



RACP Foundation Research Awards

FINAL REPORT

Project / Program Title	Ventricular remodelling in volume- and pressure- loaded states in response to left sided structural heart disease interventions.	
Name	Dr Sara Hungerford	
Award Received	2018 RACP Fellows Research Entry Scholarship	
Report Date	14 May 2019	
Chief Investigator / Supervisor	Prof Christopher Hayward	
Administering Institution	University of New South Wales (UNSW)	
Funding Period	Start Date:	1 February 2018
	Finish Date:	1 February 2019

PROJECT SUMMARY

Dr Sara Hungerford's research seeks to better understand and predict the hemodynamic responses to transcatheter mitral and aortic valve implantation using non-invasive techniques such as two-dimensional speckle tracking echocardiography, arterial tonometry and cardiac magnetic resonance imaging.

PROJECT AIMS / OBJECTIVES

Project One:

1. To assess and validate existing and novel non-invasive echocardiographic parameters of left ventricular contraction in patients' with severe mitral regurgitation (MR). This includes the use of 20 speckle-tracking echocardiography (2DSTE) to assess multidirectional myocardial deformation (longitudinal and circumferential strain); to evaluate the immediate and long-term effect of TMVI for patients with severe MR using echocardiographic parameters including 2DSTE.
2. To evaluate the immediate and long-term effect of minimally invasive open mitral valve surgery using echocardiographic parameters including 2DSTE; and
3. To compare the impact of TMVI and minimally invasive open mitral valve surgery on the recovery of myocardial mechanics.

We hypothesise that non-invasive indices such as left ventricular strain may more accurately detect load dependent changes in contraction from which inferences regarding contractility can be made. Furthermore we hypothesise that the correction of volume loaded states (i.e. TMVI) will

not demonstrate an immediate improvement in left ventricular mechanics, but that myocardial recovery may be demonstrated over time.

Project Two:

1. To evaluate the influence of arterial compliance, as measured by state of the art methods, on left ventricular function and arterial haemodynamics, and on clinical outcome in patients with aortic stenosis undergoing transcatheter or surgical aortic valve replacement.
2. To evaluate, where possible, the influence of arterial compliance on the novel entity of paradoxical low flow aortic stenosis (AS) and associated diastolic impairment.
3. To develop and evaluate state of the art measures combining arterial tonometry, echocardiography and magnetic resonance imaging, in the assessment of aortic and large arterial stiffness in patients with AS undergoing transcatheter aortic valve implantation (TAVI).

We hypothesise the following: (1) Reduced arterial compliance portends a poor haemo-dynamic outcome in patients with AS undergoing TAVI, mediated by high aortic characteristic impedance and left ventricular afterload, and; (2) Impaired arterial compliance is strongly associated with "paradoxical low flow" AS and left ventricular diastolic impairment.

SIGNIFICANCE AND OUTCOMES

Project One:

TMVI has emerged as a possible non-invasive alternative treatment option to open surgery for high risk patients' with severe MR. Several technologies have been developed over the past few years, and it is expected in the next 5 to 10 years that these TMVI devices will further complement conventional cardiac surgery. These devices are numerous and exist within the continuum of medical devices approval, ranging from pre-clinical studies and first-in-man use. Of vital importance is our ability to answer whether TMVI is efficacious in the treatment of MR and what are the changes in left ventricular function that occur with TMVI?

Project Two:

The scientific significance of the project is improved understanding of the role of the arterial tree in left ventricular function and dysfunction in the presence of AS, and following TAVI. The clinical significance is better risk stratification of elderly patients being considered for TAVI, using state of the art methods, in an era where TAVI is increasingly being sought out by patients and clinicians. The economic benefits of the project are better cost benefit profile of T AVR with potential for providing insights into improved patient selection.

PUBLICATIONS / PRESENTATIONS

Hungerford S. "Left ventricular mechanics in patients undergoing transcatheter, transapical mitral valve replacement with the Tendyne mitral valve." 2018. Heart, Lung & Circ. (27); S371.

Hungerford S. "Right ventricular remodeling in patients undergoing mitral valve replacement with the Tendyne mitral valve system." 2018. Heart, Lung & Circ. (27); S747.

Muller DWM & Boland J. "Interventional Cardiology and Cardiac Catheterisation: The essential guide. Chapter 11, Medical management of the cardiac patient undergoing coronary angiography by Sara Hungerford, Peter Ruchin and Gerard Carroll. Taylor and Francis Group. 2018. In preparation.

Hungerford S. "Echocardiographic outcomes of MitraClip TM repair for patients with severe mitral regurgitation and pre-existing left ventricular dysfunction." Accepted for Heart, Lung & Circ. 2019.

Hungerford S. "Non-invasive assessment of vascular impedance using cardiac magnetic resonance imaging and applanation tonometry to better estimate the severity of aortic valve stenosis." Accepted for Heart, Lung & Circ. 2019.

Hungerford S. "Echocardiographic outcomes following surgical minimally invasive mitral valve repair in patients with severe mitral regurgitation and pre-existing left ventricular dysfunction." Accepted for Heart, Lung & Circ. 2019.

Conference presentation at Cardiac Society of Australia and New Zealand Annual Scientific Meeting 2018 and Structural Heart Disease Australia Symposium 2019.