

NEUROSURGERY

Lecture....2

Brain Tumors

Dr. Ali Adnan AL-Kafajy

Neurosurgeon

2022

Brain tumours

- Brain tumours are responsible for approximately 2% of all cancer deaths.
- Central nervous system tumours comprise the most common group of solid tumours in young patients, accounting for 20% of all pediatric neoplasms.
- The overall incidence of brain tumours is 8–10 per 100 000 population per year.

Table 1 General classification of brain tumours.

Neuroepithelial tumours

Gliomas

Astrocytoma (including glioblastoma)

Oligodendrocytoma

Ependymoma

Choroid plexus tumour

Pineal tumours

Neuronal tumours

Ganglioglioma

Gangliocytoma

Neuroblastoma

Medulloblastoma

Nerve sheath tumour — acoustic neuroma

Meningeal tumours

Meningioma

Pituitary tumours

Germ cell tumours

Germinoma

Teratoma

Lymphomas

Tumour-like malformations

Craniopharyngioma

Epidermoid tumour Dermoid

tumour Colloid cyst

Metastatic tumours

Local extensions from regional tumours

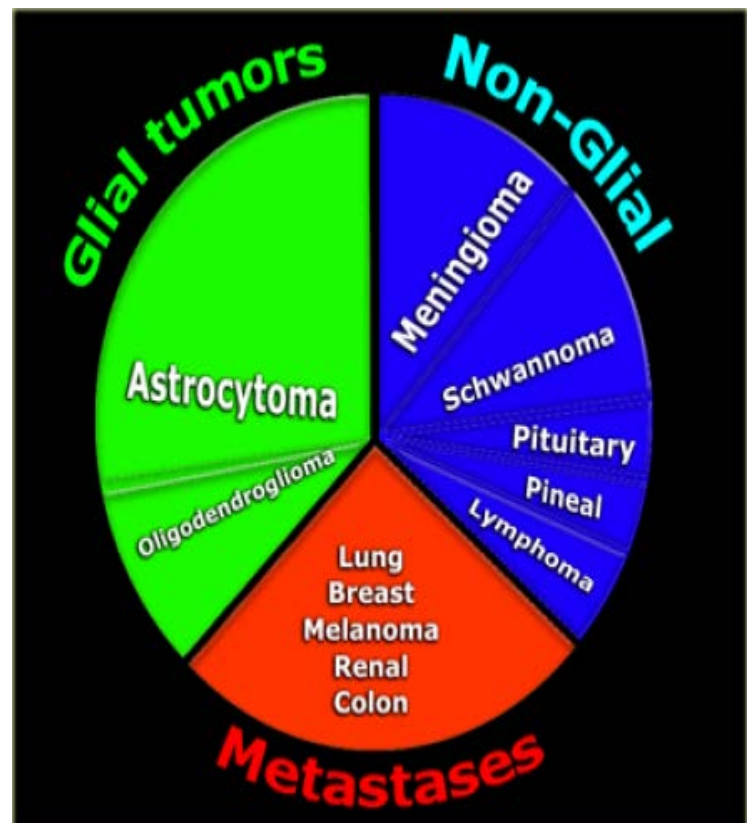
e.g. glomus jugular (i.e. jugulare), carcinoma of ethmoid

Classification

The general brain tumour classification is related to the cell of origin, and is shown in Table 1.

Generally classified into:

1. Primary brain tumors.
2. Secondary brain tumors (metastatic tumors) »»»» commonest type.



Etiology

- ✓ Epidemiology studies have **not indicated** any particular factor (viral, chemical or traumatic) that causes brain tumours in humans, although a range of cerebral tumours can be induced in animals experimentally.
- ✓ There is **no** genetic predisposition but chromosome abnormalities have been noted in many CNS tumours like Glioblastoma multiforme »»»» 17p, 19q and Meningioma »»»» 22q and Pituitary adenoma »»»» 11q.
- ✓ There is no specific evidence linking CNS tumours to environmental carcinogens, although many chemicals, especially ethyl and methyl nitrosourea and anthracene derivatives, show carcinogenic activity in animals and produce CNS tumours.
- ✓ Viral induction of brain tumours has been used in animal models but there is no firm evidence for viral aetiology in humans. A human polyoma virus injected into primates produces tumours similar to human astrocytomas
- ✓ Immunosuppression is known to increase markedly the risk of primary lymphoma of the brain, particularly in transplant recipients.

