66° SIGG CONGRESSO NAZIONALE
ROMA, 1-4 DICEMBRE 2021
Geriatria e Rinascita
SOCIETÀ ITALIANA DI GERONTOLOGIA E GERIATRIA

INDICAZIONI ALLA VENTILAZIONE MECCANICA

D.ssa A. Zito

Unità di Subintensiva Pneumogeriatrica

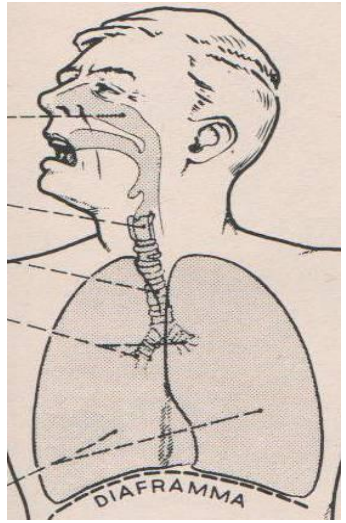
Responsabile: Prof. R. Antonelli Incalzi

UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA

Lo scopo della respirazione è di far arrivare O2 alle cellule e di espellere la CO2 (processo di ventilazione).

O2

CO2



LAVORO RESPIRATORIO

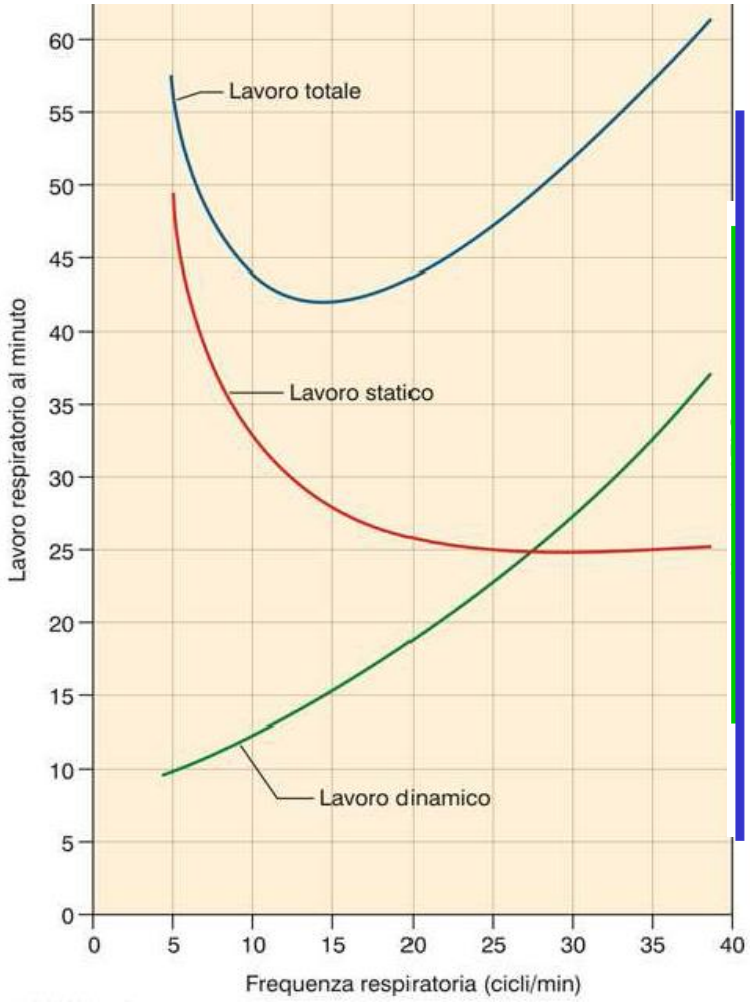
Quantità di energia spesa nella respirazione dipende da:

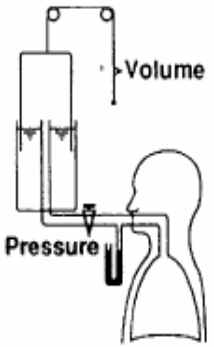
Frequenza, profondità del respiro e resistenza al flusso aereo(che può essere aumentata per secrezioni e broncospasmo) determinano il lavoro dinamico

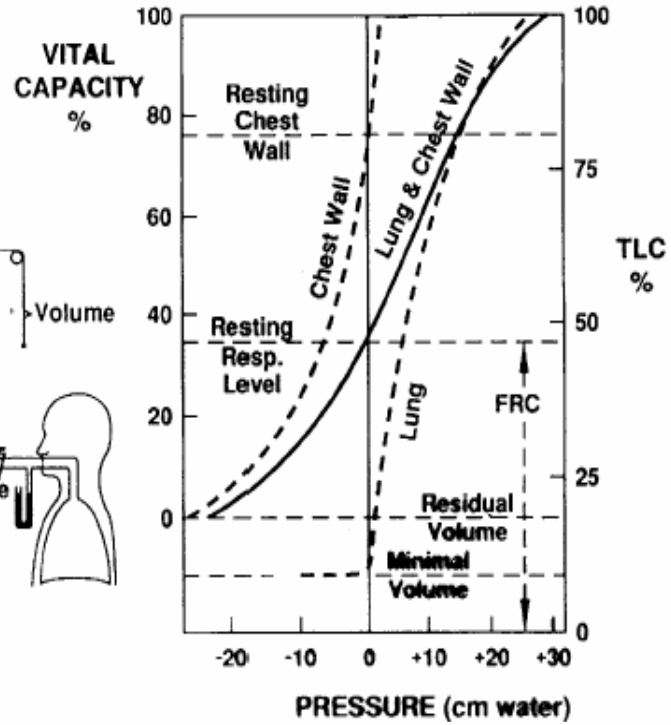
Facilità con cui polmoni e gabbia toracica si espandono (compliance) determinano il lavoro elastico

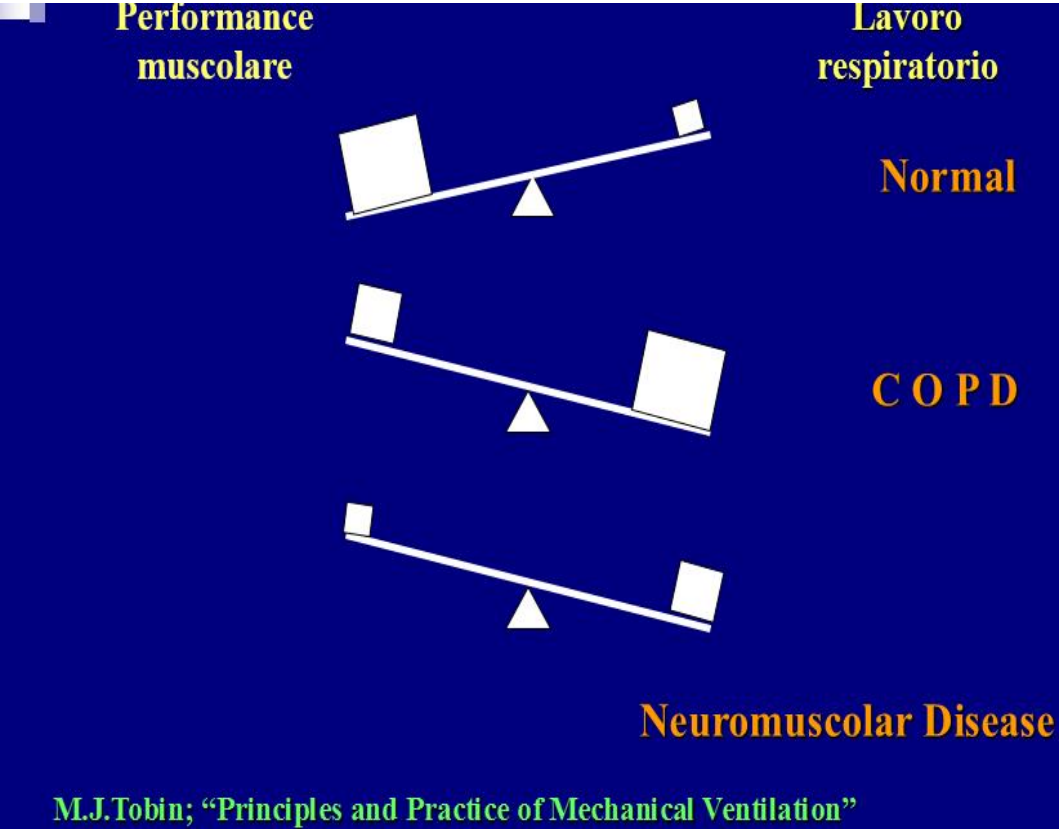
Con l'aumentare della frequenza respiratoria , il lavoro elastico (statico) diminuisce perché si riduce il volume corrente , ma aumenta il lavoro dinamico) perché aumenta il flusso nelle vie Aeree :Il lavoro è min per RR 12-14 apm

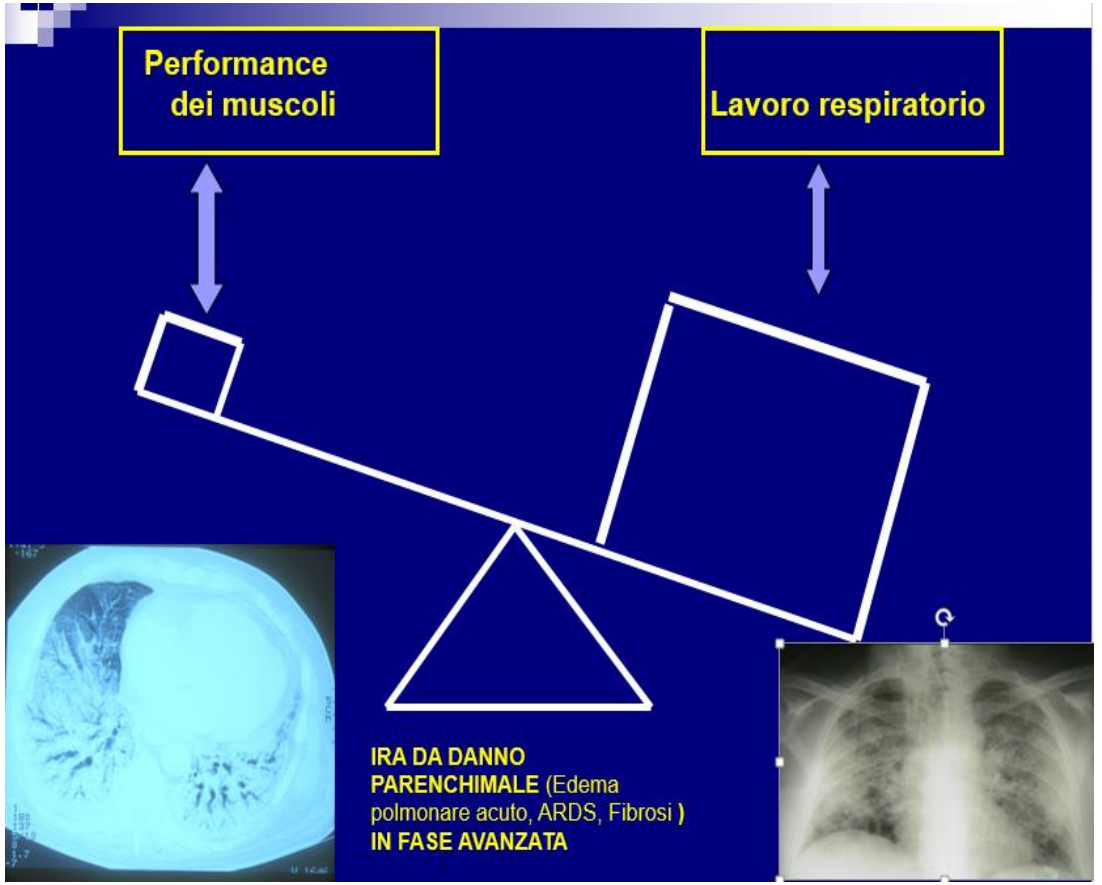
DISTENSIBILITÀ (COMPLIANCE): E' espressa dalla variazione di volume in risposta alla variazione di pressione applicata al sistema (ΔV/ ΔP).








Performance muscolare
Lavoro respiratorio
Normal
COPD
Neuromuscolar Disease
M.J.Tobin; "Principles and Practice of Mechanical Ventilation"


Performance dei muscoli
Lavoro respiratorio
IRA DA DANNO PARENCHIMALE (Edema polmonare acuto, ARDS, Fibrosi)
IN FASE AVANZATA

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

Invasiva: l'interfaccia è costituita dalla tracheostomia o tubo endotracheale

Non invasiva : l'interfaccia è una maschera o un casco

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.

NIV GUIDELINES 2016

Thorax. 2016 Apr;71 Suppl 2:ii1-35. doi: 10.1136/thoraxjnl-2015-208209.

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

Davidson AC[1], Banham S[1], Elliott M[2], Kennedy D[3], Gelder C[4], Glossop A[5], Church AC[6], Creagh-Brown B[7], Dodd JW[8], Felton T[9], Foëx B[10], Mansfield L[11], McDonnell L[12], Parker R[13], Patterson CM[14], Sovani M[15], Thomas L[16]; 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.

Recommendations

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

25. NIV should be started when pH<7.35 and pCO_2 >6.5 kPa (48,75 mmHg), RR>22 apm persist or develop despite optimal medical therapy (Grade A).

ed ancora ….

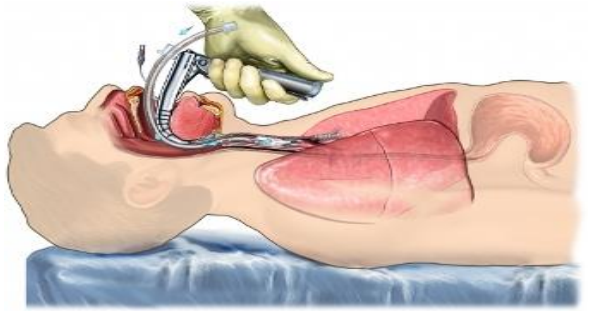
Dispnea ingravescente con uso evidente dei mm accessori e/o dissincronismo toraco-addominale

Ipossiemia nonostante la somministrazione di ossigeno ad elevate concentrazioni (SO2 <90% nonostante ventimask al 50-60%, FiO2>60% con Of)

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.

Ci sono condizioni in cui non dovremmo neanche iniziare ed intubare il paziente

- **Quando l'insufficienza respiratoria è accompagnata da 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**
- **pH<7.1**
- **Necessità di proteggere le vie aeree**
- **Ostruzione delle vie aeree superiori**
- **PNX non drenato**



Vantaggi della NIV

Precoce supporto ventilatorio

Facilità di applicazione e rimozione

Applicazione intermittente

Possibilità di sospensione in qualsiasi momento

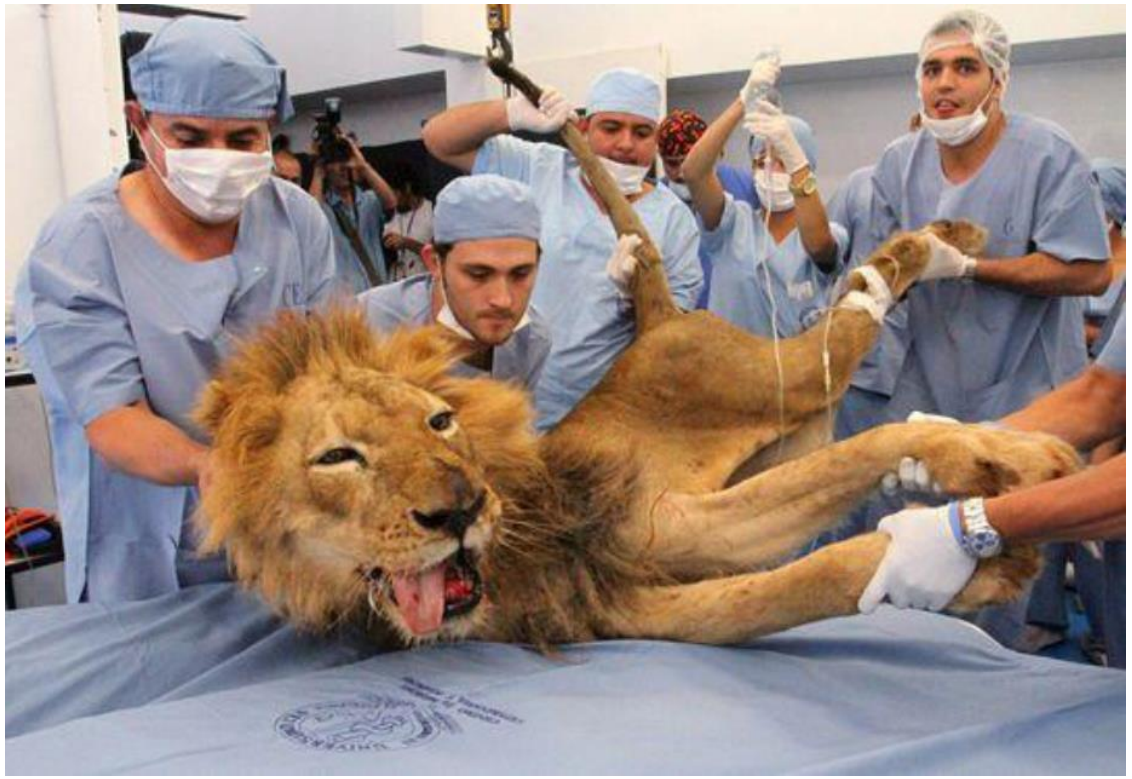
Conservazione dei meccanismi di difesa delle vie respiratorie

Il pz può bere, mangiare e comunicare

Il pz può collaborare ed effettuare fisioterapia

Riduce la necessità di sedazione

Purchè il paziente collabori!



