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ORIGINAL ARTICLE

A Comparative Study of Gravidogram and Ultrasound in Detection of IUGR

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Abstract
Objectives The present study was conducted to compare the gravidogram and ultrasound in the detection of intrauterine growth restriction.
Methods This study was conducted in the Department of Obstetrics and Gynecology, Voluntary Health Services, Chennai (TN) from August 2007–May 2009. The study included 321 women with singleton pregnancy in a longitudinal lie. These women underwent serial symphysio-fundal height measurements and ultrasound. Birth weights of the newborns were noted at the time of delivery. Gravidogram and ultrasound findings were correlated with the birth weights.
Results The sensitivity of the ultrasound in the detection of IUGR was higher (85.2 vs 74.1 %) than the gravidogram, but the specificity was almost the same (96.6 and 95.9 %).
Conclusions The gravidogram is a simple and inexpensive screening tool and as useful as an ultrasound in detection of intrauterine growth restriction. Both gravidogram and ultrasound, when used together, have higher detection rates.

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Introduction

With a gradual reduction in maternal mortality rates in both developed and developing countries, attention has shifted to perinatal outcome. The perinatal mortality rate gives an index of obstetric and pediatric services available in a country. A progressive increase in both perinatal mortality and morbidity is observed as birth weight percentile falls [1]. The early detection of intrauterine growth restriction is therefore important to institute specific treatment wherever possible or appropriate timed delivery to reduce neonatal morbidity and mortality.

In a developing country like India, sophisticated methods of monitoring are not available in all centers. So, a simple sensitive clinical method like gravidogram is of utmost importance. The gravidogram system is designed for supervision of pregnancy by means of a graphic comparison between changes in maternal symphysio-fundal height, abdominal girth, weight and known normal values. Normal growth charts are constructed for each population as these parameters are population-specific. This is used for monitoring fetal growth in pregnancy, especially high-risk pregnancy, to see if the growth curve falls within normal limits. The serial symphysio-fundal height measurements are reported by Westin [2] to have 75 % accuracy in detecting small for date infants, and symphysio-fundal

height measurements were found to be superior to both HPL and urinary estriol in detecting retarded fetal growth. In 1987, Pearce and Campbell [3] reported that the sensitivity of the symphysio-fundal height measurement (76 %) was only slightly less than that of a single measurement of fetal abdominal circumference by ultrasound in the third trimester (83 %) in the detection of intrauterine growth restriction. An impressive fall in perinatal mortality was demonstrated by Westin in 1977 following the introduction of the gravidogram.

Objective

The study was undertaken with the aim to compare the gravidogram and the ultrasound in the detection of intrauterine growth restriction.

Materials and Methods

This study was conducted in the Department of Obstetrics and Gynecology, Voluntary Health Services, Chennai. All women attending the antenatal clinic after 24 weeks of pregnancy with singleton pregnancy in a longitudinal lie were included in the study, excluding those with hydramnios, fetal anomalies, and diabetes complicating pregnancy.

The symphysio-fundal height measurements were taken with the women in supine position with the legs straight and the bladder empty. The uterine height was measured with a nonelastic tape; the highest part of the uterus was identified by gentle palpation. The zero of the tape was placed at this point. The upper border of the pubic symphysis was then palpated and the tape placed over this point and the measurement in centimeters recorded. These measurements were plotted on a graph constructed for the South Indian population at CMC, Vellore. All women had their subsequent symphysio-fundal height measurements taken during all visits. All women underwent routine ultrasound examinations also. The birth weights of the newborns at delivery were noted. The birth weights were compared with the nomogram for the South Indian population from Kerala for classifying as IUGR.

Results

The results were analyzed by dividing these women in two groups:

Group 1: 54 women had growth-restricted babies (babies with a birth weight of less than the 10th percentile for the population).

Group 2: 267 women had their babies with a birth weight between the 10th and 90th percentile for the population.

The incidence of IUGR in the present study was 16.8 %. The annual statistics for the year 2008–09 showed an incidence of 14.6 % in the hospital.

A majority of the women in this study belonged to the lower socioeconomic class. Among them, 47 (19.1 %) women had growth-restricted babies. There were 6 (11.3 %) women in the middle income group and 1 (4.5 %) in the higher income group with the birth weight of their babies being less than the 10th percentile. The low income group women showed a statistically significant increase in the incidence of IUGR (Table 1).

This study shows that 35 (21.2 %) of the nulliparous women had growth-restricted babies. There were 18 (13.2 %) women with growth-restricted babies among the primiparas. Among women with a parity of two, there was 1 (5.9 %) woman with an IUGR baby. Statistical significance was found between the groups in relation to parity. Nulliparous women had a significantly higher incidence of growth-restricted babies ($p < 0.03$) (Table 2).

In group 1, there were 16 (29.6 %) women who had normal vaginal delivery, 7 (13 %) women had instrumental vaginal delivery, and 31 (57.4 %) had cesarean section. Among the women in group 2, 95 (35.6 %) had normal vaginal delivery, 26 (9.7 %) had instrumental delivery ,and 146 (54.7 %) had cesarean section. The difference in the mode of delivery among the two groups was not statistically significant. Although the cesarean section rates were almost similar in both the groups, it was found that the most common indication in the IUGR group was fetal distress—20 out of 31 cases (64.9 %)—whereas in babies with a normal birth weight, there were 58 (39.7 %) cesarean sections for fetal distress.

