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2381556 Effect of Preeclampsia on Umbilical Vein Blood Volume Flow in a Limited Cohort

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Objectives: Measurement of umbilical vein blood volume flow in normal and preeclamptic maternal subjects using a 3D/4D sonographic method that is independent of traditional pulsed wave Doppler flow limitations and assumptions: eg, beam-to-flow angle, vessel diameter, and vessel flow profile.

Methods: A GE LOGIQ E9 ultrasound system and RAB6-D transducer (2.0–8.0 MHz) were used to acquire multivolume 3D/4D color and power Doppler data. Volumetric flow was computed offline via a user-specified focal c-surface (lateral-elevational) with surface integration of Doppler-measured velocity vectors. Power Doppler data were used to eliminate partial volume effects. Under Institutional Review Board approval, a cohort of 8 normal subjects (singletons; gestation 25.9–34.7 weeks) and 5 preeclamptic subjects (singletons; gestation 29.7–34.3 weeks) were recruited from the University of Michigan Medical Center High-Risk Obstetrics Clinic. Subjects were followed full term, and outcomes were verified. For each subject, average umbilical vein flow was determined from 3 different positions along the cord. Flow measurements were computed using an average of 28 ± 2 (mean ± SD) volumes, and estimates were depth corrected. Weight-normalized flow was computed using the 50th percentile weight (Hadlock et al, *Radiology* 1991; 181:129–133). Cohorts were compared based on absolute flow (mL/min) and normalized flow (mL/min/kg) using an unpaired *t* test.

Results: Absolute flow was 177.5 ± 21.5 and 155.5 ± 7.5 mL/min (mean ± SE) in the normal and preeclamptic cohorts, respectively, with moderate separation between groups ($P = .36$). Weight-normalized flow was 96.2 ± 7.6 and 74.1 ± 4.6 mL/min/kg (mean ± SE) in the normal and preeclamptic cohorts, respectively, with a statistically significant difference ($P = .032$).

Conclusions: Results indicate that weight-normalized umbilical vein blood flow is reduced in preeclamptic subjects and encourage further studies in a larger clinical population. Volume flow measurement with 3D/4D sonography may provide a complementary diagnostic metric to manage at-risk pregnancies. (This work was supported by the AIUM Endowment for Education and Research (Samsung Medison America). Volume flow is under development by the Quantitative Imaging Biomarkers Alliance.)

2384611 The Role of the First-Trimester Maxillary Gap in a Series of 4 Cases in Lebanon

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Objectives: The maxillary gap (MxG) has recently been described as a first-trimester marker for cleft lip and palate (CLP). As such, we sought to assess its role in our population.

Methods: This was a retrospective study carried out by 2 experienced sonologists (R.A.R. and N.H.) on 20 first-trimester fetuses: 4 confirmed cases of CLP each matched with 4 normal controls. There were stored volume data sets on all cases. Outcome was available on all fetuses. R.A.R. retrieved the midsagittal plane for all 20 cases, assessed the images for the MxG, measured it when present, and then deidentified, cropped, and mixed all images. Images were sent for offline analysis to N.H., who was completely blinded to the outcome and the number of affected cases. N.H. was asked to identify the cases with an MxG. The data were analyzed using a Student *t* test. $P < .05$ was considered significant.

Results: The mean crown-rump length was 67.85 mm in the controls and 68.53 mm in the affected fetus ($P = .87$). The mean nuchal translucency was 1.78 mm in the controls and 1.7 mm in the affected fetuses ($P = .65$). Of the 4 cases of CLP, 1 was isolated unilateral, 1 was isolated bilateral, 1 was unilateral with multiple anomalies, and 1 was bilateral with multiple anomalies. The MxG was clearly identified by both sonologists in all 4 cases. The MxG measured >1.5 mm in all 4 cases with CLP. There were no false-positive cases noted by either reviewer.

Conclusions: Even in this small cohort of patients, our study attests to the feasibility of visualizing the MxG and its clinical utility as a new first-trimester marker in the early screening for CLP. Incorporating the MxG into first-trimester screening may enhance the sensitivity for early detection of CLP. However, larger prospective studies are needed to assert its role prior to routine incorporation into the first-trimester anatomy scan.

2384672 The Role of Adjunct Ultrasound Parameters During Antepartum Testing: The Doppler Cerebroplacental Ratio Versus the Amniotic Fluid Deepest Vertical Pocket

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Objectives: Evaluate the role of ultrasound measurement of the deepest vertical pocket (DVP) vs the cerebroplacental ratio (CPR) in fetuses undergoing antepartum testing.

