Oligodendrogliomas

EPIDEMIOLOGY

1. Oligodendroglioma (WHO grade II) ≈ 80%, median survival 6-10 yrs.
2. Anaplastic (malignant) oligodendroglioma (WHO grade III) = 15-20%; median survival 2-2-4 yrs.

N.B. there is no grade IV oligodendroglioma.

GENETICS, MOLECULAR MARKERS

- definitive diagnosis (a must mutations!): - IDH1/2 mutation + 1p19q co-deletion (assay by FISH)
  N.B. most of low grade oligodendrogliomas are positive for IDH1 R132H mutation with intact ATRX nuclear staining.
  - if histology looks like oligo, but IDH wild type – call astrocytoma!
  N.B. deletions of both 1p36 and 19q13 = greater response to chemotherapy.
  N.B. it has to be deletion of both (co-deletion!)

100% response to chemotherapy with 1p 19q LOH.

- ATRX remains present (vs. astrocytoma).

LOCATION

- single lesion in cerebral hemispheres (white matter):
  FRONTAL > PARIETAL, TEMPORAL > OCCIPITAL lobe (3:2:2:1 ratio).
- rarely, in cerebellum, brain stem, spinal cord.
- 10% tumors disseminate through CSF.

PATHOLOGY

Low-grade oligodendroglioma (grade 2)

- grossly well demarcated (but generally infiltrative); 20% are cystic.
- very cellular - monotonous side-by-side collection of homogeneous, compact, rounded cells with distinct borders and clear cytoplasm surrounding dark uniform central nucleus ("fried egg" appearance).
  - No conspicuous fibrillary background!
- may infiltrate diffusely into cortex; around normal neuronal elements (without causing loss of function) — may extend to leptomeninges.
- neoplastic cells may tightly surround neurons (perineuronal satellitosis).
- within tumor, branching blood vessels (delicate network of anastomosing capillaries) are highly characteristic - divide cells into discrete clusters - "chicken-wire" capillary pattern.
- microvascularization may be extensive.
- many oligodendrogliomas have some component of astrocytoma within them:
  - it is difficult to distinguish neoplastic astrocytes from reactive astrocytes.
  - some tumors are truly mixed oligo/astrocytoma (both cell types arise from common precursor - oligodendrocyte type-2 astrocyte, x. O2A cell); minimum proportion of astrocyte is 10-25%.

Most "benign" of gliomas! - never grade IV
Classic "fried-egg" appearance with perinuclear halos and "chicken-wire" capillary pattern:
Oligodendrogliomas

Anaplastic (malignant) oligodendroglioma (grade 3) - increased cellularity, nuclear pleomorphism, endothelial proliferation, mitotic activity, and necrosis.

- May progress to glioblastoma multiforme.

Clinical Features

- Duration of symptoms before diagnosis averages 7-11 years.
- Most common (50%) presenting symptom is seizure; 80% patients have seizures at some time.
- Seizures are more common with oligodendrogliomas than other gliomas.
- Focal cerebral dysfunction, rarely ICP.

Diagnosis

- CT - invisible (unless calcified*).
- MRI: Low-grade tumors - generally do not enhance (FLAIR is positive), while anaplastic oligodendroglioma does enhance; intratumoral calcification is common (≈ 90%).
- Definite diagnosis - biopsy (almost always possible).

Differentiate intraventricular oligodendroglioma from central neurocytoma and dysembryoplastic neuroepithelial tumor – do not need chemotherapy and radiotherapy.

A. Noncontrast CT - calcified mass in left temporal lobe (arrows); mild mass effect but little edema.
B. MR T2 - heterogeneous mass with hypointense signal (black arrows) surrounded by higher signal zone (white arrows); consistent with calcified temporal lobe mass.
Anaplastic oligodendroglioma:
A. T1-MRI - minimal heterogeneous contrast enhancement; central area of low signal intensity indicates necrosis (arrow).
B. Spin density - better delineates extent of atrophic changes and vascular structures within and adjacent to neoplasm (arrow).
C. T2-MRI - large portions of left temporal lobe are involved by neoplastic process.

Spontaneous hemorrhage into mixed oligodendroglioma:
A. Noncontrast CT - spheroid hematoma in mass with calcification located in left parietal lobe surrounded by zone of decreased attenuation.
B. Contrast CT - enhancing tumor and relationship of hematoma.
C. Noncontrast T1-MRI - hematoma in tumor and surrounding edema.
D. Noncontrast T2-MRI - edema and reaction to oligodendroglioma with acute hemorrhage.

TREATMENT

- **No intervention**  ÷ aggressive multimodal treatment

  Grade II guidelines - see p. Onc10 >>
  Algorithm - see p. Onc10 >>

- **Anticonvulsant therapy** is recommended once oligodendroglioma is diagnosed.
- some small asymptomatic (except for controlled seizures) tumors can be observed.
- **Surgery** - mainstay of treatment (resection is usually subtotal because of infiltrative nature of tumor - **surgical cure remains unlikely**);
  - total gross resection Æ **observation** for recurrence; recurrence Æ **radiotherapy.**
  - incomplete removal Æ **radiotherapy.**

**Anaplastic oligodendrogliomas** (regardless of resection extent) Æ **radiotherapy.**
OLIGODENDROGLIOMAS

- use 2-3 cm margin for 54-60 Gv radiotherapy (children – 50 Gv).
- chemotherapy - favorable response (most chemosensitive of gliomas)!!! (esp. in combined loss of 1p/19q).
  a) for recurrences
  b) adjuvant for ANAPLASTIC OLIGODENDROGLIOMA

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- standard - PCV = procarbazine + lomustine + vincristine

- staged Laser Interstitial Thermal Therapy (LITT) Treatments to Left Insular Low Grade Glioma.

- left-sided insular oligodendroglioma treated in two stages (3 months apart - due to large 5 cm size - to prevent severe edema and seizures) with no permanent clinical deficit (temporary mild difficulty with word repetition) → chemoradiation → near resolution of the tumor at 2 yrs:

PROGNOSIS

- prognosis is much better than for ASTROCYTOMAS!
  N.B. late progression of disease is common (5-year survival time used to indicate “cure” in other cancers is not relevant for oligodendrogliomas)
- indolent course - patients may survive for many years.
- combined loss (co-deletion) of 1p/19q is significant predictor of longer survival in anaplastic oligodendroglioma.
- prognosis is worse for mixed tumors (OLIGOASTROCYTOMAS).

BIBLIOGRAPHY for ch. “Neuro-Oncology” → follow this LINK >>

Viktor’s Notes℠ for the Neurosurgery Resident
Please visit website at www.NeurosurgeryResident.net