

## **The Clinical and Radiological Signs during the Evolution of Acute Heart Failure Correlate with Lung Impedance**

Michael Shochat<sup>1</sup>, Mark Kazatsker<sup>1</sup>, Vladimir Gurovich<sup>1</sup>, Elena Neyman<sup>1</sup>, Aya Asif<sup>1</sup>, Aaron Frimerman<sup>1</sup>, Paul Rabinovich<sup>2</sup>, David Blondheim<sup>1</sup>, Avraham Shotan<sup>1</sup>, Simcha Meisel<sup>1</sup>

<sup>1</sup>Heart Institute, Hillel Yaffe Medical Center, Rappaport Faculty of Medicine, Technion, Haifa, <sup>2</sup>Department of Internal Medicine C, Sourasky Medical Center, The Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

*Background* - there is no non-invasive method to predict acute heart failure (AHF) before the appearance of clinical signs. The implantable impedance device is the only method that predicts AHF with sensitivity of 48-76%. Our aim was to validate the ability of the non-invasively measured lung impedance (LI) to predict AHF by comparison with chest x-ray findings and with the physical examination in patients hospitalized for acute myocardial infarction (AMI).

*Methods and Results*- We used a non-invasive method for LI measurement. A radiological score (RS) of 0 to 10 was devised for lung fluid quantification. 37 healthy volunteers and 523 AMI patients with normal physical examination and chest x-ray on admission were monitored for 94±35 hours. LI decrease in healthy volunteers was < 6% (p=NS). LI decrease in 395 AMI patients that did not develop AHF was <12% from baseline (p=0.3) and RS increased from 0.8±0.5 to 1.3±0.5 (p=0.06). In the other 128 AMI patients, LI decreased by >12%, which was predictive of AHF. At the interstitial stage of AHF, LI decreased by 13.2± 1.5% (p<0.0001) with an RS of 2.9±0.5 (p<0.05). When rales appeared, LI decreased by 21± 2.7% (p<0.0001) and RS further increased to 4.5±0.8 (p<0.001). At full-blown AHF, LI decreased by 36± 5.5% and RS increased to 9.5±1.1. LI correlated with RS (r= -0.92, p<0.001). The time elapsed from the point at which LI decreased >12% to the appearance of rales and radiological signs of AHF was 242±105 min.

*Conclusions*- Non-invasive LI monitoring has a 95% positive predictive value for prediction of AHF at the interstitial edema stage. Prediction was feasible early enough to allow initiation of effective therapy as a preventive measure.