

348 Fetal cardiac imaging in early gestation: what can be seen and when?

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OBJECTIVE: The purpose of our study is to determine how frequent a detailed cardiac exam can be obtained in morphologically normal fetuses in early gestation.

STUDY DESIGN: Transabdominal fetal echocardiogram was performed on 121 women between 11+0 and 14+6 weeks of gestation. Exclusion criteria included fetal anomalies, maternal age <18, BMI >30, and multifetal gestations. The cardiac examination included assessment of the following eight planes: abdominal circumference (situs), four-chamber view (4CV), left ventricular outflow tract (LVOT), right ventricular outflow tract (RVOT), three-vessel-trachea view (3VTV), aortic arch (AoA), ductal arch (DA), and right atria inflow view (RA inflow).

RESULTS: Successful visualization of each diagnostic cardiac plane as well as a complete exam increased with gestational age (see table). At 11+0 to 11+6 weeks of gestation the ability to perform a complete exam was 16.7% compared to 75% at 14+0 to 14+6 weeks of gestation. The 4CV plane had the highest visualization rate at each gestational age.

CONCLUSION: The four-chamber cardiac view can be obtained in the majority of first trimester ultrasound exams. In our study, over half of the cases achieved a complete cardiac exam in the first trimester. Detailed sonographic evaluation of fetal cardiac anatomy including multiple cardiac planes is possible in 1st and early 2nd trimester of pregnancy and may help improve the detection of congenital heart anomalies in early gestation.

Visualization rate (%) of different diagnostic cardiac planes

GA, weeks	N	Situs	4CV	LVOT	RVOT	3VTV	AoA	DA	RA inflow	Full examination
11+0-11+6	18	83.3	83.3	50.0	55.6	72.2	50.0	66.7	33.3	16.7
12+0-12+6	61	93.4	95.1	54.1	65.6	85.6	73.8	63.9	50.8	46.2
13+0-13+6	26	100	100	84.6	88.5	92.3	76.9	73.1	69.2	65.4
14+0-14+6	16	100	100	87.5	93.8	100	93.8	87.5	81.3	75.0

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349 Abnormalities in anatomic components of the three-vessel-trachea view in various congenital heart defects

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OBJECTIVE: The purpose of this study is to evaluate abnormalities in anatomic components of the three-vessel-trachea view (3VTV) in various congenital heart defects.

STUDY DESIGN: One hundred and twenty-six congenital heart anomalies were detected between January 2006 and August 2009 in the Fetal Diagnostic Center at Eastern Virginia Medical School. Fetal echocardiograms, which incorporated the 3VTV, were performed between 16 and 32 weeks gestation. Assessment of anatomic components of the 3VTV included analysis of the vessel number, size, alignment, and arrangement as well as the anatomic location of the aortic arch in relation to the trachea. In addition, Color Doppler was used to detect blood flow patterns. Prenatal diagnosis was confirmed in all cases by postnatal echocardiography, angiography, operative findings, or autopsy.

RESULTS: Ninety-one cases (72.2%) of the 126 congenital heart defects revealed abnormalities at the 3VTV. Thirty-five had a normal 3VTV (27.8%). The most frequent abnormality was that of vessel size discrepancy which was noted in 70 of the 91 cases (76.9%). Abnormal

vessel number was found in 43 of 91 fetuses (47.3%). Abnormal anterior-posterior vessel alignment and vessel arrangement was seen in 35 (38.5%) and 8 cases (8.8%) respectively. Abnormal blood flow patterns within the great vessels were identified in 59 cases (64.8%). Abnormal relationship of the of ductal and the aortic arches to the trachea was observed in 21 cases (23%). In 27 of 91 fetuses only one component of the 3VTV was affected. However, 64 fetuses showed multiple abnormalities of the 3VTV. In 73 cases, the 3VTV provided additional information critical to postnatal management. Furthermore, in 18 congenital heart defects the 3VTV was the only abnormality noted on fetal echocardiogram.

CONCLUSION: The 3VTV is an essential component to fetal echocardiography as it adds significantly to the complete diagnosis of heart defects. Furthermore, in some cases of congenital heart defects, anatomic abnormalities are isolated to the 3VTV.

