Brain Tumours

A brain tumour is a mass of abnormal cells growing in the brain.
They can be defined as

Benign or Malignant

Benign tumours grow slowly & don't invade surrounding tissues, but they can put pressure on brain areas, causing problems and symptoms.
Examples include:
meningioma, pituitary adenoma, craniopharyngioma, pilocytic astrocytoma, colloid cyst

A primary tumour can be benign or malignant. A secondary (metastatic) tumour is always malignant, this is when cancerous cells have spread from elsewhere in the body to the brain

A **malignant** tumour is cancerous. These cells invade surrounding tissues
Examples include:
Glioma, astrocytoma, **glioblastoma**, oligodendroglioma, ganglioglioma, lymphoma, medulloblastoma

The location of a tumour is more important than size in how it affects the individual and when considering treatment options.
Figure 1 shows a glioblastoma, also called a grade IV astrocytoma.
This tumour is very close to the brain area for language production, identifying this allows sufficient precautions to be taken during the treatment.

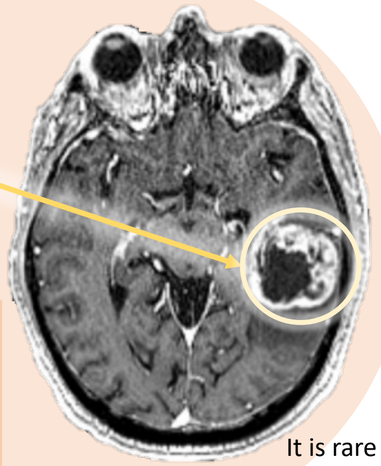

Figure 1

Symptoms

Headaches,
Changes in vision,
Nausea and dizziness,
Seizures,
Tiredness,
Loss of taste and smell

Causes

It is rare that someone will develop a brain tumour through their genetics (the NF1 and NF2 are 2 of the more common inheritable tumour genes)
Risk factors, such as exposure to radiation may play a role in tumour development. But for the whole, the causes of a brain tumour are unknown

Incidence of brain tumours are increasing by 2% a year, this is not due to better diagnostics

World Health Organisation classification:

Grade 1: slow growth, cells appear normal, may be resected by surgery (difficult if in the brain stem)
Grade 2: grows slowly but may spread to neighboring tissue & recur
Grade 3: Grows quickly, likely to spread, look different from normal cells
Grade 4: grows and spreads quickly, doesn't look normal, areas of dead cells in tumour, harder to manage and treat

A tumour is defined as cancerous when it reaches grade 3 or 4. They can be a mix of grades, so are defined by the highest one present

Why research brain tumours? 12,000 people are diagnosed with a primary brain tumour every year, that's 33 a day

Brain tumours account for only 3% of cancers in UK but for more deaths in men < 45 than prostate cancer and for more deaths than breast cancer in women < 35

Brain tumours are the biggest killer of children and adults under 40, reducing life expectancy by an average of 27 years

There are an estimated 88,000 children and adults currently living with a brain tumour in the UK

Diagnosis & Treatment

Computed Tomography (CT) (Figure 2) or forms of Magnetic Resonance Imaging (MRI) (Figure 3) provide images of the brain that are important in diagnosing a tumour.
A tumour may be suspected during an eye test, if there is swelling of the optic disc or pressure on the optic nerve

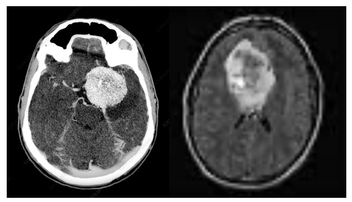

Fig.2 (left) A CT scan of a brain tumour & Fig.3 (right) A T1 MRI scan of a brain tumour

A biopsy (sample) of the tumour allows diagnosis of the grade to be made

Usually, neurosurgery is used to remove brain tumours. However, this is not always practical as the location of the tumour may mean that surgery increases risk of stroke, loss of senses or loss of functions
Radiotherapy and chemotherapy are also used, together or individually, to destroy cancerous cells

Figure 5

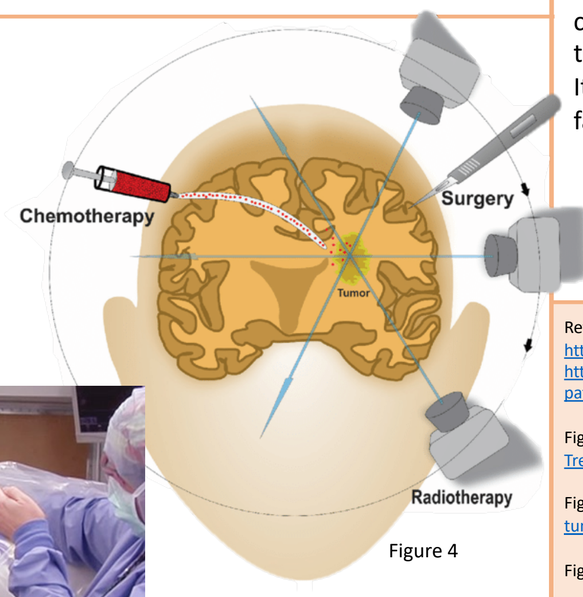

Figure 4

Brain surgery can be performed while the patient is awake. They are given tasks to do such as playing the violin (Figure 5) or talking, to make sure that vital areas for brain function are not being damaged.

Geoffrey Jefferson Brain Research Centre

The GJBRC furthers scientific research into brain tumours and translates this to healthcare.
The GJBRC are:

- Developing a leading centre for clinical and preclinical trials,
- Establishing a phase 0 study centre – to trial small doses of new drugs on people in a safe environment
- Developing a leading centre for radiobiology and quality of life which will have implications for post treatment and terminal tumours
- Leading multicentre Phase III study from candidate agents targeted at inflammatory microenvironment. This will compare new drugs with standard ones on a larger scale to try and find better treatments

Tessa Jowell BRAIN MATRIX
This project is a collaborative, multicentre clinical trial which will use highly targeted drugs. An individual tumour will be analysed and a molecular profile created. This will be linked to clinical data to offer appropriate experimental treatments.
It will allow future drug treatments to be tested faster

There is also ongoing research investigating brain and skull base tumours in the Surgical Neuro-oncology Manchester Lab (SNOMan Lab)

References:
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https://brainstrust.org.uk/brain-tumour-support/navigating-your-pathway/anatomy-tumour-types/

Figure 1: https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Glioblastoma-Multiforme

Figure 2: https://www.sciencephoto.com/media/696184/view/brain-tumour-ct-scan

Figure 3: http://www.ajnr.org/content/27/3/475

Figure 4: https://www.researchgate.net/publication/359071379_Nanocarriers_Call_the_Last_Shot_in_the_Treatment_of_Brain_Cancers

Figure 5: https://www.pacificneuroscienceinstitute.org/blog/brain-tumor/the-evolution-of-awake-brain-surgery/

Statistics: https://www.thebraintumourcharity.org/get-involved/donate/why-choose-us/the-statistics-about-brain-tumours/