ΓΕΝΙΚΟ ΝΟΣΟΚΟΜΕΙΟ ΑΘΗΝΩΝ
Ο ΕΥΑΓΓΕΛΙΣΜΟΣ

Εθνικό και Καποδιστριακό
ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

Μη επεμβατικός μηχανικός αερισμός (ΜΕΜΑ) στην οξεία αναπνευστική ανεπάρκεια

Σωτηρίου Αδαμαντία

Πνευμονολόγος-Εντατικολόγος

Επιμελήτρια ΚΕΕΛΠΝΟ

Α’ Πανεπιστημιακή Κλινική Εντατικής Θεραπείας ΕΚΠΑ

1ο Εκπαιδευτικό συμπόσιο Α’ Κλινικής Εντατικής Θεραπείας ΕΚΠΑ
Επείγοντα Στην Πνευμονολογία
26-27 Μαΐου 2017

1ο Εκπαιδευτικό Συμπόσιο
«**Επείγοντα στην Πνευμονολογία**»
Α’ Κλινική Εντατικής Θεραπείας ΕΚΠΑ, Γ.Ν.Α. ‘’Ο Ευαγγελισμός” 26-27 Μαΐου2017

Δεν υπάρχει σύγκρουση συμφερόντων με τις παρακάτω χορηγούς εταιρείες:

ASPEN

ASTRAZENECA

BAYER

CHIESI

ELPEN

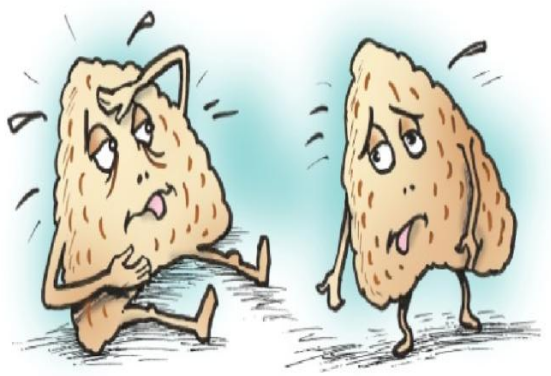
GLAXOSMITHKLINE

MENARINI HELLAS

NOVARTIS

PFIZER

Αναπνευστική Ανεπάρκεια



- **Τύπου Ι** (υποξαιμική) : PaO_2 <60 mmHg ($PaCO_2$ N or ⬇)

Διαταραχές αερισμού-αιμάτωσης (V/Q mismatch)

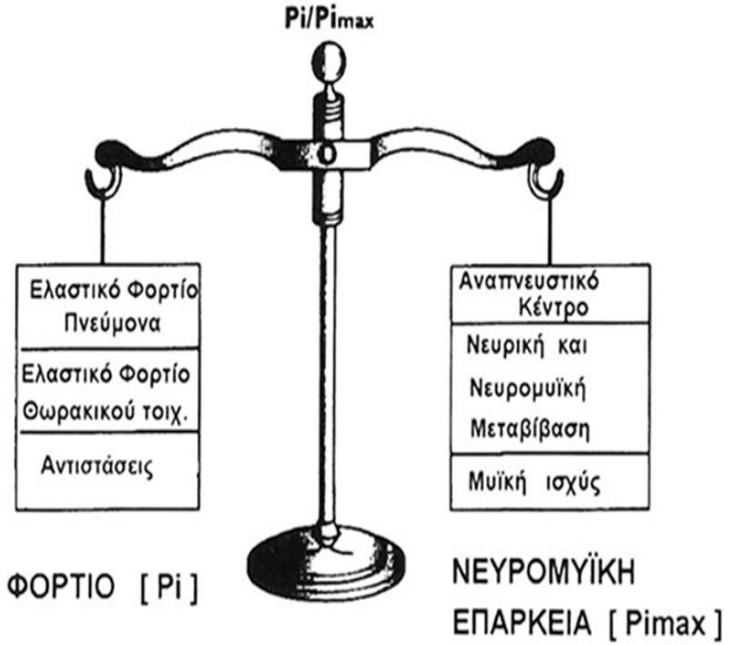
- **Τύπου ΙΙ** (υπερκαπνική): $PaCO_2$ > 45mmHg

(συχνά + PaO_2 < 60mmHg)

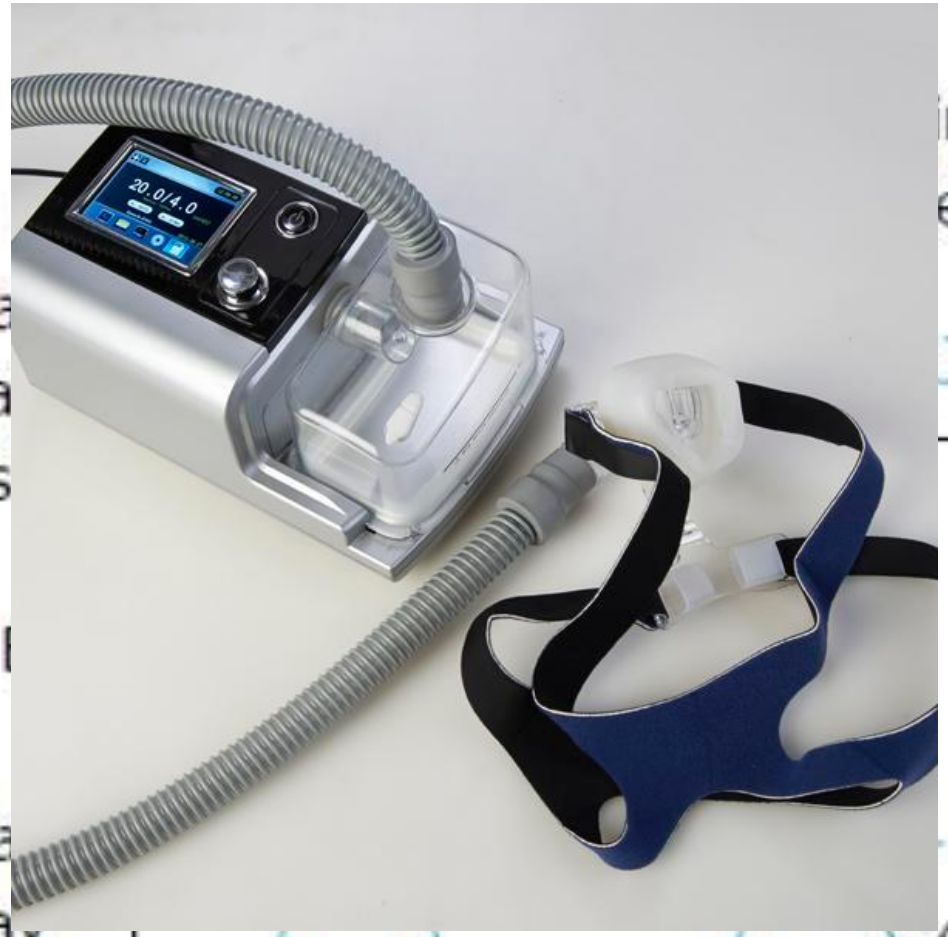
ΜΕΜΑ:

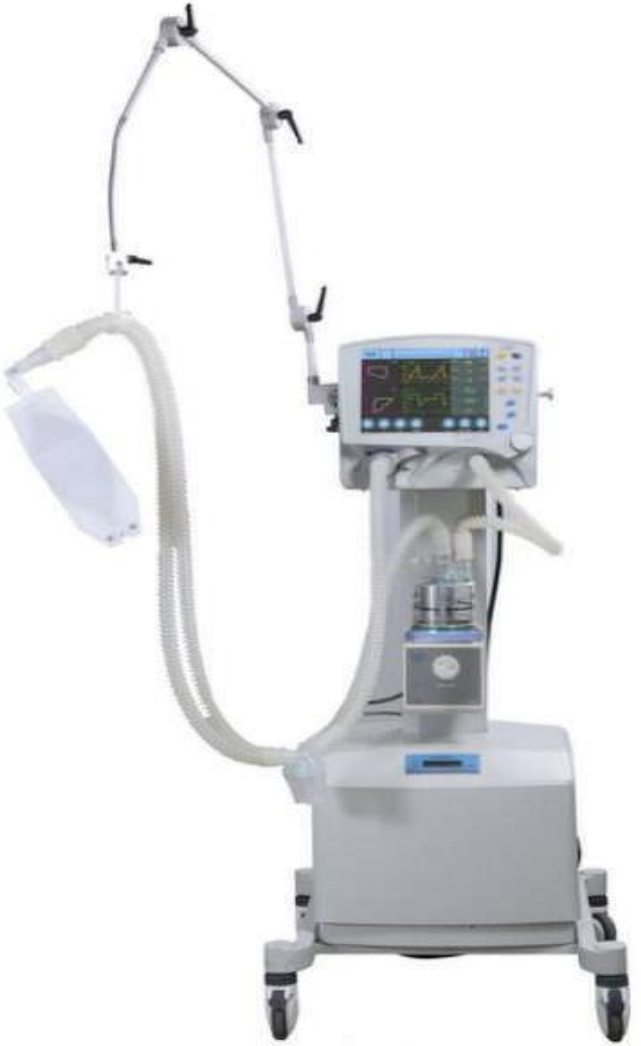
➡ **Βελτιώνει τον αερισμό**

➡ **Μειώνει το έργο της αναπνοής**



CPAP IPAP < EPAP





iratory
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Actua
airwa
press

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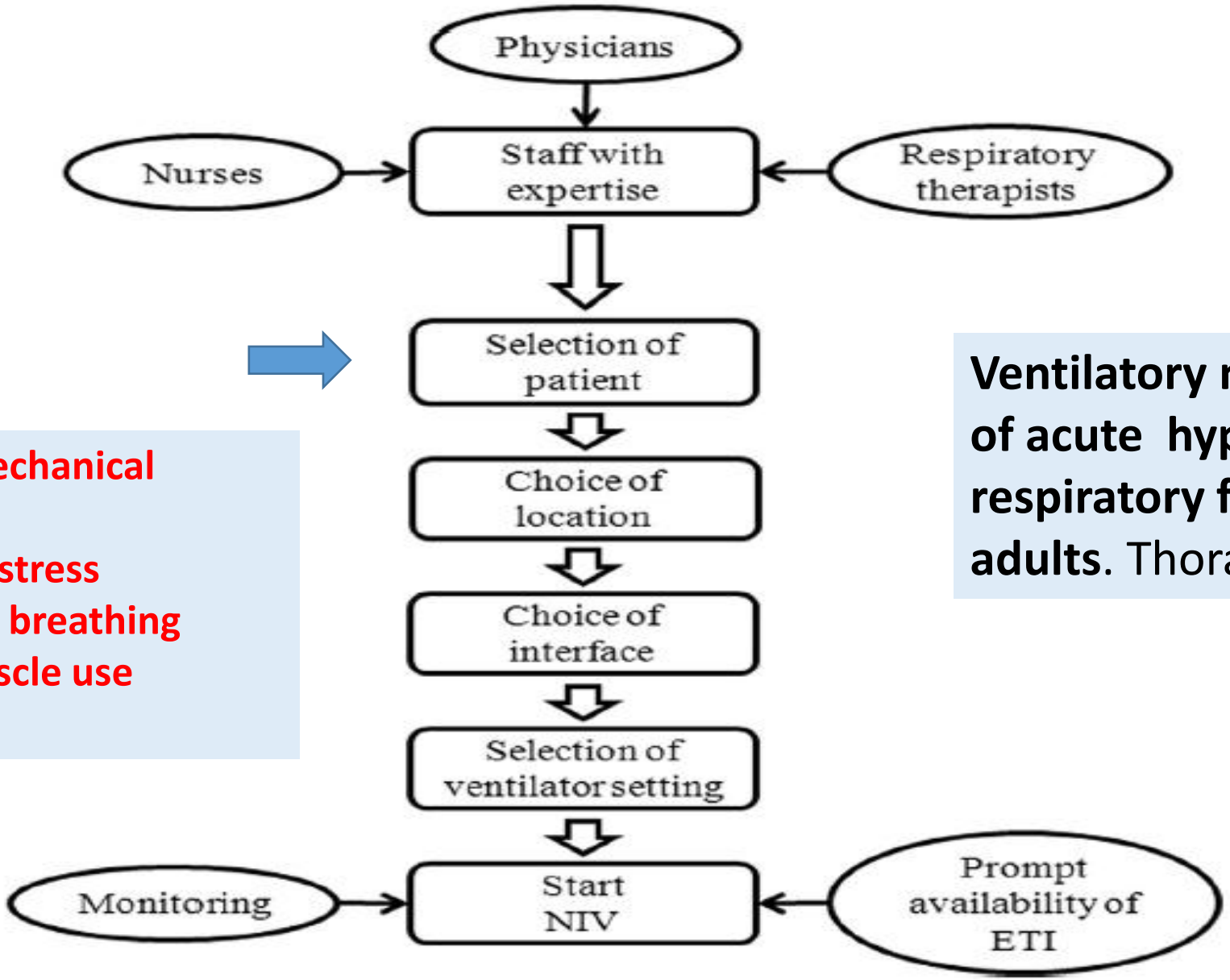
pressure

EPAP

level

BTS/ICS guidelines 2016



Indications of mechanical ventilation:

- ✓ **Respiratory distress**
- ✓ **Rapid shallow breathing**
- ✓ **Accessory muscle use**
- ✓ **Tachypnoea**

Ventilatory management of acute hypercapnic respiratory failure in adults. Thorax 2016

Ενδείξεις ΜΕΜΑ

BTS/ICS guidelines 2016

Indications for NIV

COPD
pH <7.35
pCO2 >6.5
RR>23
If persisting after bronchodilators and controlled oxygen therapy

Neuromuscular disease
Respiratory illness with RR > 20 if usual VC <1L even if pCO2< 6.5
Or
pH < 7.35 and pCO2> 6.5

Obesity
pH <7.35, pCO2>6.5, RR>23
Or
Daytime pCO2> 6.0 and somnolent

Contraindications for NIV

Absolute
Severe facial deformity
Facial burns
Fixed upper airway obstruction

Relative
pH<7.15
(pH<7.25 and additional adverse feature)
GCS <8
Confusion/agitation
Cognitive impairment (warrants enhanced observation)

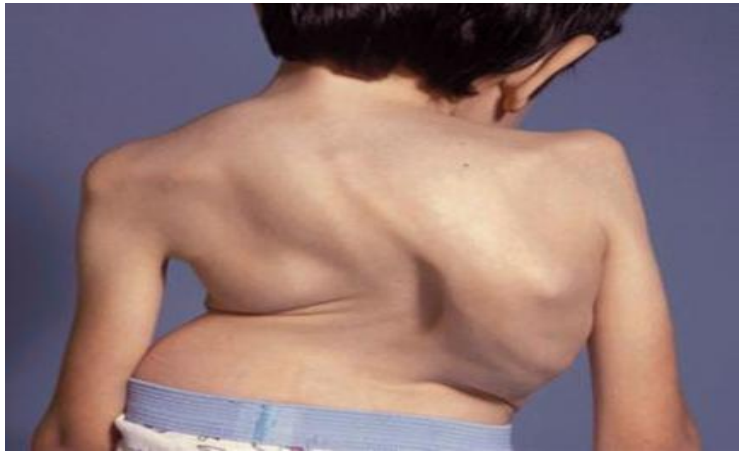
Indications for referral to ICU
AHRF with impending respiratory arrest

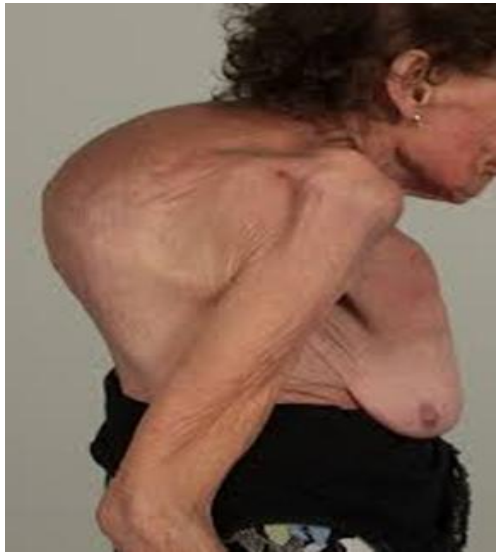
NIV failing to augment chest wall movement or reduce pCO2

Inability to maintain Sao2 > 85-88% on NIV

Need for IV sedation or adverse features indicating need for closer monitoring and/or possible difficult intubation as in OHS, DMD.

