Bi-Atrial Geometrical Changes Following Secundum Atrial Septal Defect Closure Using Magnetic Resonance Imaging and Their Effect on Electrical Changes

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Disclosure

- The Authors of this abstract have nothing to disclose
- No conflict of interest

Background

- Chronic atrial stretch caused by atrial septal defect (ASD) results in atrial mechanical and electrical remodeling, This is manifested as prolonged P-wave duration, and P wave dispersion and has been proposed as a substrate for atrial arrhythmia later on.

Background (cont.)

- We studied atrial geometric and volumetric changes 6 months after percutaneous and surgical Secundum ASD closure in Adult patients by CMR and compared the effect of these two methods of closure on P wave dispersion.

Methods

- A 12- leads ECG was recorded at a speed of 50mm/s and amplitude of 1mV/cm before and 6 months after ASD closure.
- P wave duration: Distance between the junction of baseline with the point of the earliest and latest P-wave activity. The longest P wave duration was noted as P wave maximum (P max)and the shortest duration as P wave minimum (P min).

Methods (cont.)

- P wave dispersion (Pd): defined as the difference between the maximum and the minimum recorded P-wave duration.
- CMR assessment pre and 6 months post-ASD closure using a 1.5 Tesla MRI scanner (Ingenia Philips). Cine Steady-State Precession (SSFP) ECG gated sequences in 2, 3, 4 chambers were recorded.

Methods (cont.)

- The left atrium (LA) volumes were measured by manual tracing of the endocardial contours in 2- & 3- and 4-ch SSPS cine images with the exclusion of the left atrial appendage and pulmonary veins. Longitudinal and transverse diameters were measured in the 4 and 2 chamber views, figure 1. LA anteroposterior diameter was measured in the 3-chamber view

Methods (cont.)

- the maximum diameters and volumes were measured in the 4- and 2-chambers views. The same method was used to calculate the maximum and minimum volumes of the RA, the cava veins were excluded, but the atrial appendage was included. figure 2.

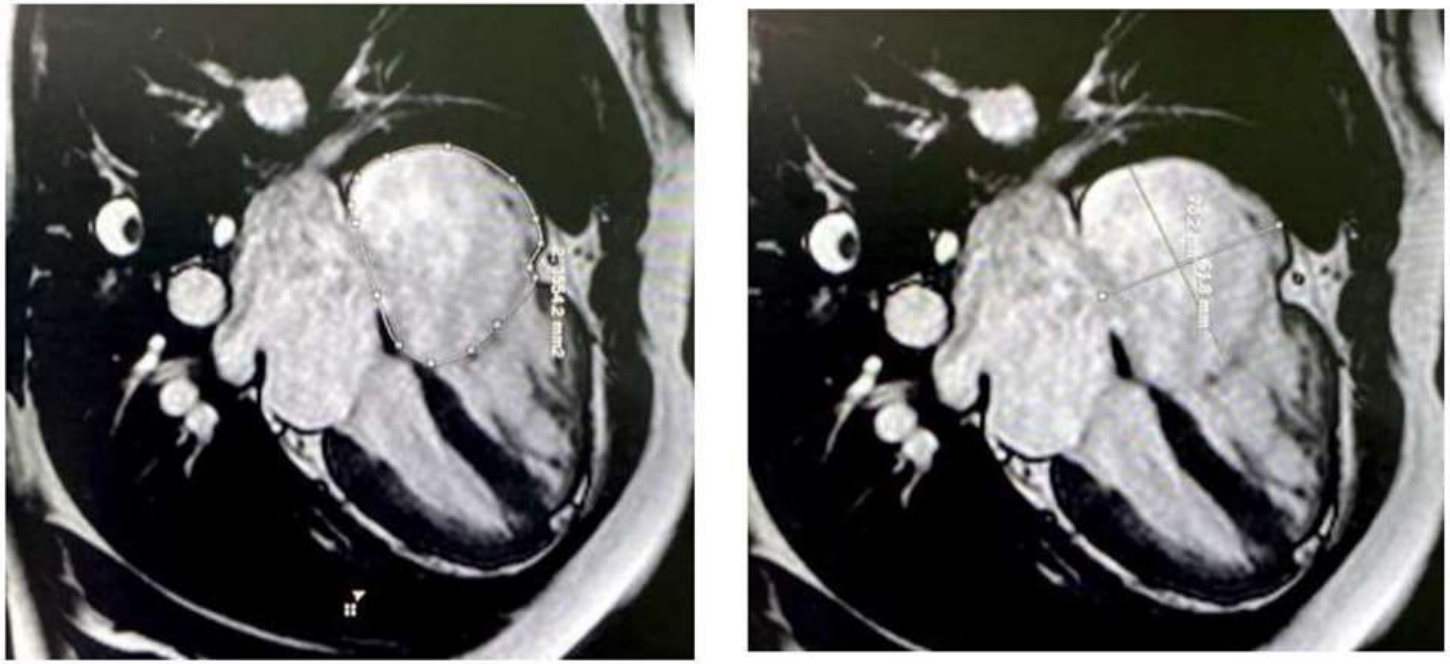


Figure 1: Cine SSFP 4 chamber MRI view in ASD case preclosure showed LA vertical & horizontal diameters and area measures.

