# Preoperative Planning, Diagnosis, and Grading for Brain Tumors

SPARK ACADEMY COURSES 2025

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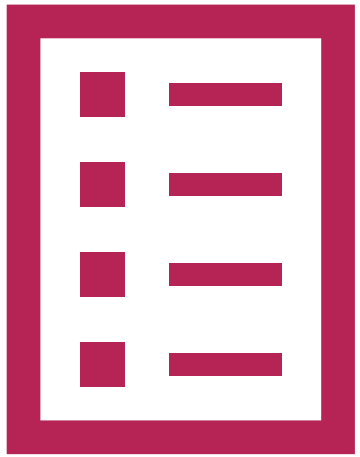
# PLAN

- Introduction
- Understanding Brain Anatomy
- Clinical evaluation
- Diagnostic imaging modalities
- Preoperative surgical planning
- Grading for  brain tumors
- Take home messages
- Conclusion and Q&A



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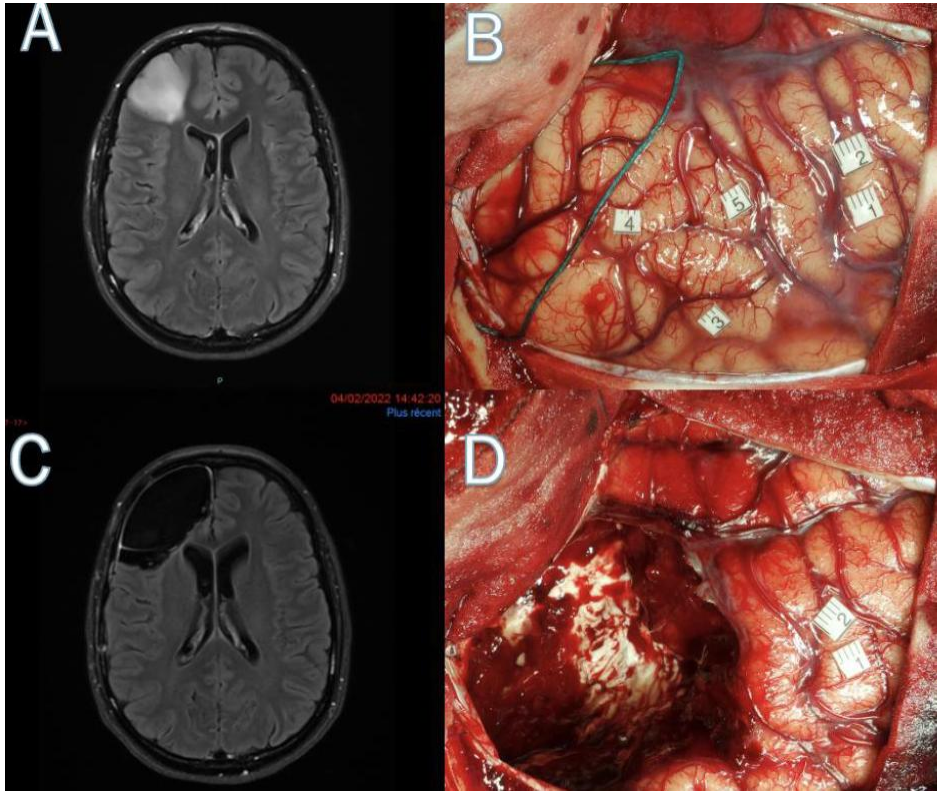
# INTRODUCTION

- Importance of preoperative planning
- Challenges in brain tumor management
- Goals: Maximize tumor removal, preserve function, guide therapy



