CURSO DE VMNI

NIPPON 2026

VMNI nas exacerbações de DPOC

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NIPPON GASES Healthcare

A VNI tem um papel determinante nas exacerbações de DPOC

- A DPOC é a 3ª causa de morte a nível global
- As exacerbações agudas de DPOC (EADPOC) causam frequentemente insuficiência respiratória global aguda (ou crónica agudizada) e admissão em UCI
- A intubação traqueal (IOT) associa-se a internamentos mais prolongados, maior mortalidade e aumento dos custos
- A VNI tornou-se o suporte respiratório *gold standard* no doente com EADPOC grave e IRG descompensada

O doente com insuficiência respiratória aguda é, por definição, um doente grave

Classification of the Severity of COPD Exacerbations

Figure 4.2

COPD Patient with Suspected Exacerbation

↓

Confirm Exacerbation Diagnosis and Episode Severity

↓

Severity	Variable thresholds to determine severity
Mild (default)	• Dyspnea VAS < 5 • RR < 24 breaths/min • HR < 95 bpm • Resting SaO_2 ≥ 92% breathing ambient air (or patient's usual oxygen prescription) AND change ≤ 3% (when known) • CRP < 10 mg/L (if obtained)
Moderate (meets at least three of five*)	• Dyspnea VAS ≥ 5 • RR ≥ 24 breaths/min • HR ≥ 95 bpm • Resting SaO_2 < 92% breathing ambient air (or patient's usual oxygen prescription) AND/OR change > 3% (when known) • CRP ≥ 10 mg/L *If obtained, ABG may show hypoxemia (PaO_2 70-80 mmHg)
Severe	• Dyspnea, RR, HR, SaO_2 and CRP same as moderate • If obtained, ABG may show hypoxemia (PaO_2 ≤ 60 mmHg) and/or hypercapnia and acidosis ($PaCO_2$ > 45 mmHg and pH < 7.35)

↓

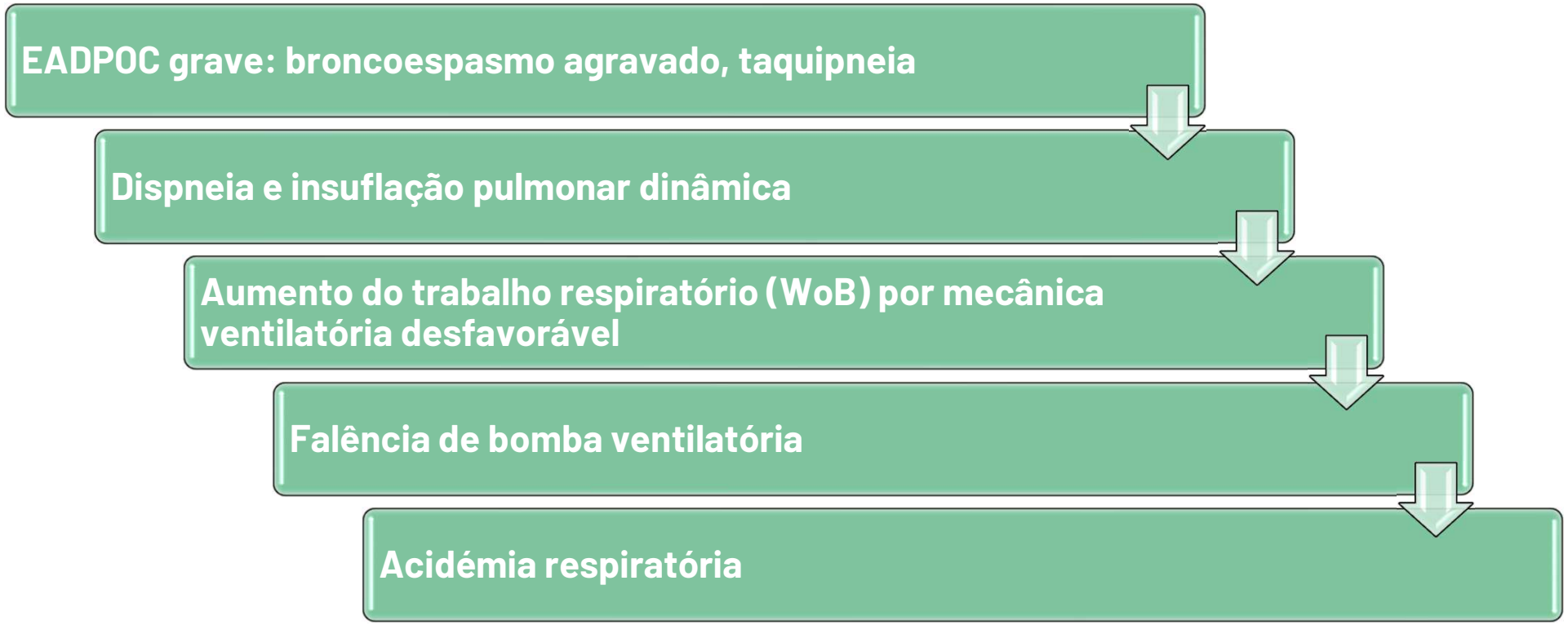
Determine etiology:
viral testing, sputum culture, other

Adapted from: The Rome Proposal, Celli et al. (2021) Am J Respir Crit Care Med. 204(11): 1251-8.

