

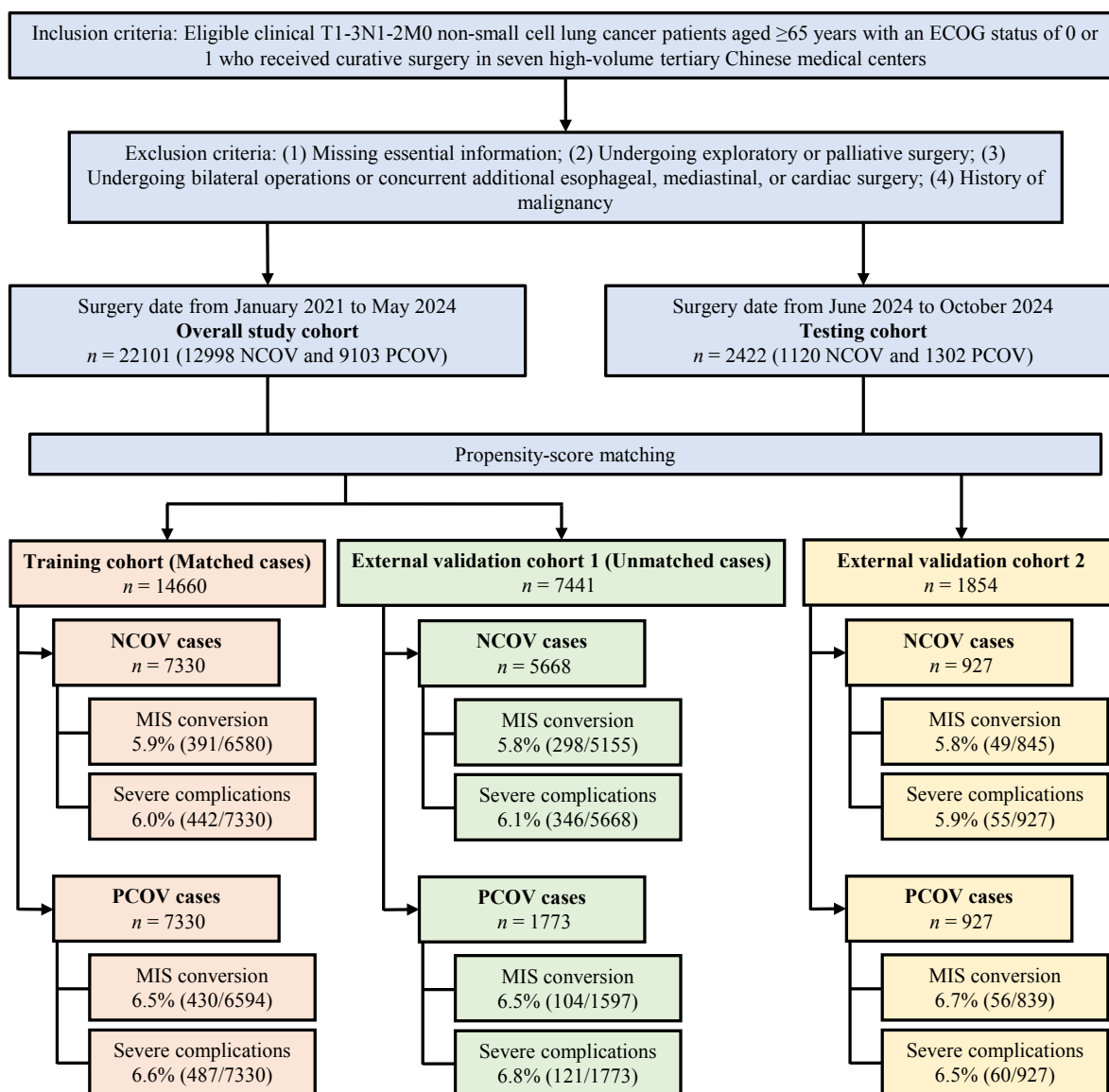
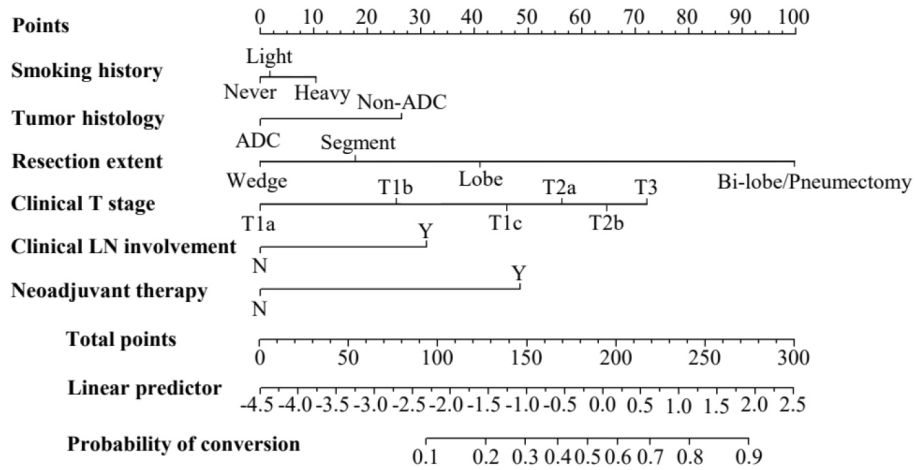


Figure S1 Flowchart of the population used for prediction model development and validation. MIS, minimally invasive surgery.

A

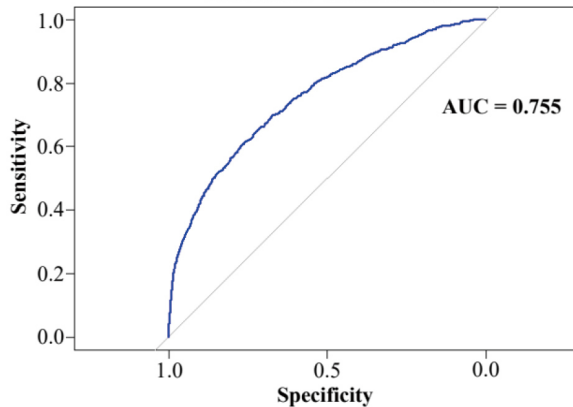
Prediction of MIS conversion for the overall cohort

C-index = 0.755

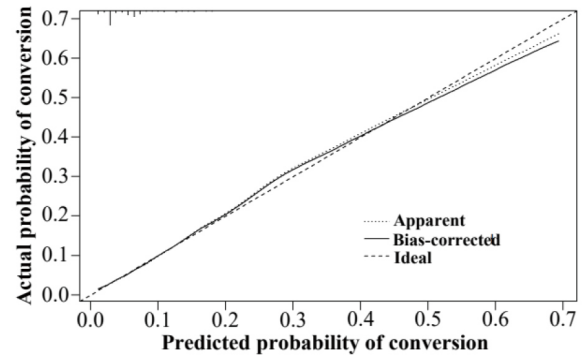


B

Internal validation

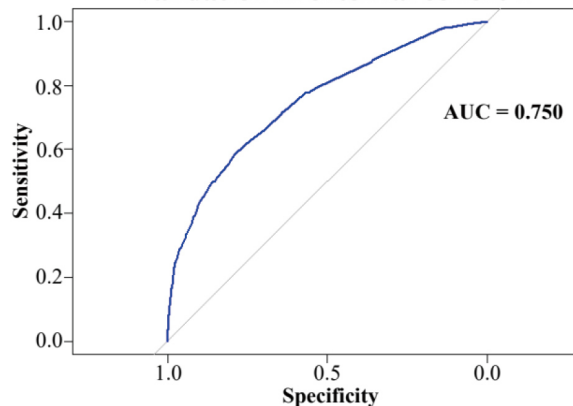


C



D

Validation in external cohort 1



E

Validation in external cohort 2

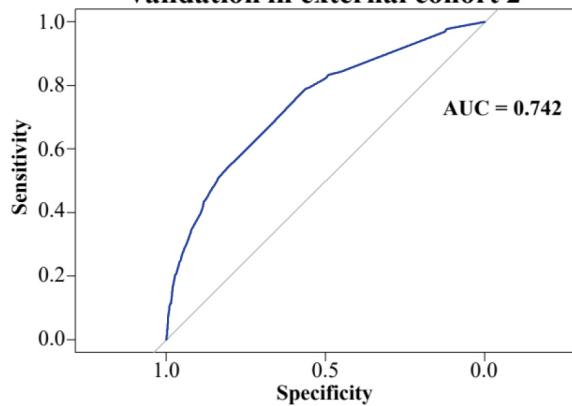


Figure S2 Establishment and validation of a prediction model for unexpected MIS conversion in the overall cohort. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

