

Appendix 1 Variable screening

For variables with missing values less than 10%, we performed five imputations using the chained random forests method and subsequently combined the results into a single dataset for analysis. Baseline variables that were considered clinically relevant, with a $P < 0.2$ on univariate analysis (43) and least absolute shrinkage and selection operator (LASSO) regression technique was used to screen for the covariates. Since there were 120 death cases, we restricted the number of covariates no more than 12 to the greatest extent possible to ensure parsimony of the final models according to 10 EVP (44).

The variation characteristics of the significance and the coefficient of these variables were shown in *Figure S1*. The results converged after 430 iterations, at which point λ was 0.01227, yielding a model with excellent performance but minimum number of variables was obtained (*Figure S1*).

The screened 12 covariates included (I) donor factors: sex, CIT; (II) recipient factors: sex, age, BMI, CVP, NT-proBNP; (III) intraoperative factors: transplant method, ECMO strategy, operation time; (IV) postoperative factors: Lac, mechanical ventilation time. Weighted multivariate Cox regression model was further established based on parameters screened by LASSO regression.

References

43. Kang SJ, Cho YR, Park GM, et al. Predictors for functionally significant in-stent restenosis: an integrated analysis using coronary angiography, IVUS, and myocardial perfusion imaging. *JACC Cardiovasc Imaging* 2013;6:1183-90.
44. Riley RD, Ensor J, Snell KIE, et al. Calculating the sample size required for developing a clinical prediction model. *BMJ* 2020;368:m441.

(A) Factors Influencing Overall Survival in LTx Recipients

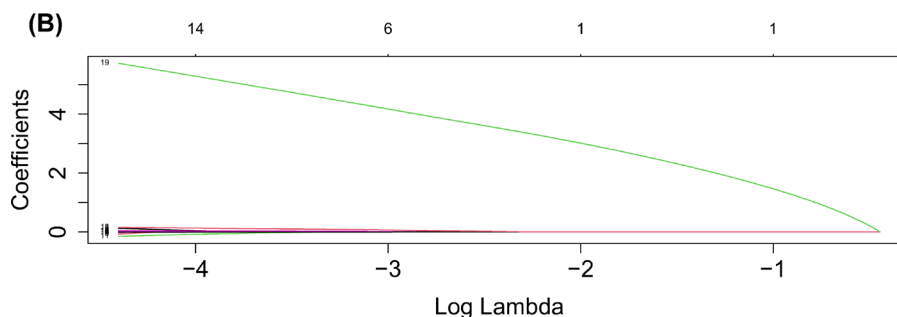
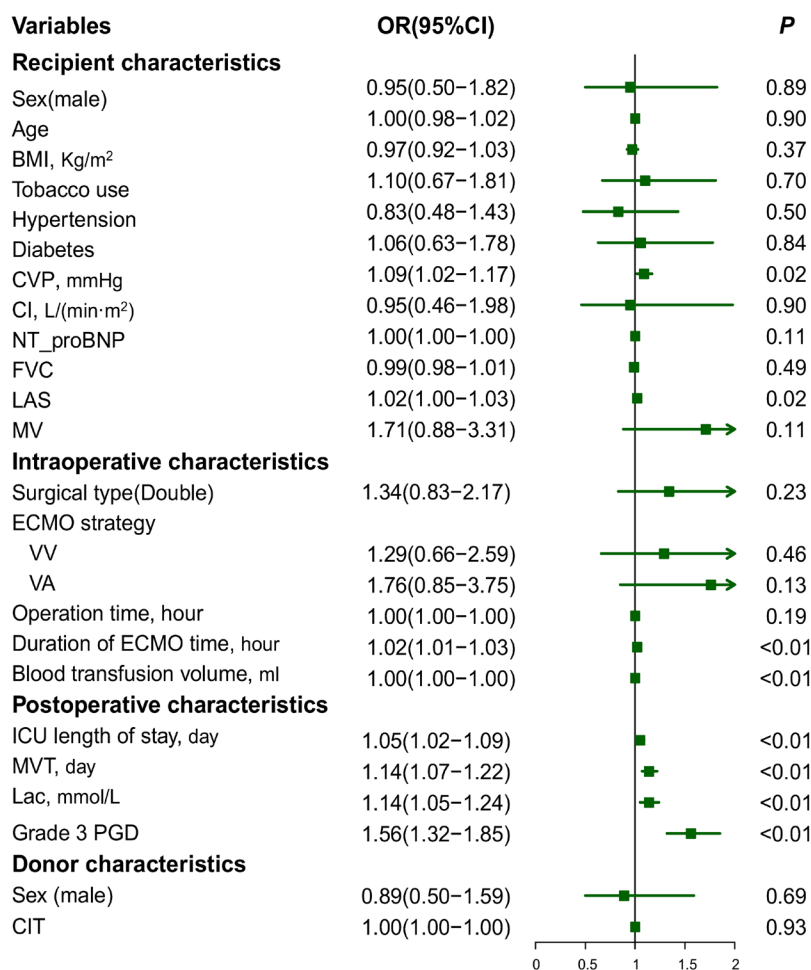


