NICE National Institute for Health and Care Excellence

NICE guideline

Brain tumours (primary) and brain metastases in adults

NICE guideline

Published: 11 July 2018
nice.org.uk/guidance/ng99

1.1 Investigation of suspected glioma

- Imaging for suspected glioma

- 1.1.1 Offer standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as the initial diagnostic test for suspected glioma, unless MRI is contraindicated.

- 1.1.2 Refer people with a suspected glioma to a specialist multidisciplinary team at first radiological diagnosis for management of their tumour.

- 1.1.3 Consider advanced MRI techniques, such as MR perfusion and MR spectroscopy, to assess the potential of a high-grade transformation in a tumour appearing to be low grade on standard structural MRI.

Use of molecular markers to determine prognosis or guide treatment for glioma

1.1.4 Report all glioma specimens according to the latest version of the World Health Organization (WHO) classification. As well as histopathological assessment, include molecular markers such as:

- IDH1 and IDH2 mutations
- ATRX mutations to identify IDH mutant astrocytomas and glioblastomas
- 1p/19q codeletion to identify oligodendrogliomas
- histone H3.3 K27M mutations in midline gliomas
- BRAF fusion and gene mutation to identify pilocytic astrocytoma.

1.1.5 Test all high-grade glioma specimens for MGMT promoter methylation to inform prognosis and guide treatment.

1.1.6 Consider testing IDH-wildtype glioma specimens for TERT promoter mutations to inform prognosis.

1.2 Management of glioma

Initial surgery for suspected low-grade glioma

1.2.1 The surgical expertise in the multidisciplinary team should include: access to awake craniotomy with language and other appropriate functional monitoring and expertise in intraoperative neurophysiological monitoring and access to neuro-radiological support and access to intraoperative image guidance.

1.2.2 Consider surgical resection as part of initial management (within 6 months of radiological diagnosis) to: obtain a histological and molecular diagnosis and remove as much of the tumour as safely possible after discussion of the possible extent of resection at multidisciplinary meeting and with the person with the brain tumour, and their relatives and carers.

1.2.3 If surgical resection is not appropriate, consider biopsy to obtain a histological and molecular diagnosis

1.2.4 Consider active monitoring without a histological diagnosis, for lesions with radiological features typical of very low-grade tumours, for example, DNET (dysembryoplastic neuroepithelial tumour) or optic pathway glioma.

1.2.5 If people having active monitoring show radiological or clinical disease progression, discuss this at a multidisciplinary team meeting and consider: surgical resection or biopsy if surgical resection is not possible.

Further management of newly diagnosed low-grade glioma

1.2.6 After surgery, offer radiotherapy followed by up to 6 cycles of PCV chemotherapy (procarbazine, CCNU [lomustine] and vincristine) for people who: have a 1p/19q codeleted, IDH-mutated low-grade glioma (oligodendroglioma) and are aged around 40 or over, or have residual tumour on postoperative MRI.

1.2.7 After surgery, consider radiotherapy followed by up to 6 cycles of PCV chemotherapy for people who: have a 1p/19q non-codeleted, IDH-mutated low-grade glioma (astrocytoma) and are aged around 40 or over, or have residual tumour on postoperative MRI.

1.2.8 Consider active monitoring for people who are aged around 40 or under with an IDH-mutated low-grade glioma and have no residual tumour on postoperative MRI.

1.2.9 Consider radiotherapy followed by up to 6 cycles of PCV chemotherapy for people with an IDH-mutated low-grade glioma who have not had radiotherapy before if they have:

- progressive disease on radiological follow-up or
- intractable seizures.

1.2.10 When delivering radiotherapy for people with IDH-mutated low-grade glioma, do not use a treatment dose of more than 54 Gy at 1.8 Gy per fraction.

1.2.11 Be aware that the prognosis for people with histologically confirmed IDH wildtype grade II glioma may be similar to that of people with glioblastoma if other molecular features are consistent with glioblastoma. Take this into account when thinking about management options.

Management of newly diagnosed grade III glioma following surgery or if surgery is not possible (or has been declined)

- 1.2.12 For guidance on using temozolomide for treating newly diagnosed grade III glioma, see the NICE technology appraisal guidance on carmustine implants and temozolomide for the treatment of newly diagnosed high-grade glioma.