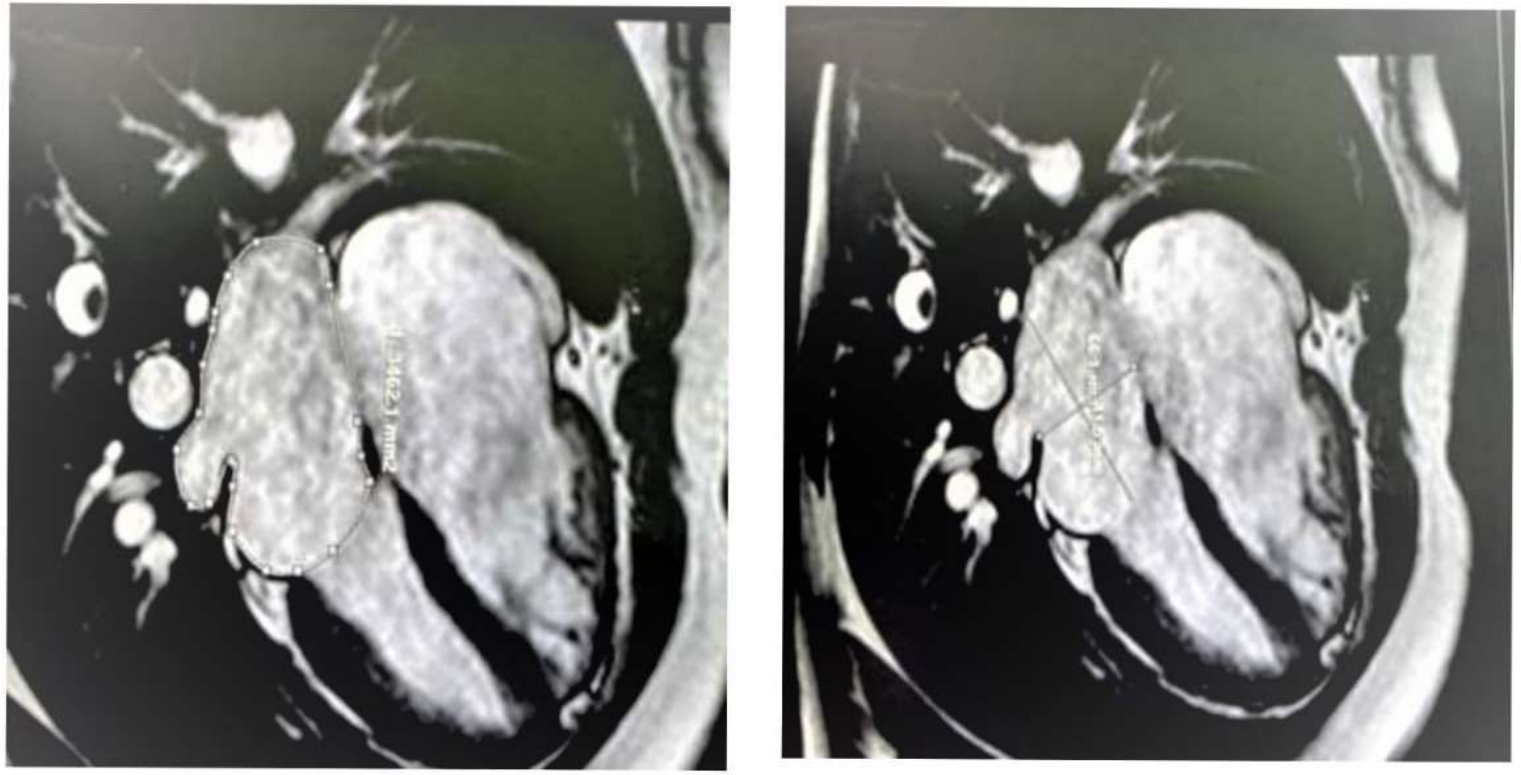


Figure 2 : Cine SSFP 4 chamber MRI view in ASD case preclosure showed RA vertical & horizontal diameters and area measures.

