Transplantation. 2014 Sep 15;98(5):499-506. doi: 10.1097/TP.0000000000000254.

Hydrogen preconditioning during ex vivo lung perfusion improves the quality of lung grafts in rats

Kentaro Noda [1], Norihisa Shigemura, Yugo Tanaka, Jay Bhama, Jonathan D'Cunha, Hirosuke Kobayashi, James D Luketich, Christian A Bermudez

Affiliations

PMID: 25121557 DOI: 10.1097/TP.0000000000000254

Abstract

Background: Although the benefits of ex vivo lung perfusion (EVLP) have been globally advocated, the potentially deleterious effects of applying EVLP, in particular activation of proinflammatory cascades and alteration of metabolic profiles, are rarely discussed. This study examined proinflammatory events and metabolic profiles in lung grafts on EVLP and tested whether preconditioning lung grafts with inhaled hydrogen, a potent, cytoprotective gaseous signaling molecule, would alter the lungs' response to EVLP.

Methods: Rat heart-lung blocks were mounted on an acellular normothermic EVLP system for 4 hr and ventilated with air or air supplemented with 2% hydrogen. Arterial and airway pressures were monitored continuously; perfusate was sampled hourly to examine oxygenation. After EVLP, the lung grafts were transplanted orthotopically into syngeneic rats, and lung function was examined.

Results: Placing lung grafts on EVLP resulted in significant upregulation of the messenger RNAs for several proinflammatory cytokines, higher glucose consumption, and increased lactate production. Hydrogen administration attenuated proinflammatory changes during EVLP through upregulation of the heme oxygenase-1. Hydrogen administration also promoted mitochondrial biogenesis and significantly decreased lactate production. Additionally, in the hydrogen-treated lungs, the expression of hypoxia-inducible factor-1 was significantly attenuated during EVLP. These effects were maintained throughout EVLP and led to better posttransplant lung graft function in the recipients of hydrogen-treated lungs.

Conclusions: Lung grafts on EVLP exhibited prominent proinflammatory changes and compromised metabolic profiles. Preconditioning lung grafts using inhaled hydrogen attenuated these proinflammatory changes, promoted mitochondrial biogenesis in the lungs throughout the procedure, and resulted in better posttransplant graft function.

Comment in

Hydrogen in lung reconditioning--more than just inflation.

Dark J.

Transplantation. 2014 Sep 15;98(5):497-8. doi: 10.1097/TP.0000000000000311.

PMID: 25102304 No abstract available.

Related information

PubChem Compound (MeSH Keyword)

LinkOut – more resources

Full Text Sources

Ovid Technologies, Inc.

Wolters Kluwer

Other Literature Sources

The Lens - Patent Citations

scite Smart Citations

Medical

ClinicalTrials.gov

MedlinePlus Health Information