

POSTER PRESENTATION

Open Access

# Right ventricular remodeling and dysfunction among the spectrum of heart failure phenotypes

Harris Wang<sup>1</sup>, Lingyu Xu<sup>1</sup>, Kelvin Chow<sup>2</sup>, Joseph J Pagano<sup>2</sup>, Anna Schmidt<sup>3</sup>, James A White<sup>3</sup>, Evangelos Michelakis<sup>4</sup>, Justin Ezekowitz<sup>1</sup>, Jason Dyck<sup>4</sup>, Mark Haykowsky<sup>4</sup>, Gavin Y Oudit<sup>1</sup>, Richard B Thompson<sup>2</sup>, Ian Paterson<sup>1\*</sup>

From 19th Annual SCMR Scientific Sessions  
Los Angeles, CA, USA. 27-30 January 2016

## Background

Right ventricular dysfunction (RVD) and enlargement (RVE) are increasingly associated with poor outcomes however their prevalence among patients with heart failure and those at risk has not been well characterized.

## Methods

Healthy controls and patients with heart failure related structural heart disease underwent a standard cardiac magnetic resonance examination. Right and left ventricular ejection fraction (EF) and end diastolic volumes (EDV) were traced from cine imaging. RVD was defined as RVEF less than mean minus 2 standard deviations of healthy gender matched controls. RVE was defined as either indexed RVEDV or RVEDV/LVEDV exceeding mean plus 2 standard deviations of healthy gender matched controls. The prevalence of RV abnormalities and pattern of ventricular remodeling was compared among patient subgroups.

## Results

89 healthy controls, age  $57 \pm 10$  years, and 502 patients, age  $56 \pm 16$  years, were included. Among controls, RVEF was  $61 \pm 6\%$  for women and  $60 \pm 5.6\%$  for men,  $p = 0.5$ , indexed RVEDV was  $63 \pm 11 \text{ mL/m}^2$  for women and  $71 \pm 12 \text{ mL/m}^2$  for men,  $p < 0.05$ , and mean RVEDV/LVEDV was  $0.94 \pm 0.12$  for women and  $0.98 \pm 0.14$  for men,  $p = 0.19$ . Among patients, RVD was detected in 47%, RVE in 38% and either RV abnormality in 61%. RV abnormalities were common in all patient subgroups, ranging from 31% in hypertensive heart disease to 100% in right sided valvular heart disease.

## Conclusions

RV dysfunction and/or enlargement are prevalent among patients with heart failure related structural heart disease. Routine assessment is therefore recommended in 3-D cardiac imaging.

Table 1. Baseline Characteristics and CMR Measures in 89 Healthy Controls

	All (N = 89)	Female (N = 42)	Male (N = 47)	p-value*
Age at Exam (yrs)	57 ± 10	59 ± 9	55 ± 11	0.11
BSA (m <sup>2</sup> )	1.9 ± 0.2	1.8 ± 0.2	2.0 ± 0.2	< 0.001
Systolic Blood Pressure (mmHg)	130 ± 15	129 ± 16	131 ± 14	0.59
Diastolic Blood Pressure (mmHg)	77 ± 9	74 ± 8	81 ± 9	< 0.001
Heart Rate (bpm)	68 ± 10	67 ± 11	68 ± 9	0.61
LVSV (ml)	83 ± 16	74 ± 13	92 ± 15	< 0.001
Indexed LVSV (ml/m <sup>2</sup> )	43 ± 6	41 ± 5	45 ± 7	0.002
LVEF (%)	62 ± 4	62 ± 4	62 ± 4	0.988
LVEDV (ml)	135 ± 28	119 ± 19	148 ± 27	< 0.001
Indexed LVEDV (ml/m <sup>2</sup> )	70 ± 10	66 ± 7	73 ± 11	0.001
LVESV (ml)	51 ± 13	45 ± 8	57 ± 14	< 0.001
Indexed LVESV (ml/m <sup>2</sup> )	27 ± 5	25 ± 4	28 ± 6	0.014
LV mass (g)	102 ± 26	83 ± 13	119 ± 22	< 0.001
Indexed LV mass (g/m <sup>2</sup> )	53 ± 9	46 ± 6	58 ± 8	< 0.001
RVSV (ml)	78 ± 17	69 ± 14	85 ± 15	< 0.001
Indexed RVSV (ml/m <sup>2</sup> )	40 ± 7	38 ± 7	42 ± 7	0.011
RVEF (%)	60 ± 6	61 ± 6	60 ± 6	0.50
RVEDV (ml)	129 ± 30	113 ± 24	144 ± 27	< 0.001
Indexed RVEDV (ml/m <sup>2</sup> )	67 ± 12	63 ± 11	71 ± 12	0.001
RVESV (ml)	52 ± 16	45 ± 12	58 ± 16	< 0.001
Indexed RVESV (ml/m <sup>2</sup> )	27 ± 7	25 ± 6	29 ± 7	0.007
LVmass/LVEDV (g/ml)	0.76 ± 0.11	0.70 ± 0.08	0.81 ± 0.10	< 0.001
RVEDV/LVEDV	0.96 ± 0.13	0.94 ± 0.12	0.98 ± 0.14	0.19

