Oligodendrogliomas

Last updated: December 22, 2020

Most "benign" of gliomas! - never grade IV

EPIDEMIOLOGY

- 4-19% of all intracranial tumors.
- 2-25% of all gliomas (only 6% in children).
- most commonly - young and middle-aged adults (median age 25-50 yrs).

CLASSIFICATION

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.
- ***microcalcification*** 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 *OLIGOASTROCYTOMAS* (both cell types arise from common precursor - *oligodendrocyte type-2 astrocyte, s. O2A cell*); minimum proportion of astrocyte is 10-25%.

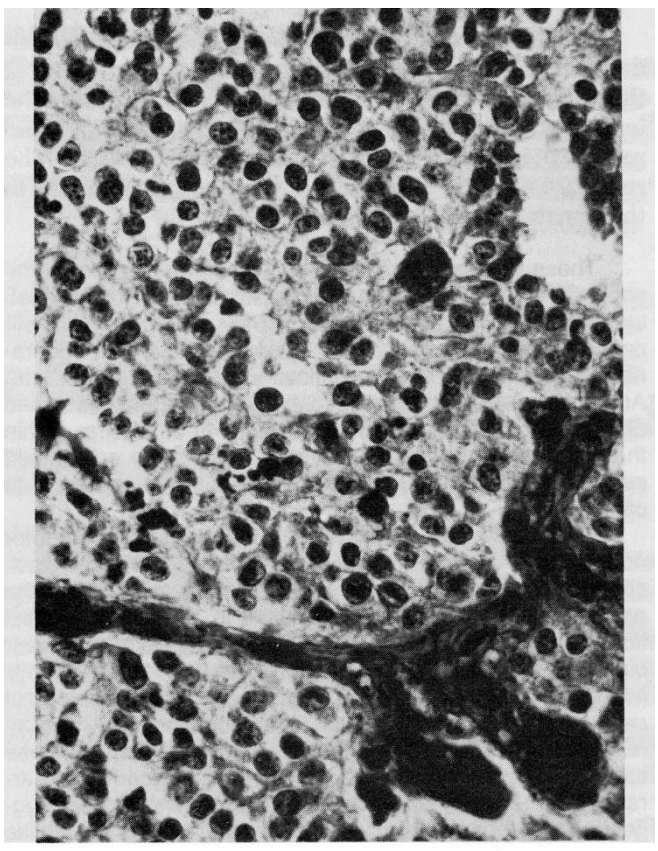
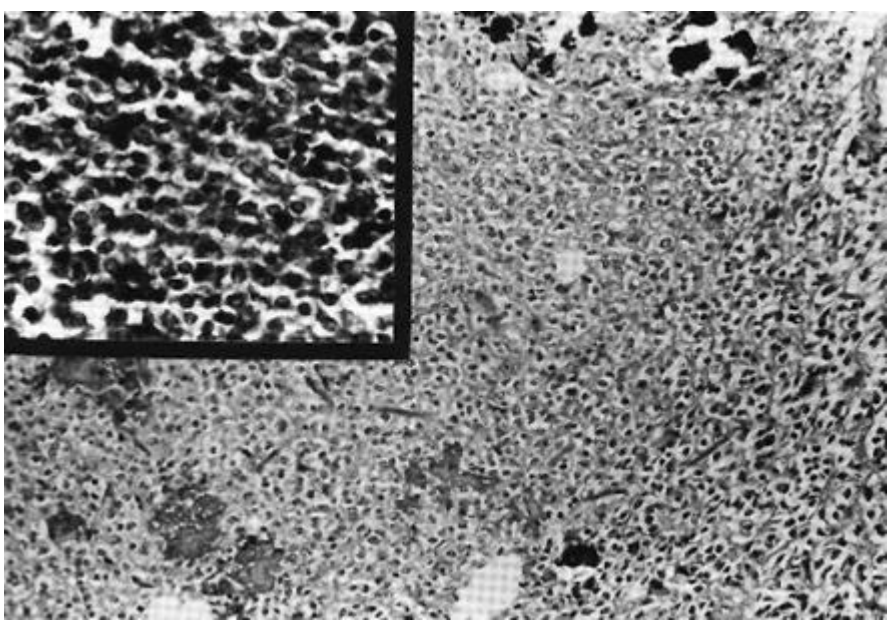
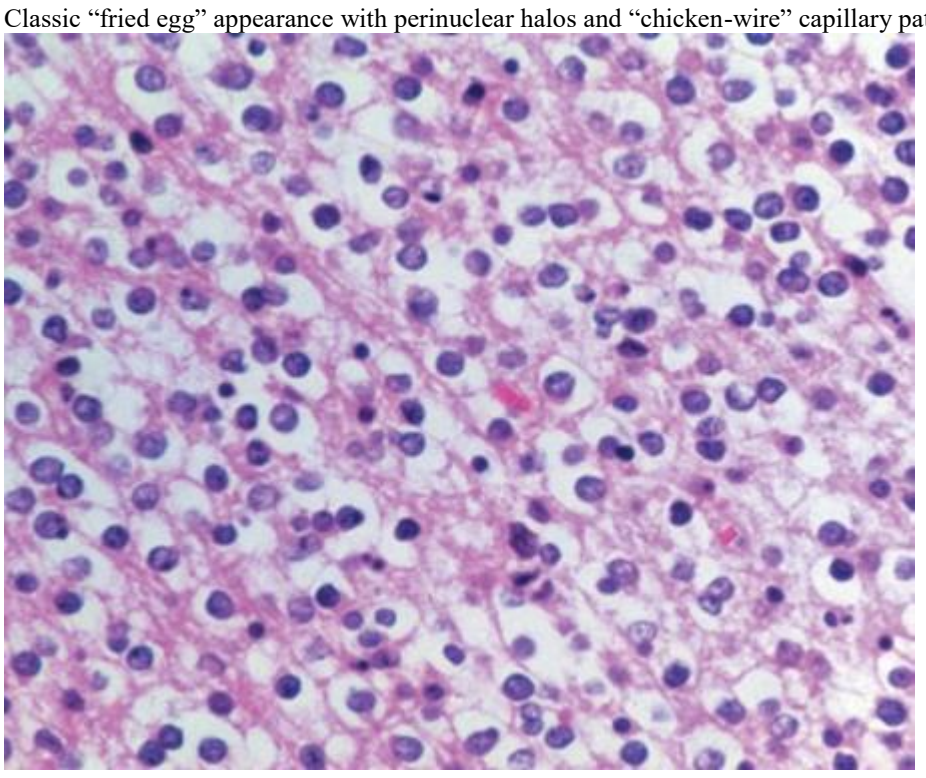
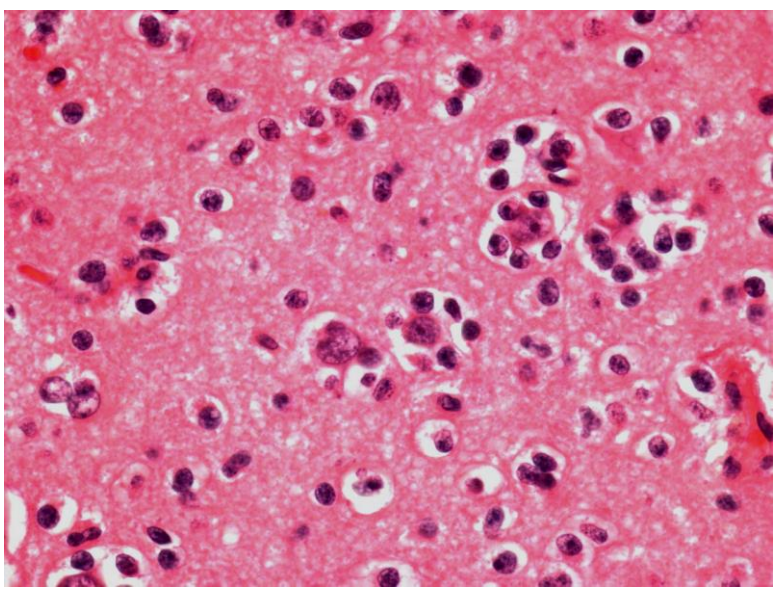


