

Long-term incidence of chronic postsurgical pain after thoracic surgery for lung cancer: A 10-year single-center retrospective study

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Supplemental Table S1. Patient characteristics and perioperative parameters between patients included and excluded in the study due to missing data.

	Patients included in the study	Patients excluded in the study ^a	P-value ^{b,c}
Sample size, n	3200	827	
Demographic characteristics			
Age, years	64 (56–71)	65 (56–72)	0.38
Sex, n			0.02
Male	1798 (56.2)	502 (60.7)	
Female	1402 (43.8)	325 (39.3)	
Body-mass index, kg/m ²	23.6 (21.6–25.6)	23.1 (21.0–25.2)	<0.001
Current smoker, n	912 (28.5)	226 (27.3)	0.53
Background medical status, n			
ASA class I/II/III	912 (28.5)/2113 (66.0)/175 (5.5)	241 (29.1)/525 (63.5)/61 (7.4)	0.09
Diabetes mellitus	457 (14.3)	141 (17.0)	0.05
History of tuberculosis	247 (7.7)	71 (8.6)	0.45
Chronic analgesic use	134 (4.2)	52 (6.3)	0.01
Chronic opioid use	6 (0.2)	10 (1.2)	<0.001
Antipsychotics use	57 (1.8)	11 (1.3)	0.81
Preoperative chemotherapy	103 (3.2)	55 (6.7)	<0.001
Postoperative chemotherapy	863 (27.0)	274 (33.1)	<0.01
Preoperative radiation therapy	72 (2.2)	36 (4.4)	<0.01
Postoperative radiation therapy	361 (11.3)	101 (12.2)	0.49
Previous other surgeries	2036 (63.6)	511 (61.8)	0.35
Surgical characteristics			

Operation year, n			<0.001
2007/2008/2009/2010/2011/ 2012/2013/2014/2015/2016	167/152/165/185/339/ 397/385/442/469/499	77/85/95/79/65/ 84/78/38/106/120	
Operative technique, n			<0.001
Thoracotomy	804 (25.1)	328 (39.7)	
VATS	2396 (74.9)	499 (60.3)	
Operation type, n			<0.001
Pneumonectomy	70 (2.2)	33 (4.0)	
Lobectomy	2588 (80.9)	552 (66.7)	
Segmentectomy	241 (7.5)	31 (3.7)	
Wedge resection	283 (8.8)	158 (19.1)	
Biopsy	16 (0.5)	45 (5.4)	
Pleurodesis	0 (0)	6 (0.7)	
Combined aortic surgery	0 (0)	2 (0.2)	
Explorative surgery	2 (0.1)	0 (0)	
Operation time, min	150 (120–195)	145 (100–200)	<0.001
Maximal NRS during POD 2, 0- 10	7 (5–8)	7 (5–8)	0.06
All-cause death within 36 months after surgery	297 (9.3)	263 (31.8)	<0.001

The values are presented as the median (interquartile range) or number (%).

Abbreviations: ASA, American Society of Anesthesiologist physical status classification; VATS, Video-assisted thoracic surgery; NRS, numeric rating scale; POD, postoperative day

a: Patients with history of previous thoracic surgery, those who underwent re-operation at the ipsilateral site during the study period, and treated with surgical methods other than VATS and thoracotomy were not included in this group.

b: P-value compares the patients included in the study and excluded in the study due to missing data.

c: Continuous variables were compared using the Mann-Whitney U test. Proportions were compared using the Chi-squared or Fisher's exact test according to their expected counts.

Supplemental Table S2. The trend for the incidence of chronic postsurgical pain during the first 36 months after thoracic surgery.

