



Рис. 30-14. Транслокация главных ветвей артерий. У этого плода невозможно добиться нормального изображения выходящих трактов левого и правого желудочка. Вместо нормального расположения аорта (показана стрелкой) и легочной артерии (полная стрелка) идут параллельно друг другу при выходе из сердца. Высота, какой из сосудов является аортой, удалась при сканировании в дорозентальных плоскостях по отклонению артерий головы и шеи. (Изображение предоставлено Peter M. Doubilet, M. D., Ph. D., Boston, MA)

чаянный параллельный ход магистральных артерий. Закрученная из-за вращательного поворота вертушка желудочка может помочь неслучайно идентифицировать морфологический ПЖ, который при этом пороке располагается снизу, а от него отходит аорта. Морфологический ЛЖ с его остроконечной вертушкой располагается сверху, а от него отходит ЛА. Этот порок может сочетаться с инверсией желудочных органов. Могут обнаруживаться и другие пороки, такие как стеноз легочной артерии или ДМЖП. Вследствие гетерогенности проводящих путей может развиваться атриовентрикулярная блокада.

## Заключение

Хотя 4К позиция является основной для обследования сердца плода, дополнительное исследование обоих выходящих трактов помогает повысить чувствительность пренатальной ультразвуковой диагностики ВПС. Если специалист ультразвуковой диагностики может адекватно оценить шесть ключевых признаков, рассмотренных выше (четыре в 4К проекции и два в проекции выходящих трактов), большинство врожденных аномалий сердца будет диагностировано до рождения ребенка у пациентов как с высоким, так и с низким риском развития ВПС.

В будущем более широкое применение УЗИ на поздних этапах первого триместра для оценки сердца плода у пациентов с высоким риском ВПС может привести к более ранней диагностике ВПС. Также

важную роль могут сыграть такие новые технологии, как трехмерное и четырехмерное ультразвуковое изображение.<sup>12,13</sup>

## Литература

- Andager RH. Genetic counseling in congenital heart disease. *Pediatr Ann* 1997;26:99-104
- Boughtman JA, Berg KA, Awaszinski JA, et al. Familial risk of congenital heart defect assessed in a population-based epidemiologic study. *Am J Med Genet* 1987;26:839-845
- Cooper ME, Enderlein ME, Dyson DC, Roge CL, Tamoff H. Fetal echocardiography: retrospective review of clinical experience and an evaluation of indications. *Obstet Gynecol* 1995;86:577-582
- Allan L. Fetal cardiology [editorial]. *Ultrasound Obstet Gynecol* 1994;4:441-444
- Szyrak P. New developments in fetal echocardiography. *Curr Opin Cardiol* 1997;12:78-83
- Abraham A. A Practical Guide to Fetal Echocardiography. Philadelphia: Lippincott-Raven; 1997
- Rice MJ, McDonald RW, Pitu G, Chaoui R. Cardiac malformations. In: Nyberg DA, McGahan JP, Pretorius DH, eds. *Diagnostic Imaging of Fetal Anomalies*. Philadelphia: Lippincott Williams and Wilkins; 2003:451-506
- Nora JJ, Nora AH. Update on counseling the family with a first-degree relative with a congenital heart defect. *Am J Med Genet* 1988;29:137-142
- Genetics of disorder with complex inheritance. In: Nussbaum RL, McInnes RR, Willard HF. *Thompson and Thompson Saunders* 2004:289-310
- Romano-Zelekha O, Hirsch R, Bloden L, Green M, Scharf T. The risk for congenital heart defects in offspring of individuals with congenital heart defects. *Clin Genet* 2001;59:325-329
- Burn J, Brennan P, Little J, et al. Recurrence risk in offspring of adults with major heart defects: results from first cohort of British collaborative study. *Lancet* 1998;351:311-316
- Whitmore R, Wells JA, Castelletto X. A second-generation study of 427 probands with congenital heart defects and their 317 children. *J Am Coll Cardiol* 1994;23:1459-1467
- Nora JJ, Nora AH. Maternal transmission of congenital heart disease: new recurrence risk figures and question of cytoplasmic inheritance and vulnerability to teratogens. *Am J Cardiol* 1987;59:459-463
- Clark EB. Pathogenic mechanisms of congenital cardiovascular malformations revisited. *Semin Perinatol* 1996;20:463-472
- Gill HK, Splitt M, Sharland GK, Simpson JM. Patterns of recurrence of congenital heart disease: an analysis of 6,540 consecutive pregnancies evaluated by detailed fetal echocardiography. *J Am Coll Cardiol* 2003;42:923-929
- Kohl T, Sharland G, Allan LD, et al. World experience of percutaneous ultrasound-guided balloon valvuloplasty in human fetuses with severe aortic valve obstruction. *Am J Cardiol* 2000;85:1230-1233
- Towetky W, Wilkins-Hang L, Jennings RW, et al. Balloon dilation of severe aortic stenosis in the fetus: potential for prevention of hypoplastic left heart syndrome: candidate selection, technique, and results of successful intervention. *Circulation* 2004;110:2125-2131
- Thomas JA, Graham JM. Chromosome 22q11 deletion syndrome: an update and review for the primary pediatrician. *Clin Pediatr (Phila)* 1997;36:253-266
- Strauss AW, Johnson MC. The genetic basis of pediatric cardiovascular disease. *Semin Perinatol* 1996;20:564-576

