La ventilation mécanique périopératoire

Quoi de neuf en 2024?

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Objectifs

- Revoir le consensus d'experts récent sur la ventilation mécanique protectrice pour le patient chirurgical
- Avoir un aperçu des nouveautés dans la littérature au sujet de la ventilation périopératoire

Conflit d’intérêt

- Consultant pour le groupe d’échographie “point-of-care” de GE Healthcare

Pourquoi devrions-nous nous soucier des complications respiratoires post-opératoires?

Complications respiratoires post-opératoires

Variable	All patients	Low risk of PPCs	Increased risk of PPCs
Postoperative pulmonary complications			
Total PPCs[a]	10.4 (1004/9697)	7.0 (467/6675)	19.2 (505/2632)
Unplanned supplemental O_2[b]	8.5 (826/9697)	5.8 (390/6675)	15.5 (408/2632)
Respiratory failure	1.6 (156/9697)	0.9 (60/6675)	3.4 (90/2632)
Invasive MV	1.1 (107/9697)	0.6 (41/6675)	2.3 (61/2632)
ARDS	0.1 (9/9697)	0.0 (1/6675)	0.3 (8/2632)
Pneumonia	0.4 (40/9697)	0.1 (10/6675)	1.1 (28/2632)
Pneumothorax	0.1 (13/9697)	0.1 (8/6675)	0.2 (4/2632)
Postoperative outcome			
Length of hospital stay	1.0 [0.0 to 4.0]	1.0 [0.0 to 3.0]	4.0 [1.0 to 7.0]
In-hospital mortality	0.6 (56/8973)	0.2 (13/6163)	1.7 (41/2445)
Hospital-free days[c]	26.0 [23.0 to 27.0]	26.0 [24.0 to 27.0]	23.0 [21.0 to 26.0]

LAS VEGAS investigators. Eur J Anaesthesiol. 2017; 34(8): 492-507.

Complications respiratoires post-opératoires

Variable	All Patients (N = 1202)	Hospital		ICU		7-d Mortality (n = 9)
		Patients, No. (%) (n = 1179)	LOS, Median (IQR), d	Patients, No. (%) (n = 270)	LOS, Median (IQR), d	
No. of PPCs						
0	801 (66.6)	781 (97.5)	3 (2-6)	133 (16.6)	1 (1-2)	0 (0)
1	231 (19.2)	228 (98.7)	5 (4-8)	57 (24.7)	2 (1-4)	0 (0)
2	91 (7.6)	91 (100.0)	8 (5-14)	35 (38.5)	3 (1-6)	3 (3.3)
3	58 (4.8)	58 (100.0)	9 (5-15)	32 (55.2)	4 (2-7)	4 (6.9)
4	17 (1.4)	17 (100.0)	8 (7-18)	9 (52.9)	7 (6-15)	2 (11.8)
5	2 (0.2)	2 (100.0)	22 (21-22)	2 (100.0)	14 (9-18)	0 (0)
6	2 (0.2)	2 (100.0)	25 (24-26)	2 (100.0)	9 (6-11)	0 (0)
At least 1 PPC	401 (33.4)	398 (99.3)[a]	6 (4-11)[b]	137 (34.2)[b]	3 (2-6)[b]	9 (2.3)[b]
RR or MDiff (95% CI), (≥1 PPC vs 0 PPCs)	NA	1.02 (1.00-1.03)	3.0 (2.0-5.3)	2.1 (1.7-2.5)	2.0 (0.7-3.0)	ND[c]

Fernandez-Bustamante A, Frendl G, Sprung J, et al. JAMA Surg. 2017; 152(2): 157-66.

<u>266 millions</u> de chirurgies en 2015

Holmer H, Bekele A, Hagander L, et al. Br J Surg. 2019; 106(2): e139-50.

SPECIAL ARTICLE

Lung-protective ventilation for the surgical patient: international expert panel-based consensus recommendations

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Young CC, Harris EM, Vacchiano C, et al. Br J Anaesth. 2019; 123(6): 898-913.

Recommandations sur la ventilation protectrice

- Processus
- Recommandations
  - Évaluation du risque pulmonaire
  - Préparation du cas
  - Induction de l'anesthésie
  - Maintien de l'anesthésie
  - Manoeuvres de recrutement
  - Émergence de l'anesthésie
- Littérature actuelle et mise en contexte

Évaluation du risque pulmonaire

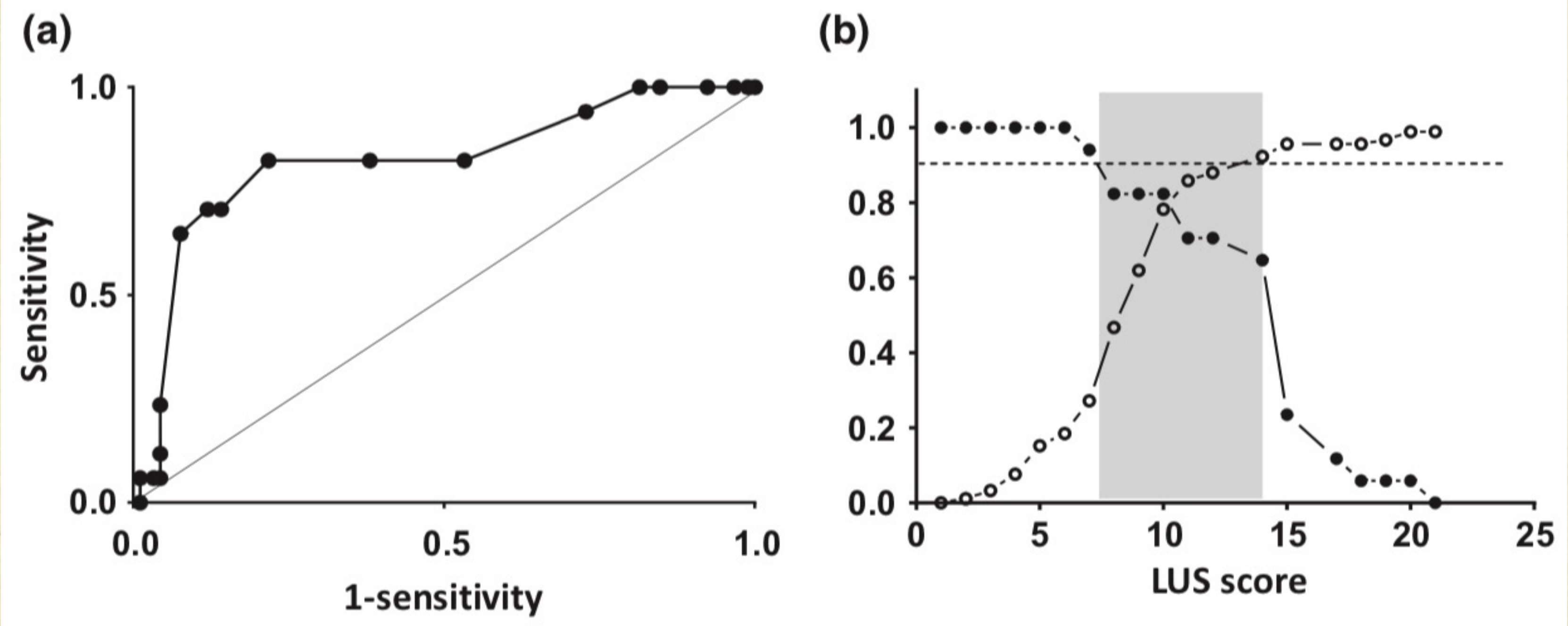
Question	Statement/recommendation	Consensus (%)	Quality of evidence	Strength of recommendation
1.1	A dedicated score should be used for risk evaluation.	100	☒☒☐☐	Strong
	The greatest risk factors for PPCs include age >50 yr, BMI >40 kg m^{-2}, ASA >2, OSA, preoperative anaemia, preoperative hypoxaemia, emergency or urgent surgery, ventilation duration >2 h, and intraoperative factors (such as haemodynamic impairment and low oxyhaemoglobin saturation).	100	☒☒☐☐	Statement
1.2	Use a low-tidal-volume protective-ventilation strategy (6–8 ml kg^{-1} PBW). ZEEP is not recommended. Appropriate PEEP and recruitment manoeuvres may improve intraoperative respiratory function and prevent PPCs.	86	☒☒☒☐	Strong
1.3	The formation of perioperative clinically significant atelectasis may be an important risk factor for the development of PPCs.	100	☒☒☒☒	Statement

Hypothèse

Atélectasie intraopératoire → Atélectasie postopératoire → Complication respiratoire postopératoire

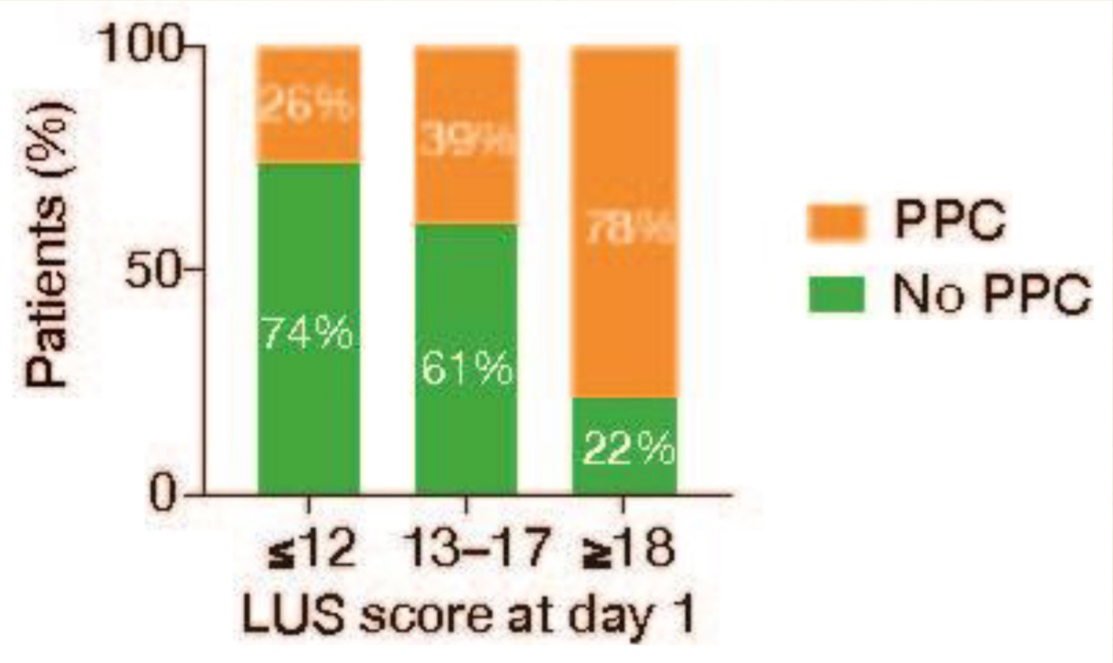
Atélectasie
Pneumonie
ARDS

Atélectasie post-opératoire



Dransart-Rayé O, Roldi E, Zieleskiewicz L, et al. Anaesthesia 2020; 75(2): 202-9.

Atélectasie post-opératoire



Boussier J, Lemasle A, Hantala N, et al. Anesthesiology 2023; 140(3): 417-29.

Atélectasie post-opératoire

Table 2. LUS Performed in the Postanesthesia Care Unit According to the PPCs

	Patients With PPCs (n = 63)	Patients Without PPC (n = 264)	*P*
Delay between extubation and the practice of ultrasound (min)	60 [30–120]	60 [30–120]	.40
LUS score anterior	3 [0–4]	1 [0–4]	.04
LUS score lateral	3 [1–6]	2 [0–4]	<.001
LUS score posterior	6 [3–8]	4 [2–6]	<.001
LUS score total	12 [7–18]	8 [4–12]	<.001
Immediate alveolar consolidation[a]	33 (52)	60 (23)	<.001
Immediate pleural effusion	11 (17)	7 (3)	<.001
Pneumothorax	4 (6)	6 (2)	.20
B-patterns[b]	51 (81)	189 (72)	.18

Zieleskiewicz L, Papinko M, Lopez A, et al. Anesth Analg 2021; 132(1): 172-81.

RCT récents

Table 1. Overview of Lung-Protective Ventilation Trials

Trial	Type of surgery	Laparoscopic (%)	n	Intervention TV (mL/kg)	Intervention PEEP[a] (cm H_2O)	Comparator TV (mL/kg)	Comparator PEEP (cm H_2O)
Asida and Badawy 2015[19]	Urology	0	104	5–7	10 +RM	10–12	0
Choi et al, 2006[20]	GI, urology	30	46	6	10	12	0
Liu et al, 2020[21]	Gynecology	100	92	7	NR[b] +RM	9	0
Park et al, 2016[22]	GI	100	62	6	5	10	0
Pi et al, 2015[23]	GI	0	66	7	8 ±RM	9	0
Severgnini et al, 2013[24]	GI	0	56	7	10 +RM	9	0
Weingarten et al, 2010[25]	GI	0	40	6	12 +RM	10	0
Chugh et al, 2019[26]	GI	0	90	6	10	10	0
Futier et al, 2013[27]	GI	21	400	6–8	6–8 +RM	10–12	0
Liu et al, 2019[28]	GI	100	120	7	NR[b] +RM	10	0
Mølsted et al, 2020[29]	Urology	100	24	6	10	10	4
Soh et al, 2018[30]	Neurosurgery	0	78	6	6 +RM	10	0
Fu et al, 2020[31]	GI	0	100	6–8	6–8 +RM	8–10	0
Huang et al, 2021[32]	Urology	100	256	6	7	9	0

Table 3. Overview of PEEP Trials

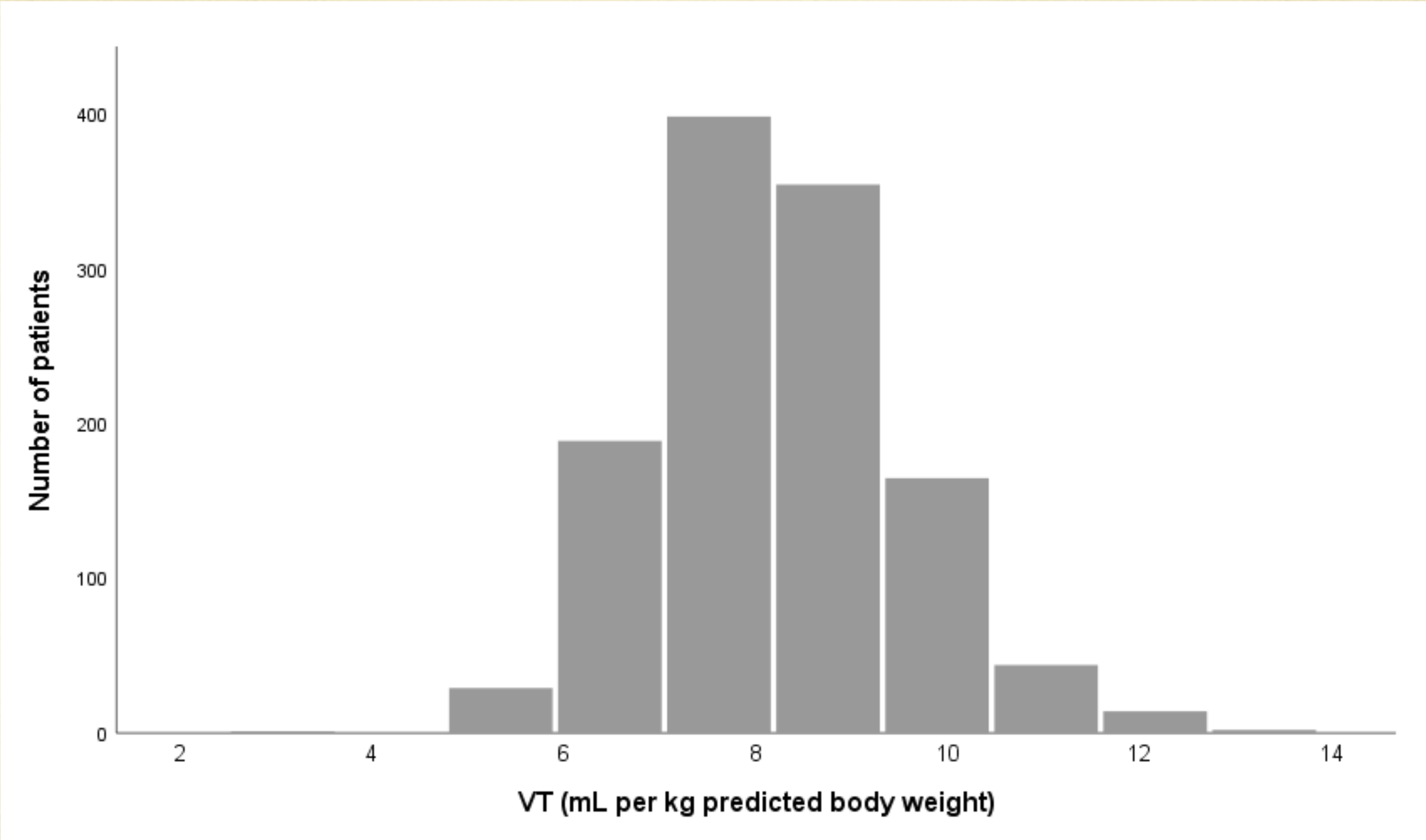
Trial	Type of surgery	Laparoscopic (%)	n	PEEP (cm H_2O) Intervention	PEEP (cm H_2O) Comparator
Individualized PEEP[a]					
Pereira et al, 2018[33]	Multiple	50	40	12 (6–16)	4
Ruszkai et al, 2020[34]	Urology	0	39	10 (8–14)	6
Wetterslev et al, 2001[35]	GI	0	40	5, 8, or 10[b]	0
Ferrando et al, 2018[36]	Multiple	38	967	10 (8–12)	5
Piriyapatsom and Phetkampang, 2020[37]	Gynecology	100	44	13 (2)	5
Nestler et al, 2017[38]	GI	100	54	18 (5)	5
Elshazly et al, 2020[39]	GI	100	40	8 (2)	4
Yoon et al, 2021[40]	Urology	100	60	14 (12–18)	7
PEEP ≥5 cm versus zero PEEP					
Kim et al, 2013[42c]	Gynecology	100	100	5	0
Talab et al, 2009[43]	GI	100	66	5 or 10[d]	0
Kim et al, 2019[45]	Urology	0	68	7	0
Almarakbi et al, 2009[41e]	GI	100	60	10	0
Abd Ellatif and Mowafy, 2020[44]	GI	100	69	5[f]	0
Wei et al, 2018[46]	GI	100	36	8	0[f]
Azab et al, 2005[47]	GI	100	30	5	0
High versus low PEEP					
Chun et al, 2019[51]	Gynecology	100	40	8	4
Bluth et al, 2019[48]	Multiple	75	1976	12	4
Elokda and Farag, 2019[49]	GI	100	50	15	5
Hemmes et al, 2014[50]	Multiple	0	900	12	2
Whalen et al, 2006[52]	Abdominal	100	20	12	4
Other PEEP comparisons					
El-Sayed and Tawfeek, 2012[53]	GI	100	60	15	10
He et al, 2016[54g]	GI	100	50	10	8
Van Hecke et al, 2019[55]	GI	100	100	10 (3)	10

Bolther M, Henriksen J, Holmberg MJ, et al. Anesth Analg 2022; 135(5): 971-85.

