Four Decades of Progress in Heart-Lung Transplantation: Lessons Learned From 300 Cases at a Single Institution

Objective:
To analyze the progress made over four decades of heart-lung transplantation (HLT) at a single institution.

Methods:
First time HLT recipients >18 years of age at a single institution between the years of 1981 and 2022 were identified. Kaplan-Meier survival curves were used to compare eras. Eras were defined as 1981-1987, the Pioneering Era; 1988-2005, the Lung Transplant Era; 2006-2013, the Era of Modern Immunosuppression; and 2014-2021, the Mechanical Circulatory Support (MCS) Era. Fischer's exact test and Wilcoxon's rank-sum test were applied where appropriate.

Results:
A total of 301 patients underwent HLT at a single center between 1981-2022. Pediatric and redo HLT recipients were excluded for this analysis. There were 42 patients in the Pioneering Era, 131 in the Lung Transplantation Era, 41 in the Modern Immunosuppression Era, and 44 in the MCS Era. In the MCS Era, patients were significantly older (42 vs 34 years [Pioneering Era], P<0.001) and more frequently bridged to transplant with ECMO than in the previous eras (25% vs 2.5% [Modern Immunosuppression Era] P<0.001). Survival has improved with each successive era (Figure 1A), with an estimated 1-year survival in the MCS Era of 93.2% (CI 86.0-100%), 87.5% (CI 77.8-98.4%) in the Era of Modern Immunosuppression, 73.9% (CI 66.7-81.3%) in the Lung Transplant Era, from 67.5% (CI 54.4-83.7) 1-year survival in the Pioneering Era of HLT (P=0.0081). When the first two eras (1981-2005) are compared against the most recent two eras (2006-2021), 5-year survival (Figure 1B) has improved to 60.6% (95% CI, 50.4-72.9) from 49.2% (95% CI, 42.2-57.4; P=0.036). Remarkably, 10-year survival has also improved to 48.2% between 2006-2021 (95% CI: 36.6-63.5), compared to 30.1% (95% CI, 23.9-38.0) between 1981-2005, P=0.012 (Figure 1C).

Conclusions:
Since the pioneering innovation of en bloc HLT in 1981, remarkable progress has been made over the past four decades. Despite expanding HLT to progressively older and sicker patients, a quarter of whom required ECMO as a bridge to transplantation, both short and long-term survival have improved since 1981 due to improvements in immunosuppressive regimens and aggressive utilization of mechanical circulatory support.
A) 1-year Survival

![Graph showing survival probability over time with different eras labeled and a p-value of 0.0081]

B) 5-year Survival

![Graph showing survival probability over time with two periods labeled and a p-value of 0.036]