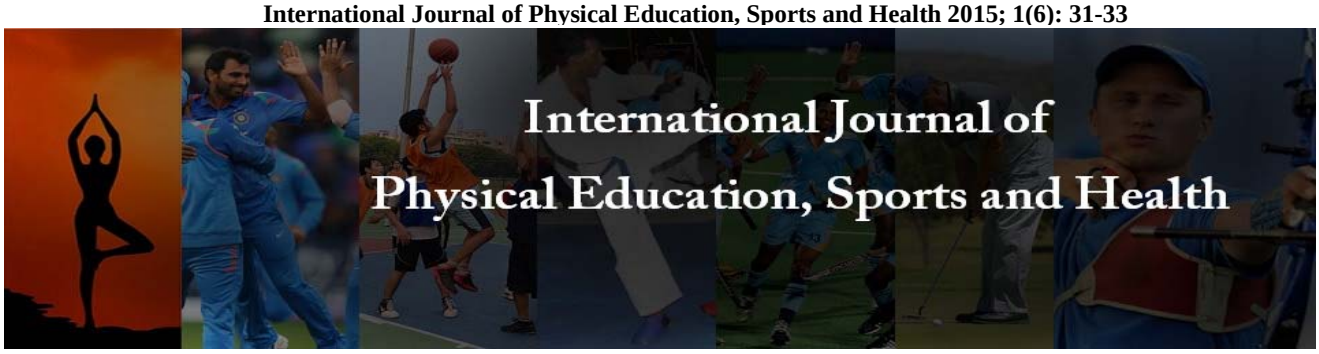

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Study of motor nerve conduction velocities of upper extremity in the female archers

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Abstract
Though studies are available delineating musculoskeletal injuries in archery but not much has been reported in literature about nerve injuries sustained in this sport. Upper limb nerves of archers, especially, females, could also be at risk of pathological changes induced by repetitive stresses inherent to game of archery. Present study attempted to identify whether any alteration in functions of nerves (median and ulnar) of both upper extremities (bow arm and drawing arm) of female archers existed by performing Motor Nerve Conduction Velocities (NCV) on sample of 10 archers with mean age 20.9 (1.79) years. Wilcoxon signed rank test revealed that motor nerve conduction velocities of drawing arm were significantly lower than bow arm suggesting presence electrodiagnostic changes in nerves of drawing arm, indicative of peripheral nerves being subjected to physical and physiological stresses in game, that needs to be taken care of or else there would be impending risk of archers developing some asymptomatic neuropathy similar to subclinical entrapment nerve neuropathy.

Keywords: Nerve Conduction Velocities, archery, bow arm, drawing arm.

1. Introduction
Ones sporting career and injuries are inseparable. Substantial injuries sustained by athletes can jeopardize their professional career. Despite the sports personnel being vigilant, occurrence of injury in athletes remains inevitable. High incidence of injuries frequently being reported in contact sports such as hockey, volleyball, basketball and wrestling (1, 2) makes one presume that non-contact sports are injury free games. However every sport whether contact or non-contact has its own unique injury profile as each game has its own physical demands and stresses (3). Archery is one of such non-contact sport that has evolved from bow and arrow weapon used in wars and hunting into competitive and recreational game and its popularity continues to grow since being included in Olympic Games. Considering the kind of physical and physiological demands that archery places on its players it could be well imagined that they too remain under constant risk of injuries. Co-ordination of muscles for repetitive motion requires archers to possess muscular strength, upper body endurance and high levels of stability (4).
Studies so far conducted on archery have mainly reported about musculoskeletal injuries around shoulder, elbow and wrist but in most of them involvement of nervous system has been ignored. Very few studies have reported about the status of nerves of upper limb in game of archery (4, 5, 6).
Soft tissue injuries are commonest form of injuries occurring in all kinds of sports. Ligament sprain, meniscal tear, tendon rupture, tenosynovitis and muscle strain are frequently reported and huge amount of literature is available on these types of injuries. Nervous tissue in form of peripheral nerves also constitutes important soft tissue of extremities and hence too remains at risk of injury in sports (1) but in literature not much attention has been paid to explore the types of injuries inflicted on peripheral nervous system especially in female archers.
Hence, present study was undertaken to investigate and compare motor conduction velocities of nerves of upper limb in female archers. Present study will help in finding the pattern of nerve injury in the upper extremities of archery. The Nerve Conduction Velocity (NCV) studies performed on nerves of both upper limbs will demonstrate the presence of characteristic symmetry and asymmetry of abnormalities. NCV tests are held as the 'gold standard' method for an objective, quantitative evaluation of peripheral nerve function and are widely used in diagnosis of neuropathies (8, 9, 10).

2. Materials and Methods

2.1 Sample

Participants of the study were recruited from female archery team of Punjabi University, Patiala. Inclusion criteria set for study was female archers who had been training archery regularly since last 5-7 years while participants having any signs or symptoms of peripheral neuropathy, compression syndrome of upper extremities, any history of traumatic injury of upper limb and history of rotator cuff injuries, injuries of wrist and elbow were excluded. 36 female archers were contacted and their participation in study was sought, 22 players consented to participate in study, out of these, 19 national and state level players who met the inclusion criteria were finally recruited in the study. 6 participants withdrew from study and hence study was completed on 13 participants while data of 10 archers with mean age (20.9±1.79) years, was used for analysis. Prior to study, approval of Departmental Research Board and ethical clearance was obtained from Institutional Ethical Committee (IEC), Punjabi university, Patiala. Participants were informed in detail about the purpose, aims, objectives, procedure of study and thereafter their informed consent for participation in the study was taken.

