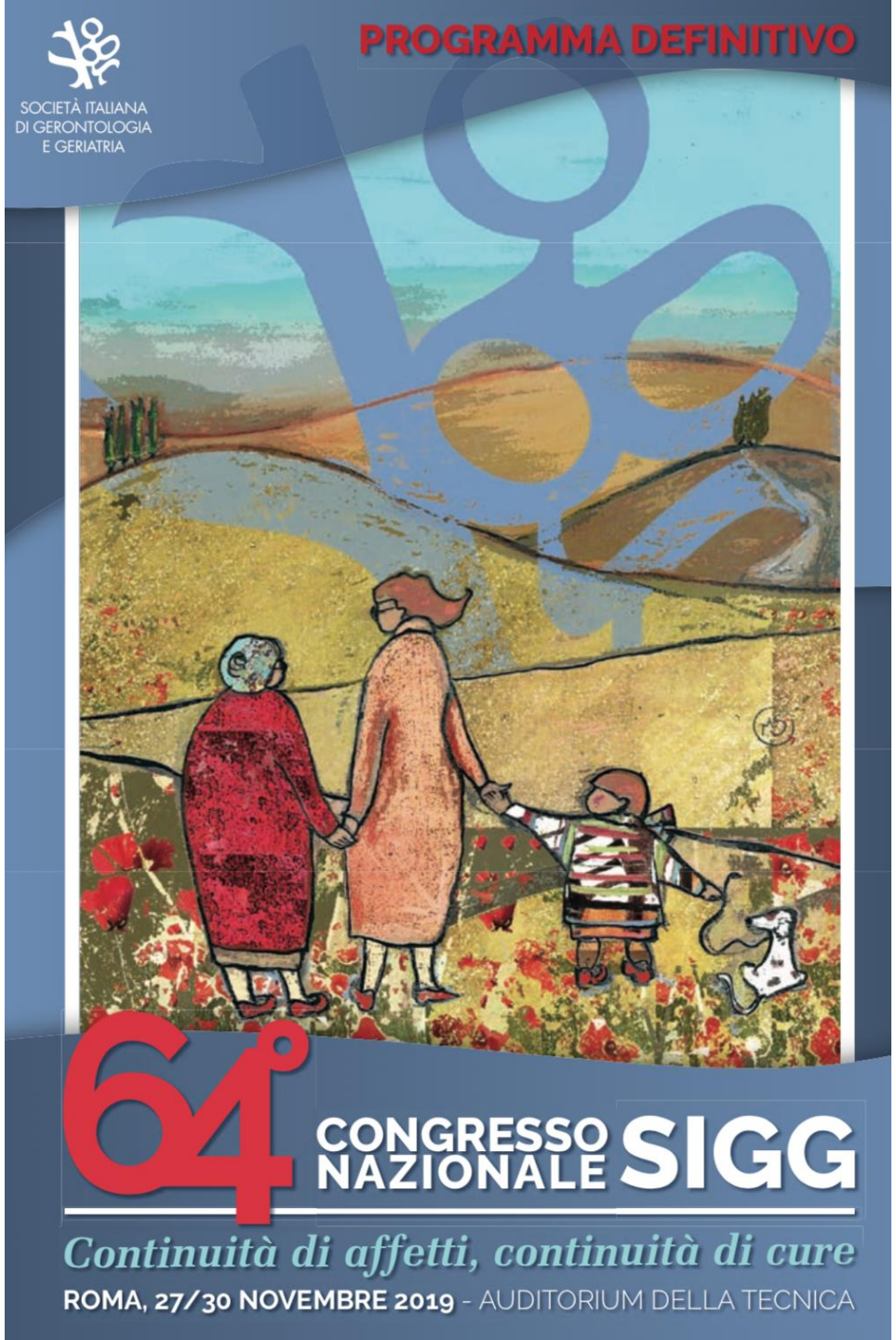

LA NIV nel paziente ristretto e nel paziente ostruito

(Anziano)

Antonio Greco
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UOC di Geriatria

LA DIMENSIONE DEL PROBLEMA

100.000 admission/year in UK for acute exacerbation of copd (AECOPD). Of these around 20% **(20.000)** develop hypercapnia an indicator of risk of death.

Plant PK, Owen J, Elliott MW. One year period prevalance study of respiratory acidosis in acute exacerbation of COPD; implications for the provision of non-invasive ventilation and oxygen administration. Thorax 2000;
55:550–4.

Roberts CM, Stone RA, Buckingham RJ, et al. Acidosis, non-invasive ventilation and mortality in hospitalised COPD exacerbations. Thorax 2011;66:43–8.

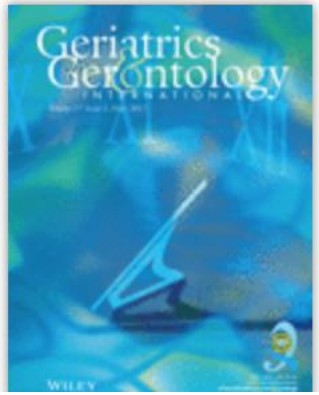
Since the publication of the BTS guideline in 2002 and subsequent National Institute for Health and Care Excellence (NICE) recommendations, the use of NIV in AECOPD has increased and most hospitals admitting unselected medical patients are able to provide an NIV service.

British Thoracic Society Standards of Care Committee. Non-invasive ventilation in acute respiratory failure. Thorax 2002;57:192–211.

Kaul S, Pearson M, Coutts I, et al. Non-invasive ventilation (NIV) in the clinical management of acute COPD in 233 UK hospitals: results from the RCP/BTS 2003 National COPD Audit. COPD 2009;6:171–6.

PROSPETTO 2 PERSONE DI 65 ANNI E PIÙ PER TIPO DI MALATTIA CRONICA DICHIARATA E GRAVI LIMITAZIONI MOTORIE, DELLA VISTA E DELL'UDITO, PER CLASSI DI ETÀ E SESSO, ITALIA E UNIONE EUROPEA (UE-28). Anno 2015, per 100 persone con le stesse caratteristiche

MALATTIE CRONICHE LIMITAZIONI FUNZIONALI		65-74			75+					
		Maschi	Femmine	Maschi e Femmine	Maschi	Femmine	Maschi e Femmine	Maschi	Femmine	Maschi e Femmine
Ipertensione	Ue (28)	46,5	51,2	49,2	45,3	47,7	46,6	48,0	54,9	52,1
	Italia	48,2	51,7	50,2	45,2	46,1	45,7	51,6	56,5	54,6
Artrosi	Ue (28)	27,1	44,5	37,0	23,0	38,5	31,3	32,6	50,7	43,4
	Italia	34,1	58,4	47,9	26,3	48,3	37,9	43,1	67,1	57,5
Patologia lombare	Ue (28)	30,7	39,8	35,9	29,0	36,9	33,3	33,0	42,8	38,8
	Italia	26,6	38,8	33,5	24,6	34,6	29,9	28,9	42,5	37,1
Patologia cervicale	Ue (28)	19,6	29,2	25,0	18,8	28,8	24,2	20,6	29,7	26,0
	Italia	21,8	33,9	28,7	20,7	33,2	27,3	23,1	34,6	30,0
Diabete	Ue (28)	19,3	16,6	17,8	18,2	14,6	16,3	20,8	18,7	19,6
	Italia	19,2	16,9	17,9	17,1	13,2	15,1	21,6	20,1	20,7
Incontinenza urinaria	Ue (28)	12,8	16,6	15,0	8,2	10,7	9,5	18,9	22,6	21,1
	Italia	13,9	15,4	14,7	8,1	6,4	7,2	20,5	23,1	22,1
Bronchite cronica, enfisema	Ue (28)	10,2	8,9	9,5	8,3	7,6	7,9	12,8	10,3	11,3
	Italia	13,7	11,8	12,6	9,0	8,6	8,8	19,2	14,6	16,4
Allergie	Ue (28)	10,7	15,8	13,6	11,3	17,4	14,6	9,9	14,1	12,4
	Italia	9,5	13,0	11,5	11,5	14,4	13,0	7,3	11,9	10,0
Depressione	Ue (28)	5,8	11,1	8,8	5,3	9,8	7,7	6,5	12,4	10,0
	Italia	7,5	14,7	11,6	5,7	12,2	9,1	9,5	16,9	13,9



Geriatr Gerontol Int. 2017 May;17(5):689-696. doi: 10.1111/ggi.12810. Epub 2016 May 23.

Non-invasive mechanical ventilation in elderly patients: A narrative review.

Piroddi IMG[1], Barlascini C[2], Esquinas A[3], Braido F[4], Banfi P[5], Nicolini A[1].