Complicanze della NIV

Segni e sintomi

• Discomfort al contatto della pelle o guasto dell'interfaccia

• Distensione gastrica, aspirazione e vomito

•Crampi, sensazione di formicolio

•Difficoltà a dormire

•Claustrofobia

✓Abrasione nasale, secchezza, congestione e riniti

✓Irritazione oculare, congiuntivite

✓Otalgia e/o sinusite

✓Dispnea atipica

✓Dolore dentale

✓Dolore toracico, dispnea

Possibili cause

Eccessiva pressione
Frizione, reazione o irritazione della pelle

Deglutizione di aria
Scarso adattamento
Eccessiva insufflazione
Mangiare o bere in prossimità della NIV

iperventilazione che causa alcalosi respiratoria

Ansia

Ventilazione inadeguata

✓Aria secca esalata dalla macchina

✓Perdite aeree intorno alla maschera

✓Pressione eccessiva della macchina

✓Perdita di pressione di supporto e riduzione Vt

✓Pressione esercitata dalla maschera buccale

✓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 > 50, meglio 100
- Miglioramento del pH rispetto al basale
- PaCO2 riduzione del 20% rispetto al basale

è inutile insistere e ritardare l'intubazione se :

Peggioramento livello di vigilanza

Agitazione psicomotoria (!)

Instabilità emodinamica

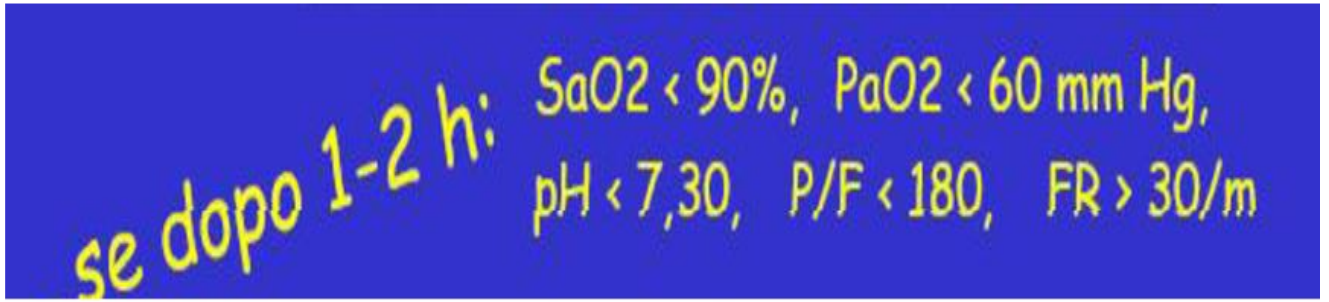
MOF

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

Polmoniti acquisite in comunità soprattutto nel BPCO , e nell'immunodepresso

Acute lung injury- ARDS

Polmonite da Covid

Trauma toracico

Malati sottoposti a chirurgia

Attacco asmatico acuto non responsivo a terapia medica

Svezzamento dalla ventilazione invasiva

Medical Progress

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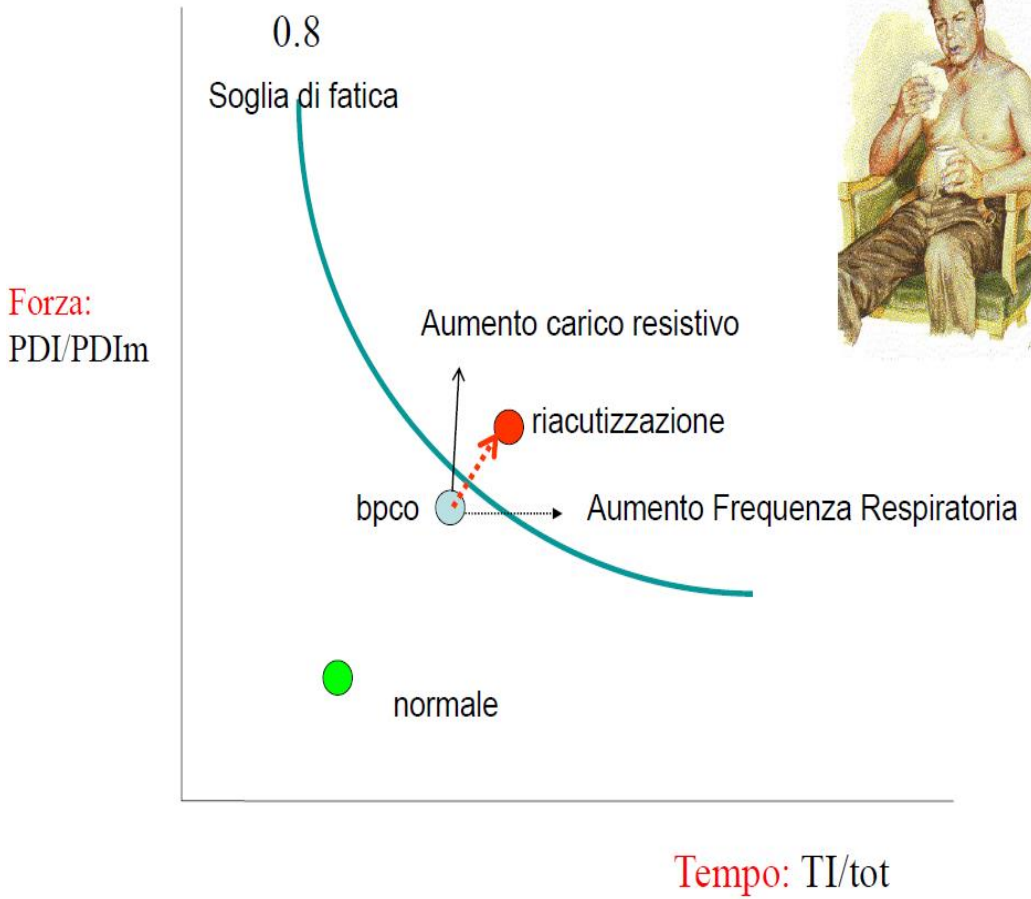
MARTIN J. TOBIN, M.D.

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.

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.

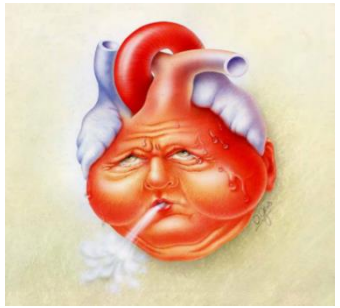
Nella BPCO la NIV è una certezza:

evita l'intubazione e le sue complicanze ,

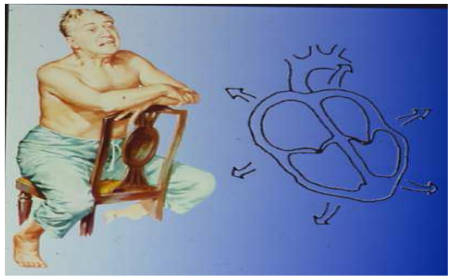
- Brochard L et al. NEJM 1995 (RCT)
- Guerin C et al Intensive Care Med 1997
- Nava S et al . Ann Intern Med 1998 (RCT)
- Girault C et al JAMA 1999
- Nourdine K Intensive Care Med 1999

riduce la mortalità

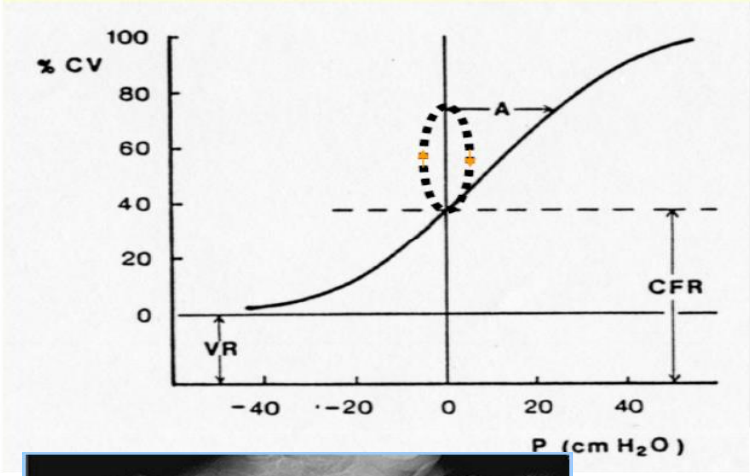
- Bott T et al. Lancet 1993
  reduced from 30%(CT) to 3.8%(NPPV)
- Brochard L et al . N. Engl J Med 1995
  reduced from 29%(CT) to 9%(NPPV)
- Plank Pk et al The Lancet 2000
  reduced from 20% (CT) to 10% (NPPV)
- Nava S et al . Ann Intern Med 1998
  reduced from 28% (CV) to 8%(NPPV)



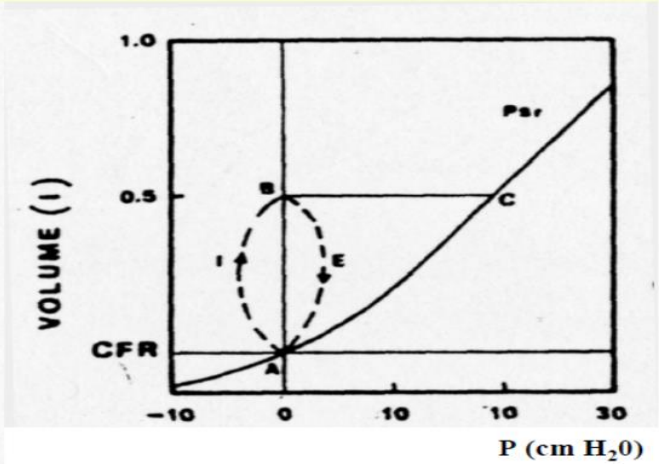
Razionale della ventilazione nell'edema polmonare



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

Ulteriori fattori complicanti il quadro clinico :

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 riduzione dell'endurance muscolare causata da sarcopenia con perdita del tessuto muscolare per riorganizzazione dei miofilamenti , riduzione del numero di fibre muscolari soprattutto di tipo II e delle unità motorie a contrazione rapida, sostituzione delle fibre muscolari con collagene

frequente malnutrizione per deficit vitaminici, soprattutto del gruppo B , in parte anche secondari al'uso di diuretici ad alte dosi

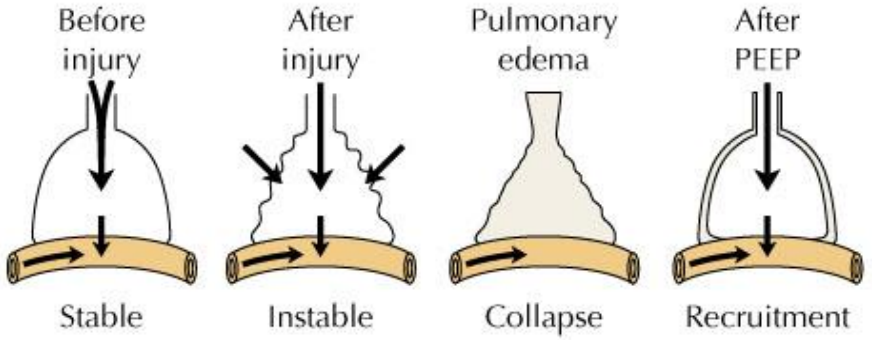
Verissimo P, Casalaspo TJ, Gonçalves LH, Yang AS, Eid RC, Timenetsky KT. High Prevalence of Respiratory Muscle

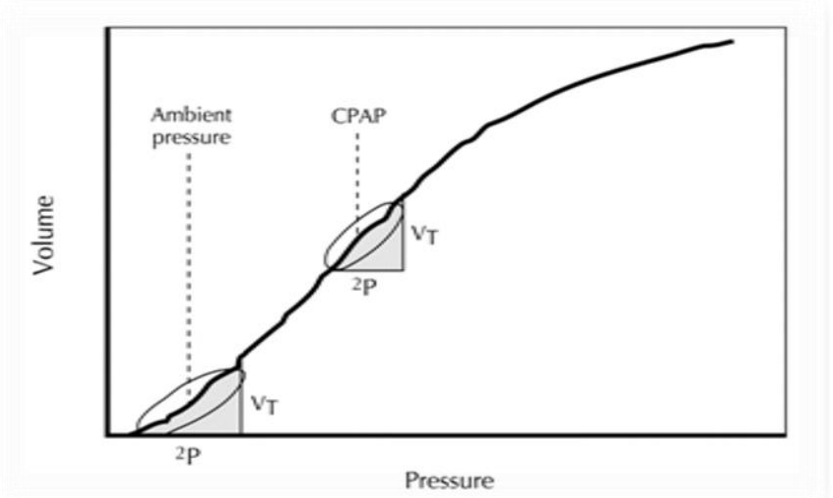
Weakness in Hospitalized Acute Heart Failure Elderly Patients. PLoS One 2015; 10: e0118218.

