Mechanical Ventilation of Obese patient in the Perioperative Period

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JRUR, Marseille, France, 2012

Body mass index (BMI) and Waist measurement
The most common indicators of Obesity

BMI =
Weight (Kg)/Height ^{2} (m^2)

Underweight	< 20
Normal	> 20 - < 27
Overweight	> 27 - < 30
Obese	> 30 - < 40
Morbidly Obese	> 40

Peate I et al. (2005) BJN 2005 5: 134-138

Waist measurement as an indicator of obesity

Agenda

- **Effects of Anesthesia on the Respiratory Function**

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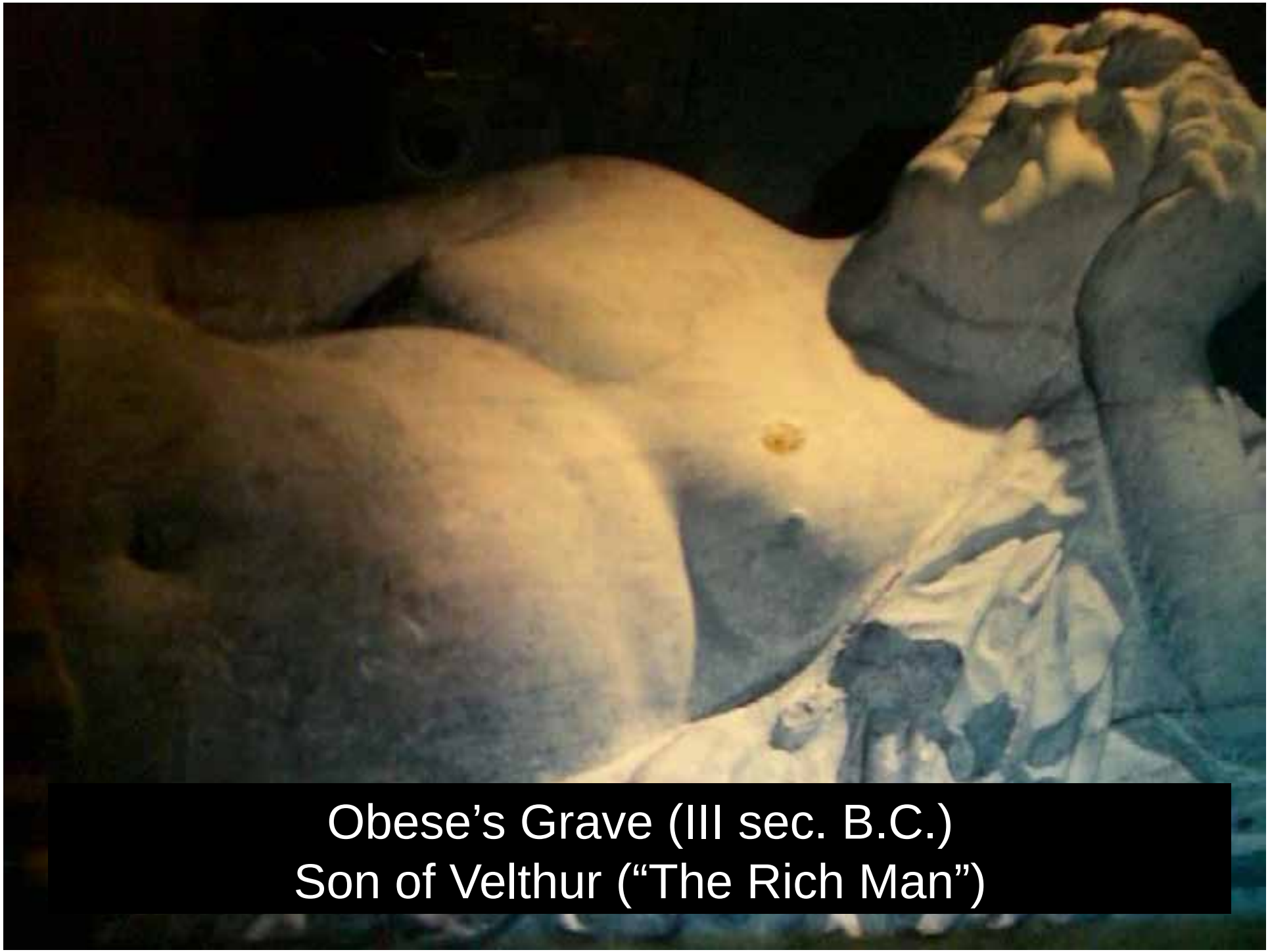
- PEEP and recruitment

- **Postoperative period**

- Prediction of PPCs

-Positioning and Physiotherapy

- Non invasive respiratory support



Obese’s Grave (III sec. B.C.)
Son of Velthur (“The Rich Man”)

Peri-operative respiratory modifications : Lung volume reduction and atelectasis

Pelosi P and Gregoretti C. Eur Crit Care 2010; 1: 1-8

Pelosi P, Gregoretti C. Best Pract Res Clin Anaesthesiol. 2010 Jun;24(2):211-25

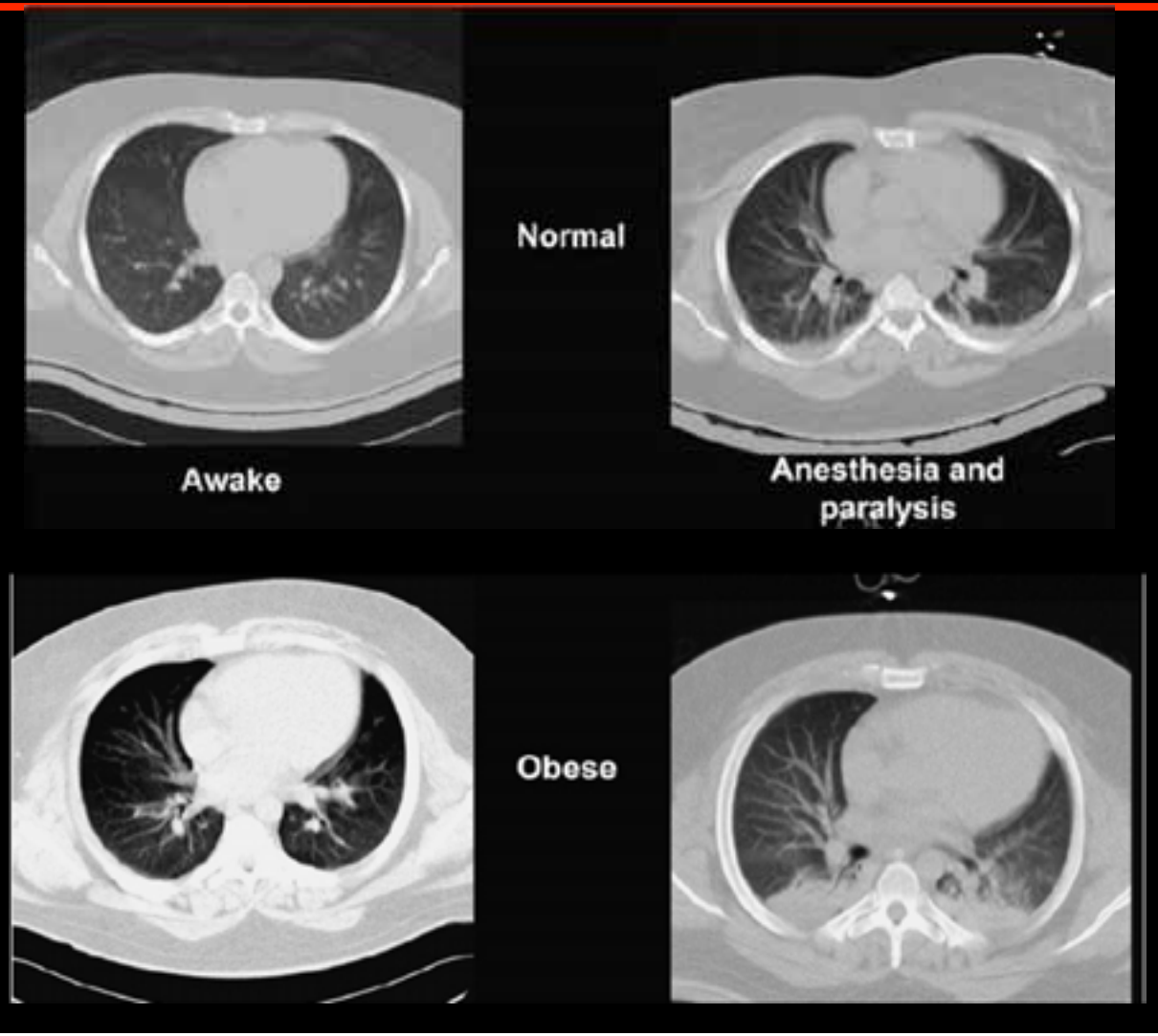
LUNG
- Muscular tone loss
- High FiO2 > 80%
- Surfactant alteration
- Lung Weight

HEART
- Weight

ABDOMEN
- General anesthesia
- Intra-pressure increase (obese++)

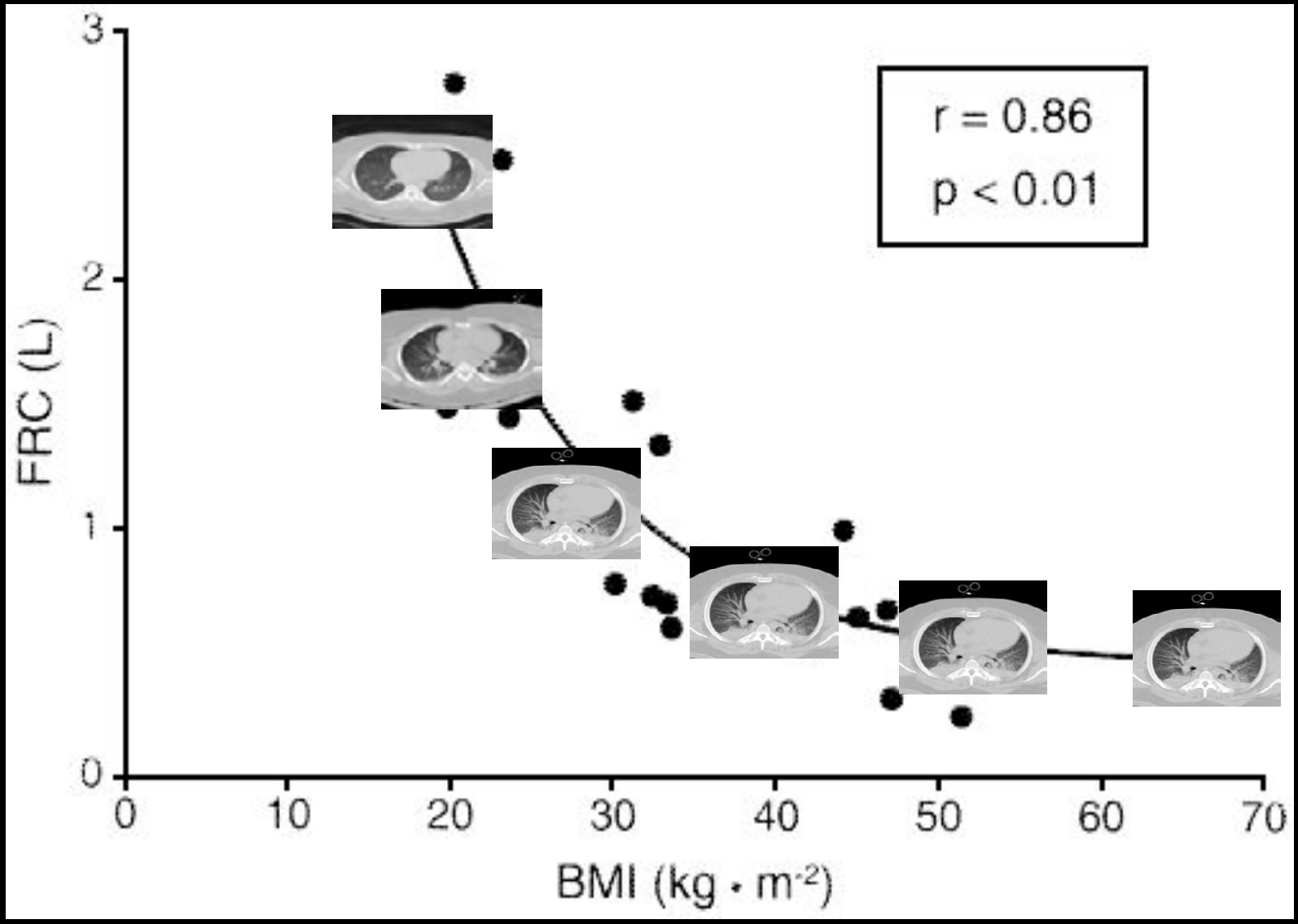
Effects of anesthesia on lung morphology in obese patients

