Patients should be followed up by a member of the specialist pituitary MDT at a multidisciplinary clinic. More local follow-up based on protocols may be arranged in conjunction with the specialist pituitary MDT or the cancer network MDT and the relevant endocrinology team.

238. Specialist histopathological assessment should be available, as should mechanisms for ready access to second opinion.

Box 8 Membership of the pituitary MDT Appropriate cross cover should be available for all MDT members	
Endocrinologist	An endocrinologist with a special interest in tumours of the pituitary gland and appropriate expertise in the diagnosis and management of pituitary dysfunction.
Clinical Nurse Specialist	A nurse with expertise and experience in neurology/neurosurgery and/or endocrinology working in close association with the specialist endocrinologist as defined by the Manual of Cancer Standards[17].
Specialist pituitary surgeon	A neurosurgeon or ENT surgeon with appropriate training who works in

[17] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

	close association with the specialist endocrinologist and has specialist surgical responsibility for at least 50% of their programmed clinical activities.
Neuropathologist(s)	An accredited pathologist who is registered as a neuropathologist or histopathologist, has specialist expertise in the pathology of tumours in the region of the pituitary gland, and takes part in the national External Quality Assurance (EQA) scheme for neuropathology organised by the British Neuropathological Society or an equivalent EQA scheme for endocrine pathology.
Neuroradiologist(s)	*A* consultant radiologist in a substantive post with at least 50% of clinical programmed activity spent in the practice of neuroradiology.
Specialist AHP(s)	Representative(s) of the allied health professionals, including, prosthetist, speech therapy, dietetics and others as appropriate who have knowledge and experience of dealing with this patient group.
Coordinator(s)	An administrative post responsible for coordinating patient registration with the neuroscience MDT and data collection.
Clinical oncologist	A consultant clinical oncologist with specialist expertise in the management and irradiation of tumours of the sellar region.

Others as required (extended MDT members)	• A consultant ophthalmologist with expertise in the management of patients with visual disturbance associated with a CNS tumour • Specialist palliative care

Intradural spinal cord tumours

Background

239. There is a wide variety of primary spinal column tumours and all are relatively rare. Intradural tumours may be within the spinal cord (intramedullary; 5% of spinal column tumours) or outside the cord (extramedullary; 15% of spinal column tumours) or occasionally both. The majority of spinal intradural lesions are slow growing and clinical presentation may be protracted. Rapid deterioration may occasionally occur in patients with glial tumours. The prognosis for high grade tumour types is nearly always poor with an average life expectancy of between 6 and 12 months.

240. The following principles of care apply:

- All patients will benefit at presentation from specialist multidisciplinary team (Box 9) discussion to formulate a management plan.
- Imaging with MRI is used to investigate these tumours. Spinal angiography may be necessary for a few patients.
- In patients with benign tumours the main aim of treatment, usually surgical, is to prevent further neurological deterioration.
- Patients need to be managed by teams treating other spinal disease that may require surgical management (for example disc prolapse), including emergency services for patients with suspected spinal cord compression.

- There needs to be a single point of referral into the on-call spinal team for both imaging and specialist referral.

- The majority of intradural tumours can be completely excised. The excision of intramedullary glial tumours risks further damage to the spinal cord and survival is not improved if the lesion is malignant. The intraoperative pathological evaluation of biopsy material is therefore essential to ensure that further excision of a malignant lesion, for example an invasive anaplastic astrocytoma, is not performed.

- Intraoperative neurophysiological recording helps to identify and thereby preserve normal spinal cord and should be available.

- Certain groups of patients, for example those with neurofibromatosis types I and II, are at particular risk of developing intradural spinal tumours. They require monitoring and early resection if lesions enlarge or cause symptoms.

- Radiotherapy is appropriate treatment for some patients with malignant tumours.

- Regular follow-up requires MRI scanning and clinical examination to identify and treat post operative complications or tumour recurrence.

Box 9 Membership of the spinal cord MDT Appropriate cross cover should be available for all MDT members	
Spinal Surgeons(s)	Specialised spinal surgeon (neurosurgical/orthopaedic) but spends at least 50% of clinical programmed activities in neuro-oncology/spinal surgery and are members of a national specialist organisation.

Neuropathologist(s)	An accredited pathologist who is registered as a neuropathologist or histopathologist, has specialist expertise in neuro-oncology, and takes part in the national External Quality Assurance (EQA) scheme for neuropathology organised by the British Neuropathological Society.
Neuroradiologist(s)	A consultant radiologist in a substantive post with at least 50% of clinical programmed activities spent in the practice of neuroradiology.
Clinical Nurse Specialist(s)	A nurse with specialist knowledge of CNS tumours and skills in communication as defined by the Manual of Cancer Services.[18]
Specialist AHP(s):	Representative(s) of the allied health professionals, including, occupational therapy (OT), physiotherapy, dietetics and others as appropriate who have knowledge and experience of dealing with this patient group.
Coordinator(s)	An administrative post responsible for coordinating patient registration with the neuroscience MDT and data collection.
Others as required (extended MDT members)	• A named clinical oncologist • Specialist palliative care

[18] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

A. Recommendations – intradural spinal cord tumours

241. These patients should be managed by teams that deal with patients with other spinal disease that may require surgical management (for example disc prolapse), including emergency services for patients with suspected cord compression.

242. There should be a single point of referral into the on-call spinal team for both imaging and specialist referral including urgent MRI scans, CT myelography, spinal angiogram and specialist management.

243. There should be access to intraoperative histopathological evaluation and intraoperative neurophysiological recording with appropriate neurophysiologist and technical support.

244. There should be access to appropriate rehabilitation services.

Skull Base Tumours

Background

245. There is a wide variety of tumours of the base of the skull, ranging from slow growing to very aggressive, but they are usually associated with progressive morbidity as the tumour grows and invades. Most are diagnosed following the investigation of sino-nasal, balance, or hearing problems. Symptoms may include seizures, headache, nerve palsies, facial pain, hearing loss and balance disorders.

246. The commonest tumour at this site is the schwannoma, a benign, generally slow growing tumour that arises from the vestibular nerve.

247. The following principles of care apply:

- All patients will benefit at presentation from specialist multidisciplinary team (Box 10) discussion to formulate a management plan.

- A combination of MRI and high resolution CT are used to assess the tumour before surgery. MR angiography, CT angiography, conventional angiography or a combination of these techniques may be needed to

assess vascular involvement.

- Endoscopic or CT-guided needle biopsy is usually required depending on the site involved. Occasionally, open intracranial biopsy is necessary.

- Patients with skull base tumours also may require the following assessments before treatment:

    - Neuro-otological evaluation

    - Audiological testing

    - Specialist pathological assessment

    - Auditory-evoked brain stem responses testing

    - Vestibular testing

    - Prosthetic assessment to establish the need for ocular, aural or skull bone replacement.

    - Speech and language therapy assessment and explanation to the patient of likely postoperative impairment.

    - Dietetic assessment of neurological status and the need for post operative nutritional support (for example, nasogastric or percutaneous endoscopic gastrostomy (PEG) feeding).

- Surgery is often the treatment of choice but complete excision is not always possible because of involvement of surrounding structures. Ventricular shunting or draining may be required for large tumours.

- Because of the nature and location of these tumours the expertise of a variety of surgical specialists (ENT surgeon, maxillo-facial surgeon, specialist neurosurgeon or reconstructive surgeon) may be required.

- Specialised techniques, such as embolisation of very vascular tumours, may be required.

- Where complete excision is not possible, radiotherapy may be considered. The use of external beam conformal radiotherapy is well established and there is increasing evidence for the role of stereotactic techniques. Patients with small acoustic schwannomas can be offered the choice of surgery or stereotactic radiotherapy.

- Follow-up may include imaging with CT, MRI, PET and bone scan and audiology.