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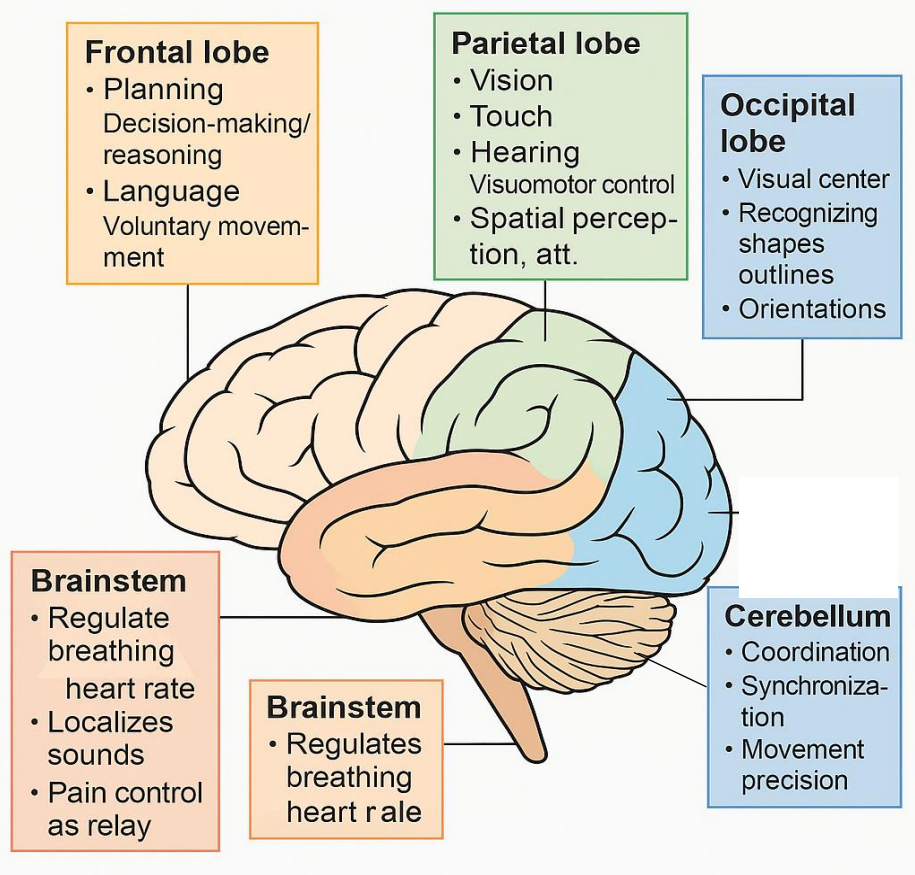