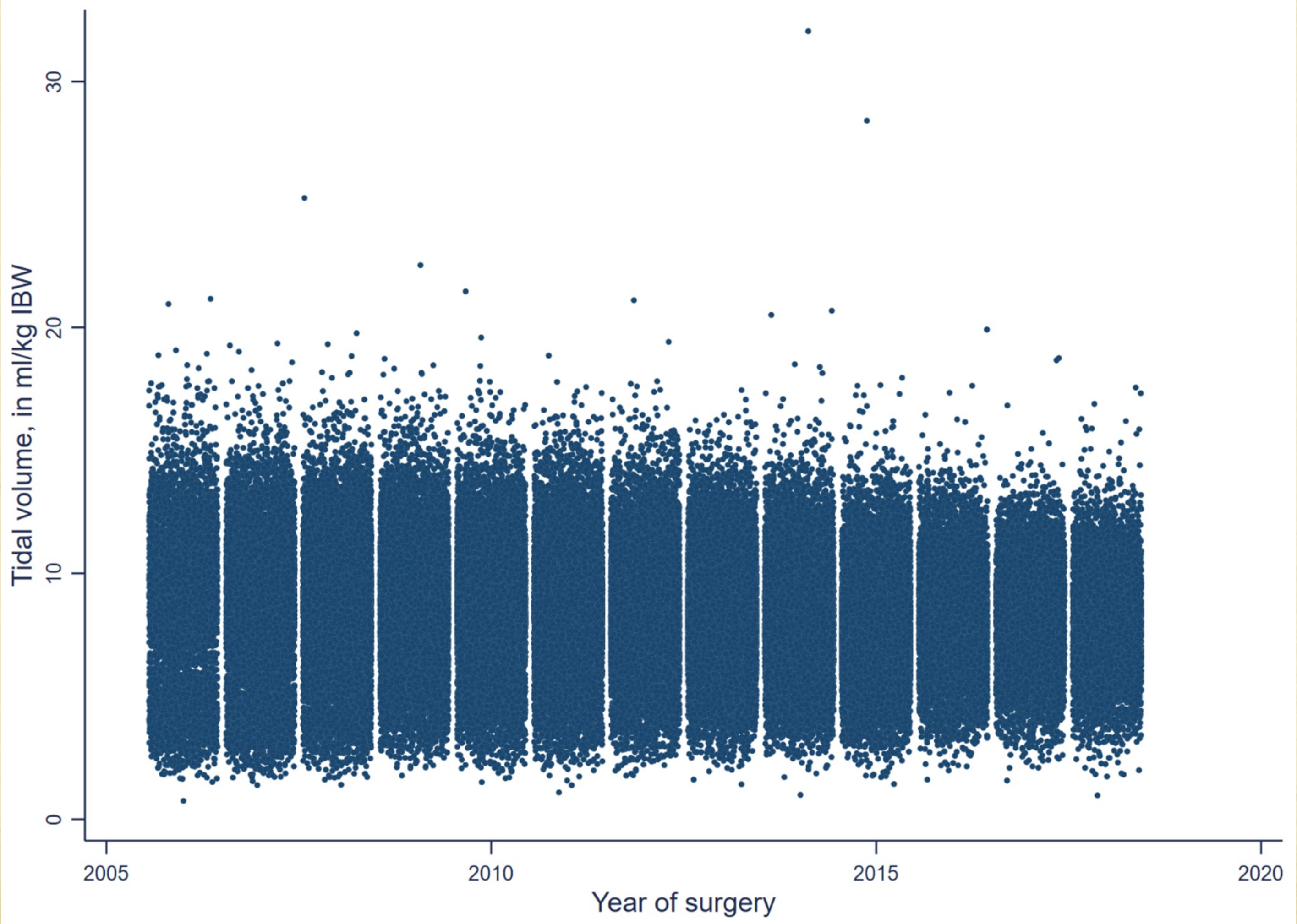
Préparation du cas

Question	Statement/Recommendation	% consensus	Quality of evidence	Strength of recommendation
2.1	Individualized mechanical ventilation should be used and may improve intraoperative respiratory function, but the beneficial effects are likely to disappear after extubation.	100	☒☒	Strong
2.2	The ventilator should initially be set to deliver $V_T \leq$ 6-8 mL kg^{-1} PBW and PEEP = 5 cmH2O. Evidence regarding I:E ratio settings is lacking.	86	☒☒☒	Strong
2.3	PEEP should be individualized to the patient in order to avoid increases in driving pressure (P_{plat} - PEEP) while maintaining a low V_T. To optimize intraoperative respiratory function in obese patients, during pneumoperitoneum insufflation, and during prone or Trendelenburg positioning, PEEP adjustment may be required.	100	☒☒	Strong

2.2 Volume courant

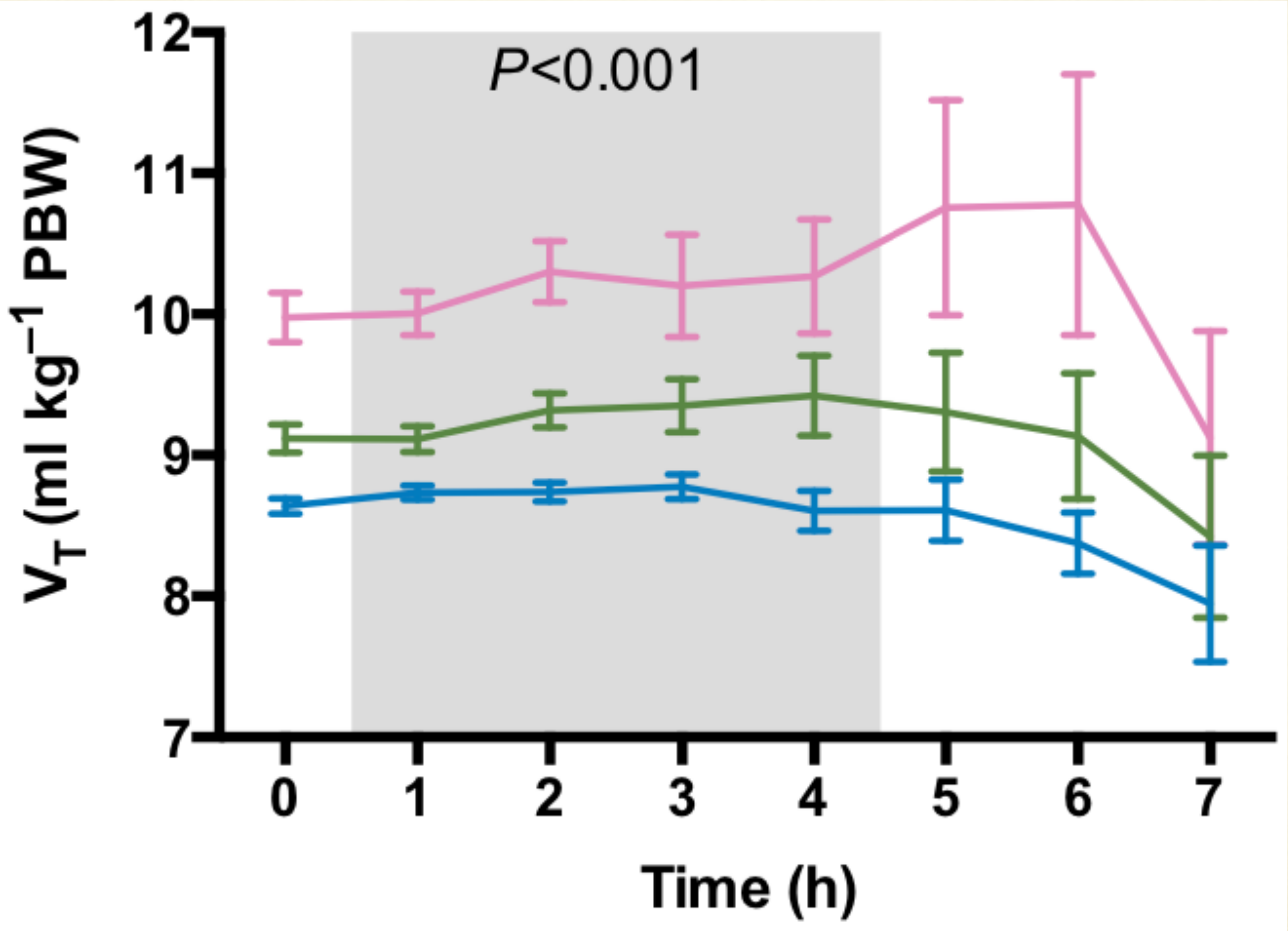


2.2 Volume courant



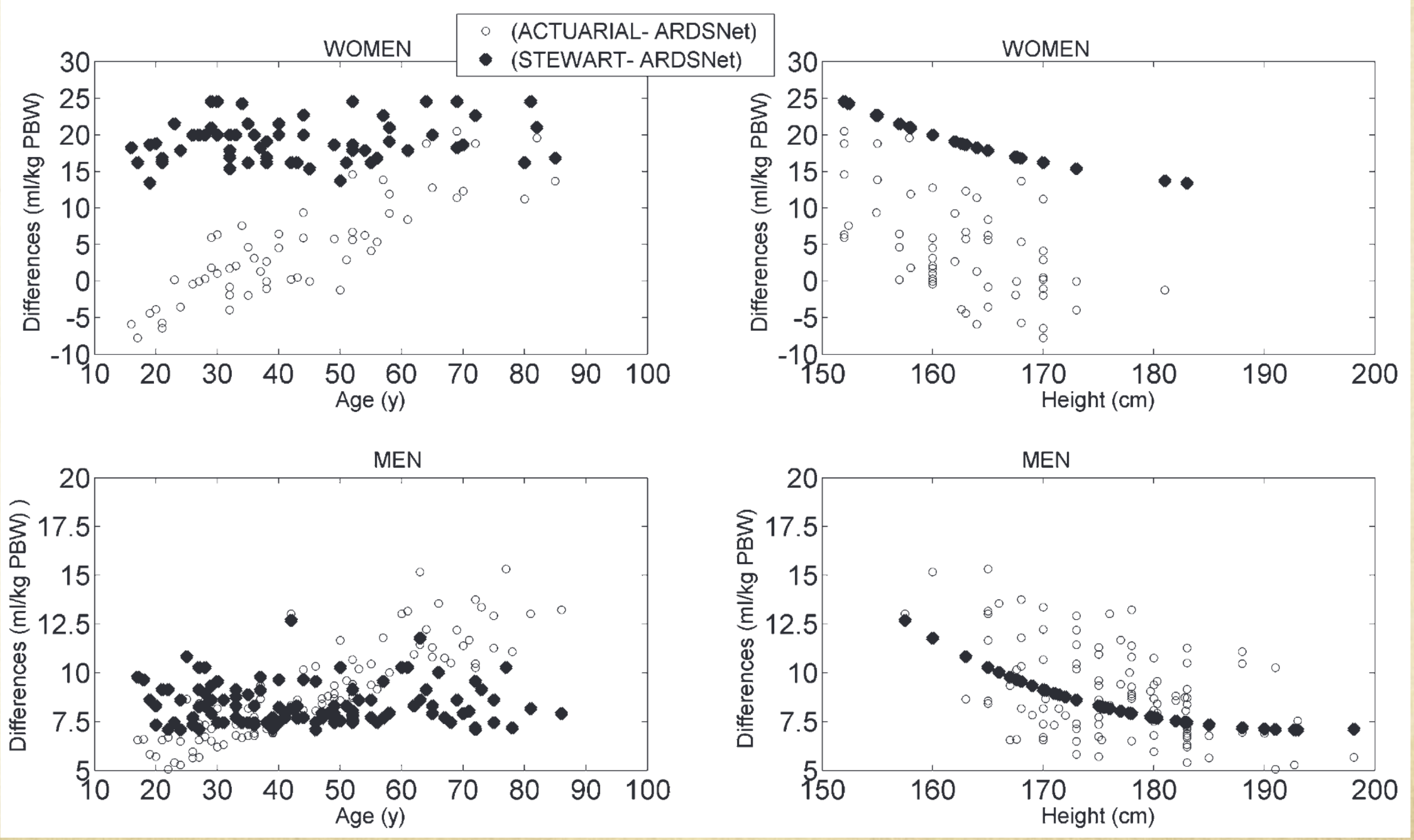
Suleiman A, Costa E, Santer P, et al. Br J Anaesth. 2022; 129(2): 263-72.

2.2 Volume courant



Ball L, Hemmes SNT, Serpa Neto A, et al. Br J Anaesth. 2018; 121(4): 899-908.

2.2 Volume courant



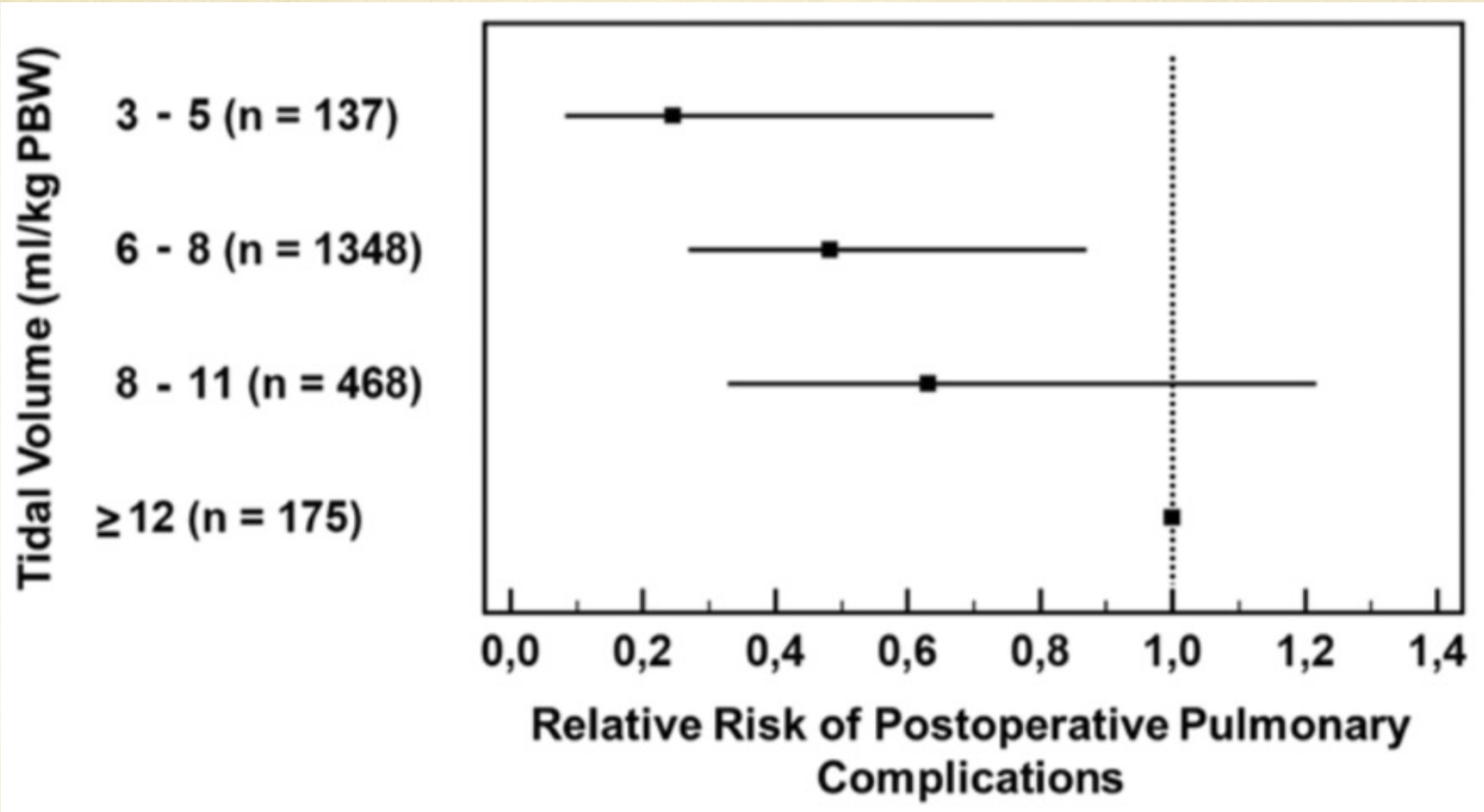
Linares-Perdomo O, East TD, Brower R., et al. Chest. 2015; 148(1): 73-8.

