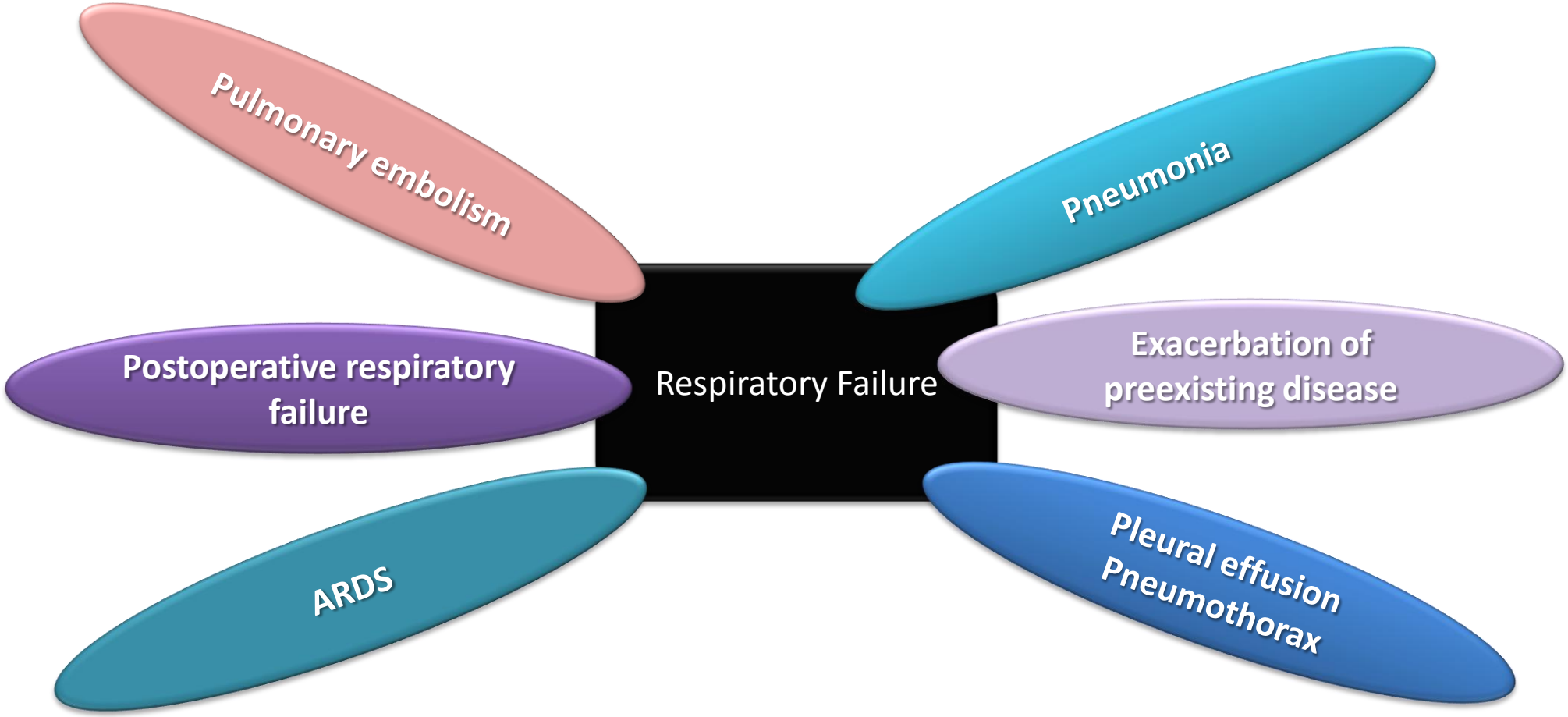
Ο ρόλος του Πνευμονολόγου στην προ και μετεγχειρητική φροντίδα του μη θωρακοχειρουργικού ασθενούς

- Μετεγχειρητική παρακολούθηση

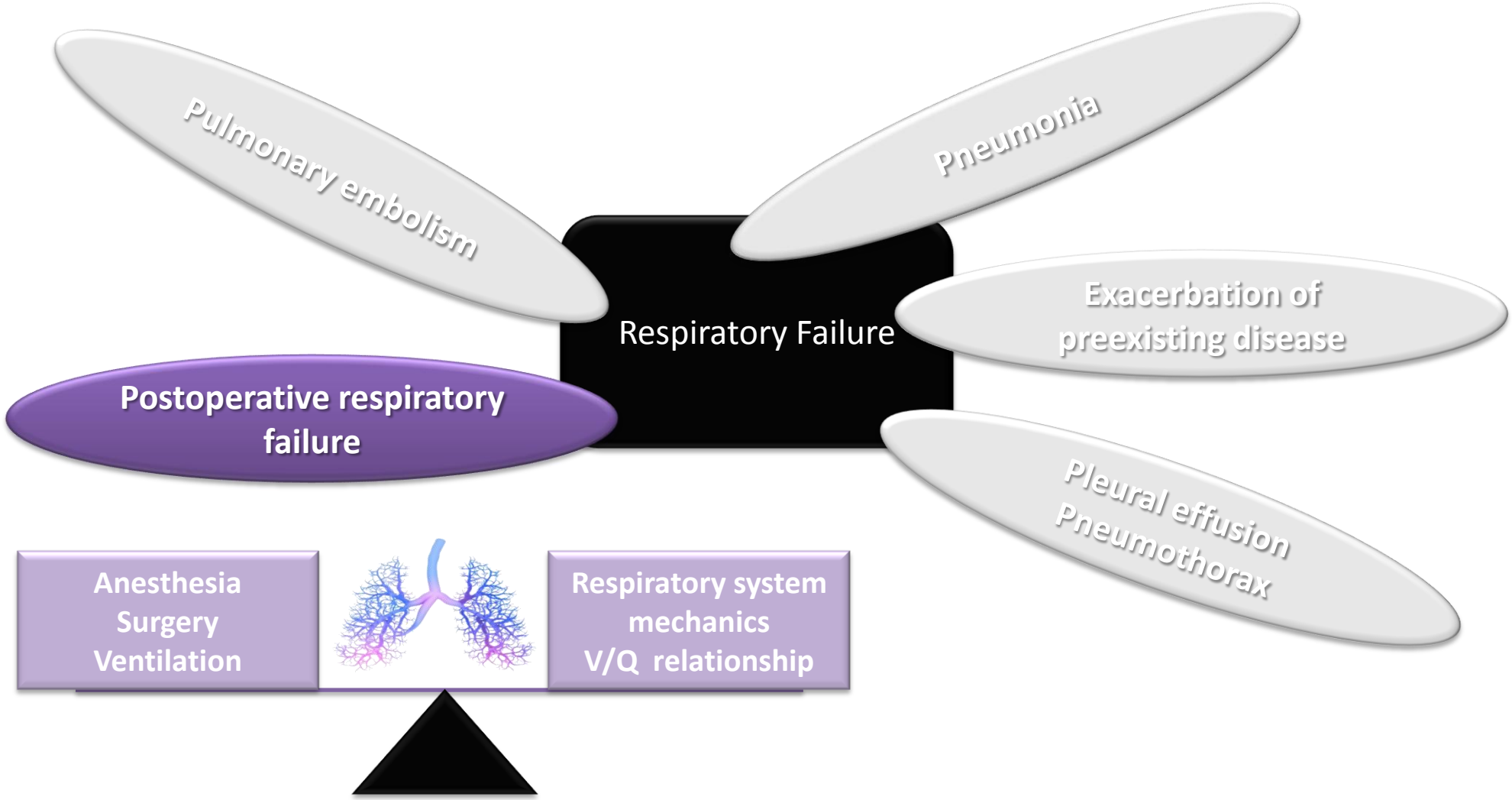
28ο ΠΑΝΕΛΛΗΝΙΟ Πνευμονολογικό ΣΥΝΕΔΡΙΟ

Αντωνογιαννάκη Ελβίρα-Μαρκέλα
Επικουρική Επιμελήτρια Β'
Β' Πνευμονολογική Κλινική
ΕΚΠΑ, ΠΓΝ Αττικόν

Postoperative pulmonary complications



Postoperative pulmonary complications



Postoperative pulmonary complications
Risk factors

Anesthetic factors	Surgery factors	Patient factors
Anasthesio-induced atelectasis	Vascular surgeries	Age >65 and <6 ys
Positive fluid balance	Thoracic surgery (one lung ventilation)	ASA≥3
Blood tranfusion 4 units or more	Upper abdominal surgery	COPD
Ventilatory settings (VT/Pplateau)	Neurosurgery	OSAS
General anesthesia	Orofacial and neck surgery	Preoperative Sp02
Use of nasogastric tube	Emergency surgery	CHF
Need for postoperative ventilation	Reoperation	Respiratory infection within a month
Long-acting muscle relaxants	Surgeries 3hr or more	Functional dependency
Intravenous vs inhalation anesthesia	Open vs laparoscopic	Smoker
Mask vs endotracheal tube		Family history of asthma/atopy
		Alcohol abuse
		PH
		Weight loss>10%
		Albumin <3.5g/dl
		Hb<10g/dl
		Impaired sensorium
		Abnormal chest x-ray
		BMI >27kg/m2

Tusman G et al, Curr Opin Anesthesiol, 2012

Postoperative pulmonary complications
Surgery factors

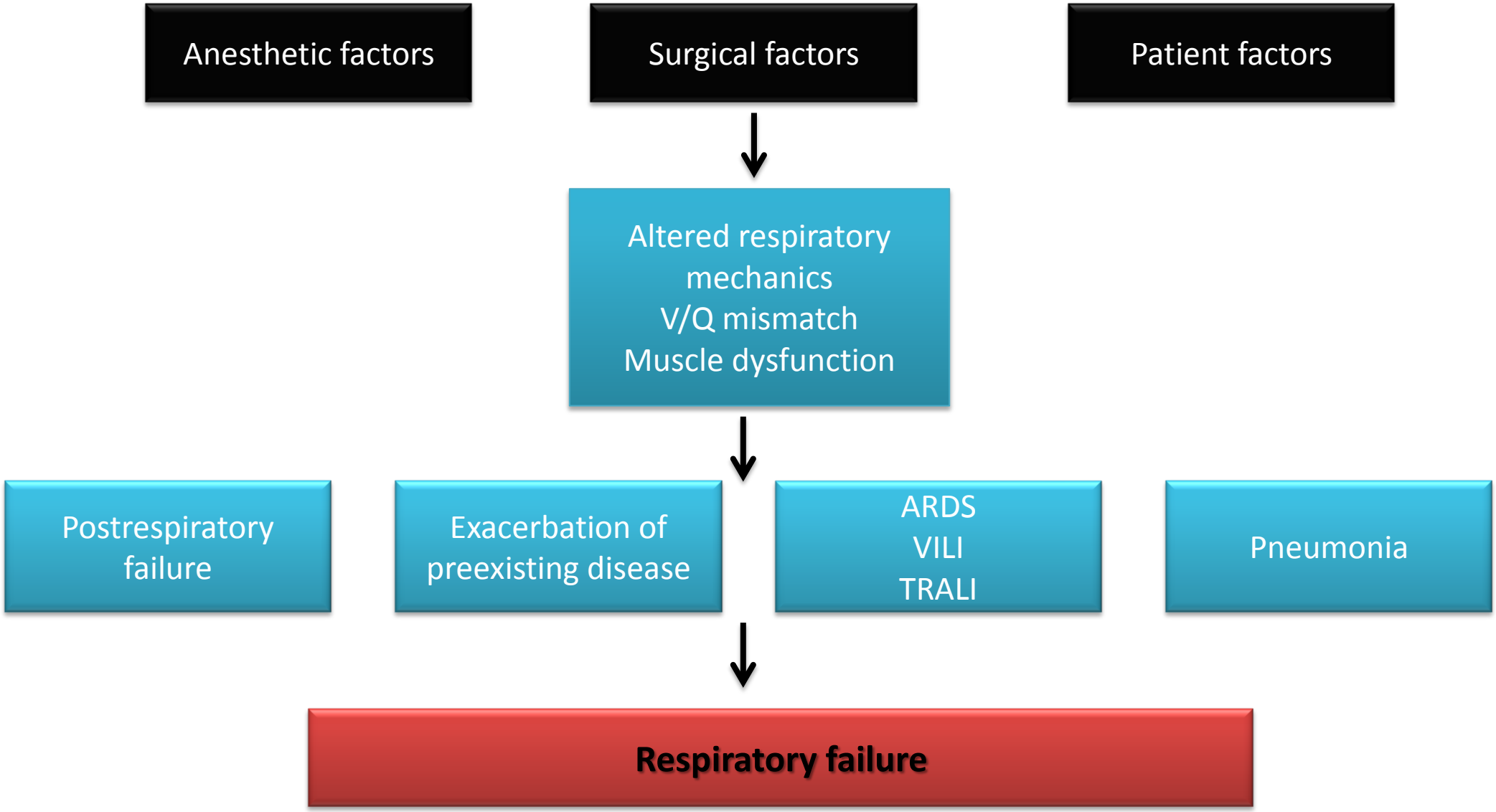
	Point values assigned by each scoring system					
	PRF risk index[a] [9]	Pneumonia risk index[b] [8]	ARISCAT PPC score [6]	SLIP [23▪]	UEPI [7▪]	PRF risk calculator[c] [45▪]
Cardiac	Excluded	Excluded	24	19[d]	Excluded	1.32
Thoracic	21	14	24	16[e]	1	1.96
Abdominal aortic aneurism	27	15		32[f]	1	2.94[g]
Upper abdominal	14	10	15		1	2.64
Neurosurgery	14	8			1	2.08
Neck	11	8				1.11[h]
Peripheral vascular	14	3			1	
Urology						1.36
Other medium to very high risk surgery					1	
Duration of surgery						
2–3 h			16	Excluded		
>3 h			23	Inclusion criteria		
Emergency surgery	11	3	8	Excluded		0.56
General anaesthesia		4				

Canet J et al, Curr Opin Anesthesiol, 2013

Postoperative pulmonary complications Incidence-Mortality

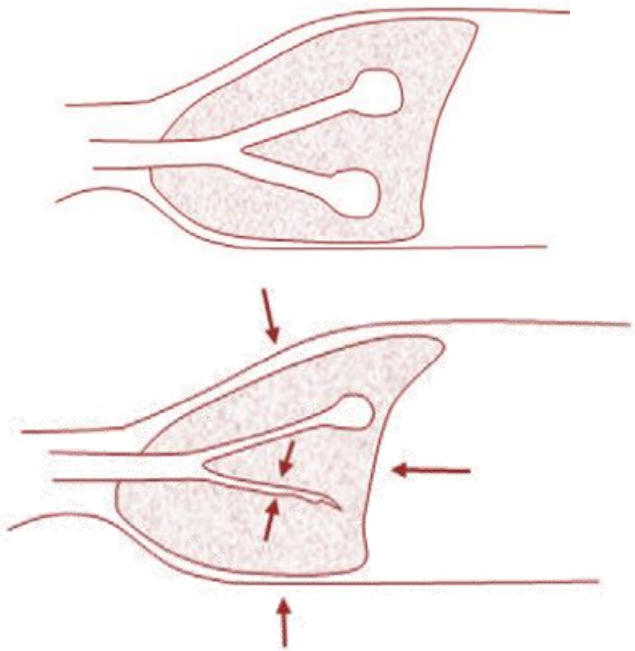
- Risk incidence >20% in high risk procedures
- 19-59% after thoracic surgery
- 16-20% after upper abdominal surgery
- 0-5% after lower abdominal surgery
- Postoperative pulmonary complications mortality 10-25%

