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Original Research Article

Effect of pregnancy on median and ulnar nerve conduction

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ABSTRACT

Background: Pregnancy causes altered function of excitable membranes such as muscle and nerve, due to hormonal changes and edema. We failed to find any studies focusing on the issue of nerve conduction during pregnancy, in India. Thus present study aims to see the difference between nerve conduction parameters viz. motor and sensory conduction, in pregnant and non-pregnant women.
Methods: This was a cross-sectional study carried out in randomly selected 30 pregnant women, of any age, in 28-40 weeks of gestation and age matched non-pregnant controls. We studied distal motor latency, compound muscle action potential amplitude, motor nerve conduction velocity, F-minimum latency, sensory latency, sensory nerve action potential amplitude and sensory nerve conduction velocity in bilateral median and ulnar nerves using Aleron-RMS.
Results: Present study found no statistically significant difference between motor and sensory conduction of above said nerves in pregnant and nonpregnant women, except F minimum latency of left median nerve in pregnant women and sensory latency of left ulnar nerve in non-pregnant women were prolonged significantly ($p<0.05$).
Conclusions: All motor and sensory parameters of bilateral median and ulnar nerves were normal as compared to non-pregnant controls.

Keywords: CMAP, Carpal tunnel syndrome, Neurophysiology, Sensory latency, SNAP

INTRODUCTION

Pregnancy causes altered function of excitable membranes such as muscle and nerve, due to hormonal changes and edema.[1] Carpal tunnel syndrome (CTS) is a frequent complication of pregnancy. The pathology involves the compression of the median nerve passing through the carpal tunnel in the hand. Its prevalence is as high as 62% in some populations during third trimester of pregnancy.[2] Available published research points towards various causes of CTS in pregnant woman as influence of hormonal changes, neural oedema, anatomically narrow carpal tunnel etc.[2,3] However increase incidence of CTS in woman on regular hormonal contraception and cessation of CTS symptoms in post-partum period suggest the hormonal theory to be true.[2-4] Thus to supplement this hypothesis and association of nerve conduction abnormalities with pregnancy, we focused on this research.

We failed to find any studies focusing on the issue of nerve conduction during pregnancy, in India. Thus present study aims to see the difference between nerve conduction parameters viz. motor and sensory conduction, in pregnant and non-pregnant women. Our objective was to study the electrophysiological changes in median and ulnar nerve conduction during pregnancy, who have no symptoms of carpal tunnel syndrome during the third trimester in our local population.

METHODS

This was a cross-sectional research carried out in randomly selected 30 pregnant women, of any age, in 28-

40 weeks of gestation, coming for routine check up at the Shri Vasantrao Naik Government Medical College, Yavatmal, (GMCH) Obstretic Out Patient Department (OPD). We also enrolled, 30 age matched non-pregnant women, who volunteered to participate in this research and were ready to give written informed consent. We carried out this study in NCV OPD of our teaching hospital, only after approval from institutional ethics committee. The mean age of cases and controls were 22.77±0.459 and 22.80±0.750 respectively.

We excluded the women suffering from Diabetes, Hypertension, Peripheral neuropathy, Rheumatoid arthritis and fracture at wrist joint which may affect our study parameters. Our study parameters were distal motor latency (DML), compound muscle action potential amplitude (CMAP), nerve conduction velocity (MNCV) and F-minimum latency in bilateral median and ulnar nerves to study the motor nerve conduction. Also we studied sensory latency, nerve action potential amplitude (SNAP) and nerve conduction velocity (SNCV) in bilateral median and ulnar nerves.

At first we asked participants for presence of clinical symptoms like tingling, numbness in fingers, weakness etc.[2,3,5] Then we recorded anthropometric parameters like height and weight of each pregnant and non pregnant women, entered data in pre-designed case record forms (CRF) as well as in computer attached with RMS-Aleron machine.

Measurement of study parameters

We performed nerve conduction studies of median and ulnar nerves bilaterally on RMS –Aleron machine in GMCH neurophysiology OPD. We used reference, active, and ground electrodes for both motor and sensory conduction.

