ACCURACY OF ULTRASONOGRAPHY FOR DIAGNOSIS OF FETAL MACROSOMY

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ABSTRACT

INTRODUCTION: Fetal macrosomia is a birth weight greater than or equal to 4000g, regardless of gestational age. The weight of the fetus estimated by ultrasound (USG) significantly influences the decision to continue or to terminate the pregnancy. OBJECTIVE: To define the accuracy of USG in the estimative of fetal macrosomia in a municipal maternity hospital in Goiânia. METHODS: Retrospective descriptive transversal epidemiological study carried out at Hospital e Maternidade Dona Íris (HMDI), Goiânia, Goiás. The population consisted of patients undergoing cesarean delivery in 2019, with a total of 2742 people. Inclusion criteria: obstetric USG performed at the HMDI up to 7 days before delivery. Data collection was carried out in the hospital's database. Patients were ordered in decreasing manner based on the birth weight of the newborns. 1033 patients were selected by convenience. After inclusion and exclusion criteria, the n sample was 189. RESULTS: The accuracy of the USG for diagnosis of fetal macrosomia was 76.2%, sensitivity 59.5% and specificity 80.3%. The rate of caesarean delivery for fetal macrosomia in 2019 at HMDI was 27.5%. CONCLUSION: As it is an exam with greater specificity and a high negative predictive value, obstetric USG has better applicability when associated with clinical suspicion of fetal macrosomia.

KEYWORDS: MACROSOMIA; ULTRASONOGRAPHY; FETAL WEIGHT; CAESAREAN

INTRODUCTION

Fetal macrosomia is defined as birth weight greater than or equal to 4000g, regardless of gestational age, or above the 90th percentile (p90) in relation to gestational age and is related to an increased risk of birth trauma, maternal and neonatal morbidity and mortality[1].

In 2017, newborns weighing 4000g or more accounted for 5.26% of births in Brazil and 3.94% in Goiás[2].

Some experts recommend elective caesarean section as a way to avoid more serious complications, such as biacromial dystocia and brachial plexus palsy. However, this practice does not present sufficient scientific evidence to establish a consensus, and the applied weight limit is also not well defined, ranging from 4000g to 5000g depending on the literature[3].

It is known that the number of caesarean sections has grown in developing countries and has become a public health problem, since caesarean delivery is associated with higher rates of maternal mortality and neonatal morbidity and mortality when compared to vaginal delivery. Studies show that the suspicion of fetal macrosomia is among the most frequent indications for caesarean sections[4].

However, elective caesarean section is indicated in fetuses with estimated weight above 5,000 g, as level A recommendation and vaginal delivery should be attempted in fetuses with estimated weight below 4500 g without other associated complications[5].

The fetal growth, development and its deviations are evaluated throughout the gestation, from the evaluation of the uterine fundal height and the obstetric ultrasonography. Currently, obstetric ultrasound is the most efficient way to identify low or high fetal weight[6].

There are several formulas for estimating fetal weight by ultrasonography, which are calculated directly by the USG equipment software, the main ones are the formulas of Warsof, Shepard, Hadlock with two parameters, and Hadlock with four parameters, and there is no superiority of one in relation to others. However, all of them have greater chances of error in fetuses at the extremes of weight variations[7].

Kacem et al., (2013) demonstrated that 26.6% of ultrasound assessments of fetal weight have a relative error greater than 10% in relation to birth weight. The most used formula for calculating fetal weight is Hadlock's, which uses four measures: cranial circumference, biparietal diameter, abdominal circumference and femur length[8].

The fetal weight estimated by ultrasonography, especially when a deviation to more or less is identified, considerably influences the conducts related to the maintenance or interruption of pregnancy[9].

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Fetal macrosomia is an obstetrical challenge involved in controversies from the conceptual definition to the decision on the mode of delivery and timing of pregnancy interruption. Knowing that ultrasound is used as a complementary method in the diagnosis of fetal macrosomia and sometimes used as the only intrauterine diagnostic parameter, it directly influences the choice of the mode of delivery and the timing of termination of pregnancy.