PelosiP, Gregoretti C. Best Pract Res Clin Anaesthesiol. 2010 Jun;24(2):211-25



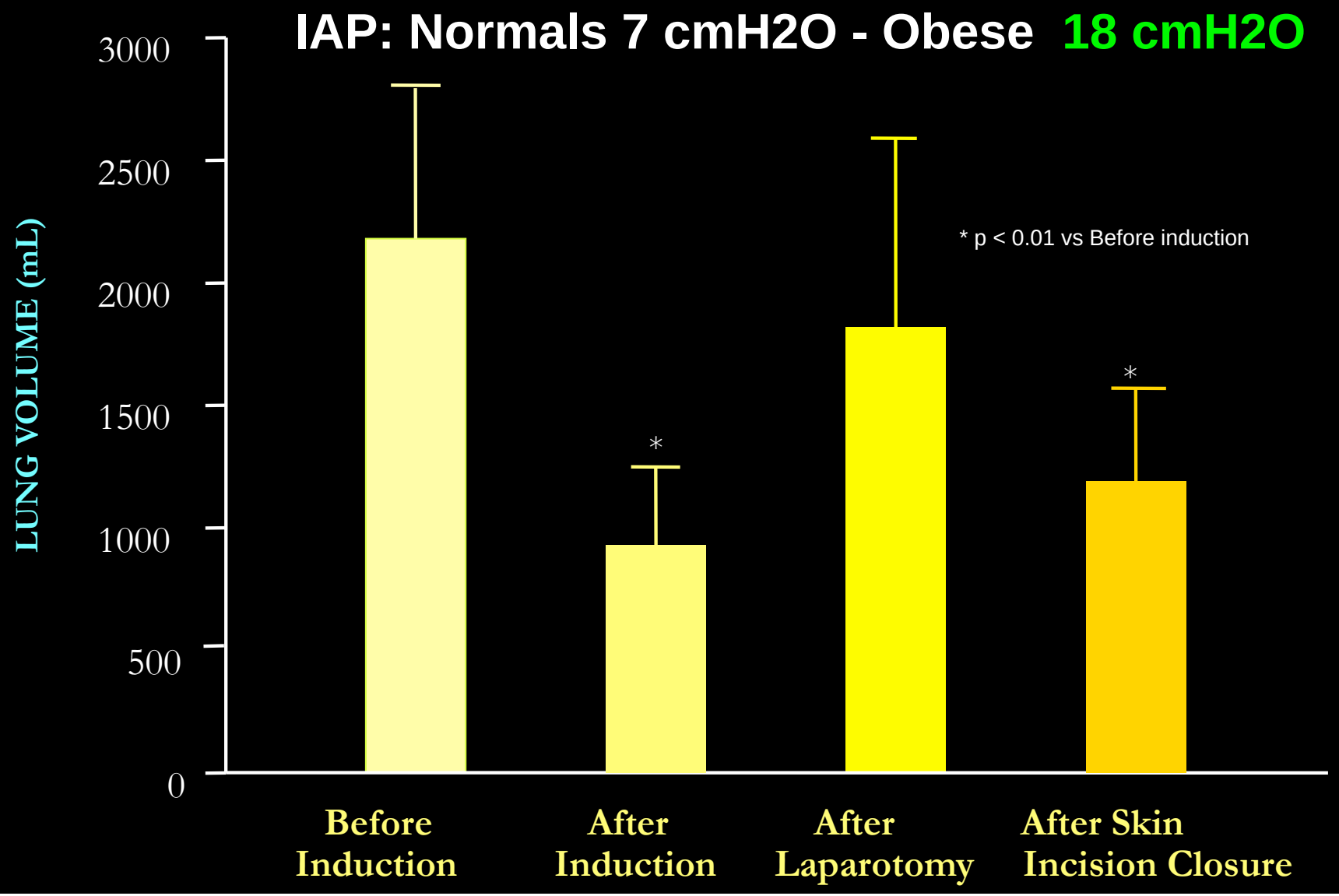
Lung volume as a function of obesity

Pelosi P et al. Anesth Analg. 1998 Sep;87(3):654-60



IAP is the main determinant of lung volume

Damia, Br J Anaesth 1988; 60:574-578; Pelosi, Anesthesiology 1999; 91: 1221-1231



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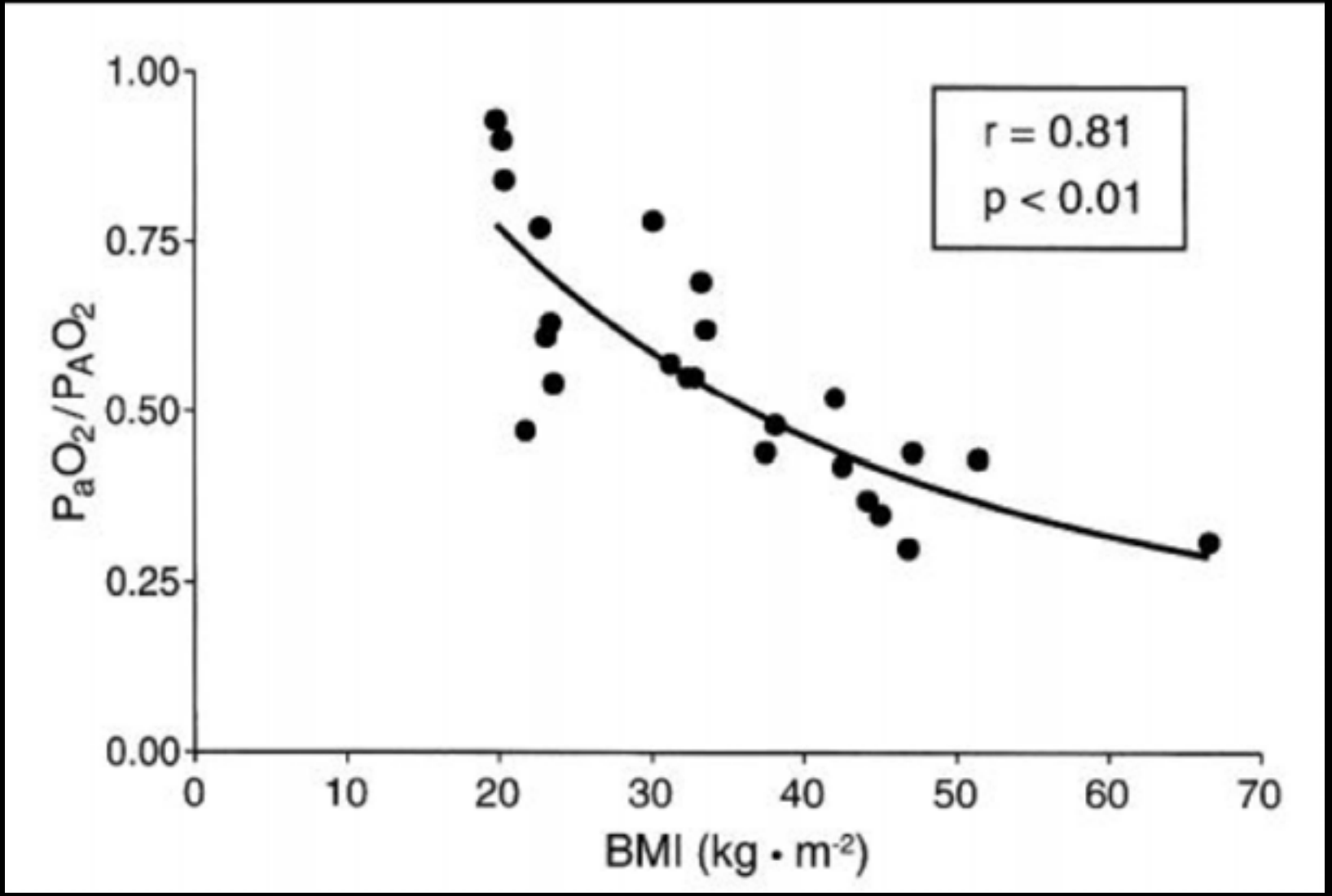
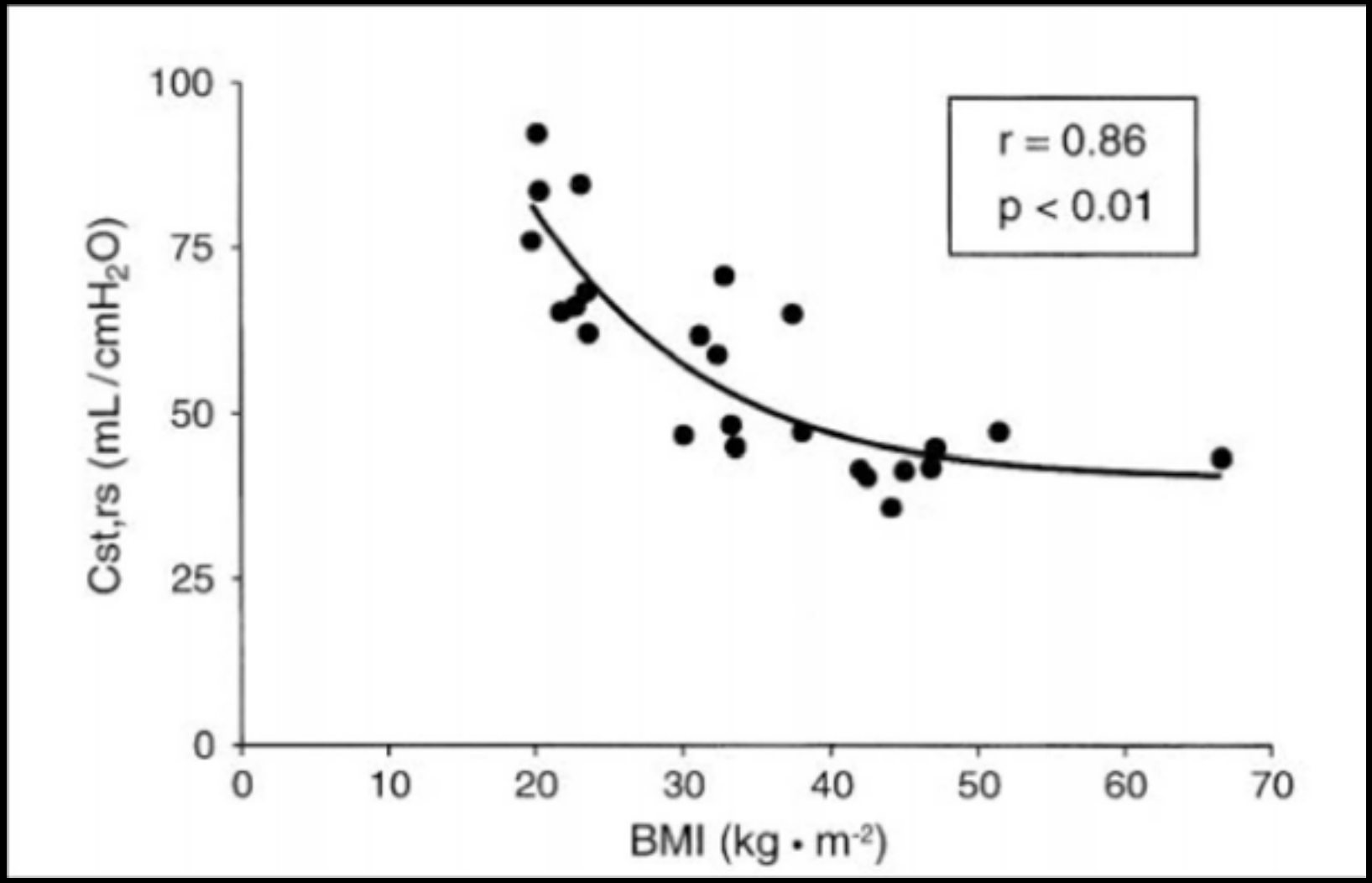


