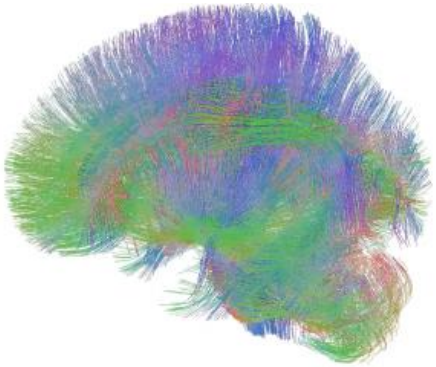
Welcome to the Neuro-Oncology Clinic

Resource Sheet 1



About neuro-oncology

We look after teenage and adult patients with tumours of the brain and spine and are responsible for non-surgical treatments i.e. radiotherapy and systemic treatment. We also deliver stereotactic radiosurgery for patients with cerebral oligometastatic disease.

We have a general neuro-oncology clinic on Friday morning where we see new patients, and some patients on systemic treatments. We also have a skull base tumour clinic that runs on the 2nd and 4th week of each month. It runs at the same time but is based in ENT clinic.

We have five consultants and three specialist nurses taking part in our clinics:

- Dr Sarah Jefferies is interested in general neuro-oncology, skull base tumours and clinical trials
- Dr Raj Jena is interested in general neuro-oncology and radiosurgery treatment
- Dr Fiona Harris is interested in in general neuro-oncology and the teenage and young adult patients
- Dr Gary Doherty is interested in glioma, brain metastases and early phase trials
- Kate Burton is a consultant radiographer who oversees radiotherapy treatment for our patients
- Lorraine Muffett is our clinical nurse specialist in neuro-oncology
- Nicola Gamazo and Juliette Gair are our NF2 nurse specialists

In the general neuro-oncology clinic the commonest groups of patients you are likely to see are:

- Patients with newly diagnosed low and high grade glioma who are being assessed for radiotherapy +/- chemotherapy treatment
- Patients with oligometastatic cancer being considered for radiosurgery. We have to see these patients promptly and deliver treatment within a 2-week window to fulfil national guidelines
- Patients with a wide range of benign tumours who may need radiotherapy to prevent a tumour from growing back
- A small number of patients with aggressive Neurofibromatosis type II who are receiving anti-angiogenic therapy

Key learning objectives

Learning how to assess patients with brain tumours.

Thinking about benign and malignant tumours in neuro-oncology.

Understanding how molecular pathology integrates with diagnosis and optimum treatment for glioma patient in particular.

Understanding the basic biomechanics of tumour – brain interactions.

Learning how to describe MRI scans and a differential diagnosis for space occupying lesions in the brain.

Assessing patients with brain tumours

Co-factoring is extremely important for brain tumour patients. Understanding the neurological deficits caused by the patient tumour, surgical treatment, and medication is necessary to offer the most appropriate treatment.

Most of our patients cannot drive, and many will require assistance for many of their daily activities. Understanding how well the patient is supported by their family, friends or carers is crucial. Sadly we have patients where we might wish to be more aggressive in offering drug.

You will see that we rely heavily on **performance status**, **mini mental state examination**, and **mobility assessments**. We tend not to perform formal neurological testing on patients as it doesn't impact as much on decision making.

Benign and malignant tumours in neuro-oncology

You will observe that we tend not to use the terms benign and malignant in the neuro-oncology clinic, as they can cause confusion. Benign tumours arising in the brain-stem and skull base can be life-threatening, and most malignant brain tumours lack the capacity to spread outside the neuraxis.

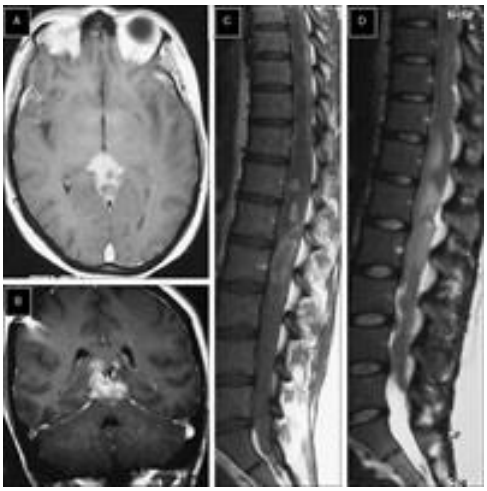
We do tend to lump together **high-grade** and **low-grade** tumours when thinking about our patients, as they share important management factors.

High grade lesions are generally aggressive infiltrative tumours, with a high risk of local recurrence and a risk of dissemination through the brain and spine. We give radiotherapy and chemotherapy to stabilise neurological function and prolong life as much as possible, but cure is generally not achieved.

Low grade lesions tend to grow more slowly, and tend to recur locally. Young patients with low grade tumours may have decades of life ahead of them and we must balance the benefits of treatment (local control) against the risks (such as second tumour induction, neuro-cognitive deficits, endocrinopathy). Sometimes we will perform radiological surveillance for these patients, delaying treatment as long as possible, until we have clear evidence that the tumour is starting to grow.

There are a few brain tumours that are curable with radiotherapy and chemotherapy, even with disease that is disseminated through the neuraxis:

- Intracranial germ cell tumours
- Medulloblastoma
- Ependymoma
- Lymphoma (not treated by us)



This is a pineal germ cell tumour with diffuse metastatic spread in the spine. It is still curable.

Molecular pathology of Glioma (see Resource Sheet 2)

We make extensive use of molecular pathology testing in neuro-oncology, and the current WHO classification of gliomas features an integrated diagnostic classification. This takes into account both old-school (histopathology with microscopy and ultrastructural appearances) and new molecular diagnostics (Immunohistochemistry, next generation sequencing, methylomics).