- 1.2.13 After surgery, offer sequential radiotherapy and 4 to 6 cycles of PCV
- chemotherapy to people who have: a Karnofsky performance status of 70 or more and a newly diagnosed grade III glioma with 1p/19q codeletion (anaplastic oligodendroglioma).

- 1.2.14 Agree with the person with the anaplastic oligodendroglioma the order of PCV chemotherapy and radiotherapy after discussing the potential advantages and disadvantages of each option with them (see table 1).

Table 1 Factors to take into account when deciding whether to have PCV or radiotherapy first for management of anaplastic oligodendroglioma

	PCV first	Radiotherapy first
Overall survival	No clinically important difference.	No clinically important difference.
Progression-free survival	No clinically important difference.	No clinically important difference.
Fertility preservation	Trying to preserve fertility may cause a delay in the start of treatment.	Allows additional time for fertility preservation without delaying treatment.
Planning treatment around important life events	Initially much less contact with the health system, but potentially more fatigue. Harder to give a precise date for when radiotherapy will start, as people's tolerance of chemotherapy is less predictable.	Initially much more contact with the health system: daily visits to radiotherapy department lasting several weeks. Timing of start of chemotherapy much more predictable.

- 1.2.15 After surgery, offer radiotherapy followed by up to 12 cycles of adjuvant temozolomide to people who have:

- a Karnofsky performance status of 70 or more ***and***
- a newly diagnosed IDH-wildtype or mutated grade III glioma without 1p/19q codeletion (anaplastic astrocytoma).

- 1.2.16 Do not offer nitrosoureas (for example, CCNU [lomustine]) concurrently with radiotherapy to people with newly diagnosed grade III glioma.

- 1.2.17 If asked, advise people with an initial diagnosis of grade III glioma (and their relatives and carers, as appropriate) that the available evidence does not support the use of:

- cannabis oil
- immunotherapy
- ketogenic diets
- Metformin
- statins
- valganciclovir.

Management of newly diagnosed grade IV glioma (glioblastoma) following surgery or if surgery is not possible (or has been declined)

- 1.2.18 For guidance on using temozolomide for treating newly diagnosed grade IV glioma (glioblastoma), see the NICE technology appraisal guidance on carmustine implants and temozolomide for the treatment of newly diagnosed high-grade glioma.

- 1.2.19 Offer radiotherapy using 60 Gy in 30 fractions with concomitant temozolomide, followed by up to 6 cycles of adjuvant temozolomide, for people aged around 70 or under who have: a Karnofsky performance status of 70 or more and had maximal safe resection, or biopsy when resection is not possible, for a newly diagnosed grade IV glioma (glioblastoma).

- 1.2.20 Offer radiotherapy using 40 Gy in 15 fractions with concomitant and up to 12 cycles of adjuvant temozolomide for people aged around 70 or over who have: a Karnofsky performance status of 70 or more and a newly diagnosed grade IV glioma (glioblastoma) with MGMT methylation.

- 1.2.21 Consider radiotherapy using 40 Gy in 15 fractions with concomitant and up to 12 cycles of adjuvant temozolomide for people aged around 70 or over who have: a Karnofsky performance status of 70 or more and a newly diagnosed grade IV glioma (glioblastoma) without MGMT methylation or forwhich methylation status is unavailable.

1.2.22 Consider best supportive care alone for people aged around 70 or over who have: a grade IV glioma (glioblastoma) and a Karnofsky performance status of under 70.

1.2.23 For people with an initial diagnosis of grade IV glioma (glioblastoma) not covered in recommendations 1.2.19 to 1.2.22, consider the treatment options of:

- radiotherapy using 60 Gy in 30 fractions with concurrent and up to 6 cycles of adjuvant
- temozolomide
- radiotherapy alone using 60 Gy in 30 fractions
- hypofractionated radiotherapy
- up to 6 cycles of temozolomide alone if the tumour has MGMT methylation and the person is aged around 70 or over
- best supportive care alone.

1.2.24 Assess the person's performance status throughout the postoperative period and review treatment options for grade IV glioma (glioblastoma) if their performance status changes.

