Meningiomas

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Overview

- Definition
- Epidemiology
- Types of brain tumors
- Diagnosis
- Treatment
Definitions

- Meninges- coverings of the brain (pia, arachnoid, dura)
- Meningiomas arise from arachnoidal cells
- Along venous sinuses
Location

- Parasagittal/falcine (25%)
- Convexity (surface of the brain) (19%)
- Sphenoid ridge (17%)
- Suprasellar (9%)
- Posterior fossa (8%)
- Olfactory groove (8%)
- Middle fossa/Meckel's cave (4%)
- Tentorial (3%)
- Peri-torcular (3%)
- Uncommon: lateral ventricle, optic nerve, foramen magnum, spinal
Central Brain Tumor Registry of the US (CBTRUS) 2006-2010
Age-Adjusted Incidence Rate per 100,000

Age Groups

20-44  45-54  55-64  65-74  75+

All Other Astrocytoma
Glioblastoma
Oligoastrocytic Tumors
Oligodendroglioma
Vestibular Schwannoma
Meningioma (Non-Malignant)
Tumors of the Pituitary

* ICD-O-3 Code: 9560
† ICD-O-3 Histology Codes: 9381, 9384, 9424, 9400, 9401, 9410, 9411, 9420
‡ ICD-O-3 Histology Codes: 9450, 9451, 9460
§ ICD-O-3 Histology Codes: 9530/0, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/0, 9538/1, 9539/1
Epidemiology

• Incidence approx. 8/100,000
  – Some asymptomatic
• Peak incidence 45
• Meningiomas are 2-3 times as common in women as men
  – Estrogen, progesterone receptors
Possible Causes of Brain Tumors and Risk Factors - Environmental
• 24 RH F with progressive bilateral vision loss for one year
• R eye can count fingers only
• L eye 20/40 corrected
• L temporal visual field loss
Clinical Features of Brain Tumors

- Symptoms of brain tumors are usually associated with increased ICP

- Monro-Kellie Hypothesis
  - Skull is a closed system comprising 3 elements
    - 80% brain tissue
    - 10% CSF
    - 10% intravascular blood
  - If one or more of these components increase in size, intracranial pressure will rise
  - A growing tumor in a closed system will elevate ICP
Clinical Features of Brain Tumors

- **Symptoms**
  - **Headache**
    - Generalized
    - Worse in the am
    - Aggravated by stooping, bending, and coughing
  - **Vomiting**
    - with acute rise in ICP
    - usually in the morning
Clinical Features of Brain Tumors

- Signs of focal damage from tumor
  - Seizures
    - Occurs in 30% of patients with brain tumors
    - Consequence of paroxysmal uncontrolled discharge of neurons.
Clinical Features

**Frontal Lobe**
- Contralateral weakness
- Expressive dysphasia
- Personality changes

**Parietal Lobe**
- Disturbed sensation
- Visual field defect
  - lower quadrantanopia

  - Gerstmann’s syndrome (Dominant hemisphere)
    - Right/left confusion, finger agnosia, acalculia, agraphia

  - (Non dominant) Dress apraxia, geographic agnosia, Construction apraxia, anosognosia

**Occipital Lobe**
- Visual field defect
  - homonymous hemianopia

**Temporal Lobe**
- Receptive dysphasia
- Visual field defect
  - upper quadrantanopia
WHO Meningioma Grading System

• Grade I, benign
  – Slow growing cells
  – Cells are well differentiated (resemble normal cells)
  – Least malignant
  – Good prognosis, usually associated with long-term survival
  – Approximately 80%

• Grade II, atypical
  – Relatively slow growing cells
  – Cells are moderately differentiated
  – Approximately 15%

• Grade III, anaplastic or malignant
  – Actively reproducing abnormal cells
  – Cells are poorly differentiated (lack the structure and function of normal cells and grow uncontrollably)
  – Abnormal cells which reproduce rapidly
  – Form new blood vessels to maintain rapid growth
  – Associated with poor prognosis
  – < 5%
Pathological Classification – Tumors of Meninges

- Meningiomas
  - Most are benign
  - Slow growing
  - Arise from arachnoid granulations not dura
  - Most lie around venous sinuses
  - Malignant meningiomas
    - Rapid recurrence

- Histologic Features
  - “whorl” pattern
Radiology

• Evaluation/Imaging
  – CT
    • Less costly, faster
    • Less detail
  – MRI
    • gadolinium (contrast) enhances tumor
    • Better detail
    • More difficult for patients with claustrophobia, problems sitting still
Meningiomas - Imaging

- Well circumscribed, dural tail
- Striking enhancement with contrast
- Often causes hyperostosis of adjacent bone (bony thickening)
Treatments

• Close observation

• Surgery
  – Craniotomy

• Radiation
  – Fractionated radiation
  – Radiosurgery

• Chemotherapy
  – Only for adjuvant treatment
Observation

- Small, asymptomatic tumors
- Little mass effect
- No cerebral edema
- Caution for certain areas of the brain where a small amount of growth would greatly increase the risks of future treatment
  - Proximity to the optic, oculomotor, facial, vestibulocochlear, vagus nerves; carotid artery; brain stem; spinal cord
Surgical resection