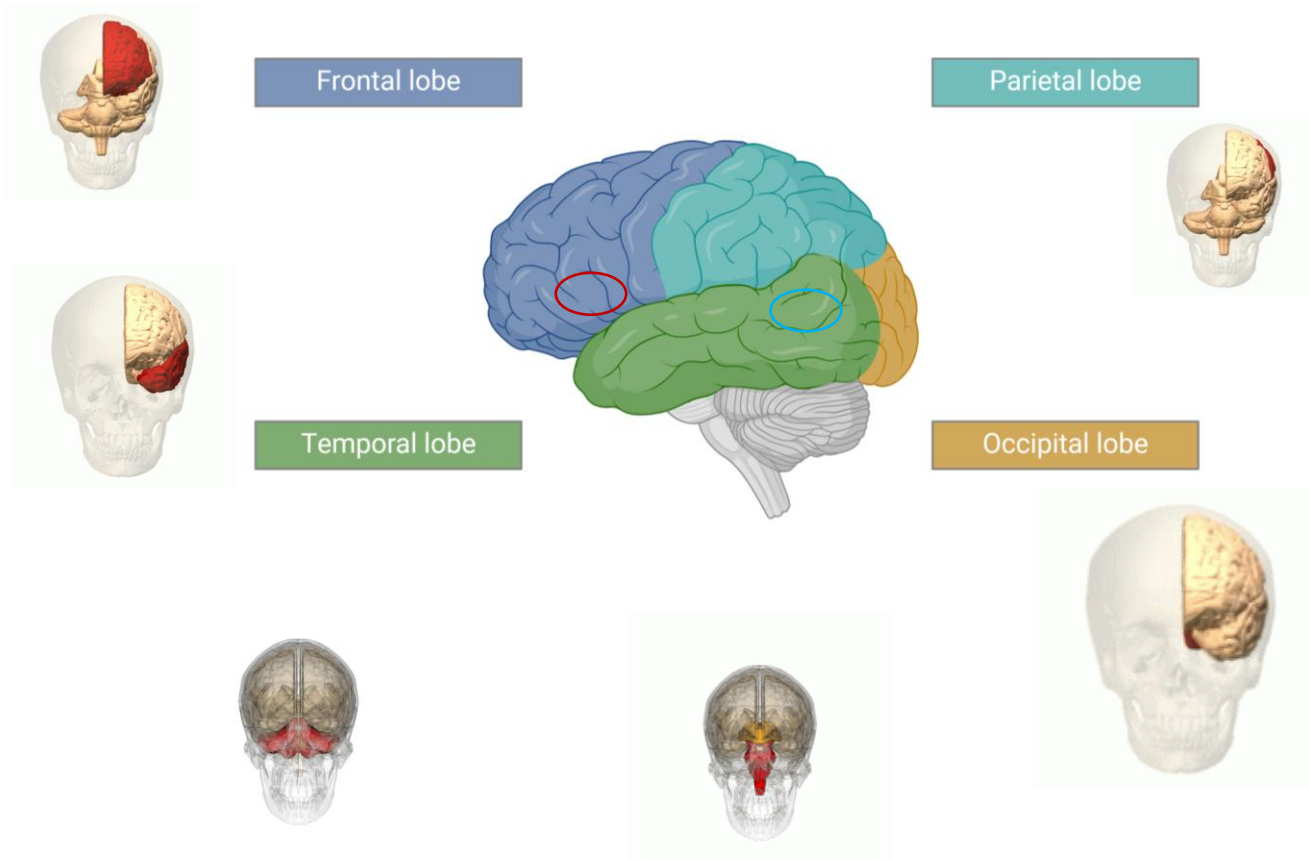
# BRAIN ANATOMY

