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Risk factors for ventricular arrhythmias in tetralogy of Fallot using cardiovascular magnetic resonance

Rizk J., Shehu N., Mkrtchyan N., Latus H., Martinoff S., Ewert P., Stern H., Meierhofer C.
German Heart Center Munich, Germany

Introduction:
Tetralogy of Fallot (TOF) is the most common congenital cyanotic heart disease. The development of ventricular arrhythmias (VA) and sudden cardiac death (SCD) is the most common cause of late mortality.

Although previously pulmonary regurgitation (PR) was found to be the most common hemodynamic abnormality associated with VA, later cardiovascular magnetic resonance (CMR) based studies did not find this association.

The aim of this study is to investigate the risk factors for VA using CMR in TOF.

Methods:
Electronic records of TOF patients and their CMR studies between July 2006 and October 2018 in one center were retrospectively reviewed. Demographic, clinical and CMR data of patients were collected. Outcome data included sustained ventricular tachycardia (VT), SCD as well as aborted SCD.

Results:
The total number of TOF patients with complete CMR studies identified was 434. 19 patients developed a positive outcome (14 VT, 3 SCD, 2 aborted SCD) at a median age of 25 (19 – 39) years. Among CMR parameters, the relative risk (RR) for VA was most significant for right ventricular end-diastolic indexed volume (RVEDVI) and right ventricular end-systolic indexed volume (RVESVI) compared to pulmonary regurgitant fraction (PR %) and left ventricular parameters. The highest area under the ROC curve for predicting a positive outcome was 0.721 for RVEDVI,0.755 for RVESVI compared to 0.524 for PR%.

CMR data

	Outcome (n =19)	No outcome (n = 415)	P value
RVEDVI	139 ± 47 (102 -171)	107 ± 34 (85 – 121)	0.001
RVESVI	76 ± 35 (55 – 90)	52 ± 23 (38 – 61)	0.0002
RVEF	46 ± 10 (39 – 54)	53 ± 9 (47 – 59)	0.007
PR	24 ± 17 (6-39)	21 ± 17 (4 – 34)	0.480

Mean±SD (interquartile range)

Relative risk for VA

	RR (95% CI)	P value
RVEDVI ≥150ml/m2	5.6 (2.33-13.41)	0.0009
RVEDVI ≥130ml/m2	3.8 (1.57-8.93)	0.004
RVESVI ≥80 ml/m2	5.3 (2.21-12.76)	0.0012
RVEF <40%	0.2 (0.07-0.50)	0.005
PR >40%	1.8 (0.61 – 5.34)	0.290

Conclusions: Right ventricular dimensions are the most significant factors associated with the development of VA in TOF patients. PR severity in isolation has no significant influence on the risk of development of VA.