Brain Tumors

For undergraduate

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Brain Tumors/Introduction

- The prevalence of brain tumor is between 5-18/100.000 population
- In Jordan; 5.01/100.000 population Only(*)
- Slightly more in Male.
- Some tumors are more common in males, and others are more common in female.
- Median age presentation of brain tumors, 38-42 years.
- Malignant Brain tumors are raely metastasize outside of the CNC.
- It is excellent host for systemic cancer(40% of autopsy for systemic malignant tumor have brain metastasis

(*) *Epidemiology of Malignant and non-malignanat primary brain tumors in Jordan; Tamimi AF, Tamimi I, Abdelaziz M, Saleh Q, Obeidat F, Al-Husseini M, Haddadin W, Tamimi F.*

Neuroepidemiology. 2015;45(2):100-8.

Classification .

- **The first WHO classifications for brain tumors was in 1979**
- **WHO(2007) classification of CNS tumors was based mainly in:**

  - Histological features of the tumor microscopically (light microscopy in hematoxylin- and eosin-stained sections.

  - Immunohistochemical [IHC] lineage-associated proteins, and ultrastructural characteristics)

- **WHO (2016) classification of CNS tumors is updated the WHO(2007) with addition of:**

  - Genetic basis of tumorigenesis
  - Molecular marker.
  - Provides prognostic or predictive data within diagnostic categories established by conventional histology which allow effective targeted treatments.

<u>Limitations of classification WHO(2016)</u>

- International institutional variations (facilities)
- Adoption of tests to genetic alterations and markers is a time-consuming process

Classifications of WHO (2007)

TUMOURS OF NEUROEPITHELIAL TISSUE

Astrocytic tumours	
Pilocytic astrocytoma	9421/1[1]
Pilomyxoid astrocytoma	*9425/3**
Subependymal giant cell astrocytoma	9384/1
Pleomorphic xanthoastrocytoma	9424/3
Diffuse astrocytoma	9400/3
Fibrillary astrocytoma	9420/3
Gemistocytic astrocytoma	9411/3
Protoplasmic astrocytoma	9410/3
Anaplastic astrocytoma	9401/3
Glioblastoma	9440/3
Giant cell glioblastoma	9441/3
Gliosarcoma	9442/3
Gliomatosis cerebri	9381/3
Oligodendroglial tumours	
Oligodendroglioma	9450/3
Anaplastic oligodendroglioma	9451/3
Oligoastrocytic tumours	
Oligoastrocytoma	9382/3
Anaplastic oligoastrocytoma	9382/3
Ependymal tumours	
Subependymoma	9383/1
Myxopapillary ependymoma	9394/1
Ependymoma	9391/3
Cellular	9391/3
Papillary	9393/3
Clear cell	9391/3
Tanycytic	9391/3
Anaplastic ependymoma	9392/3
Choroid plexus tumours	
Choroid plexus papilloma	9390/0
Atypical choroid plexus papilloma	*9390/1**
Choroid plexus carcinoma	9390/3
Other neuroepithelial tumours	
Astroblastoma	9430/3
Chordoid glioma of the third ventricle	9444/1
Angiocentric glioma	*9431/1**
Neuronal and mixed neuronal-glial tumours	
Dysplastic gangliocytoma of cerebellum (Lhermitte-Duclos)	9493/0
Desmoplastic infantile astrocytoma/ ganglioglioma	9412/1
Dysembryoplastic neuroepithelial tumour	9413/0
Gangliocytoma	9492/0
Ganglioglioma	9505/1
Anaplastic ganglioglioma	9505/3
Central neurocytoma	9506/1
Extraventricular neurocytoma	*9506/1**
Cerebellar liponeurocytoma	*9506/1**
Papillary glioneuronal tumour	*9509/1**
Rosette-forming glioneuronal tumour of the fourth ventricle	*9509/1**
Paraganglioma	8680/1
Tumours of the pineal region	
Pineocytoma	9361/1
Pineal parenchymal tumour of intermediate differentiation	9362/3
Pineoblastoma	9362/3
Papillary tumour of the pineal region	*9395/3**
Embryonal tumours	
Medulloblastoma	9470/3
Desmoplastic/nodular medulloblastoma	9471/3
Medulloblastoma with extensive nodularity	*9471/3**
Anaplastic medulloblastoma	*9474/3**
Large cell medulloblastoma	9474/3
CNS primitive neuroectodermal tumour	9473/3
CNS Neuroblastoma	9500/3
CNS Ganglioneuroblastoma	9490/3
Medulloepithelioma	9501/3
Ependymoblastoma	9392/3
Atypical teratoid / rhabdoid tumour	9508/3

