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FETAL BIOMETRY PARAMETERS IN A PREGNANT WOMAN WITH GESTATIONAL DIABETES

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ABSTRACT

The objective of this study was to evaluate fetal biometry parameters in the second and third trimesters of pregnancy, in a 37-year-old pregnant woman who developed gestational diabetes. Repeated ultrasound examinations consistently showed an estimated fetal weight above the 90th percentile of the fetal growth. Fetal biometry performed at 33w0d estimated a weight of approximately 4393+/-459 grams at 38w0d of gestation, if the average weekly growth is considered to be 250 grams, but which will probably be exceeded given the current growth rate. Considering that the patient gave birth the first time by cesarean section, the birth will be performed at 38 weeks of gestation, also by this method.

INTRODUCTION

Gestational diabetes is defined as the occurrence of hyperglycemia for the first time during pregnancy. If hyperglycemia is detected before 20 weeks of gestation, diabetes was most likely present before pregnancy. The incidence is approximately 7 % and it increases with gestational age (ACOG 2014).

Gestational diabetes is associated with an increased risk of fetal death, macrosomia, premature birth, preeclampsia, and polyhydramnios. In the newborn, the diabetes can cause respiratory distress syndrome, jaundice, hypoglycemia, hypocalcemia, and an increased incidence of perinatal mortality (Mackeen & Lott 2019).

Preventing the onset of gestational diabetes can be achieved before pregnancy by optimizing maternal health and body mass index through diet and physical activity. The goals of prophylaxis are to maintain fasting blood glucose < 95 mg/dl, below 140 mg/dl one hour postprandial, and below 120 mg/dl two hours postprandial (ACOG 2011).

Gestational diabetes screening should be performed between 24 and 28 weeks of gestation through the glucose tolerance test. Women with risk factors should be tested before conception and at the first prenatal medical examination. If the first screening is negative, it will be repeated between 24 and 28 weeks of gestation (ACOG 2013).

The risk factors are represented by: obesity, age over 35, personal or hereditary history of diabetes, birth of a macrosomic fetus, stillbirth, chronic use of steroids, glycosuria, and altered carbohydrate metabolism (Mackeen & Lott 2019).

Therapeutic management consists of blood sugar monitoring, diet, physical activity, and oral hypoglycemic medications or insulin if the blood sugar is not within normal limits (ACOG 2013).

MATERIAL AND METHODS

The objective of this study was to evaluate by ultrasonography the fetal biometry parameters in the second and third trimester of the pregnancy, in a 37-year-old pregnant woman, who developed gestational diabetes.

Through the anamnesis, information was obtained regarding the following aspects:

- demographic information: name, age, adress;
- menstrual history;
- sexual history;
- history of births and spontaneous or on-demand abortion;
- the date of the last menstrual period;
- the anterior medical examinations;
- the general state of health, weight, height and current complaints.

The ultrasound examination was performed using a General Electrics Voluson E8 Ultrasound Scanner and a transabdominally transducer of 3.5 MHz.

The following biometric parameters were evaluated by ultrasonography:

- the biparietal diameter (BPD) and cranial circumference (HC);
- the abdominal circumference (AC);
- the length of the humerus (HL) and forearm bones, ulna and radius;
- the length of the femur (FL) and the shin bones, tibia and fibula;
- the cerrebelar diameter;
- the CRL (crown-rump length) at 14w0d.

The ultrasound examinations were performed at the gestational ages of 14w0d, 20w0d, 24w0d, 29w0d, 33w0d and 35w0d.

In the third trimester, after 28w0d, the Doppler velocimetry in the umbilical artery and in the middle cerebral artery was performed.

The fetal heartbeats (FHR) were recorded at every examination.

RESULTS AND DISCUSSIONS

A. The following information were obtained through the anamnesis:

- the patient's age: 37 years old;
- the reproductive medical history: one birth by cesarean section, two abortion on-demand;
- the history of previous menstrual periods: irregular menstrual periods;
- date of the last normal menstruation: 14 weeks ago;
- normal body mass index, weight gain during pregnancy 12 kilograms.

The patient was diagnosticated with gestational diabetes in the second trimester of pregnancy, at 27 weeks of gestation, by performing the tolerance glucose test, which showed values increased of blood sugar, 165 mg/dl one hour postprandial and 138 mg/dl two hours postprandial.

