A 9-day-old neonate weighing 3 kg was referred to our institution for cyanosis and a systolic murmur. A 2-dimensional echocardiogram suggested SDL, levocardia, criss-cross heart with double-outlet right ventricle, hypoplasia of the tricuspid valve and right ventricle, and severe pulmonary stenosis. A real-time 3-dimensional echocardiogram (Sonos 7500, Philips Medical Systems, Andover, Mass) demonstrated the complex anatomy of the criss-cross heart as clearly as if one were viewing an anatomic specimen.

The atria were situated in relatively normal positions, with normal venous connections. The left atrium was posterior and communicated via the mitral valve with the morphologically left ventricle situated inferiorly and extending to the right (Figure 1). The right atrium was anterior and communicated by means of a tricuspid valve with the hypoplastic morphologically right ventricle, positioned superiorly and extending to the left (Figure 2). The right atrium–right ventricle axis was nearly orthogonal to, rather than parallel to, the left atrium–left ventricle axis so that the atrioventricular valves were seen to cross each other, as viewed in the frontal plane (Figure 3 and Movies I and II). The ventricles appeared to have been twisted clockwise about their long axes when viewed from the apex, whereas the base of the heart remained fixed. This gave the characteristic appearance of each atrium emptying into the contralateral ventricle. Given the rarity of this cardiac defect and the specimen-like quality of the images, the 3-dimensional echocardiogram was very useful not only for clinical diagnosis but also for didactic purposes.

Disclosures
None.
Figure 1. Three-dimensional echocardiographic subcostal view (posterior cut): The arrow traces the route from the left atrium to the left ventricle through the mitral valve. The left ventricle is normal in size, whereas the right ventricle is clearly hypoplastic. A indicates aorta; RV, right ventricle. Spatial orientation symbols: R indicates right; L, left; S, superior; I, inferior; A, anterior (toward observer); and P, posterior (away from observer). *Ventricular septal defect.

Figure 2. Three-dimensional echocardiographic subcostal view (more anterior cut with respect to Figure 1): The arrow traces the route from the right atrium to the right ventricle through the tricuspid valve. Note that the axis of the tricuspid valve is nearly orthogonal to the axis of the mitral valve. The subpulmonary stenosis resulting from deviation of the infundibular septum is demonstrated. A indicates aorta; P, pulmonic valve; and I, infundibular septum. *Coronary sinus ostium; °atrial septal defect. Spatial orientation symbols as in Figure 1. *Ventricular septal defect.

Figure 3. Three-dimensional echocardiographic subcostal view (a more inferior view obtained by rotating Figure 2): Both ventricles and atrioventricular valves are visualized. The mitral valve is seen en face (small arrow), whereas the tricuspid valve is seen in long-axis view (the big arrow traces the route from the right atrium to the right ventricle), demonstrating the “criss-cross.” The hypoplastic right ventricle is now evident, with only the inlet and outlet portions well represented. Small arrow indicates mitral valve orifice; S, interventricular septum; RV, right ventricle; A, aorta; P, pulmonic valve; and I, infundibular septum. Spatial orientation symbols as in Figure 1. *Ventricular septal defect.
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