Box 10 Membership of the skull base MDT Appropriate cross cover should be available for all MDT members	
Surgeons.	Neurosurgical, ear, nose and throat (ENT), maxillofacial, ophthalmic or plastic surgeons. The skull base team should include or have access to surgeons proficient in reconstruction, including micro-vascular techniques. Each surgeon should be expected to dedicate specific time to skull base cancer.
Neuropathologist(s)	An accredited pathologist who is registered as a neuropathologist or histopathologist, has specialist expertise in neuro-oncology, and takes part in the national External Quality Assurance (EQA) scheme for neuropathology organised by the British Neuropathological Society.
Neuroradiologist(s)	A consultant radiologist in a substantive post with at least 50% of clinical programmed activities spent in

	the practice of neuroradiology.
Oncologist(s)	A clinical oncologist with a special interest in tumours of the skull base.
Clinical Nurse Specialist(s)	A nurse with specialist knowledge of brain and other CNS tumours and skills in communication as defined by the Manual of Cancer Standards[19]**.**
Specialist AHP(s):	Representative(s) of the allied health professionals, including, prosthetist, speech therapy, dietetics and others as appropriate who have knowledge and experience of dealing with this patient group.
Coordinator(s)	An administrative post responsible for coordinating patient registration with the neuroscience MDT and data collection.
Others as required (extended MDT members)	• Specialist palliative care

A. Recommendations – skull base

248. There should be ready access to MRI, high resolution CT, MR angiography, CT angiography and conventional angiography.

249. There should be ready access to pre-operative neurophysiological assessment.

250. An appropriate mix of surgical skills is required for these patients. This will necessitate that those surgeons forming the core or extended surgical team should have sufficient flexibility in their timetable to accommodate joint operating when necessary.

[19] Department of Health (2004) *Manual for cancer services*. Available at www.dh.gov.uk

251. There should be access to stereotactic radiotherapy/radiosurgery.

The following sections (B, C, D and E) apply to all tumours types described above.

B. Anticipated Benefits

252. Management by specialist MDTs will improve the access to and appropriateness of treatment, as well as continuity of care and rehabilitation.

253. Early diagnosis and appropriate treatment that preserves neurological function will:

- improve survival
- reduce treatment related morbidity
- improve the patients' quality of life.

254. Improved extent of resection and functional and cosmetic outcome from the use of multiexpertise surgical teams.

C. Evidence

Pituitary tumours

255. Consensus-based UK clinical guidelines recommend the referral of patients with pituitary tumours to specialist centres where management plans may be agreed jointly by endocrinologists, pituitary surgeons and radiotherapists.

256. Consistent evidence supports the recommendation for specialist pituitary neurosurgery. A population-based American study reported lower perioperative mortality and complication rates for those hospitals and surgeons with a high case volume of transsphenoidal pituitary surgery. A UK institutional audit reported better cure rates when responsibility for pituitary surgery was transferred from a group of

neurosurgeons to a single dedicated pituitary surgeon. In a large survey of American neurosurgeons, more experienced surgeons reported fewer complications of transsphenoidal pituitary surgery.

Spinal cord tumours

257. No studies comparing different service models for the management of patients with spinal cord tumours were identified.

258. A UK case series describing 13 children with primary spinal cord tumours highlighted the problem of diagnostic delay due to poor referral pathways. The delay between the onset of symptoms and diagnosis was several years for two patients and averaged approximately 10 months in the remainder of cases. The importance of prompt diagnosis and treatment is supported by case series describing the prognosis of patients with intramedullary spinal cord tumours. These studies identify tumour histology, neurological status before surgery and complete removal of the tumour as prognostic factors for outcome after surgery.

Skull base tumours

259. While no direct evidence relating to skull base MDTs was identified, other studies suggest that the concentration of expertise within dedicated teams could improve patient outcomes. Two population-based American studies, one nationwide and one limited to California, reported that outcomes for patients with acoustic neuroma were better if their surgery was performed at higher volume hospitals or by higher volume surgeons. Evidence-based clinical guidelines note that patients with acoustic neuroma require multidisciplinary care and recommend that such patients should be managed by centres treating large numbers of cases.

D. Measurement

Structure

- Evidence that fully staffed and functional MDTs for pituitary, spinal cord and skull base tumours have been established.
- Clear protocols for referral and management of such patients.

Process

- Staff attendance at MDT meetings.
- Times from presentation and diagnosis to first definitive treatment.

Outcome

- Survival.
- Treatment related morbidity.
- Quality of life.
- Patient and carer satisfaction.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Treatment and follow-up - primary CNS lymphoma, medulloblastoma, pineal tumours and optic gliomas

Background

260. Tumours of the brain and CNS in adults with an incidence of less than 1-2 per million per year include primary CNS lymphoma, medulloblastoma, pineal tumours and optic gliomas. As described in the background section, reliable data on the incidence of some of these CNS tumours are not available.

261. The majority of these patients will be managed initially by the neuroscience brain and other CNS tumours MDT through the pathways described in the MDT section. As with other CNS tumours, the diagnosis will often be suspected on imaging before surgery or biopsy confirmation.

262. Because of their rarity very few centres and clinicians will gain wide experience in managing patients with these tumours, which means that they present particular problems in management and service coordination. These problems are quite similar to those experienced in the management of tumours in children. The national coordination of treatment protocols through the UK Childrens' Cancer Study Group provides an excellent model for standardisation of care for adults with rarer tumours.

263. It is proposed that national tumour groups should be established and funded to standardise care for these patients. The neuroscience MDT would normally act as the conduit through which these national treatment protocols would be applied. It will be a responsibility of these MDTs to audit the adherence of patients to these treatment protocols.

A. Recommendations – general

264. National tumour groups should be established to develop standardised guidelines and protocols for the investigation, management and clinical research of rare CNS tumours.

265. All patients with rare CNS tumours should be managed within the context of an MDT - usually the neuroscience MDT but, where appropriate, in collaboration with the cancer network MDT.

Primary Central Nervous System Lymphoma (PCNSL)

Background

266. Primary central nervous system lymphoma (PCNSL) accounts for about 2% of all primary CNS tumours. A disease of middle and older age, it may be associated with immunosuppression (particularly HIV infection) and so all patients need to be investigated for evidence of immune suppression, including HIV infection.

267. Patients with PCNSL present in the same way as patients with other primary CNS tumours. Although the diagnosis may be suspected from CNS imaging, a biopsy is essential to diagnose and classify the lymphoma. Intraoperative histopathological evaluation of the biopsy specimen is necessary to establish the diagnosis and avoid further surgery. The prognosis is usually very poor and the disease may be associated with serious neuropsychological problems, the most severe of which is dementia. There is no benefit from surgical resection.

268. Management policies appear to vary around the country and there is little good research evidence on which to base management decisions. Steroids help to reduce symptoms and most patients who are fit enough are treated with chemotherapy. Regimes with high CNS penetration are required and the expertise to safely administer and monitor these treatments is essential in the multidisciplinary team managing the patients.

269. Post-chemotherapy radiotherapy may help to control the disease but its usefulness may be outweighed by the increased risk of dementia or other neuropsychological problems. Early neuropsychological input and advice as part of the MDT approach is therefore essential. Patients who are frail, elderly or immunosuppressed may only tolerate less intensive treatment.

270. Following treatment most patients with PCNSL relapse and many of those who do not relapse or who relapse late have neurological problems. Follow-up arrangements are required that provide supportive care for patients during remission and consider further palliative treatment at relapse. There is no consensus about what this should be and no evidence that early detection and intervention is beneficial.

A. Recommendations - PCNSL

271. A national PCNSL tumour group should be established to unify management approaches, develop national standardised guidelines and treatment protocols and determine research programmes.

272. A multidisciplinary approach to the management and care of patients with PCNSL should be provided by the neuroscience MDT, and the cancer network MDT as described in the MDT section. It is important that a haemato-oncologist, medical or clinical oncologist with a special interest is involved in the management of lymphomas. Where the neuroscience MDT does not have appropriate expertise in the core membership, there should be a named representative of the lymphoma MDT who will act in this capacity.

273. Facilities for neurosurgery should include stereotactic biopsy, image guided surgery and on-site neuropathology service for intraoperative histopathological evaluation.

274. The on-site neuropathology service should have access to specialist lymphoreticular pathology services to distinguish lymphoma from other lymphoid pathologies and to grade and classify the lymphoma.