Figure 1 All values are given as mean +/- standard deviation except for number of subjects. \* p-value of comparison between male and female healthy controls

<sup>1</sup>Cardiology, University of Alberta, Edmonton, AB, Canada  
Full list of author information is available at the end of the article

Table 3. Demographics and Cardiac MR Measures by Disease Group										
Disease Group	HTN	HFPEF	Infiltrative	Dilated	Ischemic	Myocarditis	Valvular (L)	Valvular (R)	PH	All
Number (male)	64 (36)	22(17)	25(19)	127 (90)	61(70)	79(57)	33(9)	15(5)	56(19)	<b>502(325)</b>
Age (yrs)	63 ± 12*	75 ± 7*	54 ± 14	53 ± 14*	69 ± 13*	42 ± 14*	61 ± 19	53 ± 19	57 ± 16	<b>56 ± 16</b>
LVEF (%)	61 ± 8	56 ± 7*	59 ± 14	32 ± 14*	32 ± 12*	49 ± 14*	55 ± 12*	60 ± 11	62 ± 8	<b>47 ± 17</b>
Indexed LV mass (g/m <sup>2</sup> )	65 ± 13	66 ± 13	64 ± 32	67 ± 24	63 ± 23	66 ± 28	73 ± 25*	49 ± 13	57 ± 16	<b>74 ± 23</b>
Indexed LVEDV (mL/m <sup>2</sup> )	63 ± 15	69 ± 17	60 ± 23	129 ± 39	112 ± 44	69 ± 37	104 ± 44	64 ± 15	62 ± 16	<b>97 ± 43</b>
LVM/LVEDV (g/mL)	1.06 ± 0.19	1.04 ± 0.29	1.05 ± 0.25	0.69 ± 0.15	0.74 ± 0.16	0.6 ± 0.2	0.76 ± 0.22	0.79 ± 0.2	0.95 ± 0.23	<b>0.83 ± 0.24</b>
RVEF (%)	56 ± 8	53 ± 8	52 ± 14	41 ± 14	46 ± 14	49 ± 11	53 ± 12	56 ± 8	41 ± 12	<b>47 ± 13</b>
Indexed RVEDV (mL/m <sup>2</sup> )	63 ± 14	72 ± 21	77 ± 17	92 ± 30	80 ± 28	65 ± 26	80 ± 26	108 ± 33	103 ± 32	<b>65 ± 29</b>
RVEDV/LVEDV	1.01 ± 0.15	1.06 ± 0.24	1.01 ± 0.26	0.74 ± 0.23	0.79 ± 0.39	0.99 ± 0.24	0.65 ± 0.32	1.7 ± 0.45	1.76 ± 0.66	<b>0.99 ± 0.47</b>
RVD	12 (19%)	6 (36%)	9 (36%)	64 (66%)	40(49%)	33(42%)	10(30%)	3 (20%)	36 (66%)	<b>237 (47%)</b>
RVE	9 (14%)	5 (23%)	7 (28%)	52 (41%)	18(22%)	26(35%)	6 (24%)	15 (100%)	47(84%)	<b>169 (36%)</b>
RVD or RVE	20 (31%)	11 (50%)	11 (44%)	94 (74%)	41(51%)	49 (62%)	14 (42%)	15 (100%)	50 (89%)	<b>305 (61%)</b>

Figure 2 All values are given as mean +/- standard deviation except for number of subjects.

#### Authors' details

<sup>1</sup>Cardiology, University of Alberta, Edmonton, AB, Canada. <sup>2</sup>Biomedical Engineering, University of Alberta, Edmonton, AB, Canada. <sup>3</sup>University of Calgary, Calgary, AB, Canada. <sup>4</sup>University of Alberta, Edmonton, AB, Canada.

Published: 27 January 2016

doi:10.1186/1532-429X-18-S1-P73

Cite this article as: Wang et al.: Right ventricular remodeling and dysfunction among the spectrum of heart failure phenotypes. *Journal of Cardiovascular Magnetic Resonance* 2016 18(Suppl 1):P73.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
[www.biomedcentral.com/submit](http://www.biomedcentral.com/submit)

