Anaesthetic Management of a Patient Undergoing Acoustic Neuroma Resection with Intraoperative Electromyographic Monitoring

Arun Mathur[1*], Anand Rampure Vittal Rao[2], Prajeesh M .Nambiar[3]

[1,3]Assistant professor, [2]Professor, Department of Anaesthesiology and Critical Care, Kannur Medical College, Kannur, Kerala, INDIA.

[*]Corresponding Address:

mathurarun21@gmail.com

Case Report

Abstract: Acoustic neuromas are the most common benign tumours of the posterior cranial fossa, with an impending danger of injuring the facial nerve during its resection. Usage of intraoperative electromyographic (EMG) monitoring during resection will definitely reduce the possibilities of injuring the facial nerve, but as such pose a great anaesthetic challenge of maintaining a motionless patient while preserving the EMG response. We managed a case of Acoustic neuroma excision, in a patient with renal dysfunction, balancing the neuromuscular blockade level by administration of cisatracurium infusion under TOF watch monitoring without interfering with the EMG response.

Keywords: Acoustic neuroma, facial nerve, electromyography, cisatracurium, TOF watch.

Introduction

Acoustic neuromas are the most common benign tumors of the posterior cranial fossa. Cranial nerve involvement with acoustic neuroma is common. Auditory nerve impairment is present in almost all cases. In addition, nerve conduction studies before any surgical procedures reveal electrical evidence of neuropathy of the facial nerve in 83% of patients[(1)]. The course of the facial and auditory nerve within the internal auditory canal, accounts for the combined cranial nerve involvement commonly seen with acoustic neuromas. Intraoperative electromyographic (EMG) monitoring of the facial nerve during acoustic neuroma resection allows the early detection of surgical stimulation and reduces nerve dysfunction postoperatively. The gains achieved by advances in monitoring technology, however, may place additional challenge on the anaesthetic management of these patients, since neuromuscular blocking agents have to be avoided for these types of procedures to exclude any compromise of facial EMG monitoring capability. The retro sigmoid approach to acoustic neuroma resection maximizes facial nerve preservation. However, the additional hazards of posterior fossa exploration are encountered. Delicate microsurgical resection of these tumors demands absolute immobility of the patient. Close proximity of the trigeminal nerve and brainstem structures may result in unintentional stimulation of these structures as well, producing rapid motor or haemodynamic reflexes. Ensuring immobility in the lightly anaesthetized, unparalyzed patient under these circumstances may be difficult, but also administering high doses of anaesthetic agents to ensure immobility can have deleterious consequences. The anaesthetic management in this case was based on previous studies in which controlled levels of neuromuscular blockade (NMB) were achieved, while still preserving the ability to adequately monitor facial nerve electromyography[(2)].

Case Report

A 47 year old female weighing 62 kg, presented in the department of Neurosurgery of our institution with a history of swaying on walking for the past 3 months. There was also history of occasional headache & decreased hearing in left ear for the past 18 years. Patient was diabetic, otherwise no other significant past medical illness. During preanaesthetic checkup, all routine investigations were found to be within normal limits except Serum Creatinine which was 1.5 mg/dl (Normal range 0.6-1.2 mg/dl). Computed tomographic and magnetic resonance imaging of the brain showed a left Cerebellopontine angle cystic Acoustic Neuroma. Patient was electively posted for left retro mastoid suboccipital craniotomy & excision of the tumour. Once in the operating room, along with standard monitors, the left radial artery was cannulated for direct arterial pressure monitoring and arterial blood gas analysis intra and post operatively. CVP monitoring was done through a double lumen CVP catheter inserted into the right subclavian vein. The bladder was catheterized to monitor the urine output. The level of peripheral neuromuscular blockade was determined using the TOF-Watch®SX instrument(Organon, Holland) on the ulnar nerve. The stimulation composed of a train of four stimulations (supramaximal, constant current of four twitches at 2 Hz) and the adduction of the thumb was assessed by an accelerometer. As per the standard protocol, the TOF-

