



# Maternal Central Blood Pressure is Associated with Middle Cerebral Artery Dopplers



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## Background

- Cardiovascular adaptations to pregnancy involve mechanisms that increase cardiac output, decrease total vascular resistance, and decrease systolic (sBP) and diastolic blood pressure (dBP).
- Central blood pressure (cBP) can be measured non-invasively using the Uscom BP+, a previously validated supra-systolic oscillometric cBP monitoring device which performs a central and peripheral pulse waveform analysis to quantify cBP and augmentation index, a measure of arterial resistance.
- In non-gravids, cBP (versus peripheral BP) has been shown to more accurately reflect organ perfusion pressure and better predict vascular changes and end organ damage.
- cBP in relation to the feto-placental unit is largely unknown.

## Objective

- Our objective was to create maternal cardiac profiles of women throughout pregnancy using non-invasive measurements of cBP to document changes in maternal hemodynamics during pregnancy and determine the correlative effects on the fetal circulation.

## Study Design

- This was a prospective cohort study of all pregnancies followed in a single perinatal referral center from January-April 2018.
- All pregnant women were eligible for the study.
- Antenatal data including ultrasounds were chart abstracted and combined with study parameters using the Uscom BP+ device.
- Kruskal-Wallis rank sum test was used to compare medians by trimester.
- Spearman rank correlations were used to evaluate the relationships between cBP and peripheral BP, gestational age (GA), estimated fetal weight (EFW), and the pulsatility indices (PI) of both the umbilical artery (UA) and middle cerebral artery (MCA).

## Results

- 282 patients were recruited, resulting in 299 total visits during the study time period.
- 275 patients met inclusion criteria.
- Cardiovascular information derived from the Uscom BP+ was categorized by patient and ultrasound-determined gestational age at visit:

	1st Trimester n=123	2nd Trimester n=121	3rd Trimester n=31	p <sup>a</sup>
Age	32.0 [29.0, 36.0]	34.0 [30.0, 36.0]	34.0 [30.5, 37.5]	0.3585
Gestational Age	12.7 [12.4, 13.1]	19.6 [18.7, 20.7]	32.9 [32.1, 33.7]	<0.0001
Peripheral Systolic BP	109.0 [101.0, 121.0]	107.0 [101.0, 116.0]	116.0 [106.5, 122.0]	0.0103
Peripheral Diastolic BP	64.0 [60.0, 71.5]	63.0 [61.0, 68.0]	68.0 [63.0, 77.5]	0.0103
Central Systolic BP	101.0 [94.0, 111.5]	97.0 [92.0, 107.0]	107.0 [95.0, 111.5]	0.0293
Central Diastolic BP	66.0 [62.0, 73.0]	64.0 [62.0, 70.0]	71.0 [65.0, 79.5]	0.0113
Pulse Rate	80.0 [73.0, 88.0]	80.0 [75.0, 92.0]	91.0 [84.0, 97.5]	0.0001
Mean Arterial Pressure	80.0 [75.0, 89.0]	77.0 [75.0, 85.0]	85.0 [76.0, 90.0]	0.0229
Central Mean Arterial Pressure	83.0 [79.0, 95.0]	81.0 [78.0, 88.0]	89.0 [80.0, 96.0]	0.0231
Augmentation Index	55.0 [43.0, 67.5]	48.0 [37.0, 61.0]	43.0 [31.0, 57.0]	0.0107

a. Kruskal-Wallis rank sum test

- Both central sBP and dBP were correlated to peripheral sBP and dBP at all three timesters ( $p < 0.01$ ).
- Neither central sBP nor central dBP was correlated to gestational age ( $p = 0.36$  and  $p = 0.41$ , respectively).