TUMOURS OF CRANIAL AND PARASPINAL NERVES

Schwannoma (neurilemoma, neurinoma)	9560/0
Cellular	9560/0
Plexiform	9560/0
Melanotic	9560/0
Neurofibroma	9540/0
Plexiform	9550/0
Perineurioma	
Perineurioma, NOS	9571/0
Malignant perineurioma	9571/3
Malignant peripheral nerve sheath tumour (MPNST)	
Epithelioid MPNST	9540/3
MPNST with mesenchymal differentiation	9540/3
Melanotic MPNST	9540/3
MPNST with glandular differentiation	9540/3

TUMOURS OF THE MENINGES

Tumours of meningothelial cells	
Meningioma	9530/0
Meningothelial	9531/0
Fibrous (fibroblastic)	9532/0
Transitional (mixed)	9537/0
Psammomatous	9533/0
Angiomatous	9534/0
Microcystic	9530/0
Secretory	9530/0
Lymphoplasmacyte-rich	9530/0
Metaplastic	9530/0
Chordoid	9538/1
Clear cell	9538/1
Atypical	9539/1
Papillary	9538/3
Rhabdoid	9538/3
Anaplastic (malignant)	9530/3
Mesenchymal tumours	
Lipoma	8850/0
Angiolipoma	8861/0
Hibernoma	8880/0
Liposarcoma	8850/3
Solitary fibrous tumour	8815/0
Fibrosarcoma	8810/3
Malignant fibrous histiocytoma	8830/3
Leiomyoma	8890/0
Leiomyosarcoma	8890/3
Rhabdomyoma	8900/0
Rhabdomyosarcoma	8900/3
Chondroma	9220/0
Chondrosarcoma	9220/3
Osteoma	9180/0
Osteosarcoma	9180/3
Osteochondroma	9210/0
Haemangioma	9120/0
Epithelioid haemangioendothelioma	9133/1
Haemangiopericytoma	9150/1
Anaplastic haemangiopericytoma	9150/3
Angiosarcoma	9120/3
Kaposi sarcoma	9140/3
Ewing sarcoma - PNET	9364/3
Primary melanocytic lesions	
Diffuse melanocytosis	8728/0
Melanocytoma	8728/1
Malignant melanoma	8720/3
Meningeal melanomatosis	8728/3
Other neoplasms related to the meninges	
Haemangioblastoma	9161/1

LYMPHOMAS AND HAEMATOPOIETIC NEOPLASMS

Malignant lymphomas	9590/3
Plasmacytoma	9731/3
Granulocytic sarcoma	9930/3

GERM CELL TUMOURS

Germinoma	9064/3
Embryonal carcinoma	9070/3
Yolk sac tumour	9071/3
Choriocarcinoma	9100/3
Teratoma	9080/1
Mature	9080/0
Immature	9080/3
Teratoma with malignant transformation	9084/3
Mixed germ cell tumour	9085/3

TUMOURS OF THE SELLAR REGION

Craniopharyngioma	9350/1
Adamantinomatous	9351/1
Papillary	9352/1
Granular cell tumour	9582/0
Pituicytoma	*9432/1**
Spindle cell oncocytoma of the adenohypophysis	*8291/0**

METASTATIC TUMOURS

[1] Morphology code of the International Classification of Diseases for Oncology (ICD-O) (614A) and the Systematized Nomenclature of Medicine (http://snomed.org). Behaviour is coded /0 for benign tumours, /3 for malignant tumours and /1 for borderline or uncertain behaviour.

* The italicised numbers are provisional codes proposed for the 4th edition of ICD-O. While they are expected to be incorporated into the next ICD-O edition, they currently remain subject to change.

Summary of the major changes in the WHO Classification(2016)

- **Formulating concept of how CNS tumor diagnoses are structured in the molecular era**
- Major restructuring of diffuse gliomas, with incorporation of genetically defined entities
- Major restructuring of medulloblastomas, with incorporation of genetically defined entities
- Major restructuring of other embryonal tumors, with incorporation of genetically defined entities and removal of the term “primitive neuroectodermal tumor”
- Incorporation of a genetically defined ependymoma variant
- Novel approach distinguishing pediatric look-alikes, including designation of novel, genetically defined entity
- Addition of newly recognized entities, variants and patterns
- IDH-wildtype and IDH-mutant glioblastoma (entities)
- Diffuse midline glioma, H3 K27M–mutant (entity)
- Embryonal tumour with multilayered rosettes, C19MC-altered (entity)
- Ependymoma, RELA fusion–positive (entity)
- **Diffuse leptomeningeal glioneuronal tumor (entity)**
- Anaplastic PXA (entity)

