

Gas exchange and respiratory mechanics after a cardiac arrest: a clinical description of Cardiopulmonary Resuscitation-Associated Lung Edema.

François M Beloncle¹, Hamid Merdji¹, Arnaud Lesimple¹, Bertrand Pavlovsky¹, Elise Yvin¹, Dominique Savary³, Alain Mercat¹, Ferhat Meziani² and Jean-Christophe Richard¹.

1. Medical ICU, University Hospital of Angers, Vent'Lab, University of Angers, Angers, France
2. Medical ICU, University Hospital of Strasbourg, University of Strasbourg, Strasbourg, France
3. Emergency Department, University Hospital of Angers, University of Angers, Angers, France

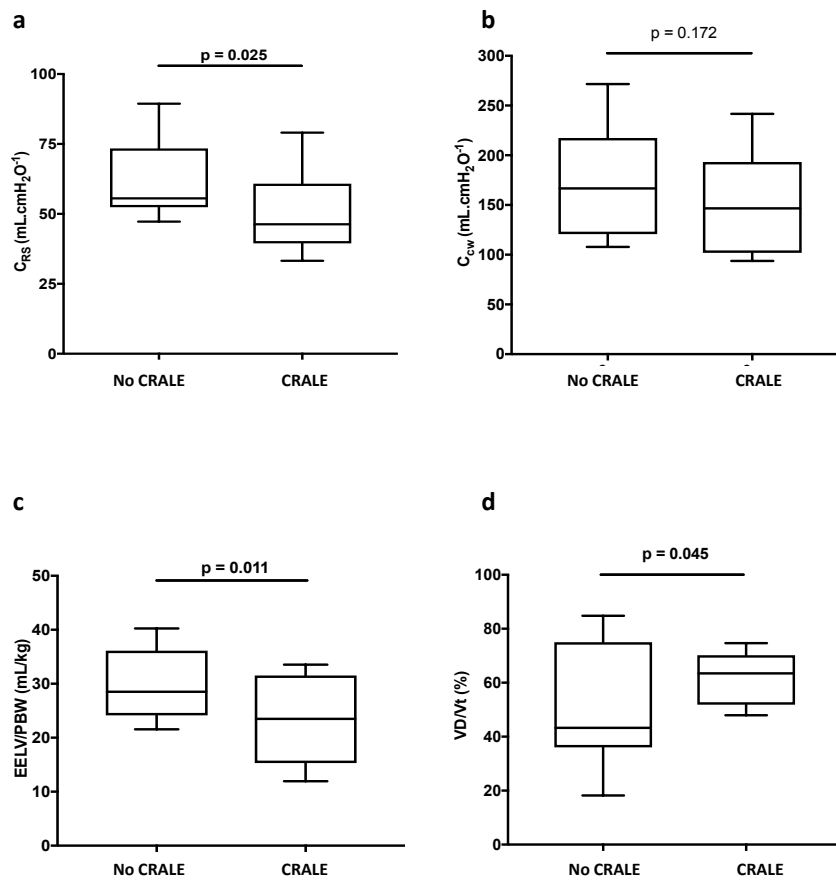
Rationale. Cardiac arrest is a major cause of ICU admission and is associated with a high mortality rate. Beside the well described post-cardiac arrest syndrome, lung injury has often been neglected while it may contribute to poor outcomes. The concept of Cardiopulmonary Resuscitation-Associated Lung Edema (CRALE) has been recently described in an animal study coupled with a retrospective series of patients. Nevertheless, respiratory mechanics of patients mechanically ventilated after a cardiac arrest have not been comprehensively described so far. This study aimed at assessing whether patients defined as CRALE exhibited altered respiratory mechanics and gas exchange compared to patients without CRALE.

Methods. All patients admitted in two French university-affiliated hospitals ICUs after a cardiac arrest were prospectively included in the study. Exclusion criteria were age < 18 years, contra-indication to esophageal pressure measurement and use of ECMO. Respiratory mechanics (including esophageal pressure and end-expiratory lung volume (EELV) measurements) and gas exchange were assessed within 24 hours after intubation under deep sedation and paralysis in volume-controlled mode (V_t of 6 mL.kg^{-1} of predicted body weight (PBW) and positive end-expiratory pressure (PEEP) of $5 \text{ cmH}_2\text{O}$). CRALE was defined as a $\text{PaO}_2/\text{FiO}_2$ ratio $\leq 300 \text{ mmHg}$ at PEEP $5 \text{ cmH}_2\text{O}$ and bilateral infiltrates on the chest radiograph. Patients with CRALE were compared to those without CRALE using nonparametric tests.

Results. Forty-three patients undergoing manual chest compressions after a cardiac arrest were included in the study and 26 (60%) patients were considered to have CRALE. Patients with CRALE had lower C_{RS} and EELV/PBW than those without CRALE (Figure). C_{CW} was not different between patients with or without CRALE. VD/V_t and respiratory system resistances were higher in patients with CRALE than in those without CRALE (Figure). An airway closure at PEEP $5 \text{ cmH}_2\text{O}$ was found in 10 patients (23%).

Conclusion. The present systematic respiratory mechanics evaluation showed that patients developing what we defined as CRALE soon after a cardiac arrest present lower compliance and EELV and a higher dead space that deserve to be identified to justify lung protective ventilation in a context where normocapnia and low PEEP are often considered first.

Figure



Distribution of Respiratory System (C_{RS} , **a**) and Chest Wall Compliances (C_{CW} , **b**, $n = 30$), ratio of End-Expiratory Lung Volume at Positive End-Expiratory Pressure 5 cmH_2O to Predicted Body Weight (EELV/PBW, **c**) and dead space fraction (VD/V_t , **d**) at positive end-expiratory pressure 5 cmH_2O in patients with or without Cardiopulmonary Resuscitation-Associated Lung Edema (CRALE) within 24hours after cardiac arrest. Boxplots display medians, 10th, 25th, 75th, and 90th percentiles. P-values refer to the comparisons between the patients with and without CRALE.