Gamma Knife

Meningiomas

The London Gamma Knife Centre
at The Wellington Hospital

part of HCAHealthcare UK

Meningiomas

This guide should be read in combination with the general information brochure which outlines the principles of Gamma Knife stereotactic radiosurgery and details the options relating to head immobilisation during treatment (mask or frame). The content of this leaflet should be considered a useful guide, rather than an authoritative manual.

What is a meningioma?

Meningiomas are almost always benign (non-cancerous) tumours, normally arising from the coverings (meninges) of the brain and spine, although rarely they can also arise within the fluid spaces inside the brain (ventricles). They usually grow quite slowly, around 1-2mm in diameter per year, although this is variable. They have been known to grow rapidly during pregnancy, probably driven by the increased levels of the hormones progesterone and oestrogen.

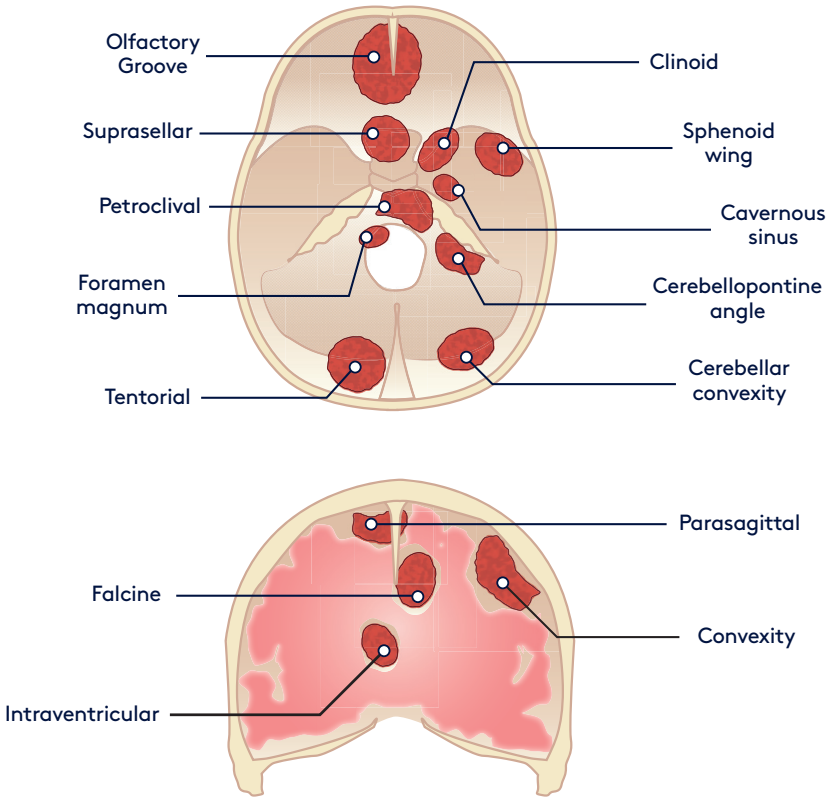
There are many different microscopic tumour patterns recognised if these tumours are removed and analysed by pathologists, but the important distinction relates to the 'grade' of the tumour, which relates to the risk of recurrence and speed of growth. Grade I tumours (the vast majority) typically grow slowly and are cured by complete surgical removal, with only a very small risk of recurrence. Grade II tumours are more rapidly growing but still benign. These have a greater risk of recurrence even if apparently completely removed at surgery. Sometimes radiotherapy is recommended to reduce that risk. Grade III tumours are thankfully rare, but are aggressive, malignant tumours with a very rapid growth rate. Although these can be removed, they invariably recur and as yet are not curable.

Meningiomas may come to light due to symptoms provoked by their location within the head. They are also increasingly discovered as a result of a brain scan performed for symptoms completely unrelated to the tumour. These 'incidental' discoveries then pose a dilemma with regards to management. In elderly patients with no symptoms, it may be better simply to watch and wait, with scans at intervals to assess growth. For younger patients, particularly if the tumours are already large or causing a reaction in the surrounding brain, treatment will often be recommended.

Symptoms of a meningioma

The range of symptoms is extensive. If the nerves entering and leaving the brain are affected (cranial nerves) there can be loss of the sense of smell, progressive loss of vision, double vision, facial pain, facial numbness, hearing loss, tinnitus (noise in the ear), facial twitching, facial weakness, hoarseness or difficulty swallowing.

If sensitive parts of the brain (eloquent regions) are under pressure, there may be speech disturbance, limb weakness, limb numbness, balance and coordination problems. More general effects include a reduction in the ability to think and reason (cognitive decline), and fits (epileptic seizures). Increasing headaches can be secondary to interference with the normal fluid circulation around the brain (hydrocephalus).



