The Cold hands prone to develop Carpal Tunnel syndrome

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الأيادي الباردة معرضه للإصابة بمتلازمة نفق الرسغ

ألخلاصة

إن متلازمة نفق الرسغ من أشهر و أهم مسببات الم و خدر اليد، يصيب متوسطي العمر والكبار، وبالأخص النساء. حديثا البحوث تنصب على تقصي جريان الدم، فنقصان ألترويه ألدمويه تشارك مع انضغاط العصب الوسطي في إحداث متلازمة نفق الرسغ.

إن التصوير الحراري طريقه تشخيصيه لقياس تباين انبعاث الحرارة باختلاف جريان الدم في اليد المصابة.

الأشخاص في هذه الدراسة، اجري لهم الفحص ألسريري، تخطيط الأعصاب ، فحص إجهاد البرودة المعزز بالتصوير الحراري،ثم فحص الدوبلر.

تبين أن هناك % ٣١ أي ٤٤ من ١٤٢ شخص لديهم أيادي باردة أصلا ، النساء أكثر ست مرات من الرجال، موزعين على 27% من مجموعه المصابين بمتلازمة نفق الرسغ ،و شخص واحد فقط طبيعي لايشتكي و الاكثريه من الأيادي الباردة 51% من مجموعه الذين يشكون من أعراض متلازمة نفق الرسغ مع نتائجهم ألسلبيه لتخطيط العصب الكهربي، وذلك لاحتمال كون ألبروده من بوادر المتلازمة أو لوجود مسببات باثولوجية أخرى غير انضغاط العصب الوسطي

في هذه الدراسة، كانت نتائج إجهاد البرودة التي تؤثر سلبا على ألدوره ألدمويه في اليد، وتبين أن فترة الخلاص (وهي الفترة الزمنية للوصول للحظه التخلص من وطأة البرودة مؤيداً بمتابعه التصوير الحراري) في الأيادي الباردة فترة أطول منها في الأيادي السليمة وهذا دلاله على ضرر في أداء عصب ألاوعيه الدموية، إضافة لذلك، كل هذا مدعم ومعزز بفحص الدوبلر حيث أظهرت أن الأيادي الباردة تعاني بشكل غير خاضع للشك (قيمه ألاحتماليه اقل من 0.05) انخفاض في التدفق الدموي ألتقلصي لشرايين اليد وخصوصا الشريان الكعبري الذي يغذي مساحه انتشار العصب الوسطي.

ABSTRACT:

Carpal tunnel syndrome (CTS) is commonest cause of hand paresthesia, usually idiopathic, occurs during middle or advanced age and attack the women more.

Recent Investigations evaluated the blood flow and emphasized the vascular cause of CTS in addition to median nerve compression.

Thermal imaging is a diagnostic technique for measuring blood flow in CTS hands by determining the probable temperature changes and how these are affected by cold.

For all the study sample had been done a physical examination, Nerve Conduction Study (NCS), cold stress test, Thermal imaging, Doppler study.

31 % (44 of 142) study sample having constantly primary Cold hands, as 27% (18 of 66) CTS hands group, 4% (1 of 27) Normal hands group and 51% (25 of 49) hands having normal NCS but with complain (NWC) hands group.

Affected mostly the female at younger age, specially in NWC group, and this is maybe the early sings and symptoms of CTS, or due to different underling pathology, even that both groups with similar hand complain.

Recovery period (which is the real time of recovery from coldness stress confirmed by thermal imaging), of Normal hands were significantly lower ($p<0.005$) than that of cold hands probably because of hand vasomotor changes, suggested sympathetic neural pathology in CTS, this confirmed by Doppler study which indicated that the cold hands shows significant reduction ($p<0.05$) of peck systolic blood flow of the ulnar artery, and the radial artery which supplies the median nerve territory nervation area, as compare to corresponding Normal hands.

