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CLINICAL INFORMATION

Anesthetic considerations for awake craniotomy: case report



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Abstract

Background and objectives: The conscious patient cooperation during neurological procedures has become necessary for the delimitation of areas to be managed by a neurosurgeon, with better results in the treatment of tumor lesions, vascular or epileptic foci, and lesser sequelae. The need for perioperative awareness (responsiveness to commands) challenges anesthesiologists to further ensure patient safety during the procedure. Several techniques have been described for this purpose.

Case report: In this case, interaction with the patient during brain tumor resection enabled a broad approach of the tumor lesion, limited by deficits in speech and naming observed during surgical manipulation, avoiding major consequences. The chosen technique was deepening of general anesthesia during surgical times of most painful stimulus with intraoperative awakening of the patient.

Conclusions: Patient selection, an exhaustive explanation of the procedure to him, and the selection of drugs are crucial for a successful procedure. Laryngeal mask is useful in times requiring greater depth and anesthetic ventilation control, primarily in situations where endotracheal intubation may be hindered by the position. The continuous infusion of remifentanyl and adjuncts in the awake period associated adequate analgesia and full consciousness.

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PALAVRAS-CHAVE

Craniotomia acordado;
Neurocirurgia;
Remifentanil;
Máscara laríngea

Considerações anestésicas para craniotomia em paciente acordado: relato de caso**Resumo**

Justificativa e objetivos: A colaboração consciente do paciente durante procedimentos neurológicos tem se tornado necessária para delimitar áreas a serem abordadas pelo neurocirurgião, com melhores resultados no tratamento de lesões tumorais, vasculares ou focos epilépticos e minimização de sequelas. A necessidade de consciência perioperatória e responsividade a comandos desafia o anestesiológico a garantir ainda a segurança do paciente durante o procedimento. Várias técnicas têm sido descritas para esse fim.

Relato de caso: No presente caso, a interação com paciente durante ressecção de tumor cerebral possibilitou abordagem ampla de lesão tumoral, limitada por déficits de fala e de identificação notados à manipulação cirúrgica, e evitou sequelas maiores. A indução de anestesia geral em tempos cirúrgicos de maior estímulo doloroso com despertar intraoperatório do paciente foi a técnica escolhida.

Conclusões: A seleção do paciente, seu exaustivo esclarecimento e a seleção das drogas são de fundamental importância para o sucesso do procedimento. A máscara laríngea é instrumento útil em tempos que exigem maior profundidade anestésica e controle da ventilação, primariamente em situações em que a intubação endotraqueal pode estar dificultada pelo posicionamento. A infusão contínua de remifentanil e coadjuvantes no período desperto associou analgesia adequada e consciência plena.

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Introduction

Neurosurgery in awake patients has emerged for epilepsy treatment and has since been used to manage supratentorial tumors, arteriovenous malformations and aneurysms in eloquent areas of the brain. Cortical mapping requires the patient participation and his/her response to stimulation defines the limits of the surgical approach.¹

The main challenges for anesthesiologists are to ensure a safe perioperative period and to associate patient collaboration and maintenance of the awake status with satisfactory analgesia and minimal psychological and physical stress.^{1,2}

Some anesthetic techniques have been described, among them the association of local anesthesia and sedation, or under general anesthesia (asleep-awake-asleep). The choice of drugs with rapid onset and easily titrated, minimal effects on the cardiovascular and respiratory systems, poorly associated with nausea and vomiting, and without interference in neurological evaluation is required.^{3,4} Careful selection of the patient, high levels of motivation on the part of the patient and surgical team, and attention to his/her psychological preparation are essential.

The objective of this paper is to present the technique that associated general anesthesia with laryngeal mask airway for access to cerebral cortex, intraoperative awakening for cortical mapping with patient interaction via stimulation, followed by induction of general anesthesia for surgical closure.

Case report

A 30-year-old male patient with a diagnosis of grade II glioma in the left fronto-temporo-parietal region, presenting with convulsions that were difficult to control, as well as a

decreased strength in the upper and lower right limbs. Potential motor and speech sequelae required brain mapping during the injury management.