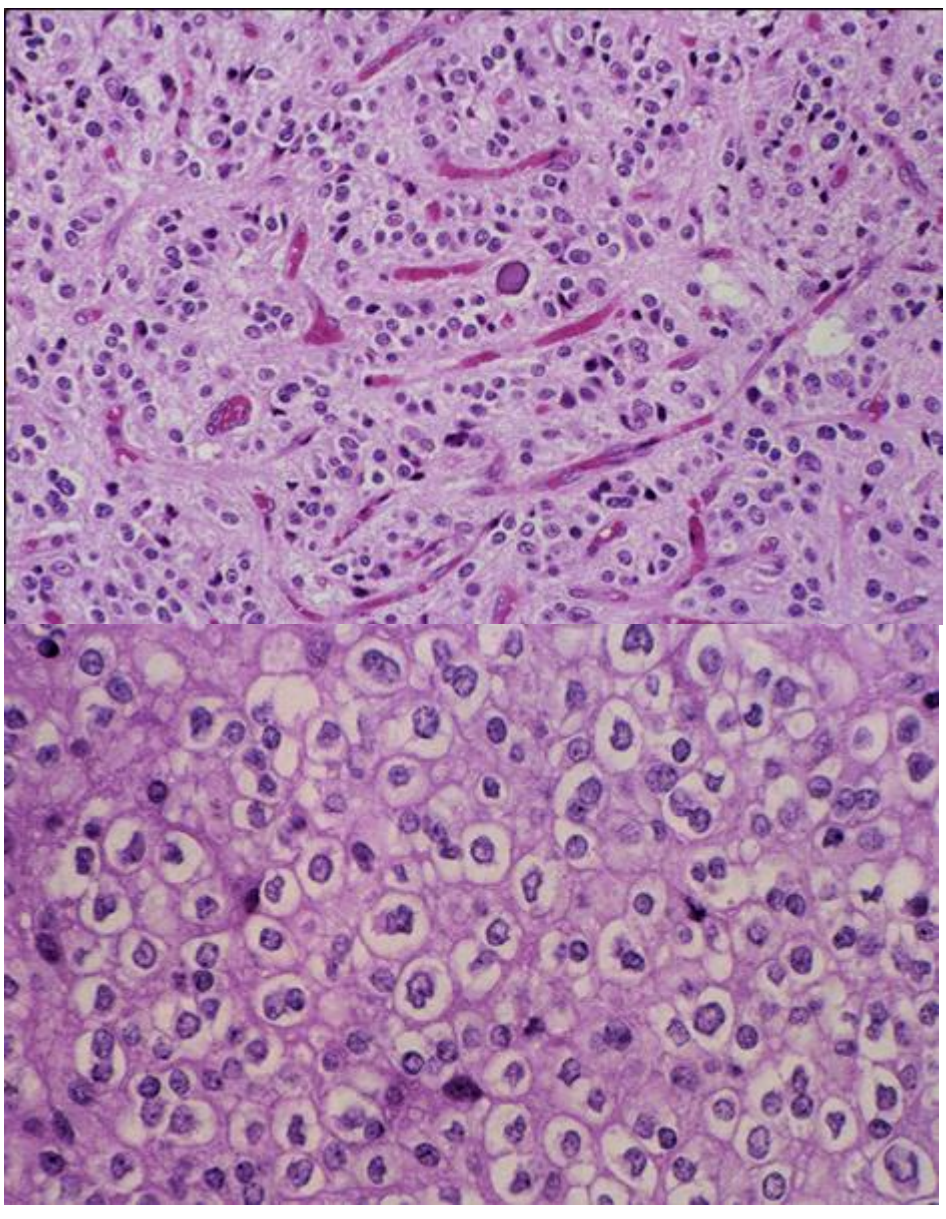
Figure 29–28. Oligodendroglioma. Cells are round and small and have perinuclear halos. (H and E stain.)