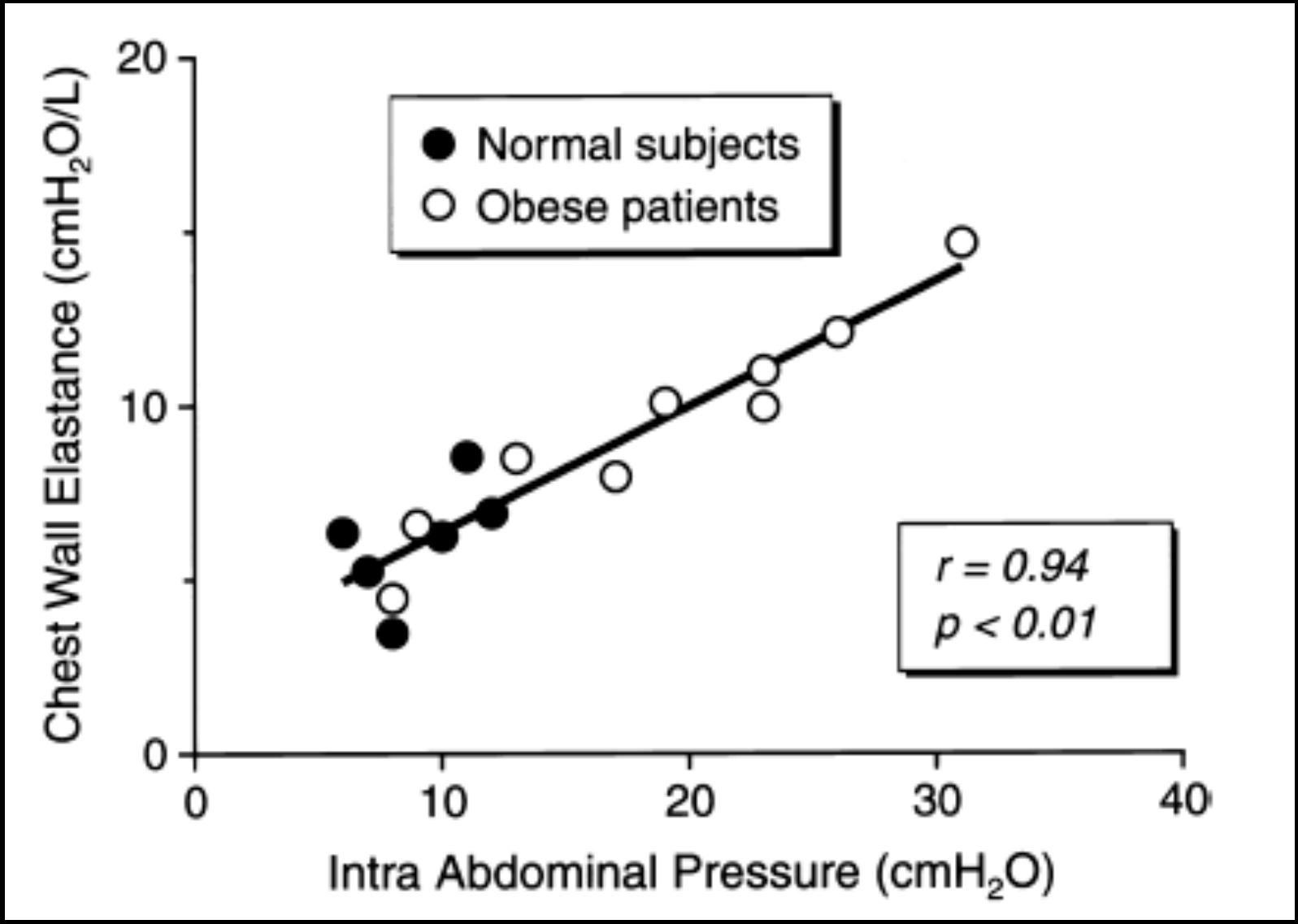
Cst,rs as a function of BMI

Pelosi P et al. Anesth Analg. 1998 Sep;87(3):654-60



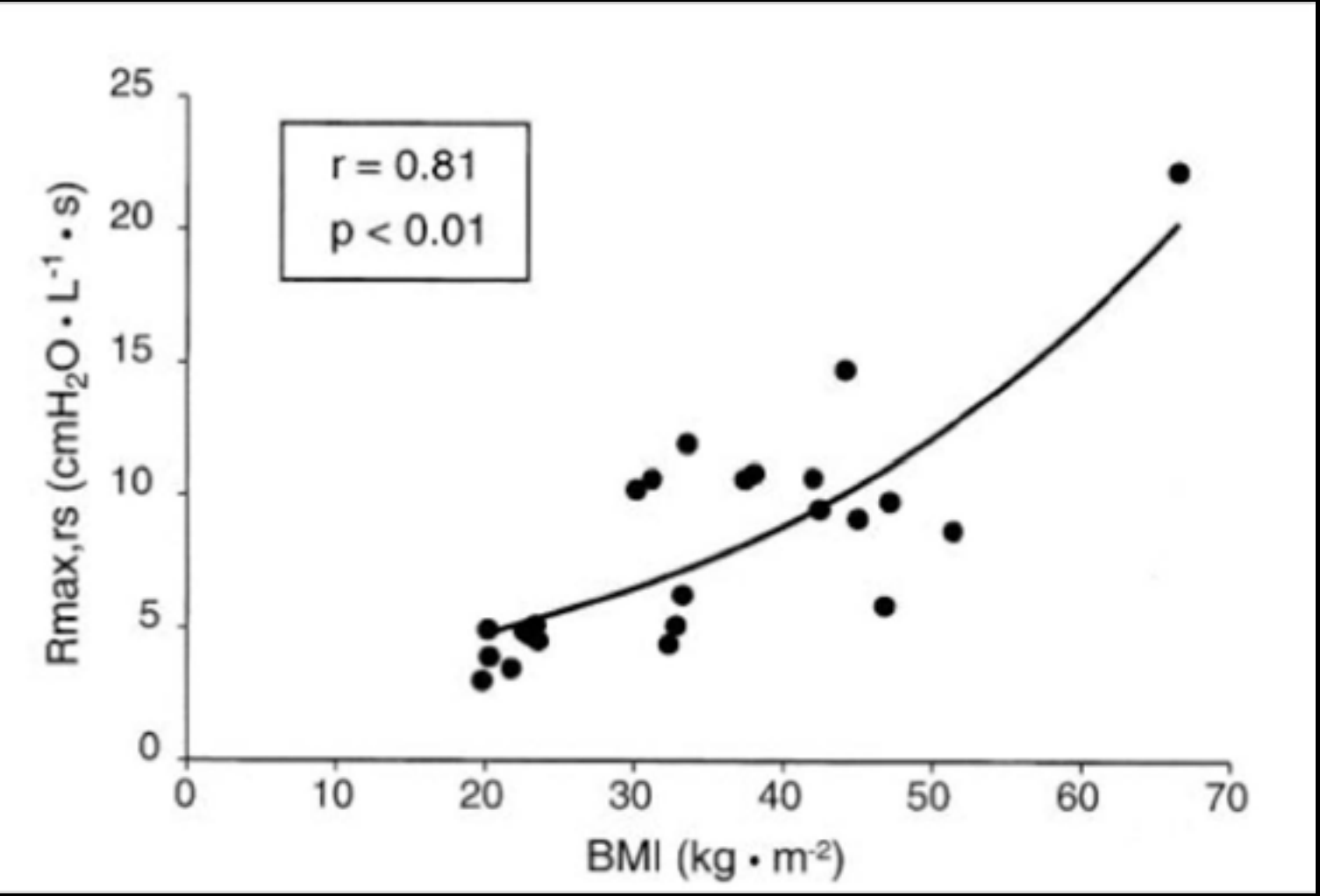
IAP and chest wall mechanics in obese

Pelosi et al. Anesthesiology 1999; 91: 1221-1231



Rmax,rs as a function of BMI

Pelosi P et al. Anesth Analg. 1998 Sep;87(3):654-60



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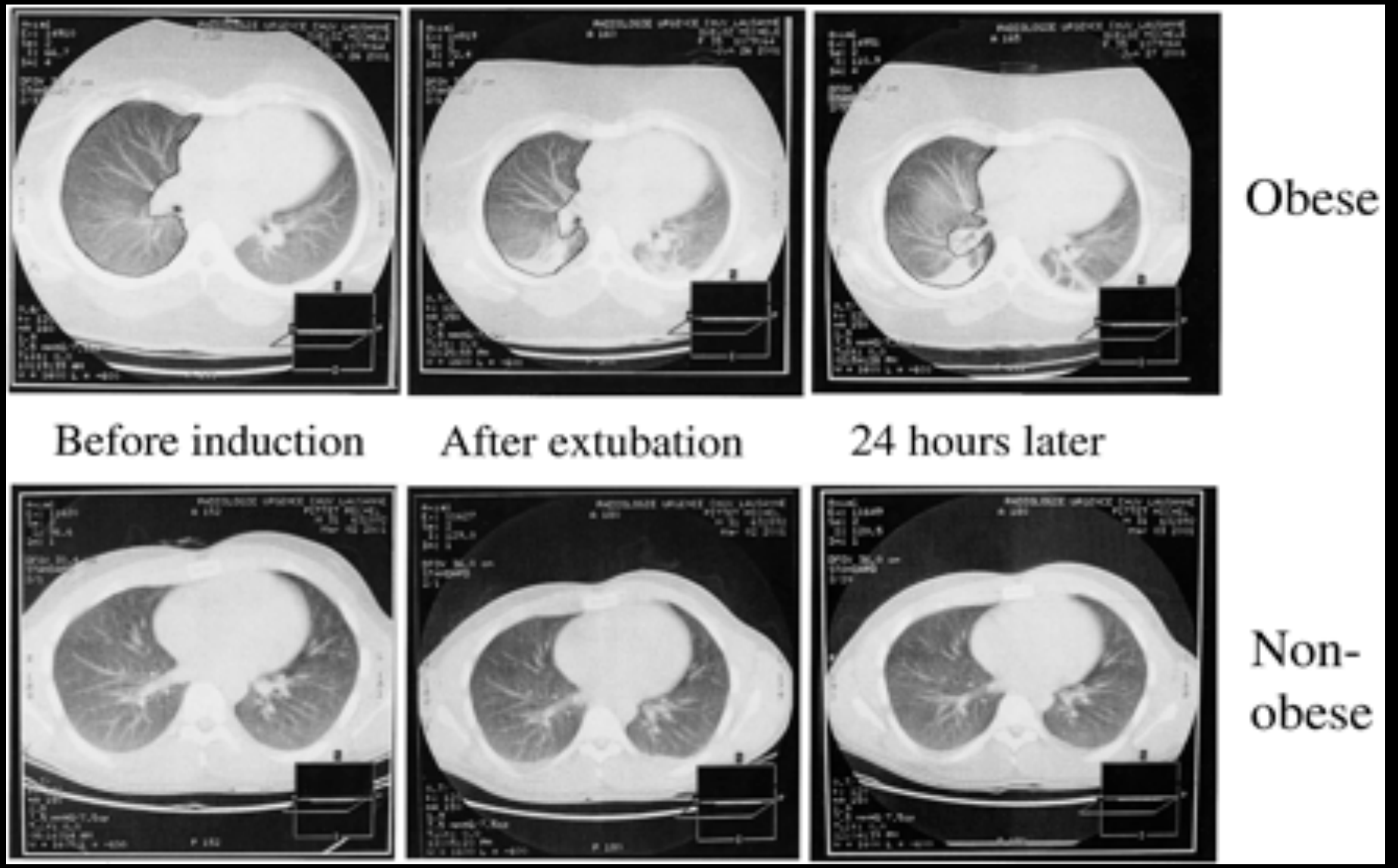
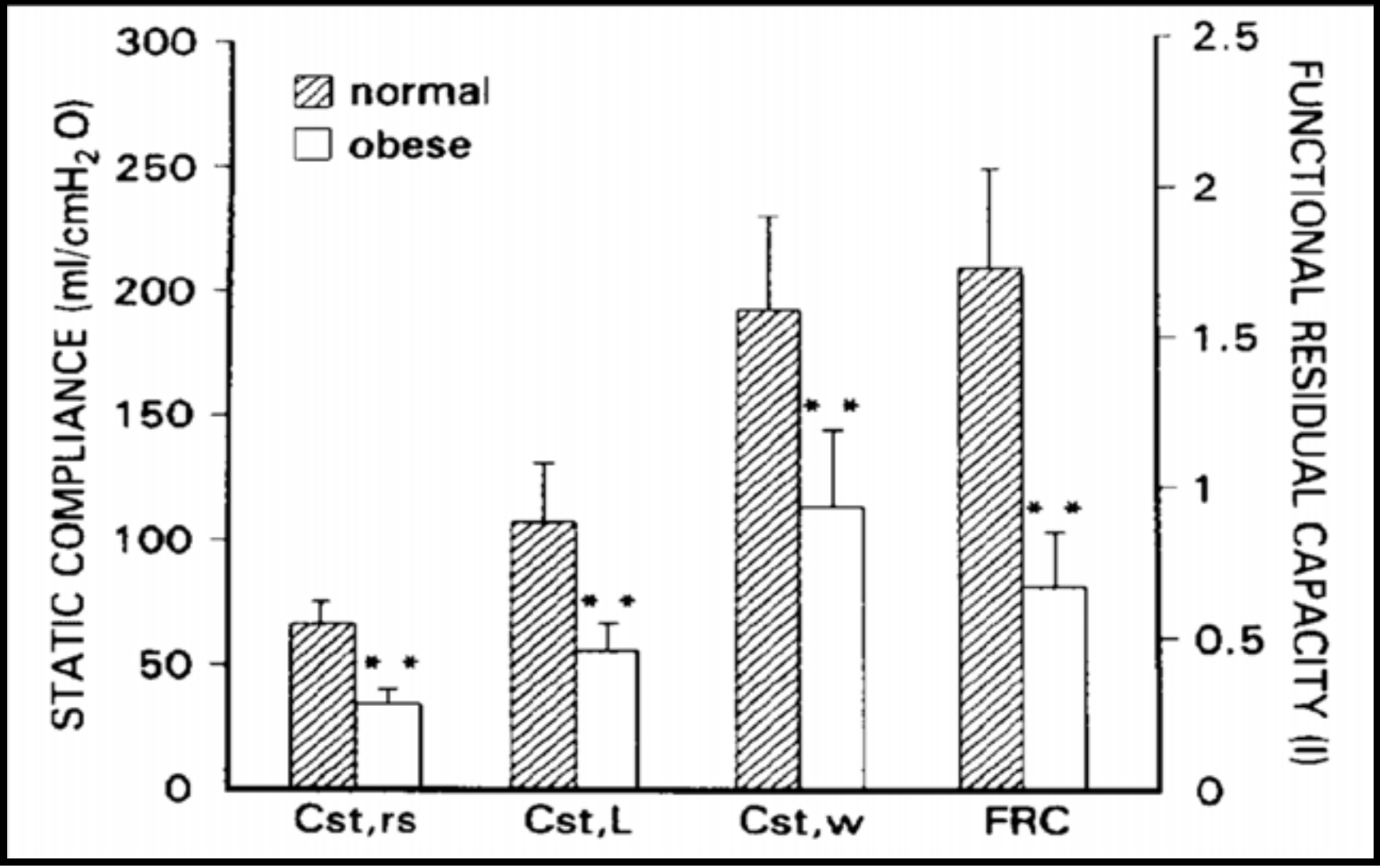
Obesity and post-operative atelectasis

Eichenberger et al. *Anesth Analg 2002; 95: 1788-1795*



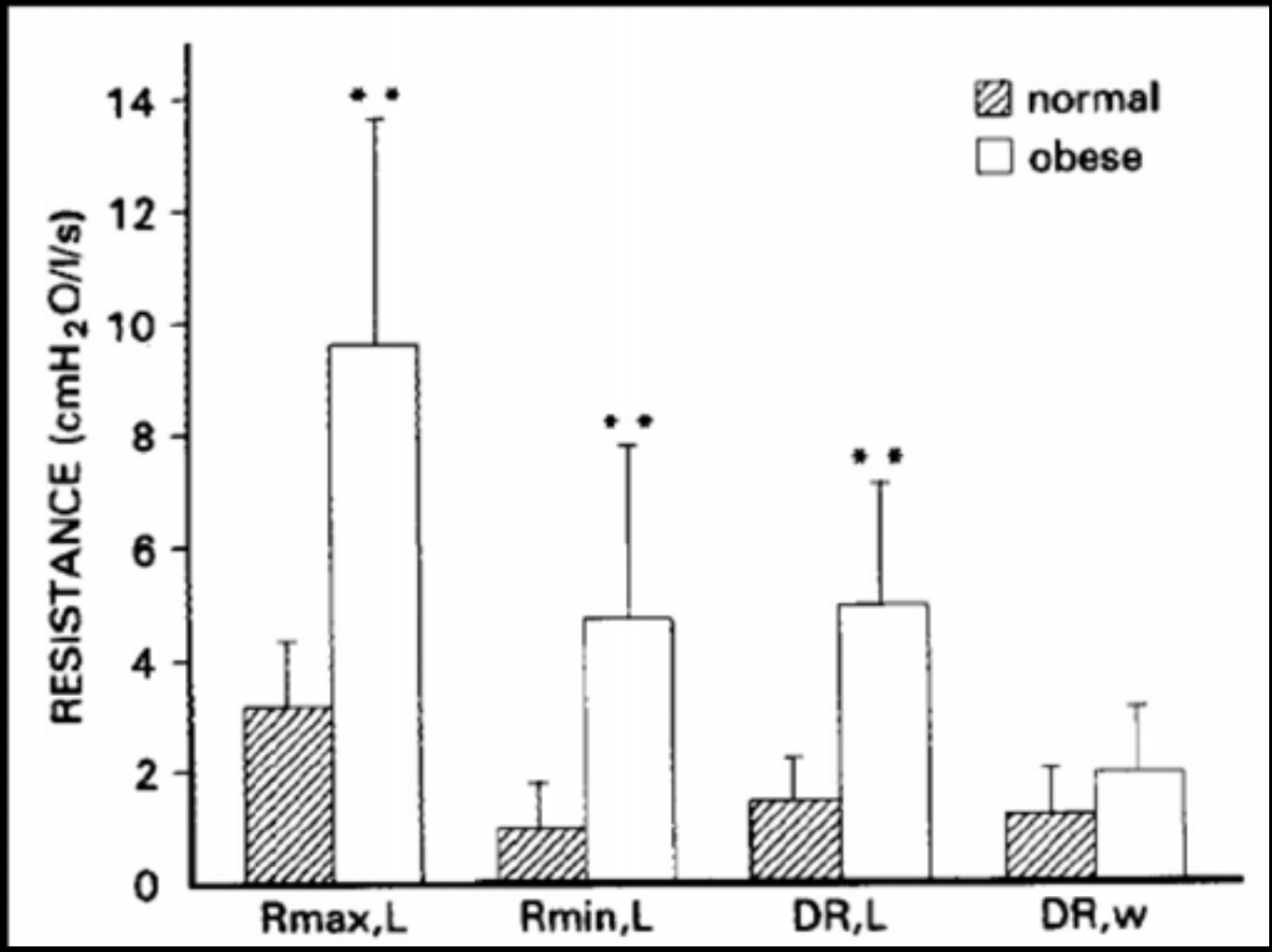
Lung and Chest wall mechanics are impaired in obese

