WHITE PAPER

Intraoperative evaluation of the radial nerve during humeral shaft fracture ORIF

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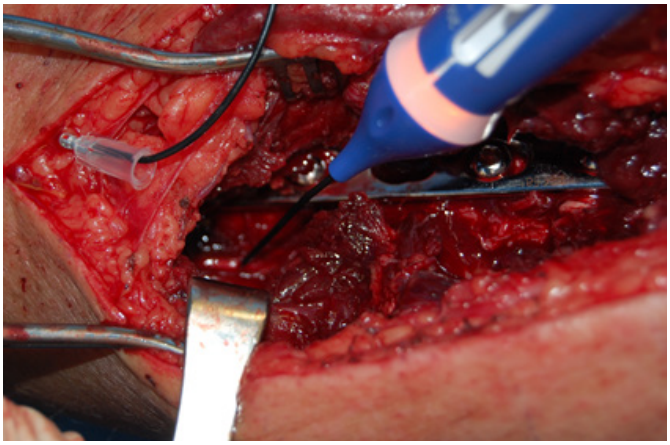
Most humeral shaft fractures can be successfully treated without surgery. When operative intervention is required, the most common technique is an open reduction with internal plate fixation. The main indications for surgical intervention include open fractures, severe displacement or angulation, and an inability to treat conservatively due to polytrauma where early mobilization is paramount. A posterior or anterior approach is typically used for humeral shaft fractures. However, the radial nerve at risk of injury throughout the posterior approach, and within the distal aspect of the anterolateral approach. Surgical approaches for revision of humeral shaft fractures, including malunion or nonunion, present a challenging soft tissue dissection due to prior scarring and injury, increasing the risk of radial nerve injury.

The median, ulnar, musculocutaneous, and radial nerves travel within the arm, surrounding the humerus. During fracture fixation the radial nerve is at greatest risk due to its proximity to the fracture site. The radial nerve originates from the posterior cord of the brachial plexus, travels along the posterior aspect of the humerus near the mid point, and is bound close to the humeral shaft by the lateral intermuscular septum. As described by Holstein and Lewis, the radial nerve is most likely to be injured if the fracture is near the junction of the middle and distal third.



After initial dissection, the CHECKPOINT® Nerve Stimulator is utilized to safely identify the radial and other nerves. The return current needle is placed into adjacent non-stimulatable tissue, and the amplitude is set to 2 mA with pulse width of 200 µs. Nerve location is mapped by first locating the nerve through the tissue, and then progressively lowering the pulse width to hone in on the nerve location. Then surrounding tissue can be stimulated while looking for a motor response, and the path of the nerve can be determined within the surrounding tissue. Once the nerve location and path are known, dissection can be performed to safely expose and protect the nerve.

If absent or diminished radial nerve function is observed clinically, the nerve stimulator can be used at 0.5 milliamp, starting at a 0 µsec pulse width and

gradually increasing the pulse width until the intended motor response is observed. If there is no response then decrease the pulse width to 0 µsec, increase amplitude to the 2 milliamp setting, and repeat increasing the pulse width until a motor response is visually observed. The amplitude and pulse width where motor response is first observed is the threshold level for the nerve (example: 2 mA, 100 µsec). This procedure can be performed at different locations along the nerve, to confirm the threshold level. After nerve release, the steps can be repeated to determine if the threshold level for the nerve is the same or lower for both pulse width and amplitude (example: 0.5 mA, 50 µsec). It is important to note that tourniquet use can alter the nerve response after a period of time, and if this is suspected, let the tourniquet down, allowing reperfusion of the extremity. Additionally, paralytic anesthetic agents should be avoided, and regional anesthesia can be used but not directly in the region of nerve stimulation.

The Checkpoint Nerve Stimulator/Locator can be helpful in radial nerve identification during primary or revision surgery for humeral shaft fractures. It can be especially useful when there is an acute or chronic radial nerve injury. The radial nerve can be stimulated across the zone of injury before and after nerve release to help aid clinical decisions regarding a radial nerve injury. Other adjacent nerve can also be identified and safely protected. Confirmation of nerve integrity and function can be performed at the end of the procedure by threshold testing.

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.

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