Results

- Thirty adult patients with isolated secundum ASD were included in a prospective study. (15 patients had successful transcatheter ASD device closure and 15 age and sex matched group had surgical closure. The majority (66%) were females under the age of 40)

- **Assessment of the mechanical remodelling by CMR:**

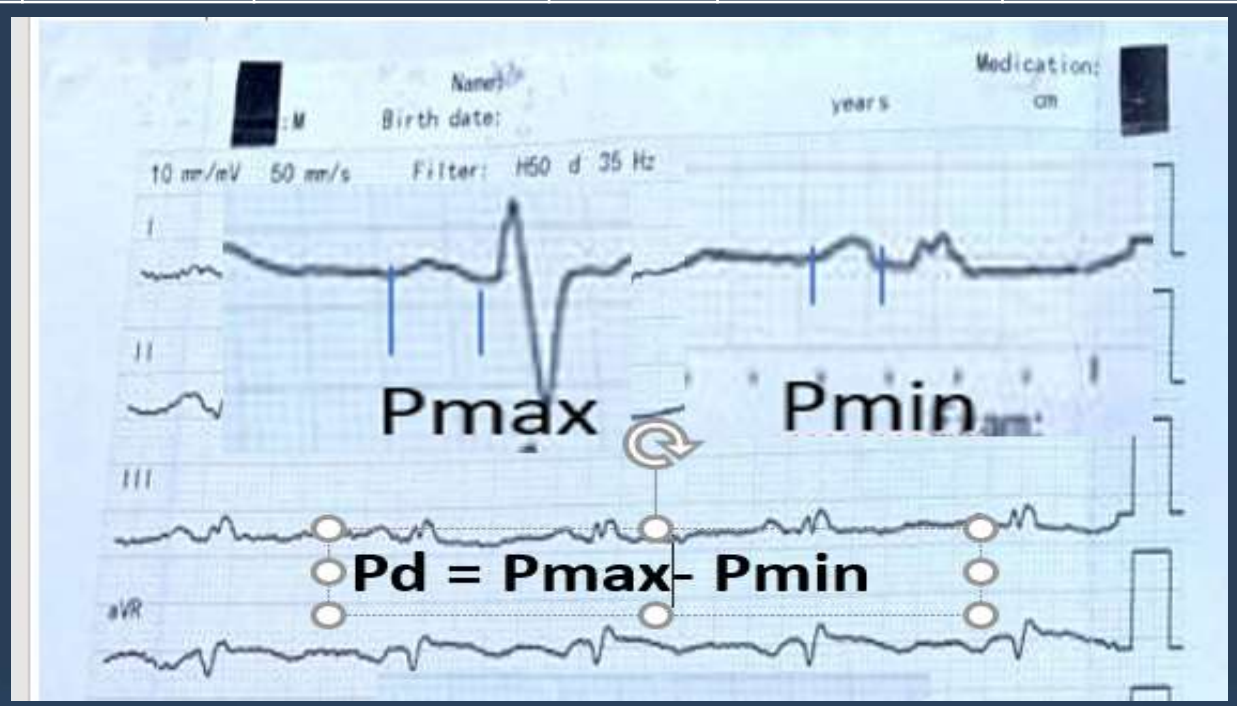
- CMR showed normalization of QP/QS (from 2.5 to 1) in both groups at follow up indicating complete abolishment of shunt.

Results (cont.)

- **Assessment of the electrical remodelling parameters:**
  - When compared to baseline values, both groups showed a non-significant reduction in P wave dispersion- after ASD closure with no significant difference between the two methods of closure, table 1.

Results (cont.)

	Group 1 (Device closure)			Group 2 (Surgical closure)		
	Before	After	P value	Before	After	P value
Pd (ms)	29.33 ± 10.32	27.33 ± 9.61	**0.42**	32 ± 12.64	28 ± 10.14	**0.08**



Results (cont.)

- Parameters of Right Atrium among studied patients
  - RA maximal and minimal volumes decreased significantly in both groups as compared to the baseline values (P value <0.001), Device closure had significant lower minimum volume after closure (20.66 ± 7.88 vs. 30.24 ± 11.38 (mm); *P*= 0.01).
  - Also, RA's function after closure was significantly higher in case of device closure (58.87 ± 7.54 vs.46.40 ± 5.11 (%), *P*< 0.001) , table 2 .

Results (cont.)

