CURSO DE VMNI

NIPPON 2026

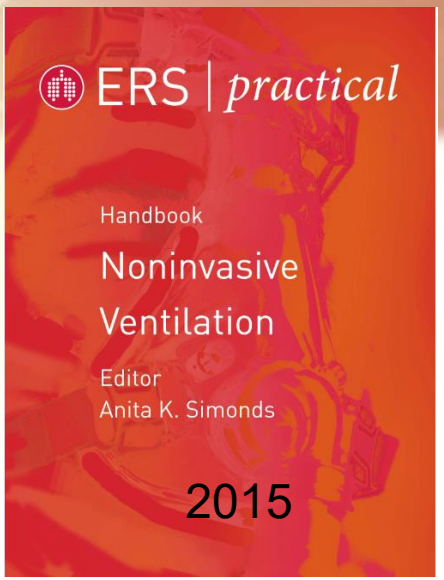
VMNI no Edema Agudo do Pulmão

João Carlos Winck
Professor Catedrático Convidado
FMUP

NIPPON GASES Healthcare

Agenda

Introduction
Evidence Pre-3CPO
3CPO
Evidence Post-3CPO
Conclusions



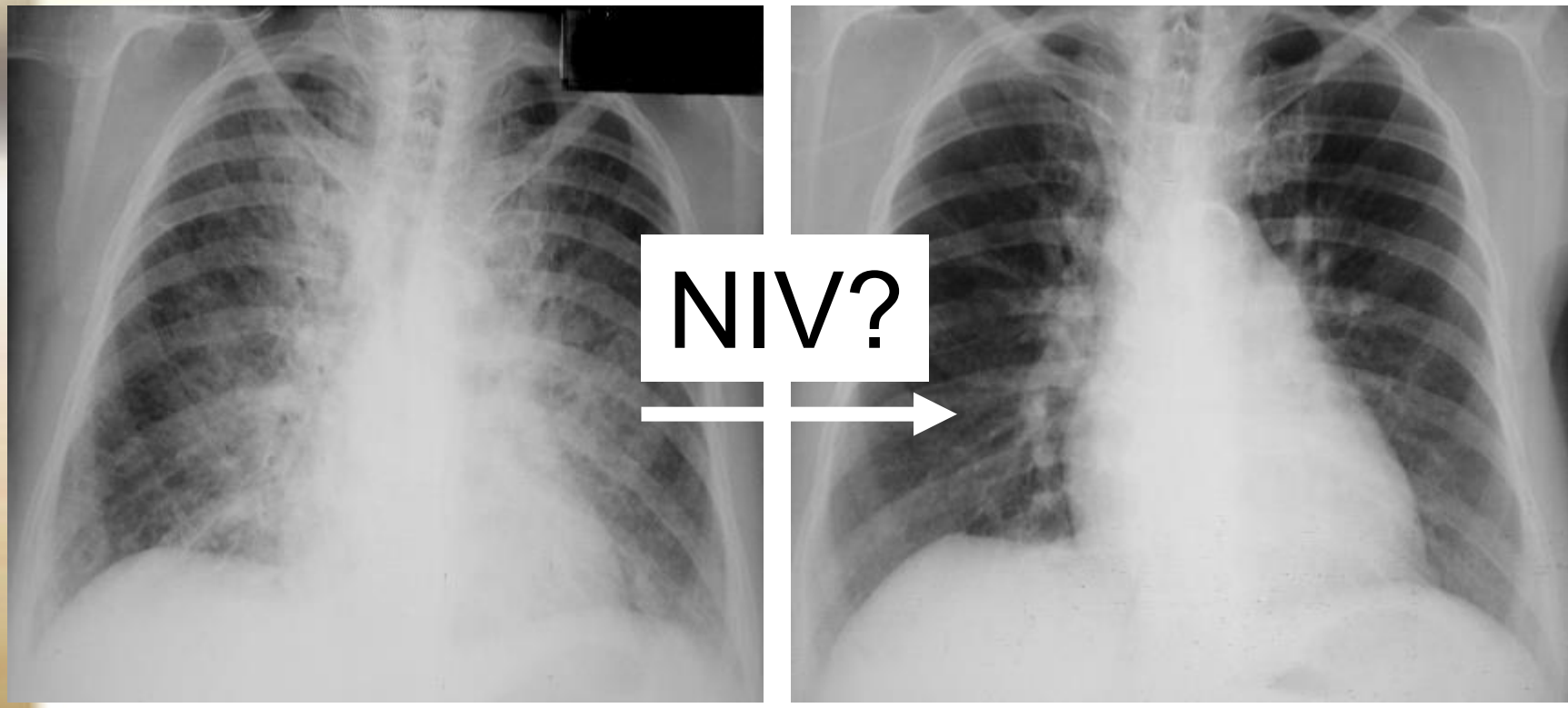
The basics: patient selection

The patient with acute hypoxaemic failure and cardiogenic pulmonary oedema

João C. Winck and Luís F. Azevedo

Acute Pulmonary Edema

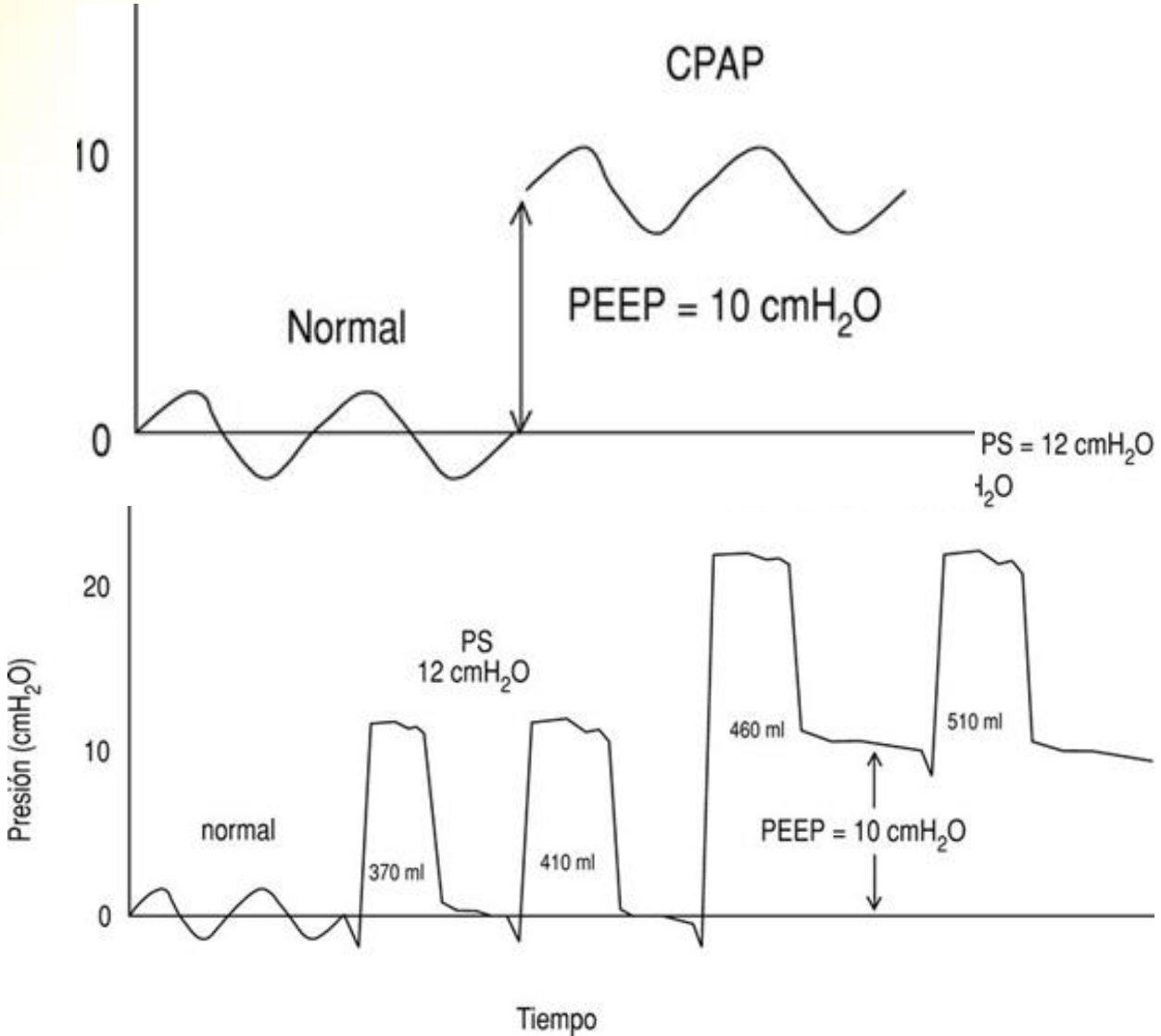
When Medical Therapy does not work….



4 a.m.

9 a.m.

CPAP versus Bi-level PAP



CPAP or BiPAP?

6 patients ACPE. Physiological indexes (breathing pattern, effort, ABG, hemodynamics). Face mask: CPAP 10, PSV5+PEEP5, CPAP 5 (random).

NIV was more effective at unloading respiratory muscles than CPAP. Both NIV and CPAP, reduced right and left ventricular preload. ABG were similar.

