POSTER SESSION

1019 Catheter Closure of Atrial Septal Defects

Sunday, March 07, 2004, 9:00 a.m.-11:00 a.m.
Morial Convention Center, Hall G
Presentation Hour: 9:00 a.m.-10:00 a.m.

1019-199 Anatomic Interaction Between the Aortic Root and the Atrial Septum: An Echocardiographic Prospective Study

Géraldine Bertaux, Jean-Christophe Eicher, Annie Petit, Petr Dobsak, Pierre Louis, Jean-Eric Wolf, St Ann University Hospital, Dijon, France, St Ann University Hospital, Brno, Czech Republic

Background : Platypnea-orthodeoxia syndrome is a rare pattern of dyspnea that may be observed with atrial right-to-left shunting (RLS). A few cases have been reported in association with an aortic aneurysm, but no documented pathophysiological explanation has been proposed.
Methods : We studied 72 consecutive patients (mean age 66.2 ± 10, 68% males) referred for pre-operative assessment of either an aortic valve disease or an aneurysm of the ascending aorta. During catheterisation, a careful search for a patent foramen ovale (PFO) was performed. During multiplane transesophageal echocardiography we measured : maximal diameter of the ascending aorta (AoD), minimal atrial septal dimension (ASd) at the level of the aortic root, and maximal oscillation amplitude of the atrial septum (ASo) (4 patients with an atrial septal aneurysm were excluded). A PFO was sought by contrast infusion through a brachial vein and through the femoral vein, and the RLS was categorized as grade 1, 2 or 3. The relationships between AoD, ASd, and ASo were studied. In patients with a PFO, we looked at the relationship between RLS grade and ASo.
Results :
Mean AoD was 43.4 ± 9 mm (range 30-64) . A PFO was found in 26% of the patients

Correlation study	r	p
AoD / ASd	-0.49	<0.002
AoD / ASo	0.24	0.041
ASd / ASo	-0.37	<0.002
In 19 patients with a PFO		
ASo / RLS grade	0.52	0.038

Interpretation: These results demonstrate that a dilatation of the aortic root significantly affects the atrial septal morphology by reducing its apparent size, decreasing its tautness, and increasing its mobility. The increased septal mobility appears to be an important risk factor for RLS in the presence of a PFO.

1019-200 Migraine Relief Following Transcatheter Closure of Patent Foramen Ovale

Mark Reisman, Jill T. Jesurum, Merrill P. Spencer, Kimberly A. Krabill, Lance Diehl, John V. Olsen, Christine Smith, William A. Gray, Swedish Medical Center, Seattle, WA

Background: Current theory suggests that right-to-left shunt (RLS) through a patent foramen ovale (PFO) permits paradoxical microemboli and neuromediators to bypass lung filtration thereby potentially triggering migrainous aura. The purpose of this study was to determine if transcatheter PFO closure in migraineurs is associated with a reduction in migraine frequency.
Methods: Between July 2001 and 2003, 120 patients underwent transcatheter PFO closure to prevent recurrent cryptogenic stroke or transient ischemic attack. According to criteria defined by the International Headache Society, 42% (50/120) of patients experienced active migraine symptoms and 28% (34/120) of those reported migrainous aura. Following PFO closure, patients were serially evaluated to assess residual RLS and migraine frequency. Contrast transcranial Doppler was used to measure microembolic signals during normal respiration and during calibrated (40 mmHg) respiratory strain. The mean time of follow-up was 4 months after PFO closure.
Results: Migraineurs with aura (n = 23) experienced a mean reduction in migraine frequency from 7.8 ± 10.9 (pre-closure) to 1.7 ± 4.7 (post-closure) events monthly (p <.01). Migraineurs without aura (n = 9) reported a clinically important reduction in migraine frequency from 11.8 ± 12.7 (pre-closure) to 3.4 ± 8.1 (post-closure) events monthly (p = .07). Overall, 42% (21/50) of migraineurs experienced complete resolution of migrainous symptoms. Additionally, 5 (10%) patients reported a substantial (> 50%) reduction and 2 (4%) patients reported a partial (< 50%) reduction in migraine frequency. Only 5 (10%) patients reported no reduction in migraine frequency following PFO closure. A significant reduction in RLS was observed following PFO closure in migraineurs with and without aura (N = 44), during normal respiration (146 ± 128 vs. 22 ± 63, p < .01) and with calibrated strain (270 ± 65 vs. 92 ± 125, p < .01). Complete closure without residual RLS was achieved in 61% (27/44) of patients.
Conclusion: Transcatheter PFO closure results in significant reduction in migrainous events. The mechanism of this causal effect warrants further investigation.

