

Diagnostic Ability to Differentiate between Ulnar Neuropathy and C8-T1 Radiculopathy: A Survey of 26 Indian Orthopedic Surgeons

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ABSTRACT

Introduction: There is large morbidity in the Indian population in relation to the orthopedic problems so we did the study to evaluate the importance of continuous medical education in retaining diagnostic efficiency of Indian Orthopaedic Surgeons by surveying their ability to differentiate between ulnar neuropathy and C8-T1 radiculopathy.

Material and Methods: 26 orthopedic surgeons who got masters degree completed a questionnaire containing following questions about the topic. (1) where is the sensory loss in ulnar neuropathy when it is injured at elbow? (2) The muscles specifically weak in ulnar neuropathy but intact in C8-T1 radiculopathy?

Results: Sixteen of the 26 (53%) correctly answered the first question-that is ulnar neuropathy at elbow causes sensory loss only over the small and ring fingers. Nobody except one was able to identify all the 7 muscles innervated by ulnar nerve. And that exceptional one was in the category of less than 3 years of experience after obtaining degree. Only 3 participants correctly answered the muscles innervated by ulnar nerve (not all) without naming C8-T1 root supplied muscles.

Conclusion: Since all the participants were qualified orthopaedic surgeons but differ in their field experience and touch from the college education. Our study revealed surprising deterioration in basic anatomy knowledge and diagnostic ability to differentiate between ulnar neuropathy and C8-T1 radiculopathy after passing out from college educational system. This mandates the importance of continuous medical education involving practicing orthopaedic surgeons.

Keywords: Cervical spondylosis, ulnar neuropathy, cubital tunnel syndrome, C8-T1 radiculopathy

INTRODUCTION

In India the industrial and agricultural mechanization has not been developed so far. Despite all the mechanical advancement in the world we still depend heavily on manual Labour. Our population specially the labour class whether urban or rural carry a lot of weight over their head. A practicing orthopedic surgeon usually see a huge number of patients with cervical spondylosis and associated radiculopathy. In a study by radhakrishnan et al the prevalence is 83 per 100000 population of cervical radiculopathy.¹ Of this C6 and C7 are more common. C8-T1 radiculopathy is relatively less common^{1,2} but yet its burden may be significant in relation to numbers. In contrast the upper extremity nerve entrapment syndromes are far more common. Ulnar nerve compression at elbow also known as cubital tunnel syndrome is second only to carpal tunnel syndrome.^{3,4} Moreover the upper extremity compression syndromes is on the rise in recent decades.³

EMG and NCV my assist in diagnosis between peripheral neuropathy and cervical radiculopathy following clinical examination.^{2,3,5,6} But since these investigations are a bit

costlier and also they have high false negative rate and lower specificity(40%)^{2,5-8} and a lower sensitivity (42%) in diagnosing cervical radiculopathy.⁷ Above all these investigations are not available routinely in rural areas. Hence a thorough knowledge of clinically relevant anatomy and good physical examination has an exceptional importance in diagnosing and differentiating between radiculopathy and peripheral neuropathy.

What we see today that a practicing orthopedic surgeon who has lot of patients in OPD has less time per patient and less time to study to refresh their theoretical knowledge.for example many surgeons examine only grip strength for testing radiculopathy and they are not very well versed with the intrinsic hand muscles innervated by C8 and T1 root. So we decided to test the knowledge of practicing orthopedic surgeons with the Questionnaire containing clinically relevant questions regarding ulnar nerve and C8-T1 root muscle innervation.

MATERIAL AND METHODS

The study questionnaire was developed with the help of various review articles⁹ and inclusion of extra question according to the need of this study (Q:3). This was simple but very comprehensive to test the knowledge for different manifestations of C8-T1 radiculopathy and ulnar cubital tunnel syndrome. The correct answers were confirmed with the reference of various anatomy books (Gray's anatomy and snell's Anatomy). This Questionnaire was distributed to the participants of a cadaveric spine workshop organized in a medical college (SRMS, Bareilly, U.P, India) on the day of 19 Nov. 2016. The invitation of the workshop was send to all practicing orthopaedic surgeons and who want to enhance their skill in spine surgery. The questionnaire distribution was done as a personal request to the participants solely by senior author of the article. Since it was a questionnaire study, no ethical clearance was taken. Only delegates who wished to answer the questionnaire were included in the study.

Thirty surgeons completed the course. Each surgeon was requested to fill the Questionnaire which was described as an investigatory tool to assess their knowledge about upper extremity neurological examination. The surgeons were asked not to discuss with one another neither to take help of any alternative source like books, mobile phone or internet.

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Questions

- If there is ulnar neuropathy at the level of elbow, where will be the sensory loss? Kindly circle the single best answer.
 - Ulnar Forearm, small and ring fingers
 - Only the ulnar forearm
 - Only the small and ring fingers
 - None of the above
- Kindly circle all those muscles which are likely to be weak in ulnar neuropathy but intact in C8-T1 radiculopathy?
 - Flexor digiti minimi brevis
 - Flexor pollicis brevis
 - Abductor digiti minimi
 - Medial lumbricals
 - Lateral lumbricals
 - Abductor Pollicis brevis
 - Opponens digiti minimi
 - Adductor Pollicis
 - Opponens Pollicis
 - Palmar Interossei
 - Dorsal Interossei
- How much Time elapsed after Obtaining their Post Graduate Degree?
 - Less than 3 Years
 - More than 3 Years

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the statistical analysis. Descriptive statistics like mean and percentages were used for interpretation of results.