ARCHIVOS DE BRONCONEUMOLOGIA

www.archbronconeumol.org

Original Article

Non-invasive Ventilation in an Elderly Population Admitted to a Respiratory Monitoring Unit: Causes, Complications and One-year Evolution☆

Gonzalo Segrelles Calvo,* Enrique Zamora García, Rosa Girón Moreno, Emma Vázquez Espinosa, Rosa Mar Gómez Punter, Gilda Fernandes Vasconcelos, Claudia Valenzuela, Julio Ancochea Bermúdez

Servicio de Neumología, Hospital Universitario La Princesa, Madrid, Spain

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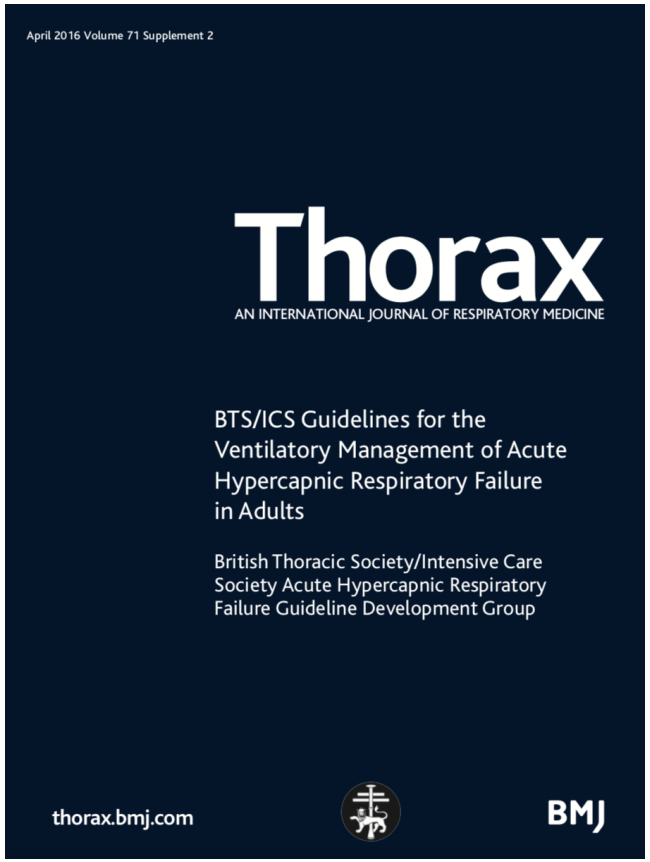
Chronic obstructive pulmonary disease
Heart failure
Respiratory Monitoring Unit

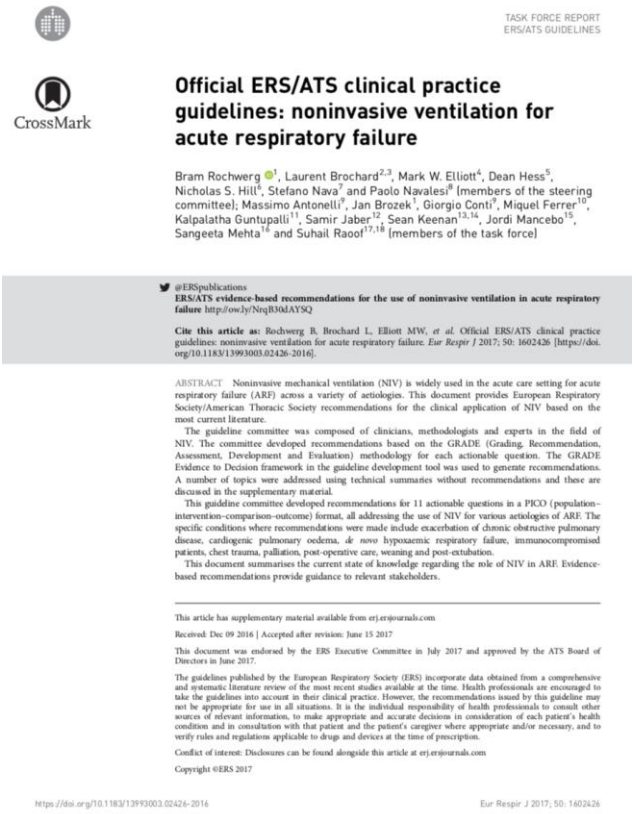
ABSTRACT

Objective: To determine the usefulness of NIV in elderly patients (≥75) admitted to a Respiratory Monitoring Unit (RMU) during hospitalization and 1 year later in comparison with the results from the younger age group (<75).
Materials and methods: Ours is a prospective observational study carried out at the Hospital Universitario La Princesa (Madrid). We recruited all patients who were ≥75 years old and were admitted to our RMU during the period 2008–2009 with respiratory acidosis (pH<7.35 and $PaCO_2$>45 mmHg) requiring NIV. We gathered data for basic variables as well as sociodemographics, history of previous pathologies, reason for hospitalization and severity, analysis upon admission and the evolution of blood gases at the start of NIV (within the first hour and after 24 h), complications and evolution at the 1-year follow-up.
Results: Mean age of the sample was 80.6. The Charlson index was 3.27. About half of the patients had some limitation for performing daily activities. The main reasons for admission were chronic obstructive pulmonary disease (COPD) exacerbation and heart failure (HF). There were complications in 36% of the cases (11 renal failure and 6 atrial fibrillation). The survival rate at the 1-year follow-up was 63.21%.
Conclusions: NIV is a good alternative in elderly patients admitted to the hospital with respiratory acidosis. We did not detect differences in mortality during admission between the 2 groups. The elderly patients were more frequently re-admitted than the younger group in the 6–12 months after hospital discharge. This could be due to their poorer functional state after hospitalization requiring NIV.

Non evidenza di differenze significative risposta degli anziani rispetto ai giovani adulti

QUALI EVIDENZE ?





TASK FORCE REPORT
ERS/ATS GUIDELINES

CrossMark

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)

@ERSpublications
ERS/ATS evidence-based recommendations for the use of noninvasive ventilation in acute respiratory failure http://ow.ly/NrqB30dAYSQ

Cite this article as: Rochwerg B, Brochard L, Elliott MW, *et al*. Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure. *Eur Respir J* 2017; 50: 1602426 [https://doi.org/10.1183/13993003.02426-2016].

ABSTRACT Noninvasive mechanical ventilation (NIV) is widely used in the acute care setting for acute respiratory failure (ARF) across a variety of aetiologies. This document provides European Respiratory Society/American Thoracic Society recommendations for the clinical application of NIV based on the most current literature.

The guideline committee was composed of clinicians, methodologists and experts in the field of NIV. The committee developed recommendations based on the GRADE (Grading, Recommendation, Assessment, Development and Evaluation) methodology for each actionable question. The GRADE Evidence to Decision framework in the guideline development tool was used to generate recommendations. A number of topics were addressed using technical summaries without recommendations and these are discussed in the supplementary material.

This guideline committee developed recommendations for 11 actionable questions in a PICO (population–intervention–comparison–outcome) format, all addressing the use of NIV for various aetiologies of ARF. The specific conditions where recommendations were made include exacerbation of chronic obstructive pulmonary disease, cardiogenic pulmonary oedema, *de novo* hypoxaemic respiratory failure, immunocompromised patients, chest trauma, palliation, post-operative care, weaning and post-extubation.

This document summarises the current state of knowledge regarding the role of NIV in ARF. Evidence-based recommendations provide guidance to relevant stakeholders.

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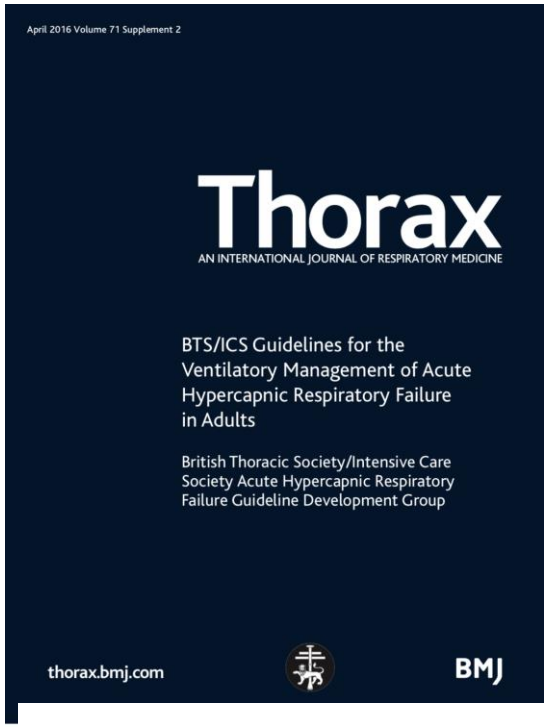
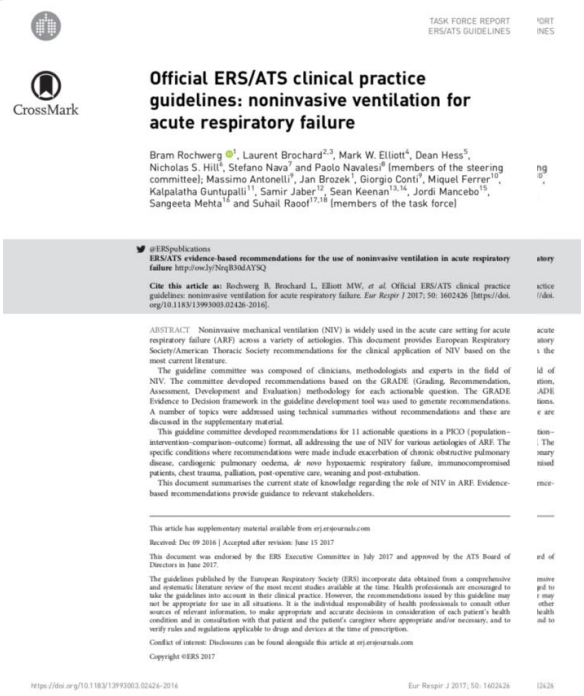
This document was endorsed by the ERS Executive Committee in July 2017 and approved by the ATS Board of Directors in June 2017.





