Factors That Affect Subclinical Carpal Tunnel Syndrome (CTS) During Pregnancy Period

Dr. Ihsan M. Ajeena (M.B.Ch.B, M.Sc., Ph.D.)*
Dr. Mohammed A. Al-Aaridie (M.B.Ch.B, M.Sc.) **
Dr. Huda N. M. Al- Kuffai (M.B.Ch.B.)**
* Assist. Prof. of Neurophysiology \ Physiology Dept. \ College of Medicine \ University of Kufa
** Teaching Hospital \ An-Najaf Al-Ashraf Health directorate

العوامل التي تؤثر في متلازمة نفق الرسغ غير المصحوبة بأعراض مرضية أثناء فترة الحمل

الخلاصة:

الخلفية: الحمل ظاهرة فسلجية طبيعية تصاحبه العديد مِنْ التغييراتِ الكيماوية الحيويةِ تَتراوحُ مِنْ التغييراتِ في تركيز الأملاح إلى التغييراتِ الأكثر تعقيداً في ايض الكورتزول والكالسيوم. هذه التغييراتِ مع ازدياد نسبة السوائل يُمْكِنُ أنْ تُؤدّي إلى أمراض إجهادِ تكراريةِ مثل متلازمة نفق الرسغ وهذه التغييرات مع إنها قَدْ تَكُون غير ظاهرة سريريَا إلا انها قد تكون مزمنة وقد تؤدي إلى تعقيدات مرضية جدية.

الهدف من البحث: من أجل معرفة النساء الحوامل الأكثر عرضة للإصابة بمتلازمةِ نفق الرسغ غير المصحوبة بأعراض مرضية.

النتائج و المناقشة: تم فحص تأثير عدد من العوامل مثل عمر الحمل، تأريخ الولادات السابقة،عمل النساء الحوامل مع بعض قياسات الدم على وجود متلازمةِ نفق الرسغ غير المصحوبة بأعراض مرضية و لقد وجد بأنه لم يكن هناك اختلاف معتبر إحصائيا بين النِساءِ الحبلى اللواتي عِنْدَهُنّ اعتلال في دراسة فحص الأعصاب واللواتي كانت دراسة فحص الأعصاب سليمة فيما يتعلق بالكثير من هذه العوامل فيما عدا دليل وزن الجسم، عمر الحمل، مرات الحمل وعدد الأطفال المولودين وهم أحياء و كذلك معدل ترسب كريات الدم. و يمكن تفسير هذه النتائج بازدياد الاحتفاظ بالسوائل المصحوبة بازدياد وزن الجسم أثناء تقدم عمر الحمل، وكذلك بسبب تكرار التعرض للأسباب المؤدية إلى تغير في كفاءة العصب الرسغي عند تعدد مرات الحمل.

ABSTRACT:

Background: Pregnancy is a normal physiological phenomenon with many biochemical changes ranging from alterations in electrolyte concentrations to more complex changes in cortisol and calcium metabolism. These changes together with fluid retention can lead to repetitive strain illnesses like carpal tunnel syndrome and these changes may be subclinical, yet could be chronic and might lead to serious complications.

Aim of the study: Is to know which of the pregnant females are at more risk of developing subclinical CTS.

Results & discussion: The effect of some factors like the gestational age, gestational history, occupation of the pregnant females and some blood parameters on the presence of the subclinical CTS have been tested and it was shown that there were no statistically changes in most parameters other than the BMI, gestational age and

part of the gestational history with the ESR. These results can be explained by the increment in fluid retention that is accompanied with maternal weight gain with the progress of the gestational age, also due to recurrent exposure to pathophysiological changes into the median nerve function that take place during repetitive pregnancies.

Key: Neurophysiology – CTS – pregnancy

Correspondance: Assistant Prof. Dr. Ihsan M. Ajeena\ e mail: ihsanabud@yahoo.com

INTRODUCTION:

CTS is the commonest peripheral nerve problem in the United Kingdom that has considerable employment and healthcare costs.[1]

Although CTS is the commonest cause of nocturnal hand paraesthesia and some other symptoms and signs, it could be asymptomatic disease.[2,3].

CTS is not a life-threatening condition but it can negatively affect lifestyle if left untreated and may cause loss of feeling in some fingers, permanent weakness of the thumb and the thumb muscles can actually be wasted over time, eventually, trouble telling the difference between hot and cold temperatures by touch. In worst case, the median nerve can become severely damaged and result in total loss of movement within that hand.[4]

Pregnant women who develop CTS are not likely to develop this condition again after delivery,[4,5] unless there is another pregnancy because the problem usually clears up after delivery[6] where the symptoms usually disappear.[7] Yet, up to 20% of pregnant women complain of nocturnal hand parasthesia and if the syndrome is severe and chronic it may leads to irreversible changes of median nerve [8,9,10] that might lead to disability. It is reported that 40 % of pregnancy related CTS cases had residual signs of median nerve damage (two point discrimination abnormality with thenar atrophy and weakness) after delivery.[11,12,13]

The aim of this study is to know the factor that put the pregnant females at risk of developing subclinical CTS.

