Original Research

Occurrence of Pregnancy Related Carpal Tunnel Syndrome (PRCTS) in different trimesters of Pregnancy

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Abstract

Background: Carpal tunnel syndrome (CTS) is a problem faced by the pregnant women as the pregnancy advances. Physiological changes ensure a hypervolemic state of the pregnant female and added pressure on the median nerve which is already packed in the carpal tunnel at the level of the wrist leading to pregnancy related carpal tunnel syndrome (PRCTS). The weight gain and increase in volume of the pregnant female with the advancing trimesters of pregnancy poses an increased risk of the occurrence of PRCTS. Electrophysiologic studies remain an important means for documenting possible CTS in pregnancy so that potentially beneficial conservative therapies can be implemented.

Aims and Objective: To assess any positive association of pregnancy related carpal tunnel syndrome with the advancement of trimesters of pregnancy.

Material and methods: In this cross-sectional study, 75 pregnant females were recruited from the obstetrics ANC clinic of J.N. Medical College, Aligarh Muslim University. The pregnant females recruited were from all the three trimesters. These pregnant women were screened for pregnancy related carpal tunnel syndrome (PRCTS) via the electrodiagnostic technique. Out of the 75 pregnant females screened, 36 were found to be PRCTS positive. The study then analyzed any positive association between the advancing trimesters and PRCTS occurrence.

Result: The incidence of PRCTS was found to be 24%, 52% and 68% in the first, second and third trimester respectively. Thus, Electrodiagnostic study (EDX) study for the diagnosis of PRCTS has greater incidence of positivity as the trimester of pregnancy advances.

Conclusion: This study concluded that the incidence of PRCTS is markedly increased as the trimester advances through the journey of pregnancy in case of a pregnant female.

Keywords: Pregnancy, Pregnancy related carpal tunnel syndrome, Trimester, Electrodiagnostic technique.

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common mononeuropathy that involves the impairment of the functioning of the median nerve [1]. The median nerve traverses along the forearm and the wrist joint. It passes through the carpal tunnel below the fibrous flexor retinaculum [2]. The median

nerve is very compactly placed in the carpal tunnel and this makes it at a very high risk for getting damaged. The environment of raised pressure in the tunnel or volume of fluid in circulation causes CTS [2]. There are various causes and etiologies of CTS. They are of two categories namely primary and secondary. Primary CTS is mainly caused due to factors that are directly linked to the anatomical disruption of the carpal tunnel or any injury that causes anatomical disruption of the flexor retinaculum therefore carpal tunnel finally disrupts the functioning of the median nerve [1]. The secondary CTS are mainly caused by any condition that raises the pressure inside the carpal tunnel as a consequence to the pathogenesis of any disease. The rise in pressure could be due to a state of hypervolemia which can be due to physiological changes in the human body. The most common cause for secondary CTS due to physiological changes is pregnancy. CTS that occur in pregnancy is known as pregnancy related carpal tunnel syndrome (PRCTS) [1].

The normal functioning of median nerve during pregnancy, depicted by the electrodiagnostic values of various parameters is of paramount importance. The narrow passage of median nerve through the carpal tunnel affects its functioning due to the added pressure endured during the advancement of pregnancy through the three trimesters. Pregnancy related carpal tunnel syndrome is hence a major problem faced by the pregnant women as the pregnancy advances [3]

Compression of the median nerve underneath the flexor retinaculum over the wrist joint leading to pain and paresthesia in the hands and arm (Carpal tunnel syndrome) may appear in the later months of pregnancy. Similarly, paresthesia and sensory loss over the anterolateral aspect of the thigh may occur. It is due to compression of the lateral cutaneous nerve of the thigh. During pregnancy, the amount of water retained at term is about 6.5liters. The water content of the fetus, placenta and amniotic fluid is about 3.5 liters.