Abbreviations: VAS visual analog dyspnea scale; RR respiratory rate; HR heart rate; SaO_2 oxygen saturation; CRP C-reactive protein; ABG arterial blood gases; PaO_2 arterial pressure of oxygen; $PaCO_2$ arterial pressure of carbon dioxide.

Alterações fisiopatológicas na EADPOC

A lógica por detrás da VNI



Alterações fisiopatológicas na EADPOC

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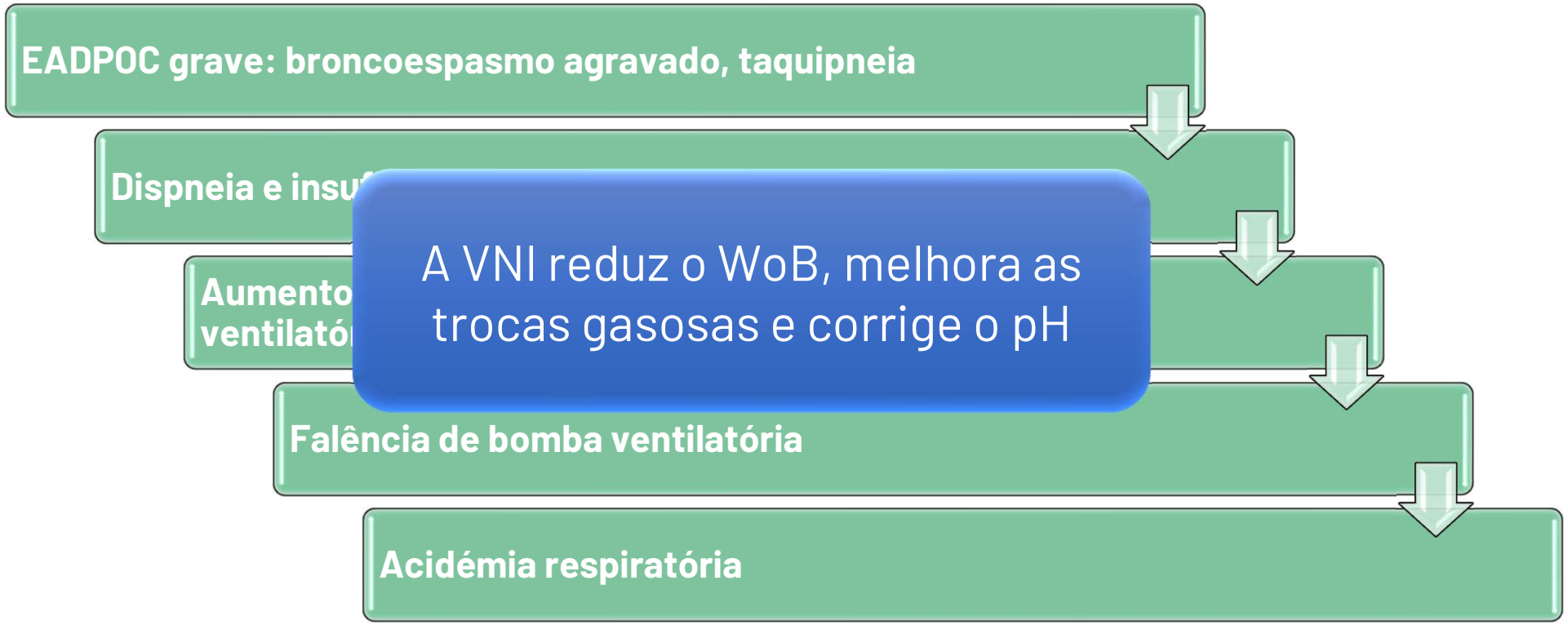


Effects of Noninvasive Ventilation on Pulmonary Gas Exchange and Hemodynamics during Acute Hypercapnic Exacerbations of Chronic Obstructive Pulmonary Disease

ORLANDO DIAZ, RAQUEL IGLESIA, MIQUEL FERRER, ELISABETH ZAVALA, CRISTINA SANTOS, PETER D. WAGNER, JOSEP ROCA, and ROBERT RODRIGUEZ-ROISIN

Servei de Pneumologia i Al.lèrgia Respiratòria and UCI Quirúrgica, Hospital Clinic, Departament de Medicina, Universitat de Barcelona, Barcelona, Spain; and Section of Physiology, University of California–San Diego, La Jolla, California