1019-201 Device Closure of Atrial Septal Defect After the Fifth Decade of Life: Beneficial Effect on Symptoms and Ventricular Function

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Background: The majority of secundum atrial septal defects (ASD) can be closed by transcatheter techniques. The benefit in older patients remains unclear.
Aim: We assessed the effect of device closure of ASD on symptoms and ventricular function in patients > 50 years of age.
Methods: Symptoms, right and left heart size and function were assessed at baseline and 2-18 months post ASD device closure in 20 patients (13 female, mean age 63 (range 50-78) years).
Results: All defects were closed using an Amplatzer septal occluder. Mean (range) stretched diameter was 24 mm (16-40)and device size 26.7mm (18-40). Device closure was succesful in all patients with no residual leaks. Eighteen patients reported symptomatic improvement following the procedure. This was associated with a significant reduction in right atrial transverse diameter (5.5±0.9 to 4.5±0.9 cm, p<0.001) and right ventricle inlet diameter (5.1±0.9 to 3.8± 0.7 cm, p<0.05). Peak pulmonary flow velocity also fell from 115±30 to 90±16 cm/s, p<0.01, . In contrast left ventricular end-diastolic dimension increased from 4.1±0.6 to 4.6± 0.5 cm, p<0.001, while aortic velocity increased from 105± 25 to123±25 cm/s, p<0.001 consistent with increased left ventricular filling and systemic cardiac output. The 2 patients who reported no change in symptoms despite successful device implantation both had evidence of coronary artery disease. In them, the left ventricle was at the upper limit of normal before procedure and dilated further post ASD closure while the left atrium was already dilated before procedure (>5 cm) and increased further in diameter during follow-up. Left ventricular filling demonstrated signs of raised left atrial pressure before procedure (short isovolumic relaxation time and dominant E wave with short deceleration time <120 ms) and became more restrictive afterwards.
Conclusion: The majority of older patients report symptomatic improvement following device closure of ASD. This is associated with right ventricular remodelling and increased systemic cardiac output. However, benefit may be limited in patients with left ventricular dysfunction that could be masked by the ASD.

1019-202 Effect of Rim Deficiency and Occluder Size on Acute and Mid-Term Results of Transcatheter Atrial Septal Defect Closure in Adults

Maria Heger, Raphael Rosenhek, Harald Gabriel, Thomas Binder, Gerald Maurer, Peter Probst, Helmut Baumgartner, University of Vienna, Vienna, Austria

