

# **Cardiovascular structure and function in obesity**

## **Impact of body composition, sleep apnoea and long-term weight loss**

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The thesis is based on the following papers:

- I. Kardassis D, Bech- Hanssen O, Schönander M, Sjöström L, Karason K. **The influence of body composition, fat distribution and sustained weight loss on left ventricular mass and geometry in obesity.** *Obesity* 2012 Mar; 20 (3): 605–611
- II. Kardassis D, Bech- Hanssen O, Schönander M, Sjöström L, Petzold M, Karason K. **Impact of body composition, fat distribution and sustained weight loss on cardiac function in obesity.** *Int J Cardiol.* 2012 Aug 23; 159 (2): 128-133
- III. Kardassis D, Grote L, Sjöström L, Hedner J, Karason K. **Sleep apnoea modifies the long-term impact of surgically induced weight loss on cardiac function and inflammation.** *Accepted for publication in Obesity* 2012
- IV. Kardassis D, Schönander M, Sjöström L, Karason K. **Carotid artery remodeling in relation to body fat distribution and sustained weight loss in obesity.** *Submitted*

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# Cardiovascular structure and function in obesity

## Impact of body composition, sleep apnoea and long-term weight loss

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**Background:** Obesity is associated with disturbances in cardiovascular structure and function varying along with the degree of fatness, but the mechanisms underlying this co-variation are unclear. Short-term weight loss appears to have favourable effects on the cardiovascular system, but whether such improvements are maintained in the long run is unknown.

**Aims:** To study how body composition, fat distribution and obstructive sleep apnoea relate to cardiovascular structure and function and to evaluate the effects of long-term sustained weight loss on the heart and vascular system.

**Methods:** At the 10-year follow-up of the Swedish obese subjects (SOS) study cohort we identified 44 obese patients, who following bariatric surgery had displayed 10-year sustained weight losses (*surgery group*, BMI 31.5 kg/m<sup>2</sup>) and 44 matched obese patients, who during the same time period had maintained stable weight (*obese group*, BMI 42.5 kg/m<sup>2</sup>). We also included 44 matched subjects with normal weight (*lean group*, BMI 24.4 kg/m<sup>2</sup>). All study participants were evaluated with echocardiography, carotid ultrasonography, computed tomography, dual-energy X-ray absorptiometry (DXA) and analysis of blood tests. In addition, 19 patients from the surgery group and 20 from the obese group were examined with polysomnography.

**Results:** As compared with obese controls, the surgery group showed lower left ventricular end-diastolic volume (87±12 vs. 114±24 ml,  $p<0.001$ ), wall thickness (0.79±0.12 vs. 0.93±0.19 cm,  $p<0.001$ ) and mass (158±21 vs. 201±22 g,  $p<0.01$ ), and also improved estimates of systolic (SMV 10.6±1.0 vs. 9.3±1.6 cm/s,  $p<0.01$ ) and diastolic (E/A ratio 1.24±1.10 vs. 1.05±0.20,  $p<0.01$ ) left ventricular function. Further, surgery patients had lower apnoea hypopnoea index (20±22 vs. 38±28 n/h,  $p<0.05$ ) and inflammatory activity (hsCRP 2.3±3.0 vs. 7.2±5.0 mg/L,  $p<0.001$ ) than obese controls. Lumen diameter, intima-media thickness and total plaque area in the carotid artery did not, however, differ between the surgery and obese groups. In forward stepwise multivariate analysis including all subjects ( $n=132$ ), stroke volume, left ventricular cavity size and carotid artery lumen diameter were mainly predicted by lean body mass, whereas blood pressure, left ventricular wall thickness and carotid artery intima-media thickness were more influenced by visceral adipose tissue. In multiple regression analyses including subjects examined with polysomnography ( $n=39$ ) and controlling for BMI, the AHI remained independently associated with estimates of inflammation and diastolic dysfunction.

**Conclusions:** Body composition and fat distribution are of importance with respect to cardiovascular structure and function in obesity. Whereas lean body mass determines stroke volume, left ventricular cavity size and carotid artery diameter, visceral adipose tissue is more related to blood pressure, left ventricular wall thickness and carotid artery intima-media thickness. Patients with sustained weight loss after bariatric surgery display lower left ventricular mass, enhanced cardiac function, less severe sleep apnoea and reduced inflammatory activity as compared to weight stable obese counterparts, but not less premature carotid artery atherosclerosis. Sleep apnoea that persist despite obesity intervention appears to limit the beneficial effect of weight loss on cardiac performance and inflammation.

**Keywords:** Obesity, weight loss, cardiac function, cardiac structure, inflammation, intima-media thickness, obstructive sleep apnoea.

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