

## **Left ventricular global wall thickness is easily calculated, detects and characterizes hypertrophy, and has prognostic utility**

Magnus Lundin<sup>1</sup>, Einar Heiberg<sup>2</sup>, David Nordlund<sup>2</sup>, Tom Gyllenhammar<sup>2</sup>, Katarina Steding Ehrenborg<sup>2,3</sup>, Henrik Engblom<sup>2</sup>, Marcus Carlsson<sup>2</sup>, Dan Atar<sup>4</sup>, Jesper van der Pals<sup>5</sup>, David Erlinge<sup>6</sup>, Rasmus Borgquist<sup>5</sup>, Ardavan Khoshnood<sup>7</sup>, Ulf Ekelund<sup>7</sup>, Jannike Nickander<sup>1</sup>, Raquel Themudo<sup>1</sup>, Sabrina Nordin<sup>8</sup>, Rebecca Kozor<sup>9</sup>, James C Moon<sup>8</sup>, Eva Maret<sup>1</sup>, Kenneth Caidahl<sup>1</sup>, Andreas Sigfridsson<sup>1</sup>, Peder Sörensson<sup>10</sup>, Erik B Schelbert<sup>11</sup>, Håkan Arheden<sup>2</sup>, Martin Ugander<sup>1</sup>

<sup>1</sup> Department of Clinical Physiology, Karolinska Institute, and Karolinska University Hospital, Stockholm, Sweden

<sup>2</sup> Department of Clinical Physiology and Nuclear Medicine, Skåne University Hospital, and Lund University, Lund, Sweden

<sup>3</sup> Department of Health Sciences, Physiotherapy, Lund University, Lund, Sweden

<sup>4</sup> Institute of Clinical Medicine, Faculty of Medicine, University of Oslo, and Oslo University Hospital, Dept. of Cardiology B, Oslo, Norway

<sup>5</sup> Arrhythmia clinic, Skåne University Hospital, and Department of Cardiology, Clinical Sciences, Lund University, Lund, Sweden

<sup>6</sup> Department of Cardiology, Clinical sciences, Skåne University Hospital, and Lund University, Lund, Sweden

<sup>7</sup> Department of Clinical sciences, Emergency and internal medicine, Skåne University Hospital, and Lund University, Lund, Sweden

<sup>8</sup> Institute of Cardiovascular Science, University college London, London, United Kingdom

<sup>9</sup> Advanced cardiovascular imaging group, Sydney Medical School, University of Sydney, Sydney, New South Wales, Australia

<sup>10</sup> Department of Cardiology, Karolinska University Hospital, and Department of Clinical Physiology, Karolinska Institutet, Stockholm, Sweden

<sup>11</sup> University of Pittsburgh Medical Center, Pittsburgh, PA, USA

**BACKGROUND:** Cardiovascular magnetic resonance (CMR) can be used to measure left ventricular end-diastolic volume (LVEDV) and left ventricular mass (LVM). However, there is currently no good way to measure the normality of LVM in relation to a given LVEDV. We hypothesized that a simple measure of left ventricular global wall thickness (GWT) would be accurate, beneficial for detecting and characterizing hypertrophy, and have prognostic significance.

**METHODS:** Subjects underwent CMR at 1.5T, including healthy volunteers (n=99) and patients assessed for heart disease (n=2828).

**RESULTS:** GWT calculated from LVEDV and LVM had excellent agreement with measured mean end-diastolic wall thickness of the entire left ventricle (bias 0.01±0.23mm). GWT was most predictive of death or hospitalization for heart failure in patients with normal findings by CMR (n=326, log-rank 26.8, p<0.001, median [interquartile range] follow-up 5.8 [5.0–6.7] years). GWT indexed to body surface area (GWTi) was most predictive of outcomes in patients with normal LVEDV index (n=1352, log-rank 36.4, p<0.001, follow-up 5.5 [4.1–6.5] years). Patients with concentric remodeling had worse prognosis than the normal patients (p=0.02), and the patients with hypertrophy had worse prognosis than both normal patients (p<0.001) and patients with concentric remodeling (p=0.045), see Figure 1. Of patients with suspected heart disease but normal CMR findings regarding left ventricular volumes, function, mass, and scar, 22% were found to have increased mean GWTi corresponding to concentric remodeling, see Figure 2.

**CONCLUSIONS:** Left ventricular GWT is an intuitive measure that can be easily calculated from mass and volume with high accuracy, and has prognostic utility in patients with normal CMR findings. Also, GWTi classifies hypertrophy as concentric or eccentric, and detects concentric remodeling in a substantial portion of patients with otherwise normal findings.