CASE REPORT

Awake Craniotomy: A Case Series of Anaesthetic Management using a Combination of Scalp Block, Dexmedetomidine and Remifentanil in Hospital Universiti Sains Malaysia

W Mohd Nazaruddin W Hassan, MMed (Anaesth), Mohd Fahmi Lukman, MMed(Anaesthesiology), Laila Abd Mukmin, MMed(Anaesthesiology), Zamzuri Idris, MMed (Neurosurgery), Abdul Rahman Izaini Ghani, MMed (Neurosurgery), Rhendra Hardy Mohamad Zaini, MMed(Anaesthesiology)

School of Medical Sciences, Universiti Sains Malaysia, Anaesthesiology and Intensive Care, Jalan Sultanah Zainab II, Kota Bharu, Kelantan 16150, Malaysia

SUMMARY

Awake craniotomy is a brain surgery in patients who are kept awake when it is indicated for certain intracranial pathologies. The anaesthetic management strategy is very important to achieve the goals of the surgery. We describe a series of our first four cases performed under a combination of scalp block and conscious sedation. Scalp block was performed using a mixture of ropivacaine 0.75% and adrenaline 5 µg/ ml administered to the nerves that innervate the scalp. Conscious sedation was achieved with a combination of two recently available drugs in our country, dexmedetomidine (selective α 2-agonist) and remifentanil (ultra-short acting opioid). Remifentanil was delivered in a target controlled infusion (TCI) mode.

KEY WORDS:
Awake craniotomy, Scalp block, sedation, Dexmedetomidine, Remifentanil, Target controlled infusion

INTRODUCTION

Awake craniotomy has become more frequently used worldwide but it is still new in our country. It is done in brain surgery involving pathology that is close to the vital areas of the brain and requires the patient to be awake during surgery for neurological assessment. The objectives of the series are to show the feasibility of dexmedetomidine for cortical mapping and the benefit of scalp block in combination of target controlled infusion (TCI) remifentanil for analgesia during awake craniotomy.

CASE REPORT

Three of the cases were preoperatively diagnosed as highly suspicious of metastatic tumors and the other case was primary brain tumor. All of the tumors were close to the speech, motor and sensory areas. Patients were selected and gave consent to undergo awake craniotomy and tumor excision. During preoperative assessment, the patients were informed regarding our plan of management. All of the patients were planned for anterior craniotomies with incision sites in the fronto temporo parietal area. Demographic of the patients were shown in table I.

In the operating theatre, an arterial line was inserted under local anaesthesia at the radial artery. Two large bores intravenous (IV) branulas were also inserted. Other monitors were invasive blood pressure, non invasive blood pressure, oxygen saturation, electro cardiogram, catheterized bladder drainage and end tidal carbon dioxide monitoring connected to nasal prong. The bispectral index (BIS) was recorded in one of the cases before starting the sedation to monitor the depth of sedation. This was supported with Observer Assessment of Alertness/ Sedation score (OAAS). The electromyogram (EMG) was also monitored by neurophysiology technician. Oxygen at 3 l/ min was initially supplied through nasal prongs. Conscious sedation was initiated with dexmedetomidine infusion with a loading dose of 1.0 µg/kg for 10 minutes and followed by maintenance between 0.5-0.7 µg/kg/h. TCI remifentanil between effect concentration of 0.25-1.0 ng/ml was started after loading a dose of dexmedetomidine. TCI propofol was prepared in all cases as a backup sedation in case the patient was of restless and agitated patient. One patient required a supplement of TCI propofol between 1-2 µg/ml. The aim of the sedation was to achieve OAAS of 2 (responds only after mild prodding or shaking) to 3 (responds only after name is spoken loudly or repeatedly, or both) when performing the scalp block. BIS showed the reading of 80 to 95 (light sedative state) during the scalp block. Blood pressure (BP) and heart rate (HR) were stable during the block.

All patients then received scalp block using mixture of 0.75% ropivacaine and adrenaline 5 µg/ml. The total volume of ropivacaine used was 30-40 ml and within the range of a maximum dose of 3.6 mg/kg. It was given subcutaneously at 6 sites of scalp nerves innervations on each side of the scalp. The nerves involved are were the supraorbital nerve, supratrochlear nerve, auriculotemporal nerve, zygomaticotemporal nerve, occipital nerve (greater) and occipital nerve (lesser) (Pneumonic: **S^2AZO^2**). All the patients were subjected to be blocked at all six sites of scalp nerves

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Corresponding Author: W Mohd Nazaruddin W Hassan, School of Medical Sciences, Universiti Sains Malaysia, Anaesthesiology and Intensive Care, Jalan Sultanah Zainab II, Kota Bharu, Kelantan 16150, Malaysia Email: nazarudin@kb.usm.my