La pressione positiva espiratoria

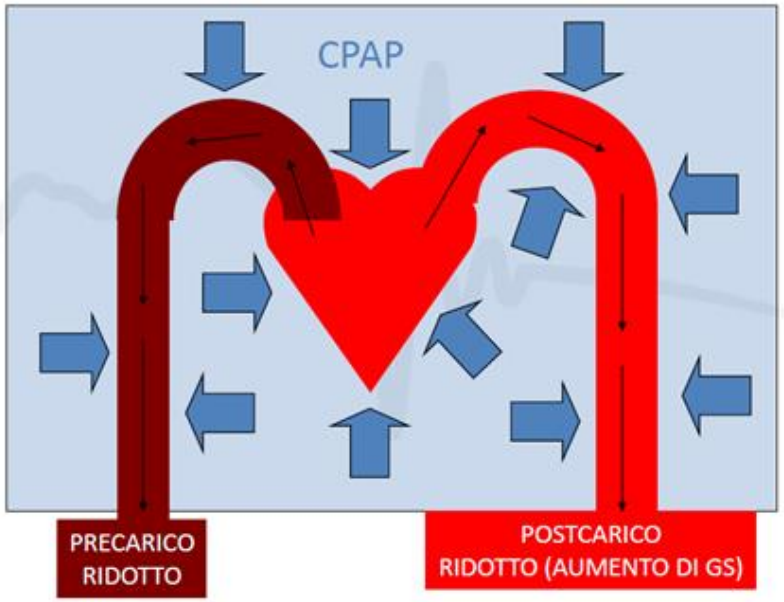
Aumenta il volume alveolare di fine espirazione aiutando lo spostamento di liquidi dagli alveoli allo spazio interstiziale , riducendo lo shunt e migliorando l' ossigenazione consentendo di ridurre la FiO2 a dosi non tossiche

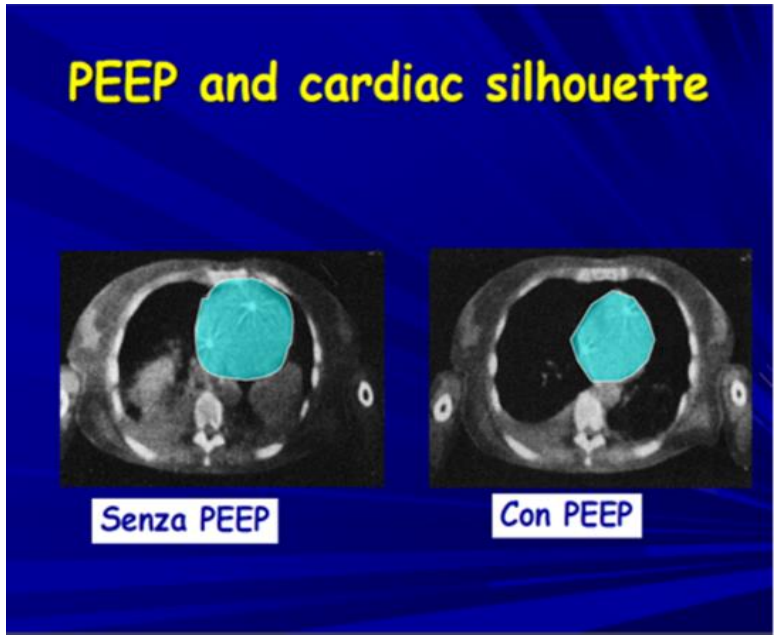
Riduce il lavoro respiratorio per aumento della compliance polmonare





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)

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

Ritesh Agarwal
Dheeraj Gupta

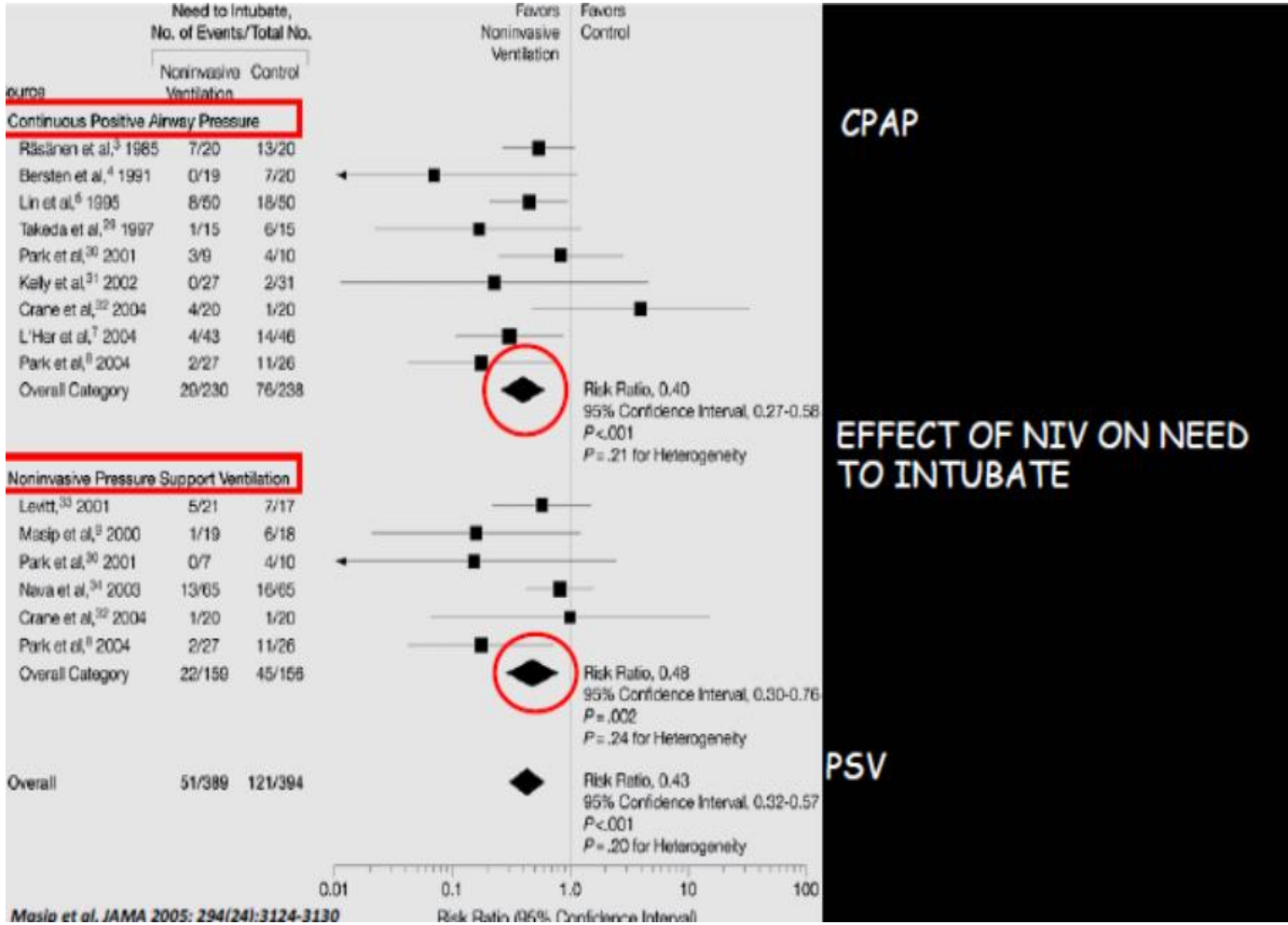
What is the role of noninvasive ventilation in diastolic heart failure?

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

ne, 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].

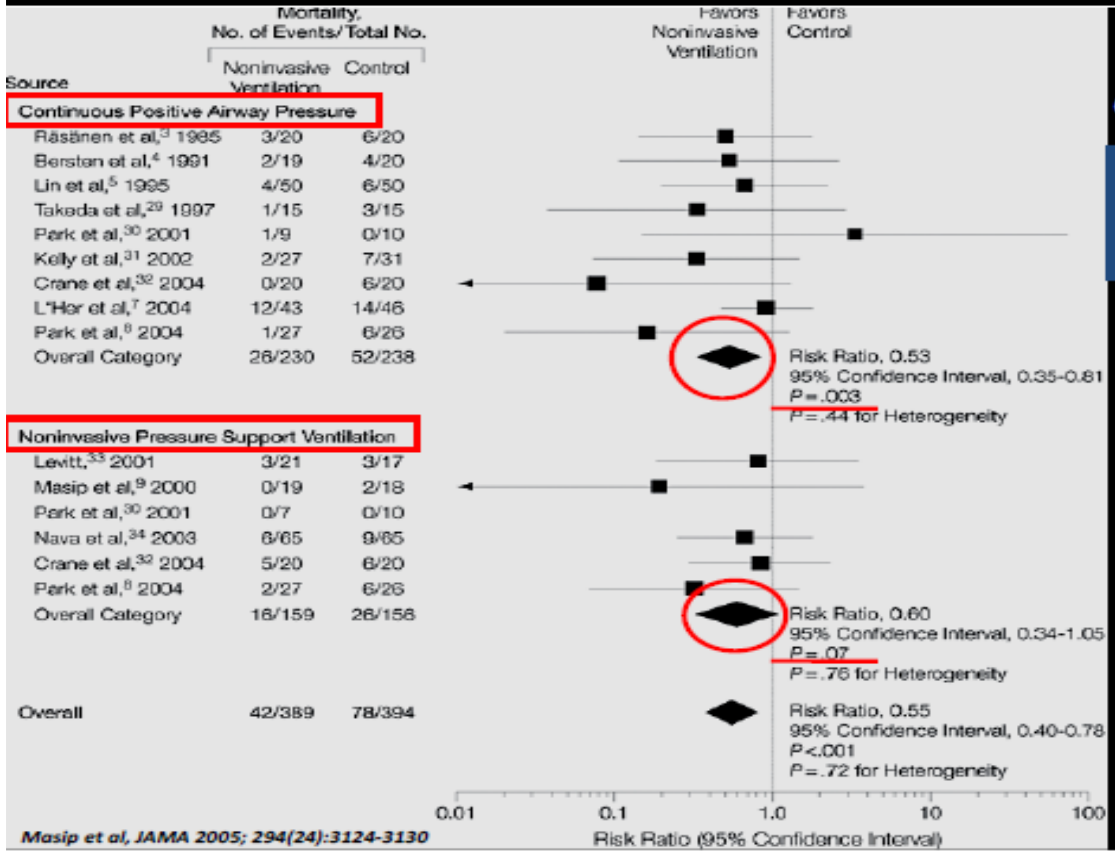
NIV ed edema polmonare acuto: risolti i dubbi , l'efficacia è indiscutibile

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



E sulla mortalità….

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



CPAP

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

EFFECT OF NIV ON DEATH

PSV

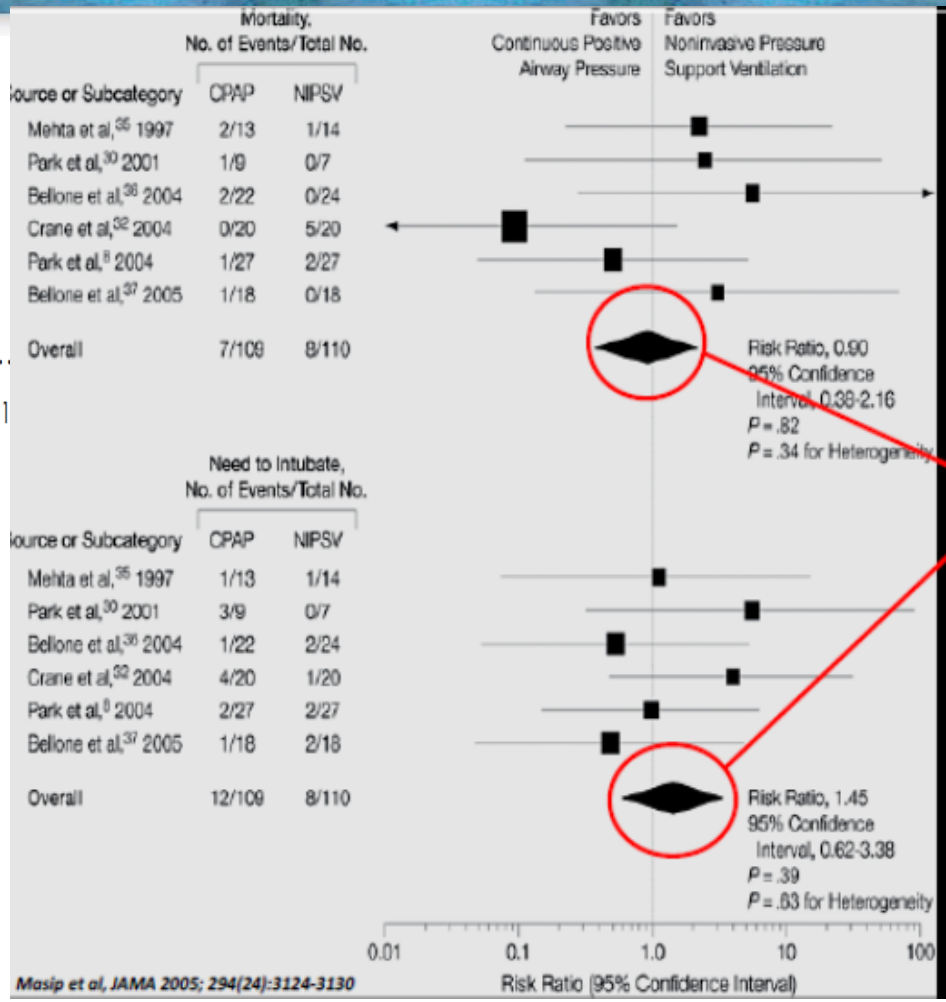
BTS GUIDELINE

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**]



CPAP e PSV: metodiche complementari

? NON INTERCAMBIABILI

MASCHERA FACCIALE O CASCO?

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.

Altre applicazioni

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
I risultati sono sovrapponibili a quelli dell'ossigeno ad alti flussi nella cardiotoracica
NB: escludere che ci siano leak anastomotici

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

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.

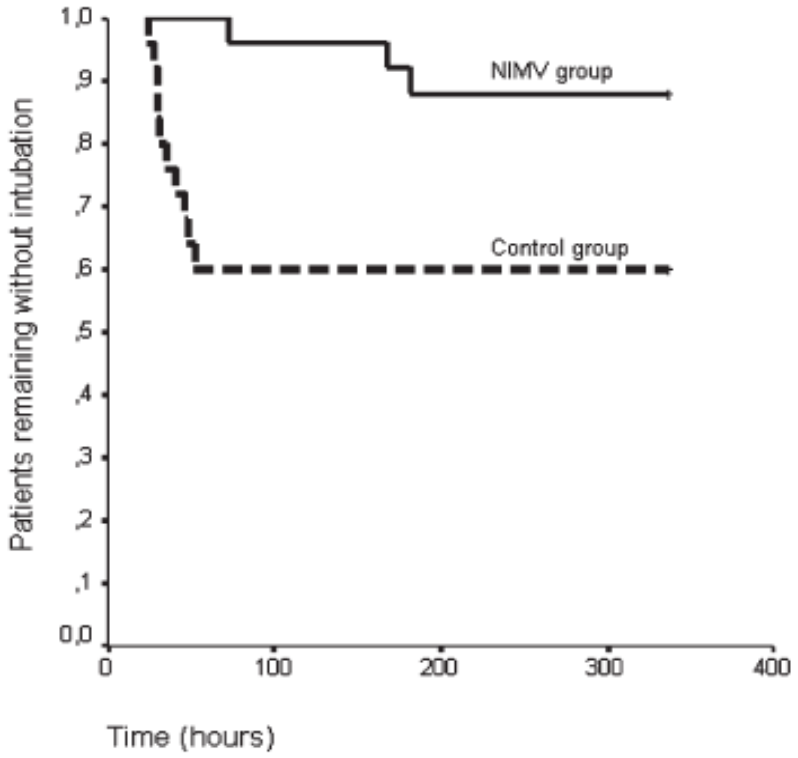
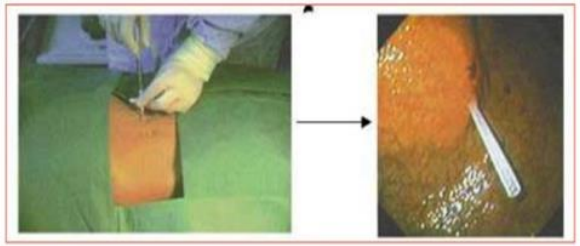


FIGURE 2. Kaplan-Meier curve for the probability of remaining without intubation in both groups. See Figure 1 legend for expansion of abbreviation.

Ed ancora ….

Noninvasive ventilation allows gastrostomy tube placement in patients with advanced ALS

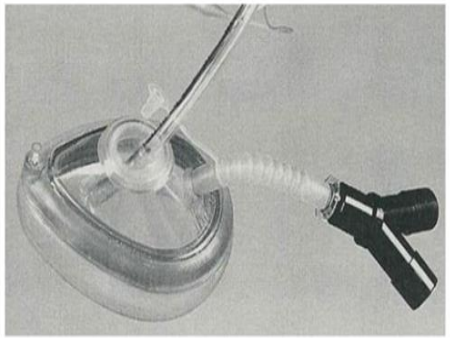
Neurology. 2001; 56:413-4



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

La NIV nel DO NOT INTUBATE

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

key point della gestione del DNR

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 (?)

Crit Care Med 2007 Vol. 35, No. 3

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

Effetto sulla dispnea maggiore negli ipercapnici

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.

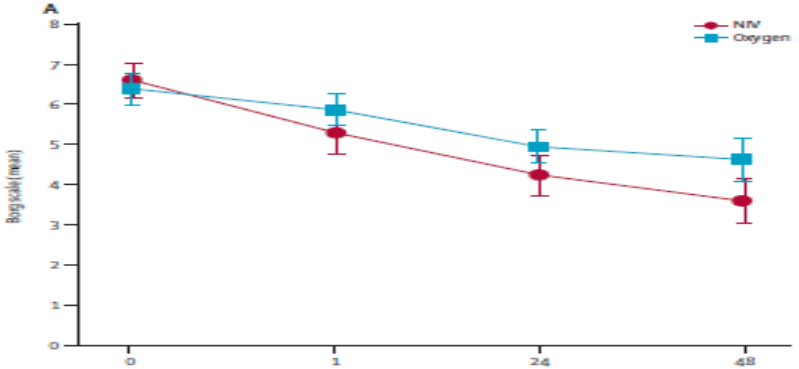


Figure 2: **Changes in dyspnoea scores with time**
(A) Comparison between non-invasive ventilation (NIV) and oxygen therapy assessed using the Borg scale over time. (B) Comparison between NIV and oxygen therapy within hypercapnia strata assessed using the Borg scale over time.

