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A COMPARATIVE STUDY OF CAROTID ARTERIAL INTIMA-MEDIA THICKNESS IN PRE-ECLAMPSIA AND NORMOTENSIVE PREGNANT WOMEN IN DEPARTMENT OF OBSTETRICS & GYNAECOLOGY, SMS MEDICAL COLLEGE, JAIPUR

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Abstract

Background: Pre-eclampsia, a condition specific to pregnancy, is a leading cause of maternal and perinatal mortality and morbidity. It has been shown in non-pregnant patients that hypertension increases the tensile stress applied on the carotid artery; in essential hypertension this leads to increased carotid arterial intima–media thickness (IMT) and stiffness.

Methods: It was a hospital based comparative observational study conducted at department of Obstetrics and Gynecology, SMS Medical College and attached hospitals, Jaipur. The study included two groups consisting of 30 women in each group. The study group was consist of 30 women with singleton pregnancy with gestational period of ≥20 weeks with preeclampsia. 30 normotensive women with singleton pregnancy with gestational period of ≥20 weeks was the controls.

Results: Mean IMT in study group was higher as compared to control group and the difference was statistically significant (0.45 ± 0.09 mm v/s 0.35 ± 0.09 mm). Carotid artery internal diameter was higher in study group as compared to control group (7.36 ± 0.61 mm v/s 6.73 ± 0.72 mm). The difference was statistically significant.

Conclusion: Intima media thickness measurements in women with pre-eclampsia could offer an opportunity to identify a high-risk group of women who might benefit from early screening and preventive measure. These measures would include life style modification such as improving diet and physical activity and increase surveillance of blood pressure, blood glucose and serum lipid, thereby reducing their cardio-vascular related morbidity and mortality in later life.

Keywords: Intima media thickness, pre-eclampsia, blood pressure.

Introduction

Preeclampsia is a complex, multi-system, hypertensive disorder pregnancy traditionally defined as new-onset hypertension (systolic blood pressure ≥140 mm Hg and/or diastolic blood pressure ≥90 mm Hg) with proteinuria (≥300 mg/24 hours) after 20 weeks of gestation. Preeclampsia affects 2–7% of all pregnancies and not only increases the risk for both maternal and fetal morbidity and mortality, but also represents a risk factor for future hypertension, ischemic heart disease, stroke, and premature cardiovascular death in women.[3] Factors contributing to the increased risk reflect a constellation of cardiometabolic parameters that may exist prior to pregnancy or occur during the pregnancy and persist thereafter,[3] subsequently leading to asymptomatic atherosclerosis first, and clinical cardiovascular disease (CVD) events years to decades later.[1] Atherosclerosis and PE share common risk factors such as hypertension, obesity, insulin resistance, diabetes mellitus, metabolic syndrome and general inflammation. PE is independent risk factor regarding subsequent CAD. MBS and endothelial dysfunction seem to be key factors in the pathogenesis of PE and atherosclerosis.

The Common Carotid artery is a large elastic artery which provides the main blood supply to the head and neck. Its wall is composed of three layers: the intima, the media, and the adventitia, from inside to out. The intima is composed of endothelium and a thin layer of underlying fibro-collagenous tissue. The carotid artery lends itself to study by high-resolution ultrasound devices because it is superficial in location, is relatively stationary, and runs parallel to the surface of the neck, at least to the level of the carotid bifurcation. Employing B-mode ultrasound, the combined width of the carotid artery intima and media, can be readily and reproducibly visualized in nearly all subjects. Because the carotid artery is an elastic artery, CIMT in healthy young subjects consists almost entirely of media. The normal carotid arterial wall appears unaffected

by age or gender until approximately 18 years of age; thereafter there is diffuse progressive intimal thickening.[2]

Measurement of carotid intima-media thickness (CIMT) with B-mode ultrasound is a non-invasive, sensitive and reproducible technique for identifying and quantifying subclinical vascular disease and for evaluating CVD risk in pre-eclamptic women.