1-Glioma

Gliomas comprise the majority of cerebral tumours and arise from the neuroglial cells. There are four distinct types of glial cells: astrocytes, oligodendroglia, ependymal cells and neuroglial precursors. Each of these gives rise to tumours with different biological and anatomical characteristics.

1.1 Astrocytoma

- ✚ The **most common** gliomas arise from the astrocyte cells which comprise the vast majority of intraparenchymal cells of the brain.
- ✚ The tumours arising from astrocytes range from the relatively benign to the highly malignant.
- ✚ The term 'malignant' for brain tumours differs from its usage for systemic tumours. Intrinsic brain tumours **very rarely** metastasize (**except** for medulloblastoma and ependymoma), and '**malignant**' refers to aggressive biological characteristics and a poor prognosis.
- ✚ The World Health Organization (WHO) classification recognizes four grades of astrocytoma:
 - i. WHO Grade I »»»» pilocytic astrocytoma.
 - ii. WHO Grade II »»»» diffuse astrocytomas.
 - iii. WHO Grade III »»»» anaplastic astrocytoma.
 - iv. WHO Grade IV »»»» glioblastoma multiforme (GBM).

Clinical presentation

The presenting features can be classified under:

- a) Raised intracranial pressure.
- b) Focal neurological signs.
- c) Epilepsy.

Investigations

CT scan or MRI of the brain are the essential radiological Investigations.

Management

Following the presumptive diagnosis of a glioma the management involves:

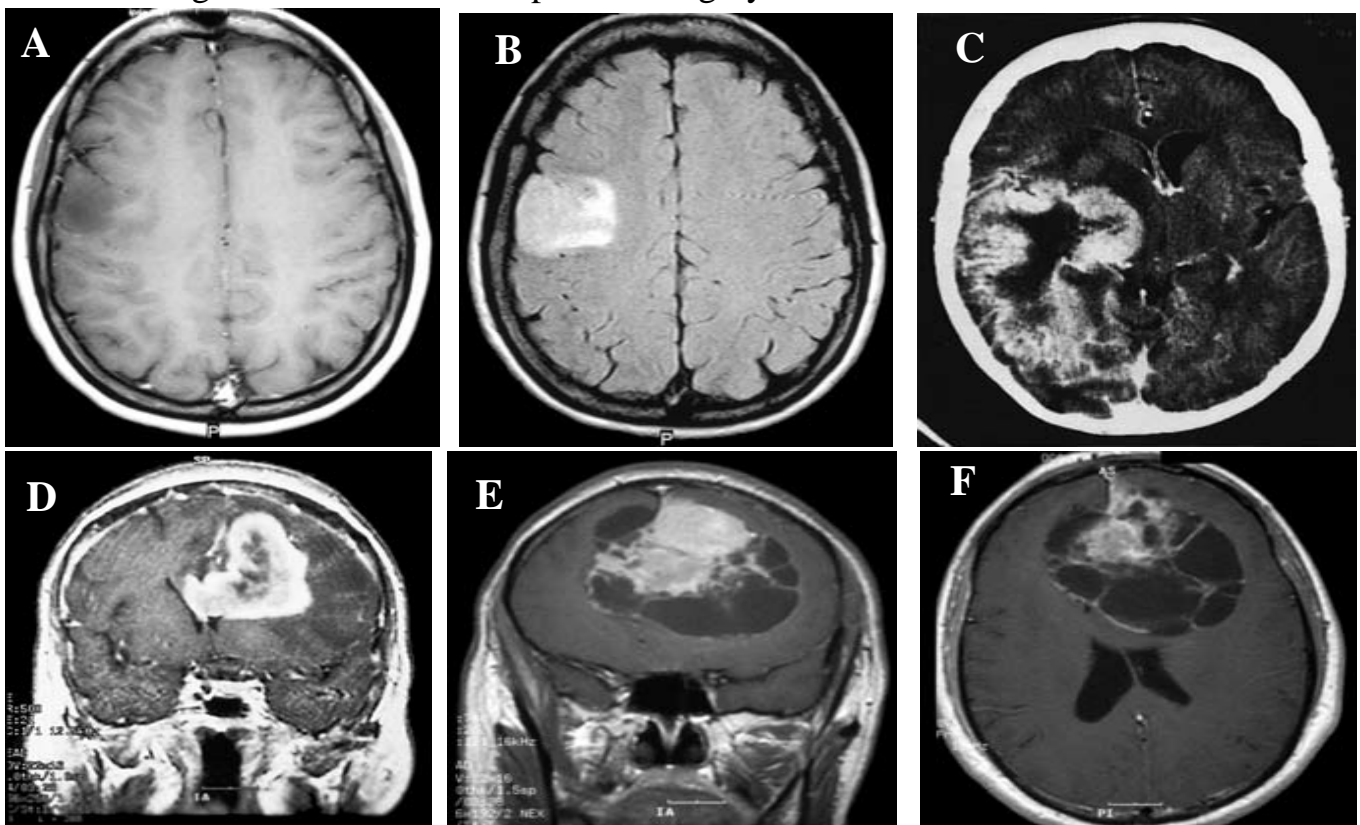
1. Surgery.
2. Radiotherapy.
3. Other adjuvant treatments these include the use of new chemotherapeutic agents, new methods of administering cytotoxic chemicals, immunotherapy and gene therapy.