Chadda K, Crit Care Med 2002

BiPAP vs. CPAP in acute pulmonary edema

Mehta S et al.: Crit Care Med 1997;25:620-28

	Bilevel PAP (n=14)	CPAP (n=13)	
Patients with acute myocardial infarction	10 (71%)	4 (31%)	p = 0.06
max. CK (IU/l)			
in all pat.	400±81	135±80	
in MI pat.	547±354	225±43	
hypotension (SBP < 90 mmHg)	1 (7%)	1 (7%)	
intubations	1 (7%)	1 (7%)	
died	1 (7%)	2 (15%)	

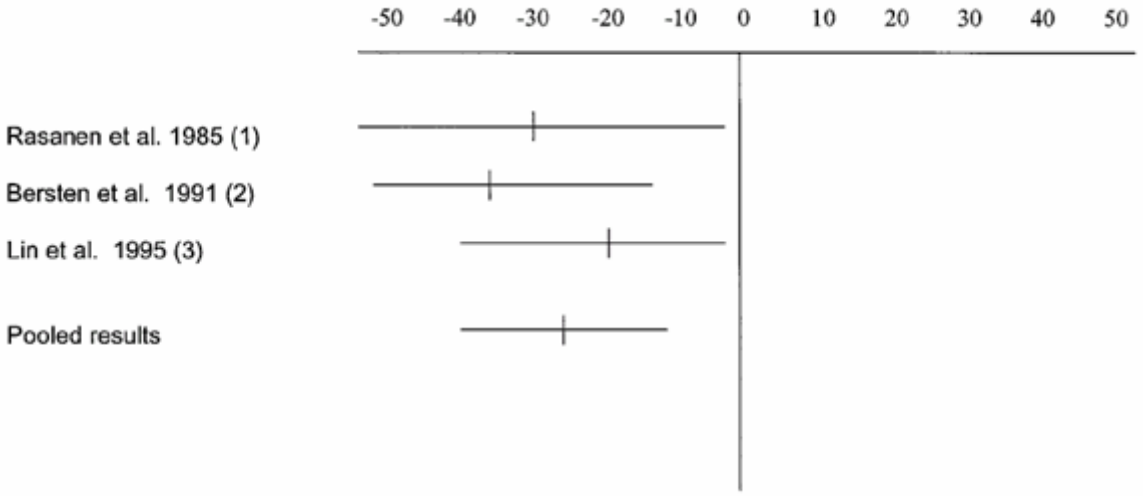
CPAP = 10 cmH2O; BiPAP = 15/5 cmH2O

The Effect of Positive Pressure Airway Support on Mortality and the Need for Intubation in Cardiogenic Pulmonary Edema*

A Systematic Review

David Pang, MB; Sean P. Keenan, MD; Deborah J. Cook, MD, FCCP; and William J. Sibbald, MD, FCCP

Endotracheal Intubation



CHEST 1998; 114:1185–1192

The Effect of Positive Pressure Airway Support on Mortality and the Need for Intubation in Cardiogenic Pulmonary Edema*

A Systematic Review

David Pang, MB; Sean P. Keenan, MD; Deborah J. Cook, MD, FCCP; and William J. Sibbald, MD, FCCP

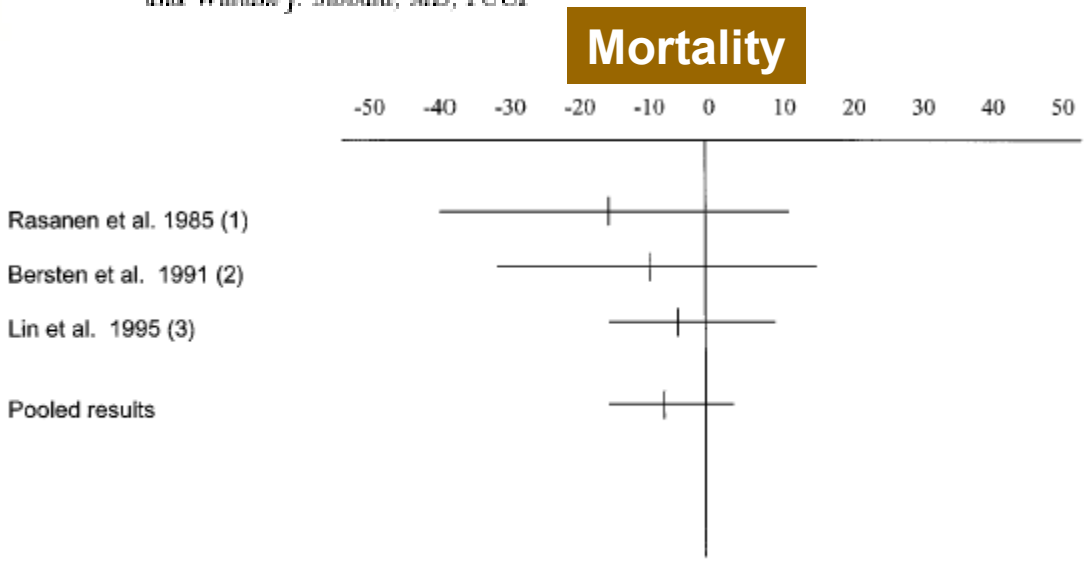


FIGURE 1. Effect of CPAP on mortality in individual trials and pooled results.

CHEST 1998; 114:1185–1192

Research

Open Access

Efficacy and safety of non-invasive ventilation in the treatment of acute cardiogenic pulmonary edema – a systematic review and meta-analysis

João C Winck[1], Luís F Azevedo[2,3], Altamiro Costa-Pereira[2,3], Massimo Antonelli[4] and Jeremy C Wyatt[5]

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[4]Unita Operativa di Rianimazione e Terapia Intensiva, Instituto di Anestesia e Rianimazione, Policlinico Universitario A Gemelli, Universita Cattolica del Sacro Cuore, Rome, Italy
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Received: 9 Mar 2006 Accepted: 24 Mar 2006 Published: 28 Apr 2006

Critical Care 2006, **10**:R69 (doi:10.1186/cc4905)
This article is online at: http://ccforum.com/content/10/2/R69
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Efficacy and safety of NIV in CPE: a metanalysis

Key-messages

- CPAP and NPPV both decrease ETI and CPAP reduces mortality
- No difference in risk of AMI between CPAP and NPPV
- No superiority of NPPV, so CPAP could be considered first line intervention in CPE

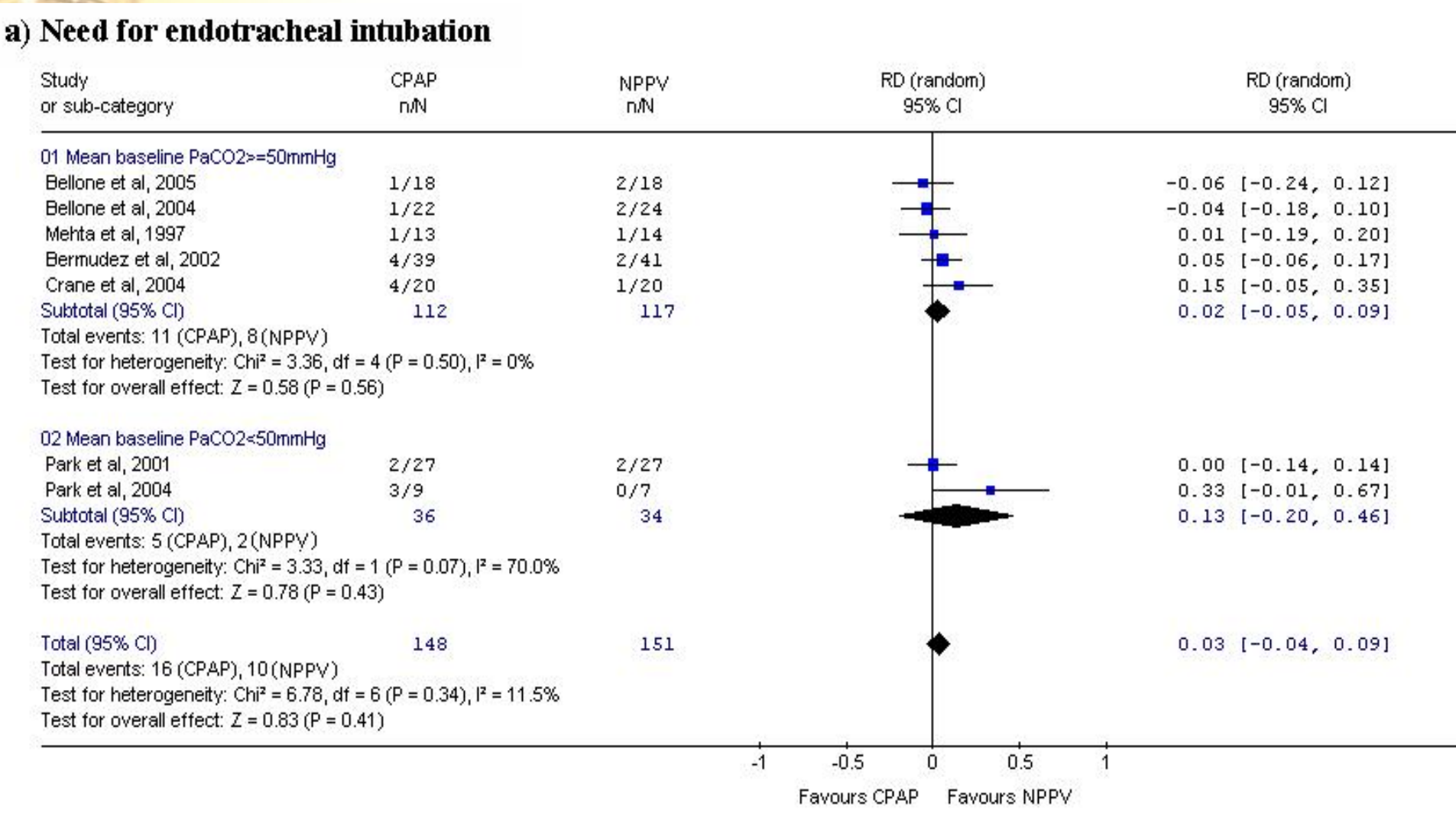
JCWinck et al , Critical Care 2006, 10:R69 (doi: 10.1186/cc4905)

WHAT ABOUT HYPERCAPNIC PATIENTS?

