

EFFECT OF WRIST INVOLVEMENT ON MEDIAN NERVE ELECTROPHYSIOLOGY IN JUVENILE IDIOPATHIC ARTHRITIS

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Abstract

Objectives: Localized compression of the median nerve due to wrist arthritis is a frequently reported complication in adult patients with rheumatoid arthritis. However, in only two cases median nerve compression has been reported in juvenile idiopathic arthritis (JIA) patients. In this study, we aimed to assess the effect of wrist involvement on median nerve electrophysiology in JIA patients.

Patients and methods: Thirty-three patients fulfilling the diagnostic criteria for JIA according to the International League of Associations for Rheumatology and twenty-three healthy controls were enrolled. All subjects underwent a thorough neuromuscular examination and median and ulnar nerve conduction studies. The presence of wrist arthritis was noted. Complete blood count, erythrocyte sedimentation rate, C reactive protein, renal/liver function tests were measured.

Results: Sensory examination and provocative tests for CTS were normal both in patient and control groups. Age, height and electrophysiological data of the subjects were compared within three groups: JIA patients with wrist arthritis, those without wrist arthritis and healthy controls. None of the electrophysiological data of median nerve revealed significant differences between groups.

Conclusions: In the light of our preliminary results, the median nerve seems not to be affected due to wrist involvement in patients with JIA.

Keywords: Carpal Tunnel Syndrome; Juvenile Idiopathic Arthritis; Median Nerve; Electrophysiology; Conduction Study.

Introduction

Inflammatory synovitis and its destructive effects on the joints may cause various neurological complications in patients with rheumatic diseases.¹⁻³ Among those, localized compression of the median nerve due to wrist arthritis has been the most frequently reported entrapment neuropathy in adult patients with rheumatoid arthritis (RA).^{2,3} Although wrist involvement in juvenile idiopathic arthritis (JIA) is similar to that seen in adults,⁴ only two cases of median nerve compression in JIA patients have been reported in the literature.^{5,6}

On the other hand, electrophysiological measurements have been performed in few studies concerning JIA patients; however, median nerve conduction tests have not been evaluated with respect to the wrist involvement.⁷⁻⁸ Accordingly, in this study, we aimed to assess the effect of wrist involvement on median nerve electrophysiology in JIA patients.

Patients and methods

Patients admitted to the Pediatric Nephrology/Rheumatology Clinic, Hacettepe University Medical School between January 2007 and November 2007 were recruited. All patients were examined by an experienced physician and those fulfilling the diagnostic criteria for JIA according to the International League of Associations for Rheumatology⁹ were consecutively enrolled in the study. The concomitant diagnosis of hypothyroidism, diabetes mellitus, chronic renal failure, drug usage causing neuropathy, vitamin B 12 and folic acid deficiency and wrist fracture were taken as the exclusion criteria. Control subjects were selected from the healthy relatives of the hospital staff. All participants gave informed consent in accordance with the Helsinki Declaration, 1975. Local Ethical Committee approved the study protocol.

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All subjects underwent a thorough neuromuscular examination by a physiatrist. Range of motion, thenar atrophy, hypoesthesia (light touch and pin prick) in the hands, and specific tests for carpal tunnel syndrome (CTS) (tunnel, Phalen and reverse Phalen) were evaluated. The presence of wrist arthritis was also noted. Laboratory tests included complete blood count, erythrocyte sedimentation rate, C reactive protein, blood glucose, renal/liver function, thyroid stimulating hormone, free thyroxine, vitamin B12 and folate measurements. Antero-posterior X-rays of wrists were performed in all patients with JIA.

Electrophysiological evaluations were performed for all individuals according to the recommendations of American Association of Electrodiagnostic Medicine Professional Practice Committee.¹⁰ Nerve conduction studies were performed using 5 channels Synergy (Medelec, Vickers Medical) device in normal room temperature via standard techniques of supramaximal percutaneous stimulation with a constant current stimulator. All participants underwent median and ulnar sensory-motor nerve conduction studies. Motor responses were measured with stimulation of the nerves at the wrist and elbow (antecubital region for median nerve, ulnar fossa for ulnar nerve) using belly-tendon recordings from the lateral thenar muscles (median nerve) or hypothenar muscles (ulnar nerve). Sensory responses were obtained antidromically, by stimulating at the wrist and elbow, and recording from the third finger (median nerve) and the little finger (ulnar nerve), using ring electrodes.