1.2.25 Do not offer bevacizumab as part of management of a newly diagnosed grade IV glioma (glioblastoma).

1.2.26 Do not offer tumour-treating fields (TTF) as part of management of a newly diagnosed grade IV glioma (glioblastoma).

1.2.27 If asked, advise people with an initial diagnosis of grade IV glioma (and their relatives and carers, as appropriate) that the available evidence does not support the use of:

- cannabis oilimmunotherapy
- ketogenic diets
- metformin
- statins
- valganciclovir.

Management of recurrent high-grade glioma (recurrent grade III and grade IV glioma)

1.2.28 When deciding on treatment options for people with recurrent high-grade glioma, take into account:

- Karnofsky performance status
- the person's preferences
- time from last treatment
- tumour molecular markers
- what their last treatment was.

1.2.29 Consider PCV or single agent CCNU (lomustine) as an alternative to temozolomide for people with recurrent high-grade glioma.

1.2.30 For guidance on using temozolomide as an option for treating recurrent highgrade glioma, see the NICE technology appraisal guidance on temozolomide for the treatment of recurrent malignant glioma (brain cancer).

1.2.31 Consider best supportive care alone for high-grade glioma if other treatments are not likely to be of benefit, or if the person would prefer this. Refer to the NICE guidance on improving supportive and palliative care for adults with cancer.

1.2.32 For people with focally recurrent high-grade glioma, the multidisciplinary team should also consider the treatment options of:

- further surgery
- further radiotherapy.

1.2.33 Do not offer bevacizumab, erlotinib or cediranib, either alone or in combination with chemotherapy, as part of management of recurrent high-grade glioma.

1.2.34 Do not offer tumour treating fields (TTF) as part of management of recurrent high-grade glioma.

1.2.35 If asked, advise people who have recurrent high-grade glioma (and their relatives and carers, as appropriate) that the available evidence does not support the use of: cannabis oil, immunotherapy, ketogenic diets, metformin, statins, valganciclovir.

Techniques for resection of glioma

1.2.36 If a person has a radiologically enhancing suspected high-grade glioma and the multidisciplinary team thinks that surgical resection of all enhancing tumour is possible, offer 5-aminolevulinic acid (5-ALA)-guided resection as an adjunct to maximise resection at initial surgery.

1.2.37 Consider intraoperative MRI to help achieve surgical resection of both lowgrade and high-grade glioma while preserving neurological function, unless MRI is contraindicated.

1.2.38 Consider intraoperative ultrasound to help achieve surgical resection of both low-grade and high-grade glioma.

1.2.39 Consider diffusion tensor imaging overlays in addition to standard neuronavigation techniques to minimise damage to functionally important fibre tracts during resection of both low-grade and high-grade glioma.

1.2.40 Consider awake craniotomy for people with low-grade or high-grade glioma to help preserve neurological function.

1.2.41 Discuss awake craniotomy and its potential benefits and risks with the person and their relatives and carers (as appropriate) so that they can make an informed choice about whether to have it. Only consider the procedure if the person is likely not to be significantly distressed by it.

1.2.42 Involve other specialists as appropriate, such as neuropsychologists and speech and language therapists, before, during and after awake craniotomy.

1.3 Follow-up for glioma

1.3.1 Offer regular clinical review for people with glioma to assess changes in their physical, psychological and cognitive wellbeing.

1.3.2 Base decisions on the timing of regular clinical reviews and follow-up imaging for people with glioma on:

- any residual tumour
- life expectancy
- the person's preferences (see table 2 for factors to discuss with them)
- treatments used before
- treatment options available
- tumour subtype.

Table 2 Factors to take into account when deciding on frequency of follow-up for people with glioma

Possible advantages of more frequent follow-up	Possible disadvantages of more frequent follow-up
May identify recurrent disease earlier which may increase treatment options or enable treatment before people become symptomatic.	There is no definitive evidence that identifying recurrent disease early improves outcomes.
May help provide information about the course of the illness and prognosis.	May increase anxiety if changes of uncertain significance are detected on imaging.
Some people can find more frequent imaging and hospital contact reassuring. Provides an opportunity to identify patient or carer needs (such as psychosocial support and late side effects of treatment).	Some people can find more frequent imaging and hospital contact burdensome and disruptive – they feel their life revolves around their latest scan. There may be a financial cost from taking time off work and travelling to appointments.
–	More imaging and follow-up is resource intensive for the NHS.

