

Table S1 Sensitivity analysis: association between alternative cutoffs for early pleural intervention and initial pleural effusion control

Variable	n	PE control	No-PE control	P values
PI ≤7 days	7	7 (100)	0	0.090
PI ≤14 days	12	12 (100)	0	0.007
PI ≤21 days	15	15 (100)	0	0.002
PI ≤30 days	19	18 (94.7)	1 (5.2)	0.004
PI ≥30 days	9	3 (33.3)	6 (66.6)	0.052

Data are presented as n (%). P values were calculated using Pearson’s Chi-squared test; Fisher’s exact test was used when any expected cell count was <5. PI, pleural intervention; PE, pleural effusion.

Table S2 Univariable and exploratory multivariable logistic regression analyses of factors associated with pleural effusion control

Variable	Univariate analysis		Exploratory multivariate analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Age	0.99 (0.96–1.02)	0.494	0.99 (0.93–1.06)	0.911
Sex				
Male				
Female	0.73 (0.28–1.91)	0.532	0.54 (0.12–2.41)	0.425
Smoking				
Never/Former smoker				
Smoker	1.71 (0.42–6.90)	0.445	3.76 (0.34–40.85)	0.275
ECOG PS				
0-1				
2-4	0.34 (0.10–1.14)	0.081	0.05 (0.00–0.96)	0.047
Histology				
NSCLC				
SCLC	1.37 (0.53–3.58)	0.509	Not estimable	0.999
TNM				
<M1c2				
=M1c2	1.45 (0.47–4.49)	0.513	1.83 (0.37–8.99)	0.453
MPE at cancer diagnosis				
No				
Yes	1.5 (0.47–4.78)	0.493	4.33 (0.80–23.34)	0.088
Pleural Cytology				
Negative				
Positive	0.78 (0.20–2.98)	0.728	–	–
Radiological burden MPE				
<50% of hemithorax on CXR				
≥50% of hemithorax on CXR	1.18 (0.45–3.09)	0.725	0.70 (0.18–2.76)	0.617
Pharmacologic therapies				
CT				
CT + ICI				
Targeted therapies	0.58 (0.17–1.91)	0.373	0.00	0.99
EPI				
No				
Yes	12.57 (1.55–99.78)	0.017	69.60 (3.63–1334.43)	0.005
Overall responses				
Disease control				
Progressive disease	0.21 (0.03–1.24)	0.085	0.65 (0.02–14.98)	0.789
Progression to treatment				
No				
Yes	0.17 (0.02–1.45)	0.107	0.09 (0.00–1.31)	0.079

Cytology was excluded from multivariable analyses due to missingness (23 cases), to preserve sample size and model stability. ECOG PS, Eastern Cooperative Oncology Group performance status scale; NSCLC, non-small cell lung cancer; SCLC, small-cell lung cancer; CXR, chest-X Ray; TNM, tumor-node-metastasis classification system; MPE, malignant pleural effusion; CT, chemotherapy; ICI, immunotherapy; EPI, early pleural intervention.

Table S3 Logistic regression analysis for predictors of pleural effusion control

Variable	OR	95% CI	P values
EPI	38.43	3.37–437.97	0.003
MPE diagnosis year	0.96	0.83–1.11	0.612
ECOG PS ≥ 2	0.11	0.01–0.61	0.012
SCLC	3.12	1.02–9.57	0.048

CI, confidence interval; EPI, early pleural intervention; MPE, malignant pleural effusion; SCLC, small cell lung cancer; ECOG PS, Eastern Cooperative Oncology Group performance status; OR, odds ratio.

Table S4 Kaplan-Meier overall survival according to alternative time cutoffs used to define pleural intervention

Variable	Patients	Median OS, months (95% CI)	Log-rank P
PI ≤ 7 days			0.330
No	76	13.2 (9.3–17.1)	
Yes	7	16.9 (0.0–81.0)	
PI ≤ 14 days			0.031
No	71	12.3 (8.1–16.6)	
Yes	12	38.6 (6.5–70)	
PI ≤ 21 days			0.016
No	68	11.9 (7.6–16.3)	
Yes	15	25.4 (0.0–62.1)	
PI ≤ 30 days			0.008
No	64	11.7 (8.5–15.0)	
Yes	19	25.4 (0.0–53.8)	
PI ≥ 30 days			0.449
No	74	14.4 (10.4–18.4)	
Yes	9	12.8 (4.4–21.1)	

Overall survival is reported as median months (95% confidence interval [CI]) estimated using the Kaplan-Meier method. P values were calculated using the log-rank (Mantel-Cox) test. CI, confidence interval; PI, pleural intervention; OS, overall survival.

Table S5 Factors affecting overall survival

Variable	n	Median OS months	Univariate analysis		Multivariate analysis	
			HR (95% CI)	P value	HR (95% CI)	P value
EPI						
No	64	11.8				
Yes	19	25.4	0.41 (0.21–0.80)	0.009	0.36 (0.17–0.77)	0.009
Sex						
Male	45	11.9				
Female	37	17	0.91 (0.55–1.49)	0.713		
Age	83		0.98 (0.96–0.99)	0.034	0.99 (0.97–1.01)	0.677
MPE diagnosis year	83		1.05 (0.98–1.14)	0.143		
MPE at cancer diagnosis						
No	15	11.7				
Yes	68	14.4	0.82 (0.44–1.52)	0.533		
Pleural Cytology						
Negative	12	14.3				
Positive	50	12.8	1.17 (0.56–2.43)	0.665		
Radiological burden MPE						
<50% of hemithorax on CXR	48	12.8				
≥50% of hemithorax on CXR	35	16.8	0.65 (0.38–1.10)	0.11		
ECOG PS						
0-1	68	15.8				
2-4	15	1.8	2.51 (1.35–4.65)	0.003	2.23 (1.04–4.76)	0.039
Histology						
NSCLC	47	40.2				
SCLC	36	14.4	2.33 (1.39–3.90)	0.001	1.19 (0.22–6.45)	0.83
TNM stage						
=M1a	29	30.7				
>M1a	54	11.7	2.32 (1.33–4.07)	0.003	2.34 (1.26–4.47)	0.009
Pharmacologic therapies						
CT	20	11.9				
CT+ICI	19	6.2				
Targeted therapies	44	25.4	0.31 (0.16–0.59)	0.002	0.33 (0.07–1.55)	0.160
Overall responses to SACT						
Disease control	76					
Progressive disease	7	1.6	24.21 (7.91–74.05)	<0.001	24.92 (6.74–92.18)	<0.001
Progression to treatment						
No	12	11.7				
Yes	71	14.3	16.82 (2.33–121.48)	0.005	24.54 (3.23–186.48)	0.002

Multivariable estimates are reported only for covariates included in the pre-specified parsimonious model (selected a priori for clinical relevance and data completeness). Other candidate covariates were evaluated in univariable analyses but were not entered into the primary multivariable model to avoid over-parameterisation and complete-case losses due to missingness (e.g., pleural cytology), which would reduce sample size and model stability. CI, confidence interval; ECOG PS, Eastern Cooperative Oncology Group performance status; EPI, early pleural intervention; HR, hazard ratio; NSCLC, non-small cell lung cancer; OS, overall survival; SACT, systemic anticancer therapy; SCLC, small cell lung cancer; TNM, tumor-node-metastasis classification system.