Prevention and management of medical complications in perioperative period

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Table of Contents

Perioperative complications

- Decreased lung function and functional status
- Surgical site infection
- Post op pneumonia (POP)
- Venous thromboembolism
- Post op nausea/vomiting (PONV)
- Arrhythmia
- COPD/ILD

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Cureus

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Length of Postoperative Hospital Stay and Related Factors After Lobectomy for Lung Cancer: A Pre-enhanced Recovery After Surgery (ERAS) Single Center Assessment

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- 99 patients undergoing lobectomy
- Median postoperative LOS : 5.2 days
- Complication rate 19.2%
- 30-day readmission rate : 13.1%

Cureus. 2024 Feb 22;16(2):e54724.

Relation between postoperative hospital days and patients' characteristics

Variables		Postoperative Length of hospital Stay*	P-value#
Gender	Male	5.6 (4.8-6.9)	0.076
	Female	5.1 (4.5-6.2)	
Age group	<60	5.2 (4.6-6.9)	0.578
	>=60	5.2 (4.8-6.8)	
BMI classification	< 18.5	5.1 (4.3-10.9)	0.855
	18.5-22.9	5.7 (4.8-6.8)	
	≥ 23	5.1 (4.8-6.7)	
ASA classification	I	5.5 (4.1-6.9)	0.128
	II	5.2 (4.8-6.7)	
	III	6.9 (4.9-7.9)	
Cigarette smoking status	Never cigarette smokers	5 (4.3-5.8)	<0.001
	Former cigerette smokers	5.4 (4.8-6)	
	Current cigarette smokers	6.9 (5.9-8.9)	

Cureus. 2024 Feb 22;16(2):e54724.

Asthma /COPD	Yes	7.0 (5.5-7.8)	0.171
	No	5.2 (4.8-6.8)	
Diabetes	Yes	5.0 (4.8-5.7)	0.291
	No	5.2 (4.8-6.8)	
Dyslipidemia	Yes	5.5 (5.1-5.8)	0.97
	No	5.2 (4.8-6.8)	
Coronary artery disease	Yes	6.9 (5.5-14.0)	0.009
	No	5.2 (4.8-6.8)	
Thyroid dysfunction	Yes	4.7 (4.2-5.0)	0.123
	No	5.2 (4.8-6.8)	
Anemia	Yes	6.7 (5.0-7.8)	0.385
	No	5.2 (4.8-6.8)	
Other cancers	Yes	4.4 (3.9-4.9)	0.117
	No	5.2 (4.8-6.8)	
Tumor location	Left-upper lobe	5. 9(4.8-6.9)	0.86
	Left-lower lobe	5.2 (4.2-6.0)	
	Right-upper lobe	5.2 (4.9-6.8)	
	Right-lower lobe	5.0 (4.8-7.0)	
	Right-center lobe	5.1 (4.8-7.0)	

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Variables		Postoperative Length of hospital Stay *	P-value
Operation method	Open surgery	6.9 (5.9-8)	<0.001##
	Thoracoscopic surgery	5 (4.6-5.8)	
	Thoracoscopic surgery converts to open	6.9 (5.8-7.9)	
Early extubation	Yes	4.3 (4-4.8)	<0.001#
	No	5.9 (5-6.9)	
Multimodal pain relief	Yes	4.9 (4.2-5.8)	<0.001#
	No	6.5 (5.2-8)	
Physical therapy before surgery	Yes	4.7 (4.1-4.9)	<0.001#
	No	6 (5.2-7)	
Using opioids before surgery	Yes	5.1 (4.9-8.8)	0.612#
	No	5.2 (4.8-6.8)	
Physical therapy at the recovery unit	Yes	4. 9 (4.2-5.2)	<0.001#
	No	6.2 (5-7.9)	
Physical therapy after surgery	Yes	5.2 (4.8-6.8)	0.577#
	No	5.6 (4.9-6.9)	
Vomiting after surgery	Yes	6 (5.2-14)	0.005#
	No	5.1 (4.8-6.8)	
Complication	Yes	8 (6,8-14)	<0,001#
	No	5,1 (4,7-5,9)	
Amount of blood loss (ml)		R=0.526	<0.001a

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European Journal of Cardio-Thoracic Surgery 55 (2019) 91–115
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GUIDELINES

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Guidelines for enhanced recovery after lung surgery: recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS)

Timothy J.P. Batchelor[a,*], Neil J. Rasburn[b], Etienne Abdelnour-Berchtold[c], Alessandro Brunelli[d], Robert J. Cerfolio[e], Michel Gonzalez[c], Olle Ljungqvist[f], René H. Petersen[g], Wanda M. Popescu[h], Peter D. Slinger[i] and Babu Naidu[j]

- Hospital LOS ↓
- Postoperative complication rates ↓

Eur J Cardiothorac Surg. 2019 Jan 1;55(1):91-115.

Guidelines for enhanced recovery after lung surgery

Recommendations	Evidence level	Recommendation grade
Preoperative phase		
Preadmission information, education and counselling		
Patients should routinely receive dedicated preoperative counselling	Low	Strong
Perioperative nutrition		
Patients should be screened preoperatively for nutritional status and weight loss	High	Strong
Oral nutritional supplements should be given to malnourished patients	Moderate	Strong
Immune-enhancing nutrition may have a role in the malnourished patient postoperatively	Low	Weak
Alcohol dependency management		
Alcohol consumption (in alcohol abusers) should be avoided for at least 4 weeks before surgery	Moderate	Strong
Anaemia management		
Anaemia should be identified, investigated and corrected preoperatively	High	Strong
Admission		
Preoperative fasting and carbohydrate treatment		
Clear fluids should be allowed up until 2 h before the induction of anaesthesia and solids until 6 h before induction of anaesthesia	High	Strong
Oral carbohydrate loading reduces postoperative insulin resistance and should be used routinely	Low	Strong
Preanaesthetic medication		
Routine administration of sedatives to reduce anxiety preoperatively should be avoided	Moderate	Strong
Perioperative phase		
ical VTE prophylaxis		
Patients at high risk of VTE may be considered for extended prophylaxis with LMWH for up to 4 weeks	Low	Weak
Hair clipping is recommended if hair removal is required	High	Strong
Chlorhexidine–alcohol is preferred to povidone-iodine solution for skin preparation	High	Strong
Preventing intraoperative hypothermia		
Maintenance of normothermia with convective active warming devices should be used perioperatively	High	Strong
Continuous measurement of core temperature for efficacy and compliance is recommended	High	Strong
Standard anaesthetic protocol		
Lung-protective strategies should be used during one-lung ventilation	Moderate	Strong
A combination of regional and general anaesthetic techniques should be used	Low	Strong
Short-acting volatile or intravenous anaesthetics, or their combination, are equivalent choices	Low	Strong

- Smoking cessation at least 4 weeks before surgery
- Rehabilitation for patients with borderline lung function or exercise capacity
- VTE prophylaxis : pharmacological and mechanical
- Antibiotic prophylaxis within 60 min, prior to the skin incision

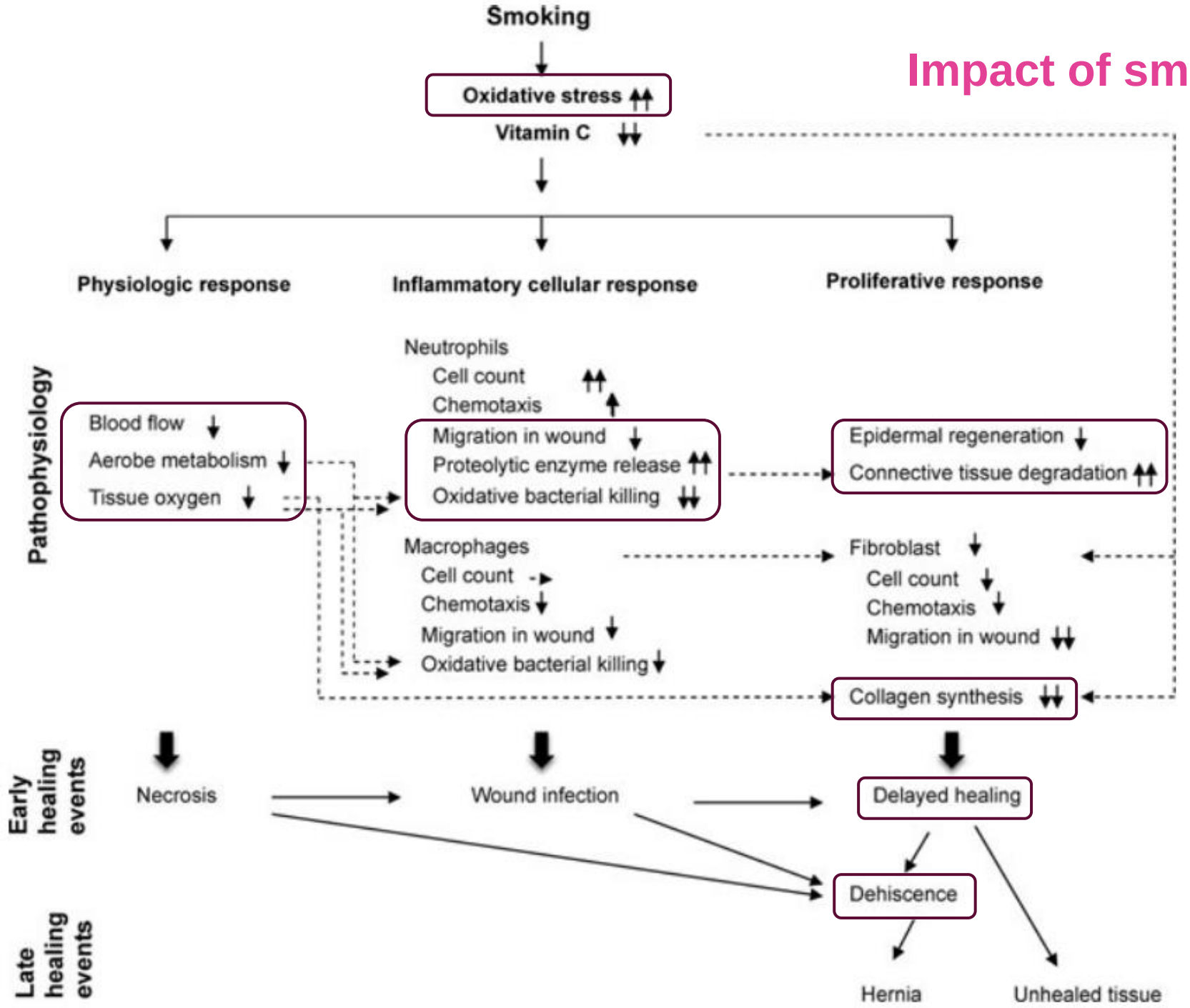
Eur J Cardiothorac Surg. 2019 Jan 1;55(1):91-115.

- PONV control
- Pain relief : acetaminophen & NSAIDs, dexamethasone
- Atrial fibrillation prevention

A multimodal pharmacological approach for PONV prophylaxis is indicated in patients at moderate risk or high risk	Moderate	Strong
Regional anaesthesia and pain relief		
Regional anaesthesia is recommended with the aim of reducing postoperative opioid use	High	Strong
unless contraindications exist		
Ketamine should be considered for patients with pre-existing chronic pain	Moderate	Strong
Dexamethasone may be administered to prevent PONV and reduce pain	Low	Strong
Perioperative fluid management		
Very restrictive or liberal fluid regimes should be avoided in favour of euvolemia	Moderate	Strong
Balanced crystalloids are the intravenous fluid of choice and are preferred to 0.9% saline	High	Strong
Intravenous fluids should be discontinued as soon as possible and replaced with oral fluids and diet	Moderate	Strong
period		
Magnesium supplementation may be considered in magnesium deplete patients	Low	Weak
It is reasonable to administer diltiazem preoperatively or amiodarone postoperatively for patients at risk	Moderate	Weak
Surgical technique: thoracotomy		
If a thoracotomy is required, a muscle-sparing technique should be performed	Moderate	Strong
Intercostal muscle- and nerve-sparing techniques are recommended	Moderate	Strong
Reapproximation of the ribs during thoracotomy closure should spare the inferior intercostal nerve	Moderate	Strong
Surgical technique: minimally invasive surgery		
A VATS approach for lung resection is recommended for early-stage lung cancer	High	Strong
Postoperative phase		
Chest drain management		
The routine application of external suction should be avoided	Low	Strong
Digital drainage systems reduce variability in decision-making and should be used	Low	Strong
Chest tubes should be removed even if the daily serous effusion is of high volume (up to 450 ml/24 h)	Moderate	Strong
A single tube should be used instead of 2 after anatomical lung resection	Moderate	Strong
Urinary drainage		
In patients with normal preoperative renal function, a transurethral catheter should not be routinely placed for the sole purpose of monitoring urine output	Moderate	Strong
It is reasonable to place a transurethral catheter in patients with thoracic epidural anaesthesia	Low	Strong
Early mobilization and adjuncts to physiotherapy		
Patients should be mobilized within 24 h of surgery	Low	Strong
Prophylactic minitracheostomy use may be considered in certain high-risk patients	Low	Weak

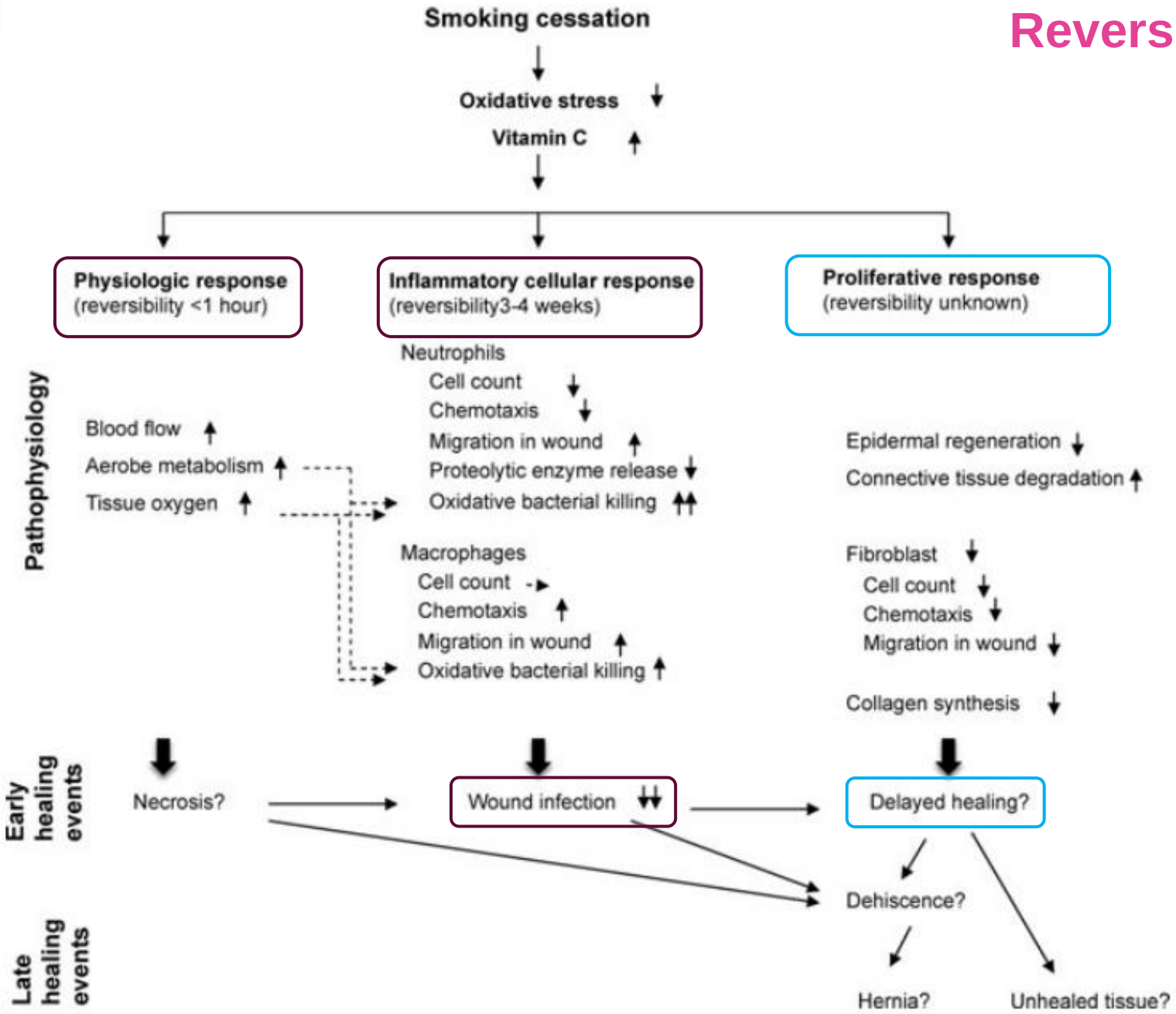
Eur J Cardiothorac Surg. 2019 Jan 1;55(1):91-115.