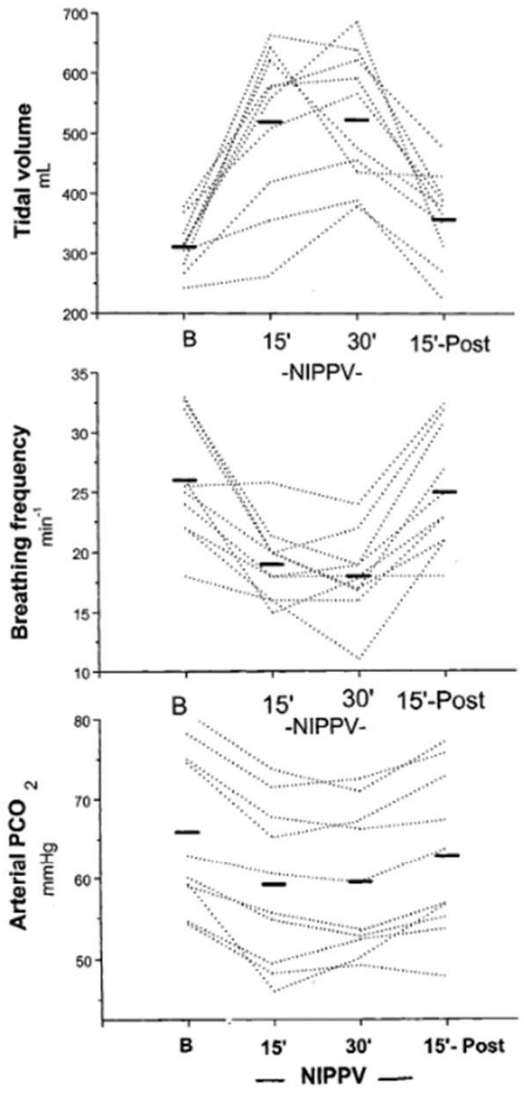
TABLE 1

GENERAL CLINICAL CHARACTERISTICS OF THE PATIENTS AT ADMISSION

Patient No.	Age (*yr*)	FEV_1 (*L*) (*% predicted*)	FEV_1/FVC (%)	Pa_{O_2} (*mm Hg*)	Pa_{CO_2} (*mm Hg*)	pHa	$F_{I_{O_2}}$	PSV (*cm H_2O*)	PEEP (*cm H_2O*)
1	69	0.51 (19)	38	48	89	7.23	0.24	14	0
2	54	0.54 (17)	28	57	75	7.33	0.24	12	4
3	61	0.88 (31)	55	44	59	7.39	0.21	10	5
4	72	2.14 (74)	62	53	73	7.32	0.21	10	4
5	71	1.41 (51)	48	45	66	7.25	0.21	10	3
6	72	0.77 (26)	34	47	54	7.39	0.21	10	3
7	57	1.59 (45)	55	39	66	7.36	0.21	15	0
8	79	0.58 (21)	36	34	60	7.32	0.21	12	3
9	78	0.29 (11)	23	34	93	7.20	0.21	14	4
10	70	0.93 (31)	32	35	76	7.31	0.21	13	3
Mean	68	0.93 (31)	41	44	71	7.31	0.22	12	3
SD	8	0.59 (20)	13	8	13	0.06	0.01	2	2

Definition of abbreviations: pHa = arterial pH; $F_{I_{O_2}}$ = fraction of inspired oxygen; PSV = pressure support ventilation; PEEP = positive end-expiratory pressure.

Spirometric data were measured during stable clinical conditions or during recovery (33). PSV and PEEP levels were measured at baseline.



Am J Respir Crit Care Med. 1997; 156(6): 1840-5. doi: 10.1164/ajrccm.156.6.9701027

A VNI na EADPOC grave é uma intervenção com benefício comprovado

Vários ensaios clínicos desde o início dos anos 1990 demonstram que a VNI é uma intervenção de 1ª linha na EADPOC com IRG aguda

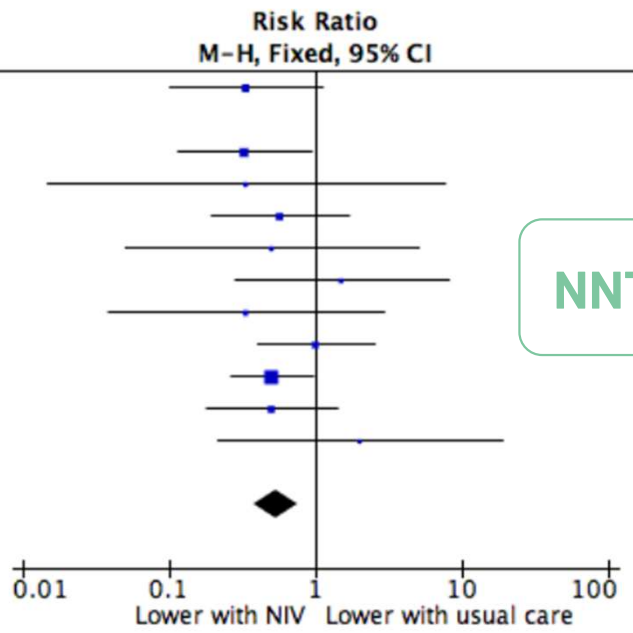
A VNI reduz a mortalidade em 46%

Figure 3. NIV vs usual care (overall) - Mortality

Study or Subgroup	NIV Events	NIV Total	Usual care Events	Usual care Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Avdeev 1998	3	29	9	29	11.5%	0.33 [0.10, 1.11]
Barbe 1996	0	14	0	10		Not estimable
Brochard 1995	4	43	12	42	15.6%	0.33 [0.11, 0.93]
Celikel 1998	0	15	1	15	1.9%	0.33 [0.01, 7.58]
Collaborative 2005	5	100	8	91	10.7%	0.57 [0.19, 1.68]
Dikensoy 2002	1	17	2	17	2.6%	0.50 [0.05, 5.01]
Khilnani 2010	3	20	2	20	2.6%	1.50 [0.28, 8.04]
Liu 2005	1	18	3	18	3.8%	0.33 [0.04, 2.91]
Matuska 2006	7	30	7	30	9.0%	1.00 [0.40, 2.50]
Plant 2001	12	118	24	118	30.8%	0.50 [0.26, 0.95]
Samaria 2009	4	20	8	20	10.3%	0.50 [0.18, 1.40]
Thys 2002	2	10	1	10	1.3%	2.00 [0.21, 18.69]
Total (95% CI)		**434**		**420**	**100.0%**	**0.54 [0.38, 0.76]**
Total events	42		77			

Heterogeneity: $Chi^2 = 6.36$, $df = 10$ ($P = 0.78$); $I^2 = 0\%$

Test for overall effect: $Z = 3.49$ ($P = 0.0005$)



NNT 12

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Osadnik CR, et al. Non-invasive ventilation for the management of acute hypercapnic respiratory failure due to exacerbation of chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2017; 7(7): CD004104. doi: 10.1002/14651858.CD004104.pub4.