Methods: The antepartum testing records of 534 women who underwent antepartum testing were retrospectively reviewed between 2009 and 2013. All patients underwent a nonstress test, measurement of the DVP, and Doppler evaluation of the resistance index (RI) of the middle cerebral artery (MCA) and umbilical artery (UA). The CPR was computed as follows: RI of the MCA/RI of the UA, with a value <1 considered abnormal. A DVP <2 cm was considered abnormal. The patients were divided into 2 groups at the time of their last antepartum test based on the recommendation of the maternal-fetal medicine specialist: continuation of the pregnancy or recommendation for delivery. The gestational ages of the fetuses evaluated were between 36 and 41 weeks.

Results: Of the 534 pregnancies, recommendations were made for delivery in 23.6%. There were no significant differences in the DVP between those who continued the pregnancy and those in whom delivery was recommended (Table 1). There were no significant differences in the CPR between those who continued the pregnancy and those in whom delivery was recommended for gestational ages between 36 and 38 weeks 6 days. However, in pregnancies at 39 weeks and greater, there was a significant difference ($P < .05$) between those with an abnormal CPR in whom delivery was recommended (13%) vs those in whom continuation of the pregnancy was recommended (2.5%).

Conclusions: The CPR has recently been shown to be a predictor of adverse perinatal and neonatal outcomes. This retrospective study demonstrates that the CPR identified fetuses in whom recommendations were made for delivery at 39 weeks of gestation and greater. Therefore, while the clinician may utilize the DVP as part of antepartum assessment, the CPR may be a useful measurement from 39 weeks onward in evaluating the high-risk fetus.

Table 1

Weeks of Gestation	36–36.+6	37–37+6	38–38+6	38–41
DVP (no delivery vs delivery)	0% vs 0%	0.95% vs 3.8%	0.8% vs 4.3%	1.2% vs 3.1%
CPR (no delivery vs delivery)	6.35% vs 11%	5.1% vs 0%	6.2% vs 12%	2.55% vs 13% ($P < .05$)

2384600 Midwifery Students' Perceptions of the Importance of Ultrasound in Medical Education in Lebanon

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Objectives: Evaluate 4th-year midwifery students' perceptions of the importance of ultrasound (US) before and after the first integrated US course in the midwifery curriculum in Lebanon.

Methods: Responses to precourse and postcourse surveys from 14 enrolled students were collected. Using a 5-level Likert scale, students responded to questions in 5 categories: exposure to US and need of training; role of US in enhancing comprehension of obstetrics (OB) and gynecology (Gyn); importance of US integration into medical education; role of US in their future; and postcourse impressions. Data were analyzed using the Mann-Whitney nonparametric test. $P < .05$ was considered significant.

Results: All students completed precourse and postcourse surveys with an individual response rate >95% to each question. Even though 78% of students agreed/strongly agreed (A/SA) to sufficient exposure to US after the course in comparison to 42.9% before the course ($P = .05$), >85%, both before and after the course, indicated their persisting need for more structured instruction in US. Persisting before and after the course, >95% of students A/SA on the role of US in enhancing their Ob knowledge. On the other hand, their perception toward the role in Gyn declined significantly from ≈75% to 40% ($P = .021$). Students' perceptions were as strong before and after the course on the role of US in medical education and their future clinical practice: >85% of students A/SA to the importance of US integration into their own education and globally, and >95% of students A/SA to the role of US in their future clinical practice. After the course, all students SA to the course benefits and their willingness to serve as future instructors.

Conclusions: Our study demonstrates that US integration into medical education is a positive experience for midwifery students, enhancing their knowledge. Our data indicate the insufficiency of our course in addressing their Gyn needs and the need for earlier and longer structured training in Ob sonography. The student's strong belief in US's clinical applicability in their future, the need for its universal implementation, together with their willingness to serve as future instructors, provide further evidence in support of the importance of global implementation of US in medical education.

2385125 Comparison of Third-Year Medical Students Using Vscan Handheld Ultrasound With Obstetric Sonographers for Determination of Biparietal Diameter and Fetal Lie in Obstetric Patients

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Objectives: The purpose of this study was to evaluate the accuracy of third-year medical students (M3) in measuring fetal biparietal diameter (BPD) and determination of fetal lie (FL) using handheld ultrasound as compared to experienced sonographers using hospital-based ultrasound systems.

