Imaging of Pediatric Brain Tumours

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Locations

- Posterior Cranial Fossa
- Pineal Region
- Suprasellar & Sellar
- Intraventricular
- Cerebral Hemispheres

Primitive intra-axial tumours
- Embryonal tumours
- Neoplastic Malformation (Neuronal-glial tumours)
Brainstem Glioma
WHO Grade II-IV

Focal Intrinsic Tumour
Diffuse Tumour
Dorsally Exophytic Tumour

Involves segment
Symptoms ~ location
Expands pons, worse prognosis
Benign, gradual progression

T2W
T1+ Contrast
Medulloblastoma
WHO Grade IV

- Imaging:
  - High-nuclear-to cytoplasmic ratio
    - CT: hyperdense
    - T2W: iso-/hypo- to gray matter
    - DWI: high signal
    - ADC: low signal
  - Contrast: variable

Restricted Diffusion
Ependymoma
WHO Grade II

- Imaging:
  - CT: isodense
  - T2W: hyperintense to gray matter
  - DWI: low signal
  - ADC: high signal
  Not restricted

- Contrast: variable

Different from medulloblastoma
Atypical Teratoid Rhabdoid Tumour (ATRT)
WHO Grade IV

- **Age:** < 2 year old
- **Primitive tumour**
- **Markedly aggressive**
- **High nuclear-to-cytoplasmic ratio**
- **Imaging:**
  - Heterogeneous
    - Necrosis, cysts
    - Calcifications, hemorrhage
  - Restricted diffusion on DWI
  - T1+c: Leptomeningeal spread (1/3)
Pilocystic Astrocytoma
WHO Grade I

- **Age:** 5-15
- Benign clinical course
- Low nuclear-to-cytoplasmic ratio

**Imaging:**
- Sharply demarcated
- Cyst with mural tumour nodules
  - Multiple, markedly enhanced
- Cyst with high protein content:
  - T2 hyperintense
- Neovascularity lines cyst wall
- Spinal seeding - exceptional
Cerebellar Lesions

- **DWI**: high signal
  - Low ADC value

- **DWI**: low signal
  - High ADC value

**Restricted**
- High signal
- > 2 y.o.

**Not restricted**
- Low signal
- < 2 y.o.
- Extends to outlets/foraminae/4V
- No extension +/- cyst component

- Medulloblastoma
- ATRT
- Ependymoma
- Pilocytic Astrocytoma

ADC value cut off: 100% Specificity

Rumboldt et al. AJNR 2006
Pineal Tumours

Common Presentations:
- Obstructive hydrocephalus (3V/ aqueduct)
- Paralysis of gaze (midbrain)

Pathology:
- Majority: Germ Cell Tumours (GCT) 60%
- Most common: Germinoma
- Parenchymal tumours 15%
  - Pineocytoma
  - Pineoblastoma (- Trilateral retinoblastoma)
Age: peak at puberty
- Germinoma (65%): 10-21 year old
- Non-germinomatous (26%): earlier

Biochemical markers:
- αFP, β-HCG, PLAP
- Inconsistent elevation

Imaging:
- CT: calcifications (70%)
- MR: marked enhancement
- Non-specific for histological diagnosis
- 10 year old boy
- Polydipsia, Polyuria, Diabetes insipidus

**Germinoma**

- Second most common location
- T1W: iso-/hypointense
- T1+c : moderate- marked
- Calcification: rare
+ Cystic- necrotic changes

**Images:**
- Absent T1 bright spot
- Optic chiasm compression
- T1+ contrast
Craniopharyngioma

- **Age:** bimodal incidence peak
  - Children: 5-14 year old
  - Adults: 40-60s
- **Remnants of craniopharygeal duct**
- **Site:** intrasellar, suprasellar, combined
- **Imaging:**
  - 90% calcifications
  - 90% cystic
  - 90% enhance
  - 90% suprasellar
Non-tumoral congenital malformation

Heterotopic neuronal tissue

Presentation:
- Precocious puberty. Gelastic seizure

Site:
- Tuber cinereum
  - Suprasellar (pediatrics)

Imaging:
- Sessile or pedunculated base
- Isointense to gray matter on T1W, T2W
- Non-enhancing
Congenital: intrauterine

Age: first two years
  - Peak: first two months

Locations:
  - Supratentorial typically
  - Lateral ventricles (80%), atria (glomus)
  - Third ventricle (4%)

  - Fourth ventricle (16%)

- CP angle

Adult location
Choroid Plexus Carcinoma

- Not congenital/ neonatal
- **Age:** peak < 5 years
- **Locations:**
  - Trigones of lateral ventricles
- **Imaging:**
  - Heterogeneous
    - Necrosis, haemorrhage
  - Surrounding edema
  - Infiltration of adjacent tissue
  - Leptomeningeal spread
CONCLUSION

• Site
• Age
• Characteristic features: cyst, mural nodules, calcifications
• Imaging sequence
  • Conventional sequences
  • DWI: cellularity
• Advanced Imaging:
  – MR Spectroscopy: ↑ Cho, ↓ NAA, ++Lac
  – (Tau, ml)