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The Effect of Repetitive Wrist Load in Athletes on Median Nerve Neurophysiological Evaluation

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The summary
Background: *Fine wrist repetitive movements or aggressive weight lifting movements may cause abnormal nerve conduction parameters. Some sports are characterized by non-traumatic disorders of the soft tissues of the musculoskeletal system that include activities such as repetitive forceful motions, and awkward postures loads; of these, athletes specialized with Tennis table or Wrestling were the target of this study. Abnormalities of median nerve conduction study include wide variety of findings including carpal tunnel syndrome (CTS) which is the most common peripheral neuropathy in sport medicine.*
Objectives:
1. *To study the relationship between training duration and type on the conduction of sensory and motor branches of median nerve at wrist.*
2. *Early detection of the carpal tunnel syndrome in athletes.*

Methods: *85 subjects included in this study 55 professional athletes and 30 healthy normal people were the control group. After physical examination, a neurophysiological study was done that is consisted of motor and sensory nerve conduction studies of the median nerve.*
Results:*There was significant sensory and motor latencies prolongation and also significant decrease velocities that was more in those whom trained more than 5years.*
Athletes with forces and weights bearing added to repetitive wrist movements are significantly more affected than athletes with fine repetitive wrist movement only. Six cases were diagnosed as carpal tunnel syndrome.
Conclusions*:The duration and type of training affect median nerve conduction study. Many of the asymptomatic hand load athletes have altered nerve conduction tests reflecting pre-symptomatic or asymptomatic neuropathy similar to subclinical entrapment nerve neuropathy.*
Keywords: *median nerve, carpal tunnel syndrome, sport medicine.*

I. Introduction

Upper extremities are usually affected in some form of sports participation and are quite common and could be estimated in 50% of athletes will sustain injury, and 25% to 50% of these are from overuse syndromes (1). Overuse syndromes is defined as a level of repetitive micro-trauma sufficient to overwhelm the tissues' ability to adapt. Micro-trauma represents damage at the molecular level and can be produced by either a tension or shear load (2). These syndromes are most frequently seen in racquet sports, rowing, volleyball, handball, and gymnastics (3).

Carpal tunnel syndrome is used to describe a collection of clinical symptoms and physical signs secondary to a median nerve insult at the level of the transverse carpal ligament of wrist joint (4). It occurs due to increase intra-carpal tunnel pressure (ICTP) as a final common pathway. ICTP is a product of two generators: the interstitial fluid pressure within the carpal tunnel and the direct contact pressure on the median nerve from the adjacent tissues (5).

1 to 5% of normal populations are affected by CTS, which is the most common of all nerve compression syndromes (6). The prevalence is more in women than men by three to four folds which may be due to differences in carpal tunnel volume (7). Also obesity and age has also been reported to have increased incidence. A number of medical conditions including rheumatoid arthritis, acromegaly, hypothyroidism, pregnancy and trauma could also be considered as risk factors. Certain occupational activities have also been associated with an increased risk of CTS but its true association with occupation and/or vigorous joints activity still remains controversial. Such diseases affect the workers whom might be regard as work-related in a number of ways and might be partially caused by adverse working conditions and aggravated, accelerated or exacerbated by workplace exposures and so impair working capacity (8).

There is evidence that the CTS is triggered when the working hand is exposed to vibration, force and repetitive movements (9). There is even stronger evidence for the hypothesis that the combination of force and repetition or force and posture may cause CTS in the working hand (7).

The repetitive digital flexion activities in some types of sports cause some young athlete to be occasionally presented with acute carpal tunnel syndrome due to significant tenosynovitis of the digital flexors. In the majority of these cases, symptoms will resolve with rest, immobilization, non-steroidal, and with or without steroid injection. A short course of oral corticosteroids may be indicated if initial treatment fails. EMG is usually normal, and it is rare that the athlete requires carpal tunnel release (10).

II. Subjects and methods

Eighty five male subjects, thirty of them were non athletic control group subjects and fifty five athletic volunteers were included in this study. They represent group of professionals for the emerging, youth &national Iraqi teams. Athletes were divided into (group A (32 athletes)) which represented tennis table players where the training is depending on the fine wrist movements, fine vibration without forces or weights load. While (group B (23 athletes)) were wrestling teams.

To determine the relationship between duration of training and nerve conduction study both groups were subdivided into (a) for training less than 5 years and (b) subgroups represented those trained 5 years or more.Interventions and practices considered were done according to American Academy of Orthopedic Surgeons (AAOS) (11) which include:

1. Patient history.
2. Physical and neurological examination
3. Electrophysiological diagnostic tests.

Neurophysiological studies consisted of motor and sensory nerve conduction studies of the median nerve including Sensory distal latency (SDL), Motor distal latency (MDL), Sensory nerve conduction velocity (SNCV) and, Motor nerve conduction velocity (MNCV).

Sensory responses were obtained by antidromically stimulating at the wrist and recording from the index finger (median nerve) with ring electrodes. The median motor nerve was examined by stimulating the median nerve at the wrist (between the tendons of the flexor carpi radialis and palmaris longus and at the elbow next to the brachial artery, The nerve was stimulated with bipolar surface electrodes and the recording was carried out over the abductor pollicis brevis muscle with surface electrodes (5).

The study conducted in the electro -neuro physiological unit of Al- Kadhimiya teaching hospital on the period from October 2010 to the end of April 2011.

Statistical analysis: The statistical analysis of the data was done under the guidance of statistician. The data was reported as mean ± SD. P values of less than 0.05 were considered as statistically significant.

