“The Rocking Right Ventricle Paradigm”

D. Seaton1, B Shearer1, Kam Aldridge1, F Kermeen2
1Queensland Nuclear Imaging, The Prince Charles Campus, Brisbane, Australia
2Queensland Lung Transplant Service, The Prince Charles Hospital, Brisbane, Australia

Introduction

• Systolic displacement of the tricuspid annulus towards the right ventricular apex, referred to as tricuspid annular plane-systolic excursion (TAPSE) is an indirect marker of right ventricular dysfunction (RVD), has been reported to be an important predictor of mortality and morbidity in pulmonary arterial hypertension (PAH).

Figure 1: Predictors of morbidity and mortality. ERS/ESC Guidelines for the diagnosis and management of PAH. N Engl J Med 2009; 361: 1293

Methods

• 82 consecutive adult PAH out-patients (64% female) from a tertiary PAH centre who underwent echocardiography with an RVSP >50 mmHg over a three month period in 2012.

• 20 and Doppler echocardiography was performed using a dedicated right ventricular protocol. Echocardiographic images were reviewed by an echocardiologist blinded to patients clinical or haemodynamic information.

• A subgroup analysis of 14 adult outpatients, 50% female, 5 IPAH, 2 FPAH, 3 PAH-CHD, 2 CTEPH, and 2 out of proportion PHT with normal TAPSE, S’ and severe RVD underwent one echocardiogram with a dedicated RV protocol including FAC, TAPSE & S’ velocity and compared with RV parameters of RVEDV and RVFP on cardiac MRI.

Aim

• Thus we conducted a prospective, observational study to assess the efficacy of echocardiographic parameters in the assessment of RVD in patients with advanced PH as directed by current guidelines.

• Secondly, we performed a comparative subgroup analysis on imaging modalities in PH patients with RVD and report the concerning anomaly of normalisation of quantitative parameters of annular motion in the setting of severe RVD characterised by “the rocking right ventricle”.

Results

• The baseline characteristics are presented in table 1 and echocardiographic parameters in table 2.

• Echocardiography confirmed severe PHT with mean RVSP 90.6 mmHg (±24), mRA size 25.4 cm2 (±6.6). (Figure 2).

• However, despite the presence of moderate to severe RV dysfunction in 84% of this cohort (table 2 & figure 1), the mean TAPSE and mean S’ velocity were preserved within normal limits (19.9 mm ±3.7: 11.8 ±1.8 cm/s respectively).

Discussion

• The treatment guidelines in PHT have placed great emphasis on TAPSE and S’ velocity as important markers of prognosis and response to PAH treatment.

• We have shown the visual assessment of rocking RV and dissociated tricuspid annular motion has high specificity for RVD in the in PAH group and correlates well with cardiac MRI and FAC on echocardiography.

• The echocardiographic assessment of the RV should include a dedicated RV protocol and physicians should not judge the severity of RVD and PH on one parameter.

• RV strain appears promising as part of the RV assessment and should be evaluated in more detail in future studies.

Table 3: Baseline demographics of the subgroup population n = 14

| Age years | 52.4 ± 17 |
| WHO-FC | 2.6 ± 0.5 |
| mRVDV metres | 480 ± 166.2 |
| mRAP size cm2 | 27.4 ± 5.5 |
| mRVSP mmHg | 96.2 ± 18.4 |
| mTAPSE mm | 119 ± 3.3 |
| mS’ velocity cm/sec | 10.8 ± 1.6 |

Table 4: Echocardiographic right ventricular parameters of the subgroup population n = 14

| mRAP size cm2 | 27.4 ± 5.5 |
| mRVSP mmHg | 96.2 ± 18.4 |
| mTAPSE mm | 119 ± 3.3 |
| mS’ velocity cm/sec | 10.8 ± 1.6 |

Table 2: Baseline echocardiographic parameters n = 82

| Age years | 54.3 ± 17.7 |
| WHO-Functional Class | 2.7 ± 0.6 |
| mRVDV metres | 464 ± 156.3 |

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