ARE THEY BETTER RESPONDERS TO NPPV?

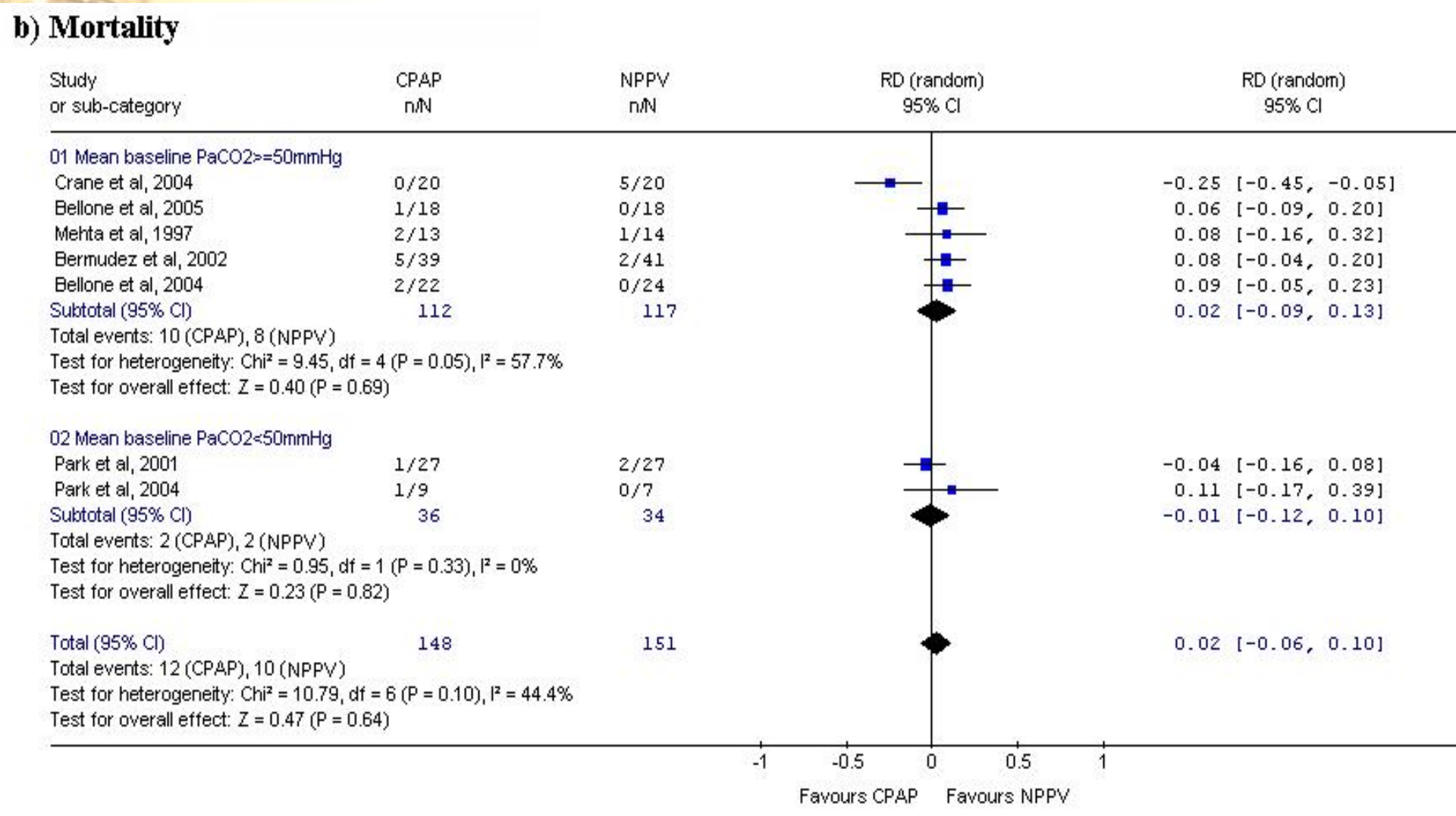
Subgroup Analysis (Hypercapnic patients)

JCWinck et al , Critical Care 2006, 10:R69 (doi: 10.1186/cc4905)



Subgroup Analysis (Hypercapnic patients)

JCWinck et al , Critical Care 2006, 10:R69 (doi: 10.1186/cc4905)



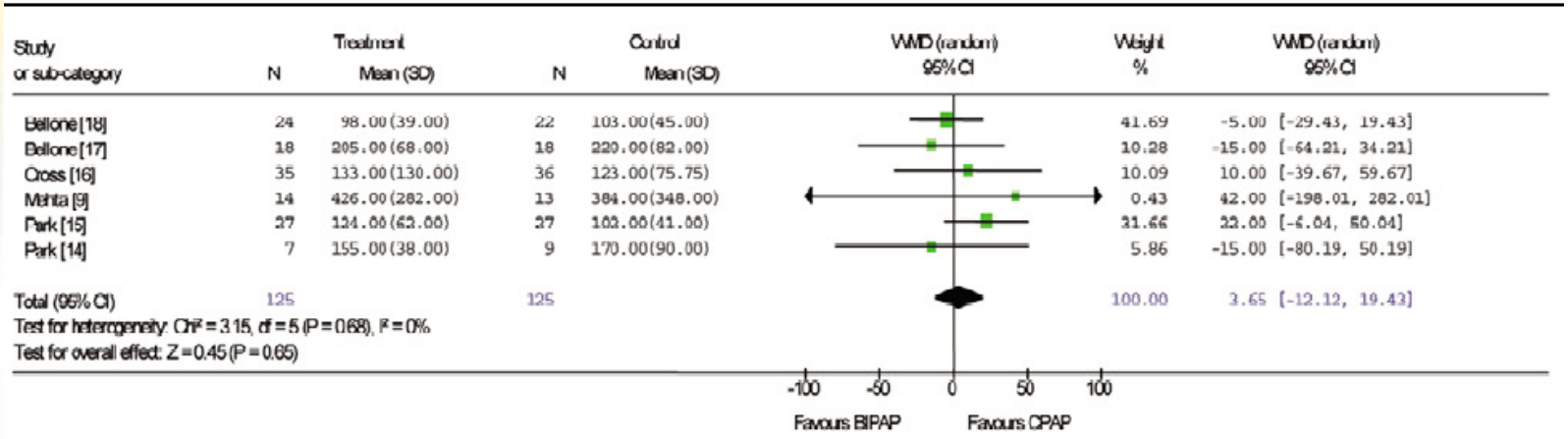
WHAT ABOUT EFFICACY?

DO PATIENTS RESPOND QUICKLY TO NPPV AND TO HIGHER SPAN PRESSURES?

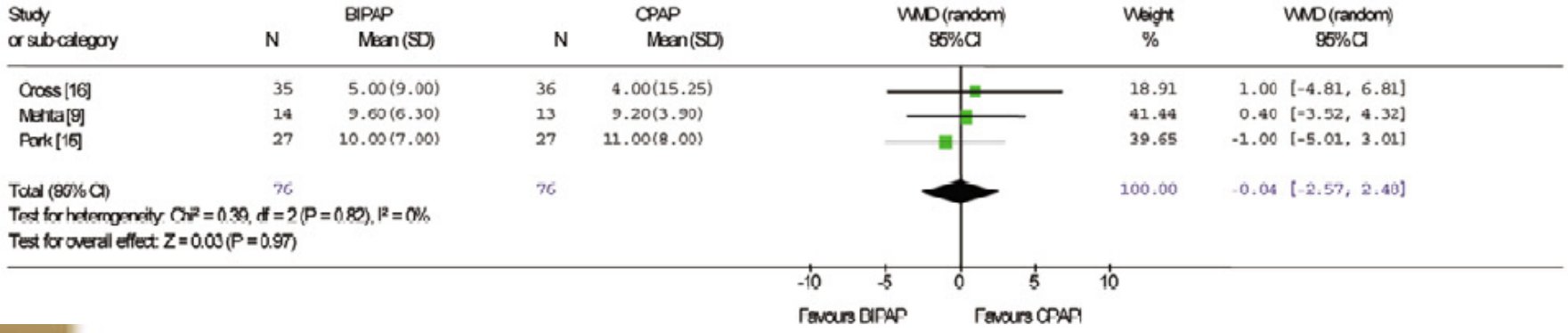
LOS and duration of support CPAP vs BiPAP