Impact of smoking on wound healing



Ann Surg. 2012 Jun;255(6):1069-79.

Reversibility of impaired healing by smoking cessation



Ann Surg. 2012 Jun;255(6):1069-79.

Importance of Smoking Cessation on Surgical Outcome in Primary Lung Cancer

Mariko Fukui, PhD, Kenji Suzuki, PhD, Takeshi Matsunaga, PhD, Shiaki Oh, PhD, and Kazuya Takamochi, PhD

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- Lung cancer diagnosis : chance to stop smoking
- Current smokers at the time of surgery (~20%)
- 666 patients with primary lung ca (stage I to III)
- Postoperative complications
  - hypoxia, pneumonia, air leakage, BPF, empyema, arrhythmia, pneumonia, atelectasis, IPF AE

Ann Thorac Surg. 2019;107(4):1005-9. Epub 20190102.

Morbidity within 30 days and mortality after surgery

Table 2. Unadjusted Morbidity Within 30 Days and Mortality After Surgery

Variable	Never Smoker (n = 256)	Smoker (n = 410)	*p* Value[a]
Morbidities			
Respiratory morbidity[b]	9 (3.5)	77 (22.3)	<0.001
Hypoxia that needed home oxygen therapy	4 (1.6)	43 (10.5)	<0.001
Pneumonia	1 (0.4)	15 (3.7)	0.007
Atelectasis	3 (1.2)	12 (2.9)	0.138
Phlegm that required bronchoscopy	0 (0)	11 (2.7)	0.008
Other morbidity			
Intractable air leakage	13 (5.1)	26 (6.3)	0.499
Bronchopleural fistula	2 (0.8)	8 (2.0)	0.227
Empyema	3 (1.2)	7 (1.7)	0.580
Arrhythmias	14 (5.5)	47 (11.5)	0.009
Exacerbation of interstitial pneumonia	1 (0.4)	4 (0.9)	0.395
30-day mortality	0	5 (1.2)	0.076
90-day mortality	0	8 (2.0)	0.025
2-year mortality	6 (2.3)	40 (9.8)	<0.001

Ann Thorac Surg. 2019;107(4):1005-9. Epub 20190102.

Predicting factors of pulmonary complication

	Univariate Analysis			Multivariate Analysis		
Variable	Odds Ratio	95% CI	*p* Value[a]	Odds Ratio	95% CI	*p* Value
Age	1.034	1.009–1.060	0.008	…	…	…
Sex: male	3.922	2.193–6.897	<0.001	…	…	…
Smoker versus never smoker	6.346	3.121–12.905	<0.001	2.832	1.203–6.670	0.017
Smoking status (pack-year)	1.020	1.020–1.020	<0.001	…	…	…
Current smoker or not	3.676	1.927–6.993	<0.001	…	…	…
%VC < 80%	2.488	1.294–4.784	0.006	…	…	…
$FEV_{1.0}/FVC < 0.7$	3.715	2.304–5.991	<0.001	2.656	1.481–4.764	0.001
%DLCO < 40%	5.909	3.275–10.661	<0.001	4.217	2.238–7.946	<0.001
Surgical procedure	1.543	0.916–2.602	0.103	…	…	…
Cancer stage c-II and III versus I	3.754	2.336–6.032	<0.001	2.320	1.293–4.163	0.005

Ann Thorac Surg. 2019;107(4):1005-9. Epub 20190102.

Pulmonary complications by smoking status

Variable	Number	Pulmonary Complications, n (%)	Odds Ratio[a]	95% CI	*p* Value
Overall	660	86	…	…	…
Never smoker	256	9 (3.5)	…	…	…
Smoker	410	77 (22.3)	6.346	3.12–12.91	<0.001
Preoperative smoking cessation duration					
Current	50	16 (32.0)	12.915	5.294–31.509	<0.001
<1 month	22	6 (27.3)	10.292	3.258–32.508	<0.001
1–3 months	21	5 (23.8)	8.576	2.572–28.602	<0.001
3–6 months	16	4 (25.0)	6.333	1.530–26.222	0.011
6–12 months	28	5 (17.9)	5.966	1.845–19.295	0.003
>12 months	248	38 (15.3)	4.966	2.347–10.508	<0.001

Ann Thorac Surg. 2019;107(4):1005-9. Epub 20190102.

clinical investigations

The Relationship Between Cigarette Smoking and Quality of Life After Lung Cancer Diagnosis*

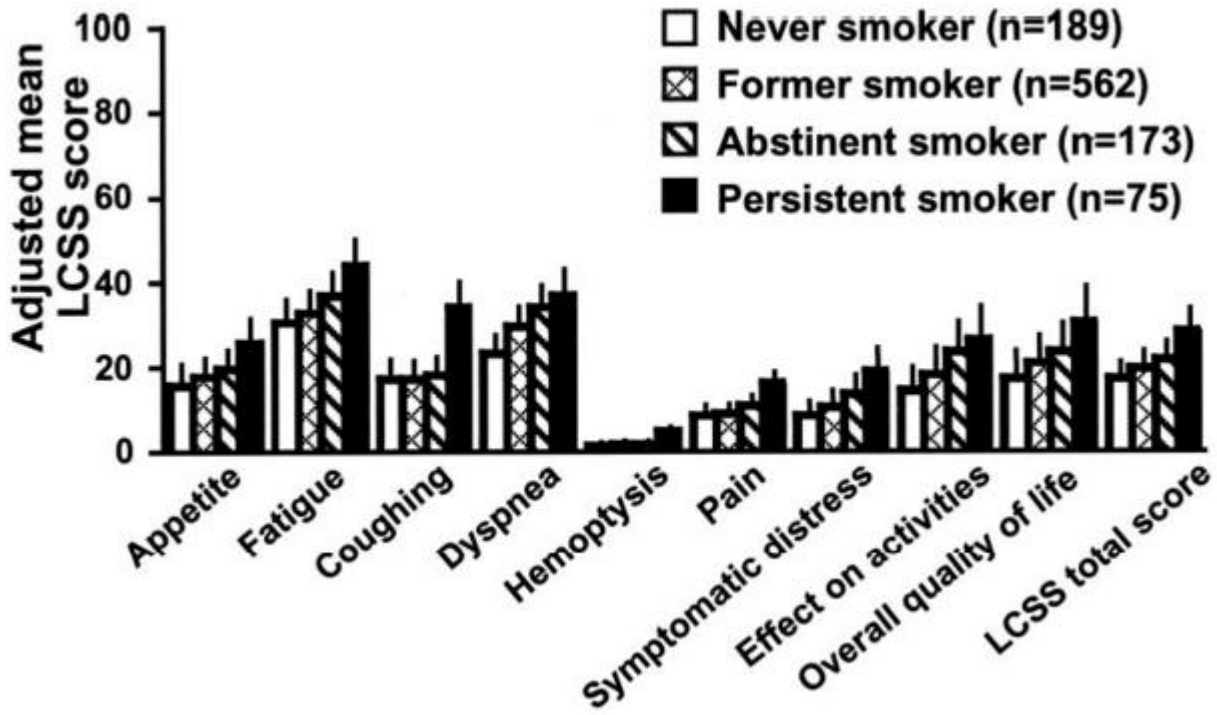
Yolanda I. Garces, MD; Ping Yang, MD, PhD; Julia Parkinson, BS; Xinghua Zhao, MS; Jason A. Wampfler, BS; Jon O. Ebbert, MD, MS; and Jeff A. Sloan, PhD

- 1,506 lung cancer patients
- LCSS (lung cancer symptom score)
- Never (18%), former (58%) and current (24%) smokers

Chest. 2004 Dec;126(6):1733-41.

LCSS scores according to smoking status

LCSS Item	Never-Smokers Mean (SD)	Persistent Smokers Mean (SD)	Difference in Means Between Persistent and Never-Smokers*
Appetite	16.1 (4.88)	26.1 (5.57)	10
Fatigue	31.0 (5.14)	44.4 (6.24)	13.4
Coughing	17.5 (4.53)	34.5 (5.66)	17
Dyspnea	23.4 (4.50)	37.0 (5.96)	13.6
Hemoptysis	1.6 (0.81)	5.2 (1.27)	3.5†
		16.2 (2.53)	7.4†
		19.1 (5.34)	10.3
		26.6 (7.84)	11.9
		31.1 (8.03)	13.7
		28.7 (5.09)	11.1



Chest. 2004 Dec;126(6):1733-41.

Published in final edited form as:
J Thorac Oncol. 2011 June ; 6(6): 1059–1065. doi:10.1097/JTO.0b013e318215a4dc.

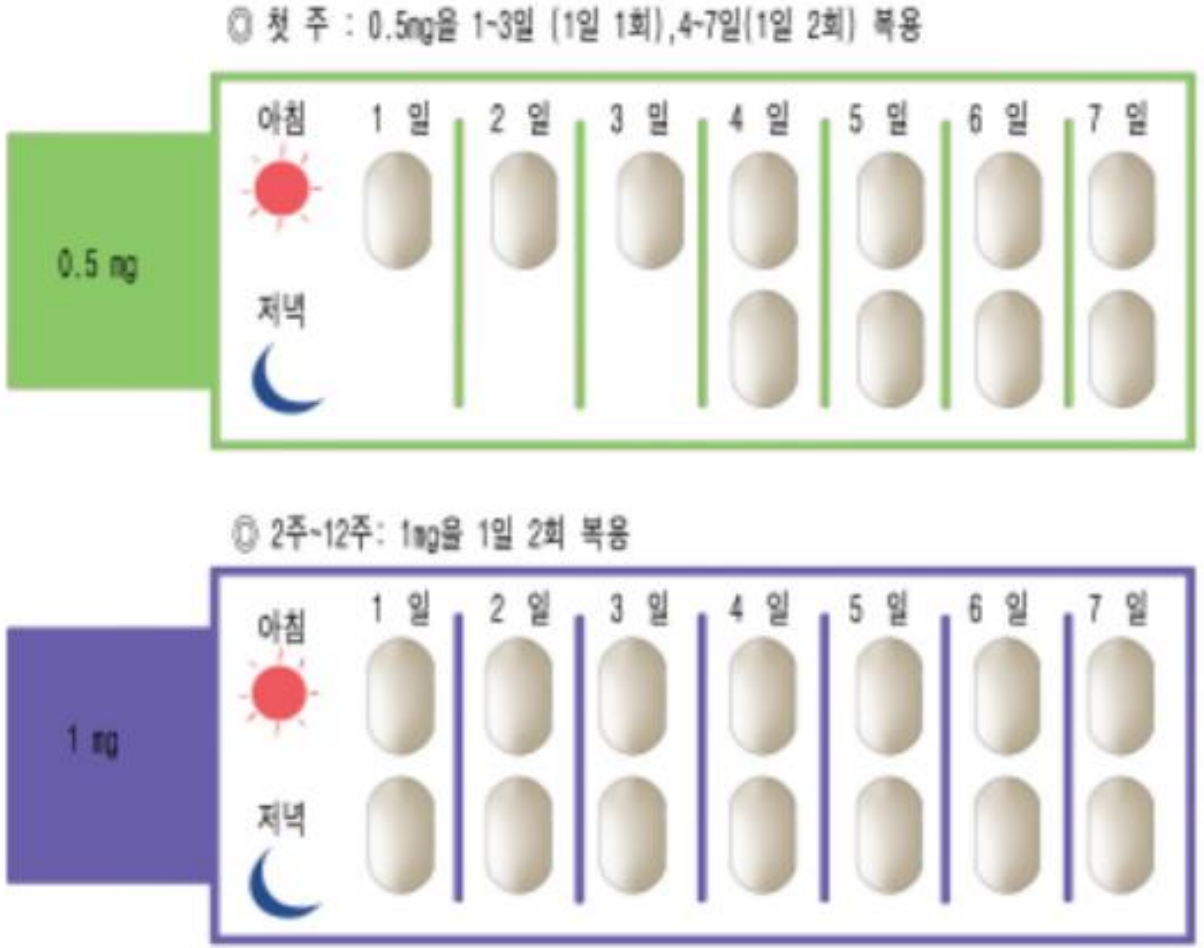
A smoking cessation intervention for thoracic surgery and oncology clinics: a pilot trial

Elyse R. Park, Ph.D., MPH, **Sandra Japuntich, Ph.D.**, **Jennifer Temel, M.D.**, **Michael Lanuti, M.D.**, **Jennifer Pandiscio, B.A.**, **Joanna Hilgenberg, LCSW**, **Diane Davies, R.N.**, **Carolyn Dresler, M.D.**, and **Nancy A. Rigotti, M.D.**

- 12-week program (counseling & varenicline)
- 1’ endpoint: 7-day point prevance abstinence rates
- 1130 patients, 187 current smokers (17%)
- Control group (n=17), intervention group (n=32)

J Thorac Oncol. 2011 Jun;6(6):1059-65.

Varenicline



2017 smoking cessation guideline, TRD

Baseline smoking characteristics

Variable SMOKING CHARACTERISTICS	All (N=49)	Control (N=17)	Intervention (N=32)	*p-value*
Years smoked *M (SD)*	37.8 (13.9)	34.1 (13.7)	39.7 (13.8)	0.18
Cigarettes per day *M (SD)*	16.4 (11.6)	15.4 (9.0)	17.0 (12.8)	0.65
Smoke within 30 minutes of waking (%)	76.6	73.3	78.1	0.72
Past cessation treatment: %				
Any counseling	31.0	41.7	26.7	0.46
Any pharmacotherapy	64.4	73.3	60.0	0.38
Nicotine replacement therapy	44.4	50.0	41.9	0.75
Varenicline	34.8	43.8	30.0	0.52
Bupropion	25.0	33.3	21.4	0.45
Live with a smoker (%)	34.7	35.3	34.4	0.95
Allows smoking in home (%)	87.8	94.1	84.4	0.33
Importance of quitting *M (SD)* *	8.9 (2.5)	8.1 (3.1)	9.3 (2.0)	0.12
Confidence in ability to quit *M (SD)* *	5.9 (2.8)	5.35 (3.0)	6.25 (2.6)	0.28
Knowledge about smoking & cancer *M (SD)* *				
Quitting will reduce treatment complications	8.9 (2.0)	8.6 (2.6)	9.0 (1.8)	0.56
Quitting will result in living longer	9.3 (1.5)	9.4 (1.4)	9.2 (1.5)	0.73
Quitting will reduce likelihood of future tumors	8.9 (2.0)	8.7 (1.9)	9.0 (2.1)	0.62

J Thorac Oncol. 2011 Jun;6(6):1059-65.