For the purpose of statistical analysis, JIA patients were separated into two groups: JIA with and JIA without wrist involvement. One way ANOVA was performed to compare age, height and elec-

trophysiological data among the three groups. SPSS 11.0 was used for statistical analysis and *p* values less than 0.05 were accepted as statistically significant.

Results

Thirty-three JIA patients (21 F, 12 M) who fulfilled the inclusion criteria were enrolled. Twenty-three healthy controls were also evaluated. Demographic and clinical data of the subjects are shown in Table I. Patients were classified to have systemic arthritis (9,1%), oligoarthritis (39,4%), polyarthritis (33,3%), psoriatic arthritis (9,1%) and enthesitis-related arthritis (9,1%). Thirteen patients had wrist arthritis; twelve had bilateral wrist swelling and pain during range of motion, one had unilateral wrist arthritis. In only two JIA patients, there were significant joint deformities including ulnar deviation in the wrists. None of the patients and controls had suffered numbness, pain, tingling sensation on their hands. Sensory examination and the above-mentioned provocative tests for CTS were unremarkable both in patient and control groups. In two JIA patients with wrist deformity thenar muscle atrophy was detected, probably due to the disuse. Plain radiography of the patients were normal other than ankylosis in those two patients with wrist deformity.

Mean age and height values of the patients with and without wrist arthritis, and of the controls revealed no statistically significant differences ($P>0,05$). There was no significant differences between the electrophysiological data pertaining to the left and the right hands of the control subjects ($P>0,05$); therefore their data were combined to make a group of 46 hands. Mean values of me-

Table I. Demographic and clinical data of JIA patients and controls

Data	JIA patients				Controls	
	Without wrist arthritis	With wrist arthritis	Without wrist arthritis	With wrist arthritis	Mean (SD)	Min-max
	Mean (SD)	Min-max	Mean (SD)	Min-max	Mean (SD)	Min-max
Age	11,9 (4,4)	5-17	12,1 (5,5)	4-22	14 (6,2)	4-25
Height	142,1 (18,2)	99-167	143,8 (19,6)	99-165	143 (22,1)	105-183
Disease duration	3,2 (2,6)	1-12	6,3 (5,5)	0,5-21		
Sedimentation rate	22,5 (16,7)	3-79	27,2 (16,9)	6-55		
C-reactive protein	1,4 (2,6)	0,1-12	1,2 (1)	0,4-3,4		

Table II. Comparison of median and ulnar nerve electrophysiological data in JIA patients and controls

Data	JIA patients				Controls	
	Without wrist arthritis		With wrist arthritis		Mean (SD)	Min-max
	Mean (SD)	Min-max	Mean (SD)	Min-max		
MSDV	54 (4)	44,4-62,2	56,9 (6,6)	44,8-67,8	57,7 (6,1)	45,9-69,7
MSDA	46,8 (14,1)	24,8-73,3	50,5 (19,2)	22,7-86,9	52 (17,3)	18,3-88
MMDL	2,9 (0,4)	2,1-3,7	2,9 (0,5)	1,8-4,1	2,7 (0,4)	2,25-3,6
MMDA	8,6 (2,6)	3,8-15,8	8,4 (2,3)	3,8-12,7	8,3 (3,8)	2,1-17,0
USDV	55,4 (4,2)	44,4-62,9	56,5 (5,1)	47,6-73,9	56,3 (4,5)	46,9-64,5
USDA	39,5 (12,8)	15,4-66,4	43,6 (23,1)	11,6-72,3	47,8 (15,9)	22,5-73,3
UMDL	2,3 (0,3)	2-3	2,2 (0,4)	1,6-3	2,2 (0,3)	1,7-2,8
UMDA	8,6 (2,1)	3,7-12,3	8,5 (3)	3,1-15,1	8,2 (2,2)	4,9-13,4

MSDV: Median sensory distal velocity (m/s); MSDA: Median sensory distal amplitude (°V); MMDL: Median motor distal latency (ms); MMDA: Median motor distal amplitude (mV). USDV: Ulnar sensory distal velocity (m/s); USDA: Ulnar sensory distal amplitude (°V); UMDL: Ulnar motor distal latency (ms); UMDA: Ulnar motor distal amplitude (mV)

dian and ulnar nerve electrophysiological data in JIA patients and controls are shown in Table II. None of the parameters were found to be different among the three groups ($P>0,05$).