1.3.3 Consider the follow-up schedule given in table 3 for people with glioma.

1.3.4 Consider standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as part of regular clinical review for people with glioma, to assess for progression or recurrence, unless MRI is contraindicated.

1.3.5 Consider advanced MRI techniques, such as MR perfusion, diffusion tensor imaging and MR spectroscopy, if findings from standard imaging are unclear about whether there is recurrence and early identification is potentially clinically useful.

1.3.6 For people with glioma having routine imaging: explain to them, and their relatives and carers, that imaging can be difficult to interpret and results can be of uncertain significance and be aware that having routine imaging and waiting for the results may cause anxiety.

1.3.7 Consider a baseline MRI scan within 72 hours of surgical resection for all types of glioma.

1.3.8 Consider a baseline MRI scan 3 months after the completion of radiotherapy for all types of glioma.

1.3.9 Arrange a clinical review, including appropriate imaging, for people with glioma who develop new or changing neurological symptoms or signs at any time.

Table 3 Possible regular clinical review schedule for people with glioma depending on grade of tumour

	Years after end of treatment					
	0 to 1	1 to 2	2 to 3	3 to 4	5 to 10	>10 (for the rest of life)
Grade I	Scan at 12 months, then: • consider discharge if no tumour visible on imaging unless completely resected pilocytic astrocytoma • consider ongoing imaging at increasing intervals for 15 years for completely resected pilocytic astrocytoma • consider if ongoing imaging is needed at a rate of once every 1 to 3 years for the rest of the person's life if the tumour is visible on imaging.					
Grade II 1p/19q non-codeleted, IDH mutated	Scan at 3 months, then every 6 months		Annually		Every 1 to 2 years	Consider ongoing imaging every 1 to 2 years
Grade II 1p/19q codeleted						
Grade III 1p/19q codeleted						
Grade II IDH wildtype	Every 3 to 6 months		Every 6 to 12 months		Annually	Consider ongoing imaging every 1 to 2 years
Grade III 1p/19q non-codeleted						
Grade IV (glioblastoma)						

1.4 Investigation of suspected meningioma

1.4.1 Offer standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as the initial diagnostic test for suspected meningioma, unless MRI is contraindicated.

1.4.2 Consider CT imaging for meningioma (if not already performed) to assess bone involvement if this is suspected.

Management of confirmed meningioma following surgery or if surgery is not possible (or has been declined)

1.4.3 Base management of meningioma after surgery, or if surgery is not possible or the person declines surgery, on the extent of any surgery and grade of meningioma, as described in table 4.

Table 4 Treatment choices after surgery or if surgery was not possible for different kinds of meningioma

Grade	Extent of surgery			Recurrent
	Completely excised (Simpson 1 to 3)	Incompletely excised (Simpson 4 to 5)	No excision (radiological only diagnosis)	
I	Offer active monitoring.	Consider further surgery (if possible), radiotherapy or active monitoring.	Consider active monitoring or radiotherapy.	Consider further surgery or radiotherapy (if not previously used).
II	Offer a choice between active monitoring and radiotherapy.	Consider further surgery (if possible). Offer radiotherapy if surgery is not possible, including if the person declines surgery, or if the tumour is incompletely excised afterwards.		Consider further surgery and offer radiotherapy (if not previously used).
III	Offer radiotherapy.	Consider further surgery (if possible) and offer radiotherapy.		Consider further surgery and offer radiotherapy (if not previously used).

1.4.4 Before a decision is made on radiotherapy for meningioma, take into account:

- comorbidities
- life expectancy
- neurological function
- Oedema
- performance status
- rate of tumour progression
- size and location of tumour
- surgical and radiotherapy morbidity
- the person's preferences (see table 5 for factors to discuss with them)
- treatments used before.