NIV Not indicated
Asthma/Pneumonia
Refer to ICU for consideration IMV if increasing respiratory rate/distress
or
pH <7.35 and pCO2 >6.5





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Or
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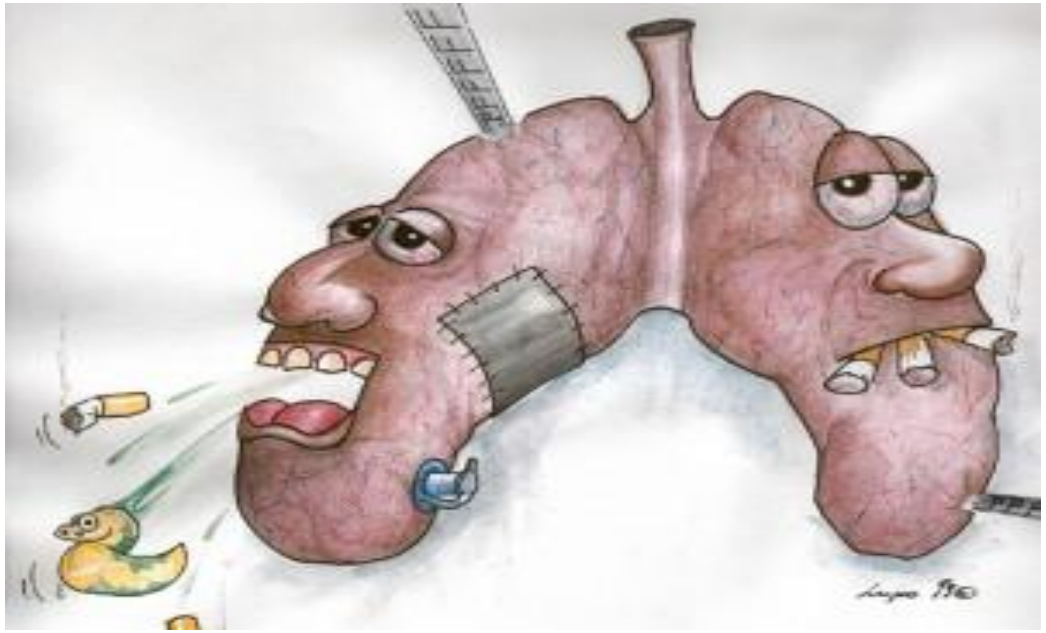
Χρόνια Αποφρακτική Πνευμονοπάθεια (ΧΑΠ)

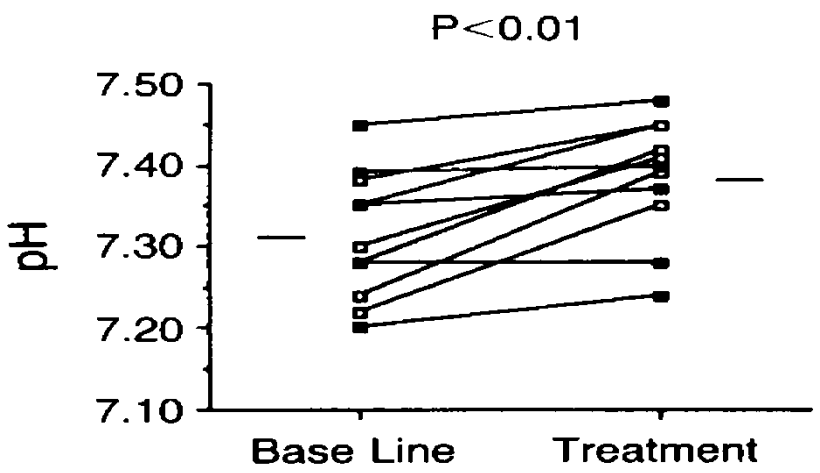


REVERSAL OF ACUTE EXACERBATIONS OF CHRONIC OBSTRUCTIVE LUNG DISEASE BY INSPIRATORY ASSISTANCE WITH A FACE MASK

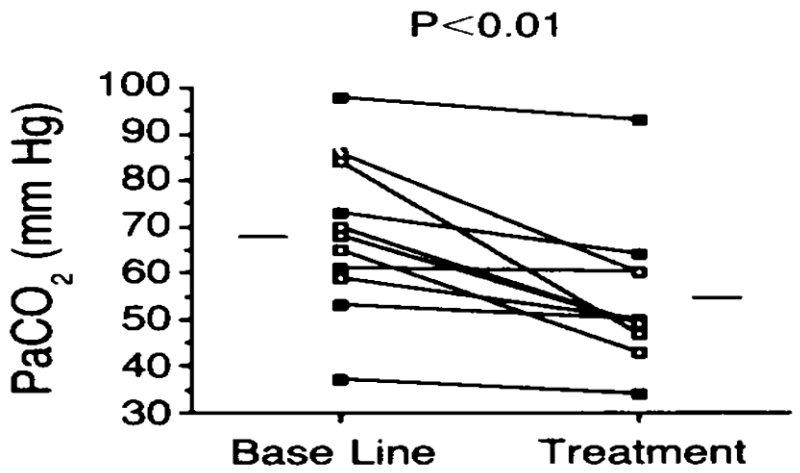
LAURENT BROCHARD, DANIEL ISABEY, JACQUES PIQUET, PIEDADE AMARO, JORGE MANCEBO, AMEN-ALLAH MESSADI, CHRISTIAN BRUN-BUISSON, ALAIN RAUSS, FRANÇOIS LEMAIRE, AND ALAIN HARF

N Engl J Med. 1990 Nov 29;323(22):1523-30

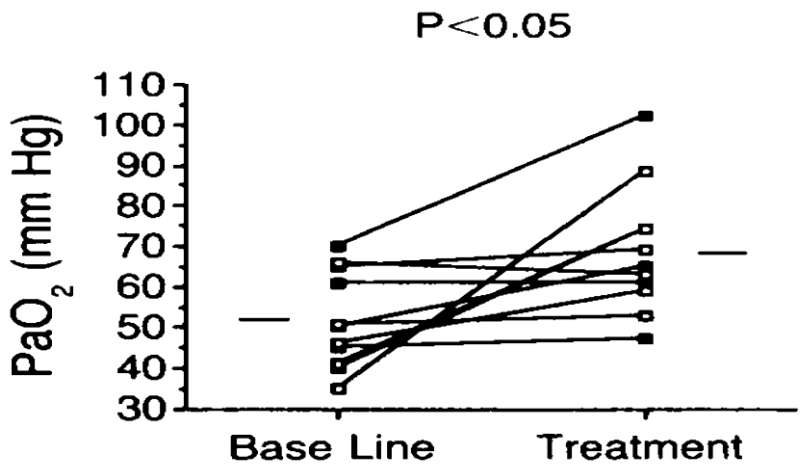
pH



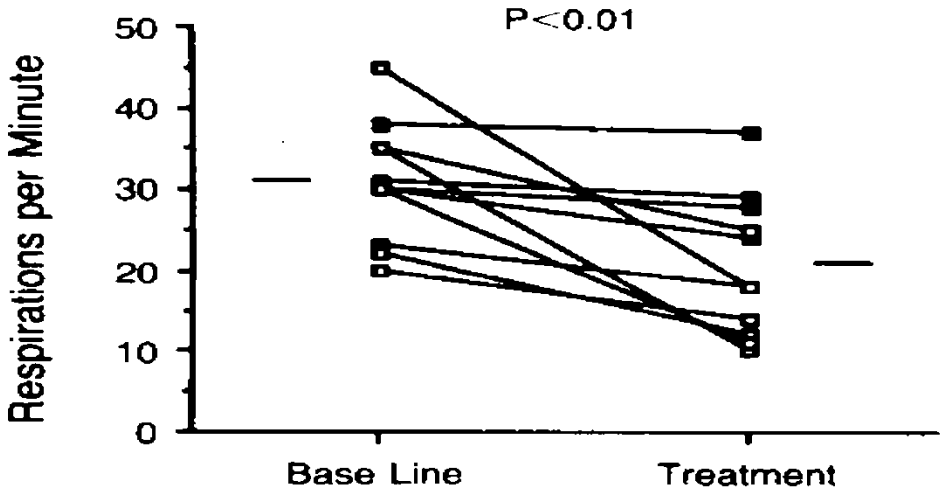
PaCO2



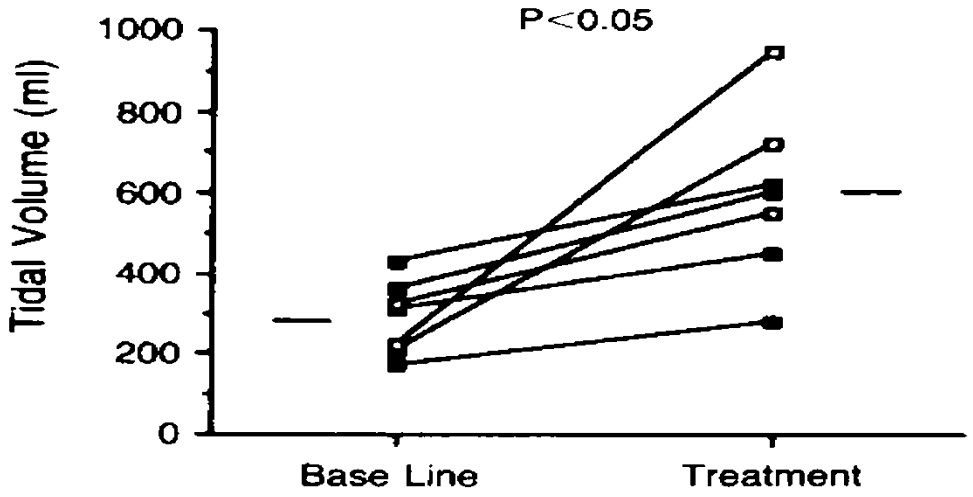
PaO2



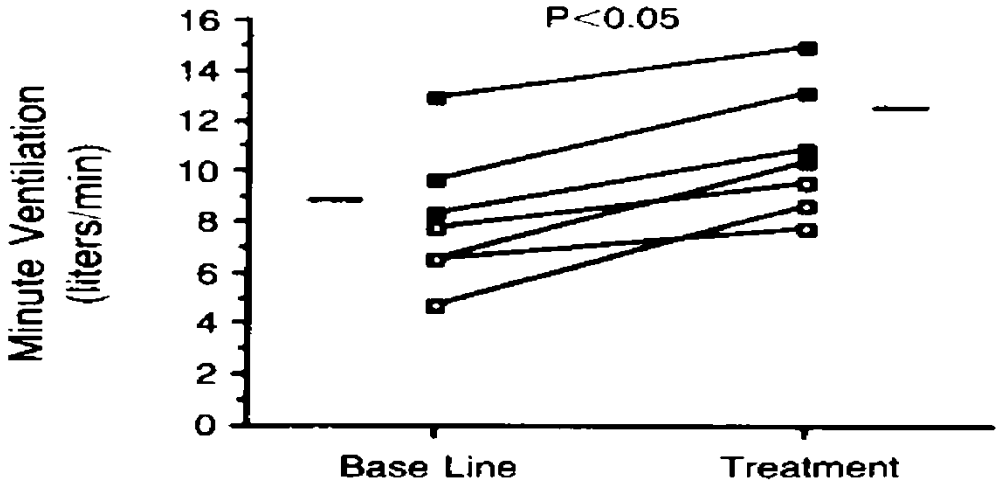
Respiratory rate



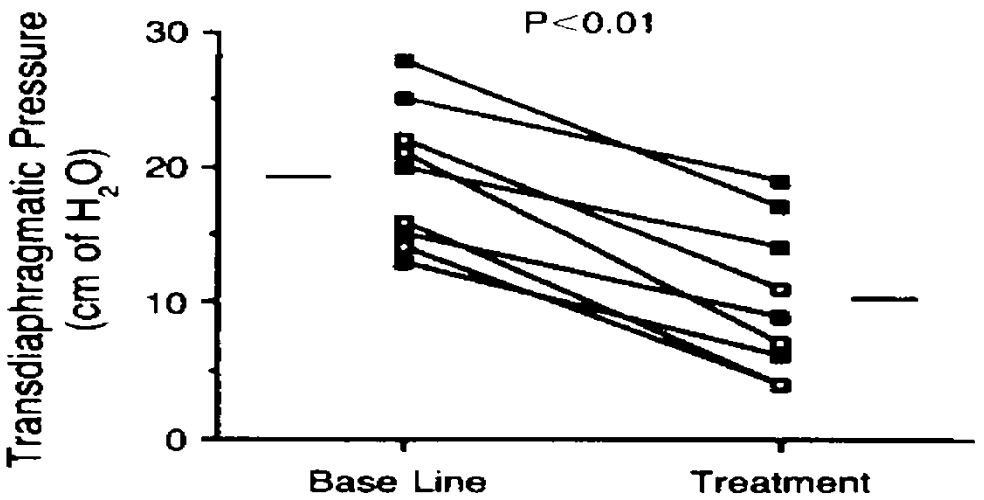
Tidal Volume



Minute Ventilation



Pdi



The 90s

- **Randomised controlled trial of nasal ventilation in acute ventilatory failure due to chronic obstructive airways disease**.

  Bott J, Carroll MP, Conway JH, Keilty SE, Ward EM, Brown AM, Paul EA, Elliott MW, Godfrey RC, Wedzicha JA, Moxham J

  Lancet. 1993; 341(8860):1555-7.

- **Randomized, prospective trial of noninvasive positive pressure ventilation in acute respiratory failure**

  Kramer N, Meyer TJ, Meharg J, Cece RD, Hill NS.

  Am J Respir Crit Care Med. **1995**; 151(6):1799-806

- **Noninvasive ventilation for acute exacerbations of chronic obstructive pulmonary disease**.

  Brochard L, Mancebo J, Wysocki M, Lofaso F, Conti G, Rauss A, Simonneau G, Benito S, Gasparetto A, Lemaire F, Isabey D, Harf A

  N Engl J Med. **1995**; 28;333(13):817-22.

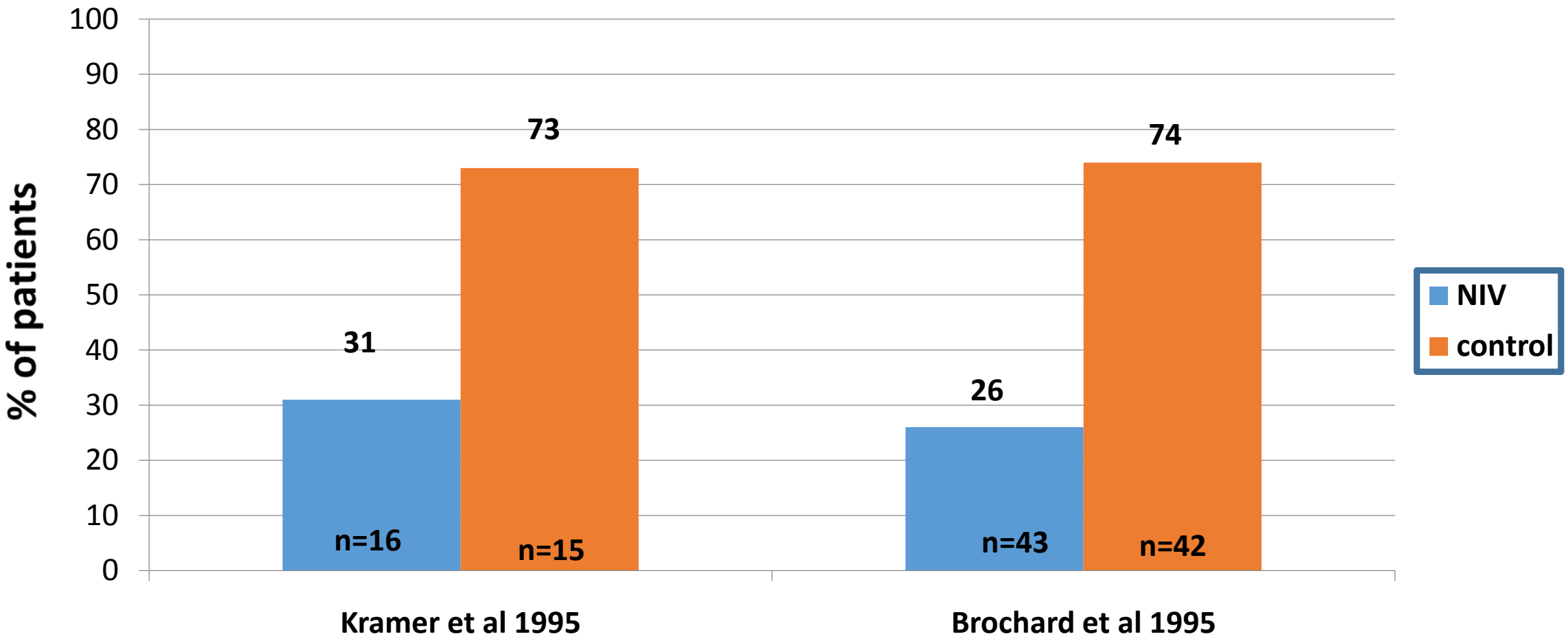
- ✓Πολυκεντρικές μελέτες, τυχαιοποιημένες

- ✓Εφαρμογή NIV σε ασθενείς με παρόξυνση ΧΑΠ
  - NIV+ standard therapy
  - standard therapy

