AIUM Practice Parameter for the Performance of Detailed Second- and Third-Trimester Diagnostic Obstetric Ultrasound Examinations

Introduction

The clinical aspects of this practice parameter were developed collaboratively among the American Institute of Ultrasound in Medicine (AIUM) and other organizations whose members use ultrasound for performing detailed second- and third-trimester diagnostic obstetric ultrasound examinations (see "Acknowledgments"). Recommendations for personnel requirements, the written request for the examination, documentation, quality control, and safety may vary among the organizations and may be addressed by each separately.

The detailed obstetric ultrasound examination (*Current Procedural Terminology* [*CPT*] code 76811) is not intended to be the routine ultrasound examination performed for all pregnancies. Rather, it is an indication-driven examination performed for a known or suspected fetal anatomic abnormality, known fetal growth disorder, genetic abnormality, or increased risk for a fetal anatomic or genetic abnormality or placenta accreta spectrum (PAS). Performance and interpretation of a detailed fetal anatomic scan require advanced skills and knowledge and the ability to effectively communicate the findings to the patient and her referring physician. Thus, the performance of the detailed obstetric examination should be rare outside referral practices with special expertise in the identification and diagnosis of fetal anomalies and placental implantation disorders. Only 1 such medically indicated study per pregnancy per practice is appropriate. If 1 or more required structures are not adequately demonstrated during the 76811 examination, the patient may be brought back for a focused assessment (*CPT* code 76816). A second detailed obstetric examination should not be performed unless there are extenuating circumstances.

Indications

Indications for a detailed fetal anatomic examination include, but are not limited to, the following conditions:

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1. Previous fetus or child with a congenital, genetic, or chromosomal abnormality[1,2];
2. Known or suspected fetal anomaly or known or suspected fetal growth restriction in the current pregnancy[2,3];
3. Fetus at increased risk for a congenital anomaly, such as the following:
   a. Maternal pregestational diabetes or gestational diabetes diagnosed before 24 weeks' gestation[4–8];
   b. Pregnancy conceived via assisted reproductive technology[9];
   c. Maternal body mass index of 30 kg/m^2 or higher[10–13];
   d. Multiple gestations[10,14];
   e. Abnormal maternal serum analytes[15];
   f. Teratogen exposure[16];
   g. First-trimester nuchal translucency measurement of 3.0 mm or greater[17];
4. Fetus at increased risk for a genetic or chromosomal abnormality, such as the following:
   a. Parental carrier of a chromosomal or genetic abnormality[1,2];
   b. Maternal age of 35 years or older at delivery[1,2];
   c. Positive screening test results for aneuploidy[1,2];
   d. Aneuploidy marker noted on an ultrasound examination[1,10];
   e. First-trimester nuchal translucency measurement of 3.0 mm or greater[17–19];
5. Other conditions affecting the fetus, including the following:
   a. Congenital infections[3,16,20,21];
   b. Maternal drug use[16];
   c. Alloimmunization[22,23];
   d. Oligohydramnios[10];
   e. Polyhydramnios[10,24]; and
6. Suspected placenta PAS or risk factors for PAS such as placenta previa in the third trimester or a placenta overlying a prior cesarean scar site.[10,25,26]

Qualifications and Responsibilities of Personnel

See www.aium.org for AIUM Official Statements, including Standards and Guidelines for the Accreditation of Ultrasound Practices and relevant Training Guidelines. If the physician does not personally perform the examination, he or she must provide general supervision, as defined by the Centers for Medicare and Medicaid Services Code of Federal Regulations 410.32: "General supervision means the procedure is furnished under the physician's overall direction and control, but the physician's presence is not required during the performance of the procedure. Under general supervision, the training of nonphysician personnel who actually perform the diagnostic procedure and the maintenance of the necessary equipment and supplies are the continuing responsibility of the physician." If a sonographer performs the ultrasound examination, that individual should be credentialed in accordance with the AIUM accreditation policies.

Written Request for the Examination

The written or electronic request for an ultrasound examination should provide sufficient information to allow for the appropriate performance and interpretation of the examination.

