Pediatric Brain Tumors: Pre, Intra & Post Op Evaluation and Management

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PEDIATRIC BRAIN TUMORS

BACKGROUND:

• Incidence: Third most common pediatric tumor type
  - (leukemia, neuroblastoma, brain cancers, lymphomas, Wilms, germ cell tumors, retinoblastoma, other types)
• Midline location (third or fourth ventricle)
• Typical presenting S&S: headache, seizures, neurological deficits, endocrinopathy
PEDIATRIC BRAIN TUMORS

• Most frequently, they come from "young" cells. ("immature" or "primitive" cells) that have not reached full maturity.
• They are developing at the same time as the child is developing.
• Brain tumor types mirror the way a normal cell matures from its very beginning as a "primitive" brain cell (a precursor) towards becoming an adult cell type.
• “Cancer Stem Cell”
PEDIATRIC BRAIN TUMORS

Brain tumors behave differently than other tumors in the body

Types:
- Intraparenchymal (benign or malignant)
- Extra-axial (generally benign)
Brain Tumor Types

- **Astrocytoma / Glioma** Astrocytomas are tumors that arise from brain cells called astrocytes. Gliomas originate from glial cells, most often astrocytes.
- **Atypical Teratoid / Rhabdoid Tumor (ATRT)** This rare, high-grade tumor occurs most commonly in children younger than 2...
- **Brain Stem Glioma** The brain stem consists of the midbrain, pons and medulla located deep in the posterior part of the brain. Usually malignant, sometimes benign.
- **Choroid Plexus Tumor** The choroid plexus papilloma is a rare, benign tumor most common in children under the age of 2.
- **Craniopharyngioma** Craniopharyngiomas result from the growth of cells that have failed to migrate to their usual area just below the back of the skull early in fetal development.
- **Ependymoma** Ependymomas arise from cells lining the passageways in the brain that produce and store the cerebrospinal fluid or CSF.
Brain Tumor Types

- **Ganglioglioma** These rare, benign tumors arise from ganglia-type cells, which are groups of nerve cells.
- **Germ Cell Tumors (Brain)** The brain stem consists of the midbrain, pons and medulla located deep in the posterior part of the brain.
- **Gliomatosis Cerebri** This condition is similar to glioblastoma multiforme (GBM), but the cells of gliomatosis cerebri are more scattered and widespread...
- **Infant Brain Tumors** Medulloblastoma and ependymal tumors account for about 50 percent of tumors. Desmoplastic Neuroepithelial Tumor.
- **Medulloblastoma / PNET** Medulloblastomas are tumors that arise in the posterior fossa region of the brain. The exact cell of origin is not known.
- **Oligodendroglioma** These tumors arise from oligodendrocytes, a type of supportive brain tissue...
- **Optic Pathway Tumor** A childhood optic pathway tumor occurs along the nerve that sends messages from the eye to the brain (the optic nerve).
Brain Tumor Types

- **Esthesioneuroblastoma**: Rare tumor of the olfactory pathways
PEDIATRIC BRAIN TUMORS

• Signs & Symptoms
  – Timeline of Symptoms
  – General vs. Neurological symptoms
  – Increased Intracranial Pressure
  – Neurological Deficits
  – Generalized signs

• Diagnostic Studies
  – Lab test (electrolytes, hormone levels, tumor markers)
  – CT
  – MRI
  – fMRI
  – PET
  – MR Spectroscopy
  – Angiography
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PEDIATRIC BRAIN TUMORS

- Differential Diagnosis
  - Flu/Viral Syndrome
  - Migraines
  - Intracranial Tumors vs Parenchymal Tumors
  - Pseudotumor Cerebri (Benign Intracranial Hypertension)
  - Vascular Malformations
  - Congenital malformations (Lhermitte-Dulcos, Chiari, etc)
  - Cyst (arachnoid cyst, enterogenous, ependymal, Rathke’s Cleft, etc)
  - Abscess
  - Stroke
  - Multiple Sclerosis
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORITHM:

- SURGERY
- RADIATION
- CHEMO
- X

Strategy: To have the most direct treatment modality

The most targeted treatment is surgery

However, it is not always the best treatment!
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORISM:

SURGERY
- Open
- Stereotactic
- Endoscopic

RADIATION
- Whole Beam
- Stereotactic
- Radiosurgery

CHEMO
- Systemic
- Local delivery

X
- Antibodies
- Hormones
- Bone Marrow Transplant
PEDIATRIC BRAIN TUMOR

• GOALS of Surgery
  – Relieve Presenting Symptoms
    • Increased ICP
    • Seizures
  – Preserve Neurological Function
  – Obtain Diagnostic Tissue (Biopsy)
  – Treat Tumor
PEDiatric Brain Tumor

Pre Op Management

• Goals-
  – Diminish Pre Op symptoms
  – Make Intra Op management easier
  – Prevent Post Op complications
PEDIATRIC BRAIN TUMOR

Pre Op Management

- Correct electrolyte abnormalities (Na)
- Correct Coagulapathy
- Normalize Hematocrit
- Treat existing infections (UTI, URI, etc)
PEDiATRIC BRAIN TUMOR