Pregnancy is a state of hypervolemia. There is active retention of sodium (900 mEq), potassium (300 mEq) and water. The important causes of sodium retention and volume overload are: (i) changes in maternal osmoregulation, (ii) increased estrogen and progesterone, (iii) increase in renin-angiotensin-aldosterone system (RAAS) activity, (iv) increased aldosterone, deoxycorticosterone, (v) control by arginine vasopressin (AVP) from posterior pituitary and (vi) atrial natriuretic peptide. Serum sodium level and plasma osmolality decreases. There is resetting of the osmotic thresholds for thirst and AVP (ADH) secretion. Net Maternal Weight Gain is 6 kg, out of which Increase in blood volume is 1.3 kg and increase in extracellular fluid is 1.2 kg [3]. During subsequent months, the weight gain is progressive until the last 1 or 2 weeks, when the weight remains static. The total weight gain during the course of a singleton pregnancy for a healthy woman averages 11 kg (24 lb). This has been distributed to 1 kg in first trimester and 5 kg each in second and third trimester [3]. The weight gain and increase in volume of the pregnant female with the advancing trimesters of pregnancy poses an increased risk of the occurrence of PRCTS [1]. Electrophysiologic studies remain an important means for detecting possible CTS in Pregnancy so that potentially beneficial conservative therapies can be implemented [1].

AIM & OBJECTIVE:

To assess the association of pregnancy related carpal tunnel syndrome with the advancement of pregnancy through the three trimesters.

MATERIALS & METHODS

This was a cross-sectional study where a total of 75 pregnant females, recruited from the obstetrics ANC clinic JNMCH, AMU during the period of Oct 2018 to Sept 2020 were screened for PRCTS via the electrodiagnostic technique in the neurophysiology laboratory, Department of Physiology, JNMCH, AMU. Out of these75 pregnant females, 36 pregnant females, belonging to various trimesters were found to be positive for PRCTS. Ethical clearance was duly obtained from the Institutional ethical committee prior to the start of study.

Inclusion Criteria: Pregnant females without symptoms of CTS before pregnancy. Asymptomatic pregnant females with an electrodiagnostic finding which satisfies the criteria of CTS diagnosis. Pregnant females who have signs and symptoms of CTS starting after the beginning of pregnancy.
Exclusion Criteria: Pregnant women with a history of trauma or fracture of hand (Colle'sfracture). Pregnant women with hypothyroidism, diabetes, or any previously diagnosed neuropathy. Pregnant women with pre-existing autoimmune diseases, obese pregnant women, Smoker pregnant women.

Electrodiagnostic studies: Electrodiagnostic studies include Nerve Conduction velocity, Latency and amplitude of the sensory and motor component of median nerve [1].
It's a gold standard and confirmatory test for the diagnosis of CTS (1). A distal motor latency of >4.5ms and a sensory latency of >3.5ms are considered abnormal [4].

Sample Size: Taking prevalence of PRCTS in Asian population as 26% [5] and 10% absolute error, sample size comes out to be 72. In this study we included 75 pregnant females, in order to coverup the lost- to-follow-up, drop-out rate and non-response rate

Statistical analysis: All the data was compiled on Microsoft office excel 2013. Analysis was performed using SPSS version 20.0 statistical package for windows (SPSS, Chicago, IL).Continuous variables were expressed as mean +/- standard deviation (S.D) or range, and qualitative data was expressed in percentages. Chi-square, ANOVA, Pearson's correlation test was used to find out statistically significant association between the prevalence of PRCTS and the advancement of pregnancy through various trimesters.

OBSERVATIONS &RESULTS

This cross sectional study was conducted in J.N.Medical College, AMU, Aligarh with 75 pregnant females of various trimesters.

Table No.1: Distribution of Study population

S.NO	Trimester(study group)	frequency	Percentage (%)
1	First trimester pregnant females	25	33.33
2	Second trimester pregnant females	25	33.33
3	Third trimester pregnant females	25	33.33
Total		**75**	**100**

Table No 2: ANOVA test between nerve latencies and various trimesters of pregnancy

Nerve latency(ms)	Df(degree of freedom)	F-statistic	Significance
Right median motor latency	2	13.923	0.000
Left median motor latency	2	15.169	0.000
Right median sensory latency	2	24.256	0.000
Left median sensory latency	2	11.202	0.000

The table no 2 manifests the right & left motor as well as sensory latency has significant association with different trimesters of pregnancy.
The aforesaid results and observations are also analysed with Chi-square test.

