Awake craniotomy

- Advancing Neurosurgical Oncology and AI Innovations in Latin American Brain Cancer Care: Insights from a Center of Excellence
- A Modified Oxygenation Technique for Awake Craniotomy
- Awake Versus Asleep Craniotomy for Glioma: A Comparison of Survival and Costs Using Time-Driven Activity-Based Costing
- Intra-operative neurophysiological monitoring as an adjunct to resection of eloquent cerebral arteriovenous malformations: a retrospective cohort study
- Motor Recovery in Glioma Patients After Craniotomy: A Case Study of Continuous Rehabilitation Assessed With Diffusion Tensor Imaging
- Letter to Editor: "Glioma-induced neural functional remodeling in the hand motor cortex: precise mapping with ECoG grids during awake craniotomy"
- Integration of 5-ALA fluorescence and intraoperative MRI in awake craniotomy for glioma resection: a six-year retrospective analysis
- Intraoperative Seizures in Glioma Surgery: Is It Really Only an Intraoperative Issue?

General information

Usually employed for brain mapping, especially for speech areas. Numerous techniques and protocols have been described. Typically, the patient is temporarily anesthetized with short-acting agents (inhalational and/or injectable). This is supplemented with local anesthesia. The craniotomy is then performed and the patient is allowed to wake up while the brain is exposed to permit neurophysiologic testing during surgery. If (short-acting) paralytics are used, it is critical to reverse these agents 15–30 minutes prior to applying the electrostimulation and that a train-of-four muscle twitch can be elicited.

An awake craniotomy is a safe neurosurgical procedure that minimizes the risk of brain injury. During the course of this surgery, the patient is asked to perform motor or cognitive tasks, but some patients exhibit severe sleepiness.

For neurosurgery with an awake craniotomy, the critical issue is to set aside enough time to identify eloquent cortices by electrocortical stimulation (ECS). High gamma activity (HGA) ranging between 80 and 120 Hz on electrocorticogram (ECoG) is assumed to reflect localized cortical processing.

In recent years, there have been a number of reports on interventions in conscious patients with other neurosurgical pathologies, which may be regarded as a new emerging tendency in neurosurgery and neuroanesthesiology. Neurosurgery in conscious patients provides a special advantage because it enables highly functional neuromonitoring without use of complex devices [1)].

Awake craniotomy (AC) was first performed by Sir Victor Horsley in 1886 to localise the epileptic focus with cortical electrostimulation [2)].

Wilder Penfield, made mappings in conscious patients with severe epilepsy under local anaesthesia

(LA) by directly observing the brain and assessing the responses to electrical stimuli. He prepared detailed reports on brain physiology, speech cortex, interpreting cortex and brain regions controlling body movements [3].

Indications

Awake craniotomy indications.

Cost effectiveness

Retrospective analysis of a cohort of 17 patients with perirolandic gliomas who underwent an AC with DCS were case-control matched with 23 patients with perirolandic gliomas who underwent surgery under GA with neuromonitoring (ie, motor-evoked potentials, somatosensory-evoked potentials, phase reversal). Inpatient costs, quality-adjusted life years (QALY), extent of resection, and neurological outcome were compared between the groups.

Total inpatient expense per patient was ${\$}$ 34 804 in the AC group and ${\$}$ 46 798 in the GA group (P = .046). QALY score for the AC group was 0.97 and 0.47 for the GA group (P = .041). The incremental cost per QALY for the AC group was ${\$}$ 82 720 less than the GA group. Postoperative Karnofsky performance status was 91.8 in the AC group and 81.3 in the GA group (P = .047). Length of hospitalization was 4.12 days in the AC group and 7.61 days in the GA group (P = .049).

The total inpatient costs for awake craniotomies were lower than surgery under GA. This study suggests better cost effectiveness and neurological outcome with awake craniotomies for perirolandic gliomas [4].

Anesthesia

Awake craniotomy anesthesia.