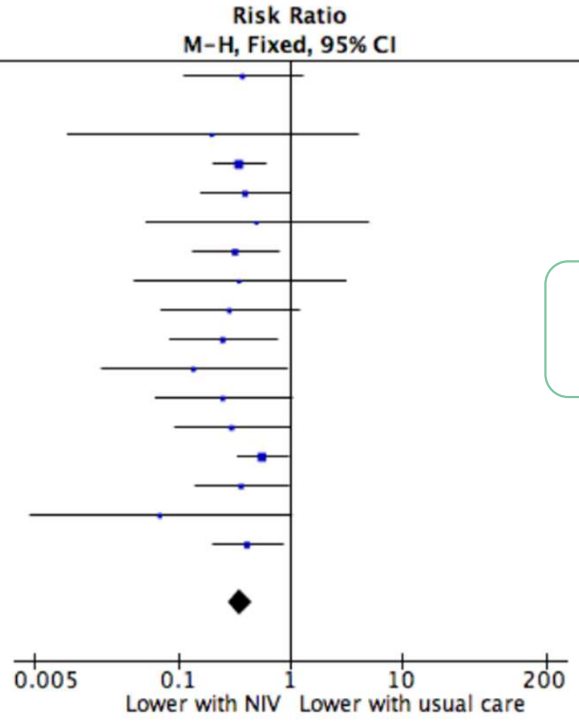
A VNI reduz a necessidade de IOT em 64%

Figure 6. NIV vs usual care (overall) - Need for endotracheal intubation

Study or Subgroup	NIV Events	NIV Total	Usual care Events	Usual care Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Avdeev 1998	3	29	8	29	4.2%	0.38 [0.11, 1.27]
Barbe 1996	0	14	0	10		Not estimable
Bott 1993	0	30	2	30	1.3%	0.20 [0.01, 4.00]
Brochard 1995	11	43	31	42	16.7%	0.35 [0.20, 0.60]
Carrera 2009	5	37	13	38	6.8%	0.40 [0.16, 1.00]
Celikel 1998	1	15	2	15	1.1%	0.50 [0.05, 4.94]
Collaborative 2005	6	100	17	91	9.5%	0.32 [0.13, 0.78]
del Castillo 2003	1	20	3	21	1.6%	0.35 [0.04, 3.09]
Dikensoy 2002	2	17	7	17	3.7%	0.29 [0.07, 1.18]
Khilnani 2010	3	20	12	20	6.4%	0.25 [0.08, 0.75]
Kramer 1995	1	11	8	12	4.1%	0.14 [0.02, 0.92]
Liu 2005	2	18	8	18	4.2%	0.25 [0.06, 1.02]
Matuska 2006	3	30	10	30	5.3%	0.30 [0.09, 0.98]
Plant 2001	18	118	32	118	17.0%	0.56 [0.34, 0.94]
Samaria 2009	4	20	11	20	5.8%	0.36 [0.14, 0.95]
Thys 2002	0	7	5	5	3.3%	0.07 [0.00, 1.01]
Zhou 2001	7	30	17	30	9.0%	0.41 [0.20, 0.85]
Total (95% CI)		**559**		**546**	**100.0%**	**0.36 [0.28, 0.46]**
Total events	67		186			

Heterogeneity: Chi² = 6.68, df = 15 (P = 0.97); I² = 0%

Test for overall effect: Z = 8.22 (P < 0.00001)



NNT 5

Osadnik CR, et al. Non-invasive ventilation for the management of acute hypercapnic respiratory failure due to exacerbation of chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2017; 7(7): CD004104. doi: 10.1002/14651858.CD004104.pub4.

A VNI altera a história natural da EADPOC grave

- Redução da demora média hospitalar
  - Sobretudo nos doentes com acidémia mais grave (pH <7.30)
- Redução das complicações não relacionadas com a VNI
  - Falência multiorgânica
  - Pneumonia associada ao ventilador
- Melhoria do pH e PaO_2 na 1ª hora de suporte ventilatório
- Resultados consistentes em vários cenários
  - Enfermaria *versus* SMI
  - Acidémia menos grave (pH 7.30 – 7.35) *versus* mais grave (pH <7.30)

Osadnik CR, et al. Non-invasive ventilation for the management of acute hypercapnic respiratory failure due to exacerbation of chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2017; 7(7): CD004104. doi: 10.1002/14651858.CD004104.pub4.

A VNI iniciada precocemente na enfermaria de Pneumologia é segura e reduz a mortalidade

O principal determinante do sucesso são equipas treinadas

- 236 doentes com EADPOC com acidémia ligeira a moderada (pH 7.25-7.35) internados em enfermarias de Pneumologia
  - 2 braços (1:1): *standard of care* versus VNI + *standard of care*

Critérios de IOT cumpridos em 27.1% (SOC) *versus* 15.3% (VNI), p=0.02

Mortalidade hospitalar 20.3% (SOC) *versus* 10.2% (VNI), p=0.05

A VNI conduziu a melhoria mais rápida do pH na 1ª hora e maior ↓ da FR às 4h

Plant, P., Owen, J., & Elliott, M. Early use of non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease on general respiratory wards: a multicentre randomised controlled trial. The Lancet 2000; 355: 1931-1935. https://doi.org/10.1016/s0140-6736(00)02323-0.

