

MP4-15

Recovery of long-term volume overloaded right ventricle after pulmonary valve implantation in patients with ToF repair.

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Introduction:

Right ventricular (RV) volume overload due to pulmonary regurgitation after tetralogy of Fallot (ToF) repair is the most frequent and expected finding. Although well tolerated for years, should be treated before RV compensatory mechanisms are exhausted. Magnetic resonance imaging (MRI) is gold standard for establishing exact RV end-diastolic/end-systolic volumes (EDV/ESV). $RV > 170 \text{ ml/m}^2$ is considered of not capable to recover but the cut-off point for re-operation is still not definitively established.

Methods:

Analyzed were 26 patients (17M/9F) after previous ToF correction with isolated severe RV volume overload who underwent pulmonary homograft (or bioprosthesis) implantation at our institution (median age 21.5y., median period after ToF repair 17.9y.).

RV was evaluated pre-operatively and during follow-up (median 2.2y.) by echocardiography (ECHO) and MRI. Compared were patients with MRI $RV \text{ EDV} > 170 \text{ ml/m}^2$ (group A) and $RV \text{ EDV} < 170 \text{ ml/m}^2$ (group B).

Results:

Early conduit dysfunction with severe pulmonary regurgitation was present in 2 patients; in all others RV improvement was experienced.

MRI findings: 1. Post-surgical decrease of RV volumes (median, in ml/m^2): EDV 172→119 ($P < 0.0001$), ESV 100.5→61.5 ($P = 0.0003$); with significant RV EDV difference in groups A/B in absolute values ($123.5/104 \text{ ml/m}^2$, $P = 0.04$) but not in % RV size decrease (37.5/34.5%). No significant ESV difference between groups A/B was found ($62.5/52 \text{ ml/m}^2$; decrease 37.5/28.5%). 2. No significant overall EF change after surgery (median RVEF 40→47%).

ECHO findings: All measured diameters with significant improvement after surgery, though w/o differences between groups A/B. After surgery: 1. most considerable improvement in RV long-axis diameter (median 38→27.5mm, $P < 0.0001$), RV dilatation ($> 33 \text{ mm}$) decreasing from 90→15.4% of patients ($P < 0.0001$); 2. significant change of RV dilatation according to 4-chamber ratio $RV/LV > 1$ from 80.8→4.2% of patients ($P < 0.0001$); 3. no change in RV systolic function after surgery.

Conclusions:

Our study showed that $RV > 170 \text{ ml/m}^2$ must not represent the upper limit for re-do. After successful elimination of volume overload RV was capable of significant improvement regardless its pre-operative size. Though, the degree of dilatation was important, as RV proved ability to decrease only by 30-40%; and this was similar in more/less dilated RVs. Very severely dilated RV is probably not able to regress to normal values. ECHO was as useful as MRI for serial pre-/post-surgical RV assessment.