

# Hypertensive Disorders in Pregnancy

Hypertension is the most commonly occurring medical complication in pregnancy. Anywhere from 2-8% of pregnancies are characterised by pre-eclampsia or some other hypertensive-related disorder which, collectively, account for 16% of maternal deaths. And although mortality is the worst possible consequence, it is not the only risk from a pre-eclamptic pregnancy. Other possible outcomes include, but are not limited to, pulmonary edema, renal failure, placental abruption, and fetal growth restriction. Several tests that aim to improve the prediction of pre-eclampsia have been suggested; however, the heterogeneous nature of the disorder suggests a multi-test approach may be most efficacious<sup>1,2</sup>.

The analysis and interpretation of the central blood pressure waveform has been shown to provide patient-specific information about arterial stiffness and ventricular-vascular coupling. One index that quantifies this information is the augmentation index – a parameter that quantifies the amount of pulse pressure due to pressure wave reflection and arterial stiffness. Several studies have identified the augmentation index as an indicator of future cardiovascular complications<sup>3,4</sup>, and it has also been shown to be useful in assessing the hemodynamics of pregnancy<sup>5</sup>.

It is well-known that there is a significant change in brachial blood pressure over the course of pregnancy. In normal pregnancy this is characterised by a drop beginning in early pregnancy, with a return towards baseline values postpartum. Only recently, however, have the changes in central hemodynamics been clearly elucidated<sup>6</sup>. The pattern of central systolic blood pressure closely follows that of brachial blood pressure. The augmentation index follows a different pattern, reaching a nadir in the second trimester, then reversing course and increasing. Unlike blood pressure, which tends to remain below preconception levels, the augmentation index overshoots its pre-pregnancy values and is significantly higher 3-4 months from the date of delivery compared to baseline (Fig. 1)<sup>6</sup>.

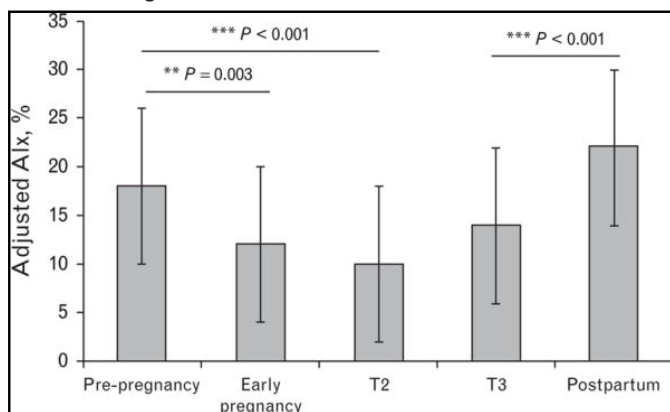


Figure 1. Changes in the AIx adjusted by heart rate from pre-pregnancy to postpartum period. (T2 = second trimester and T3 = third trimester). AIx, augmentation index.

When compared to normal pregnancies, it has been found that women who develop gestational hypertension or pre-eclampsia demonstrate significantly higher augmentation indexes in the third trimester. In fact, the more serious the condition, the higher the augmentation index. In other words, women who develop severe pre-eclampsia have higher values of augmentation index in the third trimester than those who develop mild pre-eclampsia, and they have higher values than those who develop gestational hypertension<sup>7</sup>. When measured in the first trimester, the augmentation index demonstrated a 79% detection rate for the development of pre-eclampsia with only an 11% false positive rate (Fig. 2)<sup>8</sup>.

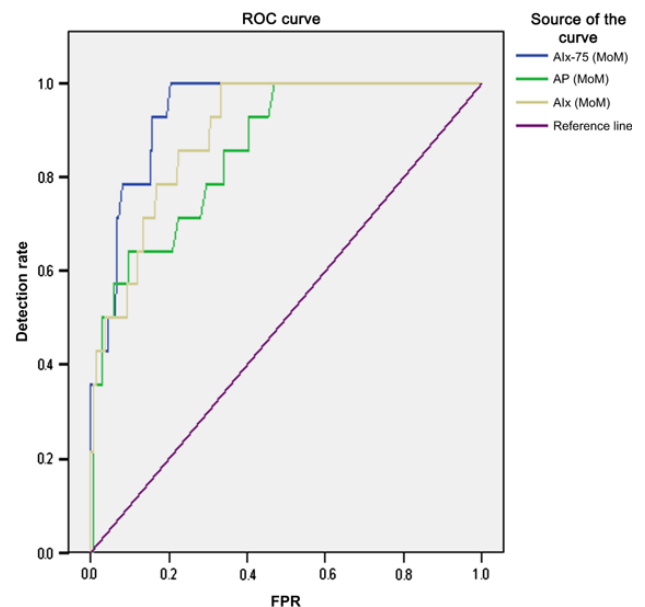


Figure 2: Prediction of pre-eclampsia. ROC curves for Augmentation Pressure MoM, AIx MoM and AIx-75 MoM in the prediction of pre-eclampsia. For an 11% FPR, the DR of pre-eclampsia was 79% by AIx-75. MoM – multiples of the gestation-specific medians; AIx – augmentation index; AIx-75 – AIx adjusted to a heart rate of 75 bpm

Although the only real cure for pre-eclampsia is delivery, the ability to predict the future development of this complication would facilitate targeted surveillance and intervention. Close monitoring and aggressive management of severe blood pressure prevention could help mitigate risk. Additionally, through standard assessment of vulnerable organ systems, it may be possible to reduce adverse maternal outcomes<sup>1</sup>. Although there is no universally accepted standard of care, the continued efforts to develop a test for the prediction of pre-eclampsia highlight the fact that early detection is desirable.

It's important to note that in addition to the significant risks to the mother and child during pregnancy, a woman who has previously had pre-



eclampsia is also at an increased risk for future cardiovascular complications. Generally these women are twice as likely to experience a cardiovascular event and may be more than six times as likely to develop hypertension later in life<sup>2</sup>. Recently Ehrental *et al.* found that women who suffered from a hypertensive disorder during pregnancy had a significantly higher augmentation index compared to those who did not one year postpartum<sup>8</sup>. Given the known associations between augmentation index and future cardiovascular risk, their results suggest that increased arterial stiffness may play a causal factor in the increased future cardiovascular disease risk. And as noted in an earlier column in this series, information obtained through pulse wave analysis can aid in more efficient blood pressure management<sup>9</sup>.

In summary, assessment of the central pressure waveform can be valuable in the prediction of pre-eclampsia and other hypertensive disorders of pregnancy, allowing for earlier detection of potential future complications. This, in turn, may assist in decreasing maternal and fetal risk. Furthermore, the incorporation of pulse wave analysis into patient care following a pregnancy with a hypertensive disorder can provide important information to assist in blood pressure management, thus reducing future cardiovascular risk.

#### References

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