



"ASSESSMENT OF FETAL RIGHT PORTAL VEIN DIAMETER BETWEEN 30 TO 35 WEEKS GESTATION AND ITS ASSOCIATION WITH PREDICTING SMALL FOR GESTATIONAL AGE AT BIRTH."

Dr. Akhila Gavini*	Post Graduate, Department of Radiodiagnosis, KIMS& RF, Amalapuram. *Corresponding Author
Dr. Akshay B	Professor & HOD, Department of Radiodiagnosis, KIMS& RF, Amalapuram.
Dr. Kucherlapati Lohith Sai Varma	Assistant Professor, Department of Radio diagnosis, KIMS & RF, Amalapuram.
Dr. Bharath Kakileti	Assistant Professor, Department of Radiodiagnosis, KIMS& RF, Amalapuram.
Dr. Jyothsna Nukala	Post Graduate, Department of Radiodiagnosis, KIMS& RF, Amalapuram.
Dr. Sampat Kumar. B. V	Post Graduate, Department of Radiodiagnosis, KIMS& RF, Amalapuram.

ABSTRACT

Purpose: This study aimed to evaluate the utility of measuring fetal right portal vein (RPV) diameter during the third trimester as a predictor for small for gestational age (SGA) fetuses, defined as those below the 10th percentile for their gestational age. **Aim:** To assess fetal right portal vein (RPV) diameter at gestation age of 30 to 35+6 and explore its utility in predicting small for gestational age (SGA) fetuses. **Methods And Materials:** The study included 126 pregnant women between 30-35+6 weeks of gestation. Each participant received a third-trimester ultrasound that included assessments of fetal biometry, amniotic fluid volume, cardiac activity, and RPV diameter. Neonatal outcomes were evaluated after delivery to assess the predictive value of RPV measurements. **Results:** The study identified a positive correlation between RPV diameter and gestational age. A threshold of 2.95 mm was established for diagnosing SGA. Combining RPV diameter with estimated fetal weight (EFW) improved sensitivity to 71.43% and specificity to 87.14% for predicting SGA, compared to using either measurement alone. **Conclusion:** RPV diameter above 2.95 mm serves as an effective tool for predicting normal fetal growth. When combined with EFW, it enhances the prediction accuracy for detecting SGA fetuses, offering a practical method for prenatal screening.

KEYWORDS :

INTRODUCTION:

Small for gestational age (SGA) refers to fetuses that weigh less than the 10th percentile for their gestational age [1]. According to guidelines from pediatric endocrinology societies, infants are classified as SGA if their weight and/or length is more than two standard deviations below the average for their gestational age and sex in the reference population. SGA encompasses growth retardation, characterized by inadequate intrauterine growth due to obstetrics issues, but also constitutionally small fetuses that achieve optimal growth potential later [2].

Identifying small-for-gestational-age (SGA) foetuses is essential for diagnosing foetal growth restriction (FGR). Antenatal management can impact future morbidity and mortality, but only if the condition is properly recognized.

Furthermore, infants born with SGA showed a higher incidence of delayed neurodevelopmental outcomes (up to 2 years) compared to children of average birth weight [3]. Individualized growth assessment (IGA) offers a way to assess fetal growth in specific cases within different birth weight categories [4].

To identify SGA, we calculate Estimated fetal weight (EFW) using ultrasonography as standard method. There seems to be an apparent contradiction in the relationship between estimated fetal weight (EFW) and birth weight (BW). [5]

A classification tool combining biometric parameters and Doppler criteria for placental insufficiency has been developed to correlate with the likelihood of adverse perinatal outcomes[6]. Umbilical artery (UA) Doppler is the established clinical method for assessing placental function and is commonly employed to differentiate between small-for-

gestational-age (SGA) and intrauterine growth restriction (IUGR). However, because it has limited predictive value on its own, uterine artery Doppler should be used alongside other tests to guide clinical decisions [7].