The request for the examination must originate from a physician or other appropriately licensed health care provider or under the provider's direction. The accompanying clinical information should be provided by a physician or appropriate health care provider familiar with the patient's clinical situation and should be consistent with relevant legal and local health care facility requirements.

Specifications of the Examination

A detailed comprehensive obstetric ultrasound examination (76811) includes all of the components of a standard fetal ultrasound examination (*CPT* code 76805). The additional specific examination content beyond that included in the standard examination is determined by both the indication for the examination and the ultrasound findings identified during the examination and is guided by the specialized knowledge and training of the responsible physician. The specific elements of a given detailed obstetric ultrasound examination may be individualized based on these considerations. Therefore, a prescriptive approach to providing universally required detailed examination content is neither taken nor congruent with the nature of this indication-driven examination. The table provides a list of elements that may be included in a detailed examination. Based on the previously noted considerations, not all of these elements

Table Components of *CPT* Code 76811 (Standard and Detailed Examinations)

Component	Standard	Detailed*
Head and neck	Lateral cerebral ventricles	3rd ventricle[27]
	Choroid plexus	4th ventricle[27]
	Midline falx	Lateral ventricular wall integrity, contour, ependymal lining[27]
	Cavum septi pellucidi	
	Cerebellum	Cerebellar lobes, vermis, and cisterna magna[28]
	Cisterna magna	
		Corpus callosum[29]
		Integrity and shape of cranial vault[30]
		Brain parenchyma[31]
		Neck[32,33]
Face	Upper lip	Profile[34–36]
		Nasal bone (15–22 wk)[37–40]
		Coronal face (nose/lips/lens)[34]
		Palate, maxilla, mandible, and tongue[41,42]
		Ear position and size
		Orbits
Chest	Cardiac activity	Situs
Heart	4-chamber view	Aortic arch
	Left ventricular outflow tract	Superior and inferior venae cavae[43]
	Right ventricular outflow tract	Ductal arch
	3-vessel view (if technically feasible)[44]	Interventricular septum
	3-vessel and trachea view (if technically feasible)[44]	3-vessel view[44]
		3-vessel and trachea view[44]
Thorax		Lungs[45,46]
		Integrity of diaphragm[47]
		Ribs[48,49]
Abdomen	Stomach (presence, size, and situs)	Small and large bowel[50–52]
	Kidneys	Adrenal glands[53]
	Urinary bladder	Gallbladder[54,55]
	Cord insertion site into fetal abdomen	Liver[56]
	Umbilical cord vessel number	Renal arteries[57]
		Spleen
		Integrity of abdominal wall[58]
Spine	Cervical	Integrity of spine and overlying soft tissue[59,60]
	Thoracic	
	Lumbar	Shape, curvature, conus medullaris[61,62]
	Sacral spine	
Extremities	Legs	Number, architecture, and position[61–65]
	Arms	
	Hands	Digits of hands and feet: number and position[65–68]
	Feet	
Genitalia	In multiple gestations	External genitalia[69]
	When medically indicated	
Placenta	Location	Masses[70,71]
	Relationship to internal os	Accessory/succenturiate lobe with location of connecting vascular supply to primary placenta and internal cervical os[72,73]
	Appearance	
	Placental cord insertion	
		Implantation site with evaluation for abnormal adherence[25]
Standard evaluation	Fetal number	
	Presentation	
	Qualitative or semiquantitative estimate of amniotic fluid	

(Continues)

Table Continued

Component	Standard	Detailed*
Maternal anatomy	Cervix (transvaginal when indicated)	
	Uterus	
	Adnexa	
Biometry	Biparietal diameter	Cerebellum[74]
	Head circumference	Inner and outer orbital diameters[75]
	Femur length	Nuchal fold thickness (16–20 wk)[37–39]
	Abdominal circumference	Humerus[37–39]
	Fetal weight estimate	Ulna/radius
		Tibia/fibula

*As noted in the text of this Practice Parameter, all of these elements may not be indicated in every detailed obstetric ultrasound examination. Likewise, obtaining additional elements not listed in the table may be warranted.

may be indicated in all detailed obstetric ultrasound examinations. Likewise, obtaining additional elements not listed in the table may be warranted.