Pelosi P et al Chest 1996; 109:144-151



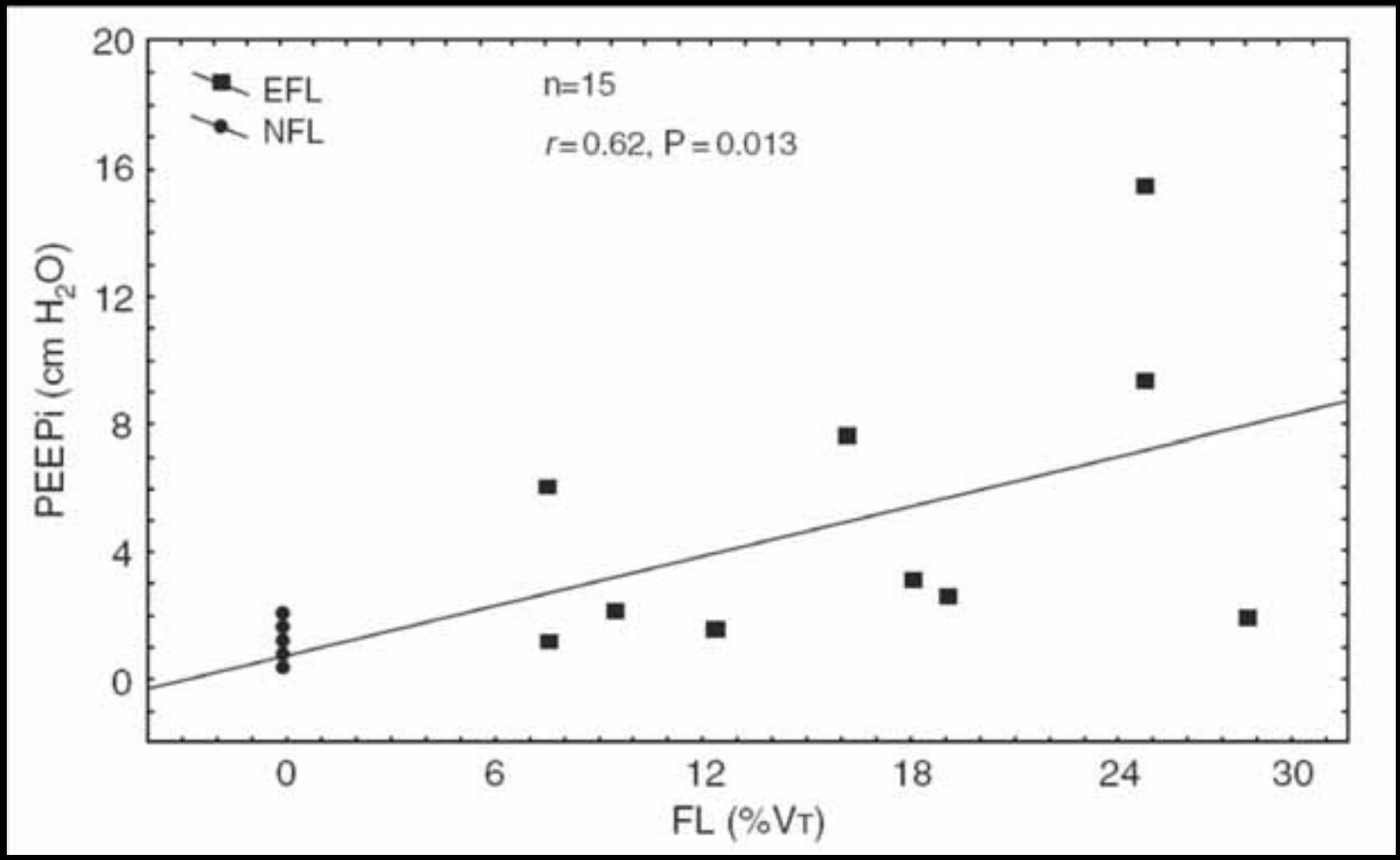
Partitioning of resistance in obese

Pelosi P et al Chest 1996; 109:144-151



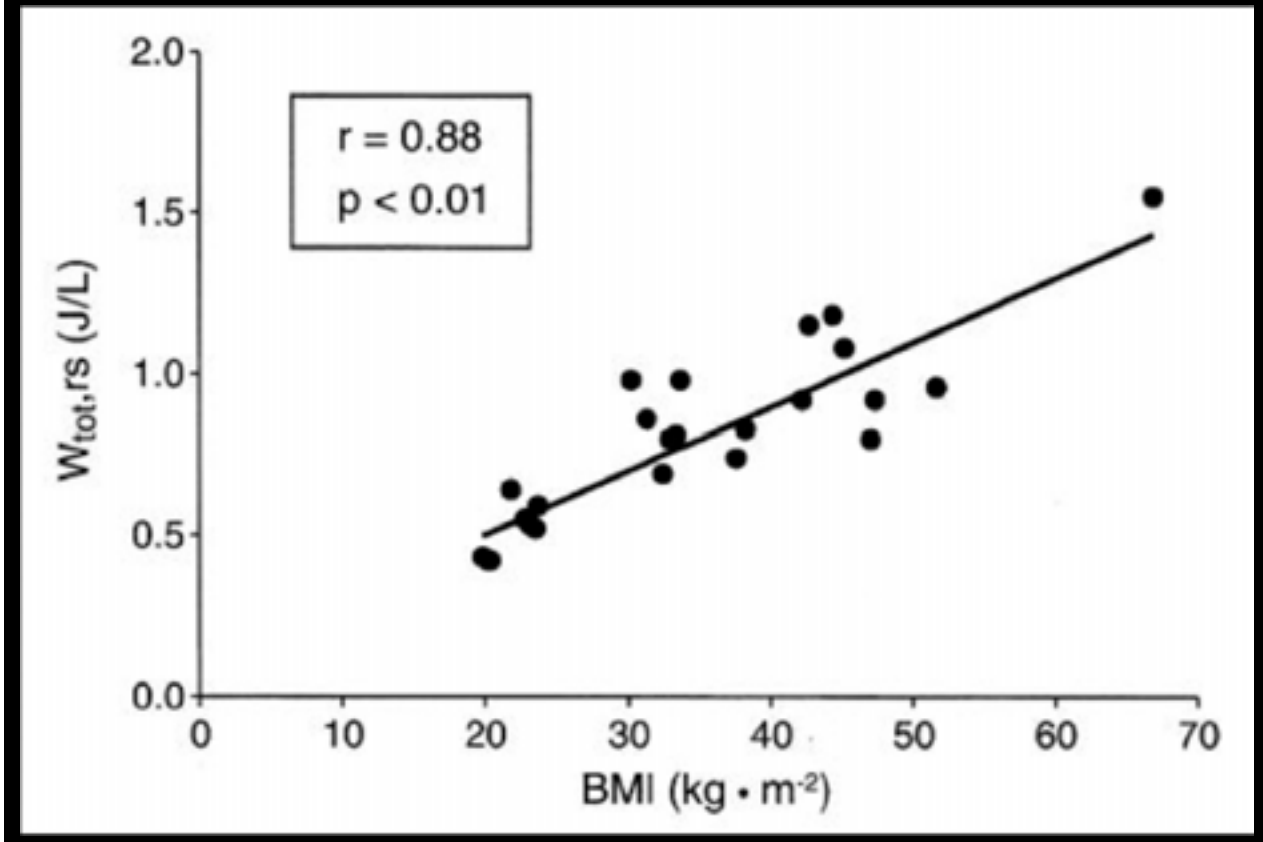
Expiratory flow limitation in morbidly obese postoperative MV patients

Koutsoukou A et al Acta Anaesthesiol Scand 2004; 48: 1080—1088



Obesity Increases Post-Op Work of Breathing

Pelosi et al., Anaesth Analg 1998; Pelosi et al., J Appl Physiol 1996
Pelosi et al., Chest 1996; Pelosi et al., Acta Clin Belgica 2007



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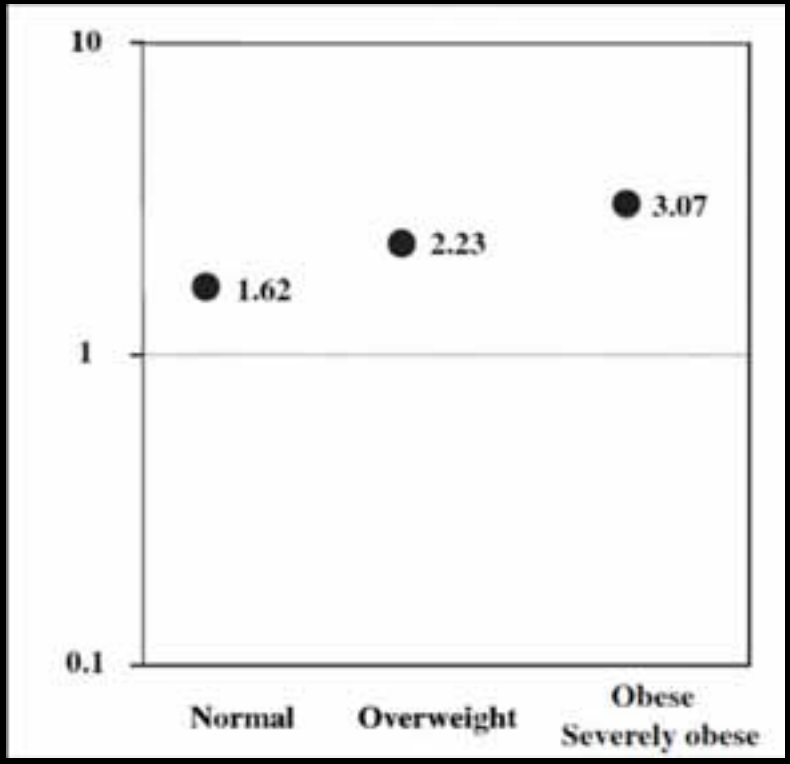
Influence of body mass index on outcome of the mechanically ventilated patients

Anzueto A et al Thorax. 2011 Jan;66(1):66-73.

Adjusted OR for the development of ARDS



Obese patients were more likely to have significant complications (ARDS and AKI) but there were no associations with increased mortality

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Reverse
Trendelenburg

Intubation at risk in anesthesia: the obese patient

Can we improve
"the oxygen reserves" during the preoxygenation before a planned intubation in obese patient ?

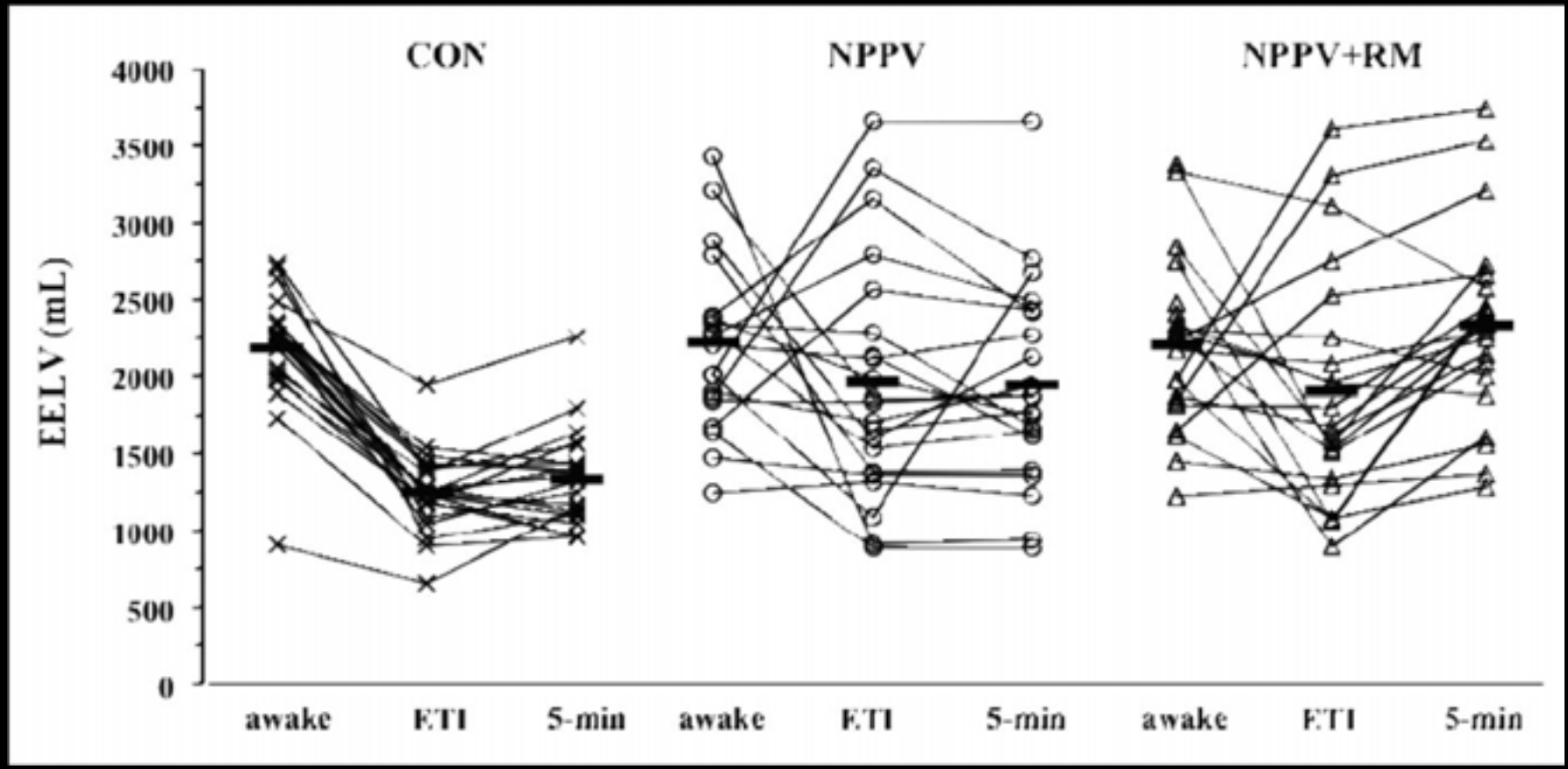
Standard (balloon)

VS

CPAP-preOxy
NIV (PSV+PEEP)-preOxy

Noninvasive Ventilation and Alveolar RM Improve Respiratory Function During and After Intubation of Morbidly Obese Patients: a RCT

Futier E, Pelosi P, Jaber S et al. Anesthesiology 2011 114: 1354-1363



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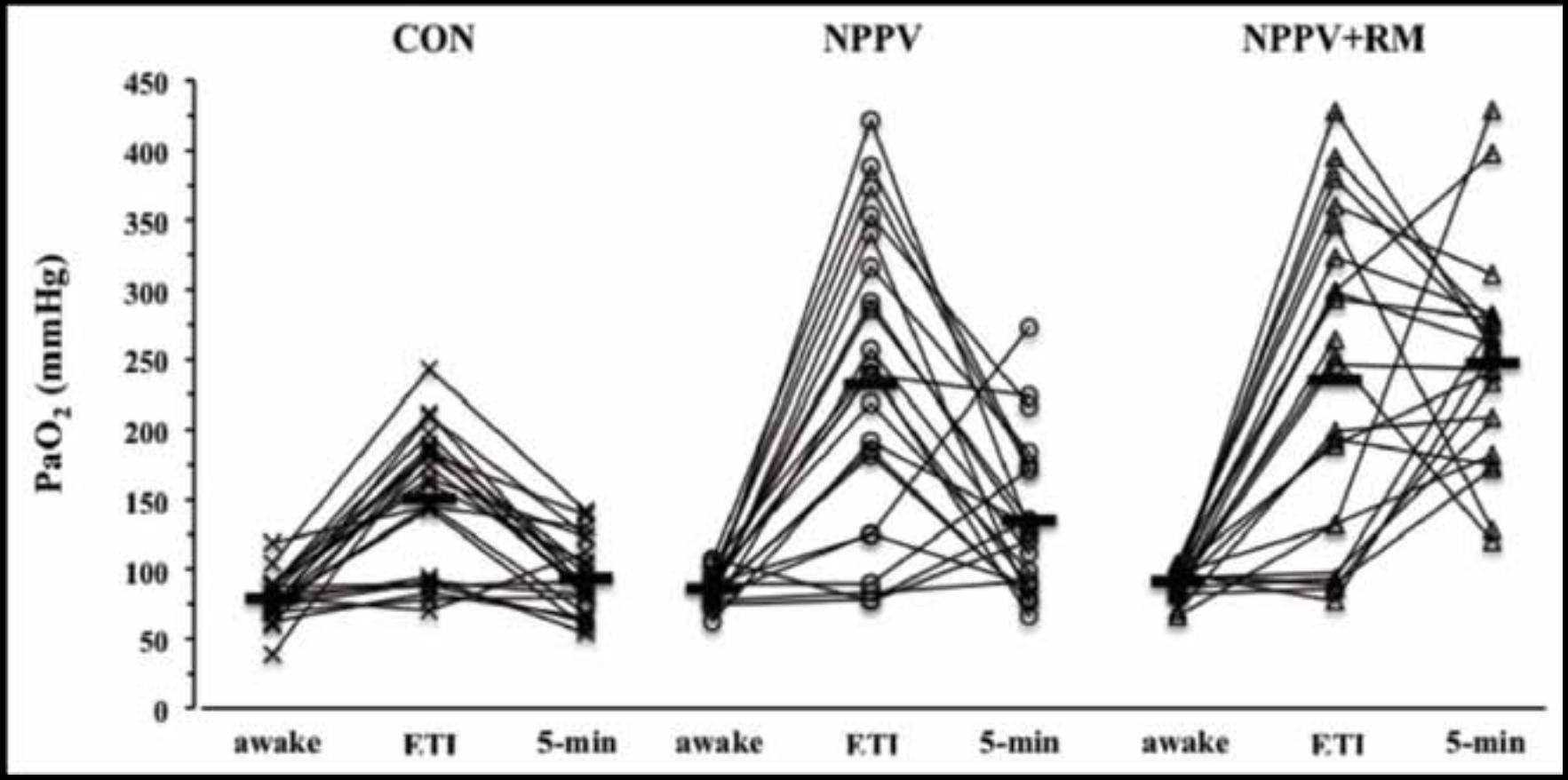