Sachdev J G et al, Surg Clin N Am, 2012
Canet J et al, Curr Opin Anesthesiol, 2013



Tusman G et al, Curr Opin Anesthesiol, 2012

Postoperative respiratory failure



Awakeness

Anesthetized

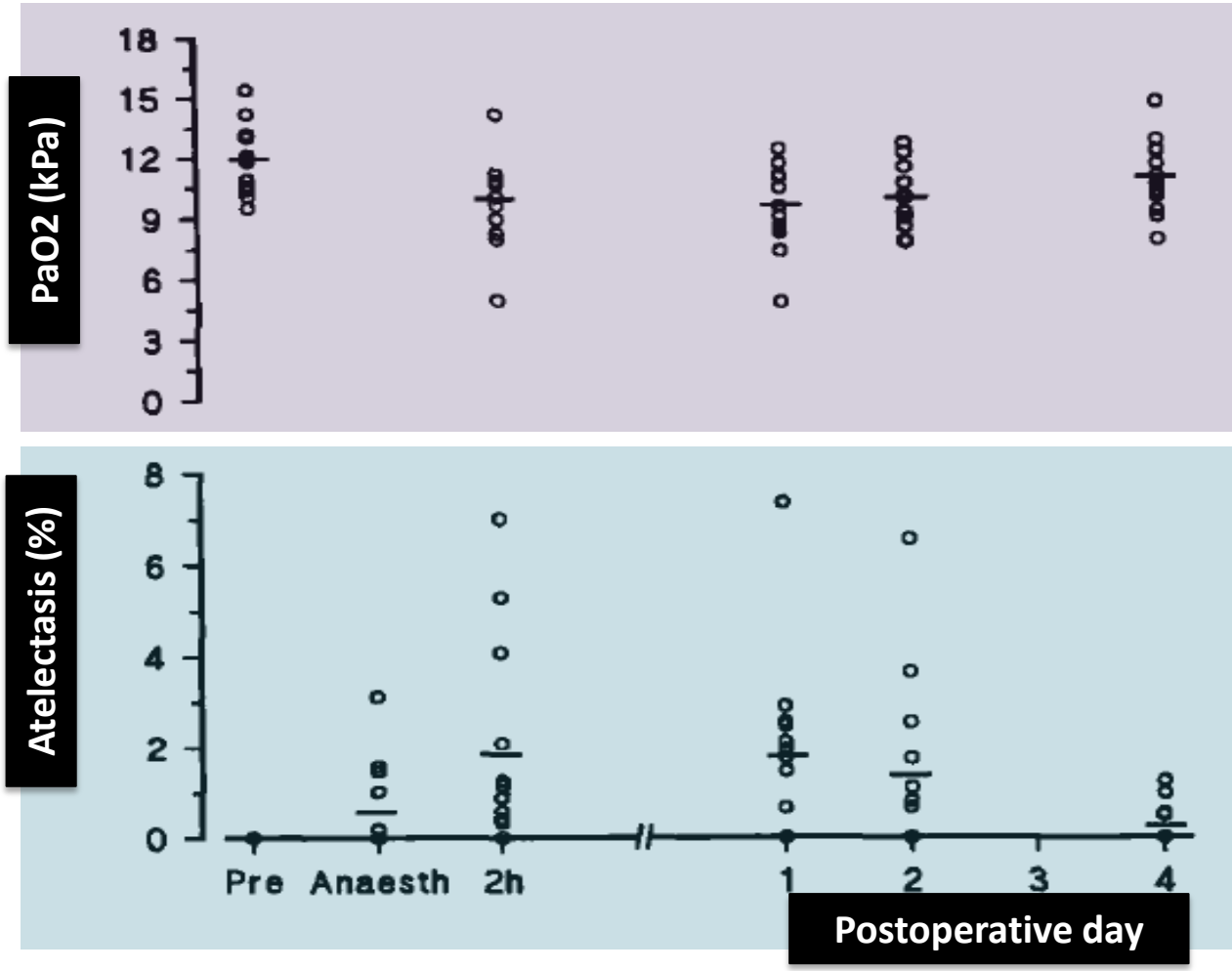
FRC ↓
Clung ↓
Raw ↑

→ Loss of tone
Smaller volume
Reduced airway dimensions

→ Airway closure
Atelectasis

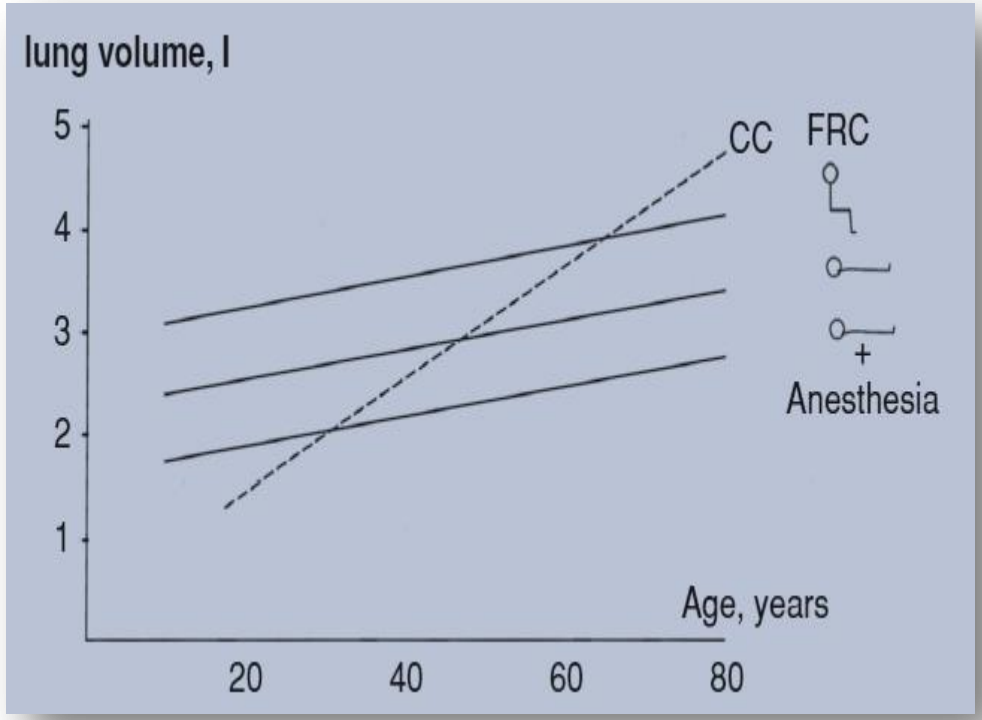
Hedensternia G, Acta Anesthesiol Scan, 2012

Postoperative respiratory failure



Lindberg P et al, Acta Anesthesiol Scan, 1992

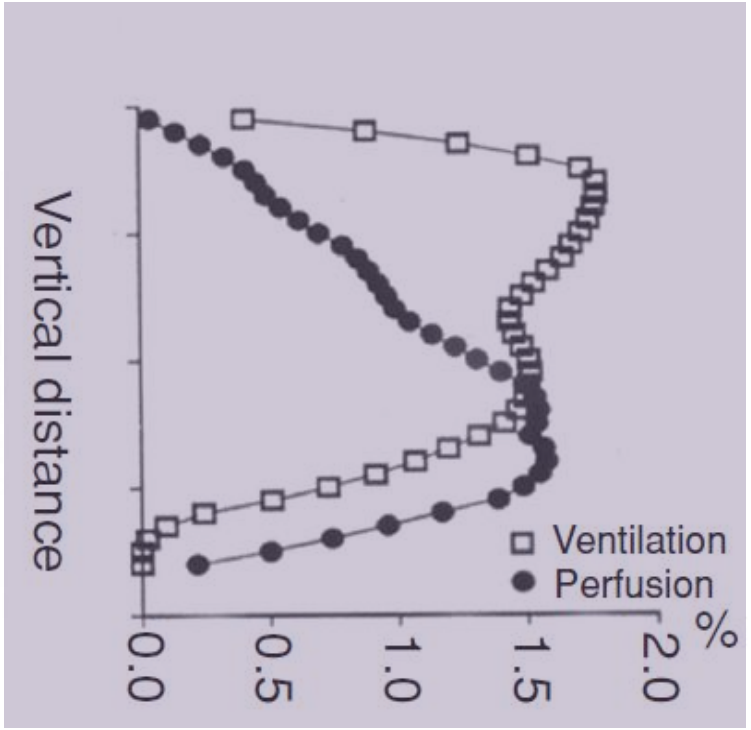
Postoperative respiratory failure
Lung mechanics



Reber A et, Anaesthesia, 1998
Hedensternia G et al, Compr Physiolody, 2012

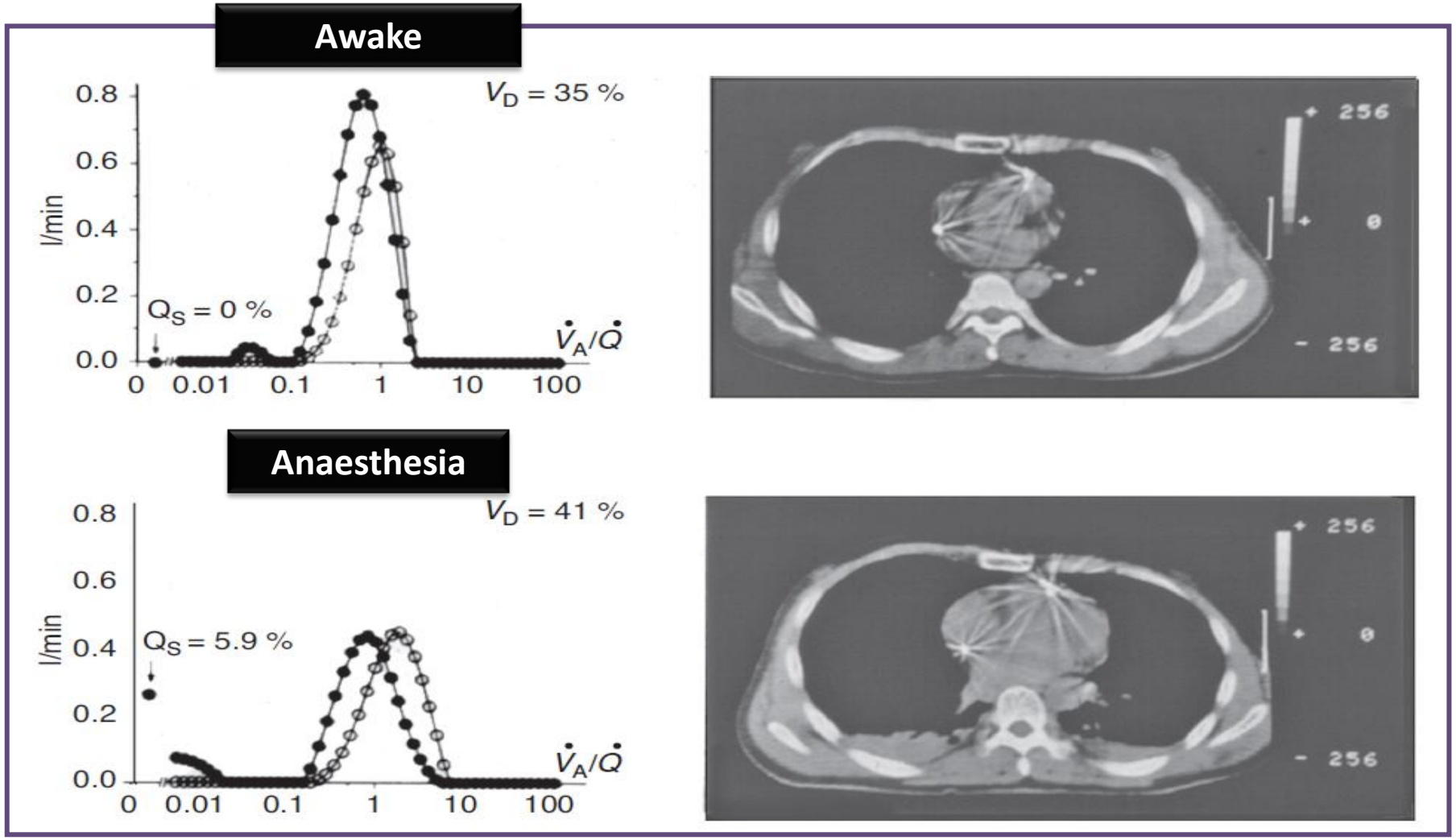
Postoperative respiratory failure
V/Q relationship