2.2 Volume courant

	N	Protective						Conventional						Type of surgery	Jadad score
		V_T	PEEP	ΔP	Mean age (years)	Male	N	V_T	PEEP	ΔP	Mean age (years)	Male	N		
Wrigge et al (2004)	62	6	10	13·8	57·0	79·3%	29	12	0	12·2	60·5	69·7%	33	Abdominal or thoracic	3
Zupancich et al (2005)	33	8	10	8·3	66·5	60·0%	21	10	2–3	12·8	68·7	75·0%	12	Cardiac	3
Reis Miranda et al (2005)	44	6	10 plus RM	9·2	63·0	54·5%	23	8	5	18·8	65·0	59·1%	21	Cardiac	4
Schilling et al (2005)	110	5	0-2	14·0	60·0	87·5%	75	10	0–2	14·4	61·0	75·0%	35	Thoracic	3
Wolthuis et al (2008)	46	6	10	13·3	62·0	67·0%	24	12	0	24·9	61·0	74·0%	22	General	3
Lin et al (2008)	102	5	3-5	13·5	55·0	75·0%	50	9	0	20·0	58·4	80·0%	52	Thoracic	2
Weingarten et al (2010)	40	6	12 plus RM	9·6	73·8	75·0%	20	10	0	19·8	72·1	80·0%	20	Abdominal	3
Sundar et al (2011)	149	6	5	11·6	66·0	66·7%	75	10	5	14·8	66·5	75·7%	74	Cardiac	4
Treschan et al (2012)	101	6	5	5·8	68·0	72·0%	52	12	5	8·7	68·0	76·0%	49	Abdominal	4
Memtsoudis et al (2012)	24	6	8	5·3	60·0	46·1%	10	12	0	7·2	50·0	46·1%	14	Spine	4
Unzueta et al (2012)	40	6	8 plus RM	11·7	59·0	75·0%	40	..	..	..	..	..	..	Thoracic	3
Severgnini et al (2013)	55	7	10 plus RM	8·3	65·5	64·3%	28	9	0	9·7	67·0	59·2%	27	Abdominal	4
Futier et al (2013)	400	6	6–8 plus RM	8·4	61·6	58·0%	200	12	0	16·3	63·4	60·5%	200	Abdominal	4
Maslow et al (2013)	32	5	5	13·6	61·2	25·0%	16	10	0	22·9	69·6	50·0%	16	Thoracic	3
Hemmes et al (2014)	889	8	12 plus RM	15·0	65·0	58·0%	445	8	≤2	15·8	66·0	57·0%	449	Abdominal	4
Qutub et al (2014)	39	4–6	5 plus RM	..	41·8	80·8%	26	8	5 plus RM	..	38·2	76·9%	13	Thoracic	4
Kokulu et al (2015)	40	6	8	5·3	41·7	0·0%	20	12	0	10·0	39·5	0·0%	20	Abdominal	3

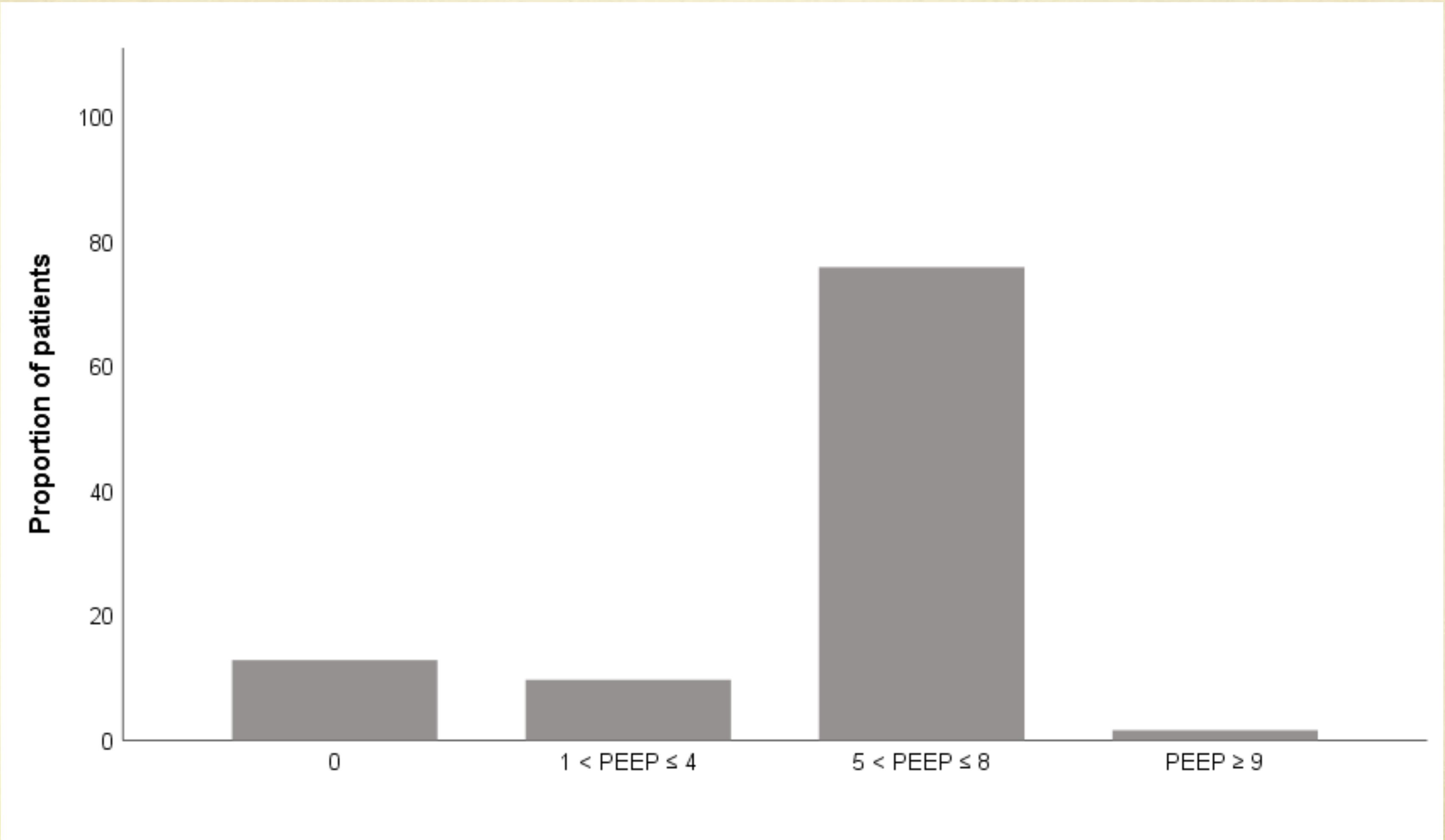
Serpa Neto A, Hemmes SNT, Barbas CSV, et al. Lancet Respir Med. 2016; 4(4): 272-80.

2.2 Volume courant



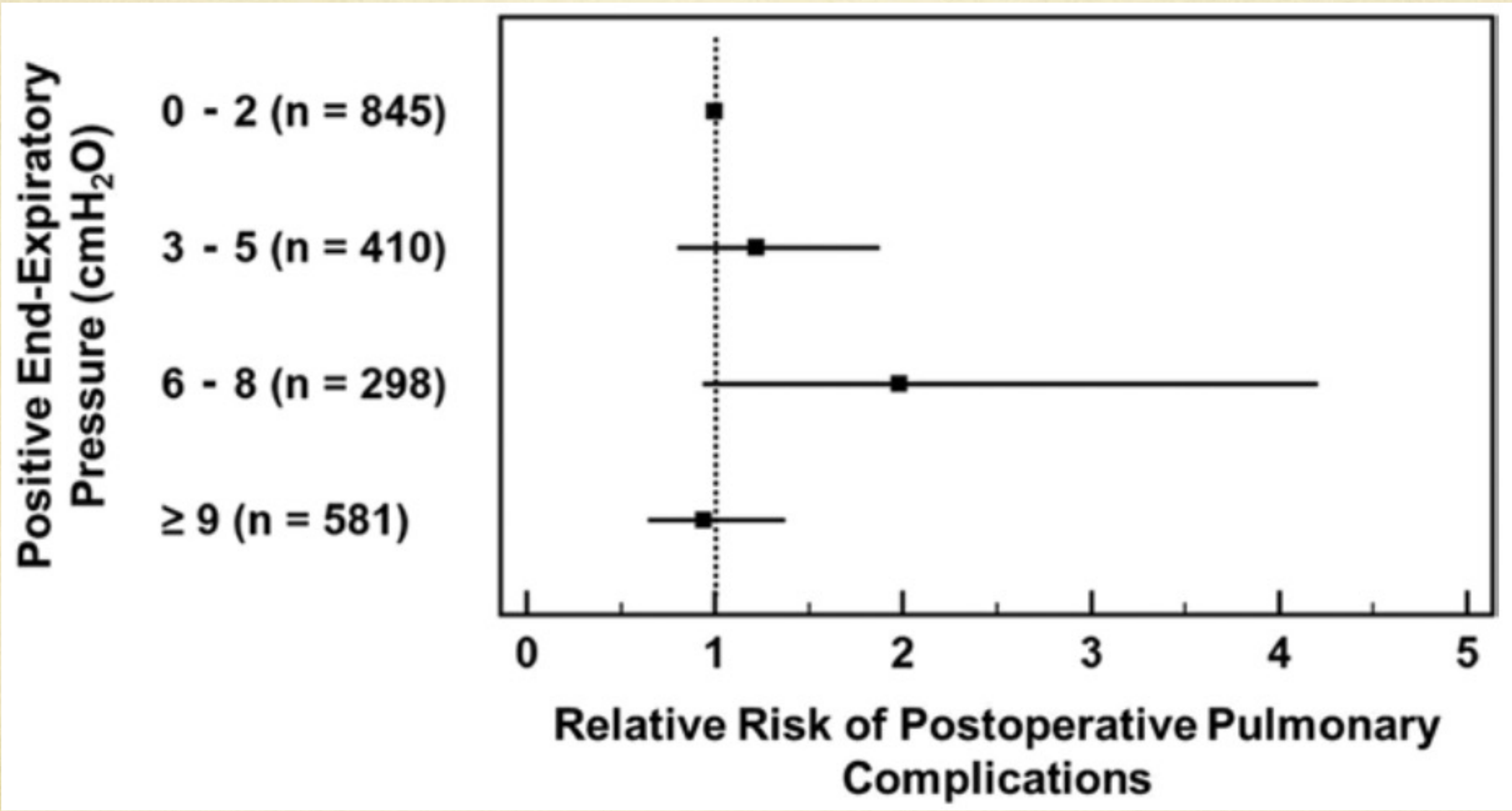
Serpa Neto A, Hemmes SNT, Barbas CSV, et al. Anesthesiology. 2015; 123(1): 66-78.

2.2 PEEP



Proportion of patients
100
80
60
40
20
0
0
1 < PEEP ≤ 4
5 < PEEP ≤ 8
PEEP ≥ 9

2.2 PEEP

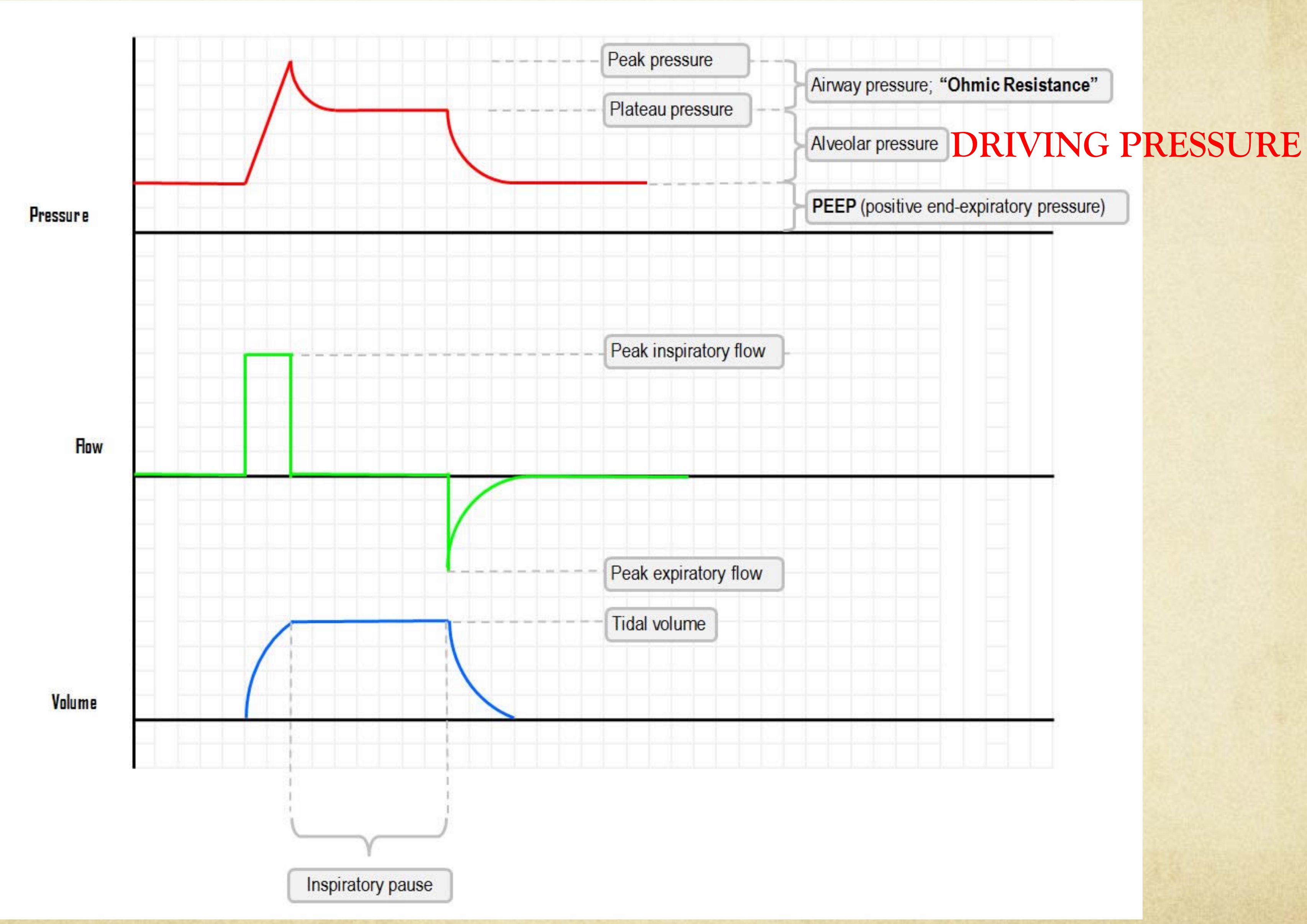


Serpa Neto A, Hemmes SNT, Barbas CSV, et al. Anesthesiology. 2015; 123(1): 66-78.

2.2 PEEP

	No. of Events (%)				
	High Level of PEEP (n = 989)[a]	Low Level of PEEP (n = 987)[a]	Absolute Difference (95% CI), %	Risk Ratio (95% CI)[b]	*P* Value[c]
Primary Outcome					
Postoperative pulmonary complications	211 (21.3)	233 (23.6)	−2.3 (−5.9 to 1.4)	0.93 (0.83 to 1.04)	.23
Components of the Primary Outcome					
Respiratory failure[d]					
Mild	135 (13.7)	154 (15.6)	−1.9 (−5.1 to 1.2)	0.92 (0.80 to 1.05)	.22
Moderate	42 (4.2)	58 (5.9)	−1.6 (−3.6 to 0.3)	0.83 (0.65 to 1.05)	.10
Severe	30 (3.0)	36 (3.6)	−0.6 (−2.2 to 1.0)	0.90 (0.69 to 1.18)	.45
Atelectasis	44 (4.4)	55 (5.6)	−1.1 (−3.0 to 0.8)	0.88 (0.70 to 1.10)	.25
Pleural effusion	43 (4.3)	21 (2.1)	2.2 (0.7 to 3.8)	1.35 (1.14 to 1.62)	.005
New pulmonary infiltrates	14 (1.4)	18 (1.8)	−0.4 (−1.5 to 0.7)	0.87 (0.59 to 1.29)	.47
Cardiopulmonary edema	17 (1.7)	9 (0.9)	0.8 (−0.2 to 1.8)	1.31 (0.99 to 1.74)	.12
Bronchospasm	12 (1.2)	10 (1.0)	0.2 (−0.7 to 1.1)	1.09 (0.74 to 1.60)	.67
Pulmonary infection	10 (1.0)	10 (1.0)	0 (−0.9 to 0.9)	0.99 (0.64 to 1.55)	>.99
Aspiration pneumonitis	2 (0.2)	1 (0.1)	0.1 (−0.2 to 0.4)	1.33 (0.60 to 2.97)	>.99
Acute respiratory distress syndrome	3 (0.3)	1 (0.1)	0.2 (−0.2 to 0.6)	1.50 (0.85 to 2.64)	.62
Pneumothorax	1 (0.1)	3 (0.3)	−0.2 (−0.6 to 0.2)	0.50 (0.09 to 2.72)	.37

Bluth T, Serpa Neto A, Schultz MJ, et al. JAMA. 2019; 321(23): 2292-305.



