Transcatheter closure of secundum atrial septal defect associated with deficient rims using the Amplatz septal occluder

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**Background:** Transcatheter closure is an alternative to surgery for secundum atrial septal defect (ASD) closure but remain controversial in cases with deficient rims. We aim to assess the feasibility of transcatheter closure for secundum ASDs with deficient rims other than the antero-superior. We went percutaneous closure of ASD in our institution. We retrospectively analyzed 175 patients under-went percutaneous closure of ASD in our institution. We retrospectively analyzed the outcomes of the 39 patients (22%) with one or more deficient rim other than the antero-superior.

**Results:** The median age and weight was 9,3(1,1 to 85 ) years and 31,6 (8,8 to 99) Kg, respectively. Deficiency of the inferior rim (toward the AV valves, n=10), of the inferior- posterior rim (toward the inferior vena cava, n=13), or of the superior – posterior rim (toward the superior vena cava, n= 16) were suspected by transthoracic echocardiography and confirmed by transesophageal echocardiography in all the cases. Transcatheter closure was successfully accomplished in 33 (84,6%) of the cases with a median ASD size of 24/10 to 40/9mm. A modified method of implantation (sizing balloon technique) was used in 28 patients (71,8%). In 6 patients (5 children), the ASD could not be closed percutaneously. Four other children experienced device embolization few hours after the procedure. They were subsequently operated with successful ASD closure and no further complication. Univariate analysis revealed that adult age was associated with low risk for device embolization and failure (p<0,05).

**Conclusion:** Transcatheter closure of secundum ASD is feasible in patients with deficient rims other than the antero-superior. However, this cannot be recommended because of an untolerable rate of embolization. Possibly, transcatheter closure of such secundum ASDs with deficient rims may be more succesful in the adult population

Transcatheter closure of multiple muscular ventricular septal defects with various Amplatzer devices

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**Background:** The management of patients with multiple muscular ventricular septal defects (VSDs) is associated with important morbidity and mortality. Percutaneous transcatheter closure of multiple VSDs is challenging and scarcely reported. We retrospectively studied our experience with multiple unrestricive VSD closure, using various Amplatzer devices.

**Method and Results:** Since January 2006, 9 children with “Swiss cheese” VSDs initially treated in infancy by pulmonary artery banding underwent transcatheter closure of their defect at a median age and weight of 2.4 (0.9 to 7) years and 13.5(7,3 to 23) Kg, respectively. Associated cardiac malformations were present in three of the nine patients, including tetralogy of fallot (n=1), D-transposition of the great arteries (n=1) and Neuhauer's anomaly (n=1). One patient underwent surgical removal of an extremely tight pulmonary artery band, prior to VSD closure. Twenty seven defects were closed during 10 procedures, using various Amplatzer devices: 9 muscular VSD occluder, 2 ADO II, one 10 mm ASO and one 35 mm Cribriform. After the procedure a blood transfusion in 2 cases. Because no significant residual shunt was documented, the pulmonary artery band was successfully removed after VSDs closure in 6 patient and has been scheduled in the last case.

**Conclusion:** Transcatheter occlusion of multiple VSDs is safe and effective after initial pulmonary artery banding. Multiple defects can often be closed with a single device.

Right ventricular isthmus mapping to determine susceptibility to ventricular tachycardia in patients with tetralogy of fallot (ToF) repair

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**Background:** Although surgical repair for tetralogy of fallot (ToF) improved the overall survival, it involves right ventricular (RV) scars that predispose to the late onset of ventricular tachycardias (VT).

Many reports have demonstrated reentry as the underlying mechanism of these VTs, with anatomically defined isthmuses.

Therefore we have evaluated the number and the location of these isthmuses and their correlation with inducibility late after ToF repair.

**Methods:** Patients referred for either catheter ablation or pulmonary valvulotomy late after ToF repair were included. They underwent a 12-lead ECG, echocardiography, cardiovascular magnetic resonance (CMR) and an electrophysiological study including RV voltage mapping. In case of inducible VT, we mapped the VT circuit, define the responsible isthmus and ablate it.

Off line analysis of the signal allows to determine conduction velocity in the different isthmuses.

**Results:** 15 patients (33±12 yo, 66% M) were referred for sustained VT (n=1), premature ventricular beats (n=2), common flutter ablation (n=2) and prior to pulmonary valve replacement for the remaining. Mean QRS duration was 152±23ms. 5 patients (33%) had inducible sustained monomorphic VT (mean cycle length=270±87 ms).
Mean number of isthmuses was 1.9±0.6. The isthmus between the pulmo-
mary annulus (PA) and the septal patch was found in 100% patients, the
isthmus between the septal patch and tricuspid annulus (TA) was found in
62% patients, the remaining isthmuses (between the TA and the RVOT patch
and between the PA and RVOT patch) were present in 12% patients.

