Study on glioma progression

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Here is a summary and analysis of the main findings of **Ge Z, Jin G, Wang H, et al. "Risk factors for postoperative malignant progression of lower-grade gliomas: a systematic review and meta-analysis." Surg Oncol. 2025 Nov 12;64:102327.** PubMed +1

🔎 Study Aim & Methods

- The authors conducted a systematic review and meta-analysis of risk factors for *postoperative malignant progression* of lower-grade gliomas (LGG), defined as progression to a higher-grade/malignant tumor after initial surgery. PubMed
- They searched PubMed, EMBASE, Web of Science and Cochrane Library up to August 2024. PubMed
- 17 observational studies were included, encompassing 3,810 glioma patients. PubMed

✅ Main Risk Factors Associated with Increased Malignant Progression Risk

The meta-analysis identified several independent factors that significantly increase the risk of malignant progression after surgery:

Risk Factor	Hazard Ratio (HR) / Effect	Comment
Advanced age	HR ≈ 1.011 (p = 0.042) PubMed	Older patients had a slightly increased risk.
Contrast enhancement on pre- or postoperative imaging	HR ≈ 1.540 (p = 0.001) PubMed	Suggests radiological aggressiveness predicts transformation.
Rapid tumor expansion speed ("rapid expanding speed")	HR ≈ 4.525 (p < 0.001) PubMed	Fast-growing LGG strongly associated with later malignant transformation.
Tumor location in the insular lobe	HR ≈ 1.514 (p = 0.020) PubMed	Insular involvement appears as a site-specific risk.
Involvement of eloquent brain areas ("eloquence involved")	HR ≈ 2.413 (p < 0.001) PubMed	Tumors in or near eloquent cortex more likely to progress — possibly reflecting limitations in resection.

Risk Factor	Hazard Ratio (HR) / Effect	Comment
Involvement of the corpus callosum	HR ≈ 1.695 (p = 0.002) PubMed	Midline/callosal location associated with higher risk.

✅ Protective Factors (Associated with Lower Risk of Malignant Progression)

Conversely, the analysis identified several factors associated with reduced risk of malignant progression:

- **High pre-operative performance status (KPS):** HR ≈ 0.955 (p = 0.001) PubMed
- **Favorable histology / molecular features**
  - Oligodendroglioma histology: HR ≈ 0.603 (p < 0.001) PubMed
  - Oligoastrocytoma histology: HR ≈ 0.693 (p = 0.016) PubMed
  - IDH mutation: HR ≈ 0.406 (p = 0.004) PubMed
  - 1p/19q codeletion: HR ≈ 0.534 (p < 0.001) PubMed
  - MGMT promoter methylation: HR ≈ 0.539 (p = 0.007) PubMed
- **Surgical factors:**
  - Having a resection (vs biopsy): HR ≈ 0.277 (p < 0.001) PubMed
  - High extent of resection (EOR): HR ≈ 0.972 (p = 0.038) PubMed

Thus, better functional status, favorable molecular/histologic features, and more aggressive/complete surgery were associated with reduced risk of malignant progression.

📚 Comparison with Previous Literature

- The result that better EOR (extent of resection) reduces risk of malignant progression echoes longstanding observations from earlier institutional series. For instance, a prior series showed gross-total removal and oligodendroglial pathology correlated with better PFS/OS and lower transformation rate. ScienceDirect +2 PubMed +2
- Similarly, favorable molecular features (IDH mutation, 1p/19q codeletion) and oligodendroglioma histology had been associated with lower malignant transformation risk in earlier reviews. PubMed +2 PubMed +2

- The association with radiological contrast enhancement or rapid growth is consistent with prior data, which linked pre- or postoperative tumor volume, residual disease, and radiological aggressiveness to risk of progression/transformation. PubMed +2 OUP Academic +2

Thus, the new meta-analysis broadly confirms and quantifies many risk/protective factors previously suspected, now with pooled data strengthening the evidence.

🧠 Implications — What This Means for Clinical Practice & Research

- **Risk Stratification & Follow-up**: The identified risk factors (age, contrast enhancement, rapid growth, insular/eloquent/corpus callosum location, molecular status, extent of resection) can help stratify LGG patients after surgery. High-risk patients might benefit from more intensive surveillance (imaging, shorter intervals), earlier adjuvant therapy, or consideration of re-resection when safe.
- **Surgical Strategy**: The protective effect of higher EOR and resection underscores the importance of maximal safe resection whenever feasible — supporting the goal of complete tumor removal, balancing functional risk.
- **Molecular / Histological Profiling**: Confirming the prognostic importance of IDH mutation, 1p/19q codeletion, MGMT methylation reinforces their value for risk assessment and therapeutic decision-making.
- **Tailored Patient Counseling**: Knowledge of individualized risk based on these factors can inform discussions with patients about prognosis, potential for malignant progression, and follow-up intensity.
- **Research & Trial Design**: Future studies and clinical protocols can use these risk factors to stratify patients, design risk-adapted follow-up, or select patients for early adjuvant therapies or novel interventions (e.g., molecular-targeted, immunotherapy).

📌 Limitations (as per authors) & Remaining Gaps

The authors mention that while several factors reached significance, the certainty of evidence was “moderate to high only for several key factors.” PubMed
Moreover:

- The 17 studies included were observational (retrospective) — so subject to biases inherent to non-randomized data. PubMed +1
- Heterogeneity across studies (different definitions of malignant progression; pre- & post-operative imaging protocols; varying follow-up lengths) may limit generalizability.

- Even though molecular markers (IDH, 1p/19q, MGMT) were protective in pooled analysis, not all original studies may have uniformly assessed them — and with evolving classification (e.g. WHO 2021), prior pathological diagnoses might not align fully with current molecular definitions.

- For some risk factors (e.g. “rapid expanding speed”), the operational definition may differ across studies — limiting reproducibility.

Therefore, while this meta-analysis strengthens the evidence base, prospective, ideally multicenter studies with standardized definitions (extent of resection by MRI, molecular subclassification, standardized imaging follow-up) remain needed.

🔖 Reference

Ge Z, Jin G, Wang H, Wang S, Fei X, Li S, Zhang L, Jiang X, Zhang Y. Risk factors for postoperative malignant progression of lower-grade gliomas: a systematic review and meta-analysis. *Surg Oncol.* 2025 Nov 12;64:102327. PubMed