

Portable Normothermic Ex Vivo Lung Perfusion

to Reduce Warm Ischemia Time
and Increase Graft Usage

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Presented at the 3rd Annual
O.H. "Bud" Frazier Trans-
plant Roundup; Houston,
22 March 2018.

Section Editors:
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Key words: Graft rejection/
prevention & control; graft
survival; lung transplantation/
adverse effects/instrumenta-
tion/methods; primary graft
dysfunction/etiology; time
factors; treatment outcome

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Dr. Loor receives grant and
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Medics, Inc., for his involve-
ment in the INSPIRE and
EXPAND clinical trials.

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The need for better-quality donor lungs and their improved usage can be met by using portable ex vivo lung perfusion (EVLP) technology. A major problem affecting donor-lung quality is the risk of primary graft dysfunction (PGD), a form of reperfusion injury caused by a period of no blood flow (ischemia) after explantation, and then reperfusion with the recipient's blood after implantation. As ischemic time lengthens, the risk and severity of PGD increase. Grade 3 PGD is associated with high 30-day mortality rates and long-term bronchiolitis obliterans syndrome. Approximately 80% of donor lungs are wasted because of PGD and other factors.

Portable EVLP reduces ischemia, continuously tracks lung function, and improves graft condition by replicating the temperature, ventilation, perfusion, and other conditions within the body. The TransMedics® Organ Care System™ (OCS) (TransMedics, Inc.), a type of portable EVLP, has been tested in the International Randomized Study of the TransMedics Organ Care System (OCS Lung) for Lung Preservation and Transplantation (INSPIRE)¹ to understand its effect on outcomes after transplantation (Fig. 1). The results of INSPIRE showed that OCS shortened ischemic times for the first and second lungs; decreased the incidence of grade 3 PGD to 18% in patients who received OCS-treated lungs, compared with 30% of those in the control group; and decreased the incidence of grade 2 or 3 PGD to 43% of patients in the study group, compared with 60% in the control group. Survival rates at 24 months, however, were similar in both groups. When OCS was used, ventilator times and intensive care unit lengths of stay were somewhat shorter.

In another study, the International Trial to Evaluate the Safety and Effectiveness of the Portable Organ Care System (OCS) for Recruiting, Preserving and Assessing Expanded Criteria Donor Lungs for Transplantation (EXPAND),² the investigators studied the use of OCS in extended-criteria donors to determine its ability to increase organ availability. The OCS treatment improved donor-lung use: 87% that would not have been used for transplantation were successfully transplanted. One-year survival was 91%, which was above that expected. Portable EVLP thus has the potential to increase usage and quality of donor lungs, both of which are needed in lung transplantation.

Static EVLP methods are also available. In these cases, the donor organ is preserved in ice and transferred to the home facility, where it is perfused in an EVLP circuit. To our knowledge, there has been no comparison of static and portable EVLP methods.

In general, EVLP offers a safe platform for perfusing donor lungs outside the body. It potentially enables therapy with medications, cells, and genes that can lead to im-



Fig. 1 The TransMedics Organ Care System (OCS), a portable ex vivo lung perfusion system, enables ventilation and perfusion of the donor lung throughout transportation. (Photo courtesy of TransMedics, Inc.)

proved clinical outcomes. Further adoption of EVLP will depend on the costs of treatment and continued evidence of clinical benefit. The future seems bright for EVLP, and it may have a lasting impact on the field of lung transplantation.

References

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