REVIEW ARTICLE

Role of Fetal Abdominal Subcutaneous Tissue Thickness in Predicting Large for Gestational Age in Gestational Diabetes

Mohan Smitha[1], Pallavee P[2]

Abstract

Background: Gestational diabetes mellitus (GDM) is one of the most prevalent metabolic complications in pregnancy associated with adverse pregnancy outcomes, one of which is large for gestational age (LGA) baby. Large for gestational age fetuses have increased subcutaneous fat deposition in the abdomen. This can be measured by fetal abdominal subcutaneous tissue thickness (FASTT) using ultrasound. This review has highlighted the usefulness of FASTT as a predictor of LGA neonate in GDM.

Objectives: The present review is aimed to determine the usefulness of FASTT measurement as a predictor of large for gestational age neonate in gestational diabetes mellitus.

Materials and methods: An electronic search strategy was used to select the studies from different databases like PubMed, Google Scholar, SciELO, Research Gate. A combination of keywords like FASTT, GDM, birth weight (BW), and ultrasound was used to select the studies. Inclusion criteria were English language, duration of search 15 years, cohort, and observational studies only. However, systematic reviews and meta-analyses were excluded from the review. The total number of articles reviewed was 48 out of which only 12 articles fulfilled the inclusion criteria. The selected articles were further assessed for the quality of the research and included in the review.

Conclusion: Fetal abdominal subcutaneous tissue thickness had a positive correlation with BW and can discriminate between small for gestational age (SGA), appropriate for gestational age (AGA), and LGA neonates. Fetal abdominal subcutaneous tissue thickness is a useful tool to predict LGA neonates in GDM.

Keywords: Birth weight, Fetal abdominal subcutaneous tissue thickness, Gestational diabetes mellitus, Large for gestational age, Ultrasound.

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Introduction

Gestational diabetes mellitus (GDM) is one of the most prevalent metabolic complications that affects pregnant women. One such fetal complication is large for gestational age (LGA) baby which complicates 15–45% of diabetic pregnancies.[1] Pregnancies affected by LGA babies are extremely risky with increased maternal complications like increased rate of cesarean section, postpartum hemorrhage as well as neonatal morbidity like low Apgar score, increased admission rate to NICU, shoulder dystocia, etc. Hence, they need close monitoring and constant antenatal and intrapartum care.[2]

In utero estimation of fetal weight can help plan management of the pregnancies complicated with LGA baby, thereby improving neonatal outcomes. There are several ultrasound anthropometric parameters for monitoring fetal growth. The normally utilized measures are abdominal circumference and ultrasound estimates of fetal weight. Yet, both of them are less sensitive and specific. This is justified by Cetin et al. whose reports estimate the error in these parametric methods to be as high as 25% mainly because of technical measurement mistakes or wrong fetal density assumptions.[3] This calls for a more suitable, useful, and well-researched sonographically measurable parameter. Macrosomic fetuses have the uncommon tendency of subcutaneous fat deposition in the medial abdominal and interscapular areas. Ultrasound estimation of fetal fat may be vital in detecting defects in fetal growth. Therefore, the measurement of fetal abdominal subcutaneous tissue thickness (FASTT) may have an immense potential to predict LGA neonates in diabetic pregnant women and eventually help in the better clinical management of these pregnancies.

[1,2]Department of Obstetrics and Gynaecology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India

Corresponding Author: Mohan Smitha, Department of Obstetrics and Gynaecology, Mahatma Gandhi Medical College and Research Institute, Puducherry, India, Phone: +91 9914182244, e-mail: smithzymohan@gmail.com

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Materials and Methods

An electronic search strategy was used to select the studies from different databases like PubMed, Google Scholar, SciELO, Research Gate. A combination of keywords like FASTT, GDM, birth weight (BW), and ultrasound was used to select the studies. Inclusion criteria were English language, duration of search 15 years, cohort, and observational studies only. However, systematic reviews and meta-analyses were excluded from the review. The total number of articles reviewed was 48 out of which only 12 articles fulfilled the inclusion criteria. The selected articles were further assessed for the quality of the research and included in the review.

