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Preserving Femoral Nerve Function: A Multimodal Neuromonitoring Approach in Transpsoas Lateral Access to the Spine

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Abstract

Background: Transpsoas lateral access spine surgery has many advantages as an alternative to traditional anterior or posterior approaches for discectomy and fusion. Despite neural mapping using triggered EMG to avoid injury to the lumbar plexus elements, femoral nerve deficits suspected from excessive or prolonged tissue dilation or retraction continues to be reported in the literature.

Purpose: To describe a multimodal approach to monitor femoral nerve function through saphenous nerve somatosensory evoked potential (sSSEP) and transcranial motor evoked potential (MEP).

Study Design: A retrospective analysis of a case series was performed.

Methods: A multi-center group of board certified neurophysiologists, fellowship trained orthopedic spine and neurological surgeons performed and monitored 91 lateral transpsoas procedures over the course of one year. Saphenous SSEPs were conducted as described by Silverstein, et al (2014). MEP monitoring was focused on acquiring muscle responses from the approach side quadriceps muscles (Block & Silverstein, 2014). MEPs were introduced to the monitoring paradigm after the first 14 procedures that were reviewed.

Results: In the sSSEP only portion of the cohort, 3 out of 12 patients exhibited changes to the saphenous SSEP on the approach side (2 cases were omitted due to poor data).

Intraoperative sSSEP amplitude recovery occurred following intervention with all 3 patients presenting postoperatively with varying degrees of transient femoral sensory deficits that resolved. MEPs were added to the remainder of the sample. In 11 surgeries baseline data was not recorded from one of the two modalities. 2 patients exhibited a loss of the approach side sSSEP concurrently with a loss of the quadriceps MEP responses while the retractors were in place. With removal of the retractors, the responses from both modalities returned to baseline values and no new neurological deficits were observed. 1 patient exhibited a loss in the sSSEP with return to baseline after intervention (MEPs were not obtained at baseline in this case). In 6 procedures, quadriceps MEPs were recorded at baseline and were lost following placement of the retractors (with sSSEPs unobtainable at baseline in these cases). Removal of retractors showed a full return of MEPs to baseline in 5 patients with no new post-op neurological deficits noted. Patient 6 exhibited postoperative ipsilateral quadriceps palsy; however, this case was early on in our adoption of the MEP technique and proper technique and interventional protocols were not yet in place. We also had one patient exhibit transient thigh paresthesia without intraoperative SSEP or MEP detection.

We report a sensitivity of 92% and a specificity of 100%, with a PPV of 100% and a NPV of 99%.

Conclusion: Intervention was implemented in 13% of our cases; however, we report a femoral nerve related deficit percentage of 4% (4 out of 91). In the majority of cases where a degradation of evoked potential recordings was observed, timely intervention (i.e. removal of retractors) resulted in a return of the evoked potential amplitudes to baseline levels.

These compelling initial observations suggests that a multi-modal neuromonitoring paradigm may be useful for reducing the likelihood of femoral nerve injuries. Further study is needed with a prospective cohort and larger sample size to determine statistical significance.