Smoking outcomes

	ALL (n=46)	INTERVENTON (n=32)	CONTROL (n=14)	OR (95% CI.)
7-DAY POINT PREVALENCE TOBACCO ABSTINENCE				
2 weeks				
Self-reported	17/46 (37.0%)	13/32 (40.6%)	4/14 (28.6%)	1.23 (.34-4.52)
+ Cotinine-confirmed (version 1)	16/46 (34.8%)	12/32 (37.5%)	4/14 (28.6%)	1.50 (.38-5.86)
* Cotinine-confirmed (version 2)	11/46 (23.9%)	9/32 (28.1%)	2/14 (14.3%)	2.35 (.44-12.64)
12 weeks				
Self-reported quit	17/46 (37.0%)	14/32 (43.8%)	3/14 (21.4%)	2.85 (.67-12.22)
Cotinine-confirmed (version 1)	15/46 (32.6%)	13/32 (40.6%)	2/14 (14.3%)	4.11 (.79-21.48)
* Cotinine-confirmed (version 2)	13/46 (28.3%)	11/32 (34.4%)	2/14 (14.3%)	3.14 (.59-16.62)

J Thorac Oncol. 2011 Jun;6(6):1059-65.

Rehabilitation

- Surgical resection in patients with lung cancer
  - Significant morbidity
  - Functional limitations
  - Decreased QOL

Integr Cancer Ther. 2016 Dec;15(4):455-466.

Research Article

Perioperative Rehabilitation in Operable Lung Cancer Patients (PROLUCA): A Feasibility Study

Integrative Cancer Therapies
2016, Vol. 15(4) 455–466

DOI: 10.1177/1534735416635741
ict.sagepub.com
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Maja S. Sommer, MHS, PT[1], Karen Trier, RN, MR[1], Jette Vibe-Petersen, MD[1], Malene Missel, RN, MScN[2], Merete Christensen, MD[2], Klaus R. Larsen, MD, PhD[3], Seppo W. Langer, MD, PhD[2], Carsten Hendriksen, MD[2], Paul Frost Clementsen, MD[2,4], Jesper H. Pedersen, MD, DMSc[2], and Henning Langberg, PhD, DMSc[2]

- Cardiorespiratory exercise: 2 hours weekly for 12 weeks
- Completion rate: 73% (intervention group)
- Endpoints : inclusion rate, adherence, number of adverse events

Integr Cancer Ther. 2016 Dec;15(4):455-466.

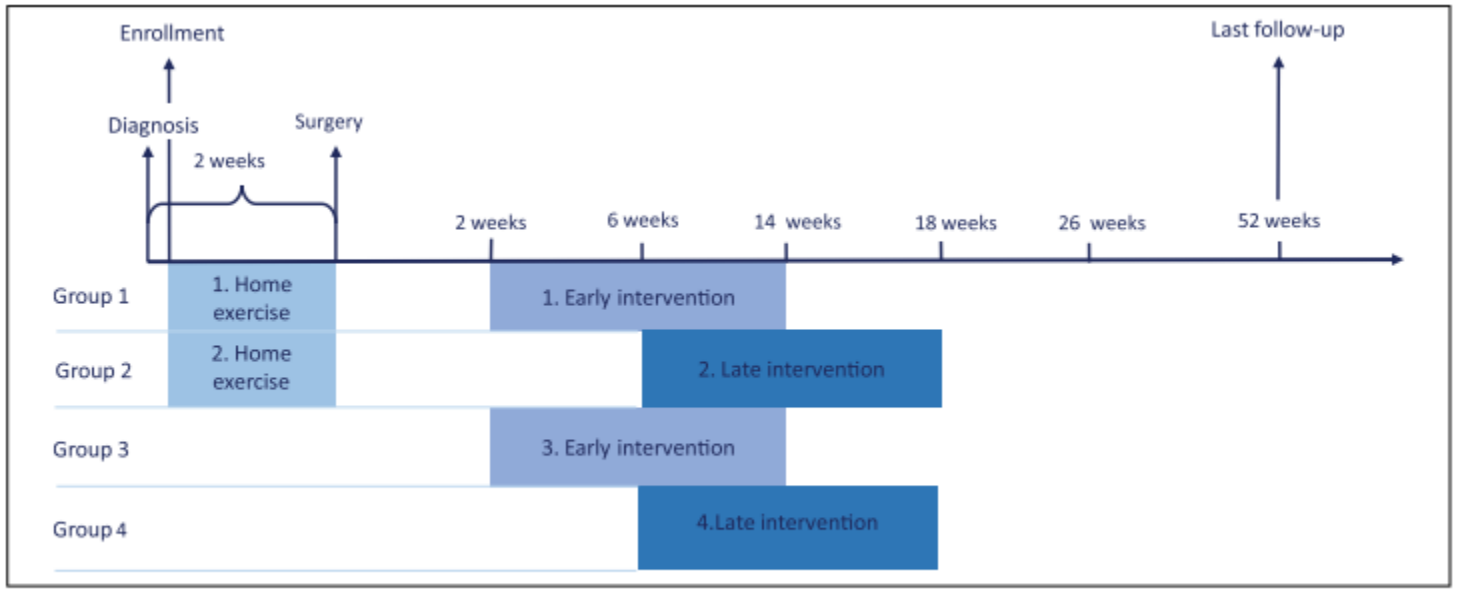
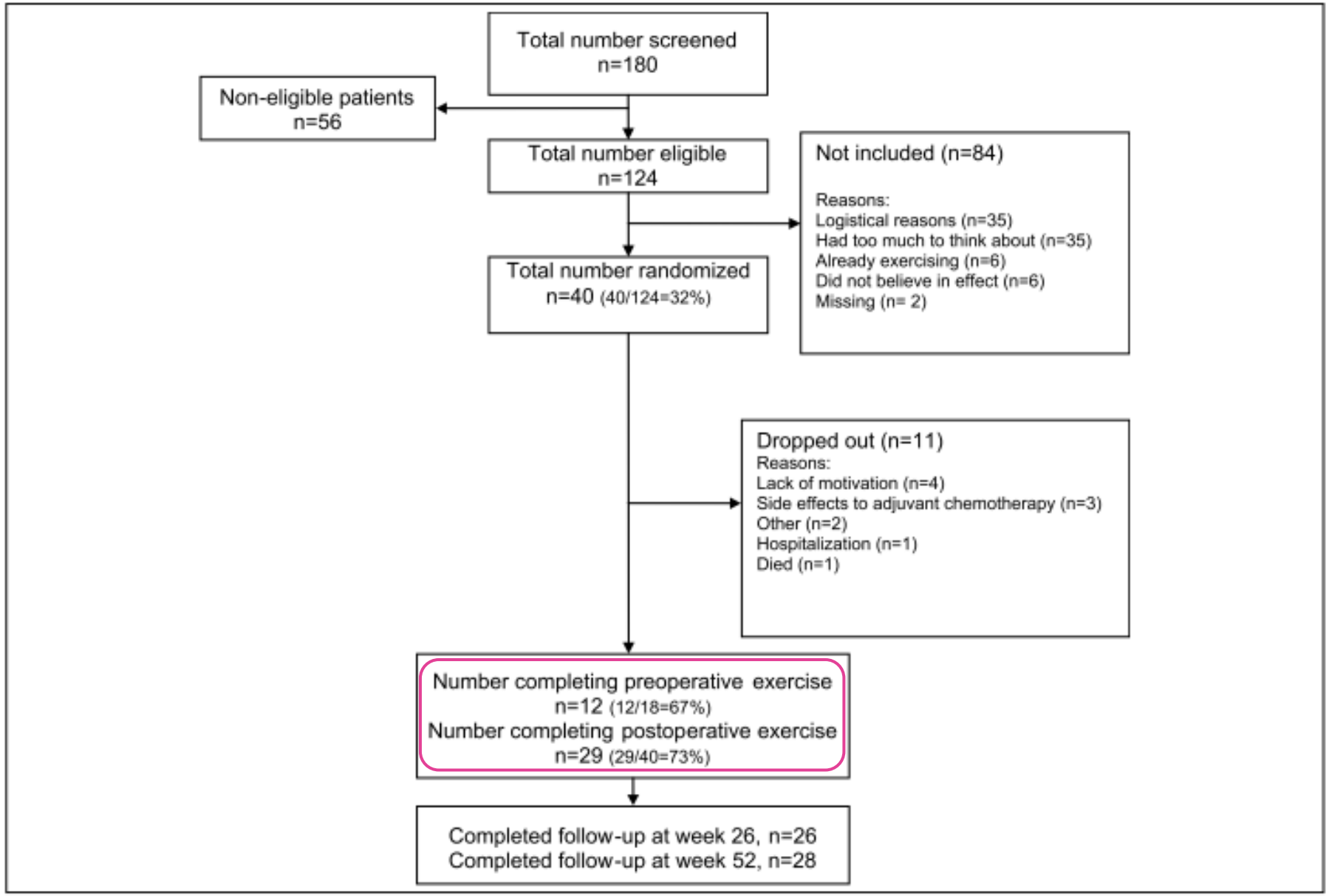


Figure 1. Timeline for the PROLUCA feasibility study.

- Postoperative exercise
  - Twice a week (60min/session) for 12 weeks, total of 24 sessions
    - Warm-up (5 min)
    - cardiorespiratory exercise (25 min) – bike
    - Strength exercise (25 min) – leg press, chest press, leg extension, pull to chest, pull down

Integr Cancer Ther. 2016 Dec;15(4):455-466.



Integr Cancer Ther. 2016 Dec;15(4):455-466.

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Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

Early initiated postoperative rehabilitation reduces fatigue in patients with operable lung cancer: A randomized trial

Morten Quist[a,*], Maja Schick Sommer[b], Jette Vibe-Petersen[b], Maja Bohlbro Stærkind[a], Seppo W. Langer[c], Klaus Richter Larsen[d], Karen Trier[b], Merete Christensen[e], Paul F. Clementsen[f,g], Malene Missel[e], Carsten Henriksen[e], Karl Bang Christensen[h], Christian Lillelund[a], Henning Langberg[i], Jesper H. Pedersen[e]

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- ERG (n=119, 14 days after surgery) vs. control-LRG (n=116, 14 weeks after surgery)
- 1’ end point: change in maximum oxygen consumption (VO_2peak)
- Fatigue (EORTC QLQ C30 LC13)

Lung Cancer. 2018;126:125-32.

VO_2Peak.

Group	N	Mean	SD	N	Mean	SD	Δ change	95% CI	Pr > |t|	Diff.	95% CI	P
Baseline 14 Weeks												
Early	108	1590	435	69	1503	421	−66	−124 to −7	0.027	−139	−224 to −54	< 0.001
Late	98	1591	526	63	1394	432	−202	−263 to −141	< 0.001			
14 weeks 26 Weeks												
Early	68	1510	407	56	1503	401	17	−34 to 68	0.504	−142	67 to 214	< 0.001
Late	63	1472	445	45	1641	488	159	−104 to −214	< 0.001			
Baseline 26 Weeks												
Early	108	1612	420	59	1536	462	−46	−104 to 12	0.119	−3	−88 to −82	0.945
Late	98	1687	521	47	1626	462	−43	−105 to 18	0.167			
Baseline 52 Weeks												
Early	108	1583	419	50	1510	387	−44	−119 to 31	0.244	11	−96 to 119	0.834
Late	98	1721	515	44	1639	474	−56	−133 to 22	0.158			

VO_2peak is expressed ml O_2/min, Abbreviations: SD, standard deviation; CI, confidence interval.

EORTC – C30 Fatique Score range 0–100 A high score for a symptom scale / item represents a high level of symptomatology / problems.

Group	N	Mean	SD	N	Mean	SD	Δ change	95% CI	Pr > |t|	Diff.	95% CI	P
	Baseline			**14 Weeks**								
Early	98	26	24	67	29	21	0	−5 to 6	0.911	10	2 to 18	0.017
Late	91	31	24	56	38	22	10	4 to 16	< 0.001			
	14 weeks			**26 Weeks**								
Early	74	28	19	56	26	21	−2	−7 to 2	0.278	−7	−14 to −1	0.020
Late	61	35	21	50	26	23	−10	−14 to −5	< 0.001			
	Baseline			**26 Weeks**								
Early	98	29	26	56	27	23	−2	−8 to 4	0.506	−3	−11 to 6	0.551
Late	91	28	22	53	26	21	1	−6 to 7	0.850			
	Baseline			**52 Weeks**								
Early	98	27	27	55	26	21	0	−6 to 6	0.912	−3	−12 to 5	0.431
late	91	27	22	50	27	21	4	−2 to 10	0.234			

Lung Cancer. 2018;126:125-32.

6MWT and FEV1.

Group	N	Mean	SD	N	Mean	SD	Δ change	95% CI	Pr > |t|	Diff.	95% CI	P
6MWT												
	Baseline			**14 Weeks**								
Early	108	498	102	69	516	91	24	10 to 36	< 0.001	−22	−41 to −2	0.029
Late	98	519	110	63	517	116	2	−12 to −16	0.786			
	14 weeks			**26 Weeks**								
Early	69	525	88	54	527	87	4	−3 to 12	0.260	19	8 to 30	< 0.001
Late	68	436	104	50	559	99	23	15 to 31	< 0.001			
	Baseline			**26 Weeks**								
Early	108	501	98	59	524	85	28	16 to 41	< 0.001	3	−15 to −21	0.751
Late	98	524	119	53	549	108	25	12 to 38	< 0.001			
	Baseline			**52 Weeks**								
Early	108	508	86	51	526	88	26	12 to 40	< 0.001	10	−11 to 31	0.345
Late	98	542	93	45	557	95	16	1 to 31	0.034			
FEV1												
	Baseline			**14 Weeks**								
Early	108	2.4	0.6	69	2.25	0.65	−0.15	−0.25 to −0.1	< 0.001	−0.15	−0.25 to −0.05	0.004
Late	99	2.55	0.75	67	2.25	0.65	−0.3	−0.25 to −0.1	< 0.001			
	14 weeks			**26 Weeks**								
Early	70	2.25	0.6	57	2.3	0.55	0	0 to 0.05	0.235	0.05	0 to 0.1	0.234
Late	69	2.3	0.65	54	2.35	0.65	0.05	0 to 0.1	0.005			
	Baseline			**26 Weeks**								
Early	108	2.5	0.6	62	2.35	0.55	−0.15	−0.2 to −0.05	< 0.001	0.15	0.05 to 0.25	0.012
Late	99	2.65	0.75	60	2.35	0.65	−0.25	−0.35 to −0.2	< 0.001			
	Baseline			**52 Weeks**								
Early	108	2.4	0.65	60	2.3	0.6	−0.15	−0.2 to −0.05	< 0.001	0.1	0 to −0.25	0.028
Late	99	2.7	0.7	55	2.4	0.7	−0.25	−0.35 to −0.2	< 0.001			

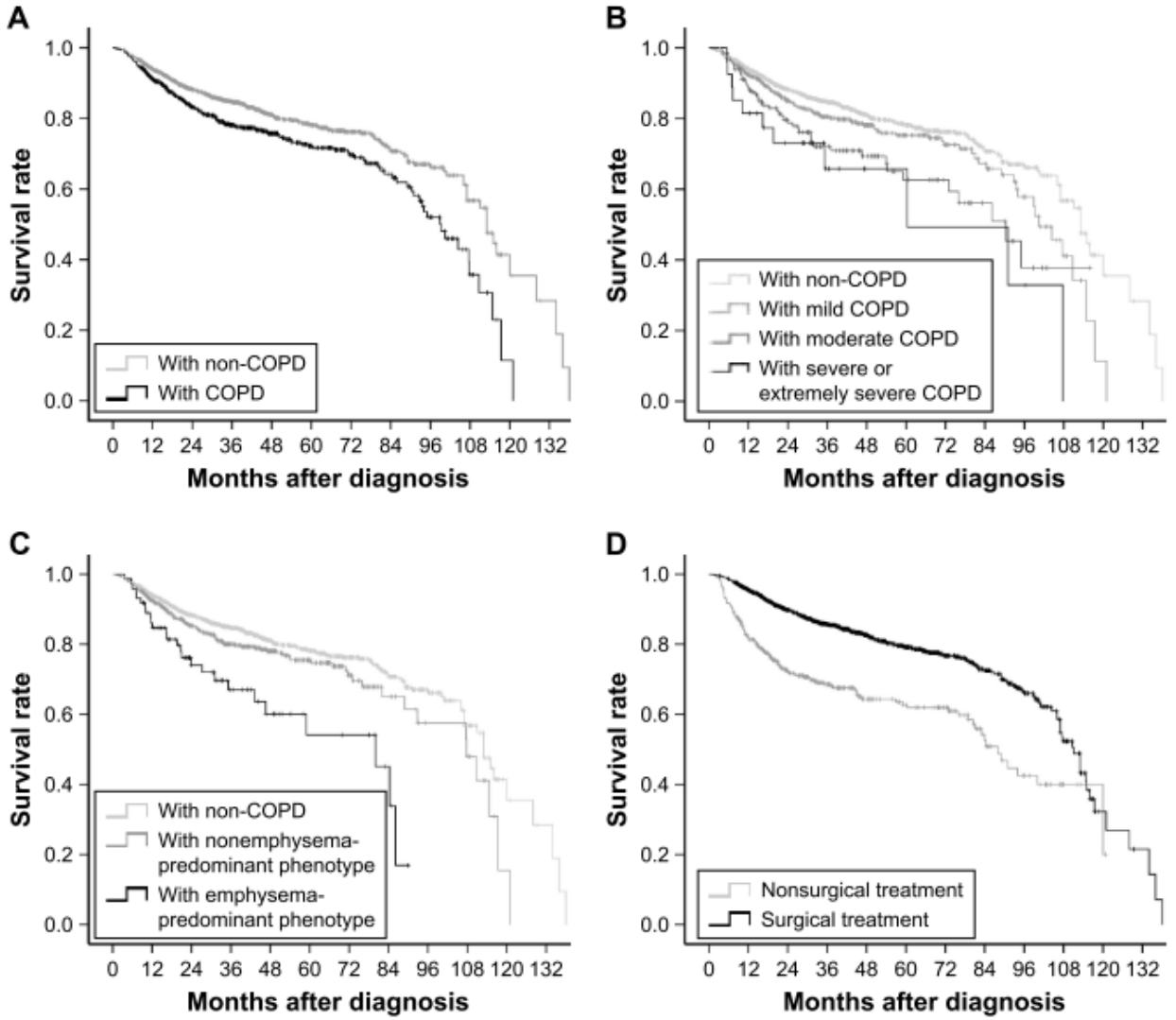
Lung Cancer. 2018;126:125-32.