Ho KM, Crit Care 2006, 10:R49 (doi: 10.1186/cc4861)

Duration support

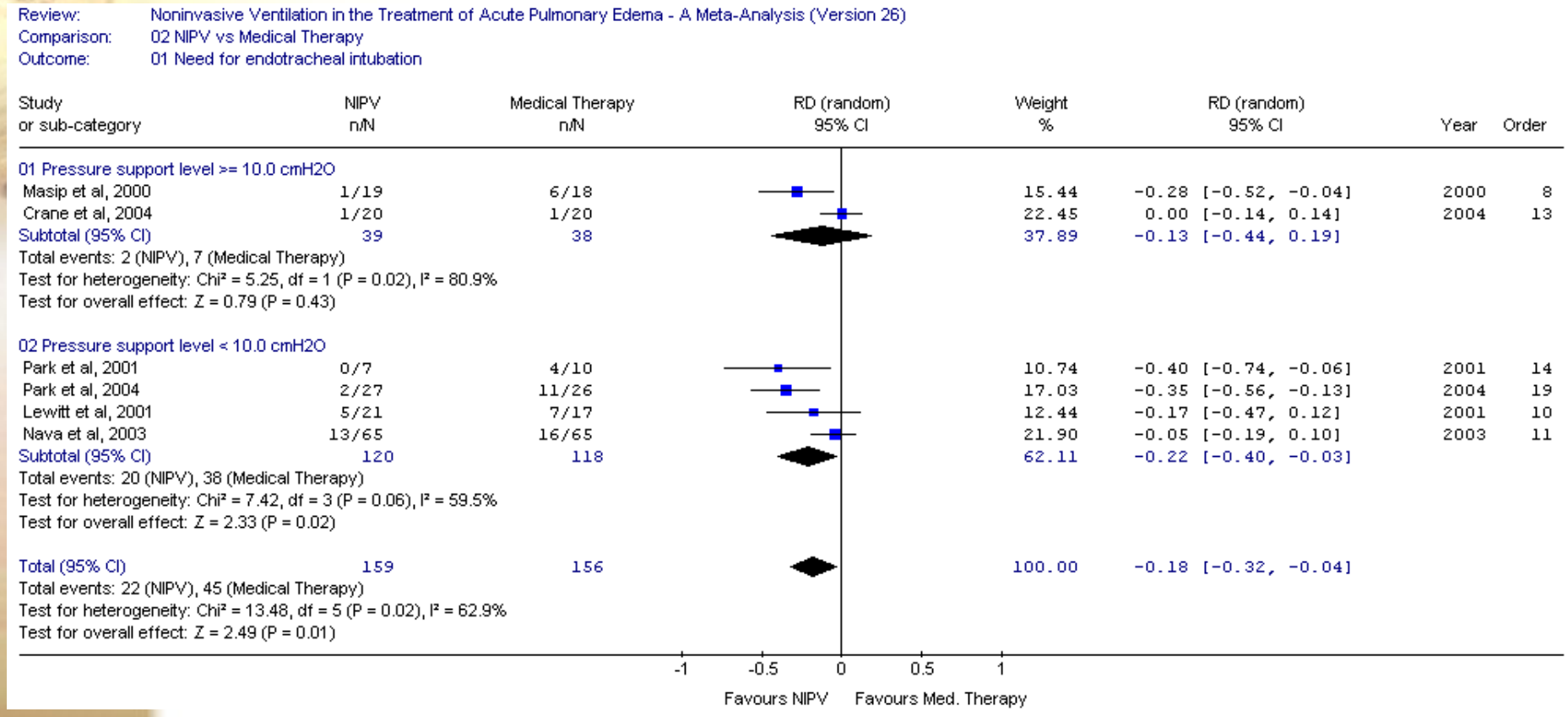


LOS



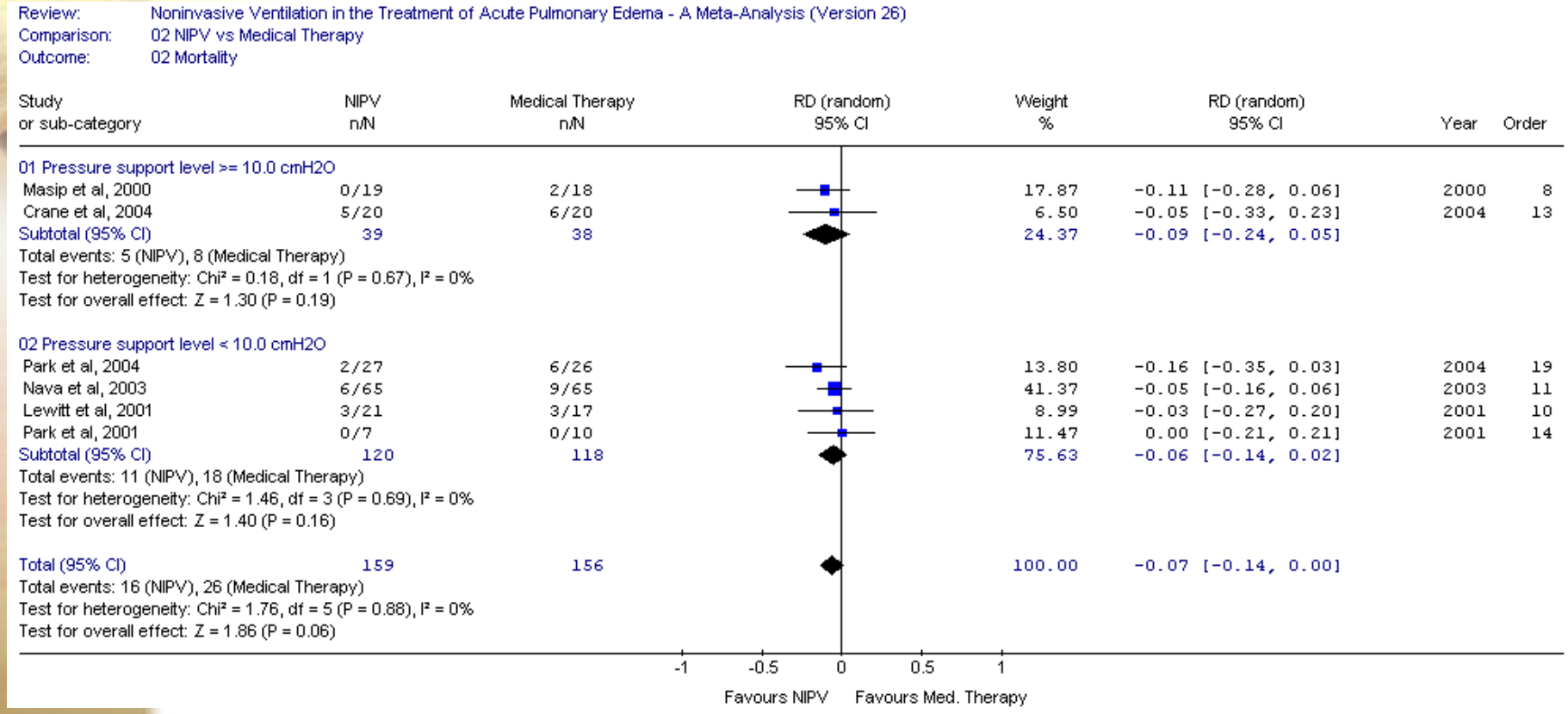
Subgroup Analysis (High vs low PS)

JCWinck et al , Critical Care 2006, 10:R69 (doi: 10.1186/cc4905)



Subgroup Analysis (High vs low PS)