A Prediction of MIS conversion for patients without a COVID-19 history

C-index = 0.753

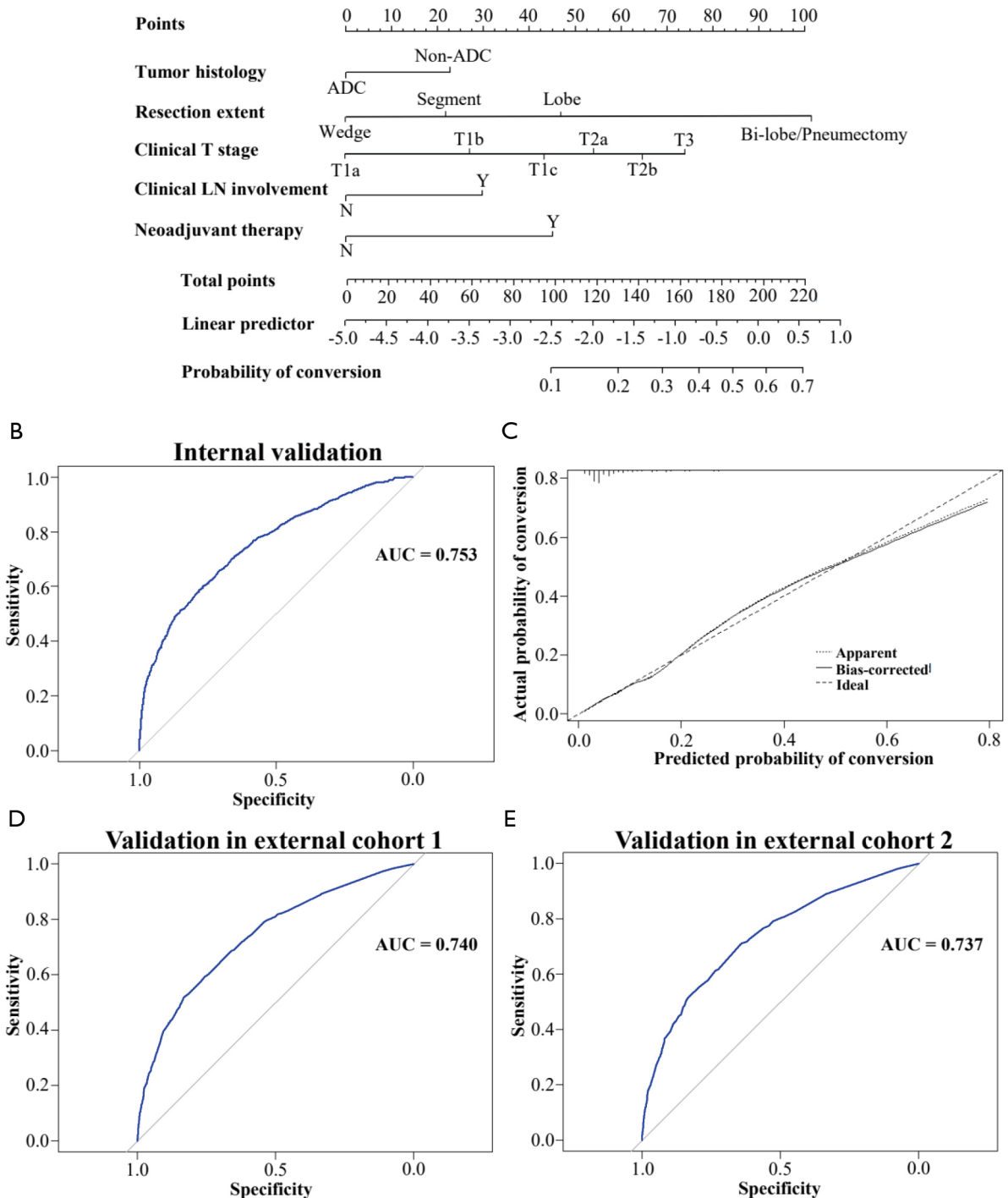


Figure S3 Establishment and validation of a prediction model for unexpected MIS conversion in patients without a COVID-19 history. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; COVID-19, coronavirus disease 2019; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

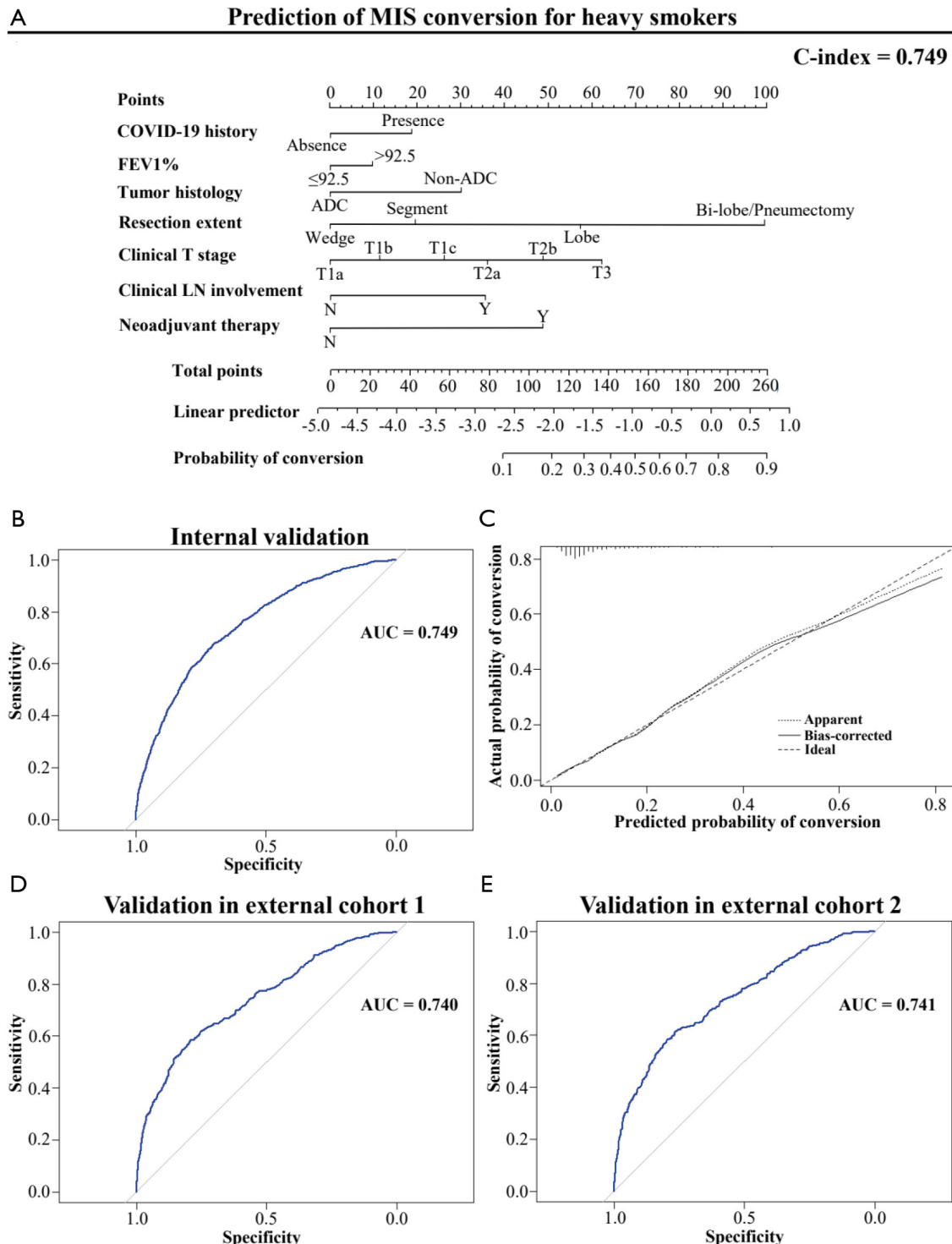


Figure S4 Establishment and validation of a prediction model for unexpected MIS conversion in heavy smokers. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; COVID-19, coronavirus disease 2019; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

A Prediction of severe postoperative complications for the overall cohort **C-index = 0.749**