TASK FORCE REPORT
ERS/ATS GUIDELINES

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)

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ERS/ATS evidence-based recommendations for the use of noninvasive ventilation in acute respiratory failure http://ow.ly/NuqB30LAY5Q

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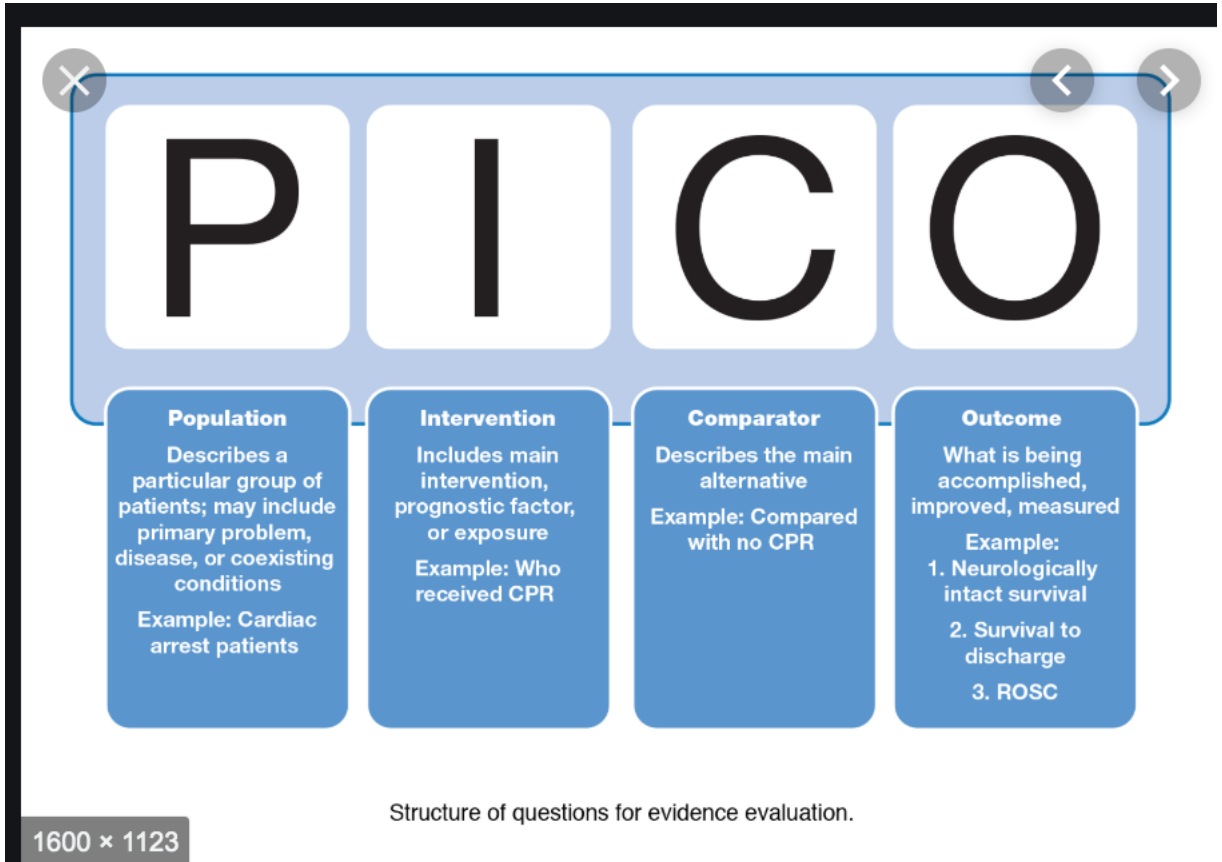
Conflict of interest: Disclosures can be found alongside this article at erj.ersjournals.com

Healthcare Improvement Scotland

SIGN



Structure of questions for evidence evaluation.

Table 1 SIGN grades of recommendations

A	At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; *or* A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results; *or* Extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; *or* Extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4; *or* Extrapolated evidence from studies rated as 2+

TABLE 1 Interpretation of strong and conditional recommendations for stakeholders (patients, clinicians and healthcare policy makers)

	Strong recommendation	**Weak recommendation**
For patients	Most individuals in this situation would want the recommended course of action and only a small proportion would not.	The majority of individuals in this situation would want the suggested course of action, but many would not.
For clinicians	Most individuals should receive the recommended course of action. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences.	Different choices are likely to be appropriate for different patients and therapy should be tailored to the individual patient's circumstances. Those circumstances may include the patient or family's values and preferences.
For policy makers	The recommendation can be adapted as policy in most situations including for the use as performance indicators.	Policy making will require substantial debates and involvement of many stakeholders. Policies are also more likely to vary between regions. Performance indicators would have to focus on the fact that adequate deliberation about the management options has taken place.

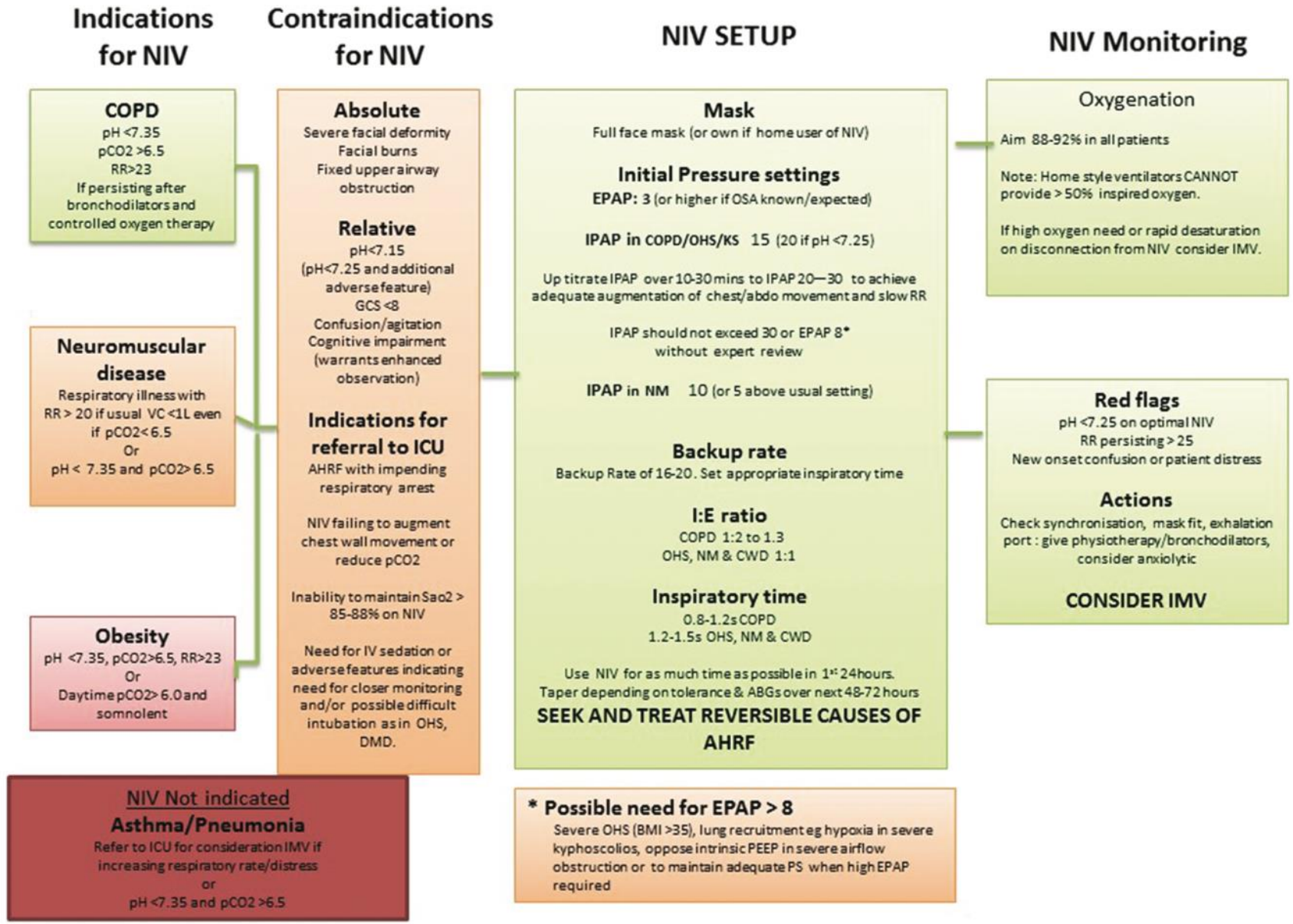
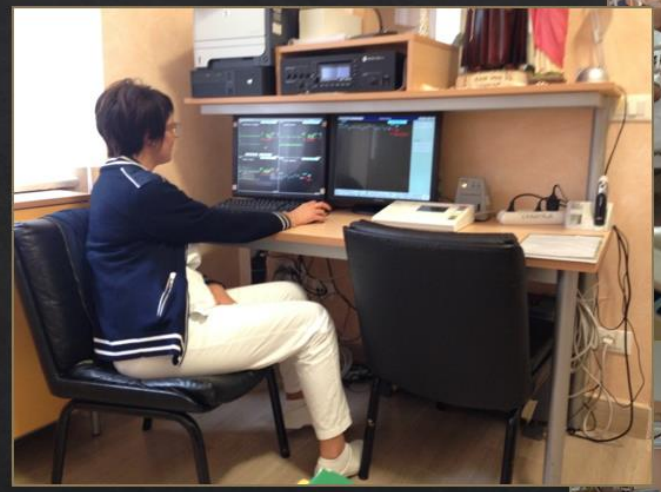
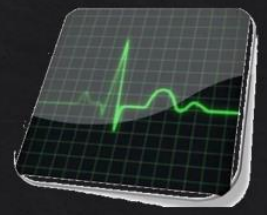


Figure 1 Summary for providing acute non-invasive ventilation.

