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Neuroanesthesia for awake Craniotomy: Clinical Protocols and Patient Selection

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Introduction

Awake craniotomy is a specialized neurosurgical procedure performed while the patient is conscious, allowing real-time neurological assessment during brain tumor resections, epilepsy surgeries and functional mapping. The primary goal is to preserve eloquent brain areas regions responsible for speech, motor control and cognition by enabling intraoperative testing during cortical stimulation and resection. Neuroanesthesia for awake craniotomy demands meticulous planning, seamless interdisciplinary coordination and patient-centered care to ensure a smooth intraoperative experience and optimal neurological outcomes. This technique is most commonly indicated for tumors located near Broca's or Wernicke's area, the sensorimotor cortex, or language-related white matter tracts, where even minimal damage can result in permanent functional deficits [1].

Description

The anesthetic plan must achieve three essential goals: patient comfort, immobility during key surgical steps and a rapid return to full consciousness for functional testing. Approaches include Asleep-Awake-Asleep (AAA), Awake-Awake-Awake (AAA), or Monitored Anesthesia Care (MAC), selected based on the surgeon's preference, case complexity and institutional expertise. Local scalp block with infiltration of long-acting anesthetics such as bupivacaine is routinely performed to blunt pain from incision, retraction and skull pin fixation. Sedative agents like dexmedetomidine, propofol and remifentanil are titrated to maintain arousable sedation without respiratory depression, ensuring patient cooperation and safety. Airway management is crucial; most protocols avoid airway instrumentation to reduce stimulation and preserve verbal communication, using nasal cannula or high-flow oxygen instead. In cases requiring initial intubation, the tube is removed before mapping begins, with continuous monitoring of oxygenation and CO_2 levels. Preoperative counseling and psychological preparation are vital for patient selection and cooperation, as anxiety or poor understanding can compromise intraoperative testing and safety. Successful awake craniotomy relies on a balance of pharmacological expertise, rigorous monitoring and compassionate perioperative communication [2].

Selecting appropriate patients for awake craniotomy is pivotal to procedural success and patient safety. Ideal candidates are those who are motivated, cooperative and capable of understanding the procedure's purpose and demands. Preoperative evaluation includes not only standard medical assessments but also cognitive, psychological and speech/language assessments to ensure suitability. Patients with severe anxiety, psychiatric disorders, claustrophobia, or inability to follow commands are typically excluded unless mitigated by strong support systems and experienced teams. Comprehensive imaging, including functional MRI and Diffusion Tensor Imaging (DTI), guides surgical planning and intraoperative mapping, enabling identification of eloquent cortex and fiber tracts. The neuroanesthesiologist must also assess for potential airway difficulties, as conversion to general anesthesia in a fixed-head position can be challenging and dangerous. Preoperative fasting, medication review and planning for seizure management are integrated into protocol development. Patients with a history of epilepsy require individualized anticonvulsant management to minimize the risk of intraoperative seizures, which can disrupt mapping and prolong surgery. Informed consent involves not only legal documentation but also detailed conversations about the sensations the patient will experience, including noise, pressure and intermittent pain, without loss of control. Simulated operating room sessions or patient testimonials are increasingly used to enhance psychological readiness and reduce procedural fear. Multidisciplinary team involvement including neurosurgeons, neuropsychologists, speech therapists and anesthesia providers ensures a holistic evaluation and consensus before proceeding. Ultimately, careful patient selection enhances cooperation, minimizes intraoperative complications and maximizes the potential for complete tumor resection with preserved neurological function [3-4].

Postoperative care following awake craniotomy emphasizes neurological assessment, pain control and psychological recovery, with the aim of minimizing complications and optimizing rehabilitation. Patients are usually monitored in a neurosurgical intensive care or high-dependency unit for at least 24 hours to detect early signs of hemorrhage, cerebral edema, or seizures. Neurological examinations begin immediately post-surgery and continue at regular intervals to evaluate any new deficits or confirm preserved function. Postoperative pain is often less severe than in traditional craniotomies due to limited muscle dissection and targeted analgesia, but should still be managed proactively using non-opioid medications when possible. Antiepileptic drugs are continued or adjusted based on intraoperative events and seizure risk profiles. Emotional responses such as fatigue, anxiety, or euphoria are common, necessitating reassurance and, if needed, psychological support. Speech therapists and physiotherapists may begin early interventions to enhance functional recovery based on intraoperative findings and immediate postoperative assessments. Long-term outcomes are influenced by tumor pathology, extent of resection and functional preservation achieved during surgery, with awake craniotomy offering significant advantages in glioma surgeries near eloquent areas [5].

Conclusion

Multidisciplinary debriefings post-surgery contribute to team learning, protocol refinement and ongoing quality improvement. Increasingly, institutions are incorporating patient-reported outcome measures and quality-of-life indices to evaluate the broader impact of awake craniotomy on recovery and well-being. Advances in neuroimaging, anesthetic techniques and intraoperative monitoring will continue to expand the scope and safety of awake neurosurgery. As this approach becomes more standardized, neuroanesthesia for awake craniotomy will remain a model of patient engagement, precision medicine and interdisciplinary excellence. By integrating protocol-driven care with empathetic communication and technical proficiency, anesthesiologists play a central role in the success of these highly specialized procedures.

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Conflict of Interest

None.

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