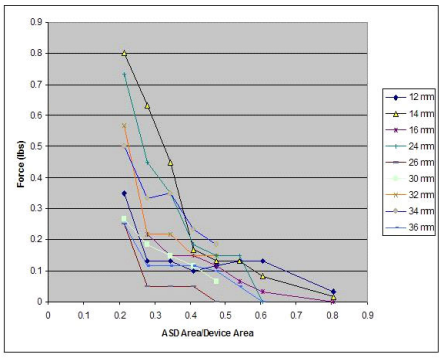
Background: Although a rim of ≥ 5mm around the defect was originally considered mandatory for transcatheter atrial septal defect (ASD) closure, defects with < 5mm rim to the aorta are now accepted. Whether this may be associated with damage of the aortic wall, a higher likelihood of residual shunt, aortic regurgitation (AR) or other unfavorable effects especially when using larger sized occluders has not been studied.
Methods: All pts in whom ASD closure was attempted between 1998 and 2002 were included (n=111, 80 female, 52±17yrs, Amplatzer occluder, mean follow-up [FU] 2.2±1.2 yrs). Sufficient rim was present in 36 pts. (group A), 48 pts. (group B) had only a small rim < 5mm to the aorta and 27 pts. had no rim to the aorta (group C). FU studies were performed at 3, 6 and 12 months and every year thereafter.
Results: The procedure was successful in all pts. (occluder size 25±5mm, range 9 to 35mm). No major complications occurred. Minor complications were: transient ST-elevation (2), transient AV block (1) and transient SVT (4). At last FU, no relevant residual shunt was present in any pt., while 5 pts. (group A: 3; group B:2) had mild shunts (Qp:Qs ≤ 1.3). Mild AR was present in 20 pts. prior to intervention. In only 1 pt. an increase to mild-to-moderate AR was found (group B). Six pts. (group A: 3; group B: 2; group C: 1) presented with a new finding of trace or mild AR at FU. Mild mitral regurgitation (MR) was common prior to intervention (71 pts.). In 4 pts. an increase to mild-to-moderate MR was observed (group A:1; group B: 3). Trace MR was an inconsistent finding disappearing in 6 pts. and occurring in 17 pts. (group A: 6; group B: 7; group C: 4). No aortic complications were observed. The only adverse events observed during FU were transient palpitations and the occurrence of atrial fibrillation (group A: 2; group B: 4; group C: 3). The occluder size was not related to any of these observations.
Conclusion: ASDs with small and even missing rim to the aorta can safely be closed with Amplatzer occluders. Neither a deficient rim to the aorta nor the use of larger occluders appears to result in an increased likelihood of residual shunt, of the occurrence or worsening of AR and MR or of other adverse events.

1019-203 Stability of the Amplatzer Septal Occluder Device: Importance of the Atrial Tissue Rim

Ankush K. Chhabra, Babak Azarbal, Hitoshi Anzai, Michael Fishbein, Catherine Dao, Vicki Chan, Richard Gaster, John Moore, Jonathan Tobis, University of California- Los Angeles, Los Angeles, CA

Background: Percutaneous closure of secundum atrial septal defects (ASD) with the Amplatzer Septal Occluder device requires an adequate rim of septal tissue to stabilize the device. The amount of septal tissue and atrial rim necessary for stabilization has not been quantified.
Methods: An artificial ASD was created in fresh autopsied hearts through a right atrial incision. ASDs (12 to 40 mm in diameter) were created and 9 sizes of Amplatzer (12 through 40mm) were inserted. The force required to pull these devices through the ASD was measured in 260 attempts with a handheld ergometer. In 9 hearts, sequential 30-degree segments of atrial rim 7 mm wide were removed, and the force required to pull the device through the atrial septum was re-measured.
Results: The force required to pull an Amplatzer device through a given ASD size with an

intact rim was directly proportional to the increasing size of the Amplatzer (range 0.05 to 1.5 lbs). In the samples with segments of atrial rim excised, the force required was significantly less (range 0.2 to 0.85 lbs, p<0.02). Loss of 30% of the atrial rim segment produced a 40% mean reduction (p<0.05) in the amount of force required to dislodge the device.
Conclusion: There is a linear relationship between the size of the Amplatzer device and force needed to pull it through an ASD. The circumference of atrial rim is important in securing the device. The ASD area plus excised rim area to Amplatzer area ratio of >0.6 causes a marked reduction in the stability of this device.



1019-204 **Doppler Tissue Imaging Analysis of Ventricular Function After Surgical and Transcatheter Closure of Atrial Septal Defect**

Yiu-Fai Cheung, Kin-shing Lun, Adolphus K. Chau, The University of Hong Kong, Hong Kong, Hong Kong