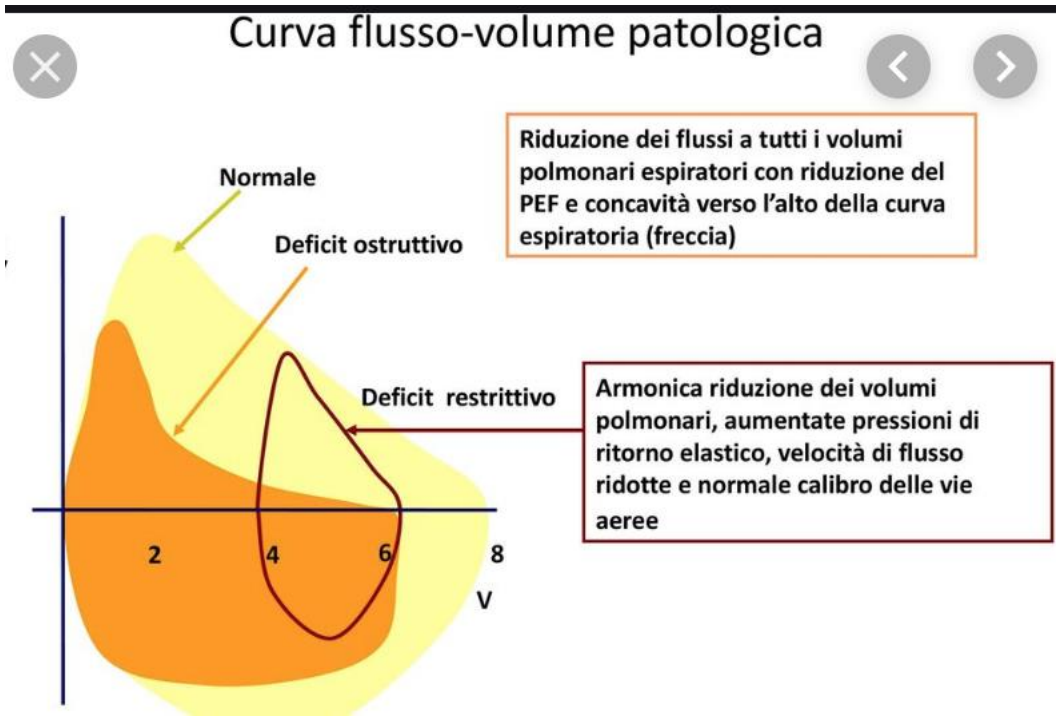
UNITÀ OPERATIVA DI GERIATRIA

Terapia sub-intensiva





PAZIENTE OSTRUITO



PRIMA DELLA NIV

In around 20% of AHRF cases secondary to AECOPD, optimised medical therapy, which includes targeting an oxygen saturation to 88–92%, will result in normalisation of arterial pH.

Established guidance is therefore to await improvement and initiate NIV if, after 60 min, the following are present: pH <7.35, pCO_2 > 6.5 kPa and RR >23 breaths/min.

Intensive Care Med. 2002 Dec;28(12):1701-7. Epub 2002 Aug 30.

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

Conti G[1], Antonelli M, Navalesi P, Rocco M, Bufi M, Spadetta G, Meduri GU.

Author information

1 Università Cattolica del S Cuore, Policlinico A. Gemelli, Largo F Vito, 00168 Rome, Italy. g.conti@rm.unicatt.it

Abstract

OBJECTIVE: We conducted a randomized prospective study comparing noninvasive positive pressure ventilation (NPPV) with conventional mechanical ventilation via endotracheal intubation (ETI) in a group of patients with chronic obstructive pulmonary disease who failed standard medical treatment in the emergency ward after initial improvement and met predetermined criteria for ventilatory support.

DESIGN AND SETTING: Prospective randomized study in a university hospital 13-bed general ICU.

PATIENTS: Forty-nine patients were randomly assigned to receive NPPV (n=23) or conventional ventilation (n=26).

RESULTS: both NPPV and conventional ventilation significantly improved gas exchanges. The two groups had similar length of ICU stay, number of days on mechanical ventilation, overall complications, ICU mortality, and hospital mortality. In the NPPV group 11 (48%) patients avoided intubation, survived, and had a shorter duration of ICU stay than intubated patients. One year following hospital discharge the NPPV group had fewer patients readmitted to the hospital (65% vs. 100%) or requiring de novo permanent oxygen supplementation (0% vs. 36%).

CONCLUSIONS: The use of NPPV in patients with chronic obstructive pulmonary disease and acute respiratory failure requiring ventilatory support after failure of medical treatment avoided ETI in 48% of the patients, had the same ICU mortality as conventional treatment and, at 1-year follow-up was associated with fewer patients readmitted to the hospital or requiring for long-term oxygen supplementation. An editorial regarding this article can be found in the same issue (http://dx.doi.org/10.1007/s00134-002-1503-3).

NIV IN AECOPD

Patient with a modest respiratory acidosis with the aim of preventing deterioration to a point when IMV would conventionally be considered;

As an alternative to IMV when conventional criteria for IMV are met (lower pH, more distress) with the intention to proceed to IMV if NIV fails.

As the ‘ceiling’ of treatment for patients who, for whatever valid reason, are not candidates for IMV.

Nava S, Navalesi P, Conti G. Time of non-invasive ventilation. Intensive Care Med 2006;32:361–70.

Role of NIV in AECOPD
Recommendations

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

NIV should be started when pH<7.35 and pCO2 >6.5 kPa persist or develop despite optimal medical therapy (Grade A).

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

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

The practice of NIV should be regularly audited to maintain standards (Grade C).

BTS GUIDELINES 2006

Cochrane Database of Systematic Reviews

Non-invasive ventilation for the management of acute hypercapnic respiratory failure due to exacerbation of chronic obstructive pulmonary disease

Cochrane Systematic Review - **Intervention** | Version published: 13 July 2017 see what's new

https://doi.org/10.1002/14651858.CD004104.pub4

We included in the review 17 randomised controlled trials involving 1264 participants. Available data indicate that mean age at recruitment was 66.8 years (range 57.7 to 70.5 years) and that most participants (65%) were male. Most studies (12/17) were at risk of performance bias, and for most (14/17), the risk of detection bias was uncertain. These risks may have affected subjective patient-reported outcome measures (e.g. dyspnoea) and secondary review outcomes, respectively.

Use of NIV decreased the risk of mortality by 46% (risk ratio (RR) 0.54. 95% confidence interval (CI) 0.38 to 0.76: N = 12 studies: number needed to treat for an additional beneficial outcome (NNTB endotracheal intubation by 65% (RR 0.36, 95% CI 0.28 to 0.46; N = 17 'moderate' quality owing to uncertainty regarding risk of bias for sev endotracheal intubation raised the possibility of some publication b with reduced length of hospital stay (mean difference (MD) -3.39 day complications (unrelated to NIV) (RR 0.26, 95% CI 0.13 to 0.53; N = 2 s 0.07; N = 8 studies) and in partial pressure of oxygen (PaO_2) (MD 7.47 hour. A trend towards improvement in $PaCO_2$ was observed, but this CI -11.05 to 1.80 mmHg; N = 8 studies). Post hoc analysis revealed tha studies at high risk of bias showed baseline imbalance for this outco Sensitivity analysis revealed that exclusion of these two studies resu $PaCO_2$. Treatment intolerance was significantly greater in the NIV grc 95% CI 0.04 to 0.17; N = 6 studies). Results of analysis showed a non- compared with usual care (standardised mean difference (SMD) -0.1(revealed no significant between-group differences.

Authors' conclusions

Data from good quality randomised controlled trials show that NIV is beneficial as a first-line intervention in conjunction with usual care for reducing the likelihood of mortality and endotracheal intubation in patients admitted with acute hypercapnic respiratory failure secondary to an acute exacerbation of chronic obstructive pulmonary disease (COPD). The magnitude of benefit for these outcomes appears similar for patients with acidosis of a mild (pH 7.30 to 7.35) versus a more severe nature (pH < 7.30), and when NIV is applied within the intensive care unit (ICU) or ward setting.

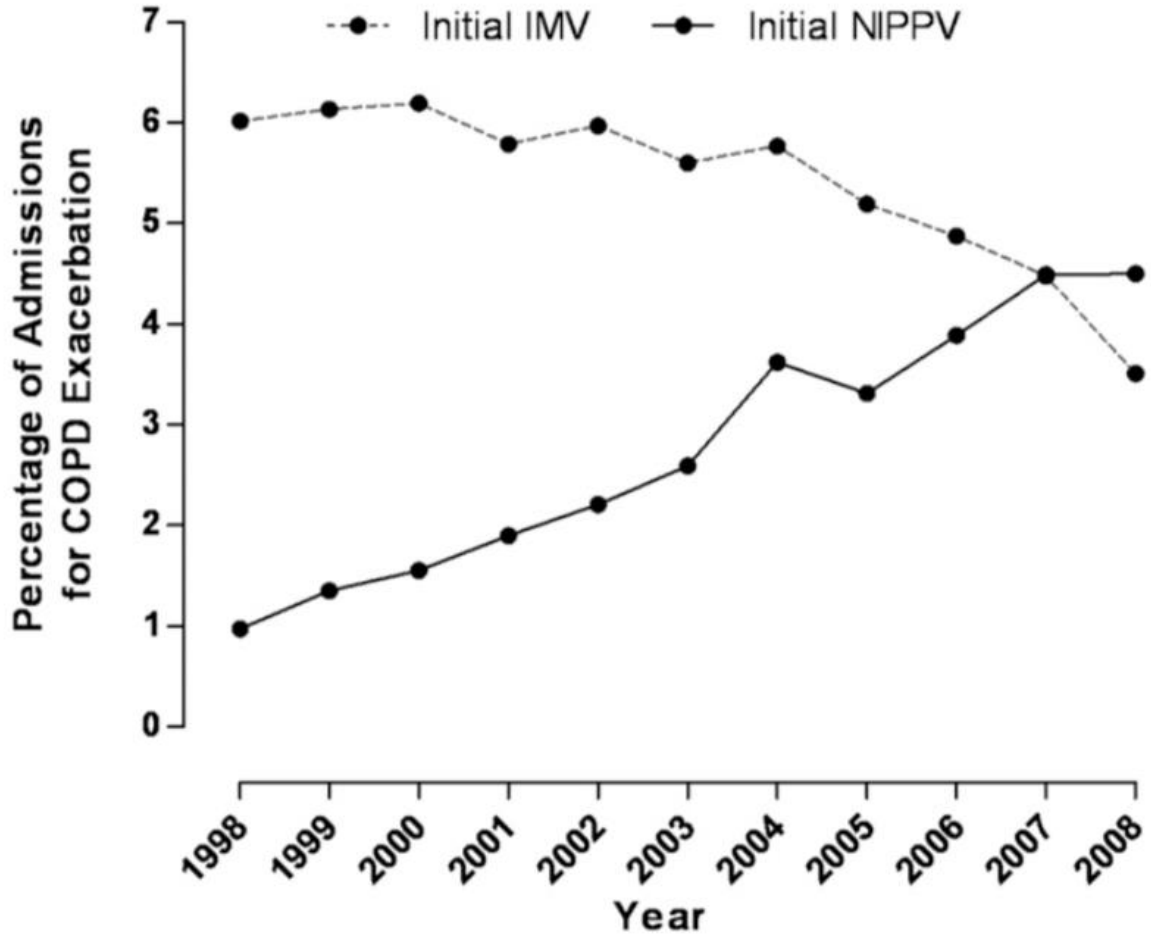


Figure 1. Temporal trends in the use of noninvasive positive pressure ventilation (NIPPV) and invasive mechanical ventilation (IMV) as the initial form of respiratory support in patients hospitalized with acute exacerbations of chronic obstructive pulmonary disease (COPD) in the United States, 1998–2008.