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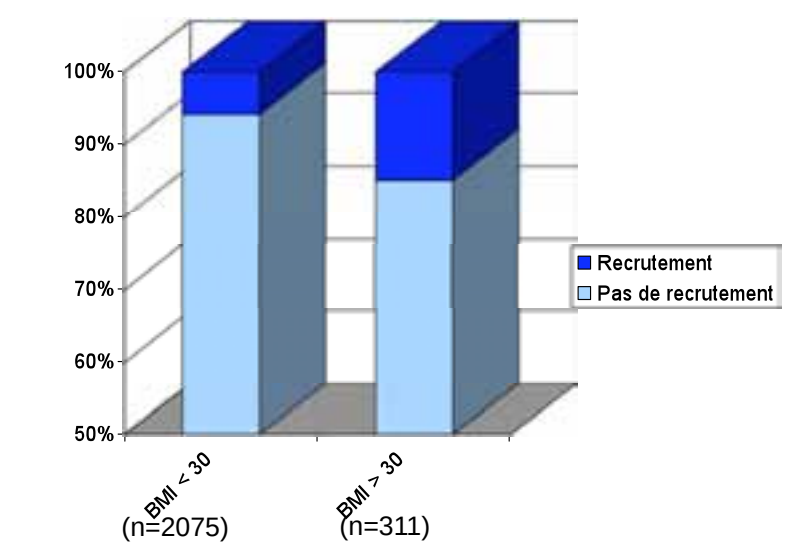
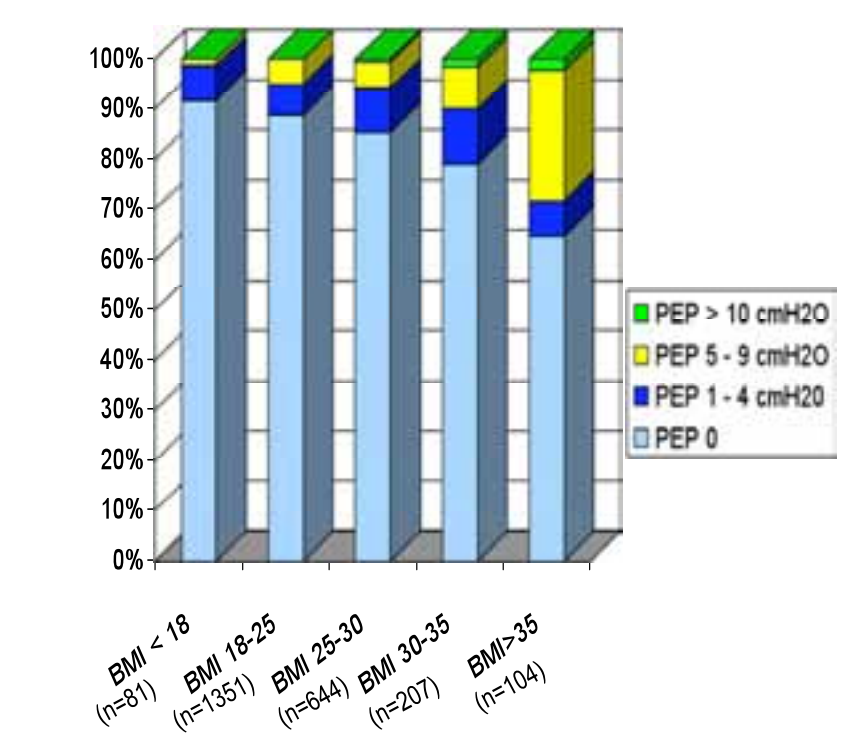
Description of anesthesia practice of ventilatory management during general anesthesia in operating room

Prospective multicenter observational French study (Jaber S et al):
2961 patients from 49 anesthesia departments

RECRUITMENT (RM)



PEEP

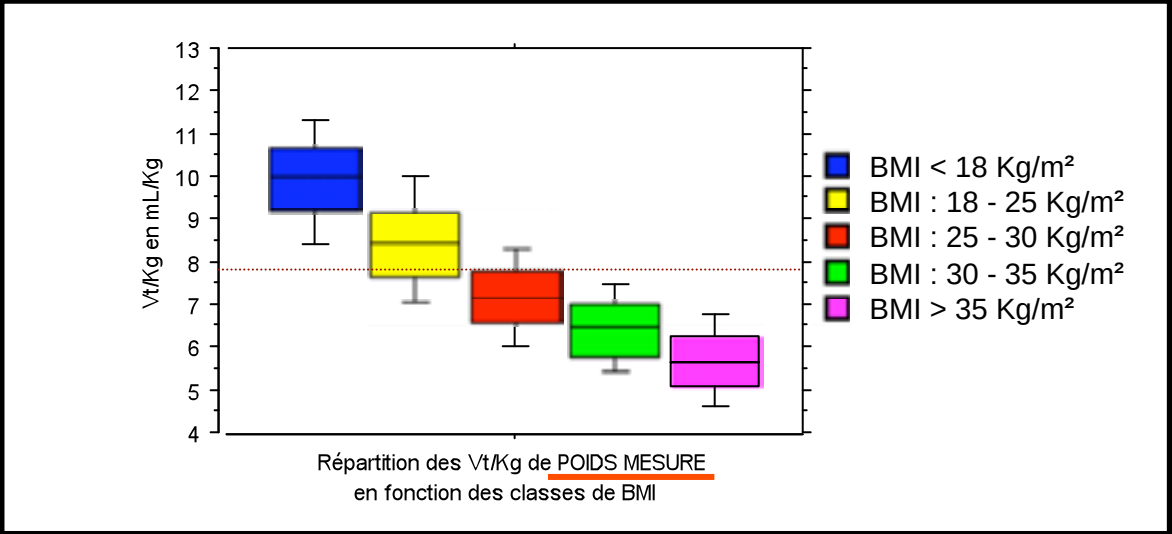


PEEP and RM are rarely used, whatever the type of surgery

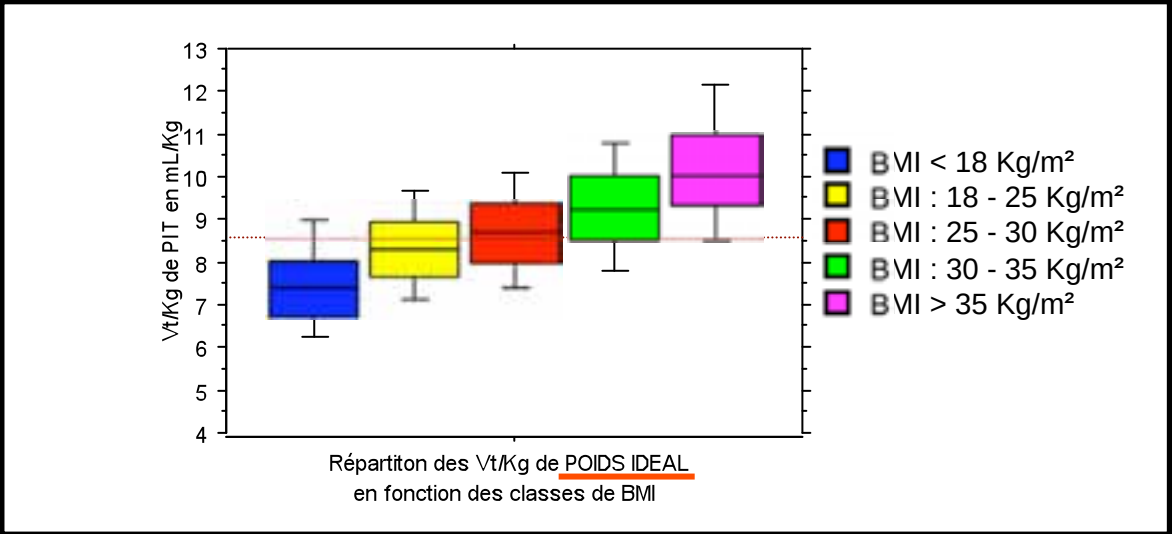
Tidal volume in obese in operating room ?

423/2961 obese patients : 16 %

VT measured

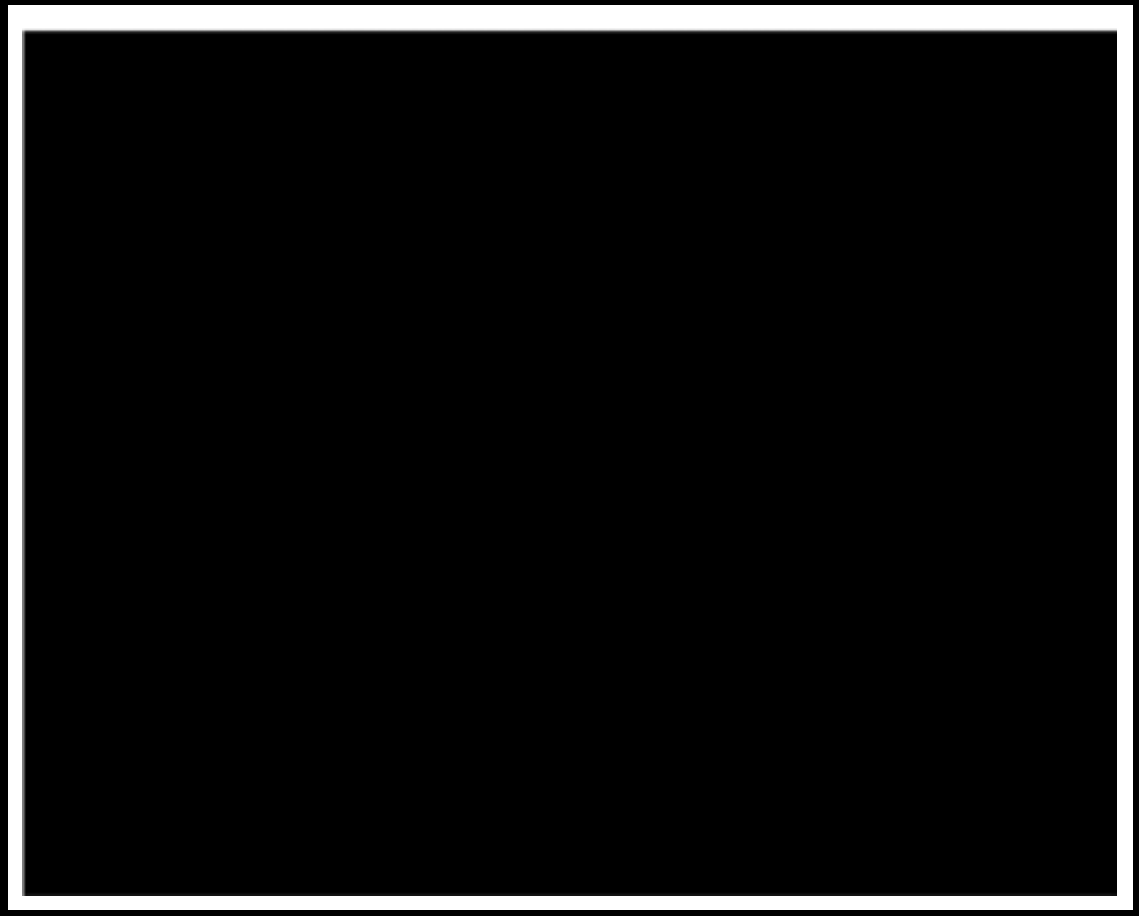


VT Calculated Ideal Body Weight (IBW)



Recruitment Menuvres in Morbidly Obese Patients During General Anaesthesia

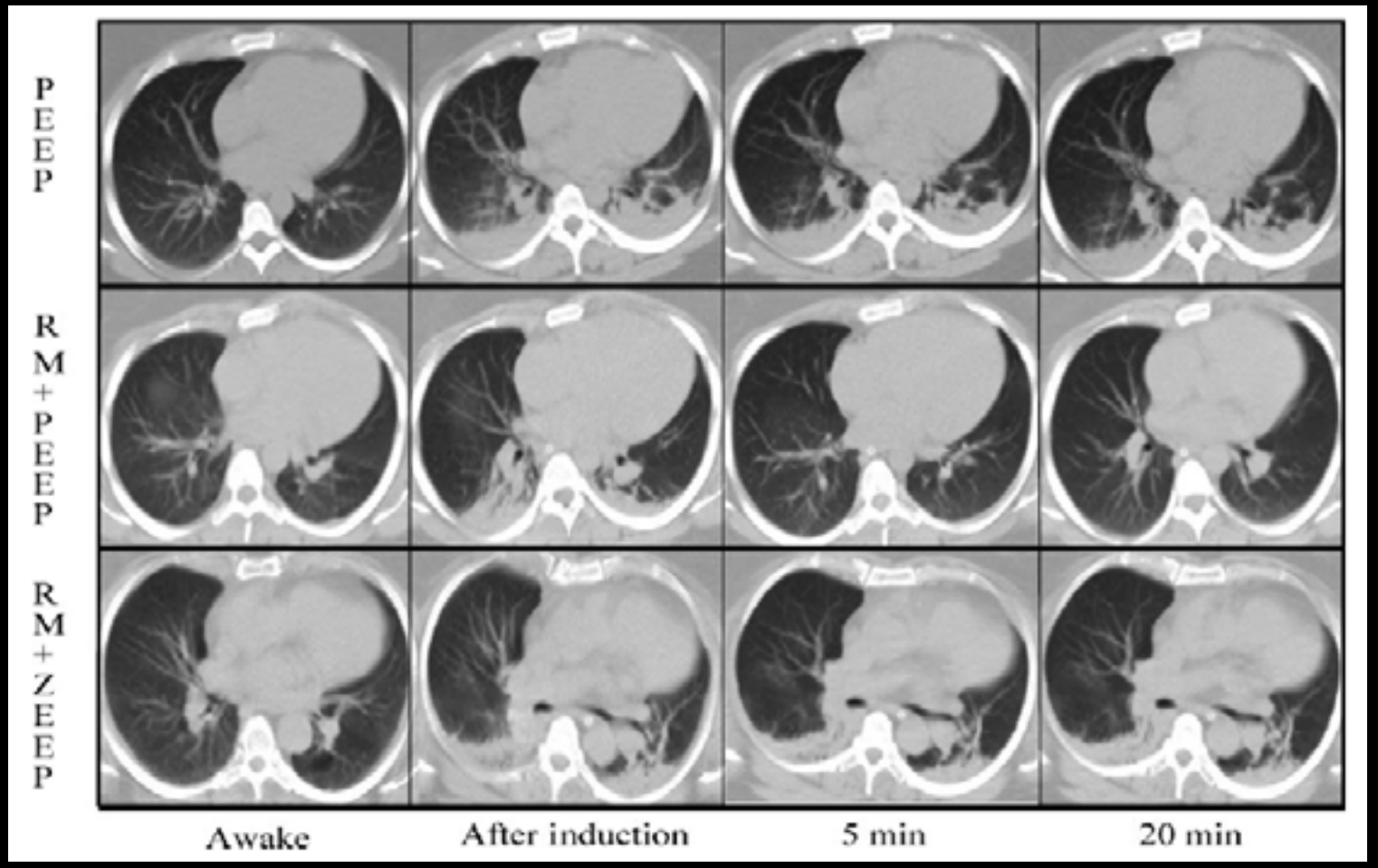
Pelosi P, de Abreu MG, Brusasco C Mechanical ventilation during general anesthesia. In: Principles and Practice of Mechanical Ventilation (ed MJ Tobin), McGraw-Hill , 2012