- Ryan AK, Goodship JA, Wilson DJ, et al. Spectrum of clinical features associated with interstitial chromosome 22q11 deletions: a European collaborative study. *J Med Genet* 1997;34:798-804
- Johnson MC, Hing A, Wood MK, Watson MS. Chromosome abnormalities in congenital heart disease. *J Med Genet* 1997;34:292-298
- Shulz SM, Pretorius DH, Badcock NE. Four-chamber view of the fetal heart: demonstration related to menstrual age. *J Ultrasound Med* 1994;13:285-289
- Allan LD. Cardiac anatomy screening: what is the best time for screening in pregnancy? *Curr Opin Obstet Gynecol* 2003;15:143-146
- DeVore GR. The aortic and pulmonary outflow tract screening examination in the human fetus. *J Ultrasound Med* 1992;11:345-348
- Brosley B, Estroff JA, Sanders SP, et al. Fetal echocardiography accuracy and limitations in a population at high and low risk for heart defects. *Am J Obstet Gynecol* 1992;166:1477-1481
- Benacerraf BR. Sonographic detection of fetal anomalies of the aortic and pulmonary arteries: value of four-chamber view is direct images. *AJR Am J Roentgenol* 1994;163:1443-1446
- Geethavathi U, Baschal AA, Knopfle G, Hansmann M. First- and early second-trimester diagnosis of fetal cardiac anomalies. In: Wladimiroff JW, Pitu G, eds. *Ultrasound and the Fetal Heart*. New York: Parthenon Publishing Group; 1996:39-46
- Huggon IC, Ghi T, Cook AC, Zouner N, Allan LD, Nicolaides KH. Fetal cardiac abnormalities identified prior to 14 weeks' gestation. *Ultrasound Obstet Gynecol* 2002;20:22-29
- Haak MC, Twink JW, Van Vugt JM. How successful is fetal echocardiographic examination in the first trimester of pregnancy? *Ultrasound Obstet Gynecol* 2002;20:9-13
- Crane JP, LeFevre ML, Winborn RC, et al. A randomized trial of prenatal ultrasonographic screening: impact on the decision, management, and outcome of anomalous fetuses. *Am J Obstet Gynecol* 1994;171:392-399
- Adelson B, Glaser J, Gelernter I, Hedges J, Yagel S. Emergent fetal echocardiographic examination for detecting cardiac malformations in low risk pregnancies. *BMJ* 1992;304:671-674
- Kirk JS, Riggs TW, Comstock CH, Lee W, Yang SS, Weishaue E. Prenatal screening for cardiac anomalies: the value of routine addition of the aortic root to the four-chamber view. *Obstet Gynecol* 1994;84:427-431
- Allan LD. *Manual of Fetal Echocardiography*. Lancaster, England: MTP Press Limited; 1986
- Brown DL, Emerson LS, Candler MS, Feller RE, DeSosa TG, Smith WC. Congenital cardiac anomalies: prenatal sonographic diagnosis. *AJR Am J Roentgenol* 1989;153:109-114
- McGahan JP. Sonography of the fetal heart: findings on the four-chamber view. *AJR Am J Roentgenol* 1991;156:547-553
- Comstock CH, Smith R, Lee W, Kirk JS. Right fetal cardiac axis: clinical significance and associated findings. *Obstet Gynecol* 1998;91:495-499
- Shepp TD, Brosley B, Herberger LK, Nadel A, Benacerraf BR. Levorotation of the fetal cardiac axis: a clue for the presence of congenital heart disease. *Obstet Gynecol* 1995;85:97-102
- Smith RS, Comstock CH, Kirk JS, Lee W. Ultrasonographic left cardiac axis deviation: a marker for fetal anomalies. *Obstet Gynecol* 1995;85:187-191
- Practice AFUM. Guideline for the performance of an antepartum obstetric ultrasound examination. *J Ultrasound Med* 2003;22:1116-1125
- Forbes M. Sonography of the normal fetal heart: a practical approach. *AJR Am J Roentgenol* 1999;173:1363-1370
