proliferation, two for vessel growth. One postoperative dilation (group 2) was complicated by acute fracture, requiring additional postdilatation. One ductal stent was completely occluded in a child with borderline hypoplastic left heart that acquired biventricular circulation. The other 11 were fully patent. Surgery performed in six patients (interval 1.9 to 10 months), showed completely endothelialized and patent stents. No ‘late’ obstructive stent fractures were seen on chest X-Ray, CT scan or fluoroscopy performed in 90% of the patients during follow-up. Predilation was the only significant risk factor for acute complication in univariate analysis. Conclusion.— The V ALEO® stent is a useful stent in growing children. Low radial force is counter balanced by high flexibility, allowing implantation in distal and tortuous lesions. Early fractures may occur. Longer-term follow-up is needed.

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11 Atrial septal defect area assessed by 3D echo is relevant for calibration during percutaneous closure
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Background.— Balloon sizing during percutaneous atrial septal defect (ASD) closure leads to bigger device, extending time procedure and radiation dose but remains the gold standard. Real time-3D-TransEsophagealEchocardiography (RT-3D-TEE) allows diameters and area measures on a 3D view. We assessed the relationships between the occlusive balloon diameter (BD), area and diameters measured using 2D- and 3D-TEE. The effect of ASD shape and the predictive value of the measures in children with ostium secundum ASD were investigated.

Methods.— From 2011 to 2013, we prospectively enrolled 30 children (mean weight 30.9 ± 12.9 kg, max 64 min 18) who underwent transcatheter closure of an isolated ASD under 3D-TEE (3D-matrix array 2–7 MHz TEE probe and IE33 ultrasound machine Philips®). ASD diameters were measured by transthoracic echo (TTE), 2D-TEE and off-line by 3D Multiplanar reconstruction (Qlab software®). ASD area was also estimated by delineating the outlines of the defect on the reconstruction software. The shape of the ASD was assessed visually on the RT-3D-TEE ’en face’ view and was defined as circular (n = 16) or ovale (n = 14). An asymmetry index was calculated by the maximal 3D diameter divided by the minimal 3D diameter (mean 1.4 ± 0.2 mm 1 max 1.84). A cut-off of 1.25 was set to distinguish ovale (n = 8) and circular shape (n = 22).

Results.— The Amplatzer® device number was equal to BD ± 1 mm in 23 cases (76.7%) and higher in the remaining cases. Difference between 3D maximal diameter and BD (2.3 mm ± 4.2 mm –6.6 max 12.2, P = 0.0051) was higher in round ASD than in oval shape (4.8 ± 3.5 vs. 1.4 ± 4.1, P = 0.04). ASD area was well correlated with BD (r = 0.82, P < 0.0001). Age, body area, weight, size, and retroaortic rim length were not correlated with the difference between 3D and BD. After multivariable linear regression analysis, ASD area by 3D delineation was the only significant variable for the prediction of BD: BD (mm) = 4.5*ASD area (cm²) +11. This formula allow a prediction with ± 1 mm difference with the observed BD in 1/2 and ≤ 2 mm in 2/3 of procedures.

Conclusion.— The relationship between BD and echo parameters are influenced by the ASD shape. ASD area estimated by delineation on a 3D view is the most relevant parameter to estimate the BD. It may be sufficient to guide percutaneous ASD closure without balloon sizing in children.

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12 Tricuspid annulus assessment using 3D echocardiography in children with and without congenital heart disease
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Tricuspid valve (TV) assessment is essential in various congenital heart diseases. 2D echo remains the cornerstone of TV annulus (TVA) measurement but is limited by its complex shape. We investigated in children, the feasibility of 3D-Transthoracic echo (TTE) in TVA assessment compared with 2D.

Methods.— Diameters of TVA were performed on three 2D sectional views [parasternal short axis (PSA), apical four chambers (A4C), parasternal right ventricular inflow (PSRVI)]. ’En face view’ of the TVA was obtained with real time zoom 3D in A4C. 3D-matrix array X7-2, X5-1, X3-1 probes, iE33 Philips®. Off-line measures of maximal (mTVA) and minimal (µTVA) diameters were performed using multiplanar reconstruction on Qlab® Software. An asymmetric ratio was calculated (mTVA/µTVA).

Results.— Sixty-four children (7.1 ± 5.4 years; weight 2.2–82 kgs) with (42.2%) and without (57.8%) cardiopathy were prospectively included. Feasibility of 3D TVA dataset was possible in all cases. Quality was estimated to be fairly good in 69.8% of cases. Leaflets visualization was possible in all unless in three children (95.2%) and was better when 3D data set quality was good (P < 0.0001) mTVA was from septal to lateral axis. Pearson Correlations were good between mTVA, µTVA and 2D sectional diameters (r ≥ 0.8 in all cases, P < 0.0001). TVA was asymmetric with a ratio >1.2 in 43 children (67.2%) without significant difference according to the cardiopathy. Difference between mTVA and µTVA was 10.3 ± 13.2 mm/m² (P < 0.0001). PSA was higher than mTVA (P = 0.001) whereas µTVA was higher than PSRVI (P < 0.0001) and closed to A4C although superior (P = 0.03) µTVA was higher than A4C when mTVA < 25 mm and the contrary was seen for mTVA > 25 mm.

Conclusion.— Feasibility of 3D imaging of the tricuspid valve is good in children with or without cardiopathy. According to 3D TVA diameters, the 2D A4C seems to be the most reliable sectional view, while the 2D-PSRVI underestimates the TAD. Conversely, the 2D PSA seems to overestimate TVA compared to 3D measures.