Introduction:

Both clinical assessment and Nerve conduction study (NCS) evaluation have their own worth and limitations in making the diagnosis of CTS, relying solely on the clinical examination or NCS in this field might lead not only to incorrect and missing the diagnosis in some patients but to unnecessary surgery in others.

The limitations in CTS diagnosis, are not due to a shortcoming, other than It has long been believed that carpal tunnel syndrome as a rule a compressive median nerve neuropathy, therefore a little attention has been focused on the possible contribution of blood flow, clinical observations have suggested that the three provocative tests (hand elevation test, closed fist clenching, and the this tourniquet tests), will induced blood flow reduction in the company of increasing peripheral resistance, therefore exciting neurological deficits (1, 2), as well the presence of vasomotor changes in repetitive movement injury, bio-mechanical effects, and stretching of the median nerve coupled with routine movement of the upper limb, and what confirms that the synovitis or other compressive structures in the carpal tunnel are seldom seen in patients who have idiopathic CTS (3,4)

More steadfast investigations in recent studies evaluated the blood flow in the median nerve and emphasized the vascular disturbance in addition to median nerve compression in pathogenesis of carpal tunnel syndrome. (5, 6,7).

"Carpal tunnel syndrome can cause hands to feel cold, and it can also cause discomfort in the hands and even forearms, so those who constantly have cold hands are more likely to develop carpal tunnel syndrome, therefore cold hands with poor blood circulation in /or near the carpal tunnel can be a causative factor to chronic CTS (8).

In fact, the symptom of cold hands can precede any symptoms of actual pain or aching, Cold hands can be a symptom of carpal tunnel syndrome, "Coldness in the hands is similar to tingling , numbness, and aching discomfort, these symptoms due to the pressure on the median nerve and temporary decrease in blood circulation loss to the nerve or lack of blood flow in the hand (8).

As well, it is important to understand that Raynaud's can be a marker of CTS by periods of many years in some cases, making it effectively their first presenting symptom(9, 10).

Thermal imaging:

The Thermal imaging is a diagnostic technique for measuring blood flow by determining the variations in heat emitted from the body and proved that human body is symmetrical right to left, and injuries to nerves, tendons, and muscles produce asymmetrical thermal images (11).

Differential diagnosis of cold hands

occurs as a result of blocked or constricted blood vessels, caused by a vascular disorder (a cold hand disease) or an injury, such as:

- Blood clotting

- Hand trauma, including occupational or recreational/sports injury (e.g., laceration wounds, fractures or penetrating injuries)
- Diseases that cause narrowing of the blood vessels in your hand and fingers, such as arteriosclerosis
- Raynaud's disease (primary Raynaud's)
- Raynaud's phenomenon/syndrome (secondary Raynaud's), caused by autoimmune or connective tissue disease (e.g., lupus, scleroderma, rheumatoid arthritis, carpal tunnel syndrome)
- Tumors or vascular malformations that cause abnormal blood flow between veins and arteries
- Frostbite

Material and Methods:

Study Sample subjects

Complaining subjects in our study had been referred to electroneurography test with suspicion of carpal tunnel syndrome (CTS), the apparatus that was used (Micro-Med) Italian made, model 2001, they selected randomly and examined in Middle Euphrates Neurosciences centre, of AL-Sader Medical City in AL-Najaf, between August 2010 and February 2011,

No patients were pregnant, breast feeder, smoker, and alcoholic or had any underlying systemic diseases such as diabetes, hypertension, thyroid dysfunctions, anemia, and uremia or a blood dyscrasia, Raynaud's disease, and rheumatoid arthritis. Patients with wrist arthropathy, trauma of the median nerve or cervical radiculopathy were also excluded.

A total of 284 hands in 142 persons, for all a physical examination, nerve conduction study, cold stress test, Thermal imaging and Doppler study had been done.

Thermal imaging and cold stress test

The Fever Scan M3000D series Canada made (Model FSM3000D) was the infrared thermal imaging camera used to screen study subjects.