Hougen et al. investigated blood circulation in the liver of near-term fetuses. They observed that the primary venous blood supply to the liver comes from the umbilical vein (UV), with a smaller contribution from the portal vein (PV). In cases of fetal growth restriction (FGR), this circulation was reduced, but compensated for by increased blood flow through the ductus venosus. During hypoxemia, the liver, particularly the right lobe, plays a crucial compensatory role in fetal development by being the first organ to receive blood directly from the placenta. However, accurately measuring hepatic venous perfusion was reportedly challenging[8,9].

Studies by Simeonova-Brachot and others have highlighted the potential of RPV diameter measurements in identifying hypoxia in SGA fetuses, particularly when RPV diameters fall below the 10th percentile [10]. It may serve as a potential marker for a suboptimal fetal environment and an increased risk of small for gestational age (SGA) at birth. During routine third trimester ultrasounds, where abdominal circumference is commonly measured for EstimatedFetalWeight (EFW), if a collapsed RPV is identified, it should raise suspicion for potential growth restriction.

Fatihoglu and Aydin's work further suggested that measurements of umbilical vein (UV), RPV, and portal sinus (PS) could serve as determinants in SGA detection during the second trimester [11].

The study aims to evaluate the fetal right portal vein (RPV) diameter in the third trimester especially the group of

individuals arriving to the hospital between 30 – 35 +/6 weeks of gestation and explore its utility in predicting small for gestational age (SGA) fetuses.

AIMS & OBJECTIVES:

To assess fetal right portal vein (RPV) diameter at gestation age of 30 to 35+6 weeks in pregnant women from Amalapuram who visited KIMS Hospital.

To explore the utility of RPV diameter in predicting small for gestational age (SGA) fetuses.

MATERIALS AND METHODS:

Place of study: Konaseema institute of medical sciences and research foundation, Amalapuram.

Duration Of Study: January 2024 to January 2025.

Consent: The present study was approved by the Ethics Committee of KIMS& RF, Amalapuram. Consent was obtained for the sonographic examinations after providing relevant information to the participants.

Inclusion Criteria:

- Pregnancies with known last menstrual period (LMP).
- Confirmed gestational age before 22 weeks of gestation.

Exclusion Criteria:

- Births occurring at other hospitals
- Multiple gestation
- Fetuses with major anomalies detected by ultrasound,
- Perinatal death.

Sample Size: 126

Study Design: Prospective, Cross-sectional study.

Method Of Collection Of Data:

126 pregnant women who had their antenatal visit at KIMS Hospital between 30 and 35+6 weeks of gestation were included in the study. Each patient underwent a third trimester ultrasound scan that included biometry, amniotic fluid analysis, cardiac activity and measurement of fetal right portal vein (RPV) diameter. Two-dimensional ultrasound images were captured for each fetus.

Fetal biometry was obtained being adhered to ISUOG practice guidelines using Voluson P8 with curved 4–8 MHz array transducer. Transverse abdominal plane images were obtained for each fetus. RPV measurements were assessed taking average diameter at the junction of the umbilical vein and portal sinus, proximal to the anterior and posterior RPV branches. Measurement was parallel to the vessel wall, obtaining three values and calculating the mean. Subjects were followed up until delivery. Neonatal status of the new born was assessed.

A small for gestational age (SGA) fetus was defined as having estimated fetal weight (EFW) below the 10th percentile of Hadlock's in utero reference or below the 10th percentile of WHO guidelines at birth, using localized anthropometric curves.

