

***Strain echocardiography in the critically ill patient.  
Studies in patients with septic shock and subarachnoid  
haemorrhage.***

Akademisk avhandling  
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Av  
**Keti Dalla**  
Leg. Läkare

Fakultetsopponent:  
**Professor Michelle Chew**  
Institutionen för Medicin och Hälsa  
Linköpings Universitet

Avhandlingen baseras på följande delarbeten

- I. Keti Dalla, Caroline Hallman, Odd Bech-Hansen, Michael Haney, Sven-Erik Ricksten  
*Strain echocardiography identifies impaired longitudinal systolic function in patients with septic shock and preserved ejection fraction.*  
Cardiovascular Ultrasound 2015; 13:30
- II. Keti Dalla, Odd Bech-Hansen, Sven-Erik Ricksten.  
*Impact of norepinephrine on the afterload and function of the right ventricle in septic shock - strain echocardiography study.* Submitted
- III. Keti Dalla, Odd Bech-Hansen, Jonatan Oras, Silvana Naredi, Sven-Erik Ricksten.  
*Speckle tracking vs conventional echocardiography for the detection of myocardial injury - A study on patients with subarachnoid haemorrhage.*  
Acta Anaesthesiologica Scandinavia 2018; 63: 365-372
- IV. Keti Dalla, Odd Bech-Hansen, Sven-Erik Ricksten.  
*General anaesthesia and positive pressure ventilation suppress left and right ventricular myocardial shortening in patients without myocardial disease - a strain echocardiography study.* Submitted.



# Abstract

In this thesis, strain echocardiography by two-dimensional speckle tracking imaging (2D-STI), was used for the evaluation of left ventricular (LV) and right ventricular (RV) function in critically ill patients with septic shock and subarachnoid haemorrhage.

The aims were to: 1) investigate the value of strain echocardiography for the early detection of LV and RV dysfunction not diagnosed with conventional echocardiography in severe sepsis and septic shock, 2) to study the effects of norepinephrine on RV systolic function and pulmonary haemodynamics in patients with norepinephrine-dependent septic shock 3) evaluate the use of strain echocardiography for detection of myocardial injury in patients with subarachnoid haemorrhage (SAH) and 4) study the impact of general anaesthesia and positive pressure ventilation (PPV) on RV and LV myocardial longitudinal strain.

The main findings were that LV and RV systolic performances, as detected by 2D-STI, were impaired to a greater extent in septic patients with preserved ejection fraction, when compared to critically ill, non-septic patients with preserved ejection fraction. In septic shock, norepinephrine-induced increases in mean arterial pressure (MAP), improves RV performance without affecting pulmonary vascular resistance (PVR). The diagnostic performance of global LV strain and regional LV strain to detect myocardial injury in patients with subarachnoid haemorrhage is not superior to that of conventional echocardiography. Finally, general anaesthesia with positive pressure ventilation decreases absolute values of LV and RV longitudinal strain in patients with no heart disease.

In conclusion, strain imaging is useful in the early detection of myocardial dysfunction in sepsis and evaluation of the vasopressor therapy. It does not have better diagnostic performance in detecting global or regional systolic dysfunction in patients with (SAH) than conventional echocardiography. The impact of anaesthesia and PPV should be taken into consideration when strain imaging is used in ICU patients.

**Keywords:** Strain echocardiography, left ventricle, right ventricle, septic shock, subarachnoid haemorrhage, norepinephrine.

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