CRILI: Cardiopulmonary Resuscitation-induced Lung Injury - a lung CT analysis in a porcine model

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Argomento: Trauma e arresto cardiaco

Objective: Cardiopulmonary resuscitation (CPR) related lung injury has been previously observed.[1]However, the incidence and the pathophysiology of lung damage after CPR have not been investigated, especially after the introduction of mechanical chest compression (CC). The aim of this study was to evaluate the presence of lung injury after CPR in a porcine model of cardiac arrest (CA) with prolonged manual or mechanical CC.

Methods: Male domestic pigs (35±1 kg) were randomized to 18 min of continuous mechanical (LUCAS® 3.0) or manual CCs after 2 min of untreated CA. Unsynchronized mechanical ventilation was provided with tidal volume 500 ml, 10 bpm, FiO2 1.0, zero positive end-expiratory pressure. Hemodynamic parameters, EKG, SpO2, $EtCO_2$were continuously recorded. Compliance of the respiratory system (Cpl,rs) was assessed at baseline and after return of spontaneous circulation (ROSC). Lung CT scan was performed at the end of CPR with a 16-slices CT scanner (GE Brightspeed,GE Healthcare). Morphological and quantitative analyses of lung CT scans were performed.

Results: Overall, lung injury was observed in all animals. Qualitative analysis showed significantly more diffuse ground-glass attenuation and airspace consolidation in the mechanical CC group compared to the manual one (**Table 1**). Lung weight was significantly higher in the mechanical CC compared to the manual CC (612±220 g *vs.* 372±90 g, p=0.0154, **Figure 1**). Lung weight was inversely correlated with Cpl,rs (r=-0.66, p=0.019, **Figure 2**). Indeed, Cpl,rs was consistently reduced in the mechanical CC compared to the manual CC after ROSC (p<0.01 **Figure 3**). Both SpO2 and P/F ratio were lower after mechanical CC. Representativelung CT scans are reported in **Figure 4**.

Conclusions: In this porcine model of CA/CPR, lung injury was more severe after mechanical CC compared to manual CC. Nevertheless, lung injury was reported in all animals, allowing for the introduction of the new concept of Cardiopulmonary resuscitation-induced lung injury “CRILI”.

Table 1. Morphological analysis

	LUCAS® (n=6)	Manual (n=8)	p
Ground Glass Attenuation	***36 lung lobes***	***48 lung lobes***	
• Absent	2/36 (6)	9/48 (19)	0.201
• Focal	4/36 (11)	22/48 (46)	0.002
• Diffuse	30/36 (83)	17/48 (35)	<0.001
Airspace consolidation	***36 lung lobes***	***48 lung lobes***	
• Absent	10/36 (28)	24/48 (50)	0.041
• Focal	11/36 (30)	16/48 (33)	0.838
• Diffuse	15/36 (42)	8/48 (17)	0.053

Figure 1

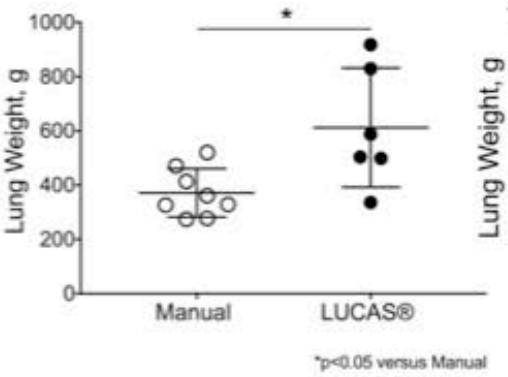


Figure 2

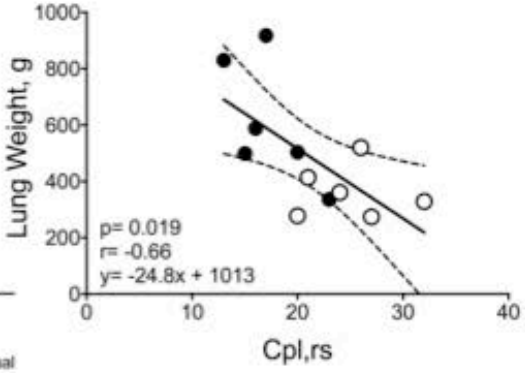


Figure 3

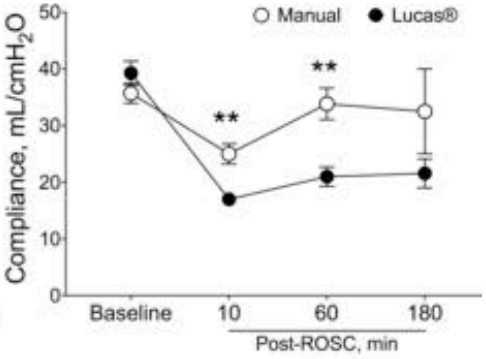
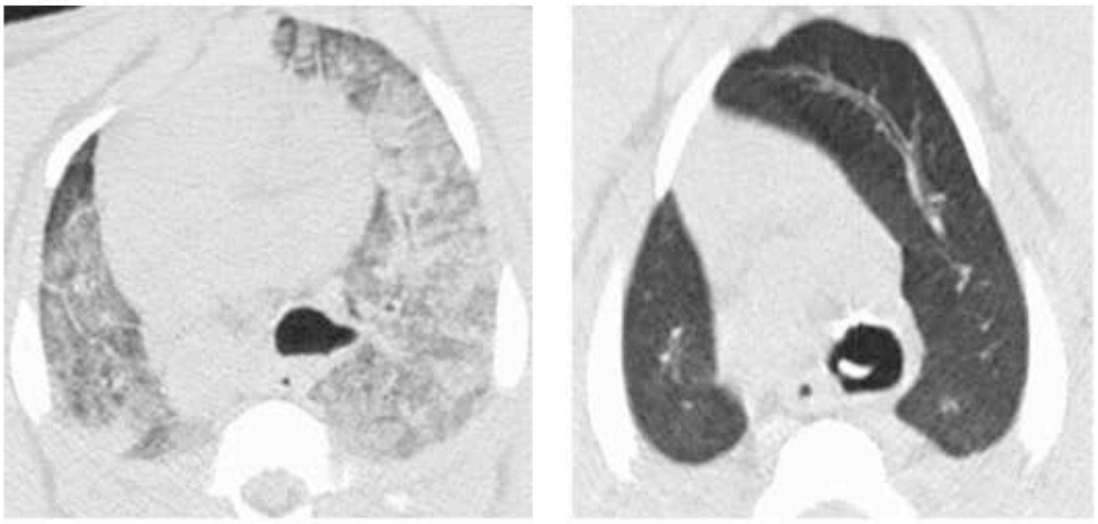


Figure 4



Mechanical CC

Manual CC