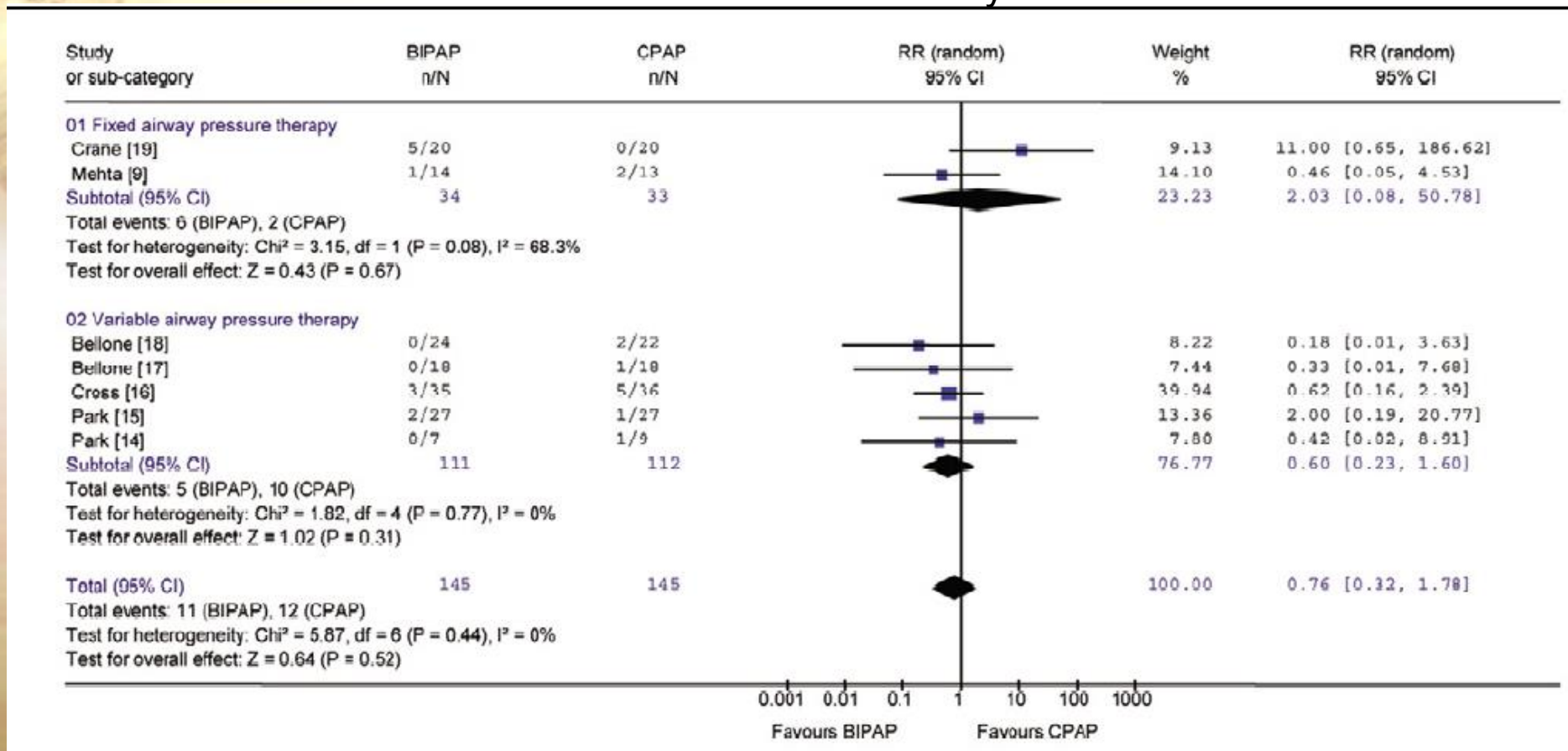
JCWinck et al , Critical Care 2006, 10:R69 (doi: 10.1186/cc4905)



IS IT BETTER FIXED OR VARIABLE PRESSURES?

Subgroup analysis (Fixed vs variable pressure)

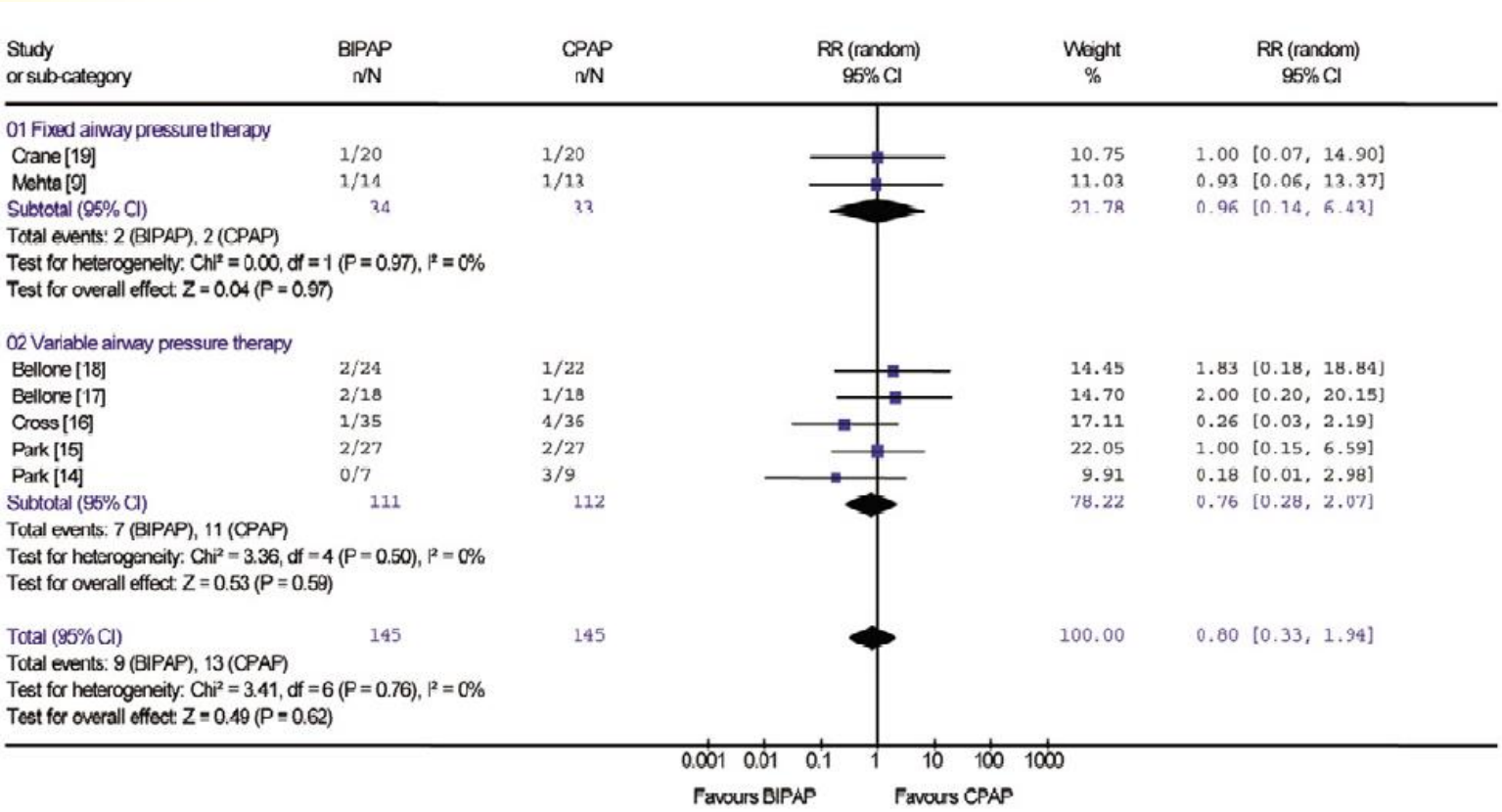
Ho KM, Crit Care 2006, 10:R49 (doi: 10.1186/cc4861)



Subgroup analysis (Fixed vs variable pressure)

Ho KM, Crit Care 2006, 10:R49 (doi: 10.1186/cc4861)

ETI



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Noninvasive Ventilation in Acute Cardiogenic Pulmonary Edema

Alasdair Gray, M.D., Steve Goodacre, Ph.D., David E. Newby, M.D., Moyra Masson, M.Sc., Fiona Sampson, M.Sc., and Jon Nicholl, M.Sc., for the 3CPO Trialists*

N ENGL J MED 359;2 WWW.NEJM.ORG JULY 10, 2008

Immediate Therapeutic Interventions

The 3CPO Study

xTime™ and a essed) decompressor o see this picture.

	Standard	CPAP	NIPPV	All
Nitrate Therapy	93%	88%	91%	90%
Diuretic Therapy	90%	89%	89%	89%
Opiate Therapy	3%	5%	4%	4%
Inspired Oxygen (L/min)	12±4	13±4	12±4	12±4
Ventilation Pressure (cmH_2O)	-	10±4	14±5/7±2	-

Gray A, N Engl J Med. 2008 Jul 10;359(2):142-51

No significant differences (P>0.05) except ventilation pressures

Mean±SD or %

The 3CPO Study

Trial treatment

	Standard	CPAP	NIPPV	P-value
Treatment allocated	365	342	351	
Started allocated treatment	365 (100%)	336 (98.2%)	341 (97.2%)	0.07
Completed allocated treatment	298 (83.2%)	284 (84.5%)	265 (77.7%)	0.016
Not tolerated	1 (0.3%)	18 (5.4%)	30 (8.8%)	<0.001
Worsening ABGs	26 (7.1%)	10 (3.0%)	15 (4.4%)	0.027
Respiratory distress	31 (8.5%)	5 (1.5%)	12 (3.5%)	<0.001
Other reason	17 (4.6%)	24 (7.1%)	25 (7.3%)	0.152