Documentation

Adequate documentation is essential for high-quality patient care. Ultrasound images that contain diagnostic information and/or direct patient treatment (both normal and abnormal) should be recorded in accordance with the AIUM Practice Parameter for Documentation of an Ultrasound Examination.

Equipment Specifications

These studies should be conducted with real-time scanners, using a transabdominal and/or transvaginal approach. Real-time ultrasound is necessary to confirm the presence of fetal life through observation of cardiac activity and active fetal movement. The choice of transducer frequency is a trade-off between beam penetration and resolution. A transducer of an appropriate frequency should be used. With modern equipment, 3-MHz and higher abdominal transducers allow sufficient penetration in most patients while providing adequate resolution. Color and/or pulsed Doppler ultrasound may be used as warranted, based on the indication for and findings identified during the detailed examination. If additional billing charges would be incurred by using these additional modalities, specific orders from the referring clinician for their use may be needed.

ALARA Principle

The potential benefits and risks of each examination should be considered. The ALARA (as low as reasonably achievable) principle should be observed when adjusting controls that affect the acoustic output and by considering transducer dwell times. Further details on ALARA may be found in the AIUM publication *Medical Ultrasound Safety*, Third Edition.[76]

Fetal Safety

Diagnostic ultrasound studies of the fetus are generally considered safe during pregnancy

(Conclusions Regarding Epidemiology for Obstetric Ultrasound).

This procedure should be performed only when there is a valid medical indication (Prudent Use in Pregnancy), and the lowest possible ultrasonic exposure setting should be used to gain the necessary diagnostic information under the ALARA principle.

The output display standard, an on-screen real-time display of acoustic output, should be visible and monitored for the thermal index (TI) and mechanical index. The dwell time should be kept to a minimum.

A TI for soft tissue (TIs) should be used at or before 10 weeks' gestation, and a TI for bone (TIb) should be used at or after 10 weeks' gestation when bone ossification is evident (Recommended Maximum Scanning Times for Displayed Thermal Index (TI) Values).

In keeping with the ALARA principle, M-mode imaging should be used instead of spectral Doppler imaging to document the embryonic/fetal heart rate (Statement on Measurement of Fetal Heart Rate).

Doppler ultrasound may be used to answer specific clinical questions. Spectral pulsed Doppler ultrasound is associated with higher energy output and should be used judiciously as part of an evaluation for anomalies.

The promotion, selling, or leasing of ultrasound equipment for making "keepsake fetal videos" is considered by the US Food and Drug Administration to be an unapproved use of a medical device. Use of a diagnostic ultrasound system for keepsake fetal imaging, without a physician's order, may be in violation of state laws or regulations.

Quality Control and Improvement, Safety, Infection Control, and Patient Education

Policies and procedures related to quality control, patient education, infection control, and safety, including equipment performance monitoring, should be developed and implemented in accordance with the AIUM's Standards and Guidelines for the Accreditation of Ultrasound Practices.

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References

1. American College of Obstetricians and Gynecologists. Practice Bulletin No. 163: screening for fetal aneuploidy. *Obstet Gynecol* 2016; 127:e123–e137.
2. American College of Obstetricians and Gynecologists. Practice Bulletin No. 162: diagnostic testing for genetic disorders. *Obstet Gynecol* 2016; 127:e108–e122.
3. American College of Obstetricians and Gynecologists. Practice Bulletin No. 204: fetal growth restriction. *Obstet Gynecol* 2019; 133:e97–e109.
4. American College of Obstetricians and Gynecologists. Practice Bulletin No. 201: pregestational diabetes mellitus. *Obstet Gynecol* 2018; 132:e228–e248.
5. American College of Obstetricians and Gynecologists. Practice Bulletin No. 190: gestational diabetes mellitus. *Obstet Gynecol* 2018; 131:e49–e64.
6. Society of Obstetricians and Gynaecologists of Canada. Clinical Practice Guideline No. 200: teratogenicity associated with pre-existing and gestational diabetes. *J Obstet Gynaecol Can* 2007; 29: 927–934.
7. Bartha JL, Martinez-Del Fresno P, Comino-Delgado R. Early diagnosis of gestational diabetes mellitus and prevention of diabetes-related complications. *Eur J Obstet Gynecol* 2003; 109:41–44.
8. Aberg A, Westbrook L, Kallen B. Congenital malformations among infants whose mothers had gestational diabetes. *Early Hum Dev* 2001; 61:85–95.
9. Davies MJ, Moore VM, Willson KJ, et al. Reproductive technologies and the risk of birth defects. *N Engl J Med* 2012; 366:1803–1813.