2.2 Recording of Nerve Conduction Velocities

The NCV/EMG machine (Neuroperfect-2000) manufactured and calibrated by Medicaid System (an ISO 9001:2000 certified Company), Chandigarh, India was used for NCV studies. The Neurophysiological study consisted of recording of motor nerve conduction velocities of median and ulnar nerves of both upper extremities. Participants were positioned in supine on the padded plinth with elbow supported in slight flexion and uniform head positions were maintained throughout the procedure. Skin temperature was checked using digital contact thermometer to eliminate the influence of temperature on the conduction parameters. Subjects were instructed to wear loose clothing, to remove any metallic ornament if wearing and were allowed to lie down for about 10 minutes prior to actual data acquisition. Forearms of both the extremities were exposed till mid of the arm. Electrodes were secured to the appropriate place using micropore adhesive tape. Prior to electrode placement area was cleaned with isopropyl alcohol solution to decrease skin resistance.

Nerve conduction studies of both nerves were accomplished by evoking Compound Motor Action Potential (CMAP) using surface bipolar method of stimulation. For the median nerve active (recording) electrode was placed over the motor point of the abductor pollicis brevis and over the abductor digiti minimi for the ulnar nerve. The median motor nerve was examined by stimulating the median nerve distally at the wrist (between the tendons of the flexor carpi radialis and palmaris longus), and proximally at level the above elbow joint (next to the brachial artery). The ulnar motor nerve velocity was examined by stimulating the ulnar nerve distally at the wrist and proximally at a level above the elbow (1–6 cm above the tip of the medial epicondyle) with bipolar surface electrodes with the elbow in 70° of flexion (11).

In the present study, the following ulnar and median nerve conduction measures were used: (1) the compound muscle action potential amplitude (CMPA), baseline-to-peak in milli Volts (mV). (2) Distal onset latency (DL) in milli seconds (ms) of potential CMAP (3) conduction velocity of the motor nerve fibers (MNCV) in meter per second (m/s) (above elbow to wrist).

3. Results and Discussion

Results of the present study revealed that significant differences existed in motor nerve conduction velocities of both extremity median nerves (Table.3.1) as well as in ulnar nerves (Table.3.2) of both sides in a segment from above elbow to wrist. On further analysis, it was found that mean values of MNCV of both nerves of drawing arm were on lower side than the mean values of bow arm which indicates that nerves of drawing arm are under some kind of physical or physiological stress as reflected by lower MNCV values. These observations are sufficient to suggest that nerves of archers specifically of drawing arm are prone to develop electrodiagnostic changes which could at any given point of time may surface as a considerable nerve impairment that can plague the performance of archers.

Table 3.1: Comparison of Median motor nerve parameters of segments between above elbow to wrist in Drawing Arm and Bow Arm of female archers

Parameters	Drawing arm	Bow arm	p-value
DL(ms)	4.04 ± 0.32	3.95 ± 0.00	0.45
CMPA(mV)	12.27 ± 0.04	13.75 ± 0.13	0.98
MNCV(m/sec)	51.17±2.38	55.86±2.81	0.005*****

*p< 0.05= significant

Table 3.1 shows significant differences exists between the median MNCV of drawing arm and bow arm.

Table 3.2: Comparison of Ulnar motor nerve parameters of segments between above elbow to wrist in Drawing Arm and Bow Arm of female archers

Parameters	Drawing arm	Bow arm	p-value
DL(mV)	3.86±0.17	3.73±0.25	0.145
CMPA (mV)	9.61±0.29	12.01±0.65	0.135
MNCV(m/s)	50.06±3.27	54.82±4.89	0.007*

*p< 0.05= significant

Table 3.2 showes significant difference exists between the MNCV of ulnar nerve of drawing arm and bow arm

Ertan (2006) suggested wide range of injuries can be inflicted to drawing arm equally in both male and female archers (12). The injuries in drawing arm may be due to the force required to draw and maintain the bowstring in the full draw and varies depending on the weight of the bow. This force is concentrated at the shoulder (4) and forearm flexor muscle at their origin. Very few studies have reported about nerve injuries in archery. In one study, Rehak *et al.*, reported median nerve compression neuropathies at wrist joint of archers (5), but no data could be found which could suggest about the condition of other nerves at elbow joint and wrist joint. Shimiju *et al.*, reported a case of 20 years old archer, who presented with gradual development of winging of scapula that developed after he started practicing archery. Muscle CT scan and electrodiagnostic studies confirmed the diagnosis of long thoracic nerve palsy that was suggestive of recurrent injury due to repetitive nerve overstretching or compression sustained during practice of archery (6). Rayan, reported 5 case studies of archers, sustaining upper extremity injuries related to use of bow and arrow. Out of five cases, two were diagnosed to have peripheral nerve involvement, one case was of median nerve compression at elbow and another was of with sensory radial nerve compression (7).

Similar to results of aforementioned studies, results of the present study to certain extent also indicate that the nerves, especially of drawing arm of female archers are at risk of some presymptomatic or asymptomatic neuropathy similar to subclinical entrapment nerve neuropathy. But due to small

sample size definitive conclusion cannot be arrived at. Hence, similar studies with large samples could be more conclusive.

4. Conclusion

On the basis of results of present study it can be concluded that nerve of archery players are at risk developing subclinical neuropathy that can become evident at any point of time and can plague the performance of archer. There is need to aware the archers, coaches, trainers and physiotherapists about impending risk of nerves injuries in game of archery, so appropriate measures could be taken during training of archery to prevent archery-related injuries.

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