Utility of Ultrasound Lung Comets in the Early Diagnosis of Acute Heart Failure in Post–Cardiac Surgery - The LUCE Study

Purpose: Acute heart failure (AHF) after cardiac surgery is associated with a very poor prognosis. Early diagnosis of AHF is key to ensure prompt and effective treatment. Lung ultrasonography (LUS) have been proposed as a reliable diagnostic tool for the assessment and grading of pulmonary congestion by means of ultrasound lung comets (ULCs) evaluation. The aim of this study is to assess the diagnostic performance of ULCs, alone or in combination with echocardiographic evaluation of left ventricular (LV) systolic and diastolic function, compared with chest-X-ray (CXR) and NT-proBNP, for the early diagnosis of postoperative AHF in a cohort of patients admitted to the cardiac surgery intensive care unit (CSICU) of our hospital.

Methods: We enrolled 42 consecutive patients (mean age: 71.1±8.8 years; mean EuroSCORE: 5.7±2.9 [±SD]), who were studied before and immediately after cardiac surgery with LUS, transthoracic echocardiography (TTE), CXR and NT-proBNP. Final diagnosis of AHF, satisfying ESC guidelines recommendations, was adjudicated by 2 independent investigators blinded to the results of LUS. ROC-curve analyses were performed to compare diagnostic accuracy and predictive values of LUS (±TTE-derived LV systolic and diastolic function), CXR and NT-proBNP with reference to the adjudicated final diagnosis.

Preliminary results: The adjudicated final diagnosis of postoperative AHF was done in 18 patients (42.9%). Mean postoperative ejection fraction was 49.3±12.37%. Decompensation was detected in 59.5% of patients when estimated by LUS (alone or in combination with TTE), 28.6% by CXR, and 26.2% by NTproBNP. At the time of admission in CSICU, a number of ULCs <5 safely ruled out postoperative AHF with both excellent sensitivity and negative predictive value of 94%. In ROC analyses, ULCs yielded a C-statistic of 0.81 (95% CI: 0.69-0.92) compared with 0.74 (95% CI: 0.61-0.87) for supine CXR, and 0.56 (95% CI: 0.42-0.70) for NT-proBNP (cut-off value >1000 pg/ml). LUS allowed significantly shorter average time to diagnosis (107 min) when compared with CXR and NT-proBNP (261 and 165 min; p<0.0001).

Conclusions: In the postoperative period after cardiac surgery LUS allows rapid and reliable ruling-out of AHF. LUS represents an attractive, radiation-free, bedside, non-invasive diagnostic tool for early detection and monitoring of extravascular lung water.

Early Diagnosis of AHF on CSICU admission

Diagnostic strategy	Sensitivity	Specificity	PPV	NPV	AUC (95%CI)
ULCs	94.4	66.7	68.0	94.1	0.81 (0.69-0.92)
CXR	55.6	91.7	83.3	73.3	0.74 (0.61-0.87)
NT-proBNP	33.3	79.2	54.5	61.3	0.56 (0.42-0.70)
ULCs/TTE	94.4	66.7	68.0	94.1	0.81 (0.69-0.92)

Sample size: 42 patients   **Disease prevalence: 42.9%**