The sensitivity of the gravidogram was found to be 74.1 %, specificity was 95.9 %, positive predictive value was 78.4 %, and negative predictive value was 94.8 % (Table 3).

The detection of IUGR by the ultrasound in this study had a sensitivity of 85.2 %, specificity of 96.6 %, positive predictive value of 83.6 %, and negative predictive value of 97 % (Table 4).

The sensitivity of both the gravidogram and the ultrasound combined together was 88.1 %, specificity was 98.8 %, positive predictive value wad 92.5 %, and negative predictive value was 98 % (Table 5).

Table 1 Socioeconomic status

SE status	Total	Group 1	Group 2	*p* value
Low	246	47 (19.1 %)	199 (80.9 %)	0.048
Middle	53	6 (11.3 %)	47 (88.7 %)	0.24
High	22	1 (4.5 %)	21 (95.5 %)	0.12

Table 2 Distribution of parity

Parity	Total	Group 1	Group 2	*p* value
Nulliparous	165	35 (21.2 %)	130 (78.8 %)	0.03
Para 1	136	18 (13.2 %)	118 (86.8 %)	0.14
Para 2	17	1 (5.9 %)	16 (94.1 %)	0.22
Para 3	3	0 (0 %)	3 (100 %)	–

Table 3 Correlation of gravidogram with birth weight

Gravidogram	IUGR	Normal
Positive	40 (True positive)	11 (False positive)
Negative	14 (False negative)	256 (True negative)

Table 4 Correlation of ultrasound with birth weight

Ultrasound	IUGR	Normal
Positive	46 (True positive)	9 (False positive)
Negative	8 (False negative)	258 (True negative)

Table 5 Correlation of combined gravidogram and ultrasound with birth weight

Gravidogram and ultrasound	IUGR	Normal
Positive	37 (True positive)	3 (False positive)
Negative	5 (False negative)	250 (True negative)

Discussion

Fetal growth restriction is an important and often underdiagnosed complication of pregnancy with important implications for maternal-, infant-, child-, and later health. The key to prevention of fetal growth restriction is recognition of those women at risk and implementation of effective interventions. Intrauterine treatments offer limited benefits to the baby with IUGR. The key to management is likely to be optimizing the conditions of delivery and minimizing neonatal morbidity as much as possible. In this study of 321 antenatal women conducted in Voluntary Health Services, the following observations were made.

This study showed that the risk of intrauterine growth restriction increased with increasing socioeconomic disadvantage. A similar conclusion was drawn by Beard JR et al. [4] in their study which stated that socioeconomic disadvantage remains one of the dominant determinants of SGA.

In this study, nulliparous women were found to have an increased incidence of growth-restricted babies, which was statistically significant ($p < 0.05$). In their study, Shonam-Vardi et al. [5] suggested that primiparity constituted an independent risk factor for IUGR. The rates of IUGR were 3.5 % among primiparae and 1.7 % in multiparae (Risk ratio = 1.99; 95 % confidence interval, 1.69–2.35).

In this study, no difference was found in the cesarean section rates between the two groups. However, the most common indication for cesarean section in women with growth-restricted babies was fetal distress, whereas in women with a baby weight appropriate for the gestational age, previous cesarean section was the most common indication. In a study by Driul et al. [6], it was found that women with intrauterine growth restriction underwent cesarean sections more often than women with appropriate fetal growth selected as controls ($p < 0.05$).

Out of the 54 women with growth-restricted babies, 40 could be identified with the gravidogram which gave a sensitivity of 74.1 % to the test. Similarly, on calculation, the gravidogram was found to have a specificity of 95.9 %, positive predictive value of 78.4 %, and a negative predictive value of 94.8 %.

In this study, it was found that the sensitivity of the ultrasound in the detection of fetal growth restriction was 85.2 %, the specificity was 96.6 %, positive predictive value was 83.6 %, and negative predictive value was 97 %. Baschat and Weiner [7] showed that a low AC percentile had the highest sensitivity (98.1 %) for diagnosing IUGR (birth weight < 10th percentile). The sensitivity of EFW (birth weight below the 10th percentile) is 85.7 %; however, an AC below the 2.5 percentile had the lowest positive predictive value (36.3 %), while a low EFW had a 50 % positive predictive value. Pearce [3] showed that the sensitivity of the AC measurement (83 %) was slightly better than that of the SFH measurement (76 %), but this difference was not statistically significant.

In this study, when both the gravidogram and the ultrasound were combined, the sensitivity increased to 88.1 %. Similarly, the specificity increased to 98.8 %, positive predictive value to 92.5 %, and negative predictive value to 98 %. Pearce [3] showed that screening with both tests and predicting IUGR with abnormal results from either test improved the sensitivity to 93 %, but as expected decreased the specificity to 67 % and the positive predictive value to 32 %.

Conclusion

Although the ultrasound was found to be slightly better than the gravidogram, the gravidogram is a simple, inexpensive, and sensitive screening test. Its routine use should be emphasized for the detection of IUGR in a developing country like India where health institutions

with sophisticated technology are often inaccessible to the majority of women. This method could also be taught to the paramedical personnel who can use it to monitor fetal growth in the periphery so that cases of growth restriction can be referred early to tertiary level care centers. However, wherever expertise in ultrasound facilities is available, a combination of both the gravidogram and the ultrasound examination will improve the detection rates and perinatal outcome.

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