B. The ultrasound examination

1. Fetal biometric parameters at 14w0d of gestation

- BPD = 3.33 cm, corresponding to 16w2d, GP > 97.7 % (growth percentage);
- HC = 12.51 cm, corresponding to 16w2d, GP > 97.7 %;
- OFD = 4.25 cm;

- AC = 10.80 cm, corresponding to 16w5d, GP > 97.7 %;
- FL= 1.93 cm, corresponding to 15w5d, GP = 96.1 %;
- HL = 1.89 cm, corresponding to 15w4d, GP > 95.0 %;
- Cereb = 1.53 cm, corresponding to 16w0d;
- CRL= 10.37 cm, corresponding to 16w2d.

The ratios between fetal biometric parameters showed proportional and symmetrical development of the fetus.

CI (BPD/ HC) = 78 %, range 70 – 86 %

FL/AC = 18 %, range 20 – 24 %

FL/BPD = 58 %

FL/ HC = 15 %

HC/AC = 1.16, range 1.14 – 1.31

Estimated fetal weight (EFW) according to AC/ BPD/ FL/ HC measurements was 150 grams, with a range of +/- 22 grams, which corresponds to 16w1d of pregnancy. Based on the data of the last menstruation period (LMP), the gestational age should have been 14w0d.

2. Fetal biometric parameters at 20w0d of gestation

The values of BPD, HC, FL were above the 95th percentile, GP > 97.7 %. The AC was above 97.7 % (Figures 1, 2, 3).

The ratio between fetal biometric parameters were within normal limits:

- CI (BPD/OFD) = 75 %, range 70 – 86 %;
- FL/AC = 21 %, range 20 – 24 %;
- FL/BPD = 71 %;
- FL/HC =19 %, range 17- 20 %;
- HC/AC = 1.12, range 1.09 - 1.26.

Estimated fetal weight according to AC/BPD/FL/HC measurements was 515 grams +/- 75 grams, which corresponds to 22w3d.

3. Fetal biometric parameters at 24w0d of gestation

Estimated fetal weight according to AC/BPD/L/HC measurements was 1046 +/- 153 grams, which corresponds to 27w0d, GP > 90.0 % (Figures 4, 5).

4. Fetal biometric parameters at 29w0d of gestation

The values of BPD, AC, FL and cerrebelar diameter were > 97.7 %, and HL and RAD > 95.0 % (Figures 6, 7, 8, 9).

Estimated fetal weight according to AC/BPD/FL/HC measurements was 2041 +/- 298 grams, which corresponds to 32w3d, GP > 90.0 %. According to the all biometric parameters, the ultrasound age of the fetus was 33w1d (Figure 10).

Doppler velocimetry in the umbilical artery: RI = 0.66, PI = 1.10, S/D = 2.94, PS = 36.16 cm/s, ED =12.28 cm/s, TAmax = 21.64 cm/s, HR = 153 bpm (Figure 11).

Doppler velocimetry in the middle cerebral artery: RI = 0.83, PI = 1.89, S/D = 5.95, PS = 24.64 cm/s, ED = 4.14 cm/s, TAmax = 10.86 cm/s (Figure 12).

5. Fetal biometric parameters at 33w0d of gestation

The values of BPD, AC, FL and cerrebelar diameter were > 97.7 %. The values of RAD and ulna were > 95.0 % (Figures 13, 14, 15, 16).

Estimated fetal weight according to AC/BPD/ FL/ HC measurements was 3143 grams +/- 459 grams, which corresponds to 37w4d, GP > 90.0 % (Figure 17).