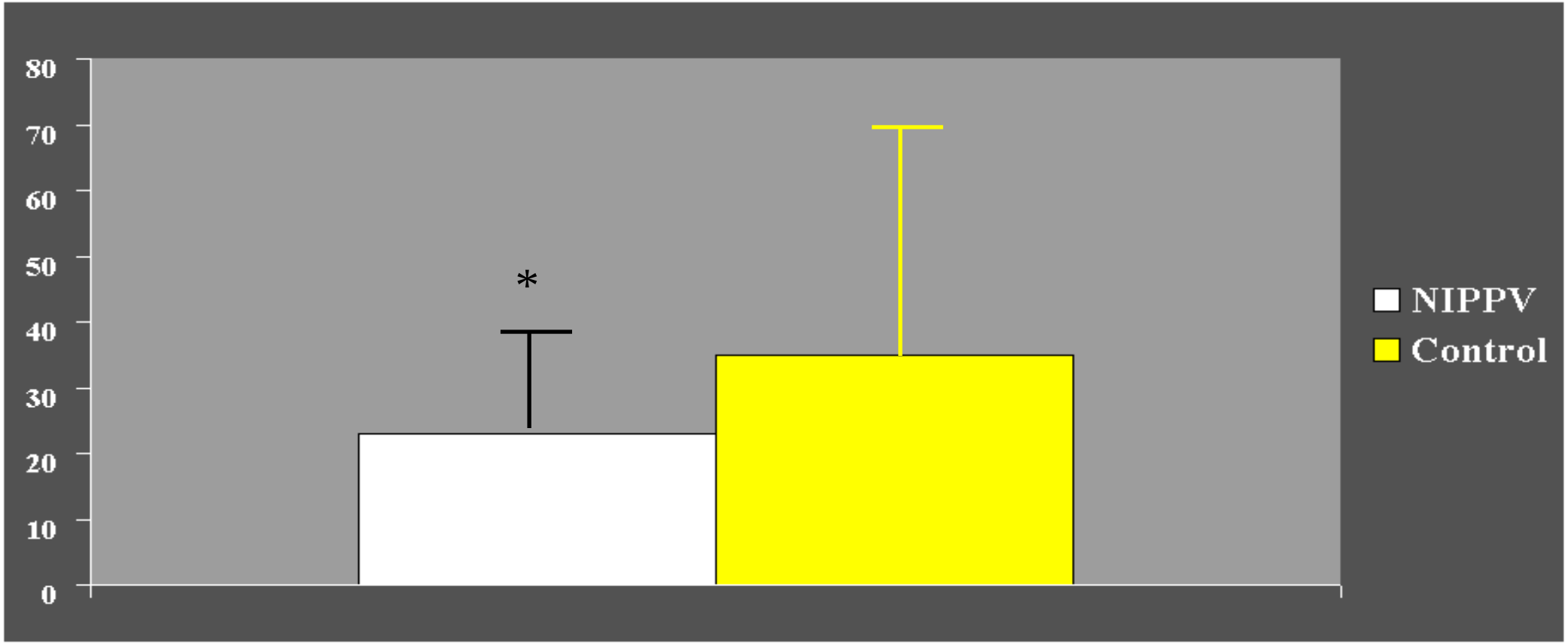
- ✓**Εξειδικευμένο περιβάλλον νοσηλείας (ICU/HDU)**

- ✓Ασθενείς που δεν πληρούσαν κριτήρια άμεσης διασωλήνωσης
  - ✓pH <7.35 και >7.25
  - ✓Καλό σχετικά επίπεδο επικοινωνίας

Intubation rate of COPD patients with acute exacerbation treated with and without NIV

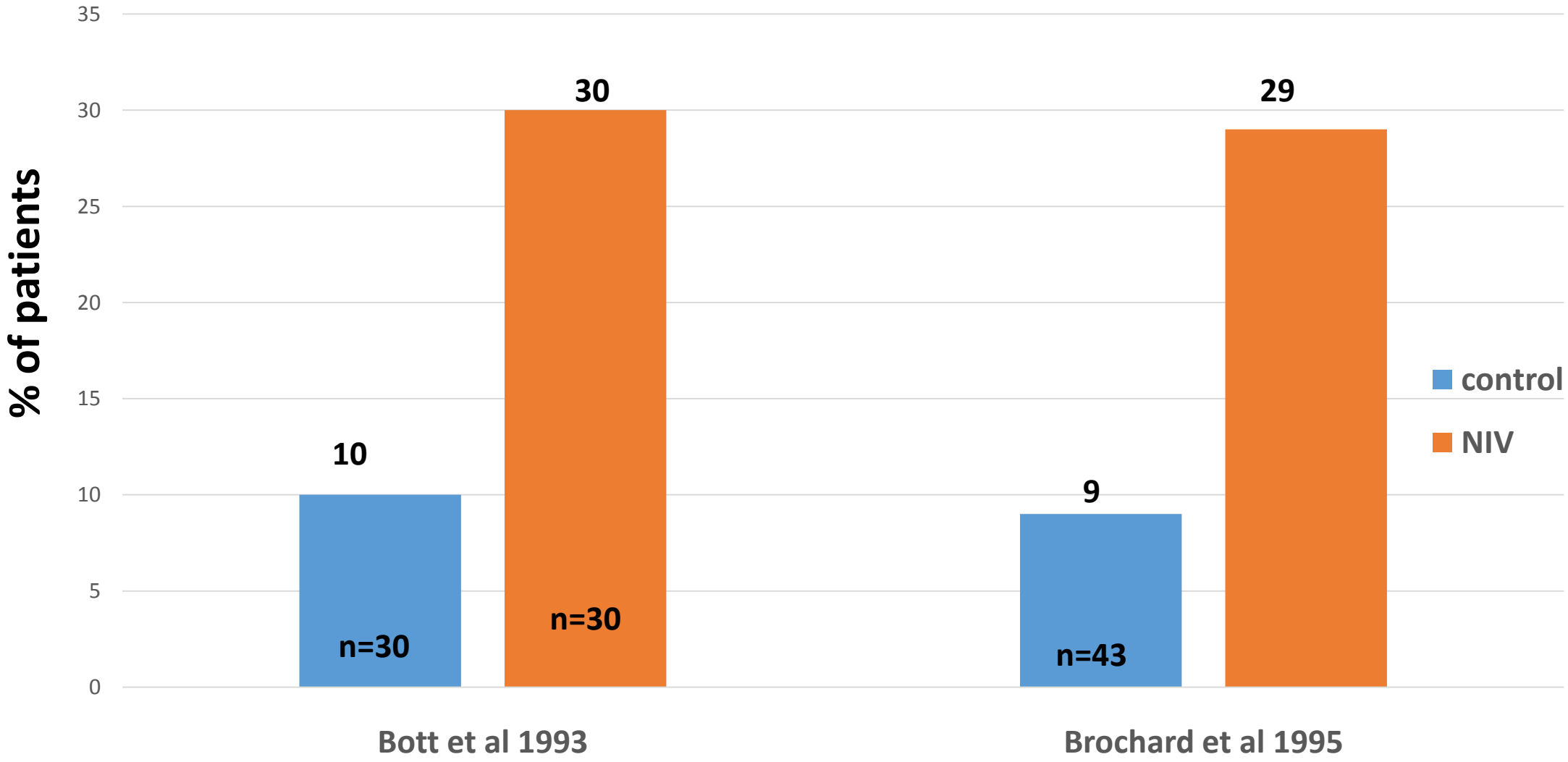


Χρόνος νοσηλείας (ημέρες) ασθενών με οξεία παρόξυνση ΧΑΠ που έλαβαν ή όχι υποστήριξη με NIV



Brochard et al. NEJM 1995;333:817

In-hospital mortality in COPD patients treated with and without NIV



The 2000's

Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general respiratory wards: a multicentre randomised controlled trial

P K Plant, J L Owen, M W Elliott *Lancet* 2000; **355:** 1931–35

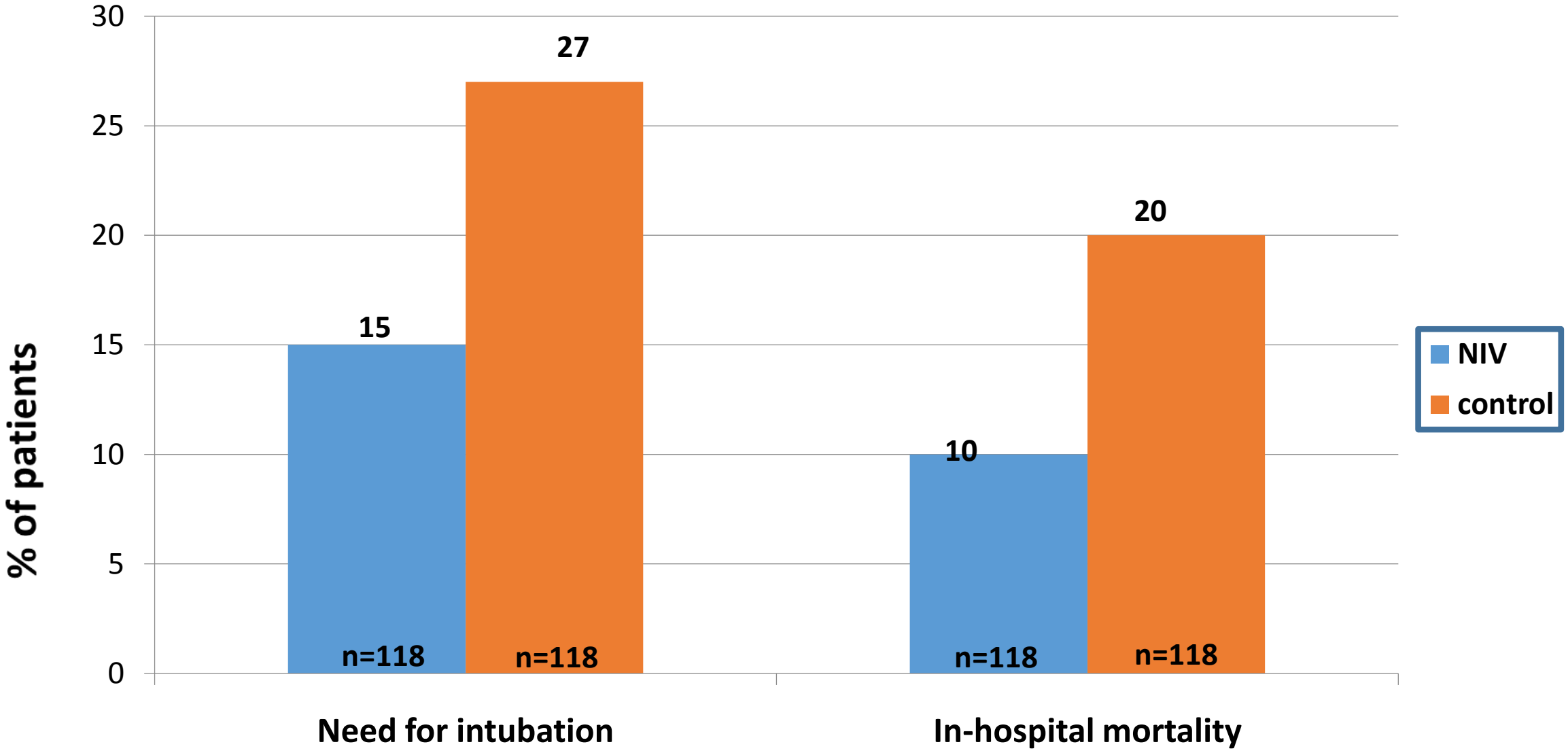
- 14 νοσοκομεία στην Μεγ. Βρετανία
- Εφαρμογή NIV **σε κοινό θάλαμο** νοσηλείας
  - 1/11 νοσηλευτές/ασθενείς
- **Τα περισσότερα νοσηλευτικά τμήματα δεν διέθεταν εμπειρία στην χρήση του NIV**

- **236 ασθενείς** με παρόξυνση ΧΑΠ
  - 118 συνήθη θεραπεία (ST),
  - 118 ST + NIV
- pH 7.25-7.35, $PaCO_2$ >45mmHg

Εντός 12 ωρών από την προσέλευση στα ΤΕΠ

Αποκλεισμός ασθενών με

- **pH< 7.25**
- **GCS<8**


30
25
20
15
10
5
0
% of patients
27
20
15
10
n=118
n=118
n=118
n=118
NIV
control
Need for intubation
In-hospital mortality

Intensive Care Med (2002) 28:1701–1707
DOI 10.1007/s00134-002-1478-0

ORIGINAL

G. Conti
M. Antonelli
P. Navalesi
M. Rocco
M. Bufi
G. Spadetta
G. U. Meduri

Noninvasive vs. conventional mechanical ventilation in patients with chronic obstructive pulmonary disease after failure of medical treatment in the ward: a randomized trial