Methods: This was a prospective observational study evaluating M3 students' accuracy in measuring BPD and determining FL during the second and third trimesters of pregnancy. M3 students utilized a GE Vscan handheld ultrasound machine during their obstetrics and gynecology clerkship at Eastern Virginia Medical School. During the clerkship, students were required to measure BPD and determine FL on patients determined to need a formal ultrasound exam. Students were asked to perform the ultrasound first unaided, followed by a second-trimester scan by sonographers. Student Vscan assessments were compared with those of 14 experienced American Registry for Diagnostic Medical Sonography–certified obstetric sonographers using traditional ultrasound systems. The 2-tailed Student t test was used to assess statistical significance between the 2 groups via P values and to determine 95% confidence intervals (CIs). For the determination of fetal lie, a κ coefficient statistic was used to determine the level of agreement between sonographers. An a priori estimation of sample size for statistical power was performed utilizing Cohen's delta.

Results: BPD measurements were recorded by 128 students, while 130 students obtained FL (M3 total class size = 155). No statistical difference was noted between the BPD measurements obtained by students versus experienced sonographers ($P = .58$ with difference between the means of –0.11 with a 95%; CI from –0.54 to 0.30). The κ coefficient for inter-rater reliability for assessment of fetal lie was 1.0, resulting in a strong level of agreement between the M3 and obstetric sonographers. The a priori sample size calculation of 128 was met for both measured end points.

Conclusions: Results indicate that M3 students can accurately determine BPD and fetal lie using the Vscan handheld ultrasound machine as compared to experienced sonographers using traditional ultrasound machines.

2385197 Collaboration Between Eastern Virginia Medical School (EVMS) and the Diagnostic Medical Sonography Program at Tidewater Community College in the Implementation of Ultrasound Into the Medical School Curriculum at EVMS

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Objectives: As Eastern Virginia Medical School (EVMS) made the decision to implement an ultrasound component into the existing medical education curriculum, it looked for support and input from a local source of sonography education: Tidewater Community College (TCC). With a well-established and accredited diagnostic medical sonography (DMS) program, TCC was able to offer supporting equipment as well as manpower. This collaboration has proven to be successful for both partners and has highlighted the strengths of both partners. We hope to encourage other such collaborations to be developed.

Methods: EVMS and TCC have collaborated to utilize resources provided by sonographers in scanning labs built into the medical student ultrasound learning labs. The community college provides faculty, students, and equipment to help run scanning labs for first- and second-year medical school students. DMS faculty earn community respect; DMS students gain self-confidence' and EVMS gains additional qualified faculty and mentoring staff. In addition, the medical students learn to respect the skills and capabilities of sonographers.

Results: EVMS and TCC have established what we feel is a benchmark collaboration between a community college and a medical school. All parties recognize the strengths of the other and gain something from the collaborative effort, including the most important of all: the medical students themselves.

Conclusions: When medical schools make curriculum changes, resources are often limited. One very effective resource available to medical schools may already be available within the community: the local community college–based sonography program. In the model of collaboration between EVMS and TCC, both partners benefit from the current collaborative process, and both partners would be negatively impacted without this partnership. As educators embrace the concepts of learning across curricula and interdepartmental learning, this medical-based skill set provides a good means to do just that at both educational levels. Further studies are underway at EVMS to see if the interactions with sonographers change general perceptions of medical students regarding sonographers as health care workers.

2374880 Prenatal Diagnosis of Absent Pulmonary Valve Syndrome: Case Series of Five Cases; Most Common and Most Rare Presentations

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Objectives: Absent pulmonary valve syndrome (APVS) is a rare congenital cardiac anomaly. Two variants of this anomaly are known. We report 5 patients who were referred to us for fetal echocardiography after abnormal findings on a detailed ultrasound scan. We discuss the fetal echocardiographic features of this rare cardiac anomaly.

Methods: We analyzed the fetal echocardiographic findings of APVS in 5 patients. The study was performed with Philips HD 11 XE and Philips iU22 ultrasound machines using a convex C5-2 transducer and fetal echo presets. The axis, size, and situs of the heart were evaluated. Color and spectral Doppler evaluation of both inflow and outflow tracts was done.

Results: The gestational age at diagnosis was 19–26 weeks. Of 5 cases, 4 cases showed typical features of APVS with a dilated pulmonary artery and its branches with a subaortic ventricular septal defect, overriding of the aorta, and ductal agenesis. There was typical to-and-fro flow noted on color and spectral Doppler examination. One fetus showed rare findings of APVS with an intact ventricular septum and patent ductus arteriosus associated with functional tricuspid atresia. We performed partial necropsy of the heart and lungs in this fetus with atypical features of APVS and confirmed these findings.

Conclusions: Antenatal diagnosis of the common variant (associated with tetralogy of Fallot) of APVS is easy due to its typical features of dilated main pulmonary and branch arteries and color Doppler detection of severe stenosis and insufficiency of the functionally absent pulmonary valve. However, the second variant of APVS can have varied findings, which can make a specific diagnosis difficult.