Outcomes of Noninvasive Ventilation for Acute Exacerbations of Chronic Obstructive Pulmonary Disease in the United States, 1998–2008

Divay Chandra[1]*, Jason A. Stamm[1]*, Brian Taylor[2], Rose Mary Ramos[1], Lewis Satterwhite[2], Jerry A. Krishnan[3], David Mannino[4], Frank C. Sciurba[1], and Fernando Holguín[1]

[1]University of Pittsburgh, Pittsburgh, Pennsylvania; [2]Emory University, Atlanta, Georgia; [3]University of Illinois at Chicago, Chicago, Illinois; and [4]University of Kentucky, Lexington, Kentucky

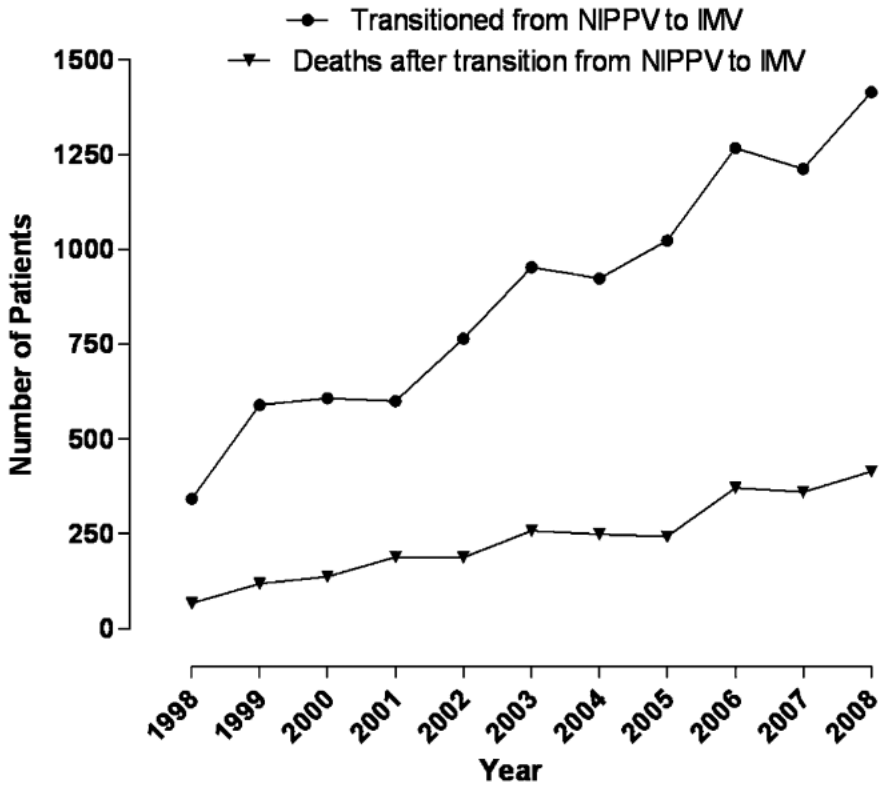


Figure 4. The number of patients and the number of in-hospital deaths among patients requiring transition from noninvasive positive pressure ventilation (NIPPV) to invasive mechanical ventilation (IMV) after admission for acute exacerbation of chronic obstructive pulmonary disease, 1998–2008.

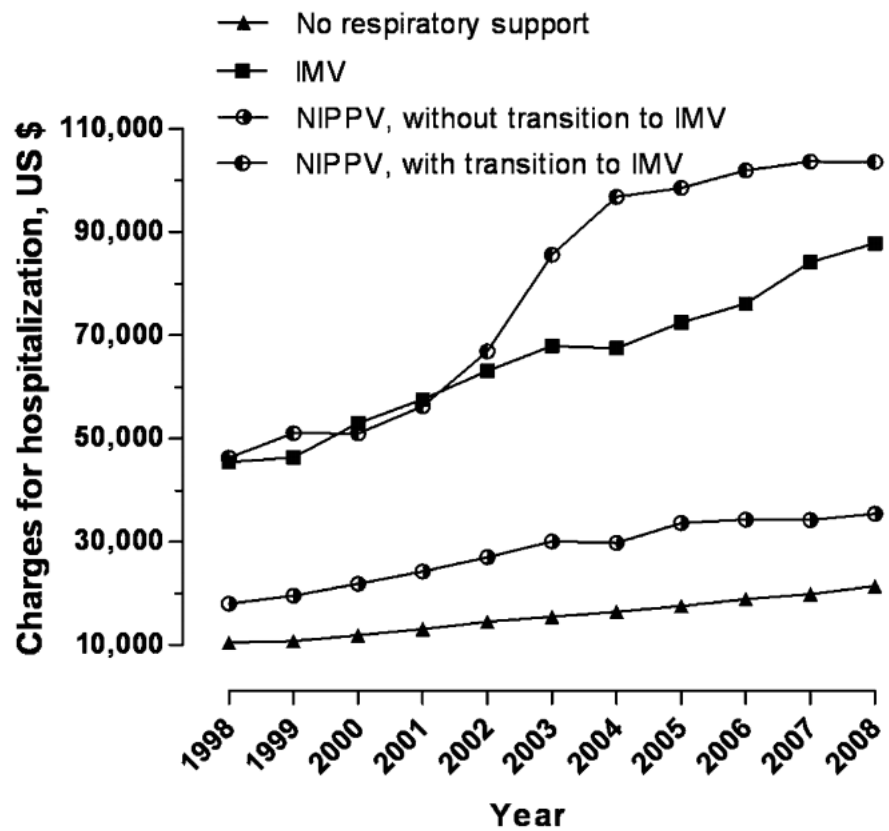


Figure 7. Charges for hospitalization for acute exacerbation of chronic obstructive pulmonary disease grouped by type or respiratory support used, 1998–2008. IMV = invasive mechanical ventilation; NIPPV = noninvasive positive pressure ventilation.

Outcomes of Noninvasive Ventilation for Acute Exacerbations of Chronic Obstructive Pulmonary Disease in the United States, 1998–2008

Divay Chandra[1]*, Jason A. Stamm[1]*, Brian Taylor[2], Rose Mary Ramos[1], Lewis Satterwhite[2], Jerry A. Krishnan[3], David Mannino[4], Frank C. Sciurba[1], and Fernando Holguín[1]

[1]University of Pittsburgh, Pittsburgh, Pennsylvania; [2]Emory University, Atlanta, Georgia; [3]University of Illinois at Chicago, Chicago, Illinois; and [4]University of Kentucky, Lexington, Kentucky

Starting NIV in COPD
Good practice points

- Arterial blood gas (ABG) measurement is needed prior to and following starting NIV.
- Chest radiography is recommended but should not delay initiation of NIV in severe acidosis.
- Reversible causes for respiratory failure should be sought and treated appropriately.
- At the start of treatment, an individualised patient plan (involving the patient wherever possible) should document agreed measures to be taken in the event of NIV failure.

BTS GUIDELINES 2006

SUMMARY OF RECOMMENDATIONS

Principles of mechanical ventilation modes of mechanical ventilation

Recommendation

Pressure-targeted ventilators are the devices of choice for acute NIV (Grade B).

Good practice points

- Both pressure support (PS) and pressure control modes are effective.
- Only ventilators designed specifically to deliver NIV should be used.

MODALITÀ DI VENTILAZIONE A PRESSIONE POSITIVA

VOLUMETRICA

Si imposta il ventilatore in modo che il paziente mantenga un volume corrente costante stabilito dall'operatore, a prescindere dalle pressioni erogate dal ventilatore necessarie per ottenerlo.

↓

IMPOSTO
volume corrente
(variabile indipendente)

LEGGO
pressione vie aeree
(variabile dipendente)

RISCHIO
barotrauma, minore tolleranza

PRESSOMETRICA

Si imposta il ventilatore in modo da erogare sempre le stesse pressioni positive scelte dall'operatore, a prescidere dal volume corrente che sarà poi sviluppato dal paziente. È la modalità di ventilazione comunemente utilizzata per la NIV.