- Τυχαιοποιημένη μελέτη –

  1 κέντρο

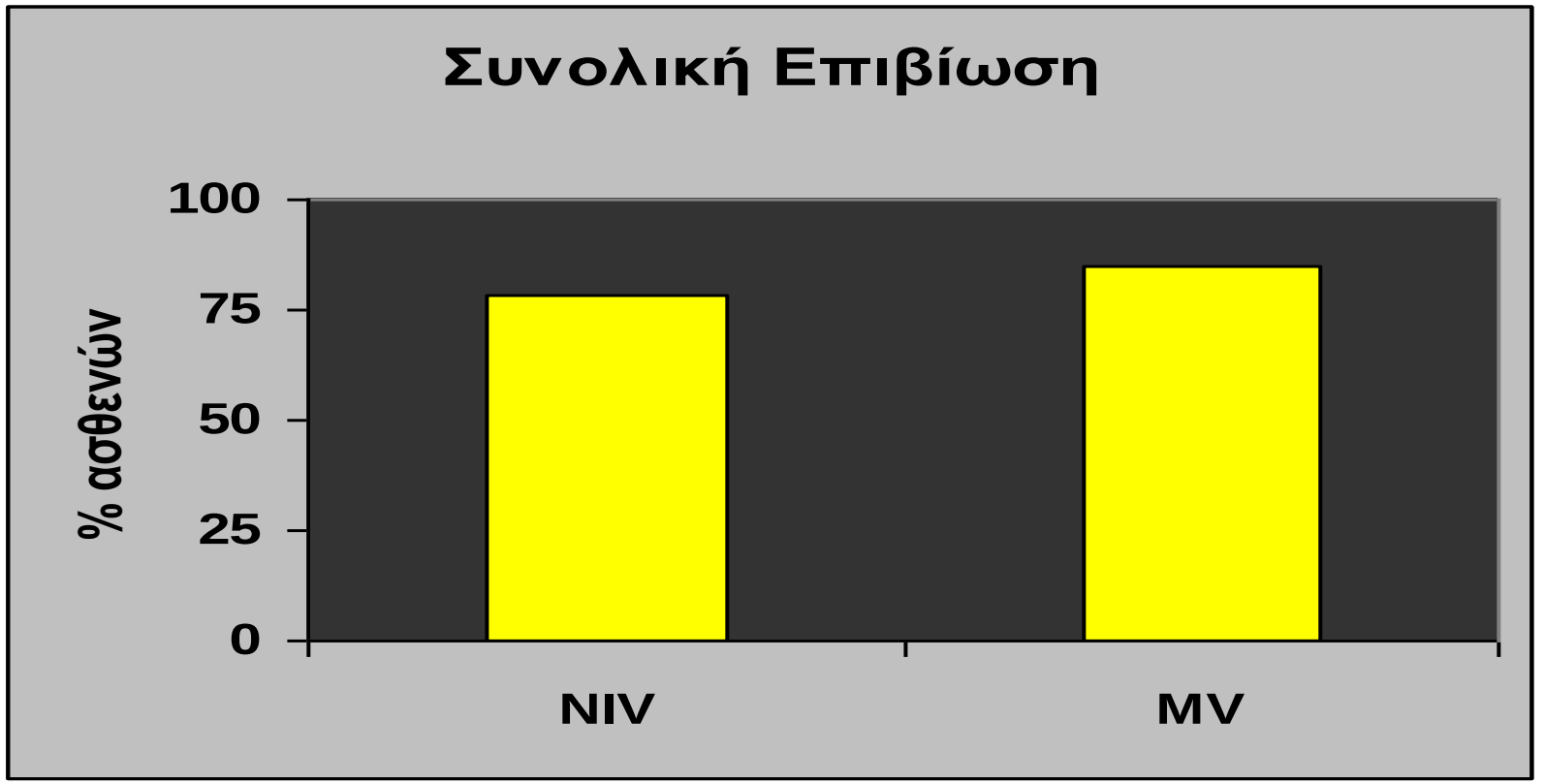
- ΜΕΘ

- 49 ασθενείς με ΧΑΠ που νοσηλεύονταν για παρόξυνση και παρουσίασαν επιδείνωση

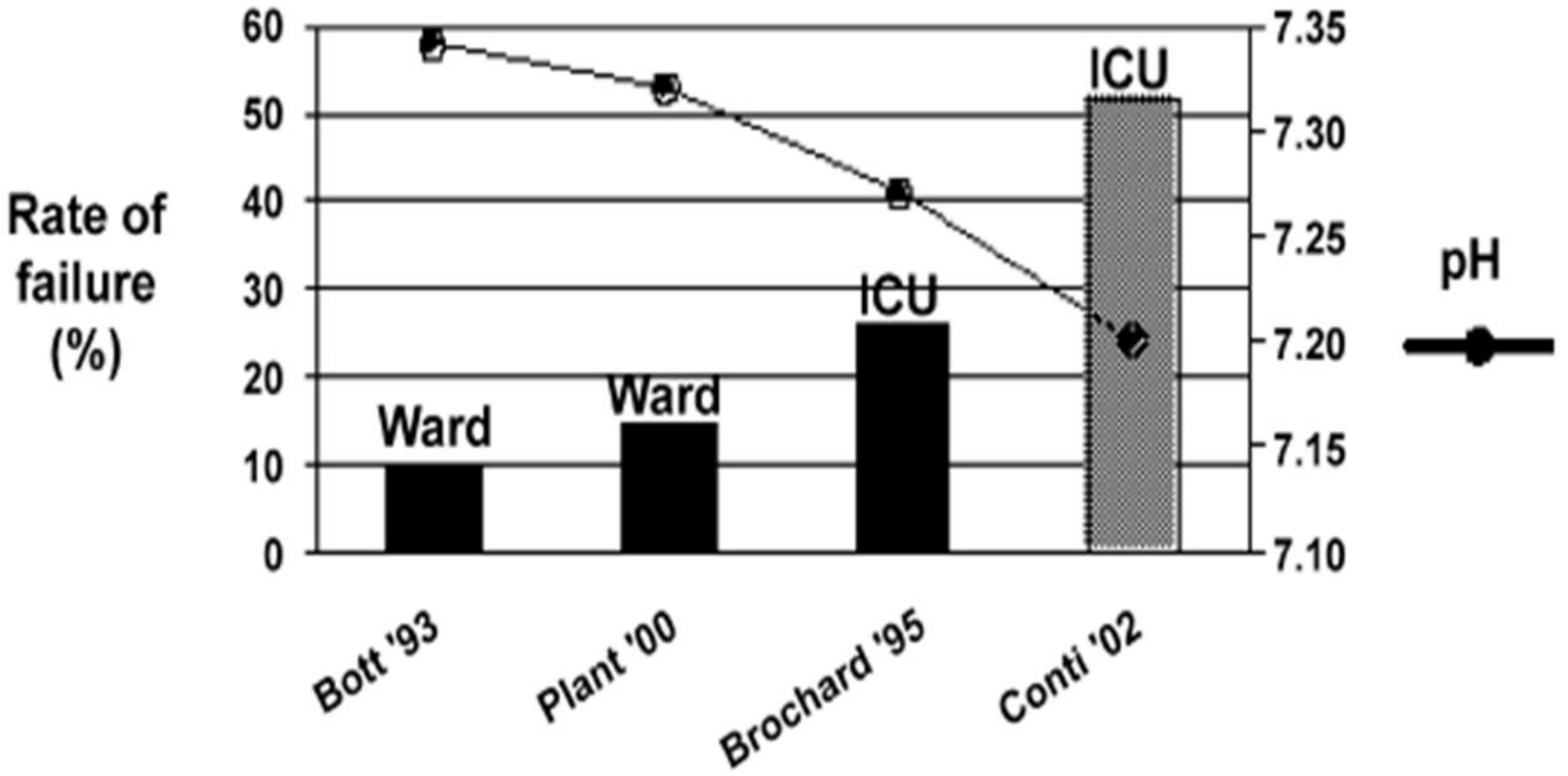
- **Πληρούσαν κριτήρια μηχανικής υποστήριξης του αναπνευστικού**
  - **pH<7.2**
  - **Επηρεασμένο επίπεδο συνείδησης (Kelly score >/= 4)**

- Ομάδες
  - NIV: 23 άτομα
  - MV: 26 άτομα

	Noninvasive ventilation group (n=23)			Conventional ventilation group (n=26)		
	Intubation not required (n=11)	Intubation required (n=12)	p	Survivors (n=22)	Nonsurvivors (n=4)	p
ICU survivors	11 (100%)	7 (58%)	0.02	22 (84%)	0 (0%)	–
Hospital survivors	10 (91%)	7 (58%)	0.02	21 (81%)	n.a.	–
Septic complications[a]	0 (0%)	6 (50%)	0.009	9 (41%)	4 (100%)	0.047



Σχέση pH αρτηριακού αίματος και αποτυχίας ΜΕΜΑ



The 2010’s

Outcomes Associated With Invasive and Noninvasive Ventilation Among Patients Hospitalized With Exacerbations of Chronic Obstructive Pulmonary Disease

JAMA Intern Med. 2014;174(12):1982-1993

Patient Characteristic	Ventilation[a] Noninvasive (n = 5225)	Ventilation[a] Invasive (n = 5225)	*P* Value
Outcomes			
Hospital-acquired pneumonia	139 (2.5)	210 (3.8)	<.001
In-hospital mortality	334 (6.0)	506 (9.2)	<.001
LOS, d	7.2	8.9	<.001
Median (IQR)	6 (4-9)	7 (4-11)	
Costs, US $	14 812	21 202	<.001
Median (IQR)	10 408 (6460-16702)	15 677 (9882-25362)	
Readmission			
COPD-specific	288 (5.5)	272 (5.4)	.78
All-cause	689 (13.3)	635 (12.7)	.35

Retrospective study, 420 US hospitals

JAMA Intern Med. 2014;174(12):1982-1993

Indications for NIV in AECOPD

BTS/ICS guidelines 2016

Recommendations

❑ For most patients with AECOPD, the **initial management** should be **optimal medical therapy and targeting an oxygen saturation of 88–92%** (Grade A).

❑ **NIV should be started when**

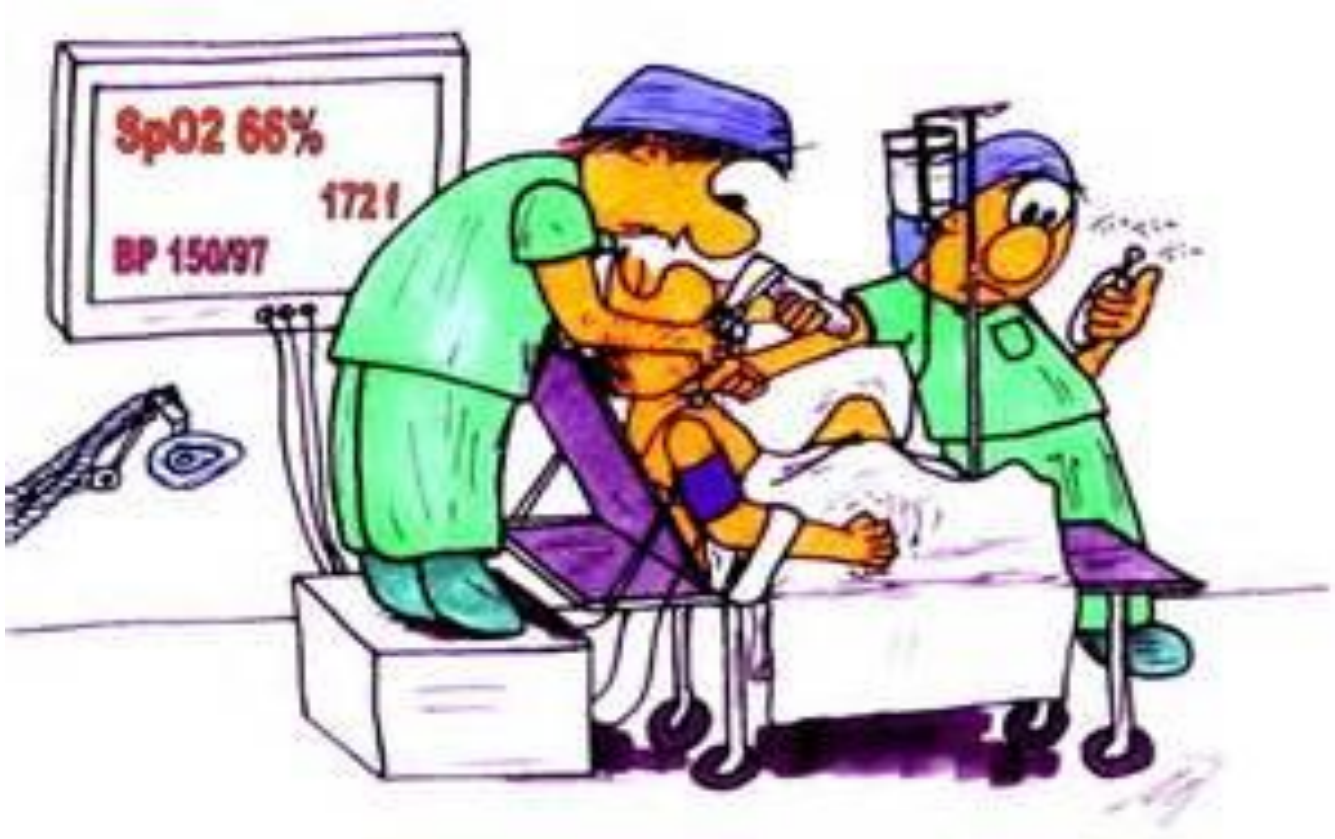
- ✓ **pH<7.35 and**
- ✓ **pCO2>6.5 kPa (49mmHg)**

persist or develop despite optimal medical therapy (Grade A).

❑ **Severe acidosis alone does not preclude a trial of NIV** in an appropriate area with ready access to staff who can perform safe endotracheal intubation (Grade B).

❑ **The use of NIV should not delay escalation to IMV** when this is more appropriate (Grade C).

Indications for MV (AECOPD)



BTS/ICS guidelines 2016

Box 1 Indications for invasive mechanical ventilation (IMV) in acute exacerbation of COPD (AECOPD)

- Imminent respiratory arrest
- Severe respiratory distress
- Failure of or contra-indications to non-invasive ventilation (NIV)
- Persisting pH<7.15 or deterioration in pH despite NIV
- Depressed consciousness (Glasgow Coma Score <8)

Risk Factors for NIV Failure

Acute hypercapnic respiratory failure

- Poor neurologic score: GCS < 11
- RR> 35 breaths/min
- pH< 7.25
- APACHE score> 29
- Asynchronous breathing
- Excessive air leak
- Agitation
- Excessive secretions
- Poor tolerance
- Poor adherence to therapy
- No initial improvement within first 2 h of NIV
- No improvement in pH
- Persistent tachypnea
- Persistent hypercapnia

Αντενδείξεις ΜΕΜΑ

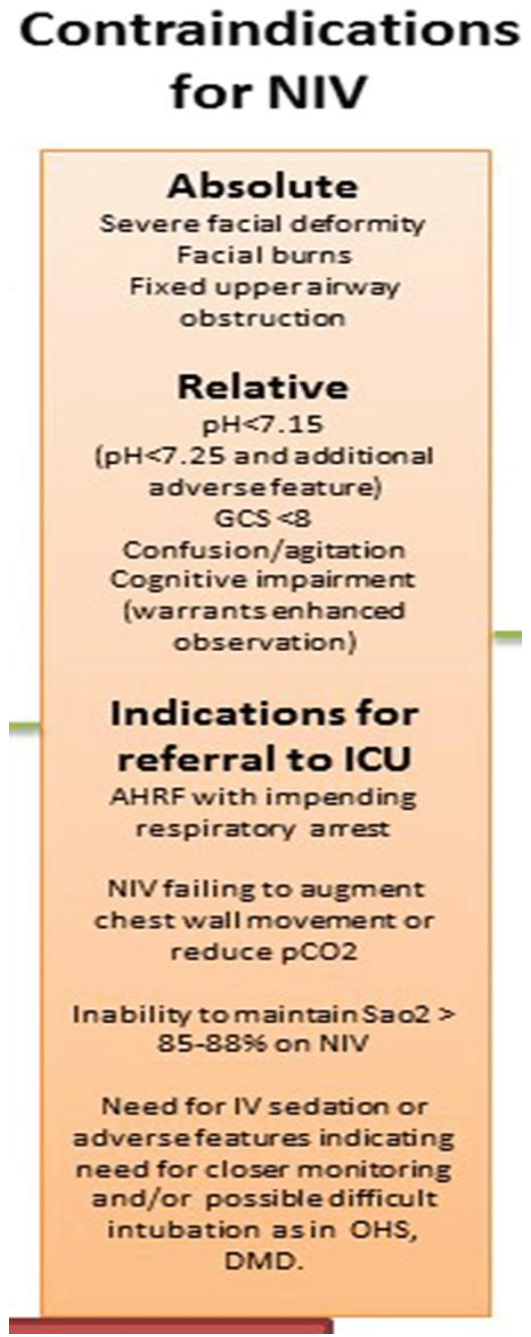
contra-indications to NIV

ABSOLUTE

- Severe facial deformity
- facial burns
- fixed upper airway obstruction

RELATIVE

- employed as exclusion criteria in clinical trials rather than being definitively shown to result in a worse outcome
- Some of the criteria have been challenged



RELATIVE CONTRA-INDICATIONS

- **Coma** – loss of airway protection
- **confusion, agitation and cognitive impairment**

  difficult to apply but should not preclude its use
- **acute pneumothorax** - should be drained before applying NIV
  - Using a lower inflation pressure seems theoretically sensible but is without evidence.
  - If the patient deteriorates, NIV should be discontinued — urgent chest radiograph
- **Vomiting**- able to rapidly remove NIV mask
  - **Marked abdominal distension-** nasogastric tube
- **copious secretions**
  - increases the risk of treatment failure
- **Respiratory arrest or peri-arrest**

BTS/ICS guidelines 2016

There are few absolute contra-indications to a trial of NIV

BUT

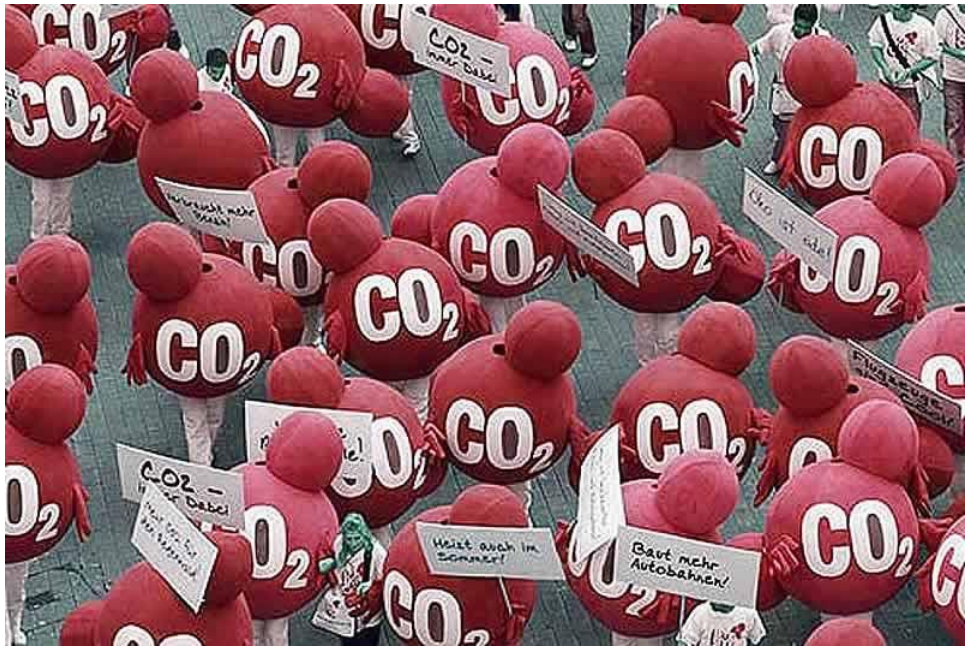
some adverse features, especially when combined, require more caution and more intense monitoring

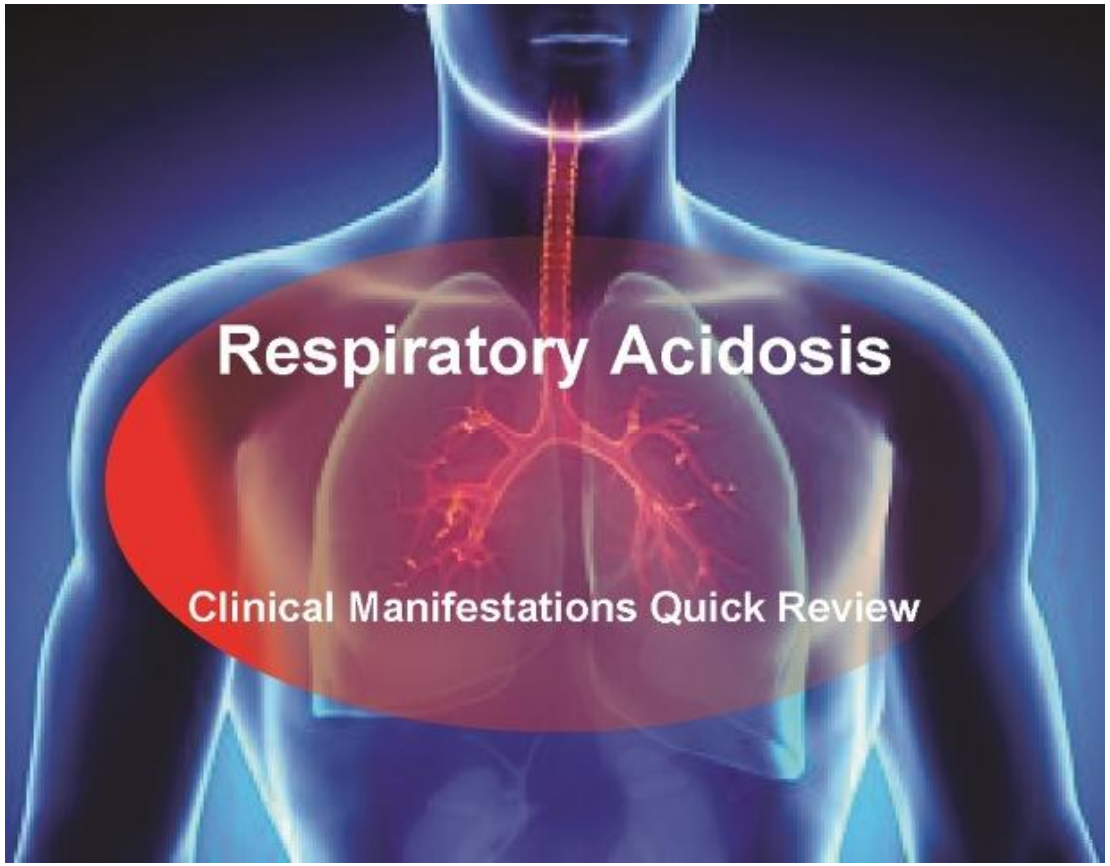
The presence of adverse features increases the risk of NIV failure and should prompt consideration of placement in HDU/ICU (Grade C).