Supine + Anesthesia



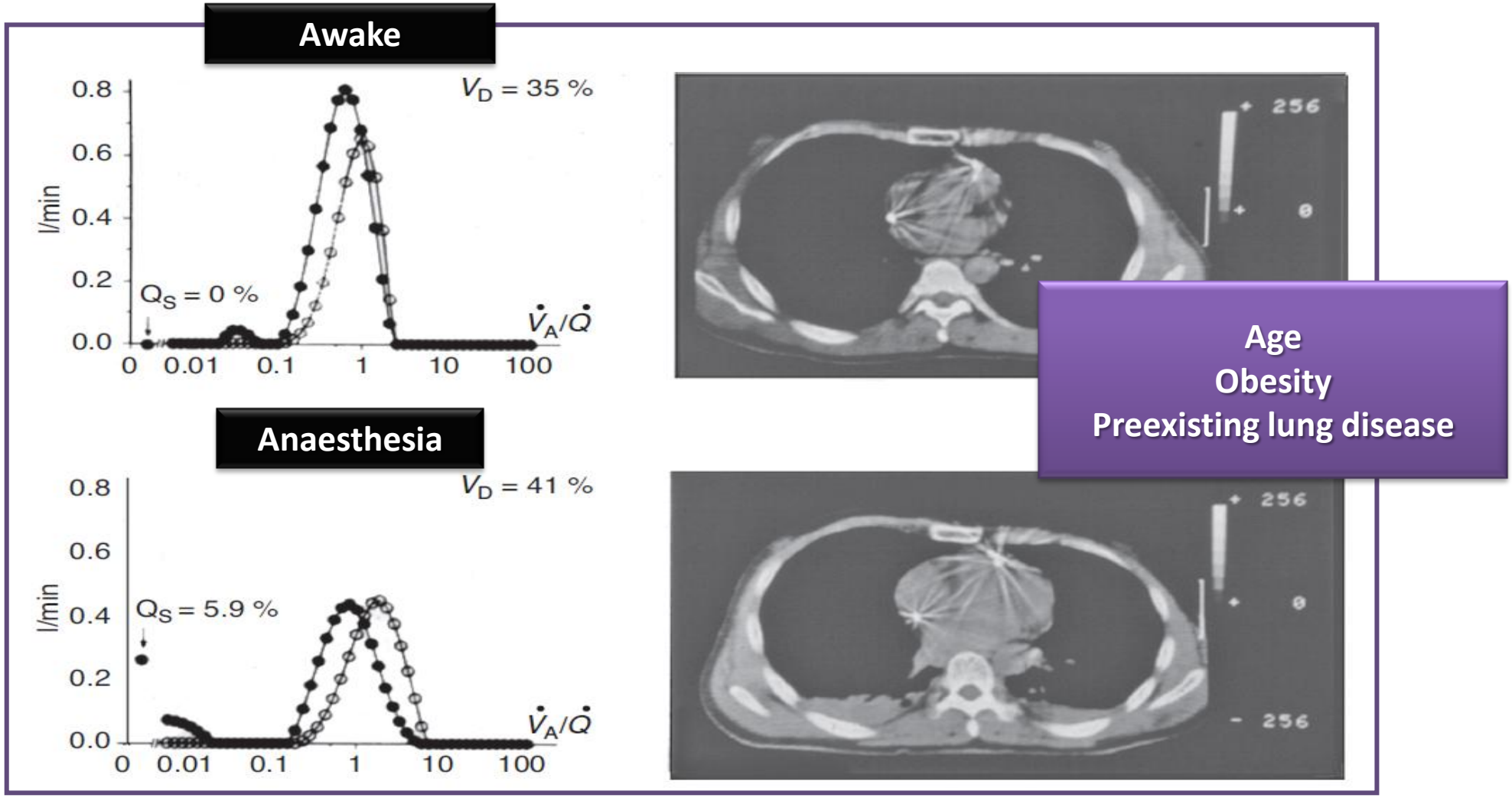
Tokics L et al, J Appl Physiol, 1996

Postoperative respiratory failure
V/Q relationship



Tokics L et al, J Appl Physiol, 1996

Postoperative respiratory failure
V/Q relationship



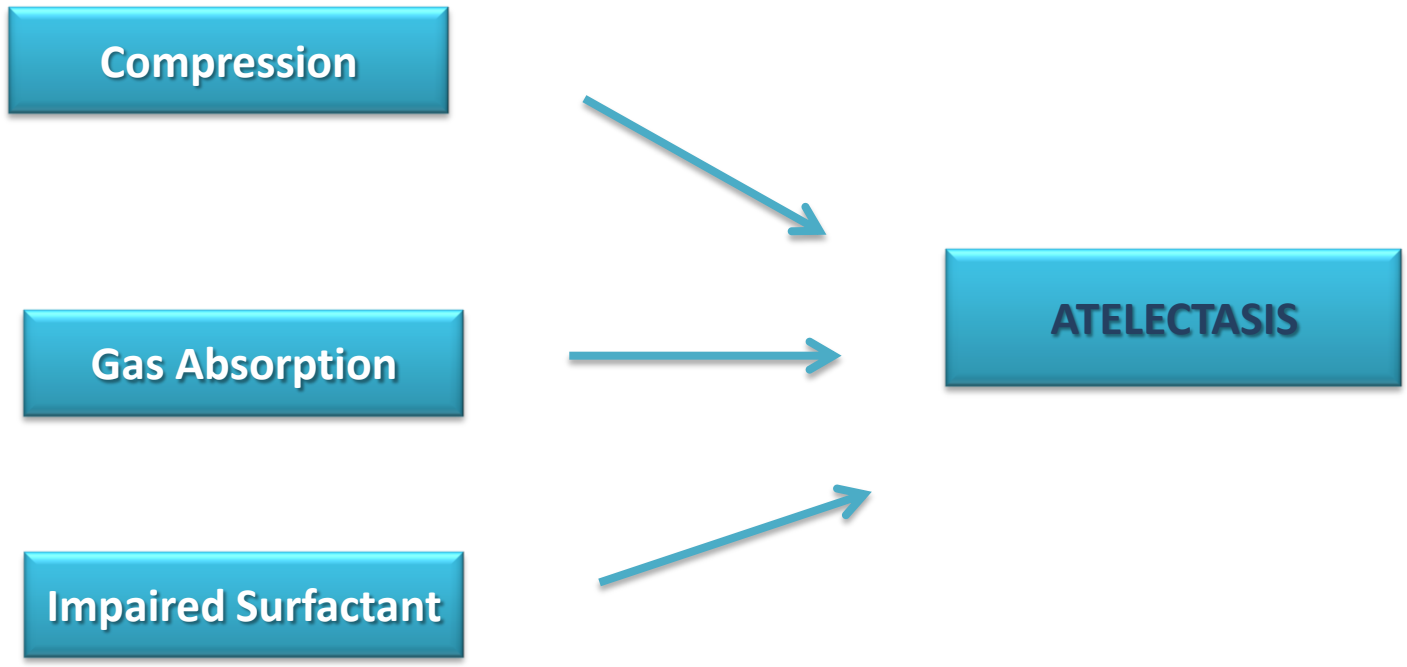
Tokics L et al, J Appl Physiol, 1996

Postoperative respiratory failure
Atelectasis

IV or inhalation anesthesia
Length of surgery
Type of surgery
Position of patient
Age
Body habitus
Lung disease
Surgical factors