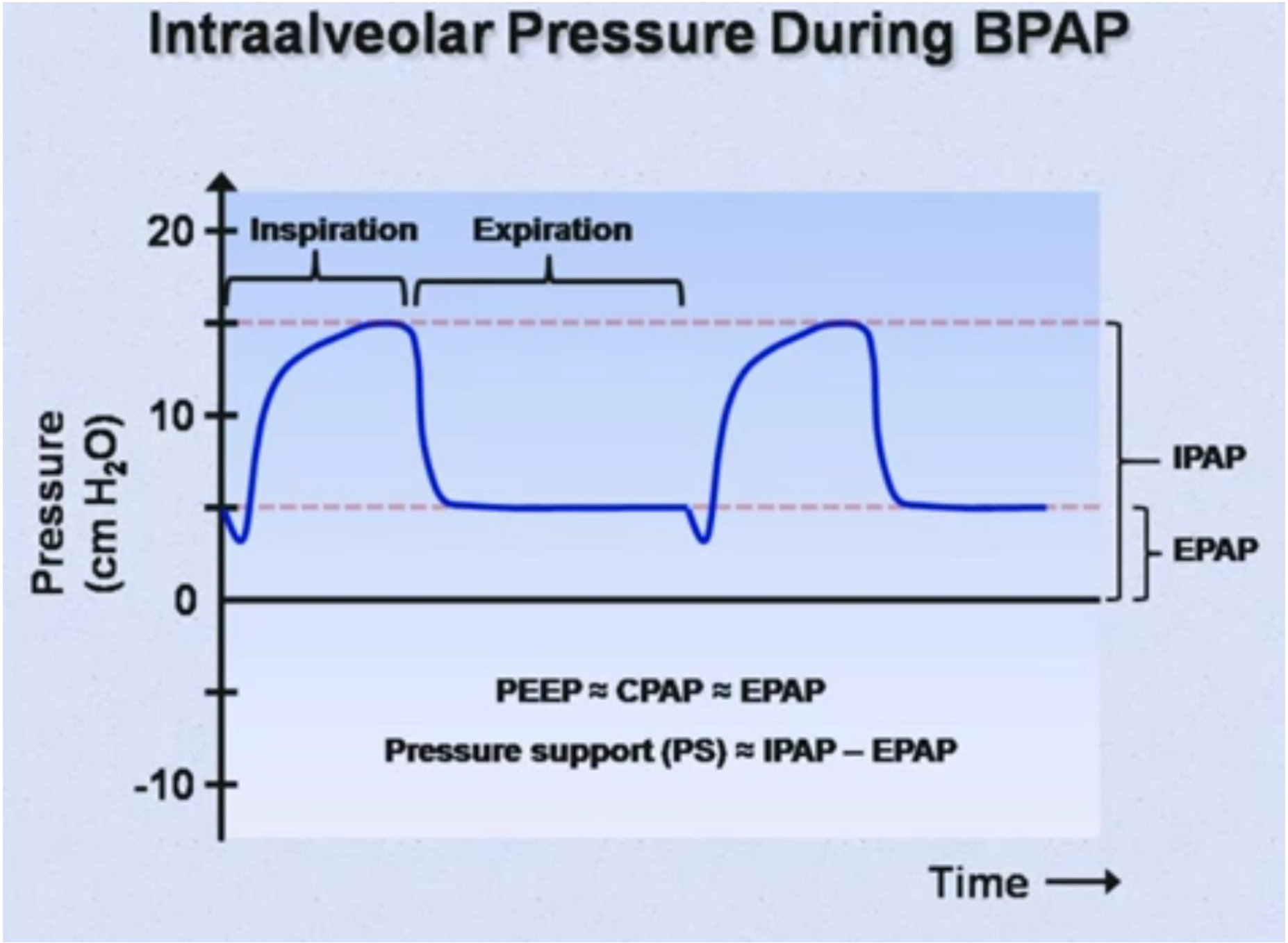
↓

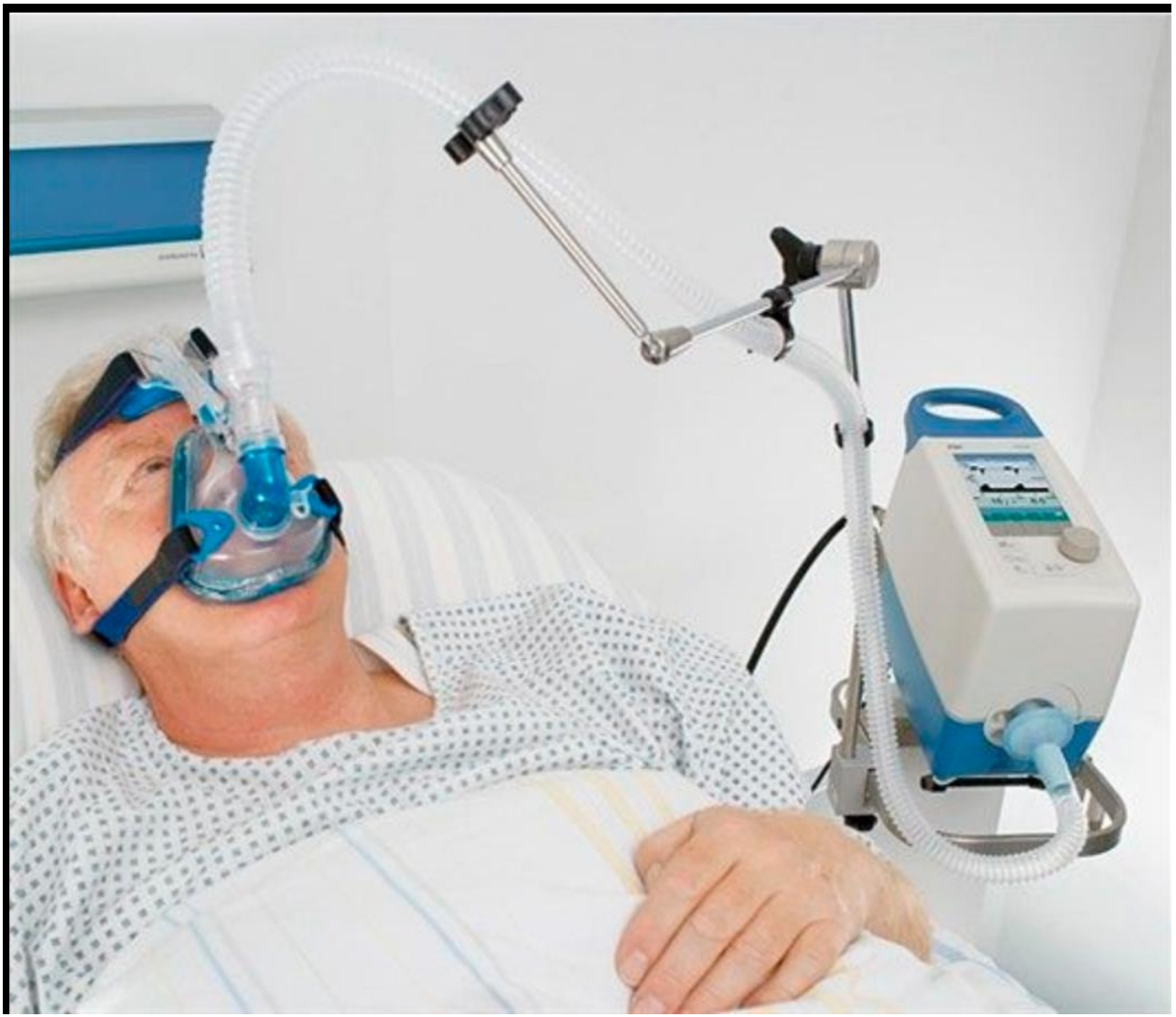
IMPOSTO
pressione vie aeree
(variabile indipendente)

LEGGO
volume corrente
(variabile dipendente)

RISCHIO
non garantisce un volume corrente costante

Intraalveolar Pressure During BPAP





SCEGLIERE IL GIUSTO VENTILATORE

Optimising NIV delivery and technical considerations

Good practice point

Before considering NIV to have failed, always check that common technical issues have been addressed and ventilator settings are optimal (table 3).

Table 3 Technical issues: a guide for when NIV is failing

Problem	Cause(s)	Solution (s)
Ventilator cycling independently of patient effort	Inspiratory trigger sensitivity is too high Excessive mask leak	Adjust trigger Reduce mask leak
Ventilator not triggering despite visible patient effort	Excessive mask leak Inspiratory trigger sensitivity too low	Reduce mask leak Adjust trigger For NM patients consider switch to PCV
Inadequate chest expansion despite apparent triggering	Inadequate Tidal volume	Increase IPAP. In NM or chest wall disease consider longer Ti
Chest/abdominal paradox	Upper airway obstruction	Avoid neck flexion Increase EPAP
Premature expiratory effort by patient	Excessive Ti or IPAP	Adjust as necessary

EPAP, expiratory positive airway pressure; IPAP, inspiratory positive airway pressure; NIV, non-invasive ventilation; NM, neuromuscular; PCV, pressure-controlled ventilation.

BTS GUIDELINES 2006

Prognostic features relating to use of NIV in COPD

Recommendations

29. Advanced age alone should not preclude a trial of NIV (Grade A).
30. Worsening physiological parameters, particularly pH and respiratory rate (RR), indicate the need to change the management strategy. This includes clinical review, change of interface, adjustment of ventilator settings and considering proceeding to endotracheal intubation (Grade A).

Good practice point

1.If sleep-disordered breathing pre-dates AHRF, or evidence of it complicates an episode, the use of a controlled mode of NIV overnight is recommended.

BTS GUIDELINES 2006

Duration of NIV in COPD

Recommendation

NIV can be discontinued when there has been normalisation of pH and pCO2 and a general improvement in the patient's condition (Grade B).

Good practice points

- ▸ Time on NIV should be maximised in the first 24 h depending on patient tolerance and/or complications.
- ▸ NIV use during the day can be tapered in the following 2–3 days, depending on pCO2 self-ventilating, before being discontinued overnight.

BTS GUIDELINES 2006

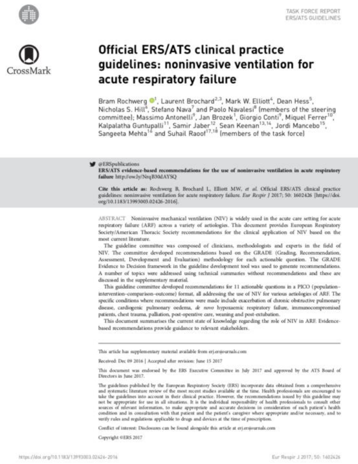
PICO questions and recommendations

Question 1: Should NIV be used in COPD exacerbation?

