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ORIGINAL

Prevalence of Carpal Tunnel Syndrome(P-CTS) in Iran: An Updated Systematic Review

Prevalencia del síndrome del túnel carpiano (P-CTS) en Irán: una revisión sistemática actualizada

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Abstract

Introduction: P-CTS depends on several factors, such as demographic changes. Regarding the changed lifestyle of the Iranian society and the economic and health consequences of the Carpal Tunnel Syndrome (CTS), the present study intended to investigate the P-CTS in the Iranian population.

Methods: The present systematic review study was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) steps. We systematically searched Scopus, Web of Sciences (ISI), PubMed, PEDro, and Science Direct databases and national databases (Magiran and SID) to identify relevant studies published from 2000 to 2020 using various combinations of the following keywords: carpal tunnel syndrome, wrist, median nerve, electrodiagnostic, and median nerve compression neuropathy. STROBE checklist was used to assess the quality of articles.

Results: 598 articles were initially identified, of which 16 (60% more than the previous meta-analysis) were evaluated with a total of 15325 subjects. The quality assessment of articles varied from 30 to 42 (all were excellent).

Conclusion: P-CTS among patients ranges from 18 to 26%. In the general population with general risk factors (i.e., diabetes, hand injuries, etc.) is 1.87-7%. In groups with a high frequency of repetitive movements of the wrist (e.g., carpenters, typists, those who use a wheelchair, computer users, employees), the prevalence is 10-15%.

Key words: Prevalence, Carpal Tunnel Syndrome, Systematic, Nerve Damage.

Resumen

Introducción: El síndrome del tunel carpiano (STC) depende de varios factores, como los cambios demográficos. En relación con el cambio en el estilo de vida de la sociedad iraní y las consecuencias económicas y sanitarias del STC, el presente estudio pretendía investigar el STC-P en la población iraní.

Métodos: El presente estudio de revisión sistemática se realizó siguiendo los pasos de los Elementos de Información Preferidos para Revisiones Sistemáticas y Meta-Análisis (PRISMA). Se realizaron búsquedas sistemáticas en las bases de datos Scopus, Web of Sciences (ISI), PubMed, PEDro y Science Direct, así como en las bases de datos nacionales (Magiran y SID), para identificar los estudios pertinentes publicados entre 2000 y 2020, utilizando varias combinaciones de las siguientes palabras clave: síndrome del túnel carpiano, muñeca, nervio mediano, electrodiagnóstico y neuropatía por compresión del nervio mediano. Se utilizó la lista de comprobación STROBE para evaluar la calidad de los artículos.

Resultados: Se identificaron inicialmente 598 artículos, de los cuales se evaluaron 16 (un 60% más que en el metanálisis anterior) con un total de de 15325 sujetos. La evaluación de la calidad de los artículos varió de 30 a 42 (todos fueron excelentes).

Conclusiones: El STC-P entre los pacientes oscila entre el 18 y el 26%. En la población general con factores de riesgo generales (es decir, diabetes, lesiones de la mano lesiones en las manos, etc.) es del 1,87 al 7%. En grupos con una alta frecuencia de movimientos repetitivos de la muñeca (por ejemplo, carpinteros, mecanógrafos, quienes utilizan una silla de ruedas, usuarios de ordenadores, empleados), la prevalencia es del 10-15%.

Palabras clave: Prevalencia, Síndrome del Túnel Carpiano, Sistemática, Daño Nervioso.

Introduction

CTS is the most common peripheral nerve neuropathy caused by increased median nerve pressure in the wrist[1-3]. Symptoms of CTS include pain, paresthesia, and sleep disturbances[4-6]. The most common cause of CTS is idiopathic, and its diagnosis is based on clinical symptoms, physical examination, and electrodiagnostic examination. Methods used to treat CTS include medication in mild to moderate cases and surgery in severe cases[7-9].

It is more common in women than men (up to 15 times) and is more common among those aged 40 to 60 years (working age) compared to the general population (up to 10 times). P-CTS depends on the study population and type of the study[10-12]. The most recent meta-analysis performed in Iran (in 2018) reported a prevalence of 17.53% for CTS, and its researchers recommended that by increasing the knowledge and awareness of people and general practitioners (GPs), the prevalence of this syndrome can be reduced in Iran[13].

As this syndrome causes several social and occupational problems and carries a high economic burden for both patients and the society[14-16], and regarding that various studies reported different prevalence rates for the CTS, particularly in Iran, the present systematic review study intended to investigate the P-CTS in Iran. Furthermore, the latest systematic review is conducted in 2018, and since then, several contributing factors have changed, including increased penetration of mobile phones, occupational accidents, neurological diseases, which probably have affected the P-CTS. Besides, several new studies are published since then, which indicates the importance of this syndrome. Hence, we decided to perform a new systematic review study with a wider perspective and by considering the limitations/weaknesses of previous studies, in order to investigate the P-CTS in Iran.