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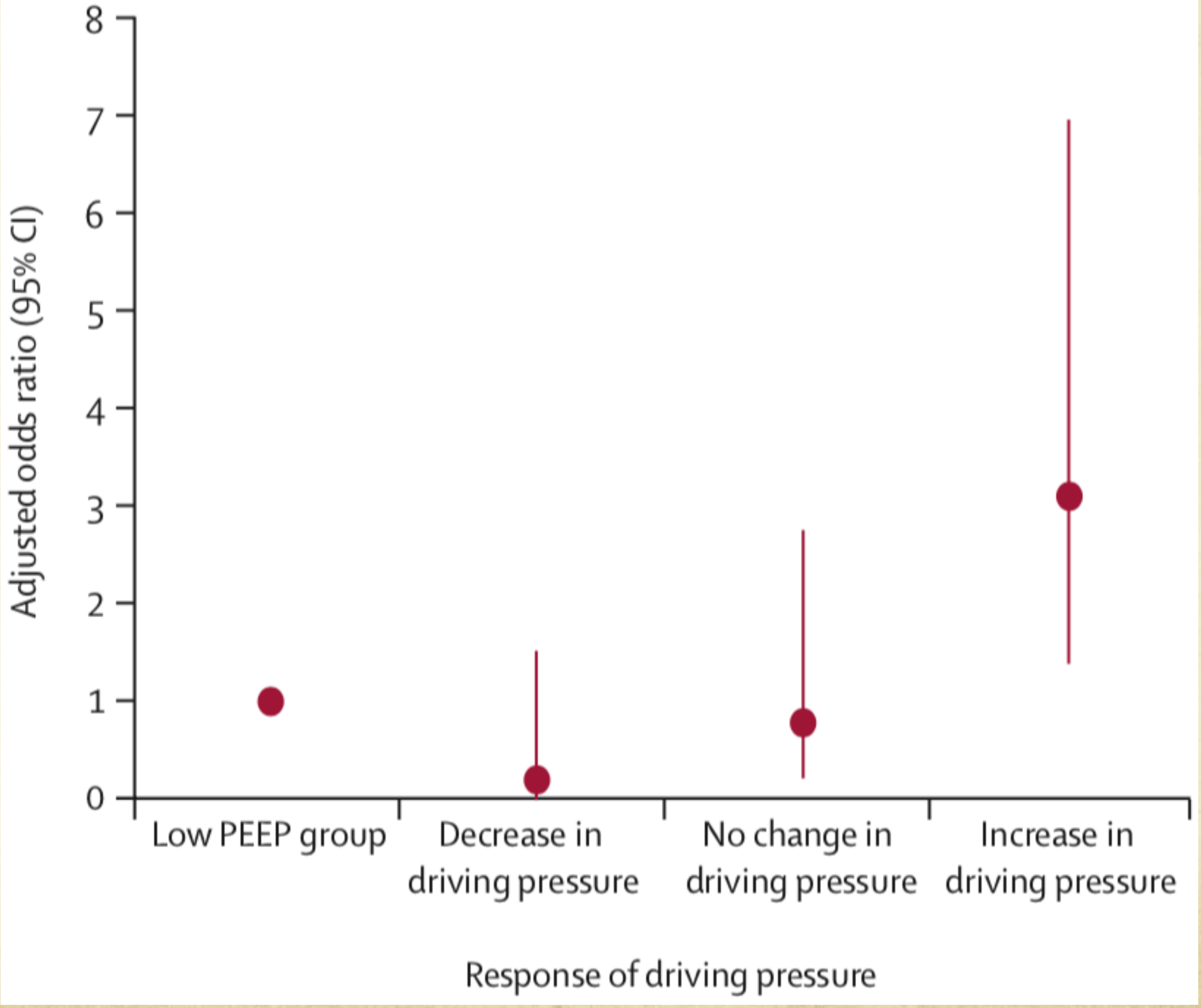
2.2 PEEP



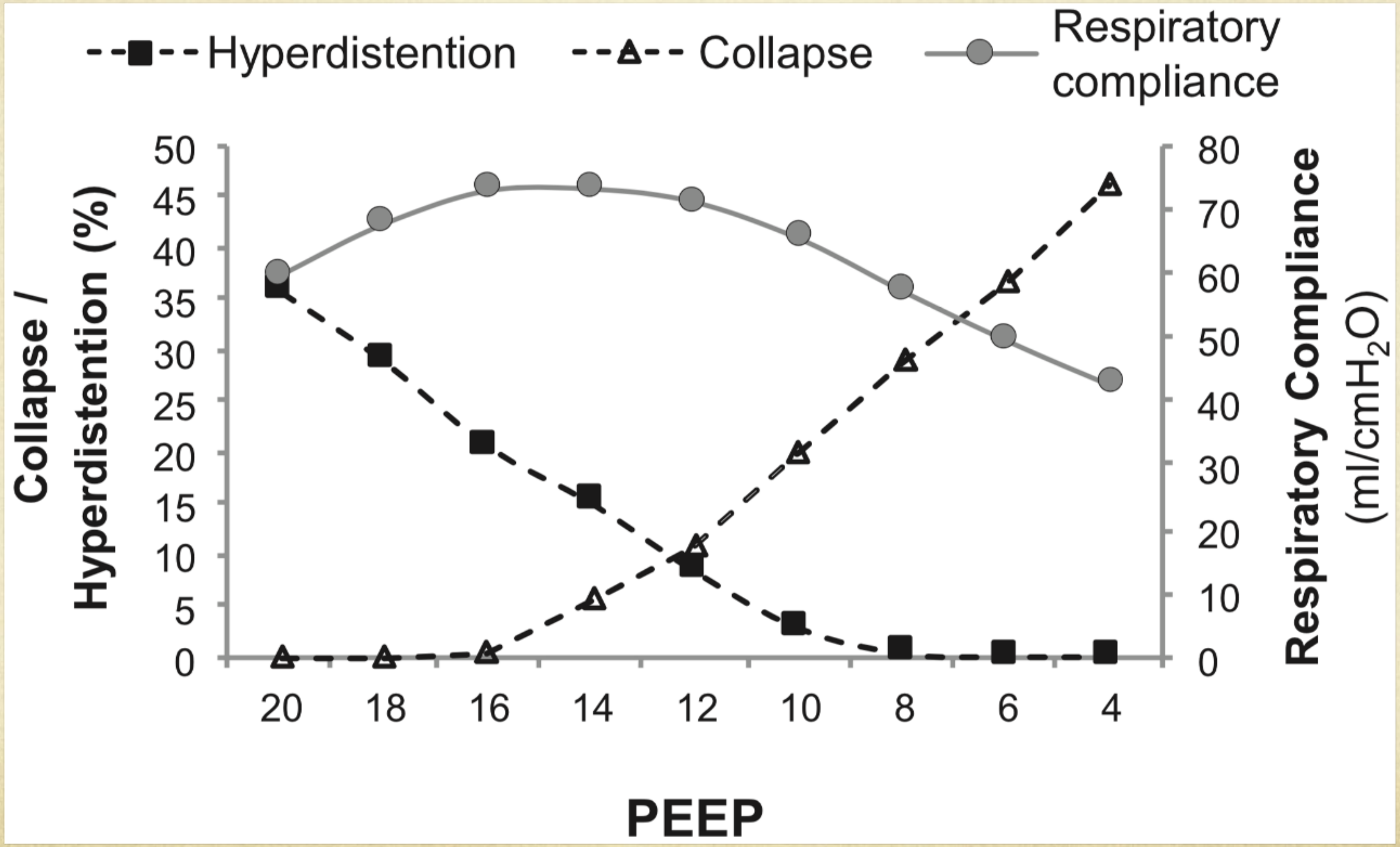
Serpa Neto A, Hemmes SNT, Barbas CSV, et al. Lancet Respir Med. 2016; 4(4): 272-80.

2.2 Volume courant & PEEP

	Univariate logistic regression (OR, 95% CI)	Multivariable logistic regression* (OR, 95% CI)	Mediation analysis using bootstrap* (ACME, 95% CI)
Randomisation (protective)	0·56 (0·42–0·75)	0·85 (0·05–13·50)	0·42 (0·14–1·19)
Tidal volume (mL/kg PBW)	1·14 (1·07–1·22)	1·05 (0·98–1·13)	0·91 (0·62–1·26)
PEEP (cm H_2O)	0·99 (0·95–1·02)	0·83 (0·59–1·16)	1·46 (0·88–2·36)
Driving pressure (cm H_2O)	1·06 (1·02–1·11)	1·16 (1·13–1·19)	1·27 (1·07–1·48)

Serpa Neto A, Hemmes SNT, Barbas CSV, et al. Lancet Respir Med. 2016; 4(4): 272-80.

PEEP & surdistension



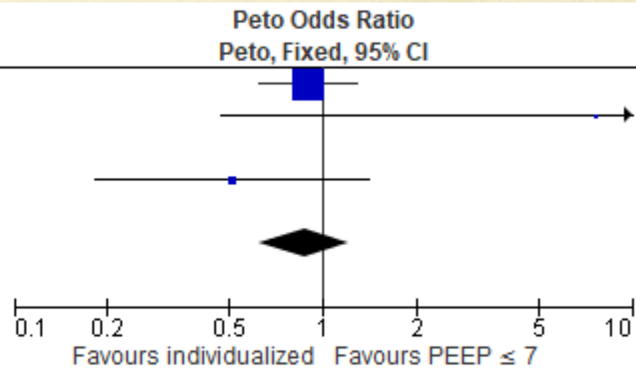
Pereira SM, Tucci MR, Morais CCA, et al. Anesthesiology. 2018; 129(6): 1070-81.

Driving pressure

	Indivualized		PEEP ≤7			Peto Odds Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**Peto, Fixed, 95% CI**
Ferrando, 2018	96	238	105	244	87.5%	0.90 [0.62, 1.29]
Nestler, 2017	2	25	0	25	1.5%	7.70 [0.47, 126.75]
Piriyapatsom, 2020	0	22	0	22		Not estimable
Yoon, 2021	10	30	15	30	11.1%	0.51 [0.18, 1.41]
Total (95% CI)		**315**		**321**	**100.0%**	**0.87 [0.62, 1.22]**
Total events	108		120			

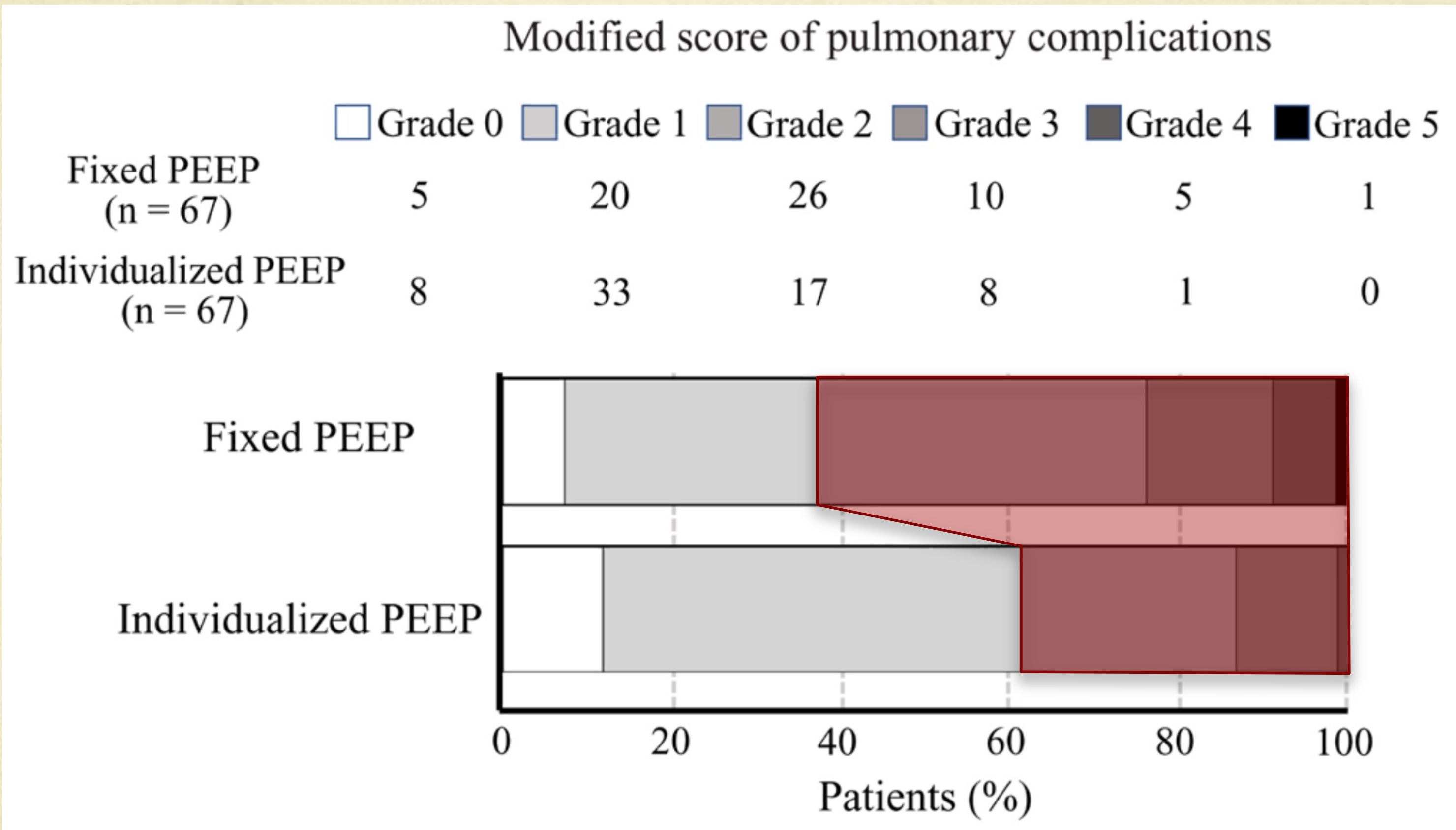
Heterogeneity: Chi² = 3.41, df = 2 (P = 0.18); I² = 41%

Test for overall effect: Z = 0.82 (P = 0.41)



Bolther M, Henriksen J, Holmberg MJ, et al. Anesth Analg. 2022; 135(5): 971-85.

Driving pressure



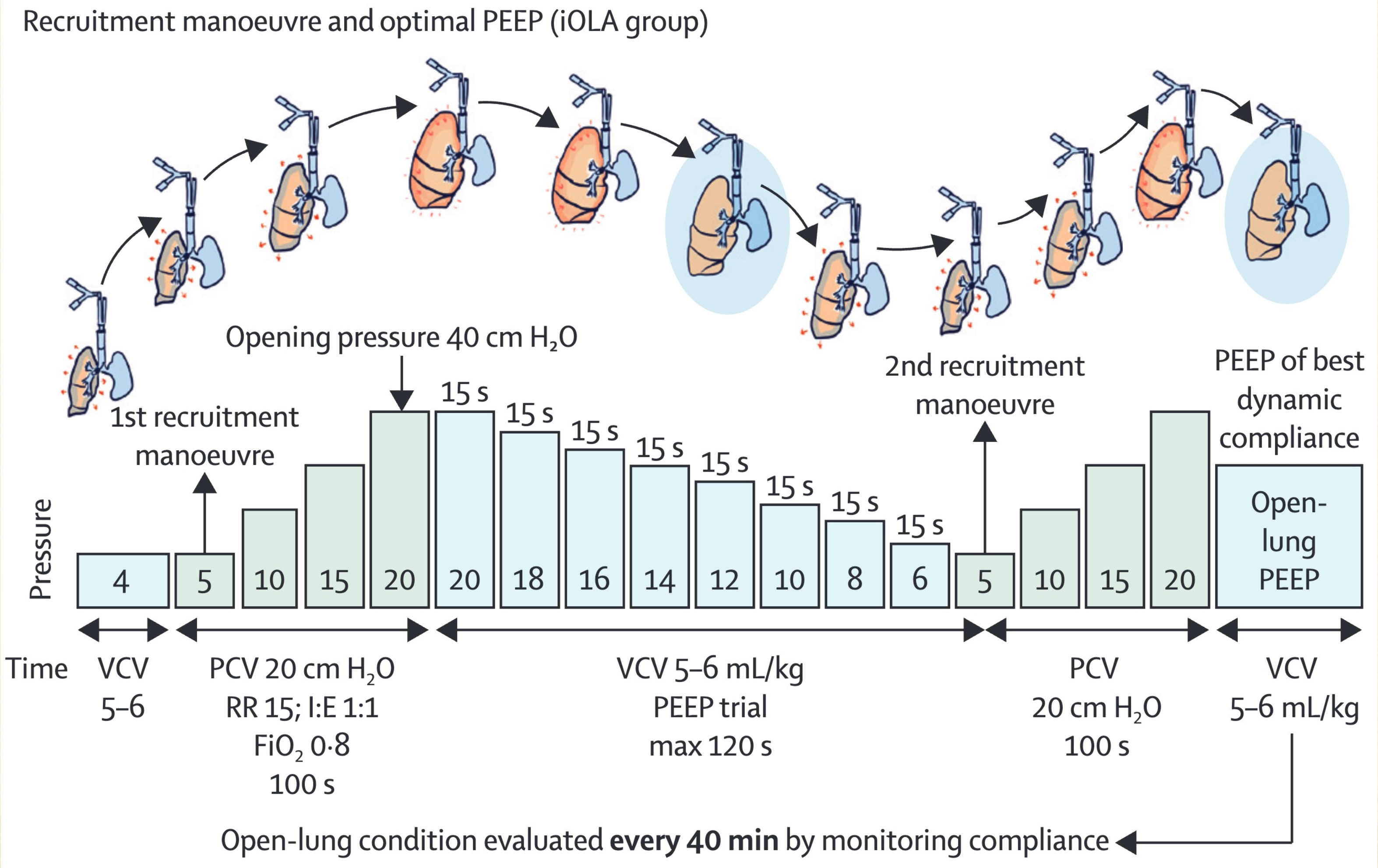
Zhang C, Xu F, Li W, et al. Anesth Analg. 2021; 133(5): 1197-205.

Driving pressure

Variables	Individualised group (n=178)	Standard group (n=185)	Risk ratio or mean difference (95% CI)	P-value
Primary outcome (composite of postoperative pulmonary complications), n (%)	25 (14.0)	36 (19.5)	0.72 (0.45–1.15)	0.215
Hypoxaemia	4 (2.2)	7 (3.8)	0.59 (0.18–1.99)	0.584
Atelectasis	16 (9.0)	29 (15.7)	0.57 (0.32–1.02)	0.076
Pleural effusion	2 (1.1)	1 (0.5)	2.08 (0.19–22.72)	0.973
Pneumonia	0 (0.0)	1 (0.5)	NA	>0.999
Requirements for rescue manoeuvres	6 (3.4)	10 (5.4)	0.62 (0.23–1.68)	0.491
Count of postoperative pulmonary complications				0.147
One complication, n (%)*	22 (88.0)	28 (77.8)	1.13 (0.90–1.42)	
Two or more complications, n (%)*	3 (12.0)	8 (22.2)	0.54 (0.16–1.84)	
PACU SaO_2 at room air, %	95.9 (2.7)	95.3 (2.8)	0.59 (-0.02 to 1.21)	0.058
Mild respiratory failure†, n (%)	4 (2.2)	4 (2.2)	1.04 (0.26–4.09)	>0.999
Length of hospital stay, day	6.3 (4.1)	7.1 (7.1)	-0.81 (-2.00 to 0.38)	0.181
ICU admission, n (%)	0 (0.0)	3 (1.6)	NA	0.260

Kim YJ, Kim BR, Kim HW, et al. Br J Anaesth. 2023; 131(5): 955-65.

Driving pressure



Ferrando C, Carramiñana A, Piñeiro P, et al. Lancet Respir Med. 2023; ePub.

Driving pressure

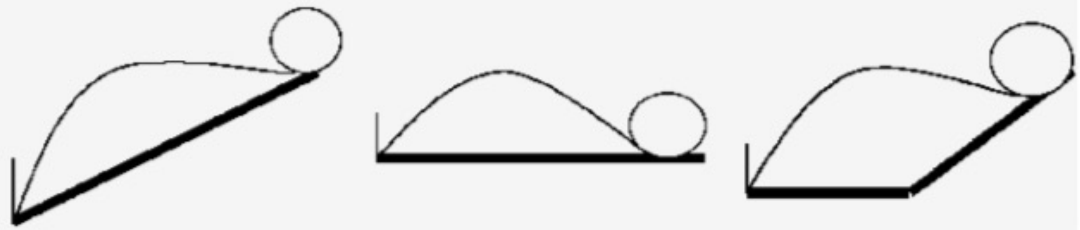
	iOLA (n=670)	STD (n=638)	Relative risk (95% CI); p value	Odds ratio (95% CI);* p value
Primary outcome				
Patients with severe postoperative pulmonary complications within the first 7 postoperative days	40 (6%)	97 (15%)	0·39 (0·28–0·56); <0·0001	0·33 (0·12–0·49); <0·0001
Secondary outcomes				
Patients with any postoperative pulmonary complications during the first 7 postoperative days	104 (16%)	175 (27%)	0·57 (0·46–0·70); <0·0001	0·44 (0·33–0·58); <0·0001
Patients with severe postoperative pulmonary complications during the first 30 postoperative days	48 (7%)	103 (16%)	0·44 (0·32–0·61); <0·0001	0·37 (0·26–0·54); <0·0001
Patients with any postoperative pulmonary complications during the first 30 postoperative days	111 (17%)	184 (29%)	0·57 (0·47–0·71); <0·0001	0·44 (0·33–0·58); <0·0001
Patients with any complication during the first 30 postoperative days	161 (24%)	227 (36%)	0·57 (0·45–0·73); <0·0001	0·53 (0·41–0·68); <0·0001
Infectious complication during the first 30 postoperative days†	19 (3%)	27 (4%)	0·66 (0·38–1·19); 0·18	0·68 (0·37–1·25); 0·22
Cardiac complication during the first 30 postoperative days	14 (2%)	15 (2%)	0·89 (0·43–1·85); 0·85	0·88 (0·42–1·85); 0·75
Acute kidney failure during the first 30 postoperative days	12 (2%)	19 (3%)	0·60 (0·29–1·23); 0·203	0·56 (0·27–1·18); 0·13
Median (IQR) hospital length of stay, days	5 (3–7)	5 (3–8)	0·74	..
Death within 30 days‡	9 (1%)	3 (<1%)	2·86 (0·78–10·50); 0·15	..

