

# ADVANCES IN PULMONOLOGY

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## Lung Transplantation: Decades of Experience and Expertise

Since the inception of the new program nearly two decades ago, the Lung Transplantation Program at NewYork-Presbyterian/Columbia University Irving Medical Center has performed more than 900 lung transplants with survival rates that far surpass national averages – at one-year, 90 percent; five years, 68 percent; and 10 years, 45 percent. As part of the Center for Advanced Lung Disease and Lung Transplantation in the Division of Pulmonary, Allergy and Critical Care Medicine and Section of Thoracic Surgery, the transplant program has flourished under the dynamic and collaborative leadership of **Selim M. Arcasoy, MD, MPH**, Medical Program Director, and **Frank D'Ovidio, MD, PhD**, Surgical Program Director, and Director of the *Ex Vivo* Lung Perfusion Program.

“The lung transplant program has grown into a large comprehensive multidisciplinary team,” says Dr. Arcasoy. “Over the years, we have almost triplicated the number of transplants, consistently improving our early and long-term results with the best survival in the country,” says Dr. D'Ovidio.

“Today, our program includes four surgeons, six pulmonary transplant specialists, seven clinical coordinators, who are either RNs, physician assistants, or nurse practitioners, and a large inpatient PA team that manages the care of post-transplant



*Dr. Selim M. Arcasoy*

patients,” continues Dr. D'Ovidio. “Patients are selected, discussed, treated, and managed collegially between the surgeons and the clinicians. The two services have different roles but even weight in the overall management of our patients.”

Historically, waiting time has been the primary determinant of lung organ allocation in the United States. “Patients were listed and waited two to three years to climb to the top of the list to get a transplant,” says Dr. Arcasoy. “This meant a

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## Dealing with Death and Dying in the ICU

In the medical ICU, pulmonary medicine and critical care physicians are often faced with the death of their patient. While trained to save the lives of the critically ill, these physicians must also have the skills and knowledge to provide palliative care to the patient and emotional support for the family when end of life is inevitable. At NewYork-Presbyterian/Weill Cornell Medical Center, educational and research programs are seeking to integrate palliative care precepts into the acute care setting that ease the passing of patients and comfort their loved ones.

Board certified in pulmonary and critical care medicine, as well as in hospice and palliative care, **Bradley Hayward, MD**, well understands that his dual training might seem incongruent to some. “I’m often asked how those two specialties relate to each other,” says Dr. Hayward. “One focuses on end of life and the other seeks to prevent that. The answer is I’m trying to do the best that I can to save someone’s life, but if I’m not able to cure them, I want to help alleviate their symptoms and let them have a peaceful death.”

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## Lung Transplantation: Decades of Experience and Expertise (continued from page 1)



Dr. Frank D'Ovidio

death sentence for late referrals who were very sick. The allocation system changed in May 2005 to incorporate a medical urgency measure. All of a sudden, we started transplanting sicker and sicker patients.”

According to Dr. Arcasoy, many patients were being admitted to the hospital and needed mechanical support devices. “For about 10 years, we have been using the ambulatory ECMO [extracorporeal membrane oxygenation] system, and we were one of the first centers to implement this kind of support for patients with end-stage lung disease. We evaluate patients, list them if eligible, and support them as a bridge to transplant until organs become available.”

“Previously, patients would go on full cardiopulmonary bypass machines during surgery, but now, almost 100 percent of the time we use ECMO,” adds Dr. D'Ovidio. “Ultimately, this allows us to minimize coagulopathy and hemodynamic instability, which can be caused by cardiopulmonary bypass. The overall management of these patients has evolved and been refined significantly, both intraoperatively and postoperatively, to accommodate the more severe conditions we treat. In recent years we've also created a senior lung transplant program in that now 30 to 40 percent of our patients are over 65.”

### Expanding the Pool of Donor Lungs

While the absolute number of organ donors is fundamentally far lower than those in need, an even smaller percentage, just 20 to 30 percent of donor lungs, is usually deemed acceptable for transplant, notes Dr. D'Ovidio. “Most lungs sustain too much damage at the time of death, which precludes them from transplantation.”

“As our experience has grown, so has our tendency to stretch the limits of what kind of lungs we would accept for transplantation,”

says Dr. Arcasoy. “We published a paper on extended donor lungs years ago that showed that donor lungs that are not perfect yield very similar outcomes to standard lungs.”