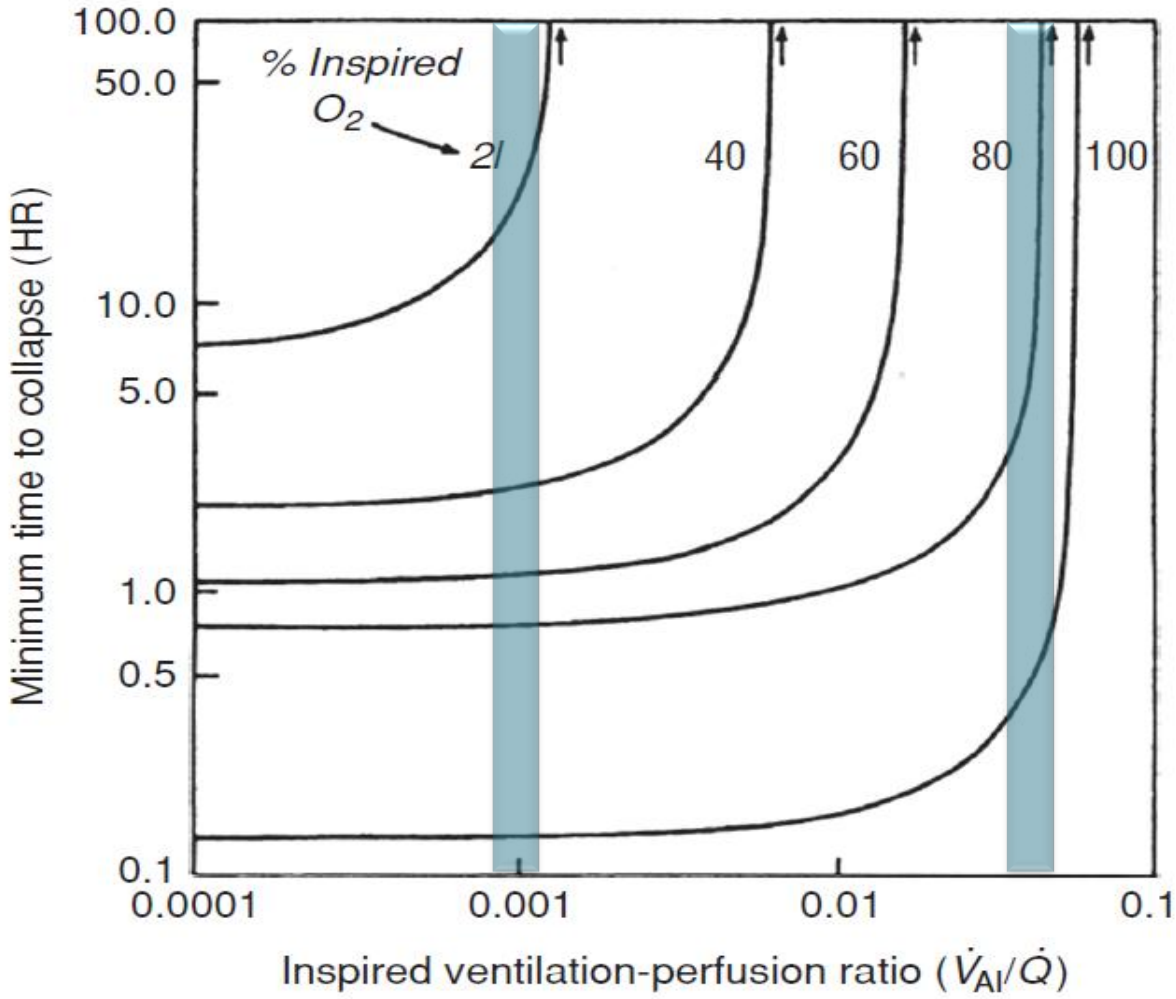
Increased FiO2
Low V/Q

Anesthetic agents
Duration of surgery
Decreased tidal volume



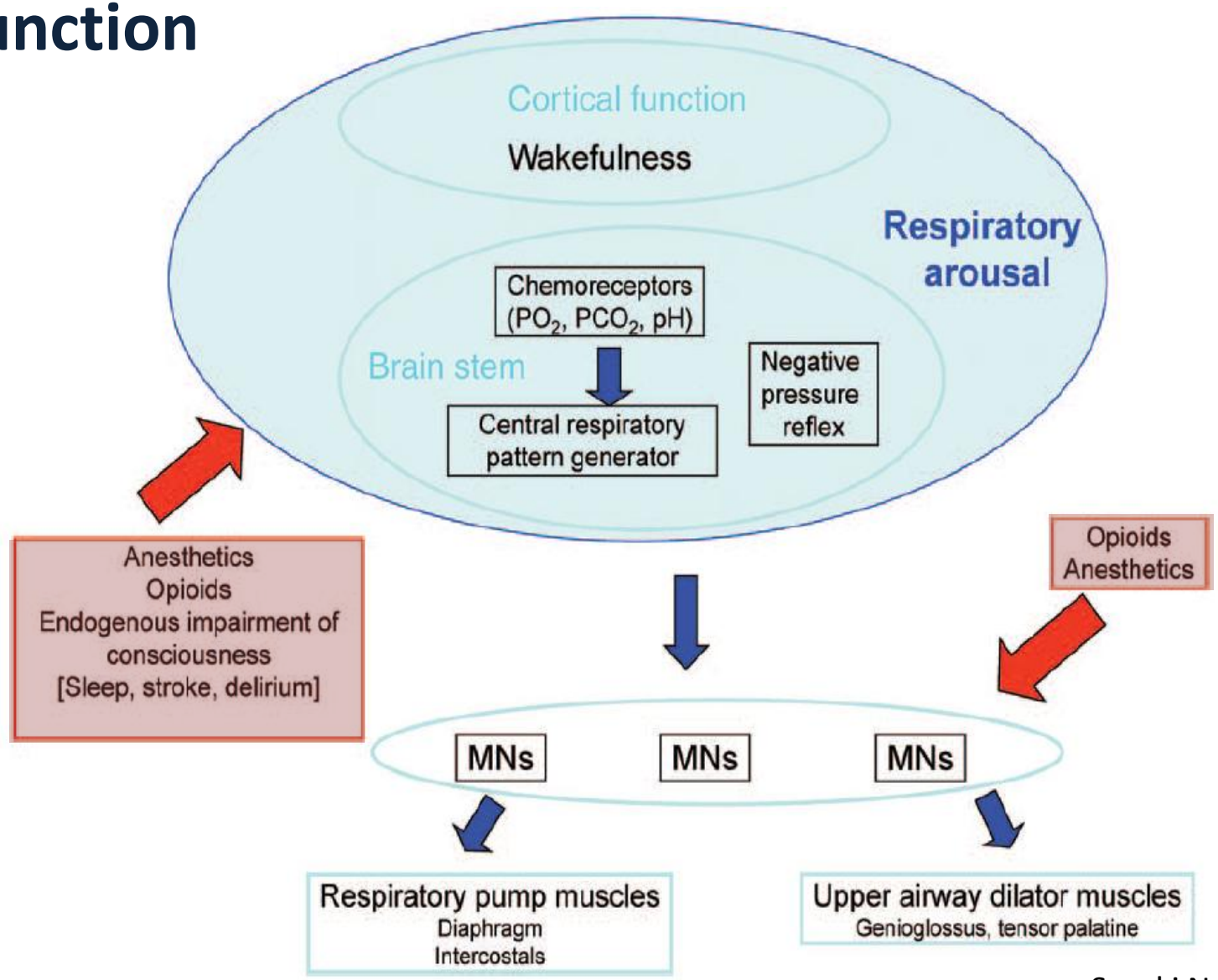
Duggan M et al, Anesthesiology, 2005

Postoperative respiratory failure
Absorption atelectasis



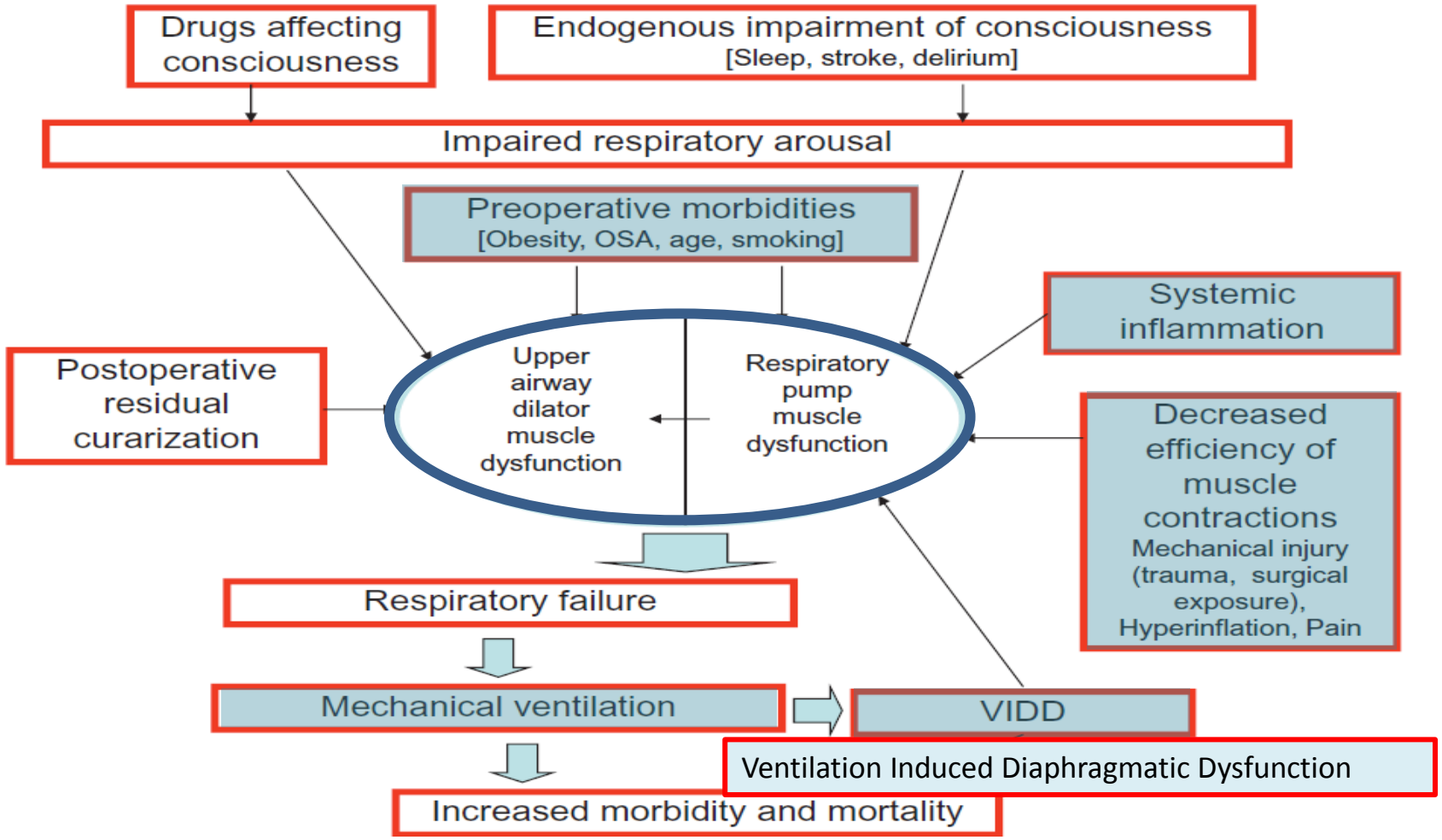
Dantzker DR et al, J Appl Physiol, 1975

Postoperative respiratory failure
Muscle function



Sasaki N et al, Anesthesiology, 2013

Postoperative respiratory failure
Muscle function

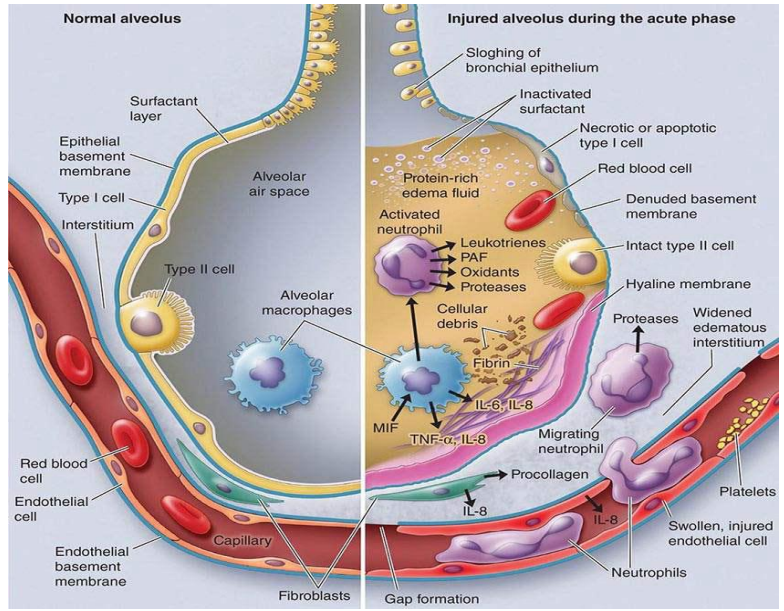


Sasaki N et al, Anesthesiology, 2013

Postoperative respiratory failure
ARDS

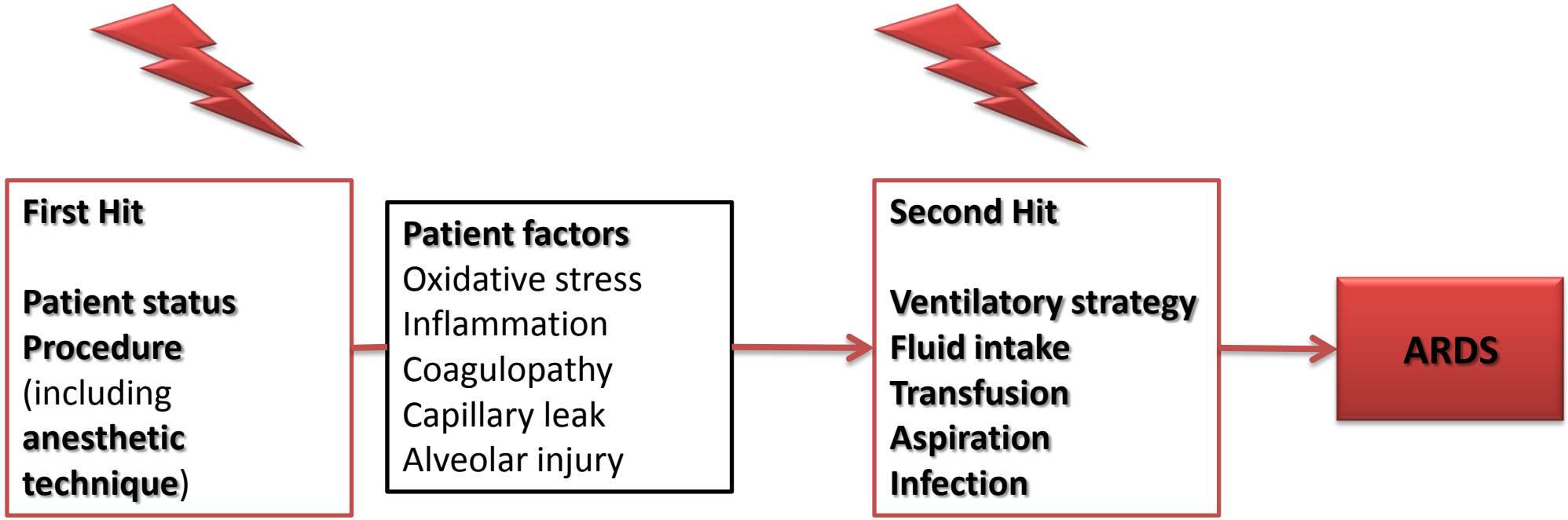
- 1/3 pts with ARDS (mild-moderate) post-surgery

- Mean incidence after high risk procedures 5-7%



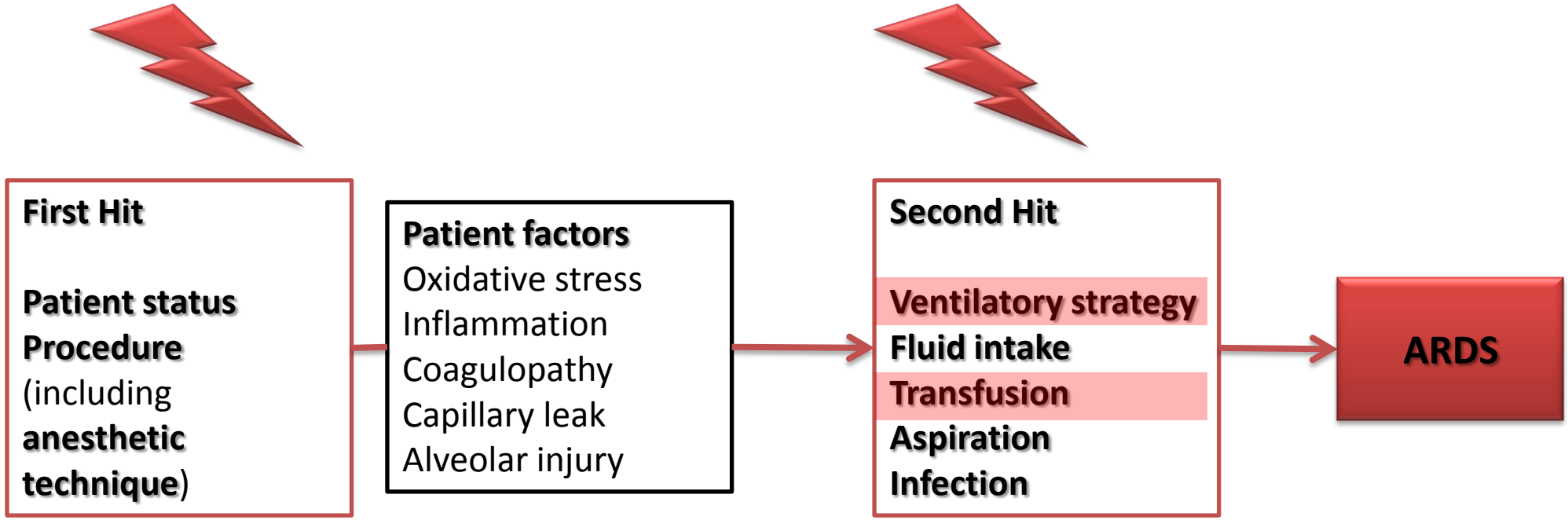
Gajic C et al, Am J Respir Crit Car Med, 2011

Postoperative respiratory failure
ARDS



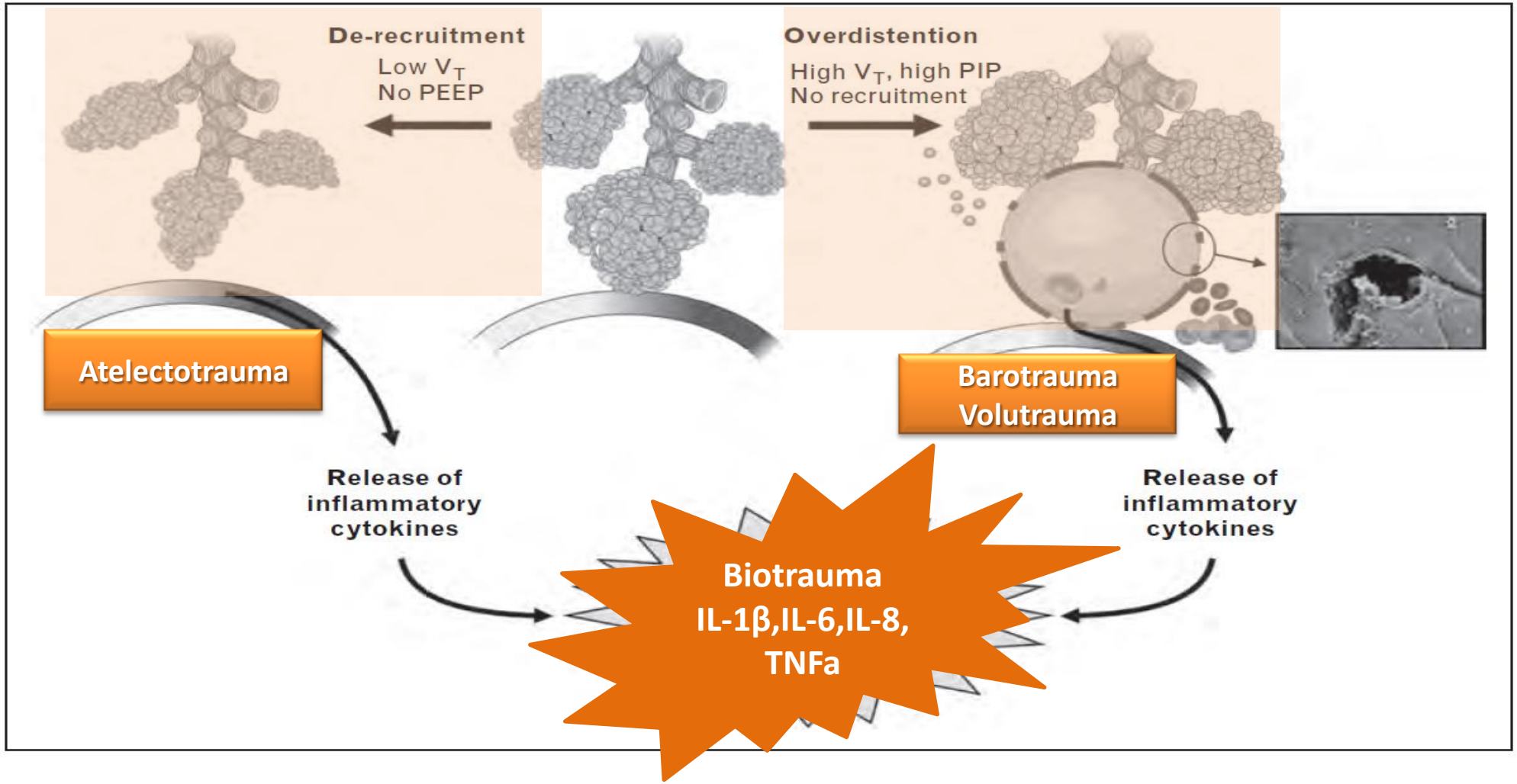
Canet J et al, Curr Opin Crit Care, 2014

Postoperative respiratory failure
ARDS



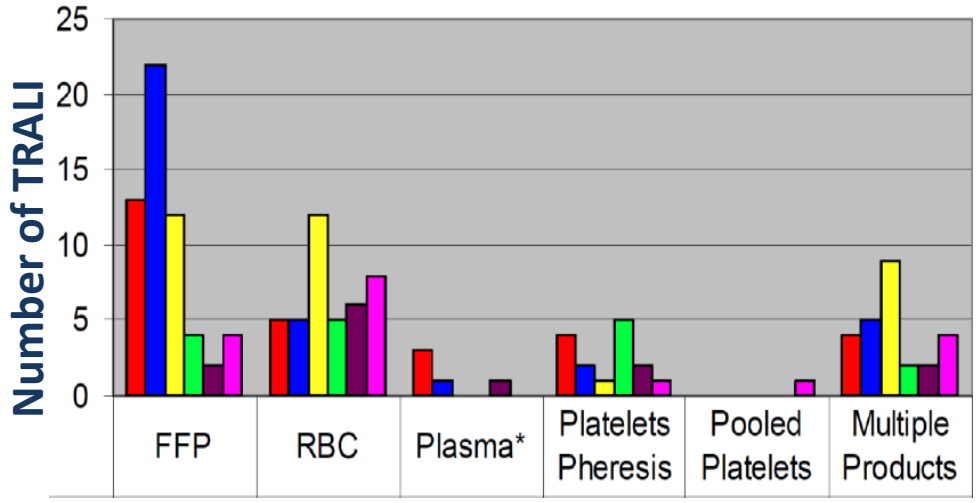
Canet J et al, Curr Opin Crit Care, 2014

Postoperative respiratory failure
VILI (Ventilation Induced Lung Injury)