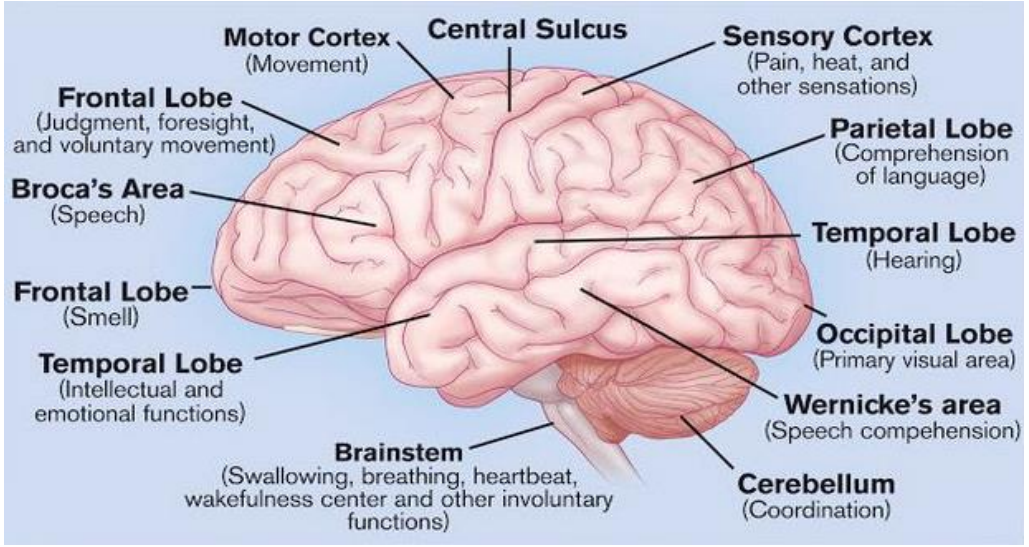
- **Epithelioid glioblastoma (variant)**
- Glioblastoma with primitive neuronal component (pattern)
- Multinodular and vacuolated pattern of ganglion cell tumor (pattern)
- Deletion of former entities, variants and terms
- Gliomatosis cerebri
- Protoplasmic and fibrillary astrocytoma variants
- Cellular ependymoma variant
- “Primitive neuroectodermal tumour” terminology
- Addition of brain invasion as a criterion for atypical meningioma
- Restructuring of solitary fibrous tumor and hemangiopericytoma (SFT/HPC) as one entity and adapting a grading system to accommodate this change
- Expansion and clarification of entities included in nerve sheath tumors, with addition of hybrid nerve sheath tumors and separation of melanotic schwannoma from other schwannomas
- Expansion of entities included in hematopoietic/lymphoid tumors of the CNS (lymphomas and histiocytic tumors)

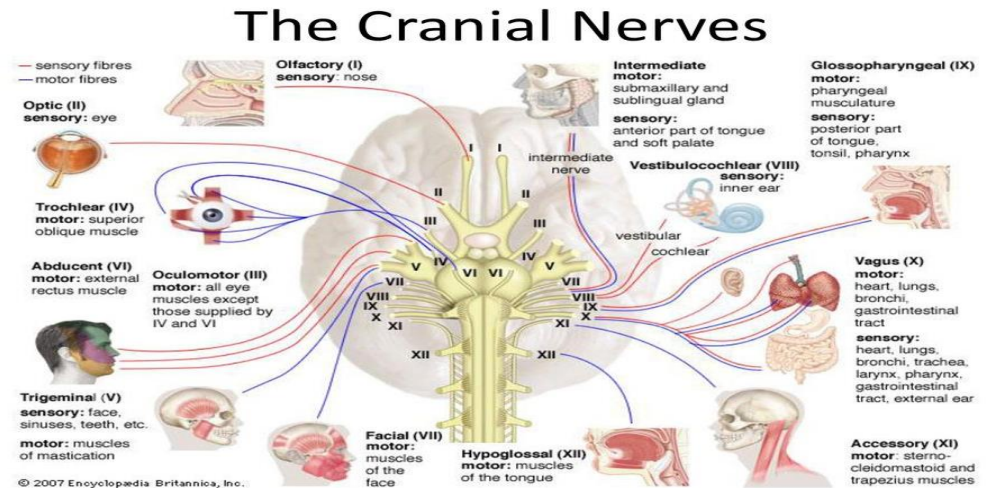
Diagnosis of brain tumors /Clinical evaluation

- **Clinical History**: asking symptoms.

Behavioral changes, memory , Headache, Dizziness, Vomiting, visual , speeches , sensory , motor and gate disturbances.