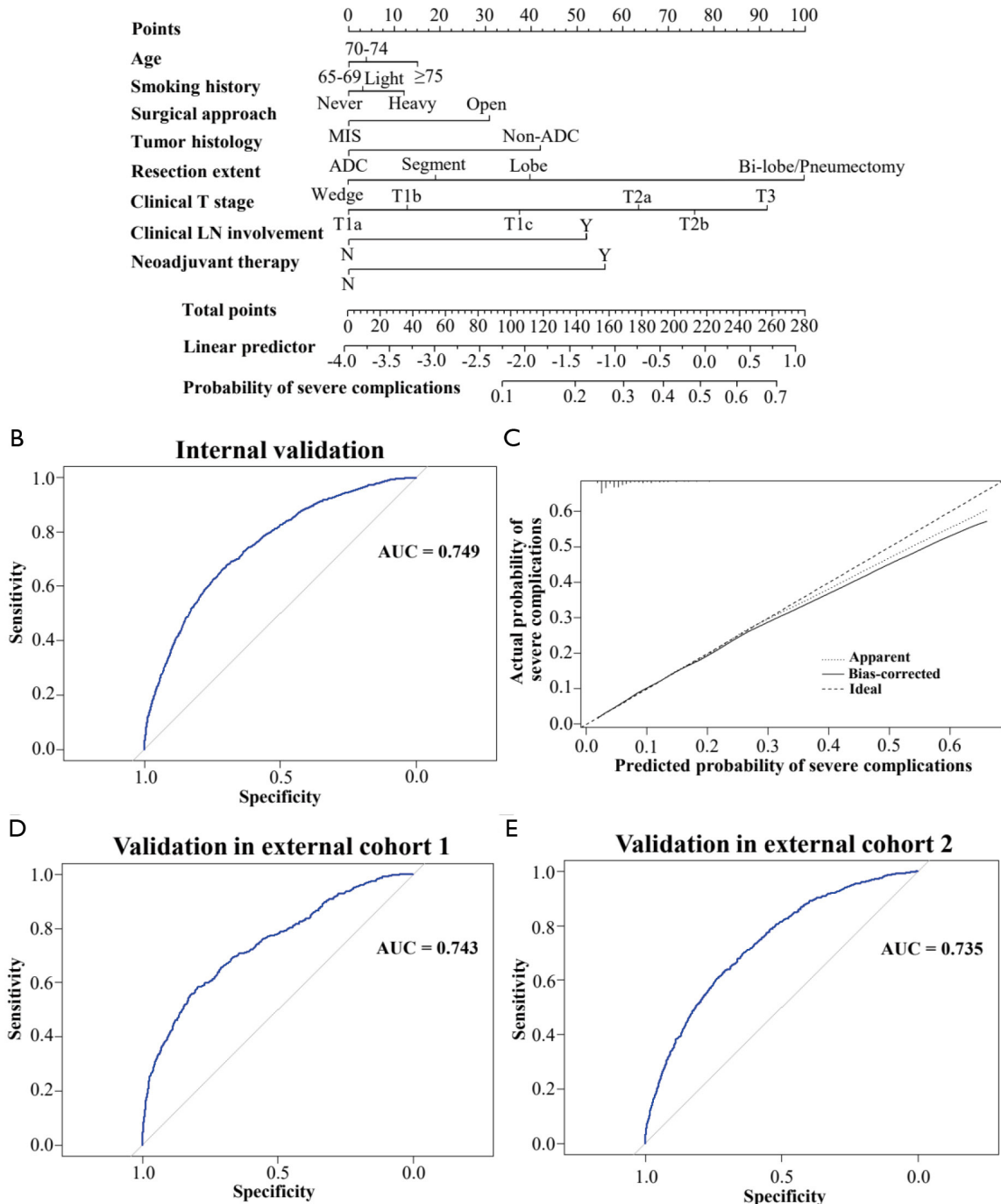


Figure S5 Establishment and validation of a prediction model for severe postoperative complications (Clavien-Dindo grade $\geq$ III) in the overall cohort. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

A Prediction of severe postoperative complications for patients without a COVID-19 history

C-index = 0.747

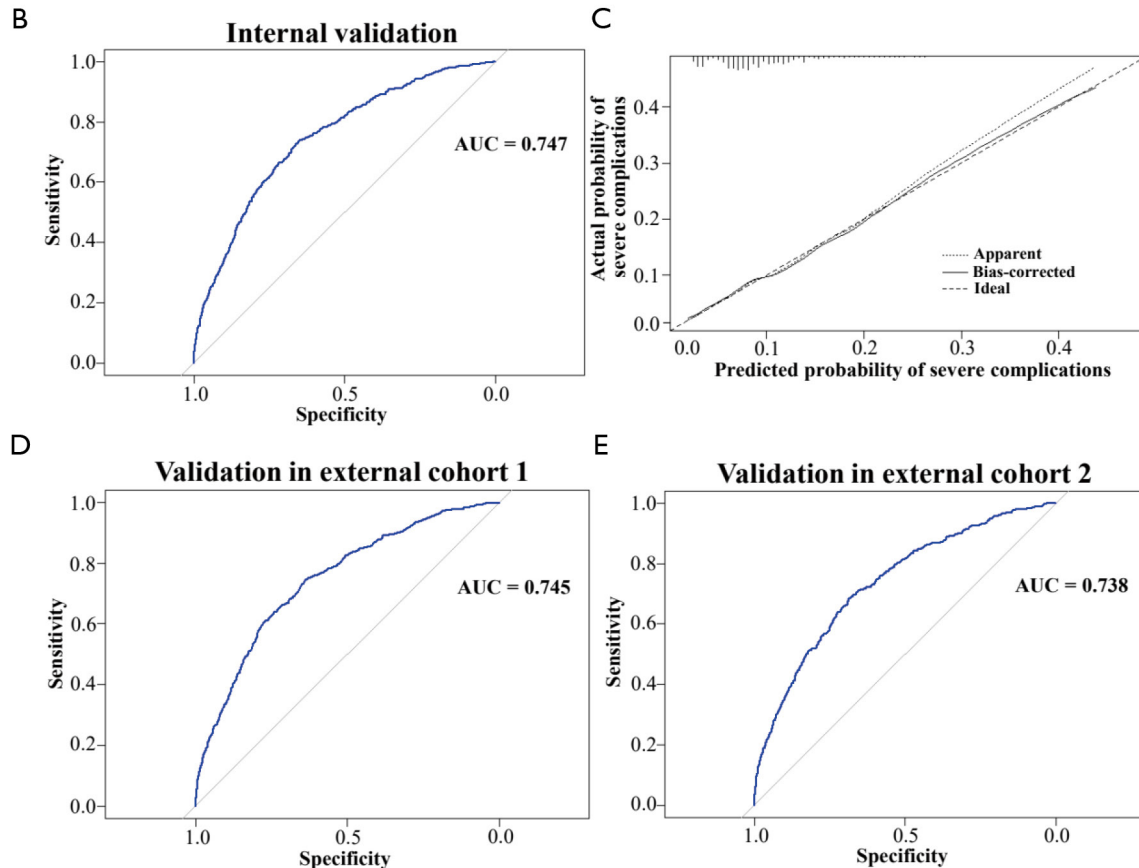
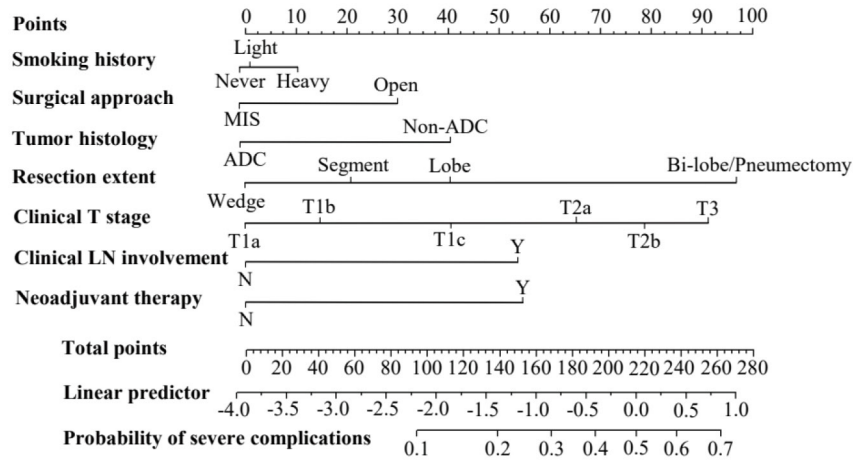


Figure S6 Establishment and validation of a prediction model for severe postoperative complications (Clavien-Dindo grade $\geq$ III) in patients without a COVID-19 history. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; COVID-19, coronavirus disease 2019; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

A Prediction of severe postoperative complications for patients aged ≥ 75 years

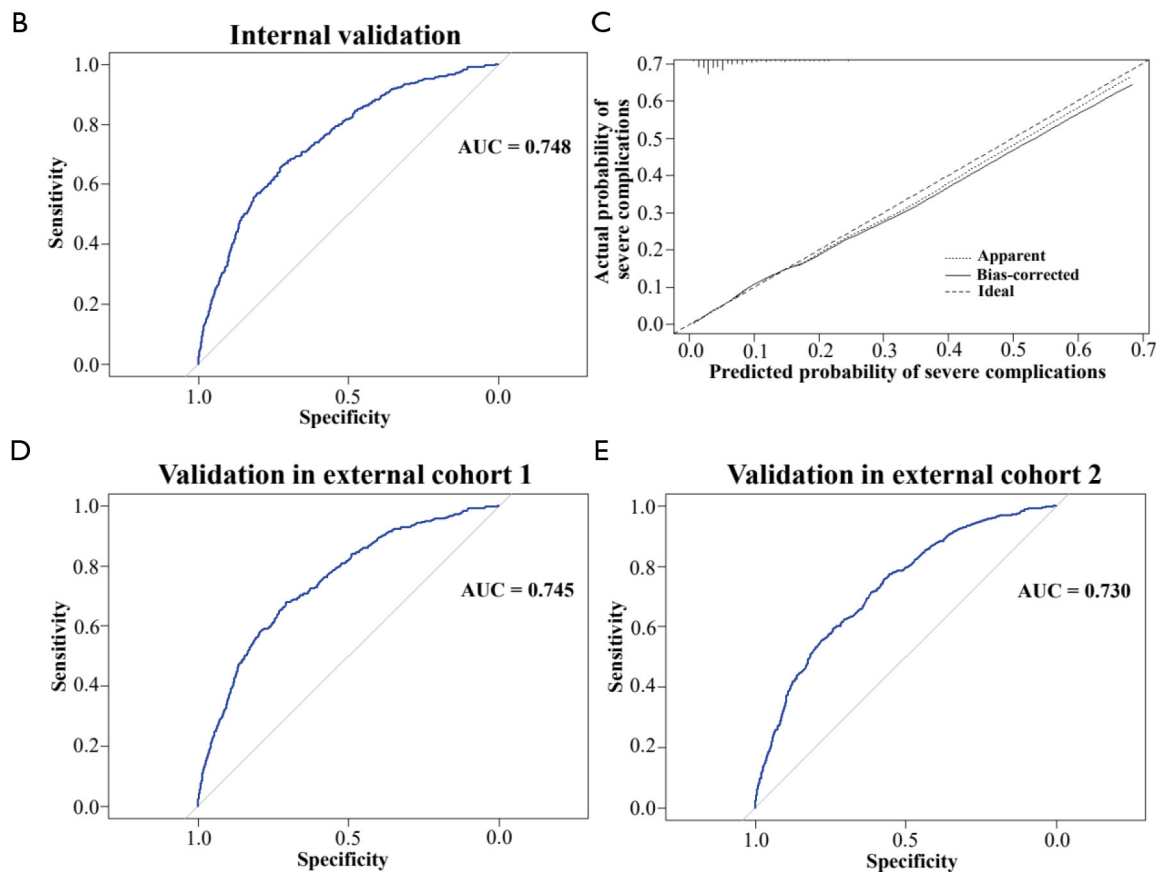
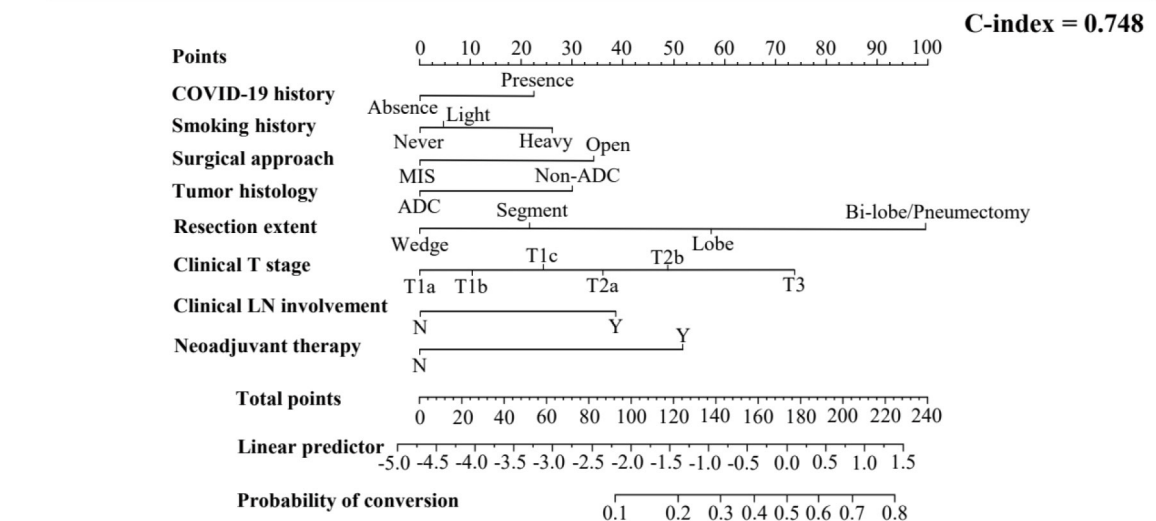