Sprung J et al, Ventilatory strategies during anesthesia, Cambridge Press, 2010

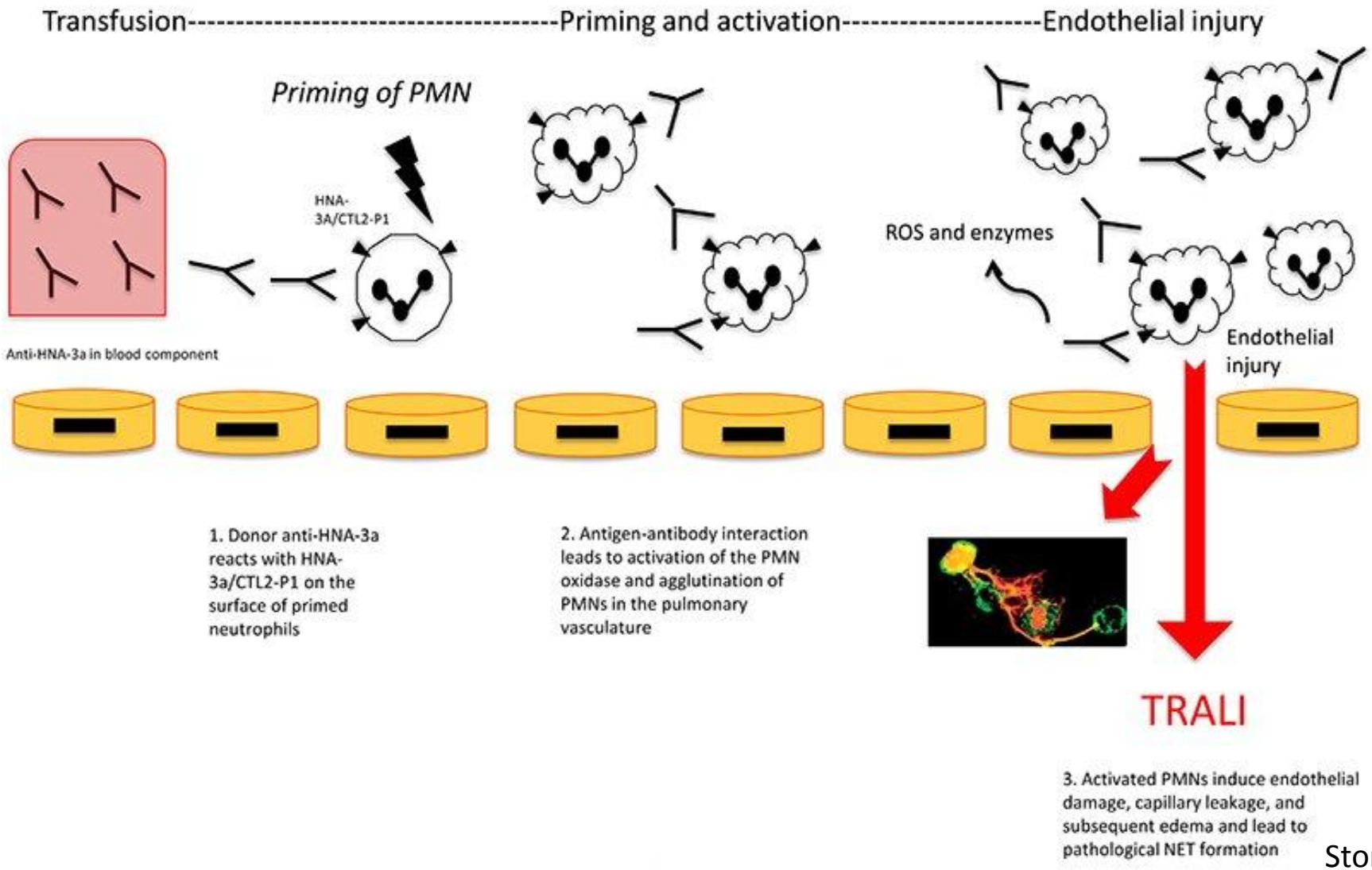
Postoperative respiratory failure
TRALI (Transfusion Acute Lung Injury)



- ARDS
- During or within 6 hrs of transfusion
- Exclusion clinical diagnosis

Kleinman et al, Transfusion, 2010

Postoperative respiratory failure
TRALI



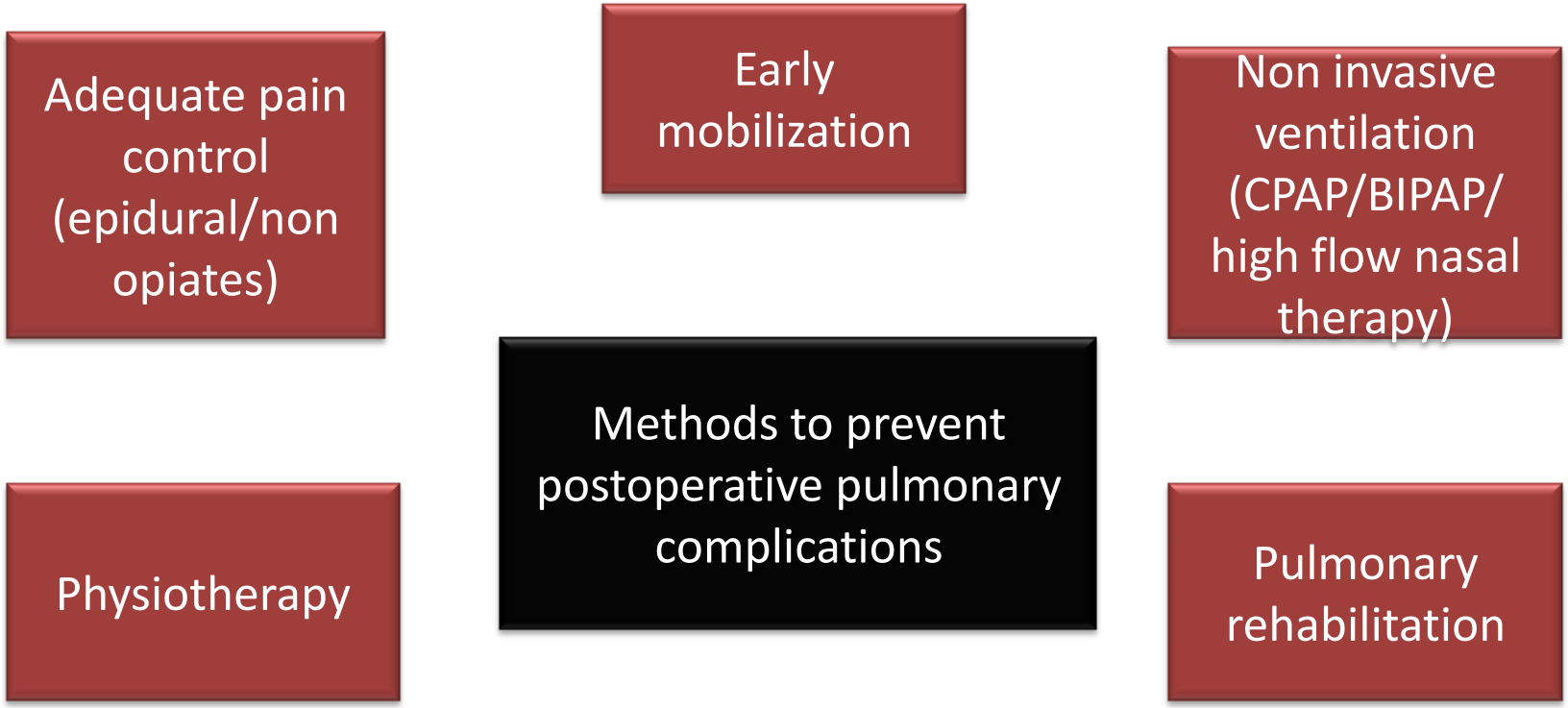
Storch E et al, Blood, 2014

Postoperative pulmonary complications
Prevention - Intraoperative

- Surgery parameters [thoracoscopic/laparoscopic procedure, duration]
- Ventilatory parameters [accurate FiO2, avoid atelectotauma (PEEP, recruitment maneuvres), avoid varotrauma (lung-protective ventilation)]
- Anesthetic parameters [neuroxial/regional/inhaled anesthesia, avoid overuse of opiates, reversal NM blockage agents]
- Others parameters (fluids, transfusion)

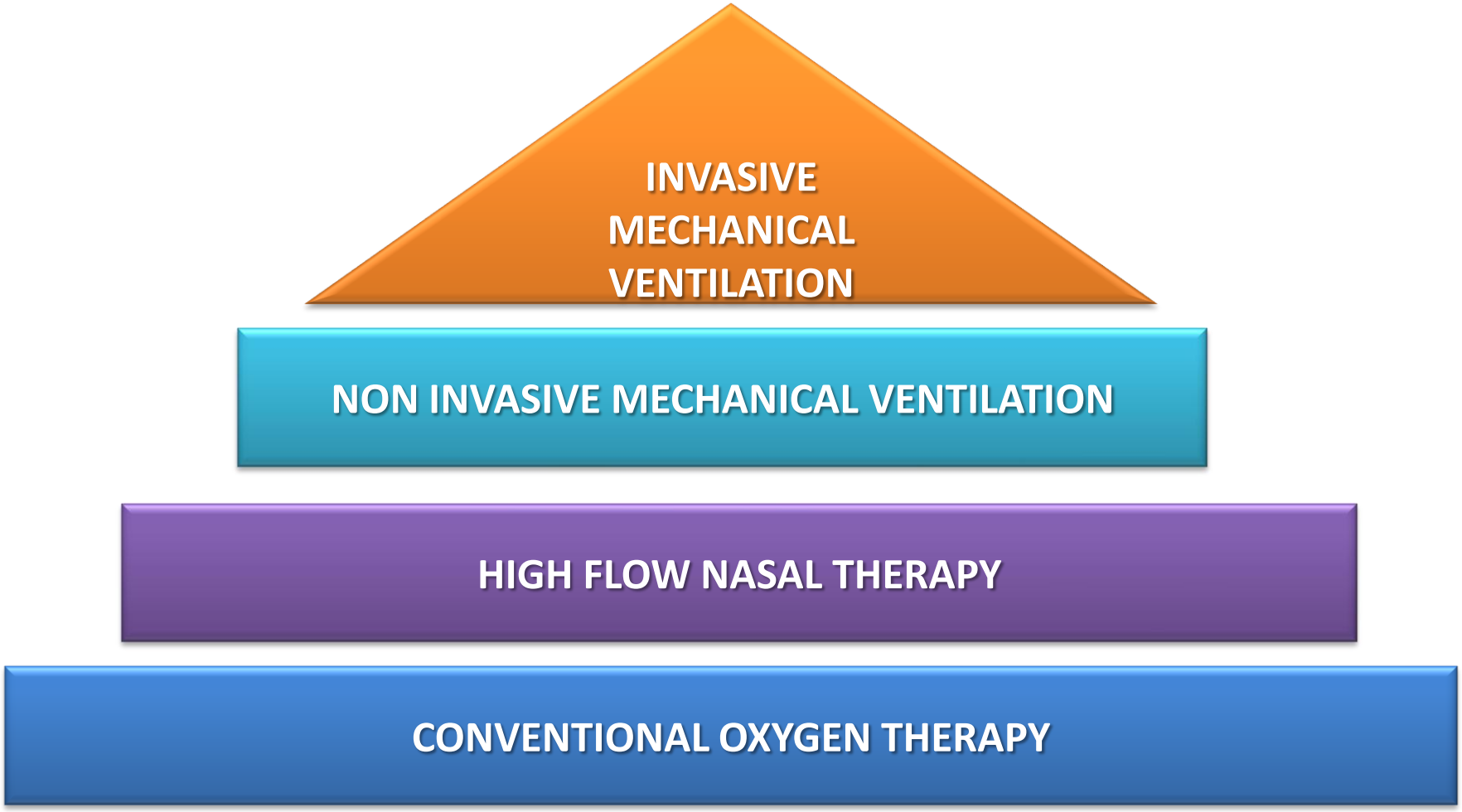
Canet J et al, Curr Opin Crit Care, 2014

Postoperative pulmonary complications
Prevention – Postoperative



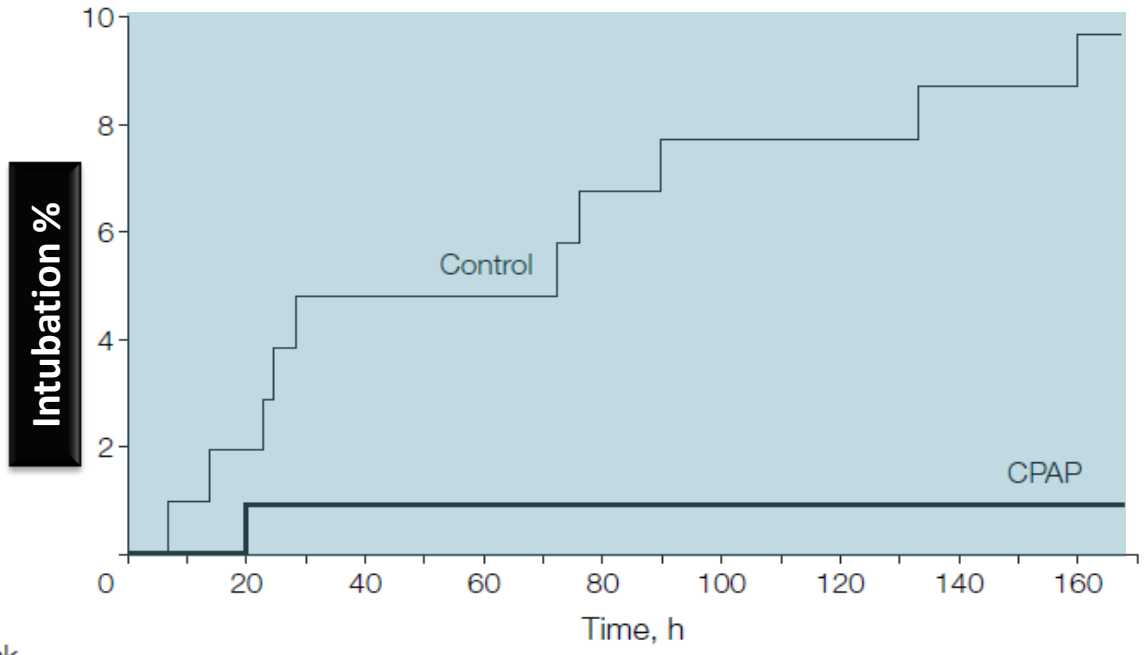
Thompson SL et al, Int Anesthesiol Clin, 2018

