Hemoadsorption perfusion strategy mitigates lung ischemia reperfusion injury associated to extended warm ischemic time

Simonato E, Berardino A, Scalini F, Costamagna A, Sales G, Steinberg I, Scanu M, Balzano S, Lorenzetti E, Caprioni F, Maddinelli D, Finiti V, Izzo G, Brazzi L, Rinaldi M, Boffini M, Fanelli V

Department of Cardiac Surgery and Intensive Care Unit, Città della Salute e della Scienza, Torino, Italy

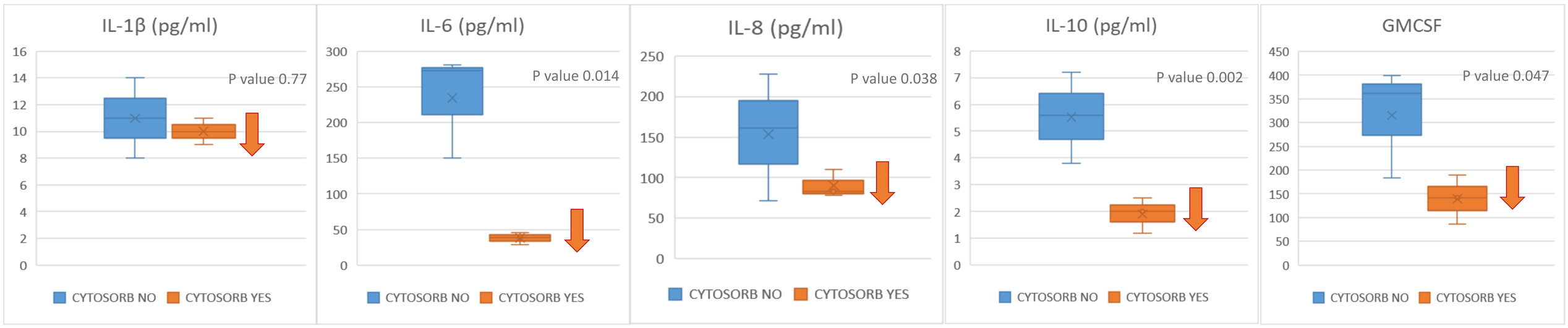
BACKGROUND

Lungs from Donation after Cardiac Death (DCD) are at risk of unforeseeable extended warm ischemic time (WIT) that in turns may aggravate the severity of lung ischemia reperfusion (IR) injury. Novel hemadsorption devices may attenuate dysregulated innate immune response associated to lung IR injury. Aims of the current study were: First, to evaluate respiratory mechanics and inflammatory response during EVLP after extended WIT; Second, to evaluate the effect of immune-sorbent therapies on lung IR injury.

METHODS

Twenty-two lungs from DCD pigs donors underwent Ex Vivo Lung Perfusion (EVLP) after being randomized to three or six hours of Warm Ischemia Time (3 or 6 WIT). Lungs after 6 hours WIT were further randomized to receive or not Cytosorb during EVLP. All lungs underwent two hours of reperfusion with blood (10%Hct) to study lung IR injury. Respiratory mechanics, vascular resistances were calculated hourly over the experimental period. Cytokines concentrations were quantified in perfusate at 1 and 4 hours of EVLP by commercially available ELISA kit. Albumin concentration was evaluated in lung perfusate at the same time points and in bronchoalveolar lavage fluid (BALF) at the end of reperfusion.

RESULTS



After Reperfusion	Perfusion		P value
	Without CytoSorb	With CytoSorb	
$Pplat_{LUNG}$ (%)*			
1hr	27(25,58)	-3(-18,14)	0.05
2hr	18(13,42)	-22(-28,-13)	0.01
$Cstat_{LUNG}$ (%)*			
1hr	-60(-70,-52)	-36(-51,-22)	0.03
2hr	-55(-65, -46)	-14(-28, -4)	0.01
Lung $PI_{ALBUMIN}$	21(14-28)	12(7-20)	0.04

* Variable is expressed as percentage change compared to baseline (1 hour after beginning of EVLP).
List of abbreviations. Pplat: plateau pressure. CstatLUNG: Lung compliance. Lung PIALBUMIN: Lung Permeability Index to Albumin.

CONCLUSIONS

Extended Warm Ischemia Time up to 6 hours is associated with impairment of lung respiratory mechanics during EVLP and more severe IR lung injury after graft reperfusion. Modulation of dysregulated immune response by hemoadsorption strategy attenuates IR-lung injury.