Figure S7 Establishment and validation of a prediction model for severe postoperative complications (Clavien-Dindo grade $\geq$ III) in patients aged ≥ 75 years. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; COVID-19, coronavirus disease 2019; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

A Prediction of severe postoperative complications for heavy smokers

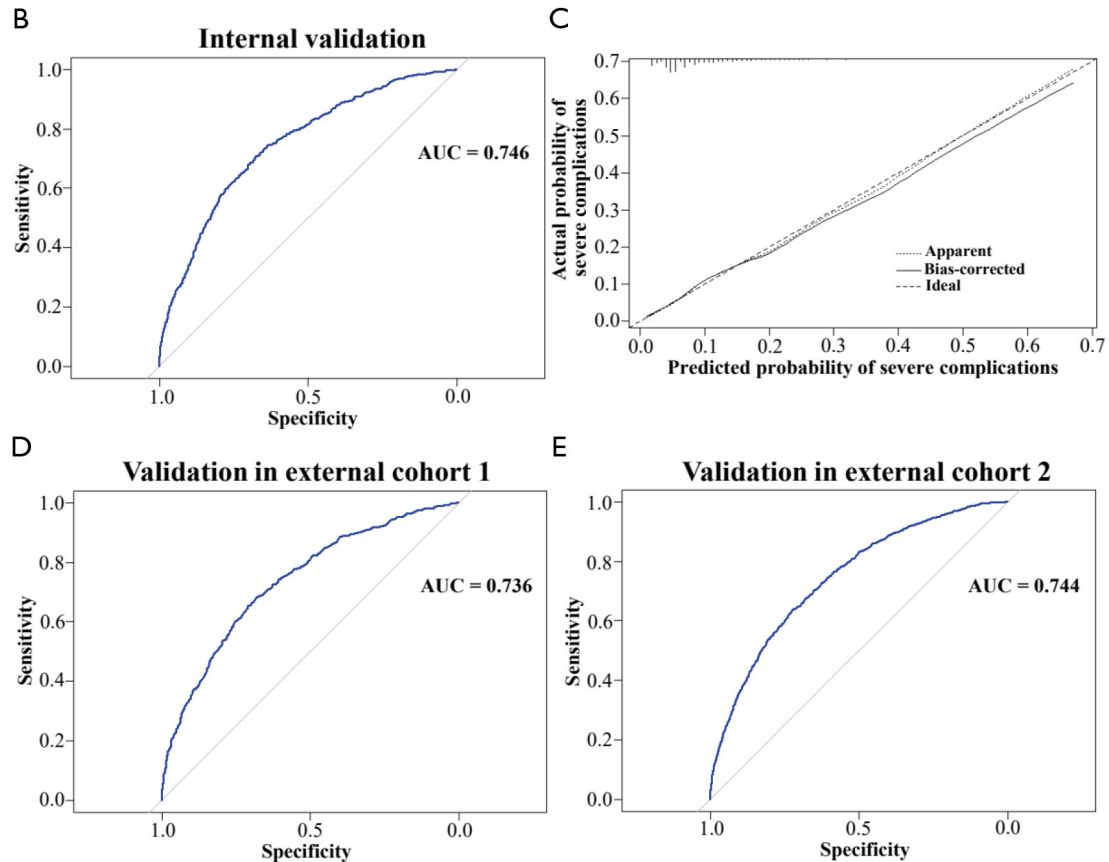
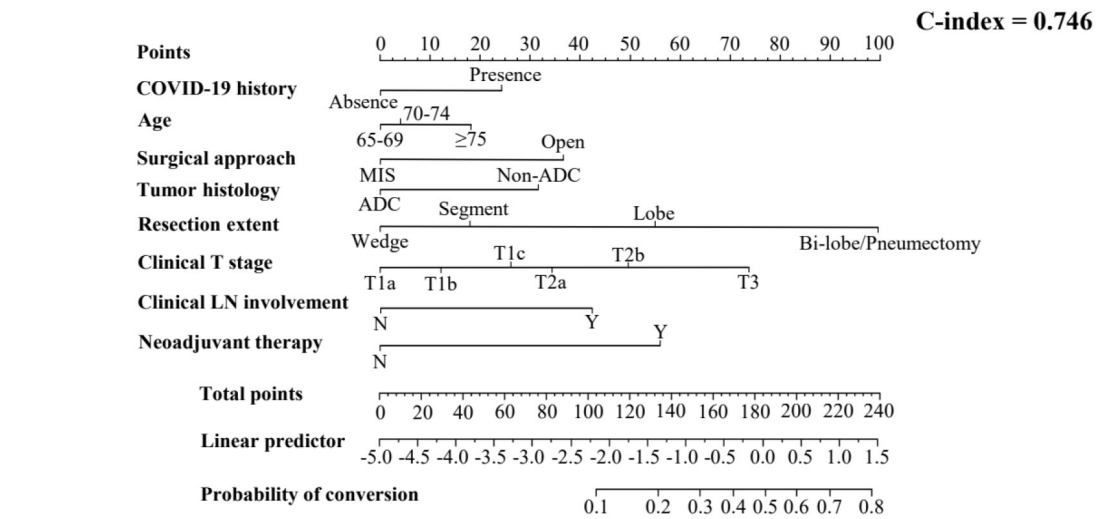


Figure S8 Establishment and validation of a prediction model for severe postoperative complications (Clavien-Dindo grade $\geq$ III) in heavy smokers. (A) Nomogram of the prediction model. (B) ROC curve in the internal validation cohort. (C) Calibration curve of the prediction model. ROC curves in (D) external validation cohort 1 and (E) 2. ADC, adenocarcinoma; AUC, area under the curve; COVID-19, coronavirus disease 2019; LN, lymph node; MIS, minimally invasive surgery; ROC, receiver operating characteristic.

Table S1 Baseline characteristics of patients in the external validation cohort

Variable	External cohort 1 (n=7,441)	External cohort 2 (n=1,854)
COVID-19 history		
Yes	5668 (76.2)	927 (50.0)
No	1773 (23.8)	927 (50.0)
Age (years)		
65–69	3,095(52.5)	1,034 (55.8)
70–74	1,771(31.8)	523 (28.2)
≥75	802(15.7)	297 (16.0)
Sex		
Male	4,029(54.1)	901 (48.6)
Female	3,412(45.9)	953 (51.4)
Smoking history ^a		
Never	4,702(63.2)	1,316 (71.0)
Light	851(11.4)	264 (14.2)
Heavy	1,888(25.4)	274 (14.8)
BMI (kg/m ²)		
<24.0	3,875(52.1)	894 (48.2)
≥24.0	3,566(47.9)	960 (51.8)
ECOG performance status		
0	5,587(75.1)	1,322 (71.3)
1	1,854(24.9)	532 (28.7)
FEV1 (% of predicted)		
≤92.5	4,065(54.6)	946 (51.0)
>92.5	3,376(45.4)	908 (49.0)
DLCO (% of predicted)		
≤95.1	4,088(54.9)	912 (49.2)
>95.1	3,353(45.1)	942 (50.8)
Surgical approach		
MIS	6,704(90.1)	1,743 (94.0)
Open	737(9.9)	111 (6.0)
Tumor histology		
Adenocarcinoma	6,489(87.2)	1,684 (90.8)
Nonadenocarcinoma	952(12.8)	170 (9.2)
Resection extent		
Wedge resection	1,330(17.9)	345 (18.6)
Segmentectomy	3,799(51.1)	1,015 (54.7)
Lobectomy	2,221(29.8)	475 (25.6)
Bilobe/Pneumectomy	91(1.2)	19 (1.0)
Clinical T stage		
T1a	1,343(18.0)	356 (19.2)
T1b	4,219(56.7)	1,111 (59.9)
T1c	925(12.4)	238 (12.8)
T2a	478(6.4)	70 (3.8)
T2b	313(4.2)	52 (2.8)
T3	163(2.2)	27 (1.5)
Clinical LN metastasis		
Yes	362(4.9)	78 (4.2)
No	7,079(95.1)	1,776 (95.8)
Neoadjuvant therapy		
Yes	307(4.1)	118 (6.4)
No	7,134(95.9)	1,736 (93.6)

Data are described as number (percentage). ^a , smoking history (pack-years): never, 0; light, >0 to <30; heavy, ≥30, pack-years. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; COVID-19, coronavirus disease 2019; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1 s; LN, lymph node; MIS, minimally invasive surgery.