Table I: Patient's Demographic

	Patient 1	Patient 2	Patient 3	Patient 4
Age (year)	35	56	58	55
Type of craniotomy	Anterior	Anterior	Anterior	Anterior
Intraoperative steroids	No	No	No	No
Duration (hours)	6	6	6	7
Total dose of dexmedetomidine	Bolus: 1 mg/kg Maintenance: 0.2-0.7 mg/kg/h	Bolus: 0.5 mg/kg Maintenance: 0.2-0.7 mg/kg/h	Bolus: 0.5 mg/kg Maintenance: 0.2-0.7 mg/kg/h	Bolus: 1 mg/kg Maintenance: 0.2-0.7 mg/kg/h
Total dose of TCI remifentanil	0.25-1.0 ng/ml	0.25-1.0 ng/ml	0.25-1.0 ng/ml	0.25-1.0 ng/ml
Haemodynamics:				
Blood Pressure (mmHg):				
• At onset of scalp block	110/70	130/80	130/80	120/70
• At pinning	130/90	140/90	130/90	130/85
• Intraoperative	120/70	130/80	120/80	120/80
Heart rate (beats/min):				
• At onset of scalp block	85	80	75	80
• At pinning	90	90	85	90
• Intraoperative	80	85	90	90

Table II: Anatomical Landmarks of Infiltration

Sensory innervations of the scalp	Anatomical landmarks of infiltration	Total volume of local anaesthetic
Supraorbital nerve	Supraorbital notch (approximately midpoint of the superior border of the orbit)	2-5 ml
Supratrochlear nerve	Superiomedial angle of the orbit	2-5 ml
Auroculotemporal nerve	Between the tragus of ear and the pulsation of the superficial temporal artery (1 to 1.5 cm anterior to the tragus)	2-5 ml
Zygomaticotemporal nerve	Supraorbital margin to the posterior part of the zygomatic arch	2-5 ml
Greater occipital nerve	Approximately halfway between the occipital protuberance and the mastoid process, 2.5 cm lateral to the nuchal medial line and medial to the occipital artery	2-5 ml
Lesser occipital nerve	2.5 cm lateral to the greater occipital nerve block, along the superior nuchal line and towards the mastoid process	2-5 ml

innervations bilaterally. Anatomical landmarks of the infiltration are shown in table II.

Another 10-15 ml of 2% lignocaine was infiltrated at the pinning and incision sites. BP and HR were maintained after the head pinning, surgical incision and craniotomy. TCI remifentanil was stopped and dexmedetomidine was maintained at the lowest dose (0.2 µg/kg/h) during cortical mapping and stimulation. Speech, sensory and motor cortical areas were mapped by electrical cortical stimulation and assessed by EMG and clinical response. Communication was maintained with the patient throughout the assessment. All the patients were comfortable throughout the surgery without any worsening neurological deficits. All tumors were successfully excised while the patients were in an arousable and cooperative state. All haemodynamics parameters were stable throughout the surgery. The sedation was deepened again during the closure stage.

Post operative analgesia was achieved with IV parecoxib 40 mg 12 hourly with patient-controlled analgesia (PCA) fentanyl back up for 24 hours. All the patients reported good post operative analgesia (Numerical Rating Scale, NRS-11 < 3) at recovery and subsequent four hourly periods over 24 hours. The consumption of PCA fentanyl was also minimal. No side effects such as nausea, vomiting, local anaesthetic overdose, respiratory depression, hyperalgesia or cardiac instability were observed.

Pathology results of all four cases came back as cavernous hemangioma, metastatic breast cancer, metastatic thyroid cancer and glioblastoma multiforme (GBM).

DISCUSSION

The objectives of anaesthetic management in awake craniotomy are to allow patient's cooperation, preserve general homeostasis and limit the interference between anaesthetic agents and quality of electrophysiological recording[1].

Dexmedetomidine has been reported to be successfully used in awake craniotomy. It causes a unique kind of sedation, acting on the subcortical areas, which resembles natural sleep without respiratory depression. It does not interfere with electrophysiological monitoring, thus allowing brain mapping during awake craniotomy and microelectrode recording during implantation of deep-brain stimulators[2].

Remifentanil has just been just introduced for use in our country. It has a very rapid onset and offset. Minimal used of remifentanil in our cases can be attributed to good analgesia by scalp block and analgesic properties of dexmedetomidine. Scalp block is not a new technique but it has gained back its popularity lately with the increase of awake craniotomy cases. It is also used in acute and chronic pain management[3]. Ropivacaine is a local anaesthetic agent that has less cardio toxicity effects if compared to the commonly used bupivacaine. The pattern of rise of plasma level of ropivacaine in scalp block was rapid compared with other regional blocks. Despite this rapid rise of plasma level, no signs of cardiovascular or central nervous system toxicity were observed in awake craniotomy patients[4].

CONCLUSIONS

Awake craniotomy is a great challenge in anaesthetic management. The combination of scalp block, dexmedetomidine and TCI remifentanil is safe and effective for this surgery.

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