10. Reddy UM, Abuhamad AZ, Levine D, Saade GR. Fetal imaging: executive summary of a joint *Eunice Kennedy Shriver* National Institute of Health and Human Development, Society for Maternal-Fetal Medicine, American Institute of Ultrasound in Medicine, American College of Obstetricians and Gynecologists, American College of Radiology, Society for Pediatric Radiology, and Society of Radiologists in Ultrasound fetal imaging workshop. *Am J Obstet Gynecol* 2014; 210:387–397.
11. Wax JR, Benacerraf BR, Copel J, et al. Consensus report on the 76811 scan: modification. *J Ultrasound Med* 2015; 34:1915.
12. Rasmussen SA, Chu SY, Kim SY, Schmid CH, Lau J. Maternal obesity and risk of neural tube defects: a meta-analysis. *Am J Obstet Gynecol* 2008; 198:611–619.
13. Stothard KJ, Tennant PW, Bell R, Rankin J. Maternal overweight and obesity and the risk of congenital anomalies: a systematic review and meta-analysis. *JAMA* 2009; 301:636–650.
14. Chauhan SP, Scardo JA, Hayes E, Abuhamad AZ, Berghella V. Twins: prevalence, problems, and preterm births. *Am J Obstet Gynecol* 2010; 203:305–315.
15. McPherson E, Thomas D, Manlick C, et al. Extreme values of maternal serum analytes in second trimester screening: looking beyond trisomy and NTDs. *J Genet Couns* 2011; 20:396–403.
16. Rasmussen SA, Erickson JD, Reef SE, Ross DS. Teratology: from science to birth defects prevention. *Birth Defects Res A Clin Mol Teratol* 2009; 85:82–92.
17. Reynders CS, Pauker SP, Benacerraf BR. First trimester isolated fetal nuchal lucency: significance and outcome. *J Ultrasound Med* 1997; 16:101–105.
18. Nicolaides KH, Azar G Byrne D, Mansur C, Marks K. Fetal nuchal translucency: ultrasound screening for chromosomal defect in first trimester of pregnancy. *BMJ* 1992; 304:867–869.
19. Comstock CH, Malone FD, Ball RH, et al. Is there a nuchal translucency millimeter measurement above which there is no additional benefit from first trimester serum screening? *Am J Obstet Gynecol* 2006; 195:843–847.
20. American College of Obstetricians and Gynecologists. Practice Bulletin No. 175: ultrasound in pregnancy. *Obstet Gynecol* 2016; 128:e241–e256.
21. American College of Obstetricians and Gynecologists. Practice Bulletin No. 151: cytomegalovirus, parvovirus B19, varicella zoster, and toxoplasmosis in pregnancy. *Obstet Gynecol* 2015; 125: 1510–1525.
22. Pretlove SJ, Fox CE, Khan KS, Kilby MD. Noninvasive methods of detecting fetal anemia: a systematic review and meta-analysis. *BJOG* 2009; 116:1558–1567.
23. Mari G, Deter RL, Carpenter RL, Rahman F, et al. Noninvasive diagnosis by Doppler ultrasonography of fetal anemia due to maternal rd-cell alloimmunization. Collaborative Group for Doppler Assessment of the Blood Velocity in Anemic Fetuses. *N Engl J Med* 2000; 342:9–14.
24. Society for Maternal-Fetal Medicine; Dashe JS, Pressman EK, Hibbard JU. SMFM consult series #46: evaluation and management of polyhydramnios. *Am J Obstet Gynecol* 2018; 219:B2–B8.
25. Cahill AG, Beigi R, Heine RP, Silver RM, Wax JR. Placenta accreta spectrum. *Am J Obstet Gynecol* 2018; 219:B2–B16.
26. Society for Maternal-Fetal Medicine Coding Committee. White paper coding for placenta accreta spectrum. Society for Maternal-Fetal Medicine website. https://urldefense.proofpoint.com/v2/url?u=https-3A__www.smfm.org_coding_white-2Dpapers_131-2Dsmfm-2Dcoding-2Dcommittee-2Dwhite-2Dpaper-2Dcoding-2Dfor-2Dplacenta-2Daccreta-2Dspectrum&d=DwIFAg&c=ST5Jxgx_zZ9nYuPWkSm01Luus8kzn0TCuX9tmQgnWms&r=zGmUNpEBZ3lV3CzGwAvJ1Q&m=qMcCxePdAWUEMj8v-ytjrUPNJxCvMYP5auJUmtISo-8&s=e_tiNmAAONIMTCggAg8Kh7zCZ_Jf9pV6h_E7iqDMqFE&e. Accessed June 11, 2019.
27. Wax JR, Bookman L, Cartin A, Pinette MG, Blackstone J. Mild fetal cerebral ventriculomegaly: diagnosis, clinical associations, and outcomes. *Obstet Gynecol Surv* 2003; 58:407–414.
28. Kapur RP, Mahony BS, Finch L, Siebert JR. Normal and abnormal anatomy of the cerebellar vermis in midgestational human fetuses. *Birth Defects Res A Clin Mol Teratol* 2009; 85:700–709.
29. Santo S, D'Antonio F, Homfray T, et al. Counseling in fetal medicine: agenesis of the corpus callosum. *Ultrasound Obstet Gynecol* 2012; 40:513–521.
30. Joó JG, Beke A, Szigeti Z, et al. Craniospinal malformations in a twelve-year fetopathological study: the efficiency of ultrasonography in view of fetopathological investigations. *Early Hum Dev* 2008; 84:115–119.
31. Pugash D, Hendson G, Dunham CP, Dewar K, Money DM, Prayer D. Sonographic assessment of normal and abnormal patterns of fetal cerebral lamination. *Ultrasound Obstet Gynecol* 2012; 40:642–651.
32. Rauff S, Kien TE. Ultrasound diagnosis of fetal neck masses: a case series [published online January 15, 2013]. *Case Rep Obstet Gynecol*. doi:https://doi.org/10.1155/2013/243590.
33. Liberty G, Boldes R, Shen O, Shaul C, Cohen SM, Yagel S. The fetal larynx and pharynx: structure and development on two- and three dimensional ultrasound. *Ultrasound Obstet Gynecol* 2013; 42:140–148.
34. McGahan MC, Ramos GA, Landry C, et al. Multislice display of the fetal face using 3-dimensional ultrasonography. *J Ultrasound Med* 2008; 27:1573–1581.
35. Lee W, McNie B, Chaiworapongsa T, et al. Three-dimensional ultrasonographic presentation of micrognathia. *J Ultrasound Med* 2002; 21:775–781.
36. Wang LM, Leung KY, Tang M. Prenatal evaluation of facial clefts by three-dimensional extended imaging. *Prenat Diagn* 2007; 27: 722–729.
37. Bethune M. Literature review and suggested protocol for managing ultrasound soft markers for Down syndrome: thickened nuchal