• Can be curative
• Can relieve pressure, symptoms
• Precise pathologic diagnosis
• Weigh risks vs benefits
  – Location of tumor
  – Medical health of the patient
Endovascular therapy

• May require pre-operative angiogram +/- embolization
  – Mapping the vascular supply and drainage from the tumor
  – Embolization of the vascular feeders
Extent of Resection

- 5% recurrence/ 10 years - complete resection including the dural root
- 10-15% - resection of the tumor + coagulation of the dural root
- 30% - resection of the tumor without the dural root
- 40+% - subtotal resection
- (Simpson grade)
Radiation therapy

– Stereotactic radiosurgery (SRS)
  • Focused radiation, one day treatment
  • X-knife – linear accelerator
    – TruBeam, Trilogy, Novalis, Cyberknife
  • Gamma Knife – cobalt 60
  • Usually for tumors < 3 cm

– Stereotactic radiotherapy (SRT)
  • Fractionated, five days

– Fractionated radiation
  • Six weeks
  • Lesion involving the optic nerve
Chemotherapy

- Few choices
- Mainly adjuvant therapy
- SOM 230- only somewhat effective
- Avastin (bevacizumab)- not very effective, question of causing hemorrhage
- Sutent (sunitinib)- can be effective, small risk of hemorrhage
Prognostic Factors

• Prognosis is based on:
  – Type of tumor
  – Tumor grade
  – Location
  – Spread (if any)
  – Age of the patient
  – How long the patient had symptoms before it was diagnosed
  – How much the tumor has affected the patient’s ability to function

• Favorable prognostic factors
  – Young age
  – High Karnofsky performance status (standard way of measuring the ability of cancer patients to perform ordinary tasks/ADLs)
  – Lower pathologic grade
Meningiomas

- Usually benign
- Can be observed if small, asymptomatic
- Surgical resection is a priority and can be curative
- Depending on size, location, health of patient, radiosurgery may be indicated
- Little choices for chemotherapy
Pathological Classification - Tumors of cranial nerves

- Vestibular Schwannomas (AKA acoustic neuroma)
  - Benign
  - Arise from the superior vestibular division of 8th CN
  - Incidence ↑ with neurofibromatosis (NFT) and with bilateral AN being pathognomonic of neurofibromatosis Type 2
Vestibular Schwannomas - Symptoms

- **Early Triad of Sx** - pressure on the 8th CN complex in IAC
  - hearing loss (insidious and progressive)
  - Tinnitus (high pitch)
  - Dysequilibrium/vertigo

- **Later sx** - compression of CN and brain stem
  - CN V and VII (>2 cm in size)
    - Otalgia
    - Facial numbness and weakness
  - CN IX, X, XII
    - Hoarseness
    - Dysphagia
  - Brain stem compression
    - Cerebellar signs
    - HA and N/V
    - Diplopia
Vestibular Schwannomas - Evaluation

• **Audiometry**
  – Baseline studies helpful for later comparison

• **MRI**
  – Round or oval enhancing tumor centered on IAC.
  – Tumor lies in cerebello-pontine angle.
  – Hydrocephalus
    • Large tumors may compress the 4th ventricle.
Vestibular Schwannomas - Treatment

- **Conservative treatment**
  - Follow symptoms
    - Audiometry for deterioration
  - Serial imaging for tumor progression
- **Radiation therapy**
  - Alone or in conjunction with surgery
    - SRS
    - EBRT
Vestibular Schwannomas - Treatment

- Surgery
  - Treatment of choice
  - Treatment aim
    - Tumor removal with minimal risk
    - Preservation of CN function
    - Retention of useful hearing unless already lost
Vestibular Schwannomas - Treatment

- Approaches
  - **Suboccipital**
    - Preferred route
    - Best for preservation of hearing
  - **Middle fossa**
    - Reserved for small, laterally located tumor
  - **Translabyrinthine**
    - Tumor with intracanalicular component
    - When hearing is non-functional
Vestibular Schwannomas – Post-op Care

• CN and brainstem dysfunction
  – CN VII
    • Impaired eye closure
      – Natural tears PRN
  – CN VIII
    • Vestibular dysfunction
      – N/V
        ✔ Antiemetic
      – Balance difficulties
        ✔ Safety
  – CN IX, X and XII
    • Swallowing difficulty

• CSF fistula
  – May develop through the
    • skin incision
    • ear (ruptured TM)
    • eustachian tube through the nose (rhinorrea) or back of throat.
  – Risk for meningitis
  – 25-35% resolves spontaneously
  – Treatment
    – Elevate HOB
    – Lumbar drain
    – Surgical CSF shunting
Pituitary Adenoma – Surgery

- Transphenoidal (procedure of choice)
  - Post op complications
    - Hormonal imbalance
      - ↓ ADH – Diabetes Insipidus
        - Tx: DDAVP SQ
      - ↓ Cortisol
      - ↓ TSH
    - Infection
    - CSF leak
    - Nasal septal perforation
    - Damage to structures in cavernous sinus