

INCIDENCE OF PERIPHERAL NEUROPATHIES IN STRING INSTRUMENT PLAYERS

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ABSTRACT: : *Playing-related musculoskeletal disorders can be painful and disabling, leading to financial hardships for musicians. Due to the high physical and psychological demands of their work, musicians are at risk for developing a variety of health problems. They are often required to hold the instrument firmly with flexed wrist, which could put them at a higher risk of neuropathies. The aim of the study was to find the incidence of peripheral neuropathies in string-instrument players using NCV Test and Quick DASH Score. A cross-sectional survey was carried out at two music academies across Pune city, where 56 musicians were enrolled. At the time of the survey 43 string instrument players were approached for evaluation of signs and symptoms of peripheral neuropathy and amongst them 30 were selected on the basis of inclusion and exclusion criteria. All of them were explained about the study. Written consent was taken and NCV test was conducted on each string-instrument player for upper limb Median, Ulnar and Radial nerves and Quick DASH outcome measure was filled. Comparison of NCV test results were done with the normal values of the upper limb nerves. The observed mean values of NCV were 29.4 ± 8.5 , 48.9 ± 8.4 , 46.76 ± 7.5 for the Median, Ulnar and Radial nerves respectively. Frequency distribution showed involvement of Median (33%), Ulnar (16%) and Radial nerve (1%) respectively. The mean of the Quick DASH Score was 24.3 out of 100 which indicated mild disability. The study concluded high incidence of peripheral neuropathy with the Median nerve being the most affected followed by the ulnar nerve.*

Key Words: *Peripheral neuropathies, String instrument players, Nerve conduction velocity test, Quick DASH*

INTRODUCTION

Musicians who play instruments know that there are few experiences in life that can be as fulfilling as making music. But often their goals are thwarted by physical limitations and pain. And it is only very recently that they are beginning to acknowledge another essential component: treating their bodies as part of their instruments, with the goal of preventing physical injury.^[1]

Playing-related musculoskeletal disorders can be painful and disabling, leading to financial hardships for musicians. Because most musicians work part-time, have intermittent periods of unemployment, or are self-employed, they lack health coverage and are underserved in primary care. Thus, early access to care, adequate follow-up, and comprehensive treatment for health problems may not be possible. Untreated or incompletely treated conditions can lead to social and psychological stress, the inability to play music, permanent disability, and the inability to earn an income.^[2]

Due to the high physical and psychological

demands of their work, musicians are at risk for developing a variety of health problems. They are often exposed to environmental hazards such as tobacco, noise, and alcohol. Playing-related musculoskeletal disorders arise from repetitive, awkward postures while playing, and postural stress from prolonged sitting or standing and transporting instruments, music stands, microphones, speakers, and other equipment. Some musicians actually accept musculoskeletal pain as a normal and necessary side effect of practice and musical improvement.^[2]

Musicians suffer from wide spectrum of upper extremity disorders causing significant symptoms such as pain, muscle weakness, numbness, tingling sensations.^[3] A musician has to practice for many hours, more than 10,000 hours before he would be able to give his concert. Playing a musical instrument implicates about 500 composite movements of hand and about more than 1200 movements per minute leading to chronic overuse and mechanical overload.^[3]

Rachel H. Kennedy et al indicates that plucked-

string musicians are susceptible to peripheral nerve injuries of the upper extremities due to the physical demands experienced during practice and performance. Nerve conduction testing can detect early neuropathy in the upper extremity of Musicians. The purpose of this study was to determine the presence of Median, Ulnar and Radial neuropathies in upper extremities of string-instrument players.^[4]

Musicians, who play string instruments such as Guitar, violin, viola, cello, and bass, are often required to hold the instrument quite firmly with a flexed wrist, which could put them at higher risk for carpal tunnel syndrome. In addition, violins and violas are also held in place by the chin, which forces the neck into a flexed position, and can therefore cause damage to the median nerve as it branches off from the brachial plexus. Also, because violinists and violists must constantly flex the left elbow to support their instrument, this arm could be at a higher risk of developing cubital tunnel syndrome. Playing requirements of each type of musician, it is hypothesized that the type of instrument played (brass, woodwind, percussion, or string) may be a determining factor in the amount of nerve damage present on the median and ulnar nerves. In addition, it is predicted that because the string group usually has the most strained playing postures, this group will be most likely to have nerve damage, while the group with the least strained playing posture (the brass group) will be least likely to show signs of Median or Ulnar nerve damage.^[2]

Nerve conduction studies (NCS) are one of the two major components of the electrodiagnostic (EDX) assessment. There are three types of NCS, motor, sensory, and mixed. Because of differing technical aspects in their performance, these must be performed sequentially, rather than simultaneously, whenever the same mixed nerve is being assessed. Similar to the Needle electrode examination (NEE) and the various special studies, all three types of NCS assess only large, heavily myelinated nerve fibres.^[5]