For motor conduction, the gain was set at 2-5mV per division. The active electrode was placed on the centre of muscle belly and the reference electrode was placed distally on the tendon. Duration of pulse was set to 100µs and current 50-100mA for stimulation.[6]

For sensory conduction, the gain was set at10-20 µV per division. A pair of ring electrodes was placed in line over the nerve at an inter-electrode distance of 3-4 cm. The active electrode placed closest to the stimulator. As sensory fibres have low threshold to stimulation current used was in the range of 5-30mA and duration for 100µs. We performed antidromic sensory conduction studies using ring electrodes.[6]

Median motor nerve conduction parameters- Recording electrodes were placed over Abductor pollicis brevis muscle (lateral thenar eminence). Stimulation performed at two sites viz middle of the wrist and antecubital fossa. We recorded two waves at two sites of stimulation. But for our study we took only distal (wrist) stimulation wave parameters viz distal motor latency (DML) in milliseconds and compound muscle action potential amplitude (CMAP). We calculated motor nerve conduction velocity by entering distance between two stimulation points. F wave minimum latency (milliseconds) recorded by stimulating at wrist and recording 8-10 waves on a rastered trace. Median sensory nerve conduction parameters- A pair of ring electrodes was placed over second digit and stimulation was performed at middle of wrist with slowly increasing current from 0-50mA till we obtained a waveform. We recorded onset latency (milliseconds) and sensory nerve action potential amplitude (µV) (SNAP). We calculated sensory nerve conduction velocity by entering distance between active electrode and stimulator.[6]

Ulnar motor nerve conduction parameters- Recording electrodes were placed over abductor digiti minimi muscle and stimulation at medial wrist and below elbow. Ulnar sensory conduction parameters- Ring electrodes were placed over fifth digit and stimulation performed at medial wrist. Ulnar nerve runs outside the flexor retinaculum, it is not subjected to the same compressive forces as the median nerve; thus ulnar nerve conduction studies were carried out in order to see the changes outside the carpal tunnel and also to exclude patients with coincidental polyneuropathy or cervical radiculopathy.[5]

Statistical analysis

The sample size of 30 pregnant and 30 non-pregnant was a convenience sample as this was a new research at our centre and for beginning study it was adequate.

Present study compared the means of all the study parameters for median and ulnar nerves by Mann-Whitney test using Graph pad prism software ver 5.01. We also compared F min latencies of both median and ulnar nerves with nonpregnant controls. ‘p’ value of less than 0.05 was considered as statistically significant.

RESULTS

Thirty pregnant women in third trimester were recruited as cases and thirty age matched nonpregnant women were enrolled as controls.

The mean ages of pregnant and nonpregnant women were 22.77±0.459 and 22.80±0.750. The bilateral upper extremities of the participating women were evaluated electrophysiologically. All motor and sensory parameters of bilateral median and ulnar nerves were normal as compared to controls like DML, CMAPs, MNCV and F minimum latencies and sensory onset latency, SNAP amplitudes, SNCV except F –min latency of left median nerve and sensory latency of left ulnar nerve (Table 1-4).

Table 1: Comparison of study parameters in right median nerve.

Study parameters	Non pregnant (n=30)			Pregnant (n=30)			'p' value
	Mean	SEM	95%CI	Mean	SEM	95%CI	
DML (ms)	2.949	0.182	2.576-3.322	2.833	0.095	2.638-3.027	0.615
CMAP(mV)	16.42	1.143	14.09-18.76	15.21	1.172	12.81-17.61	0.379
MNCV(m/s)	53.29	1.219	50.80-55.78	52.58	1.636	49.23-55.93	0.464
F min latency (ms)	26.72	0.7193	25.25-28.19	26.58	0.5519	25.45-27.71	0.882
Sensory latency(ms)	2.782	0.09997	2.578-2.986	2.721	0.1663	2.381-3.061	0.280
SNAP (µV)	28.80	3.401	21.85-35.76	48.93	8.613	31.31-66.54	0.147
SNCV (m/s)	48.08	1.216	45.59-50.57	51.03	1.942	47.06-55.01	0.819

DML- distal motor latency; CMAP- compound muscle action potential amplitude; MNCV- motor nerve conduction velocity; SNAP- sensory nerve action potential amplitude; SNCV- sensory nerve conduction velocity.

Table 2: Comparison of study parameters in left median nerve.

Study parameters	Non-pregnant (n=30)			Pregnant (n=30)			'p' Value
	Mean	SEM	95%CI	Mean	SEM	95%CI	
DML (ms)	2.810	0.153	2.497-3.122	2.721	0.098	2.521-2.921	0.684
CMAP(mV)	16.19	1.107	13.92-18.45	16.93	1.327	14.21-19.64	0.819
MNCV(m/s)	56.84	1.104	54.58-59.09	54.30	1.325	51.59-57.01	0.075
F min latency (ms)	25.06	0.4787	24.08-26.04	26.48	0.5523	25.35-27.61	0.0179
Sensory latency(ms)	3.037	0.211	2.606-3.468	2.710	0.1770	2.347-3.072	0.165
SNAP (µV)	36.16	4.521	26.92-45.41	59.56	9.325	40.48-78.63	0.174
SNCV (m/s)	48.64	2.062	44.42-52.86	52.23	2.076	47.99-56.48	0.412

DML- distal motor latency; CMAP- compound muscle action potential amplitude; MNCV- motor nerve conduction velocity; SNAP- sensory nerve action potential amplitude; SNCV- sensory nerve conduction velocity

Table 3: Comparison of study parameters in right ulnar nerve.