Estudos de vida real: o impacto da VNI *versus* VMI

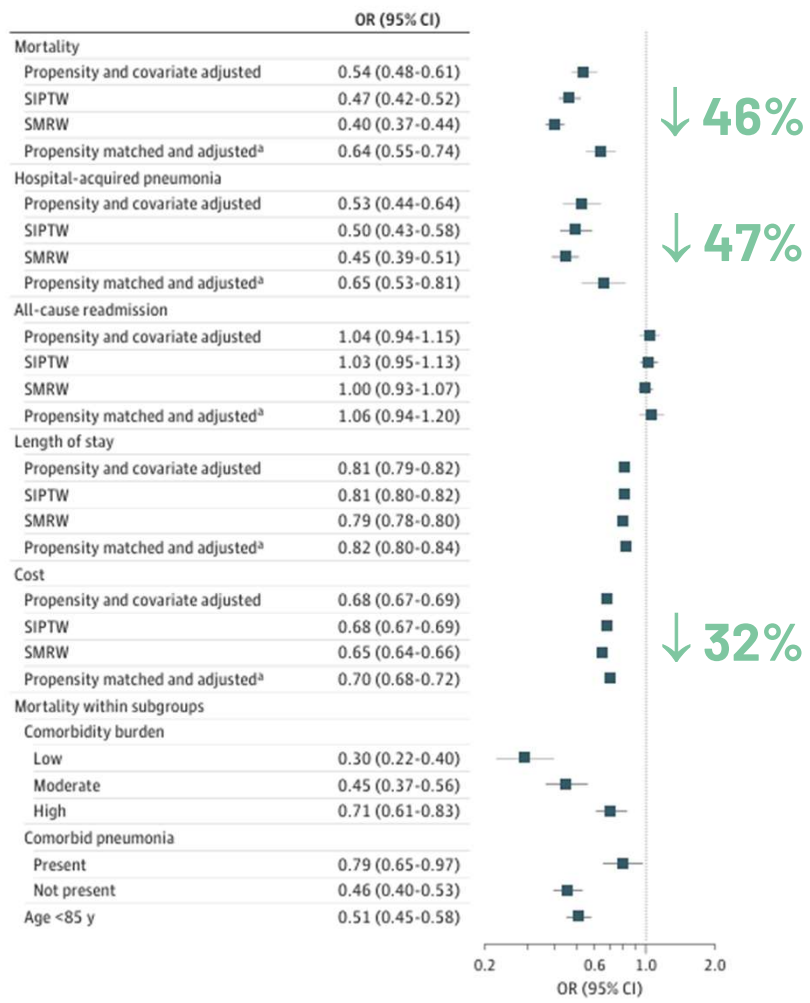
- Estudo de coorte retrospectivo (2008-2011)
- 25 628 admissões por EADPOC com necessidade de suporte ventilatório (primeiras 24-48h) em 420 hospitais dos EUA
- 70%: abordagem inicial VNI

↓1.6 dias de internamento

Risco de readmissão (todas as causas ou EADPOC) aos 30 dias pós-alta semelhante

10,408 (VMI) *versus* 15,677 USD (VNI)

Figure 2. Association Between Noninvasion Ventilation and Outcomes



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Lindenauer, P., Stefan, M., Shieh, M., Pekow, P., Rothberg, M., & Hill, N. Outcomes associated with invasive and noninvasive ventilation among patients hospitalized with exacerbations of chronic obstructive pulmonary disease.. JAMA internal medicine 2014: 174 (12): 1982-93 . https://doi.org/10.1001/jamainternmed.2014.5430.

Guideline Or Statement | ERS/ATS Guidelines Free

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

Bram Rochwerg | Laurent Brochard | Mark W. Elliott Show More

European Respiratory Journal 2017 50(2): 1602426; DOI: https://doi.org/10.1183/13993003.02426-2016

TABLE 2 Recommendations for actionable PICO questions

Clinical indication[#]	Certainty of evidence[¶]	Recommendation
Prevention of hypercapnia in COPD exacerbation	⊕⊕	Conditional recommendation against
Hypercapnia with COPD exacerbation	⊕⊕⊕⊕	Strong recommendation for
Cardiogenic pulmonary oedema	⊕⊕⊕	Strong recommendation for
Acute asthma exacerbation		No recommendation made
Immunocompromised	⊕⊕⊕	Conditional recommendation for
***De novo* respiratory failure**		No recommendation made
Post-operative patients	⊕⊕⊕	Conditional recommendation for
Palliative care	⊕⊕⊕	Conditional recommendation for
Trauma	⊕⊕⊕	Conditional recommendation for
Pandemic viral illness		No recommendation made
Post-extubation in high-risk patients (prophylaxis)	⊕⊕	Conditional recommendation for
Post-extubation respiratory failure	⊕⊕	Conditional recommendation against
Weaning in hypercapnic patients	⊕⊕⊕	Conditional recommendation for

[#]: all in the setting of acute respiratory failure; [¶]: certainty of effect estimates: ⊕⊕⊕⊕, high; ⊕⊕⊕, moderate; ⊕⊕, low; ⊕, very low.