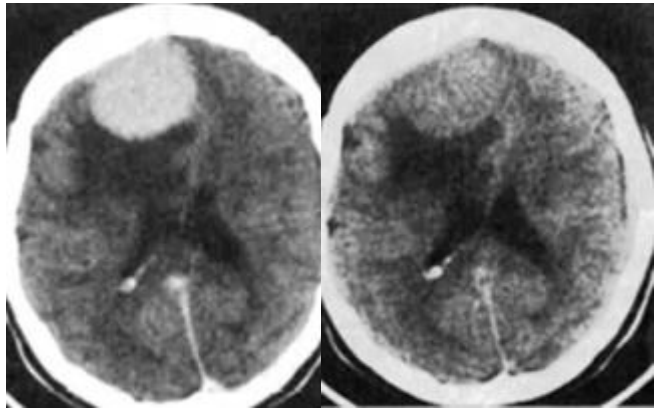
- **Neurological Examination**: looking for signs . Behavioral changes, memory, cranial nerves palsy , motor and sensory deficit, cerebellar function. Monosynaptic reflex, Polysynaptic reflex. gate.

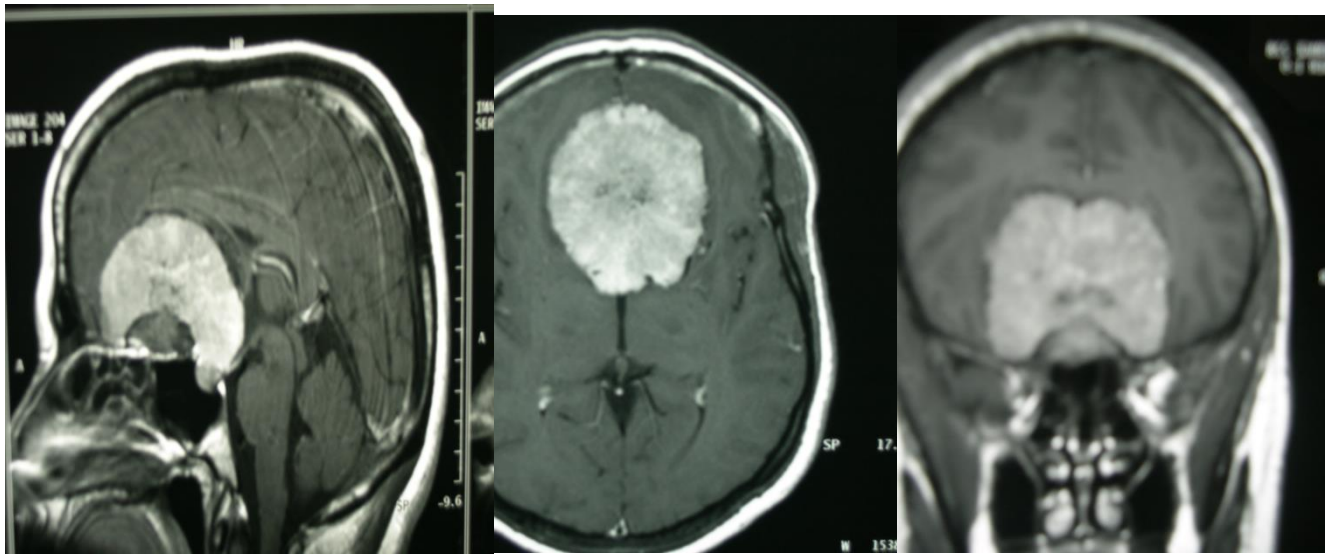




Brain MRI/ Neuroimaging

- Brain CT with and without contrast
- Brain MRI with contrast
- MRA and MRV
- MRI spectroscopy





Management/Medical treatment

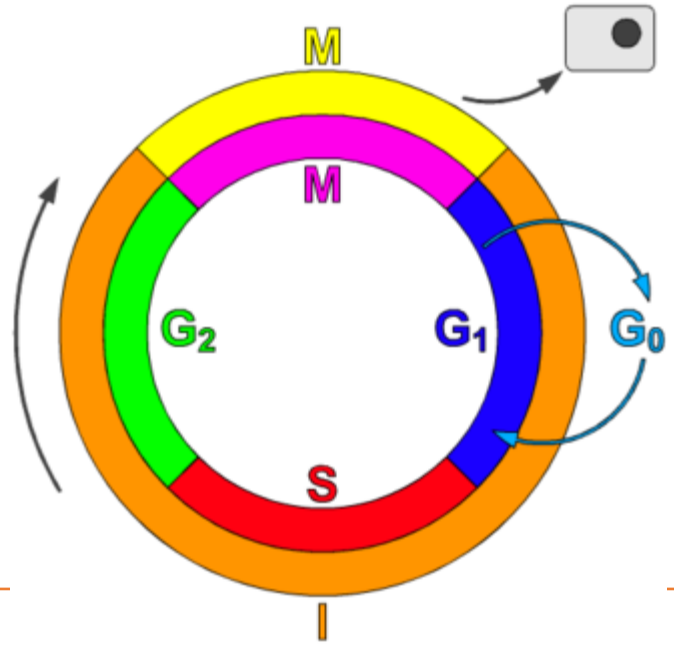
- Head elevation 30(patient with increase IC)
- Dexamethasone
- *AEDS (Phenytoin*)
- Analgesia
- Mannitol?? Rebound Effect
- Close observation