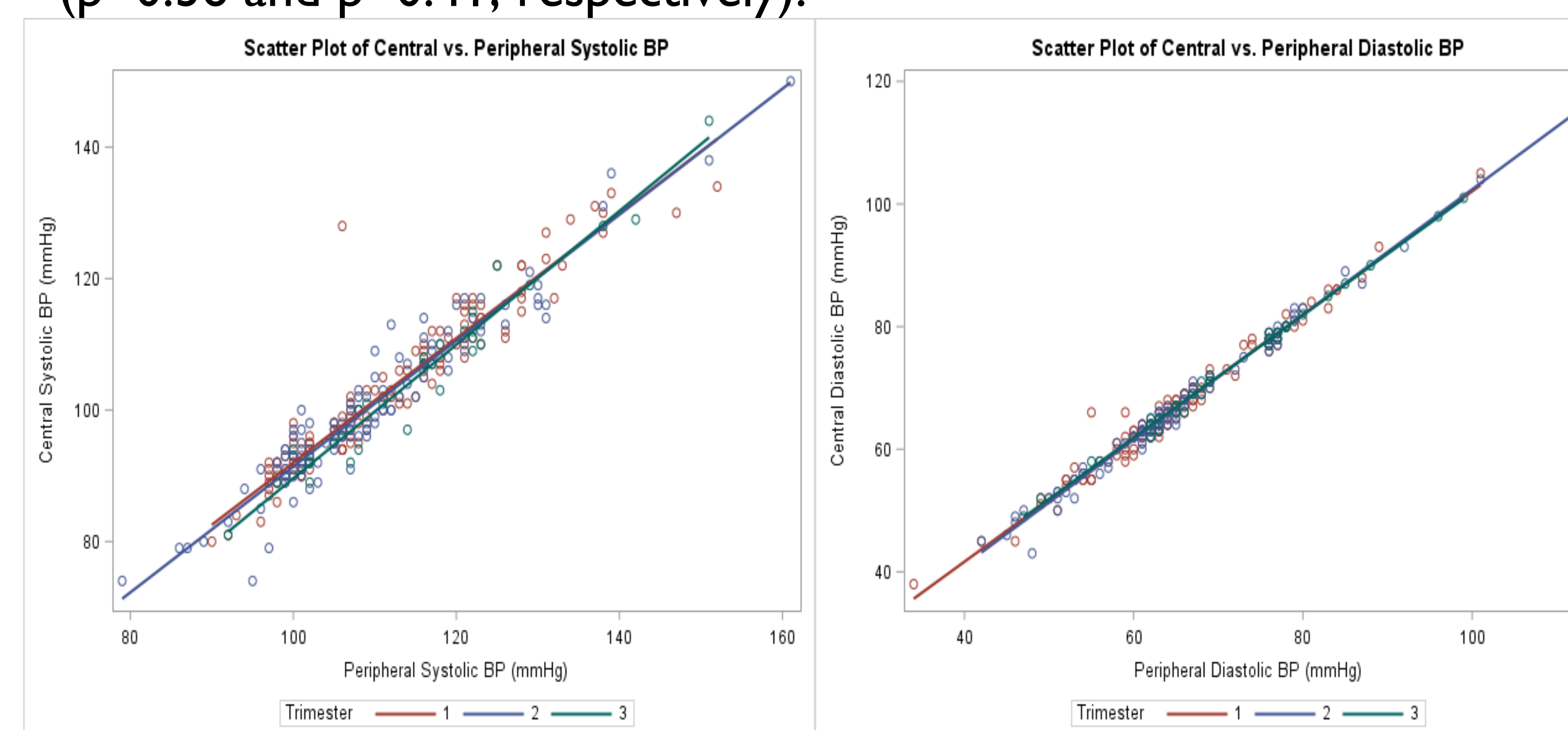


Figure 1. Central versus Peripheral Blood Pressure by Trimester

## Results continued

- EFW ( $n = 143$ ) was positively correlated to central sBP ( $p = 0.03$ ).
- EFW was not correlated to central dBP ( $p = 0.15$ ).