Therefore, this study aims to determine the accuracy of two-dimensional obstetric ultrasonography in estimating fetal weight equal to or greater than 4000g, through tests performed at a Municipal Hospital in Goiânia.

MATERIALS AND METHODS

This is a descriptive retrospective cross-sectional epidemiological study, carried out at Hospital e Maternidade Dona Íris (HMDI) in Goiânia, Goiás, from January to October 2020. The study was submitted to the HMDI Research Ethics Committee through Plataforma Brasil, complying with the ethical principles of research in human beings of resolution 466/12, with the waiver of the Free and Informed Consent Term. Data collection was performed in the hospital's database, by consulting the surgical center's virtual caesarean worksheet, the Wareline electronic medical record system and the USG Wultra system.

The virtual caesarean worksheet presented the patients in chronological order of the date of delivery and in 2019, 2742 patients underwent caesarean section at HMDI. For sample selection, patients were organized in descending order based on the birth weight of the newborns. For convenience, 1033 patients were selected sequentially from the new ordering performed, so that all who had macrosomic newborns were included.

As inclusion criteria for the study, we defined the performance of obstetric USG at HMDI up to 7 days before delivery and as exclusion criteria, having performed obstetric USG at HMDI more than 7 days before delivery and not having performed obstetric ultrasound at the time of delivery at HMDI.

After applying the inclusion and exclusion criteria, the sample number obtained was 189. Data were organized in Excel to make spreadsheets, tables and perform statistical calculations to obtain accuracy, sensitivity, specificity, negative and positive predictive values.

USG sensitivity (S) in the diagnosis of fetal macrosomia was calculated using the formula: S=(PV/(PV+FN))x 100. Specificity (S) was calculated using the formula: S=(NV/(NV+FP))x 100.. The positive predictive value (PPV) was calculated using the formula: PPV=(PV/(PV+FP))x 100, and the negative predictive value using the formula: NPV=(NV/(NV+FN))x100. To calculate the accuracy (A) the formula was used: A =((PV+NV)/(PV+NV+FP+FN))x 100.

RESULTS

Information was collected from 189 patients regarding indication for caesarean section, date of delivery, birth weight, date of ultrasound and estimated weight by ultrasound. Of these, 27.5% (52) had fetal macrosomia diagnosed by USG as an indication for caesarean delivery, and 72.5% (137) had different indications not related to fetal macrosomia (TABLE 1).

INDICATION OF CAESAREAN SECTION	n (PERCENTAGE VALUE)
Macrosomia	52 (27.5%)
Other reasons	137 (72.5%)
TOTAL	189

TABLE 1 – Indication of caesarean section. Hospital e Maternidade Dona Íris, 2019

Regarding the newborn's weight at birth, 19.5% (37) of the patients had newborns weighing 4000g or more, and 80.5% (152) had newborns weighing less than 4000g (TABLE 2).

WEIGHT AT BIRTH	n (PERCENTAGE VALUE)
Greater than or equal to 4000g	37 (19.5%)
Less than 4000g	152 (80.5%)
TOTAL	189

TABLE 2 – Birth weight of newborns by caesarean delivery. Hospital e Maternidade Dona Íris, 2019.

Comparando o peso fetal estimado pela ultrassonografia com o peso ao nascimento, 22 (42,3%) apresentaram-se como verdadeiros positivos (VP) para macrossomia, 122 (89%) como verdadeiros negativos (VN), 15 (10,9%) como falsos negativos (FN), e 30 (57,6%) como falsos negativos (FP) (TABELA 3).

Comparing the estimated fetal weight by ultrasonography with birth weight, 22 (42.3%) presented themselves as true positives (PV) for macrosomia, 122 (89%) as true negatives (NV), 15 (10.9%) as false negatives (FN) and 30 (57.6%) as false positives (FP) (TABLE 3).

