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DEXMEDETOMIDINE FOR AWAKE CRANIOTOMY WITHOUT LARYNGEAL MASK

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ABSTRACT - *Objective:* This paper reports the use of dexmedetomidine in three epileptic patients with cavernous angiomas that underwent awake surgery in order to map their speech areas. *Method:* Loading dose of dexmedetomidine varied from 1 μg/Kg/h to 3 μg/Kg/h over 20 minutes and maintenance dose from 0.4 μg/Kg/h to 0,8 μg/Kg/h. *Results:* There was no occurrence of hemodynamic instability, convulsions or respiratory depression. Patients tolerated well the procedure. *Conclusion:* Dexmedetomidine was useful for awake craniotomy as it decreased patients' level of consciousness but did not produce agitation. Laryngeal mask was not necessary to keep air ventilation.

KEY WORDS: awake craniotomy, dexmedetomidine, epilepsy surgery, cortical mapping, neuroanesthesia.

Dexmedetomidina em craniotomias com o paciente acordado sem o emprego de máscara laríngea

RESUMO - *Objetivo:* Este trabalho relata o uso de desmedetomidina em três pacientes com angiomas cavernosos próximos a área de linguagem e epilepsia que foram operados acordados para mapeamento cortical. *Método:* A dose de ataque de dexmedetomidina variou de 1 μg/Kg/h a 3 μg/Kg/h durante 20 minutos e dose de manutenção de 0,4 μg/Kg/h a 0,8 μg/Kg/h. *Resultados:* Os pacientes toleraram bem o procedimento e não houve instabilidade hemodinâmica, convulsões ou depressão respiratória. *Conclusão:* Dexmedetomidina foi útil nas craniotomias com o paciente acordado para mapeamento cortical pois gerou sedação sem agitação. A máscara laríngea não foi necessária para manter a ventilação nesses pacientes.

PALAVRAS-CHAVE: craniotomia, dexmedetomidina, cirurgia para epilepsia, mapeamento cortical e neuroanestesia.

Awake craniotomy is a useful technique when lesions near eloquent areas have to be removed[1]. Unfortunately, procedure's demands on patients and surgical team must not be neglected. Patients need to be fully alert and cooperative during testing but on the other hand, it is desirable to keep them sedated over the rest of surgery avoiding unnecessary discomfort and anxiety. It is a delicate balance, even on experienced hands, as respiratory depression also has to be taken in account. To accomplish adequate level of sedation and analgesia both local and systemic anesthetics are used. A combination of opioids and midazolan associated, or not, to propofol or droperidol is effective. But, despite satisfactory level of stress for patients, small problems like agitation, drowsiness, seizure or pain still occur in 48% of the surgeries[2].

Dexmedetomidine hydrochloride is a selective alpha-2 adrenoceptor agonist with centrally mediated sympatholytic and sedative effects. It is indicated for sedation of intubated and mechanically ventilated patients during treatment in intensive care units. Dexmedetomidine decreases the needs of analgesia and produces a kind of sedation that patient can be easily roused by verbal stimuli[3]. These characteristics brought about its use for awake craniotomy in association with volatile anesthetic delivered by laryngeal mask[4,5].

This paper reports the anesthetic and surgical technique in three cases where dexmedetomidine hydrochloride was used associated to fentanyl, midazolan and propofol for awake craniotomy and cortical mapping without laryngeal mask. To our knowledge this technique was not reported previously in the literature.

METHOD

Surgical procedures were informed to patients as

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earlier as possible. Thus, they had time to formulate questions and easy their anxieties before final surgical agreement. A psychological battery was conducted at bedside to identify patients' characteristics in order to improve language testing at the operating room.

Preoperative medication was not used and infusion of a loading dose of dexmedetomidine started following positioning of non invasive anesthesia monitors. An internal jugular vein, Foley catheter, and radial arterial line were inserted while on dexmedetomidine. The maintenance dose of the drug was tittered according to patients' needs. Oxygen delivery and monitoring of expiratory gas CO2 concentrations were obtained via a nasal cannula. Comfortable positioning was an essential step to avoid peripheral nerve injuries. A three pin head holder was placed after head block using 0.5% lidocaine, 0.25% bupivacaine with epinephrine (1:200,000) and saline. Surgical incision and skin flap base were anesthetized with the same solution. Patients were positioned laterally, with heads almost parallel to the ground and draping adjusted to keep eyes and airways easily accessible.

Patients underwent electrocorticography (ECoG) using a 32-channel Nicolet alliance portable unit (Nicolet BMSI, Inc. Madison, WI, USA) to identify epileptogenic areas near the lesions. Brain mapping was performed using an Ojemann cortical stimulator (Radionics Corp., Burlington, MA, USA) with a monopolar probe. Currents were delivered with single pulse of 1 millisecond and frequency of 60 Hz.

All patients stayed calm and cooperative during the procedure. On the day after, they were all able to recall verbal testing but kept no unpleasant fillings about it. No patient developed new deficits after surgery.

The technique is a variation of the standard of care since dexmedetomidine has been proved safe for human use, although with a different set up. The study was approved by the institutional review board.