Neuromusculoskeletal problems may occur with increased frequency among musician and may affect musicians of all ages and ability. These Neuromusculoskeletal problems range in severity from asymptomatic findings to serious injuries that significantly disable musicians from practicing or performing. There are a variety of predisposing factors associated with entrapment neuropathies in musicians. Musicians are prone to injury due to increased playing, joint laxity and improper posture from hand positioning.^[6]

The most common cause of mononeuropathy is compression injury, which may occur at any point

along the course of the peripheral nerve. It may be acute or chronic, and may produce either focal loss of myelin or axonal degeneration.^[4] Patients may present with a wide range of symptoms, ranging from a mild hypoesthesia in the fourth and fifth digits to clawing of the fingers. Sensorial symptoms including numbness, burning, and tingling are the most common symptoms.^[5] These symptoms are especially provoked by repetitive activities. In the presence of clinical suspicion, supportive diagnostic tests can be performed.^[6]

The DASH (disability of shoulder, arm and hand questionnaire) is one of the most commonly used patient reported outcomes (PRO) measures for upper extremity assessment. It has been validated in the general population and was found to be the most effective instrument for evaluating patients with disorders involving multiple joints of the upper limb. Alternatively, Quick DASH is an 11-item questionnaire assessing upper extremity disability affecting multiple upper extremity joints compared to the 30 item DASH questionnaire. It also comprises of a sports or performing arts module.^[17]

Musicians are susceptible to various types of injuries, due to their repetitive physical demands. There is a need to generate awareness amongst Musicians about types of injuries they are predisposed to so that appropriate preventive measures could be taken, to preclude these injuries.

MATERIALS & METHODS

A cross-sectional survey was carried out at two music academies across Pune city, where 56 musicians were enrolled. At the time of the survey 43 string instrument players were approached for evaluation of signs and symptoms of peripheral neuropathy and amongst them 30 musicians were selected on the basis of inclusion and exclusion criteria. History was taken in a questionnaire format which included information pertaining demographic details, musical background, hand dominance and number of years playing. The dominant hand of playing the instrument was tested. The stimulation site was at or distal to the wrist. For the motor studies, the active electrodes were placed over the motor point of the abductor pollicis brevis for the Median nerve, over the abductor digiti minimi for the Ulnar nerve; and over the extensor indicis proprius for the Radial nerve. The reference electrode was placed 4cm distal over the 1st MCP joint for the Median nerve; over the 5th MCP joint for the Ulnar nerve; and 4cm proximal to ulnar styloid for the Radial nerve. The results obtained were then compared with

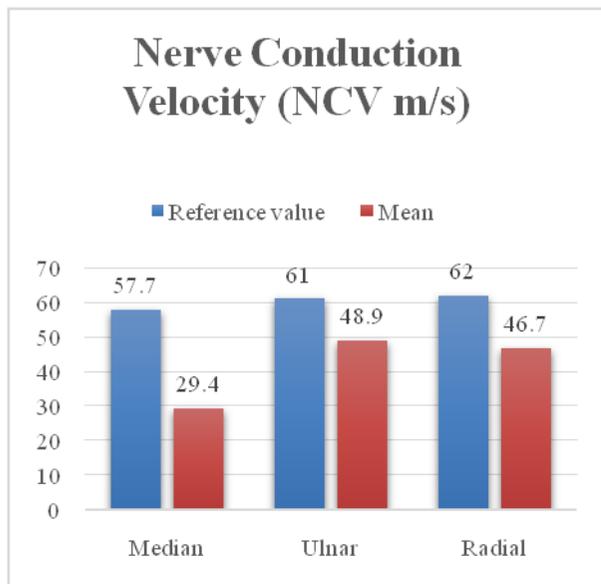
the normal values of Median, Radial & Ulnar nerve. Data was collected and analysed.

All of them were explained about the study. Witten consent was taken and NCV test was conducted on each string-instrument player for upper limb Median, Ulnar and Radial nerves and quick DASH outcome measure was filled.

RESULTS

Table I: Descriptive statistics of NCV in Median, Ulnar and Radial nerves.

NERVES	MEDIAN NERVE	ULNAR NERVE	RADIAL NERVE
MEAN ± SD of OBSERVED NCV(m/sec) VALUES	29.4 ± 8.5	48.9 ± 8.4	46.76 ± 7.5
REFERENCE VALUES	57.7 ± 4.9	61 ± 5.5	62 ± 5.1
FREQUENCY DISTRIBUTION (n)	33% (10)	16% (7)	1% (3)



GRAPH I: Comparison of NCV with reference values for Median, Ulnar and Radial nerves.

DISCUSSION

The aim of this study was to find the incidence of neuropathies in string instrument players. At the time of the survey 43 string instrument players were evaluated with ULTT (Upper Limb Tension Test) of Median, Radial and Ulnar nerves for signs and symptoms of peripheral neuropathy and amongst them 30 were selected as they had at least two ULTT's positive and these musicians underwent NCV test. Out of 30 participants, 28 were male and 2 were female in the age group of 18-35 years with the mean ± SD age of 22.4±1.92 years. The minimum years of playing the

instrument was 2 years with the mean ± SD of 4.46±1.30 years. They were examined with their prior permission after explaining the need of study. All components of outcome measure were explained and performed under guidance and supervision.

