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NEUROMONITORING
Surgical Monitoring that Raises the Standard of Care

Bone Thresholds for Pedicle Screw Stimulation - Daniel Slepian, PA, CNIM

While numerous articles have been published pertaining to pedicle screw stimulation few articles mention the need for establishing a bone density threshold prior to inserting the implant. This article explores the need to establish a bone threshold prior to screw insertion to minimize false positive findings. Additionally, little is said about the patient's age or the relative size of the pedicle in the three primary regions of the spine. Optimal bone thresholds should be set with consideration given to the patient's age, overall health and the differing sizes of the pedicle. If neurotechnologist's (NTs) are to use a specific stimulus intensity cutoff, such as 10mA to base a call on, they could be ignoring inherent physiological factors relative to optimal pedicle size and bone density.

Convincing the surgeon to establish a bone threshold prior to inserting a pedicle screw has not been readily accepted. As a result, NT's have found it was easier to convince the surgeon to establish a bone threshold when the screw tests positive at intensities below 10mA. Another point to consider is that the bone threshold may not be the same at any one level when compared to the on the opposite side. To date a bone threshold is obtained when a screw tests positive for triggered electromyographic activity. Based on this threshold NT's can confidently advise the surgeon of whether or not the implant has in fact breached the medial wall of the pedicle. Additionally the technologist should always suggest that the surgeon obtain an image for verification at this point in the surgery.

Surgical data on common bone threshold levels in the lumbar spine have shown intensities in excess of 45mA. It is of no value to use intensities this high and this may in fact cause injury to adjacent nerves or the spinal cord. We recommend intensities not to exceed 30mA in the lumbar spine; 25mA in the lower thoracic spine, T6-T12; 20mA in the upper thoracic spine and no higher than 15mA in the cervical spine. A significant amount of data is still needed at all levels to optimize these protocols and ensure patient safety, especially in the upper thoracic and cervical regions.

Case scenario: A male patient age 62 with chronic health issues underwent a posterior cervical fixation. A screw was placed into the C7 pedicle and tested positive for triggered electromyographic activity at 7mA. A bone threshold was obtained and elicited electromyographic activity at 7mA. Did the screw breach the medial wall of the pedicle?

Actual findings obtained via an AP x-ray of the cervical spine confirmed the screw was placed properly in the pedicle. See data below.

Current data obtained in the lumbosacral spine.

L1: limited data, average threshold 15.5mA

L2: 22 samples average threshold 25.80mA

L3: 34 samples average threshold 30.20mA

L4: 56 samples average threshold 26.88mA

L5: 65 samples average threshold 26.89mA

S1: 43 samples average threshold 21.33mA

Current data obtained in the thoracic and cervical spine is limited.

C4: threshold 11mA and as low as 7mA

C5: threshold 13.87mA

C6: threshold 14.16

C7: threshold 19.66

T1: threshold 12.5mA

Although the average thresholds are above 10mA that may not always be the case based on all factors discussed in this article.

Reference: The Usefulness of Electrical Stimulation for Assessing Pedicle Screw Placements: J. Richard Toleikis, J.P. Skelly, Arnold O. Carlvin, Sandra Toleikis, Thomas N Bernard, J. Keith Burkus, Max E. Burr, John D. Dorchak, Marc S. Goldman, Thomas R. Walsh