275. Chemotherapy services should be accredited for the delivery of intrathecal drugs.

276. There should be ready access to ophthalmic services as this disease often involves the visual pathways, and ophthalmic review will be required to complete disease staging.

277. All patients with HIV related lymphoma should also be under the care of the local HIV service.

Medulloblastoma

Background

278. Medulloblastoma is a very rare tumour in adults and probably less than 50 patients present annually in England and Wales. It usually occurs in the posterior fossa and is associated with cerebellar symptoms and raised intracranial pressure. It commonly spreads through the craniospinal axis.

279. Patients need to have an MRI of the brain and whole spine before surgery. Standard treatment would be surgery to remove as much tumour as possible, followed by radiotherapy to the whole neuraxis. The role of chemotherapy following surgery and radiotherapy in the management of adults is not established.

A. Recommendations - Medulloblastoma

280. A national adult medulloblastoma tumour group should be established to unify management approaches, develop national standardised guidelines and treatment protocols and determine research programmes.

281. Patients with medulloblastoma should be reviewed by the neuroscience MDT and / or further investigations and treatment as appropriate.

282. All adult patients with medulloblastoma should receive their neuraxis radiotherapy in radiotherapy centres that also treat paediatric medulloblastoma.

Pineal tumours

Background

283. Tumours involving the pineal gland or body are very unusual in adults. There are three main histological types: germ cell tumours (GCTs), astrocytomas and pineal parenchymal tumours, which include pineocytomas and pineoblastomas.

284. Pineal tumours most commonly present with symptoms and signs of raised intracranial pressure. Because they are rare their clinical course and prognosis are not well described, but many GCTs and pineal parenchymal tumours are curable with appropriate management. Germ cell tumours occurring elsewhere within the CNS are managed according to similar principles as those in the pineal region.

285. Treatment varies according to the tumour type and needs to be part of the management plan developed and agreed by the neuroscience MDT. Surgery is often the treatment of choice and may require stereotactic or endoscopic biopsy, cerebrospinal fluid diversion or surgical resection of the tumour.

286. Radiotherapy may be needed, especially for GCTs, but only once the diagnosis has been confirmed from the histopathological evaluation of biopsy material. Craniospinal axis irradiation may be required for the treatment of patients with pineoblastoma and metastatic germ cell tumours. Stereotactic radiotherapy may be appropriate for low grade pineocytomas.

287. Chemotherapy can be used in the management of GCTs but has no proven role in the management of other pineal tumours.

A. Recommendations – Pineal tumours

288. A national pineal tumour group should be established to unify management approaches, develop national standardised guidelines and treatment protocols and determine research programmes.

289. Facilities for the neurosurgical management of patients with pineal lesions should have access to surgical teams practiced in complex pineal approaches and provide the following procedures:

    - ventricular endoscopy (including third ventriculostomy)
    - stereotactic techniques.

290. An on-site neuropathology service is essential to provide intraoperative histopathological evaluation.

291. Patients with low grade pineocytomas should have access to stereotactic radiotherapy services.

Optic Pathway Glioma

Background

292. Gliomas of the optic nerve and tract account for approximately 2% of cerebral gliomas. They are slow growing and predominately occur in children with approximately 60% occurring in children less than 10 years of age. Optic pathway gliomas are classified by location and by their association or lack of association with neurofibromatosis type 1(NF1).

293. The signs and symptoms of optic gliomas usually develop over the course of 6 to 9 months and depend on the location of the tumour. Diagnosis is best made by magnetic resonance imaging (MRI), but computerised tomography (CT) is superior for bony detail and detection of intratumoural calcifications, which suggest low grade histology.

294. These tumours vary in their growth, impact on vision and effect on local structures and need careful specialist management. In adults the

tumours tend to grow quickly and result in rapid visual loss. Management is controversial and treatment decisions need to take into account the patient's age, association with NF1 and location of the tumour. Radiotherapy and chemotherapy should be considered in situations where surgery is not appropriate, eg irradiation of tumours of the optic chiasm.

295. These patients often have long term problems with vision, endocrine dysfunction and cognitive impairment.

A. Recommendations – Optic pathway glioma

296. A national optic glioma tumour group should be established to unify management approaches, develop national standardised guidelines and treatment protocols and determine research programmes.

297. A multidisciplinary approach to the management and care of patients with optic gliomas should be provided by the neuroscience MDT and the cancer network MDT, as described in the MDT section.

298. There should be access to ophthalmic services with regular ophthalmic review.

299. Endocrine support and psychological support should be available where required.

300. There should be access to conformal stereotactic procedures.

301. Lifelong follow-up and support should be provided.

The following sections (B, C, D and E) apply to all tumours types described above.

B. Anticipated benefits

302. Establishing national groups to advise on the management of these rare tumours will ensure that:

- treatment policies are standardised across the NHS in England and Wales
- clinical research is encouraged and facilitated
- national audits can take place.

303. Having local protocols, based on national guidance, will ensure that the MDTs involve other non-core MDT members (for example, haematologists for PCNSL) and that treatment is more efficient and more standardised.

C. Evidence

[Evidence for this section will be available in the second consultation version of this document.]

D. Measurement

Structure

- Establishment of national groups to advise on the management of rare CNS tumours.
- Local protocols for the management of rare tumours and for involvement of non-core MDT members in MDT meetings when needed.

Process

- Times from presentation and diagnosis to first definitive treatment.
- Number of patients treated each year per surgeon and per oncologist.
- Non-core member involvement in MDT meetings.

Outcome

- Postoperative mortality rate.
- Survival.

- Quality of life.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Genetic predispositions

304. Approximately 1% - 5% of brain tumours are due to genetic syndromes that confer an increased risk of developing tumours of the CNS. Patients with these genetic diseases provide an important insight into our understanding of the molecular mechanisms involved in cancer development. In addition, these patients need special care in terms of the management of their high risk status for the development of future tumours. Some of these tumours are associated with neurofibromatosis and several other inherited syndromes:

- **Cowden's disease**

305. Cowden's disease is characterised by multiple hamartomatous lesions and an increased risk of early onset breast and thyroid cancer and dysplastic gangliocytoma of the cerebellum.

- **Gorlin's syndrome**

306. Gorlin's syndrome is synonymous with nevoid basal cell cancer syndrome and is associated with an increased risk of medulloblastoma in children.

- **Li-Fraumeni syndrome**

307. Li-Fraumeni syndrome is primarily characterized by soft tissue and bone sarcomas and breast cancer. Other tumours that may occur are gliomas, leukaemia and adrenocortical cancer.

- **Neurofibromatosis**

308. Tumours of the CNS are seen with increased frequency in both type 1 and type 2 neurofibromatosis. These include acoustic nerve schwannomas, paraspinal neurofibromas meningiomas and gliomas. Neurofibromas may undergo malignant transformation. The astrocytic gliomas are usually low grade and have a predilection for the optic pathways, hypothalamus and cerebellum.

- **Tuberous sclerosis**

309. Tuberous sclerosis is an inherited neurocutaneous disorder that is associated with the subependymal giant cell astrocytoma and benign cysts of kidney, liver and lung.

- **Turcot's syndrome**

310. Turcot's syndrome is occasionally associated with medulloblastomas and malignant gliomas.

- **Von Hippel-Lindau syndrome**

311. The von Hippel-Lindau syndrome is associated with benign vascular tumours, especially of the eye and cerebellum (haemangioblastoma). Renal, pancreatic and epididymal cysts are also common.

A. Recommendations

312. Patients with the above conditions require management within the context of a multidisciplinary team, which should incorporate advice from clinical geneticists on diagnosis and screening.

313. Coordinated follow-up and interval imaging / investigation of patients with neurocutaneous syndromes is best performed in combined specialised neurogenetic clinics where there is access to a neurologist and geneticist.

314. Cases with familial predilection to cancer (for example, Li-Fraumeni and Turcot's syndrome) are best coordinated via cancer genetic clinics or by clinicians with most appropriate clinical skills (for example, Turcot's – gastroenterology; Gorlin's – dermatology).

B. Anticipated benefits

315. Having clearly established and well known mechanisms for the identification and follow-up of these patients will lead to earlier diagnosis and management of malignant disease.