Table No. 3: Association between right& left median motor latency and different trimesters

Trimester	Right median Nerve		Left median Nerve	
	<4.2 ms	≥4.2 ms	<4.2 ms	≥4.2 ms
0	25	0	25	0
1	24	1	21	4
2	18	7	18	7

3	8	17	7	18
Total	75	25	71	29

Table 3 described the number of females with right & left median motor latencies<4.2 ms and ≥4.2 ms

Table No. 4: Chi-SquareTests

Pearson Chi-Square Test	Value	df	Asymptomatic significance(2-sided)
Right Median Nerve	38.987	3	.000
Left Median Nerve	34.726	3	.000

Table no 4 depicted strong associations between right & left median motor latency and different trimesters.

Table No.5: Symmetric measures

Correlation coefficient	Value	Approx. Significance
Pearson's R Right Median Nerve	.589	.000
Pearson's R Left Median Nerve	.562	.000

This table no 5 implied a moderately positive correlation between right & left median motor latency and different trimesters.

Table No.6: shows ANOVA test for the depiction of association between nerve conduction velocity and different trimesters of pregnancy.

	Mean	Standard deviation	Degree of freedom	F	Significance
Right median motor NCV	54.9098	6.12816	2	6.864	0.002
Left median motor NCV	55.5025	6.71223	2	4.686	0.003
Right median sensory NCV	49.9693	12.99959	2	15.144	0.000
Left median sensory NCV	49.4879	9.85769	2	8.984	0.000

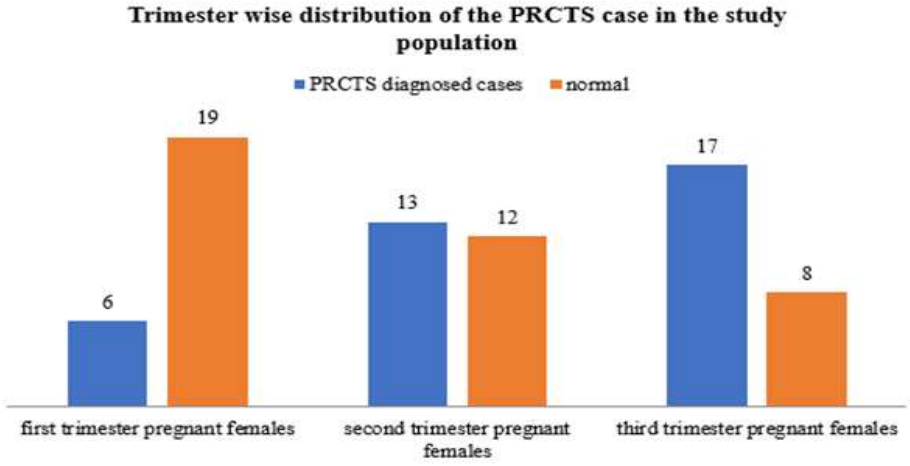
This table no 6 revealed the strong association of right & left median motor NCV and right & left median sensory NCV with the different trimester of pregnancy.

Table No.7: Correlation between the motor conduction velocity and various trimesters

NCV	Mean	Std. Deviation	Pearsons correlation	Significance
Right median motor NCV	54.90	6.12	-0.344	0.000
Left median motor NCV	55.50	6.71	-0.352	0.000

The pearsons correlation was observed which illustrated the moderately negative correlation between right & left median nerve and different trimester of pregnancy.

Figure No. 1: Trimester wise distribution of the PRCTS cases in the study population



FigureNo.1 depicted the incidence of PRCTS trimester wise. The incidence of PRCTS was found to be 24%, 52% and 68%in the first, second and third trimester respectively. Electrodiagnostic study thus proved greater incidence of positivity for the diagnosis of PRCTS as the trimester of pregnancy advances.

DISCUSSION

In this study incidence of PRCTS in different trimester of pregnancy was observed. The incidence of PRCTS was found to be 24%, 52% and 68% in the first, second and third trimester of pregnancy respectively. A very high incidence of PRCTS was found in third trimester pregnant females. This study shows that as the trimester of pregnancy advances the latency of the median nerve increases and the conduction velocity of the median nerve decrease. Both the electrodiagnostic findings are suggestive of the increased incidence of the diagnosis of pregnancy related carpal tunnel syndrome with the advancing trimester of pregnancy.

