

C Comparison of fetal Doppler indices and growth in pregnancies with anterior or posterior placental position

Comparación de los índices Doppler fetales y el crecimiento en embarazos con posición placentaria anterior o posterior

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Abstract

Background: Ultrasound assessment of fetal wellbeing and growth is widely used in obstetric practice, placental location is extensively investigated by many researchers looking for any correlation with and any impact on certain perinatal outcomes.

Aim: to study the effect of anterior or posterior placental position on fetal biometric and Doppler study of certain fetal vessels, in low risk pregnancies.

Methods: a cross sectional observational study from June–December/2019 involved 86 normal pregnant women their age ranged (14-40) years, and gestational age ranged (30-40) weeks, in cephalic presentation, after obtaining verbal consent to participate in the study.

Demographic data was obtained by a Prepared questionnaire, then ultrasound examination was performed by the same investigator obtaining the fetal gender, placental position, biometric and Doppler indices of Middle cerebral arteries(MCA) and the Umbilical arteries(UA).

Results: of the 86 studied pregnancies, 44(51.16%) were with posterior and 42(48.84%) with anterior placentas, maternal mean age was (26.18 ± 5.91) years, 51(59.3) & 35(40.7) female fetuses, 38(44.2) were preterm & 48(55.8) term fetuses.

Comparing means of different biometric parameters including the estimated fetal weights (EFW) and the Doppler indices of MCA and UA showed non-significant differences between fetuses with anterior or posterior placentas, whether term or preterm groups of fetuses.

Conclusions: placental position whether anterior or posteriorly located showed no effect on biometric parameters of fetal growth, EFW, gender, and Doppler study of certain fetal vessels

Keywords: Placentallocation, pregnancy outcome, neonatal outcome, fetal circulation

Resumen

Antecedentes: la evaluación ecográfica del bienestar y el crecimiento fetal se usa ampliamente en la práctica obstétrica, la ubicación placentaria es ampliamente investigada por muchos investigadores que buscan cualquier correlación y cualquier impacto en ciertos resultados perinatales.

Objetivo: estudiar el efecto de la posición placentaria anterior o posterior en la biometría fetal y el estudio Doppler de ciertos vasos fetales, en embarazos de bajo riesgo.

Métodos: un estudio observacional transversal de junio a diciembre / 2019 involucró a 86 mujeres embarazadas normales de su edad (14-40) años, y la edad gestacional (30-40) semanas, en presentación cefálica, después de obtener el consentimiento verbal para participar en el estudio.

Los datos demográficos se obtuvieron mediante un cuestionario preparado, luego el mismo investigador realizó un examen de ultrasonido obteniendo el género fetal, la posición placentaria, los índices biométricos y Doppler de las arterias cerebrales medias (MCA) y las arterias umbilicales (UA).

Resultados: de los 86 embarazos estudiados, 44 (51.16%) fueron con placentas posteriores y 42 (48.84%) con placentas anteriores, la edad materna promedio fue (26.18±5.91) años, 51 (59.3) y 35 (40.7) fetos femeninos, 38 (44.2) fueron fetos prematuros y 48 (55.8) a término.

La comparación de las medias de diferentes parámetros biométricos, incluidos los pesos fetales estimados (EFW)

y los índices Doppler de MCA y UA mostraron diferencias no significativas entre los fetos con placentas anteriores o posteriores, ya sean grupos de fetos a término o prematuros.

Conclusiones: la posición placentaria, ya sea anterior o posterior, no mostró efecto sobre los parámetros biométricos del crecimiento fetal, EFW, género y estudio Doppler de ciertos vasos fetales.

Palabras clave: ubicación placentaria, resultado del embarazo, resultado neonatal, circulación fetal.

The placenta is a highly specialized organ of pregnancy that supports the normal growth and development of the fetus. It needs to provide its function even during its development and thus all developmental changes need to be in accordance with its function¹.

