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Videolaryngoscope-Aided Electrode Placement for Lower Cranial Nerve Monitoring in a Child with Tonsillar Enlargement

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Abstract

Intraoperative neuromonitoring for tumor resection near brain stem consists of monitoring the lower cranial nerves (CNs) and motor evoked potentials to check for integrity of CN and corticospinal pathway. Usually CN mapping of CN VII (orbicularis oris/oculi and frontalis bilaterally), CN IX, CN X (posterior pharyngeal wall and soft palate bilaterally, vocal cords), CN XI (sternomastoid bilaterally), and CN XII (tongue bilaterally) is done. An intraoral pathology such as tonsillar enlargement especially in pediatric patients can pose a challenge to placement of the electrodes for CN monitoring. Videolaryngoscope will aid in better visualization and safe and precise placement of electrodes in the posterior pharyngeal wall, soft palate, vocal cords, and tongue. Thus, integration of different technologies aims to provide a safer and scientifically sound anesthetic technique and improves the outcome even in challenging situations.

Keywords
- ► midline suboccipital craniotomy
- ► intraoperative cranial nerve monitoring
- ► videolaryngoscope
- ► tonsillar enlargement

Introduction

Tumor resection near the brain stem is challenging and is associated with an increased risk of iatrogenic injury. This may lead to postoperative cranial nerve (CN) deficits, which profoundly affect the functional outcome in patients undergoing these procedures. Intraoperative CN mapping can help in identification of CN fibers and prevent injury to the same. Monitoring of the CN IX and X requires placement of electrodes in the pharynx.

We describe the use of C-MAC-guided placement of electrodes in a pediatric patient with tonsillar enlargement planned for midline suboccipital craniotomy for fourth ventricular mass.

Case Report

A 6-year-old child presented with headache, associated with multiple episodes of vomiting for 6 months. Magnetic resonance imaging of the brain revealed a fourth ventricular mass extending into the premedullary cistern through a complete midline medullary cleft. A midline suboccipital craniotomy with transcranial motor evoked potential (MEP) with lower CN monitoring for CNs VII, IX, X, XI, and XII, and complete excision of the mass was planned. After a smooth intravenous induction, the child was intubated with size 5.5 cuffed endotracheal tube. Laryngoscopy revealed grade 4 tonsillar enlargement (tonsils occupy > 75% of the oropharyngeal width). Difficulty in placing the electrodes to monitor the lower CNs IX, X, and XII was anticipated since it was difficult to visualize the pharyngeal structures. We decided to use a videolaryngoscope for adequate visualization, precise electrode placement, and avoiding injury to the oropharyngeal structures (►**Fig. 1**). C-MAC videolaryngoscope (Storz) was used for guide insertion of the needle electrodes into the soft palate, posterior pharyngeal wall, and base of the tongue (►**Figs. 2** and **3**). Positioning of the electrodes was confirmed visually. However, the connectivity was ensured by checking the impedance.

Intraoperative monitoring of CN VII (orbicularis oris/oculi and frontalis bilaterally), CN IX, CN X (posterior pharyngeal wall and soft palate bilaterally, vocal cords), CN XI (sternomastoid bilaterally), and CN XII (tongue bilaterally) was done. Transcranial MEP to monitor corticospinal tracts and record

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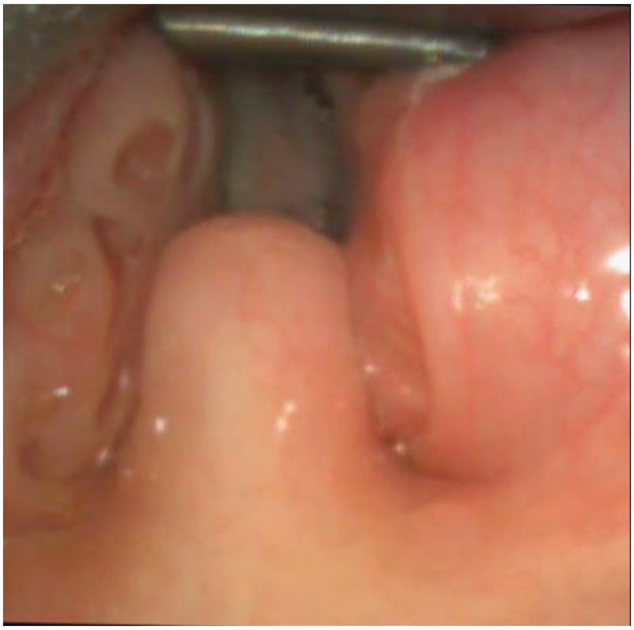

Fig. 1 Tonsillar enlargement as viewed on the C-MAC videolaryngoscope.