Watch was calibrated after anaesthetizing the patient but before administering the muscle relaxant[3]. A 16 G wide bore cannula secured on left forearm & patient preoxygenated & induced with 120 µg of fentanyl, 60 mg of 2% lidocaine, 120 mg of propofol, followed by 0.15mg/kg of cis-atracurium to facilitate endotracheal intubation. Since patient was having mildly raised Serum Creatinine, cisatracurium was preferred for NMB. Anaesthesia was maintained with air & oxygen (50:50), isoflurane (0.6–1.0%) and controlled ventilation maintaining mild hypocarbia. During Intraoperative period, analgesia was maintained by iv infusion of fentanyl 60 µg/hr and cisatracurium infusion at a basal rate of 1 µg/kg/min[4]. The NMB was observed objectively and the intensity of blockade was maintained at TOF 2 level[3]. Whenever level of NMB was above/below the level of TOF 2, the infusion of cisatracurium was increased/decreased in increments of 0.5µg/kg/min. The TOF 2 level should be considered as the choice of anaesthetic management for facial nerve monitoring based on previous study [3]. After completion of surgery, patient was extubated after adequate reversal from muscle relaxant and anaesthetic effect. Patient did not show any signs suggestive of facial nerve dysfunction postoperatively.

Discussion

In patients undergoing acoustic neuroma resection, Intraoperative EMG monitoring of the facial nerve has resulted in improved preservation of facial nerve function postoperatively[1].The anaesthetic management of these patients should not only provide an immobile patient but also preserve an optimal environment for facial EMG monitoring. To preserve facial nerve EMG monitoring, neuromuscular blockade has been used judiciously during resection of acoustic neuromas. In this case, NMB at TOF 2 level was maintained, while preserving facial EMG monitoring, by careful titration of an intermediate-acting, non depolarizing muscle relaxant using TOF watch. This was based on previous study by Won Joo Choe etal, suggesting that response to stimulation on the exposed segment of the facial nerve were apparent mostly at TOF level 1 in most cases, no response or a weak response was observed at TOF 0 while at TOF $\geq$ 2, all cases showed an EMG response to electrical stimulation[3]. In our case, there was no episode of patient movement or diaphragmatic excursion throughout the procedure, nor was there any necessity to give bolus dose of muscle relaxant anytime during the procedure. It meets the clinical desires of limiting the facial nerve damage by identifying it clearly during the surgery, and also keeping patient motionless by adequate muscle relaxation. The NMB at TOF 2 level should be considered as the choice of anaesthetic management for facial nerve monitoring, as previous studies had shown that there was a distinct difference in sensitivity to non-depolarizing muscle relaxants between the facial nerve and ulnar nerve, wherein, facial musculature seems to be less sensitive to neuromuscular blocking agents compared with hypothenar muscle, and at a given level of blockade, the response of facial nerve is always stronger than the one of ulnar nerve[5].

Conclusion

With the successful management of a patient for acoustic neuroma excision, we hereby suggest that partial NMB by cisatracurium infusion at TOF 2 level with facial nerve EMG monitoring can be a useful technique, especially in patients with renal dysfunction, in preserving facial nerve function.

References

1. Harner SG, Daube JR, Ebersold MJ, Beatty CW. Improved preservation of facial nerve function with use of electrical monitoring during removal of acoustic neuromas. Mayo Clin Proc 1987;62(2):92-102.
2. Robert L. Lennon, Michael P. Hosking, Jasper R. Daube and Jeffrey 0. Weha. Effect of Partial Neuromuscular Blockade on Intraoperative Electromyography in Patients Undergoing Resection of Acoustic Neuromas. Anesth Analg 1992;75:729-33.
3. Won Joo Choe, Jun Hyun Kim, Si Young Park and Jin Kim. Electromyographic response of facial nerve stimulation under different levels of neuromuscular blockade during middle-ear surgery. J Int Med Res 2013; 41: 762-770.
4. Mellinghoff H, Radbruch L, Diefenbach C, Buzello W. A comparison of cisatracurium and atracurium: onset of neuromuscular block after bolus injection and recovery after subsequent infusion. Anesth Analg 1996;83(5):1072-5.
5. CAI Yi-rong, XU Jing, CHEN Lian-hua and CHI Fang-lu. Electromyographic monitoring of facial nerve under different levels of neuromuscular blockade during middle ear microsurgery. Chin Med J (Engl) 2009;122(3):311-314.