Statistical Analysis:

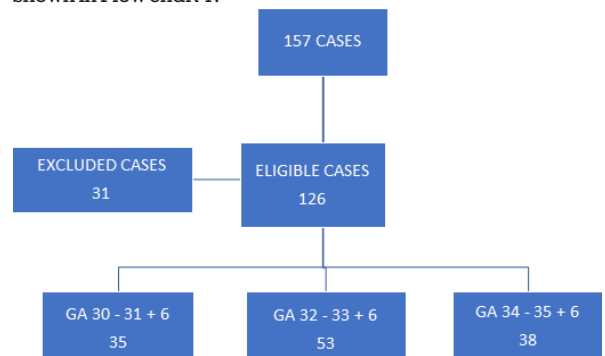
Statistical analysis utilized SPSS version 20.0 and Microsoft Excel 2016. Descriptive statistics included mean, standard deviation and percentiles. Scatter plots illustrated RPV diameter against GA, with percentile values and SDs calculated for RPV diameter. Significance was set at $p < 0.05$. Sensitivity and specificity were obtained for RPV diameter, estimated fetal weight and combined (RPV diameter and EFW) in prediction of small for gestational age. The collected

data will be compiled, tabulated, presented in graphs and will be statistically analyzed using EPI Info. Version 7.2.5.

RESULTS:

This study aimed to assess the foetal RPV diameter in the third trimester. Compared with prior research, RPV diameter in the third trimester surpassed that of the second trimester. RPV diameter growth was evaluated in relation to SGA fetuses, suggesting its potential as a predictive tool. Application of RPV diameter for foetal SGA prediction was straightforward and practical.

A total of 157 singleton pregnant women receiving antenatal care at KIMS, Amalapuram, who met the research criteria, were examined between January 2024 and January 2025. None of the participants had significant fetal or postnatal anomalies. Thirty-one women were excluded from the study as they delivered at other hospitals. The remaining 126 women delivered at KIMS. RPV measurements were taken at gestational ages (GA) of 30–31+6, 32–33+6, and 34–35+6 weeks, with a total of 35, 53 and 38 cases, respectively, as shown in Flow chart 1.



Flow chart: 1 Steps of enrolment in the study.

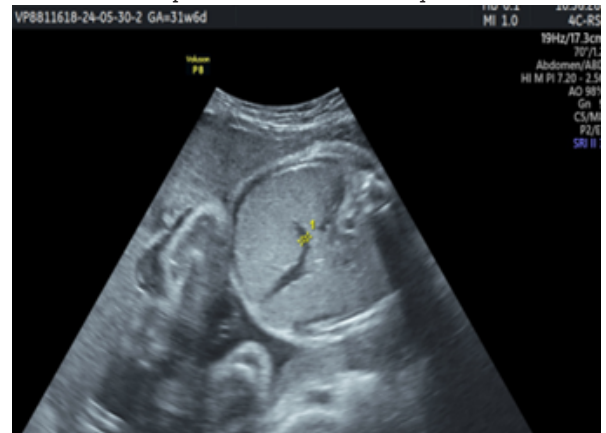


Figure 1 GA – 31 WKS 6 DAYS (RPV – 3.3 mm)

In our study, the average maternal age was 28.4 years, and the average gestational age was 33.0 weeks. 75% were multiparous. The medical records indicated that 4% had a history of small for gestational age (SGA) pregnancies.

The ultrasonographic findings and neonatal outcomes are summarized in Table 1. The average estimated foetal weight (EFW) and RPV diameter were 1874.35 g and 3.50 mm, respectively. A total of 18 cases (14.2%) were identified as SGA.

Table 1 Ultrasound Findings And Neonatal Outcomes

	Mean	SD
GA at ultrasound (week)	32.50	1.53
EFW (g)	1874.35	346
RPV (mm)	3.50	0.81

GA at birth (week)	37.6 1.5
BW at birth (g)	2857.96 784
SGA	18 (14.2%)
Abbreviations: EFW, estimated fetal weight; GA, gestational age; RPV, right portal vein; BW, birth weight; SGA, small for gestational age.	

The normal reference range for foetal RPV diameter (mm) according to gestational age (in days) was established. Table 2 presents the 10th, 50th, and 90th percentiles, as well as the standard deviation (SD) of RPV diameter for each gestational week. RPV measurements ranged from 2.35 to 6.57 mm and increased progressively with gestational age, as depicted in Figure 2.

