

Table S1 Clinicopathological characteristics of patients undergoing pneumonectomy after neoadjuvant systemic therapy						
Characteristics	Before PSM			After PSM		
	U-VATS (n=36)	Open (n=107)	P value	U-VATS (n=34)	Open (n=78)	P value
Gender, n (%)			0.13			0.32
Male	29 (80.6)	98 (91.6)		28 (82.4)	71 (91)	
Female	7 (19.4)	9 (8.4)		6 (17.6)	7 (9)	
Age (years), n (%)			0.81			0.92
≤60	23 (63.9)	66 (61.7)		21 (61.8)	49 (62.8)	
>60	13 (36.1)	41 (38.3)		13 (38.2)	29 (37.2)	
Histological subtype, n (%)			0.36			0.96
Adenocarcinoma	9 (25)	17 (15.9)		7 (20.6)	15 (19.2)	
Squamous cell carcinoma	24 (66.7)	84 (78.5)		24 (70.6)	57 (73.1)	
Other	3 (8.3)	6 (5.6)		3 (8.8)	6 (7.7)	
Tumor grade, n (%)			0.54			0.60
G1	1 (2.8)	8 (7.5)		1 (2.9)	6 (7.7)	
G2	15 (41.7)	38 (35.5)		14 (41.2)	28 (35.9)	
G3	20 (55.6)	61 (57)		19 (55.9)	44 (56.4)	
Neoadjuvant systemic therapy			0.02			0.25
Neo-chemotherapy	12 (33.3)	65 (60.7)		12 (37.5)	40 (54.8)	
Neo-immunotherapy	23 (63.9)	41 (38.3)		19 (59.4)	32 (43.8)	
Neo-target therapy	1 (2.8)	1 (0.9)		1 (3.1)	1 (1.4)	
Tumor thrombosis, n (%)			0.03			0.053
Negative	30 (83.3)	68 (63.6)		28 (82.4)	50 (64.1)	
Positive	6 (16.7)	39 (36.4)		6 (17.6)	28 (35.9)	
Nerve invasion, n (%)			0.55			0.48
Negative	29 (80.6)	81 (75.7)		27 (79.4)	57 (73.1)	
Positive	7 (19.4)	26 (24.3)		7 (20.6)	21 (26.9)	
Smoking history, n (%)			0.02			0.18
No	13 (36.1)	18 (16.8)		11 (32.4)	16 (20.5)	
Yes	23 (63.9)	89 (83.2)		23 (67.6)	62 (79.5)	
Family cancer history, n (%)			0.79			0.43
No	29 (80.6)	84 (78.5)		28 (82.4)	59 (75.6)	
Yes	7 (19.4)	23 (21.5)		6 (17.6)	19 (24.4)	
Tumor location, n (%)			0.39			0.28
LUL	20 (55.6)	59 (55.1)		19 (55.9)	42 (53.8)	
LLL	14 (38.9)	27 (25.2)		13 (38.2)	19 (24.4)	
LMB	2 (5.6)	8 (7.5)		2 (5.9)	7 (9)	
RUL	0 (0)	5 (4.7)		0 (0)	5 (6.4)	
RML	0 (0)	2 (1.9)		0 (0)	2 (2.6)	
RLL	0 (0)	4 (3.7)		0 (0)	3 (3.8)	
RMB	0 (0)	2 (1.9)		0 (0)	0 (0)	
Tumor diameter (cm), mean ± SD	4.08±1.64	4.90±1.89	0.02	4.11±1.68	4.46±1.64	0.31
Clinical stage, n (%)			0.16			0.37
I	10 (27.8)	15 (14)		9 (26.5)	12 (15.4)	
II	11 (30.6)	36 (33.6)		14 (41.2)	39 (50)	
III	15 (41.7)	56 (52.3)		11 (32.4)	27 (34.6)	
Pathology stage, n (%)			0.003			0.11
I	16 (44.4)	18 (16.8)		14 (41.2)	17 (21.8)	
II	8 (22.2)	34 (31.8)		8 (23.5)	26 (33.3)	
III	12 (33.3)	55 (51.4)		12 (35.3)	35 (44.9)	
Adjuvant therapy, n (%)			0.044			0.15
0	16 (44.4)	68 (63.6)		15 (44.1)	46 (59)	
1	20 (55.6)	39 (36.4)		19 (55.9)	32 (41)	
CCI score, n (%)			0.50			0.52
0	3 (8.3)	3 (2.8)		3 (8.8)	3 (3.8)	
1	3 (8.3)	10 (9.3)		2 (5.9)	6 (7.7)	
2	14 (38.9)	46 (43)		13 (38.2)	34 (43.6)	
3	13 (36.1)	33 (30.8)		13 (38.2)	22 (28.2)	
4	2 (5.6)	14 (13.1)		2 (5.9)	12 (15.4)	
5	1 (2.8)	1 (0.9)		1 (2.9)	1 (1.3)	
FEV ₁ (L), mean ± SD	2.48±0.55	2.30±0.63	0.15	2.48±0.56	2.41±0.64	0.61
FEV ₁ /FVC (%), median (IQR)	0.80 (0.71, 0.85)	0.80 (0.71, 0.86)	0.99	0.80 (0.70, 0.84)	0.79 (0.70, 0.85)	0.74