Ferrando C, Carramiñana A, Piñeiro P, et al. Lancet Respir Med. 2024; 12(3): 195-206.

Induction de l'anesthésie

Question	Statement/Recommendation	% consensus	Quality of evidence	Strength of recommendation
3.1	Prior to induction of anaesthesia, position the patient with the HOB elevated ≥ 30-degrees (i.e. "beach chair"); avoid flat supine position. If not contraindicated, prior to the loss of spontaneous ventilation, use NIPPV or CPAP to attenuate anaesthesia-induced respiratory changes.	100	☒☒☒	Strong
3.2	During induction, monitor for an obstructive breathing pattern and use a combination of appropriate techniques including positioning, application of NIPPV or CPAP, and/or placement of a nasopharyngeal airway to avoid upper airway obstruction.	100	☒	Strong
3.3	Following intubation, FiO_2 should be set to ≤0.4. Thereafter, use the lowest possible FiO_2 to achieve SpO_2 ≥94%.	100	☒	Weak
3.4	No specific mode of controlled mechanical ventilation is recommended.	100	☒	Statement

3.1 Beach chair



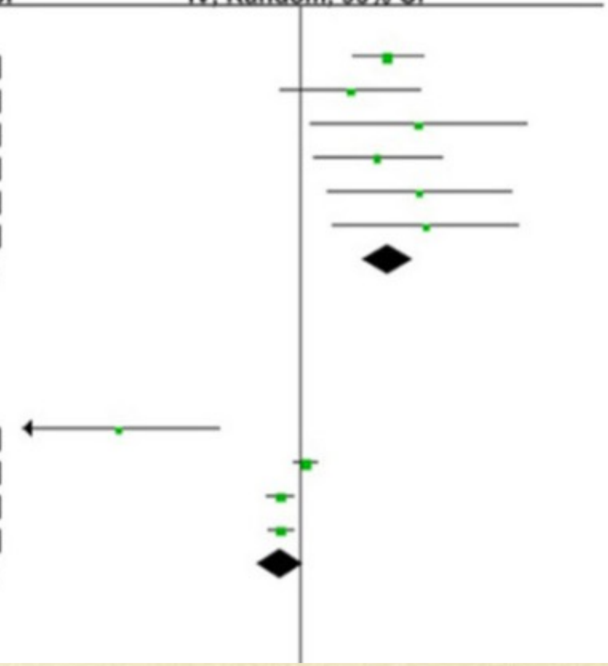
	1	2	3
Age (years)	42±1	40±2	43±3
BMI	56±8	59±10	53±9
Hip-waist ratio	0.9±0.04	0.9±0.06	0.9±0.05
N=	9	9	8
Safe Apnea Period (seconds)	178±55 (1 vs 3:p<0.05)	123±24	153±63
Recovery Time (seconds)	80±30 (2 vs 1:*P*<0.001)	206±64	97±41 (2 vs 3: *P*<0.001)
Lowest SaO_2(%)	83±4	82±5	83±4

Boyce JR, Ness T, Castroman P, et al. Obes Surg. 2003; 13(1): 4-9.

3.1 Beach chair

Study or Subgroup	Head-up position Mean	SD	Total	Supine Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
5.1.1 the safe apnea duration								
Altermatt FR 2005	214	28	19	162	38	19	9.5%	52.00 [30.78, 73.22]
Boyce JR 2003	153	63	10	123	24	10	5.9%	30.00 [-11.78, 71.78]
Dan L 2011	430	136.6	32	359.3	124.4	30	3.4%	70.70 [5.73, 135.67]
Dixon BJ 2005	201	56	21	155	70	21	6.4%	46.00 [7.66, 84.34]
Tang LJ 2008	363	117	20	292	47	20	4.2%	71.00 [15.74, 126.26]
Zhang BF 2012	365	105	25	290	95	25	4.2%	75.00 [19.49, 130.51]
Subtotal (95% CI)			**127**			**125**	**33.6%**	**52.33 [37.19, 67.47]**
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.59$, $df = 5$ ($P = 0.76$); $I^2 = 0\%$								
Test for overall effect: $Z = 6.77$ ($P < 0.00001$)								
5.1.2 the latency for SpO_2 improving to 96-97%								
Boyce JR 2003	96.9	63.5	8	205.6	63.5	9	3.8%	-108.70 [-169.18, -48.22]
Dixon BJ 2005	37.1	11.2	21	33.9	12.2	21	11.7%	3.20 [-3.88, 10.28]
Tang LJ 2008	35	7	20	47	17	20	11.6%	-12.00 [-20.06, -3.94]
Zhang BF 2012	35	17	25	47	10	25	11.6%	-12.00 [-19.73, -4.27]
Subtotal (95% CI)			**74**			**75**	**38.7%**	**-11.50 [-25.32, 2.32]**
Heterogeneity: $Tau^2 = 141.11$; $Chi^2 = 21.90$, $df = 3$ ($P < 0.0001$); $I^2 = 86\%$								
Test for overall effect: $Z = 1.63$ ($P = 0.10$)								

Mean Difference IV, Random, 95% CI

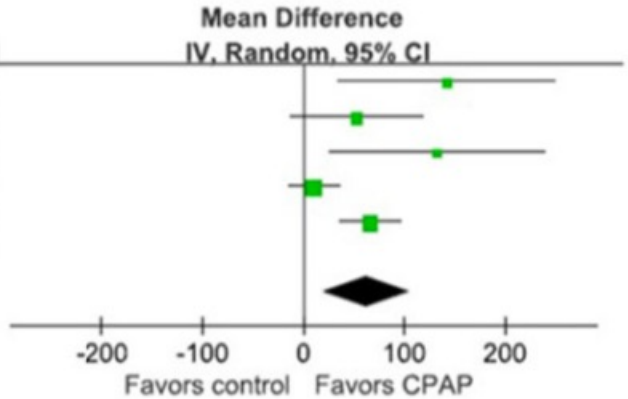


Pang QY, Mo J, An R, et al. Int J Clin Exp Med. 2017; 10(4): 5883-91.

3.1 CPAP

	CPAP			Control				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Coussa M 2001	457	130	9	315	100	9	11.0%	142.00 [34.85, 249.15]
Delay JM 2008	507.1	81	14	454.3	93.4	14	19.2%	52.80 [-11.96, 117.56]
Gender S 2005	376	145	12	243	136	15	11.0%	133.00 [25.91, 240.09]
Harbut P 2014	301.5	51.8	22	291	30	22	30.0%	10.50 [-14.51, 35.51]
Shao DQ 2015	434.7	39.8	15	368.7	43.3	15	28.8%	66.00 [36.24, 95.76]
Total (95% CI)			**72**			**75**	**100.0%**	**62.61 [19.09, 106.12]**

Heterogeneity: $Tau^2 = 1481.17$; $Chi^2 = 14.80$, df = 4 (P = 0.005); $I^2 = 73\%$
Test for overall effect: Z = 2.82 (P = 0.005)



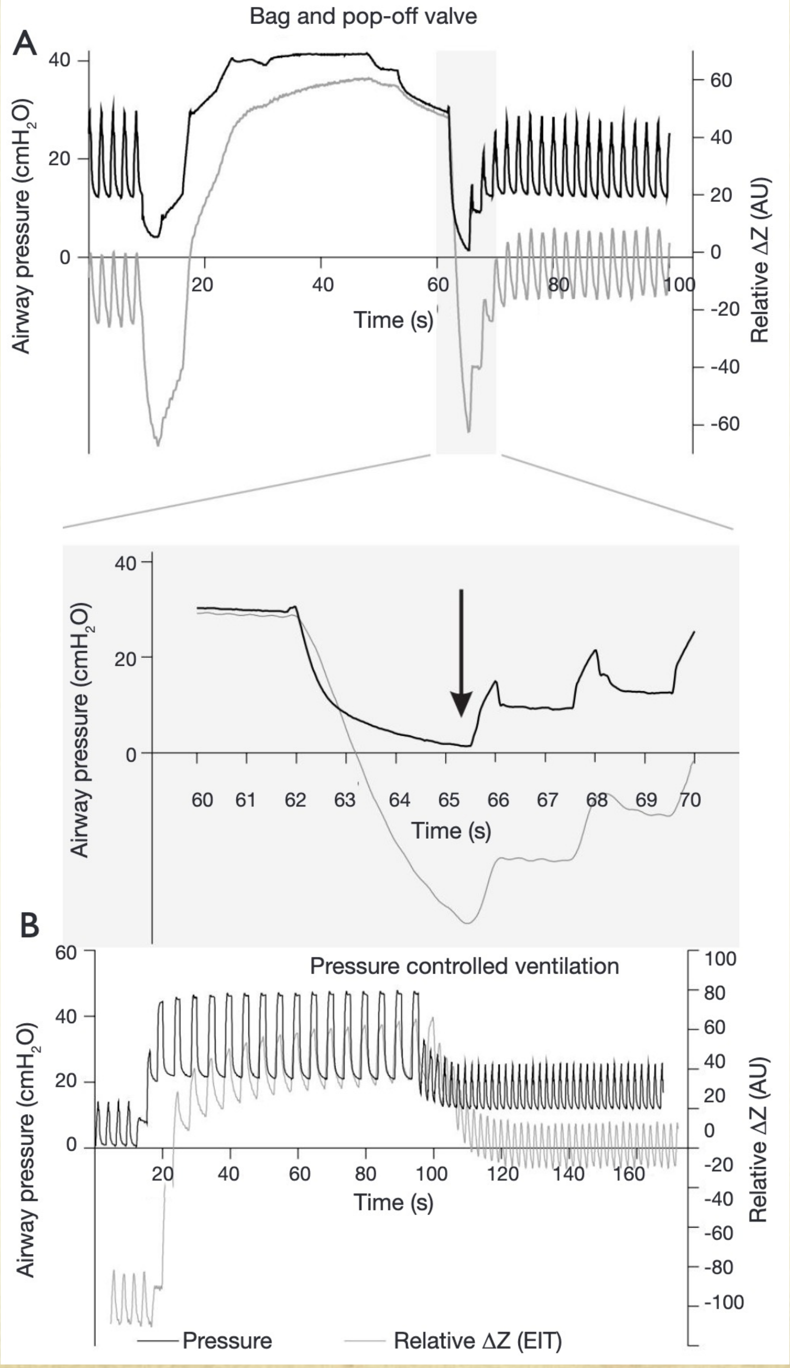
Pang QY, Mo J, An R, et al. Int J Clin Exp Med. 2017; 10(4): 5883-91.

Maintien de l'anesthésie

Question	Statement/Recommendation	% consensus	Quality of evidence	Strength of recommendation
4.1	In addition to standard monitoring (ASA/ESA) dynamic compliance, driving pressure (P_{plat}-PEEP), and P_{plat} should be monitored on all controlled mechanically ventilated patients.	100	⊠⊠⊠	Strong
4.2	Decreasing compliance caused by surgical/anaesthesia factors (i.e. pneumoperitoneum, positioning, circuit disconnect) should be treated by appropriate interventions. Individualized PEEP can prevent progressive alveolar collapse. Recruitment maneuvers can reverse alveolar collapse but have limited benefit without sufficient PEEP. Statement: Increasing FiO_2 may be effective in increasing the oxygenation, but is not an effective intervention to improve dynamic compliance of the respiratory system.	86	⊠⊠⊠⊠	Strong
4.3	The effectiveness of interventions aimed at optimizing respiratory system mechanics should be evaluated by measuring an improvement of the respiratory system compliance under constant tidal volume.	100	⊠⊠	Strong

Manoeuvres de recrutement

Question	Statement/Recommendation	% consensus	Quality of evidence	Strength of recommendation
5.1	High quality supportive evidence is lacking to recommend a routine ARM for all patients following endotracheal intubation. However, an ARM may be considered according to an individual risk-benefit assessment.	57*	☒	Weak
5.2	The bag-squeezing ARM should be avoided in favor of a ventilator-driven ARM.	100	☒	Weak
5.3	ARMs should be performed using the lowest effective P_{plat} (30-40 cmH2O in non-obese, 40-50 cmH2O in obese) and shortest effective time or fewest number of breaths.	100	☒☒	Weak
5.4	Continuous hemodynamic and oxygen saturation monitoring is recommended before and during an ARM. Ensure adequate hemodynamic stability prior to performing an ARM. Avoid ARMs when contraindicated.	100	☒☒☒☒	Strong
5.5	PEEP should be individualized following an ARM to avoid both alveolar overdistention and collapse.	71	☒☒	Weak



Tucci MR, Pereira SM, Costa ELV, et al. Ann Transl Med. 2020; 8(14): 842.

Émergence de l'anesthésie

Question	Statement/Recommendation	% consensus	Quality of evidence	Strength of recommendation
6.1	Optimize patient positioning and avoid ZEEP during emergence. Avoid ETT suctioning immediately prior to tracheal extubation.	100	☒	Weak
6.2	Avoid apnea with ZEEP prior to extubation.	100	☒	Weak
6.3	In the appropriate clinical scenario, the use of low FiO_2 (<0.4) during emergence from general anaesthesia can improve pulmonary function in the postoperative period.	71	☒	Weak
6.4	When high FiO_2 (>0.8) is used during emergence, the use of low $Fi0_2$ (<0.3) CPAP immediately following tracheal extubation may reduce the risk of resorption atelectasis.	29*	☒	Weak
6.5	Administration of postoperative supplemental oxygen is recommended when room air $Sp0_2$ falls below 94%. Avoid routine application of supplemental oxygen without investigating and treating the underlying cause.	100	☒	Weak
6.6	Prophylactic NIPPV/CPAP should be considered post-operatively for patients with prior routine use of NIPPV/CPAP.	100	☒☒	Strong

Lung Ultrasonography for the Assessment of Perioperative Atelectasis: A Pilot Feasibility Study

Audrey Monastesse, MD,* Francois Girard, MD,* Nathalie Massicotte, MD,* Carl Chartrand-Lefebvre, MD,† and Martin Girard, MD*

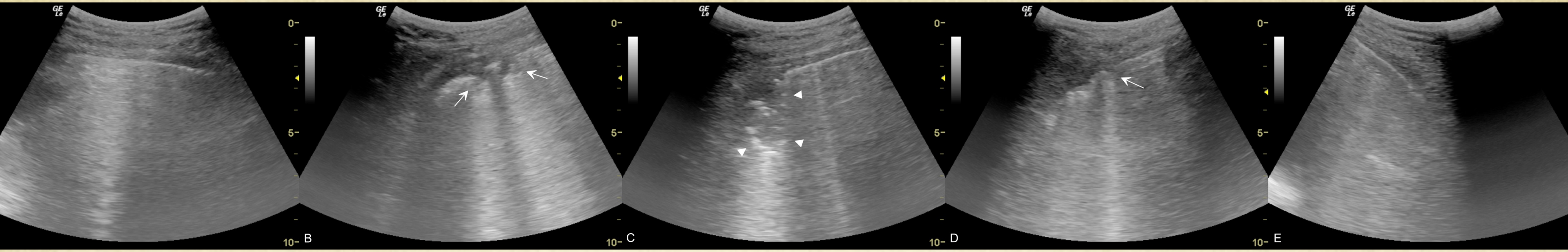
BACKGROUND: Few diagnostic tools are available to anesthesiologists when confronted with intraoperative hypoxemia. Lung ultrasonography is a safe and accurate bedside imaging modality. The aim of this study was to evaluate the feasibility of lung ultrasonography during the perioperative period and assess its ability to detect intraoperative respiratory complications and oxygenation changes resulting from perioperative atelectasis.

