

LUNG EMPHYSEMA & CARDIAC FUNCTION

Akademisk avhandling

som för avläggande av medicine doktorexamen vid Sahlgrenska Akademin vid Göteborgs
Universitet kommer att offentligens försvaras i Aulan SU/Sahlgrenska
Fredagen den 28 mars 2008, kl. 09.00

av

Kirsten Jörgensen

Leg. Läkare

Fakultetsopponent:

Docent Jan Hultman

Karolinska University Hospital, Solna, Sweden

Avhandlingen baseras på följande delarbeten

- I.** Kirsten Jörgensen, Erik Houltz, Ulla Westfelt, Folke Nilsson, Henrik Scherstén and Sven-Erik Ricksten. Effects of Lung Volume Reduction Surgery on Left Ventricular Diastolic Filling and Dimensions in Patients With Severe Emphysema. *Chest* 2003; 124 (5): p 1883-70.
- II.** Kirsten Jörgensen, Erik Houltz, Ulla Westfelt, Sven-Erik Ricksten. Left Ventricular Performance and Dimensions in Patients with Severe Emphysema. *Anesth Analg* 2007; 104: 887-892.
- III.** Kirsten Jörgensen, Markus F Müller, Jacqueline Nel, Richard N Upton, Erik Houltz, Sven-Erik Ricksten. Reduced Intrathoracic Blood Volume and Left and Right Ventricular Dimensions in Patients With Severe Emphysema: An MRI Study. *Chest* 2007; 131: 1050-1057.
- IV.** Kirsten Jörgensen, Odd Bech-Hanssen, Erik Houltz, and Sven-Erik Ricksten. Effects of Levosimendan on Left Ventricular Relaxation and Early Filling at Maintained Preload and Afterload Conditions After Aortic Valve Replacement for Aortic Stenosis. *Circulation*. 2008; 117: 1075-1081.



The Sahlgrenska Academy

AT GÖTEBORG UNIVERSITY

LUNG EMPHYSEMA & CARDIAC FUNCTION

Kirsten Jörgensen

Department of Anaesthesiology and Intensive Care Medicine,
Institute of Clinical Sciences, The Sahlgrenska Academy, Göteborg University, Sweden

ABSTRACT

Patients with severe lung emphysema have poor quality of life because of impaired lung function and reduced exercise tolerance. Concomitant heart disease in severe emphysema is well recognised. The prevailing view is that mainly the right side of the heart is involved, while the issue of left ventricular (LV) involvement is less studied. The aim of this thesis was to evaluate cardiac performance and dimensions in patients with severe emphysema, using pulmonary artery thermodilution technique, transoesophageal echocardiography and magnetic resonance imaging.

The main findings were that patients with severe emphysema have impaired cardiac performance as reflected in subnormal values of stroke volume and cardiac output compared with patients/volunteers with normal lung function. This impaired cardiac performance is caused by inadequate diastolic filling (decreased preload) of the right and left ventricle. Myocardial contractility is not affected, but the left ventricle is hypovolemic and operates on a steeper portion of the LV function curve.

One possible explanation for the decreased biventricular preload is a low intrathoracic blood volume caused by the hyperinflated lungs. In patients with severe emphysema, lung volume reduction surgery improves LV end-diastolic dimensions and filling and thereby performance, which at least partly could explain the improved exercise tolerance seen after the operation.

Levosimendan has combined inotropic and vasodilatory effects and is used in the treatment of severe heart failure. The effect on diastolic function in humans is not entirely understood. Therefore, the aim was to evaluate whether levosimendan has lusitropic effect in patients with diastolic dysfunction, using pulmonary artery thermodilution technique and transoesophageal echocardiography. The main finding was that levosimendan shortens isovolumic relaxation time and improves LV early filling.

In conclusion, patients with severe emphysema have compromised cardiac performance as reflected in impaired LV filling and low stroke volume. The decreased ventricular preload is explained by a low intrathoracic blood volume most likely caused by the hyperinflated lungs. Lung volume reduction surgery, improves LV function. Levosimendan exerts a direct positive lusitropic effect in patients with diastolic dysfunction.

Key words: Emphysema; hemodynamics; ventricular end-diastolic volumes; lung volume reduction; ventricular function; transoesophageal echocardiography; magnetic resonance imaging; diastole; simendan; hypertrophy.