Good practice points

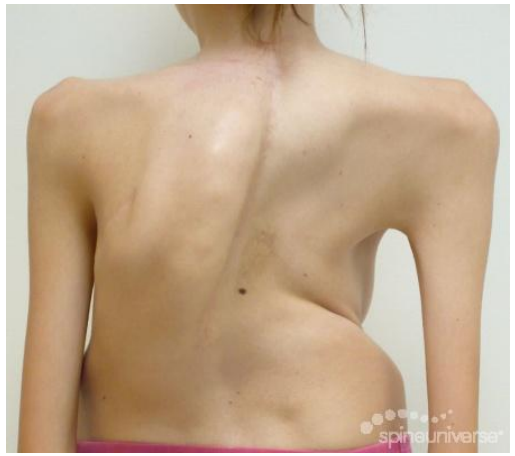
- **Adverse features should not, on their own, lead to withholding a trial of NIV.**
- **The presence of relative contra-indications necessitates**
  - a higher level of supervision
  - consideration of placement in HDU/ICU
  - an early appraisal of whether to continue NIV or to convert to IMV.

ΜΕΜΑ σε υπερκαπνική αναπνευστική ανεπάρκεια....συνέχεια





Νευρομυϊκά νοσήματα-Νοσήματα Θωρακικού κλωβού (NMD-CWD)



ALS Association
Fighting Lou Gehrig's Disease

MDA® Muscular Dystrophy Association

NIV in NMD/CWD- BTS/ICS guidelines 2016

- No randomised controlled studies for NIV versus IMV for acute hypercapnic respiratory failure in NMD/CWD
- Individuals with NMD and CWD who present with AHRF **should not be denied acute NIV.**
- NIV is the ventilation mode of choice because patients with NMD or CWD tolerate it well and because **extubation from IMV may be difficult**.
- In patients with NMD or CWD, deterioration may be rapid or sudden, making **HDU/ICU placement** for therapy more appropriate

NIV in NMD/CWD- BTS/ICS guidelines 2016

- ❑ **Controlled oxygen therapy** should be used in patients with NMD or CWD and AHRF (Grade D)
- ❑ **NIV should almost always be trialed** in the acutely unwell patient with NMD or CWD with hypercapnia. **Do not wait for acidosis to develop** (Grade D).

- ❑ In patients with NMD or CWD, **NIV should be considered in acute illness when**
  - **VC is known to be <1 L and**
  - **RR >20,**

  even if normocapnic (Grade D).
- ❑ In patients with NMD or CWD, **consider controlled ventilation as triggering may be ineffective** (Grade D).
- ❑ In NMD and CWD, **intubation should not be delayed if NIV is failing** (Grade D).

Σύνδρομο παχυσαρκίας-υποαερισμού (OHS)

NIV in OHS-BTS/ICS guidelines 2016

- **In obese patients, hospitalized for any reason, the presence of hypercapnia increases morbidity and mortality**

- **Severe OSA** is the principal cause of hypercapnia, BUT hypoventilation also results from the **mechanical effect of obesity**

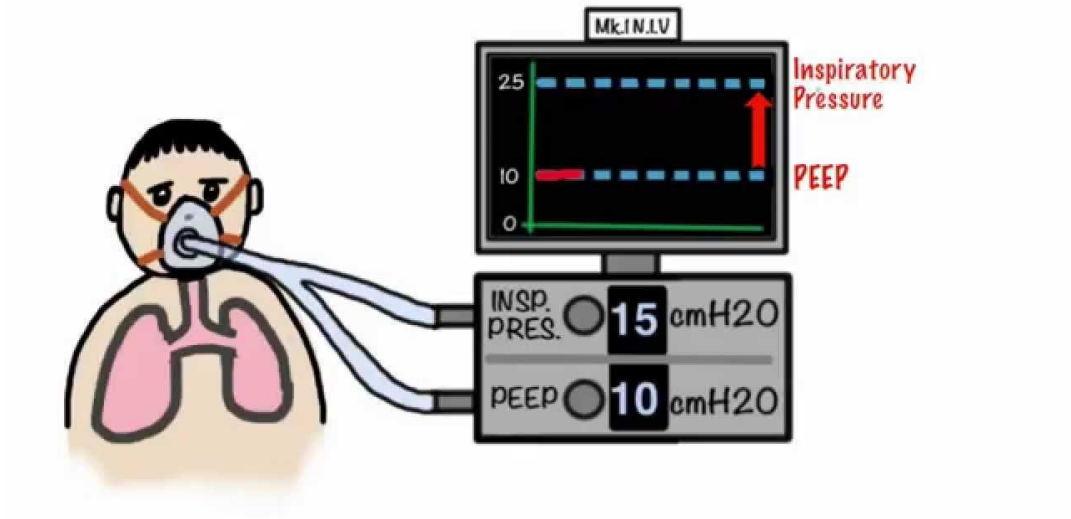
- **there is a lack of evidence to guide treatment of either chronic hypercapnia or AHRF complicating obesity**

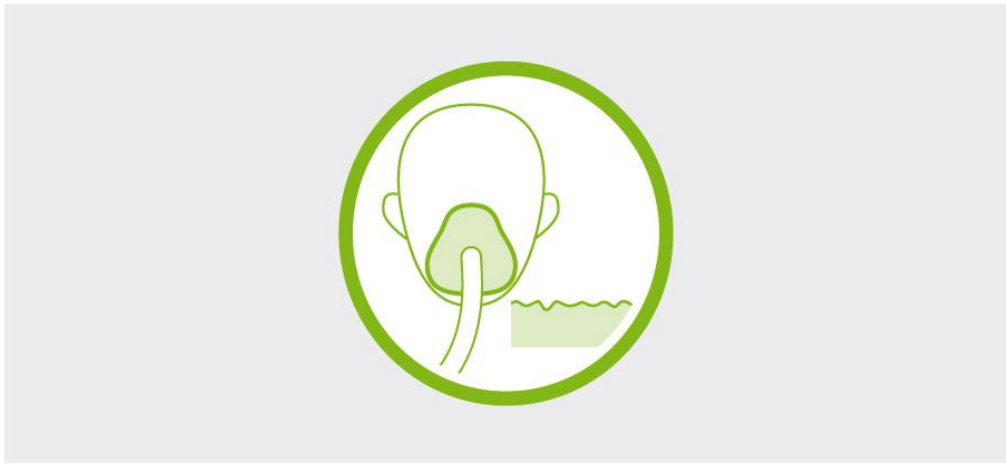
- **Presentation with acute on chronic respiratory failure is more common than de novo AHRF**
  - the **precipitant cause for destabilisation may be unclear**.
  - Commonly **chronic hypercapnia is unexpectedly revealed peri-operatively** following routine or emergency surgery in an obese patient not known to have OHS

- In OHS, **NIV should be started in AHRF, using the same criteria as in AECOPD** (Grade B).
- In the **absence of acidosis**, NIV may **be indicated in some hypercapnic and/or somnolent obese patients** (Level 2+).
- **Controlled oxygen therapy** should be used in patients with OHS and AHRF (Grade D).

- Probably different settings in application of NIV (controlled mode, high IPAP (>30cmH_2O) and EPAP (10-15 cmH_2O))
- Achieving SpO_2 88-92% may be difficult
- As the risk of NIV failure is greater, and intubation may be more difficult, **placement in HDU/ICU for NIV is recommended**

Άλλες ενδείξεις-εφαρμογές ΜΕΜΑ





ΜΕΜΑ σε ARDS

- **Noninvasive pressure support ventilation in patients with acute respiratory failure. A randomized comparison with conventional therapy.** *Chest 1995*
- **Noninvasive pressure support ventilation in patients with acute respiratory failure.** Chest 1993
- **Noninvasive positive pressure ventilation: successful outcome in patients with acute lung injury/ARDS.** *Chest 1999*
- **Predictors of failure of noninvasive positive pressure ventilation in patients with acute hypoxemic respiratory failure: a multi-center study.** *Intensive Care Med 2001*
- **Treatment of Acute Hypoxemic Nonhypercapnic Respiratory Insufficiency With Continuous Positive Airway Pressure Delivered by a Face Mask. A Randomized Controlled Trial.** *JAMA 2000*
- **Noninvasive ventilation in severe hypoxemic respiratory failure: a randomized clinical trial** *. AJRCCM 2003*
- **A multiple-center survey on the use in clinical practice of noninvasive ventilation as a first-line intervention for acute respiratory distress syndrome.** *Crit Care Med 2007*
- **Failure of non-invasive ventilation in patients with acute lung injury: observational cohort study.** *Crit Care Med 2006*
- **oVNI Study Group;REVA Network (Research Network in Mechanical Ventilation). Changing use of noninvasive ventilation in critically ill patients: trends over 15 years in francophone countries.** *Intensive Care Med 2016*

Table 3. The Berlin Definition of Acute Respiratory Distress Syndrome

	Acute Respiratory Distress Syndrome
Timing	Within 1 week of a known clinical insult or new or worsening respiratory symptoms
Chest imaging[a]	Bilateral opacities—not fully explained by effusions, lobar/lung collapse, or nodules
Origin of edema	Respiratory failure not fully explained by cardiac failure or fluid overload Need objective assessment (eg, echocardiography) to exclude hydrostatic edema if no risk factor present
Oxygenation[b]	
Mild	200 mm Hg $<$ PaO_2/FIO_2 $\leq$ 300 mm Hg with PEEP or CPAP $\geq$5 cm H_2O[c]
Moderate	100 mm Hg $<$ PaO_2/FIO_2 $\leq$ 200 mm Hg with PEEP $\geq$5 cm H_2O
Severe	PaO_2/FIO_2 $\leq$ 100 mm Hg with PEEP $\geq$5 cm H_2O

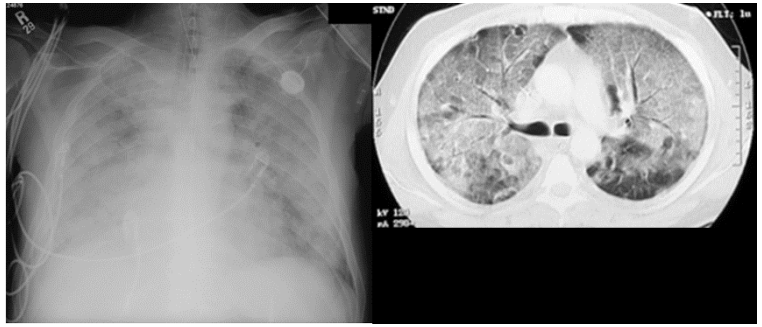
Abbreviations: CPAP, continuous positive airway pressure; FIO_2, fraction of inspired oxygen; PaO_2, partial pressure of arterial oxygen; PEEP, positive end-expiratory pressure.

[a] Chest radiograph or computed tomography scan.

[b] If altitude is higher than 1000 m, the correction factor should be calculated as follows: [$PaO_2/FIO_2 \times$ (barometric pressure/760)].

[c] This may be delivered noninvasively in the mild acute respiratory distress syndrome group.

NIV in ARDS



Pro

- Use in mild ARDS
- Avoidance of sedation/muscle paralysis
- Avoidance of ventilator-associated complications
- Less hemodynamic compromisation
- Hematologic malignancies

Cons

- Delay in intubation
- Small studies
- Comparison with oxygen administration or historical cohorts
- Broad diagnostic category (etiologies, classification)
- APACHE/SOFA score
- Vt: <6ml/kg PBW

Noninvasive Ventilation of Patients with Acute Respiratory Distress Syndrome Insights from the LUNG SAFE Study. Bellani et al *AJRCCM 2017;195(1): 67-77. JAMA 2016;315:788-800*

- Prospective, observational, international multicenter cohort study
- 50 countries
- 2813 ARDS patients: 2377 (84.5% -IMV)-436 (15.5%-NIV)
- NIV used in even moderate and severe ARDS
- NIV failure 30.7% (increased risk of death, higher mortality than ARDS with IMV)
- **Limitations:++++++++++**

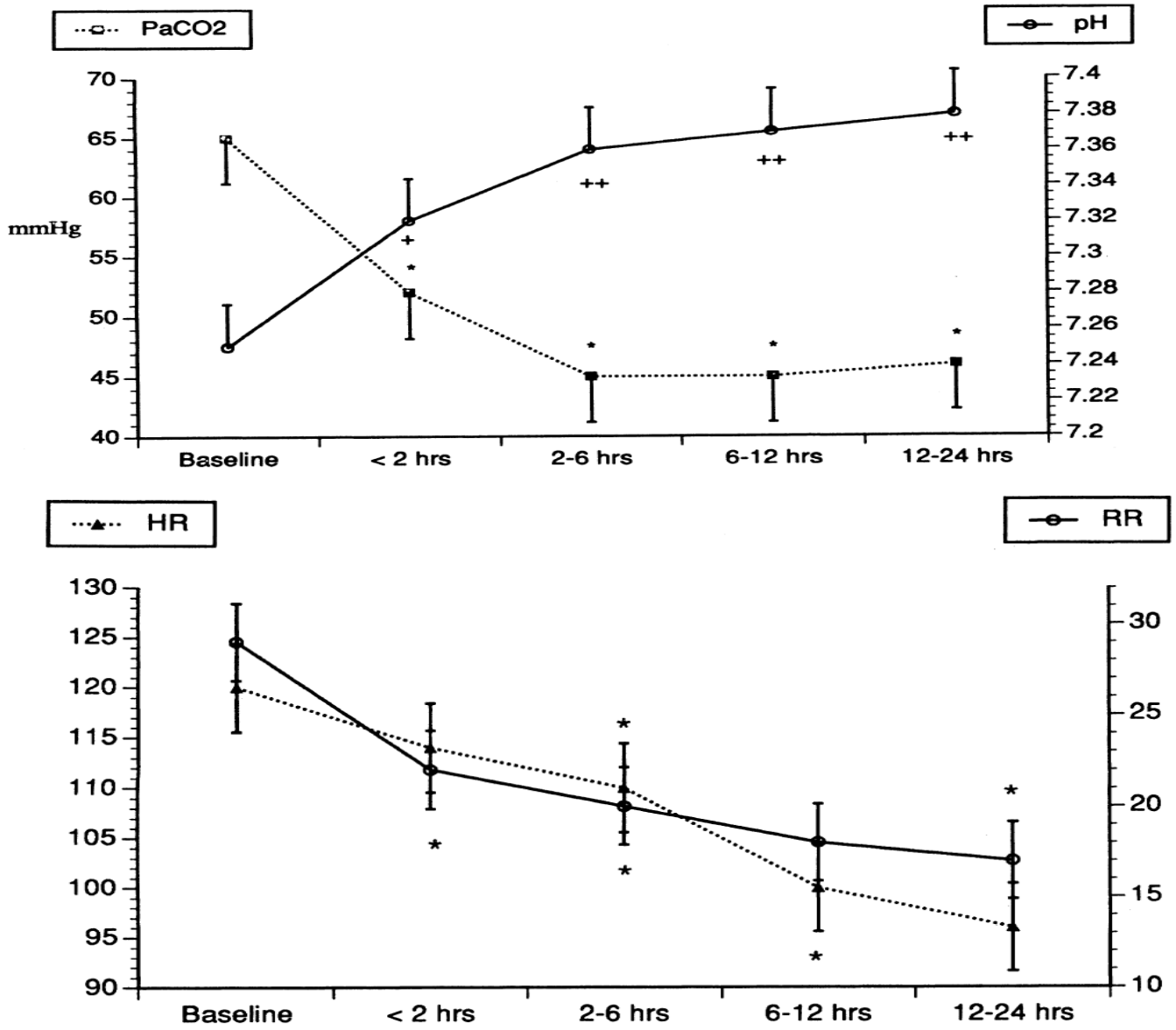
- **“Although evidence on the use of NPPV in patients with hypoxemic respiratory failure is for the most part favorable, further study is needed to establish efficacy and better define ways of identifying which subgroups within this very broad diagnostic category are most likely to benefit”** NIV state of the art. AJRCCM 2001
- **No recommendation for NIV in ALI/ARDS.** Canadian Critical Care Trials Group / Canadian Critical Care Society Noninvasive Ventilation Guidelines Group. Canadian Medical Association Journal 2011