2381505 Impact of Congenital Heart Disease on In Utero Fetal Growth

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Objectives: The aim of this study was to compare fetal biometric measurements, estimated fetal weight, and frequency of intrauterine growth restriction (IUGR) between fetuses with congenital heart disease (CHD) and normal singleton fetuses.

Methods: This is a retrospective case-control study of patients who were referred for a fetal echocardiogram between January 1985 and December 2013 at a single academic center. During the study period, 11,083 fetal echocardiograms were performed on 9745 patients based on contemporary guidelines at the time. Fetuses with known other congenital abnormalities or chromosomal anomalies were excluded, leaving 10,463 fetal echocardiographic examinations that were included in this study. The control group was constituted of randomly selected 25,000 singleton gestations without any known or suspected fetal anomaly seen on ultrasound examination during the same study period. Fetal growth restriction was defined as estimated fetal weight below the 10th percentile for the gestational age.

Results: During the study period, 875 fetuses were prenatally diagnosed with CHD of varying severity. Overall, the prevalence of any CHD was 8.4%. The prevalence of IUGR was significantly higher in fetuses with CHD compared to fetuses without any anomalies: 20.0% and 9.1%, respectively ($P < .05$). On multivariate analysis, there was no statistically significant difference in fetal growth between study and control groups at 16–28 weeks of gestation. However, after 28 weeks of gestation, fetal growth was significantly lagging in fetuses with CHD ($P < .05$). Similarly, abdominal circumference measurements were significantly lagging after 28 weeks of gestation ($P < .05$). There was no difference in biparietal diameter throughout the pregnancy.

Conclusions: Consistent with previously published literature, we confirmed that fetuses with CHD are likely to have growth restriction, which is more pronounced in the third trimester. Fetuses with CHD should be followed closely for fetal growth restriction.

2383980 The Role of the 3-Vessel and Trachea View in Antenatal Detection of Tetralogy of Fallot

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Objectives: Prenatal diagnosis of tetralogy of Fallot (TOF) remains less frequent compared to other major congenital heart defects. The aim of this study was to examine how often the 3-vessel and trachea view was abnormal in a large series of prenatally diagnosed TOF and to compare its sensitivity to that of the traditional outflow tract views.

Methods: This was a case series with retrospective analysis of all antenatally diagnosed TOF fetuses with postnatal confirmation at a single tertiary care institution between April 2007 and May 2015. Only cases of TOF diagnosed between 18 and 24 weeks were considered with regard to determination of the frequency of prenatal detection. Measurements of the aortic annulus (AA) and main pulmonary artery annulus (MPA) were obtained at the outflow tract views, and measurements of the aortic arch isthmus (AAi) and ductus arteriosus (DA) were obtained at the 3-vessel and trachea view. *Z* scores were calculated for all 4 dimensions according to Schneider's nomograms. In order to determine which measures were most sensitive in the detection of TOF, the frequencies of *Z* scores ≥2.0 were compared for all 4 measurements using McNemar's test.

Results: During the study time period, 40 fetuses were diagnosed with TOF. There were 2 additional cases of newborns delivered at our institution with postnatal diagnosis of TOF who had received a routine sonographic survey that did not detect TOF, thus accruing to a 95% (40/42) prenatal detection rate (95% confidence interval, 88%–99%). In all cases, the AA/MPA and AAi/DA ratios were >1 in the outflow tract and 3-vessel and trachea views, respectively. As a single measurement, when using the *Z* score value of 2, the AAi measurement obtained at the 3-vessel and trachea view was found to be more frequently abnormal than the AA or MPA measurement obtained at the outflow tract view (86.5% vs 42.5%; $P = .002$ for AA; and 86.5% vs 65.0%; $P = .003$ for MPA).

Conclusions: Both the outflow tract and the 3-vessel and trachea views were abnormal in all fetuses with TOF, demonstrating reversed AA/MPA and AAi/DA ratios, respectively. However, as a single measured marker, the enlarged AAi on the 3-vessel and trachea view appears to be the most sensitive for TOF.

2384593 Retrospective Versus Prospective Normograms for the Cardiac Axis at 11 to 14 Weeks in a Lebanese Population: Is There a Difference?

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Objectives: To evaluate the feasibility of measuring the cardiac axis (CAx) at 11–14 weeks and to compare our normograms to that established by Sinkovskaya et al.