Surgery

Surgery is performed with three principal aims.

- i. To make a definite diagnosis.
- ii. Tumour reduction to alleviate the symptoms of raised intracranial pressure.
- iii. Reduction of tumour mass as a precursor to adjuvant treatments.

The patient is started on glucocorticoid steroid therapy (e.g. dexamethasone) when presenting with clinical features of raised intracranial pressure with the aim of decreasing the cerebral oedema prior to surgery.



- MRI showing low-grade glioma in posterior frontal region. (A) T1 MRI scan, (B) T2 MRI scan.
- GM (C). CT shows a large tumour with contrast enhancement particularly at the margins surrounding a necrotic Centre.
- Glioblastoma multiforme (GM) (D) MRI.
- Cystic anaplastic astrocytoma MRI in (E&F)

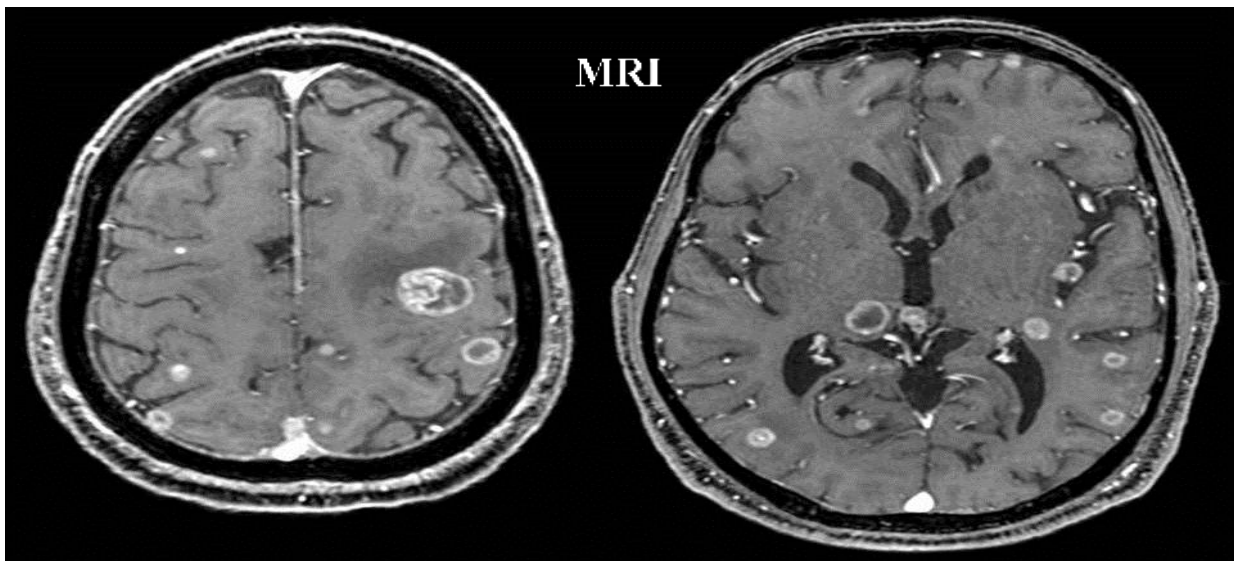
2-Metastatic tumours

- ✓ Metastatic tumours are responsible for approximately 15% of brain tumours in clinical series but up to 30% of brain tumours reported by pathologists.
- ✓ The metastatic tumours **most** commonly originate from:
 1. Carcinoma of the lung.
 2. Carcinoma of the breast.
 3. Metastatic melanoma.
 4. Carcinoma of the kidney.
 5. Gastrointestinal carcinoma.
- ✓ In 15% a primary origin is never found.
- ✓ Most metastatic tumours are multiple and **one third** are solitary.
- ✓ The incidence of tumours in the cerebrum relative to the cerebellum is **8: 1**.

Clinical presentation

The presenting features are **similar to those** described for other intracranial tumours.

- i. Raised intracranial pressure.
- ii. Focal neurological signs.
- iii. Epileptic seizures.



Treatment

- Steroid medication (e.g. dexamethasone) will control cerebral oedema and should be commenced immediately if there is raised intracranial pressure.