- Carter MS, Davidoff A, Wamke LA, et al. The normal diameter of the fetal aorta and pulmonary artery. Echocardiographic evaluation in utero. *AJR Am J Roentgenol* 1987;149:1003-1007
- Copel JA, Moratti R, Hobbins JC, Kleinman CS. The prenatal diagnosis of congenital heart disease using fetal echocardiography: is color flow mapping necessary? *Obstet Gynecol* 1990;75:1-5
- Sharland GK, Chita SK, Allan LD. The use of colour Doppler in fetal echocardiography. *Int J Cardiol* 1990;28:229-236
- Rice MJ, McDonald RW, Sahn DJ. Contributions of color Doppler to the evaluation of cardiovascular abnormalities in the fetus. *Semin Ultrasound CT and MRI* 1993;14:277-285
- DeVore GR, Ali O. The use of color Doppler ultrasound to identify fetuses at increased risk for trisomy 21: an alternative for high-risk patients who decline genetic amniocentesis. *Obstet Gynecol* 1993;83:376-386
- Brown DL, DeSosa TG, Frates FC, et al. Sonography of the fetal heart: normal variants and pitfalls. *AJR Am J Roentgenol* 1992;160:1213-1255
- Silverman NH. *Pediatric Echocardiography*. Baltimore: Williams and Wilkins; 1993
- Fegmanson E, Ed-Nei SH, Johansen OJ, Linker DT. Prenatal detection of heart defects at the routine fetal examination at 18 weeks in a non-selected population. *Ultrasound Obstet Gynecol* 1995;5:372-380
- Stoll C, Alernik Y, Durr B, Roth PM, De Getter B. Evaluation of prenatal diagnosis of congenital heart disease. *Prenat Diagn* 1993;13:453-461
- Wigton TR, Sabughy RE, Tamara RK, Cohen L, Minogue JP, Sussburger JF. Sonographic diagnosis of congenital heart disease: comparison between the four-chamber view and multiple cardiac views. *Obstet Gynecol* 1993;82:219-224
- Benacerraf BR, Pober BR, Sanders SP. Accuracy of fetal echocardiography. *Radiology* 1987;165:347-349
- Copel JA, Pitu G, Green J, Hobbins JC, Kleinman CS. Fetal echocardiographic screening for congenital heart disease: the importance of the four-chamber view. *Am J Obstet Gynecol* 1987;157:648-655
- Kirk JS, Comstock CH, Lee W, Smith RS, Riggs TW, Weishaue E. Sonographic screening to detect fetal cardiac anomalies: a 5-year experience with 111 abnormal cases. *Obstet Gynecol* 1997;89:227-232
- Paladini D, Palmeri S, Lamberti A, Todoro A, Martucci P, Nappi C. Characterization and natural history of ventricular septal defects in the fetus. *Ultrasound Obstet Gynecol* 2000;16:118-122
- Oric J, Flotta D, Sherman ES. To be or not to be a VSD. *Am J Cardiol* 1994;74:1284-1285
- Brown DL, Herberger LK. Problems and pitfalls in the sonographic diagnosis of fetal cardiac anomalies. *Ultrasound Q* 1995;11:221-227
- Carter MS, Emerson DS, Plappert T, St. John Sutton M. Hypoplastic left heart with absence of the aortic valve: prenatal diagnosis using two-dimensional and pulsed Doppler echocardiography. *J Clin Ultrasound* 1987;15:463-468
- Allan LD, Chita SK, Anderson RH, Fagg N, Crawford DC, Tynan MJ. Coarctation of the aorta in prenatal life: an echocardiographic, anatomical, and functional study. *Br Heart J* 1988;59:336-350
- Benacerraf BR, Saltzman DH, Sanders SP. Sonographic sign suggesting the prenatal diagnosis of coarctation of the aorta. *J Ultrasound Med* 1989;8:65-69
- Brown DL, Durfee SM, Hottelberger LK. Ventricular coarctation as a sonographic sign of coarctation of the fetal aorta: how reliable is it? *J Ultrasound Med* 1997;16:95-99