Table S2 Intraoperative and postoperative features in patients undergoing pneumonectomy after neoadjuvant systemic therapy

Characteristics	Before PSM			After PSM		
	U-VATS(n=36)	Open(n=107)	P value	U-VATS(n=34)	Open(n=78)	P value
ICU stay after surgery, n (%)			0.99			0.99
No	32 (88.9)	94 (87.9)		30 (88.2)	70 (89.7)	
Yes	4 (11.1)	13 (12.1)		4 (11.8)	8 (10.3)	
Lymph nodes dissected, median (IQR)	25 (19, 32)	28 (19.5, 33.5)	0.41	25.5(19.25, 32)	28(21, 33)	0.57
Lymph node stations dissected, median (IQR)	10 (9, 10.25)	10 (8, 11)	0.59	10 (9, 10.75)	10 (8, 11)	0.81
Clavien-Dindo classification, n (%)			0.06			0.11
0	32 (88.9)	82 (76.6)		30 (88.2)	65 (83.3)	
1	4 (11.1)	10 (9.3)		4 (11.8)	5 (6.4)	
≥2	0 (0)	15 (14)		0 (0)	8 (10.3)	
Complications, n (%)						
Clavien-Dindo I						
Chest tube duration (>7 d)	32 (88.9)	98 (91.6)	0.88	4 (11.8)	4 (5.1)	>0.99
Drainage of infected wounds	0 (0)	1 (0.9)	>0.99	0 (0)	1 (1.3)	>0.99
Clavien-Dindo II						
Pulmonary infection	0 (0)	2 (1.9)	0.99	0 (0)	1 (1.3)	>0.99
Atrial fibrillation	0 (0)	3 (2.8)	0.73	0 (0)	2 (2.6)	0.87
Clavien-Dindo III						
Pleural effusion needing intervention	0 (0)	2 (1.9)	0.99	0 (0)	2 (2.6)	0.87
Chylothorax	0 (0)	1 (0.9)	>0.99	-	-	-
Clavien-Dindo IV						
Respiratory failure	0 (0)	1 (0.9)	>0.99	0 (0)	1 (1.3)	>0.99
Heart failure	0 (0)	2 (1.9)	0.99	0 (0)	2 (2.6)	0.87
Cardiogenic shock	0 (0)	1 (0.9)	>0.99	-	-	-
MODS	0 (0)	1 (0.9)	>0.99	-	-	-
Clavien-Dindo V						
Death	0 (0)	2 (1.9)	0.99	-	-	-
Operation time (min), median (IQR)	116 (89.75, 155)	130 (103, 170)	0.19	114 (89.25, 153.7)	120 (100, 154.5)	0.39
Intraoperative blood loss (mL), median (IQR)	10 (10, 10)	10 (10, 15)	0.41	10 (10, 10)	10 (10, 10)	0.62
Blood transfusion, n (%)			0.13			0.31
No	36 (100)	97 (90.7)		34 (100)	73 (93.6)	
Yes	0 (0)	10 (9.3)		0 (0)	5 (6.4)	
Postoperative hospital stay (day), median (IQR)	6 (4, 7)	7 (6, 8)	0.001	6 (4, 7)	7 (6, 8)	0.002
Recurrence, n (%)						
LR	1 (2.8)	6 (5.6)	0.82	1 (2.9)	2 (2.6)	0.99
DR	4 (11.1)	5 (4.7)	0.33	3 (8.8)	4 (5.1)	0.75
30-day mortality, n (%)	0 (0)	3 (2.8)	0.73	0 (0)	0 (0)	>0.99
90-day mortality, n (%)	0 (0)	5 (4.7)	0.43	0 (0)	2 (2.6)	0.87

Table S3 Overall survival and recurrence-free survival multivariable Cox proportional hazards model after propensity score matching in neoadjuvant systemic therapy patients

