2017 INTERNATIONAL SOCIETY for the ADVANCEMENT of SPINE SURGERY

Femoral Nerve Protection in Transpsoas Lateral Lumbar Interbody Fusion (LLIF)

Authors: J. Silverstein, J. Block, M. Goldstein, H. DeWal, J. Zook, P. Slosar, R. Madhok, L. Mermelstein, S. Basra, J. Reynolds, N. Goldthwaite, H. Ball, B. Bizzini Neuro Protective Solutions, Hauppauge, NY, United States, ION Intraoperative Neurophysiology, Walnut Creek, CA, United States, Orthopedic Associates of Manhasset, Great Neck, NY, United States, Long Island Spine Specialists, Commack, NY, United States, Seton Medical Center, Daly City, CA, United States, Neuroaxis Neurosurgical Associates, New York, NY, United States

Summary: Femoral nerve injury from excessive or prolonged retraction of the psoas muscle during LLIF surgery can be a devastating complication. Multiple investigators have reported that observing free running electromyography (EMG) recordings alone may be unreliable in providing an alert for impending femoral nerve injury. A multi-modal neuromonitoring approach using saphenous nerve somatosensory evoked potentials (sSSEPs) and motor evoked potentials with quadriceps muscle recordings (qMEPs) has shown promise as a useful tool for preventing femoral nerve injuries by alerting the surgeon when there is a degradation of femoral nerve function during the time of retraction. We present a case series supporting the use of a multi-modal neuromonitoring paradigm aimed at significantly reducing the incidence of iatrogenic femoral nerve injuries.

Hypothesis: sSSEP and qMEP may reduce femoral nerve injuries in LLIF procedures.

Design: Retrospective case review.

Introduction: Novel techniques for monitoring femoral nerve function during LLIF have been reported (sSSEP and qMEP). It has been reported in the literature that excessive or prolonged retraction of the psoas muscle can result in an amplitude degradation of the surgical side femoral nerve motor and/or sensory evoked potentials (EPs). In this series, when an EP alert occurred, timely intervention of surgical countermeasures (e.g. releasing or reducing retraction, and/or increasing blood pressure) always resulted in the recovery of the degraded femoral nerve evoked potentials.

Methods: A retrospective analysis of 141 LLIF procedures performed over the course of 1 year was conducted. A multi-modal neuromonitoring paradigm using sSSEPs, qMEPs, and free running EMG recordings were used, and alerts were given when a significant degradation of the surgical side femoral EP amplitudes were observed, or any significant spontaneous EMG activity was observed.

Results: In 14 cases (10%) we observed unilateral degradation of the approach side EP amplitudes and an alert was given. In 13/14 of these cases, the surgeon responded with an intervention and the degraded EPs recovered. These patients awoke without sequelae. In one case, the surgeon did not respond to the alert with any countermeasures and the degraded EPs did not recover for the duration of the procedure. This patient awoke with new onset sensory complaints in the surgical side medial thigh and weakness of knee extension.

Conclusion: In this series, we experienced a single postoperative femoral nerve injury (0.7%) which occurred when no surgical countermeasures were employed following a neuromonitoring alert. In all other cases with a neuromonitoring alert, timely surgical countermeasures correlated with recovery of the degraded EPs and no subsequent postoperative neurological deficits occurred. It is noteworthy that all alerts were from a degradation of the motor and sensory EPs and none of the alerts involved spontaneous EMG activity. When these neuromonitoring alert occurred, they were limited to an attenuation of the surgical side femoral nerve EPs and control recordings from sciatic motor and sensory EPs remained unchanged. Although more study is needed, our initial experience suggests that the addition of femoral nerve EP monitoring (sSSEP & qMEP) may be extremely valuable in providing an early warning of impending femoral nerve injury that may be essential to allow for changes in the surgical plan that may reverse or attenuate the effects of excessive or prolonged retraction.