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Case Report

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Anaesthetic Management with Dexmedetomidine for Intraoperative Awake Test in Correction of Scoliosis; a Case Report

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ABSTRACT

Damage to spinal cord and its subsequent neurological deficits have been recognized as the complications of scoliosis repair surgery. Wake up test has been a safe, simple and reliable method to recognize such complications. Dexmedetomidine and Sevoflurane were the main anaesthetics for a 14 year old girl who underwent a scoliosis repair surgery with the intra operative wake-up test and hemodynamic stability. The analgesic property of Dexmedetomidine was complemented by the continuous Fentanyl infusion. Dexmedetomidine, Sevoflurane and continuous Fentanyl infusions were administered to achieve the maintenance of the anesthesia. These anaesthetic regimens produced a satisfactory result for the intra operative hemodynamic stability and the wake-up test with the minimum complication. Here, a case of scoliotic repair surgery was presented using Dexmetomidine, Sevoflurane and Fentanyl infusion as the safe anaesthetic regimens.

Key words: *Dexmedetomidine, Fentany, Scoliosis, Wake up Test.*

INTRODUCTION

Scoliosis is a complex spine deformity which could lead to the partial and total disability. Proper correction of spine curvature is important to maintain the normal posture in adults. However, anaesthesia for scoliosis correction surgery can be challenging since the surgical procedure can damage the central nervous system [1, 2]. The uniqueness of this procedure is the need for the intraoperative emergence and the leg movement to diagnose the intraoperative central nervous system (CNS) injuries caused by the spinal rectification after the scoliosis correction. [1, 3] Here a brief case report has been presented to highlight the important aspects of the pre-anaesthesia evaluation and anaesthesia management using Dexmedetomidine. [4] Several anaesthetic techniques were used for this procedure. Dexmedetomidine was associated to the total intravenous anesthesia combined with Sevoflurane and Fentanyl to induce sedation, analgesia and ventilatory stability during the wake-up test in the patient submitted to surgical scoliosis correction.

Case Report

A 14-year-old girl, weighing 26 kg, diagnosed as Marfan Syndrome was admitted in the tertiary referral hospital where the study was done. The surgical procedure to correct her spine deformity had been planned since three year ago. The patient presented skeletal abnormalities including increased height, extremity length, ligamentous laxity and scoliosis. The physical status was ASA 3 (American Society of Anesthesiologist). During the preoperative visit, the patient was explained about the wake up test after the surgery. All the important preoperative laboratory findings were in normal range. Echocardiography was normal with the ejection fraction of 67,6 %. Pulmonary function tests showed a severe restriction; however, the arterial blood gases were normal. A severe scoliotic deformity at the thoracic level with its Cobb's angle was 95°, and the lumbal level with its cobb's angle was 28° on the chest X-ray and spine MRI. There were no signs of neurologic symptoms. The high risk consent, post-operative ventilatory consent, paraplegia consent were taken in the view of a major surgery on spine. Preoperatively two 18G intracaths were secured in both upper limbs; an infusion ringer lactate was started; and the monitors, the electrocardiogram, and blood pressure, pulse oxymeters were attached. Again, the wake up test was explained before the induction. The sedation with Midazolam injection 2 mg and the analgesia by Fentanyl injection 50 μg i.v. were done. The induction with Propofol injection 50 mg i.v. and Atracurium injection 10 mg i.v. were administered. The bag and mask ventilation was done for 3 min; the laryngoscopy was accomplished; and the patient was intubated with a 6.5 number cuffed non-kinked tube. The correct placement of the endotracheal tube was verified with positive end tidal carbon dioxide and bilateral equal breath sounds. A 14G nasogastric tube was placed, throat packing was done, and the soft bite block was placed. Arterial cannulation was done in the left radial artery. After the prone position on the operation table, i.v. lines were attached, the monitors were connected, the vitals were monitored, and the bilateral air entry was confirmed. Anesthesia was maintained with Dexmedetomidine continuous infusion (0.2-0.4 μg/kg/hour) and Fentanyl (1-2 μg/kg/minute) continuous infusion and Sevoflurane inhalation. The intermittent positive pressure ventilation was given with the anesthesia machine. The procedures involved 16 pedicular screws with rods to correct the deformity.

Fentanyl infusion was stopped immediately after the wake-up test was performed. The concentration of the end-tidal Sevoflurane was adjusted to zero, and Dexmedetomidine continoues injection was still maintained. Fifteen minutes after returning to the spontaneous ventilation with the anaesthetic recovery and after the drug withdrawal, the patient had to be moved to her lower limbs at the verbal command. Following the successful completion of the wake-up test, the patient was given Propofol injection of 40 mg i.v. bolus and Midazolam injection 2 mg i.v. bolus. After that, the infusion of Dexmedetomidine injection of 0.4 μg/kg/hour, and Fentanyl injection of 1 μg/kg/hour were restarted. The patient remained in Ramsay's sedation stage 3 during this procedure, under analgesia, relaxed and spontaneous ventilation, with 100% oxygen saturation and 32-35 mmHg ETCO2. The total surgical time was approximately 5 hours with the estimated blood loss of 300 ml. The heart rate varied from 80 to 105 bpm, the systolic blood pressure differed from 90 to 95 mmHg, the diastolic blood pressure varied from 50 to 55 mmHg, and the mean blood pressure ranged from 60 to 75 mmHg. The patient was kept in supine position after the completion of the surgery and dressing. The injection of Fentanyl infusion was stopped, and Dexmedetomidine injection at 0.2-0.4 μg/kg/hour was continued.