## Functionnal Organization:

### Essentials Functions




Wernicke's area: comprehension of written and spoken language,
Broca's area: the production of language

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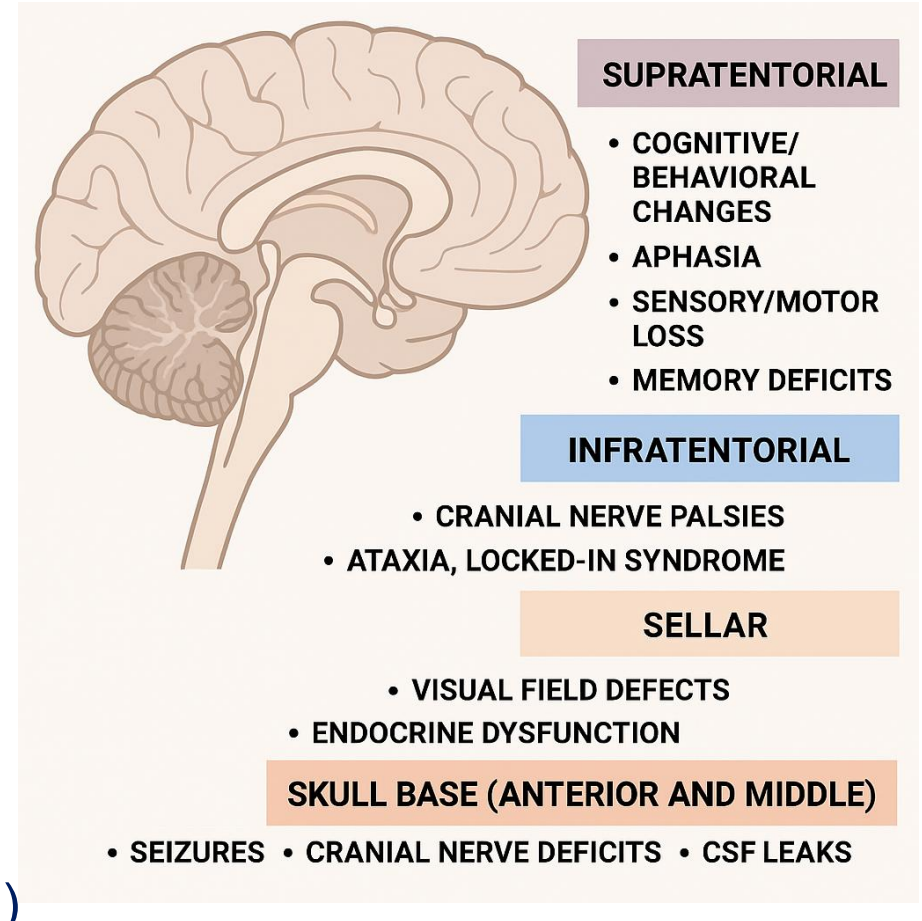
# CLINICAL EVALUATION