Table 5 Factors to take into account when deciding on radiotherapy as treatment for a surgically treated meningioma

	Radiotherapy	No radiotherapy
Control of tumour	There is evidence that radiotherapy is effective in the local control of a tumour.	Receiving no radiotherapy means the tumour may continue to grow.
Risk of developing subsequent symptoms	Controlling the tumour will reduce the risk of developing symptoms from the tumour in the future.	If the tumour grows, it can cause irreversible symptoms such as loss of vision.
Risk of re-treatment	Less risk of needing second surgery compared with no radiotherapy.	Higher risk of needing second surgery compared with radiotherapy. If the tumour has progressed, then the surgery might be more complex. If the tumour has progressed, then not all radiotherapy techniques may be possible.

Early side effects of treatment	Early side effects from radiotherapy can include: • fatigue • hair loss • headache • nausea • seizures • skin irritation.	No side effects from treatment.
Late side effects of treatment	Late side effects from radiotherapy can include: • effect on cognition • risk of stroke • risk of radionecrosis • risk of second tumours • cranial nerve effects • hypopituitarism • cataracts.	No side effects from treatment.
Management of side effects	Increased use of steroids to manage side effects.	No side effects from treatment.

1.4.5 When deciding on the radiotherapy technique for people with meningioma, take into account:

- the preferences of the person (for example, to minimise the number of appointments
- or travel distance)
- tumour grade
- tumour location (proximity to optic nerves, optic chiasm and brainstem)
- tumour size.

From the suitable radiotherapy techniques, choose the one which maximises the chances of local tumour control while minimising the radiation dose to normal brain

tissue.

1.4.6 If the multidisciplinary team thinks that radiotherapy may be appropriate, offer the person the opportunity to discuss the potential benefits and risks with an oncologist.

1.5 Follow-up for meningioma

1.5.1 Offer regular clinical review for people with meningioma to assess changes in their physical, psychological and cognitive wellbeing.

1.5.2 Base decisions on the timing of regular clinical reviews and follow-up imaging for people with meningioma on:

- any residual tumour
- life expectancy
- the person's preferences (see table 6 for factors to discuss with them)
- treatments used before
- treatment options available
- tumour grade.

Table 6 Factors to take into account when deciding on frequency of follow-up for people with meningioma

Possible advantages of more frequent follow-up	Possible disadvantages of more frequent follow-up
May identify recurrent disease earlier which may increase treatment options or enable treatment before people become symptomatic.	There is no definitive evidence that identifying recurrent disease early improves outcomes.
May help provide information about the course of the illness and prognosis.	May increase anxiety if changes of uncertain significance are detected on imaging.
Some people can find more frequent imaging and hospital contact reassuring. Provides an opportunity to identify patient or carer needs (such as psychosocial support and late side effects of treatment).	Some people can find more frequent imaging and hospital contact burdensome and disruptive – they feel their life revolves around their latest scan. There may be a financial cost from taking time off work and travelling to appointments.
–	More imaging and follow-up is resource intensive for the NHS.

1.5.3 Consider the follow-up schedule given in table 7 for people with meningioma.

1.5.4 Consider standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as part of regular clinical review for

- people with meningioma, to assess for progression or recurrence, unless MRI is
- contraindicated.

1.5.5 For people with meningioma having routine imaging, be aware that having routine imaging and waiting for the results may cause anxiety.

1.5.6 Arrange a clinical review, including appropriate imaging, for people with meningioma (including incidental meningioma) who develop new or changing neurological symptoms or signs at any time.

Table 7 Possible regular clinical review schedule for people with meningioma depending on grade of tumour

	Years after end of treatment								
	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	>9 (for the rest of life)
Grade I: no residual tumour*	Scan at 3 months	Annually		Once every 2 years					Consider discharge
Grade I: residual tumour*	Scan at 3 months	Annually				Once every 2 years			Consider discharge
Grade I: after radiotherapy	Scan 6 months after radiotherapy	Annually		Once every 2 years					Consider discharge
Grade II	Scan at 3 months, then 6 to 12 months later	Annually				Once every 2 years			Consider discharge
Grade III	Every 3 to 6 months		Every 6 to 12 months			Annually			
Asymptomatic incidental meningioma	Scan at 12 months. If no change consider discharge or scan at 5 years.								
* The presence of any residual tumour can only be established after the first scan at 3 months.									

