Journal of Cardiovascular Magnetic Resonance

Poster presentation

Open Access

Dobutamine stress MR in Tetralogy of Fallot with significant pulmonary regurgitation, safety, feasibility and haemodynamic effects

Victoria Parish*[1], Aaron Bell[2], Catherine Head[2], Eric Rosenthal[1], Gerald Greil[1], Reza Razavi[1] and Philipp Beerbaum[1]

Address: [1]King's College, London, UK and [2]Guy's and St Thomas' NHS Trust, London, UK
* Corresponding author

from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):P3 doi:10.1186/1532-429X-12-S1-P3

This abstract is available from: http://jcmr-online.com/content/12/S1/P3

Background

In Tetralogy of Fallot (TOF), surgical repair is undertaken in childhood but standard repair techniques result in pulmonary regurgitation (PR). With time this induces right ventricular (RV) dilation and dysfunction and is associated with an increased risk of sudden death. Although pulmonary valve replacement (PVR) has been shown to improve symptoms, appropriate timing for this procedure continues to be debated. This study aims to evaluate the safety, feasibility and diagnostic potential of high dose dobutamine stress magnetic resonance imaging (DS-MR) in the assessment of right ventricular contractile reserve in post repair TOF with significant PR.

Methods

26 patients with repaired TOF and PR referred for cardiac MRI were prospectively recruited. In addition to morphological assessment ventricular volumes (2D cine MRI) pulmonary artery and aortic flows (phase contrast) were obtained at baseline and during dobutamine infusion: Stage 1 DS-MR 10 mcg/kg/min an Stage 2 DS-MR 20 mcg/kg/min. Data comparison was performed using the student t-test ($p < 0.05$).

Results

Of the 26 patients, DS-MR imaging data is incomplete, in one patient due to claustrophobia and in the second due to failure of VECG triggering secondarily to frequent ventricular ectopics. Twenty-four patients completed stage 1 DS-MR. Five patients could not progress to Stage 2, due to either minor dobutamine side effects (nausea or headache) or achievement of maximum predicted heart rate. Nineteen patients went on to complete stage 2 stress with no severe adverse side effects. The heart rate (cardiac index) increased from 66 ± 6 bpm (2.9 ± 0.4 l/min/m²) at

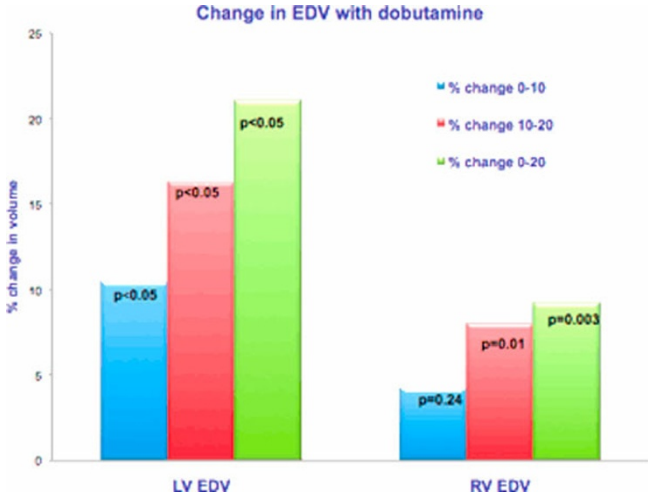

Figure 1
Change in end diastolic volume for the left and right ventricle at baseline and with dobutamine stress at 10 and 20 mcg/kg/min.

Table 1: Haemodynamic and phsyiological changes in ventricular function with DS-MR

	Baseline n = 26 (mean ± SD)	Dobutamine 10 n = 24 (mean ± SD)	Dobutamine 20 n = 19 (mean ± SD)
Heart Rate bmp	66.5 ± 9.2	91 ± 18.8	117.5 ± 14.4
Systolic BP mmhg	125 ± 14	144 ± 18	155 ± 22
Diastolic BP mmhg	70 ± 6	76 ± 7	77 ± 6
LV EDV ml/m^2	77.4 ± 14.9	67.6 ± 16.4	54.66 ± 12.8
LV ESV ml/m^2	32.9 ± 10.3	23.9 ± 8.9	16.3 ± 5.62
LV SV ml/m^2	43.7 ± 7.4	43.82 ± 12.1	38.3 ± 9.2
LV CO l/mon/m^2	2.8 ± 0.45	3.97 ± 0.9	4.5 ± 1.0
LV EF %	57.8 ± 7.3	64.7 ± 10.7	70.4 ± 6.3
RV EDV ml/m^2	127.6 ± 25.93	123.8 ± 26.9	110.8 ± 25.3
RV ESV ml/m^2	58.4 ± 17.6	50.0 ± 20.0	45.4 ± 14.9
RV SV ml/m^2	69.2 ± 11.9	73.7 ± 14.6	65.4 ± 14.4
RV CO l/min/m^2	4.5 ± 1	6.82 ± 1.85	7.79 ± 1.7
RV EF %	55 ± 6.8	60.4 ± 9.43	59.8 ± 7.7
PR (%)	43 ± 15.4	44.9 ± 11.2	43.6 ± 12.1

