

"GEORGE EMIL PALADE" UNIVERSITY OF MEDICINE,
PHARMACY, SCIENCES AND TECHNOLOGY FROM TÎRGU MUREŞ

SCHOOL OF DOCTORAL STUDIES

Summary of the doctoral thesis

The role of chest ultrasound in the management of cardiovascular disease

Doctoral student: **István Adorján Szabo**

Doctoral supervisor: **Prof. Univ. Dr. Alexandru Incze**

TÎRGU MUREŞ 2023



UNIVERSITATEA DE MEDICINĂ,
FARMACIE, ŞTIINŢE ŞI TEHNOLOGIE
„GEORGE EMIL PALADE”
DIN TÂRGU MUREŞ

The structure of the doctoral thesis includes a general part and a special part, each made of subchapters. In the general part I will present the importance of heart failure, data on its pathophysiology and diagnostic methods, followed by pulmonary ultrasound, presented with a brief history, technical principles and its clinical applications in pulmonary and cardiovascular pathologies. The special part will attain on three important aspects: the first will evaluate the hemodynamic consequences given by aortic stenosis at the pulmonary level and finding some points in their prognosis. The second will present the role of lung ultrasound in the evaluation of latent congestion in patients with heart failure. The third part will reflect an innovative image that was born in the middle of the SARS CoV-2 pandemic and will present the methodology and utility of chest ultrasound in the evaluation of COVID-19 patients.

I hope this paper will help you on your journey to discover the benefits of lung ultrasound and its utility in cardiovascular disease and beyond.

Working hypothesis

Considering pulmonary congestion, which structurally changes the pulmonary parenchyma, pulmonary echography can be a tool to quantify its severity. The retrograde pressure increases lead to changes in end-diastolic pressures, thus congestion sets in, as in the studied diseases: aortic stenosis, heart failure with preserved EF and due to an inflammatory syndrome in the SARS-CoV-2 disease.

Objectives

a. To determine the prognostic value of lung ultrasound, by the presence and quantity of B-lines, in AS pathology, and to observe if it can have a predictive factor in moderate and severe AS.

b. Evaluation of the prognostic value of B-lines and other new echocardiographic parameters, by speckle tracking methods.

c. Finding correlations between the number of B-lines and the classic factors, which represent pulmonary congestion.

d. Evaluation of the utility of lung ultrasound in COVID-19.

e. Characteristic aspects due to the inflammatory syndrome in COVID-19 can be described.

f. Lung ultrasound can be used in the daily routine of assessing the severity of the disease of COVID-19.

g. Lung ultrasound may be superior to lung radiography in the evaluation of patients and to CT.

h. Finding a limit number of B-lines that can be regarded as a prognostic factor in view of the evolution of the disease COVID-19

The originality of the thesis

The original and innovative nature of this research consists of the implementation of lung ultrasound in everyday medical practice, in various cardiovascular pathologies such as AS, HFpEF and the consequences of pulmonary inflammatory syndrome in SARS-CoV-2 infection. In what follows I will describe the originality of each presented work.

1. The prognostic value of lung ultrasound in aortic stenosis

It is an innovative, unique and unprecedented study in the specialized literature that addresses the prognostic value of B-lines for the prediction of adverse cardiovascular events in patients with AS. Given its

accuracy and simplicity, lung ultrasound can thus be considered a reliable tool in the more accurate assessment of pulmonary congestion to optimize the timing of surgery.

2. The prognostic value of lung ultrasound in patients with newly diagnosed heart failure with preserved ejection fraction in ambulatory care

The prognostic value of B-lines as well as new echocardiographic parameters by speckle tracking methods (longitudinal globular movement of the LV and the reservoir function of the AS) in patients with HFpEF was evaluated. Thus, both methods proved to be useful in establishing prognostic parameters. B-lines are adequate prognostic indicators in HFpEF patients, thus contributing to the appropriate diagnosis and stratification of this group in ambulatory care.

3. Pathophysiological background and clinical practice of lung ultrasound in patients with covid-19: a brief review

The observation of pulmonary structural changes and the development of a score system for the severity of the infection that has an essential role in determining the clinical evolution and prognosis of the disease. Implementation of lung ultrasound as an effective tool for monitoring the progression or regression of lung lesions.

4. Applicability of lung ultrasound in the evaluation of COVID-19 pneumonia: diagnostic accuracy and clinical correlations

Application of ultrasound score (A-BBC) compared to chest CT score and determination of diagnostic performance of LUS compared to chest CT and lung radiography. The initial assessment by chest CT as well as monitoring the evolution of lung lesions can be replaced by LUS, the obvious replacement of the use of chest X-ray by LUS. These evidences recommend the use of LUS in the clinical management of COVID-19.