Figure S1 (A) Univariate logistic regressions were used to screen for the covariates and $P < 0.2$ was considered statistically significant. (B) The ordinary LASSO analysis indicated that the optimal result was achieved at $\lambda = 0.01227$, and 12 covariates were selected for further cox regression analysis. OR, odds ratio; CI, confidence interval; BMI, body mass index; CVP, central venous pressure; CI, cardiac index; FVC, forced vital capacity; LAS, lung allocation score; MV, mechanical ventilation; ECMO, extracorporeal membrane oxygenation; VV, venovenous; VA, veno-arterial; ICU, intensive care unit; MVT, mechanical ventilation time; PGD, primary graft dysfunction; CIT, cold ischemia time.

Table S1 Recipient, intraoperative, postoperative characteristics associated with overall survival during lung transplantation

Characteristics	No ECMO (n=47)	ECMO (n=229)	P
Recipient characteristics			
Sex			0.25
Female	5 (10.6)	40 (17.5)	
Male	42 (89.4)	189 (82.5)	
Age (years)	62.0 [55.0, 69.0]	60.0 [54.0, 66.0]	0.21
BMI			0.31
Underweight	7 (14.9)	47 (20.5)	
Normal weight	25 (53.2)	110 (48.0)	
Overweight	14 (29.8)	53 (23.1)	
Obese	1 (2.1)	19 (8.3)	
Tobacco use			0.51
No	28 (59.6)	148 (64.6)	
Yes	19 (40.4)	81 (35.4)	
Hypertension			0.44
No	33 (70.2)	173 (75.5)	
Yes	14 (29.8)	56 (24.5)	
Diabetes			0.94
No	33 (70.2)	162 (70.7)	
Yes	14 (29.8)	67 (29.3)	
CVP (mmHg)	10.0 [8.0, 13.0]	13.0 [8.0, 14.0]	0.002
CI [L/(min·m ²)]	2.7 [2.4, 2.9]	2.53 [2.3, 2.8]	0.048
NT_proBNP (pg/mL)	97.8 [37.7, 164.8]	178.9 [63.3, 489.4]	<0.001
FVC (%)	43.1 [34.9, 50.0]	40.0 [30.4, 50.0]	0.40
LAS	38.4 [34.9, 43.19]	41.4 [35.7, 61.2]	0.006
MV			0.006
No	46 (97.9)	188 (82.1)	
Yes	1 (2.1)	41 (17.9)	
Intraoperative characteristics			
Surgical type			<0.001
Single	38 (80.9)	116 (50.7)	
Double	9 (19.1)	113 (49.3)	
Operation time (hours)	215.0 [190.0, 272.5]	340.0 [255.0, 410.0]	<0.001
Blood transfusion volume (100 mL)	6.0 [0.0, 9.38]	11.3 [7.3, 15.8]	<0.001