BP: blood pressure, LV: left ventricle, RV: right ventricle, EDV: end diastolic volume, ESV: end systolic volume, SV: stroke volume, CO: cardiac output, EF: ejection fractions, PR: pulmonary regurgitant fraction.

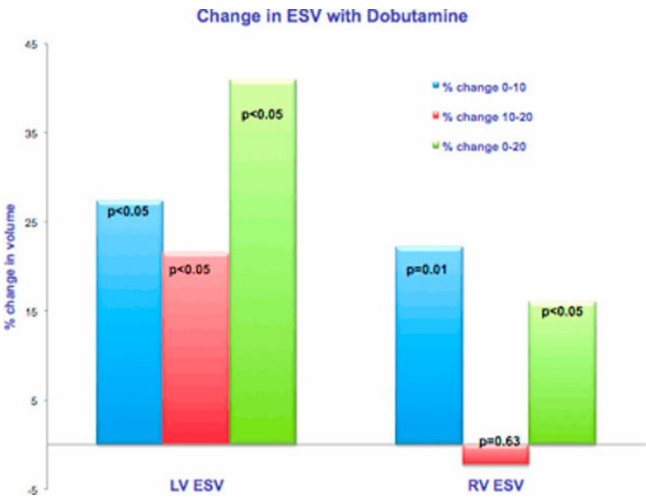

Figure 2
Change in end systolic volume for the left and right ventricle at baseline and with dobutamine stress at 10 and 20 mcg/kg/min.

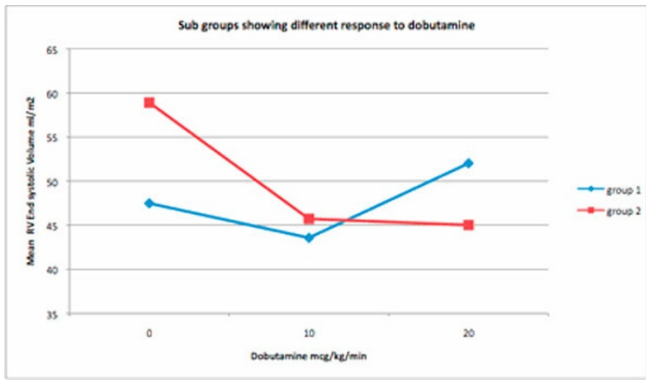

Figure 3
Sub-groups defined by change in right ventricular end systolic volume (RV-ESV). Group 1-patients with no change or an increase in RV-ESV with dobutamine 20 mcg. Group 2-patients with a decrease in RV-ESV with dobutamine 20 mcg.

baseline to 91 ± 18 bpm (3.9 ± 0.9 l/min/m^2) at Stage 1 and 117 ± 14 bpm (4.5 ± 1 l/min/m^2) at Stage 2 ($p < 0.01$), volumetric changes are detailed in Table 1. Significant reduction in left ventricular (LV) end diastolic (EDV) and end systolic volumes (ESV) is seen at dobutamine 10 and 20 ($p < 0.01$). In the right ventricle (RV) there is a less marked reduction in volumes at 10 whilst at 20 mcg dobutamine there is no significant change in end systolic volume in a sub-group ($P = 0.63$) Figures 1, 2 and 3.

Conclusion

Our data shows that high dose dobutamine stress MR is safe and well tolerated in patients with corrected TOF with PR. In the LV there is a clear reduction in volume at each level of dobutamine, whereas the RV showed less response at 10 mcg and in a sub-group failed to reduce RV-ESV at stage 2 DS-MR. The change in RV-ESV under stress may become a discriminative parameter in TOF patients being assessed for pulmonary valve replacement.