RESULTS

Thirty surgeons had participated in the cadaver course. All were male. Only twenty six surgeons (87%) wished to answer the Questionnaire. Of the twenty six who wished to answer, 15 were those who have elapsed less than 3 years after obtaining post graduate degree. Rest 11 were more than 3 years.

Sixteen of the 26 (53%) correctly answered option C on the first question—that is ulnar neuropathy at elbow causes sensory loss only over the small and ring fingers. Among this sixteen, 11(73%) are having less than three years experience and 5 are having beyond 3 years experience (45%). Nobody except one was able to identify all the 7 muscles innervated by ulnar nerve. And that exceptional one was in the category of less than 3 years of experience after obtaining degree. Only 3 participants have circled the muscles innervated by ulnar nerve (not all) without naming C8-T1 root supplied muscles. These three participants belong again to less than three years experienced group.

DISCUSSION

Since C8-T1 radiculopathy is far less common¹⁻³ so the experience with this condition may be lacking among practicing orthopedic surgeons. Overlapping clinical manifestations with cubital tunnel syndrome further complicate the diagnosis.^{2,3,6} Regarding motor dysfunction of ulnar nerve and C8-T1 Radiculopathy, many educational resources like textbooks, articles and internet are available but most of these only concentrate on grip strength, finger flexor and finger abductor weakness in C8-T1 lesions.^{5,6,10-13} In our view, to reach the correct diagnosis between ulnar neuropathy and C8-T1 lesion, one should have proper knowledge of C8-T1 dermatomal and

myotomal pattern and also should be very well versed with the intricacies of ulnar nerve anatomy. We undertook this study to assess the ability of orthopedic surgeons to differentiate ulnar neuropathy from C8-T1 radiculopathy.

Our results suggest that there is huge lacking of knowledge regarding ulnar nerve motor distribution. Only one among 26 was able to correctly identify all seven muscles without naming C8-T1 innervated muscles. Although less than 2/3 (53%) were able to correctly identify the ulnar nerve sensory distribution. Also there is large percentage of recently passed orthopedic surgeons (73%) who responded correctly when compared to more experienced surgeons(45%). Geoffrey E. et al⁹ showed 63% correct answers in their study but they have not evaluated in respect to the time elapsed after obtaining qualified degree.

The ulnar nerve supplies sensation to the medial half of the fourth finger, entire fifth finger, and medial border of the hand (Figure-1). This applies to both the palmar and dorsal sides.¹⁴ Medial forearm is innervated by the medial antebrachial cutaneous nerve and not by the Ulnar nerve.¹⁴ Medial antebrachial cutaneous nerve receives supply from C8 and T1 root via the medial cord of the brachial plexus (Figure-2). Hence an ulnar lesion at the elbow—a common site of compression or

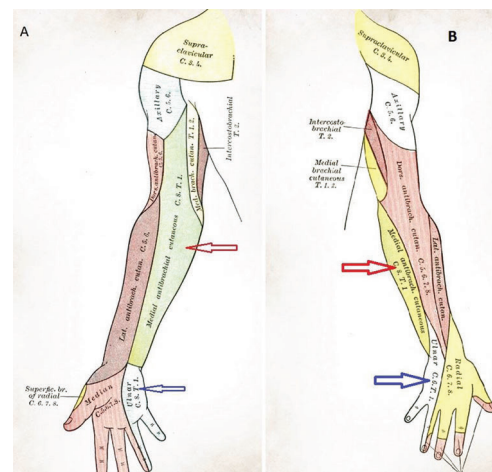


Figure-1: Diagram of the sensory distributions of the medial antebrachial cutaneous nerve (Red arrow) and ulnar nerve (Blue arrow). Anterior upper extremity (A) and posterior upper extremity (B).

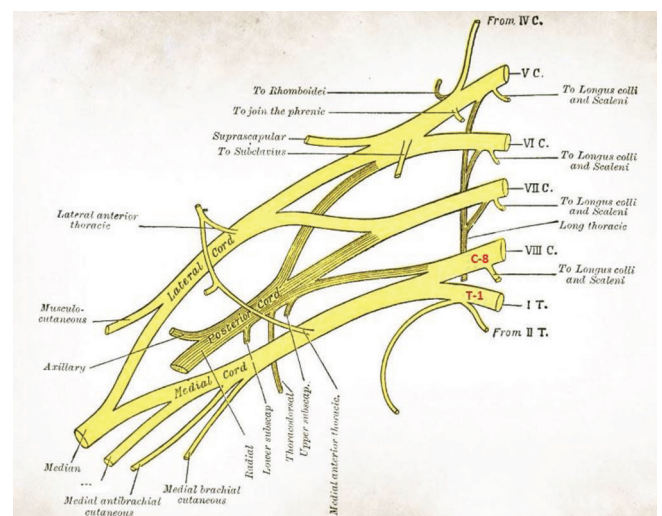


Figure-2: Illustration of the brachial plexus, with C8 and T1 root Marked with red.

