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*Case Report*

# Musculocutaneous nerve palsy following traumatic spinal cord injury

Kathleen M Abbott and Shanker Nesathurai

*Department of Physical Medicine and Rehabilitation, Boston University School of Medicine, Boston Medical Center, Preston F511, East Newton Campus, 1 Boston Medical Center Place, Boston, Massachusetts, USA*

**Study Design:** Case report of isolated musculocutaneous nerve lesion after an acute thoracic spinal cord injury. To our knowledge, this is the only reported case of isolated musculocutaneous nerve palsy associated with an acute spinal cord injury. Objectives: To determine the possible mechanisms of this isolated lesion. Also, to confirm the clinical diagnosis with a properly planned electrodiagnostic study. The differential diagnosis is considered.

**Summary of Data:** A comprehensive literature search was completed. Musculocutaneous lesions can be the result of heavy physical activity, shoulder subluxation, operative shoulder procedures, and intraoperative arm positioning. Isolated sensory lesions may be caused by carrying a heavy purse or phlebotomy.

**Conclusions:** Intraoperative, position, traction injury and premorbid physical activity may be implicated in this patients nerve palsy.

**Keywords:** musculocutaneous nerve; nerve entrapments; brachial plexus lesions

## Case Report

A 24 year old, right handed, emergency technician was involved in a motor vehicle accident. This unrestrained driver hit a tree, and was found 15 feet from his car. He suffered a fracture of the T7 and T8 vertebrae which resulted in a complete transection of the spinal cord. He did not sustain any cervical fractures. The patient was assessed by the rehabilitation service within 24 h of his injury, and was graded as a 'T6 complete' paraplegic by ASIA criterion.[1] Mini-mental status examination was within normal limits.[2] Reflexes, power and sensation in the upper extremities were normal. At the time of injury, he was not taking any medications. He was a recreational weightlifter.

Initially, the patient was not intubated, but arterial blood gases demonstrated some mild hypoxia. On day three, he was diagnosed with acute respiratory distress syndrome. As a result, the patient was intubated, paralyzed, sedated, restrained and ventilated.

On day four, the patient was taken to the operating room. The patient was placed in the prone position, and the axilla was padded. The spine was exposed from T3 through L1. A T7 decompression, and T6 through T10 posterolateral fusion was completed. Instrumentation was placed between T5 through T12 vertebral segments. A bone stimulator was also inserted. Total operating room time was 9 h and 20 min. Blood pressure was measured intraoperatively through a radial arterial line. The patient was returned to the surgical intensive care unit postoperativly and remained on the ventilator.

On day nine (4 days postoperatively), the patient was extubated. At this time, the neurological examination of the left arm was abnormal. Power of the elbow flexor (MRC scale) was three grade,[3] and biceps contraction was not palpable. The biceps reflex was decreased, and there was hypoesthesia over the lateral forearm. The remainder of the upper extremity neurological examination was normal. A clinical diagnosis of isolated musculocutaneous nerve palsy (MCN) was made.

The patient was transferred to the spinal cord rehabilitation service, and electrodiagnostic study was completed on day 30 post injury. The left median and ulnar motor nerve conduction studies were normal. The sensory conduction studies of the left and right radial, medium, ulnar, and medial cutaneous nerve of the forearm were normal. An evoked sensory potential was not obtained from the left lateral cutaneous nerve of the forearm. However, the response from the right lateral cutaneous nerve of the forearm was normal at 12 microvolts. There were 4+ fibrillation potentials in the left biceps brachii and brachialis muscles. No volitional motor units were identified in the biceps brachii and one motor unit was identified in the brachialis. Concentric needle examination of the left dorsal interosseous, supraspinatus, anconeus and deltoid muscles were normal. These electrodiagnostic findings were consistent with an isolated axonal MCN lesion.

Correspondence: S Nesathurai MD, FRCP(C)

On day 69 post injury, the patient was reexamined. Elbow flexion was (grade four) and sensation had returned to normal in the left lateral forearm. Biceps contraction was now palpable.

## Discussion

The MCN is derived from the C5 and C6 nerve roots which form the upper trunk of the brachial plexus. The anterior divisions of the upper and middle trunks join to form the lateral cord. The lateral cord separates into the lateral root of the median nerve and the MCN at the level of the midshaft of the clavicle and coracoid process. The MCN penetrates the coracobrachialis muscle 31–82 millimeters distal to the coracoid process.[5] Proximal to the elbow, the MCN supplies the coracobrachialis, biceps brachii and brachialis muscles. Two to five centimeters above the antecubital fossa, the lateral cutaneous nerve of the forearm (LCNF), the terminal sensory branch of the MCN, lies between the biceps and brachioradialis muscles.[6] At the elbow crease, this sensory nerve lies lateral to the biceps tendon just beneath the cephalic vein.[7] The LCNF supplies sensation to the lateral forearm. Please refer to Figure 1.

Anatomic variations do exist. In 14% of cadavers studied the MCN does not penetrate the coracobrachialis muscle. In 1–3% of cadavers studied, the MCN is derived from the posterior cord.[8]

To our knowledge, this is the only reported case of an isolated MCN lesion associated with an acute spinal cord injury. Electrodiagnostic testing confirmed the clinical findings. There were fibrillation potentials in the biceps brachii and brachialis muscles, which are consistent with axonotmesis. The unilateral absence of the evoked response from the left lateral cutaneous nerve of the forearm is also consistent with an isolated MCN palsy.