Surgical treatment

- Confirmation of the histological diagnosis
- Physical decompression: Biopsy, partial resection, subtotal resection and total resection.(Creating physical space in the intracranial cavity)
- Biological decompression;

(increase tumor cells vulnerability for

Complementary treatment)



Brain Tumors /Palliative treatment

- Conventional Chemotherapy ;(cytotoxic drugs for destruction of brain tumors cells. Commonest type of chemotherapy include;
  - Temozolamide
  - BCNU
  -BCNU
  - Procarbazine
  -Vincristine
- Gen Therapy: involves the delivery of genes that drive the therapy of the cancer cells (potential treatment option for brain tumor) .
- Immunotherapy, through the vaccine system(potential treatment option for brain tumor)

Brain tumor/ palliative treatment

- Radiotherapy:
  - Conventional radiotherapy (Gama-rays)
  - Radio surgery (Gama knife, linear accelerator)(Gama-rays)
  - Proton therapy.(energy from positively charged particles call protons); More effective and save than the conventional radiotherapy or radio surgery).

Meningioma

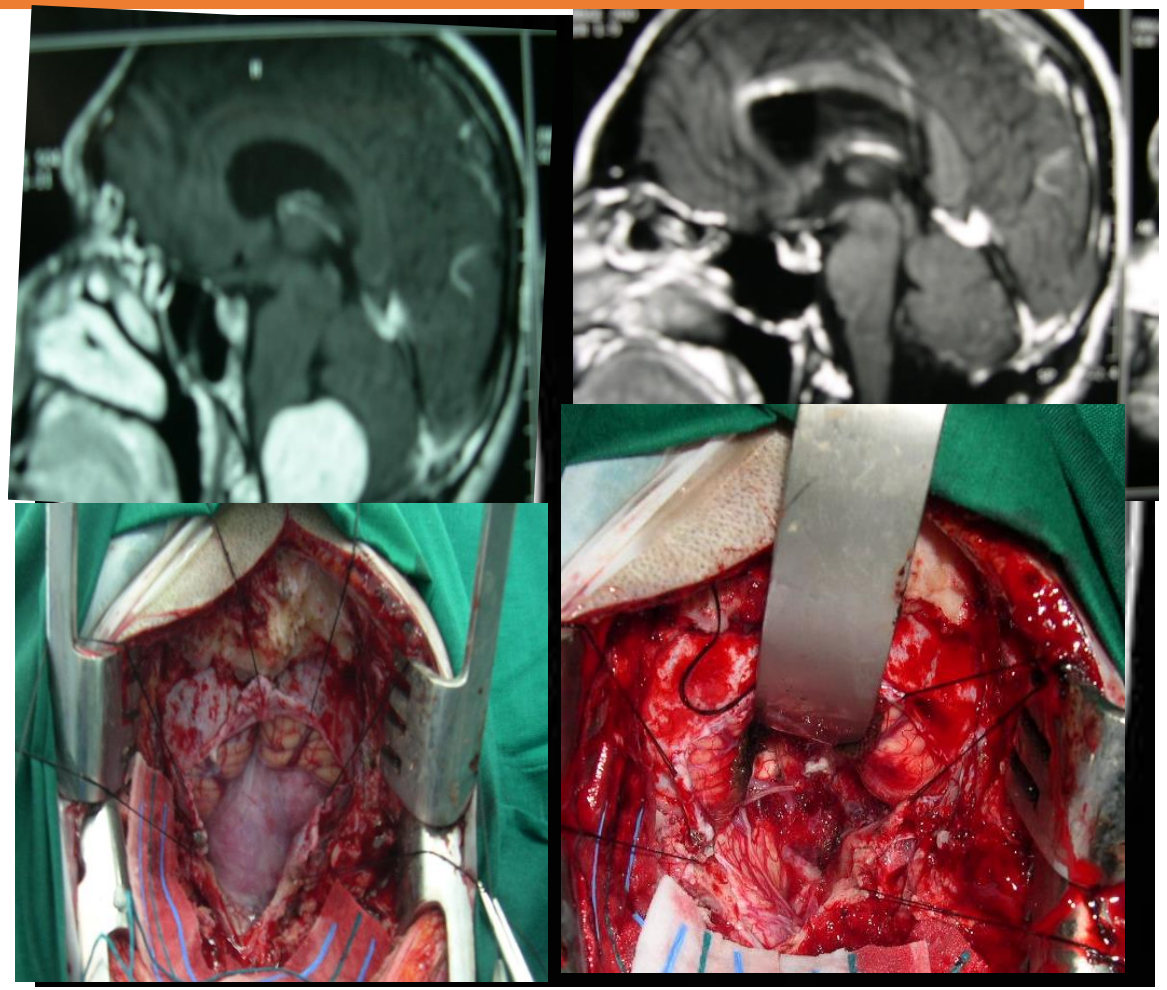
- It is more common in Female
- It is the most common primary brain tumor(18-24%) of the total of brain tumors
- Classification; (grade I is more than 95%)

