INDICAZIONI ALLA NIV

D.ssa A. Zito
Malattie dell'Apparato Respiratorio
Area di Geriatria
Direttore: Prof. R. Antonelli Incalzi

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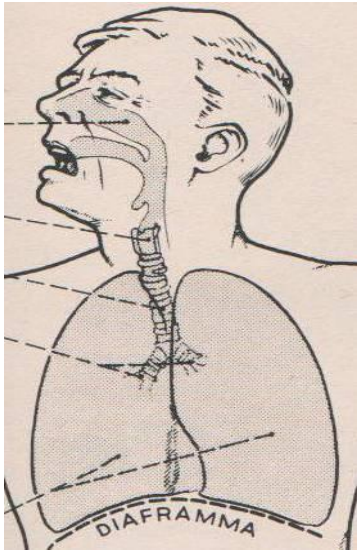
Lo scopo della respirazione è rifornire il sangue di O2 e rimuovere CO2

(processo di ventilazione).

O2

CO2



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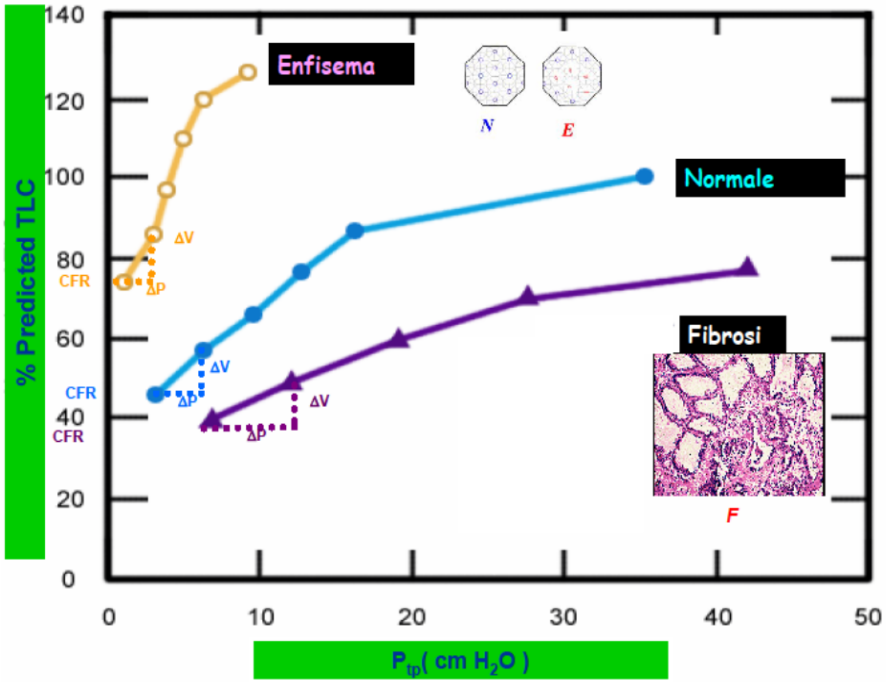
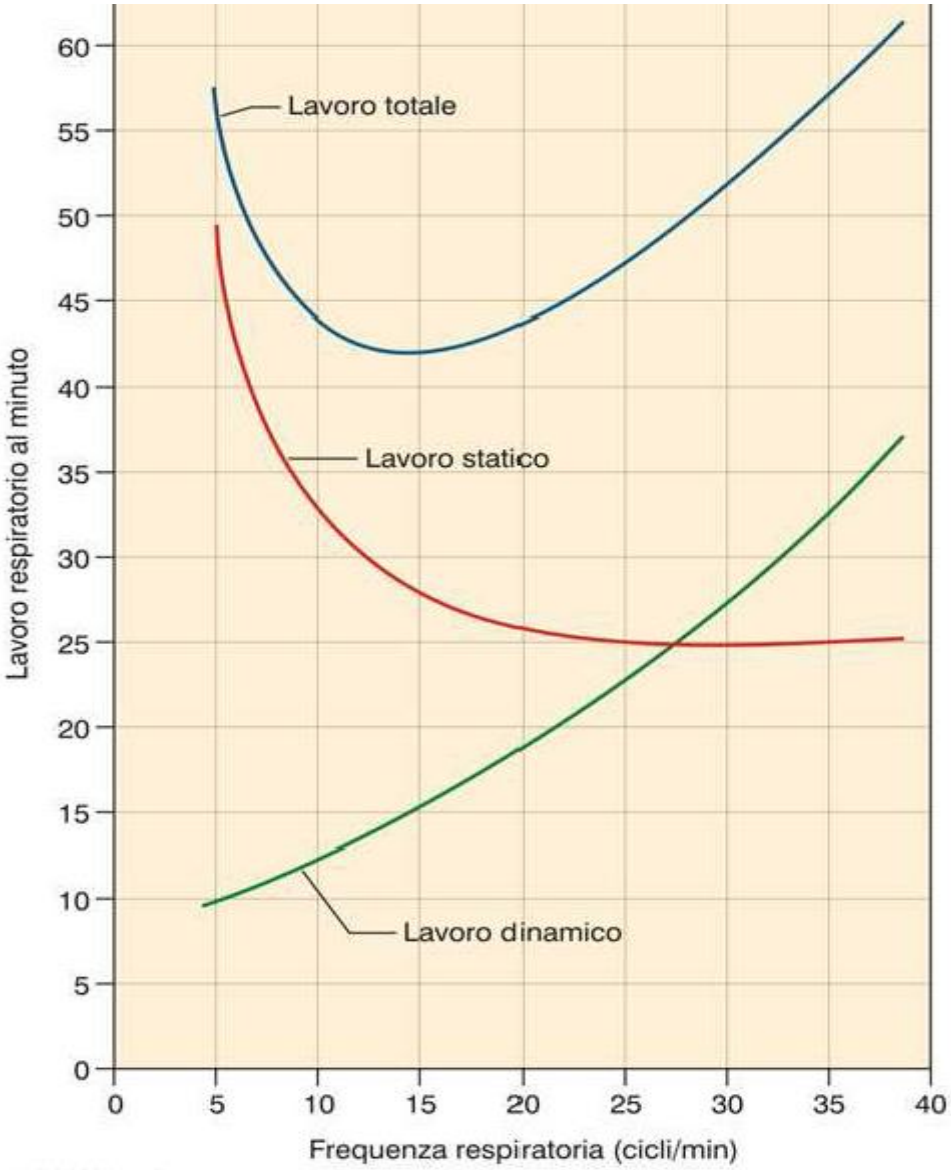
LAVORO RESPIRATORIO

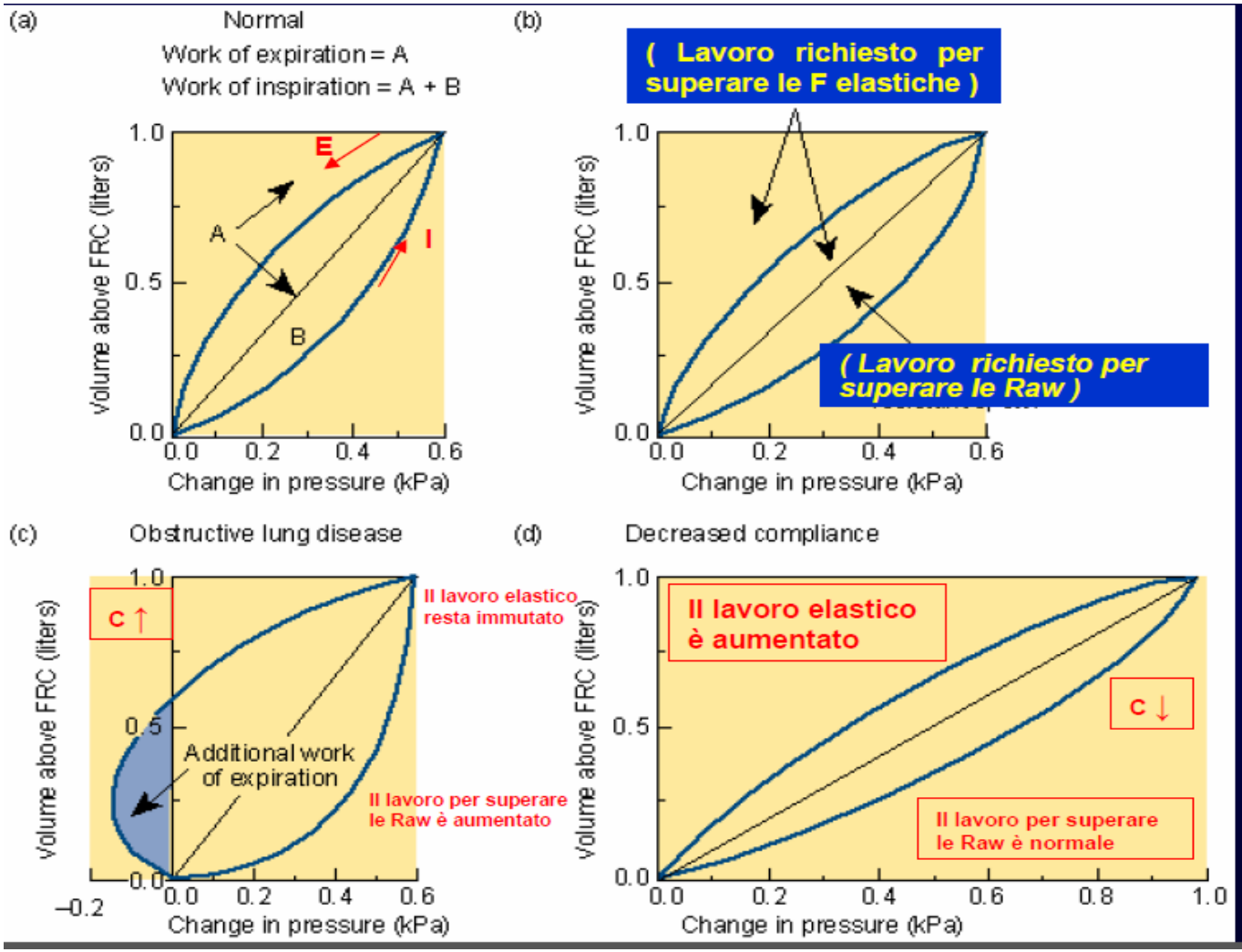
Quantità di energia spesa nella respirazione dipende da:

- **Frequenza, profondità del respiro e resistenza al flusso aereo che determinano il lavoro dinamico (aumenta in caso di secrezioni/broncospasmo)**
- **facilità con cui polmoni e gabbia toracica si espandono che determinano il lavoro elastico (compliance)**





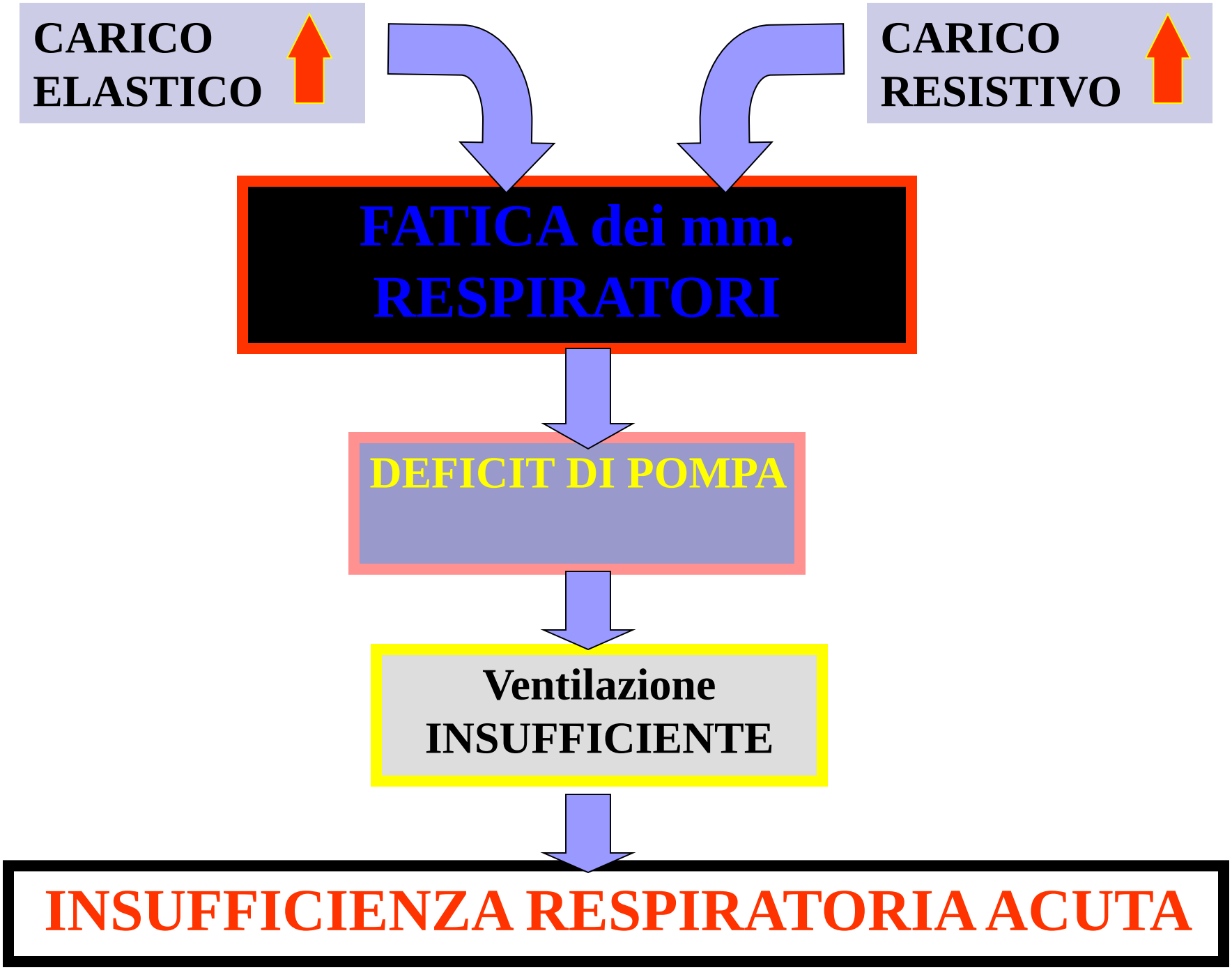
Quindi...



Misure dinamiche di pressione – volume per valutare il lavoro che si compie nel polmone durante la respirazione

L = P x Δ V

Il lavoro può essere determinato dall'area di un circuito dinamico di P-V

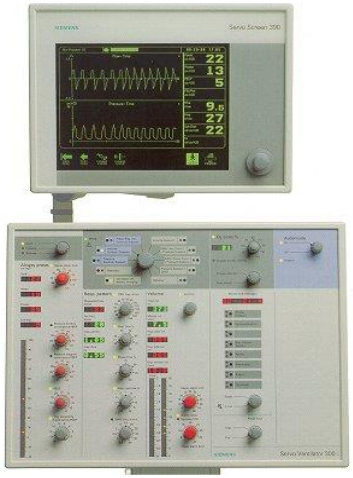

CARICO ELASTICO
CARICO RESISTIVO
FATICA dei mm. RESPIRATORI
DEFICIT DI POMPA
Ventilazione INSUFFICIENTE
INSUFFICIENZA RESPIRATORIA ACUTA

Cos’è un ventilatore?

Un **ventilatore meccanico** è un apparecchio che insuffla aria all’interno di un polmone generando un incremento di volume.

Si sostituisce in parte o completamente all’azione dei muscoli respiratori la cui efficacia può essere alterata per patologia primitiva o secondaria alle alterazioni della meccanica polmonare ed ha quindi fra i suoi scopi quello di alleviare la fatica muscolare

PROVVEDIMENTO TERAPEUTICO CHE **NON SOSTITUISCE LA TERAPIA FARMACOLOGICA**



Medical Progress

Advances in Mechanical Ventilation

Martin J. Tobin, M.D.

N Engl J Med, Vol. 344, No. 26 · June 28, 2001

The objectives of mechanical ventilation are primarily to decrease the work of breathing and reverse life-threatening hypoxemia or acute progressive respiratory acidosis.

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La ventilazione meccanica non invasiva

Si effettua attraverso maschere nasali, oro-nasali, olive nasali, full face, casco

Quando la NIV….

BTS/ICS guideline for the ventilatory management of acute hypercapnic respiratory failure in adults

A Craig Davidson,[1] Stephen Banham,[1] Mark Elliott,[2] Daniel Kennedy,[3] Colin Gelder,[4] Alastair Glossop,[5] Alistair Colin Church,[6] Ben Creagh-Brown,[7] James William Dodd,[8,9] Tim Felton,[10] Bernard Foëx,[11] Leigh Mansfield,[12] Lynn McDonnell,[13] Robert Parker,[14] Caroline Marie Patterson,[15] Milind Sovani,[16] Lynn Thomas,[17] BTS Standards of Care Committee Member, British Thoracic Society/Intensive Care Society Acute Hypercapnic Respiratory Failure Guideline Development Group, On behalf of the British Thoracic Society Standards of Care Committee

- pH <7.35
- pCO2 >48 mmHg,

NB nonostante broncodilatazione ottimale e ossigenoterapia controllata (SO2 compresa fra 88-92%)

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ed ancora ….

- **Tachipnea**
- **Dispnea ingravescente con uso evidente dei mm accessori e/o dissincronismo toraco-addominale**
- **Ipossiemia nonostante la somministrazione di ossigeno ad elevate concentrazioni (PAO2/FiO2 < a 200)**
- **Pazienti in cui il ricorso alla ventilazione invasiva non e' disponibile o indicato (tumori in fase terminale, età molto avanzata) oppure pazienti che rifiutano l'intubazione.**

Sangeeta Mehta and Hill N.S., Non Invasive Ventilation AJRCCM 2001,163; 540-577

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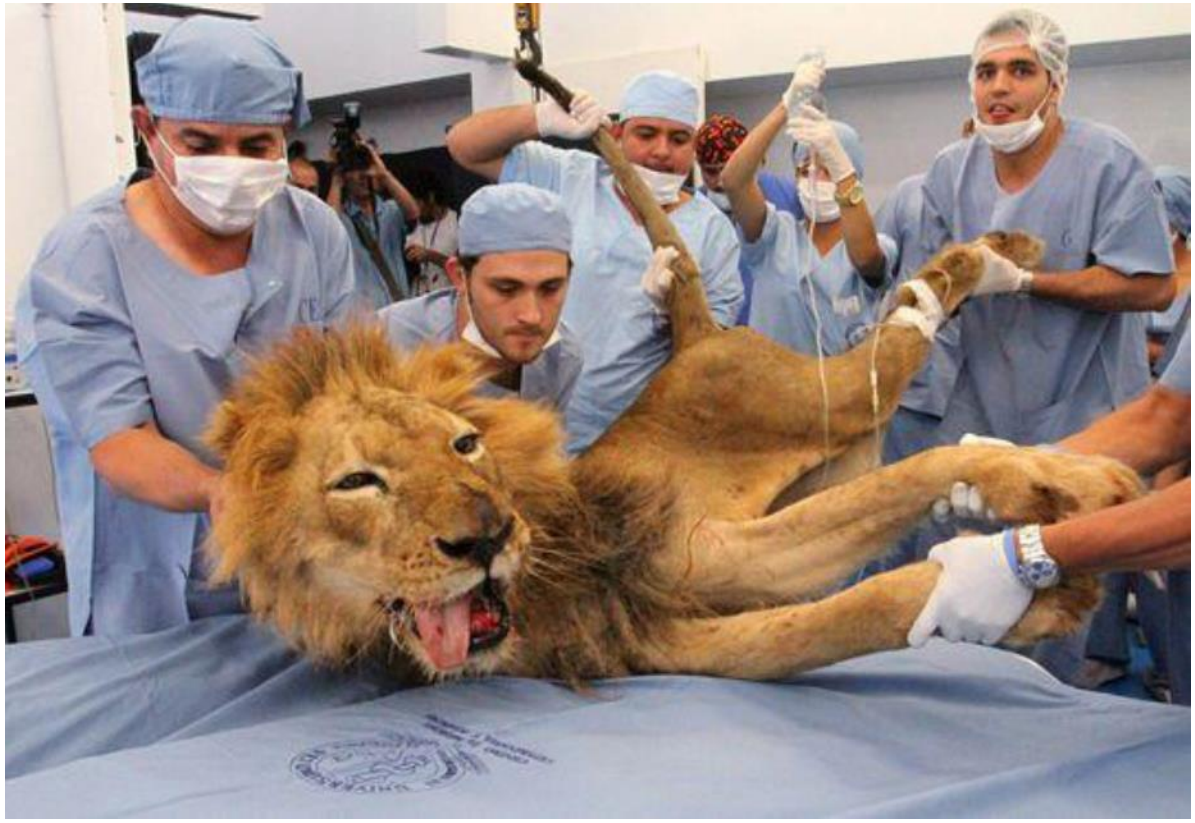
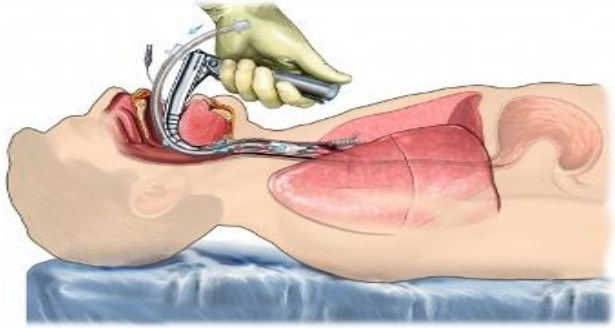
Richiede collaborazione del paziente ….