During preanesthetic evaluation, the patient reported continuous use of anticonvulsants and denied comorbidities, allergies or previous surgeries. Physical examination showed a slight decrease in strength on the right side, with subtle ipsilateral muscle hypotrophy, sensory and speech preserved. Airway examination showed no predictors of difficult airway, and additional tests were normal. The patient and relatives were informed about the surgical and anesthetic procedures and possible complications and gave written informed consent.

In the operating room (OR), the patient was introduced to the team members and devices that would be present in OR at the time of awakening. The patient was informed about the possible surgical fields near the face and about the field of vision limitation during the awake period. He was also shown the anesthetic materials, heating system, monitoring alarms, laryngeal mask airway, and informed about the mask removal techniques. He also received information about the possible pain and discomfort related to the accesses, monitoring, airway device, Mayfield head holder, and positioning.

Monitoring consisted of cardioscopy, pulse oximetry, capnography, invasive arterial blood pressure and central venous pressure, arterial blood gases, and urine output. Peripheral venous access (14G) and central venous access (16G) were obtained. Antibiotic prophylaxis with cephalothin (1 g) at fixed intervals of three hours and prophylaxis for nausea and vomiting with dexamethasone (10 mg) and ondansetron (8 mg) were administered.

We used the slow induction method with propofol and remifentanil in continuous infusion and neuromuscular block with cisatracurium (0.15 mg.kg⁻¹). Laryngeal mask

was positioned with good adaptation and maintained in controlled ventilation. The surgical team infiltrated the insertion sites of the Mayfield head holder with 0.5% bupivacaine with vasoconstrictor, and the head was positioned approximately 45° from the sagittal axis to the right, in order to facilitate access to the left parietal region.

For skin incision, craniotomy and meninges opening, general anesthesia was maintained with propofol (80–120 mcg.kg⁻¹.min⁻¹) and remifentanyl (0.1–0.2 mg.kg⁻¹.min⁻¹) in continuous infusion for approximately 120 min. At the request of the surgical team, phenytoin (1 g) was administered. After dural incision, the patient had a focal convulsive crisis, with repeated contractions of the left side of the face and right upper limb, which lasted for seconds, self-limited, still in the course of the anticonvulsant.

The infusion of venous anesthetics was discontinued after access to the cerebral cortex and, after 25 min, the patient opened his eyes upon request and was informed about the laryngeal mask airway withdrawal, collaborating with voluntary mouth opening. The patient presented a calm awakening, with no signs of airway discomfort, coughing or agitation. He responded adequately to the requested commands and complained of slight discomfort with the surgical site manipulation and immobilized limbs. After ensuring full consciousness and consistent response to commands, a low dose of morphine (20 mcg.kg⁻¹) and 1% lidocaine without vasoconstrictor (1.5 mg.kg⁻¹) was administered and a slow infusion of remifentanyl (10 mcg.kg⁻¹.min⁻¹) was re-established, which guaranteed satisfactory analgesia during the awake period and kept the patient collaborative. Transient episodes of dysarthria and decreased strength in the right upper limb during stimulation and manipulation allowed delimiting the area for the tumor resection. The patient remained awake for 120 min for mapping and resection of the lesion.

For surgical closure, with the patient still in surgical position, a new induction of general anesthesia was performed with improved doses of propofol and remifentanyl, and a new neuromuscular blockade was performed with a reduced dose of cisatracurium (75 mcg.kg⁻¹) after preoxygenation with bag-valve-mask. The laryngeal mask airway was reinserted, with good adjustment and satisfactory controlled ventilation. General anesthesia was maintained until the end of the procedure under continuous infusion of propofol (80–120 mcg.kg⁻¹.min⁻¹) and remifentanyl (0.1–0.2 mg.kg⁻¹.min⁻¹), and then discontinued. The patient was awakened under spontaneous ventilation and responded to commands. A new dose of morphine (100 mcg.kg⁻¹) and dipyrone (2 g) were given for postoperative analgesia. He was taken conscious, hemodynamically stable and without pain or deficiencies to the Intensive Care Unit, where he remained for two days and was discharged seven days later.