  - Meningioma grad I(Benign)

  -Meningioma atypical grade II

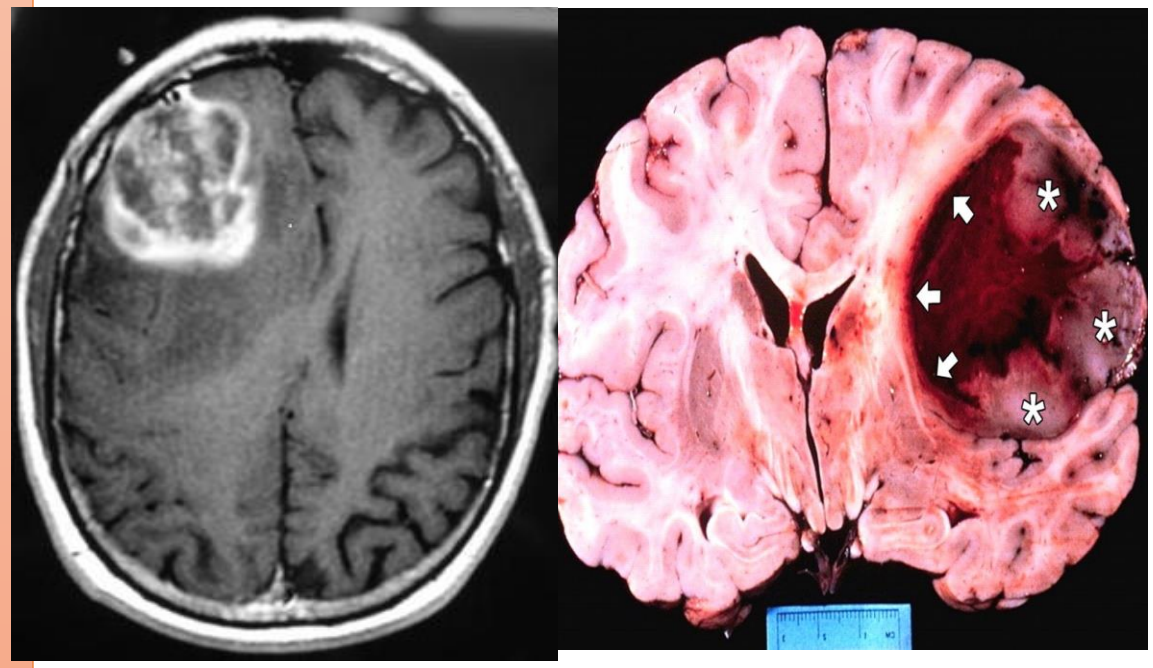
  - Malignant Meningioma III

Treatment; Resective surgery



Glioblastoma Multiforme

- Is the most malignant primary brain tumor(12-15%) of the brain tumors
- It is more common in male
- Classification: primary (90%) mean age 55 years and secondary(10%) with mean age 40 years.
- Treatment; surgical resection and complementary, Radiotherapy and Chemotherapy
- Outcome ; poor survival 3months survival for untreated, and 12-18 months for the treated patientes.



Chapter 8 Epidemiology and Outcome of Glioblastoma

Ahmad Faleh Tamimi and Malik Juweid.

Author Information

Abstract

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Glioblastoma (GBM) is the most aggressive malignant primary brain tumor. With an incidence rate of 3.19 per 100,000 persons in the United States and a median age of 64 years, it is uncommon in children. The incidence is 1.6 times higher in males compared to females and 2.0 times higher in Caucasians compared to Africans and Afro-Americans, with lower incidence in Asians and American Indians. GBM is commonly located in the supratentorial region (frontal, temporal, parietal, and occipital lobes) and is rarely located in cerebellum. Genetic and environmental factors have been investigated in GBM. Risk factors include prior radiotherapy, decreased susceptibility to allergy, immune factors and immune genes, as well as some single nucleotide polymorphisms detected by genomic analysis. Use of anti-inflammatory medication has been found to be protective against GBM. Survival from GBM is poor; only few patients survive 2.5 years and less than 5% of patients survive 5 years following diagnosis. Survival rates for patients with GBM have shown no notable improvement in population statistics in the last three decades. Molecular epidemiology integrates molecular technology into epidemiological studies and outcomes. The future of the epidemiology of GBM will depend on multicenter studies generating large clinical data sets of genomic data potentially leading to further understanding of the roles of genes and environment in the development of this devastating disease.