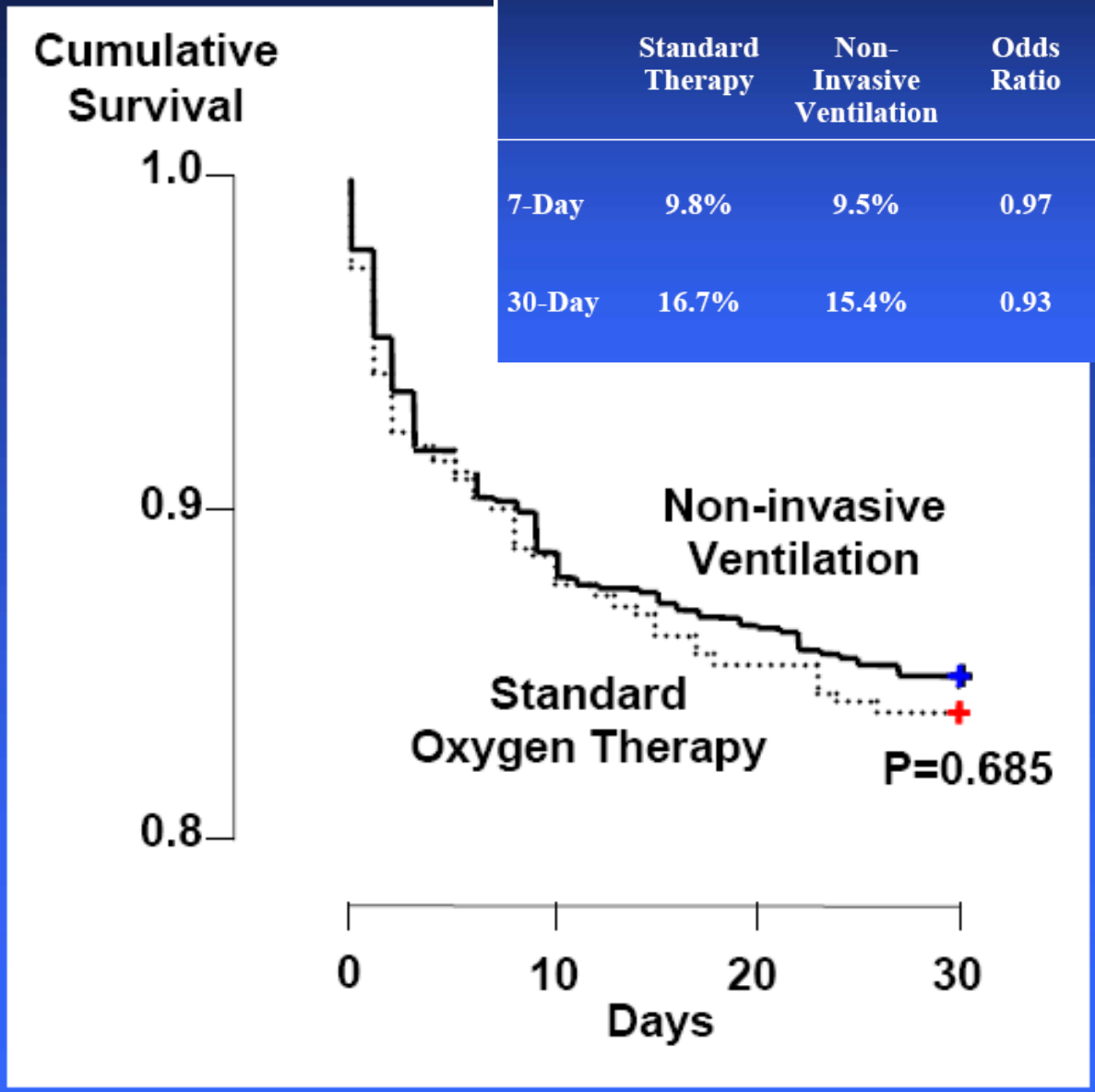
N (%)

The 3CPO Study

Primary Outcome

xTime™ and a essed) decompressor o see this picture.

	Standard Therapy	Non-Invasive Ventilation	Odds Ratio	95% Confidence Intervals	P Value
7-Day	9.8%	9.5%	0.97	0.63 to 1.48	0.869
30-Day	16.7%	15.4%	0.93	0.65 to 1.32	0.685



The 3CPO Study

CONCLUSIONS

In patients with acute cardiogenic pulmonary oedema, non-invasive ventilation:

- **Produces more rapid resolution of metabolic abnormalities and respiratory distress**
- **Is safe and beneficial irrespective of the mode of delivery**
- **Has no major effect on 7-day or 30-day mortality**

Gray A, N Engl J Med. 2008 Jul 10;359(2):142-51

REVIEW | Annals of Internal Medicine

Meta-analysis: Noninvasive Ventilation in Acute Cardiogenic Pulmonary Edema

Cui-Lian Weng, MD; Yun-Tao Zhao, PhD; Qing-Hua Liu, MM; Chang-Jun Fu, PhD; Feng Sun, PhD; Yan-Liang Ma, MD; Yan-Wen Chen, MD; and Quan-Ying He, MD

Background: Noninvasive ventilation (NIV) is commonly used to treat patients with acute cardiogenic pulmonary edema (ACPE), but the findings of a recent large clinical trial suggest that NIV may be less effective for ACPE than previously thought.

Purpose: To

Data Sources:

Study Selection:

Data Extraction: Two independent reviewers extracted data. Outcomes examined were mortality, intubation rate, and incidence of new myocardial infarction (MI).

Data Synthesis: Compared with standard therapy, continuous positive airway pressure reduced mortality (relative risk [RR], 0.64 [95% CI, 0.44 to 0.92]) and need for intubation (RR, 0.44 [CI, 0.32 to 0.60]) but not incidence of new MI (RR, 1.07 [CI, 0.84 to 1.37]). The effect was more prominent in trials in which myocardial ischemia or infarction caused ACPE in higher proportions of patients (RR, 0.92 [CI, 0.76 to 1.10] when 10% of patients had ischemia or MI vs. 0.43 [CI, 0.17 to 1.07] when 50% had ischemia or MI).

Although a recent large trial contradicts results from previous studies, **the evidence in aggregate still supports the use of NIV for patients with ACPE**. Continuous positive airway pressure reduces mortality more in patients with ACPE secondary to acute myocardial ischemia or infarction.

Primary Funding Source: None.

Ann Intern Med. 2010;152:590-600.
For author affiliations, see end of text.
www.annals.org

“New” Evidence

Intensive Care Med (2011) 37:249–256
DOI 10.1007/s00134-010-2082-3

ORIGINAL

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Hamdi Boubaker
Latifa Boudhib
Mohamed Habib Grissa
Mohamed Naceur Trimech
Hamadi Boussarsar

Non-invasive pressure support ventilation and CPAP in cardiogenic pulmonary edema: a multicenter randomized study in the emergency department

The Journal of Emergency Medicine, Vol. 46, No. 1, pp. 130–140, 2014
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0736-4679/$ - see front matter

ELSEVIER

http://dx.doi.org/10.1016/j.jemermed.2013.08.015

Brief Reports

RANDOMIZED TRIAL OF BILEVEL VERSUS CONTINUOUS POSITIVE AIRWAY PRESSURE FOR ACUTE PULMONARY EDEMA

Timothy Liesching, MD,* David L. Nelson, RRT,† Karen L. Cormier, RRT,† Andrew Sucov, MD,‡ Kathy Short, RN, RRT,§ Rod Warburton, BA,|| and Nicholas S. Hill, MD||

*Division of Pulmonary, Critical Care and Sleep Medicine, Lahey Clinic, Burlington, Massachusetts, †Department of Respiratory Care, ‡Division of Emergency Medicine, Rhode Island Hospital, Providence, Rhode Island, §Department of Respiratory Care, University of North Carolina, Chapel Hill, North Carolina, and ||Division of Pulmonary, Critical Care and Sleep Medicine, Tufts Medical Center, Boston, Massachusetts

Reprint Address: Nicholas S. Hill, MD, Division of Pulmonary, Critical Care and Sleep Medicine, Tufts Medical Center, 800 Washington St #257, Boston, MA 02111

Circulation Journal
Official Journal of the Japanese Circulation Society
http://www.j-circ.or.jp

ORIGINAL ARTICLE
Critical Care

Noninvasive Ventilation in Pulmonary Edema Complicating Acute Myocardial Infarction

Takeshi Yamamoto, MD; Shinhiro Takeda, MD; Naoki Sato, MD; Koichi Akutsu, MD; Hiroshi Mase, MD; Keiko Nakazato, MD; Kyoichi Mizuno, MD; Keiji Tanaka, MD

Journal of Cardiac Failure Vol. 17 No. 10 2011

Noninvasive Ventilation in Acute Cardiogenic Pulmonary Edema: A Meta-Analysis of Randomized Controlled Trials

JAVIER MARIANI, MD,[1] ALEJANDRO MACCHIA, MD,[1] CÉSAR BELZITI, MD,[2] MAXIMILIANO DEABREU, MD,[1] JUAN GAGLIARDI, MD,[1] HERNÁN DOVAL, MD,[1] GIANNI TOGNONI, MD,[3] AND CARLOS TAJER, MD[1]

Buenos Aires, Argentina; and Santa Maria Imbaro, Italy

Table 2. Effects of Noninvasive Ventilation on Hospital Stay and Physiologic Variables