Postoperative respiratory failure
Oxygen therapy/Ventilatory Support



Continuous Positive Airway Pressure for Treatment of Postoperative Hypoxemia

A Randomized Controlled Trial

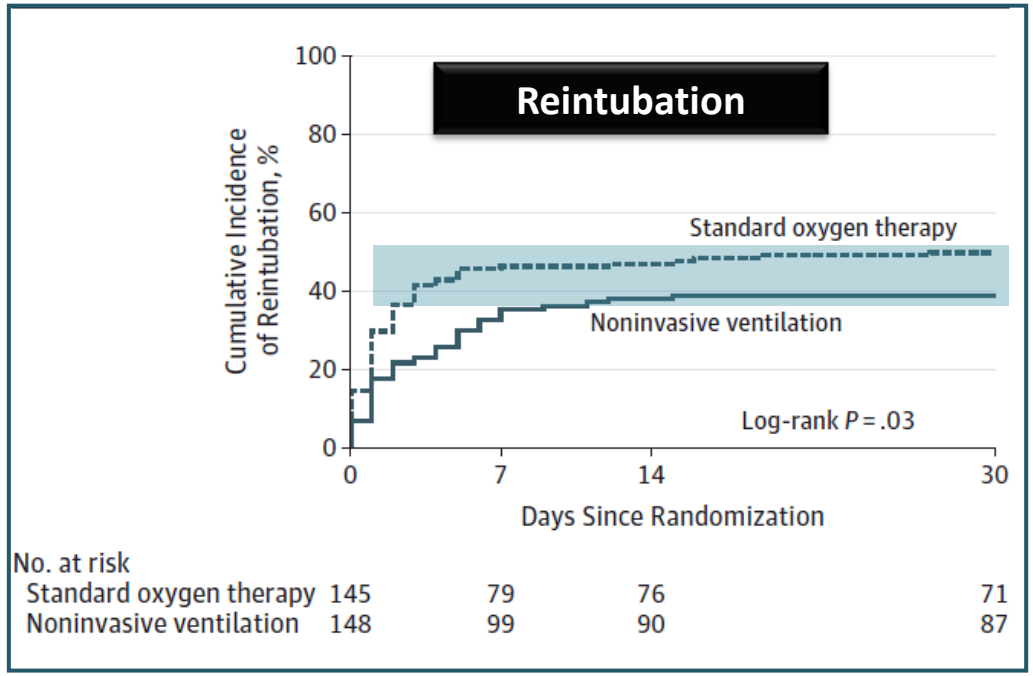


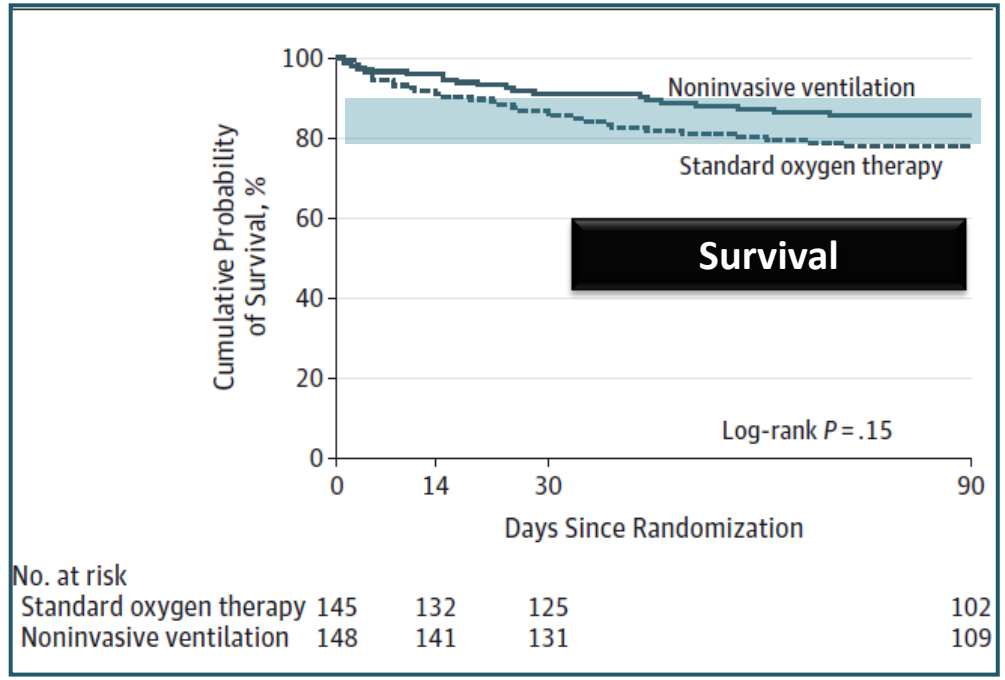
No. at Risk									
Control	104	102	99	99	97	96	96	95	95
CPAP	105	104	104	104	104	104	104	104	104

Squadrone J et al, JAMA, 2005

Effect of Noninvasive Ventilation on Tracheal Reintubation Among Patients With Hypoxemic Respiratory Failure Following Abdominal Surgery

A Randomized Clinical Trial

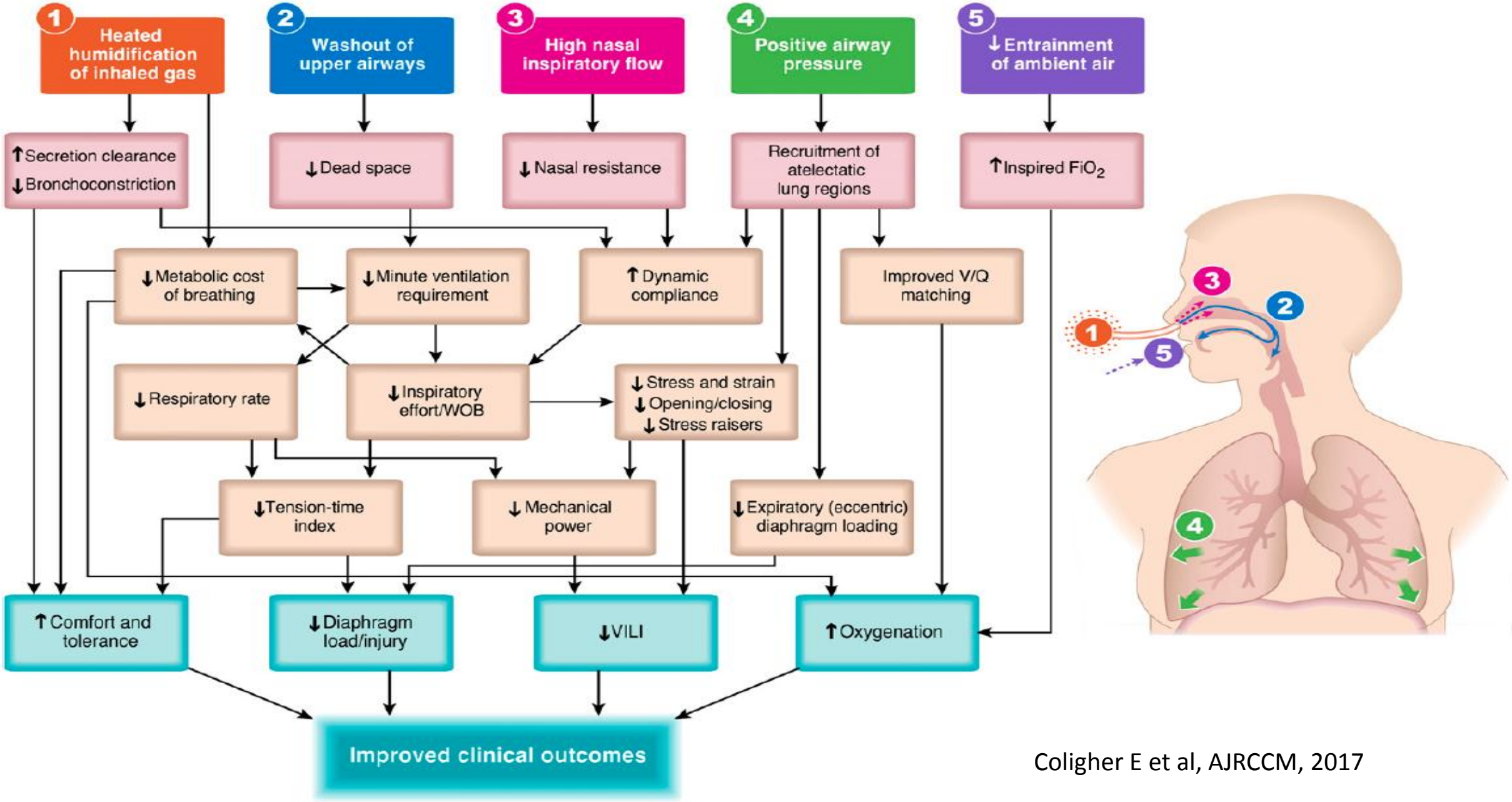




Jaber S et al, JAMA, 2016

Postoperative respiratory failure
High flow nasal therapy (HFNT)

Heated, humified mixture of air and oxygen



Coligher E et al, AJRCCM, 2017

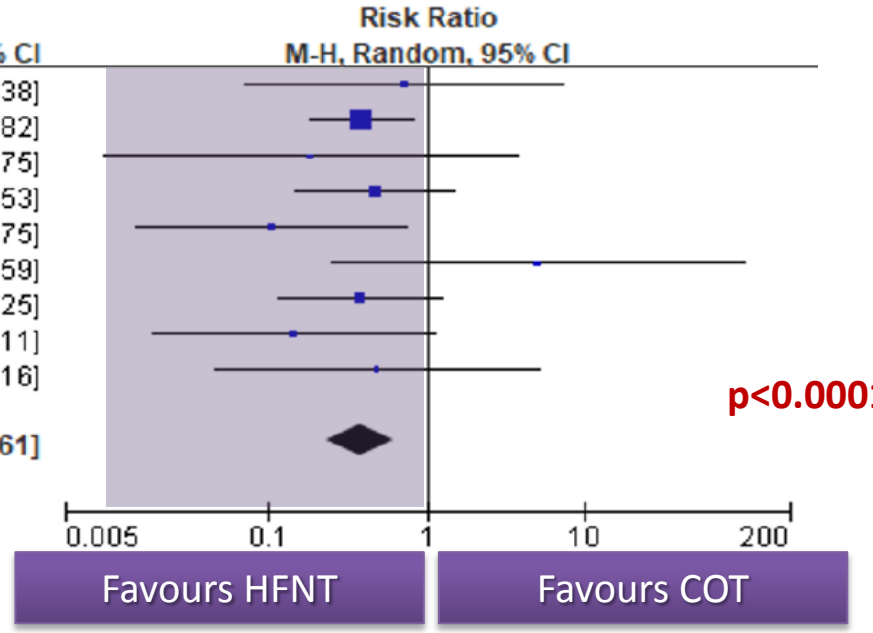
Postoperative respiratory failure HFNT

Reintubation rate

Study or Subgroup	HFNC Events	HFNC Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Brainard 2017	1	18	2	26	4.4%	0.72 [0.07, 7.38]
Chen 2018	7	43	19	45	41.0%	0.39 [0.18, 0.82]
Corley 2015	0	81	2	74	2.6%	0.18 [0.01, 3.75]
Dhillon 2017	3	46	19	138	17.2%	0.47 [0.15, 1.53]
Geng 2017	1	25	9	23	6.0%	0.10 [0.01, 0.75]
Parke 2013	2	169	0	171	2.6%	5.06 [0.24, 104.59]
Sun 2017	3	24	8	24	16.4%	0.38 [0.11, 1.25]
Xu 2018	1	45	7	45	5.6%	0.14 [0.02, 1.11]
Yu 2017	1	56	2	54	4.2%	0.48 [0.05, 5.16]
Total (95% CI)		**507**		**600**	**100.0%**	**0.38 [0.23, 0.61]**
Total events	19		68			

Heterogeneity: Tau² = 0.00; Chi² = 6.06, df = 8 (P = 0.64); I² = 0%

Test for overall effect: Z = 3.92 (P < 0.0001)



p<0.0001

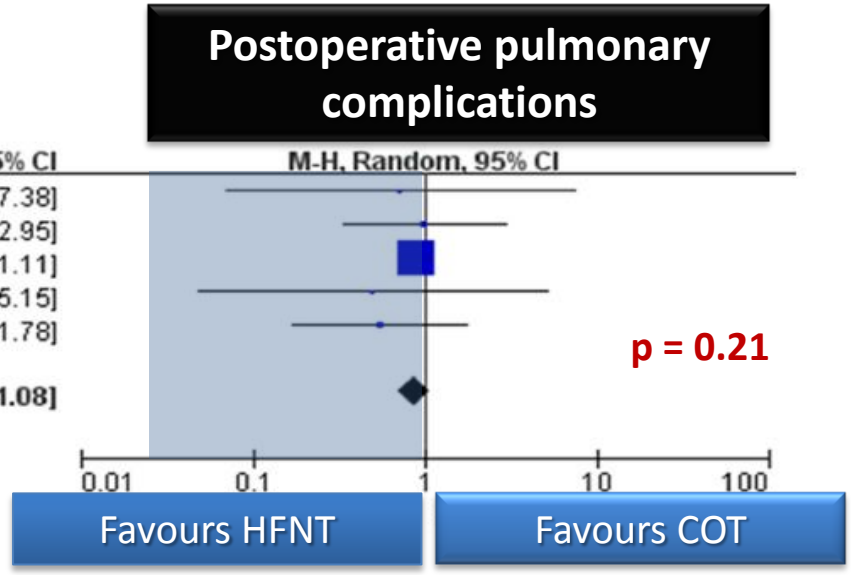
Ju Z et al, Open BMJ, 2019

Postoperative respiratory failure HFNT

Postoperative pulmonary complications

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Brainard 2017	1	18	2	26	0.9%	0.72 [0.07, 7.38]
Dhillon 2017	4	46	12	138	4.1%	1.00 [0.34, 2.95]
Futier 2016	58	108	68	112	90.6%	0.88 [0.70, 1.11]
Sun 2017	1	24	2	24	0.9%	0.50 [0.05, 5.15]
Yu 2017	4	56	7	54	3.5%	0.55 [0.17, 1.78]
Total (95% CI)		**252**		**354**	**100.0%**	**0.87 [0.70, 1.08]**
Total events	68		91			

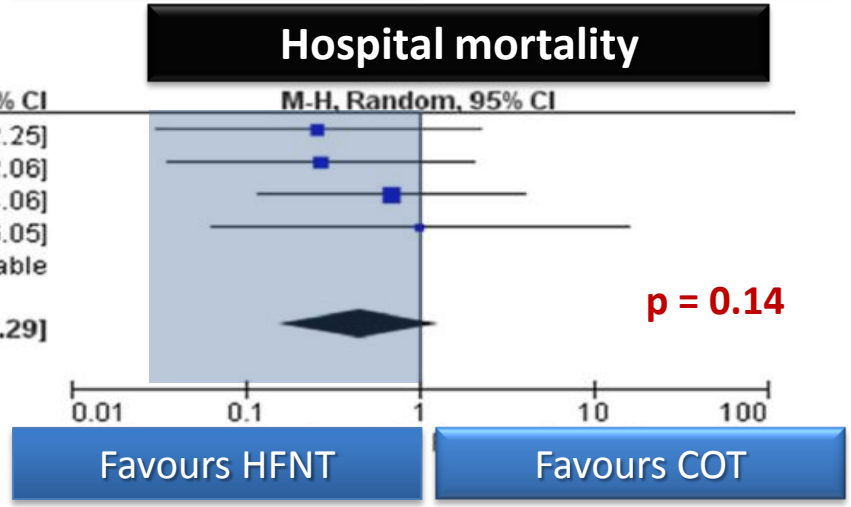
Heterogeneity: Tau² = 0.00; Chi² = 0.94, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 1.26 (P = 0.21)