Prevention of Atelectasis in Morbidly Obese Patients during General Anesthesia and Paralysis

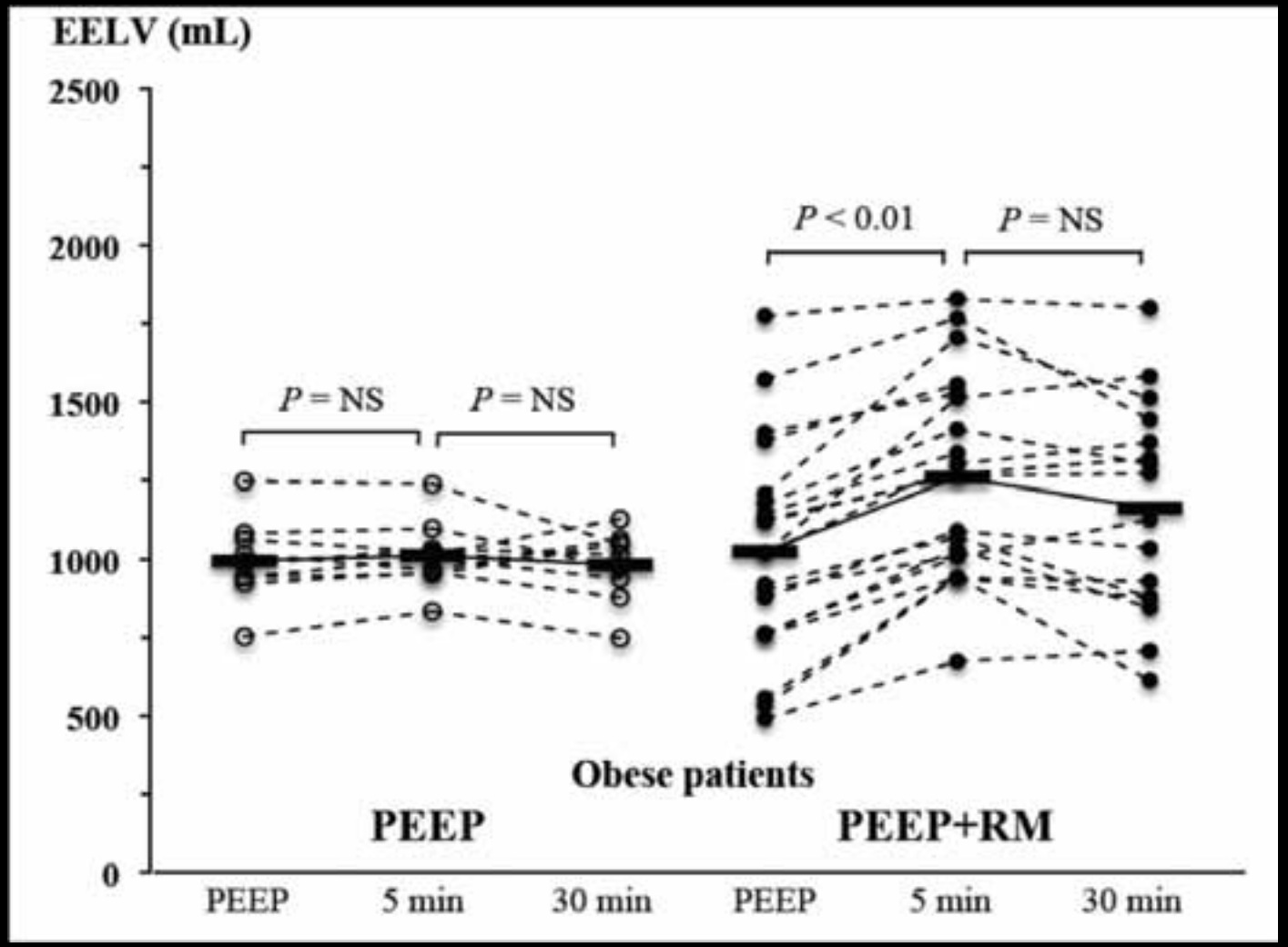
Henrik Reinius, M.D., Lennart Jonsson, M.D.,* Sven Gustafsson, M.D., Ph.D.,† Magnus Sundbom, M.D., Ph.D.,† Olov Duvernoy, M.D., Ph.D.,‖ Paolo Pelosi, M.D., Ph.D.,‡ Göran Hedenstierna, M.D., Ph.D.,§ Filip Fredén, M.D., Ph.D.**

Anesthesiology 2009; 111:979-987



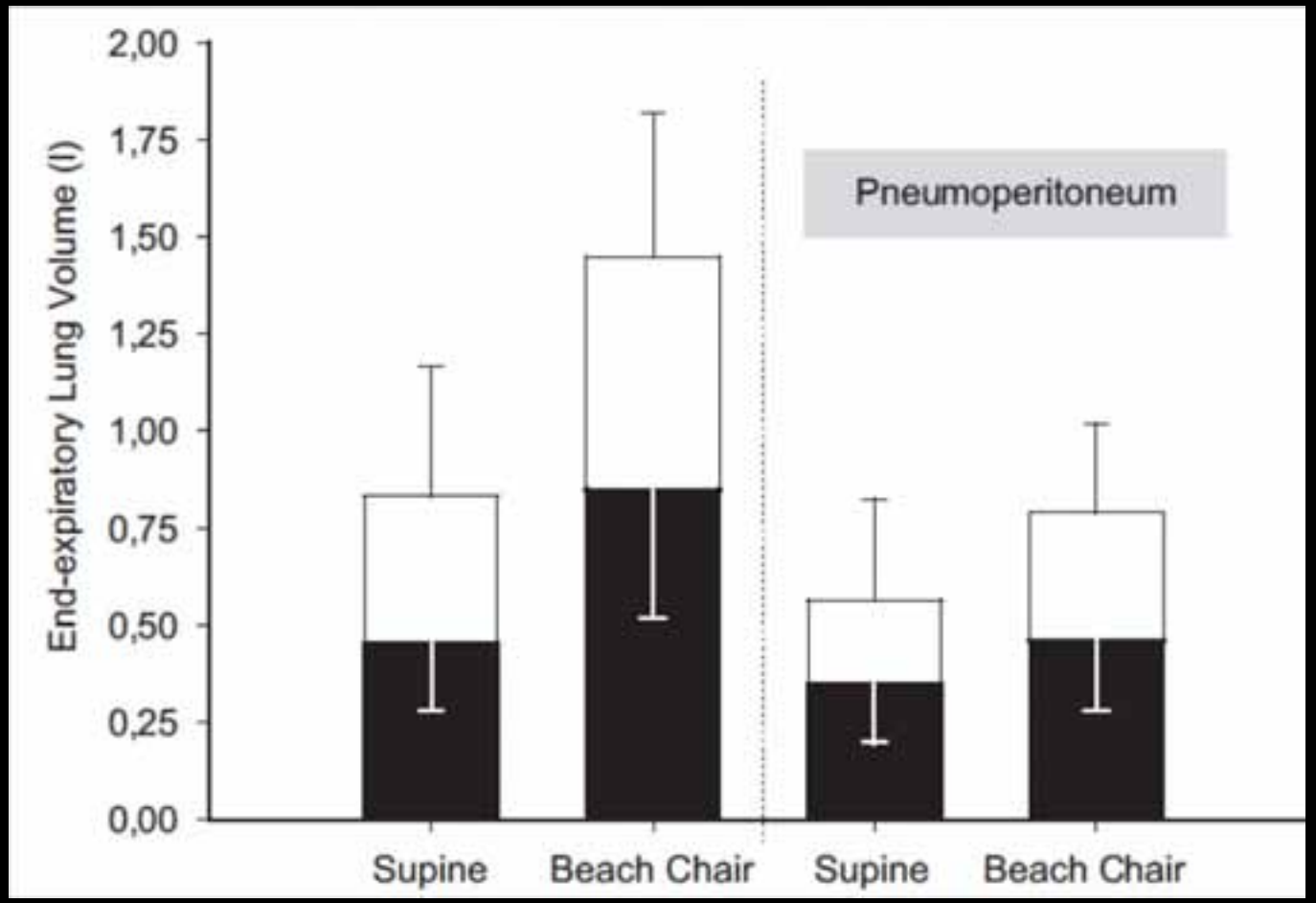
Intraoperative Recruitment Maneuver Reverses Pneumoperitoneum-induced Detrimental Respiratory Effects in Obese and Non-obese Patients Undergoing Laparoscopy

Futier E, Pelosi P, Jaber S et al. Anesthesiology. 2010 Dec;113(6):1310-9.



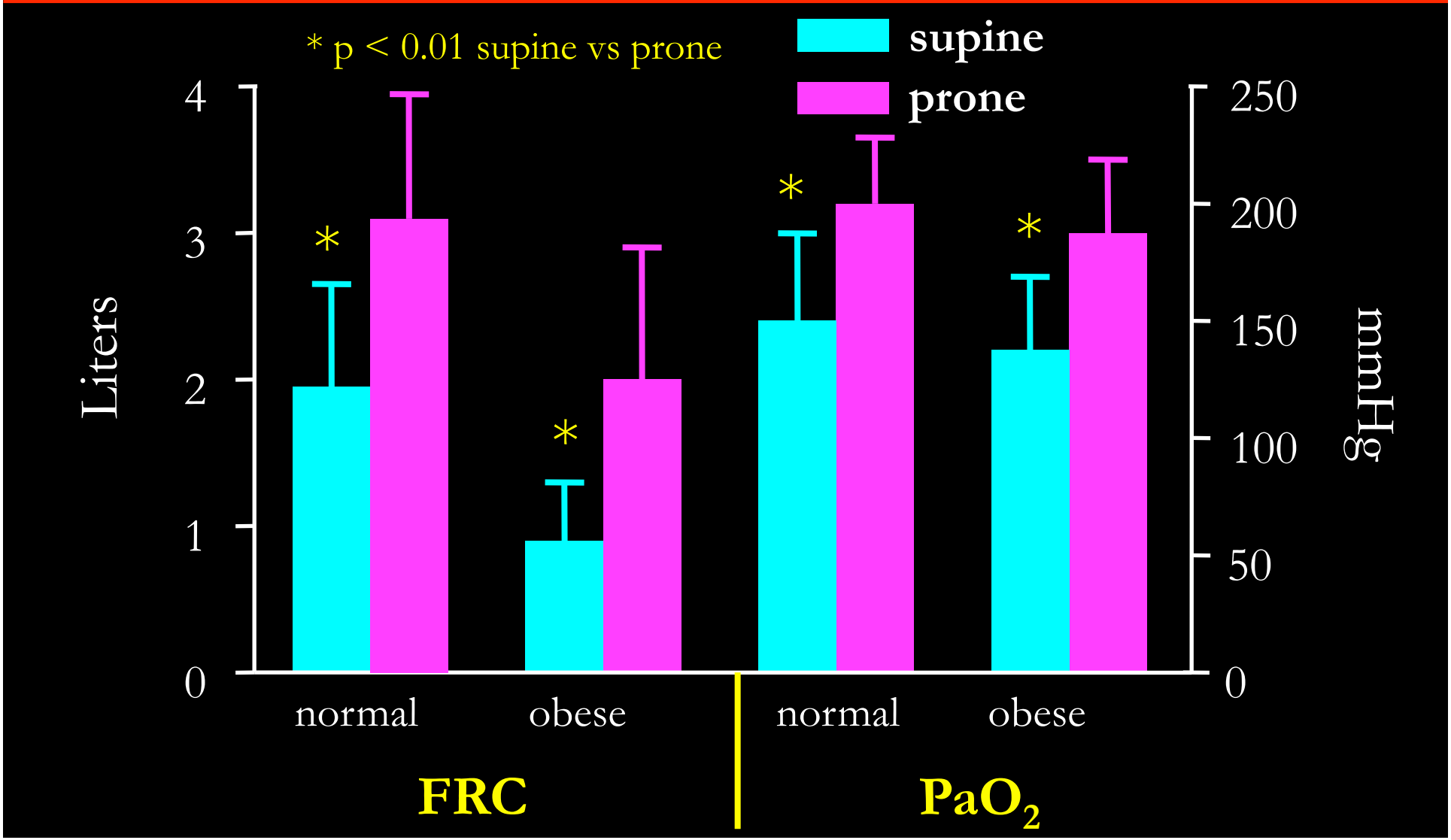
Beach chair position and PEEP improve respiratory function in obese patients during PNP and general anesthesia

Valenza et al Anesthesiology 2007; 107:725–32



Prone position does not affect respiratory function in obese

Pelosi, Anesth Analg 1995;80:955-960; Pelosi, Anesth Analg 1996;83;578-583

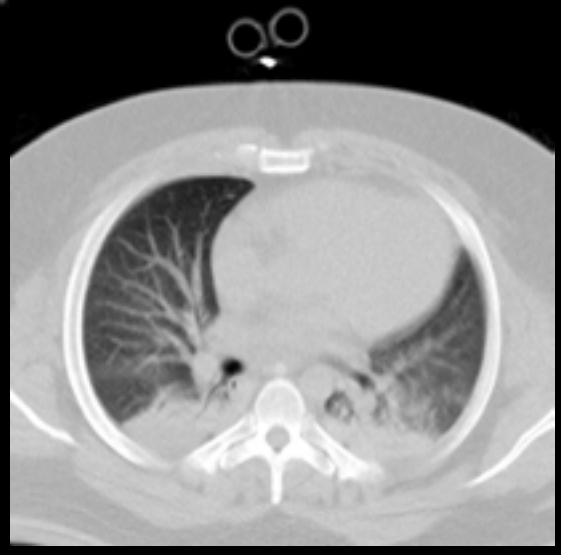


Which ventilation setting in obese patients during general anesthesia ?