Key words: Brain tumors, Epidemiology, Glioblastoma, Outcome

Introduction

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Glioblastoma (GBM) is the most aggressive diffuse glioma of astrocytic lineage and is considered a grade IV glioma based on the WHO classification (1). GBM is the most common malignant primary brain tumor making up 54% of all gliomas and 16% of all primary brain tumors (2). GBM remains an incurable tumor with a median survival of only 15 months (3). Treatment is complex, initially consisting of maximally safe surgical resection followed by radiation therapy (RT) and concurrent Temozolomide (TMZ) chemotherapy (4). The terms "primary GBM" and "secondary

Views

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Related information

PMC
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Similar articles in PubMed

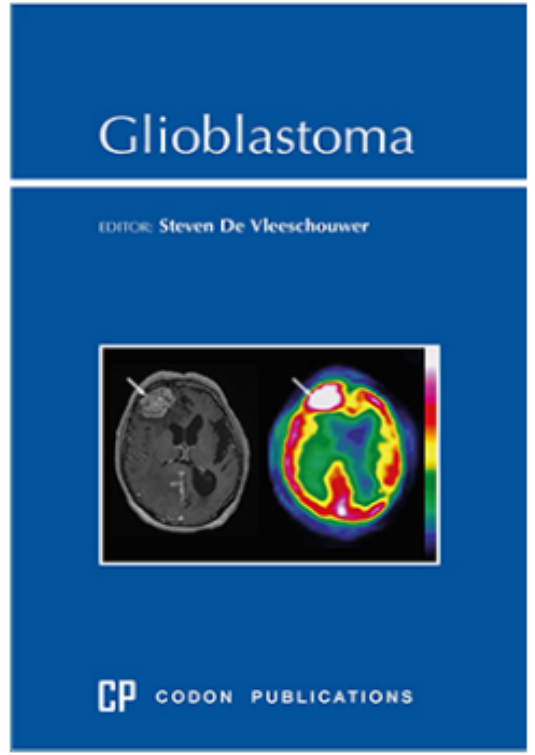
A population-based description of glioblastoma multiforme in Los Angeles County, 1974-1999. [Cancer. 2005]

Demographic variation in incidence of adult glioma by subtype, United States, 1992-2007. [BMC Cancer. 2011]

Clinical outcome of gliosarcoma compared with glioblastoma multiforme: North Central Cancer Treatment G [J Neurosurg. 1998]

Review Epidemiologic and molecular prognostic review of glioblastoma. [Cancer Epidemiol Biomarkers Pr...]