Classic "fried egg" appearance with perinuclear halos and "chicken-wire" capillary pattern:

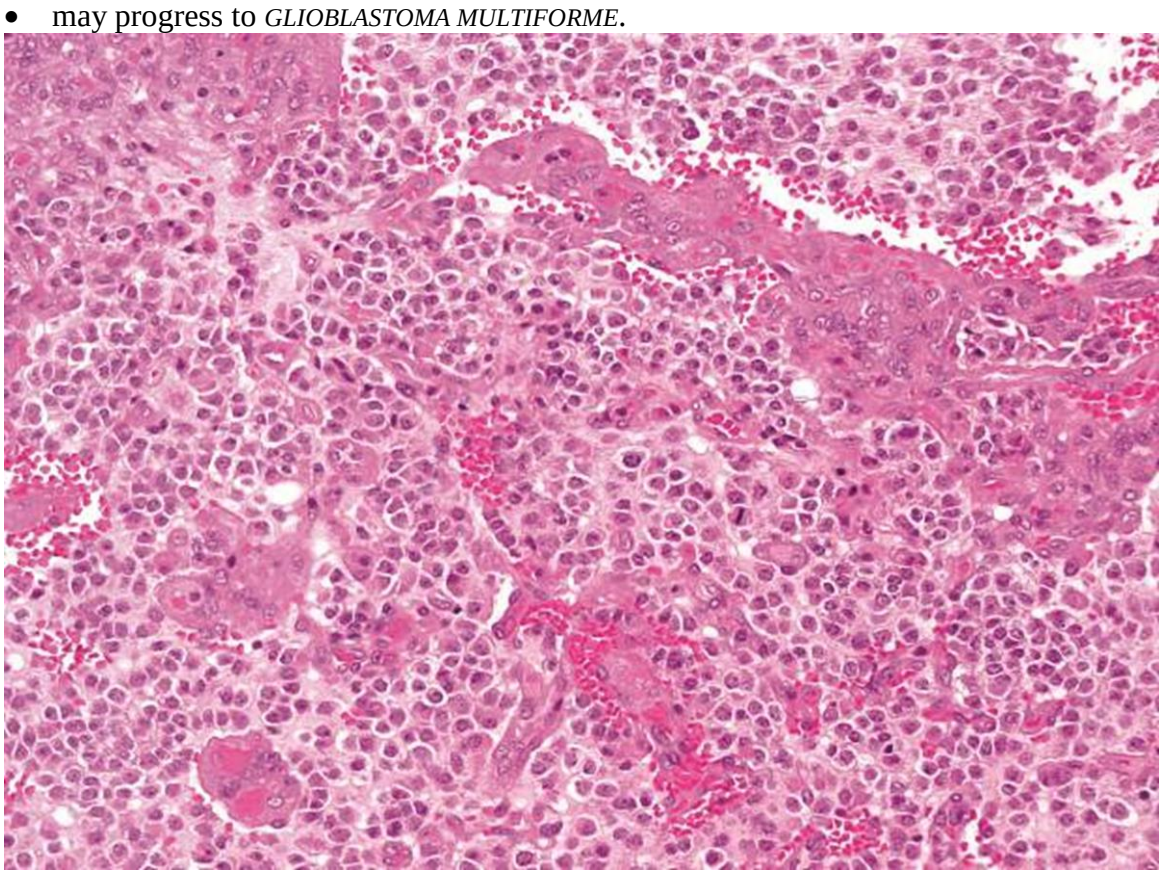






Anaplastic (malignant) oligodendroglioma (grade 3) - increased cellularity, nuclear pleomorphism, endothelial proliferation, mitotic activity, and necrosis.

- 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.

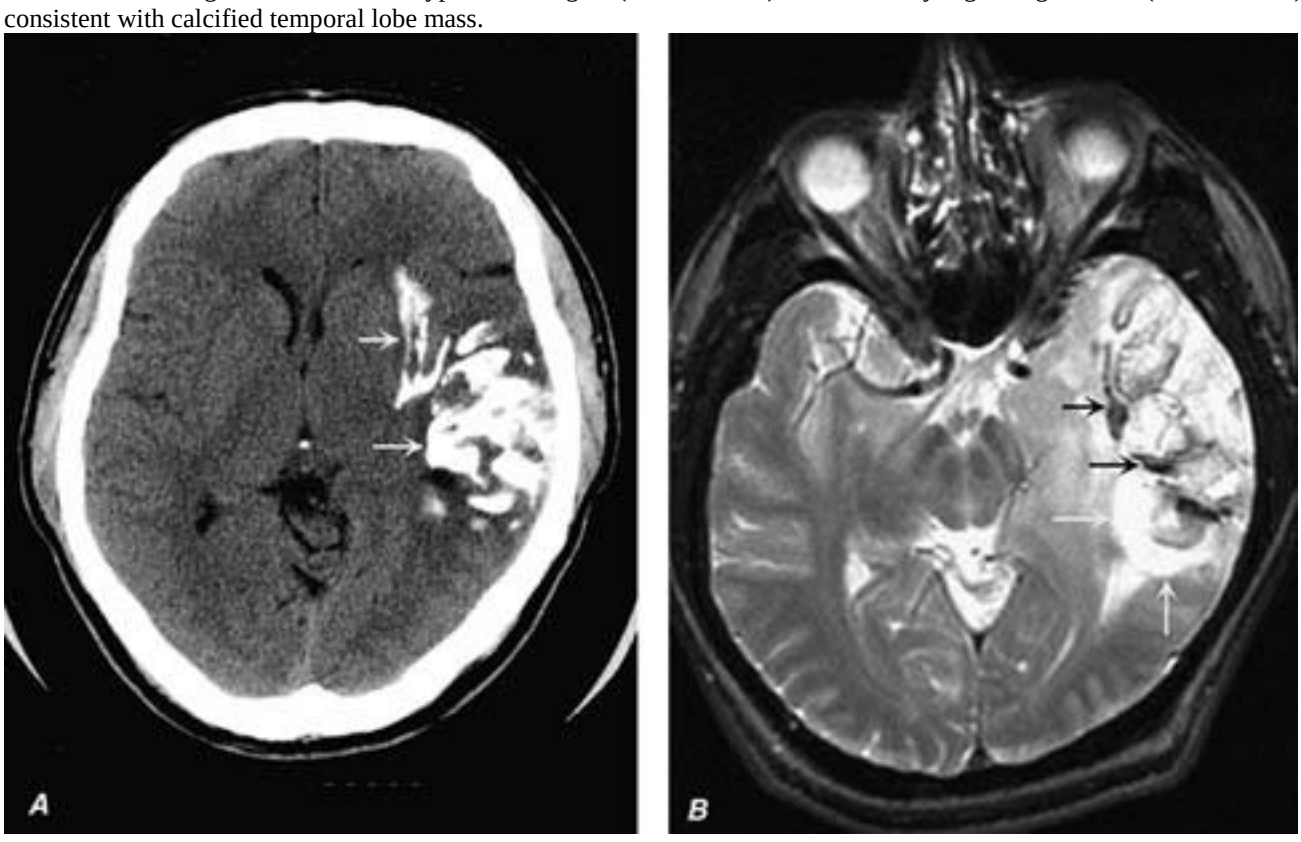
  Seizures are more common with oligodendrogliomas than other gliomas!
- ***focal cerebral dysfunction***, rarely **ICP↑**.