Background - The long-term ventricular function after surgical and transcatheter closure of ASD is uncertain. We assessed the right ventricular (RV) and left ventricular (LV) function of children after surgical and transcatheter closure of atrial septal defect (ASD) using Doppler tissue imaging (DTI), and compared to that of age-matched healthy controls. **Methods -** Two-dimensional M-mode echocardiography, transmitral Doppler assessment and pulsed DTI were performed in 17 patients at 5.4±3.0 years after surgical closure of ASD (group I), 17 patients at 3.5±0.9 years after transcatheter closure by Amplatzer septal occluder (group II) and 17 healthy control subjects (group III). The RV and LV myocardial performance was assessed by the DTI-derived Tei index. **Results -** The M-mode measurements, transmitral Doppler indexes and LV Tei indexes did not differ among groups. In group I, the tricuspid annular systolic and diastolic velocities and basal interventricular septum (IVS) systolic velocity were significantly lower than those of group II and III (p<0.05). Furthermore, these patients had impairment of RV myocardial performance as reflected by the significantly greater RV Tei index (I *vs* II *vs* III, 0.52±0.11 *vs* 0.40±0.10 *vs* 0.40±0.09, p=0.003), being related primarily to prolongation of isovolumic contraction time (p=0.001). The RV Tei index correlated negatively with tricuspid annular systolic velocity (r=-0.44, p=0.001) and basal IVS systolic velocity (r=-0.31, p=0.026). Group II patients, on the other hand, had pulsed DTI indexes and myocardial performance similar to those of normal controls. **Conclusion -** Surgical repair of ASD is associated with abnormal RV long-axis function and myocardial performance in the long-term. Transcatheter device closure, on the other hand, preserves ventricular function and should therefore be the treatment of choice for anatomically suitable defects.

1019-205 **Do Patients of Advanced Age Benefit From Transcatheter Atrial Septal Defect Closure?**

Raphael Rosenhek, Harald Gabriel, Florian Rader, Maria Heger, Thomas Binder, Gerald Maurer, Peter Probst, Helmut baumgartner, University of Vienna, Vienna, Austria

Background: Transcatheter atrial septal defect (ASD) closure has been shown to be feasible and safe in children as well as adults. However, little is known about the clinical benefit of this procedure in adult pts of advanced age.
Methods: We performed transcatheter ASD closure with the Amplatzer Septal Occluder in 144 adults (mean age 51±17 yrs, range 17 to 82 yrs; 103 female). 39 pts were younger than 40 yrs (group A), 57 were 40 to 60 yrs old (group B) and 48 were older than 60 yrs (group C). Pts were followed for up to 5 years (mean FU 1.6±1.1 yrs).
Results: Successful ASD closure was achieved in all pts (occluder size 24 ± 5 mm, range 9 - 38mm). No major complications occurred. Minor complications were self-limited SVT (4), transient AV-block (1) and transient ST-elevation (2). At follow-up, a mild residual left-to-right shunt (Qp:Qs < 1.3) was found in 5 pts. Atrial fibrillation with conversion to SR was observed in 9 pts. Prior to ASD closure, older patients had slightly but significantly larger right ventricles (RV). Mean diameters (4-Ch view) were 41±6, 42±7 and 45±7mm in group A, B and C, respectively. Pulmonary artery pressures (PAP) also increased with age, and were 33±7, 38±10 and 53±17 mmHg in group A, B and C, respectively; p< 0.001). Three months after ASD closure a similar significant (p < 0.0001) decrease in RV diameter was observed in all age groups with 8±6, 9±6 and 8±5 mm. PAP also decreased significantly (p < 0.0001) in all three groups with the greatest change in the oldest age group: 6±8, 7±9, and 11±14 mmHg in group A,B and C, respectively. The most decrease of RV size and PAP occurred already on the first day after the intervention.
Of the 81 pts who were symptomatic prior to intervention, 30 were in group B and 40 in group C. 32 patients were markedly symptomatic (NYHA class >II) of whom 25 were in group C. All but two pts improved. These two pts, who remained in NYHA class III, had persistent pulmonary hypertension and severe COPD, respectively. All other pts were asymptomatic or had only mild exertional dyspnea at FU.
Conclusion: Regression of RV size and PAP after transcatheter ASD closure can generally be expected even in patients of advanced age. These patients also show marked symptomatic improvement.

1019-206 **Reduced Adverse Event Rates After Transcatheter Closure of Patent Foramen Ovale When Using the Amplatzer-PFO™ Compared to the CardioSeal™ Device**

Sherman G. Sorensen, Peter J. Casterella, Joseph B. Muhlestein, Robert R. Pearson, Benjamin D. Horne, Laurie Raleigh, Jeffrey L. Anderson, Donald L. Lappe', LDS Hospital, Salt Lake City, UT

