I  NEUROSURGERY INITIATIVE

INTRACRANIAL TUMORS

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PRELUDE

Intracranial neoplasms is a more suitable name for these tumors, because it represents tumors originating in the brain substance and other tumors of none neural origin, like meningiomas

INCIDENCE

- PRIMARY TUMORS:
  - 6 PER 100,000 = 48% OF ALL TUMORS
  - 17,000 new cases per year in the USA
- METASTATIC TUMORS:
  - 30 PER 100,000 = 52% OF ALL TUMORS
  - 100,000 new cases per year in the USA

INCIDENCE

CHILDHOOD TUMORS

8% OF ALL TUMORS OCCUR IN CHILDREN BELOW 15 YEARS OF AGE.

SITE

- ***ADULTS***

  80-85% SUPRATENTORIAL

  15-20% INFRATENTORIAL

- ***CHILDREN***

  40% SUPRATENTORIAL

  60% INFRATENTORIAL

RISK FACTORS

- Genetic factors. Around 5% of cases have a positive family history. Brain tumors were found to occur in families with a history of von Hippel-Lindau disease (hemangioblastoma), or Li-Fraumeni syndrome (gliomas) and tuberous sclerosis (subependymal astrocytoma). Optic nerve gliomas could be found in NF1 (neurofibromatosis type one) and multiple meningioma in NF2 (neurofibromatosis type two)

RISK FACTORS

- Exposure to radiation especially at young age was noticed to be associated with increased incidence of brain tumors.
- Certain types of viruses have been shown to cause cancer in laboratory animals, the only viruses to have been associated with increased incidence of lymphoma is the Epstein-Barr virus (EBV) and (CMV) with medulloblastomas.

RISK FACTORS

- Trauma was linked to increased incidence of meningiomas.
- Suppression of the immune system was found to be associated with increased risk of CNS lymphomas.
- Racial and ethnic differences seem to affect the incidence of brain tumors. Tumors are twice as common in north Europe compared to Japan

PATHOLOGY

THE WHO CLASSIFICATION 2007, MODIFIED 2016 ACCORDING TO CELL ORIGIN

PATHOLOGY (contd.)

- *NEUROEPITHELIAL*
- *CRANIAL NERVES*
- *MENINGES*
- *LYMPHOMAS AND HEMOPOETIC NEOPLASMS*
- *GERM CELLS*
- *SELLAR REGION tumor*
- *METASTATIC TRUMORS*

PATHOLOGY (contd.)

- The WHO graded all tumors and placed each tumor in a category of I to IV, the lesser the grade the more benign the tumor. The grade of a tumor is used among many other factors to determine prognosis.

CLASSIFICATION ACCORDING TO SITE

- CEREBRAL HEMISPHERES:
  - EXTRENSIC
  - INTRENSIC
- VENTRICULAR SYSTEM
- HYPOTHALMIC
- SELLAR/SUPRACELLAR REGION
- SKULL BASE AND SINUSES
- PINEAL REGION
- POSTERIOR FOSSA:
  - EXTRENSIC
  - INTRENSIC

CLINICAL PRESENTATION

- MASS EFFECT:
  - RAISED INTRACRANIAL PRESSURE
  - BRAIN SHIFTS
- FOCAL DAMAGE:
  - EPILEPSY
  - FEATURES OF DISTURBED FUNCTION
- HORMONAL
- CSF PATHWAY OBSTRUCTION

CLINICAL PRESENTATION

- Most of the time, brain tumors follow a course dependent on their nature wither benign or malignant, and the malignant if low grade or high grade. However, some of these tumors may present acutely when they are complicated by hemorrhage or produce hydrocephalus.