Discussion

Fetal growth is affected by many factors making it a complicated process. In a prospective cohort study, it was found that fetuses of

Table 1: Correlation between FASTT and birth weight in various studies

Studies	*Gestational age (weeks)*	*Sample size*	*Study population*	*Mean birth weight (g)*	*p value; Pearson's coefficient (r)*	*Correlation with birth weight*	*FASTT (mm) cut-off for LGA*
Higgins et al.[12]	30–38	125	GDM	3654.7 ± 527	<0.05	Positive	5.8 ± 1.4
Kuttan et al.[13]	30–35	100	GDM	3310	<0.001	Positive	5
Rauf et al.[14]	31–37	50	GDM	3.46 ± 0.25	<0.001	Positive	5.15
Lertvutivivat et al.[15]	36–38	125 + 125	GDM + Control	3103.3 ± 549.2	<0.004	Positive	5.1 ± 1.1

GDM mothers at 12–16 weeks of gestation were smaller but from 24 weeks they grew faster and had higher abdominal circumference and estimated fetal weight when compared to fetuses of a non-diabetic mother. This biphasic growth pattern in a fetus with early growth restriction followed by growth acceleration is seen in GDM, pre-gestational type I, and type 2 diabetes.[4] Fetal biometry is the commonest ultrasound tool to measure fetal size. Neonatal BW is accounted for by 46% of fat mass.[5] Measurement of subcutaneous fat thickness directly correlates with energy stores. Various other researchers have proved a positive correlation between FASTT and BW.[6–8]

However, most of the work was done in term healthy pregnant women. Hardly, there are any studies to find the correlation between FASTT and BW in a specific population of pregnant women having gestational diabetes.

FASTT and GDM

Larciprete et al. found significant differences in subcutaneous tissue thickness in the abdomen between GDM and non-GDM women at 37–40 weeks of gestation.[9] Thus, measuring subcutaneous adipose tissue-like FASTT is a reliable indicator of fetal metabolic status in GDM as well as to identify fetuses at risk of overgrowth in these women. Rigano et al. found that abdominal circumference in fetuses of mothers with or without diabetes was similar but the fetal fat tissue thickness was dissimilar suggesting that the anthropometric measures may not correctly measure the nutritional status of the fetus.[10] Aksoy et al. measured anterior abdominal wall thickness (AAWT) at the time of GDM screening and found that it was significantly different between GDM and control groups as compared to standard biometry which was similar in both the groups. They commented that AAWT may have a role in evaluating fetal growth in gestational diabetes.[11]

Few other studies like Higgins et al. did a prospective cohort study including both gestational and pre-gestational diabetic women and showed that fetal AAWT measurement in the third trimester correlated significantly with BW (Pearson's = 0.31, $p <$ 0.01).[12] Kuttan et al. measured the fat thickness at two places and tried to correlate with BW. They found a strong association ($p < 0.01$) between fetal abdominal thickness and shoulder pad thickness with BW in both overt and gestational diabetes.[13] Likewise, Rauf et al. in their study measured FASTT and subscapular soft tissue thickness (SSSTT) in GDM women between 31 weeks and 37 weeks of gestation and correlated it with BW. They too found a positive correlation between FASTT and BW ($r = 0.666$; $p < 0.001$).[14] Another study comparing GDM women with non-GDM women concluded that AAWT increased as gestation advances in both GDM and non-GDM groups. However, the fetus of GDM mothers had significantly higher AAWT at 28–30 weeks and 32–34 weeks but was comparable to AAWT in non-GDM fetuses at 36–38 weeks.[15]

The present review is aimed to determine the usefulness of FASTT as a predictor of large for gestational age neonate in gestational diabetes mellitus.

Results

Higgins et al. gave cut-off levels for the prediction of macrosomia in diabetic pregnancy at various gestational ages. There were 54 neonates who were macrosomic. They obtained cut-off values of 3.5 mm at 30 weeks, 4.5 mm at 33 weeks, and 5.5 mm at 36 weeks of gestation. They concluded that third-trimester FASTT measurement will help predict fetal macrosomia and it will help in making a better clinical decision in diabetic pregnancy.[12] Lertvutivivat et al. found that AAWT of fetuses was significantly higher for LGA neonates in GDM than in non-GDM at three-time points with a cut-off value of ≥4 mm at 36–38 weeks approaching a sensitivity of 89.3%.[15]

Rauf et al. obtained a cut-off value for FASTT and SSSTT as 5.15 and 5.45 mm, respectively, with a positive correlation between FASTT and BW ($r = 0.666$; $p < 0.001$) (Table 1).[14]

Conclusion

Fetal abdominal subcutaneous tissue thickness is a simple ultrasound tool that is a good indicator of BW. It can detect fetal growth abnormalities in gestational diabetes. Use of FASTT to discriminate between restricted growth, normal and macrosomia should be explored further in a larger population. Further research to find the usefulness of FASTT in predicting the mode of delivery can improve the readiness of obstetric units for operative interventions and minimize intrapartum complications. Future studies can be directed to evaluate the combined use of FASTT, EFW, and AC in a multimodal prediction model for LGA in GDM to achieve higher precision.

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