Shultz MJ et al Anesthesiology 2007; 106;1226.1231

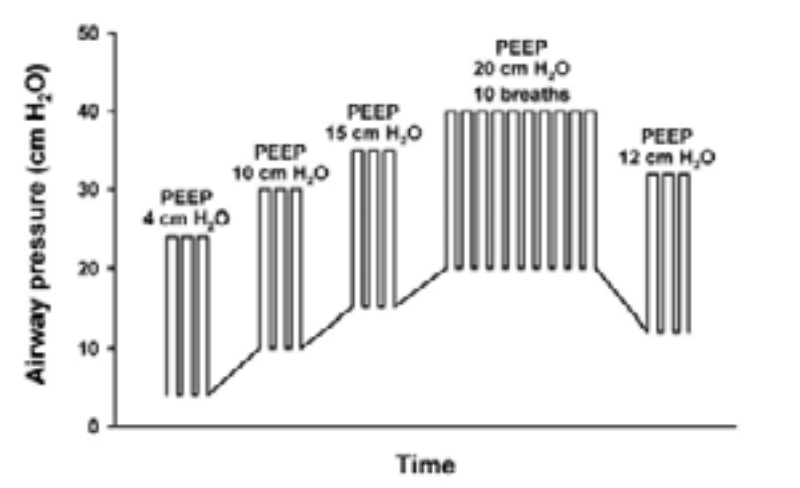
Pelosi P, Gregoretti C. Best Pract Res Clin Anaesthesiol. 2010 Jun;24(2):211-25

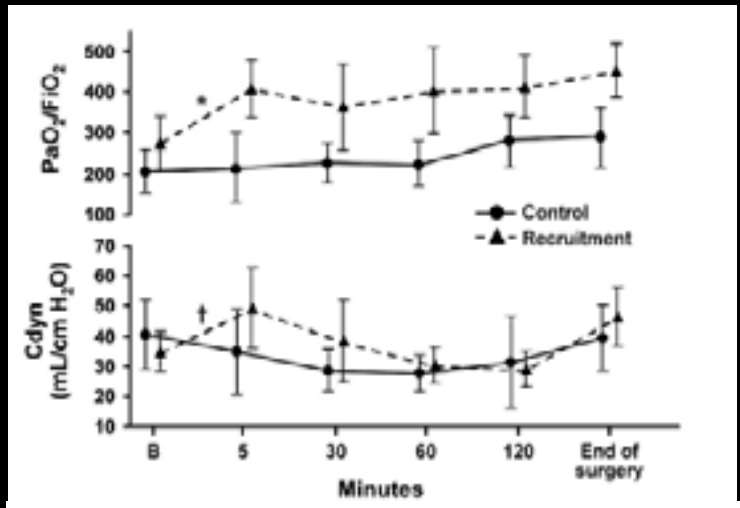
- Tidal Volume < 10 ml/Kg PBW
- Increase RR to control pHa/$PaCO_2$
- Plateau Pressure < 25-30 cmH_2O
- PEEP > 5 cmH_2O
- RM 35-40 cmH_2O – PEEP/VT – PC/VC
- Monitor Paw-Time/Check PEEPi

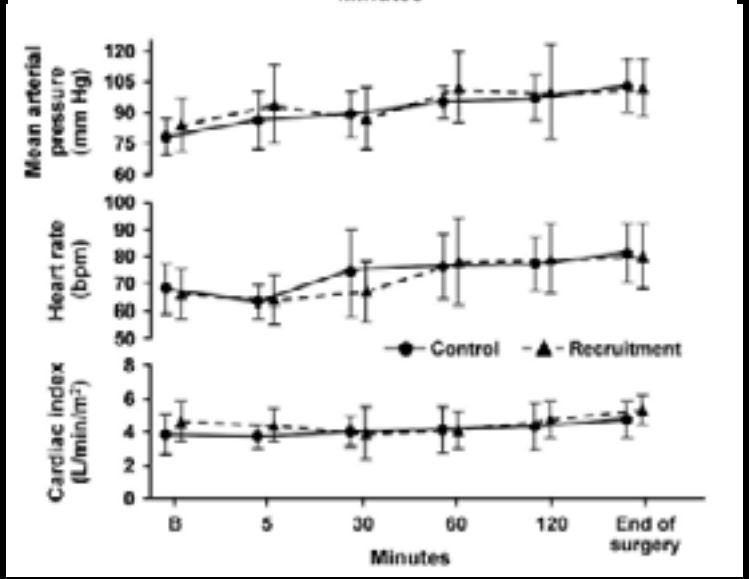


Recruitment Maneuver and PEEP are not effective during laparoscopic bariatric surgery

Whalen et al Anesth Analg 2006;102:298-305





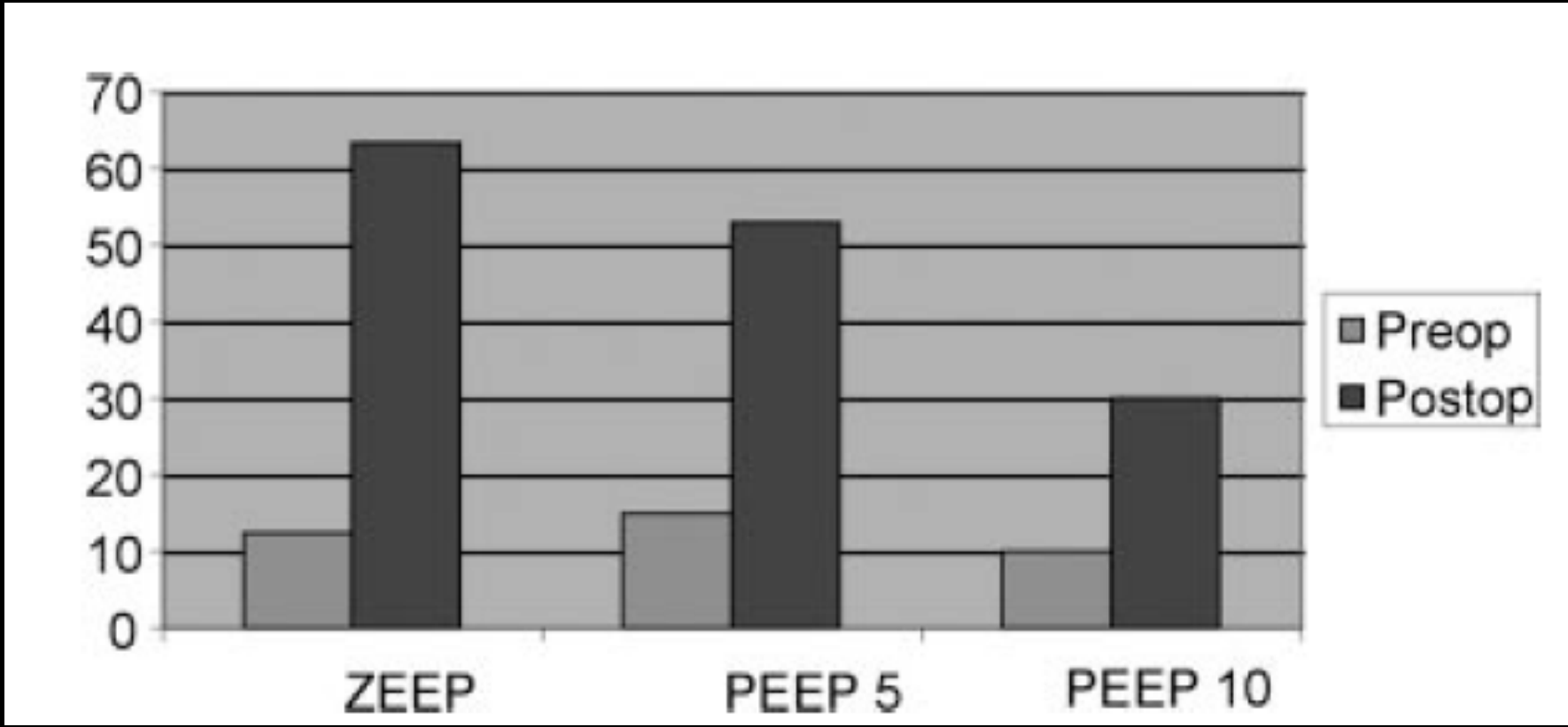


- Vasopressors treatments were larger in RM/PEEP group
- The effects of RM/PEEP were promptly dissipated in the immediate postoperative period

Intraoperative Ventilatory Strategies for Prevention of Pulmonary Atelectasis in Obese Patients Undergoing Laparoscopic Bariatric Surgery

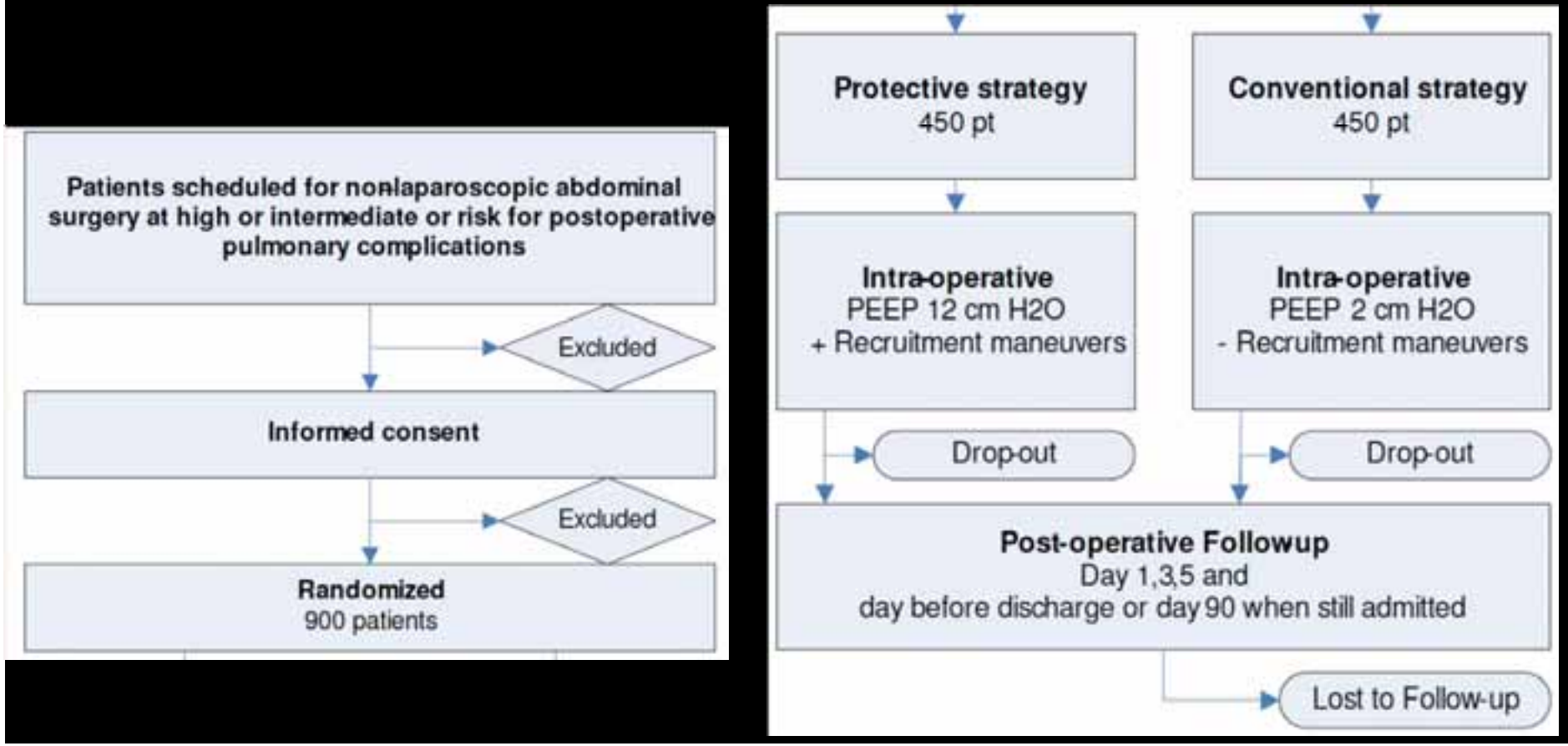
Talab HF et al Anesth Analg 2009;109:1511–6

Alveolar-to-arterial oxygen gradient (mm Hg), 22 pts per group



Rationale and study design of PROVHILO - a worldwide multicenter randomized controlled trial on protective ventilation during general anesthesia for open abdominal surgery.

Hemmes SN et al. Trials. 2011 May 6;12(1):111.



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How to evaluate the risk of PPCs ?

Canet J et al for ARISCAT, Anesthesiology. 2010; 113(6):1338-50.

13 % (score 26-44) – 54 % (score >45) risk to develop PPCs

ARISCAT inclusion criteria	Criteria values						Points
Age in years	≤ 50	☐	51-80	☐	≥ 80	☐	0 - 3 - 16
Preoperative SpO2 %	≥ 96	☐	91-95	☐	≤ 90	☐	0 - 8 - 24
Respiratory infection (last month)	yes	☐	no	☐			11
Preoperative anemia (≤ 10 g/dL)	yes	☐	no	☐			10
Emergency procedure	yes	☐	no	☐			8
Surgical incision*	peripheral	☐	upper abdominal	☐	Intrathoracic		0 - 15 - 24
Duration of surgery (hrs)	≤ 2	☐	> 2 to 3	☐	> 3	☐	0 - 16 - 23

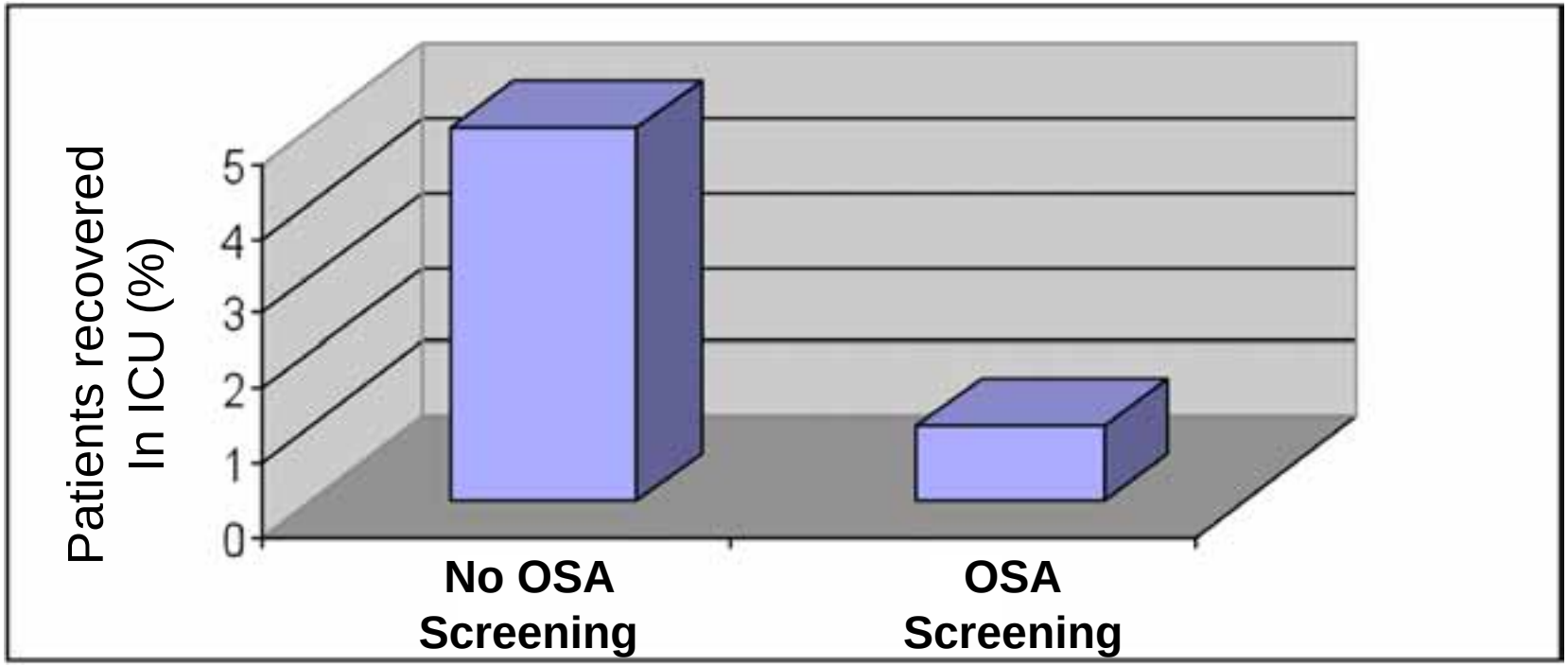
*any procedure for open abdominal surgery requiring an incision up umbilicus, totally or in part. It includes either mid-line, subcostal, lumbothomy or any other.