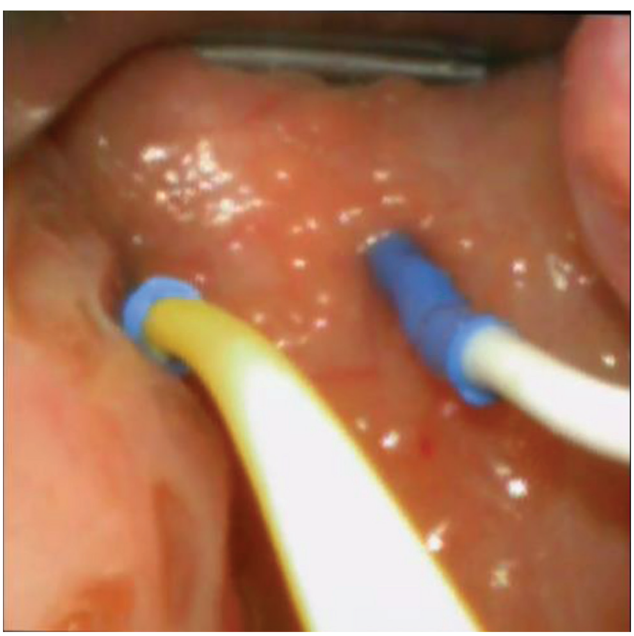

Fig. 2 Placement of the electrodes in the posterior pharyngeal wall for cranial nerve monitoring.

the activity from the upper and lower limb muscles was done by transcranial electric stimulation with free running electromyography (EMG). Mapping of the brain stem nuclei and CN fibers was done by the electrical stimulation of the monopolar hand-held probe by the surgeon with an intensity starting with 2 mA and lasting for 0.2 ms with a frequency of 1 to 4 Hz; and, at that time triggered EMG was also performed.

Discussion

Tumor resection near the brain stem is challenging and is associated with the risk of postoperative CN deficits, which may profoundly affect the quality of life of patients.[1] Intraoperative neuromonitoring of the lower CN helps to provide information about its functional integrity facilitating gross total tumor resection with CN preservation.[2,3]

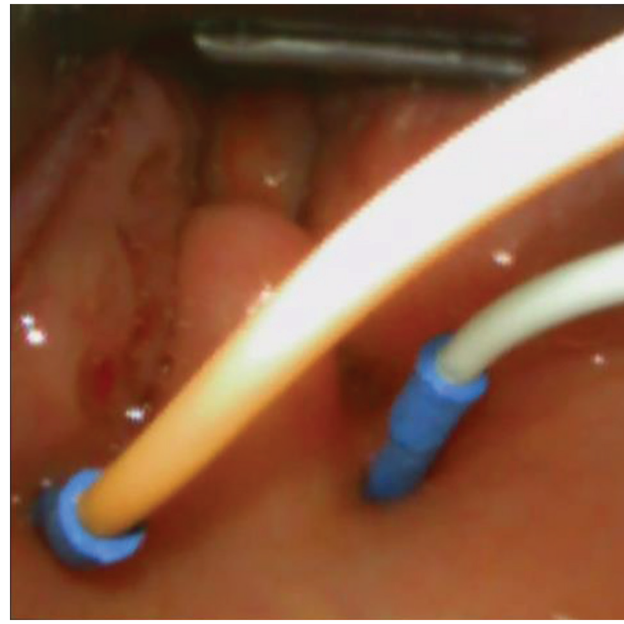

Fig. 3 Placement of the electrodes in the soft palate for cranial nerve monitoring.

Monitoring the CN IX function requires electrode placement in the soft palate. In order to observe differential recording to precisely identify neural integrity, it is important to place the recording electrode pair in the same muscle group.[4] Proper placement of this recording electrode pair is required, since only the efferent portion of the nerve innervates the stylopharyngeus muscle. To ensure consistent and reliable responses from the soft palate, electrodes are bilaterally placed in the soft palate midway between the uvula and the posterior tonsillar pillar.[5] Failure to stabilize the needle electrodes adequately may result in their premature displacement, which cannot be corrected once the patient is prepared and draped especially since these patients are often positioned prone. Partial displacement of the electrodes results in high impedance levels, which introduces the possibility of false, often confounding electrophysiologic information. These mandate that the electrodes be placed precisely and secured firmly with utmost care. It has been suggested that the electrodes be sutured or positioned carefully under vision with a Crowe Davis retractor.[5]

Placement of electrodes in the soft palate can be further challenging in pediatric patients, especially because of the limited oropharyngeal space. In those with an intraoral pathology and tonsillar enlargement, there is a significant decrease in the oropharyngeal space, making it cumbersome to firmly fix the recording electrodes.[6] Use of a videolaryngoscope significantly improves the quality of vision and allows for precise placement of the electrodes, thereby reducing the chances of injury to the oropharyngeal structures and improving the quality of recordings. C-MAC has been found to provide a better laryngoscopic view as compared to other videolaryngoscopes such as the Storz DCI videolaryngoscope and lesser time for intubation than Glidescope in cases of difficult airway.[7] C-MAC was also found to maintain better hemodynamic stability during laryngoscopy when compared to Airtraq laryngoscopes.[8] Videolaryngoscopy is a useful guide for electrode placement, particularly for locations in the posterior pharyngeal wall, soft palate and base of the tongue and must be considered in pediatric patients. By checking the electrode impedance before draping the patient, one can ascertain that electrodes are anchored properly to the muscles. Impedance can also be checked intermittently during the surgery to ensure electrode connectivity.

Conflict of Interest

None declared.

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