Table S2 Causes for MIS conversion in the matched cohort

Variables	NCOV (n=391)	PCOV (n=430)	P value
Reason			0.33
Bleeding	130 (33.2)	140 (32.6)	
Primary tumor invasion	96 (24.6)	94 (21.9)	
Dense adhesion and fibrosis	77 (19.7)	110 (25.6)	
Fibrocalcified LNs	53 (13.6)	55 (12.8)	
Other reasons	35 (9.0)	31 (7.2)	

Data are shown as number (percentage). LNs, lymph nodes; MIS, minimally invasive surgery.

Table S3 Stratified comparison of MIS conversion between the NCOV and PCOV groups in the matched cohort

Variables	NCOV (n=6580)	PCOV (n=6594)	P value
Age (years)			
65-69	210/3420 (6.1)	221/3399 (6.5)	0.54
70-74	118/2090 (5.6)	127/2103 (6.0)	0.59
≥75	63/1070 (5.9)	82/1092 (7.5)	0.13
Sex			
Male	220/3455 (6.4)	239/3476 (6.9)	0.40
Female	171/3125 (5.5)	191/3118 (6.1)	0.27
Smoking history ^a			
Never	225/4481 (5.0)	215/4420 (4.9)	0.76
Light	54/790 (6.8)	59/821 (7.2)	0.04
Heavy	112/1309 (8.6)	156/1353 (11.5)	0.01
BMI (kg/m ²)			
<24.0	203/3344 (6.1)	232/3359 (6.9)	0.17
≥24.0	188/3236 (5.8)	198/3235 (6.1)	0.60
ECOG performance status			
0	299/4895 (6.1)	324/4905 (6.6)	0.31
1	92/1685 (5.5)	106/1689 (6.3)	0.31
FEV1 (% of predicted)			
≤92.5	206/3230 (6.4)	223/3277 (6.8)	0.49
>92.5	185/3350 (5.5)	207/3317 (6.2)	0.21
DLCO (% of predicted)			
≤95.1	204/3205 (6.4)	225/3276 (6.9)	0.42
>95.1	187/3375 (5.5)	205/3318 (6.2)	0.27
Tumor histology			
Adenocarcinoma	309/6233 (5.0)	341/6266 (5.4)	0.22
Non-adenocarcinoma	82/347 (23.6)	89/328 (27.1)	0.30
Resection extent			
Wedge resection	38/1378 (2.8)	47/1395 (3.4)	0.35
Segmentectomy	164/3698 (4.4)	177/3703 (4.8)	0.48
Lobectomy	185/1498 (12.3)	201/1489 (13.5)	0.35
Bi-lobe/Pneumonectomy	4/6 (66.7)	5/7 (71.4)	>0.99
Clinical T stage			
T1a	26/1267 (2.1)	33/1250 (2.6)	0.33
T1b	190/3875 (4.9)	210/3854 (5.4)	0.28
T1c	75/810 (9.3)	82/856 (9.6)	0.82
T2a	52/387 (13.4)	54/392 (13.8)	0.89
T2b	37/214 (17.3)	38/208 (18.3)	0.79
T3	11/27 (40.7)	13/34 (38.2)	0.84
Clinical LN metastasis			
Yes	37/273 (13.6)	40/254 (15.7)	0.48
No	354/6307 (5.6)	390/6340 (6.2)	0.20
Neoadjuvant therapy			
Yes	64/403 (15.9)	79/421 (18.8)	0.28
No	327/6177 (5.3)	351/6173 (5.7)	0.34

Data are shown as number (percentage). ^a Smoking history (pack-years): Never, 0; Light, >0 to <30; Heavy, ≥30. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node.

Table S4 Subgroup comparison of severe postoperative complications between the NCOV and PCOV groups in the matched cohort

Variables	NCOV (n=7330)	PCOV (n=7330)	P value
Age (years)			
65-69	219/3798 (5.8%)	230/3776 (6.1%)	0.55
70-74	142/2324 (6.1%)	147/2332 (6.3%)	0.78
≥75	81/1208 (6.7%)	110/1222 (9.0%)	0.04
Sex			
Male	244/3979 (6.1%)	274/3961 (6.9%)	0.16
Female	198/3351 (5.9%)	213/3369 (6.3%)	0.48
Smoking history ^a			
Never	233/4776 (4.9%)	239/4810 (5.0%)	0.84
Light	70/919 (7.6%)	77/935 (8.2%)	0.62
Heavy	139/1635 (8.5%)	171/1585 (10.8%)	0.03
BMI (kg/m ²)			
<24.0	214/3598 (5.9%)	231/3653 (6.3%)	0.51
≥24.0	228/3732 (6.1%)	256/3677 (7.0%)	0.14
ECOG performance status			
0	319/5432 (5.9%)	231/5407 (6.3%)	0.22
1	123/1898 (6.5%)	139/1923 (7.2%)	0.36
FEV1 (% of predicted)			
≤92.5	219/3534 (6.2%)	247/3611 (6.8%)	0.27
>92.5	223/3796 (5.9%)	240/3719 (6.5%)	0.30
DLCO (% of predicted)			
≤95.1	226/3618 (6.2%)	250/3649 (6.9%)	0.30
>95.1	216/3712 (5.8%)	237/3681 (6.4%)	0.27
Surgical approaches			
MIS	371/6580 (5.6%)	408/6594 (6.2%)	0.18
Open	71/750 (9.5%)	79/736 (10.7%)	0.42
Tumor histology			
Adenocarcinoma	345/6394 (5.4%)	374/6409 (5.8%)	0.28
Non-adenocarcinoma	97/936 (10.4%)	113/921 (12.3%)	0.20
Resection extent			
Wedge resection	29/1382 (2.1%)	35/1401 (2.5%)	0.48
Segmentectomy	210/3746 (5.6%)	234/3757 (6.2%)	0.25
Lobectomy	185/2122 (8.7%)	199/2098 (9.5%)	0.39
Bi-lobe/Pneumonectomy	18/80 (22.5%)	19/74 (25.7%)	0.65
Clinical T stage			
T1a	48/1335 (3.6%)	55/1357 (4.1%)	0.54
T1b	190/4176 (4.5%)	218/4193 (5.2%)	0.17
T1c	92/928 (9.9%)	96/937 (10.2%)	0.81
T2a	52/473 (11.0%)	57/460 (12.4%)	0.51
T2b	40/297 (13.5%)	41/278 (14.7%)	0.66
T3	20/121 (16.5%)	20/105 (19.0%)	0.62
Clinical LN metastasis			
Yes	49/370 (13.2%)	48/344 (14.0%)	0.78
No	393/6960 (5.6%)	439/6986 (6.3%)	0.11
Neoadjuvant therapy			
Yes	84/602 (14.0%)	87/579 (15.0%)	0.60
No	358/6728 (5.3%)	400/6751 (5.9%)	0.13

Data are shown as number (percentage). ^a Smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; MIS, minimally invasive surgery.

Table S5 Perioperative outcomes of patients aged ≥ 75 years in the matched cohort

Variables	NCOV (n=1208)	PCOV (n=1222)	P value
MIS conversion	63/1070 (5.9%)	82/1092 (7.5%)	0.13
Surgical duration (mins)	81.0 [64.55-98.0]	93.0 [78.0-103.5]	<0.001
Resection margin			0.85
Negative	1172 (97.0)	1184 (96.9)	
Positive	36 (3.0)	38 (3.1)	
Intraoperative bleeding (mL)	80 [50-100]	80 [50-100]	0.78
Blood transfusion	31 (2.6)	35 (2.9)	0.65
Chest tube drainage			
Length (days)	3 [3-4]	4 [3-5]	<0.001
Volume (mL)	745 [630-800]	770 [655-830]	0.02
Postoperative hospitalization (days)	4 [4-5]	5 [4-6]	<0.001

Continuous data are expressed as median [IQR], and categorical data are shown as number (percentage). IQR, interquartile range; MIS, minimally invasive surgery.

