CASE REPORT

LARYNGEAL MASK AIRWAY IN AWAKE CRANIOTOMIES FOR CORTICAL LANGUAGE MAPPING

Nigar Baykan1, Binnaz Ay2, İ.Varlık Doğan2, Arzu Gerçek1
1Department of Anesthesiology, Institute of Neurological Science, Marmara University, Istanbul, Turkey 2Department of Anesthesiology, School of Medicine, Marmara University, Istanbul, Turkey

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 % \( \text{N}_2\text{O} \) in \( \text{O}_2 \) 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

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 hemisphere. 1-9. 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 stimulation. 7 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 vomiting. 8 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.
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⁻¹.h⁻¹, and subsequently reduced to 5 mg.kg⁻¹.h⁻¹) and alfentanil (20 µg.kg⁻¹.h⁻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 monitored. 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⁻¹.h⁻¹) was continued. Functionally eloquent cortical sites for language were determined as previously described. 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>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>Body Weight (kg)</th>
<th>Operation</th>
<th>Duration of operation (minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>M</td>
<td>80</td>
<td>Left temporal lobectomy</td>
<td>315</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>F</td>
<td>93</td>
<td>Left fronto-temporal tumour resection</td>
<td>210</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>M</td>
<td>76</td>
<td>Left parieto-occipital tumour resection</td>
<td>280</td>
</tr>
<tr>
<td>4</td>
<td>58</td>
<td>M</td>
<td>71</td>
<td>Left parieto-occipital tumour resection</td>
<td>295</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>PaCO₂</th>
<th>PaO₂</th>
<th>SpO₂</th>
<th>pH</th>
<th>PaCO₂</th>
<th>PaO₂</th>
<th>SpO₂</th>
<th>pH</th>
<th>PaCO₂</th>
<th>PaO₂</th>
<th>SpO₂</th>
<th>pH</th>
<th>PaCO₂</th>
<th>PaO₂</th>
<th>SpO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-LMA</td>
<td>7.45</td>
<td>34</td>
<td>295</td>
<td>99.9</td>
<td>7.38</td>
<td>34</td>
<td>175</td>
<td>99.5</td>
<td>7.40</td>
<td>32</td>
<td>235</td>
<td>99.9</td>
<td>7.42</td>
<td>30</td>
<td>215</td>
<td>99.2</td>
</tr>
<tr>
<td>Post-LMA</td>
<td>7.41</td>
<td>30</td>
<td>192</td>
<td>99.7</td>
<td>7.37</td>
<td>28</td>
<td>205</td>
<td>99.6</td>
<td>7.40</td>
<td>28</td>
<td>205</td>
<td>99.5</td>
<td>7.40</td>
<td>36</td>
<td>195</td>
<td>99.5</td>
</tr>
<tr>
<td>Before mapping</td>
<td>7.43</td>
<td>38</td>
<td>195</td>
<td>99.2</td>
<td>7.47</td>
<td>35</td>
<td>203</td>
<td>99.8</td>
<td>7.43</td>
<td>35</td>
<td>198</td>
<td>99.7</td>
<td>7.37</td>
<td>28</td>
<td>210</td>
<td>98.9</td>
</tr>
<tr>
<td>Second LMA</td>
<td>7.41</td>
<td>42</td>
<td>198</td>
<td>99.3</td>
<td>7.39</td>
<td>41</td>
<td>215</td>
<td>99.5</td>
<td>7.38</td>
<td>38</td>
<td>225</td>
<td>99.0</td>
<td>7.38</td>
<td>41</td>
<td>205</td>
<td>98.5</td>
</tr>
</tbody>
</table>

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 anesthesia. Each neurosurgical center seems to establish its own anesthesia technique for awake craniotomies. Generally, local anesthesia, conscious-sedation anesthesia, or monitored anesthesia care are preferred. 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. 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 circulation leading to increase in the tightness of brain; so the objective, to insert LMAs in the

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 relaxation. A success rate of 94% for LMA insertion was achieved with propofol alone. 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 intractable 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 EEG. 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 stimulation cortical mapping procedures.

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Nigar Baykan, et al.
Marmara Medical Journal 2004;17(1);133-136

As a complication, 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 LMA. 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%. 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 care are preferred 4-10. 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. 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...
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.

REFERENCES