MATERIALS AND METHODS:

This study is a cross-sectional descriptive analysis, which was performed on 75 neurologically non complaining females, 48 of them were having positive NCS findings suggesting the presence of carpal tunnel syndrome (CTS) and the remaining 27 females were having normal electrophysiological nerve conduction parameters of their median nerves. All of the participants were free from any history of trauma to their upper limbs, a past history of upper limb neurologically complaint as numbness or paresthesia, free from any disease that might affect the nerve conduction parameters as diabetes mellitus and, furthermore, they were non-smokers and are free from protein urea.

For the electrophysiological tests done, Micromed machine was used with system plus EMG soft wave. Many types of electrodes are also used, as a ribbon strap surface grounding electrode, a bipolar surface stimulating electrode with two felt tips and recording electrodes (a pair of finger ring electrodes for sensory nerve conduction study with antidromic method and a pair of surface cup electrodes for motor nerve conduction study). The recorded measurements include the Latency, Conduction Velocity and Amplitude for both sensory and motor fibers of the median and ulnar nerves. The subject is considered as having CTS, if at least the sensory latency, conduction velocity or amplitude of her median nerve was significantly different from other participants

(prolonged, decreased and decreased respectively). Yet the diagnosis might be augmented by significant changes in motor conduction parameters of this nerve.[1,4,14]

A full history about the gestational age, number of gravida, para and abortion and the type of the participant job (house wife or worker) were noted and evaluated.

Also, many non neurophysiological measurements and tests were done as the BMI (as an index of obesity), Blood pressure measurement (BP) and some Laboratory investigations like Hemoglobin Percent, Erythrocyte Sedimentation Rate, Blood sugar level and Blood group**.**

RESULTS:

The relevant job history and characteristics of the seventy five neurologically non-complaining pregnant women were divided according presence or absence of carpal tunnel syndrome (CTS) into two groups and their level of significance are shown in table (1).

Table (2) shows results and the significance level of gestational history of those pregnant women with CTS and those who are free from it.

The results of blood investigation of these two groups of pregnant women together with their degree of significance are shown in table (3).

Table 1: Characteristics of the subjects.

Parameter		Pregnant women		P value
		Negative NCS (n = 27)	Positive NCS (n = 48)	
Age (Years) Mean ± SD		27.4 ± 4.7	29.6 ± 5.7	P > 0.05
BMI (Kg/m^2) Mean ± SD		25.3 ± 3.3	30.1 ± 5.7	**P < 0.001**
Systolic BP (mmHg) Mean ± SD		112.96 ± 6.7	114.4 ± 10.9	P > 0.05
Diastolic BP (mmHg) Mean ± SD		68.4 ± 13.2	69.4 ± 11.2	P > 0.05
Job	Housewife (n = 70)	24 (88.9 %)	46 (95.8 %)	P > 0.05
	+ Work (n = 5)	3 (11.1 %)	2 (4.2 %)	

Table 2: The gestational history of the subjects.

Test		Pregnant women		P value
		Negative NCS (n = 27)	Positive NCS (n = 48)	
Trimester No. (%)	1st	14(51.9)	11(22.9)	**P < 0.001**
	2nd	12(44.4)	13(27.1)	
	3rd	1(3.7)	24(50)	
Gravida No. (%)	**Primigravida** (n =15)	11 (40.7 %)	4 (8.3 %)	**P < 0.001**
	Multigravida (n =60)	16 (59.3 %)	44 (91.7 %)	
Para No. (%)	Nuli (n = 21)	12 (44.4 %)	9 (18.75 %)	**P < 0.05**
	Multipara (n = 54)	15 (55.6 %)	39 (81.25 %)	
Abortion No. (%)	Non (n = 48)	21 (77.8 %)	27 (56.25 %)	P > 0.05
	Present (n = 27)	6 (22.2 %)	21 (43.75 %)	

Table 3: Blood parameters of the subjects.

Parameter		Pregnant women		P value
		Negative NCS (n = 27)	Positive NCS (n = 48)	
Blood Group No. (%)	A (n = 16)	4 (14.8 %)	12 (25 %)	P > 0.05
	B (n = 27)	6 (22.2 %)	21 (43.75 %)	P > 0.05
	AB (n = 7)	3 (11.1 %)	4 (8.33 %)	P > 0.05
	O (n = 25)	14 (51.9 %)	11 (22.92 %)	P > 0.05
Hb (mg/dl) Mean ± SD		11.3 ± 0.9	11.2 ± 0.9	P > 0.05
ESR Mean ± SD		28.9 ± 14.4	38.8 ± 17.5	**P < 0.05**
Blood sugar (mg/dl) Mean ± SD		97 ± 22.6	88.9 ± 16.3	P > 0.05

DISCUSSION

Women of any age can develop CTS,[18] while a study reported that CTS is most common in women during their fourth to sixth decades of life[19]. There were a lot of studies that showed the effects of age on nerve conduction study parameters in which the conduction velocity increases with the increase of age reaching adult range in 3 to 5 years and maximum at 30 to 40 years old then they decline with increasing age.[14,20,21] That is why the subjects shared in this study had the same age range ($P > 0.05$).

