WHO Grade 2 Meningioma

WHO Grade 2 meningiomas, also called **atypical meningiomas**, represent an intermediate grade between benign (Grade 1) and malignant (Grade 3) tumors. They exhibit increased proliferative activity, brain invasion, or atypical histological features, and have a **higher risk of recurrence and progression** compared to Grade 1.

Definition

A **WHO Grade 2 meningioma** is defined by one or more of the following:

- **Brain invasion** (since WHO 2016, retained in 2021)
- **Mitotic index ≥4 mitoses per 10 high-power fields (HPF)**
- **At least 3 of the following 5 histological features**:
    1. Increased cellularity
    2. Small cells with high nuclear-to-cytoplasmic ratio
    3. Prominent nucleoli
    4. Sheet-like growth pattern
    5. Foci of spontaneous necrosis

Histological Subtypes

- **Atypical meningioma (most common)**
- **Clear cell meningioma** (molecularly defined)
- **Chordoid meningioma**

Histopathological Features

- Mitotic activity ≥4 per 10 HPF
- Increased nuclear atypia and hypercellularity
- Brain invasion (any degree)
- Possible necrosis or architectural distortion
- May be diagnosed purely on molecular subtype (e.g. clear cell, chordoid)

Molecular Markers

- Loss of chromosome 1p, 14q, or CDKN2A/B deletions associated with worse prognosis
- DNA methylation profiling may further stratify recurrence risk

Clinical Behavior

- **Aggressive behavior** compared to Grade 1

- **Higher recurrence rate**, even after complete resection
- Often present in younger patients or in non-skull-base locations

Treatment

- **Maximal safe surgical resection** is primary treatment
- **Simpson grade I–III** resection is preferred
- **Postoperative radiotherapy** is often recommended, especially if:
    1. Resection is subtotal (Simpson grade IV–V)
    2. Brain invasion is present
    3. Tumor is recurrent
- Adjuvant RT improves progression-free survival but may not always be necessary after gross total resection

Prognosis

- **5-year recurrence-free survival**:
    1. ~50–70% after gross total resection
    2. Worse with subtotal resection or brain invasion
- **Regular MRI follow-up** is essential, typically every 6–12 months for the first 5 years

References

- WHO Classification of Tumours Editorial Board. *WHO Classification of Tumours of the Central Nervous System*. 5th ed. IARC, 2021.
- Goldbrunner R, et al. EANO guideline on meningiomas. *Lancet Oncol*. 2016.
- Sahm F, et al. DNA methylation-based classification and grading of meningiomas. *Acta Neuropathol*. 2017.