



CASE REPORT

LARYNGEAL MASK AIRWAY IN AWAKE CRANIOTOMIES FOR CORTICAL LANGUAGE MAPPING

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ABSTRACT

In order to determine the eloquent cortical areas responsible for speech, motor, primary sensory, or visual cortex the patient must be conscious and able to talk during cortical stimulation. The challenge for the anesthetist is to find a technique which provides adequate sedation, analgesia, and respiratory and hemodynamic control, but also an awake and cooperative patient for neurological testing. Although a craniotomy can be performed under local anesthesia, the patient will better tolerate the procedure if removal of the bone flap is performed under general anesthesia. We reported our experience with four adult patients who underwent cranial surgery concerning the dominant hemisphere. These patients had an asleep-awake-asleep technique. During asleep phase, lungs were ventilated with 50 % N₂O in O₂ via laryngeal mask airway and infusion of propofol and alfentanil was done. During awake cortical mapping, alfentanil infusion was continued and oxygenation was maintained via a nasal cannula. We concluded that the use of laryngeal mask airway together with propofol-alfentanil anesthesia may be an alternative technique for conscious cortical stimulation mapping procedures.

Keywords: Anesthetic technique, Awake craniotomy; Brain mapping; Conscious sedation; Laryngeal mask airway; Opioids,alfentanil; Propofol; Stimulation, cortical

UYANIK KRANIYOTOMİLERDE KORTİKAL BEYİN HARİTALANDIRILMASINDA LARİNGEAL MASKE KULLANIMI

ÖZET

Kortikal stimülasyon sırasında beynin hassas alanlarını haritalandırabilmek için hasta bilinçli ve konuşur durumda olmalıdır. Lokal anestezi altında kraniyotomi yapılabilirse de, kemik flebin genel anestezi altında kaldırılması hasta tarafından daha iyi tolere edilir. Biz, dominant hemisfer- temporal veya pariyeto-okspital lob cerrahisi geçiren 4 yetişkin hastadaki tecrübelerimizi bildiriyoruz. Uyanık kortikal beyin haritalandırılması işlemi sırasında propofol-alfentanil infüzyonu ile laringeal maske kullanımı alternatif bir anestezi tekniğidir.

Anahtar Kelimeler: Kortikal haritalandırma stimülasyonu, kraniyotomi, laringeal maske, bilinçli-sedasyon anestezi

INTRODUCTION

Awake craniotomy allows cortical mapping with patient cooperation and helps to prevent neurological dysfunction during brain tumour resection. Language mapping techniques with intraoperative cortical stimulation are performed during epilepsy surgery or resection of tumors involving the frontal, parietal and temporal lobes of the dominant hemisphere¹⁻⁹.

In order to determine the eloquent cortical areas responsible for speech, motor, primary sensory, or visual cortex the patient must be conscious and

able to cooperate and talk during cortical stimulation⁷. Although this technique enables the surgeon to perform a precise functional mapping of the cortex, it exposes the patient to several potential hazards such as convulsions, pain, lack of cooperation, excessive sedation resulting in hypoxemia and hypercarboxemia, nausea and vomiting⁸. We reported our experience with four adult patients who had craniotomy under general anesthesia, they were easily awakened for the language evaluation during cortical mapping, and were re-anesthetized for the surgical closure.

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CASE REPORT

Demographic features and operations of the four patients are given in Table I. Patients were premedicated with atropine 0.5 mg i.m. 30 minutes prior to surgery. Anesthesia was induced with propofol 2 mg.kg⁻¹, alfentanil 0.02 mg.kg⁻¹ and ondansetron 0.1 mg.kg⁻¹ i.v. Neuromuscular blockade was done with vecuronium bromide 0.1 mg.kg⁻¹ i.v. After the demonstration of a complete muscle paralysis with a peripheral nerve stimulator; laryngeal mask airway (LMA) size 4 (for woman) or 5 (for man) was inserted to maintain the airway. Then, continuous infusion of propofol (started with an initial rate of 10 mg.kg⁻¹h⁻¹, and subsequently reduced to 5 mg.kg⁻¹h⁻¹) and alfentanil (20 µg.kg⁻¹h⁻¹) was started. Lungs were ventilated with 50 % N₂O in O₂ via the LMA prior to cortical mapping for language assessment. Heart rate, invasive arterial blood pressures, peripheral O₂ saturation, end-tidal CO₂ and body temperature were monitorized. The patients were placed in the right lateral position with a doughnut

