IMAGES **in PAEDIATRIC CARDIOLOGY**

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Abstract

Evaluating complex cardiac defects in small children preoperatively requires multiple diagnostic procedures including echocardiography, and also invasive methods such as cardiac catheterisation, computer-tomography and magnetic resonance imaging. We assessed the complex anatomy of the atrioventricular valves in atrioventricular septal defect using bedside real-time three-dimensional echocardiography and comparing these results to the anatomic findings at the time of operative intervention.

MeSH

Echocardiography, Three-Dimensional Heart defects, congenital

Article

We report the case of a 5 month old boy in whom an atrioventricular septal defect had been diagnosed postnatally associated with the clinical signs of Down's Syndrome. Two-dimensional-echocardiography revealed an atrial septal defect of ostium primum type (ASD I), an inlet-ventricular septal defect (VSD) together with moderate tricuspid and mitral valve regurgitation. The child was gaining weight well and was presented for elective corrective surgery at the age of five months. In order to achieve more detailed information about the anatomy of the atrioventricular valves we used Real-Time Three-Dimensional-Echocardiography on a Phillips Sonos 7500 System operating a 4 MHZ-Transducer. The images obtained were suggestive of an atrioventricular septal defect of Rastelli Type A. An incompletely separated AV-valve was seen formed from a left and right ventricular part with a small posterior bridging leaflet and a relatively prominent anterior bridging leaflet. The "cleft" between the two leaflets could be demonstrated as well as the atrial septal defect (Fig.1). The surgeon's view through the right atrium during the corrective operation confirmed our diagnosis by revealing an atrioventricular connection through an incompletely separated AV-valve (Fig. 2).

Figure 1: Three-Dimensional Echocardiographic view on the Atrioventricular Valves in Atrioventricular Septal Defect from above: a prominent anterior bridging leaflet (AL), a small posterior bridging leaflet (PL) with the typical "cleft" in between is shown, R = right ventricular side, L = left ventricular side, A = aortic root, C = "cleft".

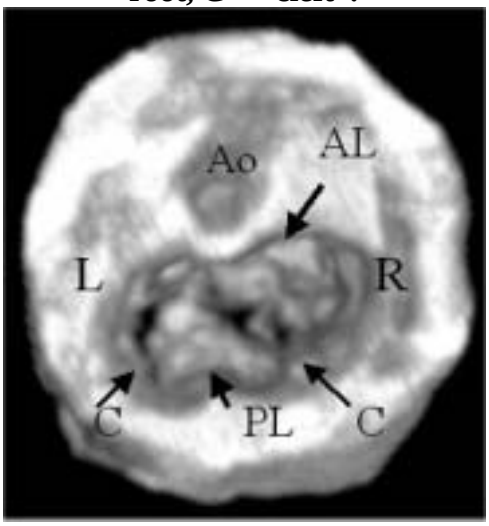
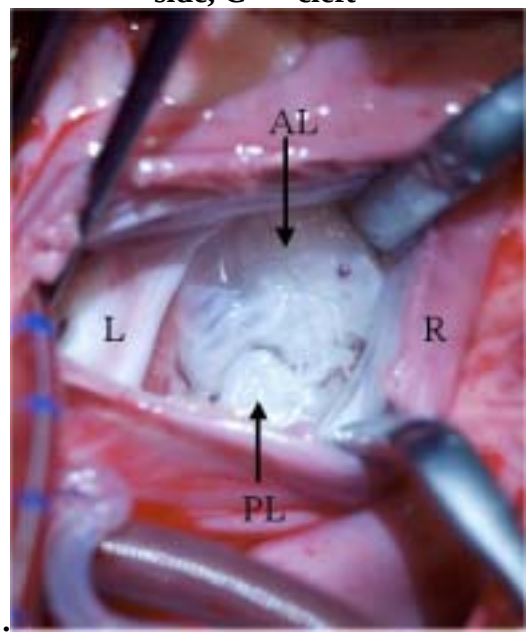


Figure 2: Intraoperative view on the Atrioventricular valves: the right atrium is open and the small anterior bridging leaflet (AL) as well as the prominent posterior bridging leaflet (PL) and the cleft is seen. R = right ventricular side, L = left ventricular side, C = "cleft"



Although two-dimensional echocardiographic assessment is a useful tool for gaining information about the anatomy of congenital heart defects it fails whenever detailed information about the three-dimensional relationship of intracardiac structures is necessary. [1] The new techniques of transcatheter closure of atrial and ventricular septal defects for example make it more difficult deciding about surgical or interventional closure of the defect. More precise information about size and location of these defects is strongly needed in order to plan the best procedure for the individual patient.

Evaluating cardiac defects in newborns and infants by MRI, CT or cardiac catheterisation on the other hand requires general anaesthesia or sedation with their associated risks. Therefore three-dimensional-echocardiography is an attractive alternative imaging system, but in past it was available only offline; the images being reconstructed after scanning the patient without the possibility of assembling new scans.[2]

Realtime-three-dimensional-echocardiography now offers the same advantages at the bedside.[3-4] The three-dimensional scan is shown on the display during the examination, every angulation in every plane is possible and allows clear demonstration of all cardiac structures in their real-time setting. In atrioventricular septal defects, a precise demonstration of the morphology of the AV-valves and clear visibility of potential straddling chordae will help substantially in planning the

surgeon`s procedures.[2] Three dimensional echocardiography will assist when transcatheter closure of an atrial septal defect is planned by delineating the size of the defect and its rims, allowing choice of appropriate size and type of device.[5] In ventricular septal defect the 3-D view will permit assessment of feasibility of transcatheter closure by determining the precise location and maximum diameter.[1]

The real-time 3-D-modality will also be useful in the examination of complex congenital heart defects such as double-outlet-right ventricle or univentricular heart. Preoperative planning will be based on very different, important new aspects of these defects otherwise available only by MRI or CT. The real-time 3-D-modality will be useful in the evaluation of aortic arch anomalies, of peripheral arteries, of pulmonary arteries and of ventricular size and performance. When 3-D-echo-color-doppler becomes available it will be possible to classify regurgitant jets with respect to their true extension in a three-dimensional image of the beating heart. So we are convinced that by real-time-3-D-echocardiography, preoperative planning of procedures will be substantially changed and facilitated.

References

1. Acar P, Abdel-Massih T, Douste-Blazy MY, Dulac Y, Bonhoeffer P, Sisi D. Assessment of muscular ventricular septal defect closure by transcatheter or surgical approach: a three-dimensional echocardiographic study. Eur J Echocardiogr 2002;3:185-191
2. Vogel M, Ho SY, Lincoln C, Anderson RH. Transthoracic three-dimensional echocardiography for the assessment of straddling tricuspid or mitral valves. Cardiol Young 2000;10:603-609
3. Balestrini L, Fleishman C, Lanzoni L, Kisslo J, Resai Bengur A, Sanders SP, Li JS. Real-time 3-dimensional echocardiography evaluation of congenital heart disease. J Am Soc Echocardiogr 2000;3:171-176
4. Mizelle KM, Rice MJ, Sahn DJ. Clinical use of Real-time three-dimensional echocardiography in pediatric cardiology. Echocardiography 2000;8:787-790
5. Acar P. Three-dimensional echocardiography in transcatheter closure of atrial septal defects. Cardol Young 2000;5:484-492

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