Retrospective observational studies

In a retrospective observational study Zigiotto et al. from the S. Chiara University-Hospital, Azienda Provinciale per i Servizi Sanitari, Trento, published in the Neurosurgery Journal on 64 glioma patients who underwent awake surgery (AwS) or asleep surgery (AsS), with neuropsychological and imaging follow-up. They evaluated the impact of awake surgery on attentional outcomes in glioma patients, and analyzed whether greater extent of tumor resection correlates with transient cognitive (attentional) decline, especially in relation to lesions within the default mode network. Awake surgery allows for more extensive supramaximal resection and is associated with longer overall survival, particularly in patients with glioblastomas. However, it also leads to a higher rate of transient postoperative attentional dysfunction, likely due to resection in attention-related brain networks. The study suggests that patient selection and intraoperative cognitive monitoring should be optimized in future glioma surgery [5].

This retrospective study compares awake versus asleep craniotomy in 64 glioma patients, using simple attention tests before and after surgery. The authors claim that awake craniotomy (AwC) allows more extensive tumor resection and leads to longer survival, albeit at the cost of transient attentional dysfunction.

1. Conceptual Inflation Meets Methodological Reductionism

The title promises a nuanced exploration of cognitive outcomes. What it delivers is a reduction of “attention” to the Trail Making Test Part A and a visual search task — an embarrassingly narrow lens for such a multidimensional construct. The study purports to evaluate the impact of surgery on attention, yet fails to define attention, stratify its subtypes, or provide any neuropsychological depth. This is not a cognitive study — it’s a surgical paper pretending to be one.

2. Supramaximal Resection: A Buzzword Without a Backbone

The authors repeatedly refer to “supramaximal resection” as a virtue of AwC. However, their criteria for this designation remain vague, lacking reproducible thresholds or clear oncological benchmarks. In the absence of molecular stratification beyond IDH status, this term becomes an exercise in surgical vanity, not science.

The survival difference observed in IDH-wildtype glioblastoma is interesting but likely confounded by patient selection bias, preoperative status, and extent of resection — all poorly controlled in this retrospective, underpowered dataset.

3. Attentional Dysfunction: A Passing Glitch or a Glossed-Over Harm?

The authors downplay postoperative attentional dysfunction as “transient,” based on a 1-month follow-up — an arbitrarily short window in neuro-oncology. There’s no follow-up at 3 or 6 months, no correlation with functional recovery or quality of life, and no assessment of whether deficits return with adjuvant therapy. This is not transience — it's truncation.

4. Academic Camouflage and Citation Padding

The paper includes 81 references but suffers from academic echo chamber syndrome. The authors avoid engaging with conflicting evidence, omit any mention of failed AwC outcomes, and never reference neuropsychology literature beyond superficial tools. This is surgical tunnel vision at its finest: cut more, assume better, test little.

5. Takeaway Message: Beware the Unmapped Mind

This paper is a cautionary tale about the hubris of maximalism in brain surgery. It seeks to validate more aggressive resections by anesthetizing its readers with promises of transient dysfunction and longer life — without the methodological rigor to justify either.

The irony? While mapping motor and language areas intraoperatively, the authors fail to map their own cognitive biases — or the deeper consequences of what they leave unmapped in their patients.

Verdict:

A statistically underpowered, conceptually overstated, and methodologically superficial attempt to justify surgical aggressiveness in the name of survival, at the expense of long-term cognitive integrity. It's time the neurosurgical community stops equating more cutting with better care — especially when what's being cut is attention itself.

Case series

see Awake surgery case series.

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1)

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2)

Piccioni F, Fanzio M. Management of anesthesia in awake craniotomy. Minerva Anestesiol. 2008 Jul-Aug;74(7-8):393-408. PMID: 18612268.

3)

Dziedzic T, Bernstein M. Awake craniotomy for brain tumor: indications, technique and benefits. Expert Rev Neurother. 2014 Dec;14(12):1405-15. doi: 10.1586/14737175.2014.979793. Epub 2014 Nov 21. PMID: 25413123.

4)

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5)

Zigiotto L, Venturini R, Coletta L, Venturini M, Monte DD, Vavassori L, Corsini F, Annicchiarico L, Avesani P, Papagno C, Sarubbo S. Maximizing Tumor Resection and Managing Cognitive Attentional Outcomes: Measures of Impact of Awake Surgery in Glioma Treatment. Neurosurgery. 2025 Jun 20. doi: 10.1227/neu.0000000000003591. Epub ahead of print. PMID: 40539789.

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