Time (months) after surgery	Continued CPSP	Recurrent CPSP	Newly developed CPSP	Non-CPSP	Loss to follow-up ^a	All-cause death
3	-	-	459 (14.3)	2741 (85.7)	-	-
6	249 (7.8)	-	3 (0.1)	2756 (86.1)	192 (6.0)	9 (0.3)
9	121 (3.8)	-	32 (1.0)	2555 (79.8)	493 (15.4)	33 (1.0)
12	87 (2.7)	5 (0.2)	14 (0.4)	2358 (73.7)	736 (23.0)	56 (1.8)
15	67 (2.1)	7 (0.2)	12 (0.4)	2145 (67.0)	969 (30.3)	87 (2.7)
18	68 (2.1)	4 (0.1)	11 (0.3)	2045 (63.9)	1072 (33.5)	119 (3.7)
21	63 (2.0)	6 (0.2)	8 (0.3)	1927 (60.2)	1196 (37.4)	146 (4.6)
24	54 (1.7)	4 (0.1)	9 (0.3)	1844 (57.6)	1289 (40.3)	181 (5.7)
27	44 (1.4)	2 (0.1)	2 (0.1)	1739 (54.3)	1413 (44.2)	210 (6.6)
30	39 (1.2)	3 (0.1)	5 (0.2)	1659 (51.8)	1494 (46.7)	238 (7.4)
33	38 (1.2)	3 (0.1)	2 (0.1)	1508 (47.1)	1649 (51.5)	259 (8.1)
36	35 (1.1)	4 (0.1)	1 (0.0)	1417 (44.3)	1743 (54.5)	297 (9.3)

The values are presented as the number (%).

Abbreviations: CPSP, chronic postsurgical pain

^aThis value includes all-cause death.

Supplemental Table S3. Patient characteristics and perioperative parameters between patients with chronic postsurgical pain (CPSP) continued from acute postoperative pain (acute-onset CPSP) and with delayed-onset CPSP after the asymptomatic period after surgery (delayed-onset CPSP).

	Acute-onset CPSP	Delayed-onset CPSP	P-value ^{a,b}
Sample size, n	459	99	
Demographic characteristics			
Age, years	64 (58–70)	65 (58–69)	0.97
Sex, n			0.53
Male	246 (53.6)	49 (49.5)	
Female	213 (46.4)	50 (50.5)	
Body-mass index, kg/m ²	23.6 (21.9–25.8)	24.1 (21.9–25.9)	0.69
Current smoker, n	124 (27.0)	27 (27.3)	>0.99
Background medical status, n			
ASA class I/II/III	128 (27.9)/303 (66.0)/28 (6.1)	32 (32.3)/61 (61.6)/6 (6.1)	0.67
Diabetes mellitus	65 (14.2)	17 (17.2)	0.54
History of tuberculosis	45 (8.1)	202 (7.6)	0.80
Chronic analgesic use	21 (4.6)	3 (3.0)	0.78
Preoperative chemotherapy	14 (3.1)	5 (5.1)	0.36
Postoperative chemotherapy	155 (33.8)	41 (41.4)	0.18
Preoperative radiation therapy	10 (2.2)	2 (2.0)	>0.99
Postoperative radiation therapy	65 (14.2)	20 (20.2)	0.17
Previous other surgeries	294 (64.1)	64 (64.6)	>0.99
Surgical characteristics			
Operative technique, n			0.32
Thoracotomy	154 (33.6)	39 (39.4)	
VATS	305 (66.4)	60 (60.6)	

Operation type, n			0.28
Pneumonectomy	15 (3.3)	1 (1.0)	
Lobectomy	379 (82.6)	92 (92.9)	
Segmentectomy	26 (5.7)	2 (2.0)	
Wedge resection	35 (7.6)	4 (4.0)	
Biopsy	3 (0.7)	0 (0)	
Explorative surgery	1 (0.2)	0 (0)	
Operation time, min	160 (130–215)	175 (135–223)	0.40
Type of anesthesia, n			<0.01
Inhalation agent	141 (30.7)	46 (46.5)	
TIVA	318 (69.3)	53 (53.5)	
Intraoperative bupivacaine use, n	123 (26.8)	20 (20.2)	0.22
Type of PCA, n			0.78
Intravenous PCA	352 (76.7)	74 (74.7)	
Epidural PCA	104 (22.7)	25 (25.3)	
Paravertebral PCA	3 (0.7)	0 (0)	
Maximal NRS during POD 2, 0-10	7 (5–8)	7 (6–8)	0.41
NRS at first outpatient visit after surgery, 0-10	4 (3–5)	3 (2–5)	<0.001

The values are presented as the median (interquartile range) or number (%).