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13 Decreased left ventricular longitudinal myocardial deformation in type 1 diabetic children: An early sign of diabetic cardiomyopathy?
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Background.— The relation between type 1 diabetes and cardiac structure and function in children is poor documented. We used 2D speckle strain imaging to investigate whether children and adolescents with type 1 diabetes have early echocardiographic signs
of subclinical cardiac dysfunction and whether state of metabolic control and diabetes duration are of influence.

Methods. — Standard 2D echocardiography, mitral TDI and 2D speckle strain imaging were prospectively performed in type 1 diabetic children and compared healthy control subjects. Standard echocardiographic indices of global systolic and diastolic function, early peak diastolic mitral velocity (Ea), longitudinal strain (LS), radial strain (RS) and circumferential strain (CS) were investigated. A possible correlation was examined for HbA1c and diabetes duration.

Results. — Overall 100 consecutive type 1 diabetic children (age: 11.3 ± 3.6 years, 52 boys, duration of diabetes ranged from 1.1 to 16 years) were compared to 79 control children. The diabetic and control children were comparable with respect to age, sex, heart rate, systolic, diastolic and mean blood pressure. Although obese patients were excluded, diabetic patients had significantly higher BMI (0.32 ± 1.17 vs. −0.16 ± 0.73; P = 0.001).

There were no significant differences between the two study groups with regard to LVEF, LV-EDD, LV-ESD, LV-PW-ESD, standard diastolic function parameters (A, E/A, and MDT) and TDI parameters. E-wave was significantly lower in the diabetic group (102.7 ± 16 vs. 108.4 ± 17.6 cm/s; P = 0.025). The LS was significantly lower in the group of diabetic children (−17.1 ± 1.7 vs. −20 ± 1.6; P = 0.001), while the circumferential strain and the radial strain did not differ. LS was positively correlated with HbA1c (r = 0.34; P < 0.01), while there was no correlation with the duration of the diabetes (r = 0.12; P = 0.22).

Conclusion. — We demonstrated that left ventricular longitudinal myocardial deformation is decreased in young patients with uncomplicated type 1 diabetes. Metabolic control may be the main risk factor for these myocardial changes. This finding might be considered a very early preclinical alteration potentially related to subsequent development of diabetic cardiomyopathy.

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14 Detection of major coronary artery anomalies in a pediatric and adult population: A prospective echocardiographic study


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Objectives. — We sought to describe our experiment with major coronary anomalies (MCA) diagnosed in transthoracic echocardiographic (TTE) in a large adult and pediatric population.

Background. — MCA may have serious clinical consequences. No echocardiographic study has identified prospectively all potentially serious coronary anomalies in a general adult and pediatric population.

Methods. — From June 2008 to January 2012, a systematic search for major coronary anomalies was conducted in children and adult patients, coming for a TTE.

Results. — Three thousand five hundred and two patients (84% adults and 16% children) received a TTE. Fourteen coronary anomalies (0.3%) were diagnosed: nine anomalous origins of coronary artery from the opposite sinus with inter arterial course, one abnormal left coronary artery from pulmonary artery, three single coronary arteries, and one coronary fistula. Cardiac symptoms initiated investigation in seven patients. Five patients underwent specific surgery: two coronary reimplantations, three coronary bypass grafting. Ten patients had already received at least one TTE without the anomalous coronary artery being either diagnosed or suspected.

Conclusions. — MCA is a rare condition which can be identified through an accurate exploration of coronary anatomy by TTE. The search for potentially lethal congenital coronary anomalies should be included in a standard echocardiographic examination.

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15 Aortic root dilatation in adult patients with repaired tetralogy of Fallot

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Intro. — Aortic root dilatation is commonly observed among patients with repaired tetralogy of Fallot. The aortic root is mostly involved, at all levels. Nevertheless, the prevalence of aortic root dilatation and its rate of growth remain to be defined.

Methods. — We conducted a retrospective study, reviewing aortic MRI measurements at different levels (sinuses of Vasalva, sinotubular junction, ascending aorta, horizontal aorta, isthmus, and descending aorta) from 51 consecutive adult patients with repaired tetralogy of Fallot. Matched controls for age and sex were recruited in a healthy population of patients undergoing a cardiac MRI study for other reason.

Moreover, the annual rate of aortic growth was determined by MRI for 28 patients with repaired tetralogy of Fallot.

Results. — Fifty-nine percent of patients with repaired tetralogy of Fallot suffered from an aortic dilation located at the level of the sinuses of Vasalva, versus 6% in the control group, according to the Roman criteria (P < 0.001). Compared to the control population, aortic segments are significantly larger at all ascending levels, including the horizontal segment in patients with repaired tetralogy of Fallot: at the sinuses of Vasalva, mean aortic diameter is 20.4 mm in the tetralogy of Fallot group, versus 15.6 mm in the control group (P < 0.001). There is no difference between the two groups at the descending level of the aorta (9.9 mm in patients with repaired tetralogy of Fallot, versus 9.8 mm in control patients, P = 0.067).

Among patients with repaired tetralogy of Fallot, the rate of aortic growth is 0.697 ± 1.6 mm/year at the sinuses of Vasalva and 0.236 ± 1.29 mm/year in the ascending aorta.

Conclusions. — Aortic root dilatation is frequent among patients with repaired tetralogy of Fallot and mostly concerns the aortic root, compared to a control group of healthy patients. Horizontal and descending aortas do not seem to be involved in the dilation. Aortic root dilatation needs to be carefully and regularly controlled, as it appears to be a dynamic and progressive phenomenon, although rather slow.

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