Methods: The study was initially carried out retrospectively. On data analysis, it was repeated prospectively. In both instances, 100 normal fetuses had a full anatomic survey at the time of nuchal translucency (NT) assessment by a single sonologist certified by the Fetal Medicine Foundation. Maternal body mass index (BMI), crown-rump length (CRL),

and NT were obtained. The CAx was measured at the level of the 4-chamber view. In the retrospective group, the optimal stored image, with or without color Doppler, was utilized. In the prospective group, the CAx was measured utilizing high-definition flow (HDF) with optimal filling of the chambers. Neonatal outcome was available on the retrospective fetuses. The Kolmogorov-Smirnov test was used to assess normality. Data were analyzed using means (SD) and ranges. The effect of CRL on the CAx was evaluated using regression analysis. A *t* test was used to compare our means to the established means. $P < .05$ was considered significant.

Results: The CAx was measured on all fetuses in both cohorts. The patient characteristics were similar in both retrospective and prospective cohorts, with a mean maternal BMI of 25.06 vs 25.42, CRL of 69.39 vs 68.43 mm, and NT of 1.75 vs 1.82 mm, respectively. CAx was found to be normally distributed in both with no significant effect of CRL on CAx ($P = .675$ and .656, respectively). However, comparing the mean CAx, it was 46.7° retrospectively and was statistically different from Sinkovskaya et al, with $P = .034$. Prospectively, the mean CAx was 45.98°, and it was not statistically different from what has been established, with $P = .302$. Of note is that in the retrospective group, the range was 27.30°–83.93° vs 26.88°–60.95° in the prospective group.

Conclusions: It is feasible to obtain the CAx at 11–14 weeks. There is a significant difference between our retrospective and prospective data particularly in the upper limits of normal. This may be attributed to utilizing HDF. As such, it may be a consideration to employ HDF to enhance accuracy when introducing this powerful new marker into routine first-trimester screening.

2384602 Are There Head Volume Alterations at 11 to 14 Weeks in Fetuses With Congenital Heart Defects?

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Objectives: To assess the presence of head volume (HV) alterations at 11–14 weeks in fetuses with congenital heart defects (CHDs).

Methods: Retrospective case-control study on 100 controls and 26 fetuses with CHDs. All fetuses had a first-trimester scan with nuchal translucency, crown-rump length (CRL), and cardiac axis measured, and volume data sets were stored. All scans and volume analyses were carried out by a single sonologist certified by the Fetal Medicine Foundation. From the 3D volumes, the plane of the biparietal diameter was reconstructed using rotation along the 3 axes. Virtual organ computer-aided analysis was activated using a manual trace at a rotational angle of 30° to calculate the HV. Fetuses with suboptimal volumes due to motion artifacts and shadowing were excluded from the analysis. All controls had a second-trimester scan and a normal neonatal exam. The presence of extracardiac anomalies and aneuploidy in fetuses with CHDs was recorded. Live-born fetuses with CHDs were evaluated by a pediatric cardiologist. The HV as a function of CRL in fetuses with CHDs (grouped as hypoplastic left heart [HLH] and other) was plotted against the normals. The Nonparametric Kruskal-Wallis H test was used for comparing the measurements. $P < .05$ was considered significant.

Results: Included in the analysis were 102 fetuses: 83 normals and 19 with CHDs. Of the CHD fetuses, there were 7/19 (36.8%) with HLH, 6/19 (31.2%) with a ventricular septal defect/atrioventricular canal, 3/19 (15.8%) with hypoplastic right heart, 2/19 (10.5%) with isomerism, and 1/19 (5.3%) with tetralogy of Fallot. Karyotype was available on 4/19 (21%); 2 were trisomy 21. Extracardiac abnormalities (excluding hydrops) were present in 9/19 (47.4%). Of the 19 fetuses, 2 were live born (10.5%). Termination of pregnancy was carried out on 13/19 (68.4%). There was spontaneous in utero demise in 2/19 (10.5%). In addition, 2/19 (10.5%) were lost to follow-up. The HV as a function of the CRL revealed a significant difference between fetuses with CHDs and normals, with a statistically smaller HV in fetuses with CHDs. This was particularly applicable to fetuses with HLH ($P = .043$).

Conclusions: Despite the small sample size, our data suggest that the brain-sparing effect, as evidenced by alterations in HV, may be apparent as early as the first trimester in fetuses with CHDs and, in particular, those with HLH. Larger prospective studies are needed to validate our findings.

2384728 Two-Dimensional Speckle Tracking of the Longitudinal Systolic Displacement of the Right and Left Ventricular Chambers: Does It Alter the Interpretation of Fetal M-Mode Echocardiography?

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Objectives: From the 2D 4-chamber view (4CV) the longitudinal systolic displacement (LSD) was measured with 2D speckle tracking obtained from the endocardium of the right ventricular (RV) and left ventricular (LV) lateral and septal walls. LSD was correlated with simultaneously recorded M-mode tracings obtained perpendicular to the interventricular septum at the basal (B), mid (M), and apical (A) levels from the 4CV.