Rehabilitation in COPD patients with lung cancer

- COPD
  - Comorbidity of lung cancer
  - Affect 55% of lung cancer patients worldwide
  - Mode, frequency and duration – no recommendation (small study)

Int J Chron Obstruct Pulmon Dis. 2018 Nov 20;13:3767-3776.

Prognosis of lung cancer patients according to COPD



Int J Chron Obstruct Pulmon Dis. 2018 Nov 20;13:3767-3776.

Clinical Trial/Experimental Study

Medicine

OPEN

Effect of postoperative exercise training on physical function and quality of life of lung cancer patients with chronic obstructive pulmonary disease

A randomized controlled trial

Zhonghua Yu, BSc[a,b], Guosheng Xie, BSc[a], Changlong Qin, MD[c], Hongchen He, PhD[a,b], Quan Wei, MD, PhD[a,b*]

- 84 patients
- Both: standard postoperative rehab for 1 wk
- Control: oxygen therapy and nebulization
- intervention: exercise program (24 training sessions)
  - Aerobic training : ride on cycle for 30 min bid, 6 days/week for 2 weeks

Medicine (Baltimore). 2024 Mar 8;103(10):e37285.

Functional status and QoL score of the baseline and endpoint assessment.

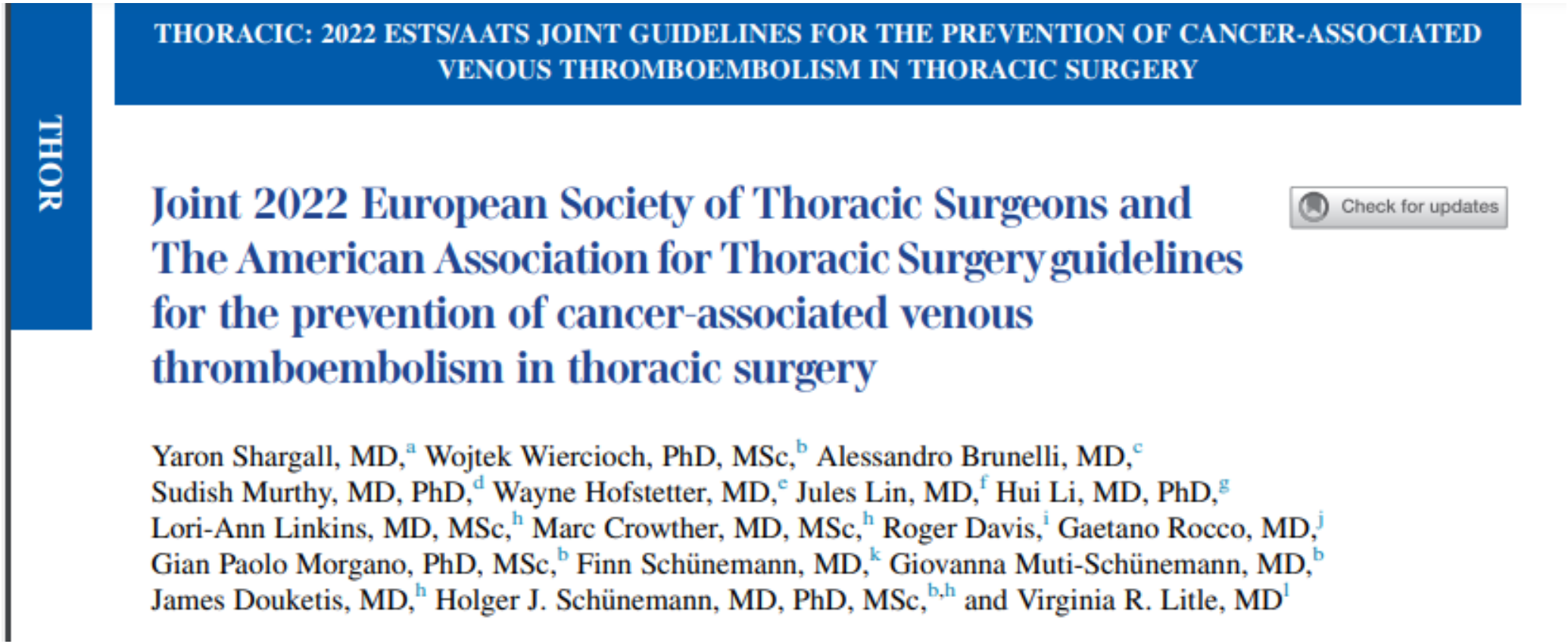
	Control group (n = 37)	Exercise group (n = 35)	*P* value
Baseline			
CPET (mL/kg/min)	16.3(1.7)	16.7(1.9)	.694
6MWT (m)	464.8(52.8)	486(57.9)	.701
FVC (mL)	2241.7(547.3)	2176.4(496.2)	.372
FEV1 (mL)	1356.9(324.6)	1474.5(390.4)	.794
SS of QLQ-C30 (V3.0)	66.8(11.3)	68.7(12.5)	.641
Daily walking step record	6348(641)	6279(563)	.781
Endpoint			
CPET (mL/kg/min)	13.1(1.3)	15.5(1.4)	.016
6MWT (min)	381.7(40.5)	437.4(48.6)	.040
FVC (mL)	1664.0(329.7)	1798.1(298.9)	.254
FEV1 (mL)	967.4(219.4)	1155.7(174.3)	.497
SS of QLQ-C30 (V3.0)	58.4(9.3)	61.7(5.7)	.318
Daily walking step record	3491(357)	4391(393)	.008

Change of Functional status and QoL score.

	Control group (n = 37)	Exercise group (n = 35)	*P* value
CPET (mL/kg/min)	−3.2(0.3)	−1.2(0.2)	.043
6MWT (m)	−83.1(9.2)	−48.6(6.0)	.029
FVC (mL)	−577.7(136.2)	−378.3(111.6)	.034
FEV1 (mL)	−389.5(89.4)	−318.8(114.3)	.213
SS of QLQ-C30 (V3.0)	−8.4(1.6)	−7.0(2.1)	.464
Daily walking step record	−2857(289)	−-1888(313)	.002

Medicine (Baltimore). 2024 Mar 8;103(10):e37285.

VTE prophylaxis



THOR

THORACIC: 2022 ESTS/AATS JOINT GUIDELINES FOR THE PREVENTION OF CANCER-ASSOCIATED VENOUS THROMBOEMBOLISM IN THORACIC SURGERY

Joint 2022 European Society of Thoracic Surgeons and The American Association for Thoracic Surgery guidelines for the prevention of cancer-associated venous thromboembolism in thoracic surgery

Check for updates

Yaron Shargall, MD,[a] Wojtek Wiercioch, PhD, MSc,[b] Alessandro Brunelli, MD,[c] Sudish Murthy, MD, PhD,[d] Wayne Hofstetter, MD,[e] Jules Lin, MD,[f] Hui Li, MD, PhD,[g] Lori-Ann Linkins, MD, MSc,[h] Marc Crowther, MD, MSc,[h] Roger Davis,[i] Gaetano Rocco, MD,[j] Gian Paolo Morgano, PhD, MSc,[b] Finn Schünemann, MD,[k] Giovanna Muti-Schünemann, MD,[b] James Douketis, MD,[h] Holger J. Schünemann, MD, PhD, MSc,[b,h] and Virginia R. Litle, MD[l]

J Thorac Cardiovasc Surg. 2023 Mar;165(3):794-824.e6.

VTE prophylaxis

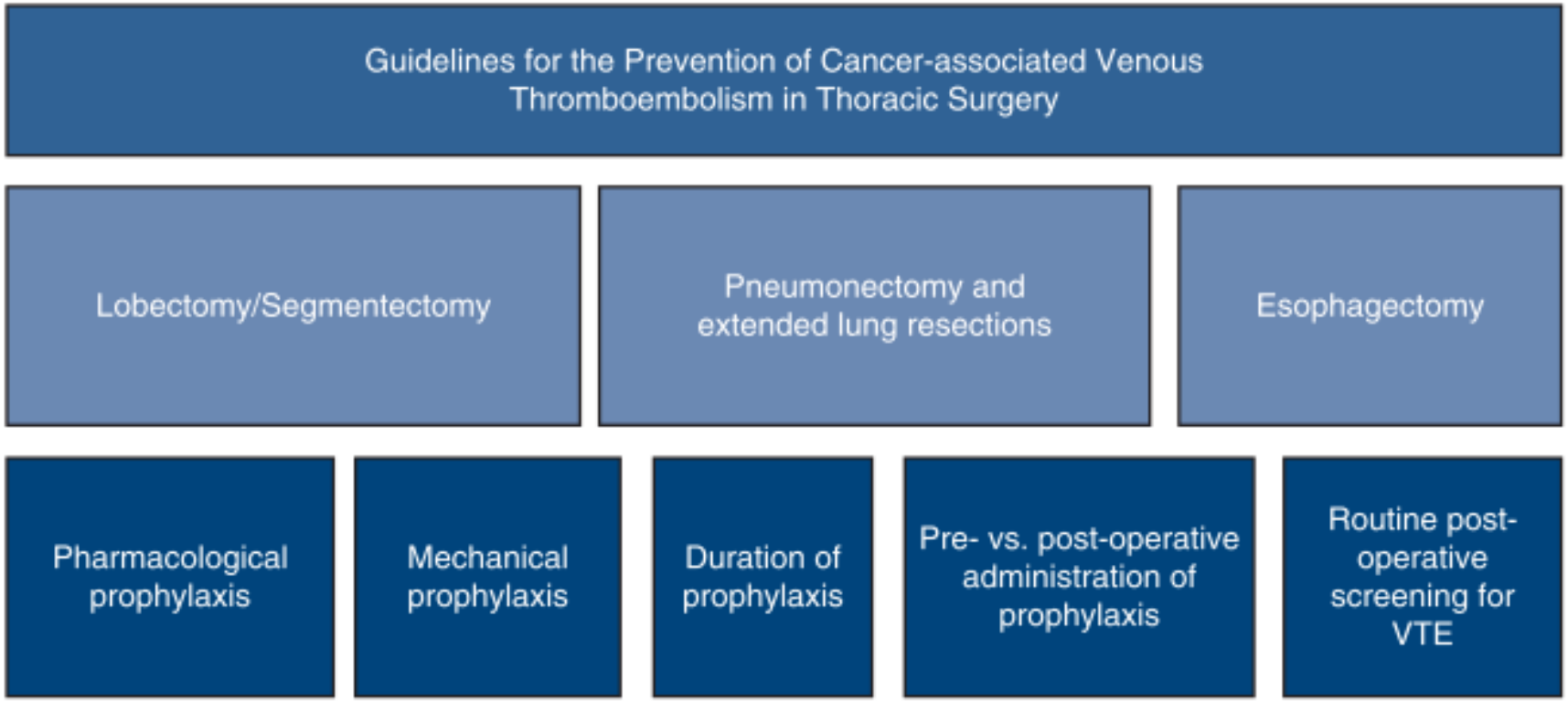


FIGURE 1. Target populations and interventions addressed by the recommendations. *VTE*, Venous thromboembolism.

J Thorac Cardiovasc Surg. 2023 Mar;165(3):794-824.e6.

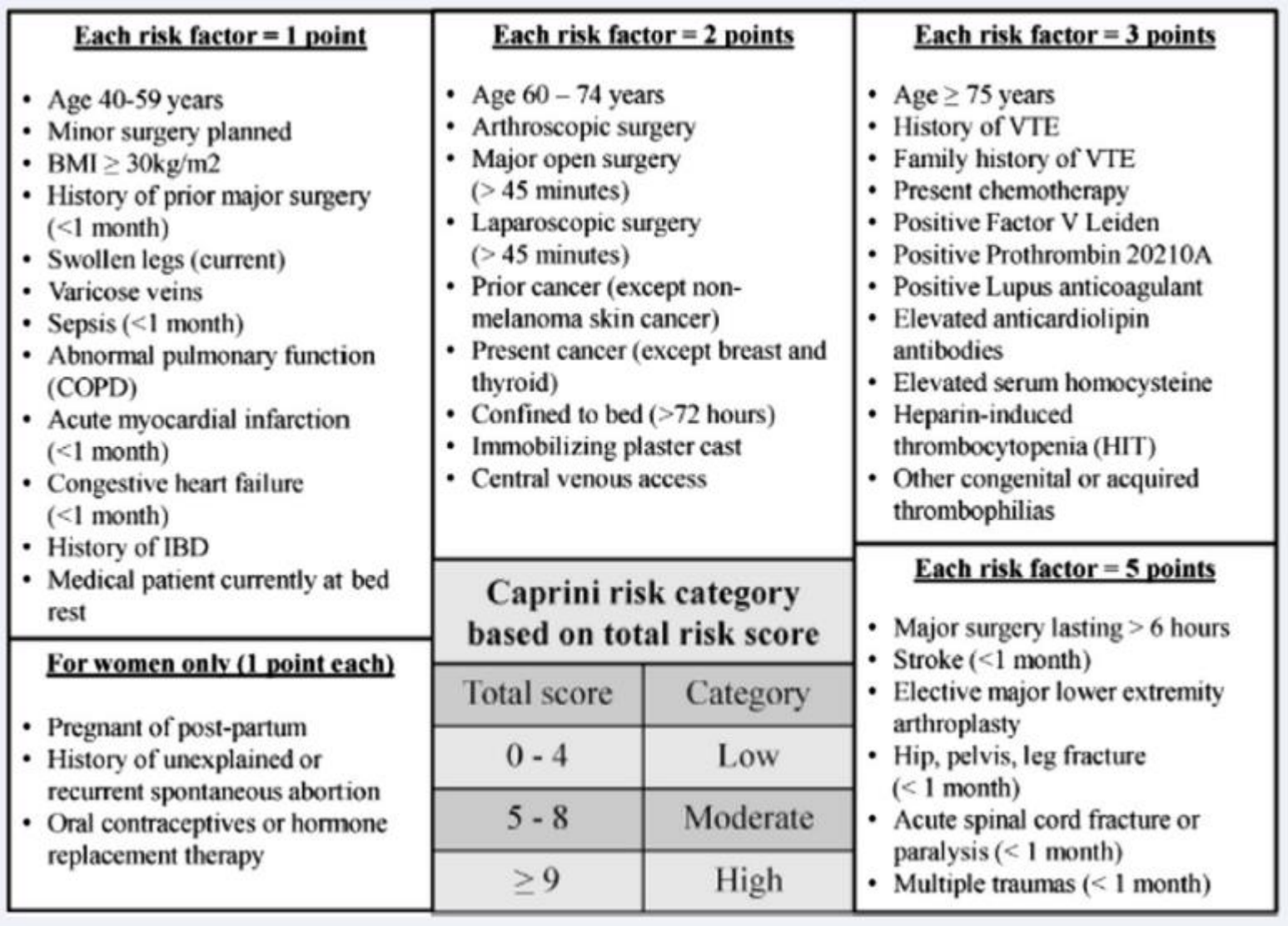
Prioritized clinical questions

Lobectomy/segmentectomy

- Should a parenteral anticoagulant (UFH, LMWH given subcutaneously) vs no thromboprophylaxis be used for patients undergoing lung resection?
- Should LMWH vs UFH be used for thromboprophylaxis in patients undergoing lung resection?
- Should DOAC vs non-DOAC anticoagulant be used for thromboprophylaxis in patients undergoing lung resection?
- Should mechanical prophylaxis (GCS or IPC) vs no thromboprophylaxis be used for patients undergoing lung resection who are not receiving pharmacological prophylaxis?
- Should combination of mechanical and pharmacological prophylaxis vs pharmacological prophylaxis alone be used for thromboprophylaxis in patients undergoing lung resection?
- Should extended pharmacological prophylaxis vs in-hospital prophylaxis only be used for patients undergoing lung resection?
- Should preoperative prophylaxis vs postoperative prophylaxis be used for patients undergoing lung resection?
- Should routine screening for postoperative VTE vs no routine screening be used in patients undergoing lung resection?

