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Case report

The use of continuous positive airway pressure during an awake craniotomy in a patient with obstructive sleep apnea

Tessa Huncke MD (Clinical Associate Professor)[a,*], Jenny Chan MD (Resident)[a], Werner Doyle MD (Associate Professor)[b], Jung Kim MD (Assistant Professor)[a], Alex Bekker MD (Associate Professor, Director)[a]

[a]*Department of Anesthesiology, New York University Medical Center, Rusk Institute, New York, NY 10016, USA*
[b]*Department of Neurosurgery, New York University Medical Center, New York, NY 10016, USA*

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Abstract We describe the anesthetic management of a morbidly obese patient with obstructive sleep apnea who underwent awake craniotomy. The patient's personal continuous positive airway pressure (CPAP) machine was used to support ventilation intraoperatively. Dexmedetomidine was used as the primary sedative. During cortical mapping, the CPAP was discontinued. The patient was comfortable and able to cooperate with language testing.

1. Introduction

Intracranial surgery involving resection of a lesion adjacent to language areas of the brain may require the patient to be awake so that intraoperative cortical mapping of language and motor areas can be performed. The anesthetic challenge in these cases is to provide anesthesia during periods of intense surgical stimulation and have a fully cooperative patient available for functional testing.

Airway compromise is one of the most serious complications of anesthesia during an awake craniotomy [1-4]. Because of concern about the possibility of airway obstruction, many clinicians consider a history of obstructive sleep apnea (OSA) to be a relative contraindication for an awake craniotomy.

Patients with OSA are at an increased risk of apnea during the administration of even small doses of sedative and analgesic agents [5]. Continuous positive airway pressure (CPAP) allows for the more liberal use of opioids and sedatives postoperatively in patients with OSA [6]. The present report examines the intraoperative use of CPAP during an awake craniotomy.

2. Case report

A 62-year-old woman with a 20-year history of a medically refractory seizure disorder was scheduled for a partial left temporal lobectomy. Because preoperative Wada testing showed left hemisphere language dominance, the patient was scheduled for an awake craniotomy with intraoperative language mapping.

Her medical history was significant for OSA that required nighttime CPAP. She also had morbid obesity, with a body

* Corresponding author. Tel.: +1 212 263 5072.
E-mail address: jkhuncke@msn.com (T. Huncke).

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mass index of 45.8 kg/m^2, asthma, a 90-pack-year history of smoking, aortic stenosis, previous myocardial infarction, gastroesophageal reflux disease, hyperlipidemia, noninsulin-dependent diabetes, renal insufficiency, and depression. Airway evaluation showed a Mallampati class III airway. Despite a significant risk of periopera- tive complications, the patient wished to proceed with the operation.

The plan was monitored anesthesia care with CPAP and a field block at the incision site. A loading dose of dexmedetomidine at 0.4 μg/kg was given for 20 minutes followed by a maintenance rate at 0.1 μg/kg per hour. During administration of the loading dose of dexmedetomidine, the patient was placed on CPAP at 10 cm H_2O with an inspired oxygen concentration (FIO_2) of 30%. A scalp block was performed using 30 mL of 0.5% bupivacaine. The patient was then placed in a right semilateral position using a left shoulder roll. The head was supported by a horseshoe-shaped gel roll.

The patient was maintained on dexmedetomidine 0.1 to 0.2 μg/kg per hour, which was titrated to comfort and a spontaneous respiratory rate of 10 to 12 breaths per minute. The patient was mildly sedated but was responsive to verbal commands. She did not complain of pain at that time. Approximately 90 minutes into the procedure, awake speech mapping was begun, and the CPAP was discontinued to allow for verbal testing. Her oxygen saturation (SpO_2) off CPAP was 90% to 93%. After completion of the cortical mapping, CPAP was restarted. During cortical resection, the patient began to complain of a headache. A remifentanil infusion at 0.025 μg/kg per minute was begun, and her CPAP was increased to 15 cm H_2O. The patient remained responsive to a loud voice despite an increase in the level of sedation. Arterial blood gas analysis during the remifentanil and dexmedetomidine infusion showed a $PaCO_2$ of 44 mmHg and a PaO_2 of 89 mmHg. The patient was comfortable, with an SpO_2 of 96% to 97% through the remainder of the procedure.