Table S6 Perioperative outcomes of heavy smokers (≥ 30 pack-years) in the matched cohort

Variables	NCOV (n=1635)	PCOV (n=1585)	P value
MIS conversion	112/1309 (8.6%)	156/1353 (11.5%)	0.01
Surgical duration (mins)	102.0 [80.5-117.5]	117.5 [92.0-129.5]	<0.001
Resection margin			0.35
Negative	2407 (94.2)	2390 (94.8)	
Positive	147 (5.8)	130 (5.2)	
Intraoperative bleeding (mL)	100 [80-100]	100 [100-100]	0.04
Blood transfusion	51 (2.0)	60 (2.4)	0.35
Chest tube drainage			
Length (days)	4 [3-4]	5 [3-5]	<0.001
Volume (mL)	780 [630-840]	815 [680-900]	0.02
Postoperative hospitalization (days)	5 [4-5]	6 [4-6]	<0.001

Continuous data are expressed as median [IQR], and categorical data are shown as number (percentage). IQR, interquartile range; MIS, minimally invasive surgery.

Table S7 Postoperative complications of patients aged ≥75 years in the matched cohort

Variables	NCOV (n=1208)	PCOV (n=1222)	P value
Any complications	269 (22.3)	318 (26.0)	0.03
Clavien-Dindo grades			0.11
Grade 0 (absence of complications)	939 (77.7)	904 (74.0)	
Grades I-II	188 (15.6)	208 (17.0)	
Grades III-IV	69 (5.7)	92 (7.5)	
Grade V	12 (1.0)	18 (1.5)	
Pulmonary			
Atelectasis	127 (10.5)	161 (13.2)	0.04
Pulmonary infection	55 (4.6)	67 (5.5)	0.29
Prolonged air leak >5 days	53 (4.4)	95 (7.8)	<0.001
Pleural effusion	49 (4.1)	73 (6.0)	0.03
Respiration failure	41 (3.4)	51 (4.2)	0.31
Cardiac			
Atrial fibrillation	136 (11.3)	151 (12.4)	0.40
Myocardial ischemia/infarction	13 (1.1)	14 (1.1)	0.87
Pulmonary embolism	2 (0.2)	2 (0.2)	>0.99
Acute cerebral infarction	1 (0.1)	2 (0.2)	>0.99
Others			
Hemorrhage	12 (1.0)	14 (1.1)	0.72
Chylothorax	10 (0.8)	9 (0.7)	0.80
Bronchopleural fistula	15 (1.2)	13 (1.1)	0.68
Hoarse voice	2 (0.2)	2 (0.2)	>0.99

Data are shown as number (percentage). One patient could be associated with multiple complications.

Table S8 Detailed postoperative complications of heavy smokers (≥30 pack-years) in the matched cohort

Variables	NCOV (n=1635)	PCOV (n=1585)	P value
Any complications	368 (22.5)	425 (26.8)	0.005
Clavien-Dindo grades			0.03
Grade 0 (absence of complications)	1267 (77.5)	1160 (73.2)	
Grades I-II	229 (14.0)	254 (16.0)	
Grades III-IV	121 (7.4)	151 (9.5)	
Grade V	18 (1.1)	20 (1.3)	
Pulmonary			
Atelectasis	207 (12.7)	241 (15.2)	0.04
Pulmonary infection	110 (6.7)	121 (7.6)	0.32
Prolonged air leak >5 days	90 (5.5)	115 (7.3)	0.04
Pleural effusion	82 (5.0)	108 (6.8)	0.03
Respiration failure	54 (3.3)	65 (4.1)	0.23
Cardiac			
Atrial fibrillation	165 (10.1)	168 (10.6)	0.64
Myocardial ischemia/infarction	18 (1.1)	16 (1.0)	0.80
Pulmonary embolism	2 (0.1)	2 (0.1)	>0.99
Acute cerebral infarction	0 (0.0)	1 (0.1)	0.49
Others			
Hemorrhage	27 (1.7)	32 (2.0)	0.44
Chylothorax	17 (1.0)	14 (0.9)	0.65
Bronchopleural fistula	19 (1.2)	17 (1.1)	0.81
Hoarse voice	4 (0.2)	3 (0.2)	>0.99

Data are shown as number (percentage). One patient could be associated with multiple complications.

Table S9 Logistic regression analysis of MIS conversion for the matched PCOV and NCOV groups

Variables	PCOV groups				NCOV groups			
	Univariable		Multivariable		Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value	OR [95% CI]	P value	OR [95% CI]	P value
Age (years)		0.28	-	-		0.75	-	-
65-69	Ref.				Ref.			
70-74	0.924 [0.738-1.158]	0.49			0.915 [0.725-1.154]	0.45		
≥75	1.167 [0.897-1.519]	0.25			0.956 [0.715-1.278]	0.76		
Sex		0.22	-	-		0.13	-	-
Male	Ref.				Ref.			
Female	0.884 [0.726-1.076]				0.851 [0.693-1.046]			
Smoking history ^a		<0.001		<0.001		<0.001		<0.001
Never	Ref.		Ref.		Ref.		Ref.	
Light	1.514 [1.124-2.041]	0.006	1.300 [0.943-1.793]	0.11	1.388 [1.021-1.887]	0.04	1.317 [0.951-1.824]	0.10
Heavy	2.549 [2.054-3.163]	<0.001	2.473 [1.958-3.124]	<0.001	1.770 [1.398-2.240]	<0.001	1.817 [1.410-2.340]	<0.001
BMI (kg/m ²)		0.20	-	-		0.65	-	-
<24.0	1.138 [0.935-1.385]				1.048 [0.854-1.286]			
≥24.0	Ref.				Ref.			
ECOG performance status		0.64	-	-		0.33	-	-
0	Ref.				Ref.			
1	0.947 [0.755-1.188]				0.888 [0.698-1.129]			
Comorbidities		0.84	-	-		0.39	-	-
Yes	0.972 [0.794-1.237]				0.913 [0.711-1.189]			
No	Ref.				Ref.			
FEV1 (% of predicted)		0.054	-	-		0.14	-	-
≤92.5	1.212 [0.996-1.475]				1.165 [0.950-1.430]			
>92.5	Ref.				Ref.			
DLCO (% of predicted)		0.26	-	-		0.16	-	-
≤95.1	1.120 [0.921-1.362]				1.159 [0.944-1.422]			
>95.1	Ref.				Ref.			
Tumor histology		<0.001		<0.001		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.		Ref.		Ref.	
Non-adenocarcinoma	6.470 [4.955-8.448]		5.303 [3.692-7.467]		5.932 [4.516-7.793]		4.524 [3.104-6.435]	
Resection extent		<0.001		<0.001		<0.001		<0.001
Wedge resection	Ref.		Ref.	0.14	Ref.		Ref.	
Segmentectomy	1.440 [1.037-1.998]	<0.001	1.294 [0.921-1.817]	<0.001	1.636 [1.144-2.342]	0.007	1.505 [1.009-2.221]	0.045
Lobectomy	4.476 [3.229-6.205]	<0.001	3.883 [2.760-5.461]	<0.001	4.969 [3.476-7.102]	<0.001	4.797 [3.312-6.947]	<0.001
Bi-lobe/Pneumonectomy	71.702 [13.560-379.151]	<0.001	10.213 [5.685-23.912]	<0.001	70.526 [12.532-396.913]	<0.001	24.163 [14.322-94.591]	<0.001
Clinical T stage		<0.001		<0.001		<0.001		<0.001
T1a	Ref.	<0.001	Ref.		Ref.		Ref.	
T1b	2.125 [1.464-3.085]	<0.001	1.843 [1.190-2.804]	<0.001	2.461 [1.625-3.726]	<0.001	1.986 [1.312-3.005]	0.001
T1c	3.907 [2.583-5.911]	<0.001	2.835 [1.490-4.905]	<0.001	4.870 [3.089-7.679]	<0.001	3.007 [1.527-5.354]	<0.001
T2a	5.892 [3.759-9.236]	<0.001	4.039 [2.132-7.109]	<0.001	7.409 [4.557-12.045]	<0.001	4.407 [2.630-7.383]	<0.001
T2b	8.243 [5.034-13.499]	<0.001	6.328 [3.322-11.425]	<0.001	9.978 [5.898-16.879]	<0.001	6.601 [3.729-11.686]	<0.001
T3	22.830 [10.536-49.470]	<0.001	10.081 [5.556-21.021]	<0.001	32.815 [13.882-77.572]	<0.001	19.284 [7.574-39.102]	<0.001
Clinical LN metastasis		<0.001		<0.001		<0.001		<0.001
Yes	2.852 [2.004-4.058]		2.648 [1.778-3.943]		2.636 [1.834-3.789]		2.759 [1.786-4.261]	
No	Ref.		Ref.		Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001		<0.001		<0.001
Yes	3.831 [2.933-5.006]		3.664 [2.714-4.945]		3.377 [2.529-4.511]		3.739 [2.697-5.185]	
No	Ref.		Ref.		Ref.		Ref.	

Data are shown as OR [95% CI]. ^a, smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; OR, odds ratio.