fold, echogenic bowel, shortened femur, shortened humerus, pyelectasis and absent or hypoplastic nasal bone. *Australas Radiol* 2007; 51:218–225.

38. Agathokleous M, Chaveeva P, Poon LCY, Kosinski P, Nicolaides KH. Meta-analysis of second-trimester markers for trisomy 21. *Ultrasound Obstet Gynecol* 2013; 41:247–261.
39. Benacerraf BR. The history of the second-trimester sonographic markers for detecting fetal Down syndrome, and their current role in obstetric practice. *Prenat Diagn* 2010; 30:644–652.
40. Cusick W, Provenzano J, Sullivan CA, Gallousis FM, Rodis JF. Fetal nasal bone length in euploid and aneuploid fetuses between 11 and 20 weeks' gestation: a prospective study. *J Ultrasound Med* 2004; 23:1327–1333.
41. Pilu G, Segata M. A novel technique for visualization of the normal and cleft fetal secondary palate: angled insonation and three-dimensional ultrasound. *Ultrasound Obstet Gynecol* 2007; 29: 166–169.
42. Wong HS, Tait J, Pringle KC. Viewing of the soft and the hard palate on routine 3-D ultrasound sweep of the fetal face: a feasibility study. *Fetal Diagn Ther* 2008; 24:146–154.
43. Hofstaetter C, Plath H, Hansmann M. Prenatal diagnosis of abnormalities of the fetal venous system. *Ultrasound Obstet Gynecol* 2000; 15:231–241.
44. Yagel S, Arbel R, Anteby EY, Raveh D, Achiron R. The three vessels and trachea view (3VT) in fetal cardiac scanning. *Ultrasound Obstet Gynecol* 2002; 20:340–345.
45. Bahlmann F, Merz E, Hallermann C, Stopfkuchen H, Krämer W, Hofmann M. Congenital diaphragmatic hernia: ultrasonic measurement of fetal lungs to predict pulmonary hypoplasia. *Ultrasound Obstet Gynecol* 1999; 14:162–168.
46. Moeglin D, Talmant C, Duyme M, Lopez AC. Fetal lung volumetry using two- and three-dimensional ultrasound. *Ultrasound Obstet Gynecol* 2005; 25:119–127.
47. Metkus AP, Filly RA, Stringer MD, Harrison MR, Adzick NS. Sonographic predictors of survival in fetal diaphragmatic hernia. *J Pediatr Surg* 1996; 31:148–151.
48. Ruano R, Molho M, Roume J, Ville Y. Prenatal diagnosis of fetal skeletal dysplasias by combining two-dimensional and three-dimensional ultrasound and intrauterine three-dimensional helical computer tomography. *Ultrasound Obstet Gynecol* 2004; 24:134–140.
49. Dugoff L, Coffin CT, Hobbins JC. Sonographic measurement of the fetal rib cage perimeter to thoracic circumference ratio: application to prenatal diagnosis of skeletal dysplasias. *Ultrasound Obstet Gynecol* 1997; 10:269–271.
50. Goetzinger KR, Cahill AG, Macones GA, Odibo AO. Echogenic bowel on second-trimester ultrasonography: evaluating the risk of adverse pregnancy outcome. *Obstet Gynecol* 2011; 117:1341–1348.
51. Mailath-Pokorny M, Klein K, Klebermass-Schrehof K, Hachemian N, Bettelheim D. Are fetuses with isolated echogenic bowel at higher risk for an adverse pregnancy outcome? Experiences from a tertiary referral center. *Prenat Diagn* 2012; 32: 1295–1299.