1.6 Investigation of suspected brain metastases

1.6.1 Offer standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as the initial diagnostic test for suspected brain metastases, unless MRI is contraindicated.

1.6.2 To help establish current disease status, offer extracranial imaging (appropriate to the primary tumour type) to people with any radiologically suspected brain metastases that may be suitable for focal treatment.

1.6.3 Perform all intracranial and extracranial diagnostic imaging and, if appropriate, biopsy of extracranial disease, before referral to the neuro-oncology multidisciplinary team.

1.7 Management of confirmed brain metastases

1.7.1 When choosing management options for brain metastases, take into account:

- extracranial disease
- leptomeningeal disease
- location of metastases
- resection cavity size
- the number and volume of metastases
- the person's preference (based on a discussion of the factors listed in tables 8 and 9)
- their age
- their performance status
- the primary tumour site, type, and molecular profile.

1.7.2 Consider systemic anti-cancer therapy for people who have brain metastases likely to respond effectively, for example, germ cell tumours or small-cell lung cancer.

1.7.3 Consider maximal local therapy with either surgery, stereotactic radiosurgery or stereotactic radiotherapy for people with a single brain metastasis.

1.7.4 Base the choice of treatment for people with a single brain metastasis on:

- comorbidities
- extent of oedema
- location of metastasis
- the person's preference (see table 8)
- tumour size.

Table 8 Factors to take into account when deciding between surgery and stereotactic radiosurgery/radiotherapy as treatment for a single brain metastasis

	Surgery	Stereotactic radiosurgery / radiotherapy
Overall survival	No clinically important difference.	No clinically important difference.
Risk of needing additional treatment	Risk that stereotactic radiosurgery / radiotherapy may be needed in any case.	Risk that surgery may be needed in any case. However, has higher local control rate than surgery (meaning surgery is less likely after radiotherapy than the other way around).
Key benefit of treatment	Has more rapid control of symptoms. Additionally, surgery allows for obtaining an up-to-date pathological diagnosis which may guide future treatment, making it more effective.	Has a higher local control rate than surgery, meaning more treatment is less likely to be needed. Additionally, is an outpatient treatment and does not need a general anaesthetic.
Key risks of treatment	Surgical procedures carry known risks that vary depending on the person and the tumour. These include infection, stroke, a prolonged hospital stay and death. Surgery is more painful than radiotherapy during recovery.	Radiation carries the risk of delayed effects such as radionecrosis, which might need surgical resection. There is an increased risk of seizures with this technique, although this appears to mostly affect people who have pre-existing epilepsy.
Steroid use	Early reduction in steroid dose.	Likely to need steroids for longer, and at a higher dose. Steroids have significant side effects when used long-term, such as changes in mood, heart problems and changes in body fat.

Planning treatment around important life events	The wound from the surgery may affect the ability to carry out certain activities in the short term, such as air travel and sport. The cosmetic appearance of the wound from surgery may be important to some people, and should be discussed.	Some people find the techniques used in radiotherapy challenging or upsetting, especially the equipment which immobilises the head. This is especially likely to be true for people with claustrophobia.
Other considerations	–	Radiotherapy can reach some areas of the brain that surgery cannot, and might be the only appropriate technique for certain tumour types.

1.7.5 Do not offer adjuvant whole-brain radiotherapy to people with a single brain metastasis treated with stereotactic radiosurgery/radiotherapy or surgery.

1.7.6 Consider adjuvant stereotactic radiosurgery/radiotherapy to the surgical cavities for people with 1 to 3 brain metastases that have been resected.

1.7.7 Consider stereotactic radiosurgery/radiotherapy for people with multiple brain metastases who have controlled or controllable extracranial disease and Karnofsky performance status of 70 or more. Take into account the number and total volume of metastases.

1.7.8 Do not offer whole-brain radiotherapy to people with: non-small-cell lung cancer and brain metastases that are not suitable for surgery or stereotactic radiosurgery/radiotherapy and a Karnofsky performance status of under 70.