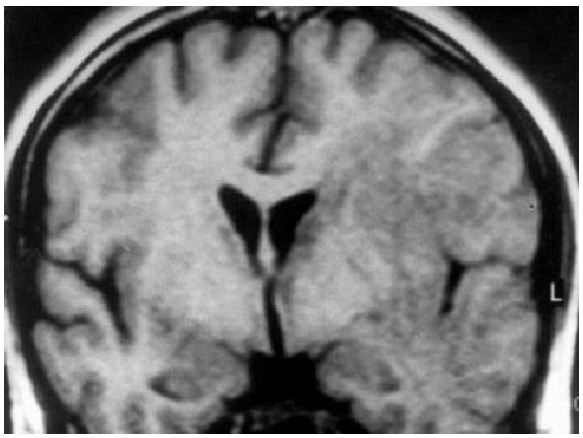
It matters to us because the optimum treatment of the lower and intermediate grade gliomas is dictated by the molecular pathology phenotype. You will hear about this when we discuss glioma patients at the beginning of clinic

Biomechanics of brain tumours (revision from your neurosurgery attachment)

We think of brain tumours as being intra-axial (i.e. arising from cerebral cortex, cerebellum or diencephalon) or extra-axial (arising from the dura or meninges lining the brain). In either case the biomechanics or a space occupying lesion are very similar.

The brain is a compliant structure contained within a bony box. Furthermore there are some stiff partitions that hold the brain in place, namely the falx, and the tentorium cerebelli. As a space occupying lesion grows in a certain location in the brain, a set pattern of events will occur:

- Oedema and mass effect. Presence of abnormal tissue in the brain results in cytokine release, causing blood vessels to become leaky and increased extracellular fluid. This causes oedema of the surrounding brain tissue and mass effect.
- Effacement of the sulci. As mass effect increases, particularly in lateralised lesions, the folds of the brain(sulci) tend to get pushed together to accommodate the mass effect.
- Compression of the ventricle. As the sulci become effaced and pressure increases, the next phenomenon to be observed is that the fluid ventricle adjacent to the lesion collapses to accommodate the mass effect.
- Midline shift. Generally, the falx tends to resist mass effect from one side of the brain being transmitted to the other. However, as pressure continues to build up the falx will deform.
- Herniation. This is when brain tissue gets pushed out through a rigid opening. Cerebrum can herniate through the opening in the falx, so for example the uncus (medial temporal lobe) can herniate and press on the brainstem. The midline cerebellar tonsils can also get pushed through the foramen magnum resulting in coning.



This T1 weighted MRI shows a diffuse non-enhancing tumour in the left temporal lobe. You can see that the temporal lobe is swollen by looking at the sulci over its surface.

Tumours in the midline of the brain may cause a slightly different picture, by obstructing the 3rd or 4th ventricle which leads to obstructive hydrocephalus.

How to approach a brain MRI scan

It is good to have a set approach to describing radiological images for exams. Remember the following principles:

- Take your time. Better to take a while and say something sensible than to speak to quickly and regret your first comment in front of Dr Harris 😊
- Check you have the right patient and have reviewed what is displayed on the screen. You may get useful information about the type of scan from the metadata (such as the administration of iv contrast).

- Sit on your hands. Try and describe the image without pointing. Refer to anatomical locations of abnormalities, and if you are not sure, use anatomical regions (e.g. right sided cortex)
- If an abnormality is not immediately obvious, look for symmetry or a lack of symmetry.
- If you do see a space occupying lesion, describe its appearance and what it is doing to the surrounding brain tissue (see section above)
- Look at the T1 scan with contrast. T1 scans image the substance of the brain very clearly, and you can differentiate a lesion as being **more intense or less intense than the surrounding brain**. Make a mental note of any areas that look like very bright contrast enhancement.
- Next look at the T1 scan without contrast. This is important because **blood** in the brain parenchyma can look just like intravenous contrast agent. However, only blood will appear on the T1 scan without contrast, allowing you to differentiate between the two.
- Finally look at the T2 or FLAIR image. This is useful for imaging extracellular water in the brain and shows the extend of **oedema**.

When characterising space occupying lesions, we start out by trying to work out if the lesion is **intrinsic** to brain tissue, or **extrinsic** (i.e. from the brain lining). For some large lesions this can be more difficult than you think, but it generally points is in different directions as extrinsic lesions are usually meningiomas or dural metastases.

For intrinsic lesions, we generally want to know if the lesion is a **high grade** tumour, **low grade** tumour, **metastasis**, **abscess** or something else.

High grade tumours will enhance with contrast, and typically have a complex texture, some areas being solid, some being cystic. They will also typically have an indistinct border with surrounding brain due to their infiltrative nature and cause surrounding oedema. They are also generally solitary lesions.

Metastases can look very similar but there are some clues. If there are multiple lesions, it is likely to be metastatic disease. If the border of the lesion is distinct and the lesion looks very round, it is likely to be metastatic disease. Finally, if the extent of oedema is greater than the size of the lesion, it is more likely to be metastatic disease.

Abscesses are what scare us the most, as it would be bad for the patient to treat an abscess with chemotherapy or radiotherapy. They tend to be round and feature a ring of enhancement round the edge. The radiologist will also use diffusion MRI to look at the restriction of water diffusion in the abscess. Abscesses can also be multiple. Look for a recent history of surgery or dental work.

Finally, don't forget that it could be something else completely. Some strokes and even MS plaques can have a 'tumefactive' appearance.

Find more teaching resources

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