Quando non iniziare la NIV ed intubare il paziente



- **Instabilità cardio-vascolare nonostante la somministrazione di inotropi(aritmie minacciose per la vita , PAsistolica <70 mmHg)**
- **Arresto cardio-respiratorio**
- **Coma soprattutto se non ipercapnico**
- **Clearance delle secrezioni bronchiali inefficace**
- **Necessità di proteggere le vie aeree**
- **Ostruzione delle vie aeree superiori**
- **PNX non drenato**

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Vantaggi della NIV

- Precoce supporto ventilatorio
- Facilità di applicazione e rimozione
- Applicazione intermittente
- Possibilità di sospensione in qualsiasi momento
- Conservazione dei meccanismi di difesa delle vie respiratorie
- Il pz può bere, mangiare e comunicare
- Il pz può collaborare ed effettuare fisioterapia
- Riduce la necessità di sedazione

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Complicanze della NIV

Segni e sintomi	Possibili cause
• Discomfort al contatto della pelle o guasto dell'interfaccia	Eccessiva pressione Frizione, reazione o irritazione della pelle
• Distensione gastrica, aspirazione e vomito	Deglutizione di aria Scarso adattamento Eccessiva insufflazione Mangiare o bere in prossimità della NIV
•Crampi, sensazione di formicolio	iperventilazione che causa alcalosi respiratoria
•Difficoltà a dormire	Ansia
•Claustrofobia	Ventilazione inadeguata
✓Abrasione nasale, secchezza, congestione e riniti	✓Aria secca esalata dalla macchina
✓Irritazione oculare, congiuntivite	✓Perdite aeree intorno alla maschera
✓Otalgia e/o sinusite	✓Pressione eccessiva della macchina
✓Dispnea atipica	✓Perdita di pressione di supporto e riduzione Vt
✓Dolore dentale	✓Pressione esercitata dalla maschera buccale
✓Dolore toracico, dispnea	✓Possibile pneumotorace

Knebel A. et al. Heart Lung 1997;26:307-316

Cosa idealmente mi aspetto ad 1 ora

- **FR < 30/minuto**
- **Distress respiratorio: riduzione della dispnea, riduzione del reclutamento della muscolatura accessoria**
- **Sensorio: miglioramento o stabilità**
- **Sp02 > 90%**
- **Pa02/FiO2: miglioramento di 100**
- **Miglioramento del pH rispetto al basale**
- **PaCO2 riduzione del 20% rispetto al basale**

sospendere se :

se dopo 1-2 h: $SaO_2 < 90\%$, $PaO_2 < 60$ mm Hg, pH < 7,30, P/F < 180, FR > 30/m

- Peggioramento livello di vigilanza
- Agitazione psicomotoria
- Instabilità emodinamica
- MOF
- Vomito
- Incapacità di gestire le secrezioni
- Intolleranza dell’interfaccia
- Peggioramento in 1-2 h o mancato miglioramento in 4-6 ore

Chi ventilo in caso di insufficienza respiratoria acuta ?

- BPCO riacutizzata
- Edema polmonare acuto
- Scompenso acuto in paziente con sindrome da ipoventilazione da ogni causa
- Attacco asmatico acuto non responsivo a terapia medica
- Polmoniti acquisite in comunità soprattutto nel BPCO , e nell'immunodepresso
- Acute lung injury- ARDS
- Svezzamento dalla ventilazione invasiva
- Trauma toracico
- Malati sottoposti a chirurgia

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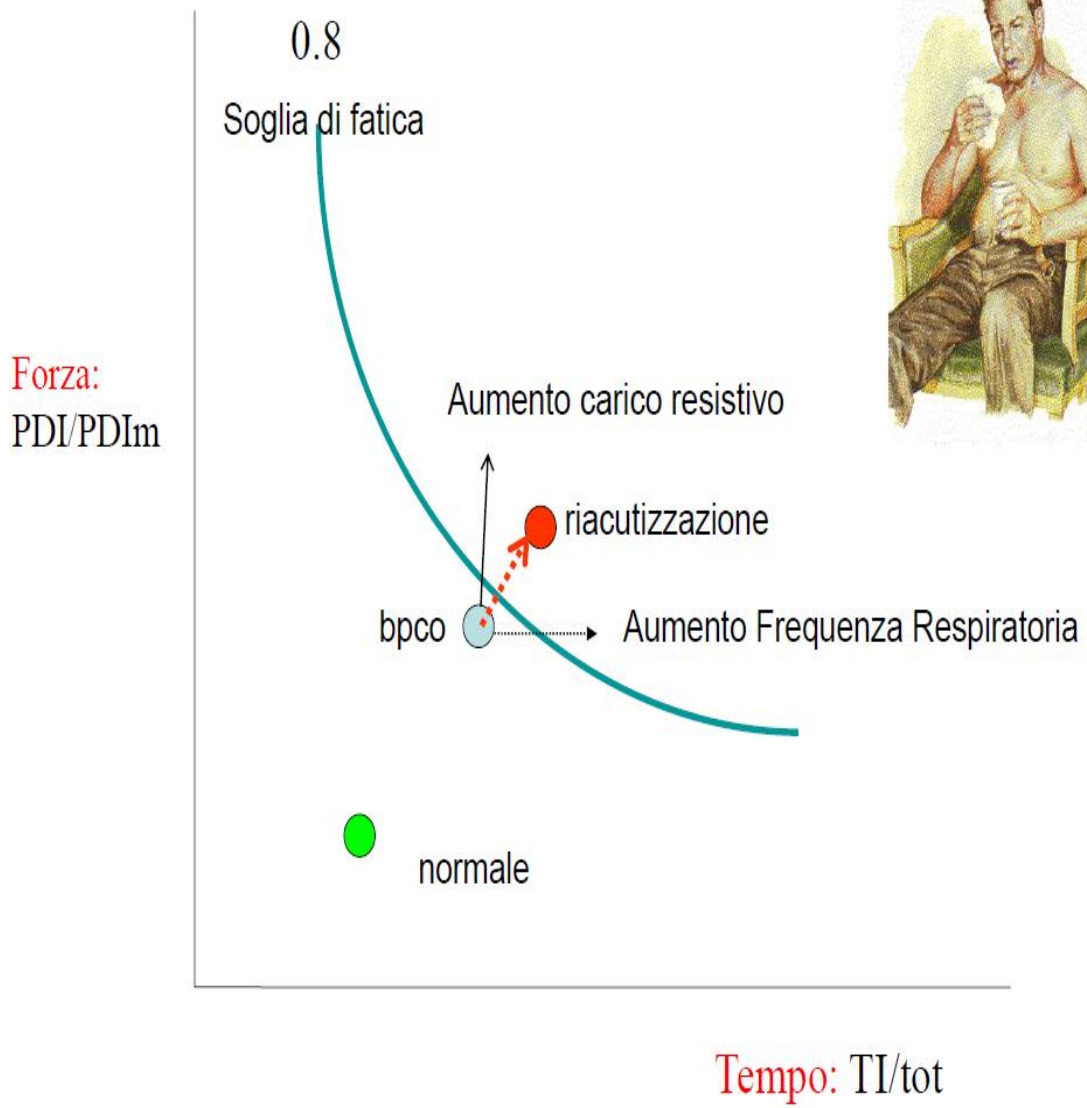
Razionale della NIV nella BPCO riacutizzata



<u>Concetto di livello soglia di fatica muscolare respiratoria</u> : Condizione caratterizzata dalla incapacità di un muscolo di sviluppare forza o velocità e/o forza contrattile in seguito ad aumentato carico di lavoro, reversibile con il riposo.

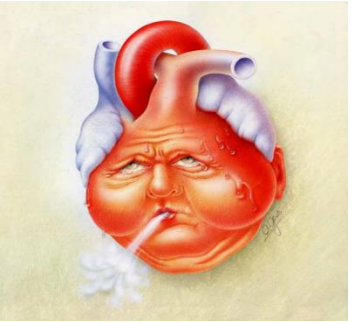
Nella BPCO la NIV è una certezza:

- evita l'intubazione e le sue complicanze ,

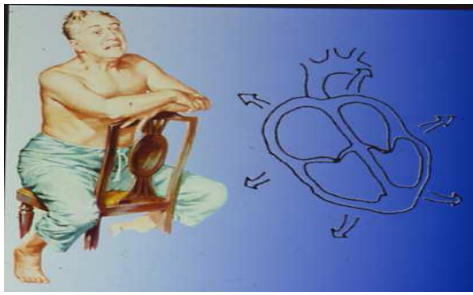
  - Brochard L et al. NEJM 1995 (RCT)
  - Guerin C et al Intensive Care Med 1997
  - Nava S et al . Ann Intern Med 1998 (RCT)
  - Girault C et al JAMA 1999
  - Nourdine K Intensive Care Med 1999

- riduce la mortalità

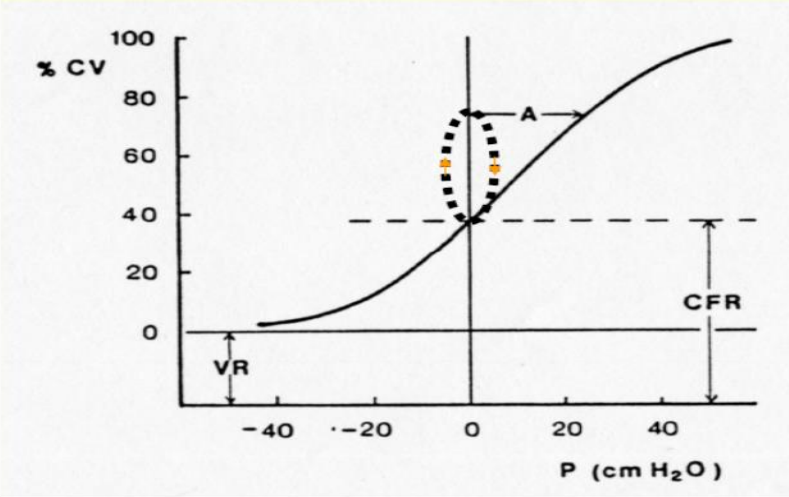
  - Bott T et al. Lancet 1993
    reduced from 30%(CT) to 3.8%(NPPV)
  - Brochard L et al . N. Engl J Med 1995
    reduced from 29%(CT) to 9%(NPPV)
  - Plank Pk et al The Lancet 2000
    reduced from 20% (CT) to 10% (NPPV)
  - Nava S et al . Ann Intern Med 1998
    reduced from 28% (CV) to 8%(NPPV)



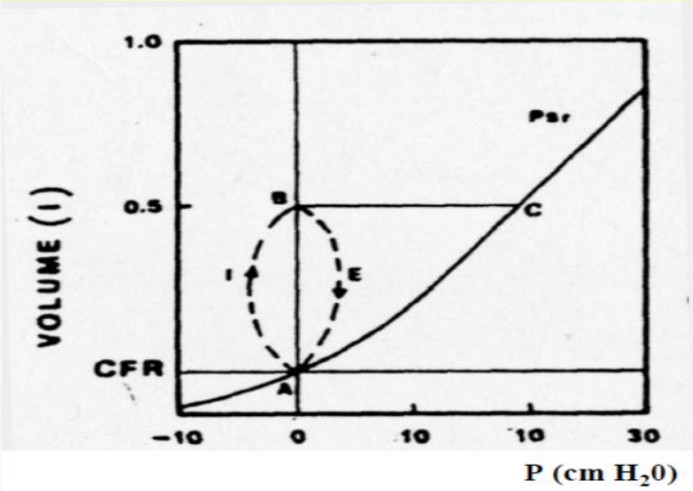
Razionale della ventilazione nell'edema polmonare



L respiratorio normale



L respiratorio durante EPA



Accumulo di liquidi extravascolare (imbibizione alveolare , scarsa diffusione alveolo-capillare di ossiegeno, collasso alveolare e bronchiolare progressivo dalle basi agli apici quindi ostruzione al flusso, airtrapping e generazione di una PEEPi)

↓

Diminuisce la compliance polmonare , diminuisce la CFR

↓

Pattern respiratorio con volumi piccoli e frequenti

Negli anziani con scompenso cardiaco

Ulteriore fattore complicante il quadro :

- debolezza muscolare (presente comunque 30-50% dei casi) causata da alterazioni organiche per riduzione dei capillari muscolari e riduzione della capacità ossidativa mitocondriale.
- una precoce esauribilità in caso di iperventilazione per progressiva atrofia delle fibre di tipo II

Verissimo P, Casalaspo TJ, Gonçalves LH, Yang AS, Eid RC, Timenetsky KT. High Prevalence of Respiratory Muscle Weakness in Hospitalized Acute Heart Failure Elderly Patients. PLoS One 2015; 10: e0118218.

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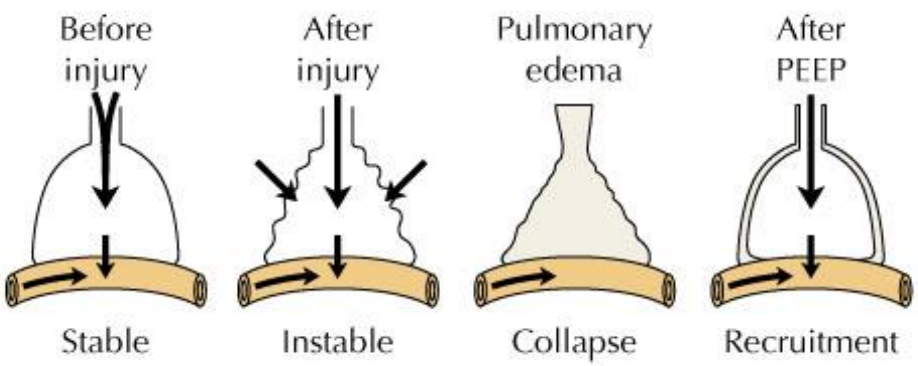
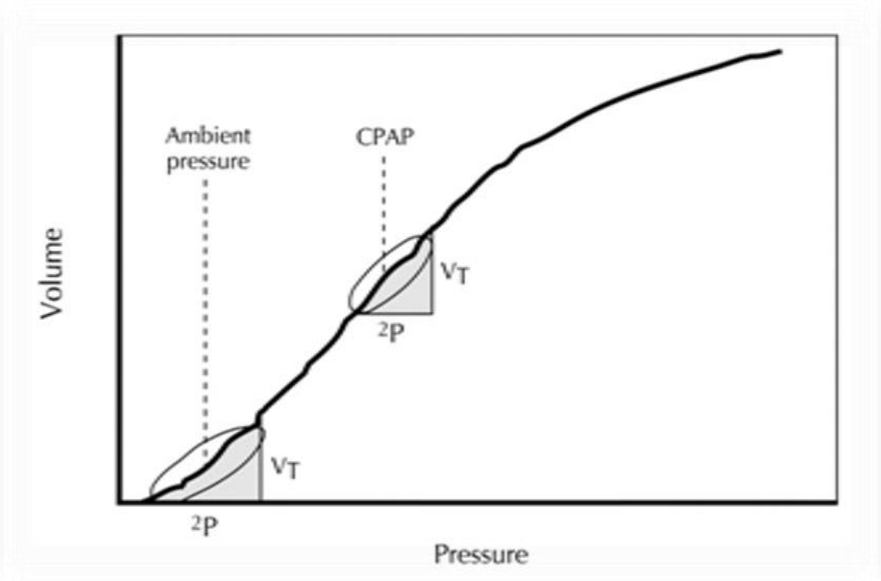
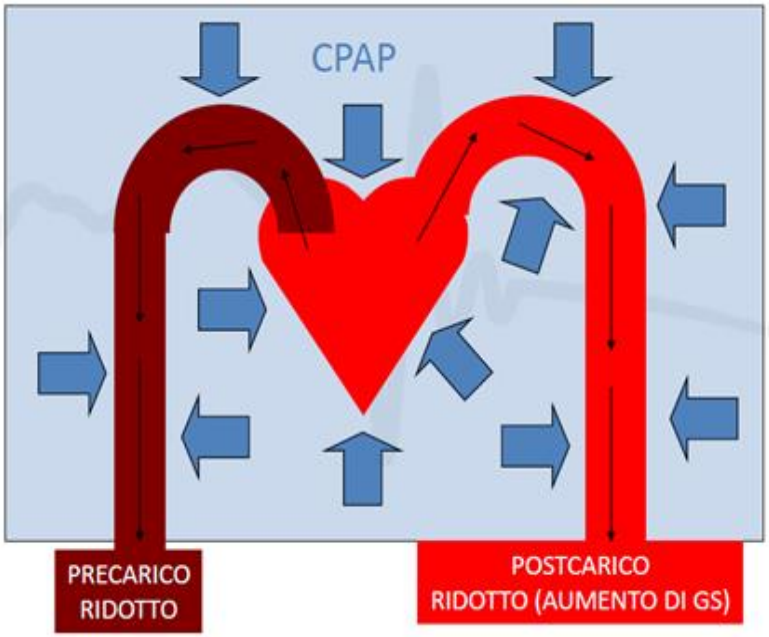
La pressione positiva espiratoria

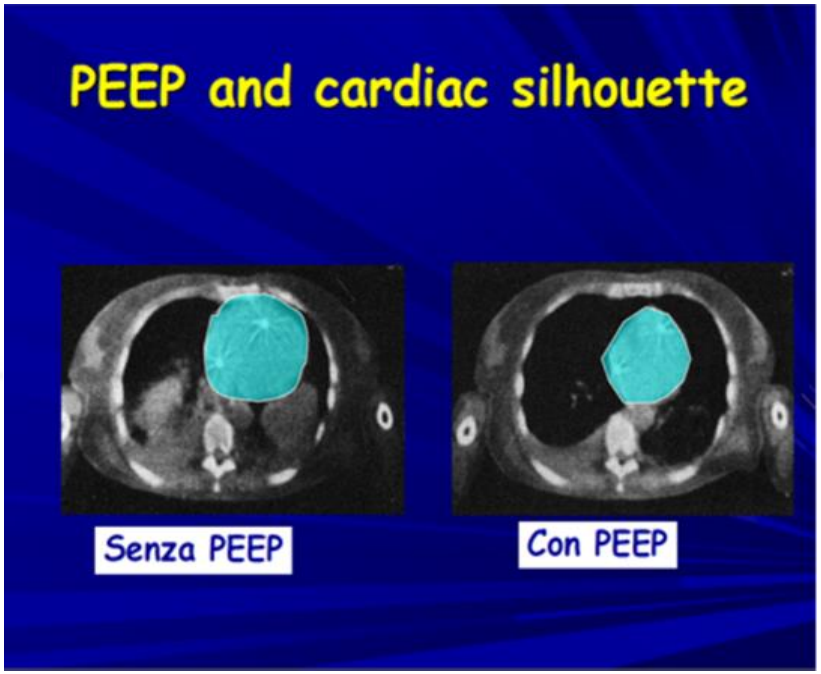
- Aumenta il volume alveolare di fine espirazione aiutando lo spostamento di liquidi dagli alveoli allo spazio interstiziale , riducendo lo shunt
- Riduce il lavoro respiratorio per aumento della compliance polmonare
- Migliora l'ossigenazione consentendo di ridurre la FiO2 a dosi non tossiche





CPAP : EFFETTI EMODINAMICI





Migliora la funzionalità cardiaca in pazienti con cardiomiopatia dilatativa attraverso la riduzione del volume cardiaco «compresso « dall'aumento di volume polmonare, la riduzione del ritorno venoso per aumento della pressione intratoracica e la riduzione del lavoro respiratorio quindi del consumo di O2

Does Continuous Positive Airway Pressure by Face Mask Improve Patients With Acute Cardiogenic Pulmonary Edema Due to Left Ventricular Diastolic Dysfunction?*

Karim Bendjelid, MD, MS; Nicolas Schütz, MD; Peter M. Suter, MD, FCCP; Gerard Fournier, MD; Didier Jacques, MD; Samir Fareh, MD; and Jacques-A Romand, MD

Conclusion: CPAP improves oxygenation and ventilatory parameters in all kinds of CPE. In patients with preserved LV contractility, the hemodynamic benefit of CPAP results from a decrease in LV end-diastolic volume (preload).