Figure 1. Measurement of the biparietal diameter and head circumference at 20w0d



Figure 2. Measurement of the abdominal circumference at 20w0d



Figure 3. Measurements of the biometric parameters at 20w0d



Figure 4. Measurements of the biometric parameters at 24w0d

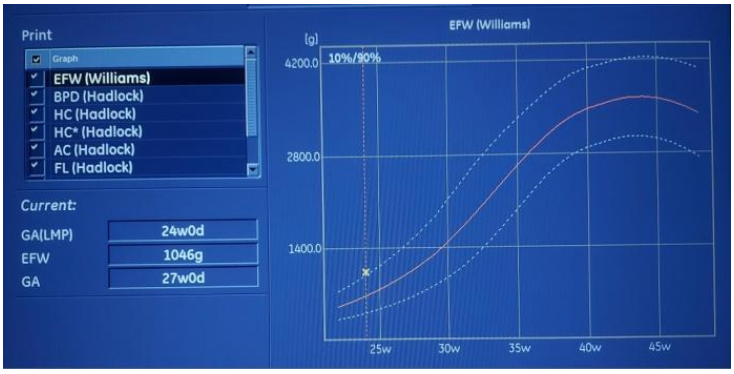


Figure 5. Graph of the fetal growth at 24w0d

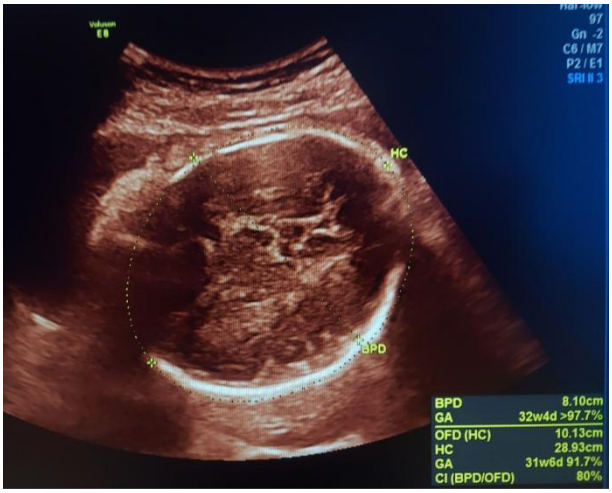


Figure 6. Measurement of the biparietal diameter and head circumference at 29w0d

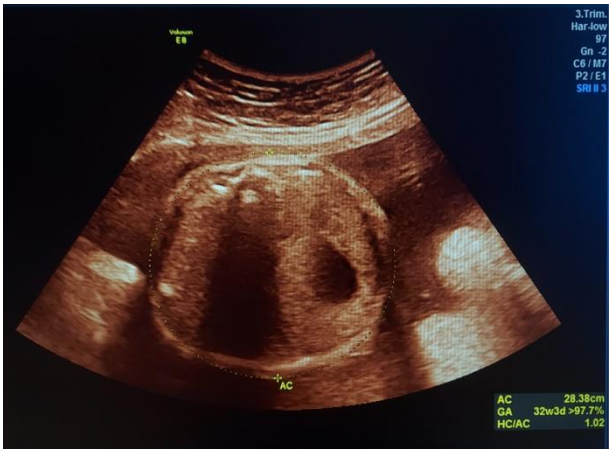


Figure 7. Measurement of the abdominal circumference at 29w0d