III. Results

The mean age, weight, height and duration of exercise were represented in table 1. There was a non-significant relation between these parameters. The SDL and MDL were of significant prolongation; while SNCV and MNCV show a significant reduction in athletes groups as compare with the normal control group results as shown in table (2). Sensory study of median nerve of group A and group B, Show prolongation of sensory distal latency in group Ab and Bb (more than five years of training) when compared with group Aa and Ba (less than five years of training). In addition to the significant decreased sensory nerve conduction velocity. As shown in table 3. Also; the motor study of median nerve of group A and group B, Showed a prolongation of motor distal latency in group Ab and Bb (more than five years of training) when compared with group Aa and Ba (less than five years of training) in addition to the decreased in motor nerve conduction velocity.

Group B which represented forces load, vibrations and weights bearing showed prolongation of SDL and MDL in both who trained less and more than 5 years, when compared with group A of fine repetitive hand movements. MNCV was decrease in group B in comparison to group A while SNCV in group B showed a non-significant changes as shown in table 4. Six athletes from the fifty five were diagnosed by a neurologist as a carpal tunnel syndrome.

Table 1: Anthropometrics of group A,B athletes and normal control group

Parameters	**Group A**	**Group B**	**Control**	**P value**
Age (years)	**22.8 $\mp$3.8**	**23.5 $\mp$ 4.85**	**26.2 $\mp$ 1.1**	**P □0.05**
Weight (Kg)	**72 $\mp$ 6.2**	**76 $\mp$ 9.11**	**79$\mp$ 2.26**	
Height (cm)	**169 $\mp$0.9**	**175 $\mp$4.1**	**171$\mp$1.8**	

Table 2: The electrophysiological study of athletes and control subjects:

Group	SDL msec Mean ± SD	MDL msec Mean ±SD	SNCV m/sec Mean ± SD	MNCV m/sec Mean ± SD	P value
Control	2 ± 0.15	2.9 ± 0.19	54.4 ± 3.1	58.3 ± 1.7	< 0.005
Athletes	2.56±0.6	3.54±0.8	48.3±5.9	52.68±5.98	

Table 3: The average reading in athletic groups subgroups:

Group	SDL m sec	MDL m sec	SNCV m/sec	MNCV m/sec	P value
Aa (16 athletes)	2.25±0.45	3.1±0.6	52±5.7	57±6	<0.005
Ab (16 athletes)	2.5±0.65	3.6±0.8	47±6.6	52.5±5	
Ba (13 athletes)	2.3±0.5	3.2±0.6	52±6.2	56±7	
Bb (10 athletes)	2.9±0.7	3.9±1	45.6±5.3	49±6.2	

Table 4: The neurophysiological study of the 2 groups studied:

Group	SDL m sec	MDL m sec	SNCV m/sec	MNCV m/sec
A	2.37±0.55	3.35±0.7	49±6.4	54.75±5.5
B	2.6±0.6	3.6±0.8	48.5±5.5	52±6.5
P value	≤0.05	≤0.05	≥0.05	≤0.05

Values expressed as mean ∓ SD.

IV. Discussion

The result of this study showed a strong relation between the load and duration training and the median nerve conduction. Carpal tunnel syndrome is closely related to sports which is the most frequent peripheral compression neuropathy found in sporting activities (12).Hypertrophy of the forearm affecting the function and position of the tendons and ligaments in the wrist so it will change the free space in the carpal tunnel (13) which lead to compression of median nerve mostly in group B, micro trauma is another important factor causing scarred the transverse carpal ligament, and leads to creation changes that predisposed to carpal tunnel syndrome which appear in both groups and this was in agreement with some studies (14). Tennis tables sport is physically demanding and imposes a high impact and the repetitive stress on the dominant extremities of tennis table players is responsible for physiological and pathological changes in the dominant wrist leading to CTS (15) which was true in the present study. The force factor is playing also a big and important role added to the previous causes affecting median nerve in wrestling (1) and this was clear in this study when group B showed MDL prolonged and MNCV reduction as compared to group A.In this study the results showed a positive significant relationship between duration of exercise and the neurophysiological changes in median nerve study and prolongation of SDL and DML and reduction in SNCV and MNCV in the groups of athletes whom trained more than five years when compared with those whom trained less than five years where the effect of the factors altered more with the more time on the anatomical and physiological characteristics of wrist and median nerve.Neither the age, weight, nor the height had a significant correlation with the development of abnormal nerve conduction study and the cause might be due small samples and the similar age and body mass index. Six cases were diagnosed as CTS (about 9%) of the athletes included with no clear symptoms. Stetson and his co-workers in 1993 (16) reported a reduced mean sensory amplitudes and prolonged motor and sensory distal latencies of the median nerve that were asymptomatic hands of industrial workers jobs, Bingham team (17) found abnormal median nerve conduction values in 17.5% of subjects exposed to different levels of occupational hand/wrist risk factors. And about 90% of whom were asymptomatic. Franzblau et al. found that 25% of active workers had abnormal median nerve sensory conduction in one or both hands and that about half of these subjects did not report any symptoms consistent with CTS in wrist, hand or fingers (18).

V. Conclusions

There is a clear significant relationship between the duration of training and median nerve electrophysiological study in which latencies were prolonged and velocities were decreased.The Type of training also has its own effect on nerve conduction study, where forces and weights demanding added to repetitive hand movement result in more added effect. Many of the asymptomatic hand load athletes have abnormal nerve conduction tests in reflecting pre symptomatic or asymptomatic neuropathy similar to subclinical entrapment nerve neuropathy.

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