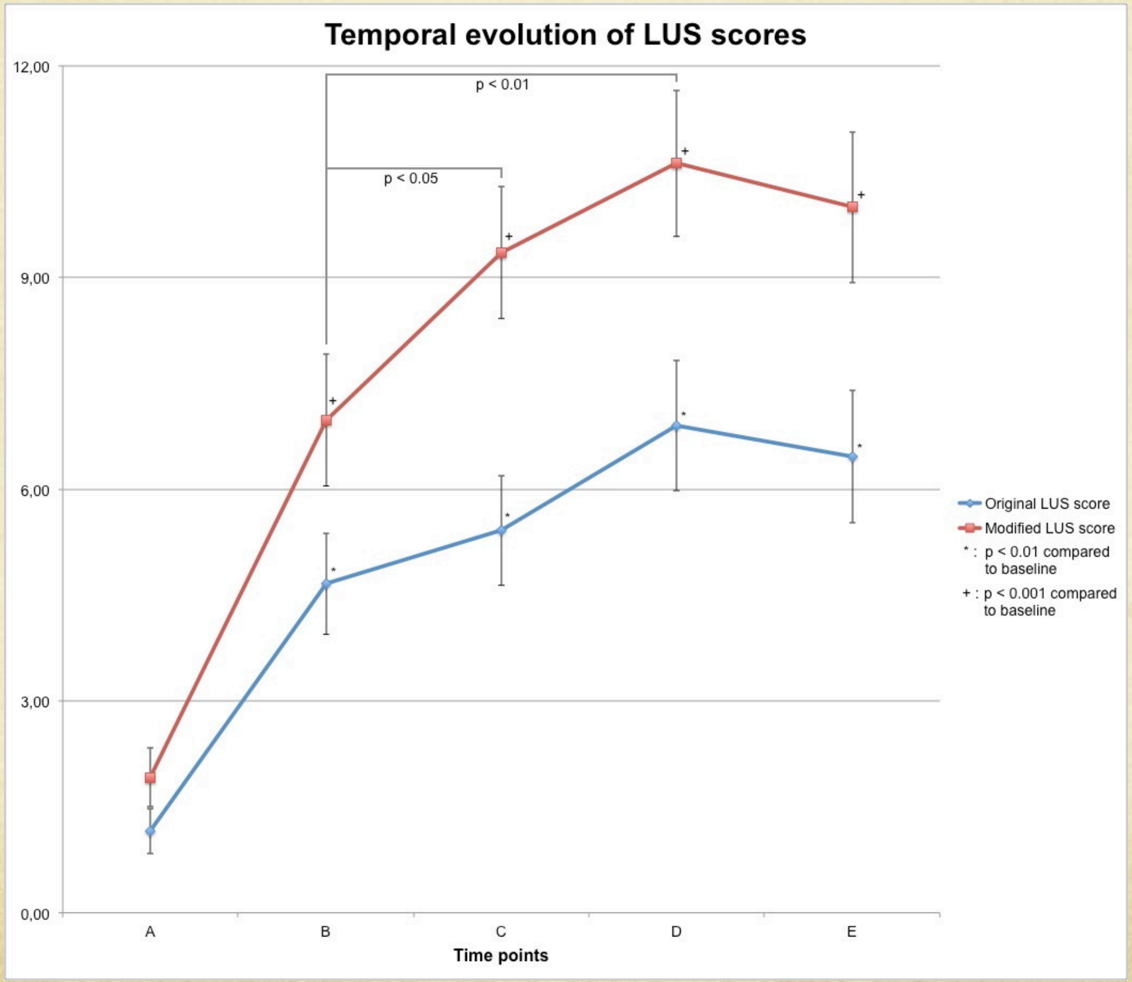
METHODS: In this prospective observational pilot study, 30 consecutive patients scheduled for laparoscopic surgery were recruited. Mechanical ventilation was standardized. Lung ultrasonography was performed at 5 predefined time points: before induction of general anesthesia (GA), after induction of GA, after pneumoperitoneum insufflation, on arrival in the recovery room, and before recovery room discharge. For each echographic examination, 12 pulmonary quadrants were imaged. From these, a semiquantitative score, the lung ultrasound (LUS) score, was calculated to assess lung aeration at each time point.

RESULTS: Lung ultrasonography was possible in all patients. Changes in the LUS score between the postinduction period and arrival in the recovery room were correlated with changes in oxygenation (Spearman $r = -0.43$, $P = .018$). Induction of GA was associated with an increase in the LUS score, which gradually worsened at all time points until recovery room discharge. This increase was significantly worse in the basal and dependent lung zones. Lung ultrasonography helped in the detection of 2 capnothoraces, 1 endobronchial intubation, and 1 episode of subclinical pulmonary edema.

CONCLUSIONS: Lung ultrasonography in the perioperative period is feasible, allows tracking of perioperative atelectasis, and facilitates the diagnosis of respiratory complications. The evolution of aeration loss correlates moderately with changes in oxygenation. (Anesth Analg 2017;124:494–504)

Monastesse A, Girard F, Massicotte N, et al. Anesth Analg. 2017; 124(2): 494-504.





Monastesse A, Girard F, Massicotte N, et al. Anesth Analg. 2017; 124(2): 494-504.

BJA

British Journal of Anaesthesia, 124 (1): 101–109 (2020)

doi: 10.1016/j.bja.2019.09.040
Advance Access Publication Date: 14 November 2019
Respiration and the Airway

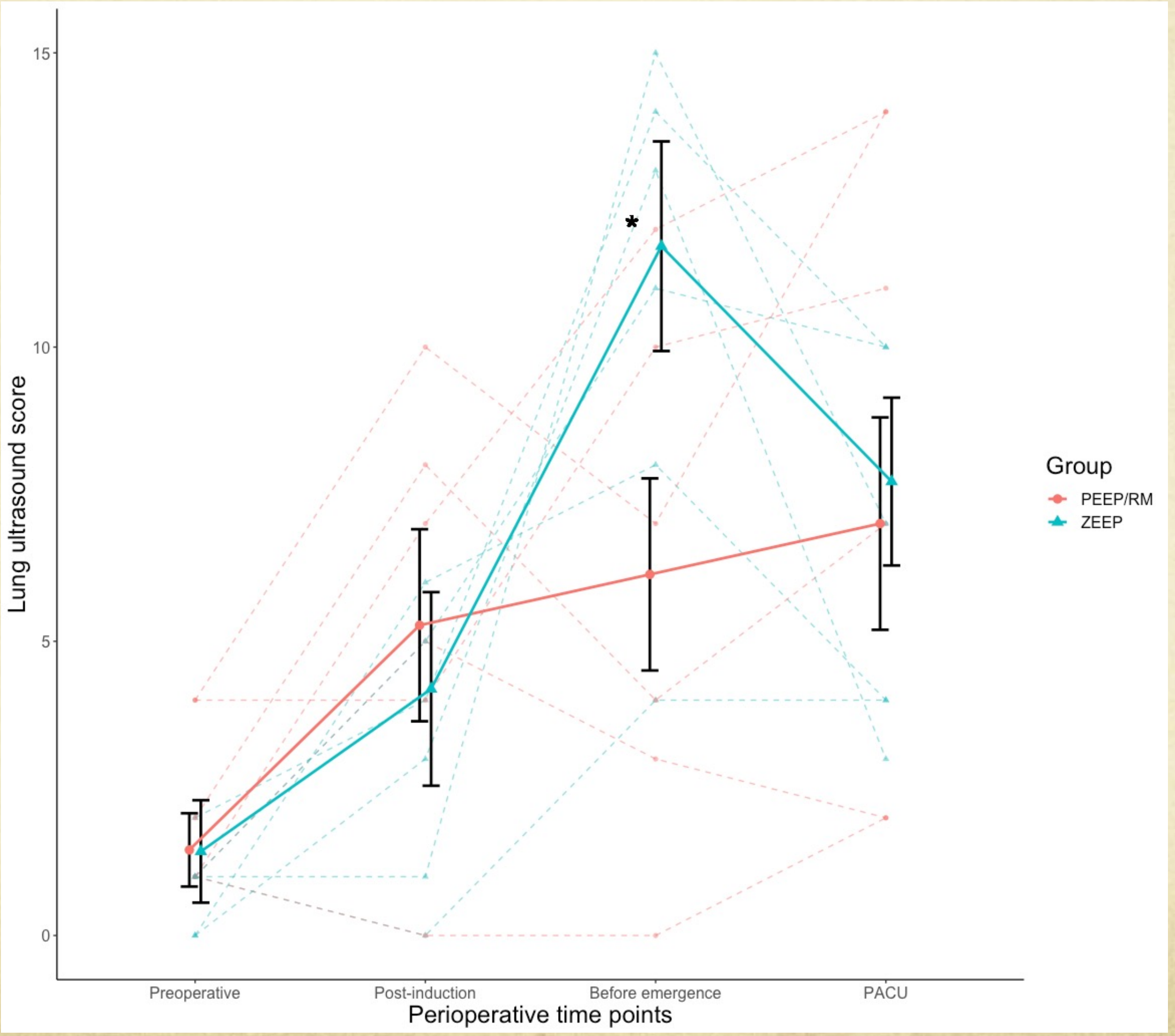
RESPIRATION AND THE AIRWAY

Effects of positive end-expiratory pressure/recruitment manoeuvres compared with zero end-expiratory pressure on atelectasis during open gynaecological surgery as assessed by ultrasonography: a randomised controlled trial

Vincent Généreux[1], Michaël Chassé[2,3], François Girard[1], Nathalie Massicotte[1], Carl Chartrand-Lefebvre[3,4] and Martin Girard[1,2,3,*]

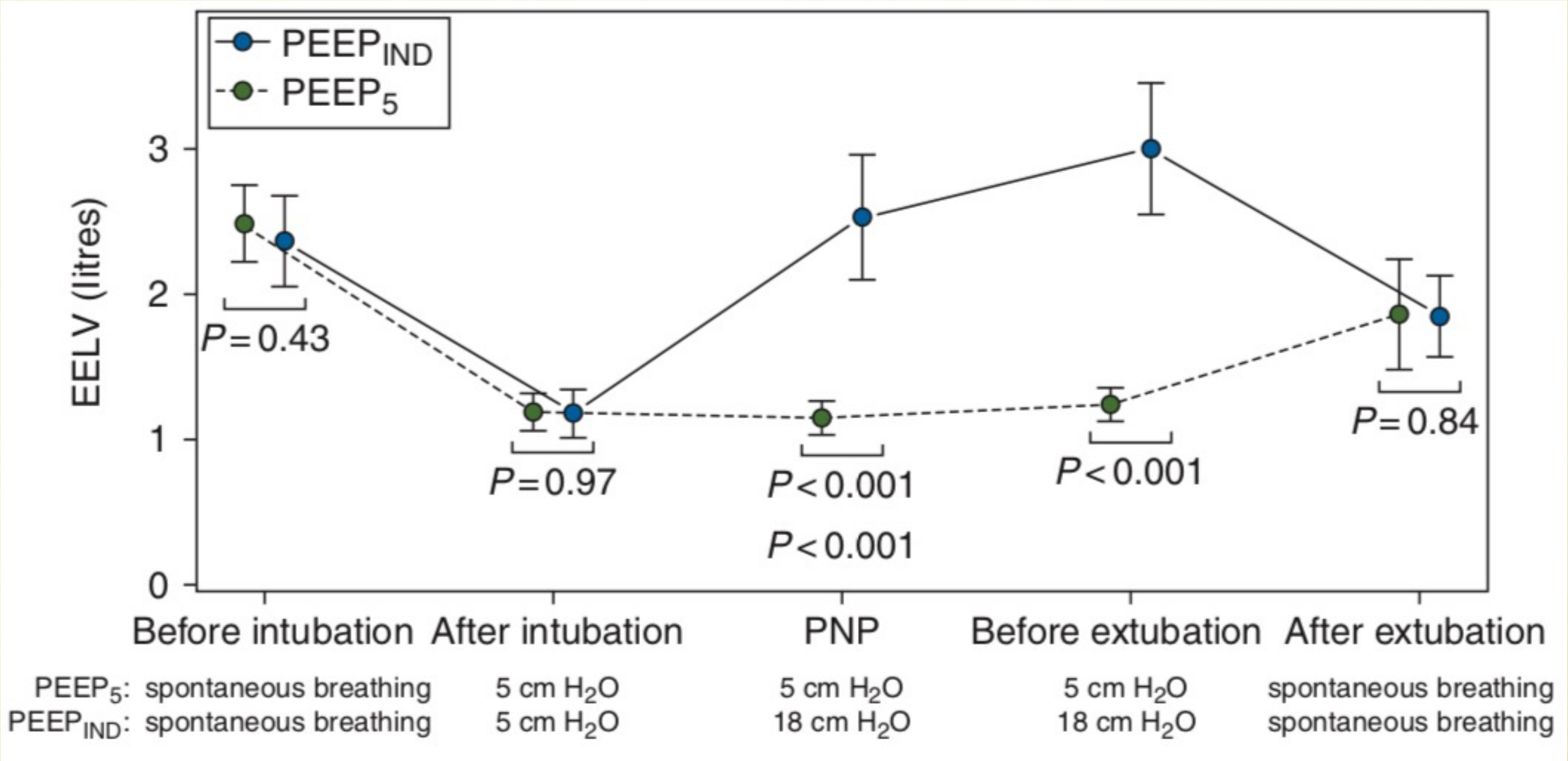
Généreux V, Chassé M, Girard F, et al. Br J Anaesth. 2020; 124(1): 101-109.

Problème à l'émergence



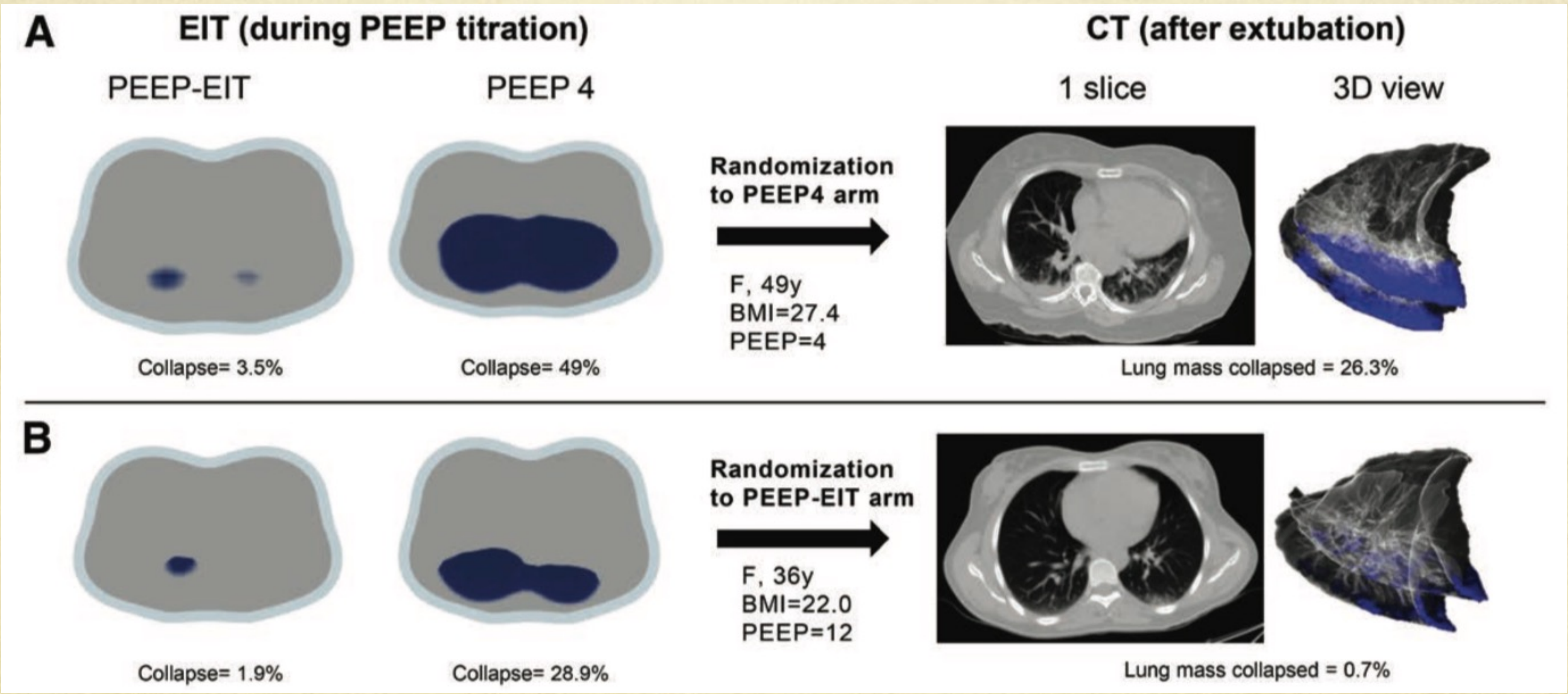
Généreux V, Chassé M, Girard F, et al. Br J Anaesth. 2020; 124(1): 101-109.

Problème à l'émergence



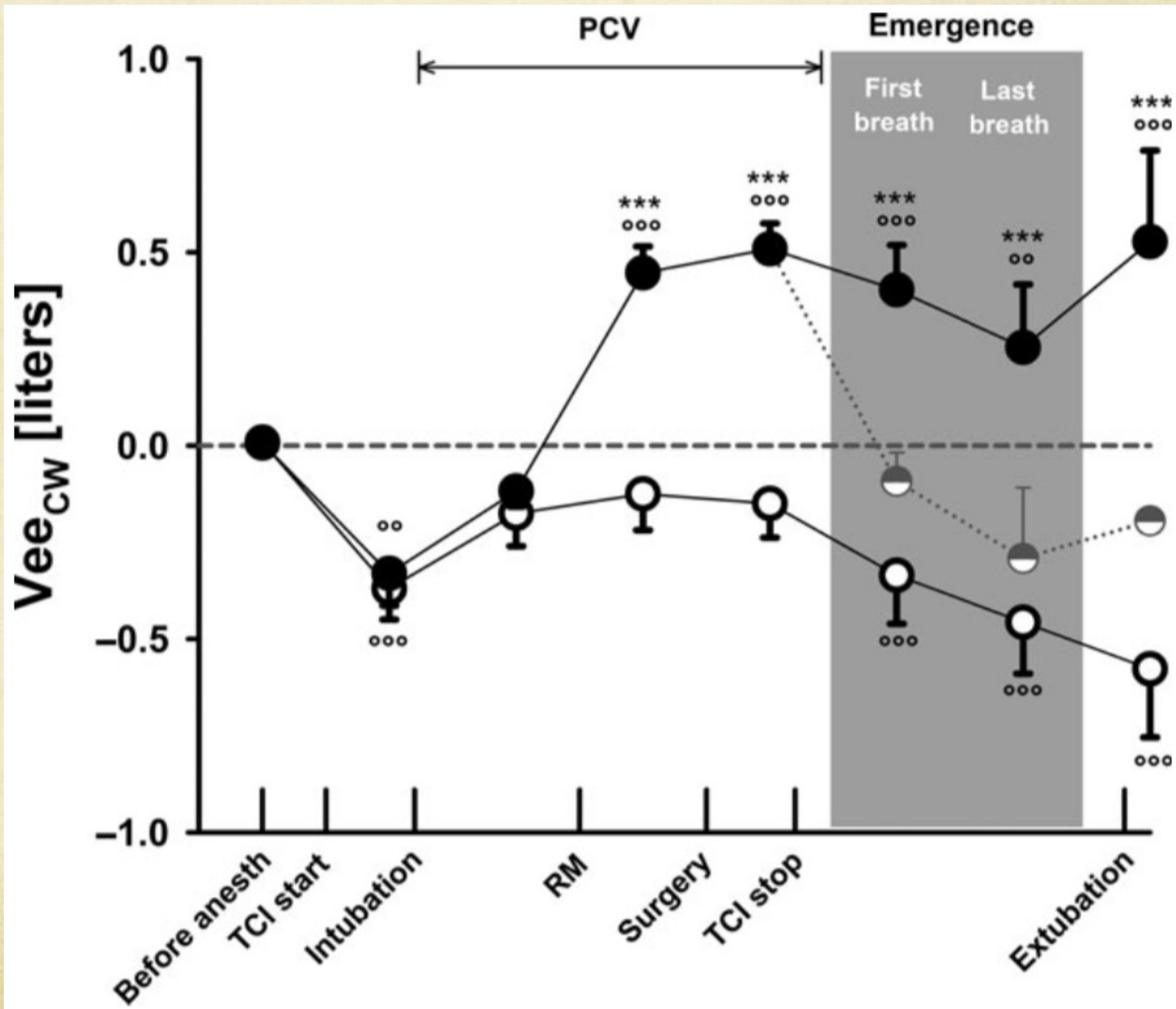
Nestler C, Simon P, Petroff D, et al. Br J Anaesth. 2017; 119(6): 1194-205.

