Abstract: P144

Transcatheter closure of atrial septal defect in adults - time-course of atrial and ventricular remodeling and effects on exercise capacity

Authors:
SS Stephensen¹, E Ostenfeld¹, S Steding-Ehrenborg¹, S Kutty², H Arheden¹, U Thilen³, M Carlsson¹, Lund University, Clinical Physiology - Lund - Sweden, Johns Hopkins University of Baltimore - Baltimore - United States of America, Lund University, Cardiology - Lund - Sweden,

Topic(s):
Cardiac Magnetic Resonance: Dimensions, Volumes and Mass

Citation:
European Heart Journal - Cardiovascular Imaging (2019) 20 (Supplement 2), ii90

Funding Acknowledgements:
Swedish Heart Lung foundation, Region of Skane, Lund University, Swedish Research Council

Objectives: To investigate the time course of ventricular remodeling following atrial septal defect (ASD) closure and examine if pulmonary-to-systemic flow ratio (QP/QS) and right ventricular (RV) volume are predictive of improvement after treatment, determined as percentage of predicted peak oxygen uptake (VO2 %).

Background: Long-term cardiovascular magnetic resonance (CMR) data on atrial and ventricular remodeling after ASD-closure is unavailable and the effects of treatment on exercise capacity is debated.

Methods: Thirty two subjects including 16 patients undergoing transcatheter ASD closure and 16 age and sex-matched controls were prospectively studied. CMR was performed before treatment, the day after, 3 months and 12 months after treatment. Exercise test with gas analysis was performed before and 12 months after treatment.

Results: The shunt (QP/QS) decreased from 2.1±0.5 before intervention to 1.4±0.3 at day 1 after ASD-closure and 1.1±0.1 at 3 and 12 months. Left ventricular (LV) volumes increased and normalized day 1 whereas left atrial volumes did not change over time. RV and right atrial volumes decreased the first 3 months and RV end systolic volume decreased further at 12 months. LV and RV volumes had not equalized at 12 months follow up (RV/LV ratio 1.2±0.1, P<0.01 vs. 1.07±0.13 in controls) and RV ejection fraction remained decreased compared to controls. Improvement of VO2% after ASD closure (P<0.01) was inversely related to QP/QS at rest (r=-0.56, P<0.05) but not related to RV end-diastolic volume at rest (P=0.16).

Conclusion: Following transcatheter ASD closure, LV adaptation is rapid, and RV reverse remodeling is prolonged in adult patients, with mildly decreased global RV function persisting at 12 months. Patients with smaller shunts had larger improvement in predicted exercise capacity suggesting that even patients with defects of borderline hemodynamic significance might benefit from closure. We speculate this may be due to impaired LV diastolic function influencing the shunt size and the potential for improved exercise capacity following ASD closure.

Figure 1. Ventricular and atrial remodeling over 1 year after transcatheter closure of atrial septal defects (ASD) compared to controls. All volumes are indexed (i) to body surface area. Left ventricular (LV) end diastolic volume (EDVi) increased the day after ASD-closure. Right ventricular (RV) EDVi and right atrial maximum volume (RAVi) decreased the day after and further decreased 3 months (3mo) after closure but RV EDVi was still larger compared to LV EDVi at 12 months (12mo) (P<0.01). Left atrial maximum volume (LAVi) did not change after closure. ** p<0.01 pre vs. post ASD-closure, † P<0.05 post vs. 3 mo, ††† p<0.001 post vs 3 mo.
Abstract:

Transcatheter closure of atrial septal defect in adults - time-course of atrial and ventricular remodeling and effects on exercise capacity

Authors:

SS Stephensen 1, E Ostenfeld 1, S Steding-Ehrenborg 1, S Kutty 2, H Arheden 1, U Thilen 3, M Carlsson 1

1 Lund University, Clinical Physiology – Lund – Sweden,
2 Johns Hopkins University of Baltimore – Baltimore – United States of America,
3 Lund University, Cardiology – Lund – Sweden,

Topic(s):

Cardiac Magnetic Resonance: Dimensions, Volumes and Mass

Citation:

European Heart Journal - Cardiovascular Imaging (2019) 20 (Supplement 2), ii90

Funding Acknowledgements:

Swedish Heart Lung foundation, Region of Skane, Lund University, Swedish Research Council

Objectives: To investigate the time course of ventricular remodeling following atrial septal defect (ASD) closure and examine if pulmonary-to-systemic flow ratio (QP/QS) and right ventricular (RV) volume are predictive of improvement after treatment, determined as percentage of predicted peak oxygen uptake (VO2 %).

Background: Long-term cardiovascular magnetic resonance (CMR) data on atrial and ventricular remodeling after ASD-closure is unavailable and the effects of treatment on exercise capacity is debated.

Methods: Thirty two subjects including 16 patients undergoing transcutaneous ASD closure and 16 age and sex-matched controls were prospectively studied. CMR was performed before treatment, the day after, 3 months and 12 months after treatment. Exercise test with gas analysis was performed before and 12 months after treatment.

Results: The shunt (QP/QS) decreased from 2.1±0.5 before intervention to 1.4±0.3 at day 1 after ASD-closure and 1.1±0.1 at 3 and 12 months. Left ventricular (LV) volumes increased and normalized day 1 whereas left atrial volumes did not change over time. RV and right atrial volumes decreased the first 3 months and RV end systolic volume decreased further at 12 months. LV and RV volumes had not equalized at 12 months follow up (RV/LV ratio 1.2±0.1, P<0.01 vs. 1.07±0.13 in controls) and RV ejection fraction remained decreased compared to controls. Improvement of VO2% after ASD closure (P<0.01) was inversely related to QP/QS at rest (r=−0.56, P<0.05) but not related to RV end-diastolic volume at rest (P=0.16).

Conclusion: Following transcatheter ASD closure, LV adaptation is rapid, and RV reverse remodeling is prolonged in adult patients, with mildly decreased global RV function persisting at 12 months. Patients with smaller shunts had larger improvement in predicted exercise capacity suggesting that even patients with defects of borderline hemodynamic significance might benefit from closure. We speculate this may be due to impaired LV diastolic function influencing the shunt size and the potential for improved exercise capacity following ASD closure.

Figure 1. Ventricular and atrial remodeling over 1 year after transcatheter closure of atrial septal defects (ASD) compared to controls. All volumes are indexed (i) to body surface area. Left ventricular (LV) end diastolic volume (EDVi) increased the day after ASD-closure. Right ventricular (RV) EDVi and right atrial maximum volume (RAVi) decreased the day after and further decreased 3 months (3mo) after closure but RV EDVi was still larger compared to LV EDVi at 12 months (12mo) (p<0.01). Left atrial maximum volume (LAVi) did not change after closure. ** p<0.01 pre vs. post ASD-closure, † P<0.05 post vs. 3 mo, ††† p<0.001 post vs 3 mo.