(CHEST 2005; 127:1053–1058)

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Intensive Care Med (2005) 31:1451
DOI 10.1007/s00134-005-2752-8

Ritesh Agarwal
Dheeraj Gupta

What is the role of noninvasive ventilation in diastolic heart failure?

Accepted: 1 July 2005
Published online: 12 August 2005
© Springer-Verlag 2005

terload, whereas in patients with diastolic dysfunction the effects of positive pressure therapy compromises venous return and decreases left ventricular end diastolic volume, further limiting stroke volume and hence cardiac output because of the steep curve for left ventricular diastolic pressure in relation to volume with resultant deterioration in hemodynamics [4]. Hence caution must be used because patients with diastolic heart failure are sensitive to the preload reduction and may develop hypotension or severe prerenal azotemia [5]. In fact it adds to the primary pathophysiological mechanism of diastolic heart failure and can worsen the pulmonary edema. In such patients NIPSV is theoretically likely to be more beneficial because of differing inspiratory and expiratory pressure. Another factor by which positive pressure therapy can act in patients with diastolic heart failure is lung inflation with activation of parasympathetic nervous system and resultant decrease in heart rate [6].

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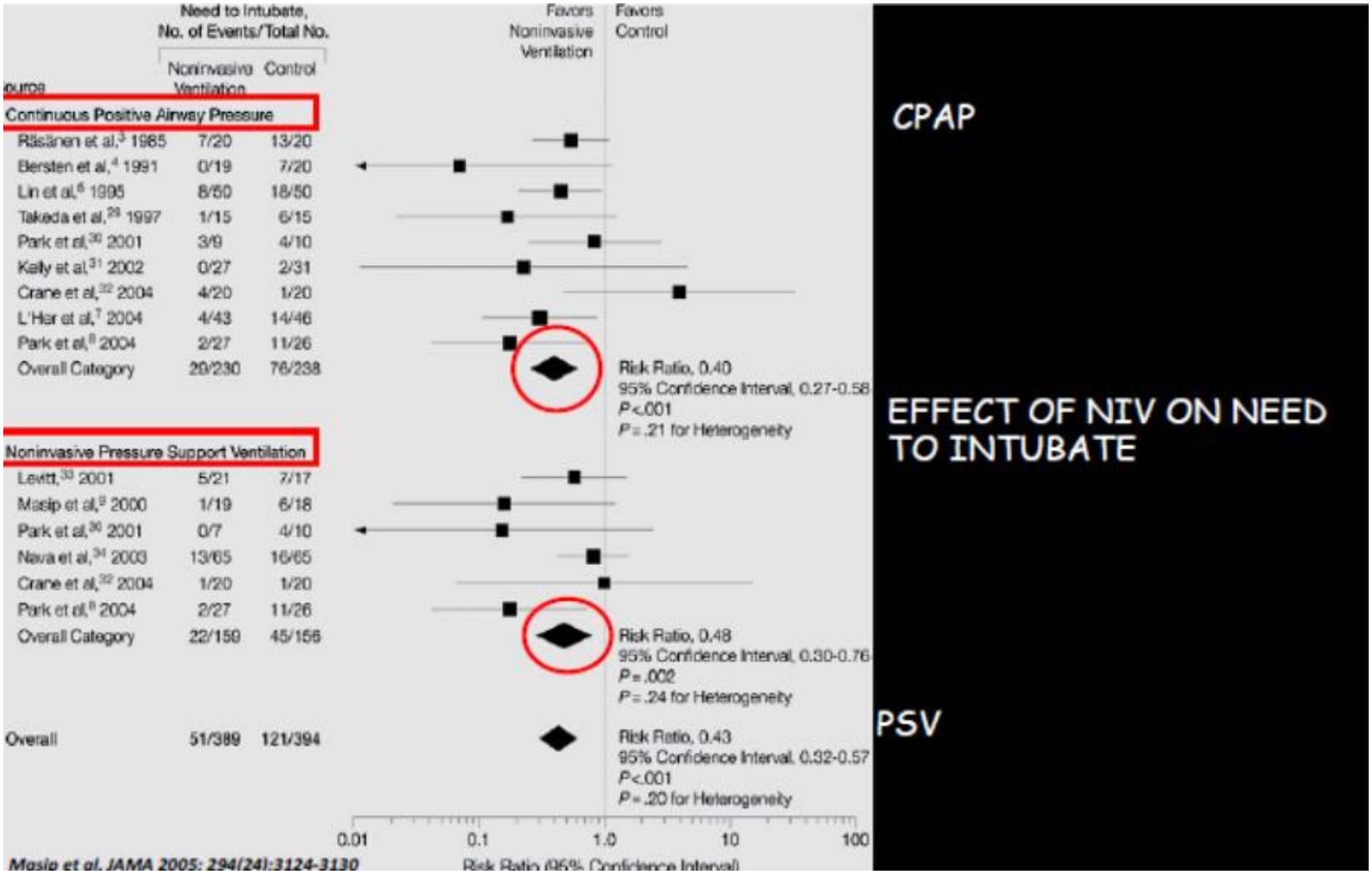
NIV ed edema polmonare acuto: negli anni tanti dubbi….

Metha	Crit Care Med 1997	NIPPV > CPAP	↑ IMA?
Wood *	Chest 1998	ST > NIPPV	↑ mortalità?
Hoffmann	Intensive Care Med 1999	1 IOT su 29	
Rusterholtz	Intensive Care Med 1999	5 IOT su 26	↑ IMA?
Masip	Lancet 2000	↓ IOT, FR, FC, ↑ pH e SpO_2	PA, CO_2
Sharon *	J Am Coll Cardiol 2000	ISDN > NIPPV	IMA 55% IOT 80% ✚ 10%
Levitt *	J Emer Med 2001	ST = NIPPV	20% intolleranza

Meglio CPAP O PSV ?



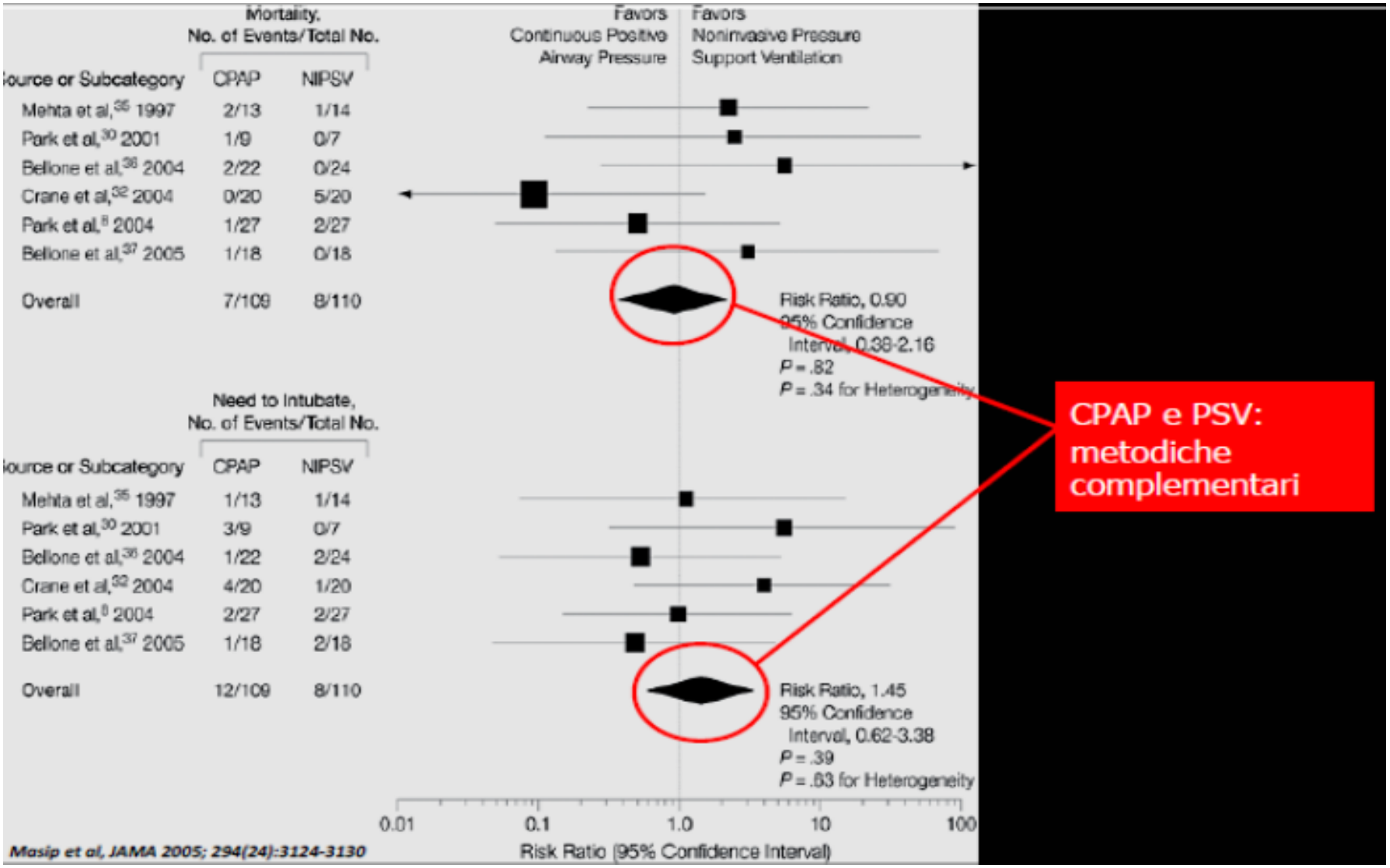
Maschera facciale o casco?

Outcome Variables 2

	Helmet N=33	Mask N=66	P
PEEP applied, cmH2O, mean (sd)	8(2)	5(1)	<.001
Patients requiring intubation - no. (%)	8(33)	21 (32)	.3
Reason for Endotracheal intubation, n, (% of intubations)			
Intolerance	0(0)	8(38)	.047
Inability to correct hypoxia	2(24)	9(43)	.13
Inability to manage secretions	2(25)	2(9.5)	.3
Mental status alterations	1(12)	0(0)	.3
Hemodynamic Instability	3(37)	2(9.5)	.11
Hours of continuous noninvasive ventilation ,mean(sd)	36 (29)	26 (13)	.05
Total hours of noninvasive ventilation, hours, mean (sd)	40(30)	42(21)	.73

Antonelli, CCM 2002; 30: 602-608

Dubbi che sono stati chiariti



BTS GUIDELINE

Non-invasive ventilation in acute respiratory failure

British Thoracic Society Standards of Care Committee

Thorax 2002;**57**:192–211

- *CPAP has been shown to be effective in patients with cardiogenic pulmonary oedema who remain hypoxic despite maximal medical treatment. NIV should be reserved for patients in whom CPAP is unsuccessful.* [**B**]

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American Thoracic Society

Am J Respir Crit Care Med Vol 163, pp 283–291, 2001
Internet address: www.atsjournals.org

International Consensus Conferences in Intensive Care Medicine: Noninvasive Positive Pressure Ventilation in Acute Respiratory Failure

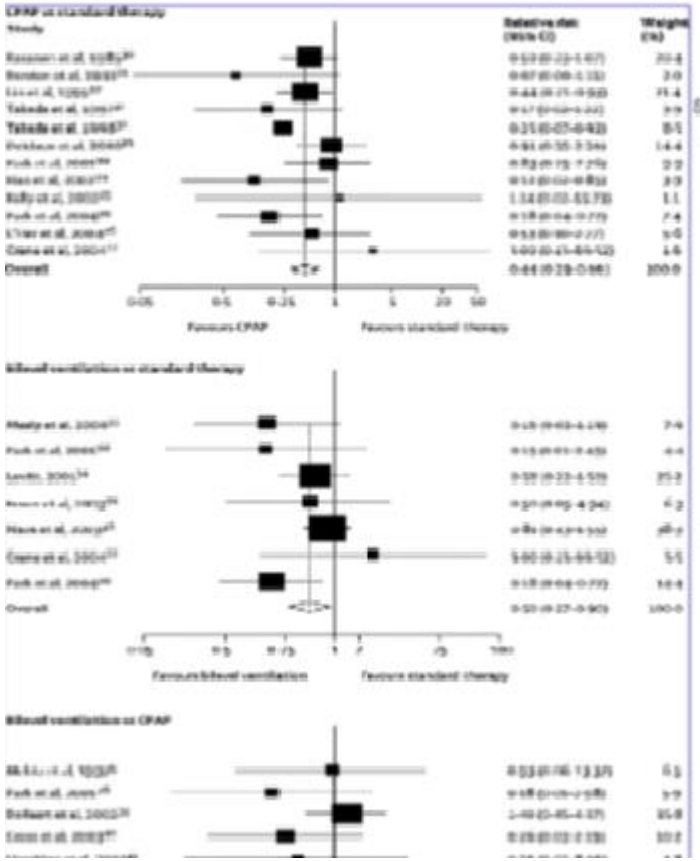
ORGANIZED JOINTLY BY THE AMERICAN THORACIC SOCIETY, THE EUROPEAN RESPIRATORY SOCIETY, THE EUROPEAN SOCIETY OF INTENSIVE CARE MEDICINE, AND THE SOCIÉTÉ DE RÉANIMATION DE LANGUE FRANÇAISE, AND APPROVED BY THE ATS BOARD OF DIRECTORS, DECEMBER 2000

Conclusions

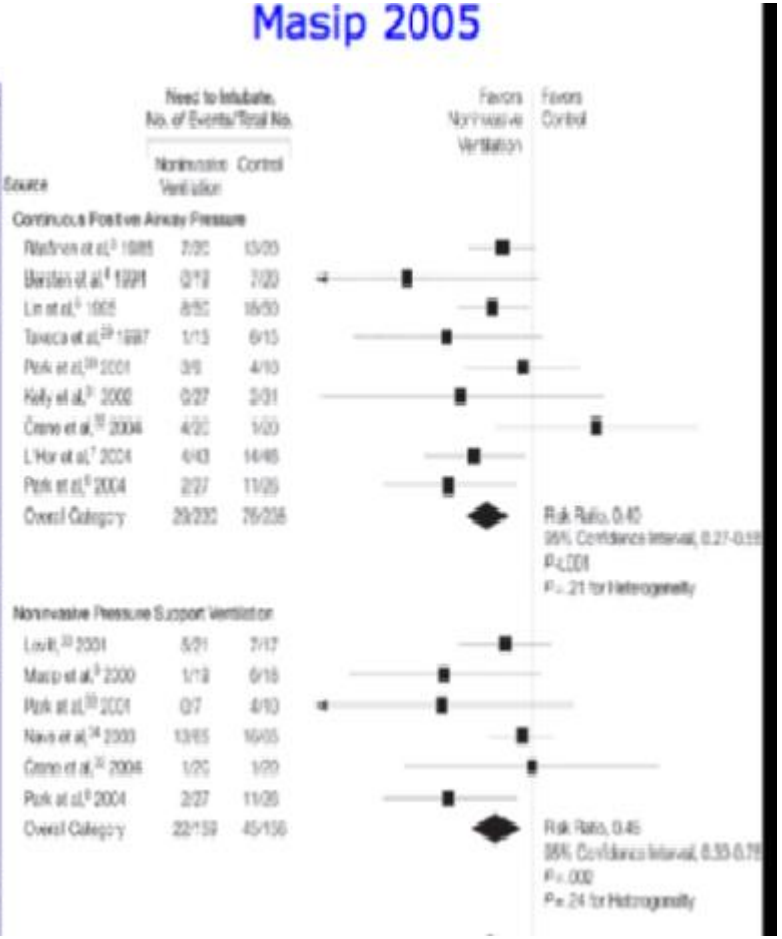
- There is no evidence to support the use of particular patient interface devices. Clinical experience suggests that full-face masks improve efficacy by reducing leaks and are more appropriate for use in the setting of severe hypoxemic ARF.
- To be effectively initiated in all clinical areas, a wide array of interfaces must be available for immediate use.
- Choice of mode should be based on local expertise and familiarity, tailored to the etiology and severity of the pathophysiological process responsible for ARF.
- Ventilator settings should be adjusted to provide the lowest inspiratory pressures or volumes needed to produce improved patient comfort (a decrease in respiratory rate and respiratory muscle unloading) and gas exchange.
- The type of ventilator and level of monitoring should be determined by the severity of illness and location of care.

pochi dubbi sull'efficacia nel ridurre l'incidenza dell'intubazione …

Bersten 2006

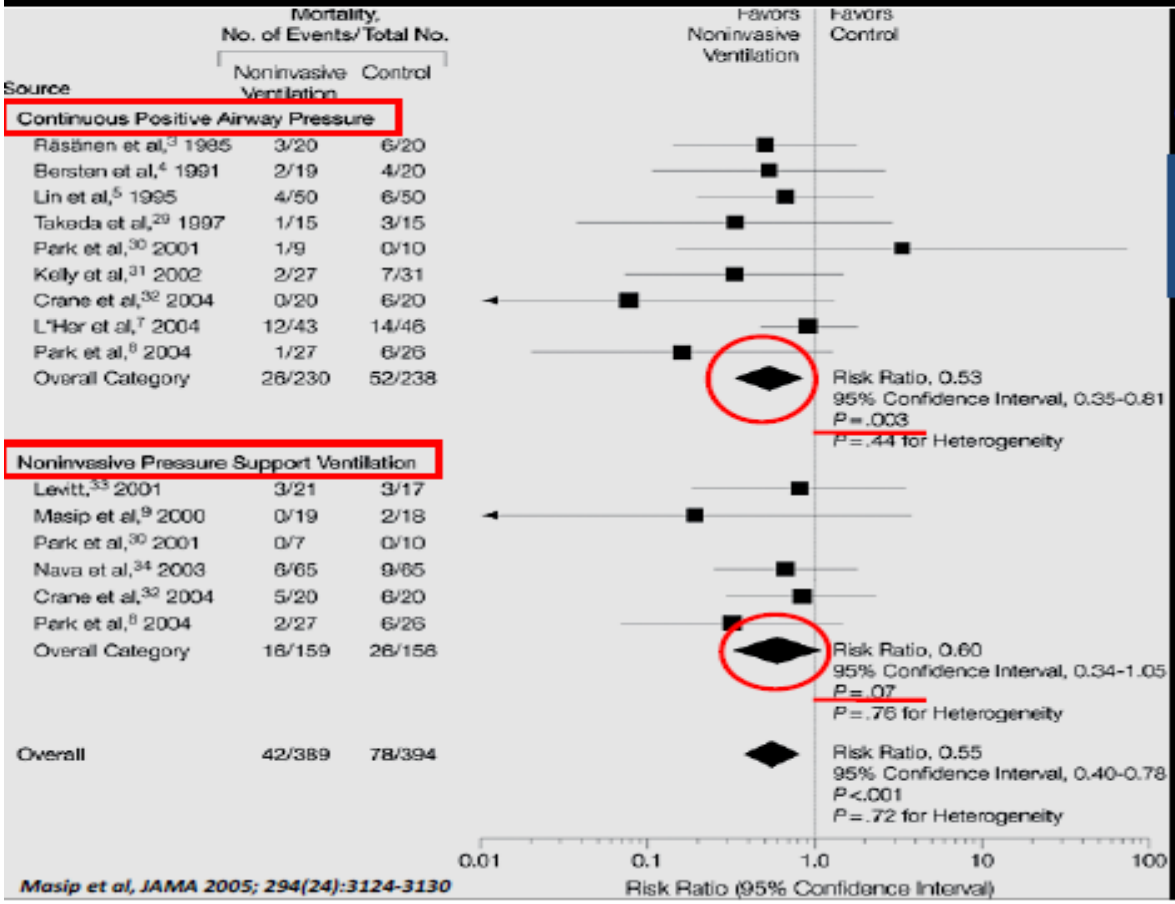


Masip 2005



E la mortalità….