Material and Methods

Study Type: A hospital based comparative observational study.

Study Design: Cross-sectional study.

Place of Study: Department of Obstetrics and Gynecology, SMS Medical College and attached hospitals, Jaipur.

Study Period: June 2018 to August 2019

Sample Size: Sample size calculated as 80% study power and alpha error of 0.05 assuming standard deviation of 95 (micrometer) of intima media thickness in preeclampsia women as per result of reference study.

For minimum detectable mean difference of 0.75 (micrometer) in carotid intima media thickness, 26 patient's in each group were required as sample size which was increased and rounded off to 30 patient's in each group as final sample size for present study.

Study Group

The study included two groups consisting of 30 women in each group:-

Group-A: 30 women with singleton pregnancy with gestational period of ≥20 weeks with preeclampsia.

Group-B: 30 normotensive women with singleton pregnancy with gestational period of ≥20 weeks

Inclusion Criteria

- Singleton pregnancy
- Women with more than ≥20 weeks gestation with preeclampsia and normotensive pregnant women.

Exclusion Criteria

- Chronic hypertension
- Congenital cardiac diseases
- Chronic renal disease
- Diagnosed patient of diabetes mellitus type 1, type 2
- Rheumatoid Arthritis
- Obesity

Methodology

- After applying inclusion and exclusion criteria informed and written consent was taken and women willing to participate in this study were recruited from routine antenatal clinic.
- Approval from Institutional Research, Review Board and Ethical Committee was taken.
- Detail history, examination and routine antenatal investigations were done.
- Height and weight were measured and body mass index (BMI) was calculated.
- Maternal echocardiography was performed by cardiologist in real time using a 2-6 MHz linear curved-array transducer to measure cardiac output.
- Carotid arterial intima media thickness and internal diameter measurement was performed in a longitudinal section, strictly perpendicular to the ultrasound beam, with both arterial walls clearly visualised. A B-mode image was acquired along a section of right common carotid artery at least 1.5 cm in length, and the carotid artery intima media thickness and internal diameter was measured.
- Results were noted and compared.

Statistical Analysis

Quantitative data was described as mean and standard deviation. Qualitative data described as proportion. Appropriate statistical test was used to find out statically significant--value, < 0.05 was taken as significant.

RESULTS

Table 1: Demographic and hemodynamic data in 30 pre-eclamptic and 30 normotensive pregnant women

Group	Cases	Controls	P-value
Mean Age (in yrs)	26.87 ± 4.80	24.5 ± 4.4	0.051
Mean Weight (in kg)	77.27 ± 10.07	68.86 ± 7.75	0.006
Mean BMI (in kg/m^2)	22.76 ± 3.87	22.20 ± 2.76	0.516
Mean Gestational Age (in wks) at IMT study	35.2 ± 3.24	35.10 ± 3.13	0.612
Brachial pressure (mmHg)			
Systolic	150 ± 14	117 ± 10	<0.0001
Diastolic	102 ± 9	76 ± 9	<0.0001
Mean	118 ± 9	90 ± 8	<0.0001
TPR (dyne/s/cm^5)	1395 ± 110.45	1279 ± 125.19	0.04
Priteinuria (+~++/+++)	15/13/2	1/0/0	0.01

Although the p-value was not significant but there was a difference in mean age, BMI between the two groups. Mean age in pre-eclampsia group was 26.87 ± 4.80 yrs and control group was 24.4 ± 4.4 yrs indicating the prevalence

of pre-eclamptics in higher age group population. The study group also showed a higher mean BMI as compared to control group (22.76 ± 3.87 kg/m^2 v/s 22.20 ± 2.76 kg/m^2).

In our study mean gestational age of cases was 35.2 ± 3.24 wks and in control was 35.10 ± 3.13 wks. Both the groups were comparable with regards to gestational age at IMT study.