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350 Development of a customized fetal growth standard for a Mid-Western American population

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OBJECTIVE: To derive coefficients for developing a customized growth chart for a Mid-Western American population.

STUDY DESIGN: Retrospective cohort study of an ultrasound database with 72,422 births between 1990-2008. After exclusion of preterm births, congenital anomalies, multifetal pregnancies, stillbirths and records with incomplete data, we defined a database of 50,527 pregnancies. Coefficients for significant physiological and pathological variables affecting fetal growth were derived using backward stepwise multiple regression. Results were expressed for a standard mother (first pregnancy, height 163 cm, weight 64kg, European ethnic origin).

RESULTS: The growth potential expressed as weight at 40 weeks in this population was 3521g (standard error: 402g). Significant physiological variables influencing fetal growth included maternal height (per cm: $7.3 + 0.068^2 - 0.004^3$); weight (per kg: $8.15 - 0.119^2 + 0.001^3$); parity (1: +109.4g; 2: +134.4g; 3: 151.6g; 4:152.6g); male/female gender (+/- 68.9g); ethnicity (African-American: -219.6g; Indian: -156.3g; Middle East -112.5; Jewish-European: -86.1). Significant pathological factors affecting fetal growth were smoking (-213.9g), gestational diabetes (+93.6g), abruption (-105.1g) and hypertensive disorders (-52.3g). In addition, low as well as high maternal body mass index (BMI) were significantly associated with reduced birthweight at term (BMI <20: -21.2g; >30: -29.4g).

CONCLUSION: Our findings validate previous studies implicating physiological and pathological factors in fetal growth. The derived coefficients allow the determination of customized growth potential individually adjusted, excluding known pathological factors.

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351 Prenatal assessment of the fetal thymus: utility of 2D and 3D ultrasound in healthy fetuses

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OBJECTIVE: To present the normative data of the volume of the developing fetal thymus and compare fetal thymus volume by 3D ultrasound (3D-US) with 2D ultrasound (2D-US) measurements.

STUDY DESIGN: We studied 135 consecutive normal singletons between 18 and 38 weeks gestation, measuring thymic maximum transverse diameter (MTD) anterior-posterior diameter (APD), superior-inferior diameter (SID), maximum transverse area (MTA) based on previously described methods. Thymus volume (TV) was obtained by 3D-US using VOCAL. Linear regression was used to assess the correlation between individual measurements corrected for estimated fetal weight and the gestational age (GA). A $p < 0.05$ was considered statis-

tically significant. Institutional review board approval obtained prior to the study.

RESULTS: Ultrasound assessment of the fetal thymus was possible in 90.4% of the cases. Both 3D-US and 2D-US measurements were significantly correlated with GA (TV $r = 0.97$, $P < 0.001$; MTA $r = 0.79$; MTD $r = 0.49$; APD $r = 0.57$; SID $r = 0.45$; all $p < 0.01$).

CONCLUSION: We present the first normative data of the volume of the developing fetal thymus. 3D-US fetal thymus volume can be obtained in a majority of cases and is more significantly correlated to GA than the MTD, APD, AID and MTA. Assessment of the fetal thymus may be indicated where conditions that could affect the thymic size are suspected (e.g. fetal infections, diGeorge syndrome).

3D Fetal Thymus Volume (mL) During Pregnancy

GA	Percentile		
	5th	50th	95th
18-20	0.93	1.52	2.03
20-22	1.76	2.03	2.45
22-24	2.13	2.39	3.37
24-26	3.70	4.35	4.53
26-28	4.27	5.40	5.60
28-38	6.27	7.27	9.47

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352 Ultrasound prediction of growth abnormalities in fetuses with gastroschisis

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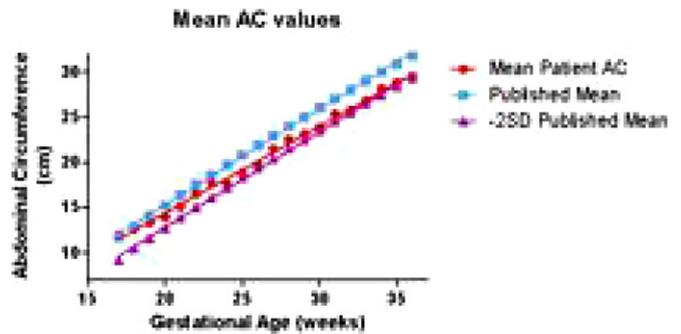
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OBJECTIVE: To determine if 1) mean abdominal circumference (AC) of fetuses with gastroschisis are smaller from published normative values and whether 2) diagnosis of AC < 5th percentile is supported by postnatal diagnosis of small for gestational age (SGA).

