Natural course of right ventricular dilatation in severe pulmonary regurgitation after repair of tetralogy of Fallot

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Introduction and purpose

- Pulmonary valve replacement (PVR) in patients with severe pulmonary valve regurgitation after repair of Tetralogy of Fallot (TOF) is recognized as a crucial intervention for preserving right ventricular function and prevent potentially lethal arrhythmias.
- We previously advocated performing PVR on patients with right ventricular end diastolic volume >150ml/m^2. However, data is sparse and the ideal timing for surgery is still subject of debate.
- The aim of our study was to assess the natural course of progression of right ventricular dilatation in patients with pulmonary regurgitation after TOF repair.

Conclusion

- **During an observation time of 7 years RVESV was the only RV parameter showing a significant increase.**
- **Technique of repair or time interval since repair did not correlate with degree or progression of RV dilatation.**
- **Endsystolic volume but not enddiastolic volume at first examination was predictive for progressive dilatation.**
- **Even though statistically significant, the changes observed are still within the range of measurement variability for RV volumes (4-8%), and therefore the clinical significance is questionable.**
- **A more conservative approach to PVR may be discussed on the base of these preliminary results.**

Methods:

Patients

- 34 patients (18 female / 16 male) with repaired TOF and severe pulmonary regurgitation.
- Two or more cardiovascular magnetic resonance exams (CMR) for evaluation of RV volume and function

- Age at TOF-repair (median (range))	17m (1d-5y6m)
- Age at first MR-examination	12y4m (5y6m-30y8m)
- Interval between examinations	2y10m (1y9m-7y4m)
- Interval since surgery	10y8m (3y10m-27y7m)

- Surgical technique:
  - Trans-annular patch: 12 patients
  - Monocusp homograft patch/Valved conduit: 1
  - Right ventricular outflow tract patch: 5
  - Pulmonary valvotomy, suravalvular patch: 1
  - Radiofrequency perforation: 1

Measurement technique

- 1.5T CMR scanner (Sigma HDx, GE Medical Systems) by using an 8-channel phased-array cardiac coil
- Steady State Free Precession sequence. Stack of 10-12 contiguous short axis slices covering both ventricles

Parameters: 20 cardiac phases, TE 1.5-1.8 msec, TR 2.8-3.1 msec, flip-angle 45°, bandwidth 125 kHz, matrix 224 x 224, number of excitations 1, field of view 250-350mm, views per segment 6-12 depending on heart rate, targeted true temporal resolution < 25 ms, retrospective cardiac gating.

- Endocardial contours of the ventricles were traced in the endsystolic and enddiastolic phase and volumes calculated as previously described (figure 1)

Statistics

- Results expressed as mean ±SD
- T-test for comparison of ventricular volumes in groups of different surgical techniques and for comparison of ventricular volume changes in patients with severe and less severe right ventricular dilatation, as well as in still growing and grown up patients (BSA).
- Regression analysis for testing correlation between ventricular volume and time interval since repair

Figure 1: Enddiastolic short axis views with traced contours and 3D reconstruction of a patient with RVEDV of 155ml/m^2

Results:

- Follow up time was 7 years and 4 months.
- A total of 83 CMR were performed in 34 pts (all patients underwent 2 CMR examinations, 9 pts had 3 CMR, 4 pts had 4 CMR and 2 pts had 5 CMR).
- RV endsystolic volume was the only parameter that increased significantly during time. All other volumes and ejection fractions of the right and left ventricle did not change (table 1 and Figure 1,2).
- RV endsystolic dilatation increased predominantly in patients without BSA changes (grown up) (figure 3) and in patients with already dilated RVESV (> 82 ml/m2) (figure 4).
- The overall mean rate of right ventricular volume change was 1.0 ± 4ml/m2/year for ESV.

	MR 1	MR last	p
RV EDV (ml/m²)	148 (±33)	154 (±35)	0.09
RV ESV (ml/m²)	78 (±25)	82 (±27)	<0.03
RV EF (%)	47 (±8)	47 (±8)	0.48
LV EDV (ml/m²)	74 (±13)	78 (±14)	0.07
LV ESV (ml/m²)	34 (±10)	34 (±10)	0.91
LV EF (%)	55 (±6)	56 (±7)	0.18

Table 1: Indexed ventricular volumes (mean ±SD)

- Surgical technique of repair did not have significant influence on the degree of RV dilatation. Patients with transannular patch did not show a more dilated RV at time of first MRI nor faster progression of dilatation.
- No correlation was found between RV volumes and time interval since surgical repair.

Figure 1. RVESV change

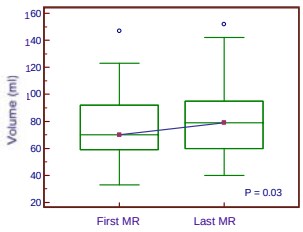


Figure 2. RVEDV change

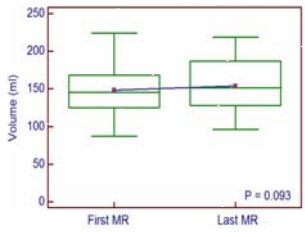


Figure 3. RVESV change in relation to BSA

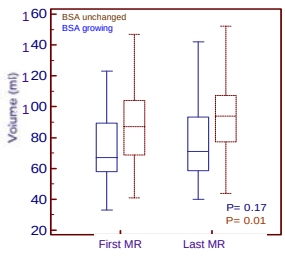
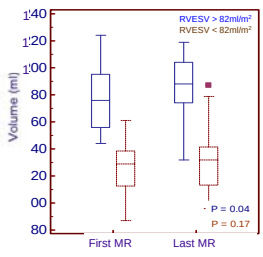


Figure 4. RVESV change according to RVESV at first



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