- Surgery to remove the metastasis is indicated if:
 - i. There is a solitary metastasis in a surgically accessible position.
 - ii. There is no systemic spread.
- Radiotherapy, together with steroid medication to control cerebral oedema, is used to treat patients with multiple cerebral metastases.

3-Benign brain tumours

- ✓ The benign brain tumours may be intimately associated with, and surrounded by, the adjacent brain, but the tumour cells do not invade the underlying brain.
- ✓ The more common benign brain tumours:
 1. Meningioma.
 2. Acoustic neuroma (vestibular schwannoma).
 3. Less common tumours: haemangioblastoma, epidermoid, dermoid cysts and colloid cysts.

3.1 Meningiomas

- ❖ Slow growing, extra-axial tumor, usually benign, arise from arachnoid (not dura).
- ❖ Imaging (MRI or CT): classically broad based attachment on dura often with dural tail, typically enhance densely, and may cause hyperostosis of adjacent bone.
- ❖ That are not satisfactorily controlled medically.
- ❖ Most (but not all) are cured if completely removed, which is not always possible.
- ❖ Most commonly located along falx, convexity, or sphenoid bone.
- ❖ Frequently calcified.

3.2 Vestibular schwannoma

- Histologically benign tumor of cranial nerve VIII located in the cerebellopontine angle (CPA)
- Three most common early symptoms (clinical triad): hearing loss (insidious and progressive), tinnitus (high pitched) and dysequilibrium (true vertigo is uncommon).
- W/U: All patients: MRI (ice cream cone appearance) & audiometrics (pure tone audiogram and speech discrimination).
- Choice of management option (observation, surgery, XRT or chemotherapy (Avastin®)) depends heavily on tumor size, growth, hearing status, VII function.