DIAGNOSIS

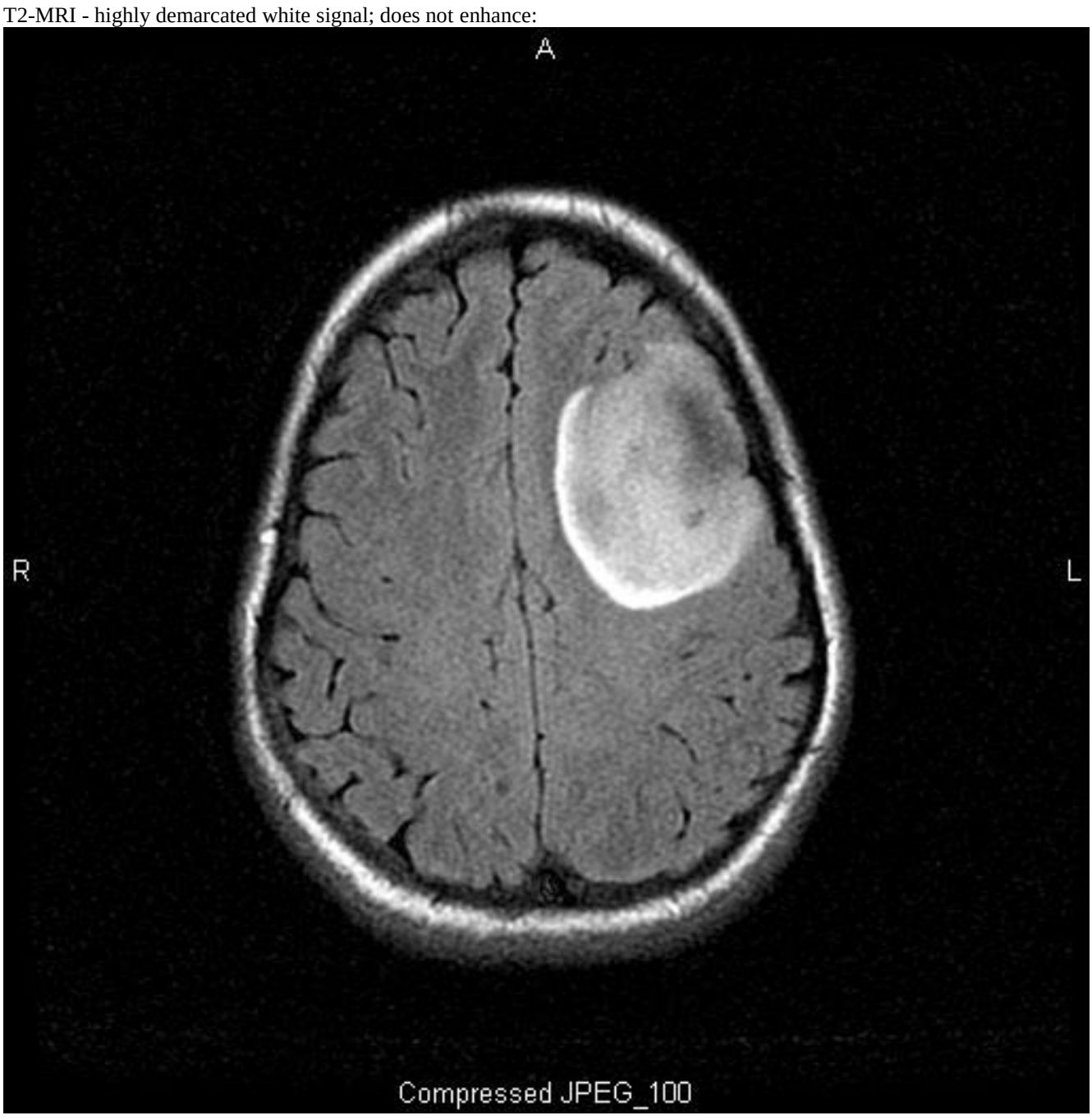
- **CT** - invisible (unless calcified*). *calcification fleck on CT may be first clue to neoplasm
- **MRI**: *LOW-GRADE TUMORS* - generally do not enhance (FLAIR is positive), while *ANAPLASTIC OLIGODENDROGLIOMA* does enhance; intratumoral ***calcification*** is common (≈ 90%).
- definite diagnosis – **biopsy** (almost always possible).