Table 2 Right Portal Vein Diameter (RPV) By Percentile And SD In Each Gestational Week

GA (weeks)	N (%)	RPV (mm)			SD
		10th	50th	90th	
30-31+6	27.77	2.60	3.20	4.0	0.55
32-33+6	42.06	2.80	3.50	4.38	0.65
34-35+6	30.15	2.90	3.65	5.39	0.93
Abbreviation: GA, gestational age (week). N, Percentage					

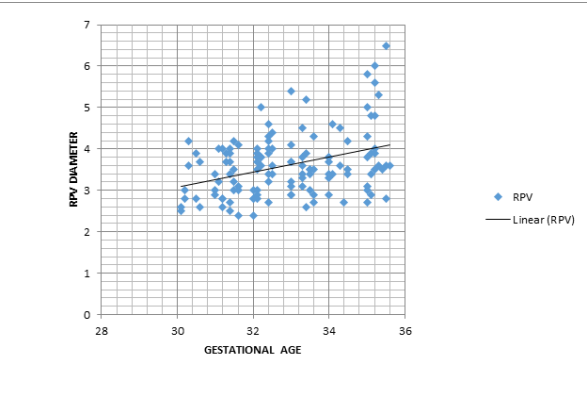


Figure:2 Right Portal Vein Diameter (RPV) Measurement According To Gestational Age

The optimal RPV diameter threshold for diagnosing SGA was found to be below 2.95 mm. The sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 42.86%, 93.88%, 66.67%, and 85.19%, respectively. These values were also determined for estimated fetal weight (EFW) and the combined test (RPV diameter + EFW). The study suggested that the sensitivity and specificity was of high value 71.43% and 87.14 %, respectively when both RPV diameter and EFW were combined to predict SGA fetuses.

Table 3 Diagnostic Performance Of RPV Diameter & EFW For Predicting SGA In The Study Population

	Sensitivity	Specificity	PPV	NPV
RPV 2.95mm	42.86	93.88	66.67	85.19
US EFW	51.85	95.96	77.78	87.96
Combine test (RPV 2.95 mm + US EFW)	71.43	97.14	83.33	94.44
Abbreviations: EFW, estimate fetal weight, NPV, negative predictive value; PPV, positive predictive value; RPV, right portal vein; US, ultrasonography.; Combine test: RPV 2.95 mm + US EFW.				

DISCUSSION:

The objective of this study was to investigate the potential of assessing the RPV during third trimester obstetric ultrasounds for detecting small for gestational age (SGA) fetuses below the 10th percentile at birth. Our findings show that the right portal vein diameter measurement could be a reliable tool,

offering a valuable complement to the current gold standard in ultrasound diagnostics. The sensitivity of RPV diameter for detecting SGA was relatively low, ranging from 35% to 55% in both current and previous studies.

In the present study among pregnant women in Amalapuram, RPV diameter 2.95 mm had 42.86% sensitivity, aligning with findings. Prediction of SGA remains challenging due to varying estimation accuracy between clinical andultrasound methods. Despite reported discrepancies in fetal weight estimation, combining RPVdiameter with EFW enhanced SGA detection sensitivity to 70.0%.

The results showed that the RPV diameter increased with gestational age. We also compared the growth of the RPV diameter with data from SGA foetus and hypothesized that a small RPV could potentially be used to predict SGA. The use of RPV diameter for predicting SGA in fetuses is straightforward, simple, and offers a practical and useful measurement.

Our findings also revealed a higher prevalence of non-reassuring foetal well-being at term and NICU admissions in the group with RPV diameter measurements below the 10th percentile. Based on this, we inferred that RPV diameter could serve as an early sonographic marker for a suboptimal foetal environment. Therefore, we believe that the presence of a collapsed RPV provides valuable information in differentiating between constitutionally small and growth-restricted fetuses.