J Thorac Cardiovasc Surg. 2023 Mar;165(3):794-824.e6.

Caprini risk factors and score risk category



Each risk factor = 1 point

- Age 40-59 years
- Minor surgery planned
- BMI ≥ 30kg/m2
- History of prior major surgery (<1 month)
- Swollen legs (current)
- Varicose veins
- Sepsis (<1 month)
- Abnormal pulmonary function (COPD)
- Acute myocardial infarction (<1 month)
- Congestive heart failure (<1 month)
- History of IBD
- Medical patient currently at bed rest

For women only (1 point each)

- Pregnant of post-partum
- History of unexplained or recurrent spontaneous abortion
- Oral contraceptives or hormone replacement therapy

Each risk factor = 2 points

- Age 60 – 74 years
- Arthroscopic surgery
- Major open surgery (> 45 minutes)
- Laparoscopic surgery (> 45 minutes)
- Prior cancer (except non-melanoma skin cancer)
- Present cancer (except breast and thyroid)
- Confined to bed (>72 hours)
- Immobilizing plaster cast
- Central venous access

Caprini risk category based on total risk score

Total score	Category
0 - 4	Low
5 - 8	Moderate
≥ 9	High

Each risk factor = 3 points

- Age ≥ 75 years
- History of VTE
- Family history of VTE
- Present chemotherapy
- Positive Factor V Leiden
- Positive Prothrombin 20210A
- Positive Lupus anticoagulant
- Elevated anticardiolipin antibodies
- Elevated serum homocysteine
- Heparin-induced thrombocytopenia (HIT)
- Other congenital or acquired thrombophilias

Each risk factor = 5 points

- Major surgery lasting > 6 hours
- Stroke (<1 month)
- Elective major lower extremity arthroplasty
- Hip, pelvis, leg fracture (< 1 month)
- Acute spinal cord fracture or paralysis (< 1 month)
- Multiple traumas (< 1 month)

J Thorac Cardiovasc Surg. 2023 Mar;165(3):794-824.e6.

Recommendation

- Postoperative VTE : 4.5~13.9%
- Based on clinical consensus
- LMWH>UFH vs. no prophylaxis or DOAC
- Mechanical prophylaxis vs. no prophylaxis
- Moderate or high risk thrombosis, extended prophylaxis for 28-35 days over in hospital prophylaxis only
- Low risk thrombosis, in-hospital prophylaxis over extended prophylaxis
- Routine postoperative screening for VTE : against for lobectomy/segmentectomy, suggest for pneumonectomy, extended lung resection and esophagectomy

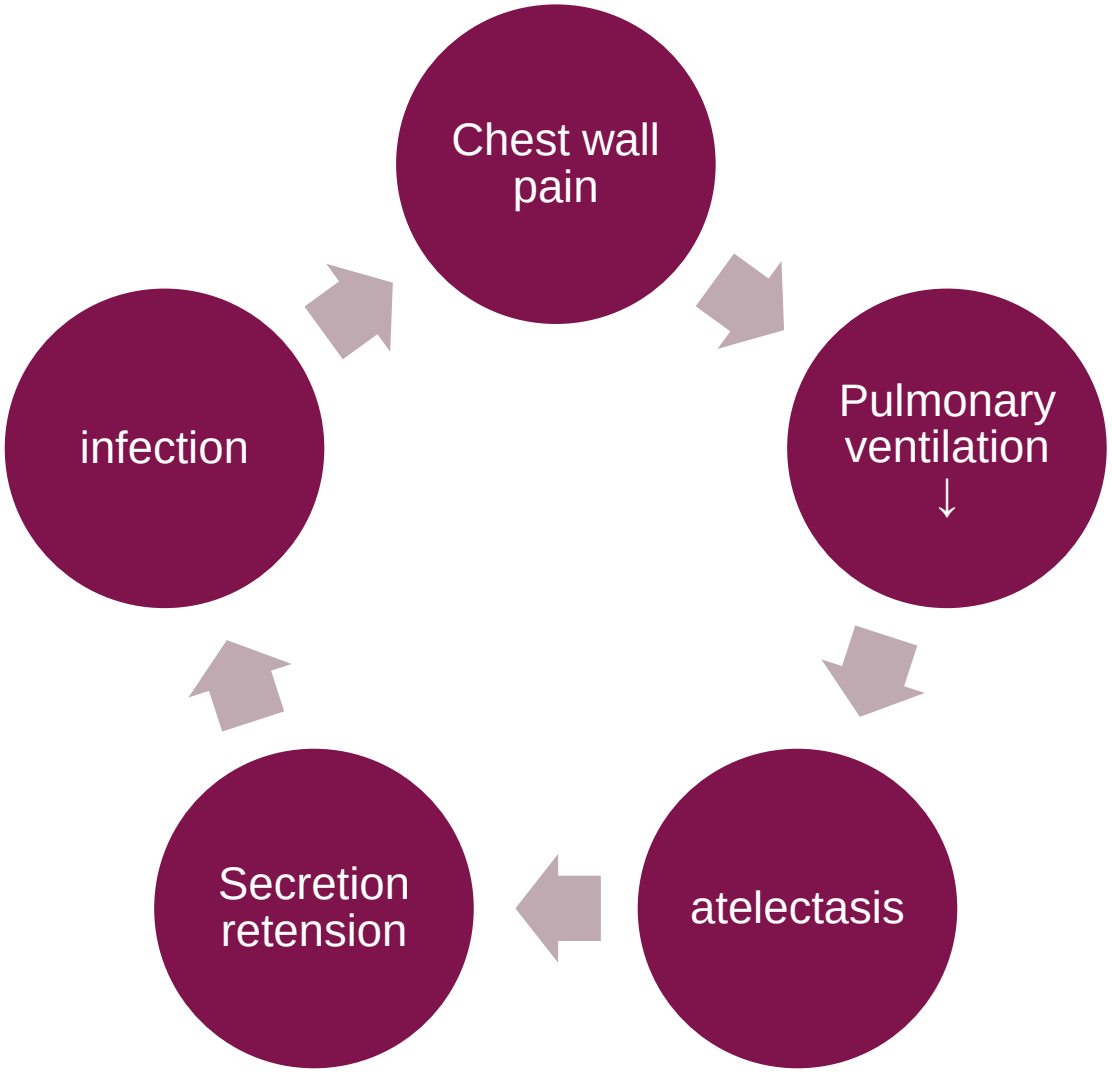
J Thorac Cardiovasc Surg. 2023 Mar;165(3):794-824.e6.

Preoperative antibiotic prophylaxis

- surgical site infection (SSI) ↓
- No effect on the rate of POP or empyema
- Extended postoperative antibacterial prophylaxis : not indicated
- Single dose of antibiotics (no more than 60 min prior to skin incision)

Eur J Cardiothorac Surg. 2019 Jan 1;55(1):91-115.

Postoperative pneumonia



J Pers Med. 2023 Feb 18;13(2):358. doi: 10.3390/jpm13020358.

Postoperative pneumonia (POP)

- Incidence : 2.9-10.7%
- Risk factors
  - Older age
  - Male
  - COPD, low FEV_1
  - Smoking
  - Obesity
  - Type of operation
  - Hx. of pneumonia

Respir Med. 2015;109(10):1340-6.

Respiratory Medicine 109 (2015) 1340–1346

Contents lists available at ScienceDirect

Respiratory Medicine

journal homepage: www.elsevier.com/locate/rmed

Risk factors for postoperative pneumonia after lung cancer surgery and impact of pneumonia on survival

Dennis F. Simonsen [a, *], Mette Søgaard [a], Imre Bozi [a], Charles R. Horsburgh [b], Reimar W. Thomsen [a]

[a] Department of Clinical Epidemiology, Institute of Clinical Medicine, Aarhus University Hospital, Aarhus, Denmark
[b] Department of Epidemiology, Boston University School of Public Health, Boston, MA, USA

- 1995~2011
- Population base cohort of 479 patients with LC surgery in Denmark

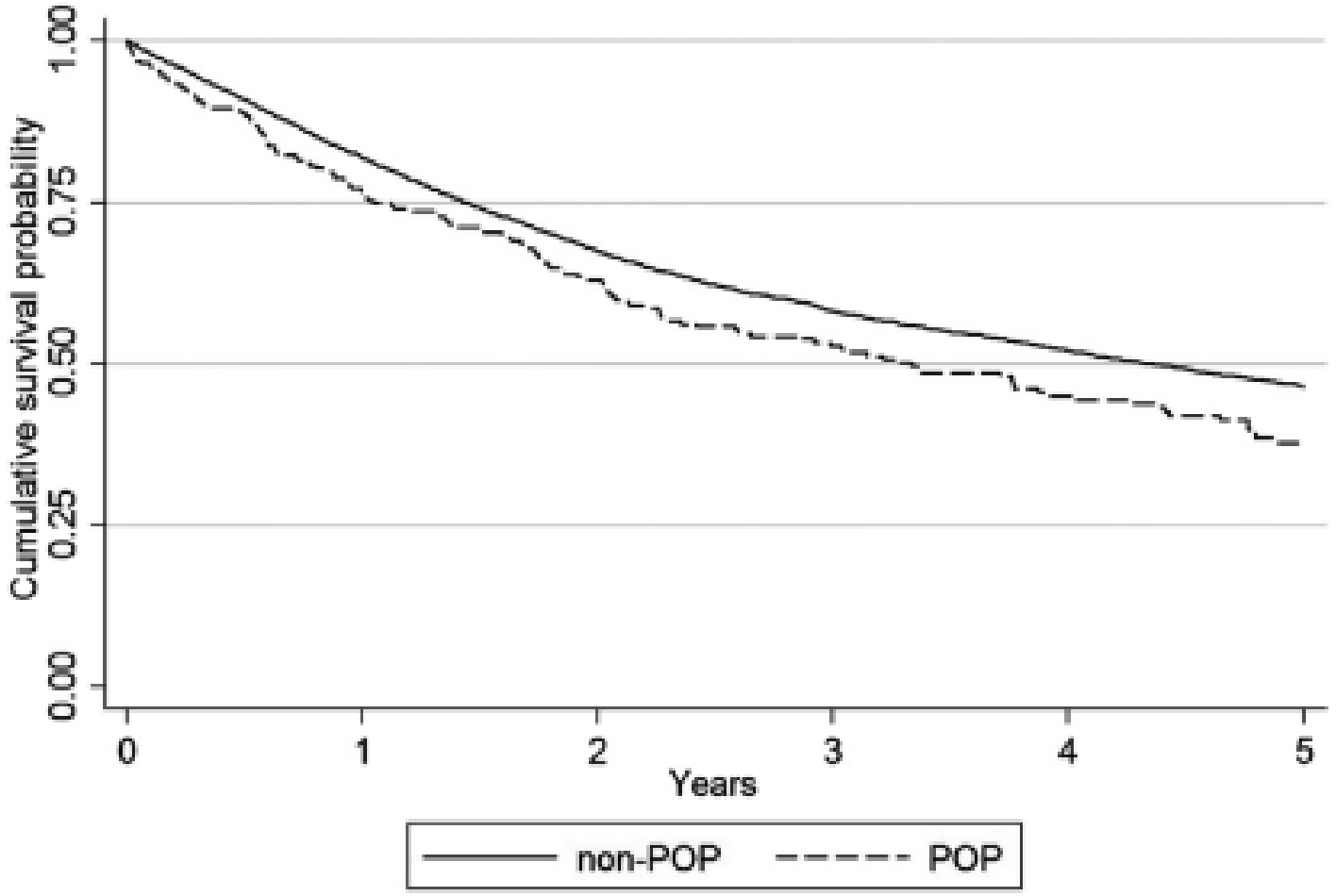
Respir Med. 2015;109(10):1340-6.

Preoperative risk factors for POP

Variables	Crude OR of POP (95% CI)	Adjusted OR of POP (95% CI)
Male sex	1.53 (1.19–1.96)	1.39 (1.08–1.80)
Age groups (in years)		
<50	0.41 (0.16–1.06)	0.44 (0.17–1.12)
50–59	1.00	1.00
60–69	1.25 (0.85–1.83)	1.16 (0.79–1.70)
70–79	1.73 (1.19–2.51)	1.51 (1.04–2.20)
≥80	4.01 (2.40–6.71)	3.64 (2.17–6.12)
Comorbidity		
CCI Score		
CCI score: 0 (low comorbidity)	1.00	1.00
CCI score: 1–2 (moderate comorbidity)	1.86 (1.44–2.42)	1.74 (1.34–2.27)
CCI score: ≥3 (severe comorbidity)	1.72 (1.16–2.55)	1.67 (1.12–2.49)
Frequent CCI comorbidities		
Cardiovascular disease	1.66 (1.25–2.21)	1.37 (1.01–1.84)
Chronic pulmonary disease	1.92 (1.43–2.58)	1.90 (1.40–2.57)
Any diabetes	1.57 (0.97–2.53)	1.40 (0.86–2.28)
Other solitary tumor	0.75 (0.46–1.22)	0.77 (0.47–1.28)
Conditions not included in the CCI		
Obesity	1.88 (0.98–3.60)	1.91 (0.99–3.69)
Alcoholism	1.55 (0.81–2.96)	1.56 (0.81–3.01)
A history of previous pneumonia	2.96 (2.26–3.89)	2.68 (2.02–3.56)
Hypertension	1.01 (0.65–1.56)	0.89 (0.57–1.38)
Atrial fibrillation	1.96 (1.16–3.31)	1.42 (0.82–2.45)
Time from diagnosis to surgery >60 days	0.95 (0.68–1.33)	1.06 (0.75–1.50)
Married	0.89 (0.70–1.14)	0.86 (0.66–1.12)
Cancer stage		
localized	1.00	1.00
regional	0.84 (0.63–1.13)	0.85 (0.63–1.14)
metastatic	0.60 (0.34–1.05)	0.62 (0.35–1.10)
unknown	1.48 (0.81–2.69)	1.48 (0.81–2.70)

Respir Med. 2015;109(10):1340-6.

Survival of patients according to the presence of POP



Respir Med. 2015;109(10):1340-6.