1.7.9 For people with multiple brain metastases who have not had stereotactic radiosurgery/radiotherapy or surgery, decide with them whether to use wholebrain radiotherapy after a discussion with them and their relatives and carers (as appropriate) of the potential benefits and risks (see table 9).

Table 9 Potential benefits and harms of whole-brain radiotherapy for multiple metastases

	Whole-brain radiotherapy	No whole-brain radiotherapy
Overall survival	No clinically important difference.	No clinically important difference.
Quality of life	Short-term deterioration in quality of life because of treatment.	No impact on quality of life because of treatment, but deterioration because of the disease progression.
Potential benefits	Can stabilise or reduce the brain metastases.	Brain metastases may continue to grow.
Side effects	Temporary hair loss and fatigue. Potential for accelerated cognitive loss because of radiotherapy.	Potential for cognitive loss because of disease progression.
Time commitment	Requires 5 to 10 hospital visits.	No time commitment.
Other considerations	People with non-small-cell lung cancer will not benefit from treatment if their overall prognosis is poor.	–

1.7.10 Do not offer memantine in addition to whole-brain radiotherapy to people with multiple brain metastases, unless as part of a clinical trial.

1.7.11 Do not offer concurrent systemic therapy to enhance the efficacy of wholebrain radiotherapy to people with multiple brain metastases, unless as part of a clinical trial.

1.8 Follow-up for brain metastases

1.8.1 Offer regular clinical review for people with brain metastases to assess changes in their physical, psychological and cognitive wellbeing.

1.8.2 Base decisions on the timing of regular clinical reviews and follow-up imaging for people with brain metastases on:

- extracranial disease status
- life expectancy
- primary cancer
- the person's preferences (see table 10 for factors to discuss with them)
- treatment options available.

Table 10 Factors to take into account when deciding on frequency of follow-up for people with brain metastases

Possible advantages of more frequent follow-up	Possible disadvantages of more frequent follow-up
May identify recurrent disease earlier which may increase treatment options or enable treatment before people become symptomatic.	There is no definitive evidence that identifying recurrent disease early improves outcomes.
May help provide information about the course of the illness and prognosis.	May increase anxiety if changes of uncertain significance are detected on imaging.
Some people can find more frequent imaging and hospital contact reassuring. Provides an opportunity to identify patient or carer needs (such as psychosocial support and late side effects of treatment).	Some people can find more frequent imaging and hospital contact burdensome and disruptive – they feel their life revolves around their latest scan. There may be a financial cost from taking time off work and travelling to appointments.
–	More imaging and follow-up is resource intensive for the NHS.

1.8.3 Consider the follow-up schedule given in table 11 for people with brain metastases.

1.8.4 Consider standard structural MRI (defined as T2 weighted, FLAIR, DWI series and T1 pre- and post-contrast volume) as part of regular clinical review for people with brain metastases, to assess for progression or recurrence, unless MRI is contraindicated.

1.8.5 Consider advanced MRI techniques, such as MR perfusion, diffusion tensor imaging and MR spectroscopy, if findings from standard imaging are unclear about whether there is recurrence and early identification is potentially clinically useful.

1.8.6 For people with brain metastases having routine imaging: explain to them, and their relatives and carers, that imaging can be difficult to interpret and results can be of uncertain significance and be aware that having routine imaging and waiting for the results may cause anxiety.

1.8.7 Arrange a clinical review, including appropriate imaging, for people with brain metastases who develop new or changing neurological symptoms or signs at any time.

Table 11 Possible regular clinical review schedule for people with brain metastases

	Years after end of treatment		
	0 to 1	1 to 2	2 onwards
Brain metastases	Every 3 months	Every 4 to 6 months	Annually

1.9 Care needs of people with brain tumours

1.9.1 Be aware that the care needs of people with brain tumours represent a unique challenge, because (in addition to physical disability) the tumour and treatment can have effects on:

- behaviour
- Cognition
- personality.

1.9.2 Discuss health and social care support needs with the person with a brain tumour and their relatives and carers (as appropriate). Take into account the complex health and social care support needs people with any type of brain tumour and their relatives and carers may have (for example, psychological, cognitive, physical, spiritual, emotional).

1.9.3 Set aside enough time to discuss the impact of the brain tumour on the person and their relatives and carers (as appropriate), and to elicit and discuss their health and social care support needs.