Endpoint	CPAP vs ST	NIPPV vs ST	NIPPV vs CPAP
ICU stay	−0.55 (−1.69 to +0.59)	*	−0.36 (−0.86 to +0.14)
Hospital stay	+0.01 (−1.38 to +1.39)	+0.13 (−0.71 to +0.97)	−0.33 (−1.41 to +0.76)
PaO_2	+13.07 (−12.18 to +38.33)	+10.02 (−10.74 to +30.79)	+7.22 (+4.07 to +10.37)
$PaCO_2$	−4.96 (−8.11 to −1.81)	−2.36 (−5.54 to +0.83)	−0.94 (−3.16 to +1.28)
Heart rate	−7.75 (−13.73 to −1.77)	−6.00 (−9.43 to −2.58)	−2.26 (−9.04 to +4.51)
Respiratory rate	−2.56 (−4.03 to −1.10)	−3.03 (−4.45 to −1.61)	−1.58 (−3.67 to +0.52)
Systolic blood pressure	−4.21 (−9.57 to +1.16)	−3.13 (−7.00 to +0.75)	−3.78 (−15.62 to +8.06)
Diastolic blood pressure	+1.58 (−3.95 to +7.11)	+0.88 (−1.62 to +3.38)	+2.03 (−3.43 to +7.49)

Abbreviations as in Table 1. Values are weighted-means difference (95% confidence interval).
*Insufficient data

AUTHORS' CONCLUSIONS

Implications for practice

Data from RCTs have demonstrated that NPPV (CPAP and bilevel NPPV) is effective in reducing hospital mortality, intubation rate

Our results support that one death can be avoided for every 14 ACPE patients treated with NPPV; Similarly, one death can be prevented for every nine ACPE patients treated with CPAP.

show a lower risk of progressive respiratory distress and neurological failure (coma) when compare NPPV to SMC and cardiorespiratory arrest when compare only CPAP to SMC as well as a lower risk of arrhythmia when comparing CPAP to bilevel NPPV. CPAP can be considered the first option in selection of NPPV due to more robust evidence for its effectiveness and safety and lower costs compared with bilevel NPPV.

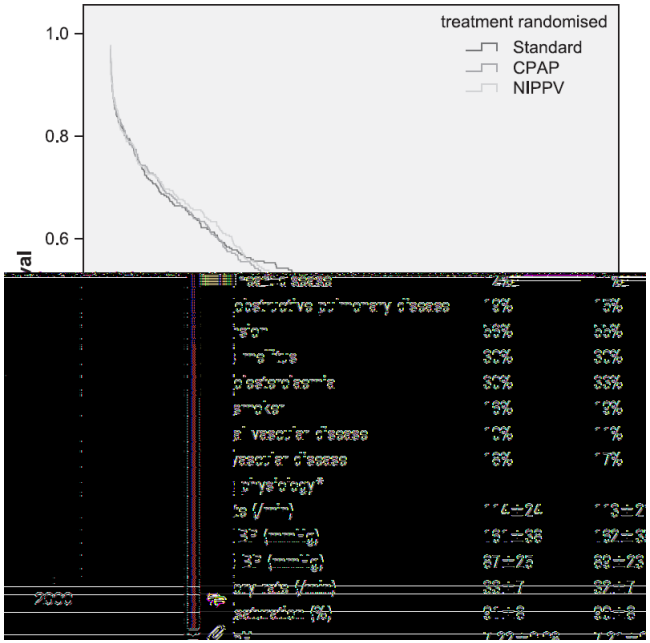
Health utility and survival after hospital admission with acute cardiogenic pulmonary oedema

Steve Goodacre, Alasdair Gray, David Newby, et al.

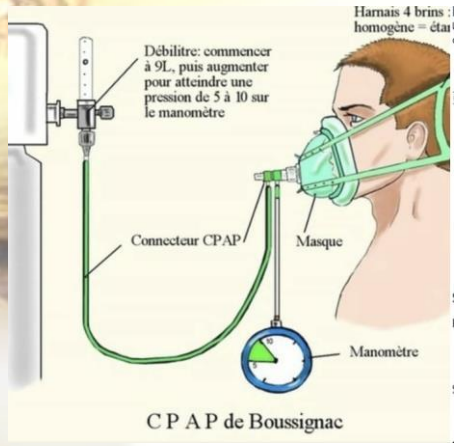
Emerg Med J 2011 28: 477-482 originally published online October 4, 2010
doi: 10.1136/emj.2009.089631

Table 4 Mean EQ-5D scores and area under the curve at 1, 3 and 6 months

	Standard therapy	CPAP	NIPPV	p
EQ-5D 1 month	0.565 (0.512 to 0.618)	0.575 (0.526 to 0.624)	0.594 (0.545 to 0.643)	0.741
EQ-5D 3 months	0.557 (0.502 to 0.611)	0.592 (0.536 to 0.648)	0.581 (0.531 to 0.631)	0.488
EQ-5D 6 months	0.592 (0.534 to 0.649)	0.621 (0.563 to 0.678)	0.538 (0.476 to 0.601)	0.152
Area under the curve	0.283 (0.254 to 0.311)	0.287 (0.260 to 0.313)	0.281 (0.252 to 0.311)	0.962



Simplified CPAP systems for APE



C P A P de Boussignac

'Boussignac' continuous positive airway pressure system: practical use in a prehospital medical care unit

François Templier, François Dolveck, Michel Baer, Marcel Chauvin and Dominique Fletcher

Continuous positive airway pressure in acute cardiogenic pulmonary edema is rarely used by prehospital emergency care units, because of the particular technical drawbacks of existing equipment. The aim of this one year prospective descriptive open study without a control group was to assess the technical feasibility of using the Boussignac continuous positive airway pressure system (Vygon) in a

These should allow this technique to be used more widely by prehospital teams. *European Journal of Emergency Medicine* 10:87–93 © 2003 Lippincott Williams & Wilkins.

European Journal of Emergency Medicine 2003, 10:87–93

Keywords: Acute cardiogenic pulmonary edema, continuous positive airway pressure, prehospital emergency care

Table 4 Initial clinical and other values: comparison of 40 non-intubated patients with 10 patients intubated during the prehospital phase or within an hour of admission to hospital.

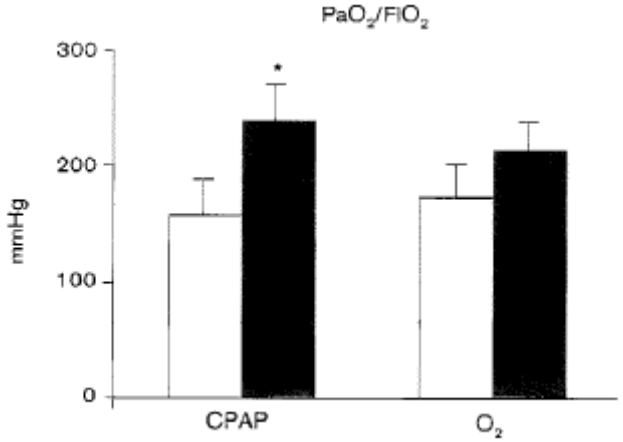
	Patients subsequently not intubated ($N=40$)	Patients subsequently intubated ($N=10$)	Student's t-test: P
Heart rate (bpm)	105 ± 22.6 (66–160)	109 ± 23.2 (80–150)	0.62 (NS)
Systolic blood pressure (mmHg)	155 ± 35.9 (90–240)	154 ± 4.3 (105–240)	0.93 (NS)
Diastolic blood pressure (mmHg)	83 ± 20.3 (45–120)	86 ± 15.8 (60–100)	0.67 (NS)
Respiratory rate (cycles/min)	36.4 ± 6.8 (24–50)	37.1 ± 9.9 (26–60)	0.8 (NS)
Transcutaneous oxygen saturation O_2 (%)	89.1 ± 6.1 (75–100)	85.8 ± 7.6 (70–96)	0.15 (NS)
Oxygen flow rate (l/mn)	13.8 ± 3.1 (0–15)	12 ± 5.3 (0–15)	0.16 (NS)

Simplified CPAP systems for APE

Boussignac continuous positive airway pressure device in the emergency care of acute cardiogenic pulmonary oedema: a randomized pilot study

Fabienne Moritz[a], Jacques Benichou[c], Marc Vanheste[a], Jean-Christophe Richard[b], Sebastien Line[a], Marie-France Hellot[c], Guy Bonmarchand[b] and Jean-Michel Muller[a]

This study aimed to assess the short-term respiratory effects of a new portable device that delivers a continuous positive airway pressure via a face mask (Boussignac-CPAP) in patients with severe acute cardiogenic pulmonary oedema, and the feasibility of using this technique in an emergency department. We prospectively studied 30 consecutive patients with acute cardiogenic pulmonary oedema. They were randomly assigned either to the Boussignac-CPAP valve, which delivered oxygen, c
standard oxygen delivery for a duration of 30 min. T
no side-effects were reported. Continuous positive pressure delivered using the Boussignac-CPAP device is feasible in an emergency care setting. It can quickly improve respiratory distress in acute cardiogenic pulmonary oedema patients. A larger trial should be initiated in such an emergency care setting to demonstrate the effectiveness of the Boussignac-CPAP device. *European Journal of Emergency Medicine* 10:204–208 © 2003



