The importance of long axis function

-an echocardiographic study with respect to ageing, response to treatment, prediction of survival and effect of warm water immersion

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Avhandlingen baseras på följande delarbeten:

I. **Gender and age related differences in left ventricular function and geometry with focus on the long axis**. Grüner Sveälv B, Fritzon G, Andersson *B.*
Eur J Echocardiogr. 2006 Aug;7(4):298-307.

II. **Pronounced improvement in systolic and diastolic ventricular long axis function after treatment with metoprolol.** Grüner Sveälv B, Scharin Täng M, Waagstein F, Andersson B.
Eur J Heart Fail. 2007 Jun-Jul;9(6-7):678-83.

III. **Ventricular long axis function is of major importance for long-term survival in heart failure patients.** Grüner Sveälv B, Lavik Olofsson E, Andersson B.
Heart. 2008;94:284-9.

IV. **Warm water immersion improves biventricular function in heart failure patients.**
Grüner Sveälv B, Cider Å, Scharin Täng M, Angwald E, Kardassis D, Andersson B.
Submitted.

V. **Exposure of enhanced venous return and preload during hydrotherapy are well tolerated in patients with chronic heart failure.**Grüner Sveälv B, Cider Å, Scharin Täng M, Angwald E, Kardassis D, Andersson B.
In manuscript.

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Abstract

Echocardiographic M-mode measurement of atrioventricular plane displacement (AVPD) and determination of annular velocity with Tissue Doppler imaging (TDI) is a reliable method to gauge ventricular long axis function for quantification of myocardial contractility and relaxation.

The aim of this thesis was to increase the understanding of the importance of long axis function with respect to ageing, response to pharmacological treatment, prediction of survival and enhanced load condition caused by warm water immersion.

In 82 healthy subjects, we observed a decrease in systolic and diastolic long axis function with advancing age, whereas short axis function remained unchanged. A remodelling of the heart towards a more spherical shape was associated with age, and was also shown to be more pronounced in female subjects.

In 24 patients with dilated cardiomyopathy, we demonstrated a significant recovery of left ventricular systolic and diastolic long axis function after 6 months of treatment with the β_1-adrenoceptor antagonist metoprolol. The improvement was observed both at rest and during pharmacological stress. The relative improvement at rest in the long axis function was 38%, compared with 20% in left ventricular ejection fraction (biplane Simpson).

A significant and striking correlation between long axis function and 10-year survival was observed in 228 patients with chronic heart failure. In contrast to short axis function, long axis function showed a more linear relationship with mortality.

We found that acute immersion in warm water caused favourable hemodynamic effects in 18 patients with chronic heart failure. Despite increased preload, long axis function improved in both chambers, most likely caused by a combination of reduced heart rate and decreased afterload. Further, we observed in 12 of these patients, that repeated exposure to increased preload (8 weeks of hydrotherapy twice times weekly) was well tolerated.

In summary, these results emphasise the importance of the long axis function for ventricular pumping mechanism and its superiority to detect minor ventricular changes.

Keywords: Echocardiography, long axis function, heart failure, age, dobutamine stress, recover, prognosis, warm water immersion.

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