Non-invasive Ventilation in Acute Cradiogenic Pulmonary Edema: Systematic Review and Meta-analysis



Masip et al, JAMA 2005; 294(24):3124-3130

CPAP

NIV riduce il tasso di mortalità di circa il 45% vs terapia convenzionale

EFFECT OF NIV ON DEATH

PSV

Applicazioni emergenti

ARF after major surgery

After thoracic surgery, pulmonary complications like ARF represent the first cause of death with a mortality rate of 60% - 80%.

Kutlu H, Ann Thorac Surg 2000

After abdominal surgery, postop hypoxemia complicates between 30% - 50% of cases.

ARF may occur early in the postop course, requiring mechanical ventilation in 8% - 10% of patients.

La NIV riduce la reintubazione e la mortalità

NB: escludere che ci siano anastomosi e leak

Stephan F. JAMA 2015
Jaber S,. Chest 2005;
Squadrone V,. JAMA 2005;
Auriant I, AmJ Respir Crit Care Med 2001

Nel trauma toracico

La NIV riduce mortalità , intubazione e incidenza di polmoniti

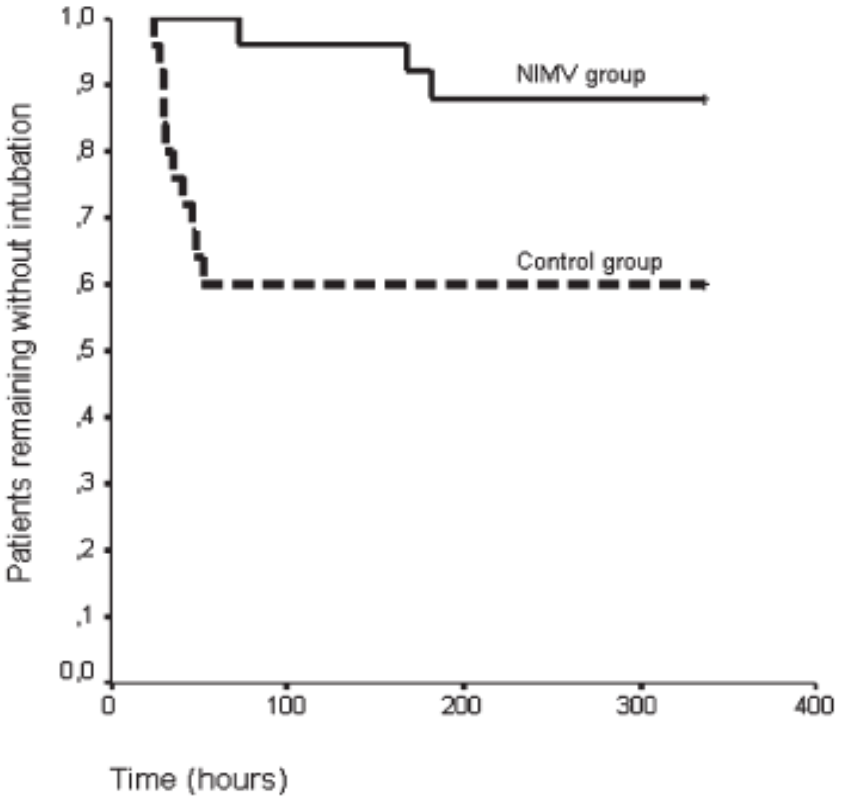


FIGURE 2. Kaplan-Meier curve for the probability of remaining without intubation in both groups. See Figure 1 legend for expansion of abbreviation.

Bolliger CT, Van Eeden SF. Treatment of multiple rib fractures. Randomized controlled trial comparing ventilatory with nonventilatory management. Chest 1990; 97: 943–948.

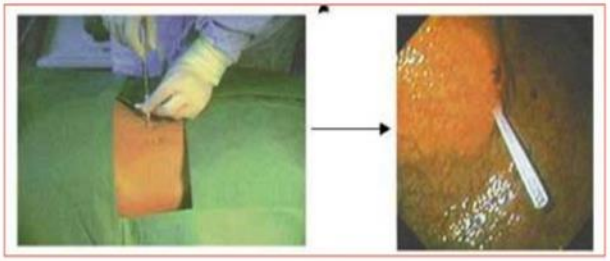
Gunduz M, Unlugenc H, Ozalevli M, et al. A comparative study of continuous positive airway pressure (CPAP) and intermittent positive pressure ventilation (IPPV) in patients with flail chest. Emerg Med J 2005; 22: 325–329.

Hernandez G, Fernandez R, Lopez-Reina P, et al. Noninvasive ventilation reduces intubation in chest trauma-related hypoxemia: a randomized clinical trial. Chest 2010; 137: 74–80.

Ed ancora ….

Noninvasive ventilation allows gastrostomy tube placement in patients with advanced ALS

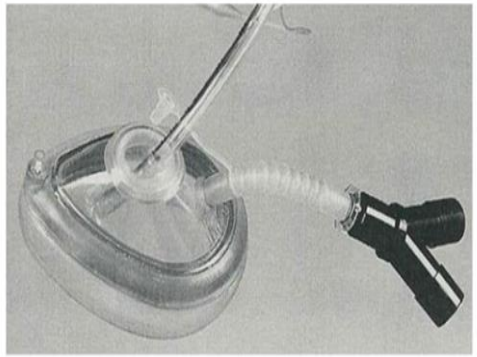
Neurology. 2001; 56:413-4



The use of NIV for ventilatory support during percutaneous endoscopic gastrostomy (PEG) tube placement is described in five patients with advanced ALS, four having significant bulbar symptoms.

No respiratory complications occurred in any of these patients, who were considered to be at high risk for PEG placement

NIV - bronchoscopy



In patients with ARF, hypersecretion and pneumonia both diagnostic but also therapeutic conventional unassisted fiberoptic bronchoscopy may worsen pulmonary status and even be contraindicate

Noninvasive positive pressure ventilation in critical and palliative care settings: Understanding the goals of therapy*

J. Randall Curtis, MD, MPH; Deborah J. Cook, MD; Tasnim Sinuff, MD, PhD; Douglas B. White, MD; Nicholas Hill, MD; Sean P. Keenan, MD, MSc(Epid); Joshua O. Benditt, MD; Robert Kacmarek, PhD, RRT; Karin T. Kirchhoff, RN, PhD, FAAN; Mitchell M. Levy, MD; the Society of Critical Care Medicine Palliative Noninvasive Positive Pressure Ventilation Task Force

- Tipo 1: NIV come supporto vitale senza limiti in alternativa all'intubazione
- Tipo 2: pz che rifiutano l'intubazione
- Tipo 3 . Pazienti che vogliono solo il controllo del sintomo dispnea e non incrementare la sopravvivenza per comunicare con i pazienti o attendono di salutare i parenti o sbrigare degli affari

Crit Care Med 2007 Vol. 35, No. 3

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key points della gestione del DNI

- Gestione del rifiuto dell'intubazione : nei momenti di riacutizzazione il paziente potrebbe cambiare idea , va riformulata la proposta
- Gestione della dispnea : l'eventuale discomfort e vantaggio rispetto agli oppioidi

Schortgen F, Follin A, Piccari L, Roche-Campo F, CarteauxG, Taillandier-Heriche E. Results of non-invasive ventilation in very old pati Intensive Care 2012; 2: 5

Quill CM, Quill TE. Palliative Use of Noninvasive Ventilation: Navigating Murky Waters. J Pall Med 2014; 17: 657–661

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La NIV nei pz non intubabili: la storia

***Meduri*, Crit Car Med 1994:** **studio non controllato sugli effetti della NIV in pz affetti da patologie terminali (SC, linfomi, FC,UIP, sarcoidosi) "non intubabili": 7/11 pz (63%) furono dimessi dalla ICU. I 5 pz che morirono ebbero cmq un trattamento della dispnea, mantenendo autonomia e comunicazione verbale.**

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Original Article

High-Flow Oxygen and Bilevel Positive Airway Pressure for Persistent Dyspnea in Patients With Advanced Cancer: A Phase II Randomized Trial

David Hui, MD, MSc, Margarita Morgado, MA, Gary Chisholm, MS, Laura Withers, MBA, RRT, CPFT, Quan Nguyen, BS, RRT, Clarence Finch, MBA, MHA, RRT, Susan Frisbee-Hume, MSN, and Eduardo Bruera, MD

Results. Thirty patients were enrolled (1:1 ratio) and 23 (77%) completed the assigned intervention. HFO was associated with improvements in both NRS (mean 1.9; 95% CI 0.4–3.4; $P = 0.02$) and MBS (mean 2.1; 95% CI 0.6–3.5; $P = 0.007$). BiPAP also was associated with improvements in NRS (mean 3.2; 95% CI 1.3–5.1; $P = 0.004$) and MBS (mean 1.5; 95% CI −0.3, 3.2; $P = 0.13$). There were no significant differences between HFO and BiPAP in dyspnea NRS ($P = 0.14$) and MBS ($P = 0.47$). Oxygen saturation improved with HFO (93% vs. 99%; $P = 0.003$), and respiratory rate had a nonstatistically significant decrease with both interventions (HFO −3, $P = 0.11$; BiPAP −2, $P = 0.11$). No significant adverse effects were observed.

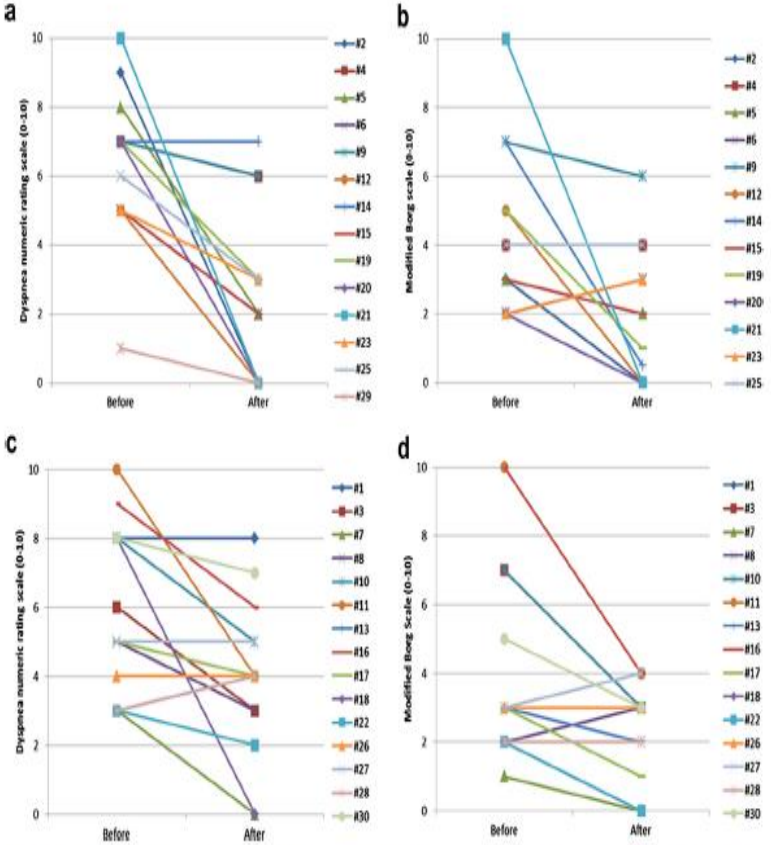


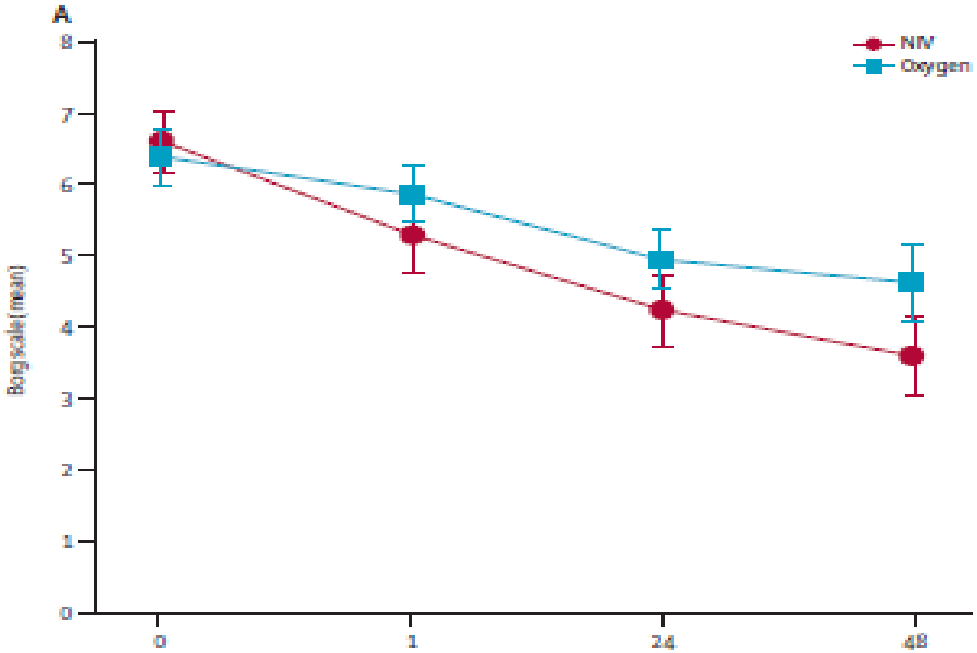
Fig. 2. Change in dyspnea scores with high-flow oxygen and BiPAP. As compared with baseline, BiPAP was associated with an average improvement in (a) the dyspnea numeric rating scale of 3.2 ($P = 0.004$) and (b) the modified Borg scale of 1.5 ($P = 0.13$). High-flow oxygen also was associated with an average improvement in (c) the numeric rating scale of 1.9 ($P = 0.02$) and (d) the modified Borg scale of 2.1 ($P = 0.007$). Intention-to-treat analysis revealed no significant differences between the two devices with the dyspnea numeric rating scale ($P = 0.32$) and the modified Borg scale ($P = 0.29$). BiPAP = bilevel positive airway pressure.

www.thelancet.com/oncology Vol 14 March 2013

Palliative use of non-invasive ventilation in end-of-life patients with solid tumours: a randomised feasibility trial

Stefano Nava, Miguel Ferrer, Antonio Esquinas, Raffaele Scala, Paolo Groff, Roberto Cosentini, Davide Guido, Ching-Hsiung Lin, Anna Maria Cuomo, Mario Grassi

Interpretation Our findings suggest that NIV is more effective compared with oxygen in reducing dyspnoea and decreasing the doses of morphine needed in patients with end-stage cancer. Further studies are needed to confirm our findings and to assess the effectiveness of NIV on other outcomes such as survival. The use of NIV is, however, restricted to centres with NIV equipment, our findings are not generalisable to all cancer or palliative care units.



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Effetto sulla dispnea maggiore negli ipercapnici

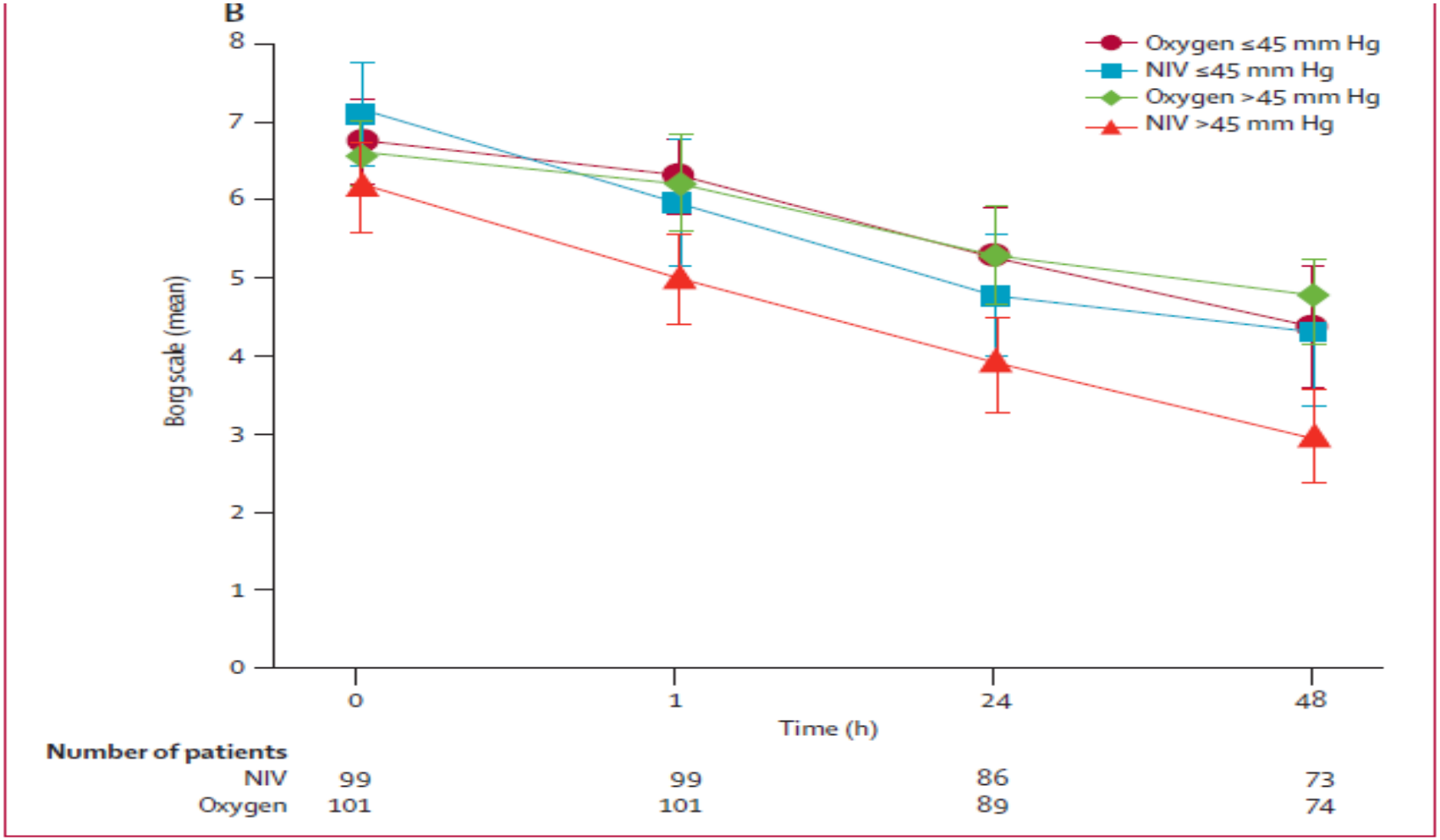

Figure 2: **Changes in dyspnoea scores with time**
(A) Comparison between non-invasive ventilation (NIV) and oxygen therapy assessed using the Borg scale over time. (B) Comparison between NIV and oxygen therapy within hypercapnia strata assessed using the Borg scale over time.

Dove lo ventilo ?

- In base al pH
- In base alla probabile risposta alla NIV
- In base alla disponibilità di monitoraggio
- In base alla disponibilità di personale esperto
- In base al numero di organi compromessi
- in base alla necessità di sedazione

UTI, RICU, reparto?

L'importanza della scelta del dove .....

Il 5-60% delle NIV fallisce anche in mani esperte

NB fallimento inteso come morte o ricorso ad intubazione

Ozyilmaz E, Ugurlu AO, Nava S. Timing of non-invasive ventilation failure:causes, risk factors, and potential remedies. BMC Pulm Med. 2014;14:19.