C. Evidence

[Evidence for this section will be available in the second consultation version of this document.]

D. Measurement

Structure

- Provision of specialised clinic for these patients.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Supportive Care

Supportive Care

316. Supportive care is an umbrella term encompassing the work of a broad range of healthcare professionals to address the changing needs of patient and carers throughout the patient journey. The supportive care issues for patients with cancer have been extensively described in the NICE Guidance *Improving supportive and palliative care for adults with cancer.*[20]

317. The needs of patients with brain and other CNS tumours are diverse and the supportive care services offered should not be dependent on diagnosis, but on need. The needs of a patient with a slow growing CNS tumour may be as great as those with a more aggressive tumour.

318. Patients with CNS tumours who require specialist supportive care may need to access these through the neuroscience brain and other CNS tumours MDT or the cancer network brain and other CNS tumours MDT. At all levels of care, referral criteria need to reflect the specific needs of this group of patients and be sufficiently flexible as to ensure the rapid and timely access to the necessary supportive care services.

319. All professionals involved in the provision of supportive care need to be aware of the full range of specialised services in the area, the local referral criteria and care pathways. Healthcare professionals offering supportive care may consider running joint clinics to facilitate the assessment and referral of patients to support services.

Communication

320. Good, rapid communication between healthcare professionals is particularly important for patients with CNS tumours whose care pathway is often complex. This will ensure that members of the

[20] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

different multidisciplinary teams caring for the patient have timely, accurate knowledge and understanding of the patient's current situation thereby reducing the possibility of conflicting information being provided to the patient and carers.

321. Another aim of good communication is to ensure that the patient and carers have the opportunity to be involved in the decision-making process about management and care. For this the patient needs sufficient information about prognosis to understand the advantages and disadvantages of treatment options. The ability however to communicate and be involved in the decision-making process may be compromised in patients with CNS tumours, as many have significant cognitive deficit either at presentation or during the course of their illness. In such cases, carers may need to be more involved in decision-making than the patient.

A. Recommendations

322. Communication skills training, sensitive to the particular needs of patients with CNS tumours, should be provided for healthcare professionals caring for these patients.

323. Healthcare professionals should have face-to-face communication with patients at critical points in the care pathway to discuss diagnosis, prognosis, treatment options (including no treatment), recurrence and end-of-life care.

B. Anticipated benefits

324. Formal communication skills training will improve clinical care, particularly for CNS tumour patients, where cognitive and communication impairments are common.

325. Good communication will improve the experience for patients and healthcare professionals throughout the patient pathway and ensure that, whenever possible, patients can participate in the decision-making process.

C. Evidence

326. A comprehensive literature review considered the issue of communication between healthcare workers and patients with malignant glioma. Evidence from three observational studies suggested that just over half the patients were aware of their prognosis. The relatives of patients tended to be more informed. There was only indirect and inconsistent evidence about how much patients wanted to know about their prognosis. No studies comparing ways of disclosing diagnosis or prognosis to patients with CNS tumours were identified.

327. In a recent UK observational study 25% of patients with brain tumours expressed concerns about the way in which doctors or nurses communicated with them.

328. Evidence from a systematic review, considered in the NICE guidance *Improving supportive and palliative care for adults with cancer*, supports the use of communication skills training for healthcare professionals.

D. Measurement

Structure

- Provision of training in communication skills for all healthcare professionals involved in the care of patients with CNS tumours.
- Availability of key professionals with advanced communication skills for communicating complex medical information and potentially distressing information about prognosis, end-of-life issues etc.
- Development of guidelines for face-to-face communications at key points in the patient pathway.

Process

- Attendance at advanced communications skills courses by senior clinicians and key professionals treating CNS tumour patients.

- Evidence of the provision of clear, written records of significant communications and consultations at all points in the patient pathway and their outcome.
- Evidence of clear, timely communication of information and policies for informing relevant clinical teams in other settings (primary, secondary and tertiary care).
- Audit of interprofessional communication.

Outcome

- Patient, carer and healthcare professional satisfaction with communication process.
- Patient awareness of their diagnosis and prognosis before treatment is started, with the opportunity to be involved in decision-making.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Patient Information

329. The patient information issues for patients with cancer have been extensively described in the NICE Guidance *Improving supportive and palliative care for adults with cancer (Topic 4, p. 64).*[21]

330. Patients with CNS tumours have specific information needs, particularly when there is some degree of cognitive impairment. There are many specialist organisations that can help with the provision of suitable information for specific groups of patients. Information can be provided in different formats such as spoken, written and audio visual. Different patient groups and their families and carers will have different needs and the provision of access to appropriate information is important.

[21] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

331. Healthcare professionals should discuss the use of complementary therapies with patients and carers and help identify possible side effects or interactions with conventional treatment.

A. Recommendations

332. There should be a nominated CNS tumours information lead at cancer network MDT level. CNS tumours information leads should consider ways to develop a regularly updated central register of information for patients.

333. Cancer networks should ensure through their patient and public involvement arrangements that patients and carers have the opportunity to ask questions of specialist healthcare professionals.

334. Information on CNS tumour services should use existing high quality sources.

335. Information on CNS tumours should include national societies, appropriate websites and other relevant publications. A list of information sources currently available is listed in Appendix xx [available at second consultation].

336. Information material containing clear, accurate and relevant information about each CNS tumour type should be made available to patients and carers. This material should explain what patients can expect to happen to them at each stage of their pathway, and when and where each event will occur, with an explanation of the terminology.

337. Information on local specialist palliative care services should be available for professionals, patients and carers at each stage of the patient pathway.

B. Anticipated benefits

338. The provision of clear accurate information throughout the patient pathway will benefit patients, carers and healthcare professionals.

339. Timely communication with the GP and primary healthcare team about the information given to the patient at various stages of the pathway will minimise the risk of patients receiving conflicting information.

340. A lead for CNS tumours patient information will enable members of MDT and healthcare professionals involved with patients in other settings to increase their knowledge and level of support and coordination of services for the patient.

341. Through the information lead, information centre and group information sessions, patients and carers can be directed to additional sources of information, self-help and support in their area, particularly voluntary organisations that have relevant helpline and information services.

C. Evidence

342. A systematic literature review considered the provision of information for adults with malignant cerebral glioma. In one UK observational study approximately one third of patients and relatives said that the information they received lacked coherence. In two observational studies patients reported having to seek out information themselves. No studies comparing different methods of providing information were identified. Qualitative data about consultations confirmed that information about diagnosis and prognosis should be tailored to the individual coping of patients and relatives but there was insufficient evidence to suggest a standard approach to disclosure.

343. An observational study of outpatients at a London cancer centre observed that 38% percent of the 60 patients with brain tumours complained of a lack of information about their illness and treatment. Problems with concentration or memory were reported by 83% of patients with brain tumours, suggesting that the method of delivery of information is an important consideration for this group of people.

344. The development and distribution of information for patients and carers is considered in the NICE guidance *Improving supportive and palliative*

care for adults with cancer. A systematic review confirms that patients with cancer obtain benefit from accurate and relevant information.

D. Measurement

Structure

- Evidence that patient pathway information is available that is specific to service provided.
- High quality patient information material available for each CNS tumour type in appropriate formats.
- A nominated lead for patient information on CNS tumours at the cancer network MDT.
- Provision of appropriate information materials.

Process

- Survey of MDT members' experience of the quality of information and support on CNS tumours provided by the cancer network lead.

Outcome

- Patient and carer satisfaction with information giving.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Psychological Support Services including Neuropsychology and Neuropsychiatry

345. The psychological support service issues for patients with cancer have been extensively described in the NICE Guidance *Improving supportive and palliative care for adults with cancer (Topic 5, p.74).*[22]

346. Patients with CNS tumours may experience psychological difficulties adjusting to a serious, life-threatening condition in the same way as

[22] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

other cancer patients. In addition patients with CNS tumours frequently have cognitive and psychological problems and undergo personality changes.

347. Therefore clinical psychologists, neuropsychologists, with specialist training and expertise in the assessment and management of cognitive impairment and personality change, and neuropsychiatrists, with specialist training and expertise in the management of patients with severe mental health problems, have a key contribution to the care of patients with CNS tumours.