Une extubation réussie?



Pereira SM, Tucci MR, Morais CCA, et al. Anesthesiology. 2018; 129(6): 1070-81.

Oups...



Kostic P, LoMauro A, Larsson A, et al. Acta Anaesthesiol Scand. 2018; 62(3): 282-92.

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Intraoperative High Positive End-Expiratory Pressure (PEEP) With Recruitment Maneuvers vs Low PEEP on Postoperative Pulmonary Complications in Obese Patients

JAMA | Original Investigation

Effect of Intraoperative Low Tidal Volume vs Conventional Tidal Volume on Postoperative Pulmonary Complications in Patients Undergoing Major Surgery

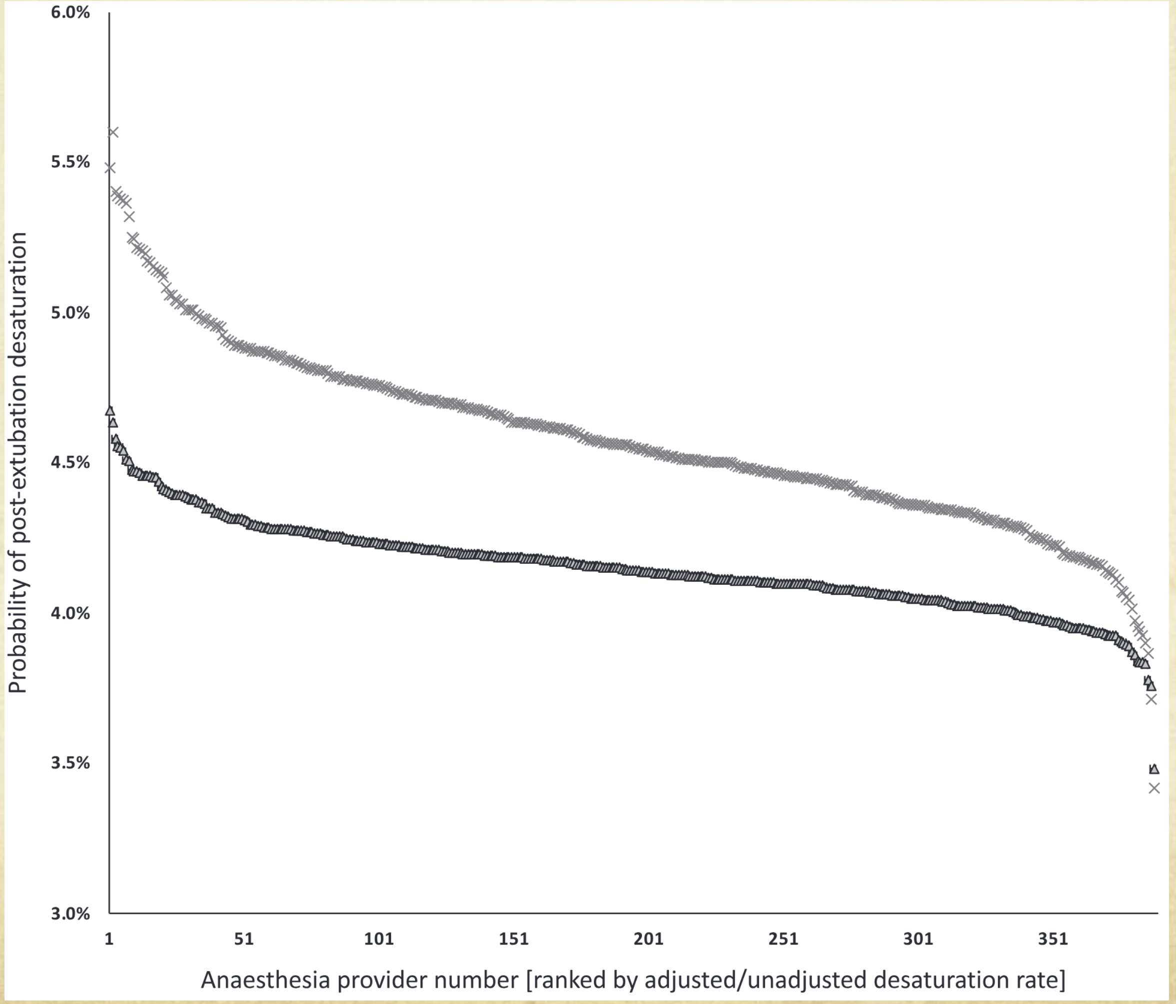
Très peu d'études décrivent comment l'extubation est réalisée

ANESTHESIOLOGY

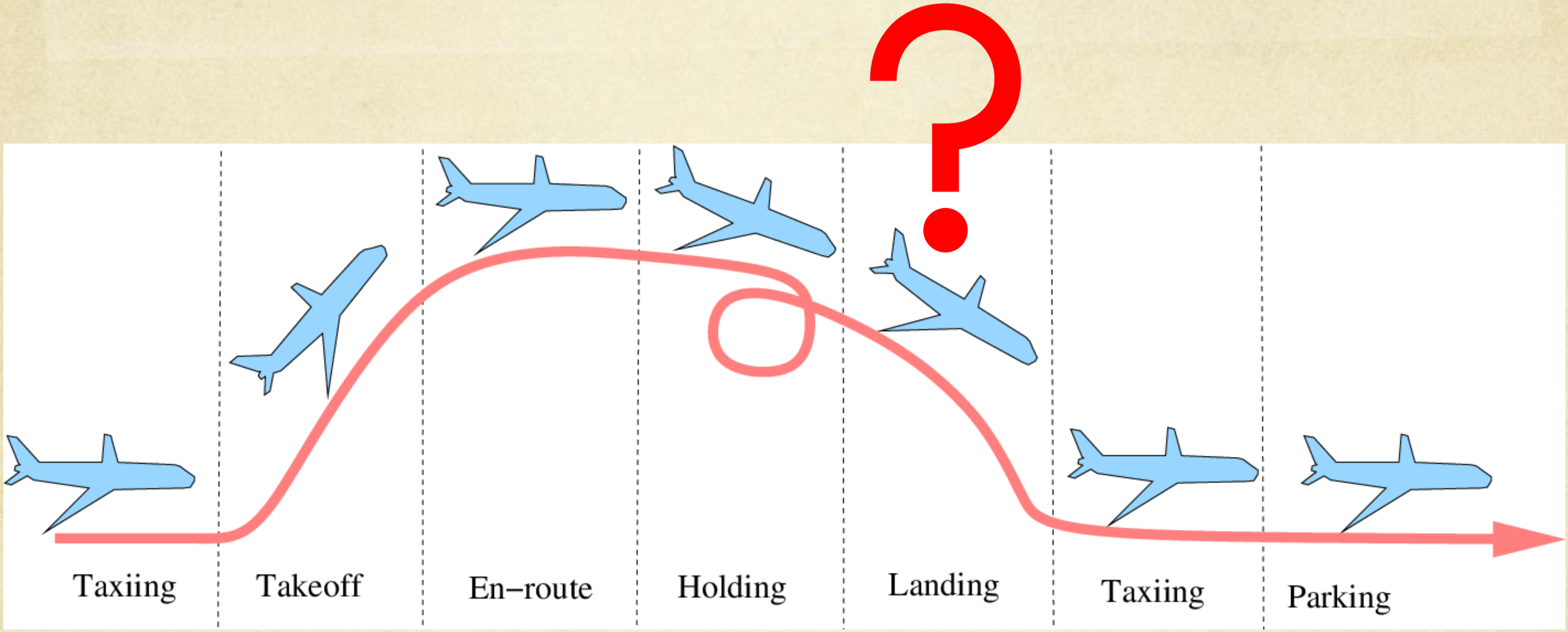
Tidal Volume and Positive End-expiratory Pressure and Postoperative Hypoxemia during General Anesthesia: A Single-center Multiple Crossover Factorial Cluster Trial

adjusting inspiratory pressure. Extubation was performed in the operating room, and then patients were transferred to postanesthesia care unit. After returning to the ward, sup-

Variabilité inter-anesthésistes



Rostin P, Teja BJ, Friedrich S, et al. Anaesthesia. 2019; 74(4): 457-67.


?
Taxiing
Takeoff
En−route
Holding
Landing
Taxiing
Parking

Programme de recherche OLEXT

Travaux préliminaires

Lung ultrasonography for the assessment of perioperative atelectasis: a pilot feasibility study
(published Anesth Analg 2017)

Positive End-Expiratory Pressure and Recruitment Maneuvers versus Zero End-Expiratory Pressure on Ultrasonographically-Assessed Perioperative Atelectasis During Open Gynecologic Oncologic Surgery: A RCT
(published Br J Anaesth 2020)

Lung-protective ventilation for the surgical patient: international expert panel-based consensus recommendations
(published Br J Anaesth 2019)

Mechanical ventilation strategies during general anesthesia: a two-month audit at a tertiary university hospital
(manuscript to be submitted to the CJA in October 2023)

ECR pilote monocentrique
OLEXT-1
(CJA 2023)

↓

ECR pilot multicentrique
OLEXT-3

↓

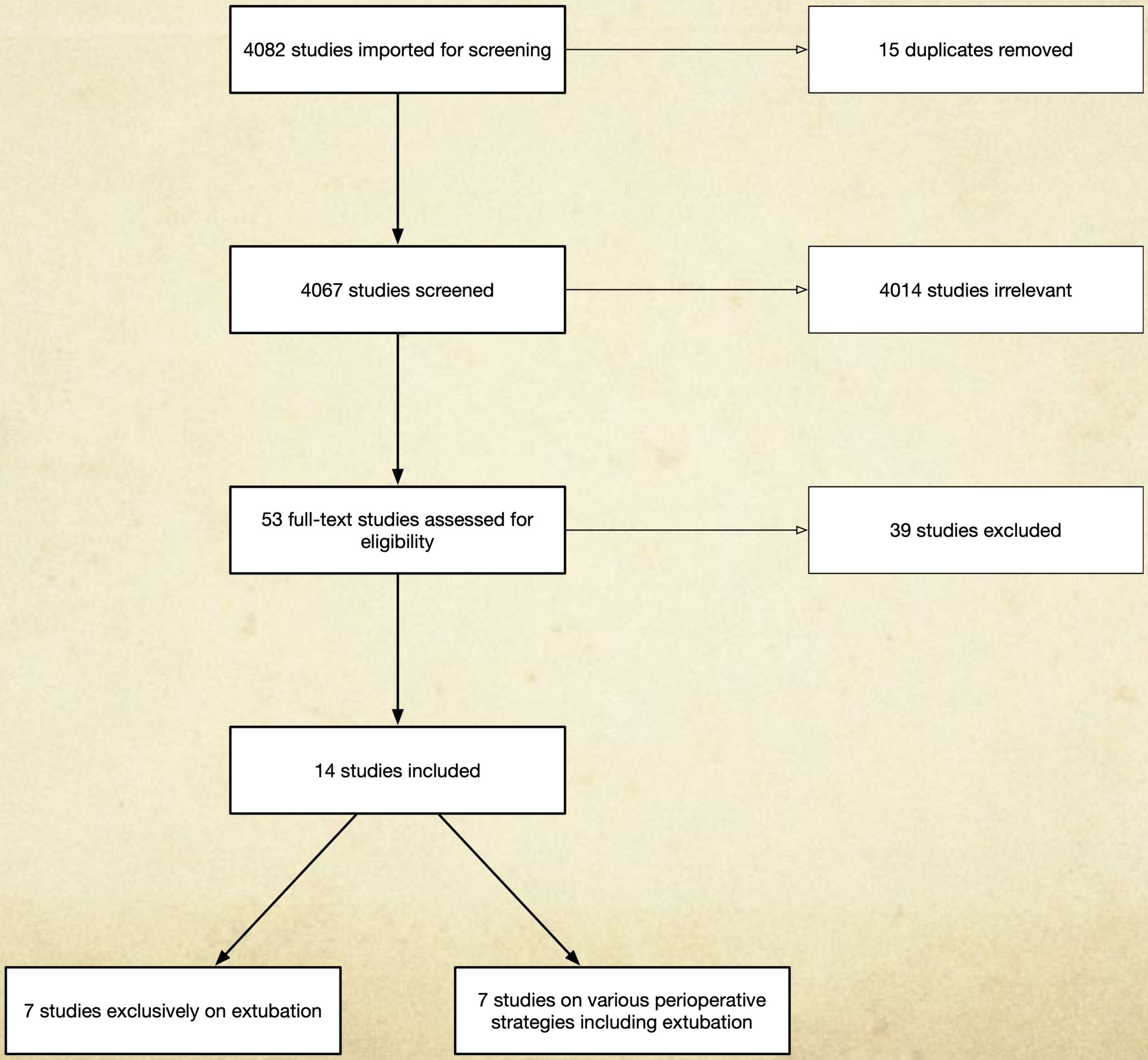
ECR d'efficacité multicentrique
OLEXT-4
(à venir)

Revue systématique sur le sevrage de la ventilation mécanique post-anesthésie (UofT), accepté Br J Aneasth)

Enquête de pratique canadienne sur l'extubation
OLEXT-2
(en cours)

PACT
Canadian Perioperative Anesthesia Clinical Trials Group
Groupe Canadien d'Essais Cliniques en Anesthésie et Médecine Periopératoire

Revue systématique



Abbot M, Pereira S, Sanders N, et al. BJA. Accepted for publication.

Table 4: Summary of the evidence for each outcome studied in the intervention compared to the control group with GRADE quality of evidence, risk of bias and overall effect assessed

Intervention	Intervention group	Control group	Outcome Measured (Source; units)	GRADE	Risk of Bias	Overall Effect
Outcome: Atelectasis						
PSV & PEEP	33% [RR 0.58; 95% CI, 0.35-0.91]	57%	Incidence of atelectasis (LUS-measured; in %) [24]	High ⊕⊕⊕⊕	Low	Likely beneficial
PSV & PEEP & FiO_2	1.6 (3.6) 6.2 (4.1)%	0.3 (3.7) 10.8 (7.1)%	Mean difference in pulmonary aeration PACU vs. pre-emergence (qLUSS score) [26] Percentage of non-aerated lung tissue (CT-measured; in %) [11]	Moderate ⊕⊕⊕	Some Concerns	Likely beneficial
FiO_2	6.8 (3.4) vs. 2.6±1.1% 5.5 [0-16.9] cm^2 3 [1-6] & 20% [RR 0.512; 95% CI, 0.311-0.843]	8.3 (6.2%) 6.8 [0-27.5] cm^2 7 [3-9] & 39%	Postoperative atelectasis (CT-measured; in %) [23] Atelectasis area (CT-measured; in cm^2) [13] LUS score & Significant atelectasis (LUS-measured; score and %, respectively) [25]	Low ⊕⊕	High	Likely beneficial
PEEP	5.2 [2.4-14.3] cm^2	4.9 [3.0-12.7] cm^2	Postoperative atelectasis (CT-measured; in cm^2) [10]	High ⊕⊕⊕⊕	Low	No effect
Outcome: Oxygenation						
PSV & PEEP	12.3 (3.5) kPa	11.1 (1.7) kPa	PaO_2 at PACU (ABG-measured; in kPa) [24]	High ⊕⊕⊕⊕	Low	Likely beneficial
PSV & PEEP & FiO_2	12% & 26 [22, 28] hrs.	58% & 13 [2, 26] hrs.	% requiring oxygen supplementation during first postoperative week & Duration of supplemental O_2 administration in hours [26]	High ⊕⊕⊕⊕	Low	Likely beneficial
FiO_2	9.9 vs. 12.7 kPa * 8.9 (0.93) kPa 57.9 (39.9-69.9) kPa 12.7% vs. 8.1%	11.3 kPa* 8.3 (0.79) kPa 56.9 (45.9-66.9) kPa 14.2%	PaO_2 at PACU (ABG-measured; in kPa) [23] PaO_2 60 mins postoperative (ABG-measured; in kPa) [12] PaO_2/FiO_2 90 mins after extubation (ABG-measured; in kPa) [27] Estimated venous admixture-(ABG-measured, in %) [28]	Moderate ⊕⊕⊕	Some Concerns	Likely beneficial
PEEP	0.20 (0.89) kPa 55.7 [46.5-77.6] kPa	0.26 (0.87) kPa 56.4 [41.1-73.8] kPa	A-a partial pressure difference (ABG-measured kPa) [14] PaO_2/FiO_2 15-45 mins after extubation (ABG-measured; in kPa) [10]	Moderate ⊕⊕⊕	Some Concerns	No effect
Outcome: Lung Volumes						
PSV & PEEP & FiO_2	+0.5 L*	-0.6 L*	End-expiratory lung volume (opto-electronic plethysmography-measured; in L) [30]	Low ⊕⊕	High	Likely beneficial
FiO_2	41 (14)% vs. 37 (13)% & 44 (17)% vs. 40 (20)% 1633 mL [1343-1948]	46 (14)% & 49 (20)% 1615 mL [1375-2318]	End-expiratory & Total lung impedance reduction (EIT-measured; in %) [29] FRC (inert gas-rebreathing method-measured; in mL) [27]	Moderate ⊕⊕⊕	Low	No effect
Outcome: PPCs						
FiO_2 & PEEP	43% [RR 0.90; 95% CI, 0.74-1.10] vs. 41% [RR 0.84; 95% CI,0.69-1.03] vs. 39% [RR 0.80; 95% CI, 0.65-0.99]	48%	% patients with PPCs [31]	Moderate ⊕⊕⊕	Low	Possibly beneficial

*Values estimated from a Figure

Note: PSV = pressure support ventilation, PEEP = positive end-expiratory pressure, LUS = lung ultrasound, FiO2 = fraction of inspired oxygen, CT = computed tomography, A-a = alveolar-arterial oxygen pressure difference, FRC = functional residual capacity, PPCs = postoperative pulmonary complications; qLUSS = quantitative lung ultrasound score

OLEXT-2

- Étude à méthodes mixtes basée sur une enquête de pratique canadienne transversale auprès des anesthésiologistes
- HYPOTHÈSE
  - Nous faisons l'hypothèse que la ventilation en aide inspiratoire et l'usage de la PEP seront fréquemment utilisées pour extuber les patients post-anesthésie générale. Nous croyons qu'une variabilité de pratique significative existe entre les différents hôpitaux et à l'intérieur de ceux-ci pour la majorité des interventions.