Differentiate *INTRAVENTRICULAR OLIGODENDROGLIOMA* from *CENTRAL NEUROCYTOMA* and *DYSEMBRYOPLASTIC NEUROEPITHELIAL TUMOR* – do not need chemotherapy and radiotherapy!

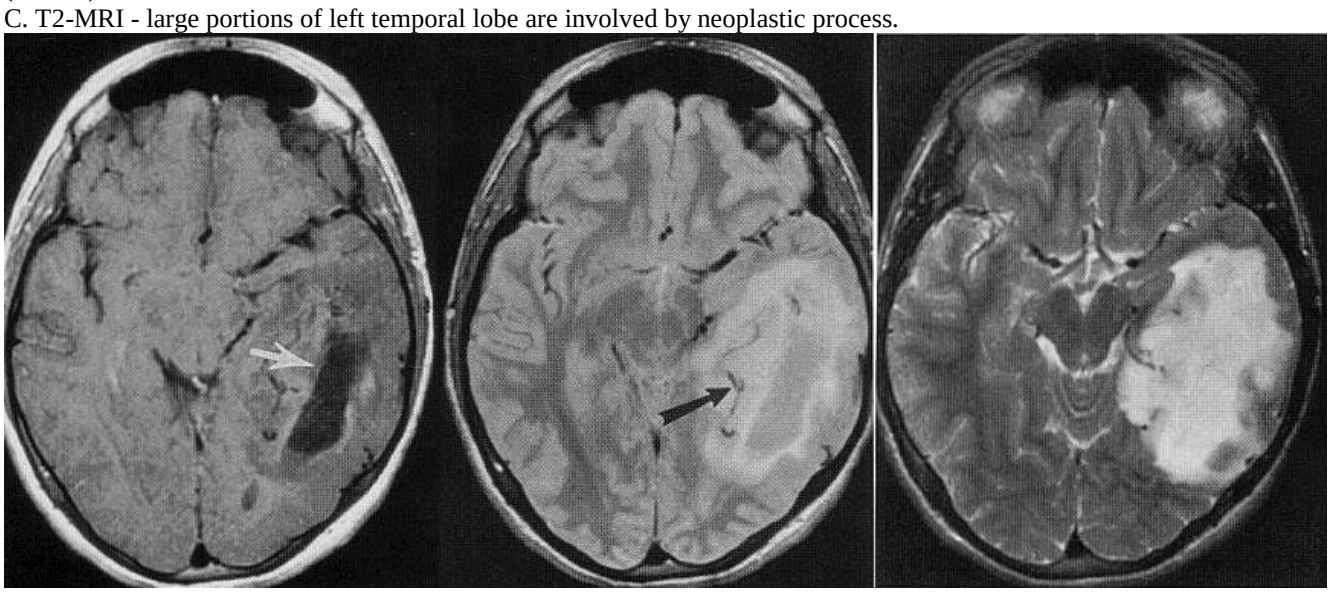
A. Noncontrast CT - calcified mass in left temporal lobe (*arrows*); mild mass effect but little edema.
B. MR-T2 - heterogeneous mass with hypointense signal (*black arrows*) surrounded by higher signal zone (*white arrows*), consistent with calcified temporal lobe mass.



