

CASE REPORT

Anesthesia in Awake Craniotomy: Advantages of Dexmedetomidine Infusion over Conventional Methods

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ABSTRACT

Background/objectives: Dexmedetomidine, an α 2 agonist used as infusion with scalp block, is a good adjuvant with analgesic, anxiolytic, and sedative effect with minimal effects on hemodynamic changes and respiration depression. In this study, we report the efficacy of dexmedetomidine for awake craniotomy.

Materials and methods: Three American Society of Anesthesiologists grade 2 patients were posted for tumor resection under awake craniotomy. Scalp block was given with local anesthetic and dexmedetomidine bolus dose of 1 μ g/kg/hr followed by 0.2 to 0.4 μ g/kg/hr. The patient's speech was monitored by oral questionnaire, motor strength by hand squeezing, and sedation by modified Ramsay Hunt Score.

Results: Bolus dose of 1 μ g/kg over 20 minutes infusion of 0.2 to 0.4 μ g/kg/hr is a good adjuvant with scalp block with minimal hemodynamic changes.

Conclusion: Dexmedetomidine is a useful adjuvant during awake craniotomy for tumor resection. It has minimal effect on hemodynamics and respiratory system. It can be used in procedures where cooperation of the patient is required intraoperatively.

Keywords: Awake craniotomy, Dexmedetomidine, Neuroanesthesia, Scalp block.

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INTRODUCTION

Anesthesia for intracranial procedures which requires patient cooperation presents a difficult situation for the surgeons and anesthetist.^{1,2} Anesthetic drugs used should provide adequate level of anesthesia but should not

interfere with functional testing and cortical mapping.^{1,2} In this study, we describe the use of dexmedetomidine infusion and scalp block for awake craniotomy.^{1,2} Studies have shown better improvement in efficacy and safety in intracranial procedures with primary and metastatic tumor resection using awake anesthesia techniques.²⁻⁵ Surgical goals of awake craniotomy, although plenty in number, have been met with modification in the techniques and with the introduction of newer anesthetic agents used for the procedures.²⁻⁵ Dexmedetomidine is a highly specific A2 adrenoceptor agonist with sedative, analgesic, anxiolytic properties without respiratory depression.⁶ Dexmedetomidine decreases the need of analgesia and produces a kind of sedation that patients can be easily roused by verbal stimuli.⁷

MATERIALS AND METHODS

We reported three cases of awake craniotomy done in our institute. Two male patients of 55 to 58 years were posted for insular glioma excision and the third case was a female of 45 years posted for excision of the tumor in the left parietal lobe.

The first case presented with a history of five to six episodes of seizures in the past 2 months. His neurological examination was normal. Other systems were normal. His routine blood investigations, coagulation profile chest X-ray, and electrocardiogram were normal. His computerized tomography scan showed insular glioma near the speech area. The second case presented with a history of projectile vomiting, severe headache, and three episodes of seizures since 15 days. His neurological examination was normal; there was no extracranial involvement. His investigations were normal. There was glioma in the temporoparietal region. The third case presented with weakness of the right side of the body since 2 months. Examination revealed neurological deficit on the right side of the body. Cranial nerves were within normal limit. All other systems were normal; investigations were within normal limits. Computerized tomography (CT) scan revealed oligodendroglioma in the parietal lobe.

All the three patients were explained regarding the awake craniotomy, its advantages, and their cooperation during the surgery. They were adequately premedicated with diazepam 5 mg and ondansetron 40 mg on the day before surgery. Informed consent was taken. On the

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day of surgery, all standard monitors were connected, O₂ 4 L/min was administered by face mask, sidestream end-tidal CO₂ monitor was kept under the face mask, and temperature monitoring probe was kept under the axilla. Two 16 g intravenous cannulas were inserted. They were premedicated with 1 mg of midazolam and 0.2 mg glycopyrrolate, 50 µg of fentanyl and dexmedetomidine; 1 µg/kg body weight was given over a period of 20 minutes as bolus dose. Arterial line inserted in the radial artery and scalp block was given with 25 mL of 0.5% bupivacaine and 20 mL of 1.5% xylocaine with adrenaline. Scalp pins were inserted after giving 50 µg of fentanyl. There was minimal increase in hemodynamic response during the scalp pin insertion in all the 3 cases. Later, dexmedetomidine infusion was continued with 0.2 to 0.4 µg/kg/hr. During the surgery, the patients' speech was assessed by oral questionnaire, motor strength of the limb was monitored by squeezing the hands of the anesthesiologist, sedation was assessed by Ramsay Hunt sedation score. The score was between 2 and 3, the patients were asleep but arousable. All the patients were hemodynamically stable throughout the procedure. There was minimal blood loss in all the cases, which was corrected by intravenous fluids.

RESULTS

Three cases were posted for tumor resection. The average age of the patient was 49.33 years. All the patients were of American Society of Anesthesiologists grade 2. The average duration of the surgery was 6.5 hours. All the patients were hemodynamically stable throughout the procedure. Dexmedetomidine was given as 1 µg/kg bolus followed by 0.2 to 0.4 µg/kg/hr. The sedation score was between 2 and 3 most of the time; however, in one of the patients the sedation score went to 4. In that patient, dexmedetomidine infusion was kept at 2 µg/kg/hr, and then the sedation score was between 2 and 3, asleep but arousable. One of the patients whose duration of the surgery was 8 hours 30 minutes started complaining of pain at the end of surgery. So, fentanyl 50 µg was given and local infiltration with 2% xylocaine with adrenaline was given. The patient was then comfortable with no pain.

