

The percentage of carpal tunnel syndrome in patients complaining of hand numbness and /or weakness: Experience at the Royal Rehabilitation centre; neurophysiology clinic

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ABSTRACT

Background: Carpal tunnel syndrome is considered the most common entrapment mononeuropathy within musculoskeletal pathologies having the median nerve compressed at the wrist with sensory and motor weakness. It is more frequent in females.

Aim: To assess the epidemiological parameters of participants with carpal tunnel syndrome among Jordanian patients.

Methods: Our retrospective investigation included 594 patients, of both sexes, ranging from 19–85 years of age and presenting with uni- or bilateral hand numbness with or without hand weakness for electrophysiological investigation, at the neurophysiology clinic in the Royal Jordanian Rehabilitation Centre, during the period of Dec. 2016 to Dec. 2017. The investigation included two exclusion phases. The first phase excluded patients with nerve injury while the second phase excluded pregnant patients and patients with diabetes mellitus, hypothyroidism and median nerve decompression surgery. The patients' evaluated characteristics included age, sex and location of pathology. Patients were classified in terms of intensity of carpal tunnel syndrome based on clinical and nerve conduction studies.

Results: After the first exclusion phase, there were 402 patients ready for the median nerve study. There were 336 (83.6%) females and 66 (16.4%) males, with a female to male ratio of 5:1. The age group associated with the majority of patients with this disorder was 36–45 yrs. in both males and females (31.3%; 126). The clinical features were recorded in both hands in 180 patients (44.8%) and in one hand in 222 patients (55.2%). After the second exclusion phase, there were 300 patients ready for further investigation who had carpal tunnel syndrome in both hands (126 patients; 42%) and in one hand (174 patients; 58%).

Conclusion: The epidemiological distribution of carpal tunnel syndrome patients in different parts of Jordan is comparable to that of other studies but with an increase in the female to male ratio.

Keywords: carpal tunnel syndrome; epidemiology; Jordan.

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Introduction

Median nerve entrapment mononeuropathy with numbness and pain is initially recognized in the wrist after a distal radius fracture (1). The median nerve passes, with nine extrinsic digital flexors, via the tunnel bound by the carpal bones and transverse ligament attached to the scaphoid, trapezoid and hamate. The carpal tunnel narrows in cross section at 2.0 to 2.5 cm distal

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To the entrance. An abnormally increased intracarpal tunnel pressure peaks at this level in patients with carpal tunnel syndrome (2). Women are more prone than males in a ratio of 3–10:1 at 50 years of age. Causes could be idiopathic but incriminating factors include, genetic, occupation, demographics, Colles' fracture, tumour, rheumatoid arthritis, diabetes mellitus, and hypothyroidism, renal failure with haemodialysis, obesity, alcoholism and pregnancy. Continuous forceful movements of the wrist and fingers are thought to be a mechanism of pathogenesis (3). The diagnosis depends on physical and electrophysiological findings. Various physical tests are Tinel's, Phalen's, carpal compression and tourniquet tests. Electrophysiological tests include electromyography and nerve conduction velocity. Mild carpal tunnel syndrome is managed by conservative therapy, but moderate, severe carpal tunnel syndrome and failure of conservative therapy require surgery (4, 5).

The frequency of carpal syndrome differs in various populations. The frequency in the Netherlands is 0.6% for males and 5.8% for females, while 2.7% of any population has carpal tunnel syndrome (1). Carpal syndrome in both hands is found in 87% of patients clinically and in 50% of patients via neurophysiological testing (1). The goal of our investigation was to evaluate the epidemiological parameters for patients diagnosed to have Carpal Tunnel Syndrome (CTS) in our clinic from different parts of the Hashemite Kingdom of Jordan.

Methods

This retrospective investigation included 594 patients, of both sexes, aged 19–85 yrs. and presenting with uni- or bilateral hand numbness with or without hand weakness for electrophysiological investigation, at the neurophysiology clinic at the Royal Jordanian Rehabilitation Centre (RJRC), King Hussein Medical Centre (KHMC), Amman, Jordan which receives patients from different parts of the whole country, during the period of Dec 2016–Dec 2017, after obtaining approval from our local ethical and research board review committee of the Jordanian Royal Medical Service (JRMS).