- Patient history and comorbidities, Age,
- History of symptoms installation (suddenly, progressively+++)
- Karnofsky status, independent prior event, mRs
- Neurological examination (GCS, neurologic deficit,
- Syndrome (summary of symptom, clinical sign)
- Neuropsychological and cognitive test +++
- Visual test, hearing test,
- Biology workup (hormonal dysfunction, inflammation, anemia…)



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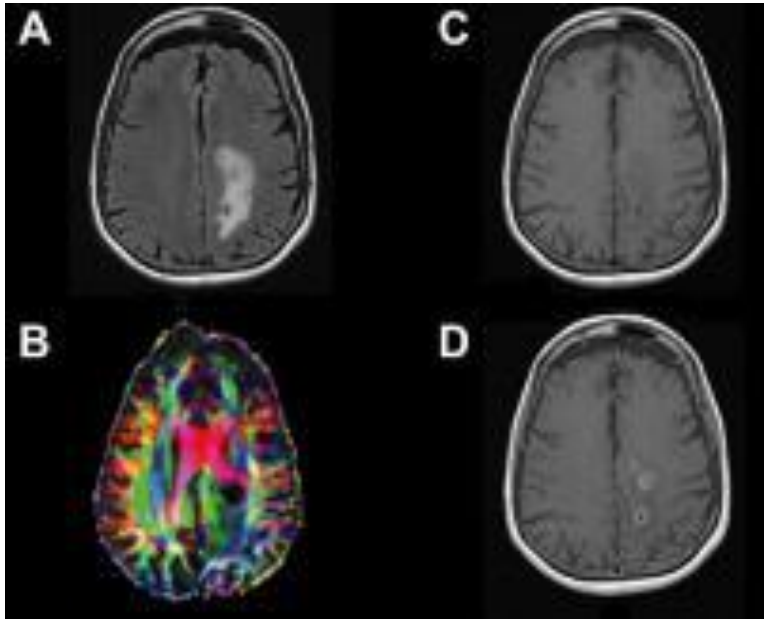
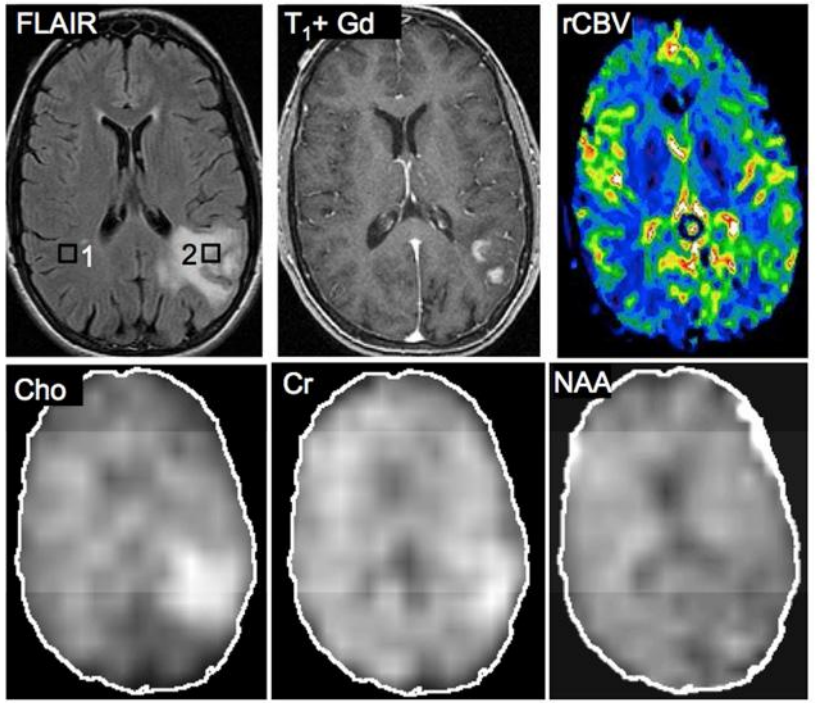
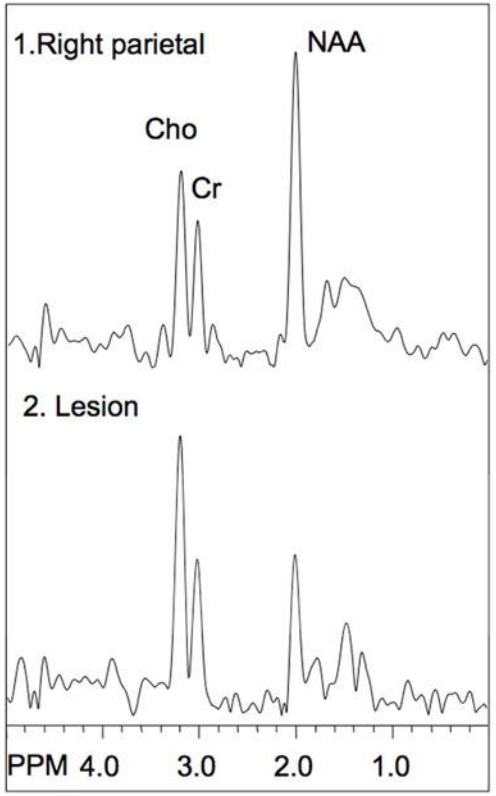
# IMAGING MODALITIES FOR THE BRAIN