The table shows the distribution of study group according to urine protein by dipstick. In study group, 15 (50.00%) patients had urine protein +1 and 13 (43.30%) patients had urine protein +2.

In control group, maximum 29 (96.67%) patients had no proteinuria and 1 (3.30%) patients had urine protein +1. The difference in two groups was statistically significant. Mean TVR in pre-eclamptic had 1345 ± 110.45 and in control group was 1279.87 ± 125.14 (p = 0.04). The difference in two groups was statistically significant.

Table 2: Distribution of Subjects According to Carotid Artery Intima Media Thickness (CIMT)

CIMT (in mm)	Cases		Controls	
	No.	%	No.	%
0.2 - 0.3	2	6.67	15	50.00
0.31 - 0.4	9	30.00	8	26.67
0.41 - 0.5	13	43.33	5	16.66
0.51 - 0.6	4	13.33	2	6.67
0.61 - 0.7	2	6.67	0	0.00
Total	**30**	**100.00**	**30**	**100.00**

p = 0.03

The distribution of patients according to carotic artery intima media thickness (CIMT). In study group, majority of patients 13 (43.33%) had CIMT between 0.41-0.50 mm, 9 (30.00%) patients had IMT between 0.31-0.40 mm and only 2 (6.67%) patients had CIMT between <0.2-0.3 mm.

In control group, majority 15 (50.00%) patients had CIMT between 0.2-0.3 mm. 8 (26.67%) patients had CIMT between 0.31-0.40 mm, 5 (16.66%) patients had CIMT between 0.41-0.50 mm and 2 (6.67%) patients had CIMT between 0.51-0.60 mm.

2 (6.67%) patients in study group had CIMT between 0.6-0.7 mm whereas none in the control group had CIMT in this high range.

Table 3: Distribution of Subjects According to Carotid Artery Internal Diameter

Carotid Artery Internal Diameter (in mm)	Cases		Controls	
	No.	%	No.	%
≤7	7	23.33	18	60.00
7.1 - 8	20	66.67	12	40.00
8.1 - 9	3	10.00	0	0.00
Total	**30**	**100.00**	**30**	**100.00**

p = 0.004

The distribution of cases according to carotid artery internal diameter (ID). In study group majority i.e. 23 (76.67%) patients had ID >7 mm, only 7 (23.33%) patients had ID ≤7 mm.

In control group maximum i.e. 18 (60.00%) of patients had ID ≤7 mm. 12 (40.00%) patients had ID between 7.1-8 mm and none had ID more than 8 mm whereas 10% of patients in study group had ID between 8-9 mm.

DISCUSSION

In this study, using ultrasound QIMT and internal diameter, we assessed elastic arterial remodeling in women with pre-eclampsia. We found that, in these women, carotid arterial IMT and internal diameter were significantly increased and closely correlated with arterial blood pressure. Our findings suggest that, in addition to the vasoconstriction of smaller peripheral arteries, abnormal arterial remodeling and mechanics occur in large, elastic arteries in pre-eclampsia.

Measurement of carotid arterial IMT in a clinical setting can identify individuals with advanced subclinical atherosclerosis and can quantify its severity non-invasively. Our findings correlated with work of Memari B et al (2018)[3] who conducted a study to determine the association of pre-eclampsia with bilateral intima media thickness. IMT is a strong predictor of future vascular events. Our present study showd that carotid arterial IMT was significantly increased in women with pre-eclampsia even after adjusting for the carotid arterial internal diameter, raising the possibility that subclinical atherosclerosis might have occurred in these women. Though acute changes in IMT in response to acute blood pressure and vascular tone modifications have been observed in healthy subjects, it has been shown that such alterations in pre-eclampsia could linger beyond parturition and even leave a persistent defect in the systemic and pulmonary circulation of the offspring.

Although the p-value was not significant but there was a difference in mean age between the two groups. Mean age in pre-eclampsia group was 26.87 ± 4.80 yrs and control group was 24.4 ± 4.4 yrs indicating the prevalence of pre-eclamptics in higher age group population. Results were comparable to study done by Memari B et al (2018)[3]. The mean age in study group was 32.86 ± 4.95 yrs v/s 30.00 ± 5.92 yrs in control group.