Characteristics	Total (N=112)	OS				RFS			
		Univariate Analysis		Multivariate analysis		Univariate Analysis		Multivariate analysis	
		Hazard ratio (95% CI)	P value	Hazard ratio (95% CI)	P value	Hazard ratio (95% CI)	P value	Hazard ratio (95% CI)	P value
Operation approach									
Open	78	Reference		-	-	Reference		-	-
U-VATS	34	0.57 (0.16–1.97)	0.37	-	-	1.14 (0.55–2.37)	0.72	-	-
Gender									
Male	99	Reference		-	-	Reference		-	-
Female	13	0.92 (0.21–4.00)	0.91	-	-	0.64 (0.19–2.11)	0.47	-	-
Age (years)									
≤60	70	Reference		-	-	Reference		-	-
>60	42	1.45 (0.58–3.63)	0.42	-	-	1.20 (0.62–2.34)	0.58	-	-
Tumor thrombosis									
Negative	78	Reference		-	-	Reference		-	-
Positive	34	2.28 (0.92–5.63)	0.07	-	-	0.80 (0.39–1.63)	0.56	-	-
Nerve invasion									
Negative	84	Reference		-	-	Reference		-	-
Positive	28	1.63 (0.64–4.15)	0.31	-	-	0.83 (0.39–1.77)	0.64	-	-
Smoking history									
No	27	Reference		-	-	Reference		-	-
Yes	85	0.62 (0.23–1.64)	0.34	-	-	0.85 (0.41–1.77)	0.68	-	-
Family cancer history									
No	87	Reference		-	-	Reference		Reference	
Yes	25	2.16 (0.84–5.49)	0.11	-	-	2.16 (1.09–4.25)	0.03	2.12 (1.07-4.18)	0.03
Clinical stage									
I	21	Reference		-	-	Reference		-	-
II	38	2.83 (0.34–23.58)	0.34	-	-	1.11 (0.42–2.93)	0.83	-	-
III	53	4.22 (0.54–32.59)	0.17	-	-	1.12 (0.44–2.84)	0.80	-	-
Tumor diameter (cm)	112	1.11 (0.87–1.42)	0.39	-	-	1.01 (0.84–1.21)	0.87	-	-
Pathology stage									
I	31	Reference		-	-	Reference		-	-
II	34	3.41 (0.41–28.48)	0.26	-	-	1.05 (0.42–2.66)	0.91	-	-
III	47	4.14 (0.53–32.04)	0.17	-	-	0.79 (0.32–1.92)	0.61	-	-
Tumor grade									
G1	7	Reference		-	-	Reference		-	-
G2	42	0.41 (0.04–3.67)	0.43	-	-	0.53 (0.11–2.44)	0.42	-	-
G3	63	1.03 (0.13–7.91)	0.97	-	-	0.96 (0.22–4.05)	0.96	-	-
Histological-subtype									
LUAD	22	Reference		-	-	Reference		-	-
LSCC	81	0.62 (0.21–1.79)	0.38	-	-	0.73 (0.33–1.64)	0.45	-	-
Other	9	1.70 (0.40–7.19)	0.47	-	-	1.35 (0.44–4.15)	0.60	-	-
Adjuvant therapy									
No	61	Reference		Reference		Reference		-	-
Yes	51	0.31 (0.11–0.81)	0.02	0.29 (0.11–0.77)	0.01	0.59 (0.31–1.13)	0.11	-	-
CCI score									
0	6	Reference		-	-	Reference		-	-
1	8	0.60 (0.03–9.69)	0.72	-	-	0.16 (0.01–1.54)	0.11	-	-
2	47	0.76 (0.09–6.35)	0.80	-	-	0.54 (0.15–1.89)	0.34	-	-
3	35	1.45 (0.18–11.70)	0.72	-	-	0.62 (0.17–2.18)	0.46	-	-
4	14	0.97 (0.08–10.81)	0.98	-	-	0.80 (0.19–3.38)	0.77	-	-
5	-	-	-	-	-	-	-	-	-
FEV ₁	112	0.69 (0.34–1.43)	0.33	-	-	0.99 (0.58–1.69)	0.98	-	-
FEV ₁ /FVC	112	0.83 (0.02–25.68)	0.92	-	-	0.81 (0.07–9.18)	0.87	-	-
Lymph nodes dissected	112	0.95 (0.91–1.00)	0.09	-	-	0.97 (0.94–1.01)	0.13	-	-
Lymph node stations dissected	112	0.53 (0.39–0.72)	<0.001	0.55 (0.42–0.72)	<0.001	0.81 (0.67–1.00)	0.05	0.82(0.67- 1.01)	0.059
Tumor-diameter (cm)	112	1.12 (0.86–1.46)	0.36	-	-	1.01 (0.84–1.21)	0.87	-	-

Table S4 Recurrence pattern between the U-VATS group and the open group

Location	Recurrence, n (%)		P value
	U-VATS (n=12)	OPEN (n=17)	
Mediastinal LN	2 (16.7)	4 (23.6)	0.99
Pleura	0 (0)	3 (17.6)	0.25
Supraclavicular LN	2 (16.7)	3 (17.6)	0.99
Lung	2 (16.7)	2 (11.8)	0.31
Brain	4 (33.2)	0 (0)	0.02
Multiple organs	2 (16.7)	3 (17.6)	0.99
Other	0 (0)	2 (11.8)	0.49

LN, lymph node.

