ABSTRACT

OBJECTIVE: To evaluate whether Doppler ultrasonography (US) velocimetry in renal interlobar arteries is altered in women with pregnancy-induced hypertension (PIH) compared with that in healthy pregnant and non pregnant women.

MATERIALS AND METHODS: Flow waveform measurements in renal interlobar arteries were obtained in 30 non pregnant women, 30 healthy pregnant women and 30 women with PIH at 20-40 weeks of gestation by using Color Doppler and Pulsed Doppler ultrasonography.

RESULTS: In the PIH group, the acceleration time values were greatly prolonged compared with those in the other groups. However the values of resistivity index were within normal limits in all 3 groups.

CONCLUSION: Acceleration time is one of the hemodynamic parameters of upstream stenosis in the proximal arteries such as main renal artery which might be implicated in the pathogenesis of PIH

Keywords: Pregnancy-induced hypertension (PIH), Ultrasonography, Pulsed Doppler, Resistivity Index, Acceleration time, Interlobar arteries.

INTRODUCTION:

Hypertension is the most common medical problem encountered during pregnancy, complicating 2-3% of pregnancies.

In normal pregnancy increase in the renal plasma flow and glomerular filtration rate occurs as a result of renal vaso dilatation and an increase in plasma volume occurs with arteriolar vaso dilatation and with late decreases in the arterial blood pressure. These renal and cardiac changes are important for the successful outcome of pregnancy.

Pregnancy induced hypertension (PIH) is associated with increased peripheral vascular resistance in the maternal circulation.

CLASSIFICATION

Hypertensive disorders during pregnancy are classified into 4 categories:
1. Chronic hypertension
2. Pre-eclampsia-Eclampsia
3. Pre-eclampsia superimposed on chronic hypertension
4. Gestational hypertension (transient hypertension of pregnancy in the later half of pregnancy).

MATERIALS & METHODS

Study period: 12 months

Sample size: 90 patients (three groups of 30 each)
Inclusion criteria and the groups:
Non pregnant females coming for regular pelvic/abdomen scan
Healthy Pregnant females > 20 weeks gestation
Pregnant females with diagnosed pregnancy induced hypertension (PIH) from > 20 weeks gestation

Exclusion criteria:
Twin pregnancy
Pregnant females with other co-existing positive past or present medical/surgical history eg. Diabetes, primary hypertension, etc
Pregnant females with PIH on treatment

PIH - Blood pressure elevation higher than 140/90 mm of Hg or an increase in either the systolic (> 30 mm Hg) or the diastolic (> 15mm Hg) values over baseline BP before 20 weeks GA in at least 2 measurements 6 hrs apart
All subjects were examined by Color Doppler Ultrasonography with a 3.5 MHz convex transducer.

RESULTS
There is no substantial difference in the mean age and parity of subjects among the three groups. Systemic arterial pressure values were recorded twice a day with 6 hour interval between measurements.
The Doppler waveform measurements in healthy pregnant women & in women with PIH are compared.
There were significant differences in acceleration time values between the PIH group & the other two groups (P< 0.0000..).In all groups there were no significant differences in resistivity indices of the interlobar arteries.
However there were no significant differences in the other indices such as acceleration time, & resistive index in non-pregnant and normotensive group and pregnant normotensive group of females.

DISCUSSION
The increase in blood volume & cardiac output during pregnancy is accompanied by a decrease in peripheral vascular resistance due to vasodilatation.
In our study there was no correlation between the resistive index of the interlobar arteries & gestational age.
These findings are similar to those obtained by Hata et al( 7)

Many investigators have evaluated the renal circulation by doppler US in healthy pregnant women (7-9)& in women with PIH (10-13 & 23,24).
The diagnostic strategies that were found to be promising in some reports have not been uniformly successful in other cases.
Sohn & fendel (10 ) & Boehut et al (13)claimed that the doppler index of renal arteries in women with PIH are different from those in healthy pregnant women .
This finding is suggestive of increased downstream vascular resistance

In this study, to examine changes in renal vascular by using Doppler US parameters, we measured the flow velocity waveforms of the interobar arteries which run between the pyramids & extend into renal cortex because these vessels are the resistance vessels of renal vasculature (12).
We evaluated the acceleration time which is one of the haemodynamic parameters of substantial upstream stenosis.
Severe stenosis of an artery causes a pressure drop in immediate post stenotic region which results in weakened pulse in the downstream arterial network known as pulsus tardus( slow to increase) & pulsus parvus(17) .
In the post stenotic region there is prolonged acceleration time, diminished acceleration index & loss of normal early systolic compliance, peak reflective wave complex (18).
Handa et al (14) found substantial decrease in the systolic acceleration distal to renal arterial stenosis.
Similar results were reported by Patriquin et al (16) in the study involving 20 children suspected of having renal arterial stenosis.
Kliewer et al (6) concluded that Doppler US based characterization of the tardus-parvus phenomenon in the distal renal artery is not an adequate screening method for the detection of renal arterial stenosis. The results of our study which demonstrated a prolonged acceleration time in the interlobar arteries of women with PIH are in agreement with former observation of renal arterial stenosis in non pregnant women (14-16). In addition, the acceleration index decreases with increasing compliance of post stenotic segment (19). Therefore one might postulate that elevated compliance in the vessels distal to interlobar arteries may occur in women with PIH. The hypertensive disorders that complicate pregnancy are associated with substantial morbidity & mortality. These disorders are second leading cause of maternal mortality(20).

The prenatal mortality rate is increasing also as a consequence of placental insufficiency, preterm delivery & placental separation.

CONCLUSION

Acceleration time is one of the hemodynamic parameters of upstream stenosis in the proximal arteries such as main renal artery which might be implicated in the pathogenesis of PIH.

REFERENCES

2) Doppler ultrasound in obstetric & gynecology; Joshua A.Copel, Katherine L. Reed; Raven press;1995;151
5) Lijun Yuan, Yunyou Duan and Tiesheng Cao ; Hemodynamic changes of renal main arteries pregnancy-induced hypertension ; European journal of Obstetrics & Gynecology and Reproductive biology; volume 131 issue 1, March 2007:36-39


FIGURES AND TABLES

**Figure 1:** Left kidney, RI=0.59, Acceleration time= 114 msec

<table>
<thead>
<tr>
<th>Doppler parameters of interlobar renal artery in PIH patients</th>
<th>Normal</th>
<th>Increased</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration time (msec)</td>
<td>16</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>RI</td>
<td>30</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1:** Renal arterial Doppler parameters of 25 pregnant females with PIH

<table>
<thead>
<tr>
<th>GROUP</th>
<th>CASES WITH ABNORMAL ACCELERATION TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIH patients</td>
<td>16</td>
</tr>
<tr>
<td>Pregnant patients without PIH</td>
<td>0</td>
</tr>
<tr>
<td>Non pregnant normotensive patients</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 2:** Patients with abnormally raised acceleration times