	Group 1 (Device closure) (n= 15)			Group 2 (surgical closure) (n= 15)		
	Before closure	After closure	P value	Before closure	After closure	P value
RA maximal volume (ml)	74.53 ± 23.98	46.88 ± 12.77	<0.001	81.90 ± 30.07	55.38 ± 18.03	<0.001
RA minimal volume (ml)	37.71 ± 15.43	20.66 ± 7.88	<0.001	41.82 ± 21.46	30.24 ± 11.38	0.01
RA EF (%)	54.60 ± 6.60	58.87 ± 7.54	0.001	52.87 ± 7.54	46.40 ± 5.11	0.01

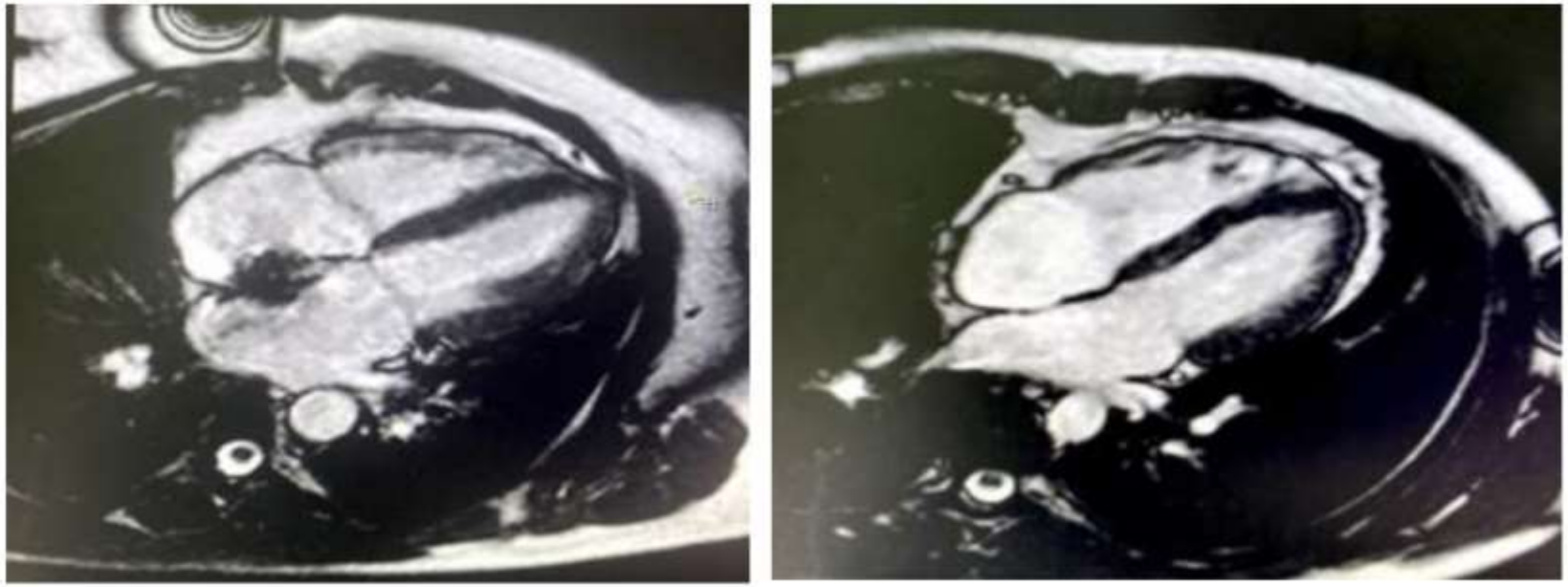


Figure 3 : Cine SSFP 4 chamber MRI view in A) transcatheter closed case by ASO B) surgically closed ASD with complete revolution of both atria and RV .

Results (cont.)

- Parameters of left Atrium among studied patients
- There was a decrease in LA volume after removal of shunt and an improvement in LV filling.
- However, it was insignificant in comparison to the baseline measurements and was similar in both groups. table 3

Results (cont.)

	Group 1 (Device closure) (n= 15)			Group 2 (surgical closure) (n= 15)		
	Before closure	After closure	P value	Before closure	After closure	P value
LA maximal volume (ml)	99.23 ± 24.20	92.33 ± 25.51	0.12	90.13 ± 33.81	91.30 ± 29.72	0.11
LA minimal volume (ml)	45.18 ± 20.19	42.73 ± 18.46	0.13	38.30 ± 18.14	35.83 ± 15.69	0.14
LA EF (%)	54.63 ± 7.72	57.36 ± 9.31	0.5	57.90 ± 9.58	57.36 ± 9.31	0.7

Conclusion / Take-home Message

- Bi-atrial electrical changes in middle-aged ASD patients do not improve 6 months after percutaneous and surgical ASD closure despite significant changes in right atrial volumes and geometry.
- This indicates a poor correlation between mechanical and electrical remodeling in adult patients.
- Larger studies and long term follow up is needed to correlate this finding with the future risk of atrial arrhythmia.
- Whether earlier closure of ASD improve electrical remodeling, is an issue of further studies.