OLEXT-2

- OBJECTIFS SPÉCIFIQUES
  - Décrire la pratique canadienne de l'extubation post-anesthésie générale telle que perçue par les anesthésiologistes.
  - Analyser la variabilité de la pratique à l'intérieur d'un même hôpital et entre ceux-ci.
  - Identifier des caractéristiques spécifiques des patients susceptibles d'influencer la pratique des anesthésiologistes.

OLEXT-2

- Élaboration du sondage
  - Comité d'experts
  - Phase 1: Génération
  - Phase 2: Réduction
  - Phase 3: Priorisation
  - Pilotage
  - Traduction

OLEXT-2

- Cadre d'échantillonnage
  - Médecins pratiquant l'anesthésiologie au Canada
    - Omnipraticiens
    - Anesthésiologiste
- Canal de diffusion
  - Courriels
    - AAQ (781) → Terminé
    - SCA (1458) → En cours
- 5 avril 2024 12h00
  - 555 sondages complétés (24,8%)

OLEXT-1

- Étude prospective, pilote, à triple insu, monocentrique, randomisée contrôlée
- HYPOTHÈSE
  - Un essai pilote multicentrique est faisable

Girard J, Zaouter C, Moore A, et al. Can J Anesth. 2023; 70(10): 1648-59.

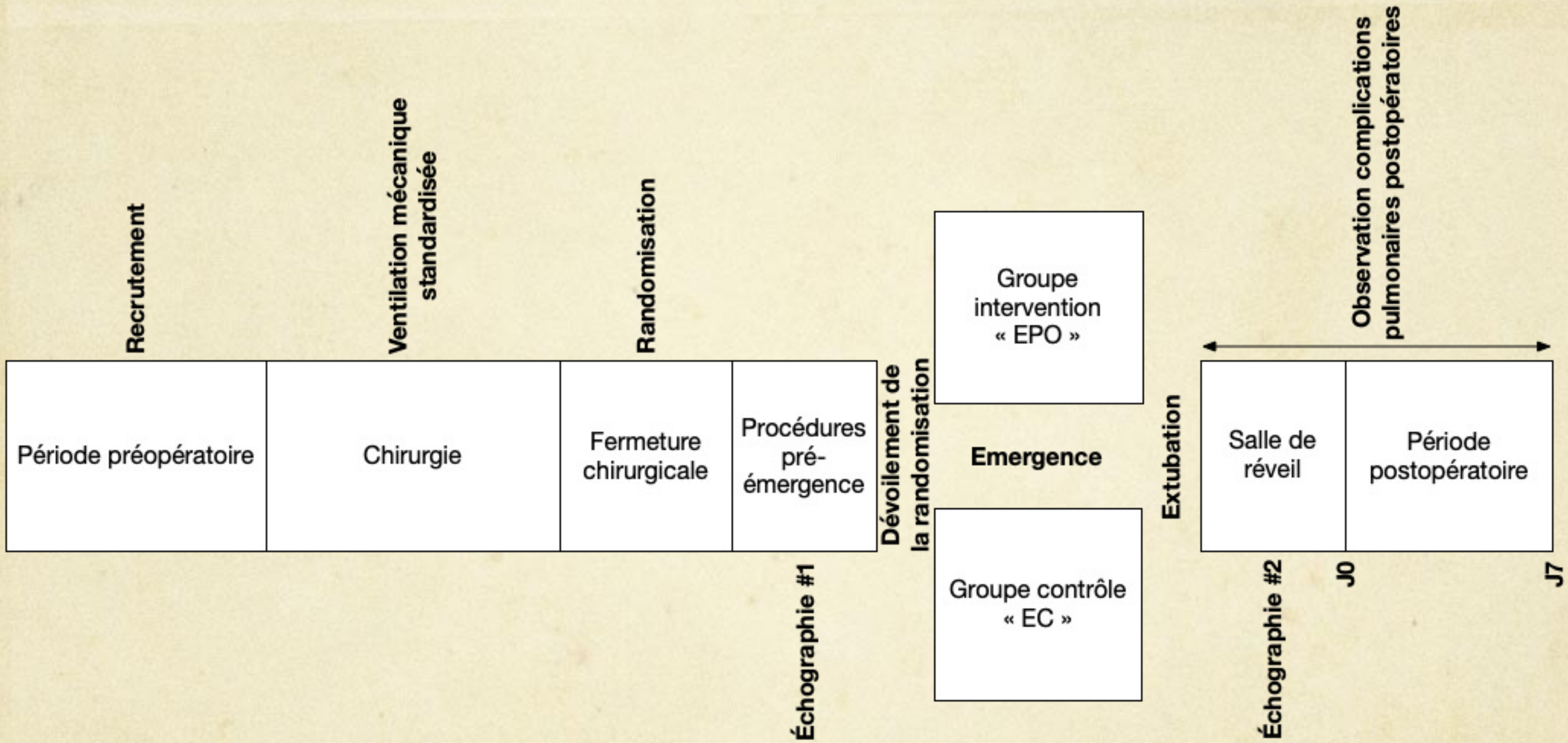
OLEXT-1

- OBJECTIFS SPÉCIFIQUES
  - Établir la faisabilité d'un essai clinique randomisé contrôlé multicentrique comparant deux stratégies cliniques dites « à poumons ouverts » et « conventionnelle » lors de l'extubation.
  - Estimer les taux de complications pulmonaires postopératoires dans les deux groupes d'intervention.
  - Vérifier l'hypothèse selon laquelle la stratégie d'extubation « à poumons ouverts » permet d'améliorer le score d'aération pulmonaire échographique post-opératoire par rapport à une stratégie d'extubation conventionnelle

OLEXT-1

- P: Adulte subissant chirurgie sous anesthésie générale avec hospitalisation post-op et à risque moyen/élevé de complications pulmonaires post-opératoires (ARISCAT)
- I: Position semi-assise, FiO2 50%, VS-AI, maintient du PEEP
- C: Décubitus dorsal, FiO2 100%, ventilation manuelle au ballon avec valve APL à 0 cm H2O
- O: Taux d'adhérence au protocole

OLEXT-1


Recrutement
Ventilation mécanique standardisée
Randomisation
Période préopératoire
Chirurgie
Fermeture chirurgicale
Procédures pré-émergence
Échographie #1
Dévoilement de la randomisation
Groupe intervention « EPO »
Emergence
Groupe contrôle « EC »
Extubation
Observation complications pulmonaires postopératoires
Salle de réveil
Période postopératoire
Échographie #2
J0
J7

Résultats

	Extubation conventionnelle (n=35)	Extubation à poumon ouvert (n=34)	Valeur p* et IC95%**
Issue primaire			
Adhérence par groupe (n)	33 (94%)	33 (97%)	1.0
Adhérence globale (n)	66 (96%)		88%, 99%

Les données sont exprimées en nombre (%).
**bootstrap chi^2 test.*
***intervalle de confiance de type score*

Autres issues

	Extubation conventionnelle (n=35)	Extubation à poumon ouvert (n=34)	Différence de risque ou médiane des différences ou différence des moyennes
Complications respiratoires première semaine postopératoire (n)	2 (6%)	6 (18%)	12% [-4%, 29%]
Patients ayant quitté la salle de réveil sans supplémentation en oxygène (n)	4 (11%)	7 (21%)	9% [-9%, 27%]
Supplémentation en oxygène première semaine postopératoire (%.h)	58 [8, 144]	12 [5, 37]	-12 [-63, 1]
Durée de la supplémentation en oxygène première semaine postopératoire (h)	13 [2, 26]	2 [1, 11]	-3 [12, 0]
Différence entre le score d'aération pulmonaire échographique calculé à la salle de réveil et préémergence	0.3 (3.7)	-1.6 (3.6)	-1.9 [-3.7, -0.1]

OLEXT-3

- ECR pilote **interne**, multicentrique
  - CHU de Québec – Université Laval (A Turgeon, M Verret)
  - The Ottawa Hospital (M Lalu, D McIsaac)
  - Unity Health Network (A Sankar, M Sklar)
  - CHUM (F Carrier, M Chassé, M Girard)
- HYPOTHÈSE
  - Un essai multicentrique est faisable

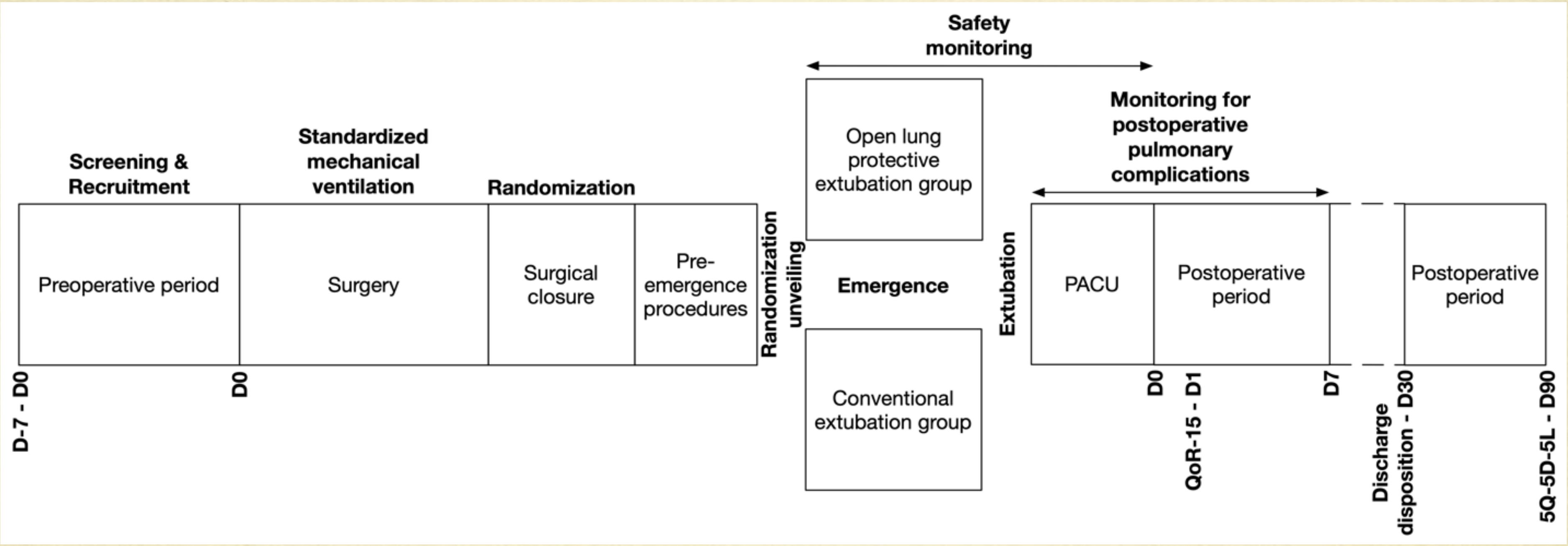
OLEXT-3

- Objectifs de faisabilité
  - Taux d'adhérence au protocole ≥ 90%
  - Nombre de patients recrutés par semaine par centre ≥ 2
  - Taux de complétion de l'issue primaire (CPP) ≥ 90%
- N = 216
  - 54 patients / centre
- Début prévu automne 2024 (7 mois)

OLEXT-3

- P: Adulte subissant chirurgie **intra-abdominale** sous anesthésie générale avec hospitalisation post-op et à risque moyen/élevé de complications pulmonaires post-opératoires (ARISCAT)
- I: Position semi-assise, FiO2 50%, VS-AI, maintient du PEEP
- C: Décubitus dorsal, FiO2 100%, ventilation manuelle au ballon avec valve APL à 0 cm H2O
- O: Taux d'adhérence au protocole

OLEXT-3



Safety monitoring
Screening & Recruitment
Standardized mechanical ventilation
Randomization
Monitoring for postoperative pulmonary complications
Preoperative period
Surgery
Surgical closure
Pre-emergence procedures
Randomization unveiling
Open lung protective extubation group
Emergence
Conventional extubation group
Extubation
PACU
Postoperative period
Postoperative period
D-7 - D0
D0
D0
QoR-15 - D1
D7
Discharge disposition - D30
5Q-5D-5L - D90

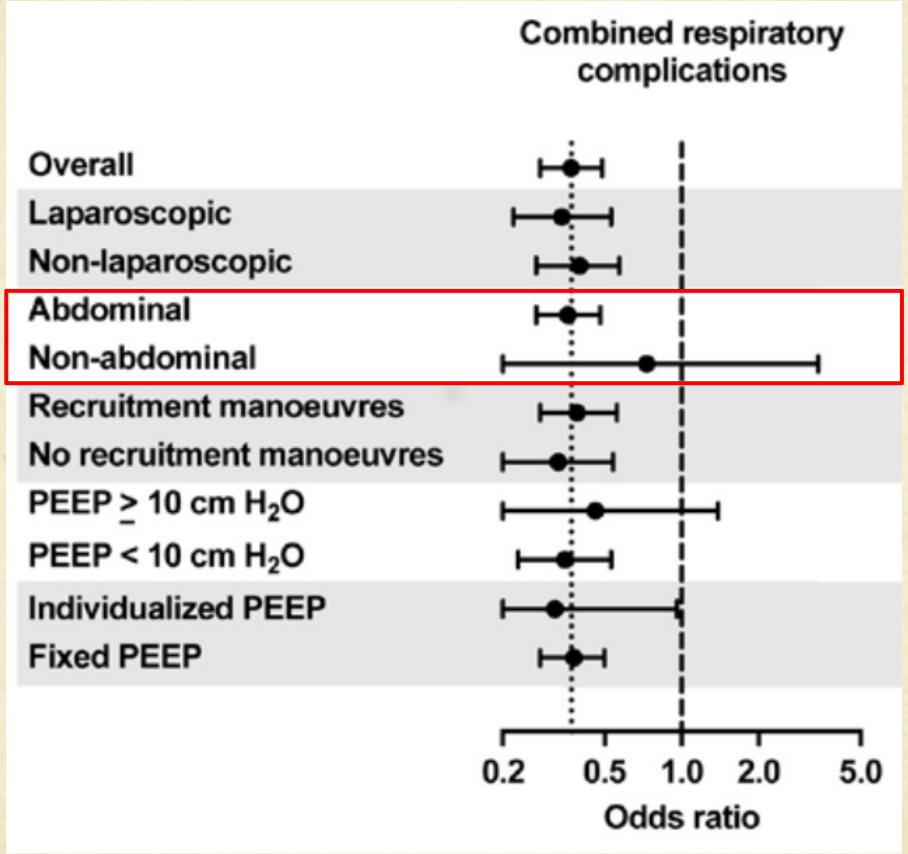
Messages à retenir

- Induction de l'anesthésie
  - Pensez au Fowler et/ou au CPAP
- Réglages du ventilateur
  - Vt 8 cc / kg PBW
  - PEEP 5 cm H_2O
  - FiO_2 30 – 40%
- Paramètre à considérer lors des modifications des réglages
  - Pression motrice
- Pas de manoeuvre de recrutement sans considérer une modification du PEEP
- Peu d'évidences pour guider l'émergence

Commentaires sur les recommandations

- Patients inclus dans les études souvent à risque modéré ou élevé de complications respiratoires postopératoires
- S'appliquent sans nuance à tous les types de chirurgies (abdominales laparoscopique, abdominales ouvertes, périphériques).
- Possibilité d'une intéraction entre le volume courant et le PEEP
- Pression motrice (*driving pressure*): est-ce une cible thérapeutique ou un marqueur de sévérité?
- Protocoles fixes dans les études (aucune individualisation, on se soucie de l'atélectasie, mais peu/pas de la surdistension)
  - L'extubation est rarement protocolisée

Type de chirurgie



Bolther M, Henriksen J, Holmberg MJ, et al. Anesth Analg. 2022; 135(5): 971-85.

Volume courant et PEEP

	V_T = 6 ml/kg	V_T = 10 ml/kg	Effect Estimate	*P* Value*
Primary outcome	(N = 1,362)	(N = 1,498)	Mean difference (97.5% CI)	
Time-weighted average Spo_2/Fio_2 in PACU†	355 ± 46	350 ± 47	3.5 (–0.4 to 7.3)	0.042
Secondary outcomes	(N = 1,112)	(N = 1,228)	Mean difference (99.2% CI)	
Time-weighted average Spo_2/Fio_2 in ward†	428 ± 42[36]	430 ± 41[60]	–2.3 (–6.8 to 2.2)	0.172
			Odds ratio (99.2% CI)	
Pulmonary complications‡	34 (3.1%)	39 (3.2%)	1.00 (0.53 to 1.87)	0.992
			Mean ratio (99.2%)	
Length of hospital stay§	3 [2, 5]	3 [2, 5]	1.03 (0.97 to 1.10)	0.154

	PEEP = 5 cm H_2O	PEEP = 8 cm H_2O	Effect estimate	*P* Value*
Primary outcome	(N = 1,526)	(N = 1,334)	Mean difference (97.5% CI)	
Time-weighted average Spo_2/FiO_2 in PACU†	353 ± 46	352 ± 47	–0.2 (–4.0 to 3.6)	0.906
Secondary outcomes	(N = 1,250)	(N = 1,090)	Mean difference (99.2% CI)	
Time-weighted average Spo_2/Fio_2 in ward†	429 ± 41[49]	429 ± 41[47]	1.1 (–3.4 to 5.6)	0.522
			Odds ratio (99.2% CI)	
Pulmonary complications‡	36 (2.9%)	37 (3.4%)	0.87 (0.46 to 1.63)	0.553
			Mean ratio (99.2%)	
Length of hospital stay§	3 [2, 5]	3 [2, 5]	0.99 (0.94 to 1.05)	0.794

Turan A, Sakr Esa WA, Rivas E, et al. Anesthesiology. 2022; 137(4): 406-17.

Conclusion

- Complications respiratoires post-opératoires fréquentes et morbides
- Éléments clés des lignes directrices
  - Fowler/CPAP
  - Vt 6 - 8 cc/kg PBW, PEEP 5, FiO_2 30 – 40%
  - Pression motrice
  - ? Rôle des manoeuvres de recrutement
  - Manque de données pour guider l'émergence
- Plus important chez les patients à risque et subissant des chirurgies abdominales