Figure 8. Measurement of the femur length at 29w0d



Figure 9. Measurements of the biometric parameters at 29w0d

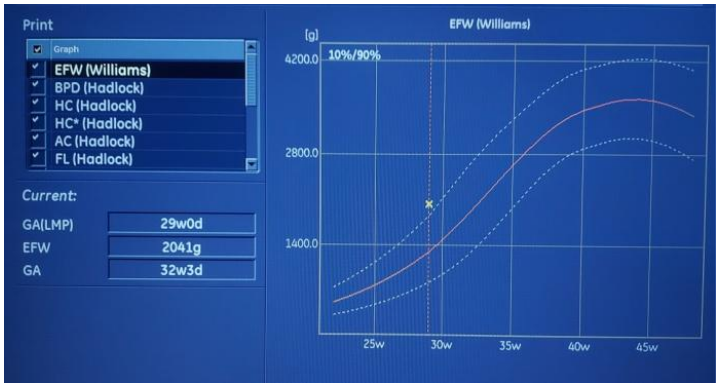


Figure 10. Graph of the fetal growth at 29w0d

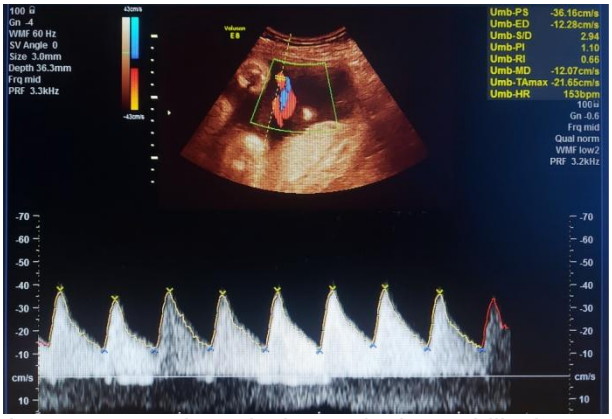


Figure 11. Doppler velocimetry in the umbilical artery at 29w0d

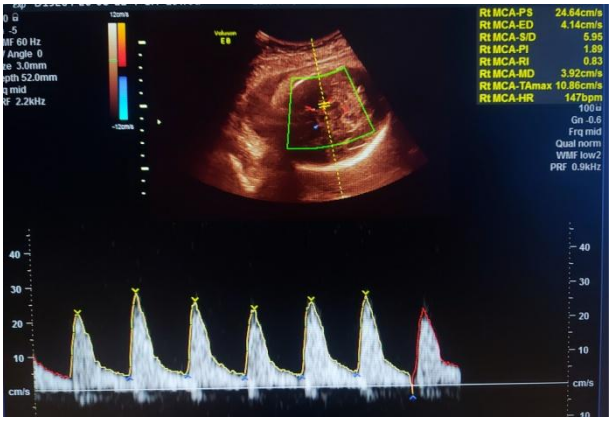


Figure 12. Doppler velocimetry in the middle cerebral artery at 29w0d

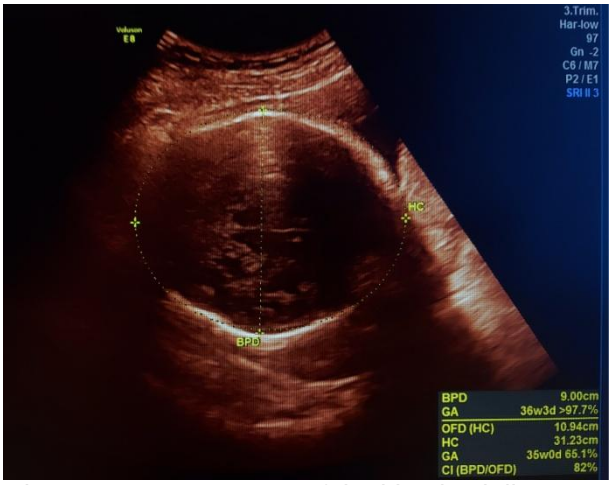


Figure 13. Measurement of the biparietal diameter and head circumference at 33w0d