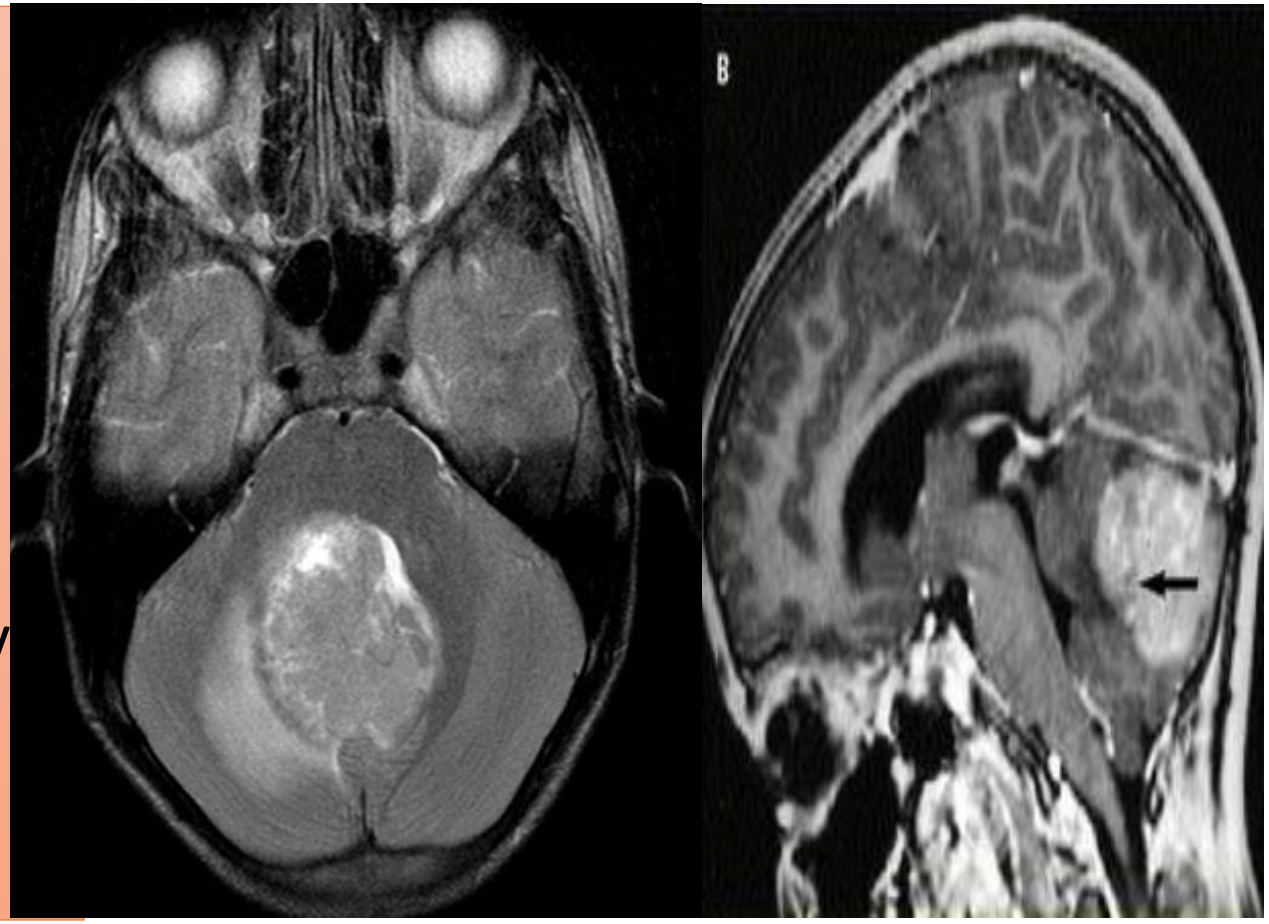
Review Candida and candidaemia. Susceptibility and epidemiology. [Dan Med J. 2013]



Front Matter

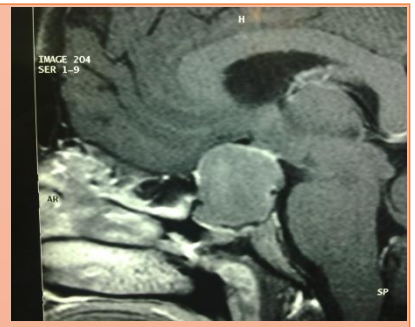
Medulloblastoma

- The most common primary brain tumor in children
- More common in male
- It is mainly in the cerebellum
- It is malignant brain tumor
- It spread through the CSF
- Treatment; surgical resection, complementary Radiotherapy for the neuroaxis, and chemotherapy when recurred.
- Outcome: 50%-60% survival at 5 years. Follow-up.



Pituitary Adenoma

- It is benign tumor
- 8%-12% of brain tumors.
- Classifications According to the seize:
  - -Microdenoma;<10mm
  - -Macroadenoma:>10mm.



  Classifications according to endocrine activity:
  - -Secreting tumor
  - -Non Secreting tumor
- Secreting tumors ; (most common types include:)

  -ACTH secreting tumor(Cushing disease

  -Growth Hormone secreting tumor(Acromegaly/ Gigantism in pediatric age)

  -Prolactine secreting tumor(Prolactinoma)

  -TSH secreting Tumor.

Clinical evaluation and Investigation:

-Clinical history(Body weight, clinical feature, obesity, sexual activity, menstruation for female, visual dysfunction)

Specific investigation;

-Pituitary MRI

- Dynamic pituitary MRI

- Endocrine analysis, standard and dynamic

- Visual field and acuity

Treatment: Surgery is the treatment of choice for Acromegaly and Cushing disease. Brmocriptine is the treatment of chose for prolactinoma, without visual dysfunction.

Surgical approach,;95% transsphenoidal approach, 5% transcranial for macroadenomas, with extension laterally or anterior or retrosellar.

Outcome; Best outcome for Cushing Disease(80%) cure

Acromegaly(60% Cure)

Prolactinoma (45%) of curability.

Brain Metastases

- The clinical serial(5%-17%) of the total of brain tumors.
- Etiology:

  -Lung cancer 48%

  - Breast Cancer 15%

  - Genitourinary tract cancer 11%

Treatment: Surgical resection(single and accessible)

Complementary Radiotherapy, chemotherapy)

Outcome ; variable .