348. Regular assessment of patients' psychological needs and monitoring of cognitive and personality changes are an important part of their continuing care.

A. Recommendations

349. Psychological assessment and support should be an integral part of the multidisciplinary team management of patients.

350. Neuropsychology and neuropsychiatry services should be adequately resourced to enable referral of patients who require specialist intervention for cognitive, emotional or behavioural problems.

351. One member of the neuroscience MDT and the cancer network MDT should be nominated to coordinate referrals and communication with specialist services.

352. Ongoing training should be provided for all staff providing psychological support to patients with CNS tumours.

B. Anticipated benefits

353. A coordinated cancer network will be more capable of delivering consistent, efficient and effective psychological / psychiatric support to CNS tumour patients within the network.

354. There will be a reduction in psychological distress and improvement in health-related quality of life and some other functional outcomes.

C. Evidence

355. There is observational evidence that neuropsychological assessment consistently reveals cognitive deficits in patients with CNS tumours, both at the time of diagnosis and in long term survivors. Observational studies, in patients with CNS tumours undergoing radiotherapy and surgery, support the use of neuropsychological testing to evaluate the effects of treatment. There is limited evidence to suggest that neuropsychological assessment during follow-up may reveal tumour recurrence although the effect of follow-up neuropsychological testing on patient outcomes is not yet established.

356. There is limited research about the changes in mood and personality associated with CNS tumours; there is some evidence that such changes are some of the hardest symptoms for relatives and carers to understand and cope with.

357. Observational studies evaluating the neurorehabilitation of patients with primary malignant CNS tumour indicate the effectiveness of such work. One such study reported on a series of patients with primary or metastatic tumours of the CNS, who underwent rehabilitation at a UK neurological rehabilitation unit. The study demonstrated a general improvement, measured using two scales of physical and cognitive functioning, and the majority of patients were discharged home.

358. Research on the effectiveness of neuropsychological rehabilitation has so far mainly involved patients with other pathologies, such as survivors of stroke or traumatic brain injury, who have comparable if distinct disabilities. Three systematic reviews of the effectiveness of cognitive rehabilitation following stroke and two evidence-based technology appraisals of cognitive rehabilitation following traumatic brain injury, however, were unable to draw firm conclusions due to variability in the methods and patient populations of the primary studies.

359. The need for neuropsychiatry services is supported by observational evidence that psychiatric states of depression and anxiety are relatively common in patients with CNS tumours, both before and after treatment, with a prevalence of between 17% and 30%. However expert opinion held that many patients who would benefit from neuropsychiatry services were not being referred. The complementary role of neuropsychology in this area is supported by consistent evidence from systematic reviews of therapeutic psychological interventions for depression and anxiety in people with cancer (NICE guidance *Improving supportive and palliative care in adults with cancer*).

D. Measurement

Structure

- Evidence of specific referral criteria to appropriate specialists, including neuropsychologists and neuropsychiatrists.
- A designated MDT member with responsibility for coordination and communication with specialist services.
- Provision of resources to enable staff to undergo the necessary training and continuing professional development.
- A documented organisational map of local specialist clinical services.

Process

- Evidence of MDT engagement in audit programmes.
- Annual record of number / proportion of patients referred on for specialist assessment and intervention.
- User surveys and questionnaires on psychological support needs and experiences.
- Delays in the provision of psychology / psychiatric services.

Outcome

- Patient and carer satisfaction.
- Quality of life.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Rehabilitation Services

360. The rehabilitation needs for patients with cancer have been extensively described in the NICE Guidance *Improving supportive and palliative care for adults with cancer (Topic 10, p.134).*[23]

361. Patients with CNS tumours experience complex physical, cognitive and psychological problems. The ensuing functional impairment, loss of independence and potentially severe disabilities are distressing for patients and carers. Patients with a poor prognosis require urgent access to rehabilitation services to optimise function and maximise the quality of their remaining life. Some tumours carry a good long term prognosis, yet the patient's ability to live and function independently may be compromised and they may require ongoing rehabilitation services for a prolonged period of time.

362. Patients who are unable to continue to live independently need to be in an appropriate environment, where their individual needs can be identified and met by a range of health and social care professionals.

363. Rehabilitation services are provided by a range of allied health professionals (AHPs) including:

- Physiotherapists
- Occupational Therapists
- Speech and Language Therapists
- Dieticians.

364. The following health and social care professionals may also have a role in the provision of rehabilitation services for patients with CNS tumours:

[23] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

- Nurses
- Neuropsychology and neuropsychiatry
- Social services care manager / Continuing care manager
- Orthotists/Appliance officers
- Wheelchair services
- Chaplaincy services
- Complementary services.

365. The NICE guidance *Improving supportive and palliative care for adults with cancer* describes a four level model of rehabilitation, assessment and support services with the range of healthcare professionals involved at each level.

Neurorehabilitation teams

366. Throughout their disease journey, patients with CNS tumours may require input from healthcare professionals depending on their own individual needs and problems. Multidisciplinary 'neurorehabilitation' teams provide services for stroke patients and patients with head injury, but it is not always possible for patients with CNS tumours to obtain treatment from these teams. There are several reasons for this:

- Strict referral criteria may exclude patients with CNS tumours
- A large workload may mean that it is not possible for the team to respond quickly enough to a patient with rapidly changing needs
- Healthcare professionals working in a neurorehabilitation team may feel inadequately trained to help patients with CNS tumours and require education, advice and support from more experienced specialist colleagues.

A. Recommendations

367. Commissioners should ensure that implementation of the recommendations in the NICE guidance *Improving supportive and palliative care for adults with cancer* [24] includes services for patients with CNS tumours.

368. There should be rapid access to AHP assessment and rehabilitation services, including specialist neurorehabilitation, as the patient's condition changes.

369. There should be immediate access to specialist equipment, as necessary.

370. Cancer networks should nominate a lead AHP in neuro-oncology who has overall responsibility for coordinating the provision of rehabilitation services, education, training and research throughout the network.

371. In addition, cancer networks should ensure that specialist AHPs, working at level 4, are available throughout the network and that patients have access to these as and when appropriate.

372. Neurorehabilitation teams should be available for the continued rehabilitation of CNS tumour patients at home or in the community.

373. Where it is not feasible for CNS tumour patients to be cared for by the existing neurorehabilitation team(s), commissioners should ensure that an equivalent service is provided by a cancer network neuro-oncology rehabilitation team.

374. Commissioners should work with local social services to ensure that age-appropriate long term placements can be found for those CNS tumour patients requiring such facilities.

375. Patients with spinal tumours should have the opportunity to undergo intensive rehabilitation in a specially adapted unit such as a spinal

[24] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

injuries unit in order for them to achieve their maximum functional potential. Commissioners need to ensure that spinal tumour patients can be admitted to such units and that the treatment program is appropriate to their needs.

B. Anticipated benefits

376. Effective and timely provision of rehabilitation services will help to optimise function and maximise quality of life for patients and carers.

377. A cancer network approach to service provision, including education and training for rehabilitation professionals, will ensure equitable access to services.

C. Evidence

378. Evidence for specialist motor and cognitive rehabilitation in patients with CNS tumours is of low quality, but several observational studies report on patients who undergo rehabilitation at specialist units.

379. These studies suggest that patients with primary or metastatic CNS tumours may benefit from rehabilitation, although efficiency of functional improvement when measured against length of stay in rehabilitation is less for cognitive improvement compared with motor improvement.

380. The levels of functional improvement observed in observational studies are reported as similar to those seen in patients with traumatic brain injury.

381. It is unclear whether greater functional improvement is seen in patients who undergo concurrent radiotherapy to those who do not, although expert review evidence suggests that rehabilitation need not be excluded where aggressive therapy is taking place.

382. Studies report that a high proportion of patients with CNS tumours are discharged home following rehabilitation, although readmission to acute hospitals is also common.

D. Measurement

Structure

- Lead AHP in neuro-oncology in cancer network.
- Availability of cancer network wide access to appropriate rehabilitation specialists and services.
- Evidence of referral criteria to neurorehabilitation teams.
- Provision of rehabilitation facilities – inpatient, outpatient, domiciliary services, hydrotherapy, specialist neurorehabilitation services, specialist palliative care services.
- Provision of cancer network wide training/support/education programmes for all healthcare professionals involved in the care of patients with CNS tumours.