Table S1 (*continued*)

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Characteristics	No ECMO (n=47)	ECMO (n=229)	P
Postoperative characteristics			
ICU stay (days)	3.0 [2.0, 5.0]	6.0 [4.0, 11.0]	<0.001
MVT (days)	1.0 [1.0, 1.0]	3.0 [2.0, 6.0]	<0.001
Lac (mmol/L)	4.1 [3.2, 5.3]	4.9 [3.7, 6.9]	0.007
PGD			0.01
0	36 (76.6)	130 (56.8)	
3	11 (23.4)	99 (43.2)	
AKI			0.99
No	18 (38.3)	88 (38.4)	
Yes	29 (61.7)	141 (61.6)	
Live status			0.27
Survival	30 (63.8)	126 (55.0)	
Death	17 (36.2)	103 (45.0)	
Donor characteristics			
Sex			0.11
Female	6 (12.8)	53 (23.1)	
Male	41 (87.2)	176 (76.9)	
CIT (hours)	420.0 [365.0, 455.0]	471.0 [370.0, 555.0]	0.009

Continuous values are presented as mean (standard deviation) or median [interquartile range, IQR], categorical values were presented as number (percentage). BMI, body mass index; CVP, central venous pressure; CI, cardiac index; FVC, forced vital capacity; LAS, lung allocation score; MV, mechanical ventilation; VV, veno-venous ECMO; VA/VAV, veno-arterial/veno-arterial-veno ECMO; ICU, intensive care unit; Lac, lactic; MVT, mechanical ventilation time; PGD, primary graft dysfunction; AKI, acute kidney injury; CIT, cold ischemia time.

Table S2 Recipient, intraoperative, postoperative characteristics associated with overall survival during lung transplantation

Characteristics	No ECMO (n=47)	VV ECMO (n=149)	VA ECMO (n=80)	P
Recipient characteristics				
Sex				0.17
Female	5 (10.6)	30 (20.1)	10 (12.5)	
Male	42 (89.4)	119 (79.9)	70 (87.5)	
Age (years)	62.0 [55.0, 69.0]	61.0 [54.0, 66.0]	60.0 [52.0, 66.0]	0.42
BMI				0.72
Underweight	7 (14.9)	30 (20.1)	17 (21.2)	
Normal weight	25 (53.2)	72 (48.3)	38 (47.5)	
Overweight	14 (29.8)	35 (23.5)	18 (22.5)	
Obese	1 (2.1)	12 (8.1)	7 (8.8)	
Tobacco use				0.79
No	28 (59.6)	97 (65.1)	51 (63.7)	
Yes	19 (40.4)	52 (34.9)	29 (36.2)	
Hypertension				0.55
No	33 (70.2)	115 (77.2)	58 (72.5)	
Yes	14 (29.8)	34 (22.8)	22 (27.5)	
Diabetes				0.55
No	33 (70.2)	109 (73.2)	53 (66.2)	
Yes	14 (29.8)	40 (26.8)	27 (33.8)	
CVP (mmHg)	10.0 [8.0, 13.0]	12.0 [8.0, 14.0]	14.0 [11.0, 15.0]	<0.001
CI [L/(min·m ²)]	2.7 [2.4, 2.9]	2.6 [2.4, 2.8]	2.5 [2.3, 2.8]	0.03
NT_proBNP (pg/mL)	97.8 [37.7, 164.8]	144.5 [56.5, 361.5]	203.1 [83.6, 931.9]	<0.001
FVC (%)	43.1 [34.9, 50.0]	39.1 [30.0, 50.0]	40.4 [34.7, 50.0]	0.33
LAS	38.4 [34.9, 43.2]	40.3 [35.7, 69.7]	44.59 [35.8, 56.2]	0.02
MV				0.003
No	46 (97.9)	117 (78.5)	71 (88.8)	
Yes	1 (2.1)	32 (21.5)	9 (11.2)	
Intraoperative characteristics				
Surgical type				<0.001
Single	38 (80.9)	69 (46.3)	47 (58.8)	
Double	9 (19.1)	80 (53.7)	33 (41.2)	
Operation time (hours)	215.0 [190.0, 272.5]	335.0 [250.0, 410.0]	357.5 [273.8, 422.3]	<0.001
Blood transfusion volume (100 mL)	6.0 [0.0, 9.4]	11.5 [7.5, 15.0]	10.0 [7.2, 15.9]	<0.001