The FSM3000D detects surface temperatures of the human body, and has very high sensitivity features and any temperature difference of 0.1°C will be measured, and its temperature resolution is 0.08.

View the initial hand state, the normal hands shows symmetry of right to the left hand, and the ulnar nerve territory zone to the median nerve zone in each hand. The normal hot hand view will be with red appearance, and if any hand immersed in cold water (cold stress test) so will be with complete black appearance and the real time to get recovery from coldness stress, recorded as (Recovery period).

While in this study there are 44 subjects who constantly have primary cold hands, thermal imaging showed semi black appearance, and there recovery period delayed for half or more than one hour, and thermal imaging showed semi black appearance even before hand immersion in cold water (cold stress test)

Then the **Doppler study** had been done in AL-Sader Medical City under observation of specialist Radiologist doctor. The Radial and Ulnar arteries Peak Systolic Flow Velocity (**Ps**) was chosen in this study, and that because it is good indicator to blood flow and not depending on transducer angle.

The Results

1-Group distribution of the study sample according to Clinical complain and Nerve Conduction Study finding.

grouping of the study sample according to NCS results into

CTS = 48 subjects, and 18 subjects with primary constant cold hands.

Normal = 76 subjects, the normal subjects was subdivided into following groups according to clinical assessment:

Normal *group=*

26 subjects with normal NCS and without hand complain, and

one subject with primary constant cold hands.

NWC (**N**ormal **W**ith **C**omplain) *group* =

24 subjects having normal NCS but with hand complain, and

25 subjects with primary constant cold hands.

So primary constant ***Cold hands*** group be 44 subjects.

2-Distribution of study sample according to the gender and age

142 subjects of study sample were:

105 Female, 37 Male as ratio 3.5: 1.

The age (mean ± SD) of 36.5 ± 10 years.

The primary constant ***Cold hands*** group be 44 subjects 31%.

38 female and 6 male as ratio 6.3: 1.

The age (mean ± SD) of 34 ± 8 years.

1 **Normal** subject with normal NCS and no hand complain. Age 25 years

25 subjects **NWC** with hand complain and normal NCS. Age (mean ± SD) of 35 ± 8 years, as 22 female and 3 male

18 subjects with **CTS**. Age of 40 ± 11 years, as 15 female and 3 male

3-The Thermal imaging and Cold stress test

Thermal imaging of the hand after one minute immersion in the cold water will be complete black appearance due to decrease blood flow , and after time with gradual recirculation of blood supply, so the hand will be returning to its preceding red colour and its previous blood flow, this period in this study was called (Recovery period) and considered as response value to cold stress test.

The recovery periods of Cold hands groups were significantly higher ($p<0.001$) than that of Normal hands.

Table 8: Recovery period of Cold hands group and Normal hands.

Recovery period (in *minutes)*			
Normal	**Groups**		**P**
8.5 ± 3.5	**CTS**	**12.8 ± 8.6**	**<0.005**
	NWC	**12.5 ± 7.6**	**<0.005**
	Cold hands	**49 ± 19**	**<0.001**

№ of Normal subjects =27 CTS=48 NWC=24 Cold Hands=44

4-Distribution of study sample according to the peak systolic of radial and ulnar arterial flow among groups.

The Peak systolic flow of radial and ulnar arteries of Cold hands group were significantly ($p<0.005$) lower than that of Normal hands

The Peak Systolic radial and ulnar arterial flow among study groups.

The Peak Systolic Flow of Whole hand arteries (in *cm/second)*		
Normal Group	Groups	***P***
62.74 ±17.55	**Cold hands 47.15±13.9**	***<0.05***
	CTS 53.64 ± 15.82	***<0.05***
	NWC 55.16 ± 14.59	***<0.05***

№ of Normal subjects =27 CTS=38 NWC=24 Cold Hands=44

5-Distribution of study sample according to the peak systolic of radial arterial flow among groups.