for the head. After craniectomy was performed by a neurosurgeon, neostigmine 0.03 mg.kg⁻¹ and atropine 0.01 mg.kg⁻¹ i.v. were administered for the reversal of neuromuscular blockade. The propofol infusion rate was gradually decreased and later stopped when the patients started to breath spontaneously. Following the removal of the LMA, oxygenation was maintained via a nasal cannula. All patients were awake, able to talk and recognize objects within 15 minutes following the removal of the LMA. During cortical mapping, alfentanil infusion (0.01 mg.kg⁻¹h⁻¹) was continued. Functionally eloquent cortical sites for language were determined as previously described^{1,2,10}. All patients tolerated the mapping procedure with full cooperation, stable hemodynamic parameters, and were re-anesthetized with intravenous propofol. Muscle relaxation was achieved with vecuronium bromide. The LMA was reinserted without any complication in all patients and positive pressure ventilation continued till the end of surgery.

Table I. Demographic features and operations of patients

Patient	Age (yr)	Sex	Body Weight (kg)	Operation	Duration of operation (minute)
1	31	M	80	Left temporal lobectomy	315
2	52	F	93	Left fronto-temporal tumour resection	210
3	47	M	76	Left parieto-occipital tumour resection	280
4	58	M	71	Left parieto-occipital tumour resection	295

Arterial blood gas analysis was performed before the induction of anesthesia (pre-LMA), at the 15th minute of the beginning of the mechanical ventilation after first insertion of LMA (post-LMA), at the 15th minute after the removal of the

LMA, (before mapping) and at the 15th minute of the beginning of the mechanical ventilation after second insertion of LMA (second-LMA). Arterial blood gas values is given in Table II.

Table II: Intraoperative arterial blood gas values

	pH	PaCO ₂	PaO ₂	SpO ₂	pH	PaCO ₂	PaO ₂	SpO ₂	pH	PaCO ₂	PaO ₂	SpO ₂	pH	PaCO ₂	PaO ₂	SpO ₂
Pre-LMA	7.45	34	295	99.9	7.38	34	175	99.5	7.40	32	235	99.9	7.42	30	215	99.2
Post-LMA	7.41	30	192	99.7	7.37	28	205	99.6	7.40	28	205	99.5	7.40	36	195	99.5
Before mapping	7.43	38	195	99.2	7.47	35	203	99.8	7.43	35	198	99.7	7.37	28	210	98.9
Second LMA	7.41	42	198	99.3	7.39	41	215	99.5	7.38	38	225	99.0	7.38	41	205	98.5

Pre-LMA; before the induction of anesthesia

Post-LMA; at the 15 minute of mechanical ventilation after the first insertion of LMA

Before mapping; **just before the mapping procedure**

Second LMA; at the 15 min of mechanical ventilation after the second insertion of LMA.

Partial pressures values of gases were given as mmHg.



