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How to minimise ventilator-induced lung injury in transplanted lungs

Michael Eberlein, Lindsey Barnes, Tahuanty Pena, and Robert M. Reed

Division of Pulmonary, Critical Care and Occupational Medicine, University of Iowa Hospitals and Clinics, Iowa City, Iowa (ME, LB, TP); and Division of Pulmonary and Critical Care Medicine, University of Maryland, Baltimore, Maryland, USA (RMR)

Editor,

We read with great interest the review by Soluri-Martins et al.¹ on how to minimise ventilator-induced lung injury in transplanted lungs. This is an important topic and we agree with the authors that mechanical ventilator settings have an important role in each stage of the management of lung transplantation.² The authors discuss the aspect of donor-to-recipient lung size mismatch and report that in a study of 70 patients in comparison with patients who received adequately sized lungs, there was no significant difference in in-hospital or 1-year mortality.³ Based on this finding, the authors recommend that the optimal ventilation strategy in such lung size-mismatched patients remains unclear. With this letter we want to clarify and expand the discussion on the data available correlating lung size mismatch and mechanical ventilation tidal volumes, primary graft dysfunction, 1-year mortality and long-term allograft function.^{2–8} First, we would like to elucidate some aspects about the study of 70 patients the authors refer to for their conclusion that the optimal ventilation strategy in such lung size-mismatched patients remains unclear.³ In that study, we selected a most-undersized (10 patients with lowest predicted total lung capacity [pTLC] ratio = pTLC-donor/pTLC-recipient), a best-matched (10 patients with pTLC ratio closest to 1.0) and a most-oversized subset (10 patients with highest pTLC ratio) within a cohort of 70 bilateral lung transplantation patients.³ This study was conducted as a pilot investigation to demonstrate the conceptual relationship between donor-to-recipient lung size mismatch and postoperative mechanical ventilation tidal volumes according to recipient and donor-predicted body weights in lung transplantation patients.³ We found that expressing tidal volumes in ml kg⁻¹ donor-predicted body weights (as a parameter of allograft size) revealed significant differences in mechanical ventilation tidal volumes between undersized, matched and oversized subsets (11.4 ± 3.1 versus 9.4 ± 1.2 versus 8.1 ± 2.1, respectively; P < 0.05). Two patients developed primary graft dysfunction grade 3, both in the undersized subset. Four patients in the undersized group underwent tracheostomy (versus none in matched and one in oversized subset). The authors are correct that there was no statistically significant

Correspondence to Michael Eberlein, MD, PhD, Division of Pulmonary, Critical Care and Occupational Medicine, University of Iowa Hospitals and Clinics, 200 Hawkins Drive, C 33 GH, Iowa City, IA 52242, USA Tel: +1 319 356 1265; fax: +1 319 353 6406; michael-eberlein@uiowa.edu.

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difference in 1-year mortality between the undersized, matched and oversized subsets (20 versus 10 versus 0%, respectively, $P > 0.05$);³ however, this study with only 10 patients in each group was not designed or powered to look at differences in clinical outcomes.³ The association between undersizing and various clinical outcomes has been well established through other studies:^{2–8} 1. Donor-to-recipient lung size mismatch (assessed by the pTLC ratio) modulates the risk for primary graft dysfunction. In a single-centre study, we found that an undersized allograft was associated with a significantly increased risk of severe primary graft dysfunction after bilateral lung transplantation.⁵ This finding was confirmed in an ancillary study to the multicentre lung transplantation outcomes group.⁷ 2. The ancillary study to multicentre lung transplantation outcomes group confirmed the observation that during mechanical ventilation after bilateral lung transplantation, patients with undersized allografts received higher tidal volumes compared with those with oversized allografts when tidal volume was considered in terms of donor-predicted body weight (as an estimate of the actual allograft size).⁷ 3. There is an independent association between undersizing and increased complications and resource utilisation during lung transplantation hospitalisation.⁵ 4. Undersizing is an independent predictor of death in the first year after lung transplantation.⁸ 5. Undersizing is associated with lower allograft function and a higher risk of bronchiolitis syndrome in the long-term follow-up.⁶ A possible conclusion from these investigations of lung size mismatch and clinical outcomes after lung transplantation is that a lung-protective mechanical ventilation strategy based on estimates of the allograft size (i.e. donor-predicted body weight) could be protective for lung transplantation recipients, especially for recipients of undersized allografts. In an international survey of lung transplantation professionals, donor characteristics usually were not considered and frequently were not known by the team managing mechanical ventilation after lung transplantation.⁴ Although we agree with the authors that the optimal ventilation strategy in such lung size-mismatched lung transplantation recipients remains unclear, we believe that the mechanical ventilation strategy should be based on donor characteristics (donor-predicted body weight as a parameter of actual allograft size), rather than recipient characteristics.^{2–4,7} This donor characteristic-based protective mechanical ventilation strategy is currently based on indirect evidence and will require validation in prospective clinical studies.

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