Simplified CPAP systems for APE

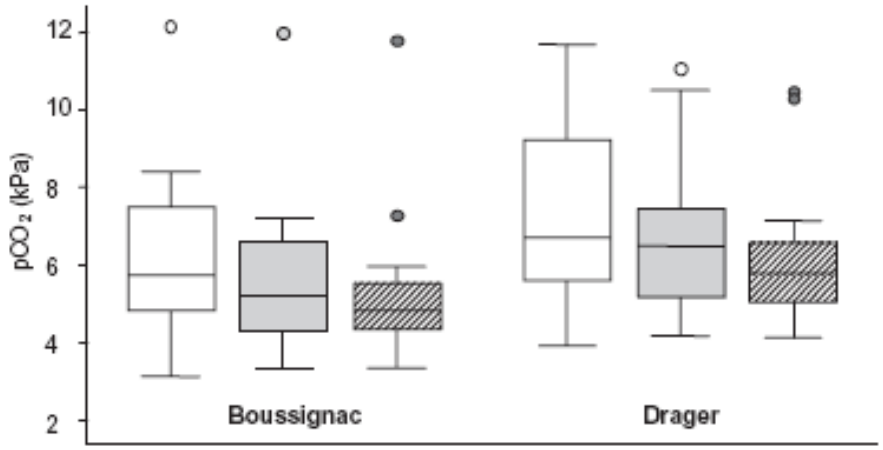
Emergency Medicine Australasia (2005) 17, 224–230

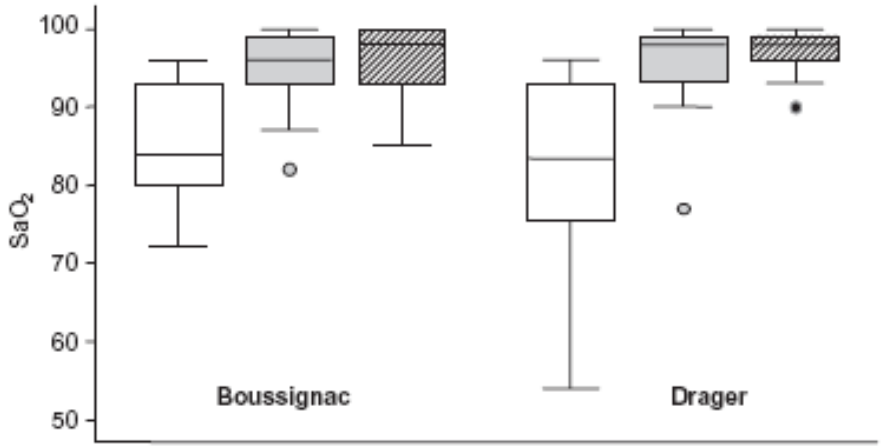
ORIGINAL RESEARCH

EMA

Simple lightweight disposable continuous positive airways pressure mask to effectively treat acute pulmonary oedema: Randomized controlled trial

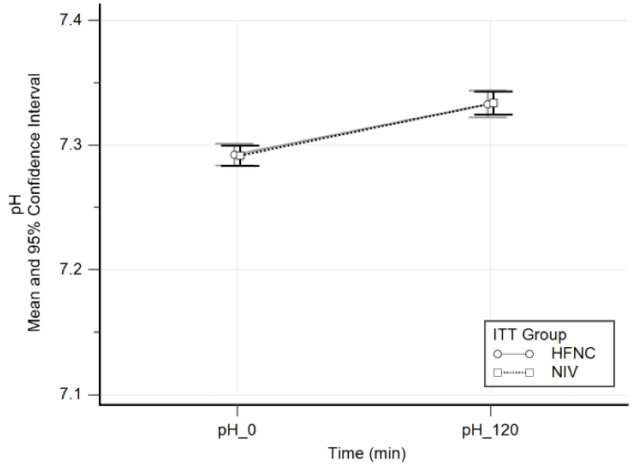
Peter Leman, Shaun Greene, Kim Whelan and Tony Legassick
Emergency Department, St Thomas' Hospital, London, UK

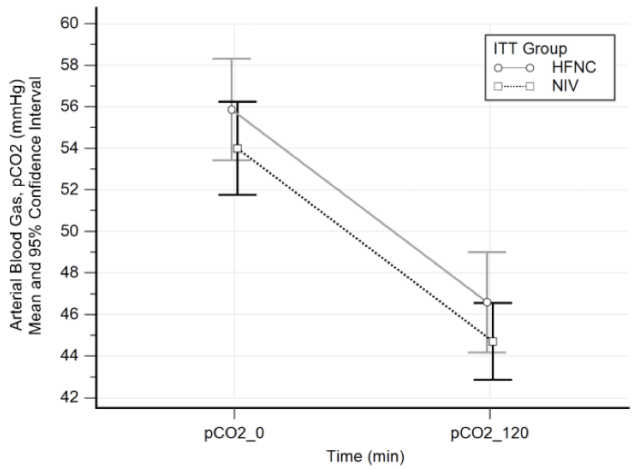




Is high-flow nasal oxygen as effective as non-invasive ventilation in acute cardiogenic pulmonary Edema?

Erhan Altunbas, MD [a], Nurseli Bayram, MD [b,*], Emir Unal, MD [b], Cigdem Ozpolat, MD [a], Sinan Karacabey, MD, PhD [a], Haldun Akoglu, MD [a], Arzu Denizbasi, MD [a]





Short-term (2h)
HFNC 90 vs CPAP 88
Mean baseline pH 7.30 PaCO2 54 SpO2 89%

No difference was found between HFNC and CPAP in reducing the symptoms and signs of respiratory failure with oxygen-ventilation support in patients with acute cardiogenic pulmonary edema. Considering that HFNC provides better patient tolerability and comfort, it may be considered a **viable alternative**

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When and how to start NIV in ACPO

- Respiratory rate >25 breaths·min^{-1}; P_{aO_2}/F_{IO_2} <200 mmHg (<26.6 kPa); S_{pO_2} <90%
- Use an oronasal mask
- Start with CPAP at 10 cmH_2O
- If patients have not started to improve within 10–20 min then EPAP or IPAP/EPAP may need to be increased
- Expect maximal benefit after 1 h
- A decrease in P_{aCO_2} is expected after 1–2 h
- An increase in pH is expected 1–2 h after NIV initiation
- NIV is usually used for between 2 h and 24 h
- In cases of intolerance to CPAP, change to bilevel PAP (start with IPAP 15 cmH_2O EPAP 5 cmH_2O)
- Weaning from NIV if respiratory rate <25 breaths·min^{-1} and S_{pO_2} >95%:
  Step wise reduction (2 cmH_2O) in IPAP/EPAP
  Step wise reduction (10%) in F_{IO_2}
- Systolic blood pressure, heart rhythm and rate, S_{pO_2} and urine output should be monitored on a regular and frequent basis until the patient has stabilised. Serial blood gases should be also performed (ideally *via* an arterial line).
- Consider NIV failure if, after adequately titrated therapy: Glasgow Coma Scale score >13, respiratory rate >40 breaths·min^{-1}; P_{aO_2}<60 mmHg (7.98 kPa), P_{aCO_2} increase of 5 mmHg (0.67 kPa).

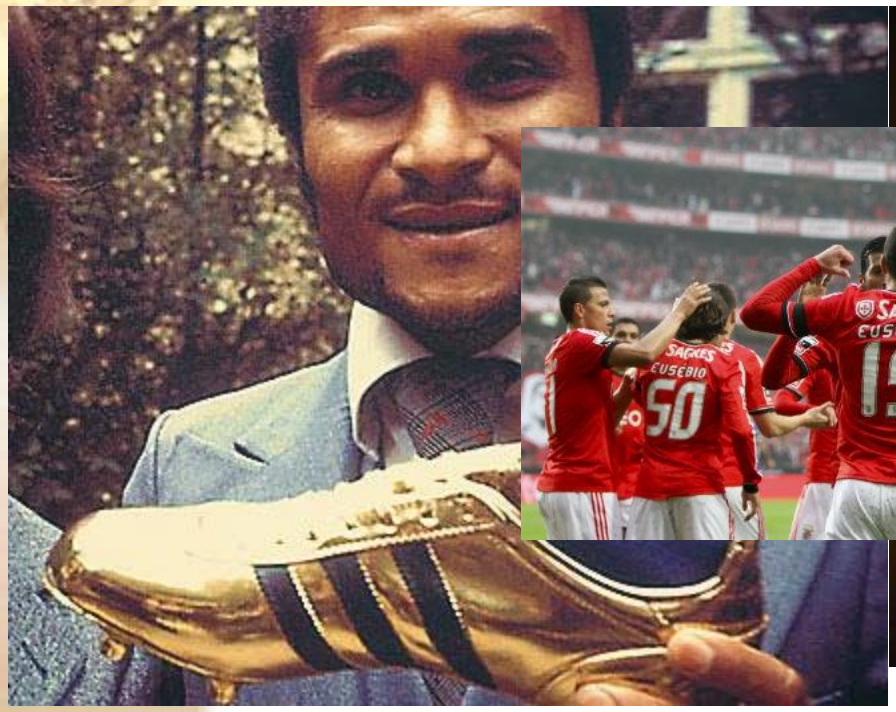
Conclusions I

- CPAP and NPPV both decrease ETI and only CPAP reduces mortality
- No superiority of NPPV, so CPAP could be considered first line intervention in CPE
- Although some caution is still advised, there is no evidence of increased risk of AMI after both techniques

Conclusions II

- NIV should be available in Coronary Units, Emergency Room
- Simple ventilators with display and O2 blending (preferable)
- CPAP valves (Boussignac)-easily available

Take home message



CPAP **OR** **BiPAP?**

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