Table S5 Characteristics of patients converted from U-VATS to open approach

Characteristics	Patients (n=18)
Gender, n (%)	
Male	13 (72.2)
Female	5 (27.8)
Age (years), n (%)	
≤60	8 (44.4)
>60	10 (55.6)
Neoadjuvant systemic therapy, n (%)	
Negative	17 (94.4)
Positive	1 (5.6)
Histological subtype, n (%)	
Adenocarcinoma	7 (38.9)
Squamous cell carcinoma	11 (61.1)
Tumor grade, n (%)	
G1	1 (5.6)
G2	6 (33.3)
G3	11 (61.1)
Tumor thrombosis, n (%)	
Negative	9 (50)
Positive	9 (50)
Nerve invasion, n (%)	
Negative	8 (44.4)
Positive	10 (55.6)
Smoking history, n (%)	
No	10 (55.6)
Yes	8 (44.4)
Family cancer history, n (%)	
No	12 (66.7)
Yes	6 (33.3)
Tumor location, n (%)	
LLL	3 (16.7)
LUL	13 (72.2)
RUL	1 (5.6)
RMB	1 (5.6)
Tumor diameter (cm), (mean ± SD)	4.28±2.03
Clinical stage, n (%)	
I	4 (22.2)
II	8 (44.4)
III	6 (33.3)
Adjuvant therapy, n (%)	
Negative	13 (72.2)
Positive	5 (27.8)
CCI score, n (%)	
1	3 (16.7)
2	6 (33.3)
3	4 (22.2)
4	4 (22.2)
FEV ₁ (L) (mean ± SD)	2.55±0.67
FEV ₁ /FVC (mean ± SD)	0.86±0.14

Table S6 Logistic regression analysis predicted risk factors for U-VATS converted to the open approach in the entire cohort.

Characteristics	Total (N=457)	Univariate analysis		Multivariate analysis	
		Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Neoadjuvant systemic therapy					
Yes	314	Reference		Reference	
No	143	8.12 (1.07–61.66)	0.043	7.81 (1.02–59.76)	0.048
Gender					
Male	399	Reference		-	-
Female	58	2.80 (0.96–8.17)	0.059	-	-
Age, years					
≤60	244	Reference		-	-
>60	213	1.45 (0.56–3.75)	0.44	-	-
Histological subtype					
LUAD	86	Reference		Reference	
LSCC	343	0.37 (0.14–0.99)	0.049	0.77 (0.24–2.42)	0.66
Other	28	-	-	-	-
Tumor thrombosis					
Negative	284	Reference		-	-
Positive	173	1.67 (0.65–4.31)	0.28	-	-
Smoking history					
No	108	Reference		Reference	
Yes	349	0.23 (0.08–0.59)	0.003	0.24 (0.08–0.74)	0.01
Tumor location					
LUL	239	Reference		-	-
LLL	156	0.34 (0.09–1.21)	0.10	-	-
LMB	28	-	-	-	-
RLL	12	-	-	-	-
RMB	5	4.34 (0.45–41.71)	0.20	-	-
RUL	13	1.44 (0.17–12.01)	0.73	-	-
RML	4	-	-	-	-
Clinical stage					
I	102	Reference		-	-
II	181	1.13 (0.33–3.85)	0.84	-	-
III	174	0.87 (0.24–3.17)	0.84	-	-
Adjuvant therapy					
No	297	Reference		-	-
Yes	160	0.70 (0.24–2.01)	0.51	-	-
Lymph nodes dissected	457	0.95 (0.90–1.00)	0.09	-	-
Lymph node stations dissected	457	0.97 (0.76–1.25)	0.84	-	-
FEV ₁	457	2.00 (0.92–4.37)	0.08	-	-
FEV ₁ /FVC	457	12.98 (0.42–397.8)	0.14	-	-
Pathology stage					
I	82	Reference		-	-
II	161	0.88 (0.25–3.12)	0.85	-	-
III	214	0.65 (0.18–2.31)	0.52	-	-

Table S7 Comparison of the thoracotomy conversion rate and reason for the neoadjuvant treatment group and the non-neoadjuvant treatment group

Characteristics	Neoadjuvant systemic therapy (n=143)	Non-neoadjuvant systemic therapy (n=314)	P value
Conversion rate	0.7% (1/143)	5.4% (17/314)	0.02
Conversion reason			
Dense adhesion of surrounding tissues	0.0% (0/143)	3.8% (12/314)	0.04
Vascular injury	0.0% (0/143)	1.0% (3/314)	0.58
Large tumor limiting exposure	0.7% (1/143)	0.6% (2/314)	>0.99