Hospital mortality

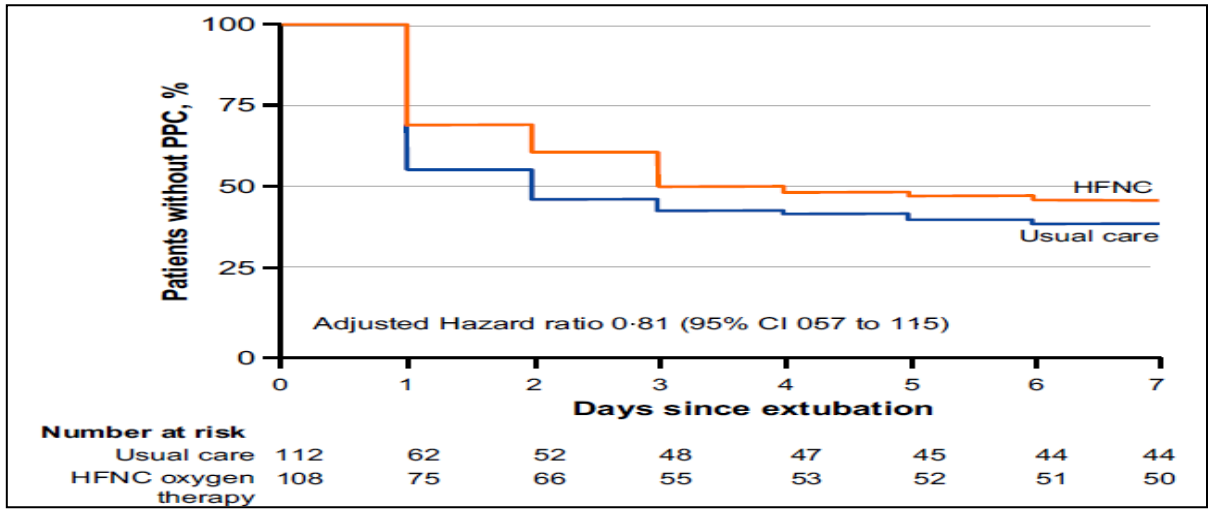
Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
Chen 2018	1	43	4	45	23.7%	0.26 [0.03, 2.25]
Dhillon 2017	1	46	11	138	26.9%	0.27 [0.04, 2.06]
Futier 2016	2	108	3	112	35.0%	0.69 [0.12, 4.06]
Parke 2013	1	169	1	171	14.4%	1.01 [0.06, 16.05]
Yu 2017	0	56	0	54		Not estimable
Total (95% CI)		**422**		**520**	**100.0%**	**0.45 [0.16, 1.29]**
Total events	5		19			

Heterogeneity: Tau² = 0.00; Chi² = 1.06, df = 3 (P = 0.79); I² = 0%
Test for overall effect: Z = 1.49 (P = 0.14)



Ju Z et al, Open BMJ, 2019

Postoperative respiratory failure
HFNT

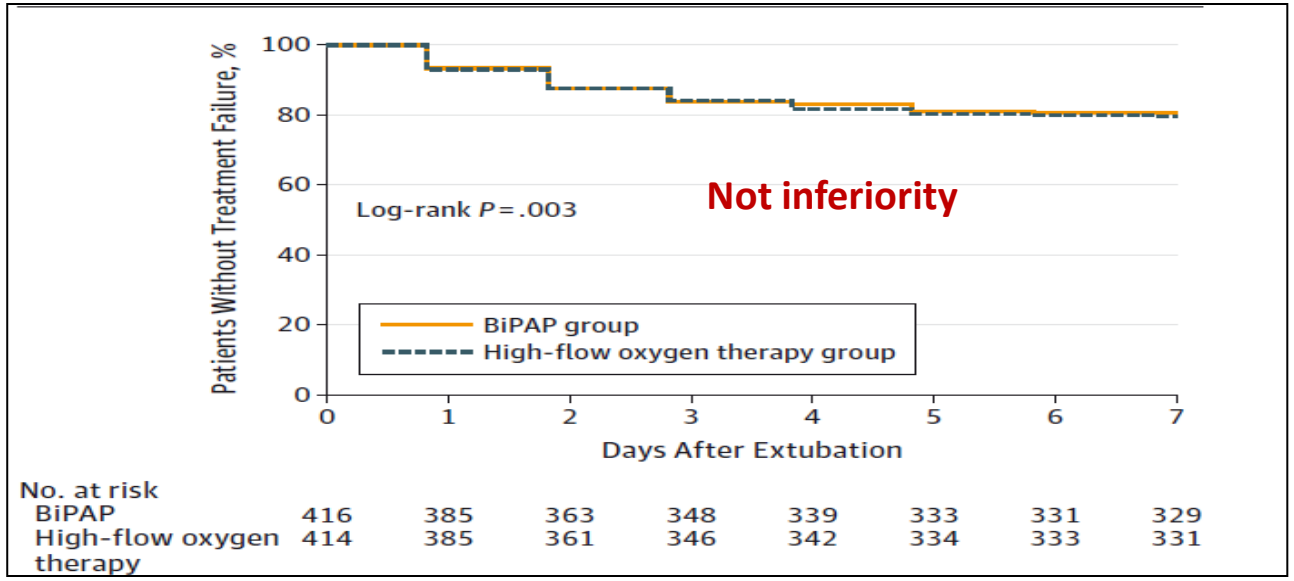


Patients after abdominal surgery without hypoxemia

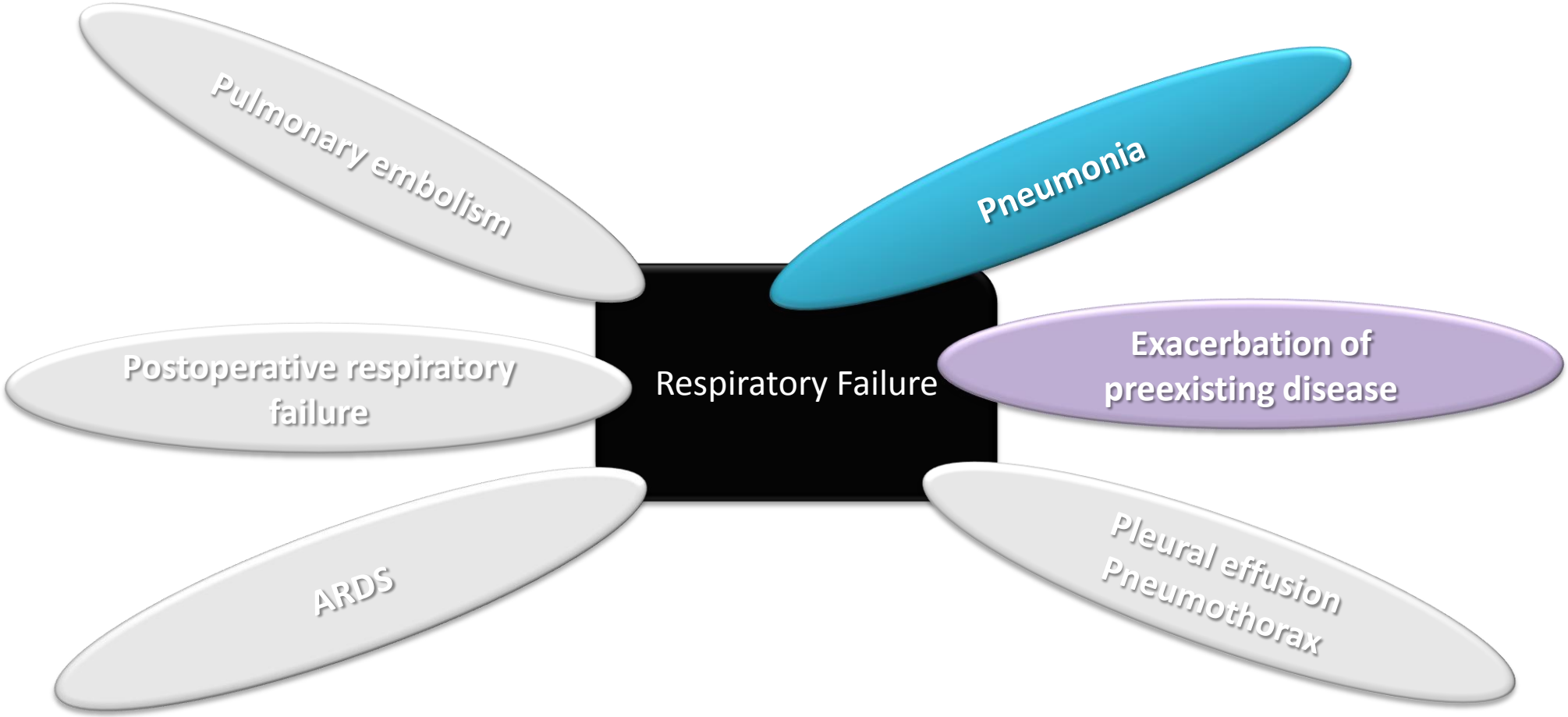
Futier et al, Crit Care Med, 2016
OPERA study

Patients after cardiothoracic surgery with hypoxemia

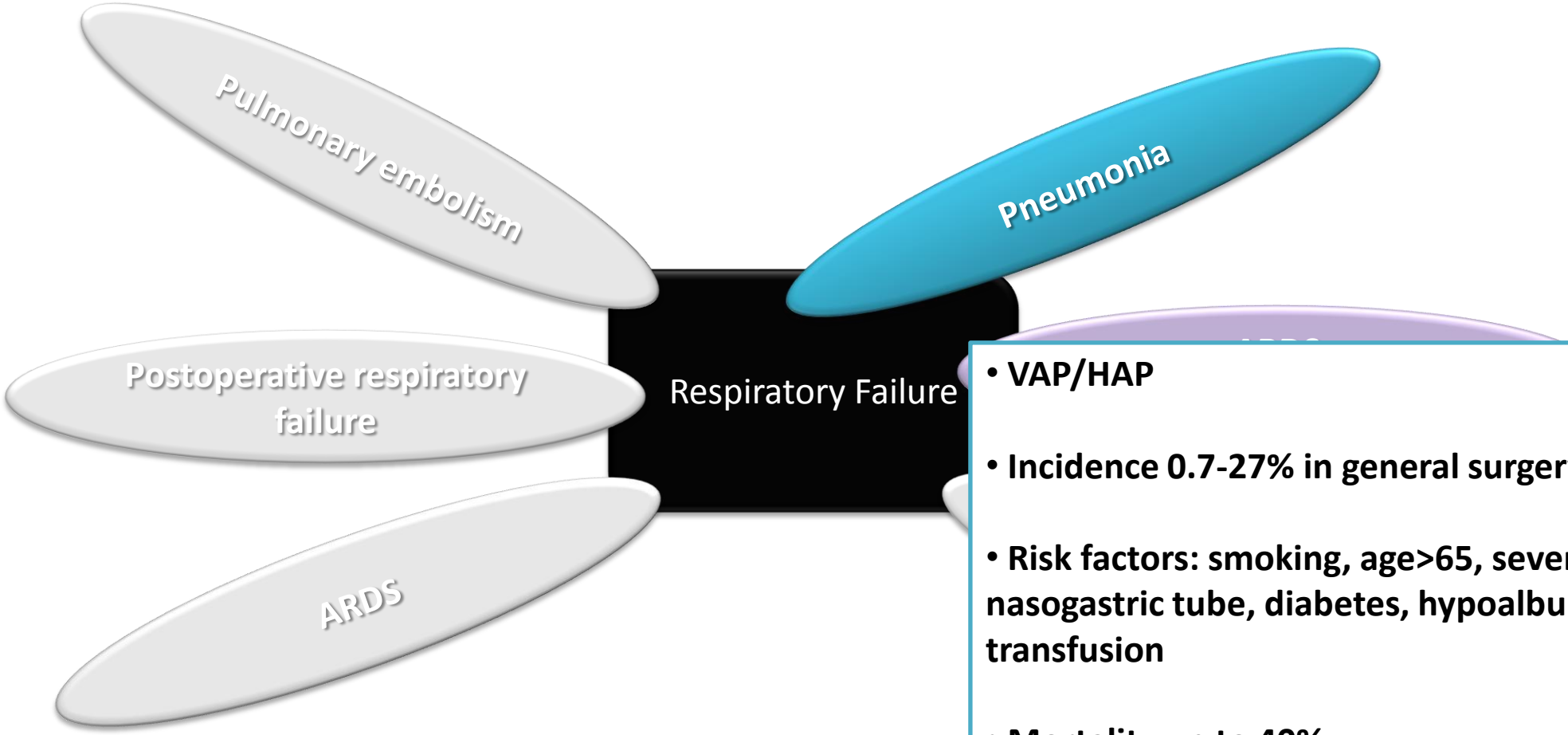
Stephan F et al, JAMA, 2017
BIPOP study group