Process

- Audit of delays in the provision of rehabilitation services and equipment.
- Audit of numbers of specialist AHP coordinating rehabilitation.
- Audit of delays in the provision of long term placements in age appropriate facilities, where appropriate.

Outcome

- Patient and carer satisfaction.
- Quality of life.
- Functional status with rehabilitation.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

General palliative care

383. The general palliative care issues for patients with cancer have been extensively described in the NICE Guidance *Improving supportive and palliative care for adults with cancer* (Topic 8, p.105).[25]

384. Although palliative care is particularly important for patients with CNS tumours in the later stages of their illness, a palliative approach is needed for many from the time of diagnosis.

385. As CNS tumours are relatively rare, most generalist health and social care professionals (members of the primary care team, community nurses, care home staff, hospital doctors and nurses, allied health professionals, social workers, self-help and support groups) will have very little experience of the particular care needs of these patients. However, they will be the ones who deliver the majority of care in most settings, including those where little or no specialist service is available. Palliative care may be only a small part of the normal workload of these professionals and so they should know when to seek advice from, or refer to, specialist palliative care services.

386. There are a number of important measures that can help them to provide a high quality service for patients with CNS tumours. These include access to education and training in palliative care, and being involved in regular assessment of the patients' needs.

387. Regular needs assessments will increase communication and cooperation between services providing care, and improve delivery of a service shaped to the individual needs of patients. To aid best practice in the community a GP practice-based managed plan of care for patients at home, such as the Gold Standards Framework[26], could be used.

[25] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk
[26] Macmillan Cancer Relief (2005) *Gold standards framework*. Available at www.macmillan.org.uk

388. Patients with brain tumours may undergo progressive cognitive impairment, personality change and other neurological deterioration and it may not be feasible for them to determine their preferred place of care or death. An increased burden therefore may fall on relatives and other carers, who will in turn need appropriate support.

389. However, it is important that the patient's preferred place of death is noted and measures taken to comply when possible.

A. Recommendations

390. Palliative care education and training for healthcare professionals should include when and how to seek advice from, or refer to, specialist palliative care services.

391. Patients with CNS tumours should have the opportunity for regular systematic needs assessment by healthcare professionals with training in general palliative care, and discussion with the local specialist palliative care service about further involvement as required.

392. The preferred place of care and place of death should be discussed with CNS tumour patients and carers and their wishes observed where possible.

B. Anticipated benefits

393. Implementation of the NICE guidance *Improving supportive and palliative care for adults with cancer*, with its emphasis on regular needs assessment, will increase communication and cooperation between the services providing care and with patients and their carers. This will lead to the delivery of a service better shaped to the patient's needs and increase the chances of the patient's preference for place of death being met.

394. Providing training and education for generalists will also aid the appropriate involvement of specialist palliative care throughout the course of the patient's illness.

C. Evidence

395. Most of the evidence presented in support of the recommendations for general palliative care was originally reviewed in the NICE guidance *Improving supportive and palliative care in adults with cancer*.

396. Evidence from surveys suggests shortcomings in the assessment of the palliative care needs of patients with advanced cancer in general healthcare settings.

397. A recent literature review noted additional difficulties in the assessment of symptoms and concerns in patients with cognitive impairments as a result of a brain tumour.

398. Surveys of healthcare professionals have identified a need for education and training in the management of patients with advanced stage illness. Evidence from randomised controlled trials supports the use of such training programmes in helping to change clinical practice. There is limited evidence that the use of guidelines can help coordinate referral from general to specialist palliative care services.

399. A UK survey into trends over a 10-year period showed that, whilst many people wanted to die at home only around 25% of people with cancer did so, the remainder dying in hospital, hospice or care home. Reasons for the change in place of death included lack out-of-hours of nursing care, medication or equipment as well as a change of mind by the patient.

D. Measurement

Structure

- Availability of criteria / pathway for referral to Specialist Palliative Care, including contact information, service provided etc.
- Availability of a Preferred Place of Care plan for patients with CNS tumours.

Process

- Development of palliative care training / education for generalists and audit of staff involved in direct patient care who have attended such sessions.
- Audit of CNS tumour patients achieving / maintaining their preferred place of care, and death.

Outcome

- Survey of MDT members experience of access to Specialist Palliative Care for patient needs.
- Surveys of CNS tumour patients and carers satisfaction with general palliative care access and provision, and the outcome of the preferred place of care plan.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Social Support and Continuing Care

400. The social support needs of the patient will vary according to the level of disability, progression of disease, patient preference, level of carer support and informal services. The provision of care should meet the needs of patients allowing for age, gender and cultural differences.

401. Continuing care (or long term care) is a general term that describes the care which people need over an extended period of time, as the result of disability, accident or illness, to address both physical and mental needs. The care can be provided in different settings: NHS hospital, nursing home, residential home or in the patient's home. Patients with an intermediate prognosis but with a high level of care require joint assessment between NHS and local council in accordance with *Continuing care: NHS and local councils' responsibilities*.[27] There is a 'duty of partnership' between health authorities and councils. Collaborative working across these boundaries is necessary.

[27] Department of Health (2001) *Continuing care – NHS and local councils' responsibilities*. Available at www.dh.gov.uk

A. Recommendations

402. The provision of long term care arrangements should be in accordance with *Continuing care: NHS and local councils' responsibilities*.

403. Younger patients with continuing care needs should also be carefully considered. Procedures must be in place to ensure the continuing care needs of younger patients with CNS tumours are appropriately met.

404. Needs for social support should be elicited as an integral component of routine assessment, ideally undertaken with or by a social care professional.

Specialist Palliative Care

Background

405. Specialist palliative care services help patients with cancer and other life-threatening illnesses that are no longer responsive to curative treatment. Specialist palliative care teams manage complex symptom problems and also provide spiritual and emotional support for patients and carers. They may also be a resource for the education and support for healthcare professionals. These services are provided by statutory and voluntary organisations and cover the spectrum of community, hospice and hospital settings. The NICE guidance *Improving supportive and palliative care for adults with cancer* published in March 2004 provides detailed information and makes recommendations about specialist palliative care which complement and inform this site-specific guidance (Topic 9, p.122).[28]

406. Brain tumour patients in particular, have palliative care service needs. They may often experience progressive neurological, cognitive and personality changes over the course of their illness and there may sometimes be rapid changes in their symptoms especially when disease is advanced. Most of these patients could benefit from specialist palliative care around or soon after the time of diagnosis, but for many this does not happen until much later in their illness when they are considered to have reached the terminal phase.

407. Closer integration between specialist palliative care and neuro-oncology services throughout the patient's illness can help a smooth transition from more active treatment to palliative care. This will require opportunities for sharing patient care, such as joint clinics and joint ward rounds, as well as ensuring that palliative care specialists are included at MDT meetings.

[28] National Institute for Clinical Excellence (2004) *Improving supportive and palliative care for adults with cancer*. Available at www.nice.org.uk

A. Recommendations

408. Palliative care specialists should be included as members of the neuroscience brain and other CNS tumours MDT and the cancer network brain and other CNS tumours MDT to provide advice on palliative and supportive care and the management of symptoms and to contribute to the patient's management plan.

409. Cancer networks should ensure that healthcare professionals in neuro-oncology services and specialist palliative care services work closely together throughout the patient's illness to ensure an appropriate balance between active treatment and palliative care.

410. Cancer networks should ensure that there are mechanisms in place for the referral of patients with CNS tumours to specialist palliative care services, with referral at the time of diagnosis, when appropriate.

411. Information on local specialist palliative care services should be available for healthcare professionals, patients and carers at each stage of the patient pathway.

B. Anticipated benefits

412. Closer integration between services and involvement of specialist palliative care earlier in the patient pathway will improve communication and ensure that services are more responsive to patients' needs. This will lead to increased levels of patient and carer satisfaction.

413. Closer working relationships between healthcare professionals will aid patients' timely transfer between services and treatments which maximise survival to those that emphasise optimising symptom control, function, emotional support and quality of life.