DIFFERENTIAL DIAGNOSIS

- *VASCULAR*
  - *HEMATOMAS, GIANT ANEURYSMS, AVMs, INFARCTS WITH OEDEMA AND VENOUS THROMBOSIS*
- *TRAUMA*
  - *HEMATOMA*
  - *CONTUSION*
- *INFECTION*
  - *ABSCESS*
  - *TUBERCULOMA*
  - *SARCOIDOSIS*
  - *ENCEPHALITIS*
- *CYSTS*
  - *ARACHNOID*
  - *PARASITIC*

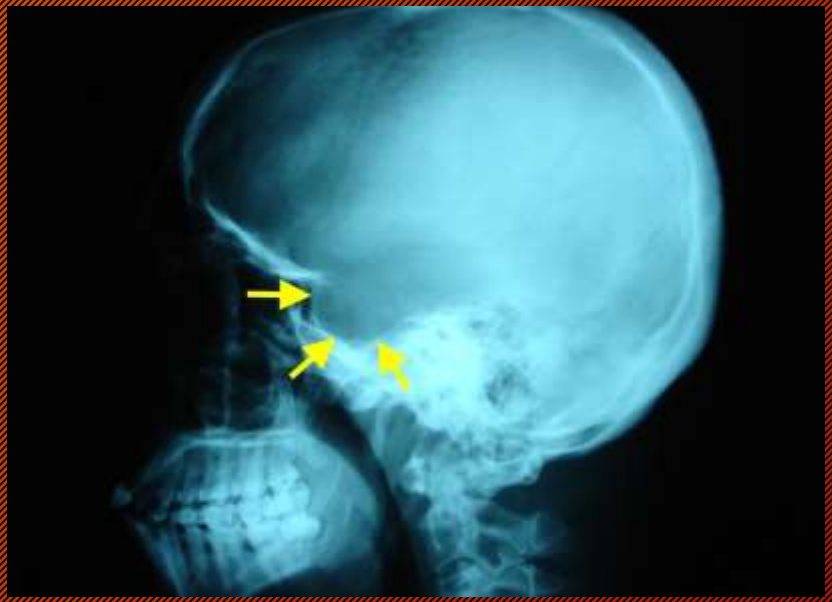
INVESTIGATIONS

- *SKULL X-RAYS*
- *COMPUTERIZED TOMOGRAPHY (CT) WITH AND WITHOUT CONTRAST*
- *HIGH DEFINITION SCANS AND RECONSTRUCTION*
- *MAGNETIC RESONANCE IMAGING (MRI)*
- *ANGIOGRAPHY / CTA / MRA*
- *CSF EXAMINATION*
- *CHEST X-RAYS, ESR, CRP*
- *HORMONAL STUDIES*

PLAIN X-RAYS

- Are of limited help, however, they may show widened sutures in children, signs of increased ICP, or calcifications. They may show osteolytic lesions of the skull like metastases, multiple myeloma or enlarged sella turcica.

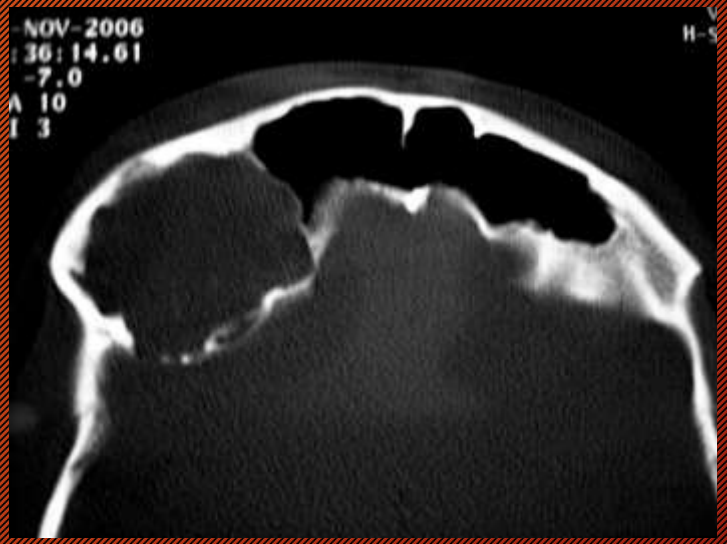
Enlarged sella turcica due to pituitary tumor.