Ideally, the coracobrachialis muscle and cervical paraspinal muscles should have been electrodiagnostically evaluted. However, the patient could not tolerate any further concentric needle examination. A brachial plexus lesion and cervical radiculopathy should be considered in the differential diagnosis. In a brachial plexus injury, the lesion is distal to the dorsal root ganglion. As a result, the sensory nerve action potentials should be abnormal. In this patient, the evoked responses from the left and right radial, median, ulnar, and medial cutaneous nerve of the forearm were within normal limits. As well the evoked response from the right LCNF was within normal limits. Although the paraspinal muscles were not studied, a fifth or sixth cervical root lesion is unlikely because the supraspinatus, and deltoid muscle are innervated by the same roots as the biceps and brachialis.[3] The needle examination of the supraspinatus, and deltoid were within normal limits. Needle examination of the coracobrachialis, which was not completed, would help define the location of the lesion.

MCN lesions have been associated with heavy physical activity,[6,8–10] shoulder subluxation,[11] clavicular fractures,[12], operative shoulder procedures,[13,14] and intraoperative arm positioning.[15] In addition, carrying a heavy purse[17] and phlebotomy[7] have been associated with an isolated lesion of the LCNF. Brachial neuritis may also be implicated.

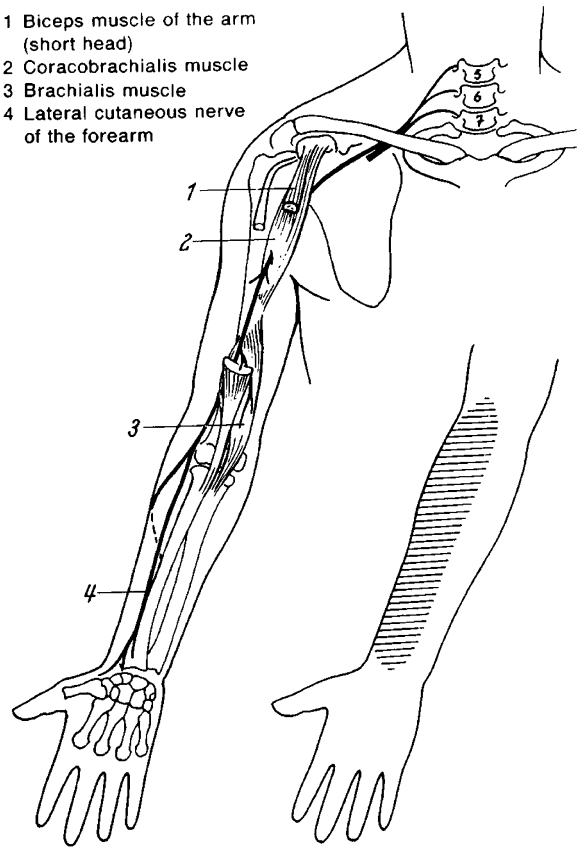


**Figure 1** Anatomical course of musculocutaneous nerve. The shaded area represents the sensory distribution of the lateral cutaneous nerve of the forearm.[4] (reprinted with permission.)

Strenuous physical activity has been implicated in isolated MCN injuries. The coracobrachialis flexes and adducts the glenohumeral joint. Certain athletic activities may result in hypertrophy of this muscle. The MCN may be susceptible to stretch injury as it pierces the hypertrophied coracobrachialis muscle.[8] Sports such as weightlifting, racquetball and football have been associated with this lesion.[6,8–10]

Liveson reviewed a series of 11 patients with electrophysiologically confirmed nerve palsies after shoulder subluxation. Most patients had multiple nerve lesions. Five patients had some involvement of MCN fibers. Only one patient had an isolated MCN lesion.[11]

Midshaft clavicular fractures have been followed by a MCN palsy.[12] Fractures of the clavicle and acromioclavicular dislocations can be surgically treated by moving the coracoid process.[14] Surgical treatment of recurrent glenohumeral dislocation can involve transposition of the coracoid process (Bristow procedure).[13]

By moving the coracoid process, the MCN may be susceptible to stretch injury.

There are reports of MCN injuries subsequent to general anesthesia.[15] The mechanism of injury is probably related to the abducted, externally rotated position of the arm. The MCN may be susceptible to injury when the patient is prone, and the arm is subjected to downward traction.[16]

Distal lesions of the MCN have been reported. The terminal sensory branch of the MCN, the LCNF, may be compromised in the antecubital fossa. An isolated lesion has been reported after phlebotomy.[7] As well, this phenomenon was described after vigorous exercise with the elbow extended and the forearm pronated (ie racquetball).[6]

The etiology of this patient's isolated lesion is probably multifactoral. He was a recreational weight-lifter, and may have developed hypertrophy of his coracobrachialis muscle. The patient was placed in a prone position for approximately 9 h in the operating room. During the procedure, his arm may have been placed in an abducted, externally rotated position. Furthermore, he remained intubated, ventilated, sedated, restrained and paralyzed postoperatively. He may have suffered a traction injury at that time. It is unlikely that his injury was sustained at the time of the motor vehicle accident, as he had an intact upper extremity neurological examination on initial presentation.

MCN nerve lesions have significant functional consequences to a paraplegic patient. These patients require upper extremity power to attain independence with mobility and transfers. Although this patient had Axontomesis of his MCN nerve, he was able to regain functional strength in his elbow flexors. To prevent future lesions, it may be prudent to increase the padding intraoperatively, as well as minimize the use of physical restraints.

MCN injuries are relatively rare. A high index of suspicion is necessary to identify these lesions. As well, a properly planned electrodiagnostic study can aid in the correct diagnosis.

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