Original Article

Association between fetal weight and amniotic fluid index in women of Central India

Nitin Wadnere, Susmit Kosta[1], Ravindra Kumar[1]

Department of Radiodiagnosis, [1]Central Research Laboratory, Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh, India

Abstract

Background: The placenta is important for fetal growth and well-being. Defective placentation and impaired placental circulation may result in anomalies in fetal growth. Placental volume in the second trimester appears to be closely related to the neonatal weight. The association of body weight with urine output has been observed in human neonates. Our goal is to assess the association of the amniotic fluid index (AFI) with the estimated fetal weight (EFW).

Materials and Methods: Thirteen hundred and ninety-three pregnant women were prospectively studied by means of an ultrasound over a 12–month period. The fetal weight (FW) was estimated using a combination of fetal parameters – bi-parietal diameter, fetal trunk cross-sectional area, and femur length. AFI was assessed using the four quadrant method. The level of statistical significance was set at $P \leq 0.05$.

Results: There was no statistically significant association between AFI and EFW ($P > 0.05$; $r = 0.413$). We also did not find a significant association between AFI and EFW for all subdivisions of gestation age, except in the 24 – 28 weeks and 29 – 32 weeks' groups.

Conclusion: The FW calculations and amniotic index show a variation in values in late pregnancy. There does not appear to be a linear association between the ultrasound estimate of FW and the amniotic index. The implication of this is that the fetal size need not be taken into cognizance when alterations in amniotic fluid values are noted.

Key Words: Amniotic fluid index, fetal weight, ultrasound

Address for correspondence:
Dr. Nitin Wadnere, Department of Radiodiagnosis, Sri Aurobindo Medical Collage and PG Institute, Indore - Ujjain State Highway near MR10 Crossing, Sanwer Road, Indore, Madhya Pradesh, 453 111, India. E-mail: nkwadnere@gmail.com
Received: 02.11.2013, **Accepted:** 06.02.2014

INTRODUCTION

Many different formulae have been used to calculate the gestational age. Two that are commonly used are the Shepard and Hadlock formulae. The Hadlock formula uses head circumference, abdominal circumference, and femur length to estimate the fetal weight (FW).[1] The estimate of random error for this method is plus or minus 15% (second standard deviation). The Shepard formula is based on biparietal diameter (BPD) and abdominal circumference (AC).[2] The EFW once obtained, is compared with the reference ranges. A value between the tenth and ninetieth percentiles is usually considered normal. These cut-offs are used in an attempt to identify fetuses at risk. However, genetic and environmental factors may influence growth, and thus, different populations have different growth curves. Information about the amniotic fluid index (AFI) is very useful in determining the fetal condition.[3,4]

Access this article online	
Quick Response Code:	Website: www.advbiores.net
	DOI: 10.4103/2277-9175.145751

How to cite this article: Wadnere N, Kosta S, Kumar R. Association between fetal weight and amniotic fluid index in women of Central India. Adv Biomed Res 2014;3:243.

Sonographic EFW, especially in late pregnancy, is an important guide in obstetric care. This is particularly important when dealing with growth-restricted or large-for-date babies.[5] Armed with this information, informed decisions about delivery can be taken, thereby minimizing perinatal morbidity and mortality.[6]

The amniotic fluid cushions the fetus from traumatic forces, cord compression, and pathogens, as well as plays an essential role in fetal lung development.[7] In late pregnancy, amniotic fluid production is largely dependent on fetal micturition[8] and renal size in the newborn has been shown to bear a significant association to birth weight.[9] It is, therefore, reasonable to postulate an association between the sonographically determined amniotic fluid index (AFI) and the EFW.

Previous reports have investigated possible associations between the sonographically attained fluid index and the EFW,[10,11] including the influence of AFI on the accuracy of sonographically EFW, among Caucasians. However, such studies are rare among Indians, especially those in Central India. This study has been carried out to establish whether there is an association between the AFI and EFW.

MATERIALS AND METHODS

In a cross-sectional study conducted between May 2012 and June 2013, we analyzed the 1393 pregnant women referred for routine obstetric ultrasound scans to the Department of Radiology, in a tertiary care hospital. All pregnant women randomly enrolled before 12 weeks' gestation and underwent a routine mid-trimester fetal anomaly examination. Each fetus underwent fortnightly fetal biometry and amniotic fluid assessment from 30 weeks' of gestation. The amniotic fluid index was measured using a standard technique.[12] All fetal biometry and AFI measurements were made by the same person (NW) using an Aloka SSD 3500 real-time scanner (Aloka, Tokyo, Japan). The data were analyzed using the Statistical Package for Social Sciences (IBMSPSS 20.0, SPSS Inc., USA). Measurements were stratified into pairs of AFI and EFW as follows: 27 – 29 weeks, 30 – 32 weeks, 33 – 35 weeks, 36 – 38 weeks, and 39 – 41 weeks. An association between EFW and AFI was sought using the Pearson's correlation. The level of significance was set at '*p*' values less than or equal to 0.05.