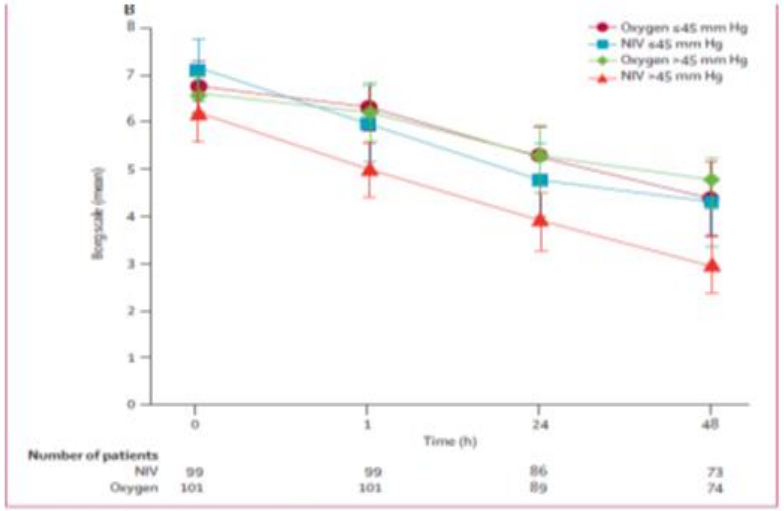


Figure 2: **Changes in dyspnoea scores with time**
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Vol. 46 No. 4 October 2013 Journal of Pain and Symptom Manageme

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.

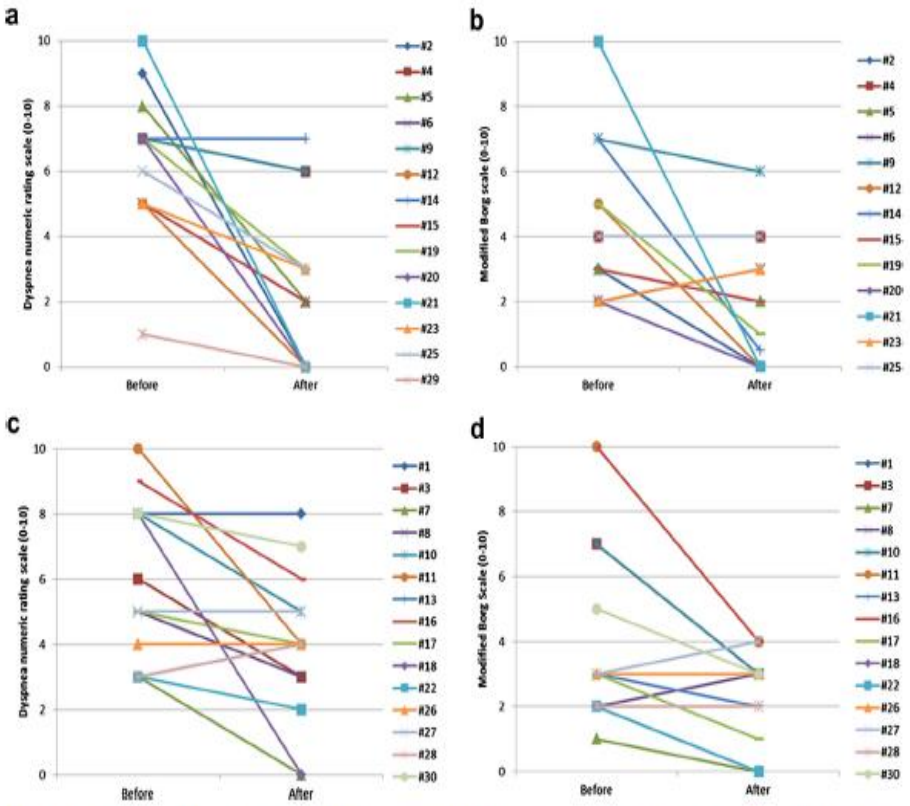


Fig. 2. Change in dyspnea scores with high-flow oxygen and BiPAP. As compared with baseline, BiPAP was associated with an average improvement in (a) the dyspnea numeric rating scale of 3.2 ($P = 0.004$) and (b) the modified Borg scale of 1.5 ($P = 0.13$). High-flow oxygen also was associated with an 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.

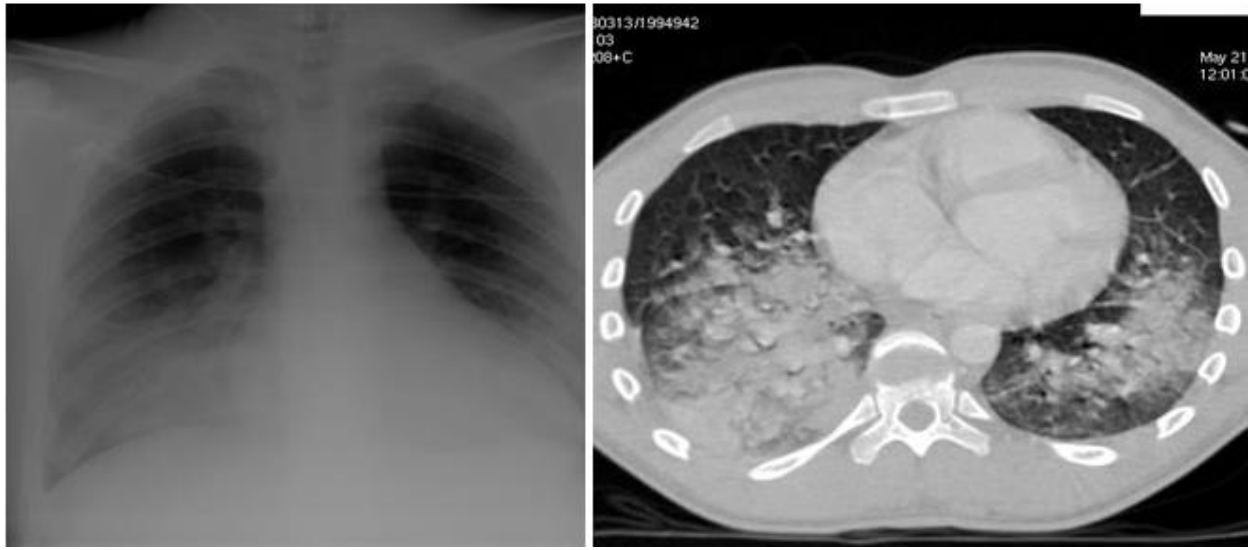
IR ipossiemica de novo

Definizione (PaO2/FIO2) <300, RR >30–35 apm senza malattia pneumologica preesistente

Cause : edema polmonare , polmoniti, infezioni

Mortalità:25-40%

La NIV HA UN RUOLO?



Noninvasive Ventilation in Severe Hypoxemic Respiratory Failure

AMERICAN JOURNAL OF RESPIRATORY AND CRITICAL CARE MEDICINE VOL 168 2003

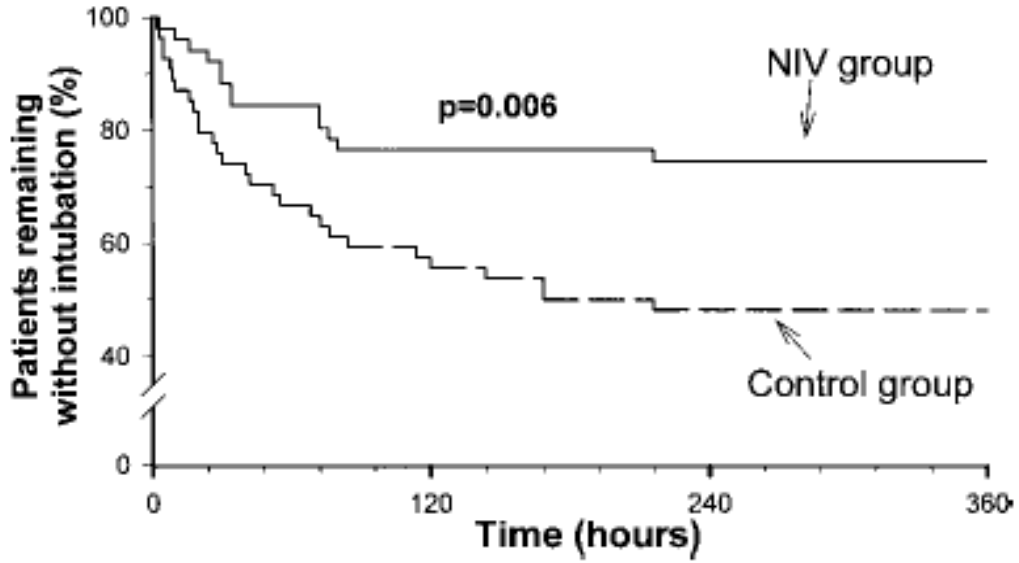


Figure 2. Kaplan-Meier curves for patients remaining without intubation after entry into the protocol. In the overall population, the cumulative probability of remaining without intubation was higher in the noninvasive ventilation (NIV) group (log-rank test). Time denotes the hours after patients were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

RESEARCH Open Access

A multicenter RCT of noninvasive ventilation in pneumonia-induced early mild acute respiratory distress syndrome

He et al. Critical Care (2019) 23:300

Conclusions: Treatment with NIV did not reduce the need for intubation among patients with pneumonia-induced early mild ARDS, despite the improved PaO_2/FIO_2 observed with NIV compared with standard oxygen therapy. High minute ventilation may predict NIV failure.

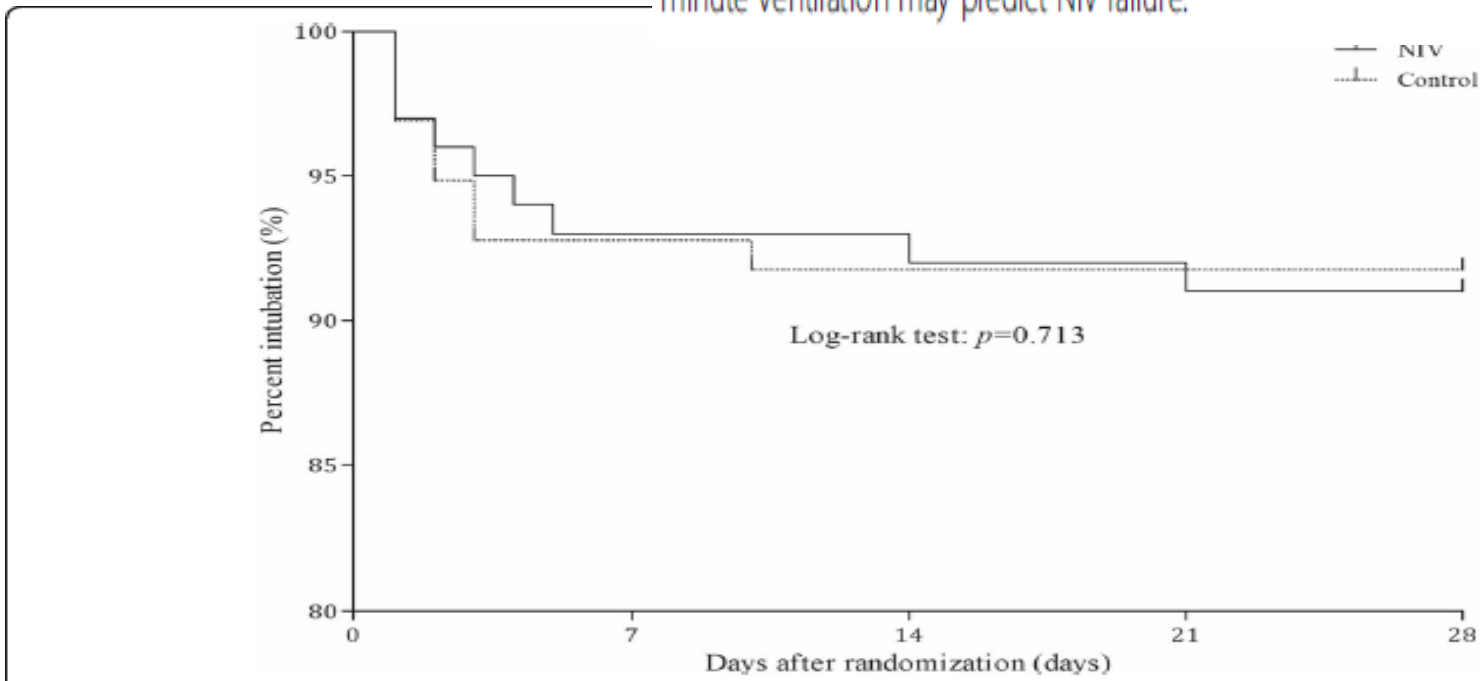


Fig. 2 Kaplan-Meier estimates of the probability of the need for endotracheal intubation based on the criteria for endotracheal intubation. No difference was found for the cumulative probability for endotracheal intubation of the two groups (log-rank test $p = 0.71$)

INDIPENDENTEMENTE DAL MIGLIORAMENTO DELL'IPOSSIEMIA

La NIV le comorbidità associate a suo fallimento

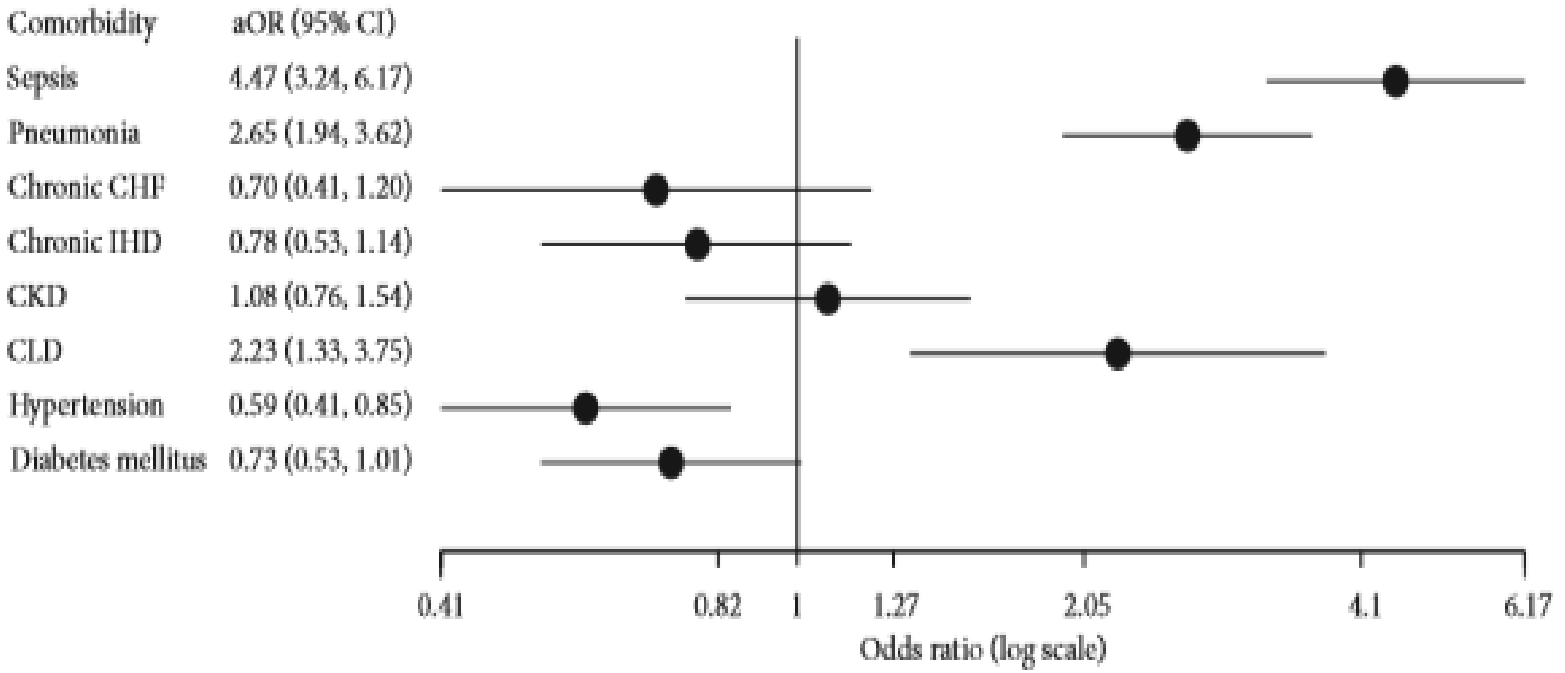


FIGURE 3: Adjusted odds ratios of noninvasive positive pressure ventilation failure for associated comorbidities. aOR: adjusted odds ratio; CI: confidence interval; CHF: congestive heart failure; IHD: ischemic heart disease; CKD: chronic kidney disease; CLD: chronic liver disease.