Case 1 – Male, 28 years old (weight 49.5 Kg) presented 8 months prior surgery with a transitory mild dysphasia and generalized seizures. CT scan showed a small hemorrhage on the left temporal lobe and MRI disclosed a cavernous angioma within the supramarginal gyrus. He went to surgery on phenitoin, 300mg per day. Using a temporal horseshoe incision, the sensorial and motor areas were mapped, with 5 mAmp, and the cavernous angioma removed.

A dexmedetomidine loading dose of 3 μg/Kg/h over 20 minutes was infused and maintained with 0.5 μg/Kg/h. During temporal muscle retraction patient complained and the dose was elevated to 0,8 μg/Kg/h. As he became too drowsy, the drug was discontinued for 15 minutes and then resumed at 0.3 μg/Kg/h for speech evaluation and maintained at this level to the end of surgery. Boluses of fentanyl (total of 300 μg), propofol (total of 150 mg), and midazolan (total 3 mg) were used when judged necessary. The procedure took 5 hours and 45 minutes.

Case 2 – Female, 45 years old (weight 75 Kg). About 1 month prior surgery she presented with recurrent focal seizures and a mild dysphasia. Prolonged EEG showed persistent ictal activity on the left temporal lobe which ceased after was put on carbamazepine 800 mg and clonazepan 2 mg per day. MRI identified a subcortical cavernous angioma in the left angular gyrus.

Craniotomy was performed over the temporal lobe with a horseshoe incision. Speech area was identified by 7mAmp monopolar stimulation on the cortex over the lesion. Spikes were seen on ECoG on the angular gyrus. The cavernous angioma was then removed while preserving at most its surroundings.

Dexmedetomidine was infused for 20 minutes at the dose of 3 μg/Kg/h and then set at 0.5 μg/Kg/h throughout the surgery. Boluses of fentanyl (total of 800μg), midazolan (total 15 mg), propofol (total 300 mg), and droperidol (2.5mg) were used along the procedure, which lasted 8 hours and 15 minutes. The higher than usual dose was employed because patient was very anxious and asked for something "stronger", then an increase in the dosage of dexmedetomidine was considered.

Case 3 – Male, 35 years old (weight 61.5 Kg) presented with generalized seizures at night, treated with phenitoin 300 mg per day. During investigation, a cavernous angioma was identified occupying part of the inferior left frontal gyrus in close relation to the Sylvian fissure.

A frontotemporal craniotomy was performed through a pterional incision. After splitting the Sylvian fissure all branches to the cavernous angioma were isolated and cut before its resection. Speech area was found behind the lesion with 5mAmp stimulation. ECoG demonstrated no spikes.

Dexmedetomidine at dose of 1 μg/Kg/h was used over 20 minutes and reduced to a maintenance dose of 0.4 μg/Kg/h till the rest of surgery. Boluses of midazolan (total of 15 mg) and fentanyl (total of 600 μg) were used to keep patients' comfort over the 9 hours of procedure.

DISCUSSION

Dexmedetomidine represents a new paradigm in anesthesia. While most sedative drugs operate on GABA receptors, dexmedetomidine is an alpha-2 adrenergic agonist which sedates through its action at the locus coeruleus[6]. Different from GABA, alpha-2 adrenoceptors produces sedation without the entire spectrum of stupor, which may be associated with paradoxical agitation. At clinical doses, patients stay somnolent but not distressed or confused and can be easily roused with verbal stimuli becoming prompt to be tested[3].

Anxiety is a common inconvenient when dealing with awake surgery. Dexmedetomidine has an anxiolytic effect, probably related to its reduction

of sympathetic responses to stress both at the central and peripheral nervous system[7,8]. Indeed, our impression is that patients on this drug were less apprehensive than expected. We kept doses from 0.3 to 0.8 μg/Kg/h, but the highest dose, used on case 1, produced undue somnolence and had to be reduced. In contrast to other studies[9,10], we had neither significant hemodynamic instability nor bradycardia in our series. We suppose it happens due to differences in drugs associations or, as patients are awake, an increase on blood level of catecholamines may occur, avoiding excessive sympathetic blockage.

Pain control is also a special challenge for the surgical team. Usually particularly painful surgical steps are the temporal muscle retraction and the detachment of cranial bone from dura mater near the temporal fossa. At those points patients frequently require an increase in analgesia, which may bring out drowsiness. As brain mapping is done shortly after craniotomy, time may be needed for recovering before verbal testing, increasing total length of surgery. Patients on dexmedetomidine need less analgesic drugs[11], which improved the quality and duration of our intra operative neuropsychological assessment.

There was no significant oxygen desaturation or hypercapnia within our group in accordance with literature[12]. Spontaneous ventilation associated to fluid balance was enough to keep the brain appropriate for microsurgery. Laryngeal mask was not necessary and was not used in any patient.

There is evidence that dexmedetomidine decreases the seizure threshold in animal models[13,14]. It has not been described in humans yet but has to be taken into account as most patients who undergo awake surgery already have epilepsy. Moreover, cortical stimulation also increases the risk of convulsions. Anesthetists need to be aware and prepared to treat convulsive incidents. In our cases we had no intra operative seizures.

In conclusion, dexmedetomidine is a useful drug for awake craniotomy as it decreases patients' anxiety, pain medication needs, and level of consciousness without agitation. The drug causes no significant respiratory depression and need not be used associated to laryngeal mask. The importance of its convulsant properties still has to be assessed in the future.

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