Accurate antenatal localization of placenta is of great importance for optimal assessment of risk related to its position and thus determine the management plan^{2,3}.

The primary method used for placental localization is ultrasonography that performed trans-abdominally, although it may have false positive findings and to overcome this problem color Doppler sonography had been used to improve the accuracy to the test. Both magnetic resonance imaging (MRI) and traditional sonography have the same accuracy for localization of placenta although MRI more accurate in localizing posteriorly located placenta⁴.

Many studies had been done to assess the relationship between placental position and certain pregnancy outcomes as those done by Warland J et al who investigated whether the placental position had a possible impact on still birth rate or not, they conclude that posterior placenta may be a risk factor for stillbirth⁵.

Level of implantation whether high or low was also assessed and found to have impact on pregnancy complication as found by E F Magann et al who observed that low lying placenta increase the risk of preterm labour while high implantation associated with low Apgar scores⁶.

Some authors encourage early determination of placental position (first trimester) to identify those who have possible late pregnancy risk, as suggested by Chhabra et al whose study found that anteriorly located placenta seems to be safe while fundal one is not⁷.

The opposite to this study was that found by Shumalia who observed that anterior implantation of placenta may predispose to both gestational hypertension and diabetes, abruptio placenta, intrauterine growth restriction and

even death in utero while posterior placenta has a strong link with preterm labour⁸.

Based on the results of these studies and others, we try in our study to assess whether there is an association between placental position and some demographic and perinatal parameters in normal or low risk pregnancies as: Doppler study of fetal circulation (umbilical UA and middle cerebral arteries MCA), fetal gender, weight and presentation, maternal age and parity.

A cross sectional observational study was conducted from June –December/2019 after approval by the ethical and scientific committees / College of medicine/ University of Babylon.

Eighty- six aberrantly (???) healthy pregnant women with singleton cephalic presenting fetuses demographic data was obtained by a Prepared questionnaire, then ultrasound examination was performed by the same investigator obtaining the fetal gender, placental position, biometric and Doppler indices of Middle cerebral arteries(MCA) and the Umbilical arteries(UA). the age range 14-40 years with mean of 26.18 ± 5.91 , their gestational age ranged between 30-40 weeks, divided into two groups according to their placental position, first group had anterior placenta 42(48.84%) and second group had posterior placenta 44(51.16%) as determined by ultrasound.

A trans-abdominal ultrasound with probe of 3-5 MHz (using ultrasound machine -MEDISON – SONOACE X8 visualizing the placental tissue which is usually of discoid, uniform echogenicity located along the back wall of uterus called posterior placenta or front wall of uterus called anterior placenta, both may extend to the lateral walls of uterus.

For both study groups Doppler study of middle cerebral artery (MCA) and umbilical artery UA were assessed using same machine mentioned above. Usually umbilical arterial wave assessed without angling in free part of umbilical cord then spectral analysis recorded after that indices analyzed including resistance index (RI), Systolic /diastolic ratio (S/D).

For MCA transverse section of the fetal head is obtained then color box activated to view the circle of Willis and middle cerebral arteries. The sampling gate is placed in the proximal MCA to obtain the waveform and spectral analysis also recorded including resistance index (RI)

Women with multiple pregnancies and those whose pregnancies were complicated by any maternal or fetal complication were excluded from the study.

Correlation of placental position done with maternal age, parity and fetal (gender, fetal biometric growth parameters, middle cerebral artery and umbilical artery Doppler indices in form of RI- resistance index and S/D Systolic/diastolic ratio).

Statistical analysis

Statistical analysis of the data using SPSS version 24 for Windows (Statistical Package for Social Science; SPSS, Inc., Chicago, IL)

Results were expressed as Mean \pm SD for continuous variables, frequencies and percentages for categorical data.

Independent samples t-test utilized for comparing means of continuous parameters, while categorical variables were tested by Chi square test. P value less than 0.05 considered statistically significant.