There was no correlation between the number of isthmuses and inducibility
but, interestingly, all 5 VT patients had conduction velocity in the responsible
isthmus during sinus rhythm <0.5 m/s.

**Conclusion:** VTs isthmuses after TOF repair are located in anatomically
defined isthmuses, with conduction velocity in the responsible isthmus <0.5 m/s
during sinus rhythm.

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**Characteristics of PAH associated with pretricuspid shunts in the registry of the French PAH network**

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Pulmonary arterial hypertension (PAH) associated with pretricuspid shunts is commonly delayed until adulthood but PAH may reveal the underlying
unknown congenital heart defect (CHD). Characteristics of this subgroup of
CHD-PAH is scarcely reported.

**Objective:** To review and analyze patients with PAH and pretricuspid shunts enrolled in the prospective PAH registry of the French PAH network.

**Patients and results:** Among the 255 pts with CHD-PAH, 105 patients
had a pretricuspid shunt. 72 were female and 28 male. The age at time of
CHD diagnosis ranged from birth to 81 years (mean 38.1 years): 17 pts were
diagnosed before the age of 18 years and 28 after 60 years. Fifteen pts had
been repaired before the diagnosis of PAH and the delay between repair and
PAH diagnosis ranged from the postoperative period (3 cases) to 54 years;
7 had their ASD closed after the diagnosis of PAH. In pts with open shunts, the
diagnosis of PAH was done simultaneously with the diagnosis of CHD in 56% of the cases whereas in 16% the diagnosis of CHD followed the diagnosis of
PAH (from 2 months to 16 years) and in 28% PAH appeared during the
follow-up of the CHD (from 2 to 47 years). At inclusion, 61% were in func-
tional class (FC) III, 32% in FC II, 5% in FC IV and 2% in FC I. Resting
oxygen saturation was below 92% in 30/92 patients. 6 minutes walking dis-
tance (n=81) was 360±107 m (range 120-700). Mean pulmonary artery pres-
ture at RHC (n=95) was 53±16 mmHg, cardiac output 5.02±1.7 L/min and
pulmonary vascular resistances 11±8.3 WU. With regards to PAH specific
treatment, only 49.6% of pts in class II-III received PAH therapy. During
follow-up, 9 pts died and 3 underwent heart-lung transplantation.

**Conclusion:** In this PAH-registry, the proportion of CHD-PAH due to pre-
tricuspid shunts compared to post-tricuspid shunts and other CHD is higher
than in previously reported series. It shows that the natural history of pretri-
cuspid (open and closed shunts) is far from being clearly understood as PAH
can be diagnosed throughout life. PAH at diagnosis was only moderately less
severe than in idiopathic PAH whereas PAH specific therapies are not widely
used in this setting.

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**Tetralogy of Fallot: impact of pulmonary valve replacement on the left ventricular function**

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Pulmonary valve regurgitation is the most common mid- to long-term comp-
plication after complete repair of Tetralogy of Fallot (ToF). The benefit of
Pulmonary Valve Replacement (PVR) on right ventricular volumes is well
established. However, impact on the left ventricular function is still debated.
We sought to determine the evolution of the left ventricular function and
septal motion after PVR.

**Methods:** Patients with a history of complete repair of ToF and requiring
a PVR were prospectively enrolled. They all underwent a cardiac MRI (CMR)
performed before and after PVR at 1.5 Tesla (Intera®, Philips Medical Sys-
tems, Best, The Netherlands). The CMR protocol included cine steady-state
free precession sequences in short axis planes (slice thickness=5mm, space
between slices=5mm) to assess the ventricular volumes. End-diastolic (EDV),
end-systolic volumes (ESV) and ejection fraction (EF) were calculated from
manual contouring of the left and right ventricular chamber. All volumes were
indexed to the body surface area. In order to quantify abnormal septum
motion, maximal excursion of the interventricular septum (IVS) was calcu-
lated. A Wilcoxon test was performed to compare these parameters before and
after PVR.

**Results:** 19 patients (mean age 29.6+/–14.5 years) has been included
between March 2009 and May 2011. LV-EDV and LV-ESV were respectively
76.7±26.3 and 38.5±19.6 mL/m² before the PVR and 78.6±22.2 and
34.0±13.9 mL/m² after, leading to a significant increase in LV-EF of 5.7±4.7%
(51.3±8.2% before PVR and 57.1±7.2% after PVR, p=0.0001). There was also
a significant reduction of RV-EDV (p=0.0001) and RV-ESV (p=0.0001) but
without improvement of RV-EF. Maximal IVS excursion decreased after PVR
(9.2±2.9 mm before and 6.7±3.2 mm after; p=0.002).

**Conclusion:** This study demonstrates a significant improvement in left
ventricular function and a decrease of the abnormal IVS excursion after PVR.