Respiratory tract bacterial colonization

ELSEVIER

European Journal of Cardio-thoracic Surgery 37 (2010) 752–757

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

www.elsevier.com/locate/ejcts

Trends of bacterial colonisation and the risk of postoperative pneumonia in lung cancer patients with chronic obstructive pulmonary disease

Yoshito Yamada [a,1], Yasuo Sekine [a,b,1,*], Hidemi Suzuki [a], Takekazu Iwata [a], Masako Chiyo [a], Takahiro Nakajima [a], Kazuhiro Yasufuku [a], Shigetoshi Yoshida [a]

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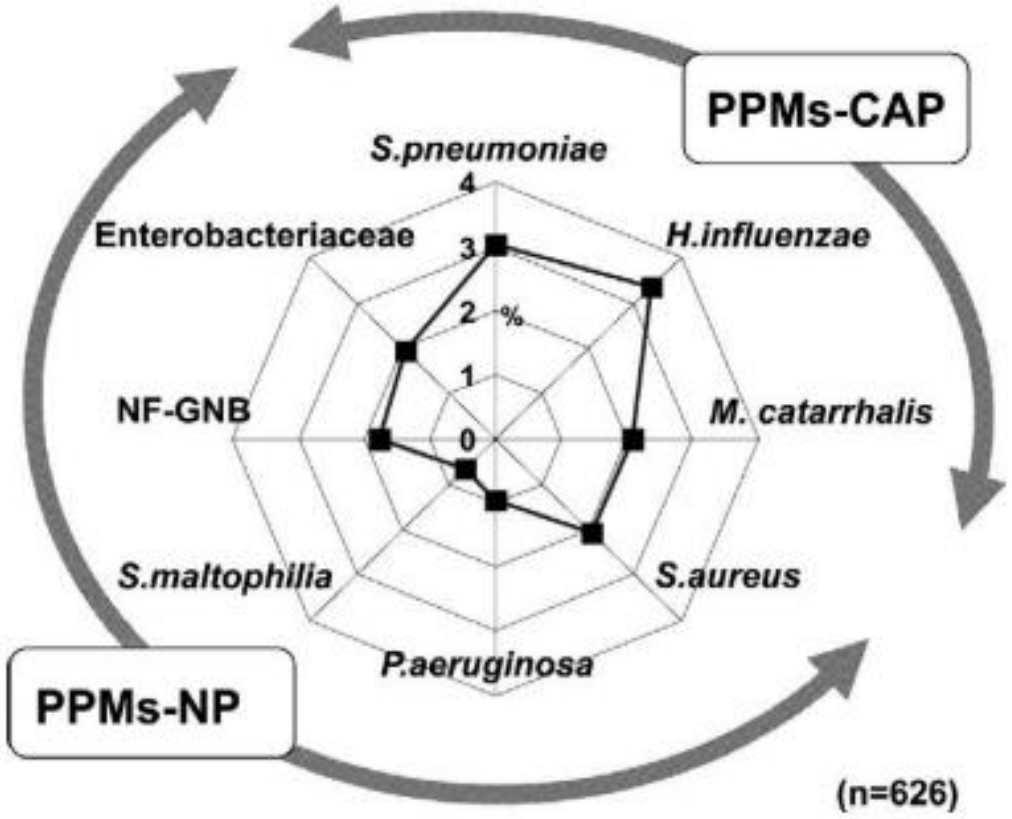
Received 7 January 2009; received in revised form 3 May 2009; accepted 7 May 2009; Available online 12 August 2009

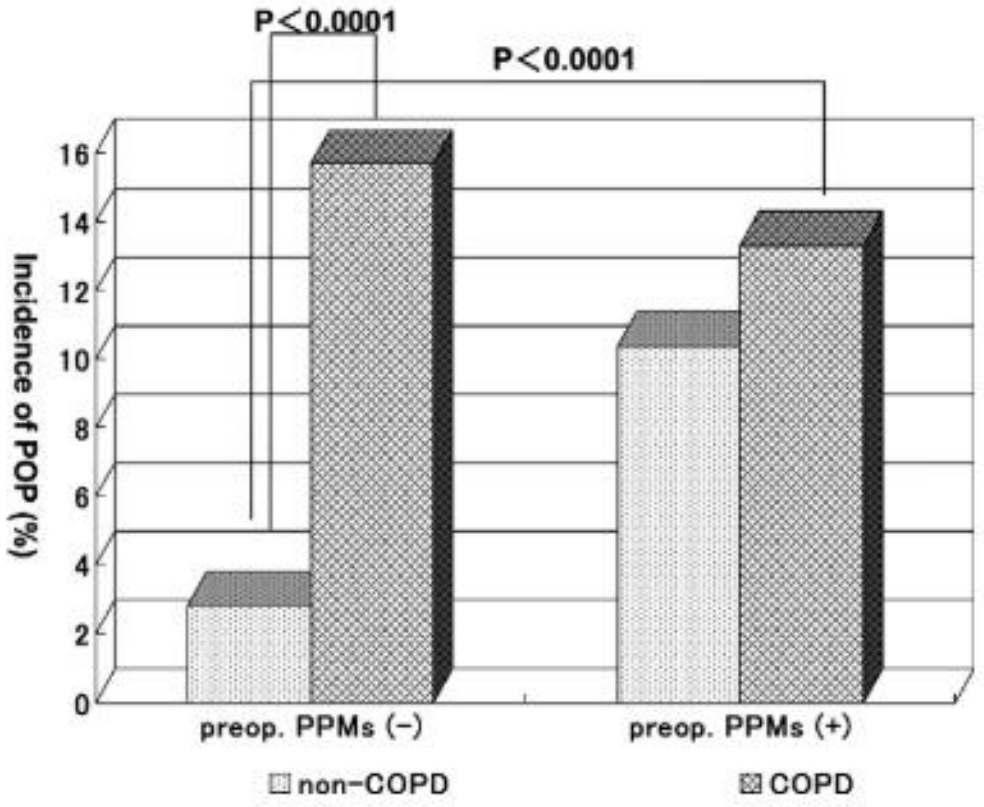
- 626 patients
- Non-COPD (n=475), COPD (n=151)

Eur J Cardiothorac Surg. 2010 Apr;37(4):752-7.

Distribution of preoperatively isolated potentially pathogenic microorganism (PPM)

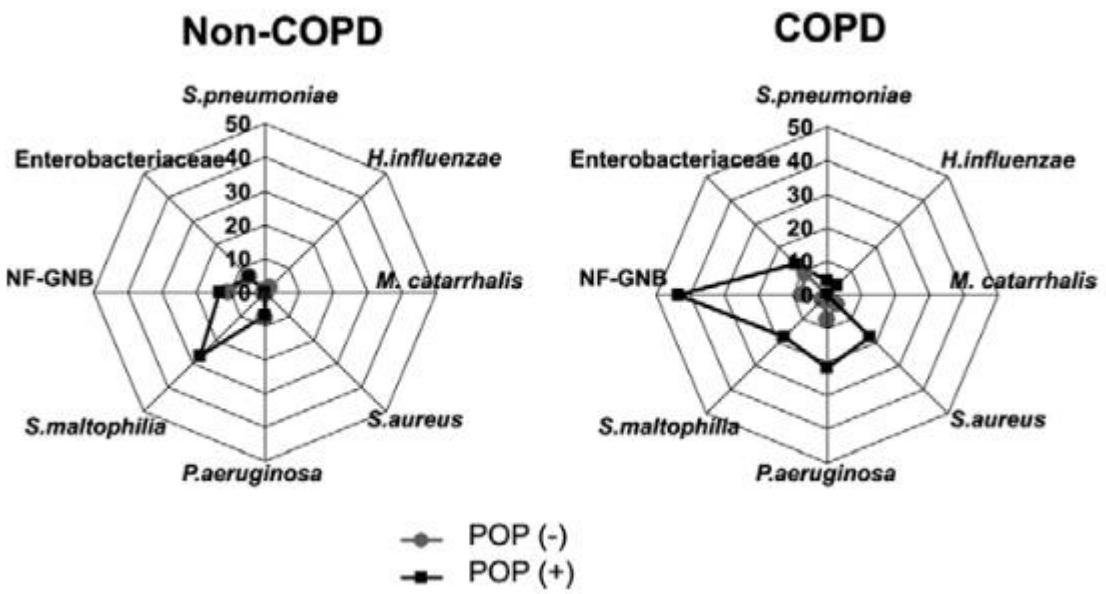


Relationship between PPM and incidence of POP



Eur J Cardiothorac Surg. 2010 Apr;37(4):752-7.

Distribution of PPMs in the non-COPD and COPD groups



Risk factors for overall mortality by proportional hazard model

Variable	Chi-square	Hazards ratio	95% CI	*p* value
Age	3.42	1.02	1.00–1.05	0.064
Male	0.27	0.84	0.44–1.62	0.602
Operation	13.0			0.002
Limited resection			1	Reference
Lobectomy	0.73	1.42	0.64–3.15	0.392
Pneumonectomy	8.68	4.75	1.69–13.40	0.003
Pathological stage	42.98			<0.0001
IA			1	Reference
IB	7.98	2.93	1.39–6.19	0.005
IIA	6.84	4.04	1.42–11.48	0.009
IIB	7.45	3.03	1.37–6.73	0.006
IIIA	30.16	6.74	3.41–13.32	<0.0001
IIIB/IV	35.13	6.30	3.43–11.57	<0.0001
FEV1/FVC	3.01	1.02	1.00–1.05	0.083
% Predicted FEV1	0.44	1.00	0.99–1.02	0.506
POP	4.98	1.92	1.08–3.39	0.023

Eur J Cardiothorac Surg. 2010 Apr;37(4):752-7.

Original Article

Influence of prophylactic antibiotic duration on postoperative pneumonia following pulmonary lobectomy for non-small cell lung cancer

Hiroyuki Deguchi, Makoto Tomoyasu, Wataru Shigeeda, Yuka Kaneko, Hironaga Kanno, Hajime Saito

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Contributions: (I) Conception and design: H Deguchi, H Saito; (II) Administrative support: H Deguchi, H Saito; (III) Provision of study materials or patients: All authors; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: H Deguchi, H Saito; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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- Retrospective study
- 477 patients who underwent radical lobectomy for NSCLC
- Cefazolin 1g prior to skin incision
- Twice a day until 72 hours after surgery vs. 3 hours after starting surgery (intraoperative)

J Thorac Dis. 2019;11(4):1155-64.

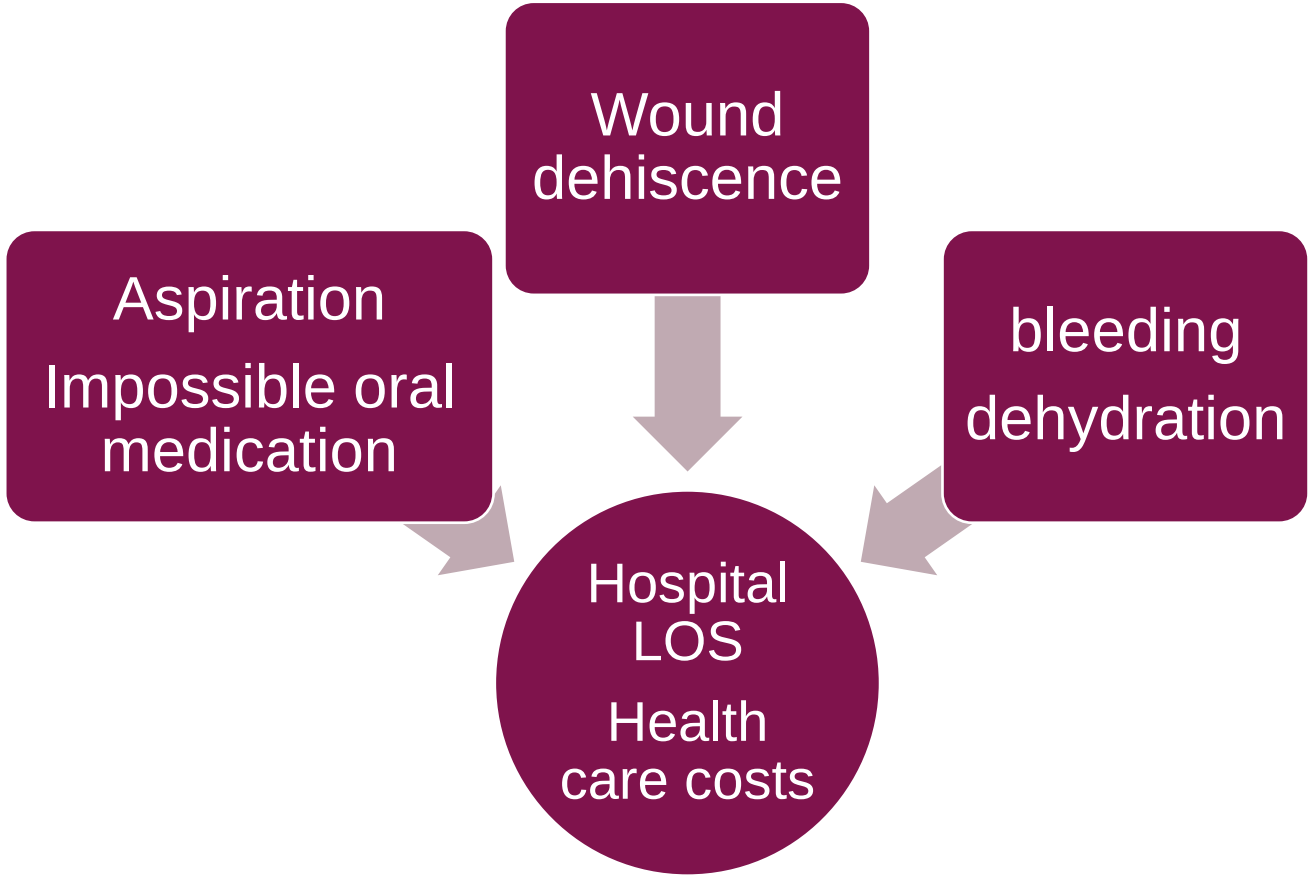
Independent risk predictors for POP in patients with NSCLC

Variable	After propensity score matching		
	OR	95% CI	P value
Age (≥70 years)	1.46	0.54–4.23	0.456
Gender (male)	6.67	1.60–30.25	0.009*
BMI (≥25 kg/m^2)	1.77	0.67–5.37	0.259
Brinkman index (≥400)	1.46	0.44–5.37	0.546
COPD (presence)	1.18	0.41–3.33	0.753
Interstitial pneumonia (presence)	1.91	0.51–8.53	0.343
Steroid therapy (presence)	1.91	0.51–8.53	0.343
Cerebrovascular disease (presence)	1.07	0.26–3.63	0.917
Diabetes mellitus (presence)	1.64	0.59–4.31	0.329
Predicted VC (<2,500 mL)	2.92	0.78–11.24	0.110
Predicted FEV_1 (<1,700 mL)	1.34	0.38–4.83	0.649
Predicted $\%D_{LCO}$ (<60%)	2.49	0.52–10.69	0.243
Tumor size (>30 mm)	2.82	0.98–9.40	0.056
Lymph node metastasis (positive)	2.98	0.99–8.25	0.051
Approach (complete VATS)	0.63	0.14–3.07	0.547
Operation time (>240 min)	1.41	0.52–4.03	0.507
Blood loss (>100 mL)	2.75	0.53–23.02	0.242
Prolonged air leakage (presence)	2.38	0.31–3.14	0.217
Prophylactic antibiotics (short period)	6.82	2.51–21.96	<0.001*

J Thorac Dis. 2019;11(4):1155-64.