This finding is supported by a study done by **F Turgut et al (2001)** which stated that in most pregnant patients with CTS, the symptoms were first noted during the third trimester [5].

Similarly, **Robert H Ablove et al (2009)** observed that median nerve function was found to be impaired in virtually all pregnant women during the third trimester, even in the absence of symptoms [6]. In another study done by **Sapuan J et al (2012)** it was found that CTS was highly prevalent in the third trimester of pregnancy, especially among Malay women, in whom the risk of developing the CTS syndrome was two-fold [7]. **Saeid Khosrawi et al (2012)** found that the prevalence and severity of CTS increases with the gestational age of pregnancy [8]. **P Yazdanpanah et al (2012)** observed a very high prevalence (62%) of CTS in pregnancy in comparison to other population groups [9].

Louis H. Weimer et al (2002) conducted a study to check the electrodiagnostic values of various parameters of functioning of median nerve in pregnant women. The study showed that all the values of the median nerve starting from 22weeks progressively worsened from baseline, reaching a lowest value ranging from gestational age 24-26 weeks. Declines were seen in all measurements including SNAP in digits two-four (92-97% decrease; D11:36.8 to microvolt), sensory conduction velocity (52-55% decrease; D11 59to 27m/s), CMAP amplitude (55%decrease; 14.6to6.5mV), DML (31%increase; 3.2 to 4.2ms), and latency difference (900%increase)[10].

Padua L et al (2002) studied 76 women in the late stages of pregnancy, enrolled prior to ascertainment of hand symptoms. Out of these 70% agreed to undergo electrodiagnostic testing and 62% had clinical symptoms of CTS. Among those who underwent testing, 43% were found to have nerve conduction abnormalities compatible with the diagnosis of PRCTS. This research by Padua L et al (2002) also assessed the risk factors and pathogenesis of CTS in pregnancy that defined that the oedema of the tissues in the carpal tunnel could induce a mechanical compression of the nerve, played a negative role in the evolution of the syndrome probably due to impairment of the microcirculation[11].Thus by the above observations it can be concluded that the incidence of PRCTS is highest in the third trimester pregnant females which were similar to our results.

CONCLUSION

This study was conducted to evaluate the electrodiagnostic values in the patients of carpal tunnel syndrome among the pregnant women of different trimesters. The incidence of PRCTS and its association with advancement of trimesters of pregnancy was evaluated. A significant association of prolonged nerve latency with different trimesters of pregnancy was found in the sensory and motor latency of median nerve. A moderately positive correlation was found in between the median motor nerve latency in the different trimesters of pregnancy (Pearson's R; +0.5) thus as the trimester of pregnancy increases the values of median nerve latency increases moderately. A significant association between nerve conduction velocity and different trimesters of pregnancy was found in

both sensory and motor aspects of the median nerve. Moderately negative correlation between the motor conduction velocity of median nerve in the different trimesters of pregnancy was found (Pearson's R;-0.3) thus as the trimester of pregnancy increases the values of median nerve velocity decreases moderately. Trimester wise distribution of the incidence of PRCTS was calculated as 24%, 52% and 68% in the first, second and third trimester pregnant females group respectively. A very high incidence of PRCTS was found in the third trimester of pregnancy. The raised fluid volume in the carpal tunnel continually compresses & amp; it decreases the blood supply to the median nerve leading to alterations in the blood-nerve barrier, and development of endoneural edema thus impairing the median nerve function. Besides these factors, excessive weight gain during the gestational period and long term hormonal exposure in multiparous pregnant females could be the possible mechanisms behind the increased incidence of PRCTS among the advanced trimesters of pregnancy. This study suggested that all the pregnant females coming to the ANC OPD should be screened for the occurrence of PRCTS in all the three trimesters of pregnancy so that early detection and diagnosis of the problem can help the pregnant females to get early and complete treatment for the same.

LIMITATION OF THE STUDY

This study could have been more informative if it conducts the follow-up electrodiagnostic evaluation of the recruited study population as the pregnancy progresses into all the trimester. The increased sample size may be helpful to the study results.

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work.

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