DISCUSSION

Awake craniotomy is quite challenging to the anesthesiologist due to the unprotected airway and limited access to the patient.¹ Patient selection is very important; they must be cooperative to understand the advantages of awake craniotomy and should be able to lie still for long hours.¹ Obese patients, patients with sleep apnea, patients with reflux esophagitis and difficult airway are not good candidates for awake craniotomy.¹

During awake craniotomy, assessment of the motor skills and speech increases the efficacy of resection of the primary and malignant tumor and also improves the prognosis of the patient.⁸⁻¹⁰ Various methods of anesthetic techniques and different drugs have been used to achieve the surgical goals.¹¹⁻¹⁴ During awake craniotomy, one should provide adequate analgesia and anesthesia such that the patient should be asleep and comfortable and easily arousable on command.^{14,15} The anesthetic technique should avoid respiratory depression, airway obstruction, coughing and hypercarbia, and acute hemodynamic changes.^{14,15} There are two techniques for awake craniotomy: First one is asleep-awake-asleep technique and the other one is monitored anesthesia care.¹⁶ In asleep-awake-asleep technique, the patient is anesthetized in the first half of the surgery; he is awake at the time of resection of vital structures and again anesthetized after the resection.¹⁶ In monitored anesthesia care technique, local anesthesia is given to block the scalp nerves and sedation is given such that patient is asleep but arousable.¹⁶ The scalp block is given to block zygomaticotemporal, supraorbital, supratrochlear, greater occipital, and lesser occipital nerves on both sides.¹⁶ Satisfactory and safe nerve blocks are given with long-acting local anesthetics in sufficient amount with no cardiac toxicity and neurotoxicity.¹⁷

Ropivacaine and levobupivacaine are preferred more than levobupivacaine in view of cardiotoxicity.¹⁸ Local anesthetics with adrenaline are preferred in view of decreased absorption of local anesthetics and prolonged duration of effects.¹⁹ In our study, the scalp was blocked with 25 cc of 0.5% bupivacaine and 20 cc of 1.5% xylocaine with adrenaline.¹⁹ If general anesthesia is used in surgeries where cortical mapping has to be done, volatile anesthetics should be avoided.^{20,21} Volatile anesthetics cause concentration-dependent distortion of electrocorticography, with consequent inaccuracies in seizure focus identification.²² Opioids and propofol also have concentration-dependent effect on electrocorticography.²²

In a retrospective analysis by Sarang and Dinsmore²³ in which they analyzed three techniques i.e., sedation with propofol, midazolam, fentanyl and droperidol, asleep-awake-asleep technique with propofol infusion and laryngeal mask airway for spontaneous airway and remifentanyl and third method with intermittent positive pressure ventilation with laryngeal mask airway. They reported that in all these techniques, though the patients were comfortable, intraoperative testing was difficult due to heavy sedation.²³ Propofol used via syringe pump is widely used for awake craniotomy as it can be easily titratable and the patient can be easily arousable with clear headache.^{14,15} It decreases the cerebral metabolic rate, decreases cerebral blood flow, and has anticonvulsant and antiemetic effect.²⁴

Opioids cause sedation with respiratory depression leading to hypercarbia which leads to brain edema.^{23,25} This interferes with providing awake and cooperative patient. Intraoperative use of opioid is unnecessary as manipulation of brain is painless. Pain associated with craniotomy is at the incision site and meninges.^{23,25} In our patients, we used fentanyl 50 µg and 1 mg midazolam before placing arterial line. Dexmedetomidine bolus dose of 1 µg/kg/min was given over 20 minutes and continuous infusion started at the rate of 0.2 to 0.4 µg/kg/hr; fentanyl 50 µg was repeated before skull pin insertion. There were no significant hemodynamic changes during scalp pin insertion and craniotomy.

In a comparative study by Costello and Cormack,²⁶ clonidine, an α₂ receptor agonist used as premedication, significantly decreased the hemodynamic response to intubation and skull pin insertion. Dexmedetomidine, a highly selective α₂ receptor agonist, is a pharmacologically active isomer of medetomidine.²⁷ It decreases the firing of locus coeruleus neurons due to hyperpolarization by its agonistic action on the α₂ adrenoceptor.²⁷ Even at a very high rate of infusion, dexmedetomidine does not depress the ventilation.²⁷ It reduces intraoperative and postoperative anesthetic requirement.¹⁴ Hypotension and bradycardia have been noted with it.¹⁴

A retrospective study by Sinha et al²⁸ reviewed 10 patients who had received dexmedetomidine with a loading of 0.5 to 1 µg/kg over 20 minutes and infusion at the rate of 0.01 to 1 µg/kg/hr. All the patients who underwent extensive neurocognitive testing reported that dexmedetomidine is a useful sedative technique for awake craniotomy.²⁸ A study by Doyle et al, who used dexmedetomidine 0.5 µg/kg over 20 minutes followed by infusion at 0.2 µg/kg/hr, reported that dexmedetomidine is a good adjuvant to give anesthesia for awake craniotomy with minimal side effects.⁶

CONCLUSION

Dexmedetomidine is a useful adjuvant during awake craniotomy for tumor resection. It is a highly specific α₂ adrenoceptor agonist with sedative, analgesic, and anxiolytic properties with minimal hemodynamic effects and without respiratory depression. It can be used in the procedures where cooperation of the patient is required intraoperatively.

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