ΜΕΜΑ σε ARDS

- Δεν υπάρχουν τυχαιοποιημένες μελέτες
- Δεν υπάρχουν κατευθυντήριες οδηγίες
- **Σωστή επιλογή ασθενών με ARDS για ΜΕΜΑ**
- **Έμπειρο προσωπικό**
- **Εφαρμογή σε περιβάλλον ΜΕΘ/ΜΑΦ**
- Καμία καθυστέρηση στη διασωλήνωση και εφαρμογή επεμβατικού αερισμού

ΜΕΜΑ στο άσθμα

MEMA σε υπερκαπνική αναπνευστική ανεπάρκεια-ασθματική κρίση



Παραμονή υπερκαπνίας
Μετά 2 ώρες φαρμακευτικής αγωγής

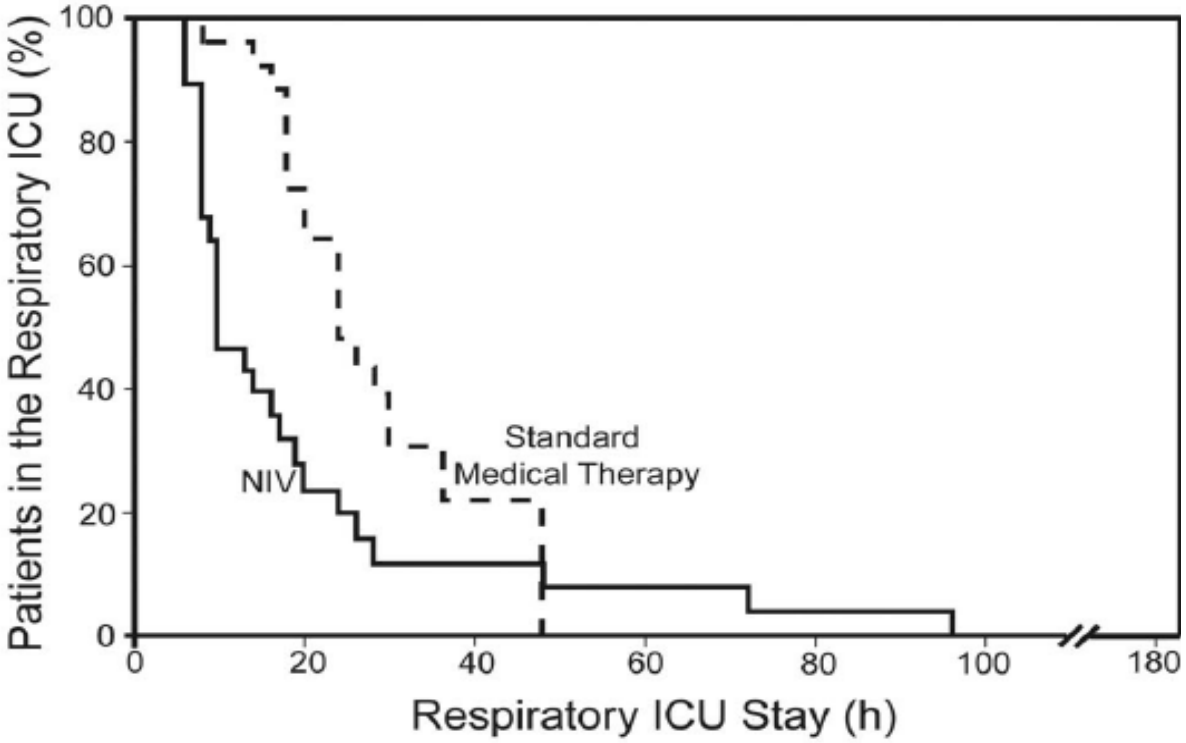
BiPAP 15/5 cmH20
17 ασθενείς

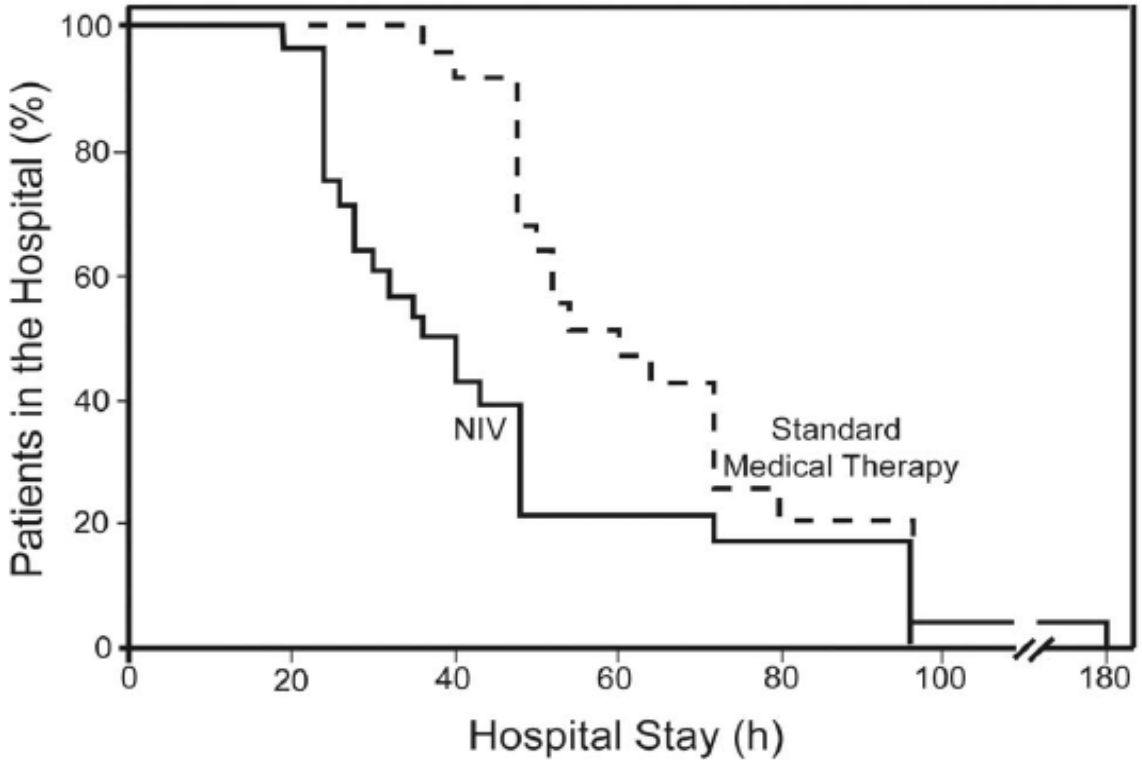
Αποτυχία NIV: 2 patients

Meduri G et al CHEST 1996; 110:767-74

A Prospective Randomized Controlled Trial on the Efficacy of Noninvasive Ventilation in Severe Acute Asthma

Gupta D et al, Respir Care 2010;55(5):536-43





Standard Medical Therapy: n=25
NIV: n=28

	Standard Medical Therapy (n = 25)	NIV (n = 28)	P
Primary Outcomes			
≥ 50% improvement in FEV_1 over baseline (n, %)			
At 1 h	11 (44)	10 (36)	.62
At 2 h	12 (48)	15 (54)	.70
At 4 h	16 (64)	24 (86)	.08
ICU stay (median and IQR h)	24 (18–36)	10 (8–20)	.01
Hospital stay (median and IQR h)	54 (48–72)	38 (24–48)	.01
Secondary Outcomes			
Time to disappearance of accessory muscle use (mean ± SD h)	3.2 ± 1.7	2.3 ± 1.4	.06
Dose of inhaled salbutamol (mean ± SD mg)	42.8 ± 10.4	31.2 ± 14.5	.008
Dose of inhaled ipratropium (mean ± SD mg)	7.6 ± 2.2	5.2 ± 2.8	.007
Failure of primary therapy (n, %)	4 (16)	2 (7)	.35

Gupa et al Respir Care 2010

ΚΑΜΙΑ ΣΥΣΤΑΣΗ ΥΠΕΡ΄Η ΚΑΤΑ ΜΕΜΑ

Αν δοκιμαστεί NIV ο ασθενής πρέπει να παρακολουθείτε στενά (Evidence D).

Όχι σε διεγερτικούς ασθενείς

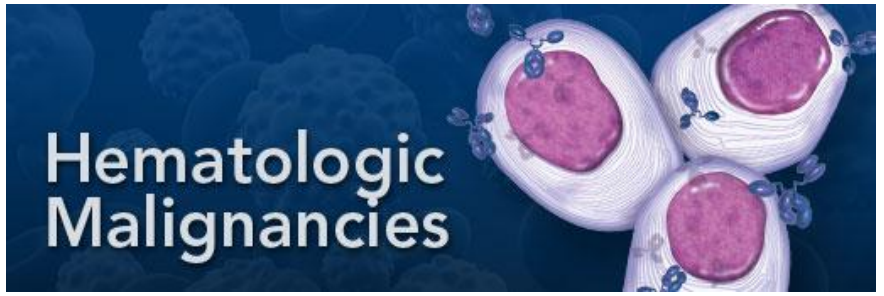
Όχι εφαρμογή καταστολής

BTS/ICS guidelines 2016

- **insufficient evidence to support the use of NIV in AHRF in acute asthma (Level 3)**

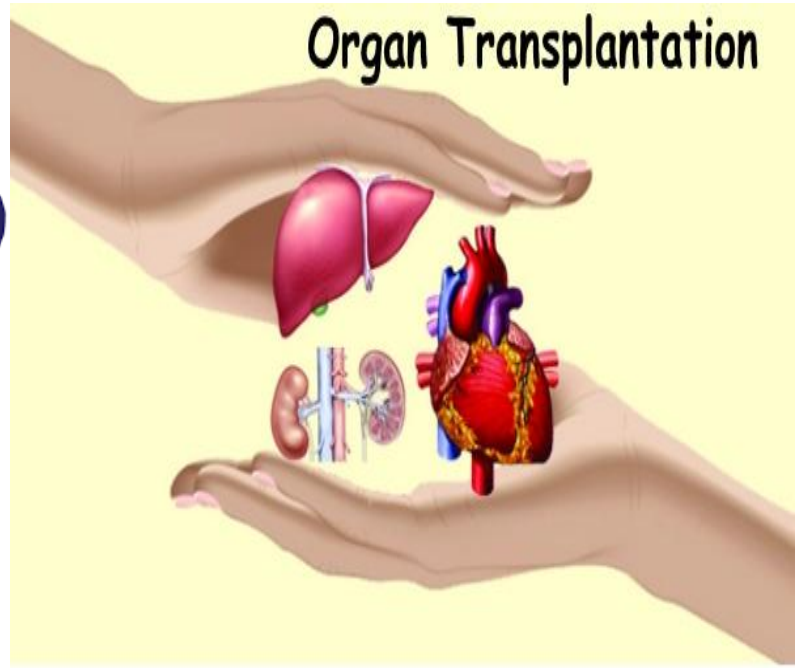
- **IMV in acute asthma carries a very low mortality rate. Most asthma deaths relate to presentation in extremis or a failure to immediately implement IMV when indicated rather than a failure of IMV per se (Level 2+)**
- **NIV should not be used in patients with acute asthma exacerbations and AHRF (Grade C)**
- **Acute (or acute on chronic) episodes of hypercapnia may complicate chronic asthma. This condition closely resembles COPD and should be managed as such (Grade D)**

ΜΕΜΑ σε ανοσοκατεσταλμένους ασθενείς



SURVIVE cancer

HIV



- Αναπνευστική ανεπάρκεια: 1η αιτία εισαγωγής σε ΜΕΘ ασθενών με ανοσοκαταστολή
- Αίτιο αναπνευστικής ανεπάρκειας και επεμβατικός μηχανικός αερισμός: καθορίζουν τη θνητότητα (*Azoulay et al J Clin Oncol 2013*)
- Θετικά αποτελέσματα ΜΕΜΑ σε ανοσοκατεσταλμένους (μείωση ανάγκης για διασωλήνωση, μείωση ενδονοσοκομειακής θνητότητας)

✓ **Improved survival in cancer patients requiring mechanical ventilatory support: impact of noninvasive mechanical ventilatory support.** *Azoulay et al, Crit Care Med 2001*

✓ **Noninvasive ventilation in immunosuppressed patients with pulmonary infiltrates, fever, and acute respiratory failure.** *Hilbert et al, NEJM 2001*

✓ **Noninvasive ventilation for treatment of acute respiratory failure in patients undergoing solid organ transplantation: a randomized trial**. *Antonelli et al JAMA 2000*

- **ΌΜΩΣ……: βελτίωση της επιβίωσης ανοσοκατεσταλμένων ασθενών, τροποποίηση παραμέτρων εφαρμογής μηχανικού αερισμού**

Non-invasive mechanical ventilation in hematology patients with hypoxemic acute respiratory failure: a false belief?

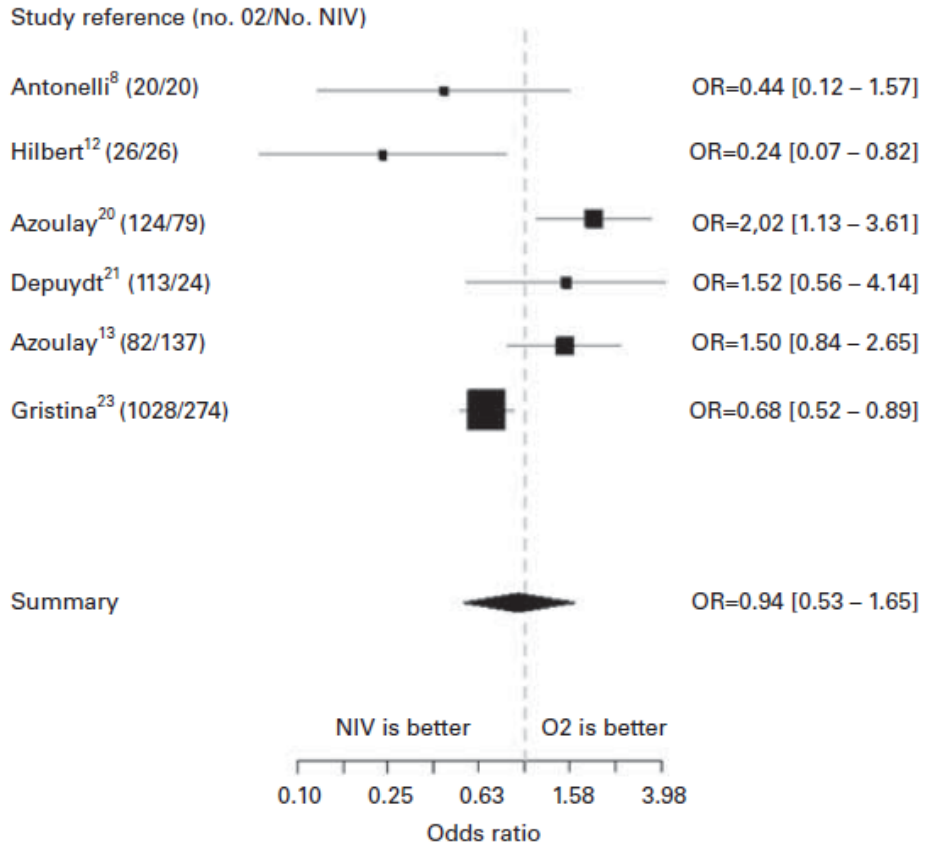


Figure 1 Outcomes associated with the in-ICU use of non-invasive mechanical ventilation in immunocompromized patients. Only cohort

Editorial

NIV in patients with hypoxemic ARF, respiratory distress, failure of oxygen and need for a ventilatory support. These patients should merely be intubated. The same is true for patients with criteria of acute respiratory distress syndrome or associated-organ dysfunction. Early (or prophylactic) NIV will need to demonstrate survival benefits at a time where ICU admission and mechanical ventilation are far from being futile interventions. In such a trial, great care should be taken to undertake appropriate diagnostic tests so as to identify the precise cause of the ARF, which can be a major confounding factor when analysing survival in immunocompromized patients with pulmonary involvement.[12,13]

Conflict of interest

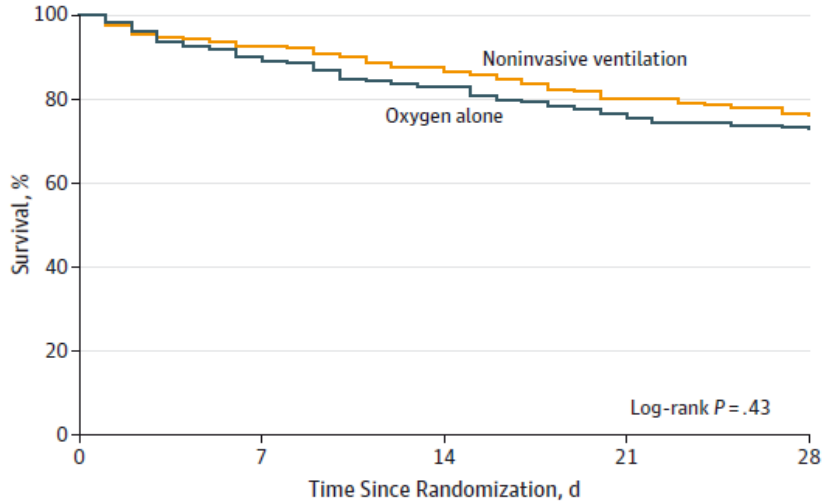
The authors declare no conflict of interest.