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Fallimento della NIV

- **Fallimento immediato(entro la 1 ora) : perdita del riflesso della tosse, secrezioni eccessive, coma ipercapnico , intolleranza e agitazione, asincronia paziente ventilatore**
- **Fallimento precoce (da 1 h a 48 h). Mancato miglioramento degli scambi o ulteriore peggioramento della malattia di fondo, persistenza di elevata frequenza respiratoria e distress muscolare**
- **Fallimento tardivo (>48 h) che si verifica dopo una iniziale risposta alla NIV generalmente correlato ad i disturbi del sonno e alle comorbidità**

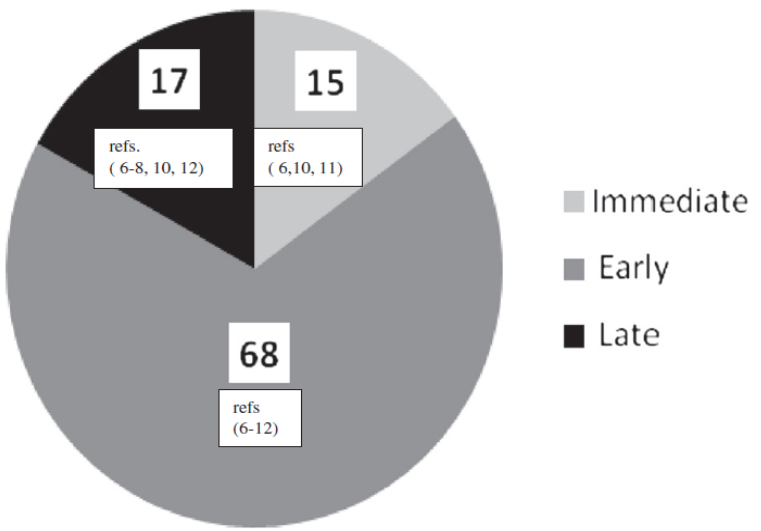

Figure 1 Mean NIV failure rates based on timing according to the data of randomised controlled trials (6–12).

Ozyilmaz E, Ugurlu AO, Nava S. Timing of non-invasive ventilation failure: causes, risk factors, and potential remedies. BMC Pulm Med. 2014;14:19.

Scala R, Bartolucci S, Naldi M, Rossi M, Elliott MW. Co-morbidity and acute decompensations of COPD requiring non-invasive positive-pressure ventilation. Intensive Care Med. 2004;30:1747–54.

Come evitare il fallimento

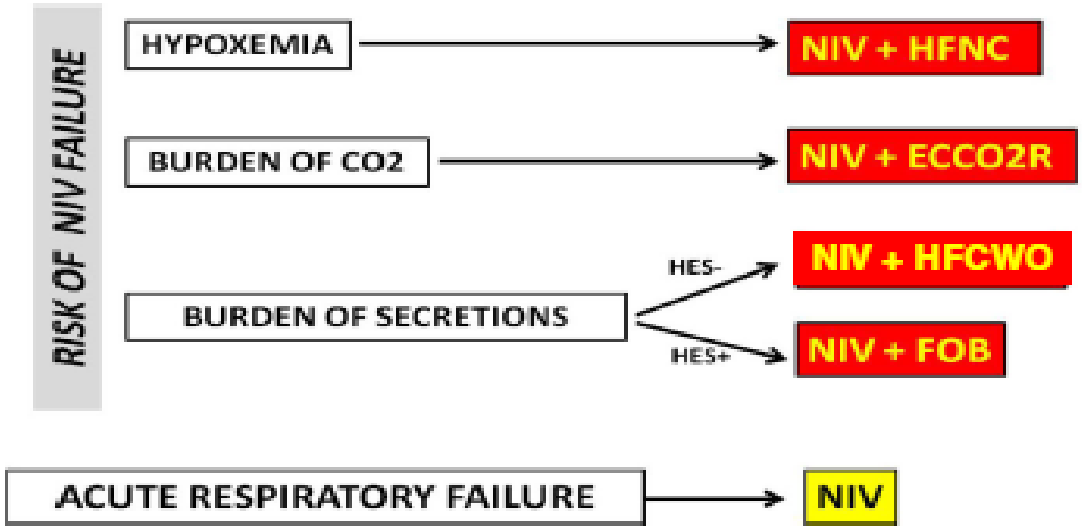

Fig. 4 Flow-chart depicting the potential integrated respiratory therapies in adjunct to NIV in case of risk of failure in cases of elderly patients with DNI status. ARF: acute respiratory failure, $ECCO_2R$: extracorporeal CO_2 removal, FOB: flexible bronchoscopy, HES: hypercapnic encephalopathy syndrome, HFCWO: high-frequency chest wall oscillation, HFNC: high-flow nasal cannula, NIV: non-invasive ventilation

Terragni P, Maiolo G, Ranieri VM. Role and potentials of lowflow CO2 removal system in mechanical ventilation. Curr Opin Crit Care. 2012;18(1):93–8.

Burki NK, Mani RK, Herth FJ, Schmidt W, Teschler H, Bonin F, et al. A novel extracorporeal CO(2) removal system: results of a pilot study of hypercapnic respiratory failure in patients with COPD. Chest. 2013;143(3):678–86.

Sklar MC, Beloncle F, Katsios CM, Brochard L, Friedrich JO. Extracorporeal carbon dioxide removal in patients with chronic obstructive pulmonary disease: a systematic review. Intensive Care Med. 2015;41(10):1752–62

negli anni sempre più pazienti vengono trattati fuori dall'UTI…

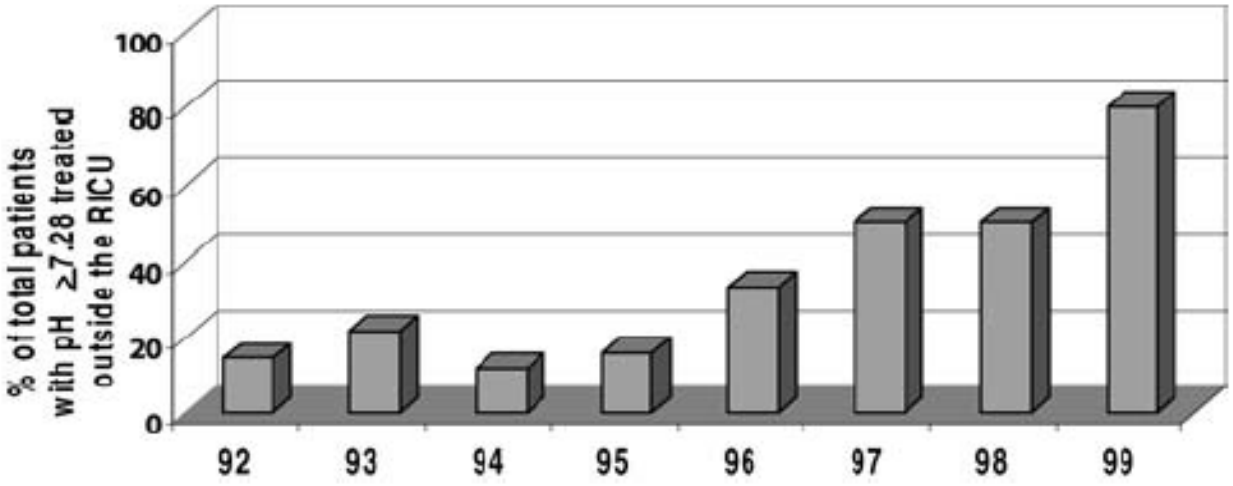

Fig. 4 Percentage of patients with pH >7.28 treated outside the RICU, in the medical ward, in the 8 years of the study. $P<0.001$ in the x^2 Hf for linear trend analysis

Carlucci A, Delmastro M, Rubini F, Fracchia C, Nava S. Changes in the practice of non-invasive ventilation in treating COPD patients over 8 years. Intensive Care Med 2003; 29: 419–25.

Ma ci sono situazioni associate ad alta probabilità di fallimento

- pH< a 7.25 di base e ad 1 h dalla NIV
- Insufficienza respiratoria severamente ipossiemica (PaO2/FiO2< 200)
- Coinvolgimento di più organi, sepsi e instabilità emodinamica
- RR>35 apm pre NIV e dopo 2 ore dalla NIV nei BPCO
- RR>25 durante NIV nelle forme ipossiemiche post-operatorie e nei pazienti ematologici
- Nell'edema polmonare :IMA, un pH< a 7.25, una FE < a 30%, una PA< a 140 mmHg sono fattori predittori di fallimento

Nava S, Hill N. Non-invasive ventilation in acute respiratory failure. Lancet.2009;374:250–9.

Ozyilmaz E, Ugurlu AO, Nava S. Timing of non-invasive ventilation failure: causes, risk factors, and potential remedies. BMC Pulm Med. 2014;14:19.

Scala R, et. Co-morbidity and acute decompensations of COPD requiring non-invasive positive-pressure ventilation. Intensive Care Med. 2004;30:1747–54.

Shirakabe A, et al : Predicting the success of noninvasive positive pressure ventilation in emergency room for patients with acute heart failure. J Cardiol 2010, 57:107–114.

dove gestire il paziente in base al pH di partenza?

- se pH < 7.25 meglio in ambiente protetto

Brochard L,. N Engl J Med 1995, 333:817–822.
Martin TJ,. Am J Respir Crit Care Med 2000, 161:807–813

- se pH>7.3 e lo staff è formato anche in reparto

Plant PK. Lancet 355(9219):1931–193

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Non abbiate paura dell'intubazione!!!!

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

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

- **Pazienti GRAVI: pH < 7.20 o frequenza respiratoria ≥ 35/min.**
- **Non differenza significativa di mortalità tra ventilazione non-invasiva (26%) ed intubazione (19%)**
- **Non differenza di durata della degenza in Terapia Intensiva (22 vs. 21 giorni in media**
- **elevata frequenza di fallimento della ventilazione non-invasiva (il 52% viene intubato)**
- **l'elevata mortalità nei pazienti con fallimento della ventilazione non-invasiva (42%).**

TRADOTTO

Nei pazienti con grave riacutizzazione di BPCO e necessità di supporto ventilatorio, la ventilazione non-invasiva non offre vantaggi clinici rispetto all'intubazione, fallisce una volta su due e quando fallisce la mortalità è molto elevata. Visti da un altro punto di vista, gli stessi numeri ci dicono però che circa la metà di questi pazienti evita efficacemente l'intubazione tracheale.

Dove ventilo in base alla patologia?

- Edema polmonare acuto: anche in ambulanza

Roessler MS,. Emerg Med J 2012;29:409–14.
Templier F,. Am J Emerg Med 2012;30:765–9.

- Palliativa in caso di dnr : fuori dall'UTI dove la presenza dei familiari migliora il comfort delle ore di fine e a volte la mortalità è minore dell'atteso
- Vargas N. Aging Clin Exp Res 2014; 26: 615–623

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Aging Clin Exp Res (2014) 26:615–623
DOI 10.1007/s40520-014-0223-1

ORIGINAL ARTICLE

Non-invasive ventilation for very old patients with limitations to respiratory care in half-open geriatric ward: experience on a consecutive cohort of patients

Results Therefore, 75 % of patients were discharged home and 12 out of 20 patients had home respiratory support. PaO_2/FiO_2 ratio and pH increased while $PaCO_2$ decreased during the 12 h of NIV with statistical significance. At the admission, alive patients had $PaCO_2$ signif-

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Per patologia : Sempre in UTI !!!!

- ALI: acute lung injury :(PaO2/FiO2 : 200-100)
- ARDS: acute respiratory distress syndrome (PaO2/FiO2 : <100)

Perché?

è alto il rischio di fallimento nell'ins. respiratoria ipossiemica de novo!

(PaO2/FIO2) <200, RR >30–35 apm senza malattia pneumologica nota

La NIV sarebbe da riservare ai casi in cui …

- PaO2/FiO2 compresa fra 200 e 300
- c'è compromissione solo respiratoria
- il team è esperto
- il paziente è monitorato per essere intubato prontamente , quindi in UTI

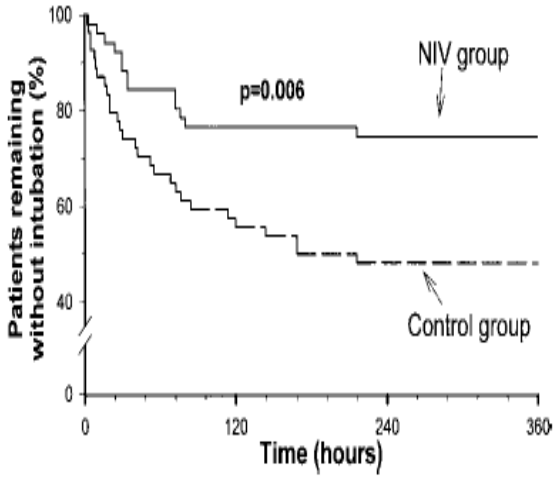

Figure 2. Kaplan-Meier curves for patients remaining without intubation after entry into the protocol. In the overall population, the cumulative probability of remaining without intubation was higher in the noninvasive ventilation (NIV) group (log-rank test). Time denotes the hours after patients were entered into the study.

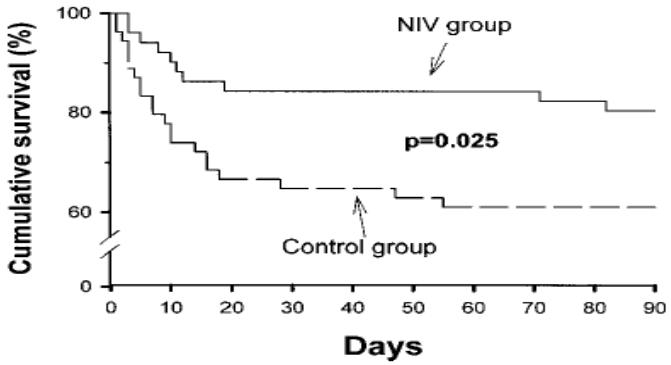

Figure 4. Kaplan-Meier curves for survivor patients within 90 days after entry into the protocol. In the overall population, the cumulative survival probability was significantly higher in the NIV group (log-rank test). *Time* denotes the days after patients were entered into the study.

Ferrer M, Esquinas A, Leon M, et al. Noninvasive ventilation in severe hypoxemic respiratory failure: a randomized clinical trial. Am J Respir Crit Care Med 2003; 168: 1438–1444

Potenziale strategia ventilatoria e rischi connessi

- La NIV è in grado di ridurre il lo sforzo inspiratorio solo se si utilizzano elevate pressioni che generano elevati tidal volume (superiori quindi ai valori di «ventilazione protettiva» compresi fra 6-8 ml/kg) e quindi aggravano il danno polmonare , provocano distensione gastrica , perdite aeree e discomfort

NB i predittori di fallimento sono: punteggio di gravità più alto, età avanzata, ARDS o polmonite come eziologia per insufficienza respiratoria, o un mancato miglioramento dopo 1 ora di trattamento

Carteaux G et al ,. Crit Care Med 2016; 44: 282–290.

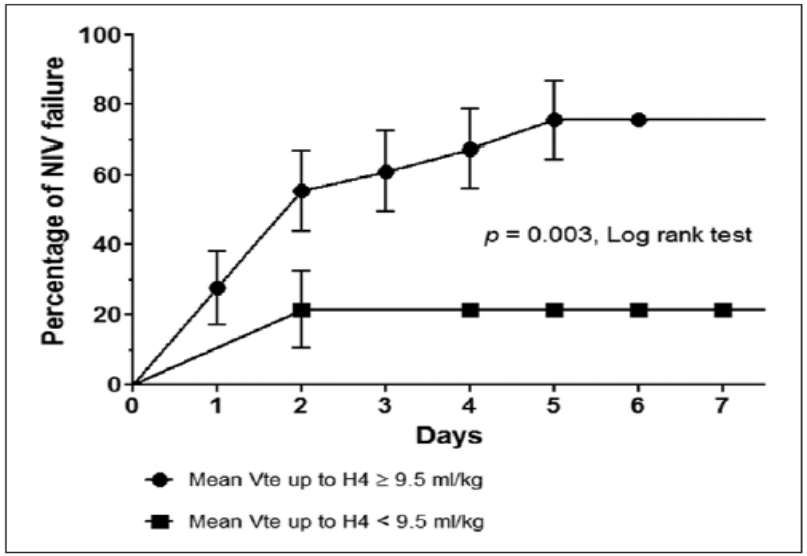

Figure 4. Kaplan-Meier estimate of the cumulative probability of noninvasive ventilation (NIV) failure according to the mean tidal volume (Vte) during the first four cumulative hours of NIV (higher or lower than 9.5 mL/kg) in patients with moderate-to-severe hypoxemia (Pao_2/Fio_2 ratio ≤ 200 mm Hg; $n = 33$).

TABLE 3. Multivariate Analysis of Risk Factors for Noninvasive Ventilation Failure in Patients With De Novo Acute Hypoxemic Respiratory Failure

Risk Factors	Unadjusted Hazard Ratio (95% CI)	*p*	Adjusted Hazard Ratio (95% CI)[a]	*p*
Simplified Acute Physiology Score II (30)	1.026 (1.008–1.043)	0.011	1.024 (1.007–1.041)	0.013
Immunosuppression	2.207 (1.054–4.622)	0.045	1.351 (0.598–3.056)	0.476
Pao_2/Fio_2 before NIV	0.995 (0.990–1.001)	0.114	0.995 (0.989–1.001)	0.109
Mean expired tidal volume during NIV, per mL/kg predicted body weight	1.318 (1.109–1.567)	0.002	1.286 (1.069–1.547)	0.008

NIV = noninvasive ventilation.
[a]Adjusted hazard ratio obtained by Cox regression.

Come minimizzare il rischio in caso di polmonite nei pazienti immunodepressi?

Antonelli M, Conti G, Bufi M, et al. Noninvasive ventilation for treatment of acute respiratory failure in patients undergoing solid organ transplantation: a randomized trial. JAMA 2000; 283: 235–241.

Elliott MW, Steven MH, Phillips GD, et al. Non-invasive mechanical ventilation for acute respiratory failure. BMJ1990; 300: 358–360.

Adda M, Coquet I, Darmon M, et al. Predictors of noninvasive ventilation failure in patients with hematologic malignancy and acute respiratory failure. Crit Care Med 2008; 36: 2766–2772.

Gristina GR, Antonelli M, Conti G, et al. Noninvasive versus invasive ventilation for acute respiratory failure in patients with hematologic malignancies: a 5-year multicenter observational survey. Crit Care Med 2011; 39:2232–2239.

Frat JP, Ragot S, Girault C, et al. Effect of non-invasive oxygenation strategies in immunocompromised patients with severe acute respiratory failure: post-hoc analysis of a randomized trial. Lancet Respir Med 2016; 4: 646–652cu

Effect of non-invasive oxygenation strategies in immunocompromised patients with severe acute respiratory failure: a post-hoc analysis of a randomised trial

Jean-Pierre Frat, Stéphanie Ragot, Christophe Girault, Sébastien Perbet, Gwénael Prat, Thierry Boulain, Alexandre Demoule, Jean-Damien Ricard, Rémi Coudroy, René Robert, Alain Mercat, Laurent Brochard, Arnaud W Thille, for the REVA network

nasal cannula alone and standard oxygen: OR 1·72 (0·57–5·18). After multivariable logistic regression, the two factors independently associated with endotracheal intubation and mortality were age and use of non-invasive ventilation as first-line therapy.