Method

The present systematic review study was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) steps in 2020[17].

Search Strategy

We systematically searched Scopus, Web of Sciences (ISI), PubMed, PEDro, and Science Direct databases and national databases (Magiran and SID) to identify relevant studies published from 2000 to 2020 using various combinations of the following keywords: carpal tunnel syndrome, wrist, median nerve, electrodiagnostic, and median nerve compression neuropathy. The search was performed on 2020/11/20 by two independent researchers. And the third person confirmed the final result to increase the comprehensiveness of the search, references of identified articles were also evaluated.

Inclusion Criteria(IC) and Exclusion Criteria(EC)

IC were as follows: (1) Studies published from 2000 to the end of 2020; (2) studies on Iranians; (3) Articles published in English or Persian; (4) Having a descriptive cross-sectional design or longitudinal cohort studies that are suitable to estimate the incidence and P-CTS; and (5) studies that reported the sample size and P-CTS. EC also included (1) articles presented at conferences; (2) articles without full text; (3) studies that used an inappropriate method to measure the P-CTS; (4) articles with the inappropriate study population.

Study Selection

Titles, abstracts, and full papers were screened against inclusion and exclusion criteria. After removing the duplicates, eligible articles were selected.

Quality Assessment

After selecting the relevant articles concerning titles and content that met the inclusion criteria, the STROBE checklist (strengthening the reporting of observational studies in epidemiology) was used to assess the quality of articles. This STROBE consists of 44 sections on text and methodology of the study, including the objectives of the study, determining the appropriate sample size, type of study, sampling method, study population, data, tests performed on data collection tool(s), how variables are defined, methodology, sample evaluation, statistical tests, study objectives, and an appropriate description of findings based on the objectives of the study. The total score of STROBE ranges from zero to 44. Based on the results of the quality assessment, articles were divided into three categories: high quality (less than 15.5), average quality (15.5-29.5), and high quality[30-44]. Articles with a score of less than 15.5 were excluded[18].

Data Extraction

An author developed form was used to collect data from each article, which included first author name, publication year, sample size (separated by male and female), target population, the criteria for estimating the P-CTS, and the P-CTS. All data were recorded using Microsoft Excel.

Results

In total, 598 articles were identified, of which 119 were excluded after limiting the search strategy. Titles and abstracts of these 479 articles were reviewed, which resulted in the exclusion of 189 articles. Afterward, the full text of the remaining 290 articles was evaluated against inclusion and exclusion criteria, which resulted in the exclusion of 274 articles. The quality assessment score of the remaining 16 articles was above 15.5, all of which were entered into this study . The quality assessment of articles indicated that all of them have an excellent level of quality, and their score ranged from 30 to 42 (**Table I**).

Tabla I: Details of selected studies for regular and meta-analysis.