The investigation involved two exclusion phases. The first phase excluded patients with nerve injury while the second phase excluded pregnant patients and patients with diabetes mellitus, hypothyroidism and median nerve decompression surgery. Grading of carpal tunnel syndrome intensity included: Mild: lengthened sensory nerve action potential or mild decreased amplitude; sensory distal latency of the upper limit of normal, peak sensory latency of more than 4.4 ms with normal motor distal latency. Moderate: Abnormal median SNAP with lengthened median motor distal latency; sensory distal latency of more than 3.4 ms and less than 3.9 ms, and peak sensory latency of more than 4.6 ms., with motor distal latency less than 4.5 ms. Severe: lengthened median motor and sensory distal latencies with no SNAP or reduced amplitude or no thenar compound muscle action potential. No sensory responses were obtained or recorded; distal latency is more than 5.6 ms and less than 6.9 ms, and peak latency is more than 7.3 ms., with motor responses distal latency of less than 7.1 ms. Very severe: No sensory responses were obtained or recorded; distal latency is more than 6.9 ms and peak latency is 9.2 ms, averaged amplitude of 1–3 μ V and remarkably reduced conductive velocity. No motor responses or lengthened distal latency; latency more than 7.1 ms, and averaged amplitude of 0.05–0.1 μ V (6).

All participants were diagnosed according to Tinel with Phalen tests and electromyography with nerve conduction velocity. The patients' characteristics included age, sex and location of pathology.

Statistics

The Student's t-test was used to compare the general characteristics. The Pearson χ^2 test was used to evaluate the association between the physical examination and CTS intensity. A P-value of less than 0.05 was considered significant.

Results

After the first exclusion phase, there were 192 patients with nerve injury and the remaining 402 patients were ready for median nerve analysis (Table I). There were 336 females and 66 males ($P < 0.005$; $r = 0.314$), with a female to male ratio of 5:1. The median age was 52 yrs. for all male and female patients (Table II). The clinical features were recorded in both hands in 180 patients (44.8%, $P < 0.05$; $r = 0.244$) and in one hand in 222 patients (55.2%), among which 108 were in the right hand and 114 were in the left hand (Table II). The age associated with the majority of patients with this disorder was in the age group of 36–45 yrs. in both males and females (31.3%; 126, $P < 0.05$; $r = 0.221$), and the 46–55 yr. age group was the next prevalent (23.9%; 96, $P < 0.05$; $r = 0.256$). Patients in the 76–85 yr. age group were least associated with this disorder (5.9%; 24). Pain and numbness together were the most common presentation of symptoms (252; 62.7%, $P < 0.05$; $r = 0.211$). In this phase, there were 36 patients with abductor pollicis brevis muscle weakness and 66 patients with abductor pollicis brevis muscle wasting. Among these patients, 66.7% had very severe carpal tunnel syndrome and 33.3% had severe carpal tunnel syndrome (Table III).

After the second exclusion phase, there were 300 patients ready for further investigation. Carpal tunnel syndrome was recorded in both hands in 126 patients (42%) and in one hand in 174 patients (58%) among which 72 were in the right and 102 were in the left hand.

Table I. Exclusion criteria.

| | | Total number |
|---|-----|--------------|
| | | 594 |
| First exclusion phase | | 402 |
| Nerve injury | 192 | |
| Second exclusion phase | | 300 |
| Diabetes mellitus | 60 | |
| Hypothyroidism | 12 | |
| Median nerve decompression surgery | 30 | |

Table II. First exclusion phase patient data.

| ITEMS | | NO (%) | P |
|------------|----------|--------|--------|
| Sex | F | 336 | <0.005 |
| | M | 66 | |

| | | | |
|---|-------------------|------------|----------------|
| Age (yrs) | range | 19-85 | <0.05 <0.05 |
| | 19-35 | 42(10.5%) | |
| | 36-45 | 126(31.3%) | |
| | 46-55 | 96(23.9%) | |
| | 56-65 | 66(16.5%) | |
| | 66-75 | 48(11.9%) | |
| | 76-85 | 24(5.9%) | |
| Location of pathology | Right hand | 108 | <0.05 |
| | Left hand | 114 | |
| | Both hands | 180 | |
| Presentation clinical features | Numbness | 120(29.9%) | <0.05 |
| | Pain | 30(7.5%) | |
| | Pain and numbness | 252(62.7%) | |
| Thenar muscle weakness wasting | | 36 | |
| | | 66 | |

Table III. Carpal tunnel syndrome intensity with thenar weakness and wasting.

| | Percentage | P |
|---|------------------|-------|
| Severe carpal tunnel syndrome | 34(33.3%) | |
| Very severe carpal tunnel syndrome | 68(66.7%) | <0.05 |

Table IV. Second exclusion phase patient's data.

| Location of pathology | Right hand | 72 | | |
|------------------------------|-------------------|------------------|-------------------|-------------|
| | Left hand | 102 | | |
| | Both hands | 126 | | |
| | Right hand | Left hand | Both hands | |
| | | | Right | Left |
| Normal | 36 | 64 | 78 | 90 |
| Mild CTS | 7 | 8 | 15 | 5 |
| Moderate CTS | 13 | 13 | 9 | 13 |
| Severe CTS | 5 | 5 | 19 | 18 |
| Very severe CTS | 11 | 12 | 5 | 0 |