DISCUSSION

The identification of the sensorio-motor strip is an essential step in many cortical resections. It is best determined by electrical stimulation under local anesthesia or sensory evoked potentials under general anesthesia. For the last 20 years, surgical interventions for the treatment of epilepsy have been carried out in conscious patients under local anesthesia¹¹. Each neurosurgical center seems to establish its own anesthesia technique for awake craniotomies^{3,10,12-14}. Generally, local anesthesia, conscious-sedation anesthesia, or monitored anesthesia care are preferred⁴⁻¹⁰. However, there is a potential risk for the patient to become uncooperative and agitated, and to object to the continuation of the procedure. Therefore, goal is to render the patient alert, cooperative and participative in verbal and motor testing when indicated. During conscious sedation, the intraoperative problems encountered include convulsions, excessive sedation, respiratory depression, nausea and vomiting, pulmonary aspiration, tightness of the brain, and local anesthetic toxicity^{3,5,10,15}. The anesthesiologist should adequately control sudden bursts of epileptic activity and may have to administer a general anesthetic to permit termination of the procedure. Respiratory depression under conscious-sedation anesthesia is an untoward effect associated with the use of high dose narcotics and / or sedatives. Hypoxia and hypercarbia have adverse effects on cerebral circulation leading to increase in the tightness of brain; so the objective, to insert LMAs in the presented cases, was to establish a patent and secured airway enabling normoventilation. More commonly, patients experience nausea or vomiting which may be exacerbated during surgical stimulation, by the stripping of the dura or temporal lobe, or by the manipulations of the meningeal vessels. This is an important issue in heavily sedated patients leading deleterious effects. Considering these limitations, general anesthesia provides optimal conditions for the surgeon, a stable and safe conditions for the patient. These restrictions aside, local anesthesia remains a useful technique when approaching an epileptogenic lesion or tumor mass in eloquent areas such as the motor and speech areas. Although in a retrospective review done by Archer et al, patients undergoing craniotomy for surgical treatment of epilepsy with conscious-sedation anesthesia, had no perioperative morbidity or mortality related to anesthesia; in a prospective study done by Sarang and Dinsmore

revealed that pain, agitation, excessive sedation and inability to perform cooperation could be seen as a complication^{3,8}. In our experience with four adult patients who had craniotomies under general anesthesia, they were easily awakened for the language evaluation during cortical mapping and were re-anesthetized after the procedure. During surgery in which cortical mapping was indicated, endotracheal intubation was not suitable since extubation of the trachea for mapping and reintubation would be dangerous and even impossible. Therefore the risks of loss of the airway and pulmonary aspiration might be minimized using the LMA¹⁶⁻¹⁸. One can argue about the possible risk of pulmonary aspiration with the use of LMA. In a prospective survey of the use of LMA in 2359 patients, the incidence of regurgitation was reported to be 0.08 %¹⁹. In all of our patients gastric decompression was accomplished prior to LMA insertion and after its removal. Use of the LMA also enables rapid induction of general anesthesia and control of the airway in the event of tonic-clonic seizure during stimulation cortical mapping procedures.

Anesthesia with propofol and alfentanil allowed a rapid return of cognitive functions and protective airway reflexes at the time of mapping procedure after propofol infusion was discontinued. Considering a complete and rapid recovery from anesthesia is essential for functional testing during awake craniotomies, propofol is the most suitable hypnotic agent for this purpose. Propofol may also facilitate LMA insertion by inducing greater jaw and upper airway relaxation²⁰⁻²². A success rate of 94 % for LMA insertion was achieved with propofol alone²³. Numerous case reports with or without the use of electroencephalography (EEG) have documented that propofol has both pro- and anti-convulsant effects. This agent seems particularly useful for the treatment of refractory epilepsy. The effects of propofol on EEG are not different from those of other intravenous sedative hypnotic drugs; this agent induces dose-dependent changes in the EEG¹¹. Skin incision and craniectomy were the most painful phases of this operation. In our cases, lungs were ventilated with 50 % N₂O in O₂ via the LMA prior to cortical mapping for language assessment and analgesic property of N₂O had an additive analgesic effect to alfentanil. Therefore the total amount of alfentanil infused in our cases was lesser than the amount used by Welling and Donegan during awake craniotomy with neuroleptanalgesia¹². We did not observe any respiratory or hemodynamic problems during our procedures. All of the



patients tolerated the mapping procedure easily and the neurosurgeons were more contented with this technique compared to the conscious-sedation anesthesia.

We conclude that anesthesia with continuous infusion of propofol-alfentanil combined with the use of the LMA may be an alternative anesthetic technique for awake craniotomies for cortical mapping.

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