Methods: The 4CV was recorded from 200 fetuses between 19 and 40 weeks of gestation in which the LSD from the endocardial B, M, and A of the lateral and septal walls of the RV and LV was measured. The displacements of the B, M, and A segments for each ventricle were summed, and the percentage of displacement computed for each segment was analyzed using repeated analysis of variance. In a subgroup of fetuses, the 4CV and a simultaneous M-mode were recorded at the B, M, and A regions of the RV and LV.

Results: The percent of LSD was not correlated with gestational age. There was a significant decrease in the percent of LSD from the base to the apex of the RV and LV (Table 1). When the simultaneous M-mode was analyzed, the end-systolic M-mode represented a different portion of the ventricular and septal endocardium than the diastolic M-mode because of LSD of the B, M, and A segments.

Conclusions: When the M-mode is used to measure diastolic and systolic dimensions of the ventricular chambers, the cursor should be placed in the midportion of the ventricular chamber to minimize measurement errors resulting from LSD.

Table 1. Percent of LSD for the B, M, and A Sections for the LV and RV Lateral Walls (LVLW and RVLW) and LV and RV Septal Walls (RVSW and LVSW)

Section	LVLW	LVSW	RVLW	RVSW
B	43.1% (SE = 0.055%)	48.4% (SE = 0.74%)	43.8% (SE = 0.43%)	46.6% (SE = 0.54%)
M	34.4% (SE = 0.55%)	32.8% (SE = 0.74%)	34.2% (SE = 0.43%)	32.6% (SE = 0.54%)
A	22.5% (SE = 0.49%)	18.7% (SE = 0.59%)	22.1% (SE = 0.40%)	20.7% (SE = 0.54%)
B vs M	$P < .001$	$P < .001$	$P < .001$	$P < .001$
M vs A	$P < .001$	$P < .001$	$P < .001$	$P < .001$
B vs A	$P < .001$	$P < .001$	$P < .001$	$P < .001$

Fetal Echocardiography

2374773 Fetal Echocardiographic Findings in Pulmonary Atresia With an Intact Ventricular Septum

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Objectives: Pulmonary atresia with intact ventricular septum (PAIVS) is a severe cardiac malformation characterized by variable right ventricular (RV) development, an imperforate pulmonary valve, and abnormal connections between the RV and the coronary arteries, known as "ventriculocoronary connections" (VCCs). VCCs are typically found when the RV and tricuspid vein are severely hypoplastic, with hypertrophy of the RV walls. In contrast, VCCs are rare in PAIVS, with a relatively large ventricle capable of supporting more significant tricuspid regurgitation (TR). We describe fetal echocardiographic features of PAIVS in 4 patients.

Methods: The study was performed on Philips HD 11 XE and iU22 ultrasound machines using a convex C 2-5 transducer. The size, wall thickness of the RV, tricuspid regurgitation (TR), morphology of the pulmonary valve, presence of a VCC, and presence of retrograde flow in the pulmonary artery (PA) through the ductus were assessed.

Results: The gestational age varied from 19 weeks in 3 patients to 26 weeks in 1 patient. Of 4 patients, 2 patients showed typical features of a hypoplastic RV cavity, no TR, a VCC, and reversal of flow through the ductus filling the PA seen in the 3-vessel and trachea view. Two patients showed uncommon features of a massive right atrium, RV enlargement, TR, no VCC, and reversal of flow through the ductus filling the PA. Three patients terminated pregnancy after knowing poor postnatal outcomes. One patient continued until term; the neonate expired a few hours after birth.

Conclusions: Fetal echocardiography exposes forms of congenital heart disease not commonly seen postnatally because of the high incidence of perinatal/immediate neonatal period loss. PAIVS is one such condition; especially when there is TR, high mortality in utero is noted. In the absence of TR, the disease is well tolerated in utero. The presence of a VCC is a poor prognostic indicator; hence, its antenatal diagnosis helps in counseling the patients.

2384586 The Role of the Left Brachiocephalic Vein in the Prenatal Diagnosis of Total Anomalous Venous Return: A Case Report

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Objectives: We present the case of a 31-year-old female, gravida 4, para 1021, with antiphospholipid syndrome, referred at 26 weeks 3 days for a right-sided stomach and abnormal outflow tracts.

Methods: Not applicable.

Results: On evaluation, there were several findings, including a right-sided stomach, an unbalanced atrioventricular canal, a small left ventricle, a single nonbifurcating large vessel exiting the right ventricle, and total anomalous pulmonary venous return (TAPVR) exemplified by a visible supracardiac collecting vessel. In addition, the left brachiocephalic vein measured 4.5 mm in width (>95th percentile for gestational age), confirming the diagnosis of TAPVR. The diagnosis of heterotaxy with right atrial isomerism and a complex cardiac defect was discussed with the family and confirmed antenatally by pediatric cardiology. The family opted for expectant management and delivered a live-born male at 36 weeks 4 days weighing 2560 g. Postnatally, the findings were confirmed. The family declined surgical intervention due to religious beliefs and unacceptability of any blood transfusions. The neonate is still alive with central cyanosis.