Postoperative pulmonary complications



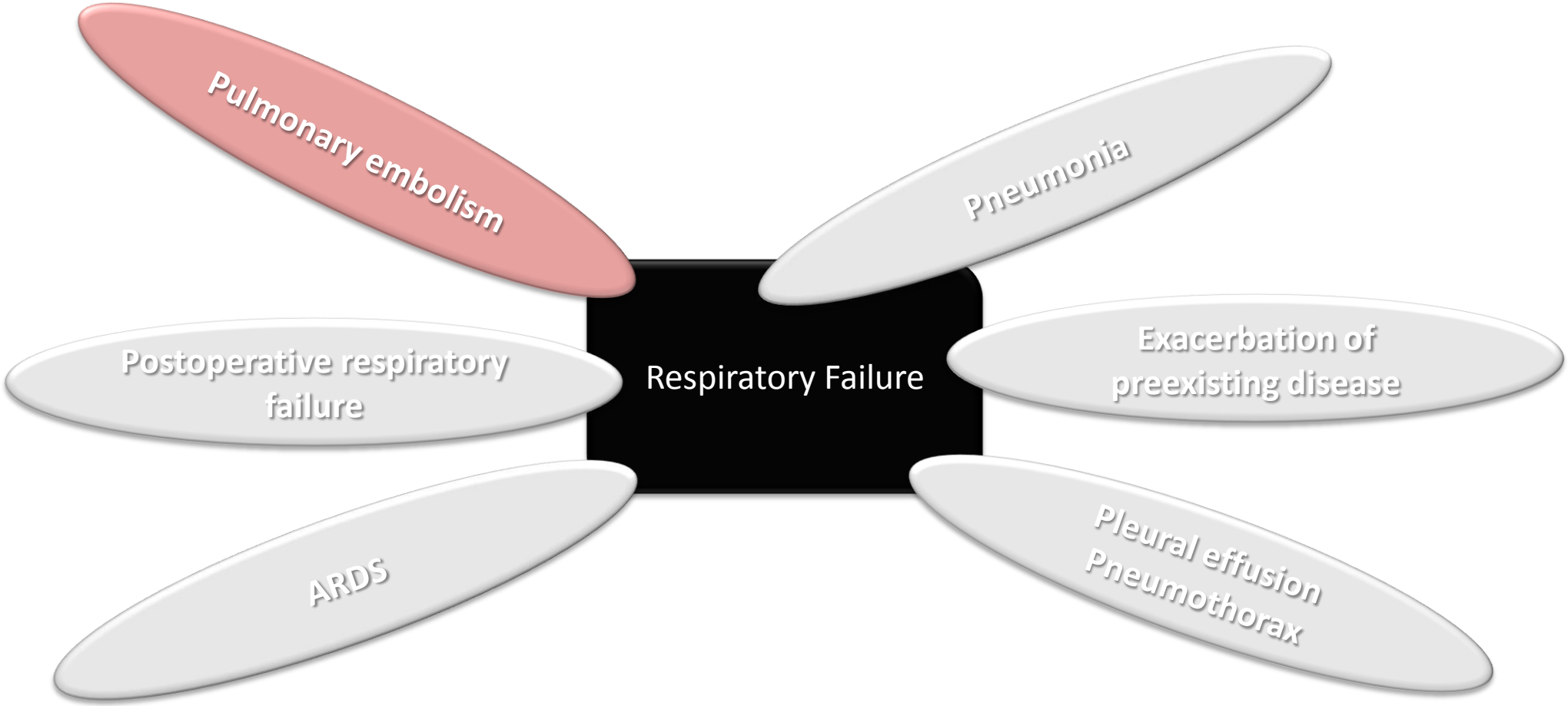
Postoperative pulmonary complications



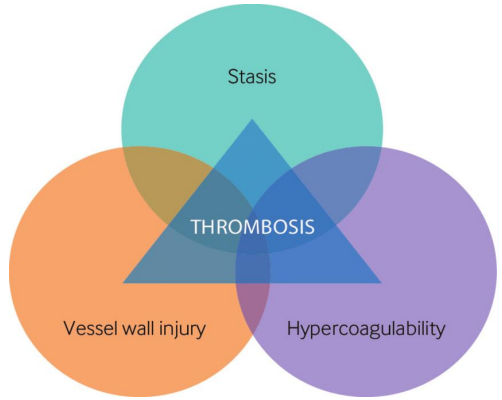
- **VAP/HAP**
- **Incidence 0.7-27% in general surgery**
- **Risk factors: smoking, age>65, severe COPD, nasogastric tube, diabetes, hypoalbuminemia, transfusion**
- **Mortality up to 40%**

Chughtai M et al, J Clin Med Res, 2017

Postoperative pulmonary complications



Postoperative pulmonary embolism Thromboprophylaxis



- Increased thrombotic risk for the first 12 weeks after surgery (especially in women)
- Thromboprophylaxis at least 10-14 days after surgery
- High risk patients for VTE extensive duration for 4 weeks
- Extending for up to 5 weeks in orthopedic surgery patients

Quyatt J et al, ACCP Guidelines, Chest, 2012
Sweetland S et al, BMJ, 2009

A1: Each risk factor represents 1 point

- ○ Age 40–59 years
- ○ Minor surgery planned
- ○ History of prior major surgery
- ○ Varicose veins
- ○ History of inflammatory bowel disease
- ○ Swollen legs (current)
- ○ Obesity (BMI > 30)
- ○ Acute myocardial infarction (< 1 month)
- ○ Congestive heart failure (< 1 month)
- ○ Sepsis (< 1 month)
- ○ Serious lung disease incl. pneumonia (< 1 month)
- ○ Abnormal pulmonary function (chronic obstructive pulmonary disease)
- ○ Medical patient currently at bed rest
- ○ Leg plaster cast or brace
- ○ Central venous access
- ○ Blood transfusion (< 1 month)
- ○ Other risk factor/s_____
  _____

A2: For women only (each represents 1 point)

- ○ Oral contraceptives or hormone replacement therapy
- ○ Pregnancy or postpartum (< 1 month)
- ○ History of unexplained stillborn infant, recurrent spontaneous abortion (≥ 3), premature birth with toxemia of pregnancy or growth restricted infant

B: Each risk factor represents 2 points

- ○ Age 60–74 years
- ○ Major surgery (< 60 minutes)*
- ○ Arthroscopic surgery (> 60 minutes)*
- ○ Laparoscopic surgery (> 60 minutes)*
- ○ Previous malignancy
- ○ Morbid obesity (BMI > 40)

C: Each risk factor represents 3 points

- ○ Age 75 years or more
- ○ Major surgery lasting 2–3 hours*
- ○ BMI > 50 (venous stasis syndrome)
- ○ History of SVT, DVT/PE
- ○ Family history of DVT/PE
- ○ Present cancer or chemotherapy
- ○ Present factor V Leiden
- ○ Positive prothrombin 20210A
- ○ Elevated serum homocysteine
- ○ Positive lupus anticoagulant
- ○ Elevated anticardiolipin antibodies
- ○ Heparin-induced thrombocytopenia (HIT)
- ○ Other thrombophilia-type_____

D: Each risk factor represents 5 points

- ○ Elective major lower extremity arthroplasty
- ○ Hip, pelvis or leg fracture (< 1 month)
- ○ Stroke (< 1 month)
- ○ Multiple trauma (< 1 month)
- ○ Acute spinal cord injury (paralysis)(< 1 month)
- ○ Major surgery lasting over 3 hours*

Total risk factor score:

High risk for VTE
Caprini score ≥ 5

Quyatt J et al, ACCP Guidelines, Chest, 2012

Postoperative pulmonary embolism
Treatment

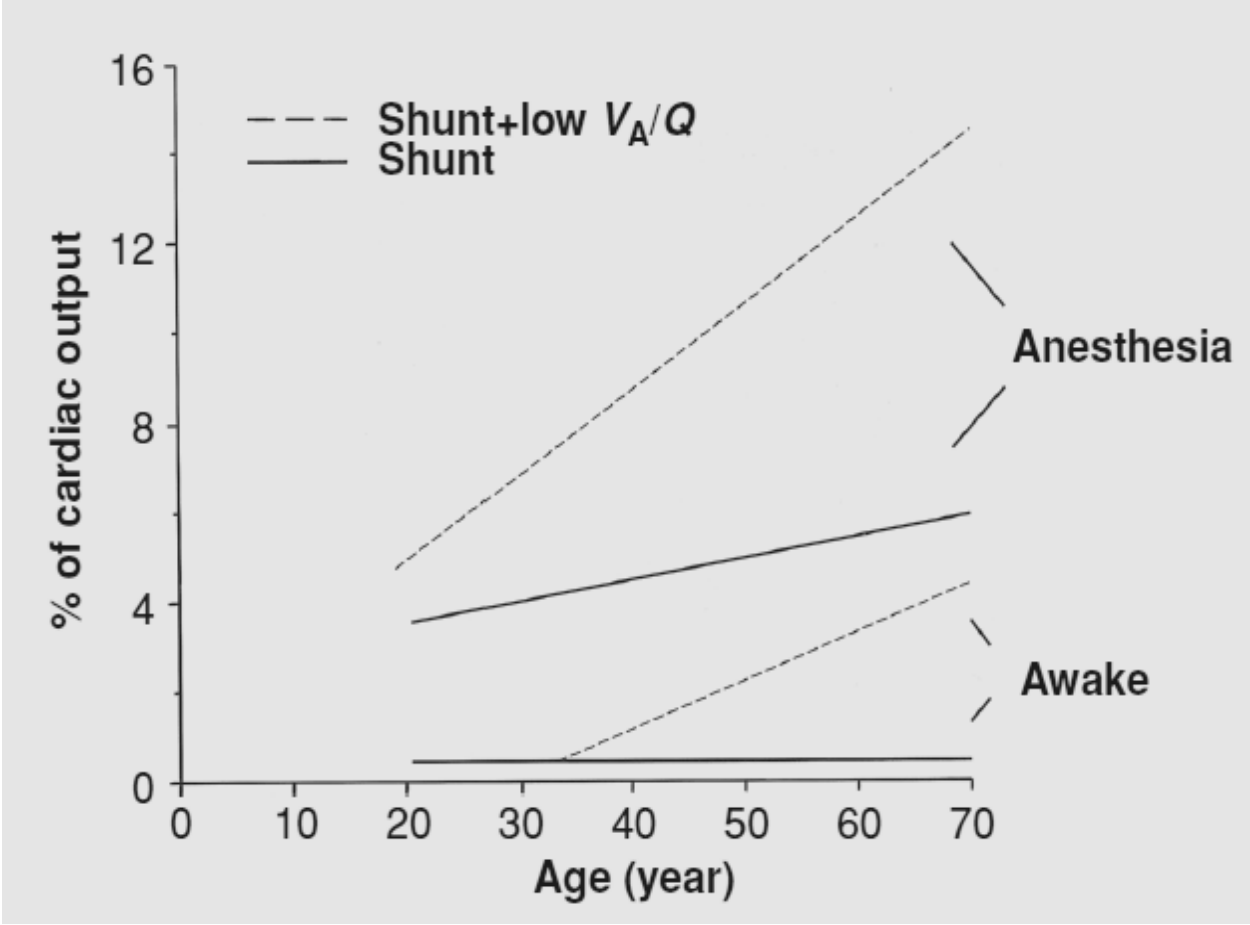
- Management dilemma – risk of thrombolysis?
- Recent surgery relative contraindication (except brain or spinal surgery, trauma)
- Major bleeding >50% within 1 week
- Major bleeding 20% in 1-2 weeks
- Significantly reduced bleeding risk 2 weeks after surgery

Quyatt J et al, ACCP Guidelines, Chest, 2012
Condliffe R, Thorax, 2014

28ο ΠΑΝΕΛΛΗΝΙΟ Πνευμονολογικό ΣΥΝΕΔΡΙΟ

Thank you !

Postoperative respiratory failure
V/Q relationship



Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Postextubation High-Flow Nasal Cannula vs Conventional Oxygen Therapy on Reintubation in Low-Risk Patients

A Randomized Clinical Trial

Hernandez G, JAMA, 2016

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Postextubation High-Flow Nasal Cannula vs Noninvasive Ventilation on Reintubation and Postextubation Respiratory Failure in High-Risk Patients

A Randomized Clinical Trial

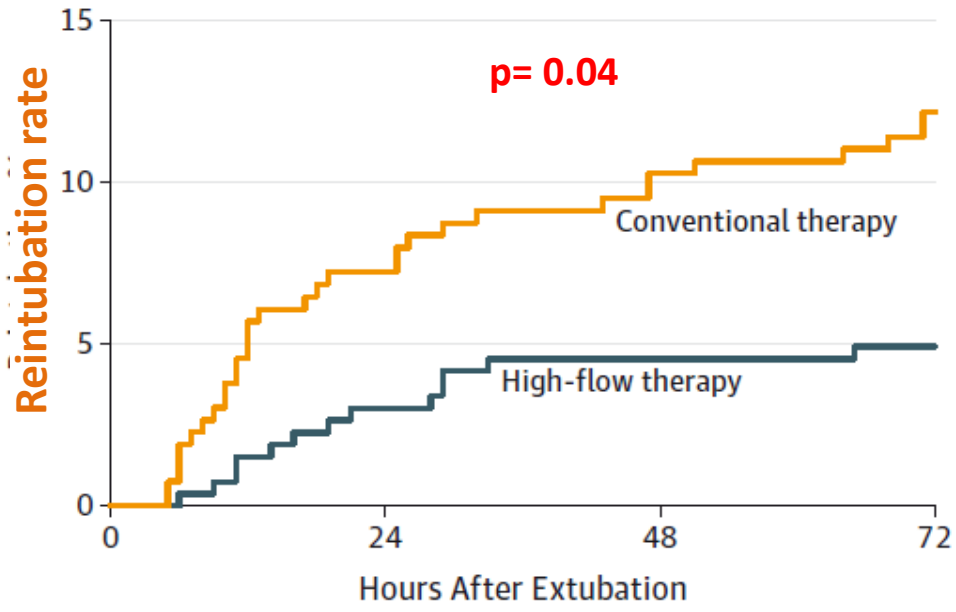
Hernandez G, JAMA, 2016

High risk patients

APACHE>12
Age>65
HF
COPD
BMI>30
>2 cormobidities
Difficult weaning
MV>7days
Airway patency
Deal of secretions

Post-extubation respiratory failure

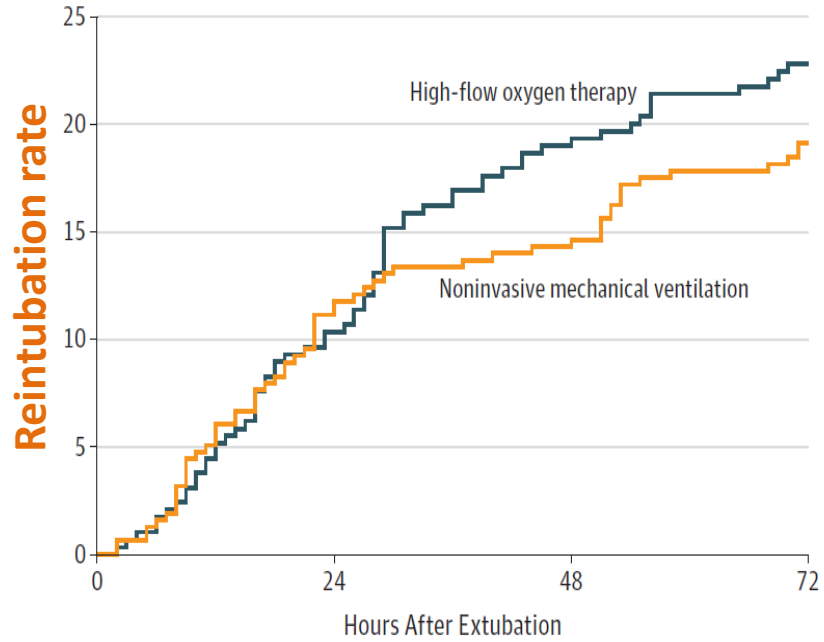
Low risk



No. at risk				
Conventional therapy	263	244	236	231
High-flow therapy	264	256	252	251

Hernandez G, JAMA, 2016

High risk



No. at risk				
High-flow oxygen therapy	290	260	234	223
Noninvasive mechanical ventilation	314	279	269	253

Hernandez G, JAMA, 2016