Although the p-value was not significant in the two groups, the study group showed a higher mean BMI as compared to control group (22.76 ± 3.87 kg/m^2 v/s 22.20 ± 2.76 kg/m^2). Buddeberg BS et al (2018)[4] studied maternal cardiac function in 30 pre-eclamptics and 40 normotensive women and found a significant difference in BMI. The

mean BMI in pre-eclampsia group was 30.99 kg/m^2 v/s 23.70 kg/m^2 in control group.

Mean CO was higher in study group as compared to control group and the difference was statistically significant. Our results were similar to Buddeberg BS et al (2018)[4] who studied the cardiac maladaptation in term pregnancies with pre-eclampsia. 30 pre-eclampsia and 11 healthy pregnant women underwent Doppler echocardiography. Cardiac output was found to be higher in pre-eclampsia group as compared to the controls (5041 $\pm$ 1419 ml/min v/s 4896 $\pm$ 849 ml/min).

Mean TVR in study group was found to be higher as compared to control group and difference was statistically significant. Similar results were obtained by Buddeberg BS et al (2018)[4] who studied biventricular cardiac changes in term pregnancies with pre-eclampsia and normotensive pregnant women by echocardiography and found mean TVR to be higher in pre-eclamptic group (1896 $\pm$ 566 dyne/sec/cm^{-5} v/s 1489 $\pm$ 849 dyne/sec/cm^{-5}).

Mean CIMT in study group was found to be higher as compared to the controls and difference was statistically significant. Similar results were obtained by Yuan LJ et al (2013)[5] who evaluated the carotid artery intima-media thickness (CIMT) and mechanical properties in 22 women with preeclampsia and 28 normotensive pregnant women by radiofrequency ultrasound technique. They also found CIMT to be higher in pre-eclampsia group (459 $\pm$ 95 μm v/s 351 $\pm$ 85 μm).

Conclusion

IMT of common carotid artery in pregnancy women with pre-eclampsia was to be found significantly higher when compared with healthy pregnant women, and pre-eclampsia was directly independently link of IMT of common carotid artery. Carotid artery IMT can lead to increase in atherosclerosis, risk of cardiovascular disease and cerebrovascular event. It measure women with pre-eclampsia could offer an opportunity to identify a high risk group of women who might benefit from early screening and preventive measure. These measures would include life style modification such as improving diet and physical activity and increase surveillance of blood pressure, blood glucose and serum lipid, thereby reducing their cardio-vascular related morbidity and mortality in later life.

References

1. Farhat MY, Lavigne MC, Ramwell PW. The vascular protective effects of estrogen. FASEB J. 1996; 10 : 615-624.
2. Karas RH, Patterson BL, Mendelsohn ME. Human vascular smooth muscle cells contain functioal estrogen receptor. Circulation. 1994; 89 : 1943-1950.
3. Memari B, Moghiseh N, Mohammadian F, Ghajarzadeh M, Ghoreishian H. Association of Pre-Eclampsia with Carotid Artery Intima Media Thickness and Non-Alcoholic Fatty Liver Disease. J Clin Med. 2018 Sep 12; 7(9). pii: E275. doi: 10.3390/jcm7090275
4. Buddeberg BS, Sharma R, O'Driscoll JM, Agten AK, Khalil A, Thilaganathan B. Cardiac maladaptation in term pregnancies with preeclampsia. Pregnancy hypertension. 2018; 13 : 198-203.
5. Yuan LJ, Xue D, Duan YY, Cao TS, Yang HG, Zhou N. Carotid arterial intima–media thickness and arterial stiffness in pre-eclampsia: analysis with a radiofrequency ultrasound technique. Ultrasound Obstet Gynecol. 2013 Dec; 42(6): 644-52.