Treatment options

Treatment options include surgery and radiotherapy, and increasingly a combination of both. For many tumours, surgery is the treatment of choice. This is particularly so if the tumour is large (over 3cm in diameter), or if smaller and in a relatively simple place for the surgeon to gain access to. Surgery for small tumours is usually curative, without the need for any other treatment, but intermittent scans may be recommended to ensure that there is no recurrence. Grade I tumours which have been completely removed have only a 5% risk of recurrence over 20 years. Grade II tumours, however, are much more likely to recur and intermittent scanning is normally advisable, possibly at annual intervals initially.

If the tumour has not been completely removed as is usually the case when they are in regions with difficult surgical access, or surrounded by delicate nerves and blood vessels which would be difficult to preserve with 'aggressive' surgery, additional radiation treatment is commonly recommended at a variable interval after the operation. Traditionally this would be standard 'external beam' radiotherapy given daily over a period of weeks. More recently, single fraction radiation (radiosurgery) has been used instead. This is partly because it can be delivered in a single day of treatment, but mainly because the results in terms of stopping tumour growth are better.

Radiosurgery can be delivered with a number of different machines, but the main 'brands' are the Gamma Knife, CyberKnife and TrueBeam (or other Linac devices). Although these all deliver accurate, high dose radiation to targets in the brain, they do so in fundamentally different ways. The Gamma Knife was the first radiosurgical tool in clinical use and has the longest history of treatments, with over 1 million patients treated worldwide. There has been a Gamma Knife in the UK since 1985 and currently there are seven in England. The machine has evolved significantly over time and the latest Gamma Knife is the Icon, released in 2016. The Icon delivers the lowest dose of radiation to the brain away from the intended target when compared with the other radiosurgery machines and also delivers a much lower dose to the rest of the body. This is important as it reduces the risk of developing a secondary cancer elsewhere in the body as a result of that radiation exposure.

The principle of radiosurgery is that multiple beams of radiation are delivered from different directions, all converging on the tumour. Any one beam is relatively weak, but at the convergence point (the tumour) a high dose of radiation is delivered, with a rapid fall-off of radiation as distance from the target increases. Here the gamma knife shows its main advantage over its rivals, a very rapid dose fall-off, which when combined with a very accurate delivery of radiation leads to a reduction in overall dose to the brain.

Over the more than 30 years that gamma knife radiosurgery has been used to treat these tumours, a wealth of experience has been accumulated. The results are now well known and the optimal dose range for treatment well defined. Excellent control of tumour growth is obtained for grade I tumours (around 95% respond well). Grade II lesions are not as sensitive and require a higher dose of radiation, but even then control rates are not as good as for grade I, with perhaps 70% responding well. The growth of Grade III lesions is slowed, but they invariably recur over months.

Their location often leads to involvement of the nerves of hearing and balance, as well as those responsible for swallowing, facial sensation and facial movement. For these tumours, radiosurgery has become an accepted first line treatment assuming they are small enough. For larger tumours, surgery is often recommended to reduce the size before later radiosurgery, unless they can be removed completely with minimal risks of additional neurological damage. The risks of radiosurgery include damage to hearing, facial nerve weakness, increased facial numbness and increased difficulty with swallowing, but these are all dependent on the initial presenting symptoms, the size of the tumour and its exact anatomical location. Potential complications specific to you will be discussed by your treating consultant.

After treatment

After treatment, there may be some headache and nausea, which if present normally passes within 24 hours. Occasionally you may be recommended to take a few days of steroid medication (dexamethasone), to reduce these symptoms.

Follow up

Follow-up will normally be with the doctor who referred you for treatment. We normally recommend follow-up scans at six months from treatment and then at yearly intervals for around five years. Meningiomas often do not show any dramatic shrinkage after treatment, but over a few years we expect to see some reduction in the tumour size, which can be very impressive in some cases. After five years we recommend additional scans every 3-5 years for reassurance, but control of growth at five years makes it very unlikely there will be growth of the treated tumour later.

Potential complications

Given the extensive range of symptoms which can occur with these tumours due to their variable location, it is not surprising that there are a range of potential complications depending on the proximity to sensitive brain structures such as the optic nerves, auditory nerves, eloquent areas of brain – and so on. Your consultant will explain the particular risks with your tumour, but a few examples are given below. This list cannot hope to be comprehensive.

Olfactory Groove meningioma

These are located under the frontal lobes of the brain, on the skull base and may present with loss of sense of smell. When small, these are associated with very little risk of adverse events after radiation treatment, but if larger there can be swelling provoked in the frontal lobes. If extreme this can lead to headaches and even personality change. Large olfactory groove tumours are usually removed surgically to avoid these problems.

Clinoid and Suprasellar

These tumours are close to the optic nerves and pathways. There are several subdivisions with regard to exact location, but in principle the risk is that vision will be disturbed as a result of radiation damage to the nerves (RION or radiation induced optic neuropathy). There are ways to reduce the risk of this during the radiosurgery planning and your consultant will make you fully aware of the extent of the risk before any treatment.