Author (Year)	Sample size	Objective	Including and Excluding Criteria	Criteria used for diagnosis	Prevalence		Conclusion
					Male	Female	
Yazdanpanah (2004)[19]	N=42	P-CTS in Carpenters	Inclusion criteria: Satisfaction with the study, carpentry Exclusion criteria: Having diseases such as diabetes, thyroid disorders, rheumatism	Clinical symptoms and electrodiagnosis	15/80	-	Carpentry is a job that leads to vibrational movements in the upper limbs, and these movements lead to an increase in the P-CTS in carpenters
Bahrami (2005)[20]	N=100	Prevalence and severity of CTS during pregnancy	Inclusion criteria: pregnancy, age >18 year Exclusion criteria: diabetes, thyroid disorders	Clinical symptoms and electrodiagnosis	26	-	Pregnancy and stress on the spine increase the incidence of CTS in pregnant women
Mehdinasab (2008)[21]	N=33	P-CTS among typewriter	Inclusion criteria: - Exclusion criteria: diabetes, thyroid disorders, rheumatism, Wrist fracture	Clinical symptoms (Pain, numbness of the finger, paraesthesia of the fingers)	4.2%		More than 12 months of work experience, female gender, increasing age, increasing work experience and body mass index above 30 lead to an increase in the severity of CTS symptoms.
Choobineh (2009)[22]	N=305	Epidemio-logical study of CTS	Inclusion criteria: Age >18 years Exclusion criteria: Dissatisfaction with participating in this study	Clinical symptoms electrodiagnosis	74%		Occupations such as tailoring, clerical work, labor, carpet weaving, and previous wrist injuries are among the risk factors for CTS among non-governmental occupations.
Rayegani (2010)[23]	N=1000	Frequency of CTS and its related risk factors in patients upper extremity pain	Inclusion criteria: Upper limb pain Exclusion criteria:-	Clinical symptoms – electrodiagnosis - Boston Questionnaire	25%		Body mass index above 25, wrist fractures, diabetes mellitus and menopause were risk factors for exacerbating carpal tunnel syndrome.
Ghasemi (2012)[24]	N=906	CTS: the role of occupational factors among 906 worker	Inclusion criteria: Age over 18, work experience more than two years, working hours more than 40 hours per week Exclusion criteria: rheumatoid arthritis, diabetes mellitus, cervical radiculopathy, hypothyroidism, thoracic outlet syndrome, trauma to the upper limbs and medically diagnosed CTS	Clinical symptoms Tinel test Phalen's test	14	8/9%	Male gender, high body mass index and wrist fractures are risk factors for CTS.
Alizadeh (2012)[25]	N=88	Wrist function, range of motion and pain between sports and non sports wheelchair-dependent persons with CTS	Inclusion criteria: Wheelchairs Professional Basketball Players Exclusion criteria: Dissatisfaction with participating in this study	Clinical symptoms – electrodiagnosis	17/14% Athlete 15/15% Non-athlete		The most important cause of CTS is repetitive wrist movements.
Haghighat (2012)[26]	N=240	Prevalence of clinical findings of CTS in Isfahanian dentists	Inclusion criteria: - Exclusion criteria: diabetics, rheumatoid arthritis, thyroid gland disease, and wrist fractures	Clinical symptoms Phalen and Tinel TEST	16/2	17/9	Increasing working hours per week as well as aging are risk factors for CTS.
Khosrawi (2012)[27]	N=100	The prevalence and severity of CTS during pregnancy	Inclusion criteria: pregnancy without symptoms of CTS before pregnancy Exclusion criteria: history of fracture or trauma to the hand, hypothyroidism, diabetes, or diagnosed neuropathy	Clinical symptoms – electrodiagnosis	19		The P-CTS in pregnant women is relatively high, increasing gestational age leads to the disappearance of symptoms, so it is better for women with CTS to be diagnosed in the first months

Author (Year)	Sample size	Objective	Including and Excluding Criteria	Criteria used for diagnosis	Prevalence		Conclusion
					Male	Female	
Yazdanpanah (2012)[28]	N=4164	Prevalence and Severity of CTS in Women	Inclusion criteria: - Exclusion criteria: DM, HTN, amyloidosis, and RD positive family history of neuropathy, previous wrist fracture, pre-pregnancy CTS and CT surgery	Clinical symptoms – electrodiagnosis Tinel's and Phalen's tests	4/2%		The severity of CTS in Iranian pregnant women is mild, but preventive measures should be considered for pregnant women.
Yazdanpanah (2015)[29]	N=105	Incidence of Recurrent and Persistent CTS following Open Transverse Carpal Ligament Release	Inclusion criteria: open surgical release of the median nerve	Clinical symptoms – electrodiagnosis MRI	12%		Recurrence of CTS follows high transverse surgery and it is recommended to make accurate diagnoses before surgery.
Karimi (2017)[30]	N=7560	P-CTS	Inclusion criteria: Neurological diseases AGE >18 years Exclusion criteria: Wrist involvement other than carpal tunnel syndrome and skin and musculoskeletal involvement	Clinical symptoms – electrodiagnosis MRI	2/23	1/82	Diabetes mellitus Hypothyroidism, anterior fracture of the dentin and rheumatoid arthritis are the most important risk factors associated with CTS.
Mohammadi (2019)[31]	N=50	enefits of Breast-feeding in the Natural Course of CTS	Inclusion criteria: AGE >15 years - bilateral paresthesia of hands Exclusion criteria: DM, HTN, amyloidosis and RD, positive family history of neuropathy, previous wrist fracture, pre-pregnancy CTS and carpal tunnel surgery	electrodiagnosis	23		Hormonal changes as well as wrist postures while breastfeeding and repetitive wrist movements during breastfeeding increase the rate of CTS in lactating women.
Roshandel (2019)[32]	N=109	P-CTS among Male Hairdressers	Inclusion criteria: symptoms of carpal tunnel syndrome Exclusion criteria: diabetes mellitus, hypothyroidism, amyloidosis, and rheumatoid disease	electrodiagnosis	20/18%		Hairdressing is one of the most common types of CTS; This syndrome manifests itself in hairdressers with mild symptoms and severe symptoms are rarely seen in them.
Pirami (2019)[33]	N=363	P-CTS symptoms in computer users	Inclusion criteria: work with computer Exclusion criteria: Diabetes, rheumatoid arthritis, thyroid disorder or wrist trauma and fracture, neck, shoulder or diffuse hand pain	Electrodiagnosis Boston Questionnaire	14.05% conflict in one hand 85.95% of the conflict in both hands		Long-term computer work, female gender, and body mass index above 25 are risk factors for CTS.
Khanbabayi Gol (2020)[34]	N=160	CTS in Women with Breast Cancer	Inclusion criteria: Complete treatment of breast cancer and at least 6 months after it, developing lymphedema after breast surgery or after receiving chemotherapy and radiotherapy Exclusion criteria: Previous history of CTS, history of shoulder surgery and shoulder nerve surgery, history of shoulder and wrist trauma, use of corticosteroids in the past 6 months, metastatic cancers, nervous system and cervical disc problems.	Electrodiagnosis Boston Questionnaire electrodiagnosis	20/62%		Old age, lymphedema, history of radiotherapy, history of surgery, lymph node dissection, and a history of diabetes mellitus are risk factors for CTS in women with breast cancer.

