

influence of such combinations on four major end-points: 30-day mortality, PGD, BOS and long-term survival. Although we aimed at constructing a homogeneous study group (adjusting for size and diagnosis), other confounding factors might have had an influence. These circumstances might have biased the results to some degree but not, in our opinion, to an extent that may invalidate the main conclusions drawn from the study.

To summarize, this single-centre, retrospective analysis found that D/R gender mismatch does not have a negative impact on short-term and long-term outcomes after lung transplantation. The survival benefit for female patients might be associated with the predominance of CF in this particular group of recipients. Therefore, gender should not be considered a significant enough issue in considering the way the lungs are allocated, because of the constraints of shortage of donor organs and the more significant effects of other donor factors including age and underlying disease. For these reasons, D/R gender matching should not be taken into consideration when allocating donors to specific lung transplant candidates. Additional investigations are required to corroborate these results.

**Conflict of interest:** none declared.

## REFERENCES

- [1] Lynch JP, Sagar R, Weigt SS, Ross DJ, Belperio JA. Overview of lung transplantation and criteria for selection of candidates. *Semin Respir Crit Care Med* 2006;27:441-69.
- [2] Rustgi VK, Marino G, Halpern MT, Johnson LB, Umama WO, Tolleris C. Role of gender and race mismatch and graft failure in patients undergoing liver transplantation. *Liver Transpl* 2002;8:514-8.
- [3] McGee J, Magnus JH, Islam TM, Jaffe BM, Zhang R, Florman SS *et al.* Donor-recipient gender and size mismatch affects graft success after kidney transplantation. *J Am Coll Surg* 2010;210:718-26.
- [4] Stehlik J, Edwards LB, Kucheryavaya AY, Benden C, Christie JD, Dipchand AI *et al.* The registry of the International Society for Heart and Lung Transplantation: 29th official adult heart transplant report—2012. *J Heart Lung Transplant* 2012;31:1052-64.
- [5] Roberts DH, Wain JC, Chang Y, Ginns LC. Donor-recipient gender mismatch in lung transplantation: impact on obliterative bronchiolitis and survival. *J Heart Lung Transplant* 2004;23:1252-59.
- [6] Thabut G, Mal H, Cerrina J, Darteville P, Dromer C, Velly JF *et al.* Influence of donor characteristics on outcome after lung transplantation: a multicenter study. *J Heart Lung Transplant* 2005;24:1347-53.
- [7] Sato M, Gutierrez C, Kaneda H, Liu M, Waddell TK, Keshavjee S. The effect of gender combinations on outcome in human lung transplantation: the International Society of Heart and Lung Transplantation Registry experience. *J Heart Lung Transplant* 2006;25:634-7.
- [8] Christie JD, Edwards LB, Kucheryavaya AI, Benden C, Dobbels F, Kirk R *et al.* The Registry of the International Society for Heart and Lung Transplantation: twenty-eighth adult lung and heart-lung transplant report—2011. *J Heart Lung Transplant* 2011;30:1104-22.
- [9] Orens JB, Boehler A, de Perrot M, Estenne M, Glanville AR, Keshavjee S *et al.* A review of lung transplant donor acceptability criteria. *J Heart Lung Transplant* 2003;22:1183-200.
- [10] Goldman HI, Becklake MR. Respiratory function tests. *Am Rev Tuberc Pulm Dis* 1959;79:457-67.
- [11] Sundaresan S, Trachiotis GD, Aoe M, Patterson GA, Cooper JD. Donor lung procurement: assessment and operative technique. *Ann Thorac Surg* 1993;56:1409-13.
- [12] Alvarez A, Salvatierra A, Lama R, Algar J, Cerezo F, Santos F *et al.* Preservation with a retrograde second flushing of Eurocollins in clinical lung transplantation. *Transplant Proc* 1999;31:1088-90.
- [13] Christie JD, Carby M, Bag R, Corris P, Hertz M, Weill D. Report of the ISHLT Working Group on primary graft dysfunction, Part II: definition. A consensus statement of the International Society for Heart and Lung Transplantation. *J Heart Lung Transplant* 2005;24:1454-9.
- [14] Estenne M, Hertz MI. Bronchiolitis obliterans after human lung transplantation. *Am J Respir Crit Care Med* 2002;166:440-4.
- [15] Alvarez A, Moreno P, Espinosa D, Santos F, Illana J, Algar FJ *et al.* Assessment of lungs for transplantation: a stepwise analysis of 476 donors. *Eur J Cardiothorac Surg* 2010;37:432-9.
- [16] Inoue S, Yamada Y, Kuzuhara K, Ubara Y, Hara S, Ootubo O. Are women privileged organ recipients? *Transplant Proc* 2002;34:2775-6.
- [17] Csete M. Gender issues in transplantation. *Anesth Analg* 2008;107:232-8.
- [18] Simpson E, Scott D, Chandler P. The male-specific histocompatibility antigen. *Ann Rev Immunol* 1997;15:39-61.
- [19] Swezey N, Tchepichev S, Cagnon S, Fertuck K, O'Brodovich H. Female gender hormones regulate mRNA levels and function of the rat lung epithelial Na channel. *Am J Physiol* 1998;274:379-86.
- [20] Silverman EK, Weiss ST, Drazen JM, Chapman HA, Carey V, Campbell EJ *et al.* Gender-related differences in severe, early-onset chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2000;162:2152-8.
- [21] Miñambres E, Llorca J, Subriviola B, Ballesteros MA, Ortiz-Melón F, González-Castro A. Influence of donor-recipient gender mismatch in early outcome after lung transplantation. *Transplant Proc* 2008;40:3076-8.
- [22] Fessart D, Dromer C, Thumerel M, Jougon J, Delom F. Influence of gender donor-recipient combinations on survival after human lung transplantation. *Transplant Proc* 2011;43:3899-902.
- [23] Christie JD, Kotloff RM, Pochettino A, Arcasoy SM, Rosengard BR, Landis JR *et al.* Clinical risk factors for primary graft failure following lung transplantation. *Chest* 2003;124:1232-41.
- [24] Prekker ME, Nat DS, Walker AR, Johnson AC, Hertz MI, Herrington CS *et al.* Validation of the proposed International Society for Heart and Lung Transplantation grading system for primary graft dysfunction after lung transplantation. *J Heart Lung Transplant* 2006;25:371-8.

