Knowledge-based 3D echocardiography reconstruction of the right ventricle documents improvement of right ventricular volumes in response to intervention

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Introduction

Right ventricular (RV) function is the key determinant of symptoms and survival in pulmonary hypertension (PH). Cardiac MRI, the gold standard for volumetric quantification of the RV chambers, is costly, resource-intensive and not widely available. Furthermore, the technique is unsuitable for claustrophobic patients and those with implanted ferromagnetic devices. We have undertaken a pilot evaluation of a novel two-dimensional echocardiography technique that involves knowledge-based 3D reconstruction (3DR) of the RV to follow up volumetric indices in PH patients. We have previously demonstrated that in test-re-test scenarios, this technique can reliably document changes in RV volumes or function of greater than 10%.

Patients

We performed baseline and follow-up 3DR in 25 PH patients (19 in group 1; 6 in group 4). 16 patients experienced an intervention during follow up: 10 were newly commenced on disease-targeted therapy, 4 had escalation or change of disease-targeted therapy, and 2 underwent pulmonary endarterectomy (PEA). 9 patients were routinely followed up without any change in therapy.

Results

Three patients had to be excluded from reconstruction due to poor image quality. 12 out of 22 patients (54%) experienced important reductions in their end-diastolic volume index (EDVI) of > 10% during a mean follow-up period of six months. This included: both patients who underwent PEA, six out of eight patients who were newly started on disease-targeted therapy (all group 1 PAH - CTD and POPH), one out of four patients who had a change or escalation of therapy and three out of eight patients who were routinely followed up. All patients who improved their EDVI by > 10% reduced their NT-proBNP levels by at least two thirds (66% reduction) or levels were already normal or near normal at baseline.

Conclusion

3DR may be a useful 3D echocardiography technique for follow up of RV volumes in PH patients. In a short-term follow-up of a mixed PH patient population we observed reductions of EDVI in 54% of patients, including patients who had an intervention or were routinely followed up. All patients who improved their EDVI by > 10% reduced their NT-proBNP levels by at least two thirds or levels were already normal or near normal at baseline.