Conclusions: Our case attests to the role of the left brachiocephalic vein in ascertaining the diagnosis of TAPVR. Measuring the width of the left brachiocephalic vein is feasible. Comparing it to the established normogram of Sinkovskaya et al proves helpful in these challenging cases.

General and Abdominal Ultrasound: Breast

2381822 The Diagnostic Performance of Automated Versus Manual Segmentations of Breast Lesions on Ultrasound Images

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Objectives: The shape of a breast lesion provides clues as to whether it is malignant or benign; therefore, a highly accurate delineation of lesion margins on ultrasound images plays an important role in the diagnosis of breast masses. Usually, a user with medical expertise draws the tissue-mass border, defining lesion margins manually. The process, however, is labor intensive and prone to significant variation due to differences in selection criteria. The aim of this study is to compare the diagnostic performance of leak-plugging (LP) automated segmentation to that of manual segmentation of breast masses on ultrasound.

Methods: Fifty-two biopsy-proven breast lesion images were analyzed by LP automated and manual segmentation. Three observers manually outlined the boundaries on each lesion. The lesions were also segmented using an automated LP algorithm on the same set of images by the same observers. From each LP segmentation and manually drawn margin, grayscale and morphologic features were extracted and classified as malignant or benign by logistic regression analysis. The performance of LP and manual segmentations was compared by the area under the receiver operating characteristic curves (A_z), size of the lesion, and overlap area (O_a) between the margins.

Results: The A_z for LP was consistently higher (0.910 ± 0.003 with a 0.29% coefficient of variation) than the A_z for the manual tracings (0.888 ± 0.012 with a 1.3% coefficient of variation). The lesion size from LP segmentation correlated closely with that from manual tracing ($R^2 = 0.91$). The O_a was higher for LP: 0.92 ± 0.01 and 0.86 ± 0.02 for benign and malignant masses, respectively, compared to 0.80 ± 0.01 and 0.73 ± 0.01 for manual tracings.

Conclusions: The diagnostic performance, size measurements, and observer variability for automated LP segmentations were either comparable to or better than those of manual tracings. LP segmentation of breast lesions is a viable alternative to manual tracings for computer-aided analysis of ultrasound images.

2385269 A Novel Ultrasound Image-Processing Technique for Detecting Microcalcifications in Surgical Breast Specimens

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Objectives: To evaluate a new commercial image-processing technique (MicroPure; Toshiba America Medical Systems, Tustin, CA) for the identification of breast microcalcifications in surgical specimens compared to fundamental grayscale ultrasound imaging (US), using x-ray imaging of the specimen as the reference standard.

Methods: Twenty women, scheduled for surgical excision of 1 or 2 areas with breast calcifications (identified on a prior mammogram), were enrolled in the study. The 22 retrieved surgical specimens underwent a standard US and MicroPure exam using an Aplio XG scanner (Toshiba

Obstetric Ultrasound: New Techniques

2361889 Delayed Postpartum Decrease in Inferior Vena Caval Diameter in Women With Persistent Severe Preeclamptic Hypertension

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Objectives: To assess changes in the postpartum inferior vena caval (IVC) diameter and collapsibility index (CI) during the early postpartum period in women with severe preeclampsia (PE).

Methods: We studied 3 groups of women within 12 hours prior to and 12 hours after delivery. One group consisted of 5 normal gravidas; a second included 4 patients with severe PE with hypertension (>160/110 mm Hg) that resolved promptly after delivery; the third consisted of 6 women with PE and severe hypertension that persisted postpartum. M-mode was used to measure the IVC diameter at end-inspiration and end-expiration. End-inspiration IVC diameter measurements were used for comparison. The CI was obtained by subtracting the difference between the end-expiratory and end-inspiratory values and dividing it over the end-expiratory IVC diameter.

Results: The groups did not differ in maternal age, body mass index, or parity. Gestational age was lowest in the PE group with persistent hypertension (26.4 ± 3.9 weeks) than the control group (31.2 ± 3.8 weeks) or those with resolved hypertension (33.3 ± 3.8 weeks; $P = .04$). The predelivery IVC measurements were not different among the 3 groups. Comparison of these values with the postpartum measurements showed that the percentage change of the IVC diameter decreased significantly in the controls (–17.8% ± 7.8%; $P = .0002$) and in the patients with resolving PE (–5.9% ± 7.2%; $P = .017$) in comparison to the PE group with persistent hypertension, whose IVC diameter was increased over predelivery levels (11.2% ± 8.9%). There were no significant differences in the CI among the 3 groups.

