

Left ventricular dysfunction in critically ill patients

Akademisk avhandling

Som för avläggande av medicine doktorexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligen försvaras i Hjärtats Aula, Sahlgrenska Sjukhuset Göteborg, den 29/9 2023, klockan 9–11 av Oscar Cavefors.

Fakultetsopponent:

Professor Michael Haney

Umeå Universitet

Avhandlingen baseras på följande delarbeten

- I. **Regional left ventricular systolic dysfunction associated with critical illness: incidence and effect on outcome**
Cavefors O, Holmqvist J, Bech-Hanssen O, Einarsson F, Norberg E, Lundin S, Omerovic E, Ricksten SE, Redfors B, Oras J
ESC Heart Failure 2021; 8: 5415-5423
- II. **Isolated diastolic dysfunction is associated with increased mortality in critically ill patients**
Cavefors O, Ljung Faxén U, Bech-Hanssen O, Lundin S, Ricksten SE, Redfors B, Oras J
J Crit Care. 2023 Aug;76:154290.
- III. **Cardiac biomarkers for screening of cardiac dysfunction in critically ill patients**
Cavefors O, Einarsson F, Holmqvist J, Bech-Hanssen O, Ricksten SE, Redfors B, Oras J
Manuscript
- IV. **RWMAs in critically ill patients with non-obstructed coronary arteries**
Rosen-Wetterholm E, Cavefors O, Redfors B, Ricksten SE, Omerovic E, Polte CL, Oras J
Acta Anaesthesiol Scand. 2023 Jul;67(6):746-754.

**SAHLGRENKA AKADEMIN
INSTITUTIONEN FÖR KLINISKA VETENSKAPER**



Left ventricular dysfunction in critically ill patients

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Abstract

Background: Cardiac dysfunction is common in Intensive Care Unit (ICU) patients and can contribute to multiorgan failure and death. Despite this, few studies have been performed on pathogenesis, prevalence, diagnosis and impact on mortality in unselected ICU patients.

Aim: The thesis aimed to assess the prevalence, significance, and etiologies behind systolic and diastolic LV dysfunction in critically ill patients, as well as explore the use of cardiac biomarkers.

Methods: Paper I was a prospective observational trial focusing on cardiac left ventricular (LV) systolic dysfunction in ICU patients. Patients underwent transthoracic echocardiography (TTE) within 24 hours of admission. A secondary analysis of the first cohort was performed in Paper II. Patients with normal systolic function and no cardiac disease were classified according to the European Association of Cardiovascular Imaging (EACVI) guidelines for diastolic dysfunction. In Paper III, a retrospective analysis focusing on cardiac biomarkers was performed using data from Paper I. Paper IV was a register study in which coronary angiography and cardiac magnetic resonance (CMR) results were systematically explored in ICU patients with Regional Wall Motion Abnormalities (RWMA).

Results: The prevalence of systolic dysfunction, defined as ejection fraction (EF) < 50% or RWMA, was 25% in unselected ICU patients. Half of the patients had systolic dysfunction unrelated to primary cardiac disease. No mortality increase was seen at 30 days (primary outcome), but the 90-day mortality was increased. (Paper I) In total, 218 patients were included in Paper II. Of these, 21 (10%) had diastolic dysfunction, and in 35 (17%) diastolic function was indeterminate. A risk-adjusted model showed increased 90-day mortality in these patient groups. (Paper II) NT-proBNP and hsTNT were associated with cardiac dysfunction but were not sensitive enough to use for screening of cardiac dysfunction in unselected ICU patients. However, biomarkers were linked to increased mortality even after adjustments for cardiac dysfunction, disease severity, age, and independently associated factors. (Paper III) In the retrospective register study, 257 patients with RWMA were identified, and 53 of these had non-obstructed coronary arteries. The majority of patients with non-obstructed coronary arteries had reversible LV dysfunction. CMR showed Takotsubo or myocardial stunning as the most common reason for the RWMA in these patients. (Paper IV)

Conclusions: Systolic and diastolic dysfunction is common and associated with increased mortality in ICU patients. Biomarkers are useful as risk markers but are not advisable for screening for cardiac dysfunction. A substantial part of ICU-associated cardiac dysfunction is not caused by coronary artery disease; those patients often have reversible cardiac dysfunction.

Keywords: : Left ventricular dysfunction; Left ventricular diastolic dysfunction; hsTNT; NT-proBNP; Coronary angiography; Regional wall motion abnormalities; Takotsubo syndrome; Septic cardiomyopathy; MINOCA; Cardiac disease; Intensive care unit; Echocardiography