Total risk score ____ High or intermediate risk: ≥ 26

Eliminating respiratory intensive care unit stay after gastric bypass surgery

Hallowell PT et al Surgery 2007;142:608-12

Mandatory OSA screening and aggressive preoperative treatment have eliminated the need for respiratory-related ICU stays after bariatric surgery.



ESA Clinical Trials Network

European Journal of Anaesthesiology 2011, 28:454–462

EuSOS: European Surgical Outcomes Study

Rupert M. Pearse, Andrew Rhodes, Rui Moreno, Paolo Pelosi, Claudia Spies, Benoit Vallet, Philip Metnitz, Peter Bauer and Jean-Louis Vincent

PERISCOPE study: predicting post-operative pulmonary complications in Europe

Jaume Canet, Jonathan Hardman, Sergi Sabaté, Olivier Langeron, Marcelo Gama de Abreu, Lluis Gallart, Javier Belda, Klaus Markstaller, Paolo Pelosi and Valentin Mazo

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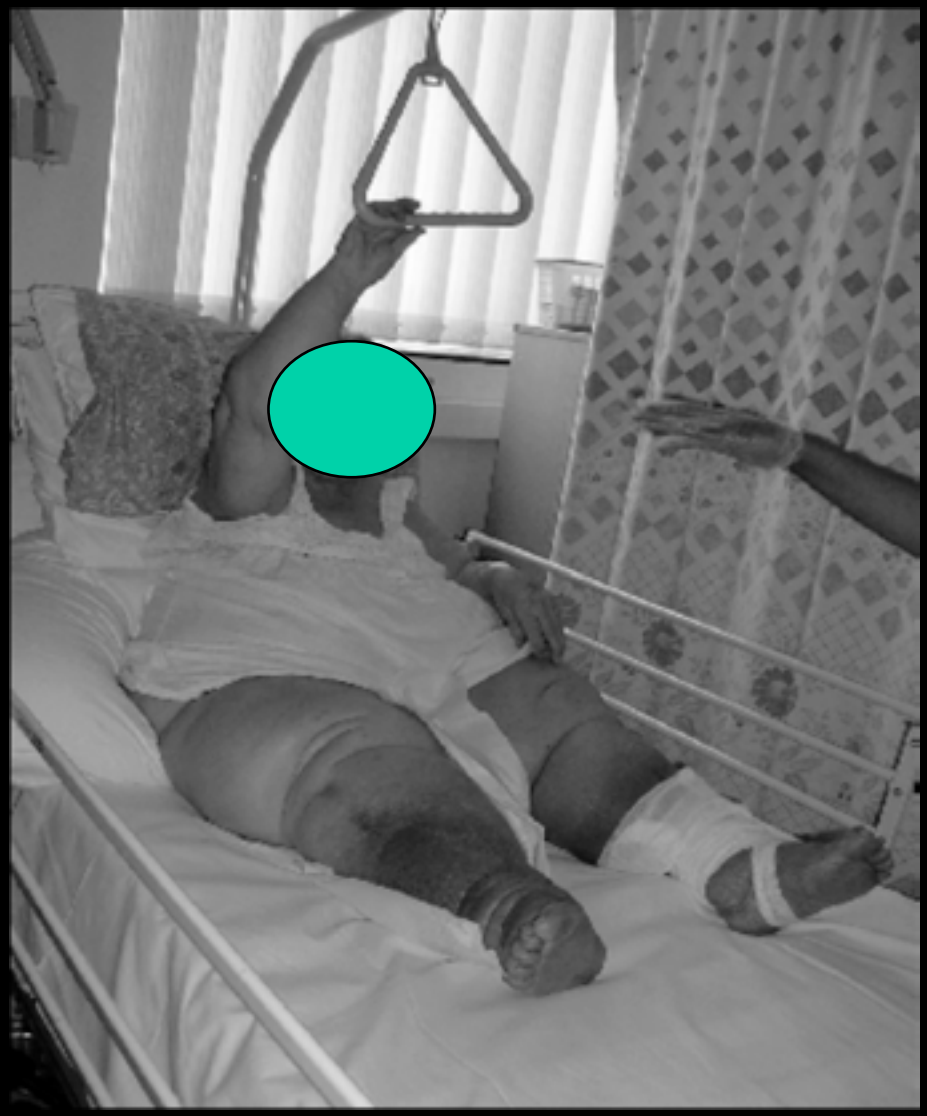
UNCORRECT

Positioning at 45º promotes better VC (avoid 0º or 90º)

- Burns et al. “Effect of body position on spontaneous respiratory effort and tidal volume in patients with obesity, adominal distension and ascites”. Am J Crit Care 1994;3:102-106
- Neill et al.”Effects of sleep posture on upper airway stability in patientswith obstructive sleep apnea”. Am J Respir Crit Care Med 1997;155:199-204

Conventional Physiotherapy

Pelosi P, Gregoretti C. Best Pract Res Clin Anaesthesiol. 2010 Jun;24(2):211-25



- Early Mobilization
- Deep-Breathing
- Cough

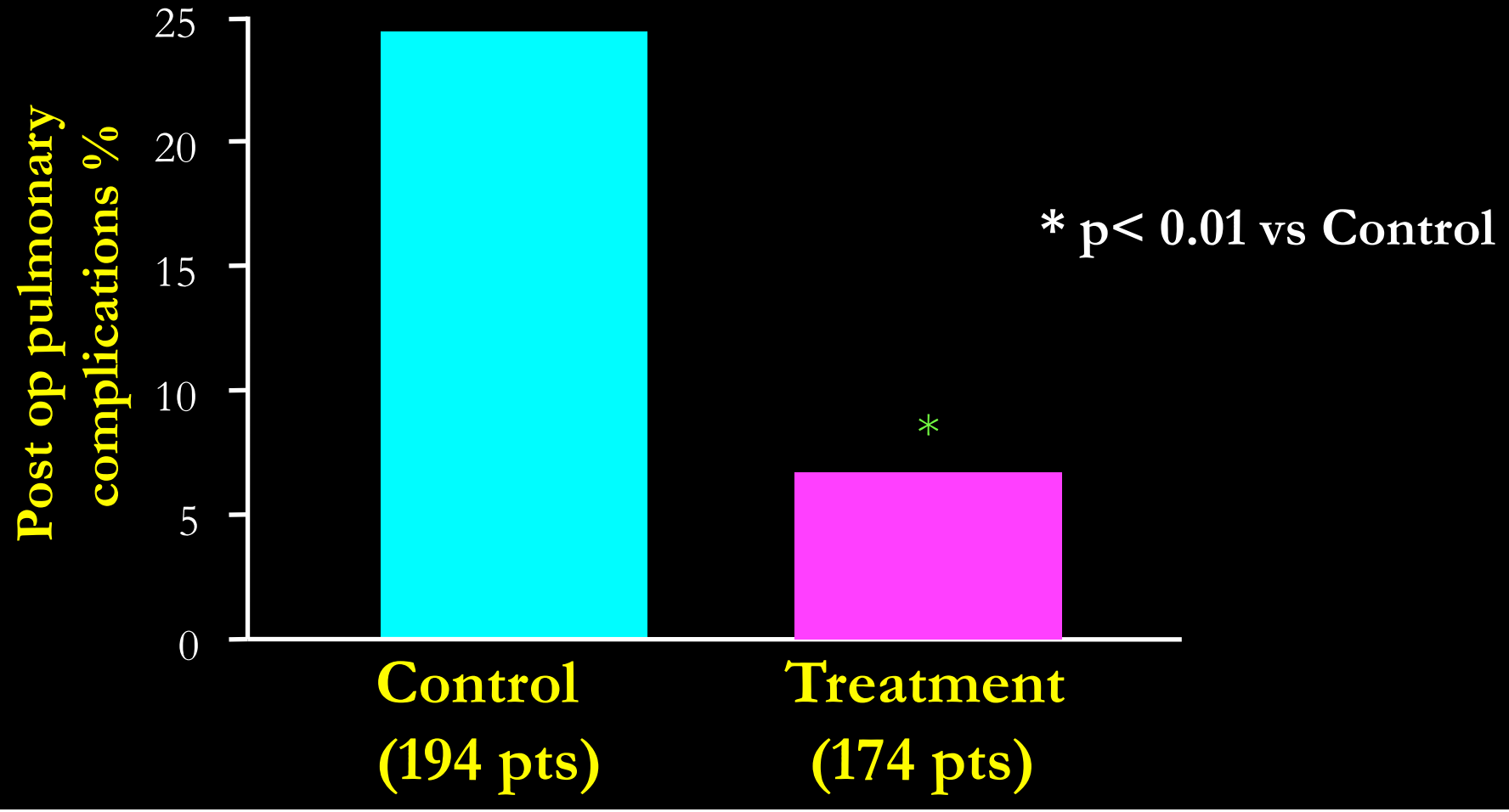
Early Mobilization

Efficacy of chest physiotherapy

(coughing, deep breathing, early mobilization)

after major abdominal surgery in obese

Fagevik-Olsen et al. Br J Surg 1997; 84:1535-1538



Room and bed dedicated for morbidly obese patients

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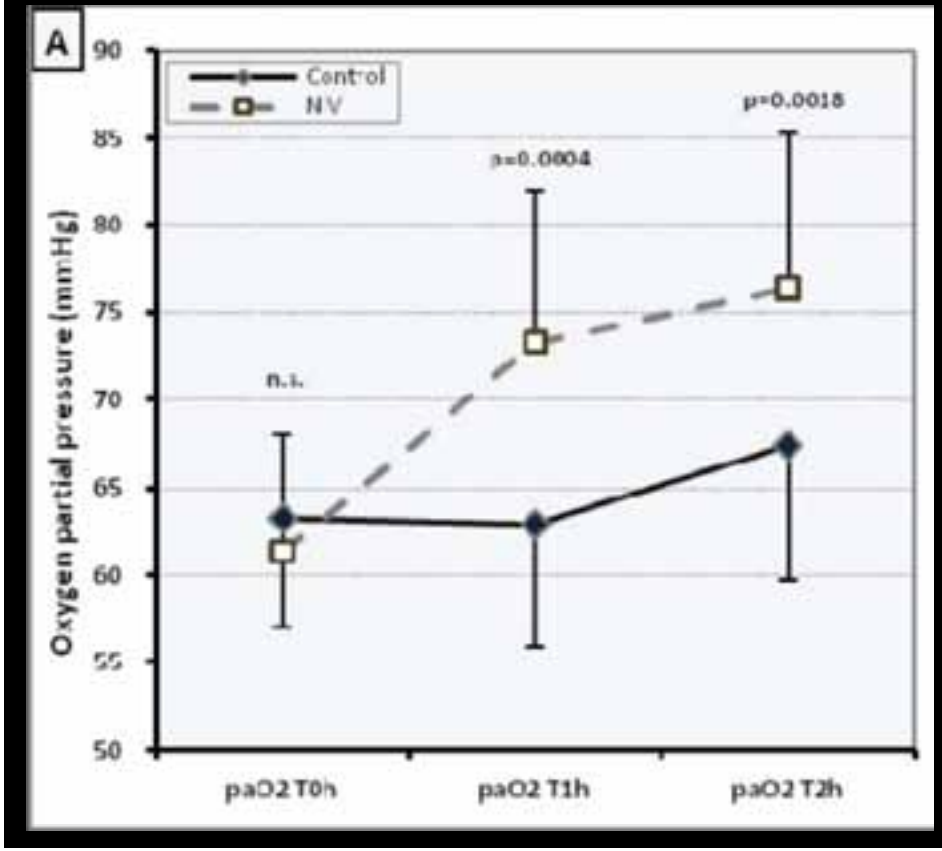
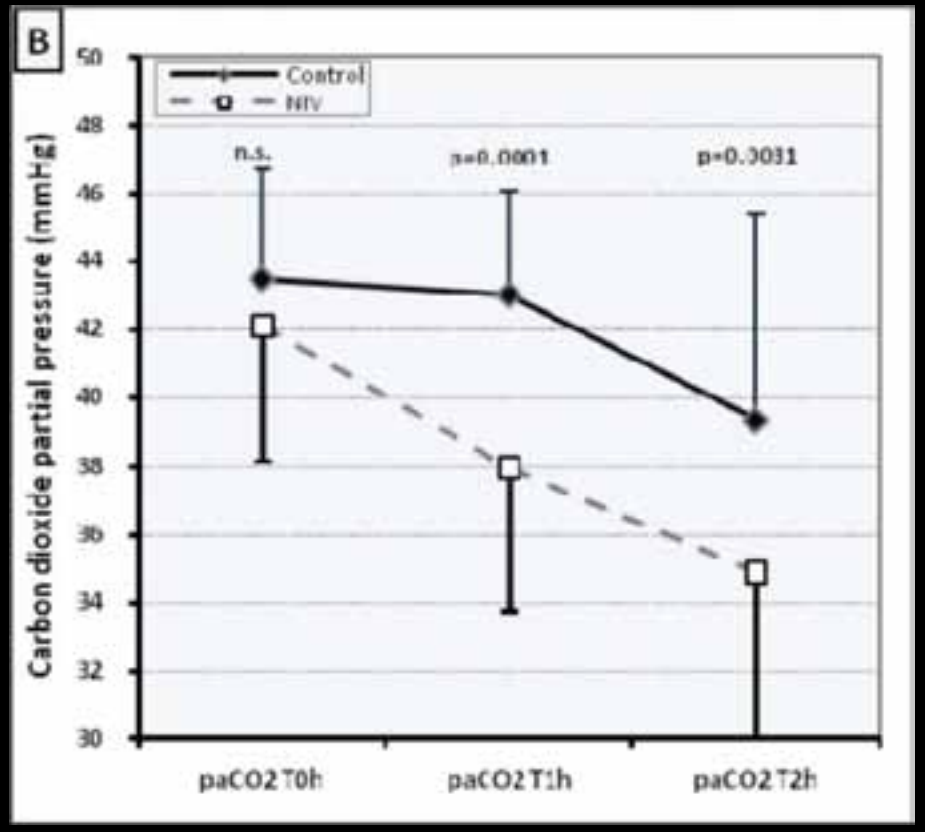
Short term non-invasive ventilation post-surgery improves arterial blood-gases in obese subjects compared to supplemental oxygen delivery - a randomized controlled trial

Zoremba et al. BMC Anesthesiology 2011, 11:10





Noninvasive ventilation for prevention of postextubation respiratory failure in obese

El Solh et al. Eur Respir J 2006;28: 588-595

	NIV n=62	Control n=62
Respiratory Failure (n, %)	6(10)	16(26)
ICU Stay (Days)	11.8	18.2
Hosp Stay (Days)	20.6	26.0
Hosp Mortality (%) in hypercapnic pts	16(4/25)	50(11/22)


Thou seest I have more flesh
than another man, and
therefore more frailty
King Henry the Fourth, Part I - Act III.
Scene III
Thanks !
National Audit Office “Tackling Obesity in England HC220 February 2001