For another major surgery, the patient then was shifted to the intensive care for the overnight ventilation. Dexmedetomidine injection was continued in the intensive care unit. The patient was extubated the next morning after she was fully awake and obeying the verbal commands, moving hands and legs. Post extubation, the visual analogue score was "0-2" with no intra operative residual events.

DISCUSSION

Scoliosis is a deformity of the spine resulting in the lateral curvature and the rotation of the vertebrae as well as a deformity of the rib cage. [1, 5, 6] There is a commonly secondary involvement of the respiratory, cardiovascular and neurologic systems. [1] Scoliosis can develop or begin at any age, but tends to appear clinically during the periods of the end somatic growth. [7] It has been reported that the prevalence in the general population varies from 0.3 – 15.3%. However, the prevalence has been less than 3% for the curves more than 10°, and became less than 0.3% for the curves more than 30°. [1, 2, 4] It has been more common in

adolescents, and has female-to-male ratio about 3:17. [1, 3] Among 75 -90% of the cases of scoliosis have been the idiopathic type, and the adolescent type has been the most common. The remaining 10 – 25% cases have belonged to various other etiologies. [1, 2, 4]

Scoliosis often requires the surgical correction. A major complication of this corrective surgery has been the spinal cord trauma leading to paraplegia. [3] In this regard, intra operative neurological monitoring is performed to rule out the spinal cord injury in the form of wake-up test,i.e. SSEP (Somato Sensory Evoked Potential) or MEP (Motor Evoked Potential). [2-4, 8]

The incidence of neurologic deficits associated with scoliosis repair surgery has been 0.3% to 1.89%, increasing to 4% when spinal fusion is combined with the segmental fixation. [4] Although the electrophysiologic monitoring of the sensory tracts mediated in the spinal cord has been available since the 1970's, the only way to monitor the motor function has been the wake-up test. [2, 4]

The intraoperative wake-up test was first introduced by Vauzelle et al. in 1973 to assess the motor function. [9] It has been a gross test of the spinal motor function. It has remained the most reliable assessment of the intact spine for several reasons. To this day, the wake-up test has remained as the gold standard for the assessment of the motor function after the application of the corrective scoliosis. [4, 8, 10]

Anaesthetic agents can suppress SSEP signals. This can make certain patient conditions like neuromuscular degeneration which would make SSEP impossible to obtain, and hence the anterior cord injury may go undetected completely in spite of SSEP monitoring. [2, 4, 8] A wake-up test should be well planned and discussed indepthly with the patient in the pre-anaesthesia visit. [1] Small doses of volatile anaesthetics, if used, should be discontinued an hour before the wake-up is anticipated. [1]

However, the neurologic injury can occur any time intra operatively from the surgical maneuvers, instrumentation, vascular injury or ischemia secondary to hypoperfusion to spinal cord which remains undetected until the wake-up test was performed. [10] Risks associated with the intra operative wake-up test include damage to the spinal cord, dislodgement of instrumentation, accidental extubation, hypoxia, venous air embolism as a result of deep inspiratory efforts. [1, 10]

Intravenous anaesthetic agents can produce effects via altering the neuronal excitability through changes in axonal, functional, and synaptic activities. [2] Dexmedetomidine is a relatively selective α2 adrenoreceptor agonist 8 times more selective than clonidine. [2-4, 8] The receptors modulate norepinephrine release through a negative feedback. There are 3 α2 adrenergic subtype receptors: α2a, α2b, α2c. α2a stimulation is responsible for sedation, analgesia, and sympatholysis, whereas α2c subtype is responsible for anxiolysis and contributes to the spinal anti nociception. [8] Dexmedetomidine sedative and analgesic properties have made it the adjuvant drug of choice to maintain the patients awaken intraoperatively and able for moving lower limbs, as recognized for the surgical scoliosis correction to evaluate the possible CNS injury. [2, 4, 8]

In this case, the combination of Sevoflurane inhalan, Dexmedetomidine and Fentanyl infusion pump was chosen due to the drugs' pharmacokinetic properties which helped the patient's fast emergence. Small doses of volatile anaesthetics Sevoflurane were used, and discontinued an hour before wake-up test began. Thirty minutes before the wake-up test, Fentanyl injection was stopped, but Dexmedetomidine was maintained. Its fast drug metabolism and no active metabolites allowed the patient to return to her consciousness and spontaneous ventilation fast. Therefore, these allowed the patient respond to verbal commands fast.

CONCLUSION

Dexmedetomidine pharmacokinetic properties in central vasomotor centers of the brain area and in cardiovascular system have been pivotal for the maintenance of the controlled arterial hypotension necessary to decrease the intraoperative bleeding. [8] Dexmedetomidine has met all the postoperative analgesic needs during its infusion time, not requiring additional doses of opioids, but sometimes continuous or intermittent intravenous opioids have been used in larger scales keeping the postoperative analgesia a matter of each center's experience. [2, 8]

The day after the surgery, the patient was asked about anesthesia and wake-up test, and reported no pain and no recalls of that moment. In this case, Dexmedetomidine infused at 0,2-0,4 μg/kg/hour combination with

Sevoflurane allowed a successful intra operative wake-up test to be done. Analgesic properties of Dexmedetomidine were complimented by the continuous infusion of Fentanyl. Dexmedetomidine showed to be a promising supportive drug in the emergence test, as well as for the perioperative analgesia and sedation. [2]

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