LETTER TO THE EDITOR

Set up of motor function monitoring for transoral approach to the upper cervical spine: a preliminary experience

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Dear Editor,

Transoral decompression of the craniovertebral junction is a procedure that requires expertise because of the significant risk of surgical damage and neurological dysfunction. Although the D-wave motor function monitoring technique is well documented in spinal cord surgery, and new techniques are always developing in neuroanesthesia,[1, 2] its adoption in the transoral approach has not been described so far. We report our experience in motor function monitoring with percutaneous placement of epidural D-wave recording electrodes in two patients during transoral surgical approach to a neoplastic and a malformative lesion. This is the first report in literature dealing with percutaneous placement of epidural D-wave recording electrodes in transoral surgical approaches.

Case 1. A 77-year-old woman presented with progressive four-limbs paresthesia. Neurological examination did not reveal any sensory or motor deficit. Magnetic resonance imaging showed an extramedullary C1-C2 spinal cord tumour. Preoperative Somatosensory-evoked potentials (SEPs) and Motor-evoked potentials (MEPs) showed normal responses in all extremities. During the microsurgical resection of the tumour through a transoral approach, the muscle MEPs showed preserved responses in all the extremities until the end of surgery, with amplitude changes up to 50% compared to the baseline signal. The variability of peak-to-peak amplitude of the epidurally recorded D-wave was under 20% (Figure 1).

Case 2. A 26-year-old man underwent a transoral surgical approach for a malformative disease with *os odontoideum* and C1-C2 cervical stenosis. The neurological examination revealed a moderate tetraparesis, more severe in the right extremities, especially in the right arm (strength 4/5 left and 3/5 right, according to the Strenght Scale), with distal paresthesias, hyperreflexia and plantar reflex with upward response. Pre-operative MEPs were decreased up to 70% in the right arm, 50% in the legs, and 30% in the left arm. We used the AXON Eclipse 16 evoked potential system for MEPs stimulation and recording. MEPs were detected by monopolar needle electrodes inserted in the *abductor pollicis brevis* (APB) and *abductor hallucis* (AH). The severity of preoperative motor deficit affected the intraoperative MEPs recording, and no new events were recorded. The peak-to-peak amplitude of the epidurally-recorded D-wave was stable.

Both patients underwent anterior decompression and posterior fixation. There were no complications related to the monitoring. In particular, we didn't notice any injury or infection due to electrode placement or stimulation, any spinal epidural haematomas after the insertion of epidural electrodes, any neurological complication or seizure associated with the transcranial motor cortex stimulation. Both patients improved after surgery, and no surgical-related morbidity or mortality was observed.

Intraoperatively, MEPs provide a continuous feedback on the functional proficiency of the motor system.[3, 4] D-wave monitoring provides corticospinal tract specificity, resistance to anaesthesia, immunity to neuromuscular blockade, and high stability.[5] However, D-Wave does not have lateralisation and it is not useful below the low-thoracic cord. A decrease of the pre-event amplitude above 50% is an empirical warning-criterion, although also a 20-30% reduction has been proposed as a warning level.[5, 6] Persistent D-wave loss or marked reduction, unexplained by any non-surgical factor, highly correlates with permanent postoperative motor deficit.[7]

During the procedure, we continuously monitored the D-Wave and, in presence of D-Wave reductions, we recorded muscle MEPs both to confirm and to localize the damage. Actually, D-wave recordings allow continuous monitoring through low stimulus intensities that do not cause jaw twitches. When the D-wave recordings show changes, a stronger stimulation can be applied to elicit muscle-based responses; this allows confirming and lateralizing the impairment within the spinal cord. Both recordings are necessary, as sometimes the D-Wave is not detectable because of fibres desynchronization. In the absence of D-wave modifications, muscle MEPs were occasionally checked to confirm D-wave recordings.