- MRI (Gold standard): T1, T2, FLAIR, Contrast-enhanced, DTI
- CT Scan: Quick evaluation, calcifications, hemorrhage
- PET/SPECT: Tumor metabolism
- Advanced: MR spectroscopy, perfusion, fMRI




Characteristics of the tumors




› Rofo. 2023 Nov;195(11):989-1000. doi: 10.1055/a-2083-8717. Epub 2023 May 24.

**Modern preoperative imaging and functional mapping in patients with intracranial glioma**

Nico Sollmann [1 2 3 4], Haosu Zhang [5], Christopher Kloth [1], Claus Zimmer [2 3], Benedikt Wiestler [2 6], Johannes Rosskopf [1 7], Kornelia Kreiser [1 8], Bernd Schmitz [1 7], Meinrad Beer [1], Sandro M Krieg [3 5]

Review › Neuroimaging Clin N Am. 2010 Aug;20(3):293-310. doi: 10.1016/j.nic.2010.04.003.

**Imaging of brain tumors: MR spectroscopy and metabolic imaging**

Alena Horská [1], Peter B Barker

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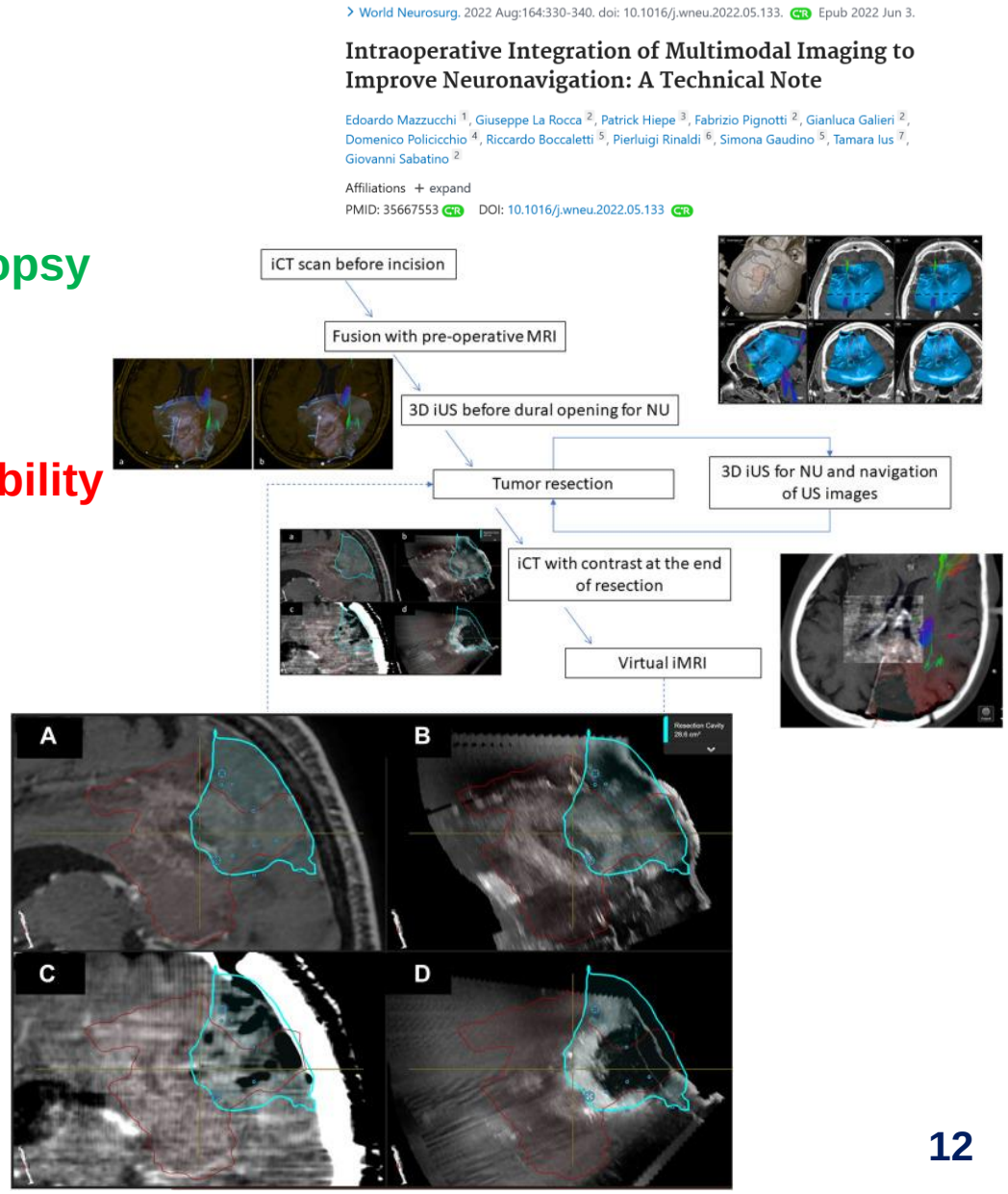
# PREOPERATIVE SURGICAL PLANNING

- **Matching symptoms, imaging, and pathology**
- **Evaluation of Tumor resectability, Goal : GTR, STR, PR, Biopsy**
- **Functional mapping: Language, motor areas**
- **Risk stratification +++, Anesthesiology workup, AAA possibility**
- **surgery steps planification,**
- **Intraoperative navigation planning**
- **Importance of multidisciplinary team approach +++**

- Preoperative Patient Counseling:
  Expected outcomes, Risks and benefits, Rehabilitation and recovery plan
- Follow-Up Strategy:
  Immediate post-op imaging, Long-term surveillance, Recurrence management, Adjuvant therapies



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# Grading for brain tumors

**History: WHO 1979,1993,2000,WHO 2016, WHO 2021**

Review > Neuro Oncol. 2021 Aug 2;23(8):1231-1251. doi: 10.1093/neuonc/noab106.