Results

Studying pregnant women and fetal characteristics considering the following (maternal age, history of abortion, parity, gender of baby and its gestational age) (table-1) it was found that posterior and anteriorly located placenta groups have no statistical differences regarding all the stated characteristics except for the gestational age of the fetuses where the posterior placenta group have more preterm fetuses while term fetuses are more among the pregnant women group whose placentas were anteriorly situated.

Testing the effect of placental position whether anteriorly or posteriorly located placenta has an impact on fetal growth parameters, it was noticed that there is no significant difference regarding the means of the biparietal diameters, femoral lengths, abdominal circumferences and the estimated weight, at the same time Doppler indices of fetal vessels including (RI of MCA and UA) and SD ratio of UA were compared between posteriorly and anteriorly located placenta groups, showed non-significant differences in both term and preterm fetuses tables (2 and 3)

Table1: The Distribution of pregnant women characteristics according to placental position:

| Demographic data | Posterior placenta 44(51.16%) | | Anterior placenta 42(48.84%) | | Total | P value |
|---------------------------------------|----------------------------------|--------|---------------------------------|--------|------------------|----------|
| | Frequency | % | Frequency | % | | |
| Parity | | | | | | |
| Primi-gravida | 8 | 18.18% | 4 | 9.5% | 12(13.95) | 0.25 * |
| Multi-parous | 36 | 81.82% | 38 | 90.5% | 74(86.05) | |
| Total | 44 | 100.0% | 42 | 100.0% | 86(100) | |
| History of abortion | | | | | | 0.15 * |
| One | 8 | 18.18% | 3 | 7.14% | 11(12.8) | |
| Two | 3 | 6.82% | 1 | 2.38% | 4(4.7) | |
| Three | 0 | 0% | 2 | 4.76% | 2(2.3) | |
| No abortion | 33 | 75% | 36 | 85.71% | 69(80.2) | |
| Total | 44 | 100.0% | 42 | 100.0% | 86(100) | |
| Gender of the baby | | | | | | 0.97 * |
| Male | 26 | 59.1% | 25 | 59.5% | 51(59.3) | |
| Female | 18 | 40.9% | 17 | 40.5% | 35(40.7) | |
| Total | 44 | 100.0% | 42 | 100.0% | 86(100) | |
| Gestational age | | | | | | 0.016 * |
| <37 weeks | 25 | 56.8% | 13 | 30.95% | 38(44.2) | |
| \geq 37 weeks | 19 | 43.2% | 29 | 69.05% | 48(55.8) | |
| Total | 44 | 100.0% | 42 | 100.0% | 86(100) | |
| Maternal mean age \pm SD (years) | (27.05 \pm 5.811) | | (25.81 \pm 5.915) | | 26.18 \pm 5.91 | 0.331 ** |

*chi square test. **t-test

Table 2 fetal biometric variables and Doppler study among (48) term fetuses (37-40) weeks in posterior and anterior placental groups

| Fetal biometry | Posterior placenta N (19) | | Anterior placenta N (29) | | P-value* |
|------------------------------|---------------------------|---------|--------------------------|---------|----------|
| | Mean | SD | Mean | SD | |
| BPD (week) Range (37-40) | 37.89 | 1.10 | 37.79 | 1.14 | 0.762 |
| Femoral length(week) | 36.79 | 1.13 | 36.90 | 1.52 | 0.794 |
| Abdomen circumference (week) | 37.47 | 1.54 | 37.79 | 1.37 | 0.456 |
| Fetal weight (gram) | 3284.89 | 363.84 | 3294.41 | 472.35 | 0.941 |
| Doppler MCA (RI) | 0.7484 | 0.08958 | 0.7290 | 0.05002 | 0.339 |
| Doppler UA (RI) | 0.5589 | 0.06616 | 0.5445 | 0.05889 | 0.432 |
| Doppler UA (SD ratio) | 2.1474 | 0.47301 | 2.2062 | 0.21838 | 0.562 |