Cold hands shows significant reduction ($p<0.05$) of peck systolic (Ps) of radial artery which supplies the median nerve territory nervation area, as compare to corresponding Normal hands.

Doppler study peak systolic flow of radial artery among Normal, CTS, NWC, and Cold hands groups.

The peak systolic flow of radial artery (in *cm/second)*		
Normal Group	Groups	***P***
60.73 ± 17.18	**Cold hands 44.56±10.74**	***<0.05***
	CTS 52 ± 15.75	***<0.05***
	NWC 52.88 ± 12.9	***<0.05***

№ of Normal subjects =27 CTS=48 NWC=24 Cold Hands=44

Discussion

1: Distribution of study sample according to the gender and age among study groups:

Cold hands be 27% of CTS hands group, 51% of NWC hands group and 4% of Normal hands group. Affected female at younger age more, , specially in NWC group that is maybe as early sings and symptoms of carpal tunnel syndrome, or due to different underling pathology, even that both groups with similar hand complain.

2:- Thermal imaging and cold stress test

In this study there are 44 subjects with constantly have primary cold hands, there recovery period delayed for half or more than one hour, and thermal imaging showed semi black appearance even before hand immersion in cold water (cold stress test), which may indicated real noticeable defects, and the severity of the clinical symptoms and the functional disability do not correlate with the degrees of severity of the CTS on NCS (12,13).

Some studies measured hands skin temperature at ambient temperature of 22°C, and after cooling at 8°C, this had induced special risk of the disturbances in blood vessels, and early vasomotor changes (14).

As one would expect, people suffering from CTS often have cold hands compared to their forearms. This is caused by constriction of the blood vessels supplying the hand, when the hand is deprived from full circulation of these critical nutrients and warmth, it does not function well (15;9).

For that (make sure to keep your hands warm) is one of five easy things you can do to help prevent the onset of carpal tunnel syndrome This can be done by raising the temperature in the room or by wearing gloves. Clinical experience shows that the symptoms worsen in cold weather and lessen in warm weather although the severity of the disease does not change.

The temperatures of median nerve distribution area in the hands were highly significantly different between CTS and the control group. The differences between the median and ulnar nerve distribution area were also highly significantly different in CTS hands. The sensitivity and specificity of thermography were 84 and 91%, respectively. So thermography suggests. It may also be useful as an additional non-invasive tool in the diagnosis of CTS especially in the early stage (16)

Blood circulation problems in the hand usually accompany chronic CTS, the restricted blood flow results in a cyclical condition where inflammation cannot be dissipated through the normal healing process and soft tissue becomes more compacted, stiff and loses even more flexibility, with the rapid advances in electronic thermal imaging, this technology is now being used extensively in medicine to diagnose circulation related issues in the body.

3:- Distribution of study sample according to the peak systolic arterial flow of radial and ulnar among groups.

In this clinical study, there was significant reduction ($p<0.005$) of peck systolic radial and ulnar arteries (Ps) of Cold hands as compare to Normal hands.

4:- Distribution of study sample according to the radial artery peak systolic (Ps) flow among groups.

The Cold hands shows significant reduction ($p<0.05$) of peck systolic (Ps) of radial artery which supplies the median nerve territory nervation area, as compare to Normal hands.

There was significant reduction of skin blood flow of median nerve territory as compared to control (unaffected hand) ($p<0.05$). There was also significant reduction ($p<0.05$) of blood flow of median nerve territory as compare to ulnar nerve territory of affected hand except in extended position. These Circulatory disturbances changes are seen in hand skin of CTS patients depending on the type and severity of CTS(17).

The affected hands in CTS, NWC, and Cold hands groups have the same complain and identical low blood flow, in spite of different NCS results, this shows disagreement between NCS and clinical features, where as thermal imaging in cold stress shows agreement involving clinical features, Doppler study and thermal imaging results, it seem that from this significant results of this study that the thermal imaging of CTS hands in cold stress were consistent with that of the Doppler study.

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