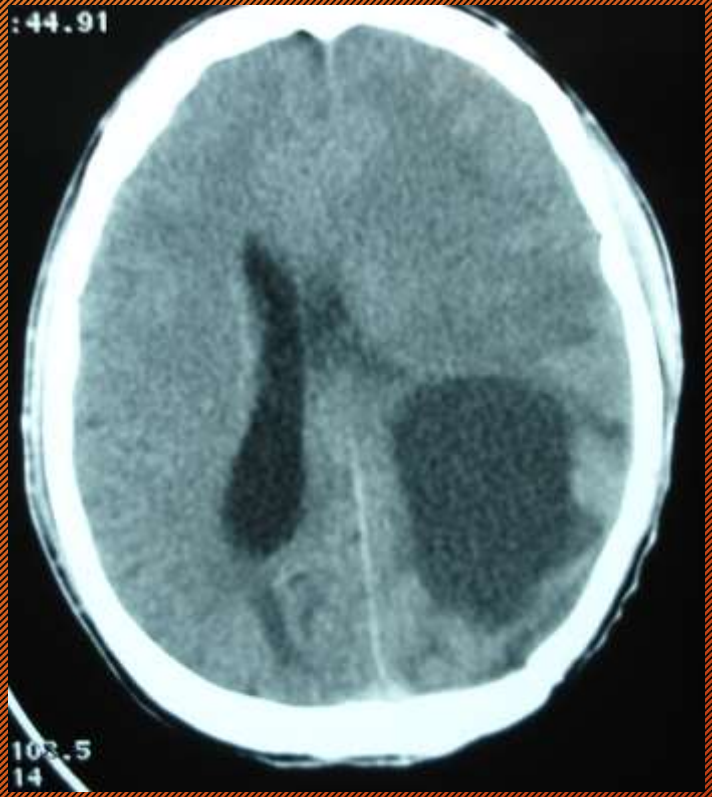
COMPUTERIZED TOMOGRAPHY (CT)

Usually used to determine the structure of the bone in case of destruction or detect calcifications. It is inferior to MRI for soft tissue recognition.

Skull destruction due to bone tumor



COMPUTERIZED TOMOGRAPHY (CT)

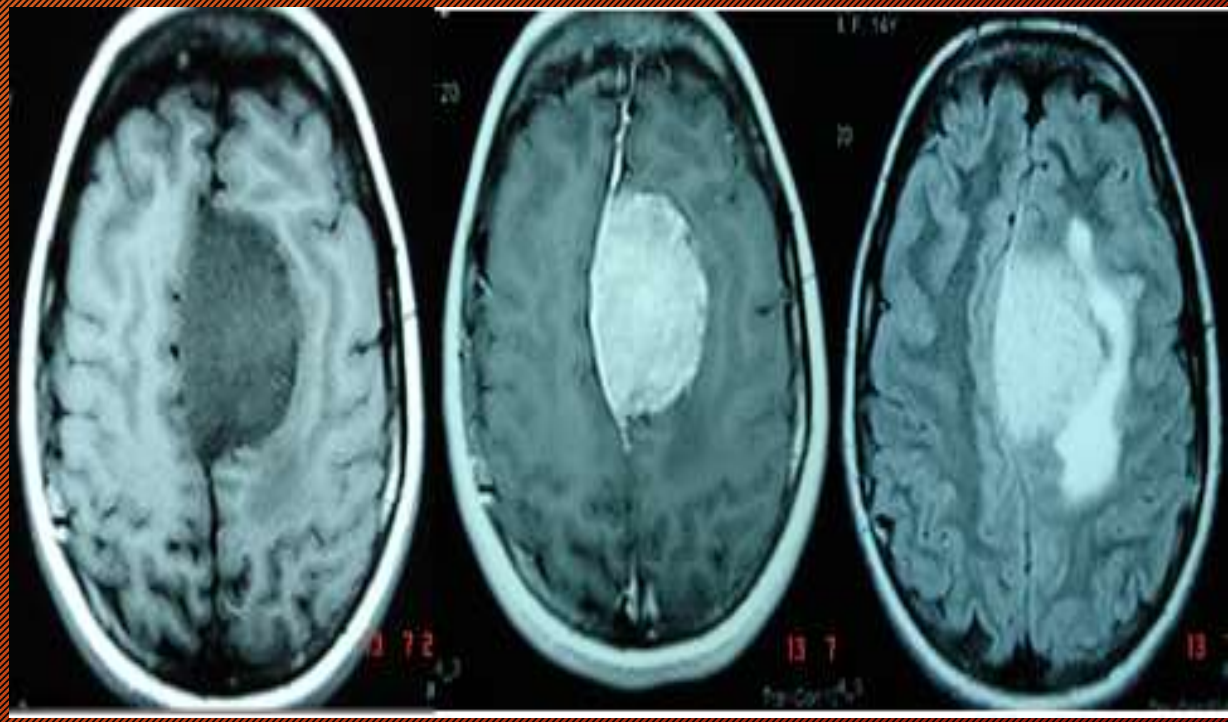


A large low density in the left cerebral hemisphere, most likely a glioma, needs contrast to be sure.