1.9.4 Health and social care professionals involved in the care of people with brain tumours should address additional complex needs during or at the end of treatment and throughout follow-up. These include:

- changes to cognitive functioning
- fatigue
- loss of personal identity
- loss of independence
- maintaining a sense of hope
- potential for change in personal and sexual relationships
- the challenges of living with uncertainty
- the impact of brain tumour-associated epilepsy on wellbeing (see the NICE guideline
- on epilepsies: diagnosis and management).

- 1.9.5 Provide a named healthcare professional with responsibility for coordinating health and social care support for people with brain tumours and their relatives and carers, for example, a key worker (often a clinical nurse specialist) as defined in NICE guidance on improving outcomes for people with brain and other central nervous system tumours.

1.9.6 Give information to the person with a brain tumour and their relatives and carers (as appropriate):

- in a realistic and empathetic manner
- in suitable formats (written and spoken, with information available to take away),
- following the principles in the NICE guideline on patient experience in adult NHS
- services[1] at appropriate times throughout their care pathway.

1.9.7 Explain to the person that they have a legal obligation to notify the Driver and Vehicle Licensing Agency (DVLA) if they have a brain tumour, and that this may have implications for their driving.

1.9.8 Provide and explain clinical results, for example, imaging and pathology reports, to the person with a brain tumour and their relatives and carers (as appropriate) as soon as possible.

1.9.9 Offer supportive care to people with brain tumours and their relatives and carers (as appropriate) throughout their treatment and care pathway

1.9.10 In people aged between 16 and 24 years old, refer to the NICE quality standard on cancer services for children and young people.

1.9.11 Discuss the potential preservation of fertility with people with brain tumours where treatment may have an impact on their fertility (see the recommendations on people with cancer who wish to preserve fertility in NICE's guidance on fertility problems).

1.9.12 If the person with a brain tumour is likely to be in their last year of life, refer to the NICE quality standards on end of life care for adults and, when appropriate, care of dying adults in the last days of life.

1.10 Neurorehabilitation needs of people with brain tumours

1.10.1 Consider referring the person with a brain tumour for a neurological rehabilitation assessment of physical, cognitive and emotional function at diagnosis and every stage of follow-up.

1.10.2 Offer people with brain tumours and their relatives and carers (as appropriate) information on accessing neurological rehabilitation, and on what needs it can help address.

1.10.3 Give people with brain tumours and their relatives and carers (as appropriate) information on: neurological rehabilitation options in the community, as an outpatient, or an inpatient **and** how to get a neurological rehabilitation assessment.

1.11 Surveillance for the late-onset side effects of treatment

1.11.1 Be aware that people with brain tumours can develop side effects of treatment months or years after treatment, which can include:

- Cataracts
- Cavernoma
- Cognitive decline
- Epilepsy
- Hearing loss
- Hypopituitarism
- Infertility
- Neuropathy (for example, nerve damage causing visual loss, numbness, pain or weakness)
- Radionecrosis
- Secondary tumours
- SMART (stroke-like migraine attacks after radiotherapy)
- Stroke.

1.11.2 Assess the person's individual risk of developing late effects when they finish treatment. Record these in their written treatment summary and explain them to the person (and their relatives and carers, as appropriate).

1.11.3 Encourage people who have had cranial radiotherapy to follow a healthy lifestyle, including exercise, a healthy diet and stopping smoking (if applicable), to decrease their risk of stroke. See the NICE guidelines on obesity prevention, physical activity and smoking cessation.

1.11.4 For people who are at risk of stroke, consider checking their blood pressure, HbA1c level and cholesterol profile regularly.

1.11.5 Consider ongoing neuropsychology assessment for people at risk of cognitive decline.

1.11.6 If a person has had a radiotherapy dose that might affect pituitary function, consider checking their endocrine function regularly after the end of treatment.

1.11.7 Consider referring people who are at risk of visual impairment for an ophthalmological assessment.

1.11.8 Consider referring people who are at risk of hearing loss to audiology for a hearing test.

1.11.9 Consider referring the person to stroke services if an MRI during active monitoring identifies asymptomatic ischaemic stroke.