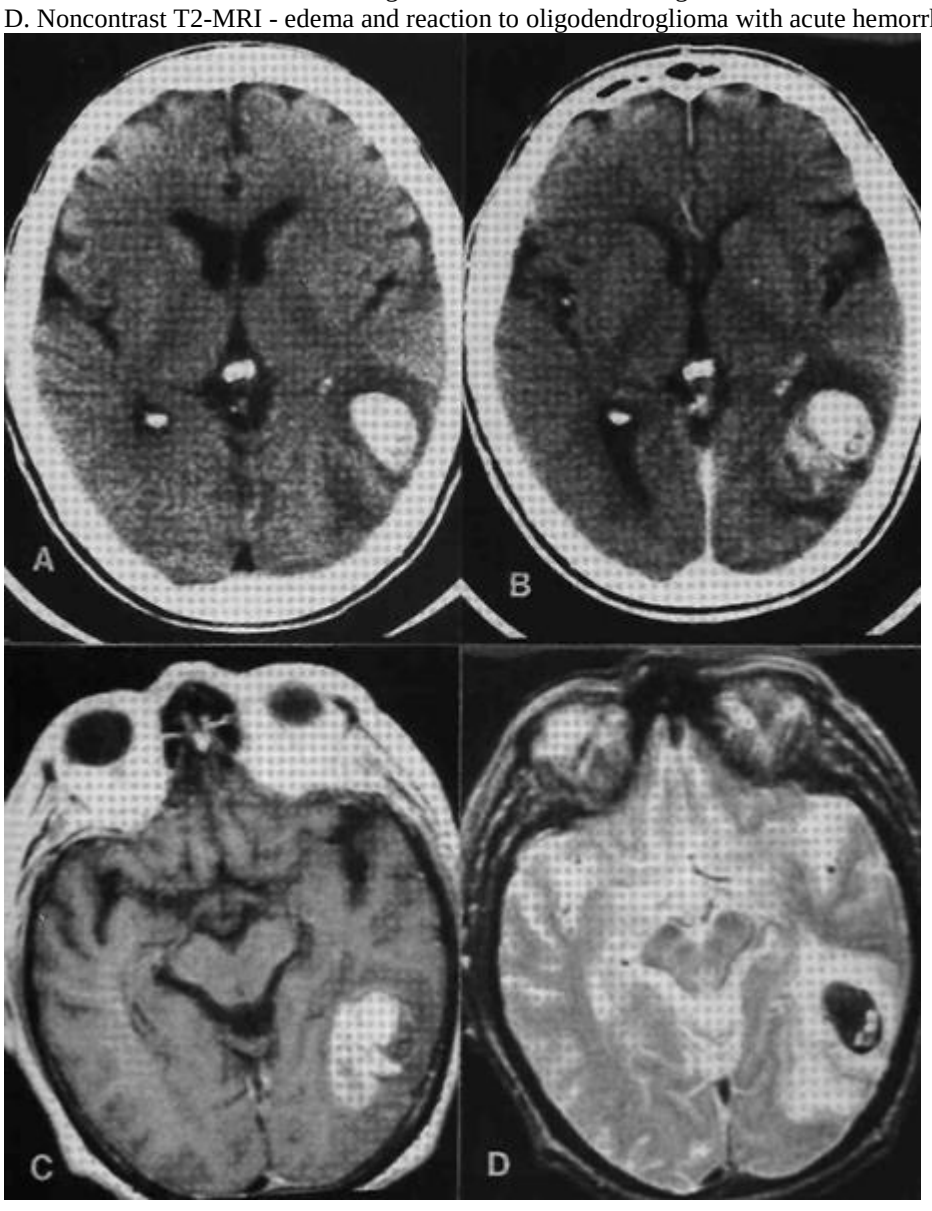
T2-MRI - highly demarcated white signal; does not enhance:



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 vasogenic edema and vascular structures within and adjacent to neoplasm (*arrows*).
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 - hemorrhage 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 >>

- **anticonvulsive 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 → **observation** for recurrence; recurrence → **radiotherapy**.
  incomplete removal → **radiotherapy**.
  ANAPLASTIC OLIGODENDROGLIOMA (regardless of resection extent) → **radiotherapy**.

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

  standard - PCV = PROCARBAZINE + LOMUSTINE (CCNU) + VINCRISTINE
  for relapses also may be tried - TEMOZOLOMIDE