Lancet Respir Med 2016; 4: 646–52

Intubation rate : 65%

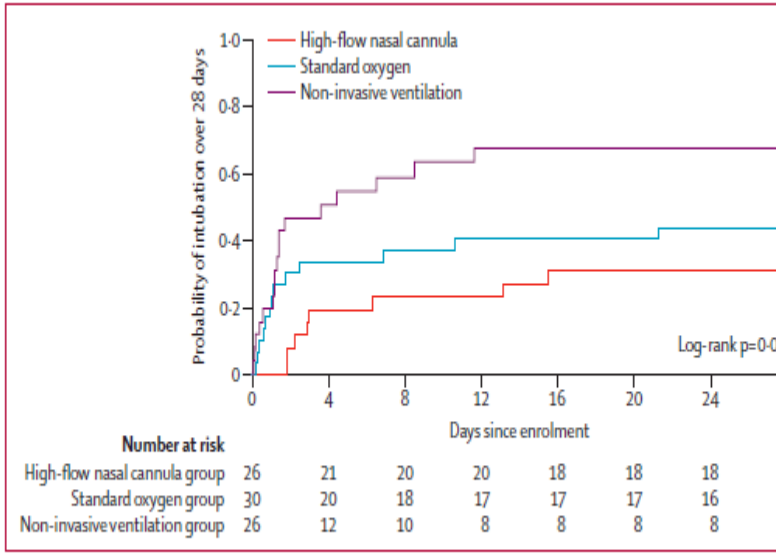

Figure 1: Probability of intubation at day 28 in patients in the non-invasive ventilation group versus standard oxygen and high-flow nasal cannula groups

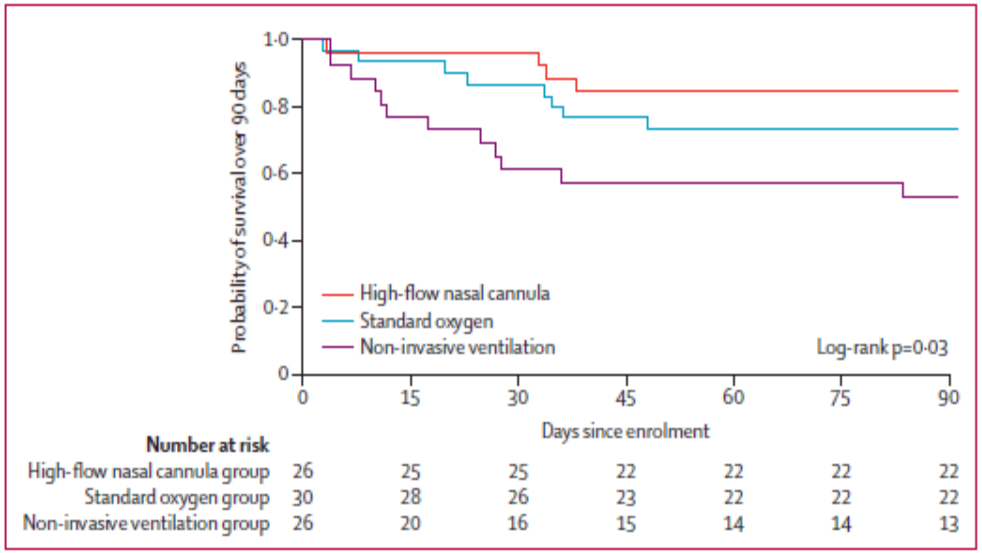

Figure 2: Probability of survival at day 90 in patients in the non-invasive ventilation group versus standard oxygen and high-flow nasal cannula groups

La mortalità però scende al 37% se :

Djamel Mokart
Cyrille Geay
Laurent Chow-Chine
Jean-Paul Brun
Marion Faucher
Jean-Louis Blache
Magali Bisbal
Antoine Sannini

and 20 (11 %) with HFNC alone. As compared to the others patients, HFNC–NIV patients presented a lower day-28 mortality rate, 37 % ($n = 28$) vs 52 % ($n = 53$), $p = 0.045$; a longer time from ICU admission to intubation 34 h (18–72) vs 16 h (7–45), $p = 0.01$; and a higher but not significant number of ventilator-free days, 24 (2–28) vs 8 (1–28), $p = 0.06$. A total of 138

High-flow oxygen therapy in cancer patients with acute respiratory failure

Intensive Care Med (2015) 41:2008–2010
DOI 10.1007/s00134-015-3994-8

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Meglio in UTI

Eur Respir J 2005; 25: 348–355
DOI: 10.1183/09031936.05.00085304
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A chart of failure risk for noninvasive ventilation in patients with COPD exacerbation

M. Confalonieri*, G. Garuti[#], M.S. Cattaruzza[¶], J.F. Osborn[¶], M. Antonelli[+], G. Conti[+], M. Kodric*, O. Resta[§], S. Marchese[f], C. Gregoretti and A. Rossi, on behalf of the Italian noninvasive positive pressure ventilation (NPPV) study group[##]**

Patients with a Glasgow Coma Score <11, acute physiology and chronic health evaluation (APACHE) II ⩾29, respiratory rate ⩾30 breaths·min^{-1} and pH at admission <7.25 have a predicted risk of failure >70%. A pH <7.25 after 2 h greatly increases the risk (>90%). The risk charts were

E il paziente anziano?

Ricovero in rianimazione e ventilazione meccanica non sono di per se associate a cattiva prognosi negli anziani senza preesistenti malattie respiratorie

Wood KA, Ely W. What does it mean to be critically ill and elderly? Current Opinion in Critical Care 2003; 9: 316–20

Esteban A, Anzueto A, Frutos-Vivar Fet al. Outcome of older patients receiving mechanical ventilation. Intensive Care Med 2004; 30: 639–646.

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Nonostante ciò….

Maité Garrouste-Orgeas
Jean-François Timsit
Luc Montuclard
Alain Colvez
Olivier Gattolliat
François Philippart
Guillaume Rigal
Benoit Misset
Jean Carlet

Decision-making process, outcome, and 1-year quality of life of octogenarians referred for intensive care unit admission

Intensive Care Med (2006) 32:1045–1051

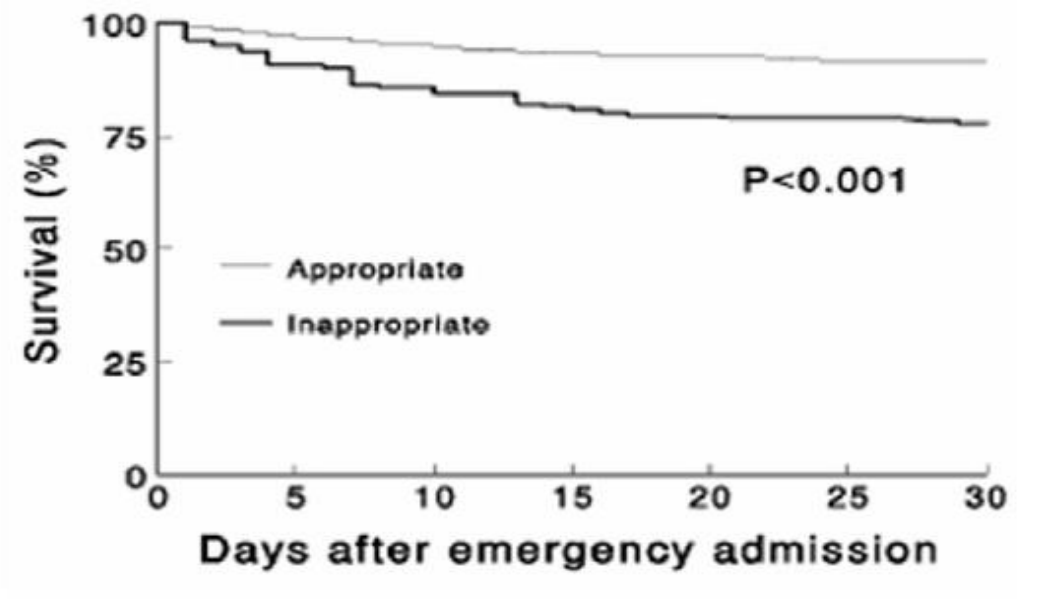
Nel 50% dei casi l'età guida la scelta di NON trasferire il pz in UTI anche quando ve ne sia l'indicazione

Table 2 Logistic regression analysis to identify factors independently associated with refusal of ICU admission (*CI* confidence interval)

	Odds ratio for refusal	95% CI	*p*
Medical patient	5.96	1.26–28.2	0.02
Examination by an ICU physician	5.75	1.21–27.2	0.02
Full unit	4.72	1.37–16.2	0.01
Age > 85 years	4.16	1.44–12.0	0.008
No help needed for toileting	0.04	0.21	< 0.0001

Però il trattamento inappropriato condiziona la sopravvivenza

Figure 2



Kaplan-Meier estimates of survival according to the initial treatment received in the emergency department. Inappropriate treatment was noted in 162 (32%) of the 514 patients. The log-rank test was used to calculate *p*.

Ray P, Birolleau S, Lefort Y et al. Acute respiratory failure in the elderly: etiology, emergency, diagnosis and prognosis. Crit Care 2006; 10: R82

Ma c'è di vero che……

Age and Ageing 2009; **38:** 515–520
doi: 10.1093/ageing/afp119
Published electronically 15 July 2009

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Age, invasive ventilatory support and outcomes in elderly patients admitted to intensive care

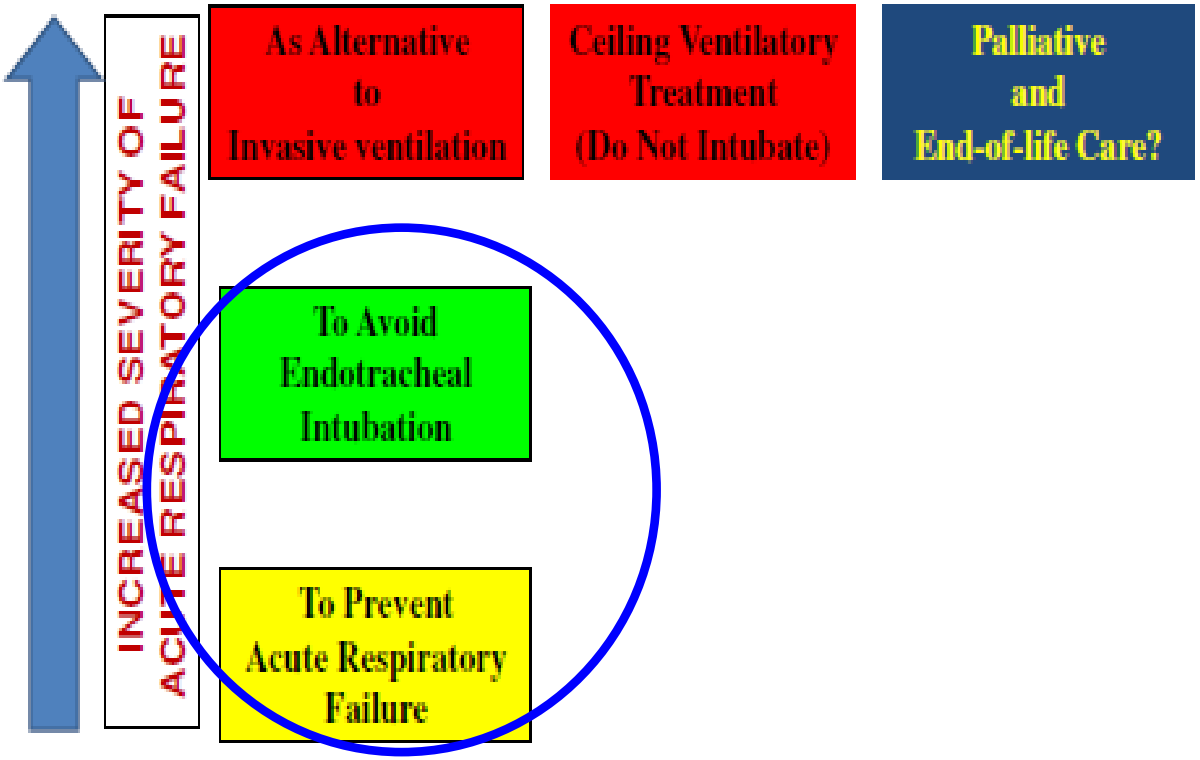
Results: age was strongly correlated with mortality among the invasively ventilated subgroup of patients and the multivariate adjusted odds ratios increased progressively with every age increment (OR = 1.60, 95% CI = 1.01–2.54 for 65–74 years old and OR = 2.68, 95% CI = 1.58–4.56 for ≥75 years). For the patients not submitted to invasive ventilatory support, age was not independently associated with in-hospital mortality (OR = 2.28, 95% CI = 0.99–5.25 for 65–74 years old and OR = 1.95, 95% CI = 0.82–4.62 for ≥75 years old).

Conclusions: the combination of age and invasive mechanical ventilation is strongly associated with in-hospital mortality. Age should not be considered as a factor related to in-hospital mortality of elderly patients not requiring invasive ventilatory support in ICU.

Table 2. Variables independently predictive of in-hospital mortality by logistic regression

Variable	Odds ratio (95% CI)	*P*-value
Age (65–74 years)	1.68 (1.11–2.53)	0.013
Age (75–84 years)	2.44 (1.56–3.80)	< 0.001
Medical admission	3.30 (2.17–5.00)	< 0.001
Unscheduled surgery	2.08 (1.27–3.39)	0.003
APS, points	1.05 (1.03–1.07)	< 0.001
Invasive ventilatory support	6.12 (4.04–9.29)	< 0.001
Time hospital/ICU (days)	1.03 (1.01–1.05)	0.011

Proprio per questo .....



Reasons for applying non-invasive ventilation in elderly at different stages of acute respiratory failure

Scala *BMC Pulmonary Medicine* (2016) 16:150

Per fortuna anche negli anziani….

Age and Ageing 2011; **40:** 444–450

Non-invasive ventilation in elderly patients with acute hypercapnic respiratory failure: a randomised controlled trial

Stefano Nava[1], Mario Grassi[3], Francesco Fanfulla[2], Guido Domenighetti[4], Annalisa Carlucci[2], Andreas Perren[5], Daniela Dell'Orso[6], Michele Vitacca[7], Piero Ceriana[2], Zuhal Karakurt[8], Enrico Clini[6]

Conclusions: compared with SMT, NIV decreased the rate of meeting the ETI criteria and the mortality rate of very old patients with AHRF. NIV should be offered as an alternative to patients considered poor candidates for intubation and those with a DNI order.

the importance of using NIV not only as a palliative measure but, also, as a preferential treatment when intubation is either not wanted by the patient or questionable for the physician.

e negli anziani immunodepressi la NIV …

- rispetto alla ventilazione invasiva riduce la mortalità a 90 gg, mentre a 30 gg la mortalità è dovuta alla polmonite di per se
- Il 50% dei pz riesce ad evitare l'intubazione
- I grossi limiti sono le comorbidità severe e le riammissioni

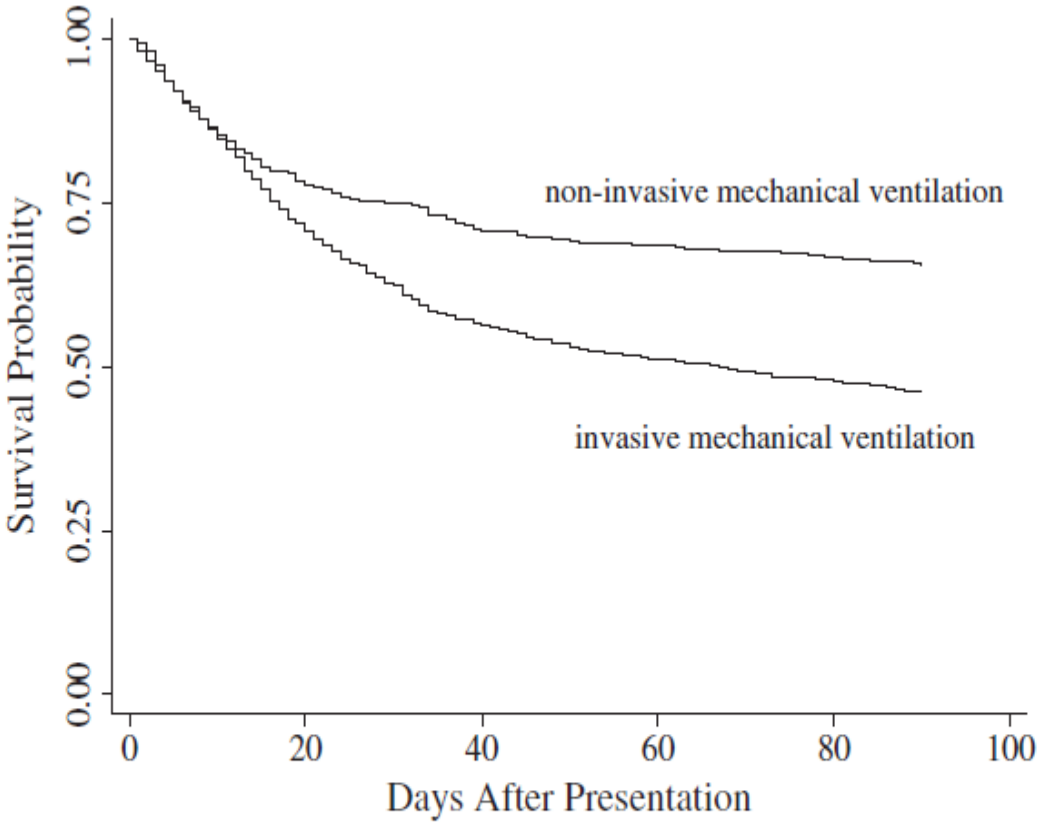


Figure 1 Kaplan-Meier plot of 90-day survival. Patients undergoing non-invasive mechanical ventilation had significantly higher survival than did invasive ventilation patients ($p < 0.001$ by the log-rank test).

Johnson CS, BMC Pulm Med 2014; 14: 7.
Molina R,. Crit Care 2012; 16: R133.
. Arch Bronconeumol 2012; 48: 349–354.
Esquinas Rodríguez AM Arch Bronconeumol 2013; 49: 275–276

Ma i limiti rimangono sempre gli stessi in base alla patologia

Table 1 Likelihood of success of NIV in elderly patients according to the different types of ARF

Clinical condition with Acute Respiratory Failure	Avoidance of intubation Reduction of Mortality
COPD exacerbations	+++
Cardiogenic pulmonary edema	+++
Immuno-compromised status	+++
Obesity-hypoventilation	+++
Chest wall deformities	+++
Weaning/Extubation in COPD	++—
Mild-moderate Encephalopathy	++—
Neuromuscular diseases[a]	++—
Community Acquired Pneumonia	+——
Mild ARDS	+——
Agitation/Delirium[b]	+——
Interstitial fibrotic lung diseases	——
Multi-organ failure/Comorbidities	——

[a] with cough augmentation techniques
[b] with low doses of sedatives

Scala *BMC Pulmonary Medicine* (2016) 16:150

e per pH…

- pH < 7.25, segni di compromissione neurologica o compromissione emodinamica sono indicazione a ricovero in ambiente rianimatorio

Nava S, GrassiM, Fanfulla F et al. Non-invasive ventilation in elderly patients with acute hypercapnic respiratory failure: a randomised controlled trial. Age Ageing 2011; 40: 444–450

- Mentre per pH > 7.28 anche reparto ordinario

Carlucci A, Delmastro M, Rubini F, Fracchia C, Nava S. Changes in the practice of non-invasive ventilation in treating COPD patients over 8 years. Intensive Care Med 2003; 29: 419–25.

La Regina M, Marinaro M, Scuotri L, Corsini F, Orlandini F. Non-invasive ventilation in internal medicine departments:a pilot study. Ital J Med 2013; 7: 172–178

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Tenendo presente che ….

	ICU	RICU	WARD	ED
Staff number				
Lenght of stay				
Monitoring/equipment				
Expertise with NIV				
Familiarity with EOL decision				
Prompt availability of ETI				
Costs				
Link with home-care				

Fig. 2 Characteristics of the different settings where non-invasive ventilation (NIV) may be applied. Green, yellow, red indicates respectively a highly favorable, favorable, unfavorable issue for the different enviro-ment. ICU: Intensive Care Unit, RICU: Respiratory Intensive Care Unit, ED: Emergency Department, ETI: endotracheal intubation, EOL: end-of-life

Scala *BMC Pulmonary Medicine* (2016) 16:150

il vecchietto dove lo metto?

NONINVASIVE VENTILATION IN OLDER ADULTS ADMITTED TO A PNEUMOGERIATRIC UNIT

To the Editor: This study involved 30 individuals aged 80 and older (range 81–101) who underwent noninvasive ventilation (NIV) in the Pneumogeriatric Unit, Department of Geriatrics, Campus Bio-Medico University, Rome, Italy between April 1, 2012, and September 30, 2013. This unit

The presence of delirium or dementia was not a barrier for the indication or for the administration of NIV; the presence of a pneumogeriatric team allowed the symptoms to be controlled and the cooperation of the subjects to be obtained. In addition, NIV in a non-ICU setting allows relatives to visit more frequently and for longer time.[4] Moreover, the presence of a pneumogeriatric team could promote hospital discharge, education of caregivers, and selection of the best discharge setting.

In conclusion, NIV is effective and safe also in very old adults; this setting and this model of care qualify as a valuable alternative to costly, busy intensive or subintensive units.