S. Sheibani-Rad, S. Wolfe, & J. Jupiter et al in the Bone and Joint Journal concluded that Musicians are not immune from the two most common entrapment neuropathies of the upper limb of the Median nerve at the wrist, and of the Ulnar nerve at the elbow.^[8] Lederman et al reported that 143 of 640 musicians (22%) had an entrapment neuropathy. Of these 143 patients, 45% had entrapment of either the median or of the ulnar nerve.^[8]

As shown in Graph I and Table I Median nerve was affected in 10 Musicians out of 30 (33 %). The reference value of nerve conduction velocity of Median Nerve is 57.7 ± 4.9 and the observed mean ± SD is 29.4 ± 8.5; Radial nerve was affected in 3 Musician out of 30 (1 %). The reference value of nerve conduction velocity of Radial Nerve is 62 ± 5.1 and the observed mean ± SD is 46.7 ± 7.5; Ulnar nerve was affected in 7 Musicians out of 30 (16 %). The reference value of nerve conduction velocity of Ulnar Nerve is 61 ± 5.5 and the observed mean ± SD is 48.9 ± 8.4. The 30 Musicians were also told to fill the Quick DASH Score which helped to understand the measure of disability in string-instrument players. The questionnaire had questions based on the symptoms as well as the ability to do certain activities. The sports or performing arts module from the Quick DASH Scale was used. The questions were related to the impact of arm shoulder or hand problem on playing the Musical instrument or both. The mean of the Quick DASH Score was 24.3 out of 100 which indicated mild disability.

Hochberg *et al* reported that Median nerve was the most commonly injured nerve followed by the Ulnar Nerve.^[8]

This study analyzed nerve compression syndromes of Median, Radial & Ulnar nerves objectively among string instrument players. Nerve conduction measurement is considered the gold standard when assessing the electrophysiologic status of the peripheral nerve.^[9] The main reason for neuropathies in musicians is that String instruments are the most difficult instruments of the world. Prolonged use of hands and holding the instrument in an awkward position of hand and doing fine finger movements in an awkward position of wrist and continuously pressurizing the *fretboard* , thus

causes injuries/neuropathies in String instrument players. Nerve compression syndromes in musicians are related to the demands and nature of musicians work, such as sustained muscle contraction pressure, or the compression arising from having to support the instrument itself. Common nerve-entrapment disorders include symptoms from compression of the ulnar nerve at the elbow, the median nerve at the wrist, cervical radiculopathies, occasional digital neuropathies and symptomatic thoracic outlet syndrome.

Additionally many musicians maintain & sustain a flexed wrist posture, which can have the effect of decreasing blood flow via the vasa nervosum sustain the axons in the region of the wrist, thus negatively affecting function.

The wrist and forearm muscles then are used more than any other muscles for producing the notes and vibrato. Often the wrist is flexed as the fingers curl to apply pressure to the strings. This is the classic position to induce carpal tunnel syndrome and may promote flexor carpi ulnaris tendinitis and ulnar nerve entrapment at the elbow and wrist. On the right side the right hand holds the bow, which is drawn across the strings to make the sound. The sustained state of abduction and flexion of the right shoulder can result in rotator cuff tendinitis if tension is not released. Some large orchestral works lasting well over one hour require prolonged periods of tremolo, in which the neck, shoulder-girdle complex, and wrist flexors and extensors are held in a state of isometric contraction as the bow is moved up and down a few centimetres very rapidly. The quick back and forth movements of the wrist required for sustained tremolo can result in overuse injury of the extensor carpi radialis and flexor carpi ulnaris muscle-tendon units. Occasionally the ulnar nerve can be compressed in Guyon's canal. Passages requiring rapid changes over the four strings of the instrument may strain the rotator cuff, deltoid, and pectoralis muscles.

The type of fibers (sensory/motor) to first manifest changes during electrophysiologic testing is an area of controversy, because there is not a fixed order of motor/ sensory loss with entrapments. Compression and ischemia affect the large fibers more than the small fibers and fibers situated peripherally in the fascicle are more susceptible than those located centrally. Some researchers have found sensory function is affected prior to motor function, while others have observed opposite.

Kimura et al found selective involvement of motor fibers with normal sensory conduction. In our study, 10 guitarists with electrophysiologic

evidence of median neuropathy at or distal to the wrist had involvement of the motor nerve fibers. Perhaps in these musicians the playing techniques/ positions created abnormal carpal tunnel pressure and nerve microcirculation affecting the motor fibers while sparing the sensory fibers. Musicians who perform a warm-up routine prior to playing are less likely to report experiences of tingling than those who do not warm-up prior to playing.

Hence, there was a need to evaluate the upper limb nerves with the help of NCV test and also was made to find out as to which nerves of the upper limb is affected in String Instrument Players.

CONCLUSION

This study concluded high incidence of peripheral neuropathy with the Median nerve being the most affected followed by the ulnar nerve.

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