Study parameters	Non pregnant (n=30)			Pregnant (n=30)			'p' Value
	Mean	SEM	95%CI	Mean	SEM	95%CI	
DML (ms)	2.249	0.164	1.914-2.584	2.213	0.205	1.795-2.632	0.663
CMAP(mV)	13.72	0.773	12.14-15.30	12.30	1.019	10.21-14.38	0.066
MNCV(m/s)	59.30	1.477	56.28-62.32	55.59	2.033	51.43-59.75	0.092
F min latency (ms)	26.61	0.957	24.65-28.57	26.24	0.517	25.18-27.29	0.673
Sensory latency(ms)	2.556	0.0951	2.362-2.751	2.276	0.105	2.060-2.491	0.072
SNAP (µV)	35.48	6.577	22.03-48.93	41.98	5.824	30.07-53.89	0.149
SNCV (m/s)	53.84	1.675	50.41-57.26	51.19	1.845	47.41-54.96	0.074

DML- distal motor latency; CMAP- compound muscle action potential amplitude; MNCV- motor nerve conduction velocity; SNAP- sensory nerve action potential amplitude; SNCV- sensory nerve conduction velocity

Table 4: Comparison of study parameters in left ulnar nerve.

Study parameters	Non pregnant (n=30)			Pregnant (n=30)			'p' Value
	Mean	SEM	95%CI	Mean	SEM	95%CI	
DML (ms)	2.332	0.186	1.951-2.713	2.221	0.221	1.769-2.674	0.593
CMAP(mV)	12.84	0.765	11.28-14.41	12.55	0.854	10.81-14.30	0.679
MNCV(m/s)	57.21	1.591	53.95-60.46	55.13	2.081	50.88-59.39	0.267
F min latency (ms)	26.32	0.911	24.45-28.18	26.72	0.467	25.76-27.67	0.773
Sensory latency(ms)	2.802	0.206	2.380-3.224	2.212	0.109	1.989-2.434	0.0076
SNAP (µV)	34.06	3.076	27.76-40.35	55.12	6.813	41.18-69.05	0.0459
SNCV (m/s)	51.70	2.499	46.59-56.81	50.85	1.942	46.88-54.82	0.442

DML- distal motor latency; CMAP- compound muscle action potential amplitude; MNCV- motor nerve conduction velocity; SNAP- sensory nerve action potential amplitude; SNCV- sensory nerve conduction velocity.

F minimum latency of left median nerve was significantly prolonged in pregnant women (Table 2) and sensory onset latency of left ulnar nerve was also prolonged significantly in non-pregnant women (Table 4), however we think both of these are chance findings and may not be replicated in future research.

DISCUSSION

Present study was conducted to determine effects of pregnancy on median and ulnar nerve conduction. We found no statistically significant difference between motor and sensory conduction of above said nerves in pregnant and nonpregnant women. However we could find statistically significant difference in F-min latency of left median nerve and sensory latency of left ulnar nerve, as an isolated finding. We consider this as a chance occurance, and we doubt the occurance of similar findings in future such studies.

Datta S et al and Padua L et al hypothesized in their research that pregnancy causes fluid retention due to raised levels of progesterone which induces mechanical compression of median nerve.[1,7] It also causes alterations in excitability of nerve and muscle membranes, through diminished depolarisation.[1] It might be due to redistribution of fluids, hormonal changes, tenosynovitis and vulnerability of the peripheral nerves.[4] Thus following the same hypothesis many researchers have found increased sensory/motor latencies and decreased amplitudes and slowed conduction velocities, particularly in cases of CTS associated with pregnancy.[4,5,8]

Baumann F et al quoted significant prolongation of all median sensory parameters like latency, amplitude and conduction velocity recorded from ring finger in pregnant women compared to controls. They also performed palm to wrist median sensory conduction which also showed significant prolongation. This study was also performed in asymptomatic pregnant women to find subclinical incidence of CTS.[4]

In present research, we could not get any such findings at our set up. We could find only one study where asymptomatic pregnant women were recruited for neurophysiological studies. All the published papers focus only on the symptomatic or diagnosed cases of CTS. This may be the reason that all previous researches have concluded that pregnancy decreases nerve conduction, while we did not get any such finding in asymptomatic pregnant women. However with this research we could generate normative data of Median and Ulnar neurophysiology during pregnancy.

CONCLUSION

All motor and sensory parameters of bilateral median and ulnar nerves were normal as compared to non-pregnant controls.

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