La NIV nell'IRA ipossiemica : le considerazioni dei detrattori

Frequenza di intubazione:46-54%

Antonelli M,. Crit Care Med 2007;35:18-25.

Carrillo A. Intensive Care Med 2012;38:458-66.

Eleva

Probal

-Ritarc

Esteban

-Ventil

Recommendation

Given the uncertainty of evidence we are unable to offer a recommendation on the use of NIV for *de novo* ARF.

Dreyfuss D. Am Rev Respir Dis 1993;148:1194-203.

Slutsky AS. N Engl J Med 2014; 370:980.

de Prost N, . Ann Intensive Care 2011;1:28.

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

- 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») e quindi aggravano il danno polmonare , provocano distensione gastrica , perdite aeree e discomfort.
  Fra I predittori di fallimento vi è la Ventilazione minuto >11 L/min :
  - tidal volumes > 9 ml/ kg del peso corporeo teorico che si associa al VILI
  -FR: più è alta maggiore sarà la ventilazione / min (VtxRR)

He , Critical care 2019

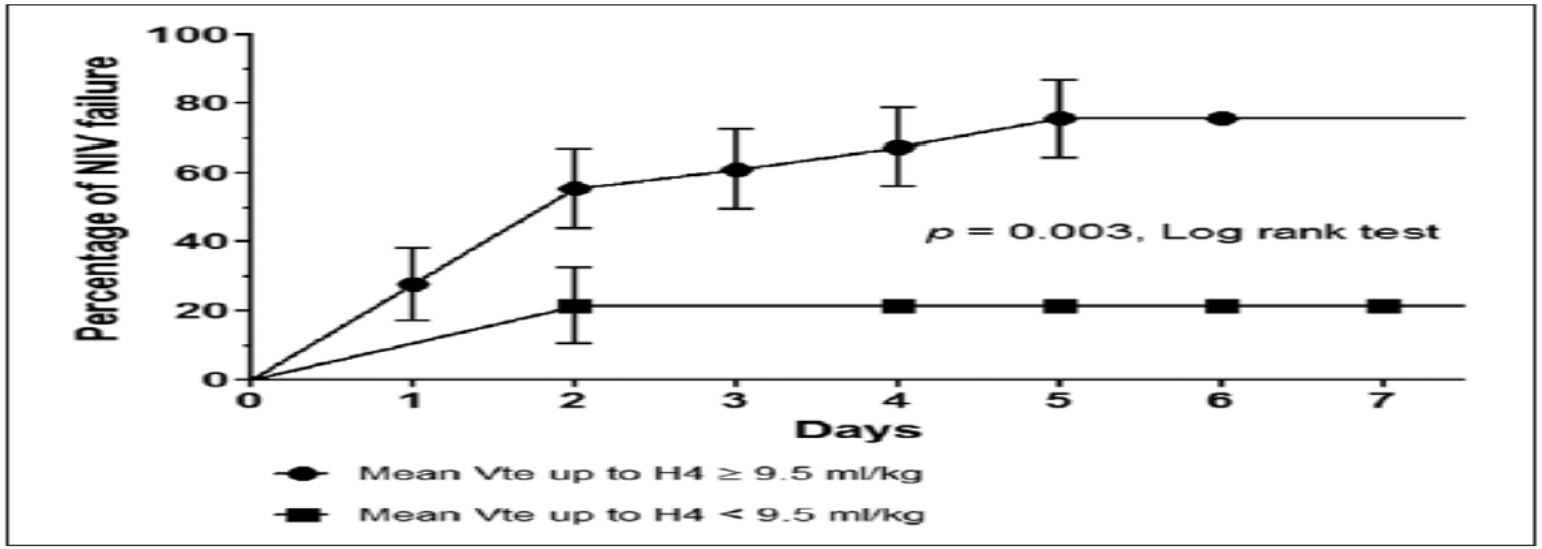
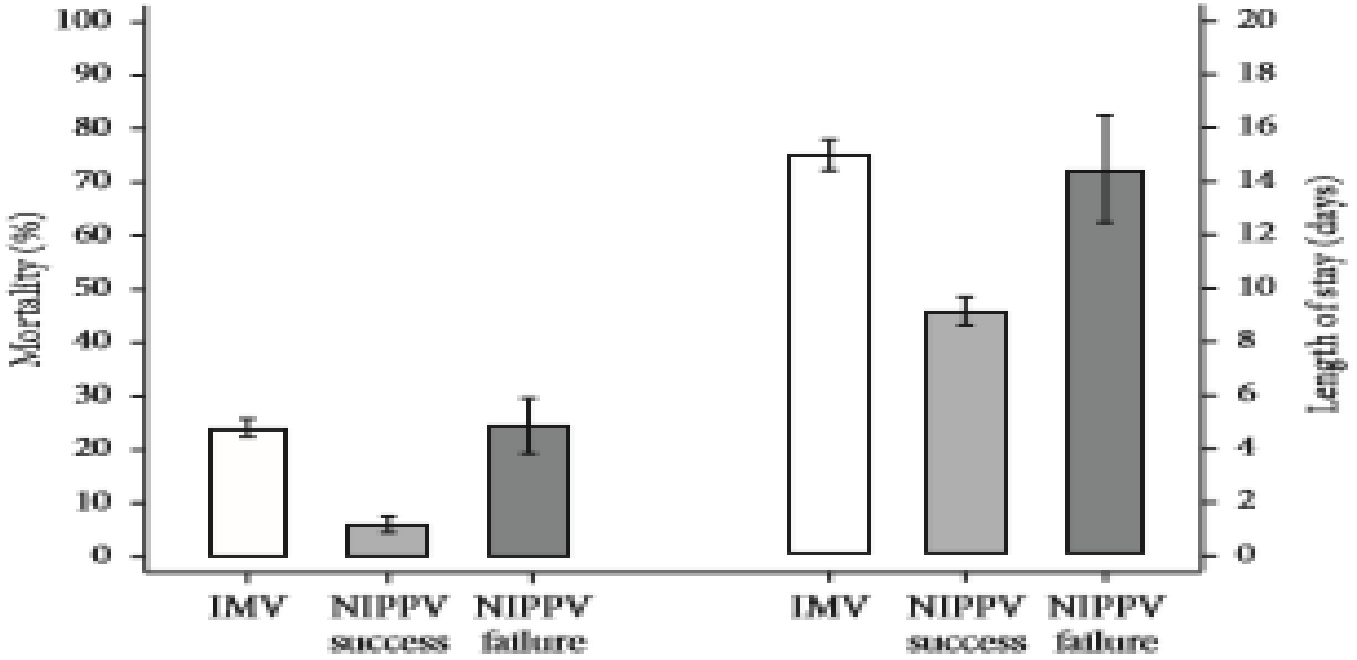


Figure 4. Kaplan–Meier estimate of the cumulative probability of noninvasive ventilation (NIV) failure according to the mean tidal volume (Vte) during the first four cumulative hours of NIV (higher or lower than 9.5 mL/kg) in patients with moderate-to-severe hypoxemia (Pao_2/Fio_2 ratio ≤ 200 mm Hg;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

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

Outcomes of Noninvasive Positive Pressure Ventilation in Acute Respiratory Distress Syndrome and Their Predictors: A

C



Critical Care Research and Practice
Volume 2019, Article ID 8106145, 8 pages

Se si fa …. FACCIAMOLO BENE!

Basso PS (massimo 10 cmH2O), PEEP la maggiore tollerata (almeno 8 cmH2O)

Helmet, sfruttando gli elevati flussi per la distensione (100-200 l/sec)

Yoshida T.. Am J Respir Crit Care Med 2017;195:985–992.,Mauri T.. Crit Care Med 2013;41:1664–73.,Morais CCA. Am J Respir Crit Care Med 2018;197:1285–1296). Taccone P, Crit Care Med. 2004; 32(10):2090–2096 ,Patel BK. JAMA. 2016;315(22):2435–41.

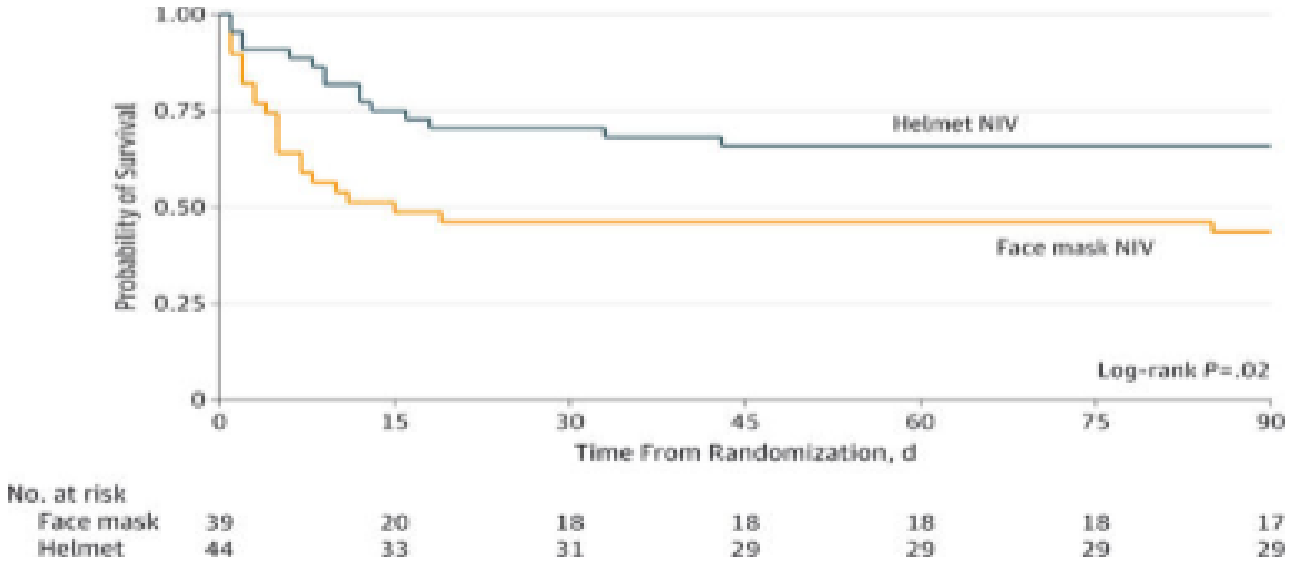


Figure 2. Probability of Survival From Randomization to Day 90
NIV indicates noninvasive ventilation.

Razionale

Con la maschera la NIV viene applicate con basse PEEP (5-7 cmH2O), mentre ne sono necessarie di alte per reclutare, ridurre la frequenza respiratoria e ridurre il lavoro respiratorio

Yoshida T. Am J Respir Crit Care Med 2017;195:985–992.

Mauri T. . Crit Care Med 2013;41:1664–73.

Morais CCA,. . Am J Respir Crit Care Med 2018;197:1285–1296).

Applicando il casco si utilizzano elevate flussi per distenderlo fra 100 e 200l /sec che contribuiscono con la peep a migliorare l'ossigenazione e ridurre il lavoro respiratorio

Taccone P, Hess D, Caironi P, Bigatello LM. Continuous positive airway pressure delivered with a "helmet": effects on carbon dioxide rebreathing. Crit Care Med. 2004; 32(10):2090–2096

Attenzione alle false aspettative!!!!

il beneficio della ventilazione a basso VT è più significativo nei casi di ARDS lieve

Shen Y,. Crit Care. 2019;23(1):254

Minore è il rapporto PaO2/ FiO2 maggiore è la possibilità di fallimento (soprattutto se < a 150)

Bellani G, LUNG SAFE Study. Am J Respir Crit Care Med. 2017;195(1):67–77.

Cortegiani *et al. Critical Care* (2018) 22:157
https://doi.org/10.1186/s13054-018-2079-9

Critical Care

RESEARCH Open Access

Immunocompromised patients with acute respiratory distress syndrome: secondary analysis of the LUNG SAFE database

MORTALITA' DIMEZZATA!

Table 3 Clinical endpoints in immunocompromised (Study) patients according to ventilation subgroup

Clinical endpoints	IMV (n = 462)	NIV (n = 63)	NIV failure (n = 59)	p Value
Duration of mechanical ventilation, d, median (Q_1–Q_3)	8.0 (4.0–14.0)	-	8.0 (5.0–15.0)	0.4352
Progression/regression of ARDS[a], n (%)				
No change	161 (40.1)	18 (32.1)	22 (43.1)	0.4449
Progression	43 (10.7)	5 (8.9)	7 (13.7)	0.7199
Regression	103 (25.7)	4 (7.1)[b]	16 (31.4)[c]	**0.0045**
Resolution	94 (23.44)	29 (51.8)[b]	6 (11.8)[c]	**< 0.0001**
Limitation of life-sustaining measures, n (%)				
Decision to withhold life-sustaining measures	124 (26.8)	18 (28.6)	16 (27.1)	0.9587
Decision to withdraw life-sustaining measures	101 (21.9)	14 (22.2)	14 (23.7)	0.9480
Decision to withhold or withdraw life-sustaining measures	154 (33.3)	21 (33.3)	20 (33.9)	0.9962
Before IMV or NIV start	1 (0.6)	0 (0.0)	1 (5.0)	0.2062
ICU mortality[d], n (%)	214 (46.3)	18 (28.6)[b]	34 (57.6)[c]	**0.0043**
Hospital mortality[e], n (%)				
All patients	242 (52.8)	25 (39.7)	37 (62.7)[c]	**0.0362**
Patients with limitations of life-sustaining measures[f]	137 (89.0)	17 (81.0)	19 (95.0)	0.3803

Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure

Bram Rochwerg[1], Laurent Brochard[2,3], Mark W. Elliott[4], Dean Hess[5], Nicholas S. Hill[6], Stefano Nava[7] and Paolo Navalesi[8] (members of the steering committee); Massimo Antonelli[9], Jan Brozek[1], Giorgio Conti[9], Miquel Ferrer[10], Kalpalatha Guntupalli[11], Samir Jaber[12], Sean Keenan[13,14], Jordi Mancebo[15], Sangeeta Mehta[16] and Suhail Raoof[17,18] (members of the task force)

Recommendation

We suggest early NIV for immunocompromised patients with ARF. (Conditional recommendation, moderate certainty of evidence.)

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

Johnson CS. BMC Pulm Med 2014; 14: 7.

Il 50% dei pz riesce ad evitare l'intubazione

I grossi limiti sono le comorbidità severe e le riammissioni

Segrelles Calvo G. Arch Bronconeumol 2012; 48: 349–354.

