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Percutaneous closure of coronary artery fistulas in pediatrics

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Background.— The prevalence of coronary fistulas is poorly known in the pediatric population. However complications are potentially serious as: heart failure, sudden death, arrhythmias, and endocarditis. In adults, transcatheter closure is an alternative to surgical treatment. In pediatric populations, few publications exist on the feasibility and effectiveness of this treatment.
Aim.— To evaluate the feasibility of percutaneous closure of coronary fistulae in pediatrics, the evolution and the occurrence of complications.
Methods.— Retrospective observational multicentric national study concerning all patients under 16 who underwent transcatheter closure of a congenital coronary fistula (complex cardiopathies excluded).
Results:

Origin	Left coronary (28)	Right coronary (28)	Double (5)
Drainage site	Right atrium (12)	Right atrium (12)	Right ventricle (4)
	Right ventricle (12)	Right ventricle (13)	Pulmonary artery (1)
	Left atrium (2)	Pulmonary artery (2)	
	Left and right ventricle (1) Pulmonary artery (1)	Left atrium (1)	

Population.— Sixty-one patients (36 girls, 25 boys), median age at diagnosis 0.6 years [0—15.4], 3,9 years at procedure [0—16]. Initial signs: precordial murmur (90%), congestive heart failure (11%), nonspecific ECG abnormalities (4.9%), left or right ventricular dilatation (31%). Efficiency: complete occlusion at hospital discharge in 82%, five procedures failures. Complications: no death. Three transient STEMI, three coil embolization, one ventricular fibrillation (recovered), one Leg ischemia. Combination therapy: antiplatelet (46%), mean duration 4.1 months. One with AVK treatment then antiplatelet. Evolution: data are available for 43 children (70%), median follow-up 91 days [min = 0, max = 4824]. At 2 years, complete occlusion rate was 72.7% ± 7.6%.
Five reoperations (three transcatheter, two surgical procedures). One late recanalization at 17 months.
No cardiovascular complication.
Conclusion.— Percutaneous closure of coronary fistulas in the pediatric population appears to be effective and relatively safe.

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The EDWARDS VALEO LIFESTENT® for treatment of cardiovascular lesions in children

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Background.— The EDWARDS VALEO LIFESTENT® is a stainless steel, premounted, open cell stent. Easy dilation to large diameters and low profile are advantages in growing children. Radial force is poor.
Methods and results.— Between 4-2011 and 12-2012, 41 VALEO® stents were placed during 33 procedures, including 30 transcatheter (group 1) and three peroperative procedures (group 2). Data were retrospectively analyzed. Median age at implantation was 2.6 years (5 days—23 years), weight 10 kg (2—53). Indications were: pulmonary artery stenosis (23), pulmonary vein stenosis (1), subhepatic vein thrombosis (1), ductus arteriosus stenting (hybrid approach) for hypoplastic left heart (6) and for interrupted aortic arch (2).
In group 1, access was femoral in all except five (4 jugular, 1 transhepatic). Stent placement was achieved in all but one. Predilation was performed in 14, postdilation in five. In group 2, stents were placed during bypass, secured with a single stitch and flared at the proximal end. Acute complications were hemoptysis (3), reperfusion edema (1), low cardiac output (2), stent dislodgement (2) and fractures (2). Median follow-up (n = 28) reached 8.8 months (1.9—34). Early recatheterization was performed in 19 patients (median 5 months). The stent was redilated in seven patients: three (group 2) to achieve better wall apposition, one due to intimal

proliferation, two for vessel growth. One postoperative dilation (group 2) was complicated by acute fracture, requiring additional postdilation. 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 VALEO® 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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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 kgs 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 min 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 min −9.6 max 12.2, $P = 0.0051$) was higher in round ASD than in ovale shape (4.8 ± 3.5 vs. 1.4 ± 4.1, $P = 0.04$). ASD area was well correlated with BD ($r = 0.82$, $P < 0001$). Age, body area, weight, size, and retroaortic rim length were not correlated with the difference between 3D and BD. After multivariate linear regression analysis, ASD area by 3D delineation was the only significant variable for the prediction of BD: BD (mm) = 4.5*ASD area (cm^2) +11. This formula allow a prediction with < 1 mm difference with the observed BD in ½ 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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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) measure 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 TV 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 (^{m}TVAd) and minimal ($_{m}$TVAd) diameters were performed using multiplanar reconstruction on Qlab® Software. An asymmetric ratio was calculated (^{m}TVAd/$_{m}$TVAd).
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 TV 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 ($P < 0.0001$) ^{m}TVAd was from septal to lateral axis. Pearson Correlations were good between ^{m}TVAd, $_{m}$TVAd and 2D sectional diameters ($r \geq 0.8$ 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 ^{m}TVAd and $_{m}$TVAd was 10.3 ± 13.2 mm/m^2 ($P < 0.0001$). PSA was higher than ^{m}TVAd ($P = 0.001$) whereas ^{m}TVAd was higher than PRSVI ($P < 0.0001$) and closed to A4C although superior ($P = 0.03$) ^{m}TVAd was higher than A4C when ^{m}TVAd < 25 mm and the contrary was seen for ^{m}TVAd > 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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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