3. Discussion

The current trend in awake craniotomy is to use the "asleep-awake-asleep" technique [2,7]. A Laryngeal Mask Airway (LMA) or endotracheal tube is advocated during the "asleep" portion of the procedure. Although general anesthesia has been recommended [7], insertion of an endotracheal tube in our patient might have been extremely difficult because of her multiple risk factors. If initial intubation is difficult, then reintubation after speech mapping is likely to be challenging in a patient whose access is limited by surgical drapes and positioning.

The LMA is particularly useful for asleep-awake-asleep craniotomies because of the ease of reinsertion for the closing portions of the surgical procedure [8,9]. However, their elective use as the primary means of controlling the airway of a morbidly obese patient is controversial. LMAs may not protect the airway from aspiration. Spontaneous ventilation with an LMA may be inadequate when there is decreased chest wall compliance. In addition, the ventilatory response to carbon dioxide and hypoxemia may be blunted by sleep apnea [5,10]. Attempts to correct the problem by assisting or controlling ventilation may be unsuccessful because of air leakage around the LMA balloon when high airway pressures are generated with positive pressure.

Using the patient's personal CPAP machine has several advantages. Familiarity with the device may reduce anxiety. The patient is ensured of a mask fit that optimizes comfort and facilitates rest during natural sleep. The optimal level of pressure necessary to prevent airway collapse was established preoperatively during a sleep study. Although CPAP can interfere with venous return leading to a "tight" brain, the maintenance of a relatively normal arterial Co_2 with CPAP in our patient might have counterbalanced any deleterious effect on cerebral venous outflow.

The semilateral position also might have improved our patient's ventilation. A recent study of OSA patients during general anesthesia showed improvement in the cross-sectional area of the pharynx when the patient was turned from a supine to a lateral position [11]. The beneficial effects of electively placing a patient with OSA in the lateral position must be weighed against the suboptimal positioning for emergent intubation if clinical circumstances arise.

A variety of agents have been used successfully in awake craniotomy [1,3,4,8,9,12]. We elected to use dexmedetomidine for anesthetic maintenance. During a dexmedetomidine infusion, patients are sedated but can be awakened with verbal stimulation. Dexmedetomidine has a greater opioid-sparing effect than does propofol [13]. Its perioperative use in a morbidly obese patient undergoing gastric bypass surgery led to a dramatic reduction in the need for postoperative opioids [14]. Moreover, it does not interfere with language testing, and it has been used successfully during awake craniotomies [9]. In a recent case report, dexmedetomidine was used as a rescue agent during an awake craniotomy when propofol and remifentanil infusions failed to treat the patient's pain and led to excessive hypoventilation and sedation [15].

The dexmedetomidine infusion did not completely suppress our patient's discomfort. A headache did develop during cortical resection that could not be relieved by additional injections of local anesthesia. In an effort to maintain wakefulness, we elected to begin a low-dose remifentanil infusion instead of increasing the dexmedetomidine. The patient's decreased respiratory effort because of remifentanil was managed easily by increasing the level of CPAP.

The need to convert to general anesthesia is always a possibility during an awake craniotomy. We used a gel roll rather than a rigid cranial fixation device to position the patient's head. This arrangement would have allowed us

easily to manipulate the airway. If the patient became unresponsive or unstable, our plan was to perform a nasal fiberoptic intubation. The possibility of a surgical airway was discussed with the patient.

4. Conclusion

Although our case report illustrates an uncommon clinical scenario, many patients have morbid obesity and OSA. Intraoperative use of CPAP during conscious sedation may allow for the more liberal use of sedatives to improve patient comfort and prevent the airway collapse that is common in patients with OSA.

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