414. Improved continuity of care between services and settings could help more patients to continue in their preferred place of care both as their illness progresses and when they are dying.

C. Evidence

415. There is consistent evidence, reviewed in the NICE guidance *Improving supportive and palliative care for adults with cancer*, to show that specialist palliative care teams in hospital, hospice and community settings are effective for the control of pain and symptoms of people with cancer. Patients cared for by such teams were also more satisfied than those cared for elsewhere. It follows that involvement of specialist palliative care, as soon as is appropriate, should benefit CNS tumour patients. The importance of early involvement of specialist palliative care teams for the specific, and often severe, symptoms experienced by people presenting with CNS cancer is supported by a recent literature review. A 2003 observational study of outpatients attending a London cancer centre, including 60 patients with brain tumours, identified a high level of unmet need for specialist palliative care, especially amongst those with lung cancer or brain tumours.

416. It seems likely that clear referral criteria and a closer working relationship between neuro-oncology and specialist palliative care services will improve communication, support and coordination of care. There is insufficient evidence at present, however, to specify the best mix of roles and links between services to ensure that patients' palliative care needs are met. The NICE guidance *Improving supportive and palliative care for adults with cancer* considered the coordination of palliative care. Evidence from two randomised controlled trials suggests that a nurse coordinator, acting as the link between patient and health services, reduced the number of days spent in hospital by the patient, the number of home visits by the community care team and helped to enable patients to die at home.

D. Measurement

Structure

- Evidence that palliative care specialists are included as members of MDT meetings

- Availability of referral criteria to specialist palliative care
- Evidence of integration of patient care between neuro-oncology services and specialist palliative care
- Provision of information on specialist palliative care services

Process

- Audit of referrals to specialist palliative care.
- Audit of shared decision-making, communication and information on patient care.
- Audit of time to provision of specialist palliative care interventions.
- Audit of symptom control.

Outcome

- Patient, carer and professional satisfaction with experience of service / care.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Information management

Background

417. The information available on the management of patients with brain and other CNS tumours in England and Wales is limited. Two regional studies within the UK have shown that the registration of patients with primary brain tumours is very incomplete. There is also very little reliable information on the national incidence of some of the rarer tumour subtypes, for example brain and CNS lymphoma.

418. Good quality data are required to establish a baseline for future comparisons, to provide commissioners with information about appropriate service provision, to monitor performance against standards and to show improvements in outcome.

419. Collecting data on this group of tumours is particularly difficult for the following reasons:

- They present via a diverse variety of routes
- They have a complex classification system subject to change between ICD-10 revisions, which often do not conform to the WHO classification
- Their management is often complex, involving different teams and services that may not be part of the same cancer network
- Some are diagnosed on the basis of imaging only, without histopathological confirmation.

420. It is therefore very important that, as a minimum, information is recorded for clinical audit purposes on:

- All patients with a radiological diagnosis of CNS tumours
- Any further investigations and the confirmed diagnosis (with the cancer registry notified)

- The management plan agreed by the specialist MDT
- The initial treatment provided
- Outcomes, both short- and long-term.

421. Complex pathways of care however, also mean that additional information has to be easily available to support MDT decision-making and clinical management.

A. Recommendations

422. Data collection systems should be in place which allow entry of information on all patients with a radiological or histopathologically confirmed CNS tumour and should be made available to healthcare professionals. Consideration should be given to a web-based information system that will allow easy data sharing across the service.

423. A local retrieval system that identifies all radiology reports that mention CNS tumours should be developed and will be required until digital, coded reporting systems are universal.

424. The lead clinician of the neuroscience MDT and the lead clinician of the cancer network MDT should assume overall responsibility for ensuring that complete data are collected, verified and recorded on all patients reviewed by the teams. Strong links with the local cancer registry should be developed to ensure complete and accurate registration of all patients.

425. The data collection responsibilities of the various MDT members should be clearly defined in local protocols.

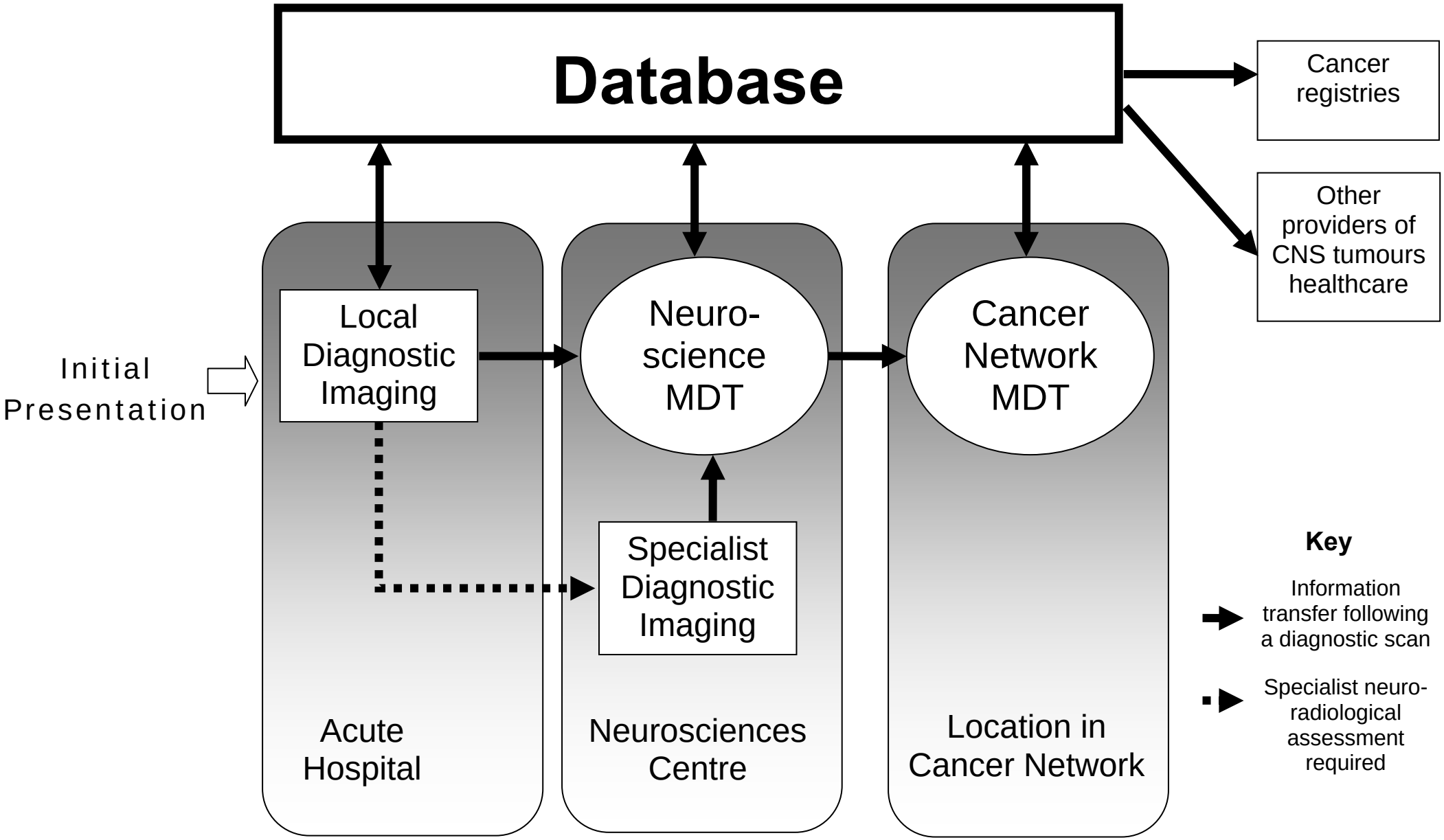
426. Adequate clerical support should be provided for the MDTs to facilitate data collection.

427. The national minimum datasets for CNS tumours should be adopted in both England and Wales when they become available.

