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Original Research Article

Impaired flow mediated dilatation – a marker of endothelial dysfunction in preeclampsia

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Abstract: The main aim was to assess endothelial function using flow mediated dilation women with pre-eclampsia. The method was analytical type observational study which included 25 normal and 25 preeclamptic women. Endothelial function was measured by brachial artery flow-mediated dilatation. In results the Mean FMD of women in PE group was 6.14±2.90% whereas mean FMD of control group was 7.70±1.81%, P- value 0.027. In conclusion the endothelial function is impaired in women with preeclampsia.
Keywords: preeclampsia, endothelial dysfunction, impaired flow mediated dilatation

INTRODUCTION

Preeclampsia is defined as new onset hypertension and proteinuria in second half of pregnancy [1]. It affects 3-5% pregnancies [2, 3]. In preeclampsia, there is excess production of sFLt1 (soluble forms tyrosine kinase 1) and sEng (soluble endoglin) which are antiangiogenic and inhibit VEGF and TGF-β1 signaling in vasculature. In 1989, Roberts and Taylor [4, 5]. Hypothesized that preeclampsia results from release of circulating factors by placenta. Several evidences support this. Vessels isolated from PE women demonstrate impaired endothelium dependent dilatation but not endothelium independent dilatation [6,7].

Clinical measurement of endothelial function is difficult owing to its heterogeneous function. Many studies have focused on assessing vaso-reactivity by NO-mediated endothelial response to agents like acetylcholine or shear stress. These were invasive as were done on coronary arteries.

Flow mediated dilatation of brachial artery for assessment of endothelial function is noninvasive, practical and enables serial evaluation. FMD of brachial artery uses ultrasound imaging to measure baseline brachial artery diameter. It also measures increase in diameter in response to shear stress induced by inflation and deflation using sphygmomanometer.

FMD of brachial artery can be used for endothelial assessment of patients with cardiovascular risks. Similar endothelial assessment is relevant for women with preeclampsia.

METHODS

This was a hospital based analytical type observational study conducted in Department of Obstetrics and Gynaecology, Zenana Hospital, SMS Medical College, Jaipur from March 2014 to December 2015. Twenty five pregnant women with preeclampsia and twenty five normotensive pregnant women attending the OPD were enrolled in the study after obtaining an informed consent. Patients with history of Heart disease, Medical diseases like Diabetes mellitus, chronic hypertension or Known cardiovascular disease were excluded from the study. Detailed history was taken. Blood pressure was taken, urine albumin measured. Routine investigations like blood grouping and typing, complete blood count, random blood sugar, urine complete microscopy were done. Endothelial function was measured by brachial artery flow-mediated dilation. The right brachial artery was longitudinally scanned in the two-dimensional mode. A pneumatic blood pressure cuff around the upper arm was inflated to 200 mmHg for five minutes, inducing increased flow upon release.

The images were stored as cine loops of five heartbeats at the beginning on the R-wave of the ECG – at baseline, and 0.5, 1, 1.5, 2, 3, 4, and 5 minutes after cuff release. Three measurements of the diameter were obtained along the vessel, and the average of these three measurements was calculated. The average value was used in further analysis. Brachial artery images were stored digitally and analyzed offline using I Lab Phillips IE 33 Holland.

Flow mediated dilatation was calculated as: -
FMD% = (D2 - D1) / D1 x 100%
D2 - Post occlusion diameter
D1 - Basal diameter

RESULTS

Both the groups were similar in terms of age, gestational age, and socioeconomic status. The PE group showed a higher mean BMI as compared to the control group (22.52 ± 1.58 kg/m^2 v/s 21.96 ± 2.11 kg/m^2). Mean FMD of women with preeclampsia was significantly lower than that of normotensive group (6.14±2.90% v/s 7.70±1.81%, P value 0.027). 8(32%) women with preeclampsia had impaired flow mediated dilatation (FMD< 5%) during pregnancy.

Table 1: Distribution of Cases According to Flow Mediated Dilatation (FMD)

Flow Mediated Dilatation (in %)	PE Group		Control Group		P-value
	No.	%	No.	%	
<3	6	24.00	0	0.00	χ^2 = 10.059 d.f. = 4 P = 0.039
3 – 5	2	8.00	0	0.00	
5 – 7	8	32.00	9	36.00	
7 – 9	6	24.00	10	40	
>9	3	12.00	6	24.00	
Total	**25**	**100.00**	**25**	**100.00**	

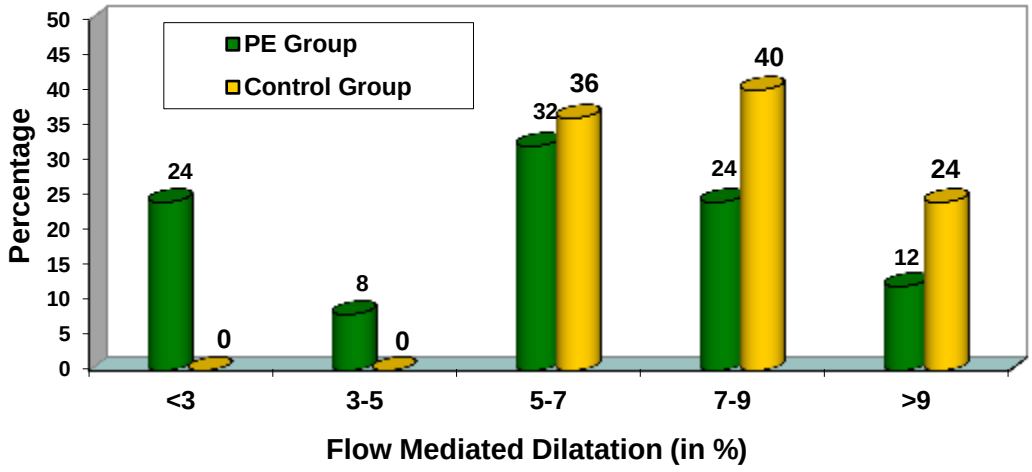

Fig 1: Distribution of Cases According to Flow Mediated Dilatation (FMD) {Antepartum}

DISCUSSION

It is known that endothelial dysfunction is involved in pathogenesis of preeclampsia. Occurrence of endothelial dysfunction in early in pregnancy can be used as predictor of PE, before the onset of disease. Also many studies have shown that degree of endothelial dysfunction correlates with morbidities associated with PE.

FMD is simple, practical, noninvasive method for assessment of endothelial function with potential for serial evaluation in pregnant women.

FMD of brachial artery when used early in pregnancy can be used to predict preeclampsia. When applied in known case of preeclampsia, can be used to assess degree of endothelial injury and hence predict complication. Endothelial assessment in postpartum period will help to screen residual endothelial dysfunction and predict higher cardiovascular risk later in life.

Our study shows that endothelial function measured by flow mediated dilatation is significantly reduced in women with preeclampsia. Similarly, T MORI 2010 [8] found that flow-mediated vasodilation

was significantly decreased in preeclamptic women compared with controls (10.6+/-6.4 vs. 3.8+/-2.0%, P<0.001). Brandão AH 2014 [9] found statistically significant difference ($p < 0.001$) in the comparison of the median FMD values between the patients who developed either early or late PE and normotensive group (4.00 ± 6.00 and 3.00 ± 3.00, and9.00 ± 5.00 respectively).

CONCLUSION

Vascular function is impaired in women with PE. FMD of brachial artery is a promising tool for clinical application in assessment of endothelial function.

Thus, FMD can be used as predictor, prognostic marker of preeclampsia. It can also screening tool for identifying women at risk for cardiovascular disease later in life.

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