Esquinas Rodríguez AM Arch Bronconeumol 2013; 49: 275–276

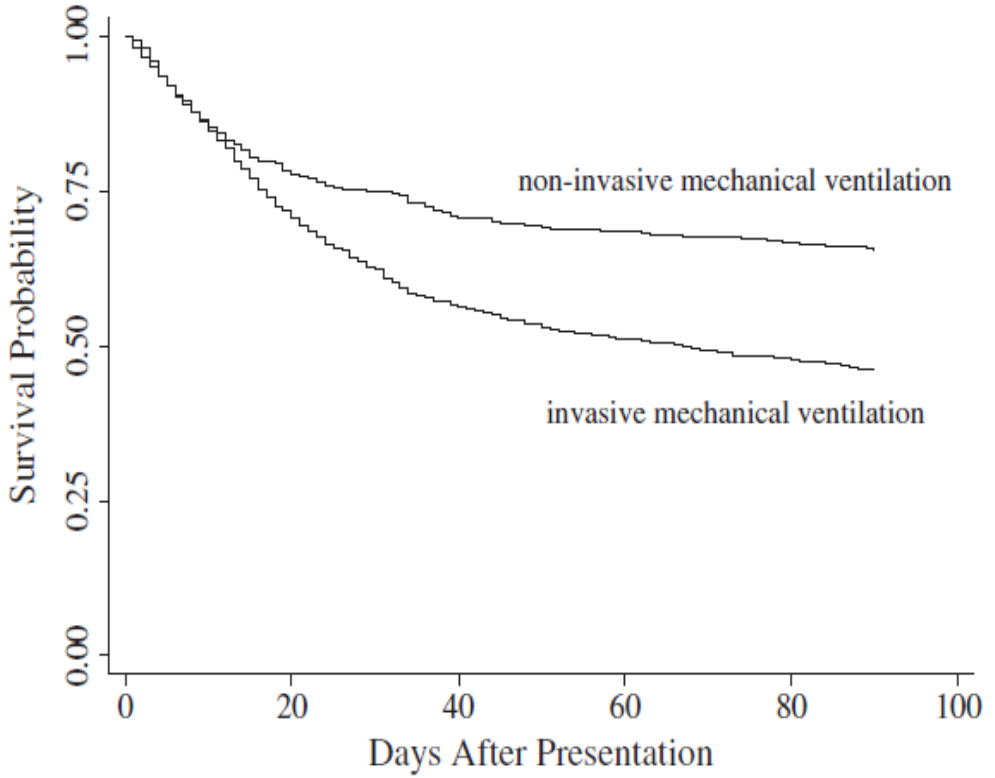


Figure 1 Kaplan-Meier plot of 90-day survival. Patients undergoing non-invasive mechanical ventilation had significantly higher survival than did invasive ventilation patients ($p < 0.001$ by the log-rank test).

Johnson *et al. BMC Pulmonary Medicine* 2014, **14**:7
http://www.biomedcentral.com/1471-2466/14/7

Il mondo ideale : NIV SI in particolare se PaO2/FiO2 è fra 200 e 300 …

Se c'è compromissione solo respiratoria

Se non c'è sepsi/shock settico (MAGARI)

Se il team è esperto (AUSPICABILE)

Se il paziente è monitorato per essere intubato prontamente , idealmente in UTI (MAGARI ALLA TERZA!)

Se il paziente è immunodepresso

Se il paziente è anziano

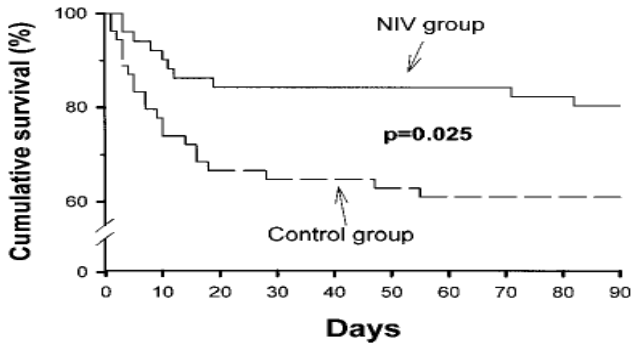


Figure 4. Kaplan-Meier curves for survivor patients within 90 days after entry into the protocol. In the overall population, the cumulative survival probability was significantly higher in the NIV group (log-rank test). *Time* denotes the days after patients were entered into the study.

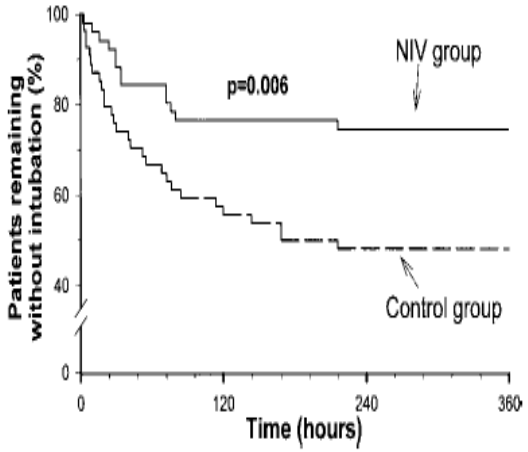


Figure 2. Kaplan-Meier curves for patients remaining without intubation after entry into the protocol. In the overall population, the cumulative probability of remaining without intubation was higher in the noninvasive ventilation (NIV) group (log-rank test). Time denotes the hours after patients were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

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

LA PANDEMIA COVID HA CAMBIATO LE INDICAZIONI ALLA NIV NELLE FORME IPOSSIEMICHE ?

Indicazione alla ventilazione meccanica non invasiva nel COVID

ERS OFFICIAL DOCUMENTS
ERS GUIDELINES

Management of hospitalised adults with coronavirus disease 2019 (COVID-19): a European Respiratory Society living guideline

TABLE 2 Summary of recommendations in this guideline

Therapy	Recommendations	Strength of recommendation	Quality of Evidence
Noninvasive ventilatory support	14] We suggest HFNC or noninvasive CPAP delivered through either a helmet or a facemask for patients with COVID-19 and hypoxaemic acute respiratory failure without an immediate indication for invasive mechanical ventilation	Conditional	Very low

Cioè????

PICO 11: In hospitalised patients with COVID-19 should continuous positive airway pressure or high-flow nasal cannula oxygen with or without adjunctive strategies such as prone positioning be used versus standard of care (defined as the absence of these interventions or invasive mechanical ventilation)?

Recommendation

We suggest high-flow nasal cannula oxygen (HFNC) or noninvasive continuous positive airway pressure (CPAP) delivered through either a helmet or a facemask for patients with COVID-19 and hypoxaemic acute respiratory failure (hARF) in the absence of immediate indications for invasive mechanical ventilation (conditional recommendation, very low quality of evidence).

Notes accompanying this recommendation: 1) HFNC and noninvasive CPAP are classified as aerosol generating and should therefore be delivered in a safe environment with staff wearing appropriate personal protective equipment; 2) HFNC and noninvasive CPAP should not delay mechanical ventilation in patients who are not responding to treatment; 3) prone positioning may improve oxygenation in non-intubated patients with hARF and is widely used for mechanically ventilated patients with COVID-19.

Molti studi osservazionali
Spesso popolazioni non comparabili per selezione di pz , tipo di ventilazione, setting, durata del trattamento

L'unica certezza è che la pronazione con qualsiasi supporto respiratorio sia un vantaggio

Perché provarci

il COVID ha un tasso di intubazione fra 69 e 88%

Grasselli G JAMA 2020; 323: 1574–81.

Simonnet A,. Obesity 2020; 28: 1195–9.

… ma anche una mortalità negli intubati del 67%

ICNARC: ICNARC report on COVID-19 in critical care 17 April 2020.

www.icnarc.org

Managing the Respiratory care

of patients with COVID-19

Niente NIV ?

Harari SA, Vitacca M, Blasi F, et al. Managing the respiratory care of patients with COVID-19 - English version. Italian Thoracic Society (AIPO – ITS), Italian Respirarory Society (SIP/IRS), 2020.

Fra le indicazioni:

✓ NIV in caso di pregresse malattie respiratorie

✓ NIV come prevenzione e trattamento del peggioramento nei pazienti con BPCO ipercapnici senza polmonite, non a rischio di edema polmonare

✓ Post-estubazione

Negli altri casi CPAP

Aspetti fisiopatologici

Fenotipo H :high elastance, high right to left shunt, high lung weight, high recruitability

Fenotipo L: low elastance, low ventilation to perfusion

ratio, low lung weight, low recruitability

Gattinoni L, Chiumello D, Caironi P, et al.: COVID-19 pneumonia: different respiratory treatments for different phenotypes? Intensive Care Med 2020; 46: 1099–102.

Marini JJ, Gattinoni L: Management of COVID-19 respiratory distress. JAMA 2020; 323: 2329–30.

NB: in questa seconda forma anche la ventilazione invasiva potrebbe avere pochi vantaggi !

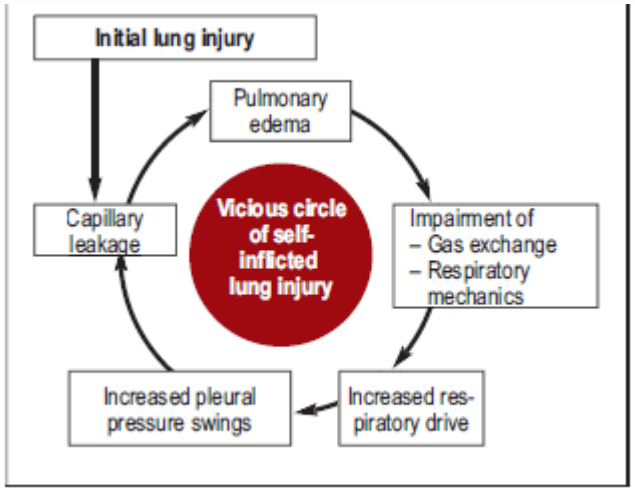
Gattinoni L, Coppola S, Cressoni M, et al. Covid-19 does not lead to a “typical” acute respiratory distress syndrome. Am J Respir Crit Care Med 2020; 201: 1299–1300.

Bos LDJ, Sinha P, Dickson RP. Response to COVID-19 phenotyping correspondence. Eur Respir J 2020; 56: 002756.

Tobin MJ, Laghi F, Jubran A. Caution about early intubation and mechanical ventilation in COVID-19. Ann Intensive Care 2020; 10: 78.

Tobin MJ. Basing respiratory management of coronavirus on physiological principles. Am J Respir Crit Care Med 2020; 201: 1319–1320.

Anche nel covid si ripropongono i temi cruciali causa di fallimento della NIV nelle forme ipossiche



Self-inflicted lung injury
A central role is played by the high respiratory drive of the spontaneously breathing and conscious patient, with or without NIV, with increasingly impaired gas exchange and restricted respiratory mechanics (19). The consequent high respiratory work may then lead to high, regionally variable, fluctuations in transpulmonary pressure. It is crucial to realize that struggling to breathe in results in a lowering of pleural pressure that exceeds the intravascular pressure decrease. With an additional elevation of intrathoracic blood volume on inspiration, this causes an increase in transmural pulmonary vascular pressure. The result is a higher risk of pulmonary edema, especially in an already damaged lung (capillary leakage). Completing the vicious circle, this then leads to further impairment of breathing mechanics with decreased compliance and restriction of gas exchange, which in turn favors shortness of breath and thus a further increase in respiratory work.
NIV, Non-invasive ventilation

Deutsches Ärzteblatt International | Dtsch Arztebl Int 2020; 117: 528–33

Prognosi sfavorevole per P/F< a 150

Bellani G, Laffey JG, Pham T, et al.: Noninvasive ventilation of patients with acute respiratory distress syndrome. Insights from the LUNG SAFE Study. Am J Respir Crit Care Med 2017; 195: 67–77.

chi si deve provare a assistere in maniera non invasiva

fenotipo H …vale quanto detto per l'ARDS

fenotipo L…. fatevi guidare più che mai dal «Less is More»:

Piccoli volumi tidal (6 ml/kg)

Piccole PEEP 5-6 cmH2O

….tanto non c'è da reclutare!

Continuous positive airway pressure to avoid intubation in SARS-CoV-2 pneumonia: a two-period retrospective case-control study

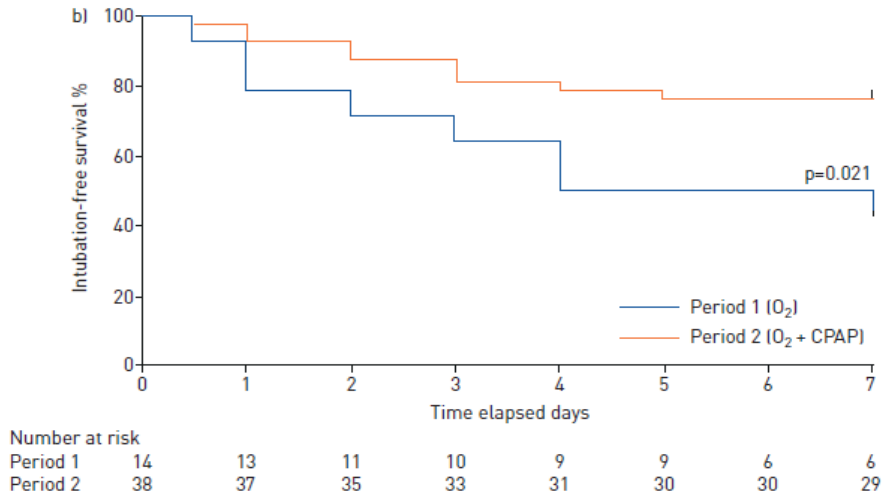


FIGURE 1 a) Study flow chart. b) 7-day intubation-free survival. #: noninvasive ventilation (NIV) and alveolar hypoventilation defined as arterial carbon dioxide tension ⩾45 mmHg; ¶: five intubations and three deaths; two of the deaths occurred in the two "do not intubate" patients; +: there were six patients with "do not intubate" decisions, none of whom died (p=0.036 *versus* controls; Fisher's exact test). COVID-19: coronavirus disease 2019; CT: computed tomography; SpO2: peripheral oxygen saturation; CPAP: continuous positive airway pressure.

Two consecutive periods were compared
During period 1, escalation consisted only in increasing supplemental oxygen, up to 15 L·min−1.
During period 2, CPAP was delivered on an as-needed basis, with a minimum of 2 h twice a day and
continuous nocturnal administration. CPAP was administered using a face mask connected to a home mechanical ventilator in most cases, or to a Boussignac positive pressure valve. CPAP was initially set at 10 cmH2O and then adjusted between 8 and 12 cmH2O according to clinical tolerance, leaks and SpO2

Oranger M, Gonzalez-Bermejo J, Dacosta-Noble P, et al. Continuous positive airway pressure to avoid intubation in SARS-CoV-2 pneumonia: a two-period retrospective case-control study. Eur Respir J 2020; 56: 2001692

…..Preferibilmente in casco

il timing della CPAP nel covid

Usare l'EGA e il PaO2/FiO2 (in assenza di ipercapnia) piuttosto che la saturazione o la frequenza respiratoria , la prima spesso falsata dall'iperventilazione con alcalosi respiratoria o metabolica per concomitanti disturbi come ipoalbuminemia, disidratazione o diarrea; le alterazioni della RR possono spesso mancare perchè molti pazienti aumentano il volume corrente piuttosto che la RR per aumentare il volume minuto soprattutto in assenza di alterazioni meccaniche che ostacolino questa forma di compenso

Guan, N. Engl. J. Med. 2020.

Cunningham, Compr. Physiol. 2011, (Suppl. 11), 475–528.

Easton, P.A. J. Appl. Physiol. 1986, 61, 906–911

Iniziare per P/F< a 250

INDICAZIONI A FERMARSI : quando intubare

Criteri maggiori di intubazione : arresto, apnea con perdita di coscienza , instabilità emodinamica, intolleranza al trattamento ventilatorio

Ma anche se ….

