Awake craniotomy using a modified nasal airway, propofol, and remifentanil in an adolescent.

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Introduction

It is now possible to map areas of proposed brain resection. If these are near speech and motor regions, intraoperative stimulation may prevent permanent injury while allowing a more complete resection (1). This requires an awake, cooperative patient to assess motor and verbal response. We describe the first reported case of an awake craniotomy, in an adolescent, using only a nasal airway, remifentanil and propofol.

Case report

Our patient, a thirteen-year-old boy with intractable partial complex seizures, had left parietal lobe focal cortical dysplasia. The planned procedure was left parietal craniotomy with resection of seizure foci. The proposed resection was close to language and motor areas, requiring awake intraoperative language and motor testing.

Preoperative evaluation revealed a healthy adolescent, on oxcarbazepine, who had no other significant history. Airway evaluation appeared normal as were pre-operative labs and vital signs. Oxymetazoline drops were placed in both nares.

In the operating room, standard monitors were applied and patient comfort was assured. After, intravenous line placement, two separate infusions were started: remifentanil (R) at 0.1 micrograms per kilogram per minute (ug/kg/min) and propofol (P) at 100 ug/kg/min. After five minutes, the patient was asleep and comfortable. A second intravenous line and radial arterial line were placed. A nasal airway with an endotracheal tube connector inside of it was inserted into the right nares without difficulty or discomfort and connected to the anesthesia machine circuit. Oxygen at four liters per minute was begun. Local anesthesia was administered by the surgeon using plain 0.125% bupivacaine at the incision and head pin sites. Vital signs remained stable and without airway obstruction. Dexamethazone, ondansetron, metoclopramide, ranitidine, and glycopyrolate were all given in the early part of the procedure. Insertion of the head pins was well tolerated. Therefore, the infusions were reduced to (R) 0.05 ug/kg/min and (P) 50 ug/kg/min.

Thirty minutes before testing, (P) and (R) were sequentially decreased to zero for (P) and (R) to 0.02 ug/kg/min. Within ten minutes, the patient was arousable, appropriate and following commands. He reported discomfort only for the nasal airway, which was removed. Intraoperative language and motor testing along with stimulation of proposed resection areas required nearly two hours. Five episodes of epileptic activity, were induced, confirmed by electrocorticography and the patient. All episodes resolved within thirty seconds using ice water irrigation of the brain surface.

The infusions were increased to (R) 0.035 ug/kg/min and (P) 50 ug/kg/min prior to closure of the craniotomy. The nasal airway was not reinserted but an oxygen facemask was substituted. Mannitol, ondansetron, fosphenytoin, and dexamethasone were given. Morphine sulfate was given when starting skin closure. (P) was turned off after skin closure. (R) was turned off after the dressing was applied. The patient was awake, comfortable, alert within ten minutes. He had an uneventful recovery room stay and later discharged to the pediatric intensive care unit.

Following an uneventful night, the patient was discharged home on the third postoperative day free of seizures and on no medications. The patient experienced a minor proprioceptive defect, which the surgeon regarded as minor, expected and temporary. Follow-up visit two weeks later revealed no seizure activity and normal proprioception.

Discussion

The use of awake craniotomy for seizure foci resection is increasing since a complete resolution of seizures without increasing neurological deficit is possible (2). This requires an “asleep, awake, asleep” anesthesia technique to produce an awake, comfortable, patient to cooperate with intraoperative testing.

Remifentanil and propofol were selected due to their short half-lives and ease of titration. Both drugs are powerful respiratory depressants particularly when using them concurrently. One should be vigilant for hypoventilation, apnea, and chest wall rigidity. Postoperative pain control should begin before conclusion of the remifentanil infusion.

Several options are available for airway management of awake craniotomy including endotracheal intubation, (LMA), and natural. The combination of a natural and nasal airway was selected since it is less invasive and can reduce upper airway obstruction while avoiding intubation and subsequent extubation for intraoperative testing.

Adverse events during pediatric awake craniotomy can include nausea, intraoperative anxiety, seizures, and brain engorgement. Archer performed a retrospective review of 354 patients with intractable epilepsy that received conscious sedation for craniotomy (3). The most frequent problems were convulsions, nausea, excessive sedation, and "tight brain".

Nausea and/or vomiting may result in significant morbidity. We chose to reduce this risk, by administering ranitidine, ondansetron, metoclopramide, dexamethasone, and glycopyrrolate.

Appropriate patient selection is critical to success. Detailed pre-operative explanation of the anesthesia plan is imperative. Despite this, uncontrollable anxiety can still occur. Our first strategy, had this occurred, would be to reassure the patient followed by increasing (P) and/or (R). This would be followed by laryngeal mask airway (LMA) placement or endotracheal intubation.

Intraoperative seizures took place but resolved quickly with the application of ice water irrigation and discontinuation of stimulation. No medications were needed and the patient was cooperative throughout these events. Fosphenytoin was administered at the end of the procedure for postoperative seizure prophylaxis. Had it been necessary, we were prepared to give intravenous midazolam and/or propofol followed by endotracheal intubation.

Brain engorgement is a possible risk during this procedure. We would initially treat this with hyperventilation, mannitol, decreasing venous pressure, and if needed, cerebrospinal fluid drainage. While challenging in an awake patient with a natural airway, we planned to encourage the patient to hyperventilate along with slightly reducing the infusions of (R) and (P). If ineffective, we would have converted to endotracheal intubation with positive pressure ventilation.

Experience is limited in the pediatric population using an "asleep, awake, asleep" technique for awake craniotomy. Recently, dexmedetomidine was used along with a (LMA), sevoflurane, remifentanil, and nitrous oxide for resection of seizure foci in two adolescents (4). Tobias has described a technique using predominantly propofol and a nasal cannula for tumor resection in an adolescent (5). McDougall describes a technique using midazolam, fentanyl, propofol, and a nasal airway in an adolescent undergoing epilepsy surgery (6). In the adult population, Berkenstadt used clonidine premedication along with remifentanil, propofol, and labetolol in twenty-five patients with a mean age of fifty (7).

In summary, we have described our management of awake craniotomy using a natural airway, remifentanil, and propofol for the treatment of intractable epilepsy in an adolescent.

References

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