Alice Laudisio, MD
Simone Scarlata, MD
Claudio Pedone, PhD
Livio Cortese, MD
Anna Zito, MD
Raffaele Antonelli Incalzi, MD
Department of Geriatrics, Campus Bio-Medico University, Rome, Italy

Table 1. Main Diagnostic and Therapeutic Procedures Scheduled in the Pneumogeriatric Therapeutic Plan for Very Old Patients Undergoing Noninvasive Ventilation

Definition of the therapeutic target, based on current and historical health status.
Nutritional assessment and support.
Monitoring of fluids, electrolytes, and acid–base balance.
Execution of echocardiography, chest X ray, and dosage of N-terminal pro-brain natriuretic peptide for screening and prognostic purposes.
Drug dose adjustment according to renal and hepatic function.
Reduction of polypharmacy by discontinuing unnecessary or inappropriate medications.
Prevention of pressure ulcers using a validated protocol.
Prevention and treatment of constipation.
Prevention and treatment of delirium and dementia using pharmacological and nonpharmacological therapies.
Early start of physical and respiratory rehabilitation.
Early removal of urinary catheter and voiding rehabilitation, as needed.
Negotiate with caregivers and social workers the destination and health and social care needs at discharge.
Design and implementation of a training program for caregivers.
Performing a comprehensive geriatric assessment at discharge and planning an integrated pneumogeriatric ambulatory follow-up.

La letteratura ci da ragione..

- Gli studi dimostrano che la demenza non è un limite assoluto
- Il trattamento in ambiente multidisciplinare:
  - riduce malnutrizione e delirium soprattutto per la riduzione del ricorso a sedativi
  - ottimizza le strategie di dimissione e l'educazione dei caregiver
  - riduce i costi rispetto ai reparti di intensiva o subintensiva

Lnghar L, D'Ambrosio CM. Noninvasive ventilation in the older patient who has acute respiratory failure. Clin ChestMed 2007; 28: 793–800.

Tate JA, Sereika S, DivirgilioD, Di VirgilioD, Nilsen Demerci J, Campbell G. Symptom communication during critical illness: The impact of age, delirium presentation. J GerontolNurs 2013; 39: 28–38.

Soguel L, Revelly JP, Schaller MD. Energy deficit and length of hospital stay can be reduced by a two-step quality improvement of nutrition the intensive care unit dietitian can make the difference. Crit Care Med 2012; 40: 412–419

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Applicazioni della NIV nel malato cronico

- BPCO
- Obesità/Ipoventilazione
- Malattie Gabbia Toracica /fibrotorace
- Neuromuscolari
- Gli anziani

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Nocturnal non-invasive nasal ventilation in stable hypercapnic COPD: a randomised controlled trial

R D McEvoy,[1] R J Pierce,[2] D Hillman,[3] A Esterman,[4] E E Ellis,[5] P G Catcheside,[1] F J O'Donoghue,[1,2] D J Barnes,[6] R R Grunstein,[6] on behalf of the Australian trial of non-invasive Ventilation in Chronic Airflow Limitation (AVCAL) Study Group

Aumenta la sopravvivenza ma non migliora la CO2 e la qualità di vita

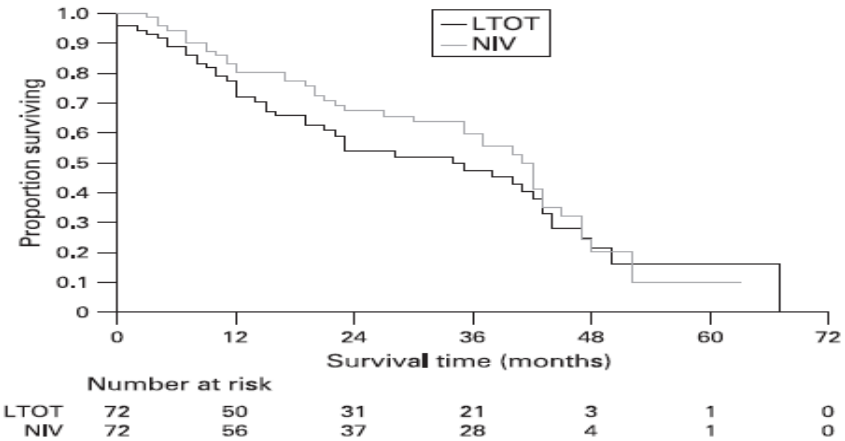


Figure 2 Survival curves of patients randomised to non-invasive ventilation plus long-term oxygen therapy (NIV + LTOT) and long-term oxygen therapy (LTOT) alone. Curves were constructed after adjustment for confounding by baseline differences in arterial oxygen and carbon dioxide tensions and respiratory quality of life measurements. Because of the small number of patients followed up for 3 or more years, there is considerable uncertainty about the true shape of the extreme right-hand end of the survival plots.

Table 3 Follow-up $Paco_2$ and $FEV_{1.0}$ results

		Baseline	6 months	12 months
$Paco_2$ (mm Hg)	LTOT	54.2 (52.0 to 56.4)	55.1 (52.1 to 58.1)	52.2 (49.5 to 54.9)
		n = 45	n = 43	n = 29
	NIV+LTOT	54.1 (51.7 to 56.5)	52.9 (50.5 to 55.3)	53.2 (50.6 to 55.8)
		n = 54	n = 44	n = 43
$FEV_{1.0}$ (% pred)	LTOT	23.9 (21.9 to 25.9)	23.4 (21.4 to 25.4)	26.3 (24.1 to 28.5)
		n = 51	n = 47	n = 38
	NIV+LTOT	25.3 (22.3 to 28.3)	24.9 (21.7 to 28.1)	24.1 (21.1 to 27.1)
		n = 58	n = 56	n = 47

Values are mean (95% CI). Sample sizes are unequal because patient data were censored if it was not possible to obtain measurements under the same conditions ($FEV_{1.0}$ prebronchodilator; arterial blood gases on room air or on oxygen at the same flow rate) on at least two of three occasions.
$FEV_{1.0}$, forced expiratory volume in 1 s; LTOT, long-term oxygen therapy; NIV + LTOT, nocturnal non-invasive ventilation plus term oxygen therapy; $Paco_2$, arterial carbon dioxide tension.

Thorax 2009;**64**:561–566.

In realtà …

- Se impostiamo valori di IPAP più alti riduce anche l'ipercapnia e migliora la qualità di vita oltre che la sopravvivenza

NB : possibile ruolo della inibizione da parte dell'ipercapnia della secrezione di IL6 eTNF e peggioramento della funzione dei neutrofili con peggiore prognosi nelle polmoniti in modelli animali

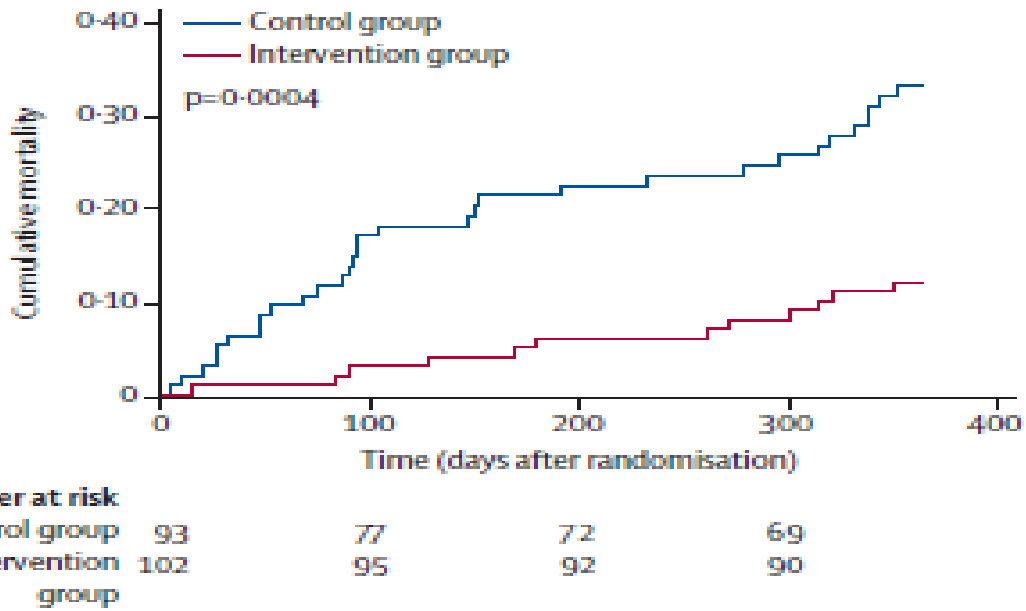
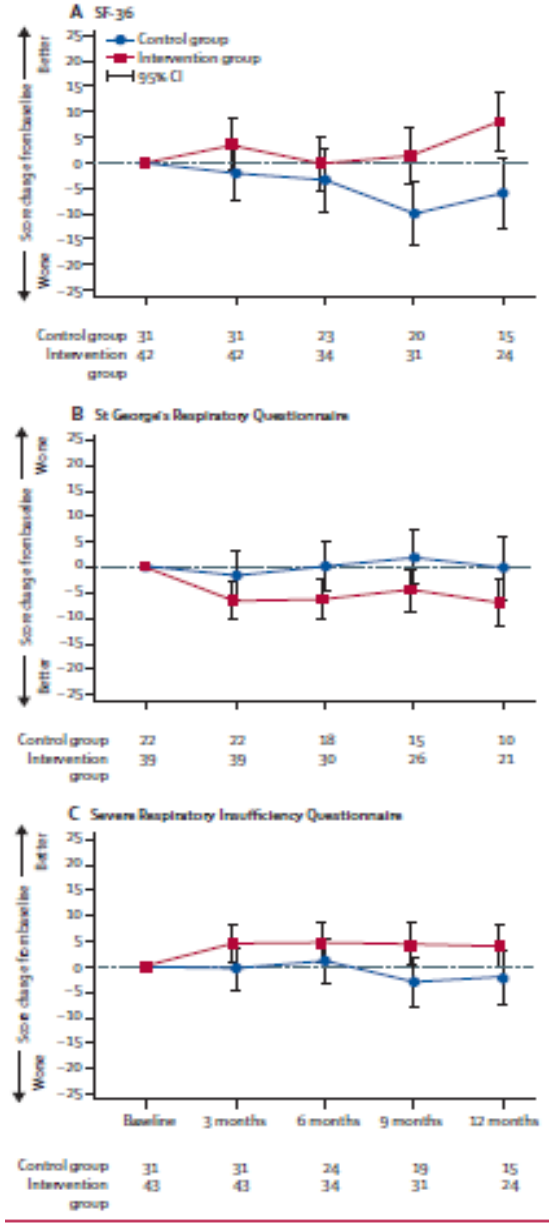


Figure 2: Kaplan-Meier estimate of cumulative all-cause mortality during the first year after randomisation (primary outcome)
The p value results from a log-rank test of the between-group difference.



Köhnlein T, et al Lancet Respir Med 2014;2:698–705
Gates KL, Am J Respir Call Mol Biol, 2013; 49(5): 821–828

Peraltro …

IPAP maggiori (28.6 vs 14.6 mmHg) si associano ad una migliore compliance

Chronic obstructive pulmonary disease

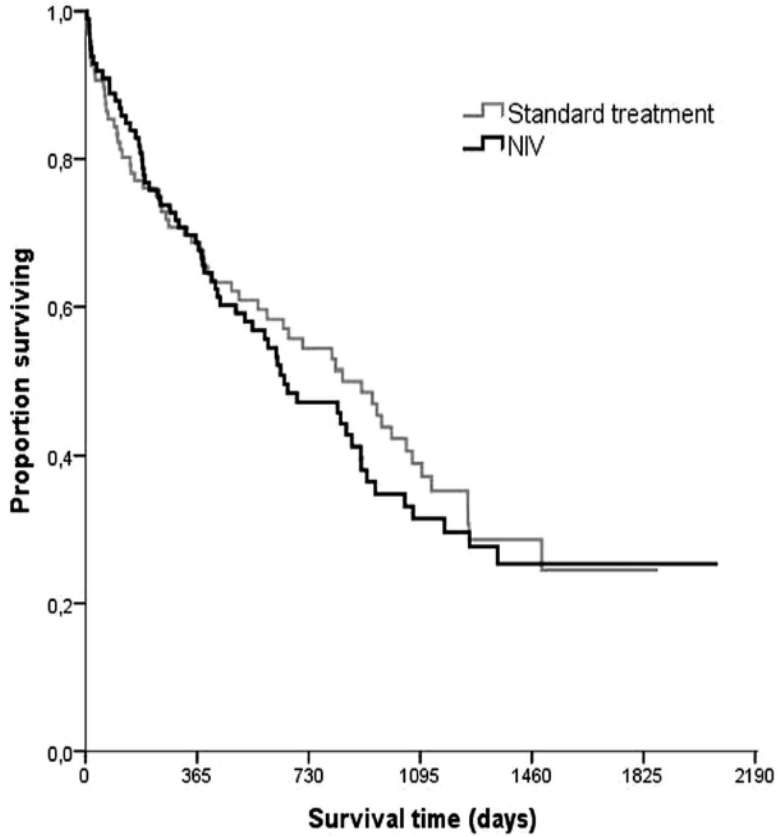
High-intensity versus low-intensity non-invasive ventilation in patients with stable hypercapnic COPD: a randomised crossover trial

Michael Dreher,[1] Jan H Storre,[1] Claudia Schmoor,[2] Wolfram Windisch[1]

Thorax 2010;**65**:303–308.

Nocturnal non-invasive ventilation in COPD patients with prolonged hypercapnia after ventilatory support for acute respiratory failure: a randomised, controlled, parallel-group study

F M Struik,[1,2] R T M Sprooten,[3] H A M Kerstjens,



Methods 201 COPD patients admitted to hospital with ARF and prolonged hypercapnia >48 h after termination of ventilatory support were randomised to NIV or standard treatment. Secondary outcomes were daytime arterial blood gasses, transcutaneous PCO_2 during the night, lung function, health-related quality-of-life (HRQL), mood state, daily activities and dyspnoea.

Results 1 year after discharge, 65% versus 64% of patients (NIV vs standard treatment) were readmitted to hospital for respiratory causes or had died; time to event was not different (p=0.85). Daytime $PaCO_2$ was significantly improved in NIV versus standard treatment ($PaCO_2$ 0.5 kPa (95% CI 0.04 to 0.90, p=0.03)) as was transcutaneous PCO_2 during the night. HRQL showed a trend (p=0.054, Severe Respiratory Insufficiency questionnaire) in favour of NIV. Number of exacerbations, lung function, mood state, daily activity levels or dyspnoea was not significantly different.

Discussions We could not demonstrate an

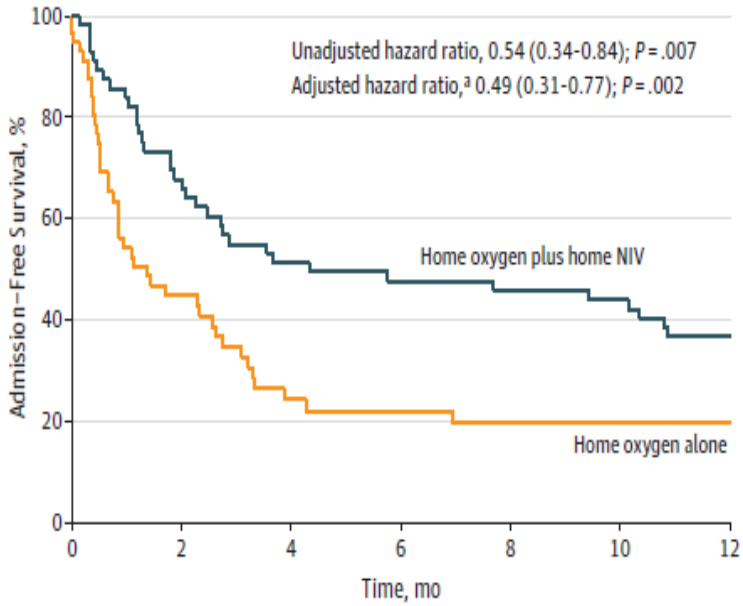
Thorax 2014;69:826-34

JAMA | Original Investigation

Effect of Home Noninvasive Ventilation With Oxygen Therapy vs Oxygen Therapy Alone on Hospital Readmission or Death After an Acute COPD Exacerbation
A Randomized Clinical Trial

Patrick B. Murphy, PhD; Sunita Rehal, MSc; Gill Arbane, BSc (Hons); Stephen Bourke, PhD; Peter M. A. Calverley, PhD; Angela M. Crook, PhD; Lee Dowson, MD; Nicholas Duffy, MD; G. John Gibson, MD; Philip D. Hughes, MD; John R. Hurst, PhD; Keir E. Lewis, MD; Rahul Mukherjee, MD; Annabel Nickol, PhD; Nicholas Oscroft, MD; Maxime Patout, MD; Justin Pepperell, MD; Ian Smith, MD; John R. Stradling, PhD; Jadwiga A. Wedzicha, PhD; Michael I. Polkey, PhD; Mark W. Elliott, MD; Nicholas Hart, PhD

Figure 2. Kaplan-Meier Survival Plot of Time to Readmission or Death From Randomization to the End of Trial Follow-up at 1 Year



No. at risk							
Home oxygen plus home NIV	57	37	28	26	25	24	16
Home oxygen alone	59	23	11	10	8	8	6

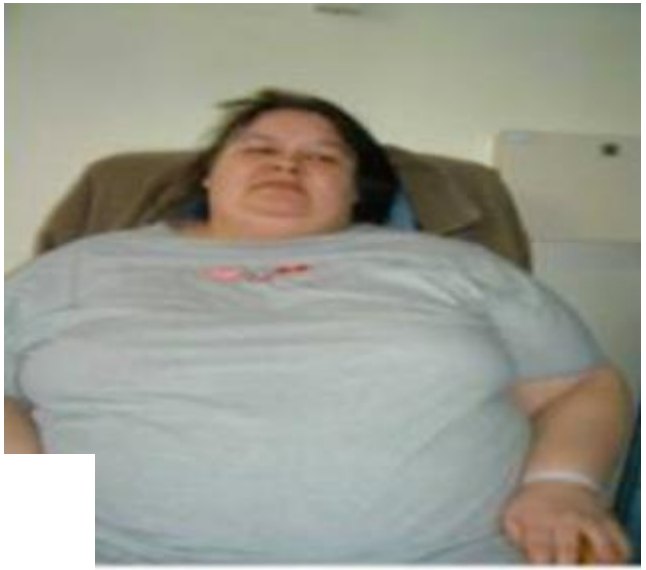
The results of this study support the use of in-home, high-pressure noninvasive ventilation in patients who have persistent hypercapnia for 2 to 4 weeks after resolution of respiratory acidemia requiring acute noninvasive ventilation. There are physiological mechanisms that underpin the effect of home noninvasive ventilation when added to home oxygen therapy that could explain the clinical benefit of reduced hospital readmission. Previous physiological studies have shown that home noninvasive ventilation in patients with severe COPD improves ventilatory response to hypercapnia, which could be expected to act as a clinically relevant effect of treatment, allowing a more robust and adaptive response to the adverse physiological challenge of an acute PaCO2 increase during an exacerbation.

La NIV nella sindrome da ipoventilazione in obesità

Background fisiopatologico : ridotta risposta all'ipercapnia e ipossia e incremento del lavoro respiratorio a causa del deposito di grasso sulla parete toracica (riduzione volume polmonare e della compliance di polmone e parete, riduzione della forza dei muscoli inspiratori)

Krachman S, Criner GJ. Hypoventilation syndromes. Clin Chest Med 1998; 19:139–155
Sampson MG, Grassino A. Neurochemical properties in obese patients during carbon dioxide rebreathing. Am J Med 1983; 75:81–90
Zwillich CW, Sutton FD, Pierson DJ, et al. Decreased hypoxic ventilatory drive in the obesity-hypoventilation syndrome. Am J Med 1975; 59:343–348
12 Sharp JT, Henry JP, Sweany SK, et al. The total work of breathing in normal and obese men. J Clin Invest 1964; 43:728–739

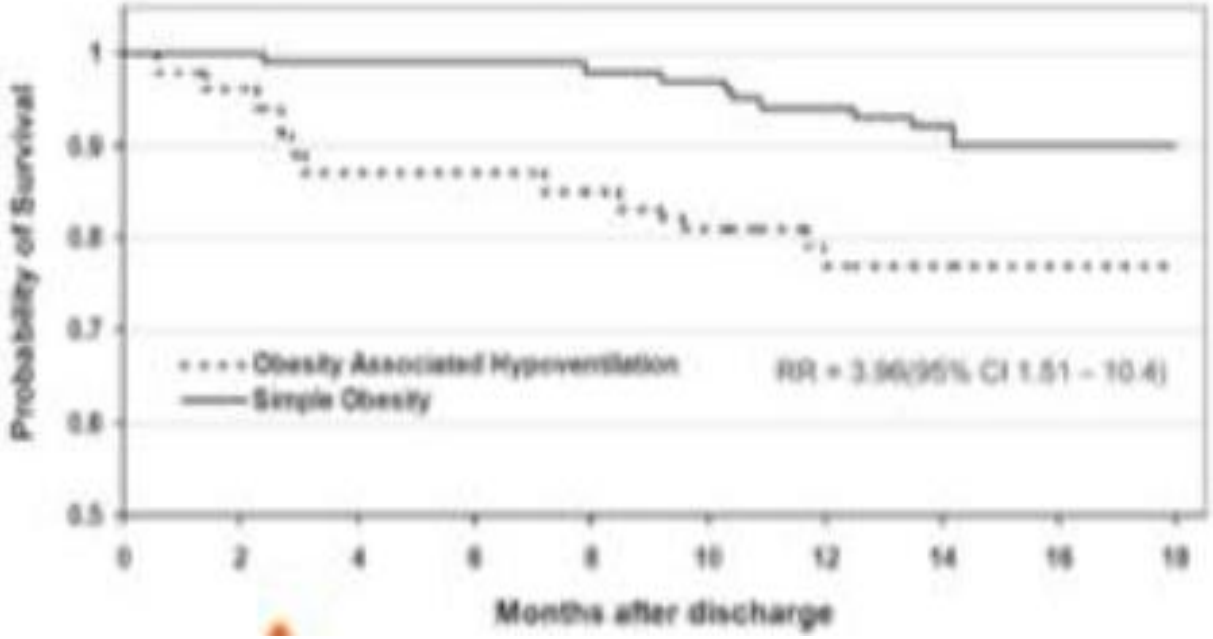
In quale obeso la NIV e perchè ?