Conclusions: Cardiovascular adaptations begin promptly after delivery, and previous studies have shown the expected reduction in blood volume is reflected in a decrease in the IVC diameter. We have confirmed this observation and shown that a similar change occurs in patients diagnosed with PE and hypertension that resolves promptly after delivery. However, in those women whose marked hypertension persisted after delivery, the fall in IVC diameter did not occur, probably a consequence of continuing vasospasm. Whether the use of IVC measurements would have some prognostic value in assessing the course of PE should be studied.

2384612 Comparing Uptake of Noninvasive Prenatal Testing at 2 Centers in Lebanon

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Objectives: Noninvasive prenatal testing (NIPT) using cell-free fetal DNA became available in Lebanon at the beginning of 2013. There are several cultural and religious beliefs that vary throughout the country affecting its uptake. As such, the aim of our study was to compare the uptake at 2 different areas of the country and to assess the patient demographics and testing indications.

Methods: Retrospective study on patients in our database at 2 centers in Lebanon (Centre de Diagnostic Prenatal [CDP] and Center for Advanced Fetal Care [CFAFC]) who underwent NIPT. All patients had undergone either first- or second-trimester ultrasound. The same counseling approach is adopted at both centers, where invasive testing/NIPT is offered to all patients over the age of 35 and to those with positive historical/sonographic/biochemical findings. In addition, it may be performed on patients who request it for reassurance following extensive counseling as to its advantages and limitations. All scans and counseling were carried out by 2 sonologists certified by the Fetal Medicine Foundation. Outcome was available on all fetuses. Data were analyzed utilizing a χ^2 test. $P < .05$ was considered significant.

Results: There were a total of 112 patients in the study. An NIPT result was available on 110/112 (98.2%) patients. There was 1 true-positive case (trisomy 21), 1 false-positive case (trisomy 18), and no false-negatives. Mean transport time was 3 days, and mean time from testing to a result was 9 days. There were 83/112 (74.4%) patients at CDP and 29/112 (25.6%) at CFAFC. The centers were similar in terms of patient age range; however, there was a statistically significant difference in the indications for testing primarily with respect to the presence of second-trimester soft markers ($P = .001$), advanced maternal age ($P = .024$), and an abnormal first-trimester scan ($P = .044$). Based on the indications for testing, 51 patients would have been offered invasive testing.

Conclusions: Even in this small cohort of patients, our study attests to the acceptability of NIPT in our cultural setup in 2 areas of Lebanon. From our preliminary data, the primary indications for testing vary across the country. The national incorporation of NIPT into our patient population may avert a significant proportion of invasive tests on normal fetuses.

2385203 Comparison of the First-Trimester Transvaginal Anatomy Scan to the Second-Trimester Structural Survey in Obese and Nonobese Patient Populations: A Pilot Study

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Objectives: To compare accuracy of fetal anatomic transvaginal ultrasound (TVUS) done at 12–14 week's gestation' to the traditional transabdominal ultrasound (TAU) for fetal anatomy at 18–22 weeks in normal-weight and obese patient populations.

Methods: In a prospective study, 26 women underwent TVUS for fetal anatomy evaluation between 12 and 14 weeks' gestational age and TAU at 18–22 weeks. The results of both scans were compared. The percentage of patients in which each structure was optimally visualized was calculated. The relative risk of visualizing a structure in the second trimester compared with the first was calculated in the sample groups.

Results: Twenty-six patients received the first-trimester TVUS, and 24 patients completed the TAU. The average body mass index (BMI) in the obese group was 34, and the average BMI for nonobese patients was 23. In all patients, all structures were more likely to be visualized during the TAU when compared to the TVUS. The cardiac views and hands and feet were more difficult to visualize at both scans but more frequently visualized during the TAU and were seen in 70%–80% of patients. In the obese patients, the posterior fossa, profile, hands and feet, cardiac views, and spine views were less likely to be visualized in the first trimester, but importantly, the cardiac structures and spine views were also difficult to view in this population at the time of the TAU. For the second-trimester scan, the cardiac views, hands and feet, and spine were also less frequently visualized in the obese patients.

Conclusions: First-trimester TVUS detects some of the structures assessed during a complete anatomic survey; however, this study shows that for obese and normal-weight patients, second-trimester TAU allows for better visualization. This study points out the need for additional imaging in obese patients. More research is needed to show if TVUS can be utilized for focused anatomy in the first trimester in this population.