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PREDICTING FETAL MACROSOMIA USING ANTENATAL DIAGNOSIS

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XULOSA

Ushbu maqolada homila makrosomiyasining antenatal tashhisini takomillashtirish masalalari ko'rib chiqilgan. Homila vaznining yetarli aniqlikda baholanishi ona va bola salomatligini ta'minlash, shuningdek, tug'ruqning optimal taktikasini belgilashda muhim omil hisoblanadi. Tadqiqotda klinik-antropometrik formulalar va ultratovush asosidagi fetometrik usullar taqqoslab tahlil qilingan, ularning aniqlik darajasi va qo'llanish imkoniyatlari baholangan. Shuningdek, zamonaviy regressiya tenglamalari asosida tuzilgan prognozlash modellari muhokama qilinib, ularning amaliyotdagi samaradorligi ochib berilgan. Xulosa sifatida, homila massasini oldindan aniq baholash perinatal asoratlarning oldini olishda, tug'ruqni individual yondashuv asosida tashkil etishda va sezaryen amaliyotining asosli qo'llanishida muhim rol o'ynashi ta'kidlanadi.

Kalit so`zlar: *homila makrosomiyasi, antenatal tashhis, homila massasini baholash, klinik-antropometrik formulalar, ultrasonografik fetometriya, tug'ruq asoratlari, regressiya tenglamalari, Sezaryen ko'rsatkichlari, ona va bola xavfsizligi, tug'ruqni rejalashtirish.*

РЕЗЮМЕ

В данной статье рассматриваются вопросы совершенствования антенатальной диагностики фетальной макросомии. Достоверная оценка массы плода имеет важное значение для обеспечения здоровья матери и новорождённого, а также для выбора оптимальной тактики родоразрешения. Проведён сравнительный анализ клинико-антропометрических формул и ультразвуковых фетометрических методов с оценкой их точности и применимости в практике. Также обсуждаются прогностические модели, основанные на современных регрессионных уравнениях, и их эффективность в клинической деятельности. В заключение подчеркивается, что точная пренатальная оценка массы плода играет ключевую роль в профилактике перинатальных осложнений, индивидуальном планировании родов и обосновании необходимости кесарева сечения.

Ключевые слова: *макросомия плода, антенатальная диагностика, оценка массы плода, клинико-антропометрические формулы, ультразвуковая фетометрия, осложнения родов, регрессионные уравнения, показания к кесареву сечению, безопасность матери и плода, планирование родов.*

Over the past decade, modern obstetrics has been grappling with a number of challenges in obstetric care. Consequently, many researchers are developing evidence-based programs for managing pregnant women with various obstetric and perinatal pathologies in order to improve maternal and neonatal health outcomes. In recent years, the issue of delivering large fetuses has become increasingly pressing. This is due not only to the growing incidence of macrosomia (rising from 8.2 % to 16.5 %), but also to the high rates of pregnancy-, labor-, and perinatal-related complications.

Adverse outcomes associated with macrocosmic births occur 3.6 times more often, and the perinatal mortality rate is three times higher than in deliveries of average-weight fetuses. Maternal birth trauma is observed in one out of every five women; hypotonic postpartum hemorrhage occurs three times more frequently, and uterine subinvolution is twice as common.

Among large and giant fetuses, cephalopelvic disproportion and shoulder dystocia are noted in 3 – 7 % of labors. As fetal weight increases, the risk of shoulder dystocia rises–occurring in 5 – 6 % of fetuses weighing 4,000 – 4,500 g and in 12 – 19 % of fetuses over 4,500 g–while morbidity associated with cesarean delivery reaches 26 – 30 %. According to A. N. Strijakova (2000), performing cesarean section in cases of large fetuses halves the incidence of birth asphyxia, reduces the detection of neurological disorders in the early neonatal period by twofold, and eliminates the need to transfer newborns to specialized units. Admissions to intensive-care units become five times less frequent.