Of 16 eligible articles, 16 evidence related to the P-CTS were found in Iran, with a total of 15325 subjects. The lowest and highest prevalence rates were 1.82% and 74%, respectively (**Table I**). Since the identified articles had different populations and had different methodologies to measure the CTS, including clinical examinations, electrodiagnosis, Boston questionnaire, and Tinel and Phalen tests, which were performed by various individuals, it was not possible to conduct a meta-analysis. Also, various studies reported contradicting results, which scientifically can not be synthesized. Hence, it is not possible to provide an overall prevalence. As a result, in this study, a prevalence rate is provided.

Discussion

This systematic review intended to investigate the P-CTS in Iran. In this study, different populations such as athletes, patients, and workers were evaluated, which can be used to justify the observed changes in the findings of the present study. According to the findings, the P-CTS in patients with neurological damages ranges from 18 to 26%. On the other hand, in the general population with general risk factors (diabetes, hand injuries, etc.), the prevalence of this syndrome is 1.82-7%. In groups with a high frequency of repetitive movements of the wrist (e.g. carpenters, typists, those who use a wheelchair,

computer users, employees), the prevalence is 10-15%. Finally, it can be argued that the more severe the damage and pressure to the nerve in the wrist, the higher will be the risk of CTS.

A meta-analysis study by Barcenila et al[35]. on 14 English-language articles reported a statistically significant association between CTS and hand force and wrist power, vibration tools, and rotating the wrist. Also, it was mentioned that different diagnostic methods used by various studies had a significant effect on the estimated P-CTS. Unfortunately, because the included articles did not evaluate the impact of rotational and repeated hand movements, we could not investigate this issue in the present study. Nevertheless, there is no doubt that these movements contribute to CTS, which can be used to justify the high P-CTS in the present study.

Various studies have used different methods to evaluate the CTS[36-40]. The most common methods were physical examinations and electrodiagnosis. In two articles, author-developed tests and questionnaires were used to evaluate the CTS. This study demonstrated that the overall P-CTS is relatively high in Iran, and its rate varies greatly according to the target population, diagnosis method, and gender. Therefore, its prevalence should be investigated according to different target groups. Based on the findings of the present systematic review study, the authors suggest investigating the P-CTS and its risk factors in a target population using similar diagnostic tools and by considering important contributing variables, such as occupation, age, body mass index (BMI), work experience, gender, etc. in future studies. Also, based on the findings, it can be argued that various criteria are used to diagnose CTS, which each has its sensitivity and specificity. It also seems that most patients are diagnosed in specialized and subspecialty healthcare centers. Therefore, if a patient with CTS symptoms is referred to a GP and the disease is ignored (i.e., not referring to a neurologist), the probability of disability will increase significantly. Therefore, it is suggested that GPs gain a deeper knowledge about the clinical and diagnostic aspects of the disease and how to manage it.

Limitations

One of the limitations of the present research is differences in study populations. The importance of this limitation roots in the fact that probably factors such as occupation, BMI, age, work experience, etc. affect the prevalence of the disease.

Suggestion

It is suggested that, due to the increasing P-CTS over time, a series of interventions be developed to increase the awareness of high-risk populations about the CTS.

Conclusion

The P-CTS among patients ranges from 18 to 26%. In the general population with general risk factors (i.e. diabetes, hand injuries, etc.) is 1.87-7%. In groups with a high frequency of repetitive movements of the wrist (e.g., carpenters, typists, those who use a wheelchair, computer users, employees), the prevalence is 10-15%.

Conflicts of interest

The authors have no potential conflicts of interest to report in connection with this article.

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