Abbreviations: CPSP, chronic postsurgical pain; ASA, American Society of Anesthesiologist physical status classification; VATS, Video-assisted thoracic surgery; TIVA, total intravenous anesthesia; PCA, patient controlled analgesia; NRS, numeric rating scale; POD, postoperative day

a: P-value compares CPSP group versus non-CPSP group, b: Mann-Whitney U test used to compare medians and chi-square test or Fisher's exact test used to compare proportions

Supplemental Table S4. Surgical and anesthesia related parameters according to the year of surgery.

Variable	2007 (n=167)	2008 (n=152)	2009 (n=165)	2010 (n=185)	2011 (n=339)
Female, n	55 (32.9)	76 (50.0)	65 (39.4)	79 (42.7)	164 (48.4)
Age, years	65 (58–71)	62 (55–68)	66 (58–71)	64 (57–69)	63 (56–69)
Thoracotomy (vs. VATS), n	113 (67.7)	90 (59.2)	76 (46.1)	64 (34.6)	80 (23.6)
Operation time, min	185 (145–230)	170 (140–220)	170 (135–225)	179 (145–220)	155 (125–200)
Inhalational anesthesia (vs. TIVA), n	167 (100)	152 (100)	165 (100)	185 (100)	219 (64.6)
Epidural PCA (vs. Intravenous PCA), n	95 (56.9)	69 (45.4)	78 (47.3)	53 (28.6)	85 (25.1)
Maximal NRS during POD 2, 0–10	7 (5–8)	5 (4–7)	6 (5–7)	7 (5–8)	7 (5–8)
NRS at first outpatient visit after surgery, 0–10	2 (0–5)	2 (0–5)	2 (0–4)	3 (0–4)	3 (1–3)
Postoperative chemotherapy, n	80 (47.9)	56 (36.8)	50 (30.3)	59 (31.9)	108 (31.9)
Postoperative radiation therapy, n	28 (16.8)	24 (15.8)	30 (18.2)	27 (14.6)	55 (16.2)
Variable	2012 (n=397)	2013 (n=385)	2014 (n=442)	2015 (n=469)	2016 (n=499)
Female, n	184 (46.3)	157 (40.8)	184 (41.6)	214 (45.6)	224 (44.9)
Age, years	63 (56–70)	64 (55–71)	64 (57–71)	65 (58–72)	64 (57–71)
Thoracotomy (vs. VATS), n	63 (15.9)	82 (21.3)	79 (17.9)	73 (15.6)	84 (16.8)

Operation time, min	140 (115–175)	153 (125–205)	156 (130–200)	136 (110–170)	130 (109–165)
Inhalational anesthesia (vs. TIVA), n	5 (1.3)	0 (0)	41 (9.3)	0 (0)	1 (0.2)
Epidural PCA (vs. Intravenous PCA), n	52 (13.1)	74 (19.2)	62 (14.0)	51 (10.9)	61 (12.2)
Maximal NRS during POD 2, 0–10	7 (6–9)	7 (5–8)	7 (6–8)	7 (5–8)	6 (5–8)
NRS at first outpatient visit after surgery, 0–10	3 (1–3)	2 (0–3)	2 (0–4)	2 (0–3)	2 (0–3)
Postoperative chemotherapy, n	94 (23.7)	104 (27.0)	100 (22.6)	96 (20.5)	116 (23.2)
Postoperative radiation therapy, n	39 (9.8)	53 (13.8)	45 (10.2)	28 (6.0)	32 (6.4)

The values are presented as the median (interquartile range) or number (%)

Abbreviations: VATS, Video-assisted thoracic surgery; TIVA, total intravenous anesthesia; PCA, patient controlled analgesia; NRS, numeric rating scale; POD, postoperative day