Background: Transcatheter closure of patent foramen ovale (PFO-C) is a low risk, outpatient procedure for stroke prevention. Although very low death or non-fatal stroke (CVA) rates occur after PFO-C, a variety of other neurologic sequelal (ONS) and device-related complications (DRC) (ie thrombus, late device deformation requiring removal, or endocarditis) do occur and may increase post-procedural testing and cost. The two available PFO-C devices, Amplatzer-PFO™ (AMP) and CardioSeal™ (CS) devices differ significantly in design, materials and deformability, but whether these differences effect post-procedural outcome after PFO-C is unknown.
Methods: A total of 370 consecutive patients undergoing PFO-C at a single institution between January, 2001 and May, 2003 were followed for occurrence of death, CVA, ONS (requiring evaluation by either brain imaging or trans-esophageal echo), or DRC. Of these, 261 (71%) (age = 50±15 yrs, males = 42%, follow-up (F/U) = 17±7 months) received CS and 109 (29%) (age = 49±15 yrs, males = 33%, F/U = 6±2 months) received AMP. Patients recieving CS or AMP were compared by cox hazard analysis adjusted for baseline variables and length of follow-up.
Results: Incidence of death (3, 0.8%) and CVA (2, 0.5%) was low and did not differ between groups. Incidence of DRC was 8 (2.2%), only occurred in the CS device and generally occurred late (median = 11 months) during follow-up. Incidence of ONS was significantly greater [78 (30%) versus 7 (6.4%), p<0.001] in patients receiving CS than AMP. The Cox hazard of ONS was significantly greater for CS versus AMP [univariate hazard ratio (HR) = 0.26 (CI=0.11-0.63, p=0.002), adjusted HR = 0.25 (CI=0.11-0.59, p=0.001)] as well as for any adverse event [univariate HR = 0.30 (CI=0.14-0.67, p=0.003), adjusted HR = 0.25 (CI=0.14-0.67, p=0.003)].
Conclusion: In this large single-center consecutive study of patients undergoing PFO-C, adverse event rates were significantly reduced by the use of the Amplatzer-PFO™ compared with the CardioSeal™ device. The underlying reasons for these results require further study.

POSTER SESSION

1039 Surgery for Congenital Heart Disease

Sunday, March 07, 2004, Noon-2:00 p.m.
Morial Convention Center, Hall G
Presentation Hour: 1:00 p.m.-2:00 p.m.

1039-199 **Reduction of QRS Duration After Pulmonary Valve Replacement in Adult Fallot Patients Is Related to Degree of Reduction of Right Ventricular Volume**

Bart Hooft van Huysduynen, Cees A. Swenne, Arie C. Maan, Alexander van Straten, Henk J. Ritsema van Eck, Martin J. Schalij, Ernst E. van der Wall, Albert de Roos, Mark G. Hazekamp, Hubert W. Vliegen, Leiden University Medical Center, Leiden, The Netherlands

Background:
Severely prolonged QRS duration in patients (pts) late after total correction of tetralogy of Fallot (TOF) is associated with ventricular tachycardia (VT) and sudden death. Stabilization of QRS duration on the long run has been shown after pulmonary valve replacement (PVR), however, the short-term effects of PVR, and the relation to degree of reduction of RV volume is unknown. Optimal timing of PVR remains subject to debate.
Methods: 26 adult TOF pts who underwent PVR were included. Standard 12 lead ECGs were recorded before and one year after PVR and analysed by a blinded observer. QRS duration was determined with a computer program using averaging techniques. Cardiac MRI was performed to assess RV dimensions.
Results: QRS duration decreased in 17 pts from 148 ± 32 to 139 ± 32 ms, remained constant: 156 ± 10 ms in 3 pts, and increased slightly in 6 pts from 149 ± 33 to 151 ± 33 ms. For the whole group, the QRS duration shortened from 149 ± 30 to 144 ± 31ms, p<0.001. Cardiac MRI showed a RV end-diastolic volume decrease from 305 ± 87 to 210 ± 62 mL (p<0.001). QRS duration correlated well with RV end-diastolic volume (r = 0.5, p = 0.01, see figure).
Conclusion: In adult patients with TOF, late after total repair, PVR leads to a reduction of QRS duration in the majority of patients. The degree of reduction of QRS duration is associated with the degree of RV reduction. Improvement of this marker for VT and sudden death supports a less restrictive management concerning PVR in these pts.