52. McNamara A, Levine D. Intraabdominal fetal echogenic masses: a practical guide to diagnosis and management. *Radiographics* 2005; 25:633–645.
53. van Vuuren SH, Damen-Elias HA, Stigter RH, et al. Size and volume charts of fetal kidney, renal pelvis and adrenal gland. *Ultrasound Obstet Gynecol* 2012; 40:659–664.
54. Shen O, Rabinowitz R, Yagel S, Gal M. Absent gallbladder on fetal ultrasound: prenatal findings and postnatal outcome. *Ultrasound Obstet Gynecol* 2011; 37:673–677.
55. Duguépéroux I, Scotet V, Audrézet MP, et al. Nonvisualization of fetal gallbladder increases the risk of cystic fibrosis. *Prenat Diagn* 2012; 32:21–28.
56. Smrcek JM, Baschat AA, Germer U, Gloeckner-Hofmann K, Gembruch U. Fetal hydrops and hepatosplenomegaly in the second half of pregnancy: a sign of myeloproliferative disorder in fetuses with trisomy 21. *Ultrasound Obstet Gynecol* 2001; 17:403–409.
57. Sepulveda W, Stagiannis KD, Flack NJ, Fisk NM. Accuracy of prenatal diagnosis of renal agenesis with color flow imaging in severe second-trimester oligohydramnios. *Am J Obstet Gynecol* 1995; 173: 1788–1792.
58. Kuleva M, Khen-Dunlop N, Dumez Y, Ville Y, Salomon LJ. Is complex gastroschisis predictable by prenatal ultrasound? *BJOG* 2012; 119:102–109.
59. Lennon CA, Gray DL. Sensitivity and specificity of ultrasound for the detection of neural tube and ventral wall defects in a high-risk population. *Obstet Gynecol* 1999; 94:562–566.
60. Dashe JS, Twickler DM, Santos-Ramos R, McIntire DD, Ramus RM. Alpha-fetoprotein detection of neural tube defects and the impact of standard ultrasound. *Am J Obstet Gynecol* 2006; 195:1623–1628.
61. Schramm T, Gloning KP, Minderer S, et al. Prenatal sonographic diagnosis of skeletal dysplasias. *Ultrasound Obstet Gynecol* 2009; 34: 160–170.
62. Dighe M, Fligner C, Cheng E, Warren B, Dubinsky T. Fetal skeletal dysplasia: an approach to diagnosis with illustrative cases. *Radiographics* 2008; 28:1061–1077.
63. Parilla BV, Leeth EA, Kambich MP, Chilis P, MacGregor SN. Antenatal detection of skeletal dysplasias. *J Ultrasound Med* 2003; 22:255–258.
64. Bowerman RA. Anomalies of the fetal skeleton: sonographic findings. *AJR Am J Roentgenol* 1995; 164:973–979.
65. Bromley B, Benacerraf B. Abnormalities of the hands and feet in the fetus: sonographic findings. *AJR Am J Roentgenol* 1995; 165:1239–1243.
66. Holder-Espinasse M, Devisme L, Thomas D, et al. Pre- and postnatal diagnosis of limb anomalies: a series of 107 cases. *Am J Med Genet A* 2004; 124A:417–422.
67. Stoll C, Wiesel A, Queisser-Luft A, Froster U, Bianca S, Clementi M. Evaluation of the prenatal diagnosis of limb reduction deficiencies. EUROSCAN Study Group. *Prenat Diagn* 2000; 20:811–818.