428. Information collected by cancer registries should be used for the national annual report on CNS tumours.

429. A schematic representation of the information management pathway is shown in Figure 6:

Figure 6: Brain and Other CNS Tumours Information Management Pathway



B. Anticipated benefits

430. A web-based database and data collection system will enable members of the MDT to enter and review information on patients at all stages of the patient pathway regardless of where treatment or care is delivered. In addition it will provide a versatile mechanism that will facilitate data entry regardless of the exact structure of service provision at a local level.

431. Such a system will:

- ensure that all patients with CNS tumours are recorded
- improve registration
- enable management of patients through an appropriate MDT structure
- enhance management of patients to agreed protocols
- allow better monitoring of the access of patients to palliative and supportive care and to advice and support from AHPs
- make regular clinical audit of the processes (access, appropriate investigation and treatment, waiting) and outcomes of care easier
- improve communication between clinical teams
- improve recruitment into trials.

C. Evidence

432. A comprehensive review of primary and secondary brain tumour incidence studies published between 1966 and 1995 provides indirect evidence of the incompleteness of existing data sources. Studies using a single source (such as a cancer registry or hospital database) to identify patients reported incidence rates that were 30% lower than studies using two to four sources, and 50% lower than studies that used more than four sources.

433. A 2001 study of primary brain tumour registration between 1992 and 1996 compared a clinical database with official figures from the Devon and Cornwall regional cancer intelligence unit. Only 52% of potential cases identified from the clinical database were entered in the official registry, suggesting that figures from registries could significantly underestimate the incidence of primary brain tumours. The study also reported that patients in the registry were not a representative sample of the clinical population with brain tumours. Factors increasing the likelihood of a patient being registered were: having had an operation, being older than 60 and requirement for radiotherapy. Survival calculated using registry data could therefore be underestimated, since patients with poorer prognosis were more likely to be registered.

434. A study of the incidence of primary and secondary brain tumours from 1989 to 1990 in the Lothian region of Scotland used multiple methods of case ascertainment to identify 442 patients. Only 34% of the patients were entered in the Scottish Cancer Registry.

D. Measurement

Structure

- Compatible local, regional and, eventually, national electronic information systems.

Process

- Evidence that information on all patients is available at MDT meetings.
- Evidence of network, supra network and national audits of treatment and care.

Outcome

- Short, medium and long-term survival of patients undergoing treatment for brain tumours that includes information on cancer stage, co-morbidity, age and other features of case mix.
- Complication rates after surgery, radiotherapy and chemotherapy.

- Quality of life and short term and long term adverse effects of treatment.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]

Research

Background

435. The research evidence on which the care of patients with brain and other CNS tumours is at present based is incomplete and often inadequate. There are several reasons for this:

- CNS tumours are uncommon with many histological tumour types, some of which are extremely rare
- only a small proportion of CNS tumour patients are recruited into clinical trials
- comparison between trials is often difficult because of varied entry criteria
- clinical trials have mainly investigated treatment and largely ignored other important issues such as diagnosis and supportive care
- there is no coordinated approach across UK neuropathology departments to the collection and storage of adult CNS tumour samples for scientific research.

436. New technologies with proven usefulness in other areas of cancer care require specific validation before being brought into general use for patients with CNS tumours.

437. Currently, clinical neuro-oncology research in this field in the UK is haphazard and uncoordinated and dependent on the enthusiasm and interest of individual clinicians and departments. This situation is unlikely to improve where the critical mass of clinical researchers is both small and dwindling from lack of support. Although a very significant proportion of laboratory research is funded by charitable bodies, improvements in the treatment of these rarer tumours is unlikely to match that of more prevalent cancers until funding for research is at least equivalent. This should be directed at strengthening

the manpower and infrastructure of clinical research units through, for example, the UKCRC network initiative. Such support would enable well supported units to compete equally for the appropriate nationally funded grant monies. Further integration of basic laboratory and translational research through such organisations as British Neuro-Oncology Society, Society of British Neurological Surgeons and NCRN should be supported. The development of the NCRI / NCRN / CTAAC trials framework together with these initiatives offers a unique opportunity to develop effective CNS tumour research with a strategic, co-ordinated approach, active leadership, careful management and administrative support to advance the field and ensure that NHS money is spent appropriately.

438. There are some specific clinical / therapeutic issues that are important and need to be considered in the development of a clinical research programme:

- Many trials of the management of patients with high grade gliomas have been selective in patient entry and future trials need to include patients that represent the spectrum of disease to reduce selection bias.

- It is not clear what is the best way of managing patients with low grade gliomas.

- There is no high quality evidence that compares the effects of resection (or its extent) and biopsy on survival or quality of life for patients with high or low grade gliomas.

- There are a several of new radiotherapy techniques, new chemotherapy agents and methods of drug delivery that are being introduced into clinical practice but still need proper evaluation.

- The effects of treatment following first and subsequent relapse on survival and quality of life are uncertain

- There is little evidence that the use of newer imaging techniques for surveillance alters clinical outcomes for patients.

- There is currently no nationally coordinated programme of translational research for adult CNS tumours, which could usefully interact with such organisations as the EORTC.

439. A particular issue for patients with CNS tumours is the effect that the disease itself and the treatment may have on cognitive function. Neuropsychological assessment, in conjunction with other performance measures, has been shown to give a better indication of adverse effects of treatments and it may also have a role in the early detection of recurrence of low grade gliomas. Further research is needed to explore these issues.

440. Communication may be or become a problem for these patients when they develop cognitive problems, and there is clearly a need for further research into the most effective ways of communicating information about diagnosis, prognosis and progression of disease and how this may affect quality of life.

441. There is also scope for health services research into various aspects of care in particular into the most appropriate use of the healthcare professionals involved in supportive care and rehabilitation, and into the links between services to ensure that patients' needs are met most effectively and efficiently.

A. Recommendations

442. NHS R&D, all relevant research charities, NCRI and senior researchers in this field should collaborate and jointly plan a programme of clinical and translational CNS tumour research and its funding and fostering the appropriate research structure in collaboration with the UKCRC.

443. Opportunities to develop new diagnostic tests for CNS tumours should be facilitated by supporting the inclusion of biological studies alongside clinical trials, the retention and storage of appropriate tumour samples

for these studies, and translational research aimed at taking molecular markers from the research to the health service environment.

444. All neuroscience brain and other CNS tumours MDTs should have an active and up to date NCRN portfolio of clinical trials to offer to patients.

445. Cancer networks will need to demonstrate how they intend to ensure that trials are supported and patient entry into these studies should be actively monitored.

446. A national approach should be developed for the storage and retention of tumour samples, with appropriate consent, and for a coordinated programme of basic science and translational research to complement the clinical research programme.

B. Anticipated benefits

447. A greater number of patients with CNS tumours will have access to clinical trials.

448. There should be further improvements in outcomes with increased research.

C. Evidence

449. A recent study estimated years of life lost using data from the East Anglian Cancer Registry to represent the population burden from 17 cancers. While patients with tumours of the CNS had the highest average years of life lost per patient, this tumour group attracted only 1.5% of NCRI research spending (using 2002 figures).

450. There is some evidence to suggest low enrolment rates of patients with CNS tumours in clinical trials. The Glioma Outcomes Project reported in 2005 that only 15.1% of their group of 788 American patients with malignant glioma were enrolled in clinical trials.

451. The incompleteness of the evidence base for the management of CNS tumours is reflected in the number of systematic reviews unable to draw useful conclusions due to lack of high quality research. A recent

review of randomised clinical trials in low grade glioma, for example, identified only three completed RCTs of radiotherapy and one of chemotherapy which was terminated prematurely. In the absence of high quality RCTs reviewers must rely on evidence from studies with diverse protocols which are often low powered. It is reasonable to assume that collaboration between research centres should improve the quality of the evidence-base both by increasing trial accrual and through the use of agreed protocols.

D. Measurement

Structure

- Adequate provision of resources including research staff for the entry of patients into clinical trials.
- Evidence that local research arrangements, particularly within the MDTs, are promoting the participation in national clinical trials.

Process

- Surveys of the number of eligible patients who are offered entry to an appropriate clinical trial.

Outcome

- Outcomes of patients treated within a clinical trial or research protocol.

E. Resource implications

[Resource implications will be available in the second consultation version of this document.]