STUDY DESIGN: This was a retrospective review of pregnancies complicated with gastroschisis between 2000 and 2008. AC was classified as < 5th percentile or > 5th percentile on the final sonogram prior to delivery. Intrauterine growth restriction (IUGR) was defined as EFW < 10th percentile. SGA was defined as neonatal birthweight < 10th percentile.

RESULTS: Three hundred sixty eight ultrasound observations, performed in 74 fetuses with gastroschisis, were used for analysis. Mean AC of fetuses with gastroschisis were between the 5th and 50th percentile for gestational age. Of the 30 (40.5%) patients with AC measurements < 5th, 15 (50%) were SGA at delivery. Eleven of the 74 fetuses (15%) were classified as IUGR and all were SGA postnatally.

CONCLUSION: Mean AC values in fetuses with gastroschisis were below the mean for population established norms. EFW is a better predictor of SGA than AC < 5th percentile. Established biometric curves can be used to evaluate in utero growth patterns in fetuses with gastroschisis.



Gastroschisis: Mean Abdominal Circumference

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353 Sonographic predictors of fetal fat accretion

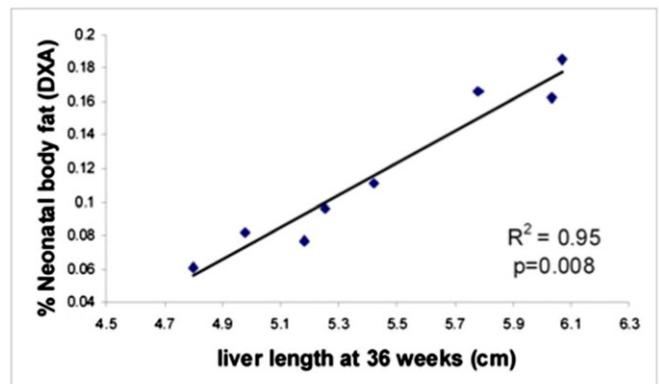
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OBJECTIVE: Data suggest that the in-utero environment affects neonatal body composition which is predictive of childhood obesity and metabolic syndrome. Percent fat at birth correlates poorly with birthweight (BW) and is more predictive than BW of offspring metabolic complications in later life. There are few data on the use of ultrasound (US) to predict neonatal adiposity yet US remains the basis for predicting abnormal growth and is necessary for any future fetal-based strategy. This study was undertaken to evaluate US measures of fetal adiposity and to correlate them with neonatal body composition.

STUDY DESIGN: Obese and normal weight women carrying normal singleton pregnancies were prospectively enrolled at 14 weeks. Multiple US measures of fetal size and fat accretion (subcutaneous tissue area) were performed at 28 and 36 wks. These were compared with BW and with neonatal body composition as measured by dual x-ray absorptiometry (DXA).

RESULTS: Among 9 women enrolled in the study, neonatal body composition ranged from 6-19% fat and correlated poorly with birth weight ($R^2 = 0.085$, NS). However, body composition correlated well with mid-femur ($R^2 = 0.74$, $p = 0.003$) and mid-humerus ($R^2 = 0.59$, $p = 0.015$) cross-sectional area of subcutaneous (adipose) tissue at 36 weeks, and with femur length ($R^2 = 0.45$, $P = 0.047$) at 28 weeks. The AC at 36 weeks was not predictive of % fat at birth ($R^2 = 0.16$). Liver length at 36 weeks was most predictive of neonatal adiposity with an R^2 of 0.95, $p = 0.008$ (Figure).



Fetal liver length predicts neonatal % body fat

CONCLUSION: This is the first study to demonstrate that fetal liver length and subcutaneous tissue (mid-femur & mid-humerus) correlate with neonatal % body fat. As previously published, BW and neonatal body composition did not correlate. These observations hold