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Letter to the Editor

Reply to "Unforeseen clinical outcome for laryngeal adductor reflex loss during intraaxial brainstem surgery"

Mirallave Pescador and colleagues have made important observations regarding our recent case report (Mirallave Pescador et al., 2019; Satomaa et al., 2019). They suggest the possibility that the unilateral loss of the laryngeal adductor reflex (LAR) had resulted from a stimulation fault or from dislodged recording electrodes. Moreover, they advocated structured examination of the laryngeal function pre- and postoperatively.

In the brainstem operation we reported, LAR was recorded contralaterally to the side of the stimulation. The right side LAR was recorded through a pair of hook-and-wire electrodes in the right cricoarytenoideus muscle while the left side of the laryngeal mucosa was stimulated through surface electrodes; the left side LAR vice versa. When the LAR response on the right side was lost during the operation, we tried ipsilateral stimulations. Ipsilateral stimulation did not improve the right LAR or changed the left side response significantly. The ipsilateral stimulation in addition to augmented stimulation intensity increased the left side amplitude from the initial 120 μV to about 150 μV. The impedance at the stimulating electrodes was optimal. Therefore, while it is true that the left LAR amplitude was lower than the right from baseline, we think this was not due to a poor stimulation electrode contact on the right, because the left-sided stimulation did not significantly improve the left LAR amplitude. Regrettably, the ipsilateral recording of LAR was not tested at baseline.

The set-up of surface stimulation and hook-and-wire recording of the LAR we used is different from the previously described paradigms, which have comprised solely either surface electrodes (Sinclair et al., 2017) or hook-and-wire electrodes (Costa et al., 2018). We chose to use the combination of the two types of electrodes, because it allows uninterrupted monitoring of free running EMG despite the repetitive LAR recording. However, the surface electrodes attached to an intubation tube have several well-known challenges regarding the proper placement and secure contact (Randolph et al., 2011) and stimulation failure is always a genuine possibility.

As pointed out by Mirallave Pescador et al., it is possible that the recording electrodes were initially placed asymmetrically resulting in the amplitude asymmetry from opening. However, the right-sided dislodgement of the recording electrodes seems an unlikely cause behind the sudden right LAR decrement. This is because the right-sided electrode pair continued to record flawless EMG signals (neurotonic discharges) and MEPs despite the LAR attenuation. Moreover, the electrode impedance was optimal.

The vocal cord function was not objectively examined pre- or postoperatively. The patient rated her laryngeal and swallowing functions normal subjectively. No clinically evident deficits were noticed. Mirallave Pescador et al. correctly comment that subjective voice evaluation has low sensitivity in detecting vocal cord paralysis, which means that formal endoscopic laryngeal examination is required to report the laryngeal outcome accurately. What is more, a damage restricted to the interneurons would not be expected to cause clinical symptoms at all; it would only be evidenced in postoperative LAR. We agree that the statement of "no new deficits" is too unconditional. "No clinically significant deficits" would have been more suitable.

While in research context the exact objective findings in laryngeal function are essential, in the clinical context of life-threatening brainstem tumors, the avoidance of clinically significant deficits is the objective. The value of any new IOM method depends on its specificity and sensitivity in the on-line detection of an imminent clinically significant deficit. In theory, the LAR recording seems a very attractive addition in the brainstem IOM protocol, because it requires little extra instrumentation. Moreover, as the stimulation and recording take place outside the operating field, they do not disturb the procedure, and the relatively robust and well reproducible LAR response can be updated continuously. LAR could also aid localizing the imminent damage in combination with the other IOM modalities. However, the significance of the intraoperative LAR changes in brainstem surgery is yet to be established. According to the case we reported, the unilateral loss of LAR does not necessarily indicate a serious complication. It may reflect such a slight disturbance within the reflex arc that it does not become apparent clinically. Much more experience in LAR during lower brainstem surgery is needed.

To conclude, the comments by Mirallave Pescador et al. give insightful advice for future experiments with LAR in the IOM setting. The examination of the larynx pre- and postoperatively should be considered. Moreover, the technical pitfalls and the appropriate stimulation route deserve attention; to aid the troubleshooting, the ipsilateral in addition to the contralateral baseline LAR measurements can be easily added.

Declaration of Competing Interest

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