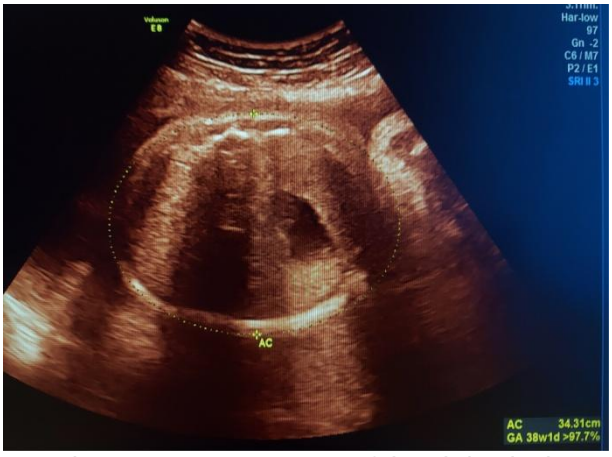


Figure 14. Measurement of the abdominal circumference at 33w0d

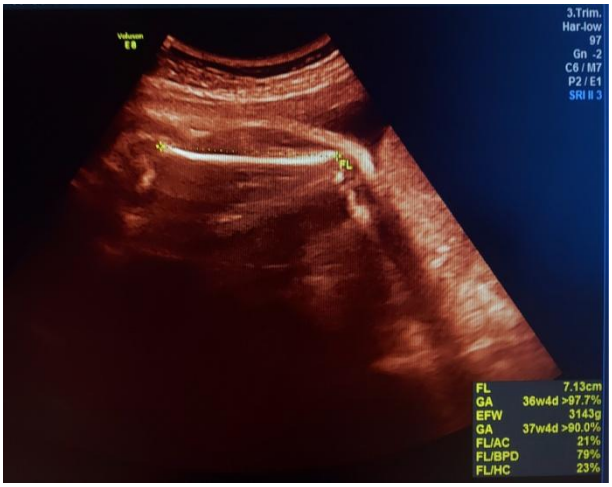


Figure 15. Measurement of the femur length at 33w0d

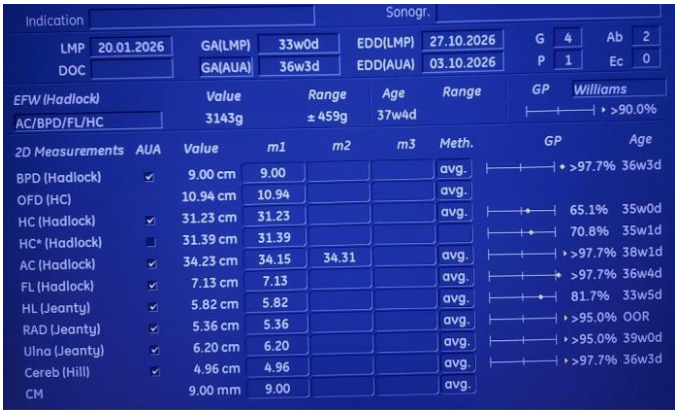


Figure 16. Measurements of biometric parameters at 33w0d

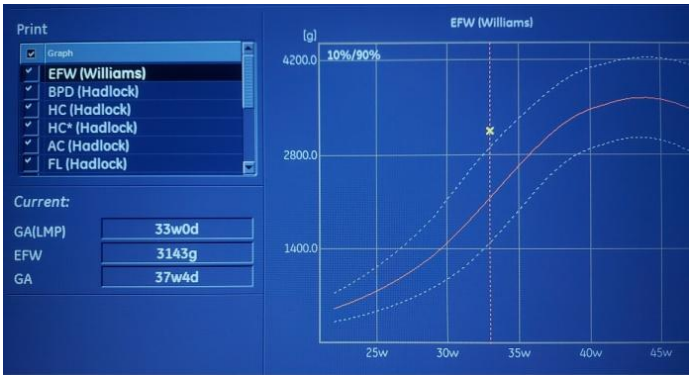


Figure 17. Graph of the estimated fetal weight at 33w0d

According to the all biometric parameters the ultrasound age was 36w1d.

Fetal biometry performed at 33w0d estimated a fetal weight at 38w0d of gestation of approximately 4393 grams +/- 459 grams, if the average weekly growth is considered to be 250 grams, but which will probably be exceeded, given the current growth rate.

Doppler velocimetry in the umbilical artery: RI = 0.60, PI = 0.91, S/D = 2.48, PS = 40.97 cm/s, ED = 16.52 cm/s, TAmax = 26.83 cm/s, MD = 16.20 cm/s, HR = 151 bpm (Figure 18).

Doppler velocimetry in the middle cerebral artery: RI = 0.81, PI = 1.66, S/D = 5.17, PS = 48.36 cm/s, ED = 9.35 cm/s, TAmax = 24.43, MD = 8.96 cm/s, HR = 159 bpm (Figure 19).

The ratio between the resistance indices in UmA and MCA was 1.35, and the ratio between the pulsatility indices was 1.82. The normal values of these parameters should be above 1.1 (Maulik 2023).

6. Fetal biometric parameters at 35w0d of gestation

Estimated fetal weight according to AC/BPD/FL/HC measurements was 3263 grams +/- 476 grams, which corresponds to 37w1d. According to the all biometric parameters, the ultrasound age was 38w1d.

7. Evaluation of the fetal morphology showed normal aspects of the structures: brain, face, spine, limbs, hearth and viscera.

8. Heart rate monitoring recorded values between 130 and 159 beats per minute.

9. The placenta showed microcalcifications in the third trimester, its thickness at the umbilical cord insertion site was 3.5 cm.