	WEIGHT AT BIRTH		
WEIGHT AT USG	Macrosomic (percentage values)	Non-macrosomic (percentage values)	TOTAL
Macrosomic (percentage values)	22 (42.3%) - PV	30 (57.6%) - FP	52
Non-macrosomic (percentage values)	15 (10.9%) - FN	122 (89%) - NV	137
TOTAL	37	52	189

TABLE 3 – Comparison between fetal weight estimated by ultrasound and birth weight. Hospital e Maternidade Dona Íris, 2019.

The sensitivity of ultrasonography in diagnosing fetal macrosomia was 59%, and the specificity was 80%. The PPV obtained was 42% and the NPV 89%. The accuracy

found was 76%. For all parameters, a confidence interval of 95% was applied (TABLE 4).

ESTIMATED	VALUE	CI 95%
Sensitivity	59.5	(52.5 – 66.5)
Specificity	80.3	(74.6 – 85.9)
Accuracy	76.2	(70.1 – 82.3)

TABLE 4 – Statistical estimates of USG in the diagnosis of fetal macrosomia, in percentage values. Hospital e Maternidade Dona Íris. 2019.

DISCUSSION

Currently, there is no method with high diagnostic accuracy for fetal macrosomia and USG is the most commonly performed test in obstetric practice, sometimes used alone in the intrauterine diagnosis of macrosomia and in the indication for caesarean section.

The USG analyzed in this study used the Wultra software, whose calculation of the fetal weight estimate was made using the Hadlock formula, assuming an error margin of ± 10%. They presented a sensitivity of 59.5% (CI 95: 52.5 - 66.5) and specificity of 80.3% (CI 95: 74.6 - 85.9) in the diagnosis of fetal macrosomia, and, consequently, high NPV (89%), which demonstrates a greater probability of a fetus not considered macrosomic by USG in fact not being macrosomic at birth.

The USG performed up to 7 days before delivery showed an accuracy of 76% when positive for fetal macrosomia, which represents a moderate risk of the result not being in line with reality. The PPV was 42%, which means that out of 100 fetuses diagnosed as macrosomic by the USG, only 42 are truly macrosomic at birth.

The results found are similar to the most current recommendations of the ACOG (2020), which point to USG as a method of low accuracy for predicting fetal macrosomia (33-44%), with 56% sensitivity and 92% specificity10.

These findings are also consistent with the study by Freire (2010), who correlated fetal weight estimated by USG performed up to 7 days before delivery with birth weight, indicating a high negative predictive value (100%, CI 95: 95.9 -100) and low positive predictive value (23.5%, CI 95: 10.8 – 41.1) for large for gestational age fetuses.

Weiner et al. (2002) compared ultrasonography in estimating fetal macrosomia with clinical estimation, and concluded that ultrasonography was not superior because it had a sensitivity of 58%, while the clinical estimate had a sensitivity of 68%. They also concluded that ultrasonography has a higher negative predictive value (70%), and a lower positive predictive value (56%) in the diagnosis of fetal macrosomia.

On the other hand, Ricci et al. (2011) concluded that ultrasonography has superiority in estimating fetal weight when compared to estimation by clinical parameters, with an accuracy of 79% using the four-parameter Hadlock formula[11].

The results found in this study, as well as those found in the literature, show that USG for fetal macrosomia is a method with greater specificity and high negative predictive value, which shows better applicability when associated with clinical suspicion of fetal macrosomia.

The latest recommendations of the ACOG (2020) on the subject corroborate the findings of this study, pointing out as level A of evidence, that ultrasonography for estimating fetal weight is not more accurate than the abdominal assessment of the pregnant woman. In addition, as level B of evidence, USG can be used to rule out fetal macrosomia when there is clinical suspicion[10].

CONCLUSION

✓ The accuracy of ultrasound in diagnosing fetal macrosomia was 76.2%.

✓ Sensitivity was 59.5% and specificity 80.3%.

✓ The caesarean rate for fetal macrosomia at Hospital e Maternidade Dona Íris in 2019 was 27.5%.

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