Cavernous sinus meningioma:

The cavernous sinus is a blood-filled space enclosed by tough membranes on either side of the pituitary gland at the skull base. In addition to blood vessels, the cavernous sinus contains the nerves responsible for eye movements (III, IV and VI) and is very closely related to the nerve giving feeling to the face (trigeminal - V). These tumours often present with a combination of pain behind the eye, a bulging eye (proptosis), a droopy eyelid (ptosis) and double vision due to impairment of the function of the eye movement nerves. Even though these tumours respond well to the radiosurgery, these symptoms do not necessarily improve due to the damage already done to the nerves. Pain often improves – but may transiently increase due to inflammation at the site of treatment. Double vision may also improve, but if it does it often requires many months or years to happen.

Convexity meningiomas

This term is used for any tumour arising from the coverings of the surface of the brain, away from the skull base. They are in contact with and often compressing the brain surface. Usually these can be safely removed surgically, with little risk, but patients with small tumours who are otherwise not fit for surgery (or unwilling to undergo an operation) may be suitable for radiosurgery. The main risk of the treatment in this location is brain swelling related to the injury caused to the tumour and this can also cause epileptic seizures. If it occurs, the swelling normally commences around 3-6 months after treatment and usually disappears again within one year.

Parasagittal meningiomas

There is a central tough membrane dividing the two halves of the brain known as the falx. At the top of this membrane is the major draining vein for the brain (the sagittal sinus). Tumours arising either side of the sagittal sinus are called parasagittal. Surgically their management is complicated by the presence of this large vein, which if damaged can lead to a severe stroke or death. Before radiosurgery was more widely available, complex operations to reconstruct the vein were performed, with high risks to the patient. The current surgical approach is to remove as much tumour as possible without injury to the vein, treating any remaining tumour with radiosurgery. When these tumours arise close to the part of the brain controlling leg movements, there can be persistent numbness or weakness of the leg (normally on the opposite side to the tumour) after treatment.

Petro-clival meningiomas

This anatomical region is at the base of the brain, in front of the brainstem. These tumours often cause some facial numbness and double vision due to nerve compression. They may also cause balance problems from pressure on the brain stem. Radiosurgery is often the safest form of treatment for these, due to the risks of additional nerve and brain injury from the difficult surgical approach needed to remove them. Size here is crucial and if the tumour is too large, surgery may be the only option, with the aim often being to remove as much of the tumour as possible, leaving a suitable target for radiation. Sometimes with large tumours, an alternative to surgery is to divide the radiosurgery into 3–5 'fractions' delivered on consecutive days. This may be less damaging to the surrounding brain, but the longer term results in respect of tumour control are not yet clear.

Cerebello-pontine angle meningiomas

These occur in the space between the brainstem (pons), hind brain (cerebellum) and the bone encasing the inner ear (petrous bone). Their location often leads to involvement of the nerves of hearing and balance, as well as those responsible for swallowing, facial sensation and facial movement. For these tumours, radiosurgery has become an accepted first line treatment assuming they are small enough. For larger tumours, surgery is often recommended to reduce the size before later radiosurgery, unless they can be removed completely with minimal risks of additional neurological damage. The risks of radiosurgery include damage to hearing, facial nerve weakness, increased facial numbness and increased difficulty with swallowing, but these are all dependent on the initial presenting symptoms, the size of the tumour and its exact anatomical location. Potential complications specific to you will be discussed by your treating Consultant.

Where to find us

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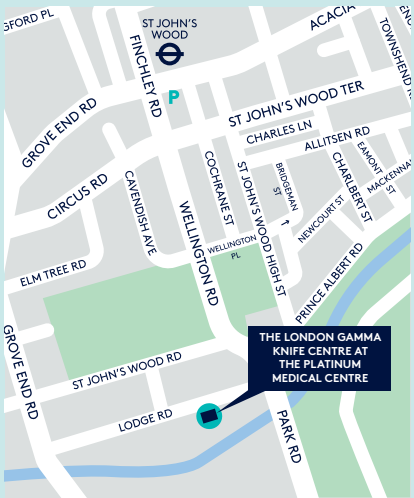

Underground

St John's Wood (Jubilee line) is a 15 min walk

Baker Street (Bakerloo, Circle, Hammersmith, Jubilee & Metropolitan lines) is a 20 min walk

National Rail

Marylebone is a 20 min walk

Bus

Bus stop: Park Road / Lord's Cricket Ground. Bus no 13, 82, 113, 274, N13

Parking

Car parking is limited at the centre however parking is available nearby at the Q-Park St John's Wood car park on Kingsmill Terrace

Our group

The Wellington Hospital

The Princess Grace Hospital

The Portland Hospital

The Lister Hospital

The Harley Street Clinic

The Christie Private Care

London Bridge Hospital

Leaders in Oncology Care

HCA UK at University College Hospital

HCA UK at The Wilmslow Hospital

GP Services

020 3214 3500

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