10. The amniotic fluid index (AFI) was within normal limits.

Macrosomia is defined as an estimated fetal weight by ultrasound and clinically above 4000 grams. A fetus is considered large for gestational age when the estimated fetal weight is above the 95th percentile of the fetal growth curve (ACOG 2014).

The prevalence of macrosomia in developed countries has decreased, complicating only 1.3 % - 1.5 % of births (Boulet et al. 2003, Campbell 2014).

The management of delivery depends on the association with gestational diabetes, history of cesarean section or history of shoulder dystocia. In uncomplicated pregnancy, labor is induced between 37w0d and 38w6d, this attitude being associated with a low risk of shoulder dystocia (Viteri & Chauhan 2019).

In the case of macrosomia associated with gestational diabetes treated with insulin, induction of labor is recommended at 38 weeks of gestation. According to the ACOG, cesarean section is indicated if the estimated fetal weight exceeds 4500 grams (ACOG 2013).

Considering that the patient gave birth the first time by cesarean section, the birth will be performed at 38 weeks of gestation, also by this method.

In gestational diabetes, medication treatment is recommended if fasting blood glucose has at least two values above 99 mg/dl or above 126 mg/dl before 35 weeks of gestation, at values above 162 mg/dl two hours postprandial regardless of the gestational age, and at values above 144 mg/dl two hours postprandial after a gestational age of 35 weeks (ACOG 2014).

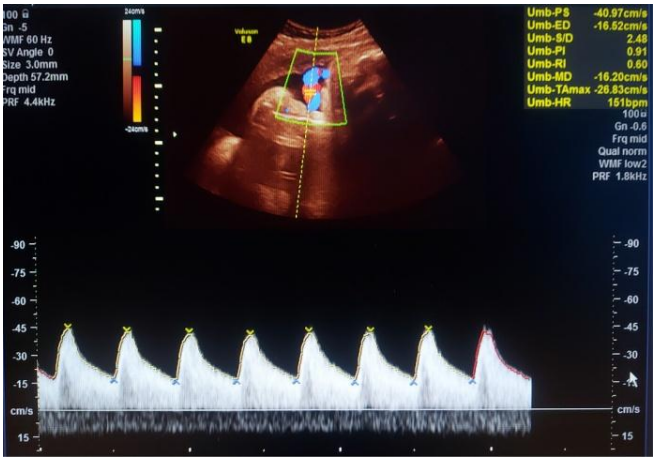


Figure 18. Doppler velocimetry in the umbilical artery at 33w0d

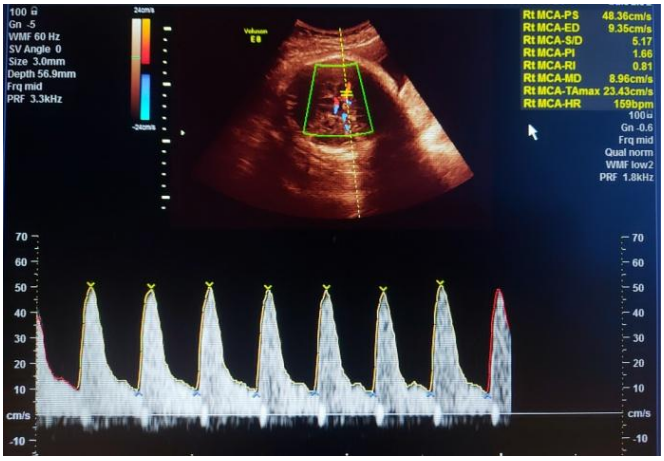


Figure 19. Doppler velocimetry in the middle cerebral artery at 33w0d

CONCLUSIONS

Monitoring of fetal biometry parameters showed an estimated fetal weight above the 90th percentile, a value that remained constant at each ultrasound examination.

The estimated fetal weight at 14w0d of gestation corresponded to a gestational age of 16w0d, which means that the fetal growth rate was increased starting from the first trimester of pregnancy. It is possible that hyperglycemia occurred long before the diagnosis at 27 weeks of gestation.

It is very important that the fasting blood sugar determination and the glucose tolerance test be performed as early is possible, considering that the hyperglycemic environment can induce the appearance of fetal congenital anomalies.

The patient developed gestational diabetes despite not having any risk factors. Fortunately, the patient followed the medical advice and the blood sugar level was kept within normal limits with diet alone.

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