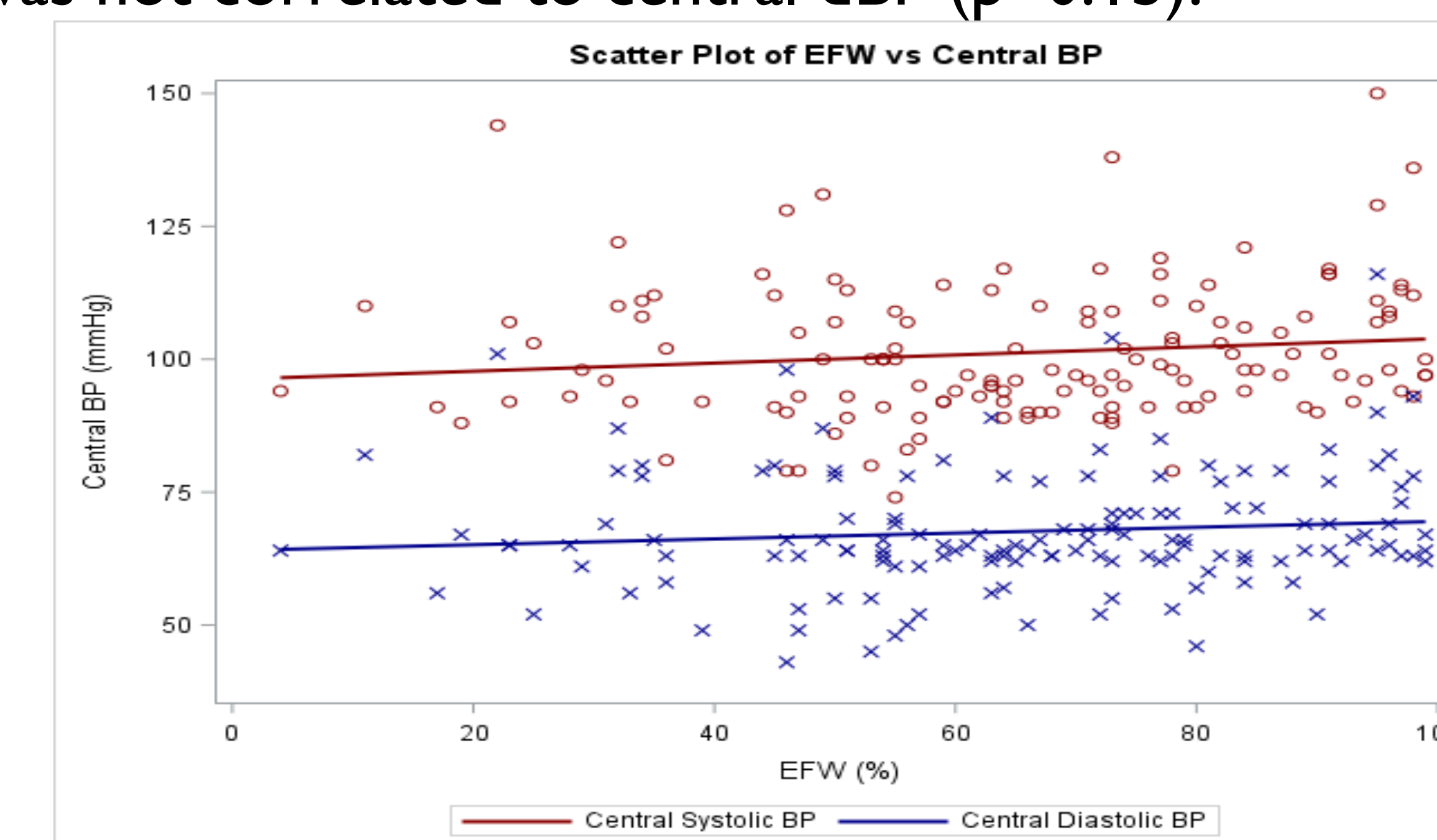


Figure 2. Estimated Fetal Weight versus Central Blood Pressure

- MCA PI ( $n = 20$ ) was correlated to both central sBP and dBP ( $p < 0.05$ ).