Riduzione > 30% della P/F rispetto al basale

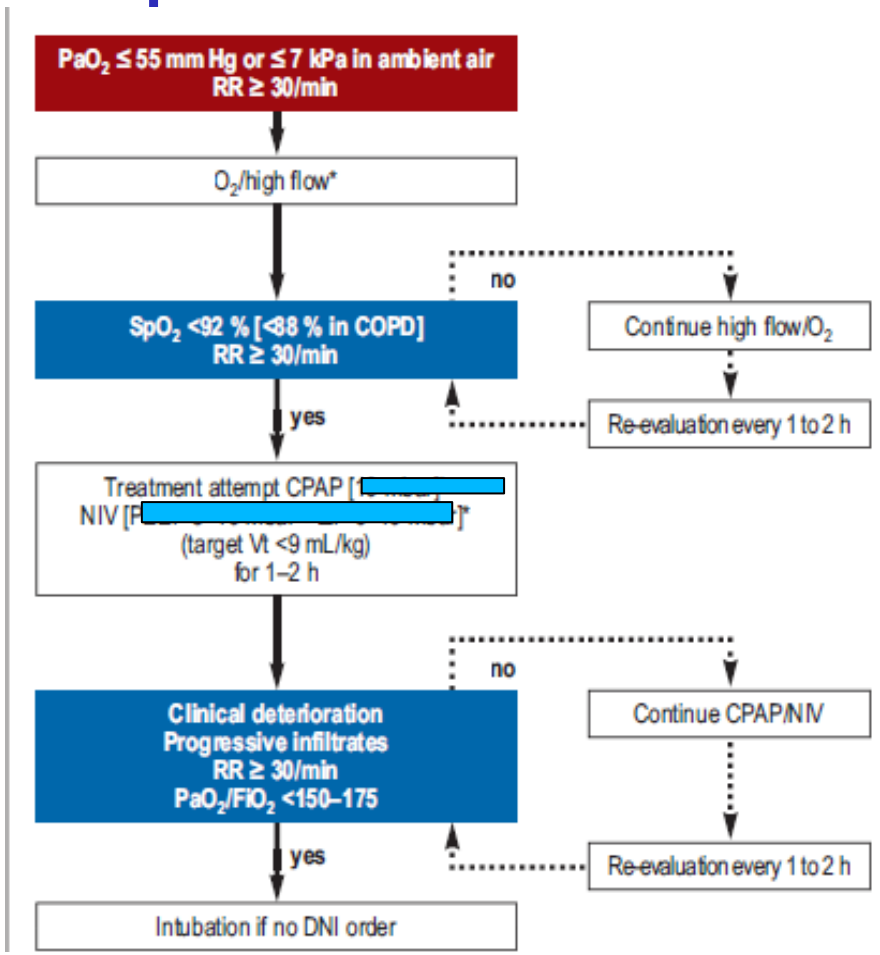
P/F <100;

Incremento del 20% della PaCO2 se la pCO2 basale era ≥40 mmHg;

Peggioramento dello stato di coscienza (che sfugge sedando il paziente !)

Peggioramento del distress o comparsa di distress durante NIV

S_{pO2} <90%;



Deutsches Ärzteblatt International | Dtsch Arztebl Int 2020; 117: 528–33

Non dobbiamo avere alte aspettative

Anche quando proviamo a trattare con ventilazione meccanica non invasive la percentuale di intubazione (21.7% *versus* 11%) e mortalità (22.9% *versus* 12%) sono più alte rispetto alle polmoniti non covid.

Aliberti S. Eur Respir J 2020; 56: 2001935

Brambilla AM et al. Eur J Intern Med 2019; **59**: 21–26.

Fattori prognostici di insuccesso della CPAP/NIV sono severità del quadro, insufficienza renale, instabilità emodinamica

LA PANDEMIA COVID HA CAMBIATO LE INDICAZIONI NELLE FORME IPOSSIEMICHE ?

No , l'assenza di risorse ha cambiato le carte , spingendoci ad adottare dei comportamenti di necessità !

Quindi abbiamo ventilato pazienti molto critici fuori dalle rianimazionioni, a volte senza monitoraggio…abbiamo usato caschi con ventilatori domiciliari, abbiamo usato sedativi per adattare i pazienti , abbiamo continuato ad usare la NIV in condizioni cliniche in cui in epoca precovid avremmo intubato i pazienti.

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, unità intensiva respiratoria, 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.

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

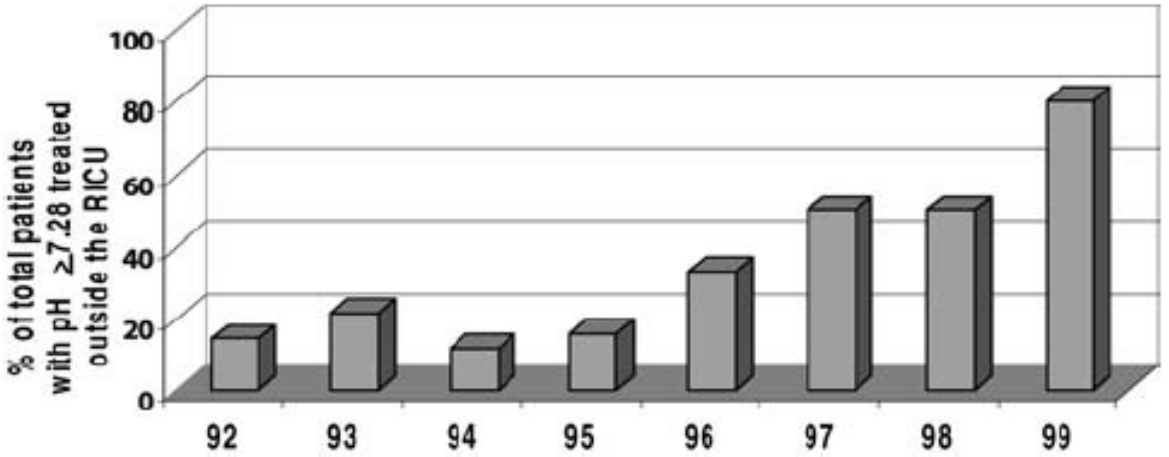


Fig. 4 Percentage of patients with pH >7.28 treated outside the RICU, in the medical ward, in the 8 years of the study. $P<0.001$ in the x^2 Hf for linear trend analysis

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.

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 intubazione ; un pH di 7.03 è il cut-off predittivo di successo della NIV.

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

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

Non abbiate paura dell'intubazione!!!!

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.

- in caso di dnr : fuori dall'UTI

1)Se palliativa anche nei reparti dove la presenza dei familiari migliora il comfort delle ore di fine vita e a volte la mortalità è minore dell'atteso (es la NIV applicata in reparto di geriatria con staff esperto ha una mortalità del 25%)

Vargas N. Aging Clin Exp Res 2014; 26: 615–623

2) Se è un do not intubate ma NON un do not care : subintensiva dove possono essere erogate cure INTENSIVE MA NON INVASIVE

Anche patologie che rispondono alla NIV meglio in UTI a volte

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. Marchesef, 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.

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

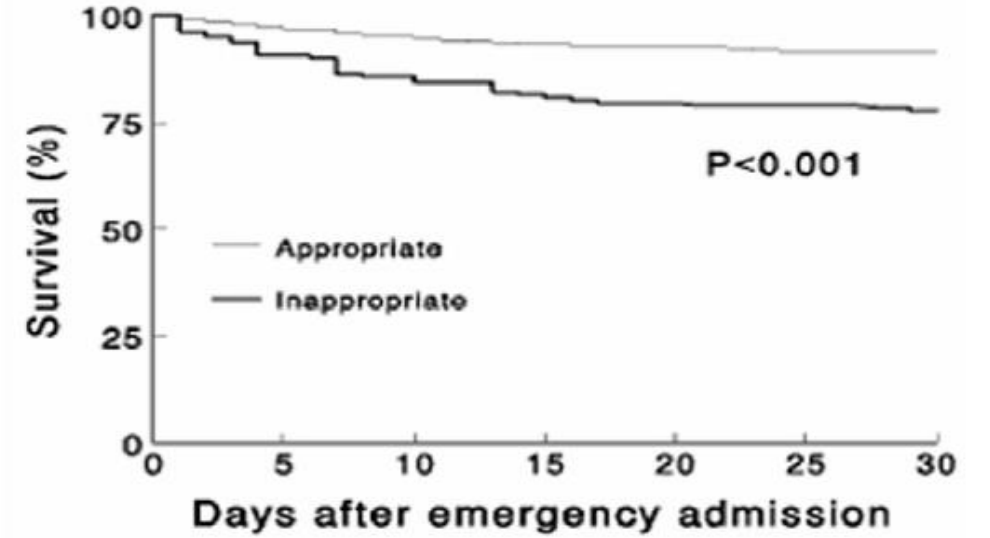
Nel 50% dei casi l'età guida la scelta di NON trasferire il pz in UTI anche quando ve ne sia l'indicazione

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

Nonostante il trattamento inappropriato condizioni 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

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

© The Author 2009. Published by Oxford University Press on behalf of the British Geriatrics Society.
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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).

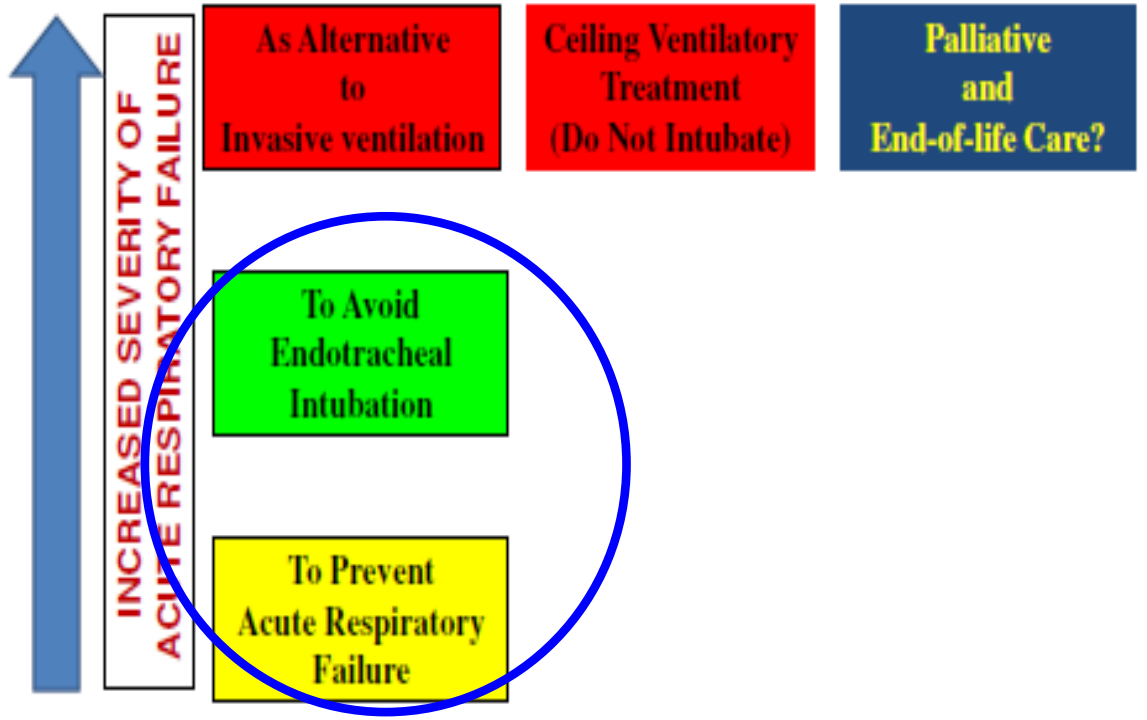
Conclusions: the combination of age and invasive mechanical ventilation is strongly associated with in-hospital mortality. Age should not be considered as a factor related to in-hospital mortality of elderly patients not requiring invasive ventilatory support in ICU.

Fattori condizionanti la mortalità : age, invasive mechanical ventilation, organ dysfunction, severity of impairment on admission, primary cause for admission and time between hospital and ICU admission

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.

Le condizioni che limitano le possibilità di successo rimangono sempre gli stessi

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

anche per gli anziani …

pH < 7.25, segni di compromissione neurologica o compromissione emodinamica sarebbero 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

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 x 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 «standard»

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, and 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 therapy: The intensive care unit dietitian can make the difference. Crit Care Med 2012; 40: 412–419

Chi ventilo in caso di ins. Respiratoria cronica

Le sindromi da ipoventilazione

La BPCO (?)

Gli anziani(?)

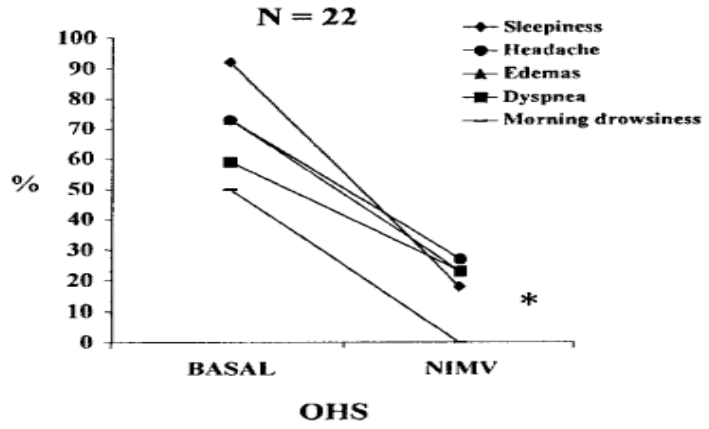
(CHEST 2001; 119:1102–1107)

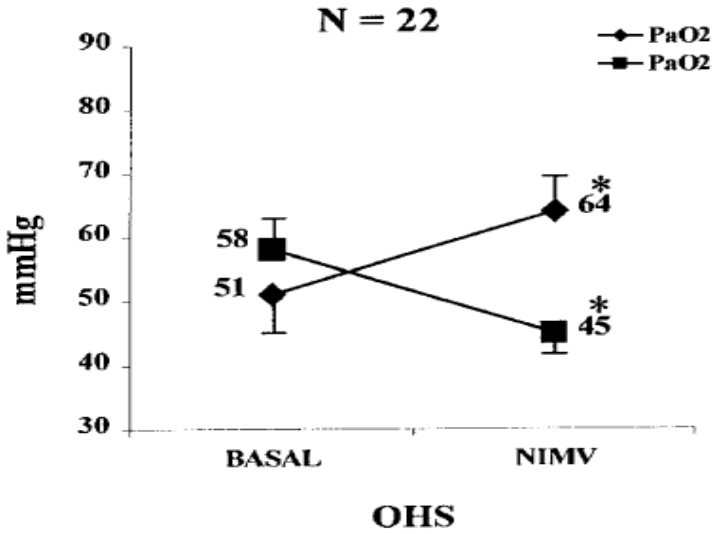
The Obesity Hypoventilation Syndrome Can Be Treated With Noninvasive Mechanical Ventilation*

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

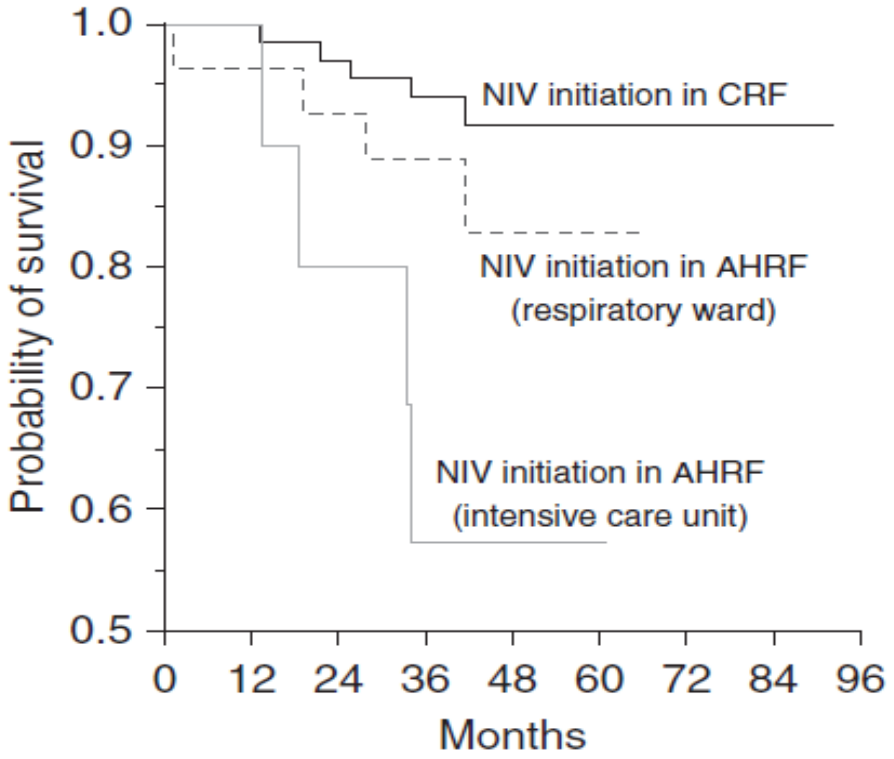
Conclusions: **NIMV improves the clinical symptoms and the respiratory failure of patients with OHS to a similar degree to that reported for diseases in which its use is completely established, such as kyphoscoliosis. Therefore, NIMV could be an alternative to the treatment of patients with OHS.**

(CHEST 2001; 119:1102–1107)





