CASE REPORT

Measures to reduce neurologic complications of latarjet procedure using the Checkpoint intra-operative biphasic nerve stimulator

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Background

Neurologic injuries are ominous and feared complications of orthopedic shoulder surgeons. Recent reports highlight the risk associated with the Latarjet procedure for the treatment of glenohumeral instability. Shah, Warner and colleagues at Massachusetts General Hospital/Harvard Medical School (2012 Mar 21:94(6); 495-501) indicated a rate of neurologic injury of 10% following the Latarjet procedure. While many of these are injuries are found to be a neuropraxia and are short term, any iatrogenic neurologic injury can be devastating to the patient and surgeon alike. According to the article, "Neurologic injury following stabilization procedures is thought to be caused by traction, patient malpositioning, and inadvertent suturing…the axillary and musculocutaneous nerves are at the highest risk for traction injury."

Some surgeons have chosen not to perform this surgery because of concerns for complications. However, when performed without incident, the Latarjet procedure is a valuable method of addressing a very difficult problem. For those surgeons who wish to perform the Laterjet procedure, the risk and potential liabilities of neurologic injury are still very real. The ability to utilize a method to prospectively identify the nearby nerves at risk would be a very useful addition to these surgeons' armamentarium. In addition, having the ability to check nerve function before concluding the procedure would not only be reassuring to the surgeon but could possibly, in some circumstances, even permit intraoperative correction of constricting or deforming structures responsible for nerve dysfunction.

Certainly, detecting a neurologic injury post-operatively is not an ideal situation. Often if the patient has had an interscalene nerve block, the ability to perform a complete neurologic evaluation is deterred even longer than the immediate post-operative period, as often the block has not worn off until the following day. At that point, if a neurologic injury is detected, the decision of whether to return to the OR to explore the neurologic structures is not an easy one. At this point, the surgeon is in the unenviable position of having to decide whether the post- operative patient is presenting with temporary and reversible neuropraxia or if indeed there was nerve injury that could have been corrected at the time of surgery. If the surgeon decides that the lack of function is due to a neuropraxia that will resolve, this could lead to months of emotional turmoil for both patient and surgeon and then ultimately lead to the need for exploration and neurolysis when function is not recovered.

Intra-operative motor nerve assessment procedure

In our own exploration of intraoperative methods to inform us that the neurologic structures at risk, mainly the axillary and musculocutaneous nerves, are in good condition pre- and post-operatively we have begun to use the Checkpoint® Stimulator to help confirm and document nerve integrity upon case initiation and again just prior to closure. In some particularly challenging situations it may also be instructive to assess nerve integrity during the procedure.

During our recent Latarjet procedures we have started to use the Checkpoint nerve stimulator to activate and evaluate the function of both the axillary and musculocutaneous nerves during initial exposure. Once the nerves have been exposed, the needle anode is placed into adjacent tissue, and the stimulating tip is used to contact the nerve or closely adjacent tissue; we then proceed to identify the threshold level of stimulation needed to elicit a muscle response. This is done by using the Checkpoint at its lowest amplitude setting of 0.5 mA and then slowly increasing the pulse width from 0 microseconds until an initial motor response is identified. The pulse width is approximated (somewhere between 25-200 microseconds) then documented for comparison later, just prior to closure.

Evaluation of the musculocutaneous nerve is typically first, and we do not often expose this nerve directly. Rather, we palpate the course of the nerve and expose the surrounding tissue. We re-evaluate the nerve after we have performed our coracoid osteotomy and have completely freed up and mobilized our coracoid transfer. We are careful not to place retractors on the conjoined tendon at any point during the case to avoid neuropraxia from over-aggressive retraction.

Following transfer of the coracoid process, the musculocutaneous nerve is not easily accessible, but retesting the nerve at this point can give us credible evidence as to the nerve's health in the relocated anatomy. In a similar fashion, to stimulate in this instance the nerve is palpated, and the tip of the Checkpoint is guided to the level of the nerve. Since nerve stimulation in this scenario is less direct than it had been prior to mobilization of the bony block, higher stimulation outputs are typical, but the response of a healthy and intact nerve can nonetheless be observed and documented prior to closure.

The axillary nerve is more easily accessible throughout all aspects of the case. Once we have completed our osteotomy, we turn our attention to the subscapularis (although some perform a subscapularis split, we take down the upper two-thirds of the subscapularis in the fashion of Burkhart et al). At this point, we can first palpate and directly expose the axillary nerve. In a similar fashion described above, we identify the threshold level of stimulation needed to elicit a deltoid muscle response. At the conclusion of the transfer, we first palpate the nerve on the medial and lateral sides of the conjoined tendon transfer. We expose the nerve for stimulation by retracting the conjoined tendon medially. At times, there is not a direct view of the nerve, and we adjust our simulation accordingly.

If either nerve were deemed unresponsive, or if the motor response to stimulation is markedly decreased, the surgeon can take immediate measures to correct the situation after considering some of the potential concerns. Certainly at times, the reason for a diminished response will be a neuropraxia. However, all possible correctable options would be ruled out prior to closing the incision and extubating the patient.

- Is the graft placement putting too much pressure on the axillary nerve?
- Were either nerves (especially the axillary) inadvertently sutured?
- Does excess conjoined tendon bulk needs to be addressed?
- Was the medial fascial release of the conjoined tendon adequate to prevent tethering of the musculocutaneous nerve when the coracoid was mobilized to the desired position?
- Did compression of the plexus occur due to residual attachment of the pectoralis minor to the coracoid?
- Are there problems that need to be identified along the nerve's course?
- Is a neurolysis and mobilization adequate, or is something tethering the plexus?

While our surgical technique does not involve retraction of the conjoined tendon in particular, surgeons may find it quite useful to use the Checkpoint in the middle of the procedure to assure that there is no degradation of nerve function due to significant or prolonged retraction, sub- optimal patient positioning, etc. A degraded response may imply that traction or retraction needs to be minimized.

Summary

Means of identifying neurological injury early in the Latarjet and similar procedures are critical to optimizing surgical outcomes. The Checkpoint stimulator, when used as directed, can provide the surgeon with important additional intra-operative information and the confidence to close without undue concern over the need to take the patient back into the operating room for additional surgery.

About the author

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The Checkpoint Stimulator is a single-use, sterile device intended to provide electrical stimulation of exposed motor nerves or muscle tissue to locate and identify nerves and to test nerve and muscle excitability. Do not use this Stimulator when paralyzing anesthetic agents are in effect, as an absent or inconsistent response to stimulation may result in inaccurate assessment of nerve and muscle function. For a complete list of warnings and precautions regarding the use of the Stimulator please see www.checkpointsurgical.com. Note: Case Reports are company funded and non-peer reviewed.