There was statistically significant increased in the BMI in pregnant women with CTS when compared with the normal pregnant women. A findings that is not consistent with other studies,[22,23] while other studies showed that the fluid retention accompanies with maternal weight gain, puts them at risk of developing CTS during pregnancy.[18] Other studies demonstrated that the risk of CTS in individuals who were classified as obese (BMI > 29) increased 2.5 times than those who were slender (BMI < 20).[24] So in this study, the causes that related to increased in BMI as hypertension and edema during pregnancy was excluded.

Some studies found that high blood pressure during pregnancy is usually associated with edema due to fluid retention and this will increase the pressure inside the tunnel that increased the risk for developing CTS.[25] Also, it is known that long standing hypertension is usually associated with different types of neuropathies.[26] That is why all the participants of this study were chosen to be normotensive ($P > 0.05$).

The absence of statistically significant difference between pregnant women who have positive NCS and those with normal NCS parameters in regard to their jobs might be due to the low number (only 5) of the worker pregnant women and because these worker women also do the same house jobs done by the non-workers. Other studies showed that the carpal tunnel syndrome was a common affliction especially among persons whose occupations require repetitive wrist motion which involves high force or vibration which is particularly hazardous, as repetitive hand and wrist work in cold temperatures.[27,28] However, other reports like that of Falkiner and Myers (2002)[29] or that of the American Society for Surgery of the Hand (ASSH) (2006)[30] do not support a causal relationship between specific work activities and the development of CTS.

The third trimester showed more effects for both sensory and motor parameters, than the first or second trimesters because of the increased BMI and more fluid retention take place in third trimester and to lesser extent the second trimester and this was correlated with the electrophysiological picture in CTS probably due to local compression of median nerve within carpal tunnel.[31,32,33]

There was statistically significant difference between pregnant women who have positive NCS and those with normal NCS parameters in regard to the gravida and para ($P < 0.001$, $P < 0.05$) respectively, but not with the presence or absent of history of previous abortion. Eogan et al. (2004)[34] and Finsen and Zeitlmann (2006)[35] performed a comparative studies between primigravid and multigravid pregnant women and did not show any significant differences in nerve conduction study parameters as with other study.[23]

In regard to the para, this study seems to be consist with other studies in which the CTS was more common in multipara[36] due to recurrent exposure to pathophysiological changes into the median nerve function that take place during pregnancy.[34]

It has been found there was no statistically significant difference between pregnant women who have positive NCS and those with normal NCS parameters in regard to their types of blood groups. Also there was no cross research that performed such

correlation of blood group and development of CTS during pregnancy and this indicates that the genetic cause does not play a role in the development of CTS during pregnancy in this study.

Anemic will be causing hypoxia (lack of oxygen) in those small nerves far from the trunk of the body that may cause peripheral neuropathy.[37,38] In many studies, the upper level of hemoglobin in a pregnant complaining of CTS was lower than that in non pregnant women because of the physiologic changes in the hemoglobin concentration during pregnancy, known as "the physiologic anemia of pregnancy".[39] In this study, hemoglobin concentration was not seen to play any significant role.

There was a statistically significant increase ($P < 0.05$) of the ESR in the pregnant women with positive nerve conduction findings. A research demonstrates that the ESR increased during pregnancy and significantly influenced by gestational age and hemoglobin concentration in which the anemic women reference range of ESR rose from 21– 62 mm/h in the first half of pregnancy to 40–95 mm/h in the second half of pregnancy.[40] While other study showed that the erythrocyte sedimentation rate (ESR) was raised as auto-antibody screen was normal apart from positive antinuclear antibody with anti-centromere antibody at a titer of I in 1000 of neuropathic patient.[41] This might put a hypothesis that auto-antibody may play a role in the development of the CTS during pregnancy.

Sugar was an important source of energy, especially for the brain and the amount of glucose in the blood was carefully controlled by the endocrine (glandular) system. This system caused sugar to be stored or used for energy depending on the needs of the body and because the need for sugar by advanced pregnancy increase gradually, the level of blood sugar decreases accordingly in advanced pregnancy especially in normal non-diabetic pregnant women.[42,43] That is why, all the participant were free form diabetes mellitus [44,45]. Furthermore, the absence of a significant change in the blood sugar percent within the pregnant subgroups eliminates any role of this parameter on the development of the CTS during pregnancy.

CONCLUSION:

- There were many factors that could deteriorate nerve conduction parameters during pregnancy in favor of developing carpal tunnel syndrome, among these are the BMI, gestation age and the history of gravida and para and the ESR.
- Special attention of these factors and in the presence of the subclinical CTS in general during pregnancy as it may lead to permanent complication.

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