RESULTS

The mean age of the subjects was 24.9 ± 4.3 years, and 51% were uniparous. Five hundred and thirteen (37%) infants were delivered at 37 weeks' gestation or later. There were no fetal anomalies. Table 1 shows the EFW and AFI in different gestational age groups. There was no significant association between AFI and EFW for all subdivisions of gestation age, except in the 24 - 28 week and 29 - 32 week groups [Table 1]. Overall, there was no statistically significant association between AFI and EFW ($P > 0.05$; $r = 0.413$) for all pairs. Figure 1 shows the scatter plot diagram for all pairs of AFI and EFW, with an r value of 0.413 in each gestational group, respectively.

DISCUSSION

Amino acids form an important nutrient component of amniotic fluid. Maternal caloric consumption may profoundly alter amino acid concentration in the amniotic fluid.[13] The rise in mean AFI seen in this series after maternal intravenous infusion of amino acids is indicative of possible intrauterine nutrient deficiency.[14]

Prematurity increases the risk of an adverse neonatal outcome and oligohydramnios is significantly increased in both spontaneous and indicated preterm deliveries, as compared to term controls.[15] Amniotic fluid disorders, oligohydramnios, and polyhydramnios have been associated with intrauterine growth restriction

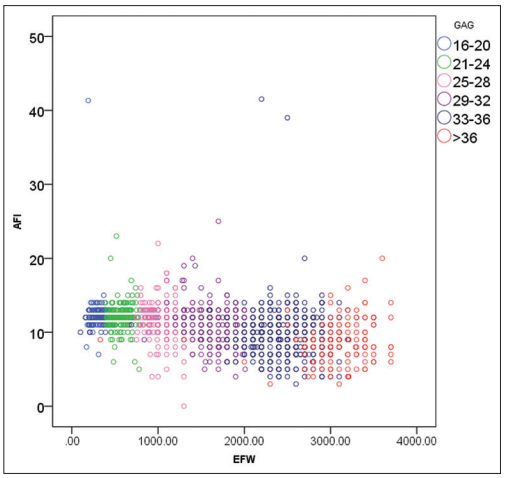

Figure 1: Association between the amniotic fluid index and estimated fetal weight in all gestational pair groups

Table 1: Correlation of the amniotic fluid index and estimated fetal weight

Gestational age (weeks)	Number of patients	Estimated fetal weight (g)	Amniotic fluid index	*r*, *P*
16-20	138	370.9±32.08	12.27±2.79	−0.116, 0.177
21-24	178	571.23±8.0	12.14±1.90	0.008, 0.920
25-28	210	1051.6±15.5	11.70±2.44	−0.148,0.032
29-32	236	1652.3±17.2	10.95±2.66	−0.167,0.010
33-36	490	2485.6±15.4	9.68±3.12	−0.040, 0.378
36	136	3086.7±34.9	8.80±2.89	0.165, 0.055

r=Pearson correlation coefficient

and abnormal fetal growth, but this association across the entire range of FWs is unclear.[16] However, when used alone, amniotic fluid measurement has been found to perform poorly in predicting fetal distress, fetal growth restriction or low Apgar scores, among others. It also has a wide range of reference values.[6] Polyhydramnios and oligohydramnios could overestimate or underestimate sonographic FW assessment.[17] Even as there are reports of AFI measurements and ultrasound EFWs,[18-20] there are few reports that assess the possible association between AFI and the estimated weight.[5,16,17,21]

As expected, an increase in FW was noticed throughout pregnancy, but there was no significant association between AFI and EFW when all the AFI and EFW pairs in the gestational group were considered ($P > 0.05$; $r = 0.413$). This lack of significant association between AFI and EFW across all gestational age strata is supported by the works of Perni *et al*., and Owen *et al*.,[3,6] The possible reasons adduced for this are that swallowing and urinating mechanisms, rather than fetal size, are more involved in the regulation of amniotic fluid volume. The implication of this is that fetal size may not need to be considered in variations of amniotic fluid volume across the gestational ages.

It is interesting to note that Kofinas and Kofinas,[21] in 2012, found a significant association between AFI and EFW for both diabetic and non-diabetic pregnancies. Although no explanation was offered for the former, it was postulated that fetuses of diabetic pregnancies spend more time breathing than swallowing. As swallowing and breathing are mutually exclusive, the fetuses do not swallow as much amniotic fluid as expected. Thus in diabetic pregnancies, it may be necessary to consider fetal size when interpreting amniotic fluid variations across gestational ages.