Bilevel NIV may be considered in COPD patients with an acute exacerbation in three clinical settings [10]:

1) To prevent acute respiratory acidosis, *i.e.* when the arterial CO_2 tension (P_{aCO_2}) is normal or elevated but pH is normal (see Question 1a).
2) To prevent endotracheal intubation and invasive mechanical ventilation in patients with mild to moderate acidosis and respiratory distress, with the aim of preventing deterioration to a point when invasive ventilation would be considered (see Question 1b).
3) As an alternative to invasive ventilation in patients with severe acidosis and more severe respiratory distress (see Question 1b).

Bilevel NIV may also be used as the only method for providing ventilatory support in patients who are not candidates for or decline invasive mechanical ventilation.


TASK FORCE REPORT
ERS/ATS GUIDELINES

CrossMark

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)

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ERS/ATS evidence-based recommendations for the use of noninvasive ventilation in acute respiratory failure http://ow.ly/NrqB30dAYSQ

Cite this article as: Rochwerg B, Brochard L, Elliott MW, *et al.* Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure. *Eur Respir J* 2017; 50: 1602426 [https://doi.org/10.1183/13993003.02426-2016].

ABSTRACT Noninvasive mechanical ventilation (NIV) is widely used in the acute care setting for acute respiratory failure (ARF) across a variety of aetiologies. This document provides European Respiratory Society/American Thoracic Society recommendations for the clinical application of NIV based on the most current literature.

The guideline committee was composed of clinicians, methodologists and experts in the field of NIV. The committee developed recommendations based on the GRADE (Grading, Recommendation, Assessment, Development and Evaluation) methodology for each actionable question. The GRADE Evidence to Decision framework in the guideline development tool was used to generate recommendations. A number of topics were addressed using technical summaries without recommendations and these are discussed in the supplementary material.

This guideline committee developed recommendations for 11 actionable questions in a PICO (population–intervention–comparison–outcome) format, all addressing the use of NIV for various aetiologies of ARF. The specific conditions where recommendations were made include exacerbation of chronic obstructive pulmonary disease, cardiogenic pulmonary oedema, *de novo* hypoxaemic respiratory failure, immunocompromised patients, chest trauma, palliation, post-operative care, weaning and post-extubation.

This document summarises the current state of knowledge regarding the role of NIV in ARF. Evidence-based recommendations provide guidance to relevant stakeholders.

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This document was endorsed by the ERS Executive Committee in July 2017 and approved by the ATS Board of Directors in June 2017.

The guidelines published by the European Respiratory Society (ERS) incorporate data obtained from a comprehensive and systematic literature review of the most recent studies available at the time. Health professionals are encouraged to take the guidelines into account in their clinical practice. However, the recommendations issued by this guideline may not be appropriate for use in all situations. It is the individual responsibility of health professionals to consult other sources of relevant information, to make appropriate and accurate decisions in consideration of each patient's health condition and in consultation with that patient and the patient's caregiver where appropriate and/or necessary, and to verify rules and regulations applicable to drugs and devices at the time of prescription.

Conflict of interest: Disclosures can be found alongside this article at erj.ersjournals.com

Question 1a: Should NIV be used in ARF due to a COPD exacerbation to prevent the development of respiratory acidosis?

Recommendation

We suggest NIV not be used in patients with hypercapnia who are not acidotic in the setting of a COPD exacerbation. (Conditional recommendation, low certainty of evidence.)

Recommendations

We recommend bilevel NIV for patients with ARF leading to acute or acute-on-chronic respiratory acidosis (pH ⩽7.35) due to COPD exacerbation. (Strong recommendation, high certainty of evidence.)

We recommend a trial of bilevel NIV in patients considered to require endotracheal intubation and mechanical ventilation, unless the patient is immediately deteriorating. (Strong recommendation, moderate certainty of evidence.)

TASK FORCE REPORT
ERS/ATS GUIDELINES

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elines: noninvasive ventilation for
e respiratory failure

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EUROPEAN RESPIRATORY *journal*

FLAGSHIP SCIENTIFIC JOURNAL OF ERS

Early View

Task Force Report

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

Begum Ergan, Simon Oczkowski, Bram Rochwerg, Annalisa Carlucci, Michelle Chatwin, Enrico Clini, Mark Elliott, Jesus Gonzalez-Bermejo, Nicholas Hart, Manel Lujan, Jacek Nasilowski, Stefano Nava, Jean Louis Pepin, Lara Pisani, Jan Hendrik Storre, Peter Wijkstra, Thomy Tonia, Jeanette Boyd, Raffaele Scala, Wolfram Windisch

Please cite this article as: Ergan B, Oczkowski S, Rochwerg B, *et al*. European Respiratory Society Guideline on Long-term Home Non-Invasive Ventilation for Management of Chronic Obstructive Pulmonary Disease. *Eur Respir J* 2019; in press (https://doi.org/10.1183/13993003.01003-2019).

PICO Question 1: Should LTH-NIV be used in stable patients with COPD as compared to not using NIV?

Recommendation: The ERS TF suggests LTH-NIV be used for patients with chronic stable hypercapnic COPD (conditional recommendation, low certainty evidence).

PICO Question 2: Should LTH-NIV be used after an episode of acute hypercapnic respiratory failure in patients with COPD as compared to not using NIV?

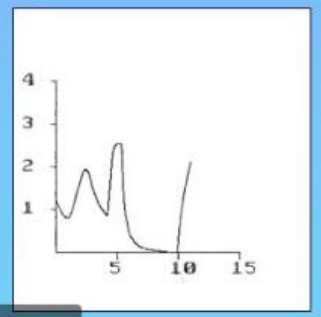
Recommendation: The ERS TF suggests LTH-NIV be used in patients with COPD following a life-threatening episode of acute hypercapnic respiratory failure requiring acute NIV, if hypercapnia persists following the episode (conditional recommendation, low certainty evidence).

PICO Question 3: When using LTH-NIV in COPD patients, should NIV settings be titrated to normalize or at least cause a significant reduction in PaCO2 as compared to titrating not according to PaCO2 levels?

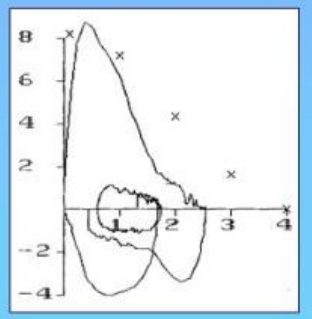
Recommendation: The ERS TF suggests titrating LTH-NIV to normalize or reduce PaCO2 levels in patients with COPD (conditional recommendation, very low certainty evidence).

PAZIENTE RISTRETTO

		oss.	teorici	%	lim.
VC	l	2.56	4.18	61 ↓	3.26-5.10
FVC	l	2.56	4.01	64 ↓↓	3.01-5.01
FEV1	l	2.29	3.22	71 ↓	2.38-4.06
FEV1/VC	%	89.26	77.36	115 ↑	65.6-89.2
RV	l	0.90	2.20	41 ↓	1.53-2.88
FRC	l	2.10	3.45	61	2.46-4.44
TLC	l	3.47	6.51	53 ↓	5.36-7.66
RV/TLC	%	26.08	35.04	74	26.0-44.0



SINDROME RESTRITTIVA



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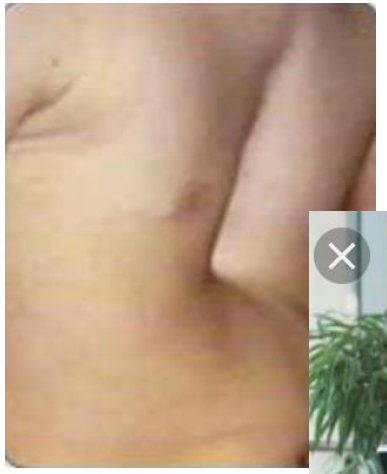
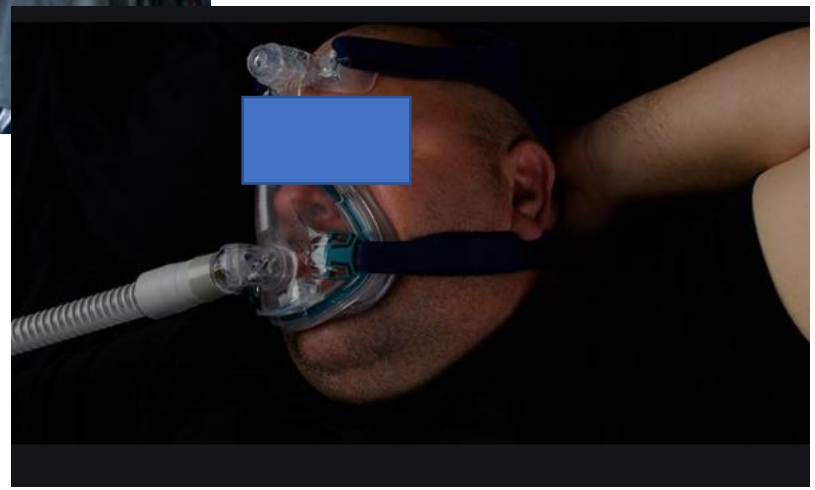
RESTRICTIVE LUNG DISEASE CAUSES





1. CHEST WALL DISEASE
2. NEUROMUSCOLAR DISEASE THAT AFFECT RESPIRATORY MUSCLE
3. OBESITY HYPOVENTILATION SYNDROME

NIV NEL PAZIENTE RISTRETTO

Unlike AECOPD, recurrent critical episodes do not preclude intervening good life quality, acceptable health status and prolonged survival.
There are no RCTs to guide practice in AHRF and the recommendations presented are extrapolated from the AECOPD literature, from reports of the value of domiciliary NIV (most evidence coming from trials in the more progressive NMDs) and from expert opinion.