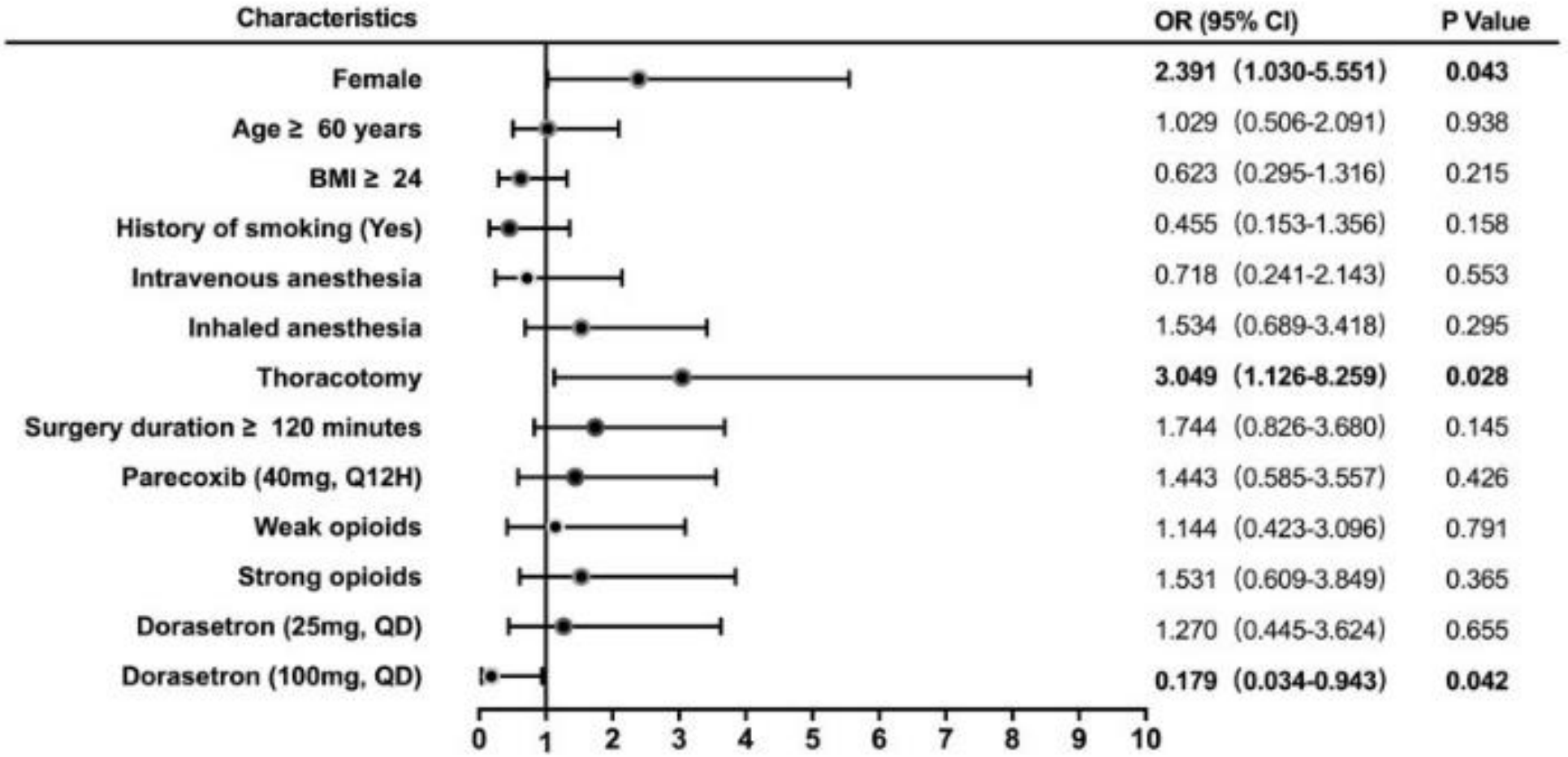
Post op nausea/vomiting (PONV)

- Incidence: 20-30%



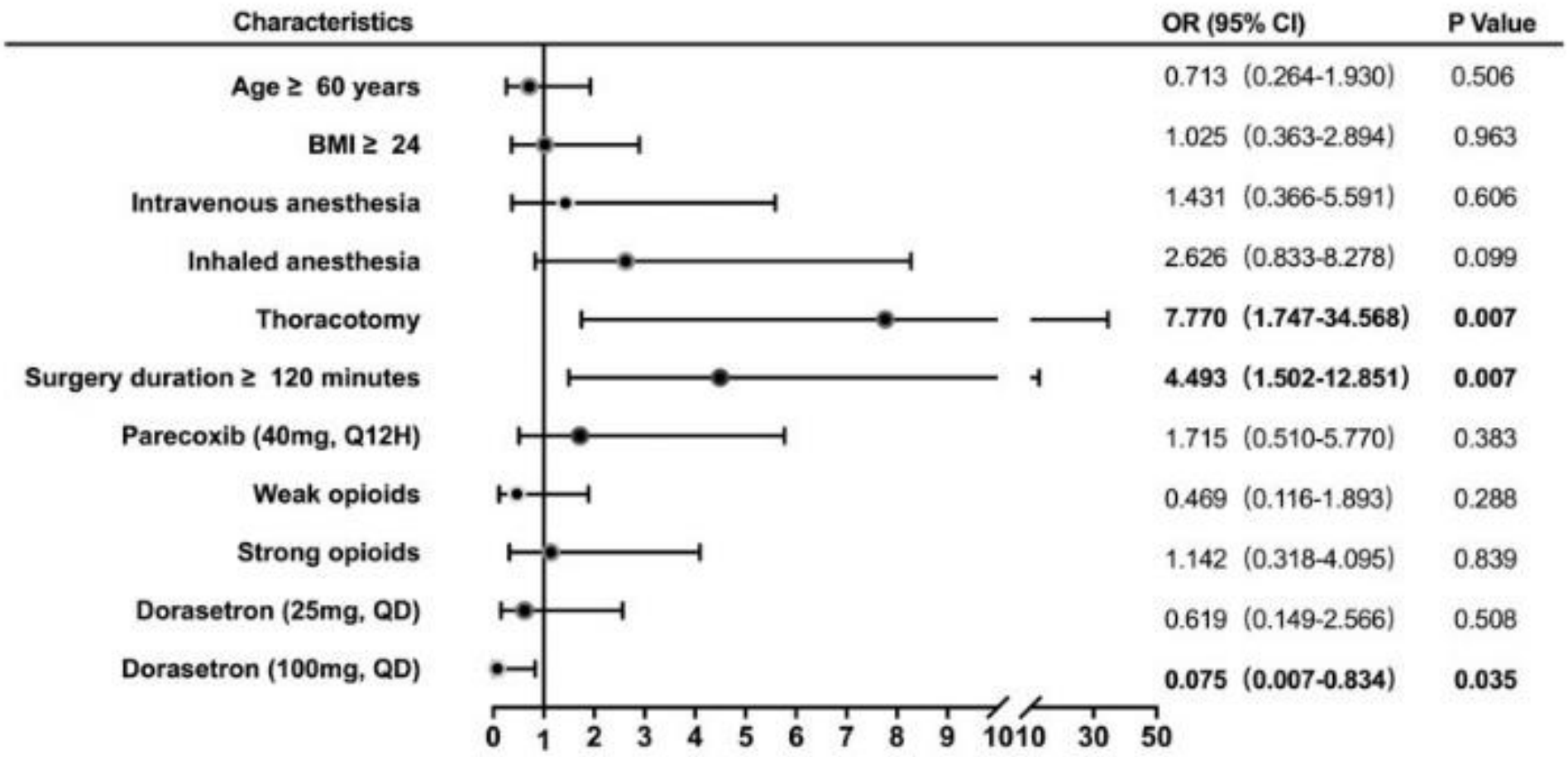
J Int Med Res. 2022 Jun;50(6):3000605221105343.

Incidence and risk factors of PONV



J Int Med Res. 2022 Jun;50(6):3000605221105343.

Incidence and risk factors of PONV in female patients



J Int Med Res. 2022 Jun;50(6):3000605221105343.

Strategy

- Preoperative carbohydrate loading with the avoidance of fasting and dehydration
- Intraoperative use of TIVA with propofol (vs. desflurane)
- Pharmacological control
  - 5-HT3 receptor antagonists
  - Neurokinin-1 receptor antagonist
  - corticosteroids

Eur J Cardiothorac Surg. 2019 Jan 1;55(1):91-115.

European Journal of Clinical Pharmacology (2022) 78:1777–1790
https://doi.org/10.1007/s00228-022-03383-2

REVIEW

Pharmacological interventions for preventing atrial fibrillation after lung surgery: systematic review and meta-analysis

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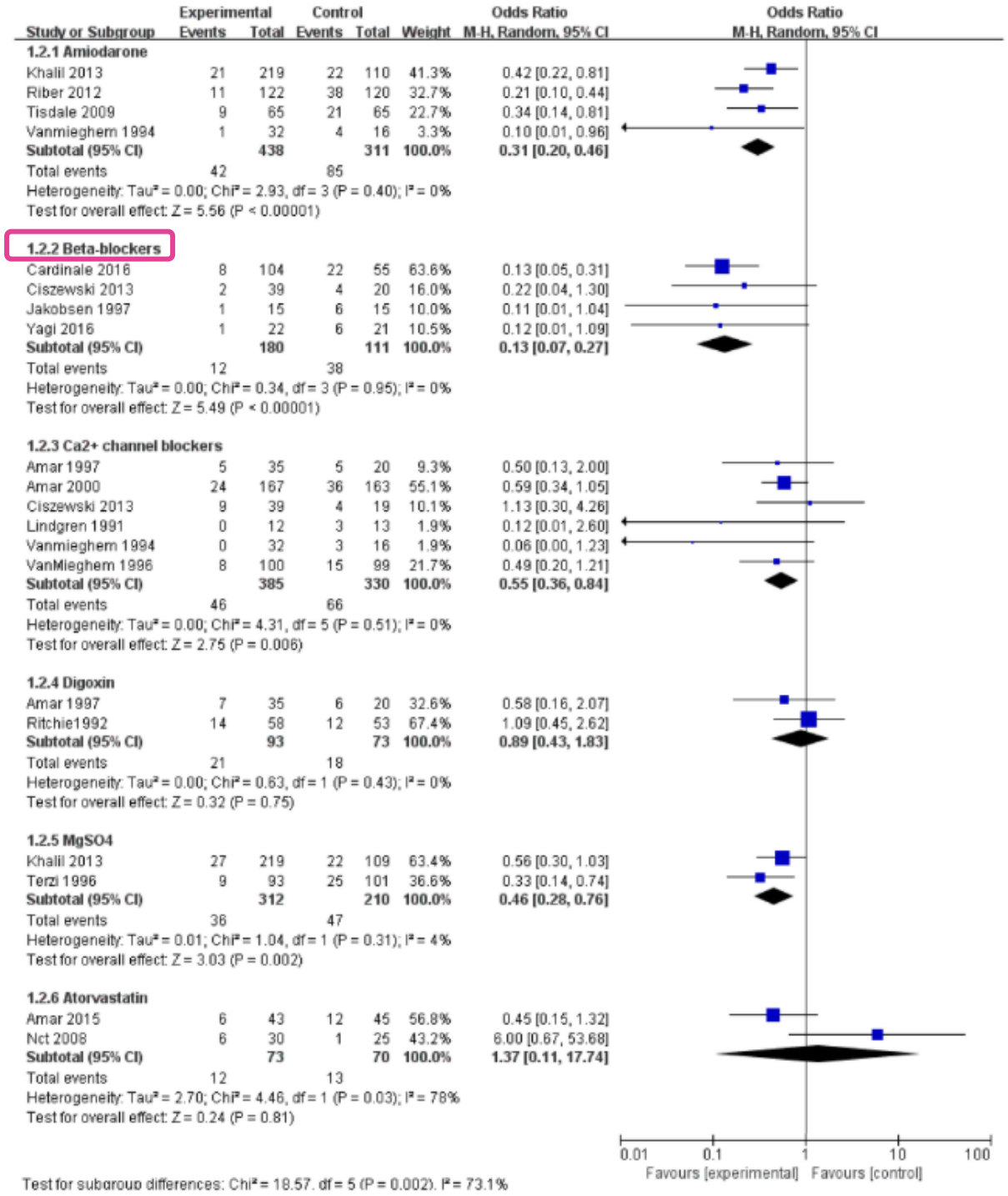
- POAF : 10-20% of incidence
  - ~46 % in patients following pneumonectomy
  - 2-3 days after surgery
  - Morbidity, mortality and long-term risk of stroke

Eur J Clin Pharmacol. 2022 Nov;78(11):1777-1790.

Effect of reducing POAF based on drug class



Eur J Clin Pharmacol. 2022 Nov;78(11):1777-1790.

Surg Today (2018) 48:404–415
https://doi.org/10.1007/s00595-017-1605-8

ORIGINAL ARTICLE

What factors determine the survival of patients with an acute exacerbation of interstitial lung disease after lung cancer resection?

Masahiro Miyajima[1] · Atsushi Watanabe[1] · Toshihiko Sato[2] · Satoshi Teramukai[3] · Masahito Ebina[4] · Kazuma Kishi[5] · Yukihiko Sugiyama[6] · Haruhiko Kondo[7] · Satoru Kobayashi[8] · Yutaka Takahashi[9] · Hiroyuki Ito[10] · Ryoji Yamamoto[11] · Shigeki Sawada[12] · Hideki Fujimori[13] · Kazunori Okabe[14] · Jun Arikura[15] · Yasushi Shintani[16] · Hiroshige Nakamura[17] · Shinichi Toyooka[18] · Tohru Hasumi[19] · Takehiro Watanabe[20] · Yoshinobu Hata[21] · Hisashi Iwata[22] · Minoru Aoki[23] · Kazuhito Funai[24] · Shuhei Inoue[25] · Osamu Kawashima[26] · Tomohiko Iida[27] · Hiroshi Date[2]

- 1,763 lung cancer cases with ILDs

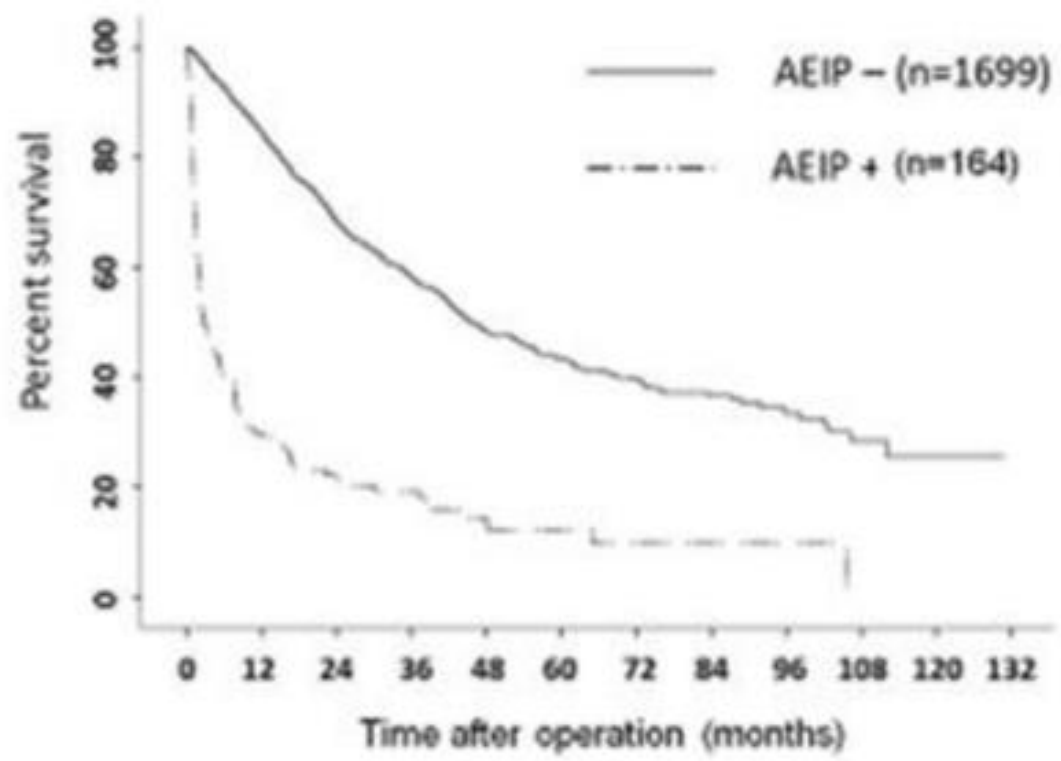
Surg Today. 2018 Apr;48(4):404-415.