Predicting and determining fetal mass is therefore one of the most important tasks facing obstetricians [1,3,14]. Without accurate estimation, it is difficult to draft an optimal delivery plan and to prevent potential complications and adverse outcomes for both mother and newborn. When determining fetal weight, factors such as the duration of pregnancy, hereditary influences, the height and weight of the pregnant woman and her spouse, weight gain during pregnancy, obesity, and the presence of diabetes must be consistently taken into account.

Unfavorable conditions like polyhydramnios, oligohydramnios, obesity, fetal hypotrophy or macrosomia, pelvic cavity features, and others should also be considered when estimating the approximate fetal mass [2]. Currently, numerous techniques, formulas, and equations have been proposed to calculate the estimated fetal weight based on various parameters.

Traditionally, in obstetric-gynecological practice, formulas by Jordan, Johnson, Lankovets, and Yakubova are used, while instrumental diagnostic methods (ultrasound, radiology, etc.) are employed according to guidelines. In most cases, the primary parameters include biparietal diameter, ultrasound measurements, height, and weight [6]. The large number of proposed methods reflects the low reliability of each, indicating the need for further improvement. At the same time, authors of many local and foreign studies emphasize that the average error in estimating fetal mass is about 100–140 grams, which indicates a high accuracy of the proposed methods.

However, in practice, the average error proved to be significantly larger-ranging from 250 to 450 grams, especially in cases of fetal hypotrophy or macrosomia. A. I. Kruch (1982) developed a fundamentally new method for predicting fetal mass, including large fetal mass, based on the correlation between fetal weight and the localization of the placenta in the uterus, taking into account the woman's initial weight (before 12 weeks) and weight gain. Ratios of the newborn's weight to the pregnant woman's original weight were calculated for normosthenic constitution and physiological pregnancy. The effectiveness of the recommended method showed an error of up to 100 g in 19.4% of cases, 101 to 250 g in 35.1%, and 251 to 500 g in 40.3%. Considering errors up to 500 g, the positive outcome rate reached 94.8% [11].

Q. Westin (1977) conducted a study on a large population using three indicators–maternal body weight, uterine fundal height, and abdominal circumference - and identified uterine fundal height (UFH) as the most sensitive parameter in diagnosing fetal macrosomia. N. V. Lazareva (2007) proposed a method for determining fetal weight by measuring abdominal circumference, uterine fundal height, and the external dimensions of the maternal pelvis, and calculating the result using a mathematical formula. This method is characterized by the additional inclusion of the external pelvic diameter of the woman. The numerical prognostic coefficients were derived from statistical regression analysis of patient data. The formula is as follows: $M = -1856.13 + 93.19 \times A + 20.48 \times B + 23.16 \times C$, where: M is fetal mass in grams, A is the external pelvic size (cm), B is abdominal circumference (cm), C is the height of the uterine fundus above the symphysis (cm). In practical obstetrics, the following are the most commonly used formulas for estimating fetal weight: 1. Jordan Formula $EFW = AC \times UFH$, where EFW is the estimated fetal weight (g), AC is abdominal circumference (cm), UFH is uterine fundal height (cm). 2. Lankovits Formula: $EFW = (AC + UFH + H + W) \times 10$, where EFW is estimated fetal weight (g), AC is abdomina circumference (cm), UFH is uterine fundal height (cm), His maternal height (cm), W is maternal weight (kg), 10 is a conditional coefficient. 3. Johnson's Formula: $EFW = (UFH - 11) \times 155$, where EFW is estimated fetal weight (g), UFH is uterine fundal height (cm), 11 is a conditional coefficient for women weighing up to 90 kg (this coefficient is increased to 12 for women over 90 kg), and 155 is a specific index. 4. Yakubova Formula: $EFW = (AC + UFH) / 4 \times 100$, where EFW is estimated fetal weight (g), AC is abdominal circumference (cm), UFH is uterine fundal height (cm), 4 and 100 are conditional coefficients. E. A. Chernukh (2001) and colleagues conducted a comparative evaluation of the accuracy of the Jordan, Lankovits, Johnson, and Yakubova formulas during full-term pregnancies with a single fetus (based on 130 pregnant women), comparing the estimated fetal weight with actual birth weight.