A VNI está indicada na EADPOC grave sem resposta à terapêutica médica e titulação de O_2 optimizadas

TABLE 1] Severity of AECOPD in Hospitalized Patients Classified by Clinical Signs

Severity	Clinical Signs
No respiratory failure	Respiratory rate: ≤ 24 breaths/min; heart rate < 95 beats/min; no use of accessory respiratory muscles; no change in mental status; hypoxemia improved with supplemental oxygen via Venturi mask 24%-35% inspired oxygen (F_{IO_2}); no increase in P_{aCO_2}
Acute respiratory failure—non-life-threatening	Respiratory rate: > 24 breaths/min; using accessory respiratory muscles; no change in mental status; hypoxemia improved with supplemental oxygen via Venturi mask > 35% F_{IO_2}; hypercarbia, ie, P_{aCO_2} increased compared with baseline or elevated 50-60 mm Hg
Acute respiratory failure—life-threatening	Respiratory rate: > 24 breaths/min; using accessory respiratory muscles; acute change in mental status; hypoxemia not improved with supplemental oxygen via Venturi mask or requiring F_{IO_2} > 40%; hypercarbia, ie, P_{aCO_2} increased compared with baseline or elevated > 60 mm Hg or the presence of acidosis (pH ≤ 7.25)

AECOPD = acute exacerbation of COPD.

Candidato ideal: IRG com pH 7.25–7.35, $PaCO_2$ ≥50–60 mmHg, dispneia moderada a grave com tiragem e taquipneia persistentes (>24–30/min)

Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

VNI na EADPOC: Contra-indicações

TABLE 3] Absolute and Relative Contraindications to NIV

Absolute
Need for emergent intubation (eg, cardiac, or respiratory arrest, severe respiratory distress, unstable cardiac arrhythmia)
Relative
Acutely life-threatening nonrespiratory organ failure associated with severe encephalopathy (Glasgow Coma Scale < 10, severe upper GI bleeding, or hemodynamic instability)
Facial or neurological surgery, trauma, or deformity
Significant airway obstruction such as tracheal tumor or laryngeal mass
Inability of the patient to cooperate, protect airway, or clear secretions precipitating a high aspiration risk
Anticipated prolonged need for mechanical ventilation (≥ 4-7 d)
Recent esophageal or gastric anastomosis
Inability to fit the interface or NIV mask appropriately
Insufficient staffing support

NIV = noninvasive ventilation.

Algumas contra-indicações podem ser ultrapassadas com equipas treinadas

Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

VNI na EADPOC: factores preditivos de falência

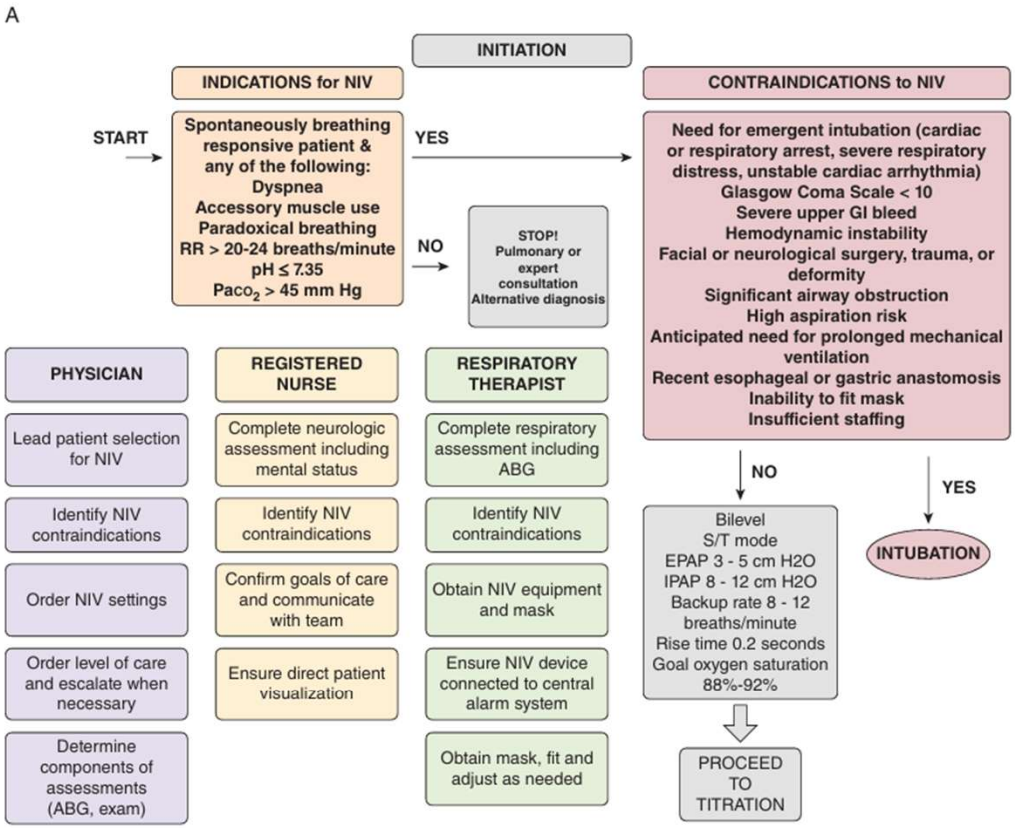
TABLE 2] Predictors of Potential NIV Failure

Inability to protect airway	Hypotension (SBP < 90 mm Hg)
Reduced level of consciousness	Age > 40 y
Asynchronous breathing	Shock of any etiology
Edentulism	Glasgow Coma Scale < 11
Severe agitation	Acute Physiology and Chronic Health Evaluation (APACHE) II score ≥ 29
Profuse secretions	Established acute respiratory distress syndrome
Tachypnea ≥ 30 breaths/min	pH < 7.25 (worsening acidosis on ABG)

ABG = arterial blood gas; NIV = noninvasive ventilation; SBP = systolic BP.

Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

Implementação da VNI: decisões e ajustes iniciais



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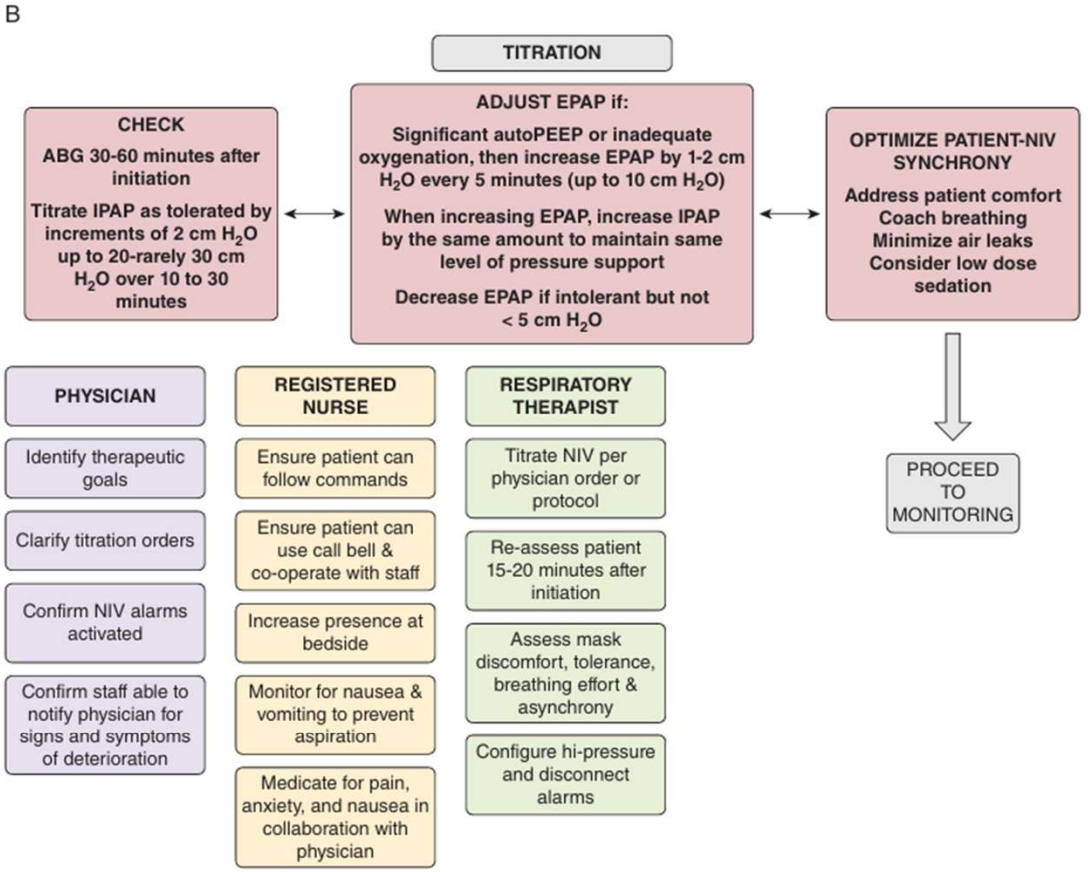
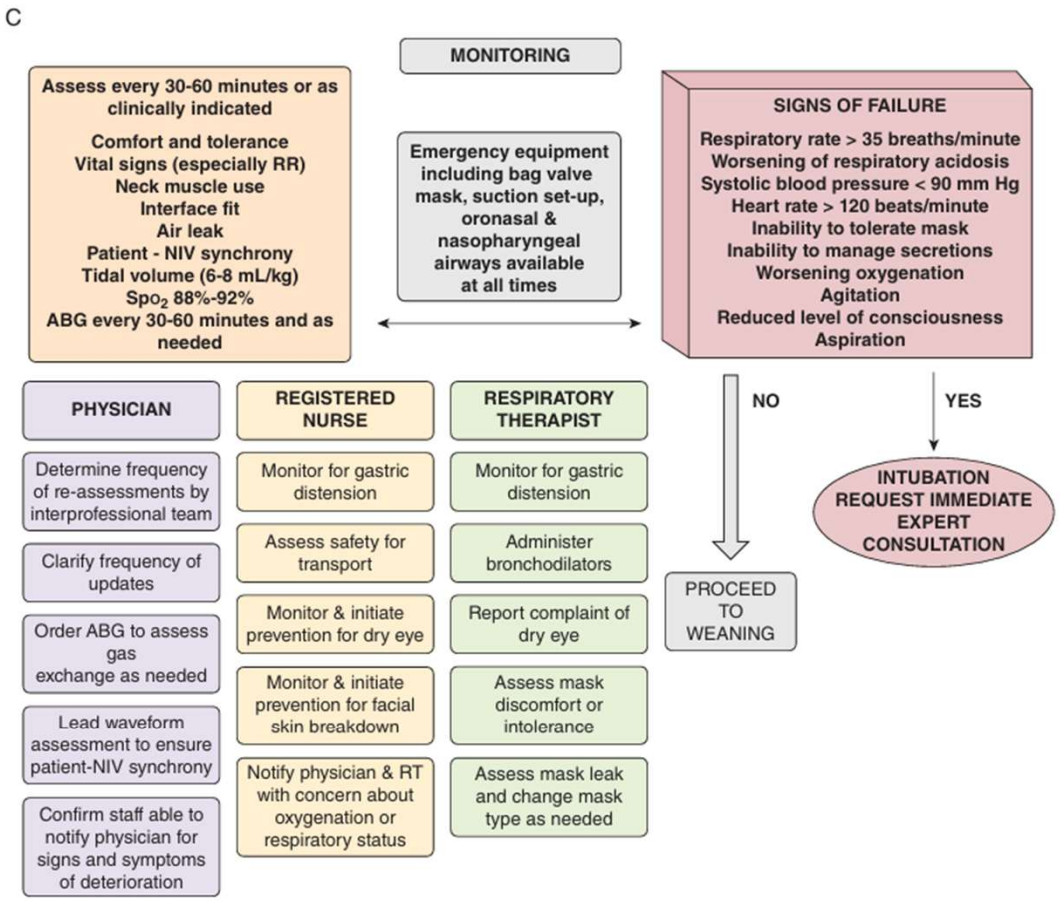
Implementação da VNI: titulação do suporte