## The 2021 WHO Classification of Tumors of the Central Nervous System: a summary

David N Louis [1], Arie Perry [2], Pieter Wesseling [3 4], Daniel J Brat [5], Ian A Cree [6], Dominique Figarella-Branger [7], Cynthia Hawkins [8], H K Ng [9], Stefan M Pfister [10], Guido Reifenberger [11], Riccardo Soffietti [12], Andreas von Deimling [13 14], David W Ellison [15]

### GLIOMAS, GLIONEURONAL AND NEURONAL TUMORS

- Adult-type diffuse gliomas:
  - Astrocytoma, IDH-mutant (grades 2–4)
  - Oligodendroglioma, IDH-mutant, 1p/19g-codeleted (grades 2–3)
  - Glioblastoma, IDH-wildtype (grade-4)
- Pediatric-type low-grade and high-grade gliomas
- Circumscribed astrocytic gliomas
- Glioneuronal and neuronal tumors

### CHOROID PLEXUS TUMORS

- Choroid plexus papilioma, carcinoma

### MENINGIOMA

- Now a single tumor type with multiple subtypes. graded 1–3 within the type; molecular markers (TERT, CDKN2A/Bican indicate grade 3

### EPENDYMAL TUMORS

- Classified by location (supratentorial, posterior fossa, spinal) and molecular features (e.g. ZFTA fusion, YAP1 fusion)

### EMBRYONAL TUMORS

- Medulioblastoma (WNT-activated, SHH-activated, non-WNT/non-SHH, all grade 4)
- Other CNS embryonal tumors (e.g., ETMR, AT/RT, CNS neuroblastoma, CNS tumor with BCOR alteration)

### OTHER GROUPS

- Pineal tumors
- Cranial and paraspinal nerve tumors
- Mesenchymal, nonmeningothelial tumors
- Melanocytic tumors
- Hematolymphoid tumors
- Germ cell tumors
- Sellar region tumors
- Metastases

## Summary of WHO Classifications of Brain Tumors (2021, 5th Edition)

The 2021 WHO Classification of Tumors of the Central Nervous System (CNS) represents a major update, integrating molecular diagnostics with traditional hitogol-gy to improve accuracy and prognostic value

### Restructuring of Major Tumor Groups

**Diffuse Gliomas**

Now classified based on IDH mutation (IDH-mutant vs. IDH-wildtype) and 1p/19q codeletion status. Oligoastrocytoma and glioblastoma subtypes are redefined or eliminated, all IDH-mutent gliomas without 1p/19q codeletion are classified as astrocytomas

**Medulloblastomas and Embryonal Tumors**

Divided into molecular subgroups (e.g.. WNT-activated, SHH-activated). CNS primitive neuroectodermal tumor (PNET) was removed as a category

**+ New Entities**

+ diffuse midline glioma, H3 K27M-mutant
+ RELA fusion-positive ependymoma
+ embryonal tumor≠ *with* multilayered rosettes, C18MC-altered

| Key Principles | Tumor Grading |
|---|---|
| **Integrated Diagnosis:** Combines histologic features with molecular markers for a layered, more precise diagnosis | Uses Arabic numerals (1-4) for grades and assigns grade within tumor types rather than across types |
| **Adult-type vs. Pediatric-type** | **New Entities & Nomenclature** |
| Clearly separates adult and pediatric diffuse gliomas and other tumor families based on molecular and clinical behavior | Introduces new tumor types and updates names to reflect molecular alterations |