Table S10 Logistic regression analysis of MIS conversion for the overall matched cohort

Variables	Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value
History of COVID-19		0.17	-	-
Presence	1.104 [0.959-1.272]			
Absence	Ref.			
Age (years)		0.37	-	-
65-69	Ref.			
70-74	0.939 [0.772-1.140]	0.52		
≥75	0.863 [0.698-1.067]	0.17		
Sex		0.051	-	-
Male	Ref.			
Female	0.868 [0.753-1.001]			
Smoking history ^a		<0.001		<0.001
Never	Ref.		Ref.	
Light	1.451 [1.171-1.796]	0.001	1.310 [1.042-1.646]	0.02
Heavy	2.153 [1.837-2.522]	<0.001	2.137 [1.802-2.536]	<0.001
BMI (kg/m ²)		0.21	-	-
<24.0	1.094 [0.950-1.260]			
≥24.0	Ref.			
ECOG performance status		0.31	-	-
0	Ref.			
1	0.918 [0.779-1.083]			
Comorbidities		0.19	-	-
Yes	0.924 [0.799-1.224]			
No				
FEV1 (% of predicted)		0.055	-	-
≤92.5	1.140 [0.983-1.321]			
>92.5	Ref.			
DLCO (% of predicted)		0.07	-	-
≤95.1	1.139 [0.989-1.312]			
>95.1	Ref.			
Tumor histology		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.	
Non-adenocarcinoma	6.185 [5.112-7.483]		4.857 [3.752-6.220]	
Resection extent		<0.001		<0.001
Wedge resection	Ref.		Ref.	
Segmentectomy	1.527 [1.199-1.945]	0.001	1.338 [1.021-1.746]	0.02
Lobectomy	4.693 [3.688-5.972]	<0.001	3.314 [2.358-4.543]	<0.001
Bi-lobe/Pneumonectomy	71.153 [21.486-235.628]	<0.001	13.930 [6.393-31.835]	<0.001
Clinical T stage		<0.001		<0.001
T1a	Ref.		Ref.	
T1b	2.274 [1.723-3.000]	<0.001	1.628 [1.075-2.362]	0.005
T1c	4.335 [3.192-5.887]	<0.001	3.098 [1.983-4.629]	<0.001
T2a	6.562 [4.719-9.123]	<0.001	4.931 [3.201-7.374]	<0.001
T2b	9.005 [6.288-12.895]	<0.001	7.182 [4.581-10.996]	<0.001
T3	27.023 [15.207-48.021]	<0.001	14.852 [8.260-26.576]	<0.001
Clinical LN metastasis		<0.001		<0.001
Yes	2.738 [2.126-3.525]		2.831 [2.139-3.745]	
No	Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001
Yes	3.615 [2.971-4.399]		3.379 [2.720-4.198]	
No	Ref.		Ref.	

Data are shown as OR [95% CI]. ^a, smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; OR, odds ratio.

Table S11 Logistic regression analysis of MIS conversion for heavy smokers in the matched cohort

Variables	Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value
History of COVID-19		0.02		0.046
Presence	1.278 [1.034-1.580]		1.224 [1.004-1.537]	
Absence	Ref.		Ref.	
Age (years)		0.48	-	-
65-69	Ref.			
70-74	0.861 [0.647-1.145]	0.30		
≥75	0.831 [0.611-1.131]	0.24		
BMI (kg/m ²)		0.74	-	-
<24.0	0.965 [0.782-1.191]			
≥24.0	Ref.			
ECOG performance status		0.07	-	-
0	Ref.			
1	0.861 [0.688-1.084]			
FEV1 (% of predicted)		0.01		0.03
≤92.5	1.308 [1.058-1.617]		1.211 [1.023-1.540]	
>92.5	Ref.		Ref.	
DLCO (% of predicted)		0.20	-	-
≤95.1	1.148 [0.930-1.417]			
>95.1	Ref.			
Tumor histology		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.	
Non-adenocarcinoma	5.628 [4.188-7.565]		4.619 [3.067-6.762]	
Resection extent		<0.001		<0.001
Wedge resection	Ref.		Ref.	
Segmentectomy	1.427 [1.003-2.029]	0.048	1.343 [0.930-1.938]	0.12
Lobectomy	3.991 [2.803-5.681]	<0.001	2.763 [1.599-4.449]	<0.001
Bi-lobe/Pneumonectomy	58.976 [6.003-479.372]	<0.001	20.401 [5.523-71.639]	<0.001
Clinical T stage		<0.001		<0.001
T1a	Ref.		Ref.	
T1b	2.007 [1.345-2.995]	0.001	2.071 [1.216-3.379]	<0.001
T1c	4.066 [2.613-6.329]	<0.001	3.462 [1.787-6.141]	<0.001
T2a	4.768 [2.916-7.794]	<0.001	6.104 [3.290-10.764]	<0.001
T2b	6.893 [4.054-11.719]	<0.001	8.391 [4.379-15.396]	<0.001
T3	21.547 [9.157-50.701]	<0.001	19.419 [9.419-35.796]	<0.001
Clinical LN metastasis		<0.001		<0.001
Yes	2.607 [1.764-3.851]		3.026 [2.036-4.497]	
No	Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001
Yes	4.106 [3.067-5.498]		3.105 [2.264-4.257]	
No	Ref.		Ref.	

Data are shown as OR [95% CI]. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; OR, odds ratio.

Table S12 Logistic regression analysis of severe postoperative complications for the matched PCOV and NCOV groups

Variables	PCOV group				NCOV group			
	Univariable		Multivariable		Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value	OR [95% CI]	P value	OR [95% CI]	P value
Age (years)		0.001		0.003		0.48	-	-
65-69	Ref.		Ref.		Ref.			
70-74	1.037 [0.838-1.284]	0.74	1.095 [0.797-1.244]	0.97	1.064 [0.855-1.322]	0.58		
≥75	1.525 [1.203-1.933]	<0.001	1.497 [1.168-1.919]	0.001	1.175 [0.902-1.529]	0.23		
Sex		0.31	-	-		0.69	-	-
Male	Ref.				Ref.			
Female	0.908 [0.755-1.093]				0.961 [0.792-1.166]			
Smoking history ^a		<0.001		<0.001		<0.001		<0.001
Never	Ref.		Ref.		Ref.		Ref.	
Light	1.716 [1.314-2.242]	<0.001	1.582 [1.198-2.090]	0.001	1.638 [1.243-2.158]	<0.001	1.591 [1.195-2.119]	0.001
Heavy	2.313 [1.884-2.840]	<0.001	2.220 [1.793-2.750]	<0.001	1.819 [1.463-2.263]	<0.001	1.900 [1.515-2.383]	<0.001
BMI (kg/m ²)		0.27	-	-		0.77	-	-
<24.0	0.902 [0.750-1.084]				0.972 [0.802-1.178]			
≥24.0	Ref.				Ref.			
ECOG performance status		0.23	-	-		0.34	-	-
0	Ref.				Ref.			
1	1.133 [0.924-1.389]				1.111 [0.896-1.377]			
Comorbidities		0.28	-	-		0.37	-	-
Yes	1.118 [0.916-1.374]				1.107 [0.892-1.370]			
No	Ref.				Ref.			
FEV1 (% of predicted)		0.51	-	-		0.56	-	-
≤92.5	1.064 [0.886-1.279]				1.058 [0.873-1.283]			
>92.5	Ref.				Ref.			
DLCO (% of predicted)		0.48	-	-		0.44	-	-
≤95.1	1.069 [0.889-1.285]				1.078 [0.890-1.307]			
>95.1	Ref.				Ref.			
Surgical approaches		<0.001		<0.001		<0.001		<0.001
MIS	Ref.		Ref.		Ref.		Ref.	
Open	1.823 [1.414-2.350]		2.238 [1.770-2.829]		1.750 [1.341-2.283]		1.679 [1.273-2.215]	
Tumor histology		<0.001		<0.001		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.		Ref.		Ref.	
Non-adenocarcinoma	2.257 [1.806-2.820]		2.257 [1.806-2.820]		2.027 [1.600-2.568]		2.037 [1.592-2.606]	
Resection extent		<0.001		<0.001		<0.001		<0.001
Wedge resection	Ref.		Ref.		Ref.		Ref.	
Segmentectomy	2.592 [1.807-3.718]	<0.001	1.864 [1.046-3.046]	0.02	2.771 [1.870-4.106]	<0.001	2.081 [1.166-3.443]	0.004
Lobectomy	4.090 [2.837-5.897]	<0.001	3.147 [1.854-5.024]	<0.001	4.456 [2.994-6.631]	<0.001	3.464 [1.981-5.683]	<0.001
Bi-lobe/Pneumonectomy	13.483 [7.252-25.067]	<0.001	12.065 [5.354-22.903]	<0.001	13.545 [7.136-25.710]	<0.001	10.705 [4.005-23.813]	<0.001
Clinical T stage		<0.001		<0.001		<0.001		<0.001
T1a	Ref.		Ref.		Ref.		Ref.	
T1b	1.298 [0.960-1.757]	0.09	1.221 [0.897-1.663]	0.20	1.278 [0.925-1.765]	0.14	1.281 [0.923-1.778]	0.14
T1c	2.702 [1.918-3.806]	<0.001	1.617 [1.084-2.421]	0.045	2.951 [2.059-4.228]	<0.001	2.089 [1.200-3.372]	<0.001
T2a	3.348 [2.274-4.930]	<0.001	2.136 [1.100-3.681]	<0.001	3.312 [2.203-4.977]	<0.001	2.220 [1.123-3.884]	<0.001
T2b	4.095 [2.671-6.279]	<0.001	2.933 [1.522-5.132]	<0.001	4.173 [2.686-6.483]	<0.001	3.032 [1.559-5.351]	<0.001
T3	5.570 [3.192-9.270]	<0.001	4.659 [2.164-9.122]	<0.001	5.309 [3.034-9.291]	<0.001	4.053 [1.952-7.819]	<0.001
Clinical LN metastasis		<0.001		<0.001		<0.001		<0.001
Yes	2.418 [1.756-3.330]		2.610 [1.860-3.663]		2.551 [1.857-3.503]		2.567 [1.839-3.584]	
No	Ref.		Ref.		Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001		<0.001		<0.001
Yes	2.808 [2.188-3.603]		2.885 [2.191-3.719]		2.885 [2.238-3.720]		2.722 [2.085-3.554]	
No	Ref.		Ref.		Ref.		Ref.	