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

Ino Y, et al. *Clin Cancer Res.* 2001;7:839-845

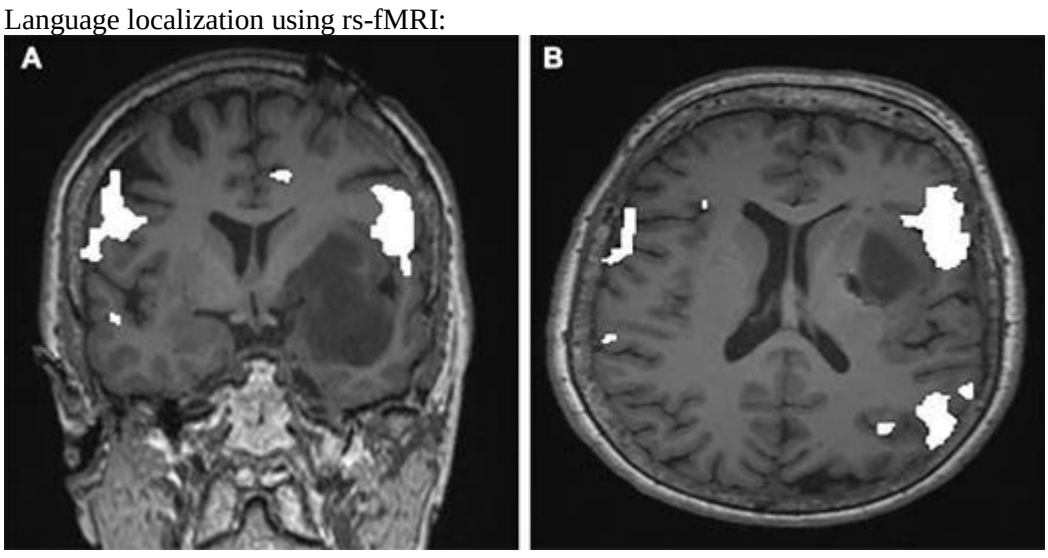
LITT

Insular oligo

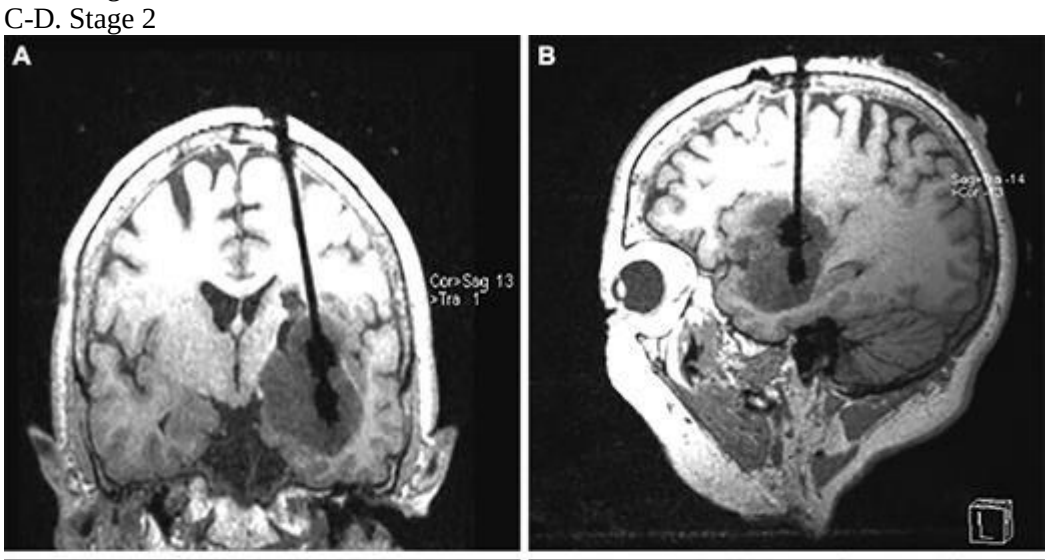
Staged Laser Interstitial Thermal Therapy (LITT) Treatments to Left Insular Low-Grade Glioma. Daniel M Hafez et al. Neurosurgery, Volume 86, Issue 3, March 2020, Pages E337–E342

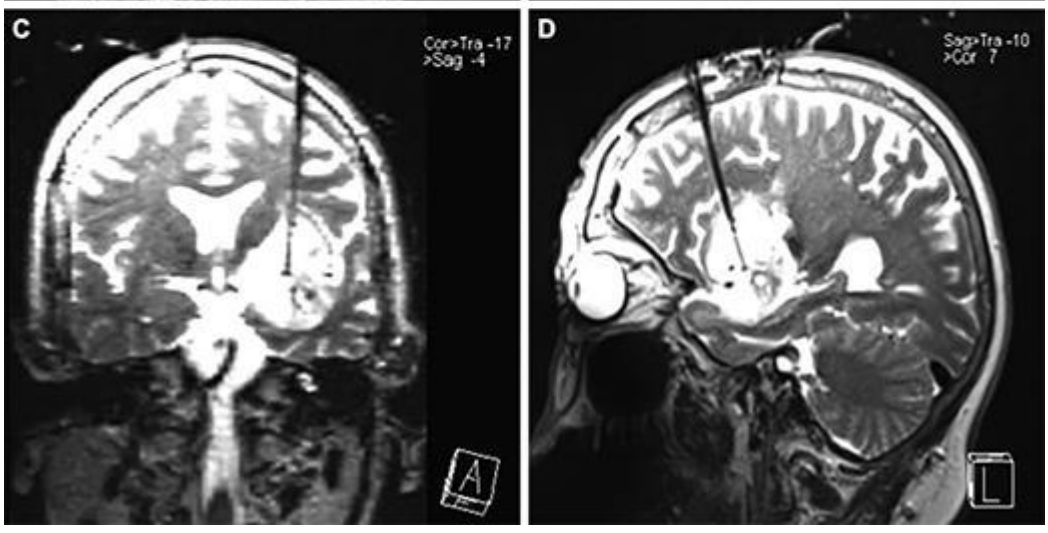
- left-sided insular oligodendroglioma treated in two stages (3 months apart - due to large 5 cm size – to prevent severe edema and seizures) with no permanent clinical deficit (temporary mild difficulty with word repetition) → chemoradiation → near resolution of the tumor at 2 yrs:

Language localization using rs-fMRI:



A-B. Stage 1
C-D. Stage 2





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 >>