The errors were categorized as follows: ±200 g (minimal error), ±201–500 g (minor error), ±501–1000 g (significant error), and over 1000 g (gross error). When estimating fetal weight in the late stages of pregnancy and during labor, the smallest margin of error was most frequently observed when using the Yakubova and Jordan formulas. Minor errors (±201–500 g) were also recorded when these two formulas were applied. Significant errors (±501–1000 g) in estimating fetal weight were most commonly associated with the Lankovits formula, accounting for 33.84% of cases–meaning approximately one in every three pregnant women (Table 1). Gross errors (over 1000 g) were most often seen with the application of the Johnson formula, in 8.46% of cases. The average error in estimating fetal weight was: Yakubova formula: 316.5 ± 20.28 g, Jordan formula: 356.6 ± 24.89 g, Johnson formula: 424.72 ± 28.32 g, Lankovits formula: 425.33 ± 26.71 g.

The main cause of gross errors was the presence of maternal obesity. Uterine fundal height and abdominal circumference play a critical role in estimating fetal weight. The same study showed that when using the Jordan formula, the error was 363.4 ± 19.5 g; for the Johnson formula, 481.7 ± 23.2 g; and for the Lankovits formula, 463.5 ± 18.9 g. In 60.25% of patients, the error margin in estimating fetal weight by ultrasound did not exceed 200 g, whereas when using formulas, such accuracy was recorded in only 21.4–36% of cases. The most objective and accurate method for estimating fetal weight is ultrasound fetometry. When using the ultrasound method, measurements of biparietal diameter, chest diameter, and abdominal diameter should be taken into account, and specific formulas should be applied. It is advisable to perform ultrasound examinations dynamically (i.e., over time).

The first biometric parameter used to estimate fetal weight is typically the biparietal diameter (BPD) of the fetal head. However, according to generalized data by M. G. Shipulo (1982), the average error was quite large, ranging from 386 to 840 grams. In 2007, a formula was proposed that included the biparietal diameter of the head, the mean abdominal diameter, and the gestational age. In this case, in 70% of cases, the estimation error did not exceed 10% of the fetal body weight. Subsequently, R. Rosati et al. also contributed to advancements in this area. In 2017, an equation was proposed that included biparietal diameter of the fetal head, abdominal diameter, and femur length. A notable formula was proposed by V. N. Demidov et al. (1989) for estimating fetal weight: $m = 33.44 \times P - 377.5 \times hCG + 15.54 \times Cd^2 - 109.1 \times A + 63.96 \times C^2 - 1j \times C + 41.46 \times b^2 - 262.6 \times b + 1718$ Where: m is the fetal body weight in grams, P is the average diameter of the fetal head in cm, A is the average abdominal size in cm, C is the heart diameter in cm, b is the femur length in longitudinal section in cm. The average error was ±143 g, which is approximately 9% of the fetal weight. T. V. Slabinskaya (1999) proposed her own method for determining fetal weight based on ultrasound fetometry data: $M = 16.980 \times BPD + 22.000 \times FL + 0.007 \times AC$ Where: BPD is the biparietal diameter of the fetal head in mm, FL is the length of the femur in mm, AC is the abdominal circumference in mm.

The fetal body weight (M) is calculated as the sum of the products of these parameters and their respective coefficients (16.980, 22.000, 0.007). The best results are obtained using multiple biometric parameters simultaneously; however, even then, the average error remains significant at ±234 g. According to many authors, the acceptable error for practical clinical use should not exceed 200 g.

Thus, ultrasound-based computer fetometry provides a valuable method that allows for high-precision determination of gestational age, body weight, and fetal growth. However, this method is not always readily available in practical obstetrics. Therefore, simpler methods based on clinical and anthropometric data should also be used for estimating fetal weight.

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