Commentary: Vienna calling—How extracorporeal life support is used as a bridge to lung transplant

Christian A. Bermudez, MD

In this issue of *The Journal of Thoracic and Cardiovascular Surgery*, Benazzo and colleagues report their 20-year experience with extracorporeal life support (ECLS) used as a bridge to lung transplant (BLT) at the Medical University of Vienna. Benazzo and colleagues implemented ECLS in 120 patients between 1998 and 2017 with the intention of BLT; of these, 107 patients received a lung allograft. The article describes the changes observed in patient selection, type of support, and outcomes in 3 eras defined by the evolution of ECLS strategies (1998-2004, 2005-2010, and 2011-2017). In the first era, before the availability of the newer pump, oxygenator, and cannula technologies, ECLS was most commonly venoarterial extracorporeal membrane oxygenation (ECMO) as a bridge to a lung re-transplant for primary graft dysfunction (PGD). This early experience was associated with poor outcomes, with only 36% survival to discharge, and the technique was abandoned in their center as a viable option for management. Since 2005, venovenous ECMO has been their preferred form of ECLS, with significant use of extracorporeal carbon dioxide removal devices since 2010. ECLS was most commonly used in patients with interstitial lung disease or cystic fibrosis in the second and third eras and was associated with better outcomes, with survival to discharge of 80%, 1-year survival of 69%, and 5-year survival of 60%. In the most recent era, as many as 34% of the patients have remained unsedated while receiving support. Awake status was independently associated with improved outcomes and was protective for survival. Benazzo and colleagues conclude that during the last 2 decades, ECLS as a BLT evolved from an acute rescue therapy to a semiletive procedure that yields similar long-term survival to that of nonbridged patients.

In single-center series of contemporary outcomes of ECLS used as a BLT, survival at 1 year has ranged from 60% to 100%. Consistently, an increased risk of morbidity (including bleeding and renal dysfunction), longer intensive care unit or hospital stay, or PGD has been noted. Although caution has been raised by some regarding the negative impact of ECLS as a BLT when prolonged wait list times are expected, most high-volume centers consider ECLS a safe and useful tool to bridge patients when rapid deterioration is noted during the wait for a transplant. Attempts to study ECLS used as a BLT by examining the Scientific Registry of Organ Recipients have been incomplete, because the depth of the current data collected in that registry unfortunately prevents a detailed analysis of specific ECLS techniques, patient management, postoperative complications, or the risk of PGD.

In contrast, the study of Benazzo and colleagues confirms what I and others have experienced during the same period, that is, acceptable midterm and long-term outcomes in well-selected patients. The study also provides interesting insight into the evolution of ECLS techniques, with an increasing use of extracorporeal carbon dioxide removal devices (as many as 23% of the patients in the recent era), and the importance of awake ECMO (a factor independently associated with improved outcomes). Interestingly, it suggests that ECLS imparts only a low risk of PGD grade 3 (5.6%)—contrary to what was previously believed—despite the fact that ECLS was used liberally in approximately 40% of the patients postoperatively. Notably, 10% to 15% of patients required a modification to the ECLS...
support, most frequently an upgrade from venovenous ECMO to venoarterial ECMO. The team caring for patients with ECLS as a BLT should be familiar with the different types of ECLS and cannulation techniques, because ECLS is not one-size-fits-all. This series also provides an interesting and somewhat sobering perspective on the ability of patients to ambulate or to be completely liberated from the ventilator, which was possible for less than 15% of the patients. This reflects the advanced clinical deterioration frequently seen at the time of ECLS implantation. An earlier consideration of ECLS, in some cases before intubation is needed, may be beneficial.

It is worth noting some of the limitations and controversial aspects of this study, including the fact that, unlike the general experience in the United States, time to transplant on ECLS was very short (5 days vs 10-14 days), with a potential impact on the outcomes. In addition, the consideration by Benazzo and colleagues1 of patients with acute renal failure requiring active renal replacement therapy for BLT differs from most transplant centers. All the patients had recovery of kidney function, however, and none required permanent hemodialysis after transplant. This is a provocative concept for consideration and requires further analysis.

The study by Benazzo and colleagues1 provides us a clear and honest perspective of the evolution of ECLS as a BLT during the last 2 decades from an active lung transplant program and addresses some of the challenges and successes of mechanical support as a BLT. This timely report is the largest single-center published series of ECLS as a BLT, and it has the added value of addressing the evolution of ECLS techniques. Their propensity-matched, controlled analyses of midterm and long-term survivals and the effects of allograft PGD according to the most recent International Society for Heart and Lung Transplantation definitions are also noteworthy. The basic concepts of ECLS as a BLT have been corroborated, and this in-depth analysis of the different techniques used for ECLS and their long-term effects on patients and allograft function is an important advance.

References