

BACKGROUND

As the COVID-19 pandemic continues to claim millions of lives globally, lung transplantation (LT) has emerged as a viable option for treating patients with COVID-19 related Acute Respiratory Distress Syndrome (COVID ARDS) whose lung disease is considered irreversible¹. While initial reports have been promising, few sizable single center cohorts exist in the literature. This cohort study describes ten patients who underwent bilateral LT for refractory COVID ARDS and their transplant course. The cohort contains the youngest, and to our knowledge the only, reported pediatric LT recipient for this diagnosis.

PURPOSE AND METHODS

Given the paucity of data on the subject, our purpose was to describe our experience and outcomes of LT for COVID ARDS. We conducted a retrospective review of all LT cases performed at our center for the diagnosis of COVID ARDS performed between 09/2020 and 08/2021.

RESULTS

Cohort Characteristics

- 10 patients that underwent lung LT for COVID ARDS were identified (5 male, 5 female)
- Average recipient age of 44.9 years (range 16-60)
- The cohort showed few comorbidities (no prior malignancy, no prior CT Surgery, if diabetic well controlled)

Pre-Transplantation

- LT occurred on average 96.5 ± 32.9 days following COVID-19 symptom onset
- Patients presented with high Lung Allocation Scores (LAS) (mean, 85.4 ± 9.7)
- 70% of patients required Extracorporeal Membranous Oxygenation (ECMO) (mean duration, 72.1 ± 25.9 days)

Age	Sex	BMI, kg/m ²	Prior Cardiac or Lung Surgery	Prior Malignancy	Diabetes	Smoking Status
44.9 (16-60)	5 Male	27.1 ± 3.5	(0) No Patients	(0) No Patients	70% No History of DM	80% Never Smoker
	5 Female				30% DM (Type II/Unknown)	20% Former Smoker

Fig 1: Cohort Demographics and Clinical Characteristics (age reported as mean (range), BMI: mean ± standard deviation)

BMI, Body Mass Index; DM, Diabetes Mellitus

Days Since Symptoms	ECMO	ECMO Days	MV	MV Days	LAS	Listing Days
96.5 ± 32.9	70% Required	72.1 ± 25.9	60% Required	65.0 ± 32.9	85.4 ± 9.7	22.1 ± 13.4
	30% No ECMO		40% No MV			

Fig 2: Pre-Transplantation Data (figures reported as mean ± standard deviation)

ECMO, Extracorporeal Membranous Oxygenation; MV, Mechanical Ventilation, LAS, Lung Allocation Score

EVLP		Incision		Mechanical Support		PRBC Transfusion	Avg. # of PRBCs, Units
Yes	5 (50%)	Clamshell	9 (90%)	VA ECMO	6 (60%)	70% Required	5.4 ± 2.5
				Off-Pump	2 (20%)		
No EVLP	5 (50%)	Sternotomy	1 (10%)	CPB	1 (10%)	30% No PRBCs	
				VV ECMO	1 (10%)		

Fig 3: Intraoperative Data (figures reported as mean mean ± standard deviation)

EVLP, Ex-Vivo Lung Perfusion; VA ECMO, Venoarterial Extracorporeal Membranous Oxygenation; VV ECMO, Venovenous Extracorporeal Membranous Oxygenation; CPB, Cardiopulmonary Bypass

ECMO	ECMO Days	MV Days	PGD Grade (72 Hrs Post-LT)	LT To Discharge (Days)	Graft/ Patient Status (5 mo.)
60% Required	2.0 ± 0.9	14.1 ± 11.7	50% No PGD	29.0 ± 11.7	100% Functioning/Alive
40% No ECMO			50% PGD Grade 1		

Fig 4: Post-Transplant Data (figures reported as mean ± standard deviation)

ECMO, Extracorporeal Membranous Oxygenation; MV, Mechanical Ventilation; LT, Lung Transplant

RESULTS (CONT.)

Pre-Transplantation (cont.)

- 60% of patients required Mechanical Ventilation (MV) (mean duration, 65.0 ± 32 days)
- LT occurred on average 22.1 ± 13.4 days after listing

Intraoperative

- 90% of cases performed with a clamshell incision
- Mechanical support strategy varied, 6 cases were completed on Veno-Arterial (VA) ECMO, 2 off-pump, 1 with Veno-Venous (VV) ECMO, and 1 via Cardio-Pulmonary Bypass (CPB)
- 70% of patients required intraoperative Packed Red Blood Cells (PRBCs) (mean, 5.4 ± 2.5 units)

Post-Transplantation

- ECMO removed shortly after LT (mean duration, 2.0 ± 0.9 days), all patients received MV
- At 72 hours post-LT, 50% of patients showed no signs of primary graft dysfunction (PGD) and all others showed PGD grade 1
- Hospital discharge occurred on average 29.0 ± 11.7 days following LT; no episodes of acute rejection were noted in this period
- As of submission, there was 100% 5 month allograft and recipient survival

CONCLUSION

While substantial center resources and expertise are required, LT for COVID ARDS can be safely performed with a high rate of success. Careful candidate selection, donor selection, and institutional support were all critical elements that contributed to the 100% success rate observed in this cohort, which includes the youngest reported patient to undergo LTx for COVID ARDS.

REFERENCES

1. Bharat A, Querrey M, Markov NS, et al. Lung transplantation for patients with severe COVID-19. Sci Transl Med. 2020;12(574):eabe4282. doi:10.1126/scitranslmed.abe4282