Factors for mortality due to acute exacerbation

Risk Factors	*N*	Death due to AEIP (%)	OR	95% CI	*P* value
History of AEIP[a]					
–	1741	68 (3.9)	1.000	–	
+	20	4 (20)	7.346	1.924–28.05	0.004
N/A	2		–	–	
Neoadjuvant radiatio					
–	1728	68 (3.9)	1.000	–	
+	32	4 (12.5)	4.977	1.602–15.46	0.006
N/A	3		–	–	
Radiologic findings					
Non-UIP pattern	463	10 (2.2)	1.000	–	
UIP pattern	1300	62 (4.8)	2.649	1.316–5.334	0.008
Surgical procedures					
Wedge resection	275	4 (1.5)	1.000	–	
Others	1480	67 (4.5)	3.848	1.350–10.97	0.012
N/A	8		–	–	
%VC					
>80	1478	53 (3.6)	1.000	–	
≤80	263	18 (6.8)	1.989	1.122–3.525	0.019
N/A	22		–	–	
Sex					
Female	170	1 (0.6)	1.000	–	
Male	1593	71 (4.5)	8.621	1.180–62.50	0.034
Comorbidity:Emphysema					
–	1167	56 (4.8)	1.000	–	
+	589	16 (2.7)	0.549	0.308–0.980	0.043
N/A	7		–	–	
Preoperative steroid use					
–	1651	63 (3.8)	1.000	–	
+	103	9 (8.7)	2.345	1.005–5.470	0.049
N/A	9		–	–	

Surg Today. 2018 Apr;48(4):404-415.

Survival rate according to AEIP

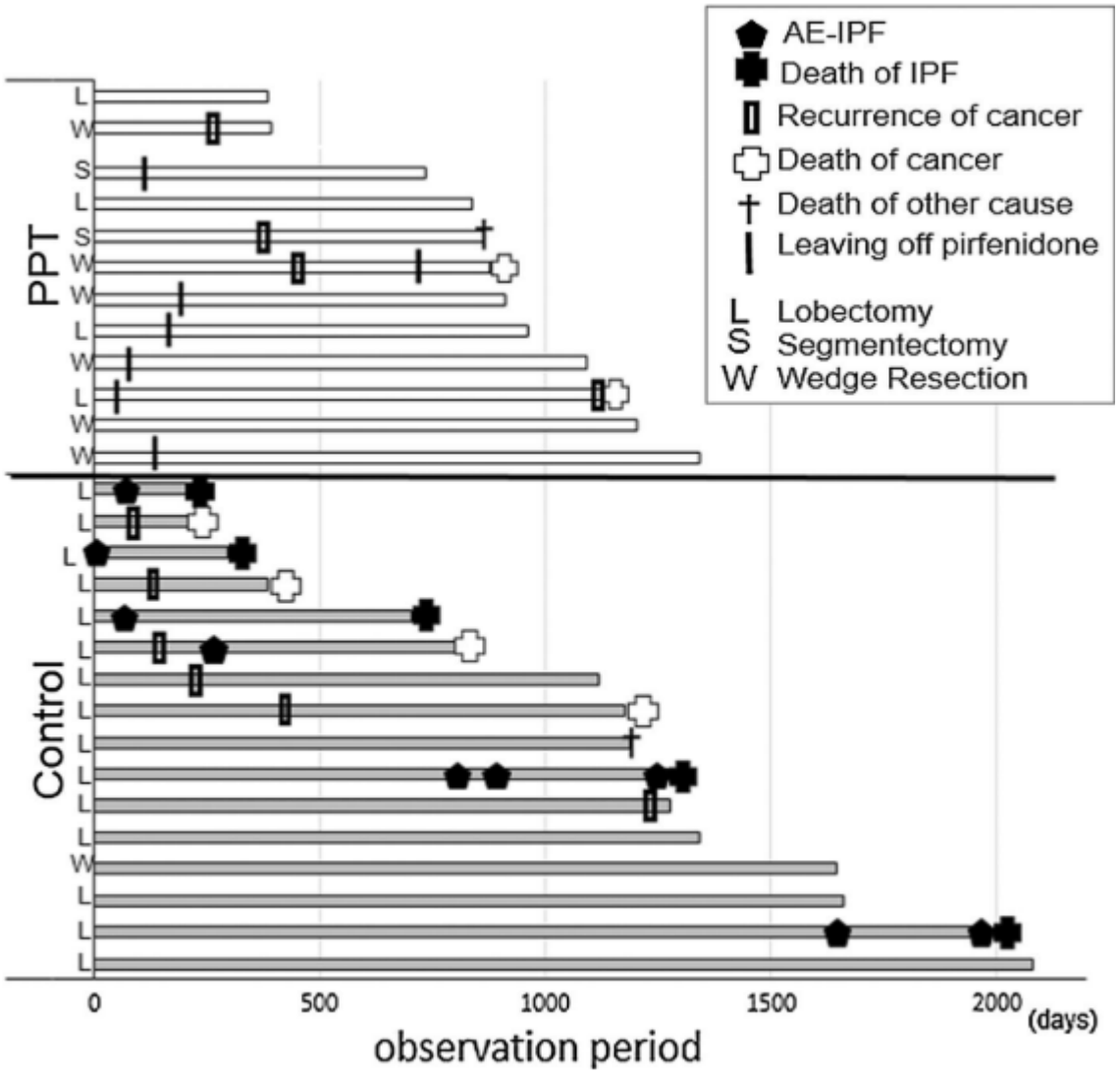


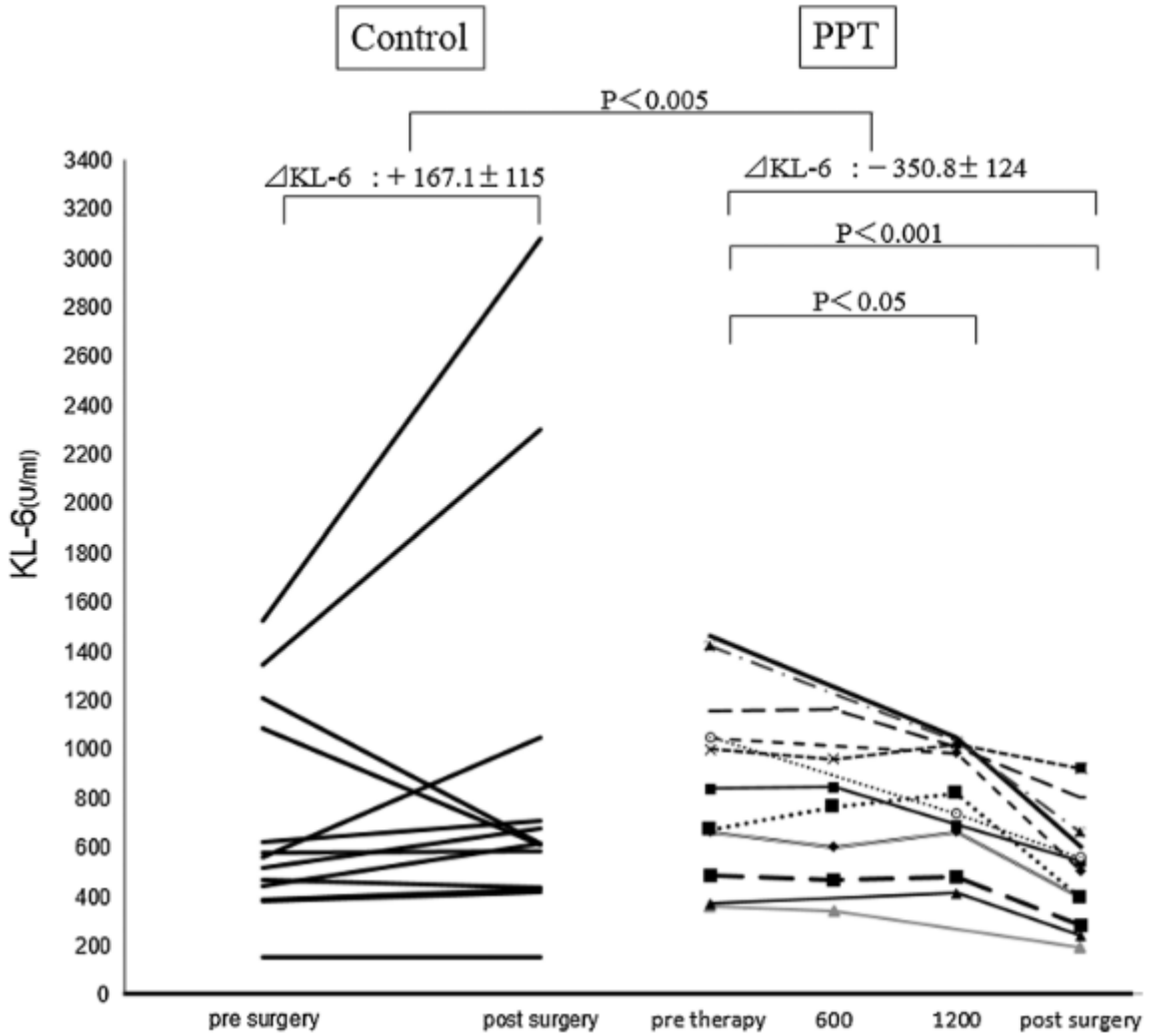
Surg Today. 2015 Oct;45(10):1263-70.

Surg Today (2015) 45:1263–1270
DOI 10.1007/s00595-014-1071-5

ORIGINAL ARTICLE

Prophylactic drug?





Surg Today. 2015 Oct;45(10):1263-70.

Study Protocol

A randomized controlled phase III trial protocol: perioperative pirfenidone therapy in patients with non-small cell lung cancer combined with idiopathic pulmonary fibrosis to confirm the preventative effect against postoperative acute exacerbation: the PIII-PEOPLE study (NEJ034)

Yuichi Sakairi[1]^, Ichiro Yoshino[1], Takekazu Iwata[2], Shigetoshi Yoshida[3], Kazuyoshi Kuwano[4], Arata Azuma[5], Shuji Sakai[6], Kunihiko Kobayashi[7]; on behalf of the North East Japan Study Group

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Contributions: (I) Conception and design: Y Sakairi, I Yoshino, T Iwata; (II) Administrative support: K Kobayashi; (III) Provision of study materials or patients: North East Japan Study Group; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: S Yoshida, K Kobayashi, A Azuma, S Sakai; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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J Thorac Dis 2023;15(3):1486-1493

ELSEVIER

European Journal of Cardio-thoracic Surgery 33 (2008) 424–429

EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

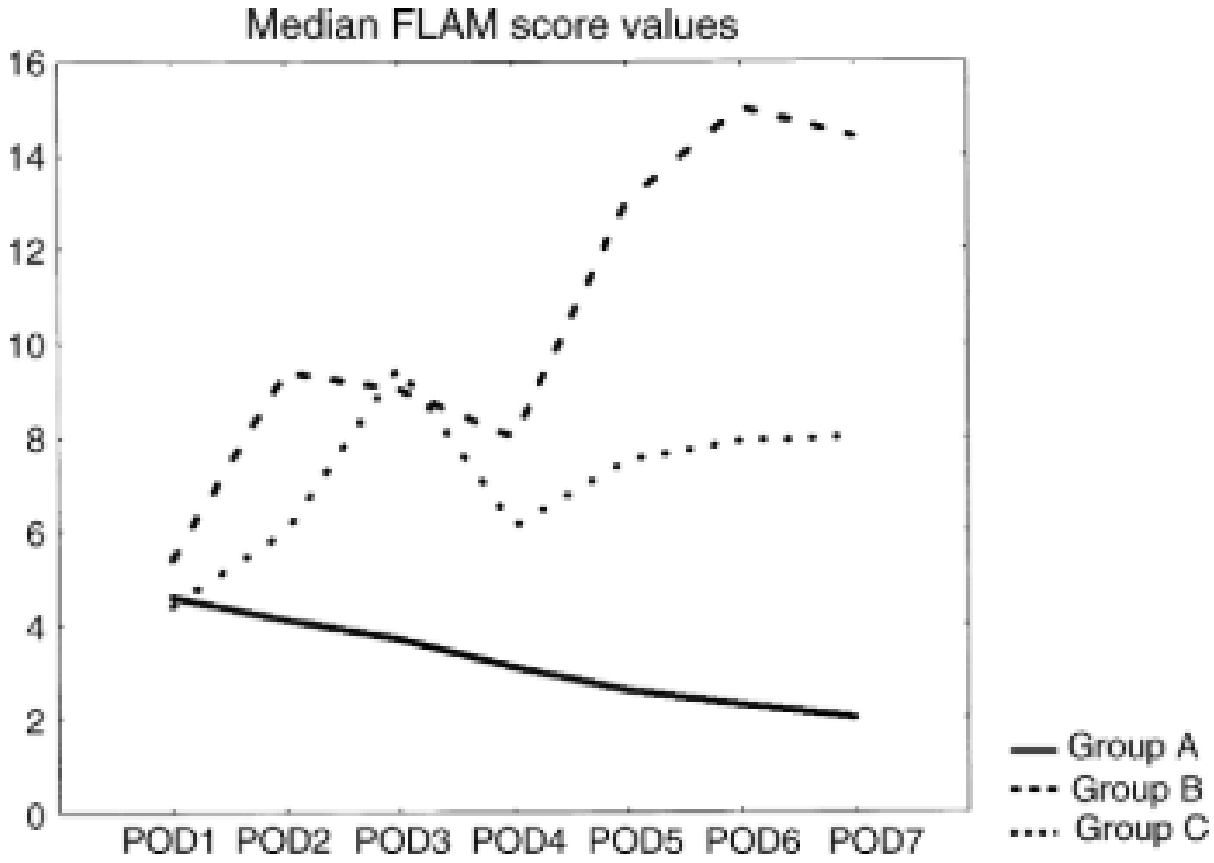
www.elsevier.com/locate/ejcts

Postoperative exacerbation of chronic obstructive pulmonary disease. Does it exist?☆

Francesco Lee[a,*] Nicolas Venissac[b] Daniel Pop[b] Piergiorgio Solli[c]

Parameter	Score		
Dyspnea: defined as a respiratory rate ≥20/min lasting more than 2 min or associated with a decrease in pulse oximetry ≥10% from the last value recorded	0 point: no dyspnea	5 points: dyspnea present only during chest physiotherapy or active mobilisation	10 points: dyspnea at rest
Oxygen	0–15 points: the highest rate of oxygen delivery (in number of litres of oxygen/min), to a maximum of 15 l/min, delivered over the previous 24-h period to maintain a haemoglobin saturation ≥94% as recorded by pulse oximetry		
Chest X-ray	0 point: no abnormality	5 points: lobar atelectasis or lobar infiltrates	10 points: complete atelectasis, partial atelectasis after pneumonectomy, pneumonia involving the entire lung, and bilateral pneumonia
Quality of bronchial secretions	0 point: absent or mucous secretions	1 point: mucopurulent secretions	2 points: purulent secretions
Quantity of bronchial secretions	0 point: less than 5 ml/24 h	1 point: between 5 and 10 ml/24 h	2 points: greater than 10 ml/24 h
Cough	0 point: efficient	1 point: partially ineffective	2 points: ineffective
Auscultation	0 point: no anomaly	1 point: secretion soundings resolved by cough	2 points: secretion soundings not resolved by cough

Eur J Cardiothorac Surg. 2008 Mar;33(3):424-9.



- Regular Bronchodilator
- Management
  - Steroid
  - Bronchodilator
  - NIV

Eur J Cardiothorac Surg. 2008 Mar;33(3):424-9.

Summary

- Recommendation of ERAS society
  - Smoking cessation : at least 4 weeks before surgery
  - Rehabilitation
  - VTE prophylaxis
  - Antibiotics prophylaxis : skin infection / POP
  - PONV control
  - A. fib prevention
- ILD
- COPD

Thank you for your listening

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