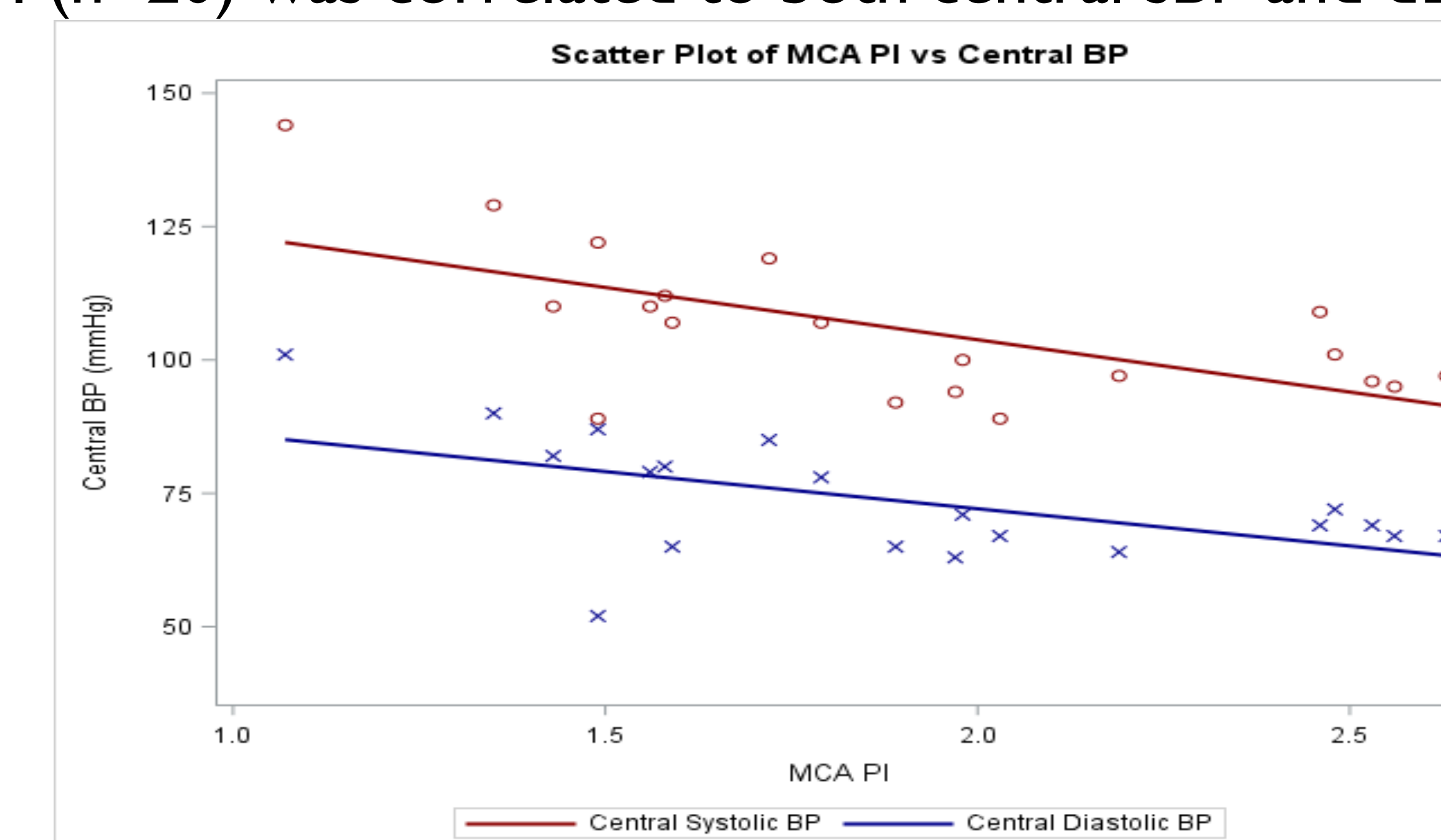


Figure 3. Pulsatility Index of the Middle Cerebral Artery versus Central Blood Pressure

- UA PI ( $n = 30$ ) was not correlated to either central sBP or dBP ( $p > 0.12$ ).
- EFW was positively correlated to MCA PI ( $p = 0.03$ ) but not UA PI ( $p = 0.98$ ).

## Conclusions

- The maternal central BP was correlated to the fetal MCA PI and the estimated fetal weight, suggesting an influence of cBP on fetal growth.
- Non-invasive maternal hemodynamic measurements can possibly be surrogates of the fetal-placental unit and potentially assist in identifying risk factors for poor fetal outcomes in pregnancy.

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