This present report on association between amniotic fluid and estimated fetal weight is probably the first among pregnant women in Central India, and therefore, raises the need for more studies on the subject, especially with larger sample sizes. It has nonetheless supported a majority of views of similar studies in foreign literature that reported the non-dependence of amniotic fluid measurements on the estimated fetal size by ultrasound.

CONCLUSION

This study has produced a range of values of AFI and EFW among Central India. However, no significant association exists between these parameters. Therefore it is suggested that the fetal size need not be taken into account when alterations in amniotic fluid values are noted.

REFERENCES

1. Hadlock FP, Harrist RB, Sharman RS, Deter RL, Park SK. Estimation of fetal weight with the use of head, body and femur measurements -a prospective study. Am J Obstet Gynecol 1985;151:333-7.
2. Shepard MJ, Richards VA, Berkowitz RL, Warsof SL, Hobbins JC. An evaluation of two equations for predicting fetal weight by ultrasound. Am J Obstet Gynecol 1982;142:47-54.
3. Manning FA, Hill LM, Platt LD. Qualitative amniotic fluid volume determination by ultrasound: Antepartum detection of intrauterine growth retardation. Am J Obstet Gynecol 1981;139:254-8.
4. Masuzaki H. Fetal diagnosis. Acta Med Nagasaki 2007;52:1-6.
5. Durbin AS, Lee CW, Parker GV. The effect of amniotic fluid index on the accuracy of sonographic estimated fetal weight. J Diagn Med Sonogr 2005;21:329-35.
6. Ikubor JE. Correlation of sonographically estimated birth weight and actual birth weight among pregnant women at the University of Benin Teaching Hospital. Nigeria: National Postgraduate Medical College of Nigeria (FMCR) Dissertation; 2011.
7. Perni SC, Predanic M, Cho JE, Kalish RB, Chasen ST. Association of amniotic fluid index with estimated fetal weight. J Ultrasound Med 2004;23:1449-52.
8. Gilbert WM, Moore TR, Brace RA. Amniotic fluid volume dynamics. Fetal Med Rev 1991;3:89-104.
9. Adeyekun AA, Ibadin MO, Omoigberale AI. Ultrasound assessment of renal size in healthy term neonates: A report from Benin City, Nigeria. Saudi J Kidney Dis Transpl 2007;18:277-81.
10. Adeyekun AA, Awosanya GG. Relationship between amniotic fluid index and ultrasound estimated fetal weight in healthy pregnant African women. J Clin Imaging Sci 2013;3:1-4.
11. Owen P, Osman I, Farrell T. Is there a relationship between fetal weight and amniotic fluid index? Ultrasound Obstet Gynecol 2002;20:61-3.
12. Phelan JP, Smith CV, Broussard P. Amniotic fluid volume assessment using the four-quadrant technique in the pregnancy between 36 and 42 weeks' gestation. J Reprod Med 1987;32:540.
13. Underwood M, Sherman M. Nutritional characteristics of amniotic fluid. Neo Rev 2006;7:e310.
14. Qureshi FU, Yusuf AW. Intravenous Amino Acids in Third Trimester Isolated Oligohydramnios. Annals 2011;17:140-4.
15. Yuan W, Duffner AM, Chen L, Hunt LP, Sellers SM, Bernal AL. Analysis of preterm deliveries below 35 weeks' gestation in a tertiary referral hospital in the UK. A case-control survey. BMC Res Notes 2010;3:119.
16. Perni SC, Predanic M, Cho JE, Kalish RB, Chasen ST. Association of amniotic fluid index with estimated fetal weight. J Ultrasound Med 2004;23:1449-52.
17. Owen P, Osman I, Farrell T. Is there a relationship between fetal weight and amniotic fluid index?. Ultrasound Obstet Gynecol 2002;20:61-3.
18. Agwu KK, Agbo JA, Okoye IJ, Ogbu SO. Sonographic assessment of normal amniotic fluid volume in pregnant Nigerian women. Trop J Obstet Gynaecol 2007;24:39-44.
19. Moore TR, Cayle JE. The amniotic fluid index in normal human pregnancy. Am J Obstet Gynecol 1990;162:1168-73.
20. Ali HS. Assessment of amniotic fluid index in normal pregnancy at a tertiary care hospital setting. J Ayub Med Coll Abbottabad 2009;21:149-51.
21. Kofinas A, Kofinas G. Differences in amniotic fluid patterns and fetal biometric parameters in third trimester pregnancies with and without diabetes. J Matern Fetal Neonatal Med 2006;19:633-8.

Source of Support: Nil, **Conflict of Interest:** None declared.