Acknowledgements

Azoulay et al Bone Marrow Transplantation 2012

Effect of Noninvasive Ventilation vs Oxygen Therapy on Mortality Among Immunocompromised Patients With Acute Respiratory Failure. A Randomized Clinical Trial.
Lemiale et al JAMA 2015

Figure 2. Probability of Survival at Day 28



No. at risk					
Noninvasive ventilation	191	177	167	153	146
Oxygen alone	183	165	152	140	134

Probability of survival and subgroup analyses of the risk of day-28 mortality Kaplan-Meier estimates of the probability of day-28 mortality in immunocompromised patients with acute respiratory failure receiving either early noninvasive ventilation or oxygen only. Statistical test used the log-rank test.

mortality were 30.9% and 34.4%. Median hospital length of

atelectasis (n = 1).

Lemiale et al JAMA 2015

Table 3. Primary and Secondary End Points

	Oxygen Alone (n = 183)	Noninvasive Ventilation (n = 191)	Absolute Difference (95% CI)	*P* Value
Primary End Point				
All cause 28-d mortality, No. (%)	50 (27.3)	46 (24.1)	−3.2 (−12.1 to 5.6)	.47
Secondary End Points				
Need for invasive mechanical ventilation, No. (%)	82 (44.8)	73 (38.2)	−6.6 (−16.6 to 3.4)	.20
SOFA on day 3, median (IQR)	4 (2-6)	4 (2-5)	−0.5 (−1.2 to 0.3)	.17
ICU-acquired infection, No. (%)	46 (25.1)	48 (25.1)	0 (−8.8 to 8.8)	.99
Length of ICU stay, median (IQR), d	7 (3-16)	6 (3-16)	−0.3 (−3.2 to 2.6)	.55
Duration of mechanical ventilation, median (IQR), d	14 (6-33)	17 (6-38)	0.3 (−5.7 to 6.3)	.70
Length of hospital stay, median (IQR), d	22 (14-42)	24 (12-43)	0.3 (−5 to 5.5)	.99
Mortality at 6 mo, No. (%)[a]	82/181 (45.3)	72/182 (39.6)	−5.7 (−16.4 to 3.9)	.23
Good performance status in 6-mo survivors, No. (%)[b]	70/75 (93.3)	85/91 (93.4)	−0.1 (−7.7 to 7.5)	.98

Abbreviations: ICU, intensive care unit; IQR, interquartile range; SOFA, Sequential Organ Failure Assessment score.

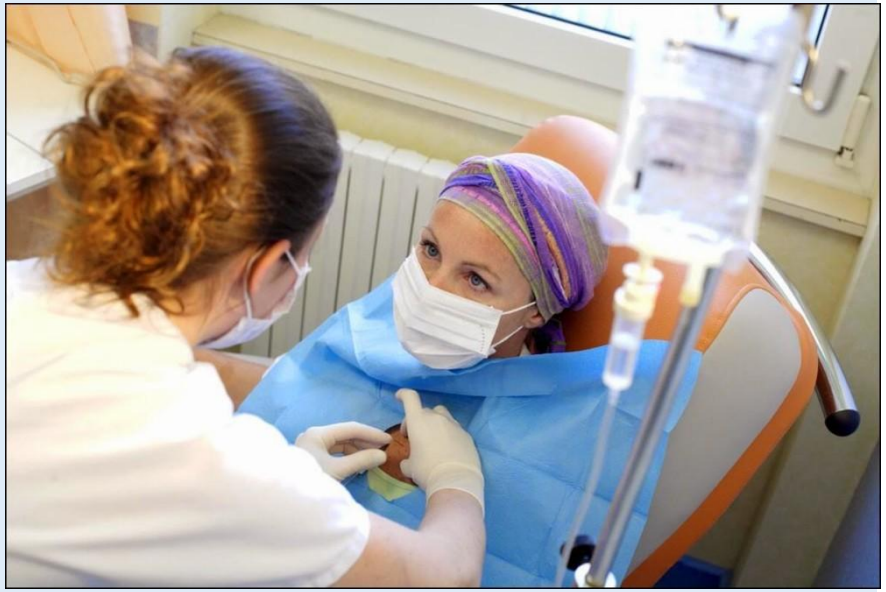
[a] Lost to follow-up: n = 2 (oxygen group), n = 9 (noninvasive ventilation group).

[b] Missing data: n = 24 (oxygen group), n = 19 (noninvasive ventilation group).

Need for mechanical ventilation was based on clinical response to oxygen or noninvasive ventilation, clinical status (including peripheral capillary oxygen saturation (Spo_2), respiratory rate, signs of respiratory distress, and bronchial secretion volume), and patient's adherence to noninvasive ventilation. Criteria for mechanical ventilation were severe hemodynamic instability (norepinephrine or epinephrine >0.3 µg/Kg/min) or cardiorespiratory arrest or ongoing myocardial infarction, severe encephalopathy (Glasgow Coma Scale score <11), severe airway secretion retention or worsening of respiratory distress (Spo2 < 92% or respiratory rate >40/min regardless of the oxygen flow rate or use of accessory muscles of respiration), inability to maintain Pao_2 greater than 65 mm Hg with fraction of inspired oxygen greater than 0.6 or dependency on noninvasive ventilation with inability to remain off noninvasive ventilation for longer than 2 h, greater than 50% increase in the time on noninvasive ventilation from one day to the next (eg, 6 hours of noninvasive ventilation on day 1, then >9 hours on day 2)

ΜΕΜΑ σε ανοσοκατεσταλμένους ασθενείς

- **ΜΕΜΑ δεν φαίνεται να μειώνει τη θνητότητα ή τη συχνότητα διασωλήνωσης σε ανοσοκατεσταλμένους ασθενείς σε σχέση με την οξυγονοθεραπεία**
- **Επιλογή ασθενών για εφαρμογή ΜΕΜΑ**
- **Σε περιβάλλον ΜΕΘ/ΜΑΦ**
- **Έμπειρο προσωπικό**
- **Να μην καθυστερεί η διασωλήνωση**



- **Μεγαλύτερο όφελος από την εφαρμογή High Flow Oxygen?**

The NEW ENGLAND JOURNAL of MEDICINE

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*

NEJM 2008;359:142-51.

CONCLUSIONS

In patients with acute cardiogenic pulmonary edema, noninvasive ventilation induces a more rapid improvement in respiratory distress and metabolic disturbance than does standard oxygen therapy but has no effect on short-term mortality. (Current Controlled Trials number, ISRCTN07448447.)

NIV application in palliative care (Do not intubate-DNI)

Acute setting

- Ameliorate breathing pattern
- Reduce dyspnoea
- Reduce respiratory muscle efforts
- Relieve the sensation of "hunger for air"
- Ameliorate sleep
- Give time to say goodbye to loved ones or make final arrangements
- Minimise the effects of opiates


THEORY
INTO
PRACTICE


START

Πού εφαρμόζεται ο ΜΕΜΑ?

ΜΕΘ/ΜΑΦ

ΤΕΠ????

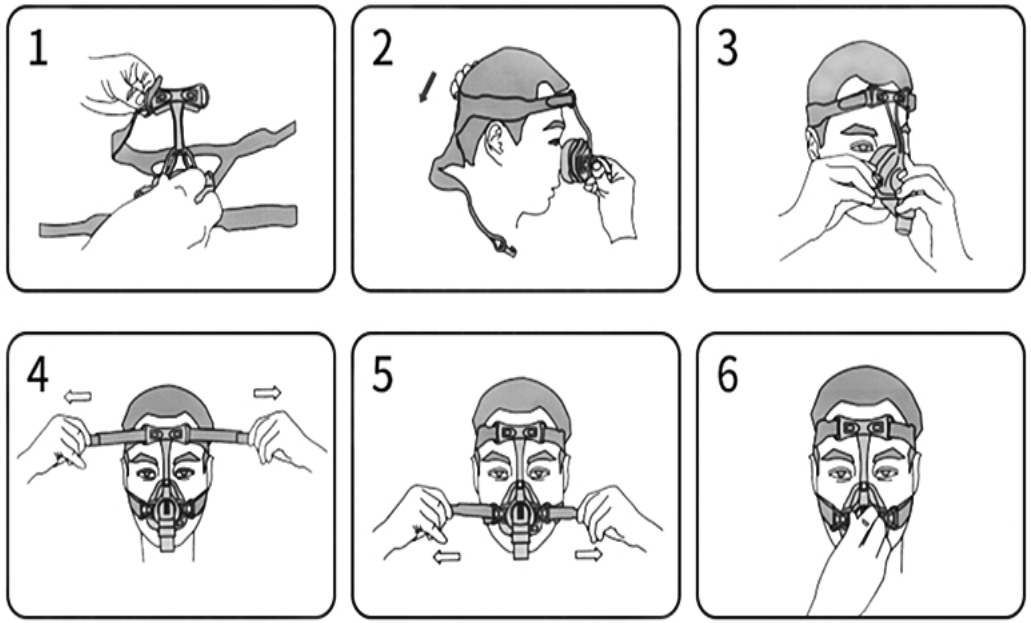
Κοινός θάλαμος

ΜΕΜΑ στο ΤΕΠ???

- Περισσότερες μελέτες βασίζονται σε εφαρμογή ΜΕΜΑ σε ΜΕΘ/ΜΑΦ
- Αποτελεσματικότητα ΜΕΜΑ όταν εφαρμόζεται σε κοινό θάλαμο
- Πολλές αναφορές για ΜΕΜΑ σε ΤΕΠ από ειδική ομάδα (Medical Emergency Team-MET: ιατρός, νοσηλευτής ΜΕΘ, respiratory physiotherapist)
- Ιδιαιτερότητες στη λειτουργία του νοσοκομείου (αυτόνομο ΤΕΠ?, βραχεία νοσηλεία?)
- Παρακολούθηση-ασφάλεια ασθενούς

Εφαρμογή ΜΕΜΑ

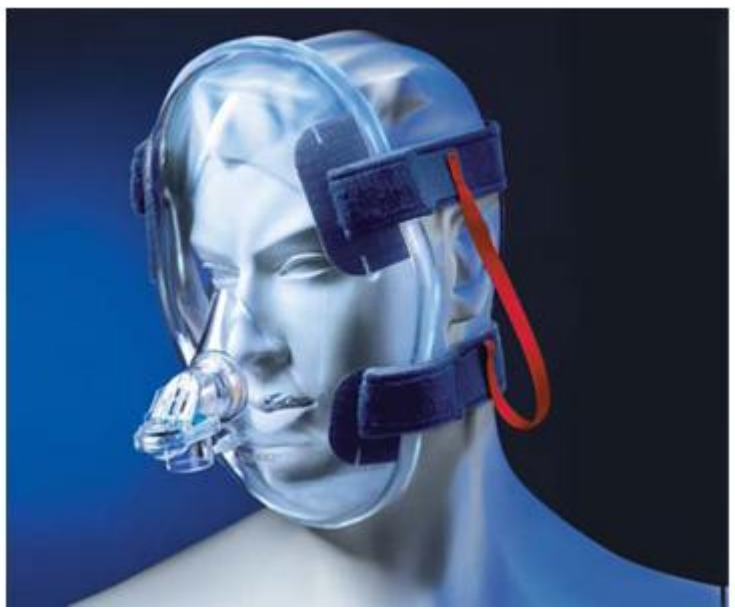
Ασθενής σε καθιστή θέση (30-45°)
Εφαρμογή μάσκας (μέγεθος!!!!!)
Εφαρμογή ιμάντων



nasal pillows

nasal mask

oronasal mask

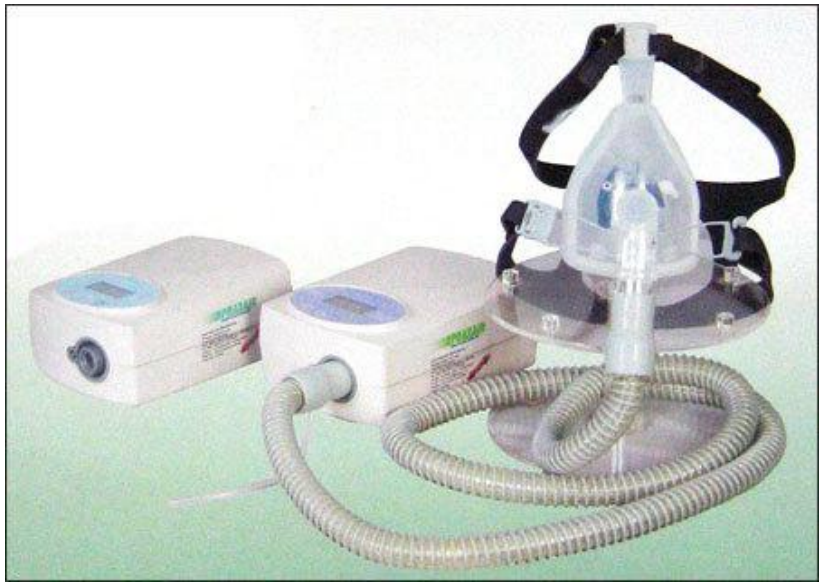


full-face mask

helmet

Έναρξη ΜΕΜΑ

- Χαμηλές πιέσεις
- Ρύθμιση EPAP και IPAP ανάλογα με
  - Άνεση ασθενούς
  - Μείωση μυϊκής κόπωσης
  - Ποιότητα αερισμού
- Αναζήτηση και διόρθωση διαρροών!
- Εξασφάλιση συνεργασίας ασθενούς-αναπνευστήρα
- **Take time**



NIV SETUP

BTS/ICS guidelines 2016

Mask

Full face mask (or own if home user of NIV)

Initial Pressure settings

EPAP: 3 (or higher if OSA known/expected)

IPAP in COPD/OHS/KS 15 (20 if pH <7.25)

Up titrate IPAP over 10-30 mins to IPAP 20—30 to achieve adequate augmentation of chest/abdo movement and slow RR

IPAP should not exceed 30 or EPAP 8* without expert review

IPAP in NM 10 (or 5 above usual setting)

Backup rate

Backup Rate of 16-20. Set appropriate inspiratory time

I:E ratio

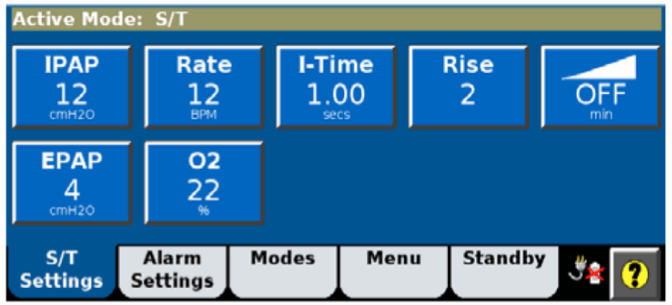
COPD 1:2 to 1.3
OHS, NM & CWD 1:1

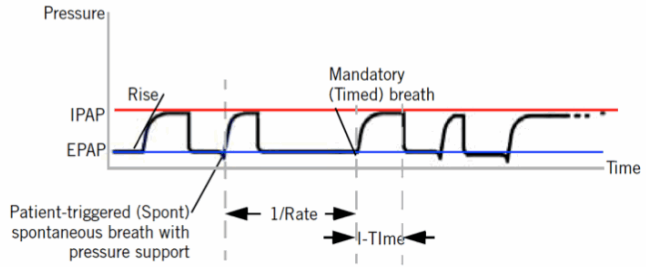
Inspiratory time

0.8-1.2s COPD
1.2-1.5s OHS, NM & CWD

Use NIV for as much time as possible in 1st 24hours.
Taper depending on tolerance & ABGs over next 48-72 hours