BTS GUIDELINES 2006

In contrast to AECOPD, where the degree of acidosis is more important than the degree of hypercapnia, any elevation of pCO2 in NMD/CWD may herald an impending crisis. Patients have a reduced respiratory reserve but may initially sustain sufficient alveolar ventilation to maintain normal carbon dioxide tension.

Minor infection, such as coryza, may be provocative and over the next 24–72 h progressive hypercapnia may develop.

Tolerance of acute and chronic hypercapnia varies considerably. Some patients are excessively sleepy with minimal elevation of pCO2, while others remain alert despite much more severe hypercapnia. NIV should be considered in any breathless/acutely unwell patient with NMD/CWD before respiratory acidosis develops.

BTS GUIDELINES 2006

In the absence of bulbar dysfunction, NIV is usually well tolerated in the restrictive causes of AHRF. Unless there is significant skeletal deformity, a low degree of PS (eg, a pressure difference of 8–12 cm) is needed in NMD.
By contrast, in severe kyphoscoliosis, an IPAP >20, and sometimes up to 30, may be required because of the high impedance to inflation. Expiratory flow is normally not limited in either restrictive category and the inspiratory/expiratory time (IE) ratio for the backup rate (or PCV) should initially be set at 1:1 to allow an adequate time for inspiration. Bulbar dysfunction renders effective NIV more difficult to achieve, requires a higher EPAP to overcome upper airway obstruction and needs special attention to aid cough and the clearing of upper and lower airways. Clinical experience in providing NIV is needed to best titrate the EPAP. A modest increase in the domiciliary ventilator settings is advised in the case of home mechanical ventilation patients being admitted with AHRF.

BTS GUIDELINES 2006

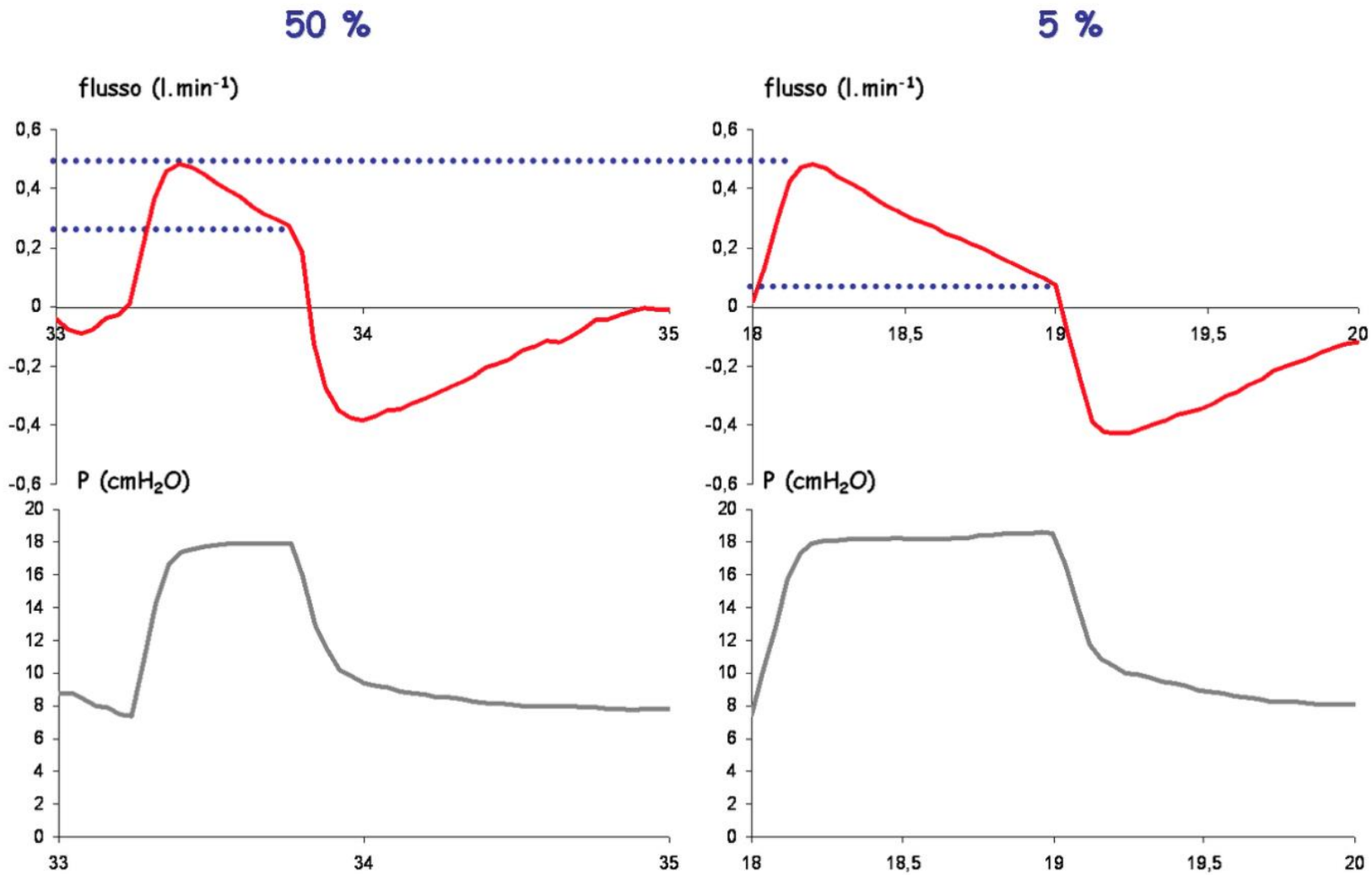


figura 5

Vediamo un esempio nella figura 5. Se scegliamo come **trigger espiratorio** il **50%** del picco di flusso inspiratorio (parte sinistra della figura) vediamo che quando si **dimezza** il **picco di flusso inspiratorio**, **l'inspirazione termina** ed **inizia l'espirazione**. Quando si sceglia un **trigger espiratorio del 5%** (parte destra della figura), l'effetto è quello di **prolungare** la durata dell'**inspirazione**: infatti ci vuole più tempo per raggiungere il valore critico di flusso che consente di passare all'espirazione. Quindi un **trigger espiratorio basso aumenta la durata dell'inspirazione** (esistono frequenti eccezioni che però meritano un post tutto per sè).

Controlled oxygen therapy should be used in patients with NMD or CWD and AHRF (Grade D).

NIV should almost always be trialled in the acutely unwell patient with NMD or CWD with hypercapnia. Do not wait for acidosis to develop (Grade D).

In patients with NMD or CWD, NIV should be considered in acute illness when VC is known to be <1 L and RR >20, even if normocapnic (Grade D).

In NMD and CWD, unless escalation to IMV is not desired by the patient or is deemed to be inappropriate, intubation should not be delayed if NIV is failing (Grade D).

BTS GUIDELINES 2006

- Individuals with NMD and CWD who present with AHRF should not be denied acute NIV.

- NIV is the ventilation mode of choice because patients with NMD or CWD tolerate it well and because extubation from IMV may be difficult.

- In patients with NMD or CWD, deterioration may be rapid or sudden, making HDU/ICU placement for therapy more appropriate.

BTS GUIDELINES 2006

In patients with NMD or CWD, senior/experienced input is needed in care planning and is essential if differences in opinion exist or develop between medical staff and patient representatives.

- In patients with NMD, it should be anticipated that bulbar dysfunction and communication difficulties, if present, will make NIV delivery difficult and may make it impossible.
- Discussion about NIV and IMV, and patients' wishes with respect to cardiopulmonary resuscitation, should occur as part of routine care in patients with NMD or CWD.
- In patients with NMD or CWD, nocturnal NIV should usually be continued following an episode of AHRF pending discussion with a home ventilation service.

BTS GUIDELINES 2006

In patients with NMD or CWD, intolerance of the mask and severe dyspnoea are less likely to cause NIV failure. Bulbar dysfunction makes NIV failure more likely.

- Deterioration in patients with NMD or CWD may be very sudden. Difficulty achieving adequate oxygenation or rapid desaturation during a break from NIV are important warning signs.

- In patients with NMD or CWD, the presence of bulbar dys- function, more profound hypoxaemia or rapid desaturation during NIV breaks suggests that placement in HDU/ICU is indicated.

BTS GUIDELINES 2006

NIV settings and placement in OHS

Obese patients with severe AHRF have a significant risk, despite receiving NIV, of sudden deterioration and are likely to be difficult to intubate (see below).
Upper airway obstruction is common and will be more apparent during sleep. It may persist, despite increasing the EPAP.
Another clue is intermittent mask leak that accompanies obstructed inspiration. A more upright position may help, but an EPAP in the 10–15 range is often required. Expert assessment is recommended to titrate the EPAP.
Tidal volume may be compromised by high level EPAP and, in some, the impedance to inflation is very high and an IPAP of >30 is required.

BTS GUIDELINES 2006

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Nessun dato sul paziente ristretto

TAKE HOME MESSAGES

- Numerose evidenze appropriano l'impiego della NIV nel paziente ostruito soprattutto in acuto

- In cronico le evidenze appiano meno forti

- Le evidenze nel paziente ristretto sono mutuate dalle esperienze sull'ostruito e sono rese deboli dalla diversità dei pazienti classificati all'interno di questa classificazione.

Il trattamento non farmacologico dell'insufficienza respiratoria nell'anziano

SAN GIOVANNI ROTONDO - 11/12 aprile 2019

CASA SOLLIEVO DELLA SOFFERENZA • SAN GIOVANNI ROTONDO •

GRAZIE PER
L'ATTENZIONE