*t- test. MCA: middle cerebral artery. UA: umbilical artery

Table 3 fetal biometric variables and Doppler study among (38) preterm fetuses (gestational age 30-36.6) weeks in posterior and anterior placental groups

| Fetal biometry | Posterior placenta N (25) | | Anterior placenta N (13) | | P-value* |
|------------------------------|---------------------------|---------|--------------------------|---------|----------|
| | Mean | SD | Mean | SD | |
| BPD (week) Range (30-36.6) | 34.96 | 1.45 | 34.92 | 1.89 | 0.411 |
| Femoral length (week) | 33.72 | 2.03 | 34.31 | 2.13 | 0.821 |
| Abdomen circumference (week) | 34.28 | 2.24 | 34.46 | 2.47 | 0.243 |
| Fetal weight (gram) | 2495.84 | 450.43 | 2705.92 | 631.86 | |
| Doppler MCA (RI) | 0.7380 | 0.06252 | 0.7631 | 0.06447 | 0.253 |
| Doppler UA (RI) | 0.5808 | 0.06563 | 0.5569 | 0.05483 | 0.269 |
| Doppler UA (SD ratio) | 2.3120 | .34919 | 2.2615 | 34288 | 0.673 |

* t- test. MCA: middle cerebral artery. UA: umbilical artery

From the above results it was concluded that placental position whether anteriorly or posteriorly located placenta has neutral effect on all of the studied parameters.

Discussion

Implantation site and placental site are extensively investigated by many researchers looking for any correlation with adverse gestational events and complications⁹.

Maternal age and parity are usually linked to many risks and adverse events during pregnancy and our study failed to find any correlation of them with the placental position, in a study done by Rana A et al (2020) who found that there is no correlation between the placental position and the risk of hypertensive disease of pregnancy which is known to be linked to maternal age and parity¹⁰, which is the opposite to the finding by other researcher who found strong association between anterior placenta and maternal hypertensive disease gestational DM and fetal IUGR, while posterior placenta is associated with preterm labour⁸ in the current study the inclusion criteria for the study sample was low risk pregnancies and excluded any complicated ones. Other study found there is no association between maternal parity and placental location¹¹.

Our study failed to find any significant correlation between anterior or posterior placental location and the gender of the fetus, this is the opposite to the finding of Jafari RM et al (2014) who found 72% of female fetuses and only 27% of male fetuses have anterior placentas¹². Other two studies Ramzi (2011) and Al-Shaikh SF et al (2019) showed that right sided implantation was linked to male gender while left sided implantation to female gender (97% vs 97%) and (92.5% vs 87.5%) respectively^{13,14}.

Gestational age is a known cofounding factor on the biometric parameters and the Doppler study of the fetal vessel for this reason we studied these parameters in two separate groups according to the gestational age term (37-40 week) group and the preterm (30-36.6 week) group of fetuses to investigate the effect of placental position either anterior or posteriorly sited on the above mentioned parameters¹⁵.

Gestational age determination with accuracy is crucial for providing high quality of obstetric care. Biparietal diameter (BPD), femur length (FL), and abdominal circumference (AC) are the main used parameters for dating pregnancies in 3rd trimester and for assessing wellbeing of fetuses at risk of IUGR in addition to measuring the EFW¹⁶.

Pregnancies with anterior or posterior placentae did not demonstrate any significant differences in between the means of BPD, FL, abdominal circumferences, EFW11 whether in the term babies or in the preterm babies.

Doppler study of UA (RI) is relatively lower with increasing fetal gestational age as part of hemodynamic changes of uteroplacental circulation¹⁷⁻¹⁹ while the MCA blood flow follow a parabolic like curve with plateauing at 28 to 30 weeks of gestation¹⁷ in the current study investigating different fetal vessels of the two groups of placental site showed non-significant differences of the means of RI of the UA and MCA in either gestational age groups.

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