In caso di desaturazione marcata

In caso di ipercapnia

Overlap syndrome



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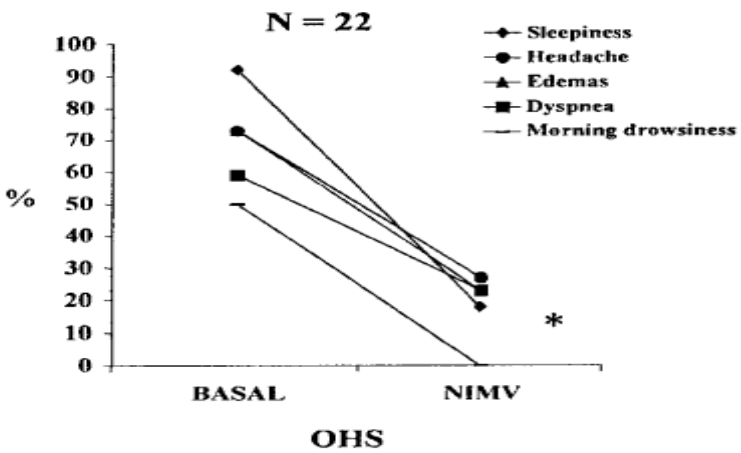
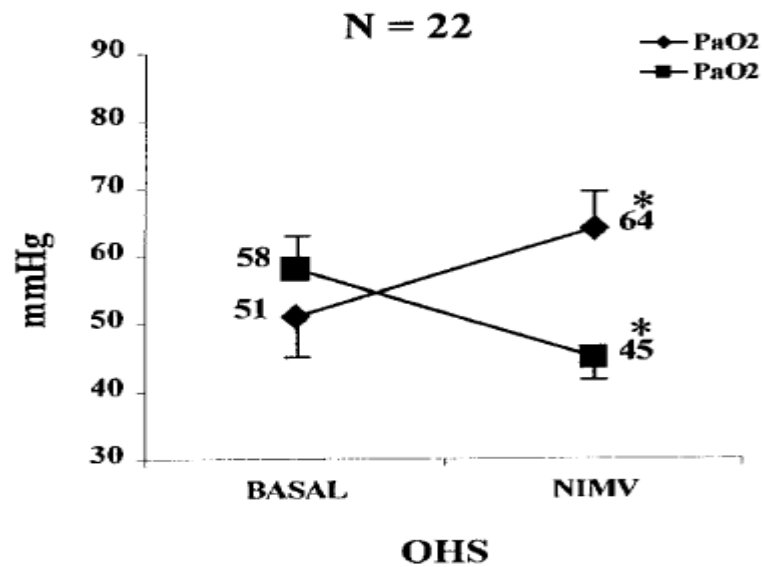
(CHEST 2001; 119:1102–1107)

The Obesity Hypoventilation Syndrome Can Be Treated With Noninvasive Mechanical Ventilation*

Juan F. Masa, MD; Bartolome R. Celli, MD, FCCP; Juan A. Riesco, MD; Manuel Hernández, MD; Julio Sánchez de Cos, MD; and Carlos Disdier, MD

Conclusions: **NIMV improves the clinical symptoms and the respiratory failure of patients with OHS to a similar degree to that reported for diseases in which its use is completely established, such as kyphoscoliosis. Therefore, NIMV could be an alternative to the treatment of patients with OHS.**



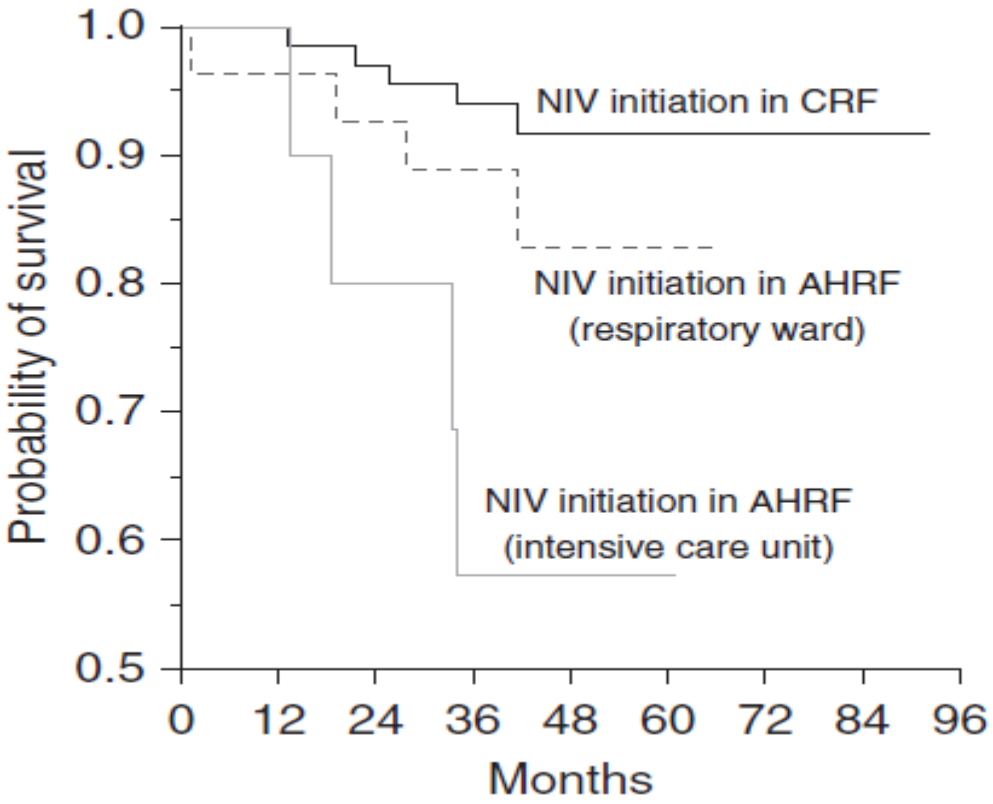


In che modalità?

- CPAP
- PS
- PSV vtg: controlla meglio la CO2 , ma non in tutti gli studi sono documentati miglioramenti della qualità di vita rispetto al PSV

Storre JH, Seuthe B, Fiechter R, Milioglou S, Dreher M, Sorichter S, Windisch W. Average volume assured pressure support in obesity hypoventilation: a randomized crossover trial. Chest 2006;130:815–821
Murphy PB, Davidson C, Hind MD, Simonds A, Williams AJ, Hopkinson NS, Moxham J, Polkey M, Hart N. Volume targeted versus pressure support non-invasive ventilation in patients with super obesity and chronic respiratory failure: a randomised controlled trial. Thorax 2012;67:727–734

l'outcome è migliore per i pazienti che iniziano la ventilazione in una condizione di cronicità



Borel J-C, Burel B, Tamisier R, Dias-Domingos S, Baguet JP, Levy P, Pepin JL. Comorbidities and mortality in hypercapnic obese under domiciliary noninvasive ventilation. PLoS One 2013;8:e52006

Predictors of noninvasive ventilation failure in critically ill obese patients: a brief narrative review

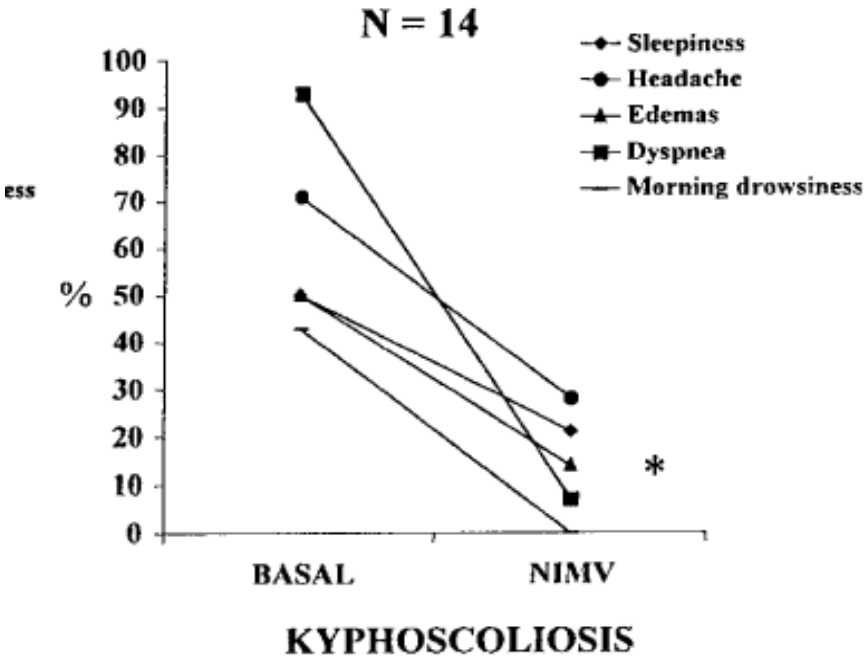
Delay in the reduction of $PaCO_2$ may be due to:

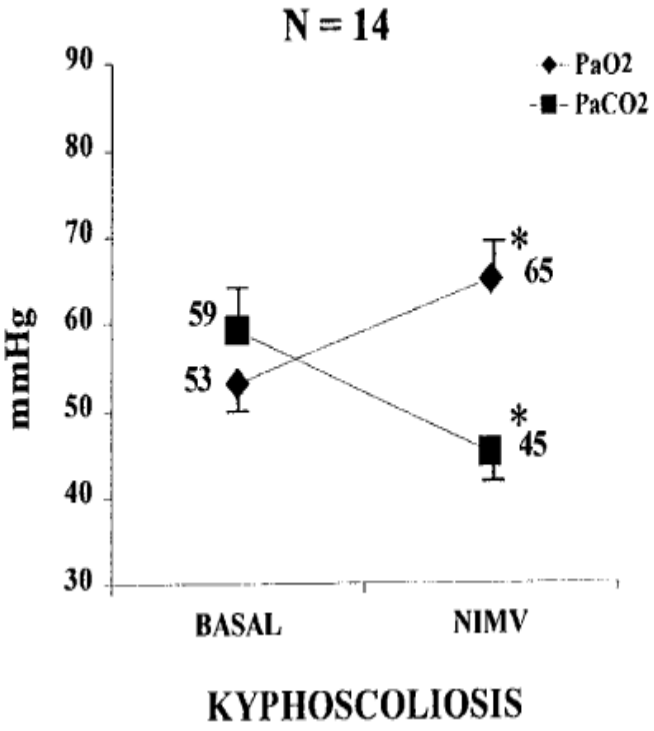
1. Inadequate level of IPAP or EPAP levels: in obese patients IPAP should ranged from 12 to 30 cm H_2O or greater and EPAP from 6 to 8 cm H_2O or greater [6, 20].
2. Inadequate duration of NIV: the obese patients as previously explained require longer NIV therapy than non-obese patients especially during the night; their apnea or hypoventilation worsen during hours of sleep [10, 20].

Conclusion

In conclusion, although few studies are available concerning morbidly obese patients with decompensation of OHS, they suggest that NIV could be safely used in patients with hypercapnic acute respiratory decompensation of OHS. OHS patients require more aggressive NIV settings and a longer time to reduce $PaCO_2$ levels below 50 mm Hg. They frequently exhibit a delayed but successful response to NIV which should encourage the pursuit of NIV rather than early intubation. Since clear predictors of failure have not been identified, a strict and prolonged monitoring is mandatory because morbidly obese patients often experienced late NIV failure.

anche in altre sindromi da ipoventilazione come la cifoscoliosi, la NIV funziona





Peraltro il buon controllo della CO2 predice la sopravvivenza nei ristretti

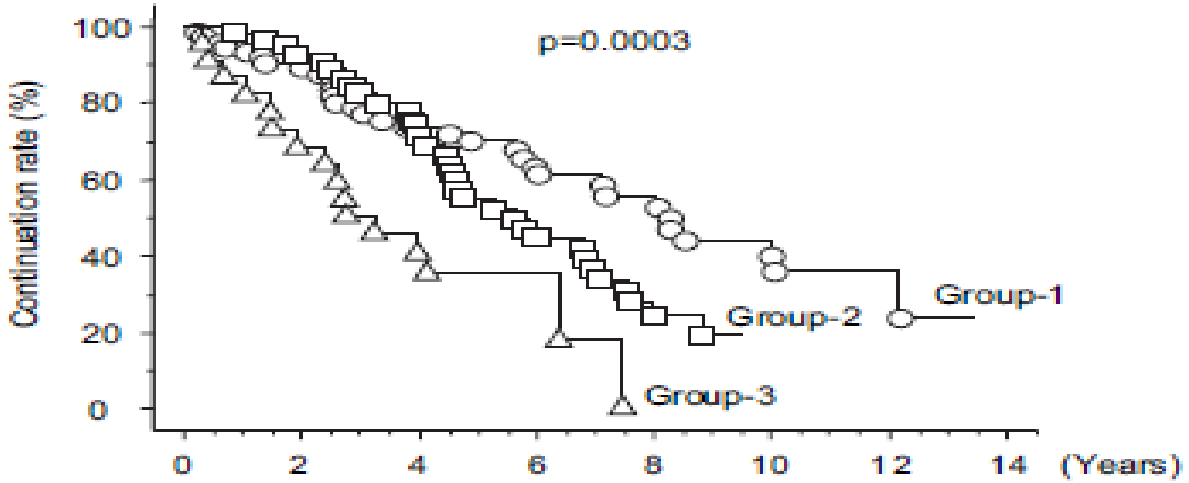


Figure 2 Kaplan—Meier curves of continuation rates of long-term NPPV in all patients. Patients were divided into 3 groups according to the average $PaCO_2$ 3—6 months after introduction of long-term NPPV (3- to 6-mo $PaCO_2$) (Group-1, 60 mmHg>; Group-2, 60—70 mmHg; Group-3, >70 mmHg). Patients with relatively low 3- to 6-mo $PaCO_2$ values had a significantly better prognosis (log-rank test, $p = 0.0003$).

Tsuboi T, et al. Importance of the PaCO(2) from 3 to 6 months after initiation of long-term non-invasive ventilation. Respir Med. 2010 Dec; 104(12):1850–7.

Martí S, Pallero M, Ferrer J, Ríos J, Rodríguez E, Morell F, et al. Predictors of mortality in chest wall disease treated with noninvasive home mechanical ventilation. Respir Med. 2010 Dec; 104(12):1843–9.

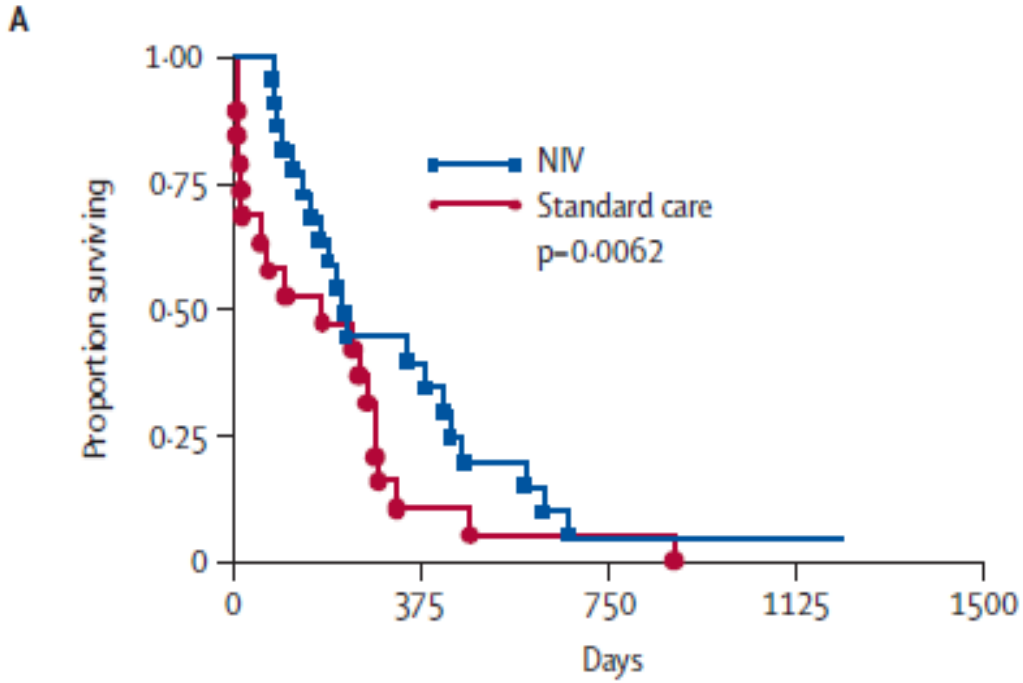
La NIV nelle malattie neuromuscolari :la SLA

- Indicazioni: SpO2<93%, FVC,70% del teor o MIP< a 60 cm H2O, disturbi respiratori nel sonno del sonno o ortopnea
- Migliore sopravvivenza nel gruppo NIV nonostante fossero pz con FVC minore
- Migliore tolleranza nei pz senza compromissione bulbare
- Nei pazienti bulbari non vi è differenza di sopravvivenza fra i tolleranti e non tolleranti con una sopravvivenza pero' migliore nei tolleranti ipercapnici alla diagnosi

Gibson GJ Lancet Neurol 2006;5:140–147

Gruis KL,. Muscle Nerve 2005;32:808–811.

Farrero E, . Chest 2005;127:2132–2138.



La NIV domiciliare negli anziani

RESEARCH ARTICLE

Home Non-Invasive Ventilation Fails to Improve Quality of Life in the Elderly: Results from a Multicenter Cohort Study

Adrien Tissot[1]*, Sandrine Jaffre[1], Frédéric Gagnadoux[2], Marc Levaillant[3], Frédéric Corne[1], Sylvaine Chollet[1], François-Xavier Blanc[1], François Goupil[4], Pascaline Priou[2], Wojciech Trzepizur[2], Antoine Magnan[1], IRSR NIV cohort group[¶]

Methods and Results

264 patients with at least a six-month follow-up were analyzed. Among them, 82 were elderly. In the elderly and the younger, we found an improvement of arterial blood gas, the Epworth sleepiness scale and the Pittsburgh sleep quality index at 6 months. Mean daily use of NIV at 6 months was 7 hours and the rate of non-adherent patients was similar in both group. Health-related quality of life (HRQL) assessed by SF-36 questionnaires did not change significantly after NIV initiation in the elderly whereas HRQL improved in the less than 75. On univariate analysis, we found that diabetes was a predictive factor for non-adherence in the elderly (Odds ratio: 3.95% confidence interval: 1.06–8.52).

Conclusion

NIV was efficient in the elderly while evaluation at 6 months showed a good adherence but failed to improve HRQL.

PLOS ONE | DOI:10.1371/journal.pone.0141156 October 21, 2015

Messaggi da portarsi dietro

- Applica la NIV attenendoti alle indicazioni garantendo un setting che preservi la sicurezza del malato
- Identifica precocemente il fallimento per l'upgrade di invasività delle cure
- Il fallimento della NIV non è il fallimento del medico che la pratica

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