Discussion

According to the results of this current study, we have found that the median nerves were electrophysiologically normal in JIA patients either with or without wrist involvement.

Electrophysiologic evaluation of the patients with rheumatic diseases ensures valuable information to detect any abnormality in the peripheral nerves. Therefore, although neurogenic involvement is rare in JIA, nerve conduction studies may be noteworthy in patients with neurogenic symptoms. It is well known that height and age have a considerable effect on nerve conduction velocity. In our study, to eradicate the effect of age and height, we have included similar patients and controls concerning these two parameters. In keeping with our results, Puusa *et al.*⁸ did not detect any mononeuropathy in JIA. In another study, it was mentioned that 7 out of 213 JIA patients had peripheral neuropathy; however, there was no detailed explanation about the electrophysiological assessment and their results.⁷

Anatomical and biomechanical aspects of the carpal tunnel are influenced by edema, flexor tendonitis, synovial thickening, periarticular fibrosis, carpal subluxation/erosion and ankylosis in JIA.

Furthermore, anomalies in growth (overgrowth and undergrowth of the carpal bones) and morphogenesis of skeletal segments resulting from irregular tractions on growing structures may also have considerable effect in this regard.⁴ All these pathological conditions are expected to result in compression of the median nerve via causing increases in the interstitial fluid pressure within the carpal tunnel and/or direct contact pressure on the median nerve from adjacent tissues.¹¹ However, in our study, although 25 wrists of 13 JIA patients had arthritis none of them revealed any symptoms associated with CTS and nor their neurophysiological testings were abnormal. Although the inflammatory pathophysiology and its destructive effect on the joint are similar, the reason why median nerve is not being compressed in JIA patients with wrist arthritis -as it is the case in RA- is unclear. Different anatomical and developmental features of carpal tunnel and their effects on the biomechanics of median nerve and the contents of the carpal tunnel in children may be responsible for the lack of this compression. Increasing the ratio of carpal tunnel contents to carpal tunnel volume resulting in increases in the carpal tunnel pressure has been proposed to be responsible for median nerve compression in the adult wrist with RA.¹² However, there have been no similar investigations in the hitherto literature for this ratio in JIA patients. We speculate that increasing the carpal tunnel content due to the inflammatory process may be tolerated by more elastic and growing fibro-cartilaginous structures of the carpal tunnel in chil-

dren with arthritis. Another factor would be the difference between the wrist deformities; being generally ulnar in JIA and being radial in adult RA.⁴ However, both of these deviations result in similar increases in the carpal tunnel pressure.¹¹ Reduction in the longitudinal and transverse sliding of the median nerve in carpal tunnel has also been stated as a possible etiological factor in CTS. Whereas, no comparative study concerning median nerve sliding in children and adults with rheumatic diseases exists.

There are two limitations of this study; first, we did not evaluate the fibrous structure of the carpal tunnel and its contents. Sonography and/or magnetic resonance imaging could be used in this regard. This may highlight the relationship between the median nerve and the ongoing inflammatory process in the wrist of JIA patients. Second, being aware of the fact that the number of patients reported to have concomitant JIA and CTS in the literature is quite few, our sample size would have not been large enough to have a reasonable conclusion.

Conclusions

In the light of our preliminary results, median nerve seems not to be affected due to wrist involvement in patients with JIA. Further studies with larger groups that will also evaluate the structures in the carpal tunnel are needed to substantiate our initial findings. This way we believe that the reason of the lack of median nerve compression in growing children with JIA will be better determined.

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