Table S2 (continued)

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Characteristics	No ECMO (n=47)	VV ECMO (n=149)	VA ECMO (n=80)	P
Postoperative characteristics				
ICU stay (days)	3.0 [2.0, 5.0]	6.0 [4.0, 10.0]	6.0 [4.0, 12.3]	<0.001
MVT (days)	1.0 [1.0, 1.0]	3.0 [2.0, 6.0]	2.5 [1.0, 5.3]	<0.001
Lac (mmol/L)	4.1 [3.2, 5.3]	4.9 [3.6, 6.9]	4.80 [3.8, 7.1]	0.03
PGD				0.04
0	36 (76.6)	85 (57.0)	45 (56.2)	
3	11 (23.4)	64 (43.0)	35 (43.8)	
AKI				0.94
No	18 (38.3)	56 (37.6)	32 (40.0)	
Yes	29 (61.7)	93 (62.4)	48 (60.0)	
Live status				0.29
Survival	30 (63.8)	86 (57.7)	40 (50.0)	
Death	17 (36.2)	63 (42.3)	40 (50.0)	
Donor characteristics				
Sex				0.20
Female	6 (12.8)	37 (24.8)	16 (20.0)	
Male	41 (87.2)	112 (75.2)	64 (80.0)	
CIT (hours)	420.0 [365.0, 455.0]	460.0 [370.0, 550.0]	487.5 [388.8, 556.3]	0.009

Continuous values are presented as mean (standard deviation) or median [interquartile range, IQR], categorical values were presented as number (percentage). BMI, body mass index; CVP, central venous pressure; CI, cardiac index; FVC, forced vital capacity; LAS, lung allocation score; MV, mechanical ventilation; VV, veno-venous ECMO; VA/VAV, veno-arterial/veno-arterial-veno ECMO; ICU, intensive care unit; Lac, lactic; MVT, mechanical ventilation time; PGD, primary graft dysfunction; AKI, acute kidney injury; CIT, cold ischemia time.

Table S3 Cox regression of ECMO duration and mortality at different ECMO duration levels in the total and VV-ECMO populations

Model	Total, HR (95% CI)			VV-ECMO HR (95% CI)		
	<0.8 d	0.8–5.54 d	>5.54 d	<1.12 d	1.12–4.67 d	>4.67 d
Model 5	0.76 (0.04, 14.20)	1.51 (1.19, 1.91)***	2.05 (1.23, 3.43)**	0.32 (0.05, 2.12)	1.03 (0.58, 1.82)	8.56E+08 (6.24E+08, 1.18E+09)***

Hazards ratios are from Cox regressions. Cox models include strata for donor factors, recipient factors, preoperative factors and postoperative factors. P values are from likelihood ratio tests comparing each model with a model that does not include body mass index categories. Model 5: adjusted for donor factors (sex, CIT) + recipient factors (age, sex, BMI, CVP, NT-BNP) + intraoperative factors (transplant method, operation time) + postoperative factors (Lac, mechanical ventilation time). As for ECMO strategy stratification, removed covariates ECMO strategy. **, P<0.01; ***, P<0.001. CI, confidence interval; HR, hazards ratio.