Pre Op Management

• Steroids
  – Decadron (long acting, high potency, glucocorticoid)
    • 0.1 to 0.3 mg/kg q6h
  – Solumedrol (moderate acting, high potency, mineralocorticoid)
• Antiepileptics
  – Dilantin (Phenytoin,Phosphenytoin (15-18mg/kg), Phenobarbital)
    • Intravenous administration
    • Good for most postoperative seizure types
  – Tegretol, Lamictal, Keppra, etc
• Analgesics
  – GOOD- Tylenol, Codeine, etc
  – OK - Ibuprophen
  – AVOID- ASA
PEDIATRIC BRAIN TUMOR

Intra Op Management

• GOALS:
  – Resect lesion
  – Prevent Neurological Deficits
  – Prevent Postoperative complications
  – Reduce operative time
Intra Op Management

- **Antibiotics**
  - Nafcillin, Ancef
    - 25mg/kg

- **Steroids**
  - Decadron (long acting, high potency, glucocorticoid)
    - 0.1 to 0.3 mg/kg q6h

- **Antiepileptics**
  - Dilantin (Phosphenytoin, Phenobarbital)

- **Diuretics**
  - Mannitol
    - 0.25 to 1.0 g/kg
  - Lasix

- **IV Fluids**
- **Hyperventilation**
- **Lumbar or Ventricular Drainage**
PEDIATRIC BRAIN TUMOR

Intra Op Management

• **Brain Mapping**
  – Asleep (EEG, SSEP, BAER, MEP, EMG, Cortical Stimulation)
  – Awake (Language mapping)

• **Image Guidance**
  – MRI or CT stereotaxis (Framed or frameless)

• **Intraop imaging**
  – Ultrasound
  – Plain radiographs
  – *MRI*

• **Multimodality Image Mapping**
• **GOALS**
  - Relieve Presenting Symptoms
    - Increased ICP
    - Hydrocephalus
    - Seizures
  - Preserve Neurological Function
  - Obtain Diagnostic Tissue (Biopsy)
  - Treat Tumor
PEDIATRIC BRAIN TUMOR

Intra Op Management

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  – Resect lesion
  – Prevent Neurological Deficits
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PEDIATRIC BRAIN TUMOR

Intra Op Management

- **Brain Mapping**
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  - Awake (Language mapping)

- **Image Guidance**
  - MRI or CT stereotaxis (Framed or frameless)

- **Intraop imaging**
  - Ultrasound
  - Plain radiographs
  - *MRI*

- **Multimodality Image Mapping**
Case 1

- 8 yo female with 3 mos of headache and seizures. Found to have adenoma sebacum & ash leaf spots.
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORISM:

SURGERY
- Open
- Stereotactic
- Endoscopic

RADIATION
- Whole Beam
- Stereotactic
- Radiosurgery

CHEMO
- Systemic
- Local delivery

X
- Antibodies
- Hormones
- Bone Marrow Transplant
Case 2

- 6 yo male with 3 days of headache, then became progressively more obtunded.
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORITHM:

SURGERY
- Open
- Stereotactic
- Endoscopic

RADIATION
- Whole Beam
- Stereotactic
- Radiosurgery

CHEMO
- Systemic
- Local delivery

- Antibodies
- Hormones
- Bone Marrow Transplant
Case 3

- 4 yo male with 2 week history of nausea, vomiting and incoordination
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORISM:
Medulloblastoma

SURGERY
- Open
- Stereotactic
- Endoscopic

RADIATION
- Whole Beam
- Stereotactic
- Radiosurgery

CHEMO
- Systemic
- Local delivery

X
- Antibodies
- Hormones
- Bone Marrow Transplant
Case 4

• 17 yo with 1 month of progressive headaches, 3 days of progressive right hemiparesis and word finding difficulty
**TREATMENT ALGORITHM:**

**GBM**

- **SURGERY**
  - Open
  - Stereotactic
  - Endoscopic

- **RADIATION**
  - Whole Beam
  - Stereotactic
  - Radiosurgery

- **CHEMO**
  - Systemic
  - Local delivery

- **X**
  - Antibodies
  - Hormones
  - Bone Marrow Transplant
Case 5

- 13 yo girl with declining school performance and headaches, brought to the ER unresponsive
PEDIATRIC BRAIN TUMORS

TREATMENT ALGORISM:
NGGCT

SURGERY
- Open
- Stereotactic
- Endoscopic

RADIATION
- Whole Beam
- Stereotactic
- Radiosurgery

CHEMO
- Systemic
- Local delivery

X
- Antibodies
- Hormones
- Bone Marrow Transplant
Case 5

• 15 year old female presents with 2-3 months of headache and vision changes.
• Ophthalmologist found papilledema and constricted visual fields
• OVERALL OUTCOME
  – Better that adults
  – Goals survival and quality of life
PEDIATRIC BRAIN TUMOR SURGERY

- OVERALL OUTCOME
  - Determined by Operative Outcome!
Future Management

- Problem with current therapy: NOT SPECIFIC

Make current therapy more specific
Treat Tumors in novel ways