MAGNETIC RESONANCE IMAGING (MRI)

Para sagittal meningioma

1) T1 showing low intensity
2) After the injection of Gadolinium.
3) FLAIR



POSITRON EMISSION TOMOGRAPHY (PET)

- Usually combined with CT. So, a PET-CT is used for following the results of treatment, mainly chemotherapy, or in cases when a recurrence is suspected. It works by detecting the metabolic activity of the brain through the use of tracer substances. Therefore, it is used to differentiate between a recurrent tumor and radionecrosis after radiotherapy.

CEREBRAL ANGIOGRAPHY

- This is the visualization of the vessels of the brain especially those in relation to the tumor. Sometimes it is important to know which vessel supplies the tumor so that measures could be taken to deal with it first (cavernoma, meningioma and hemangioblastoma), or to show the anatomy of a vessel to avoid it during surgery (pituitary macro adenoma)

COMMON BRAIN TUMORS

Astrocytomas

- Arising from (astrocytes), they are the commonest **primary** brain tumor. Occurring anywhere in the brain, they vary in malignancy, from the low grade (used to be grade I and II, and the high grade (used to be grade III and IV). However today, and according to the WHO classification (2007), we have four grades:

COMMON BRAIN TUMORS

Oligodendrogliomas

- These arise from oligodendrocytes and tend to occur at a younger age than the rest and in the superficial areas of the brain (cortical and subcortical), hence the high incidence of seizures. They are mostly well differentiated and exhibit typical calcifications.

COMMON BRAIN TUMORS

Ependymomas

- Arise from (ependymal cells) and form a small percentage of the gliomas in general (4%). Occurring in and around cavities lined by ependymal cells, they occur mainly in children and young adults, with the majority of cases being found in the infratentorial compartment in children (75%) leading to cerebellar and brain stem manifestations. Their proximity to CSF pathways, make hydrocephalus a major presenting feature.
- According to the WHO classification they occur in 4 major types

COMMON BRAIN TUMORS

MEDULLOBLASTOMAS

- A tumor of childhood (peaking between 4 and 6 years of age), it is the most common midline posterior fossa tumor. It most commonly arises from the cerebellar vermis leading to obstruction of the CSF flow from the 4th ventricle, in addition to the cerebellar signs of which the most dominant is truncal ataxia. It is a malignant tumor which metastasizes by seeding to the CSF to form tumors in the spinal theca.

COMMON BRAIN TUMORS

MENINGIOMAS

- These are tumors which arise from the pia arachnoid, and are the most common benign tumor of the brain. It has a female predominance and has been tied to hormonal disturbances and to trauma. Usually occurring around middle age, the tumors could be multiple and may be found in NF2, and it was found to enlarge during pregnancy. They form 15% of primary brain neoplasms.

COMMON BRAIN TUMORS

METASTASES

- These are secondary tumors from primaries elsewhere. They could arise in an already known patient with cancer, or could be the first indication of the cancer, the primary being undiagnosed yet (in <10%).
- Most common origin of the primary tumors is the lung, the breast, the colon and the kidney. Around 30% of patients with cancer will develop a metastasis in their brains, which can be occasionally multiple.

COMMON BRAIN TUMORS

PITUITARY TUMORS

- These are tumors (adenomas) which arise from the cells of the anterior part of the pituitary gland. Pituitary tumors form about 10% of intracranial tumors. There is no difference between male and female incidence of these tumors which generally occur between 30-40 years of age.
- They could present by one of two ways;
  - The first by compressing the adjacent structures due to enlargement of the gland, or
  - By secreting hormones which affect the bodily functions in different ways.
  - When hemorrhage or necrosis or both occur in a tumor and the adjacent pituitary gland (pituitary apoplexy) with a picture of pituitary insufficiency

MANAGEMENT

- STEROID THERAPY
- OPERATIVE: MICROSURGICAL OR ASSISTED
  - NAVIGATION
  - ENDOSCOPY
- RADIOTHERAPY
- CHEMOTHERAPY
- GENE THERAPY