Discussion

Continued swelling of the synovial sheaths in carpal tunnel syndrome (7) may cause reduced grip power with atrophy and in severe conditions may cause permanent deterioration of muscle tissue and loss of hand function (8). The flexor retinaculum is a strong fibrous band which transforms the anterior concavity of the carpus into an osseo-fibrous carpal tunnel through which the digital flexor tendons and the median nerve pass. The median nerve is the nerve responsible for sensation in the hand and motor to the thenar muscles. It enters the hand by passing deep into the flexor retinaculum (9). Normal pressure

recorded in the tunnel is in the range of 2–10 mm Hg. There are modifications of fluid pressure in the carpal tunnel with wrist position; extension increases the pressure 10-fold and flexion increases it 8-fold. The more the period and size of the pressure, the more remarkable is the neural dysfunction (10).

The frequency of carpal tunnel syndrome is between 0.125 and 1%, while the prevalence is between 5 and 16%. It is reported in middle-aged (55–60 yrs.) people. The frequency of carpal tunnel syndrome is 3 times higher in females in the 50–70 year age group with a median age of 50 years for males and 51 years for females (1). The age specific frequency for females was 50–59, and for males the frequencies were 50–59 years and 70–79 years. The prevalence in females was 3% and 2.1% in males (1). A female to male ratio of 2.07 was recorded (11). In females with a median age of 56.5, there was a right dominant hand correlated with a 5-fold increase for right hand carpal tunnel syndrome, and a left dominant hand with a 13-fold increase for left hand carpal tunnel syndrome (12). There was a sex-specific frequency of 139 for males and 506 for females (13).

Regarding the distribution of Carpal tunnel syndrome in different Arab countries, we chose Saudia in Asia and Sudan in Africa for a comparison with Jordan. Carpal tunnel syndrome was 4.5 times more frequent in Saudi females than males; the median age was 44.6 years in females and 50.5 years in males, and it was present in both hands in 73 cases and in one hand in 23 cases (1). Carpal tunnel syndrome was 4.6 times more frequent in Saudi females than males, and with a median age of 37 years in females and 44 years in males (2). It may be associated with different personal, work and psychosocial factors. An increased risk is associated with an age of more than 45 yrs., female sex, with a high body mass index, chronic diseases, contraceptive pills or hormone replacement therapy and trauma. In Sudan, 81.7% of females and 18.3% of males were affected. The most affected age group was 48–58 years. Pain was observed in 26% of patients and numbness in 70.2% of patients. Weakness was recorded in 26% of patients, and 16% of them had wasting (6).

The incidence of carpal tunnel syndrome has increased in rural areas where wrist configuration, body mass index, occupation and aging are correlated with an associated risk (14). There are important within-country specific regional differences in its frequency in North America and Europe but not in all populations. The incidence has increased over time in the UK, with an annual percentage incline of 7.81.

The female-to-male ratio of carpal tunnel incidence has decreased over time from 2.74 to 1.93. The median age of females and males afflicted with this syndrome has increased from 49 and 53 years to 54 and 59 years, respectively. The overall incidence has increased over time (15). Differences in the frequency of carpal tunnel syndrome between countries and between various regions are due to differences in diagnostic methods (16). A high frequency of this syndrome is due to the increased incidence of risk factors, an increase in the life span and enhanced public health with high use of nerve conduction investigations (17). To differentiate carpal tunnel from familial syndrome, there are systemic biochemical problems to inherent structural problems of the tunnel. Biochemical problems are familial amyloidosis polyneuropathy, myopathies and familial hypercholesterolemia. Structural problems include a thickened transverse carpal ligament, congenital small carpal tunnel and distal prolongation of the superficial flexor muscle belly (18).

ur investigation in Jordan demonstrated that the incidence of carpal tunnel syndrome was five times higher in females than in males. Females possess a higher risk for carpal tunnel syndrome (1) because they have smaller wrists and a smaller carpal tunnel size. Therefore, femininity is an important risk factor of carpal tunnel syndrome in Jordan. The median age of our patients was 52 years in females and males, with a peak age group of 36–45 years, which is similar to some findings (1) and not similar

to others (1, 5, 11). Carpal tunnel syndrome in both hands was reported in 44.8%, and in one hand in 55.2% of individuals. Carpal tunnel syndrome is a disease in both hands, with the right hand more prone than the left, which correlates with the dominant hand (11, 19). Patients with diabetes mellitus were not enrolled, and this is a limitation of our investigation.

Conclusion

The epidemiological findings of carpal tunnel syndrome (age, location and sex) in Jordan is relatively comparable to that of other studies but with a mild increase in females.

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