68. Canto MJ, Cano S, Palau J, Ojeda F. Prenatal diagnosis of clubfoot in low-risk population: associated anomalies and long-term outcome. *Prenat Diagn* 2008; 28:343–346.
69. Lev-Toaff AS, Ozhan S, Pretorius D, Bega G, Kurtz AB, Kuhlman K. Three-dimensional multiplanar ultrasound for fetal gender assignment: value of the mid-sagittal plane. *Ultrasound Obstet Gynecol* 2000; 16:345–350.
70. Sepulveda W, Alcalde JL, Schnapp C, Bravo M. Perinatal outcome after prenatal diagnosis of placental chorioangioma. *Obstet Gynecol* 2003; 102:1028–1033.
71. Lopriore E, Sueters M, Middeldorp JM, Klumper F, Oepkes D, Vandenbussche FP. Twin pregnancies with two separate placental masses can still be monochorionic and have vascular anastomoses. *Am J Obstet Gynecol* 2006; 194:804–808.
72. Hasegawa J, Farian A, Nakamura M, et al. Analysis of the ultrasonographic findings predictive of vasa previa. *Prenat Diagn* 2010; 30: 1121–1125.
73. Gagnon R, Morin L, Bly S, et al. Guidelines for management of vasa previa. *J Obstet Gynaecol Can* 2009; 31:748–760.
74. Malinger G, Lev D, Lerman-Sagie T. The fetal cerebellum: pitfalls in diagnosis and management. *Prenat Diagn* 2009; 29: 372–380.
75. Goldstein I, Tamir A, Zimmer EZ, Itskovitz-Eldor J. Growth of the fetal orbit and lens in normal pregnancies. *Ultrasound Obstet Gynecol* 1998; 12:175–179.
76. American Institute of Ultrasound in Medicine. *Medical Ultrasound Safety*. 3rd ed. Laurel, MD: American Institute of Ultrasound in Medicine; 2014.