Data are shown as OR [95% CI]. ^a, smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; MIS, minimally invasive surgery; OR, odds ratio.

Table S13 Logistic regression analysis of severe postoperative complications for the overall matched cohort

Variables	Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value
History of COVID-19		0.13	-	-
Presence	1.109 [0.971-1.267]			
Absence	Ref.			
Age (years)		0.003		0.009
65-69	Ref.		Ref.	
70-74	1.050 [0.902-1.223]	0.53	1.037 [0.885-1.215]	0.65
≥75	1.354 [1.135-1.614]	<0.001	1.326 [1.104-1.593]	0.003
Sex		0.31	-	-
Male	Ref.			
Female	0.933 [0.817-1.067]			
Smoking history ^a		<0.001		<0.001
Never	Ref.		Ref.	
Light	1.678 [1.385-2.032]	<0.001	1.583 [1.297-1.932]	<0.001
Heavy	2.061 [1.775-2.393]	<0.001	2.066 [1.770-2.413]	<0.001
BMI (kg/m ²)		0.33	-	-
<24.0	0.935 [0.819-1.069]			
≥24.0	Ref.			
ECOG performance status		0.13	-	-
0	Ref.			
1	1.123 [0.968-1.302]			
Comorbidities		0.15	-	-
Yes	1.116 [0.905-1.335]			
No				
FEV1 (% of predicted)		0.37	-	-
≤92.5	1.063 [0.930-1.214]			
>92.5	Ref.			
DLCO (% of predicted)		0.29	-	-
≤95.1	1.074 [0.940-1.226]			
>95.1	Ref.			
Surgical approaches		<0.001		<0.001
MIS	Ref.		Ref.	
Open	1.786 [1.487-2.147]		1.713 [1.413-2.076]	
Tumor histology		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.	
Non-adenocarcinoma	2.143 [1.822-2.520]		2.146 [1.811-2.542]	
Resection extent		<0.001		<0.001
Wedge resection	Ref.		Ref.	
Segmentectomy	2.672 [2.049-3.486]	<0.001	1.708 [1.068-2.547]	0.01
Lobectomy	4.253 [3.249-5.566]	<0.001	3.279 [2.254-4.627]	<0.001
Bi-lobe/Pneumonectomy	13.435 [8.609-20.967]	<0.001	10.862 [5.706-19.073]	<0.001
Clinical T stage		<0.001		<0.001
T1a	Ref.		Ref.	
T1b	1.288 [1.033-1.606]	0.02	1.152 [0.900-1.467]	0.08
T1c	2.818 [2.199-3.611]	<0.001	2.043 [1.428-2.836]	<0.001
T2a	3.325 [2.512-4.402]	<0.001	2.463 [1.671-3.520]	<0.001
T2b	4.121 [3.033-5.600]	<0.001	3.540 [2.469-5.010]	<0.001
T3	5.406 [3.644-8.018]	<0.001	4.887 [3.091-7.422]	<0.001
Clinical LN metastasis		<0.001		<0.001
Yes	2.478 [1.978-3.104]		2.593 [2.045-3.288]	
No	Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001
Yes	2.841 [2.378-3.394]		2.782 [2.307-3.356]	
No	Ref.		Ref.	

Data are shown as OR [95% CI]. ^a, smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; MIS, minimally invasive surgery; OR, odds ratio.

Table S14 Logistic regression analysis of severe postoperative complications for patients aged ≥75 years in the matched cohort

Variables	Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value
History of COVID-19		0.04		0.02
Presence	1.376 [1.021-1.855]		1.446 [1.062-1.969]	
Absence	Ref.		Ref.	
Sex		0.93	-	-
Male	Ref.			
Female	1.013 [0.753-1.361]			
Smoking history ^a		0.008		0.01
Never	Ref.		Ref.	
Light	1.407 [0.915-2.163]	0.12	1.267 [0.811-1.979]	0.30
Heavy	1.679 [1.198-2.352]	0.003	1.690 [1.191-2.398]	0.003
BMI (kg/m ²)		0.34	-	-
<24.0	1.156 [0.860-1.554]			
≥24.0	Ref.			
ECOG performance status		0.60	-	-
0	Ref.			
1	0.912 [0.648-1.285]			
FEV1 (% of predicted)		0.83	-	-
≤92.5	1.033 [0.769-1.389]			
>92.5	Ref.			
DLCO (% of predicted)		0.54	-	-
≤95.1	0.911 [0.678-1.224]			
>95.1	Ref.			
Surgical approaches		0.006		0.02
MIS	Ref.		Ref.	
Open	1.748 [1.173-2.603]		1.652 [1.094-2.496]	
Tumor histology		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.	
Non-adenocarcinoma	2.314 [1.622-3.300]		2.498 [1.724-3.618]	
Resection extent		<0.001		<0.001
Wedge resection	Ref.		Ref.	
Segmentectomy	2.011 [1.214-3.331]	0.007	2.069 [1.234-3.470]	0.006
Lobectomy	2.465 [1.463-4.154]	0.001	2.472 [1.446-4.228]	0.001
Bi-lobe/Pneumonectomy	11.096 [4.259-28.908]	<0.001	9.939 [3.620-20.288]	<0.001
Clinical T stage		<0.001		<0.001
T1a	Ref.		Ref.	
T1b	1.034 [0.899-1.455]	0.36	1.109 [0.972-1.714]	0.10
T1c	1.614 [1.053-2.385]	0.03	2.133 [1.254-3.626]	0.005
T2a	2.067 [1.232-3.468]	0.006	2.458 [1.351-4.472]	0.003
T2b	2.578 [1.446-4.594]	0.001	2.867 [1.589-5.318]	<0.001
T3	3.986 [2.583-6.631]	<0.001	4.415 [3.363-6.979]	<0.001
Clinical LN metastasis		0.01		0.003
Yes	2.019 [1.164-3.502]		2.415 [1.363-4.279]	
No	Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001
Yes	2.494 [1.662-3.743]		2.338 [1.528-3.577]	
No	Ref.		Ref.	

Data are shown as OR [95% CI]. ^a, smoking history: Never, 0 pack-year; Light, >0 to <30 pack-year; heavy, ≥30 pack-year. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; MIS, minimally invasive surgery; OR, odds ratio.

Table S15 Logistic regression analysis of severe postoperative complications for smokers in the matched cohort

Variables	Univariable		Multivariable	
	OR [95% CI]	P value	OR [95% CI]	P value
History of COVID-19		0.04		0.03
Presence	1.219 [1.005-1.478]		1.270 [1.018-1.499]	
Absence	Ref.		Ref.	
Age (years)		0.03		0.03
65-69	Ref.		Ref.	
70-74	1.045 [0.846-1.294]	0.63	1.055 [0.892-1.301]	0.58
≥75	1.287 [1.098-1.678]	0.008	1.279 [1.080-1.675]	0.01
Sex		0.09	-	-
Male	Ref.			
Female	0.845 [0.695-1.026]			
BMI (kg/m ²)		0.23	-	-
<24.0	0.888 [0.732-1.076]			
≥24.0	Ref.			
ECOG performance status		0.32	-	-
0	Ref.			
1	1.114 [0.899-1.380]			
FEV1 (% of predicted)		0.27	-	-
≤92.5	1.114 [0.919-1.349]			
>92.5	Ref.			
DLCO (% of predicted)		0.66	-	-
≤95.1	1.044 [0.862-1.265]			
>95.1	Ref.			
Surgical approaches		0.001		0.003
MIS	Ref.		Ref.	
Open	1.611 [1.225-2.118]		1.554 [1.167-2.070]	
Tumor histology		<0.001		<0.001
Adenocarcinoma	Ref.		Ref.	
Non-adenocarcinoma	2.164 [1.710-2.737]		2.345 [1.852-2.975]	
Resection extent		<0.001		<0.001
Wedge resection	Ref.		Ref.	
Segmentectomy	2.513 [1.729-3.654]	<0.001	2.045 [1.552-2.876]	<0.001
Lobectomy	3.961 [2.711-5.787]	<0.001	3.262 [1.992-5.032]	<0.001
Bi-lobe/Pneumonectomy	12.559 [6.419-24.571]	<0.001	10.349 [6.090-20.043]	<0.001
Clinical T stage		<0.001		<0.001
T1a	Ref.		Ref.	
T1b	1.304 [0.948-1.792]	0.10	1.034 [0.780-1.507]	0.50
T1c	2.681 [1.868-3.846]	<0.001	2.084 [1.313-3.200]	<0.001
T2a	2.993 [1.977-4.531]	<0.001	2.386 [1.417-3.872]	<0.001
T2b	3.798 [2.446-5.897]	<0.001	3.174 [1.817-5.474]	<0.001
T3	4.519 [2.496-8.180]	<0.001	3.915 [2.093-7.324]	<0.001
Clinical LN metastasis		<0.001		<0.001
Yes	2.275 [1.629-3.177]		2.278 [1.599-3.245]	
No	Ref.		Ref.	
Neoadjuvant therapy		<0.001		<0.001
Yes	3.805 [2.962-4.888]		3.735 [2.868-4.864]	
No	Ref.		Ref.	

Data are shown as OR [95% CI]. The mean values of BMI, FEV1, and DLCO from the entire cohort were used as the cut-off values. BMI, body mass index; CI, confidence interval; DLCO, diffusing capacity for carbon monoxide; ECOG, Eastern Cooperative Oncology Group; FEV1, forced expiratory volume in 1s; LN, lymph node; MIS, minimally invasive surgery; OR, odds ratio.