“*Ex vivo* lung perfusion [EVLV] allows for the assessment of donated lungs outside of the donor's body and also serves as a platform to potentially recondition the lungs by ventilating and perfusing them before implantation,” says Dr. D'Ovidio. “The process entails warming the lungs to normal body temperature; flushing the donor blood, inflammatory cells, and potentially harmful biologic factors; and treating the lungs with antibiotics and anti-inflammatory agents. In some cases, lungs that might have previously been deemed too poor for transplant can, in fact, be successfully reassessed, rendering them usable.”

In 2011, NewYork-Presbyterian/Columbia participated in the multicenter NOVEL Trial (Normothermic *Ex Vivo* Lung Perfusion as an Assessment of Extended/Marginal Donor Lungs) with Dr. D'Ovidio as Principal Investigator. “We were one of the first two centers in the country to transplant from an *ex vivo* procurement,” says Dr. D'Ovidio. “We've had outstanding results with this process with best early and long-term survival in the trial.”

“EVLV is also a very powerful platform, in my opinion, for research where we could someday apply treatments to the lungs using gene therapy or another approach before transplantation,” says Dr. Arcasoy.

“We are currently developing drug delivery strategies using nanoparticles to be aerosolized to the donor lung while on EVLV,” says Dr. D'Ovidio.

The paucity of suitable lung donors has led the team to explore the utilization of donors beyond brain dead-donors, which were previously the standard. “Much more frequently, we are using donors after cardiac death, a new criterion we've been proactively promoting in the U.S.,” says Dr. D'Ovidio. “It requires a more in-depth and dynamic assessment of the donor before procurement because once the patient has arrested there is no circulation and we are urged to procure the organ as quickly as possible. Instead of hours of assessment, with our dedicated protocol we're now assessing everything in a few minutes allowing us to be extremely successful. Many centers have been requiring the use of the *ex vivo* lung perfusion system in these donors, despite the good quality of the organ, to accommodate the assessment of the organ outside of the donor body.”

“We have also been considering donor lungs that we wouldn't have pursued in the past,” continues Dr. D'Ovidio. “For example, over the last nine months, we have been utilizing organs from donors who had a social history of IV drug abuse. With serological testing there has been a dramatic drop in the risk of potential and unrevealed viral infections. We have already had a 15 percent increase in transplants this year due only to donors with a history of IV drug abuse.”

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## Dealing with Death and Dying in the ICU *(continued from page 1)*

### Educational Support for Clinicians

After joining the Division of Pulmonary and Critical Care Medicine at Weill Cornell, Dr. Hayward sought to share his insights and knowledge with critical care fellows. “I wanted to work with the fellows about end-of-life care, how to approach it and do it right because even though they are focused on saving lives, the reality is that about 20 percent of their patients die. I wanted to help educate them about how to assist in that process and make it less difficult for the patients and families.”

Noting that pulmonary and critical care fellows receive little, if any, formalized palliative care education, he approached the Division of Geriatrics and Palliative Medicine to develop a case-based curriculum that would teach such skills as communication, leading family meetings, and managing symptoms of dying patients.

“We met once a month over the course of the year,” says Dr. Hayward. “The first half of the lecture was didactic and teaching, the second part was letting the fellows debrief about the process. We’ve received a lot of positive feedback, as they felt that they needed to learn more about end-of-life care because it’s something they confront on a daily basis.”

“From a doctor’s standpoint, we tend to think of end of life as a failure,” continues Dr. Hayward. “I’ve been trying to change that thinking and that palliative care really is part of our job as critical care physicians. It’s the right thing to do from a human standpoint.”

The program has since expanded to include both fellows and all internal medical residents who rotate through the MICU.

Dr. Hayward stresses the importance of being direct with the family if the patient is actually dying. “I will tell them that I think that the patient is dying, rather than couching it in euphemisms or saying they are just not getting better. We have to confront the fact that dying is an aspect of our jobs, and like any other part of our job, we have to handle it and we have to do it well. The fellows need to know what happens in the dying process – how to manage symptoms and how to manage pain. We give them the skills and tools to do that.”

Dr. Hayward believes it is important for the physicians to share their experiences in the ICU when a patient is dying. “At the end of our sessions we encourage them to talk about their own emotions and personal feelings. When family members ask difficult questions, I want them to know what they can say. When someone is crying and telling you that life is unfair, what do you say in that situation?”

Dr. Hayward also finds teachable moments in the ICU. “The other day a young man was dying, and before the resident went into his room, I said, ‘His wife is going to ask you if he is dying and what should she do? What are you going to say to her?’ The resident was stunned and unable to express what she was feeling. I wanted to help her to think about how to answer that question.”

“There are some parts of communication where you can learn to be a more effective communicator,” says Dr. Hayward. “While every situation is unique, you can learn how to frame conversations to deal with highly charged emotions and still guide the conversation to a useful end rather than letting the emotions overcome the situation.”