SEEK AND TREAT REVERSIBLE CAUSES OF AHRF



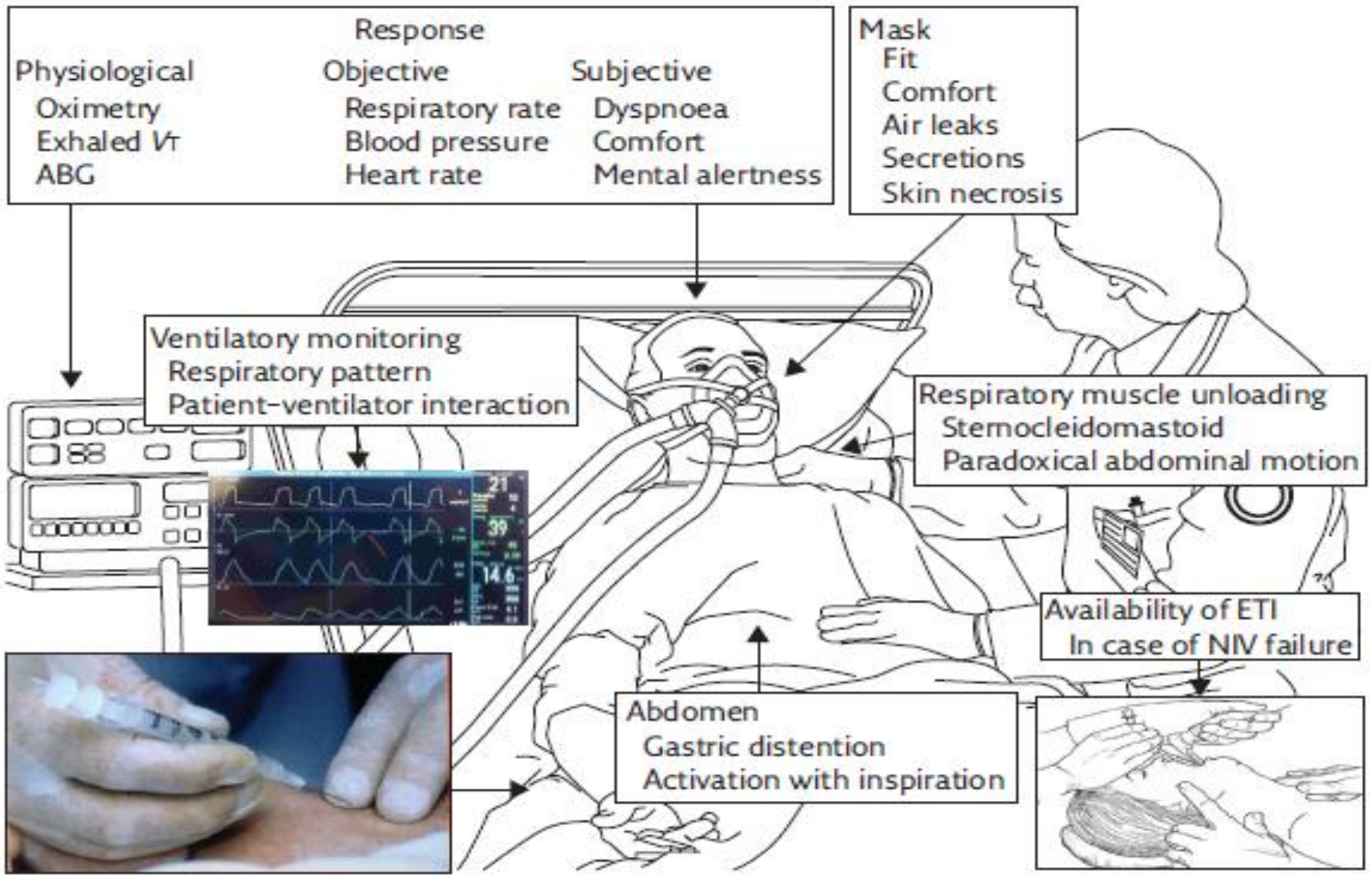


http://static.medonecapital.com/manuals/userManuals/Respironics-V60-Users-Manual.pdf

* Possible need for EPAP > 8

Severe OHS (BMI >35), lung recruitment eg hypoxia in severe kyphoscolios, oppose intrinsic PEEP in severe airflow obstruction or to maintain adequate PS when high EPAP required

MONITORING


Response
Physiological
Oximetry
Exhaled VT
ABG
Objective
Respiratory rate
Blood pressure
Heart rate
Subjective
Dyspnoea
Comfort
Mental alertness
Mask
Fit
Comfort
Air leaks
Secretions
Skin necrosis
Ventilatory monitoring
Respiratory pattern
Patient–ventilator interaction
Respiratory muscle unloading
Sternocleidomastoid
Paradoxical abdominal motion
Availability of ETI
In case of NIV failure
Abdomen
Gastric distention
Activation with inspiration

Monitoring during NIV

BTS/ICS guidelines 2016

- **Oxygen saturation** should be **continuously** monitored.
- **Intermittent measurement of pCO_2 and pH** is required.
- **ECG, pulse rate and noninvasive blood pressure** (cardiovascular complications related with NIV failure)
- **Respiratory rate (predictor of NIV outcome)**
- **Bedside evaluation (patient)**
- **Leaks**

NIV Monitoring

Oxygenation

Aim 88-92% in all patients

Note: Home style ventilators CANNOT provide > 50% inspired oxygen.

If high oxygen need or rapid desaturation on disconnection from NIV consider IMV.

Red flags

pH <7.25 on optimal NIV
RR persisting > 25
New onset confusion or patient distress

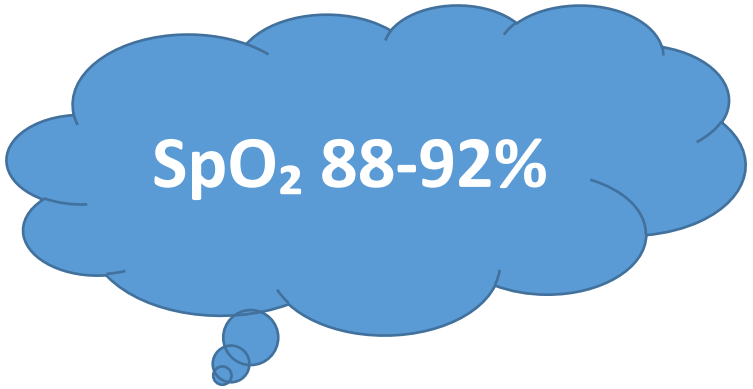
Actions

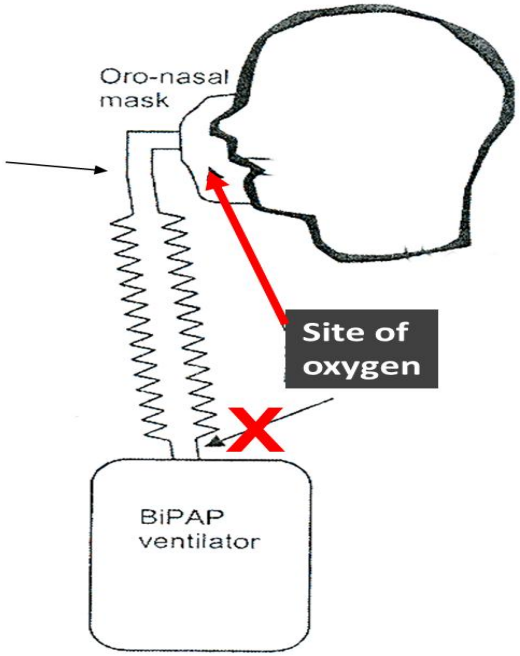
Check synchronisation, mask fit, exhalation port : give physiotherapy/bronchodilators, consider anxiolytic

CONSIDER IMV

Supplemental oxygen therapy with NIV

In the absence of harm from modest hypoxaemia
saturation range of 88–92% is recommended in all patients with AHRF either spontaneously breathing or when receiving NIV



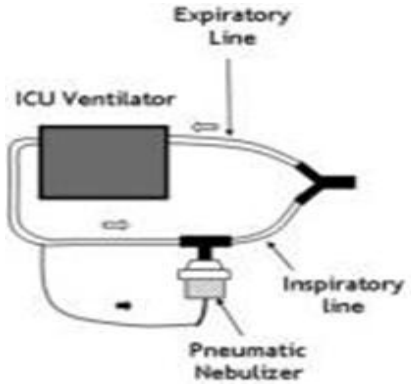


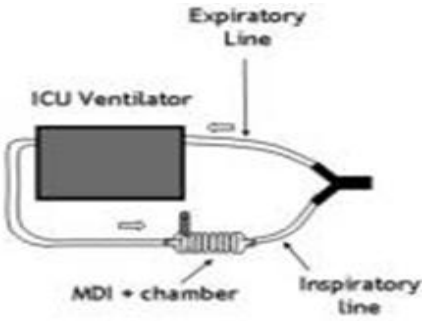
- ❑ Oxygen enrichment should adjusted to achieve **SaO2 88– 92%** in all causes of AHRF being treated by NIV **(Grade A**)
- ❑ Oxygen should be entrained **as close to the patient as possible** **(Grade C**)

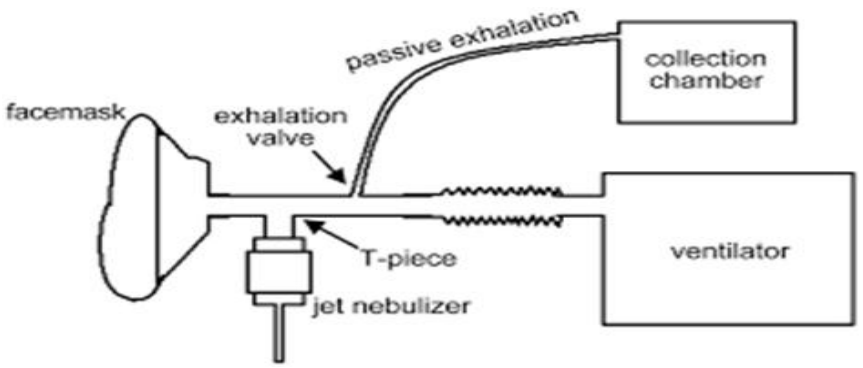
Bronchodilator therapy with NIV

Nebulized drugs should normally be administered during breaks from NIV
(Mukhopadhyay A,et al J Crit Care 2009;24:474.e1–5)

- If the patient is dependent on NIV, bronchodilator drugs can be given via a nebulizer inserted into the ventilator tubing.







Humidification with NIV

- Humidification is not routinely required (Grade D).

Heated humidification should be considered if the patient reports mucosal dryness or if respiratory secretions are thick and tenacious

Sedation with NIV

Recommendations

- **Sedation should ONLY be used with close monitoring** (Grade D).
- **Infused sedative/anxiolytic drugs should only be used in an HDU or ICU setting** (Grade D).
- **If intubation is NOT intended should NIV fail, then sedation/anxiolysis is indicated for symptom control in the distressed or agitated patient** (Grade D).

Good practice point

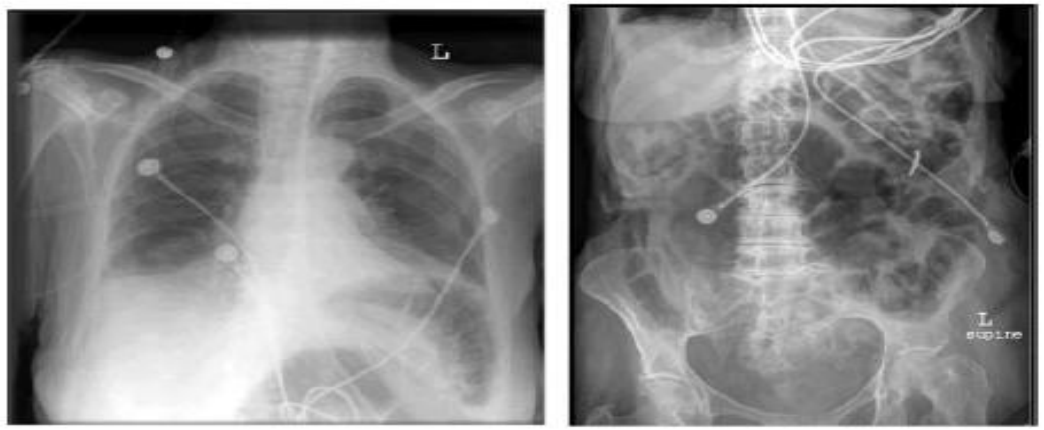
- In the agitated/distressed and/or tachypnoeic individual on NIV, **intravenous morphine 2.5–5 mg (± benzodiazepine)** may provide symptom relief and may improve tolerance of NIV.

Επιπλοκές ΜΕΜΑ

NIV complications

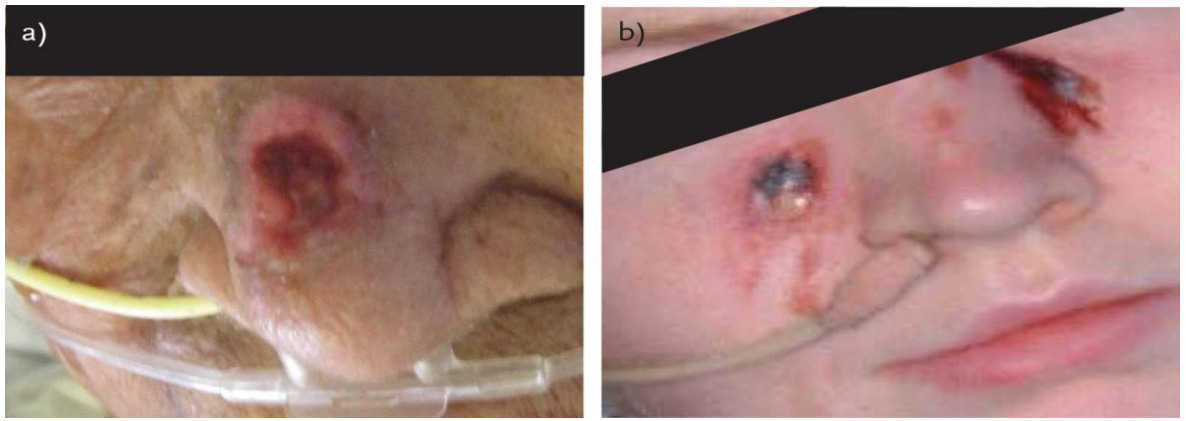
- Nasal bridge ulceration
- gastric distension
- Sinus or ear discomfort
- nasal mucosal congestion or drying/ulceration
- acute pneumothorax

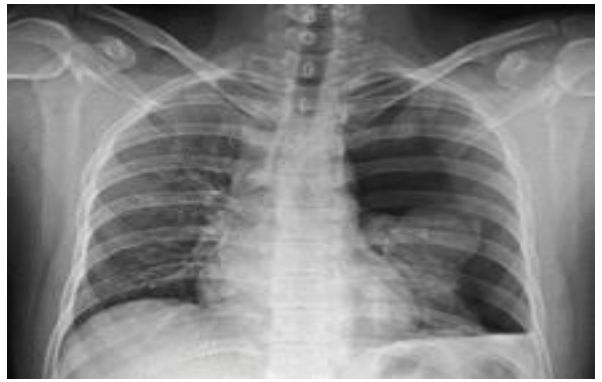
gastric distension



pneumothorax

Nasal bridge ulceration





Good practice points

- ✓ **Minor complications are common but those of a serious nature are rare**
- ✓ Care is needed to avoid **overtightening of masks**
- ✓ Previous episodes of ventilator-associated pneumothorax warrant consideration of admission to HDU/ICU and use of NIV at lower than normal inspiratory pressures
- ✓ The development of a **pneumothorax** usually requires intercostal **drainage and review of whether to continue with NIV**

Take home messages (1)

- Αποτελεσματικότητα ΜΕΜΑ σε **υπερκαπνική αναπνευστική ανεπάρκεια λόγω ΧΑΠ** και **πρέπει να εφαρμόζεται αν pH< 7.35 και $PaCO_2$>49mmHg** παρά τη φαρμακευτική αγωγή
- Να εφαρμόζεται σε υπερκαπνική αναπνευστική ανεπάρκεια λόγω NMD/CWD, OHS
- Ανεπαρκείς ενδείξεις για ARDS, άσθμα, ανοσοκατεσταλμένους
- Λίγες οι απόλυτες αντενδείξεις
- Οι **σχετικές αντενδείξεις δεν αποκλείουν την εφαρμογή ΜΕΜΑ** υπό προϋποθέσεις (ετοιμότητα για διασωλήνωση, monitoring, περιβάλλον ΜΕΘ/ΜΑΦ)

Take home messages (2)

- Σωστή εφαρμογή ΜΕΜΑ (μέγεθος μάσκας, θέση ασθενούς, παράμετροι αναπνευστήρα)
- **Σημαντικό το monitoring** (περιβάλλον, κλινική εικόνα, ζωτικά σημεία, ABGs, αναπνευστήρας….)
- Στόχος: SpO_2 88-92% (σε ΑΑ ΙΙ)
- Επαγρύπνηση για διασωλήνωση και εφαρμογή επεμβατικού μηχανικού αερισμού (επιδείνωση κλινικής εικόνας, δυσανεξία ΜΕΜΑ, επίπεδο επικοινωνίας, εμμένουσα υπερκαπνία και οξέωση, καρδιαγγειακά συμβάματα, σοβαρή υποξαιμία,…..)
- Λίγες οι σοβαρές επιπλοκές

Ευχαριστώ