Discussion

Awake craniotomy was introduced for surgical treatment of epilepsy and lesions in eloquent areas of the brain.^{1,5} Complications include seizures, which may occur in 16–18% of patients; nausea and vomiting, seen in

8–50% of cases; respiratory depression; cerebral edema; air embolism; tremors; neurological deficits; and pain that may lead to anxiety and agitation and compromise patient cooperation.^{1,3}

Prevention of complications includes the selection and preparation of the patient, through a bond of trust and clarification on planning and possible adverse events. Contraindications for awake craniotomy include confusion and difficulty in communication, such as severe dysarthria or extreme anxiety. Functional changes such as dysphagia or dysautonomia may compromise the safety of anesthesia under sedation without a well-established airway. Posterior fossa tumors, which require management in prone region, are hardly feasible at the conscious perioperative period. Airway evaluation should predict difficulties in positioning devices in atypical positions or in the face of complications.

In the operating room, describing the setting and the auditory stimuli present in the room when the patient awakens is critical in order to minimize anxiety in this period.

The incidence of seizures during awake craniotomy is variable. Remifentanyl has been less associated with seizures than other opioids.⁵ Propofol has a protective effect against seizures, but its infusion should be discontinued approximately 15 min prior to cortical stimulation.⁴ Phenytoin was administered prior to anesthetic superficialization, in order to prevent a perioperative convulsive crisis. Still, the patient had a focal and self-limiting seizure. The perioperative convulsive crisis and phenytoin administration may have contributed to a prolonged sedation time after discontinuing the anesthetics for the awake time.

The incidence of nausea and vomiting may vary according to the patient's history, lesion type and location, drug administration, and type of anesthesia.^{3,4} Surgical manipulation of the temporal lobe or tonsillar region, meningeal vessels, inadequate analgesia, and hypovolemia may contribute to increase the incidence.⁵ These events were prevented with dexamethasone (10 mg), ondansetron in a folded dose (8 mg) and continuous infusion of propofol, which synergistically promoted a potent antiemetic action.

Laryngeal mask has significant advantages compared to endotracheal tube, including an easier insertion in anomalous positions, no need for laryngoscopy and head extension, and lower incidence of cough or withdrawal reaction.⁴ The laryngeal mask removal with the patient alert, responsive, and spontaneously ventilated minimized complications related to the airway. The application of lidocaine jelly on the surface in contact with the periglottic region, as well as the maintenance with total venous anesthesia, minimized the reaction to the device. We believe that the use of a neuromuscular blocker, even if dispensable for laryngeal mask positioning may have facilitated the mask reintroduction in an anomalous position, in the preparation for surgical closure.

Upon awakening, little discomfort was reported by the patient. The long-acting local anesthetic infiltration at pin sites of the Mayfield head holder may have contributed to a greater tolerance. Other discomforts related to manipulation and positioning were minimized with low doses of morphine and local anesthetic via the venous route. The continuous remifentanyl infusion at low doses (10 mcg.kg⁻¹.min⁻¹) provided comfort associated with full consciousness.

Dexmedetomidine, a highly selective α_2 -agonist, has gained a predilection among anesthesiologists for awake craniotomy, due to its sedative, anxiolytic and analgesic effects, the easily reversible from verbal stimulation and for being poorly associated with respiratory depression. However, due to its still restricted availability in some centers, other options continue to be used with comfort for the patient and low incidence of complications.¹

Conclusion

The technique adopted is similar to the asleep-awake-asleep technique already described, with adaptations to the analgesia in the awake period and use of laryngeal mask. The strategy offers advantages such as access to the airway, allows deep sedation and adequate ventilatory support, and minimizes patient discomfort during periods of greater pain (opening and suturing of skin and meninges). The tranquil awakening and the periglottic device repositioning are the major challenges of the technique. The patient's preanesthetic preparation, as well as the careful choice of drugs,

can minimize complications and is of paramount importance for a successful procedure.

Conflicts of interest

The authors declare no conflicts of interest.

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