Dr. Hayward is currently preparing a study with pre- and post-surveys from participants to evaluate the effectiveness of the curriculum. “Initially the field of critical care wasn’t as receptive to palliative care as a specialty,” he says. “Now I think we are realizing the power in it and that there are skills that can help us make the situation better for the patients, families, and for ourselves as doctors.”



*Dr. Lindsay Lief and Dr. Bradley Hayward*

### Studies Underway to Improve End of Life

After completing residency and fellowship training in pulmonary and critical care medicine at Weill Cornell, Lindsay Lief, MD, joined the Division of Pulmonary and Critical Care Medicine. Also acknowledging the relatively high mortality in the medical ICU, Dr. Lief, now Medical Director of the MICU, working with colleagues in the Weill Cornell Center for Research on End-of-Life Care under the direction of Holly G. Prigerson, PhD, has undertaken several clinical trials to improve end-of-life care in the ICU.

“The data will tell you that patients prefer to die at home,” says Dr. Lief. “However, in the United States a quarter of people die in the hospital and many in the ICU. For some people, it’s an acute event that we were trying to prevent. For others, it is just the end of their life. We want to help make their death as peaceful and comfortable and with as much dignity as possible.”

In the recently completed SOS (severity of suffering) study, the researchers surveyed ICU nurses of patients who had died. “Ideally you would be able to survey a patient and say, ‘How bad is your pain from 1 to 10? How bad is your nausea from 1 to 10?’ But our patients are likely delirious, sedated, unresponsive, intubated, unable to phonate, and/or too weak to write. If we were to do that study, we’d have a very selective population that would not accurately represent the diversity of patients who die in the ICU.”

According to Dr. Lief, nurses have been shown to be excellent surrogates for assessing patients and rating their symptoms and overall quality of death. “Through chart extraction we determined what interventions the patients received at end of life,” explains Dr. Lief. “We then correlated their perceived suffering with interventions that were done with feeding tubes, dialysis, and ventilators, as well as DNR and withdrawal of care, to get a sense of what symptoms contribute most to suffering and loss of dignity. From our clinical experience, we hypothesized that pain was not the most prominent symptom. We found that other symptoms are as burdensome, including swelling, shortness of breath, being restrained, and weakness.”

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**Lung Transplantation: Decades of Experience and Expertise** *(continued from page 2)*

“We have also been advocating for broader sharing of lungs – not just local sharing, but allowing access to donors within a wider region in the United States,” says Dr. Arcasoy. “We’ve made this point about the lung allocation policy with nearly 10 publications, including, most recently, an article published in the *American Journal of Transplantation* in which we discussed the geographic disparities in local donor lung supply and lung transplant waitlist outcomes.

We’ve shown that individuals who live in the lowest lung availability areas have an 84 percent more likelihood of death or removal from the waiting list due to clinical deterioration and a 57 percent less transplantation rate. The United Network for Organ Sharing recently changed the policy from primarily local allocation to allocation with a 250-nautical mile radius, which is a significant improvement in the system, but it’s not yet perfect.”

**Dealing with Death and Dying in the ICU** *(continued from page 3)*

This study led to another investigation that is evaluating patients on ventilators or any form of respiratory support. “Our SOS studies told us that shortness of breath is a big problem, so we are surveying patients if they are able to communicate, as well as bedside nurses and any family members or loved ones in the room to get a sense if dyspnea is being assessed accurately,” says Dr. Lief.

One recently validated measure of dyspnea in patients in hospice, notes Dr. Lief, includes well-known signs of respiratory distress, such as patients using accessory muscles for breathing and flaring their nostrils. “This measure seems to have some reliability in the hospice setting, but it has never been looked at in patients who are on mechanical ventilation in the ICU,” says Dr. Lief.

In another study supported by the NIH and National Cancer Institute, the Weill Cornell researchers are addressing the needs of family members of patients who die in the ICU. “Many studies of surviving loved ones and caregivers show that they have more post-traumatic stress disorder and prolonged grief than people whose loved ones die at home,” says Dr. Lief. “How can we mitigate that? Does a condolence card from the doctor help? It turns out it

does not. Does a palliative care intervention specifically with the caregiver help? It does not according to the single study that has looked at it. So, through this funding we are providing family members of sick patients in the ICU with four brief interventions with a psychologist to prevent PTSD by helping them to remain present despite the difficulty of the situation, and then following up with them after the patient passes.”

“The essence of our research,” adds Dr. Lief, “is to provide symptom relief for our patients – many of whom are at the end of life – and to help their families get through this most arduous time.”

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