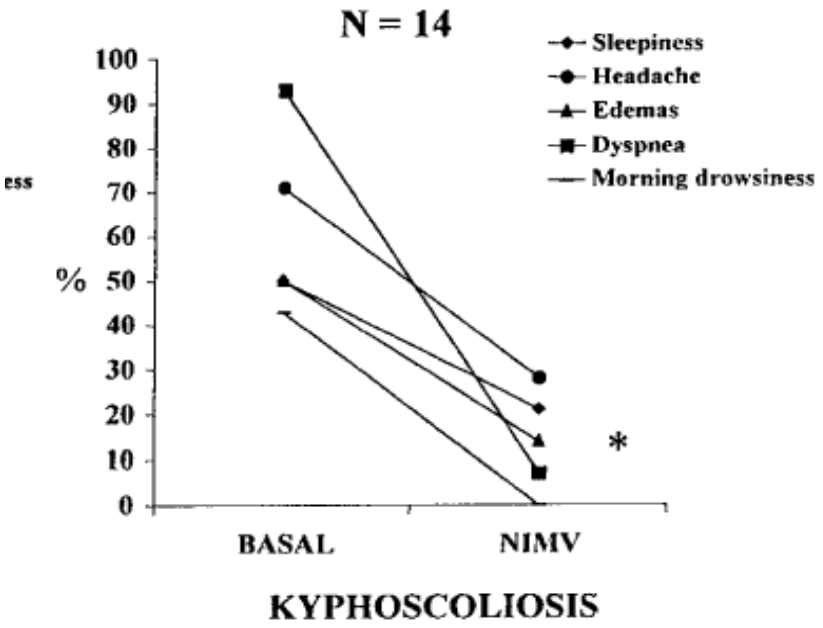
l'outcome è migliore per i pazienti che iniziano la ventilazione in una condizione di cronicità

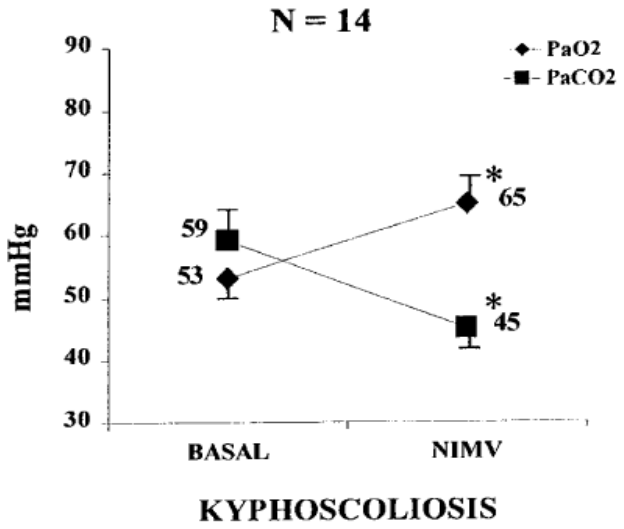


Borel J-C,. PLoS One 2013;8:e52006

(CHEST 2001; 119:1102–1107)

nella cifoscoliosi





Peraltro il buon controllo della CO2 predice la sopravvivenza nei ristretti

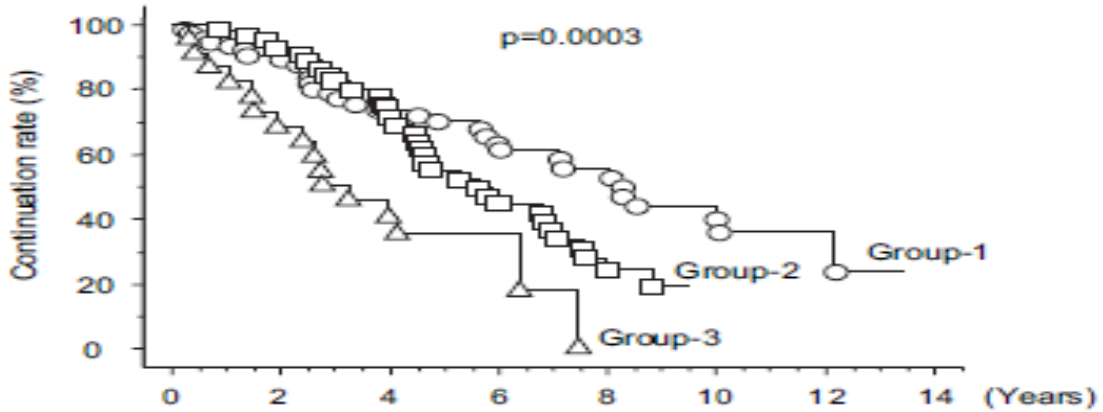


Figure 2 Kaplan—Meier curves of continuation rates of long-term NPPV in all patients. Patients were divided into 3 groups according to the average $PaCO_2$ 3—6 months after introduction of long-term NPPV (3- to 6-mo $PaCO_2$) (Group-1, 60 mmHg>; Group-2, 60—70 mmHg; Group-3, >70 mmHg). Patients with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

Tsuboi T, . Respir Med. 2010 Dec; 104(12):1850–7.
Martí S. 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

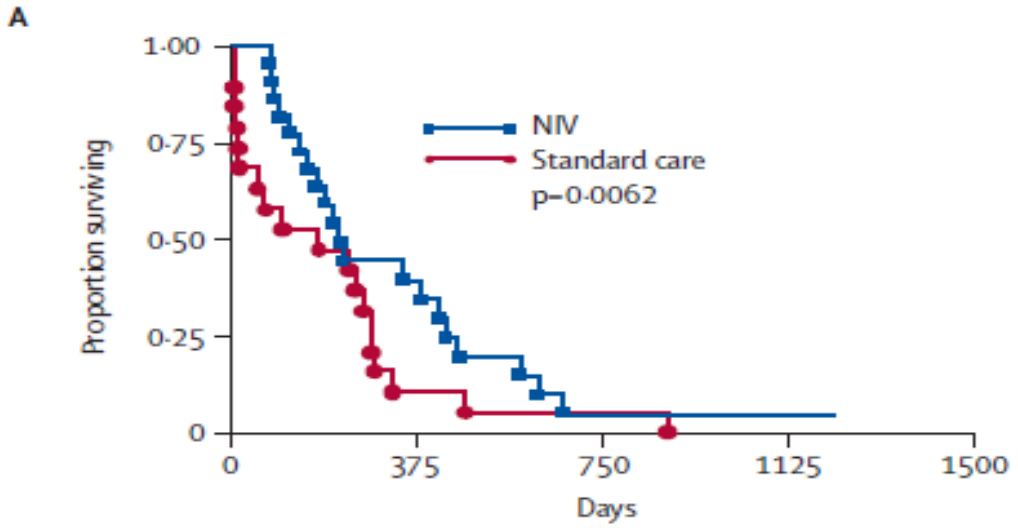
Migliore tolleranza nei pz senza compromissione bulbare

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.



NIV A LUNGO TERMINE NEL BPCO?

European Respiratory Society Guideline on Long-term Home Non-Invasive Ventilation for Management of Chronic Obstructive Pulmonary Disease

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condizioni per uso della NIV a lungo termine:

1. Nel pz BPCO con ipercapnia cronica stabile
2. Nel pz BPCO con ipercapnia persistente dopo una riacutizzazione necessitante di NIV
3. Nel pz con BPCO per normalizzare o ridurre i livelli di PaCO2

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1. NIV nel pz BPCO con ipercapnia cronica stabile?

La TF ERS suggerisce l'uso a lungo termine della NIV nel paziente BPCO con ipercapnia stabile con un basso livello di evidenza

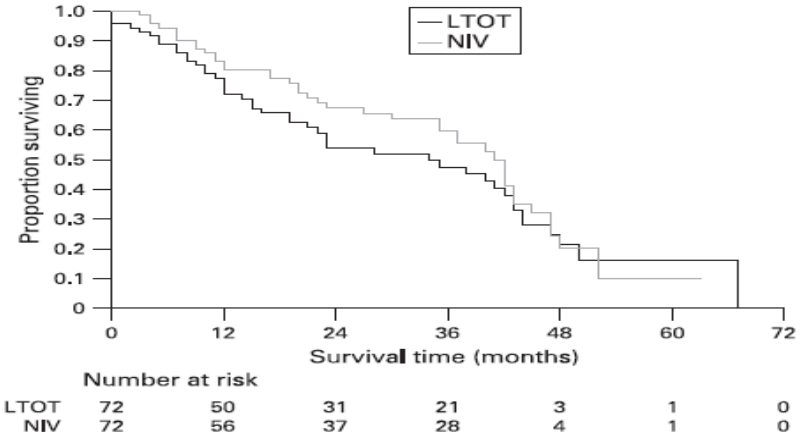

Figure 2 Survival curves of patients randomised to non-invasive ventilation plus long-term oxygen therapy (NIV + LTOT) and long-term oxygen therapy (LTOT) alone. Curves were constructed after adjustment for confounding by baseline differences in arterial oxygen and carbon dioxide tensions and respiratory 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.

Thorax 2009;**64**:561–566.

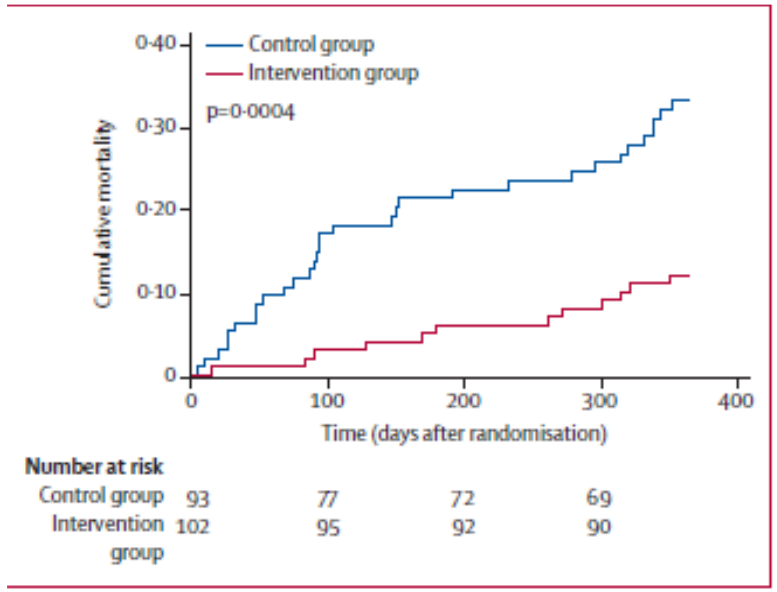

Figure 2: Kaplan-Meier estimate of cumulative all-cause mortality during the first year after randomisation (primary outcome)
The p value results from a log-rank test of the between-group difference.

Köhnlein T, et al Lancet Respir Med 2014;2:698–705

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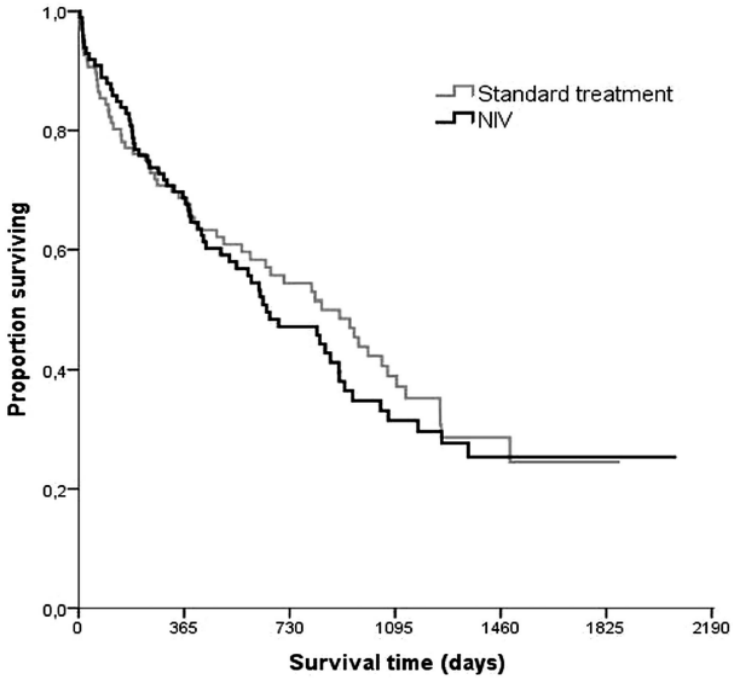
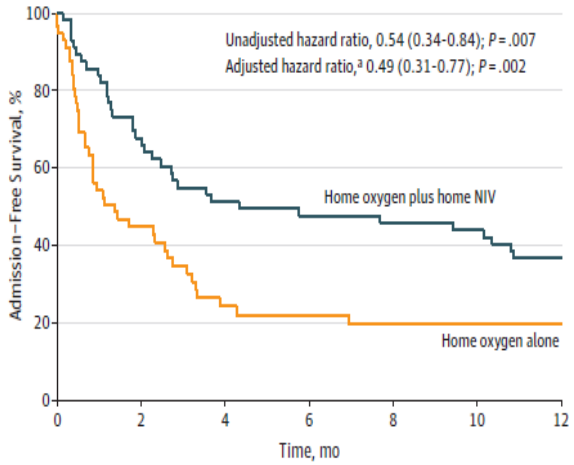
2. NIV nel pz BPCO che ha avuto riacutizzazione trattata con NIV, se persiste ipercapnia dopo l'evento acuto?

La TF ERS suggerisce di utilizzare la NIV a lungo termine nel paziente BPCO che ha presentato una riacutizzazione necessitante di NIV, se al termine dell'evento acuto persiste ipercapnia
con un basso livello di evidenza



Struik FM, *et al*. *Thorax* 2014;**69**:826–834.

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

JAMA June 6, 2017 Volume 317, Number 21

3. NIV nel pz con BPCO per normalizzare o ridurre i livelli di PaCO2?

La TF ERS suggerisce di titolare la NIV a lungo termine nel paziente BPCO per normalizzare o ridurre i livelli di PaCO2 (basso livello di evidenza)

- 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

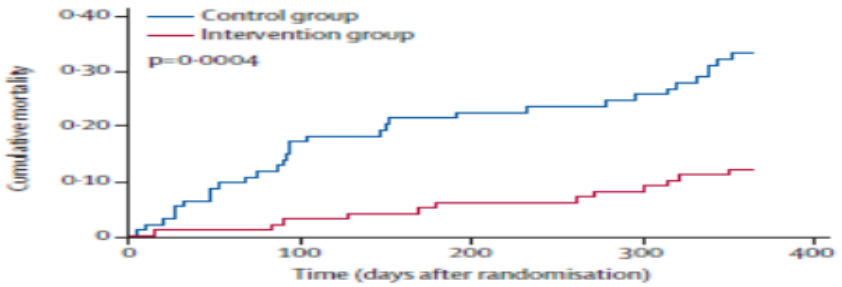
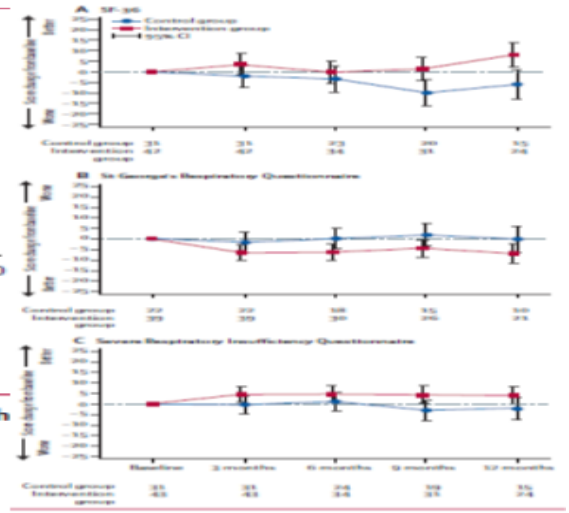


Figure 2: **Kaplan-Meier estimate of cumulative all-cause mortality during th first year after randomisation (primary outcome)**
The p value results from a log-rank test of the between-group difference.



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

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.

Messaggi da portarsi dietro

Applica la NIV cercando di garantire la sicurezza del malato

Effettua la valutazione prognostica per decidere il giusto setting e disporre un eventuale Do not Intubate

Metti in atto le strategie per evitare il fallimento della NIV (prevenzione delle lesioni da decubito dell'interfaccia e del delirium, gestione delle secrezioni e della frequenza delle evacuazioni, attenzione all'aspetto nutrizionale)

Identifica precocemente il fallimento della NIV per l'upgrade di invasività delle cure quando indicato

GRAZIE