**eComment. Gender mismatching in lung transplantation: Lung size mismatch is the issue!**

**Authors:** Michael Eberlein, Servet Bolukbas and Robert M. Reed

University of Iowa Hospitals and Clinics, Iowa City, IA, USA,

doi: 10.1093/icvts/ivt053

© The Author 2013. Published by Oxford University Press on behalf of the European Association for Cardio-Thoracic Surgery. All rights reserved.

We read with great interest the study by Alvarez *et al.* on gender mismatched lung transplantation (LTx) and clinical outcomes [1]. We agree with the authors' conclusion that donor-recipient gender mismatch does not have a negative impact on early graft function and mortality following LTx. However, we would like to use this comment to expand on the rationale.

Gender is a major determinant of lung size, together with height (age and race) [2]. Lung size can be estimated by the predicted total lung capacity (pTLC). Alvarez *et al.* describe that at their institution, the size matching decision is among other factors based on the pTLC of the donor, as compared to pTLC of the recipient. Specifically, variations in pTLC of up to 20% between donor and recipient were accepted.

In the USA, candidates for LTx are listed for acceptable donor height ranges. As an example, a 30-year old, 170-cm male candidate (with a pTLC of 6.27 l, as per the equation used by Alvarez *et al.*) could be listed for an acceptable height range from 160 to 180 cm. If the donor were a 30-year old, 160 cm tall female (with a pTLC of 4.93), the resulting donor to recipient pTLC-ratio would be 0.78. A pTLC-ratio <0.8 has been reported to be associated with worse survival after LTx [3]. When we reviewed the United Network for Organ Sharing (UNOS) Standard Transplant Analysis and Research (STAR) data of the thoracic organ transplant registry, we confirmed the association of a pTLC-ratio <0.8 with decreased survival [4]. In the pTLC-ratio <0.8 group, 87% of patients had a female donor to male recipient gender-mismatch. More importantly, when lung size mismatch (via the pTLC-ratio) was accounted for, gender mismatch was not independently associated with survival [4, 5].

We wholeheartedly agree with the approach to use donor and recipient pTLC for the size matching decisions. Utilizing pTLC will account for the gender effect on lung size. A pTLC-based approach could make apparent the possible increased risk associated with significant undersizing that can occur in a height-based allocation system, when a female donor to male recipient mismatch occurs.

**Conflict of interest:** none declared.

## References

- [1] Alvarez A, Moreno P, Illana J, Espinosa D, Baamonde C, Arango E *et al.* Influence of donor-recipient gender mismatch on graft function and survival following lung transplantation. *Interact CardioVasc Thorac Surg* 2013;16:426–6.
- [2] Egan TM. Size matters: it's all about height, sex and race! ISHLT- Links [published July 2012, accessed Jan 2013]. Available from: [http://www.isHLT.org/ContentDocuments/2012JulLinks\\_Spotlight.html](http://www.isHLT.org/ContentDocuments/2012JulLinks_Spotlight.html)
- [3] Sweet SC. Pediatric living donor lobar lung transplantation. *Pediatr Transplant* 2006;10:861–8.
- [4] Eberlein M, Arnaoutakis GJ, Yarmus L, Feller-Kopman D, Dezube R, Chahla MF *et al.* A higher predicted total lung capacity (pTLC) ratio (pTLC donor/pTLC recipient) is associated with improved survival after lung transplantation. *J Heart Lung Transplant* 2011;30(suppl 1):S127.
- [5] Eberlein M, Reed RM, Permutt S, Chahla MF, Bolukbas S, Nathan SD *et al.* Parameters of donor-recipient size mismatch and survival after bilateral lung transplantation. *J Heart Lung Transplant* 2012;31:1207–1213.