trauma—would result in anesthesia of the ulnar hand and fingers but not the forearm.^{3,14} Furthermore, loss of sensation isolated to the ventral palm and fifth finger is suspicious for ulnar nerve compression in the Guyon canal.¹⁴ Dorsal sensation is through the dorsal sensory branch of the ulnar nerve, which branches approximately 5 to 6 cm proximal to the ulnar styloid.¹⁴

Regarding the motor functions of the C8–T1 roots and ulnar nerve, all intrinsic hand muscles are innervated by ulnar nerve except five.¹⁴ The abductor pollicis brevis, flexor pollicis brevis, opponens pollicis, and lateral two lumbricals are innervated by C8–T1 via the median nerve, entering the hand through the carpal tunnel.¹⁴ To remember these five muscles there is a simple mnemonic 'AbOF the law (above the law). This means: the abductor (Ab) pollicis brevis, flexor (F) pollicis brevis, opponens pollicis (O), and lateral lumbricals (Law) are “above the law”. These are the only intrinsic hand muscles which are not supplied by ulnar nerve. All other intrinsic hand muscles are supplied by ulnar nerve. By proper examination of these five muscles, one can differentiate between ulnar neuropathy (leaves these five muscle's strength intact), and C8-T1 radiculopathy which would result in weakness of these five muscles.

Figure-3 illustrates various movements of these five muscles. For example, the abductor pollicis brevis elevates the thumb at the metacarpophalangeal joint to 90 degrees relative to the plane of the palm (Figure-3a). Its strength is tested by the examiner attempting to adduct the thumb into the same plane as of the palm. The lumbricals are responsible for flexion at the metacarpophalangeal joints and extension at the interphalangeal joints (Figure-3C). The flexor pollicis brevis flex the metacarpophalangeal joint of the thumb in approximately the same plane as the palm (Figure-3D), and the opponens pollicis allows the thumb to touch the fifth finger (Figure-3E). Despite these distinct motor innervation patterns, there is the possibility of anomalous median-ulnar neural pathways such as a Riche-Cannieu or Martin-Gruber anastomosis should be kept in mind.^{15,16}

All the surveyed orthopedic surgeons are well qualified, possessing Masters degree in the field. Our study revealed a surprisingly poor degree of knowledge regarding differentiation between ulnar neuropathy and C8-T1 radiculopathy. Often the finer yet diagnostically crucial details of hand function, which relates to spinal disorders, are sometimes neglected. Furthermore the young surgeons displayed greater degree of knowledge as compared to more experienced practicing surgeons. This finding somewhat explains that the teaching curriculum may be adequate if not good in teaching institution imparting masters degree in orthopaedics. But this also signifies that as the surgeon involved with their practice they become less involved with the basic musculoskeletal theoretical knowledge base. That's why we recommend a continuous medical education program with special emphasis to involve private practicing surgeons to boost and refresh their basic musculoskeletal examination techniques like upper extremity neurological examination. Moreover, textbook authors should also try extra effort to provide adequate physical examination instruction. The risks inherent to teach simplistic examination techniques may ultimately fail by providing a false sense of security in the examiner.

In our Knowledge this is the first study to evaluate fundamental aspects of anatomical knowledge among practicing orthopedic



Figure-3: Motor actions of the abductor pollicis brevis (a), adductor pollicis (B), lumbricals (C), flexor pollicis brevis (D), and opponens pollicis (E).

surgeons in India according to the time elapsed after obtaining post graduate degree. In the study, the utilized questions were both comprehensive and straight forward. These results may provide an insight into the importance of continued medical education. But, this study is not without limitations. The study included a very small number of surgeons. Therefore, its generalization to whole orthopedic surgeon fraternity should be done cautiously. Also this study has not included the in-depth analysis of the surveyed surgeons regarding their field of practice, level of training institution, that precludes any thorough statistical analysis. No incentives have been offered to the participants which may have some influence on their performance. In Reality, when a surgeon feel uncomfortable with a diagnosis or the significance of a neurologic deficit, he may consult a reliable text or internet. He is also free to consult with his colleague of the respective field. Such options were not utilized during our study.

CONCLUSION

Conclusively it is found that even currently practicing orthopedic surgeons may lack complete knowledge of ulnar and C8–T1 neuroanatomy. To diagnose properly and accurately, every orthopedic surgeon should be thoroughly aware of the basics behind motor and sensory sequela of ulnar neuropathy and C8–T1 radiculopathy. Although, EMG, NCV and MRI may facilitate proper diagnosis of cubital tunnel syndrome and C8–T1 radiculopathies, but these are expensive and also not available everywhere and at all the time. And finally these similar modalities should not serve as an excuse for sub optimal basic neuroanatomy knowledge.

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