

## Enrolling Clinical Trials: Ex Vivo Lung Perfusion for Improved Donor Evaluation and Safe Organ Transplantation

► Transplant surgeons at Penn Medicine are using an approach known as ex vivo lung perfusion (EVLP) to enhance donor lung evaluation for transplantation in suboptimal organs not ordinarily used for transplantation. Penn Medicine was the first in the region to incorporate this new technique into lung transplantation surgeries.

Lung transplantation is often the only treatment option available for patients with end-stage lung disease. However, only 15% to 20% of donor lungs are currently deemed viable for transplantation. Reasons for this shortage include the lung's susceptibility to injuries from excess fluid accumulation, bacteria, or damage from intensive care unit-related complications, any of which can render the organ medically unsuitable for transplantation.

Ex vivo lung perfusion is a process by which suboptimal donor lungs are pre-conditioned to improve their potential for transplantation. The technique involves connecting the lung to a ventilator, pump and filters inside a sterile plastic dome. An acellular perfusate (Steen solution) containing nutrients, proteins and a gas mixture (oxygen, carbon dioxide and nitrogen) is then circulated through the lung. A leukocyte depletion filter removes inflammatory cells from the circulated perfusate, including cytokines and tumor necrosis factor. Circulation is controlled by a centrifugal pump and normal body temperature is maintained by a heater/cooler. Together, these procedures have been shown in clinical trials to reduce post-transplantation rejection of suboptimal donor lungs<sup>1</sup> and to provide patient survival rates similar to those of standard donor lungs.<sup>2</sup>

The goal of the Penn Lung Transplant Ex Vivo Lung Perfusion Program is to expand the pool of donor lungs available and extend this life-saving therapy to more patients awaiting transplant. The Program is currently one of the few sites in the United States participating in an ongoing FDA investigational multicenter clinical research trial designed to compare outcomes from lung transplants using the ex vivo technique with those using the traditional method [ClinicalTrials.gov Identifier: NCT01365429]. Persons interested in referring patients to this accruing trial at Penn Medicine may contact Djamila Mallem at 267.608.5449.



► **Figure 1:** Ex vivo lung perfusion (EVLP) is an innovative therapy applied to donor lungs outside of the body before transplantation to improve organ quality and make lungs previously deemed unsuitable safe for transplant.

### CASE STUDY

A single left donor lung was offered to Penn Medicine for EVLP evaluation with intent for possible transplant after being rejected by all other centers as unsuitable for transplantation because of pulmonary edema and questionable aspiration. EVLP was performed according to the clinical trial protocol with reconditioning followed by functional assessment. Airway pressure, lung compliance, and pulmonary vascular resistance were recorded.

During evaluation, hemodynamic (flow, pulmonary vascular resistance, pressure) parameters were stable. Lung radiographs taken 1 hour and 3 hours into EVLP showed improvement in pulmonary edema. The donor lungs improved their oxygenation capacity to a PaO<sub>2</sub>/FIO<sub>2</sub> of 452 at the end of the EVLP.

The lungs were then deemed suitable for transplantation and Mr. M, a consented patient on the waiting list, underwent a left single lung transplant, and was extubated after 16 hours. On postoperative day one, Mr. M's PaO<sub>2</sub> was 103 mmHg at 3 liters of oxygen. He was discharged from the hospital on postoperative day 21, and had stable lung function parameters on spirometry during the entire postoperative period. Mr. M has since completed a 10-month follow-up evaluation with no hospital readmissions.

### Reference

1. Fildes JE, et al. Improved clinical outcome of patients transplanted with reconditioned donor lungs via EVLP compared to standard lung transplantation. *Transpl Int.* 2011;24:77.
2. Cypel M, et al. One year survival and functional status of patients from the Human Ex vivo Lung Perfusion (HELP) trial. *J Heart Lung Transplant.* 2011;30:S8.

### **About Lung Transplantation at Penn Medicine**

Since the inception of Penn Medicine's lung transplant program in 1991, more than 1,000 successful lung transplants have been performed and many lives have been dramatically improved. In recent years, surgeons at Penn Medicine have performed more than twice the number of lung transplants than any other transplant program in the Philadelphia region.

### **ACCESS**

#### **Paul F. Harron Jr. Lung Center Perelman Center for Advanced Medicine**

West Pavilion, 1st Floor  
3400 Civic Center Boulevard  
Philadelphia, PA 19104

#### **Penn Heart and Vascular – Cardiac Surgery Perelman Center for Advanced Medicine**

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#### **Penn Heart and Vascular Center – Heart Transplant Perelman Center for Advanced Medicine**

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