The normal RPV diameter could be used as a screening measure to reduce the need for ultrasound-based estimated foetal weight (EFW) assessments in low-risk pregnant women. Although the sample size was larger than in many other studies, it was still not large enough to fully validate RPV measurement as a dependable diagnostic method. The relatively low incidence of SGA (14.2%) in our single-center study suggests that a larger sample size will be necessary in future research to enhance SGA detection rates. Technical factors such as variability between observers, fetal positioning, fetal movements, maternal obesity, and advanced gestation affected measurement accuracy. Additionally, we did not exclude factors that could influence RPV measurements or fetal growth, such as underlying chronic conditions, obesity, or previous SGA history.

CONCLUSION:

RPV diameter increases with gestational age, with a 2.95 mm threshold for RPV diameter predicting SGA with a sensitivity of 42.86%. When combined with estimated fetal weight (EFW), the sensitivity for detecting SGA rises to 70.0%. Hence, RPV measurement proves to be a valuable tool for predicting SGA, and an RPV diameter above 2.95 mm strongly indicates normal fetal growth.

REFERENCES

1. Lee Lees CC, Stampalija T, Baschat A, da Silva CF, Ferrazzi E, Figueras F, et al. ISUOG practice guidelines: diagnosis and management of small-for-gestational-age fetus and fetal growth restriction.

2. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins-Obstetrics and the Society for Maternal-Fetal Medicine. ACOG practice bulletin no. 204: fetal growth restriction.

3. Savchev S, Sanz-Cortes M, Cruz-Martinez R, Arranz A, Botet F, Gratacos E, Figueras F. Neurodevelopmental outcome of full-term small-for-gestational-age infants with normal placental function. Ultrasound in obstetrics & gynecology. 2013 Aug;42(2):201-6.

4. Deter RL, Lee W, Dicker P, Tully EC, Cody F, Malone FD, Flood KM. Third-trimester growth diversity in small fetuses classified as appropriate-for-gestational age or small-for-gestational age at birth. Ultrasound in Obstetrics & Gynecology. 2021 Dec;58(6):882-91.

5. Nicolaides KH, Wright D, Syngelaki A, Wright A, Akolekar R. Fetal Medicine Foundation fetal and neonatal population weight charts. Ultrasound in Obstetrics & Gynecology. 2018 Jul;52(1):44-51.

6. Figueras F, Caradeux J, Crispi F, Eixarch E, Peguero A, Gratacos E. Diagnosis and surveillance of late-onset fetal growth restriction. American journal of obstetrics and gynecology. 2018 Feb 1;218(2):S790-802.

7. Martinez-Portilla RJ, Caradeux J, Meler E, Lip-Sosa DL, Sotiriadis A, Figueras

- F. Third-trimester uterine artery Doppler for prediction of adverse outcome in late small-for-gestational-age fetuses: systematic review and meta-analysis. *Ultrasound in obstetrics & gynecology*. 2020 May;55(5):575-85.
8. Haugen G, Kiserud T, Godfrey K, Crozier S, Hanson M. Portal and umbilical venous blood supply to the liver in the human fetus near term. *Ultrasound in obstetrics & gynecology*. 2004 Nov;24(6):599-605.
 9. Kessler J, Rasmussen S, Godfrey K, Hanson M, Kiserud T. Fetal growth restriction is associated with prioritization of umbilical blood flow to the left hepatic lobe at the expense of the right lobe. *Pediatric research*. 2009 Jul;66(1):113-7.
 10. Simeonova-Brachot II. Prediction of SGA at Birth by Using the Right Portal Vein Diameter Measurement at the 30–35-Week Scan. *Journal of Obstetrics and Gynaecology Canada*. 2019 Mar 1;41(3):316-26.
 11. Fatihoglu E, Aydin S. Diagnosing Small for Gestational Age during second trimester routine screening: Early sonographic clues. *Taiwanese Journal of Obstetrics and Gynecology*. 2020 Mar 1;59(2):287-92.