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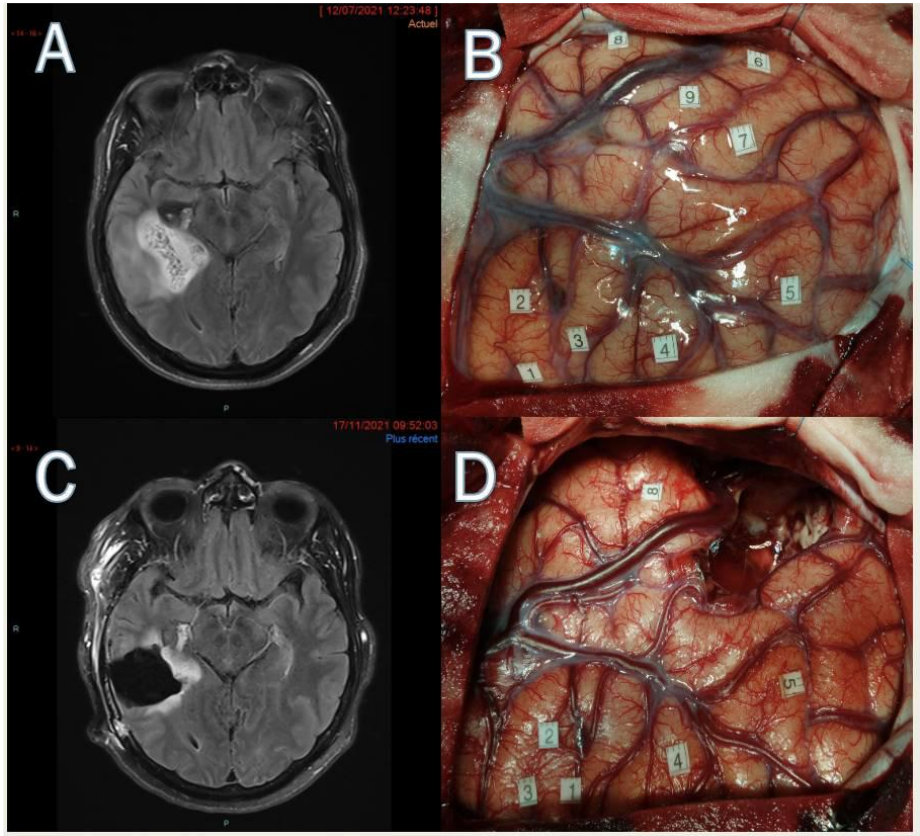
# TAKE HOME MESSAGE

- **Clinical, biology  workup is mandatory**
  - Correlation establishment with imaging, pathology
- **Imaging modalities : structural anatomy involved and characteristics of tumors**
- **Optimal planning of each steps of surgery with risk stratification (Anesthesiology consideration)**
- **Evaluated the possibility to be less Invasive (AAA vs. Hypnosis)**
- **Follow-up planification: Adjuvant therapies, recurrence according to the WHO 2021 grading of tumor**
  - through pathology, biomolecular workup, and Multidisciplinary concertation

Neurochirurgie. 2023 Nov;69(6):101494. doi: 10.1016/j.neuchi.2023.101494. Epub 2023 Sep 14.

**Asleep-awake-asleep versus hypnosis for low-grade glioma surgery: long term follow-up outcome**

Nourou Dine Adeniran Bankole [1], Ulrick Sidney Kanmounye [2], Abdessamad El Ouahabi [3], Ilyess Zemmoura [4]



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# CONCLUSION

- **Planning is essential in brain tumors surgery**
- **Clinical and Imaging correlation is crucial to be optimal in management**
- **Goal of surgery is to remove as so much possible the tumor without compromise functional outcomes**
- **Follow-up is crucial and should be planned before surgery**
    - (WHO classification 2021)
- **Multidisciplinary concertation (neuro-oncologist-radiotherapist, neurosurgeon)**

Henry Kissinger: 'If you don't know where you are going, every road will get you nowhere.'

# Thanks for your Kind Attention

# Q&A ???


28/04/2025