In our experience, the percutaneous D-wave recording electrode proved to be useful to achieve continuous monitoring during the most critical steps of the transoral procedure. Moreover,

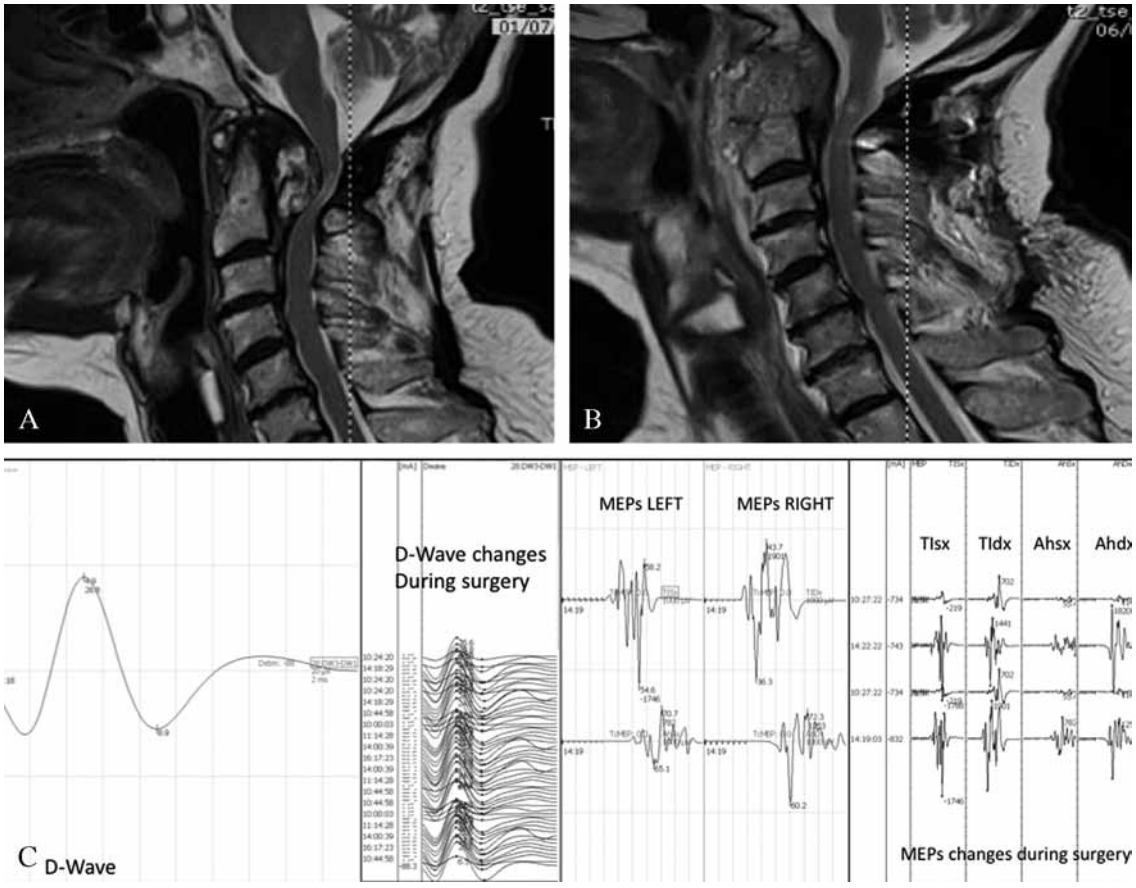

Figure 1.—Preoperative (A) and postoperative (B) sagittal T2 MR images of a 77-year-old woman with a C1-C2 spinal cord tumour. The tumour was approached transorally, with gross-total removal, homologous bone graft positioning, and posterior C1-C2 fusion. Motor function monitoring (C) shows D-wave on the right side of the panel (at the end of surgery and variability during surgery), and muscle-MEPs on the left side, with lower arms in the upper part and upper arms in the lower part (at the end of surgery and variability during surgery). Muscle-MEPs showed amplitude variability during surgery in all four extremities, with a decrease up to 50% in the left arm, while D-wave amplitude variability always remained below 20%. No new motor deficit appeared postoperatively.

it is safe, and doesn't imply any tilt movement of the surgical field. The technique is proposed for a new kind of surgery as a preliminary report. Since this is a monitoring technique, further studies are needed to evaluate its sensitivity and specificity.

Key messages

— This is the first reported experience in motor function monitoring with percutaneous placement of epidural D-wave recording electrodes during transoral surgery.

— D-wave recordings allow continuous monitoring through low stimulus intensities that do not cause jaw twitches.

— When D-wave recordings show changes, a stronger stimulation can be applied to elicit muscle-based responses (MEPs); this allows confirming and lateralizing the impairment within the spinal cord.

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