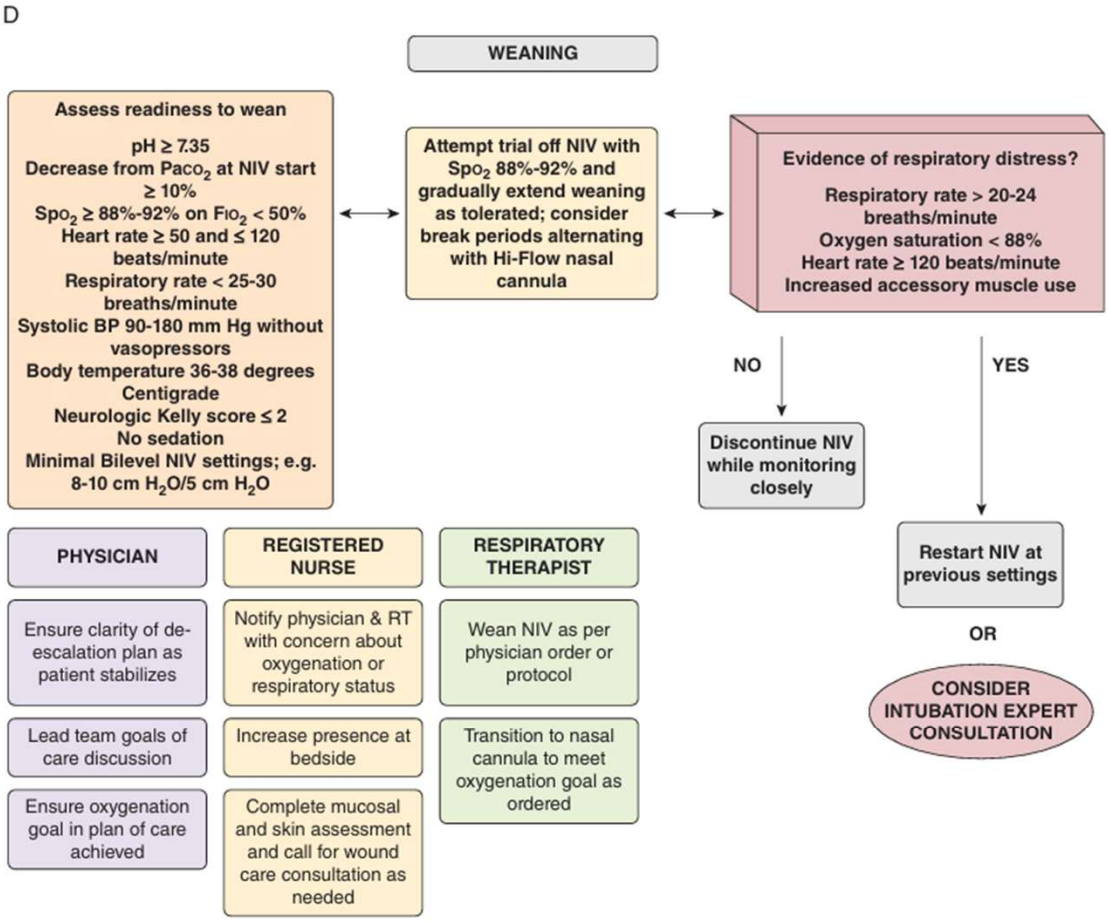
Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

Implementação da VNI: monitorização



Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

Implementação da VNI: desmame



Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

O sucesso da VNI na EADPOC requer uma equipa multidisciplinar coordenada num ambiente calmo

- Médico
- Enfermeiro de cabeceira
- Enfermeiro de reabilitação
- Fisioterapeuta

O doente que não se adapta: aprender a reconhecer as assincronias

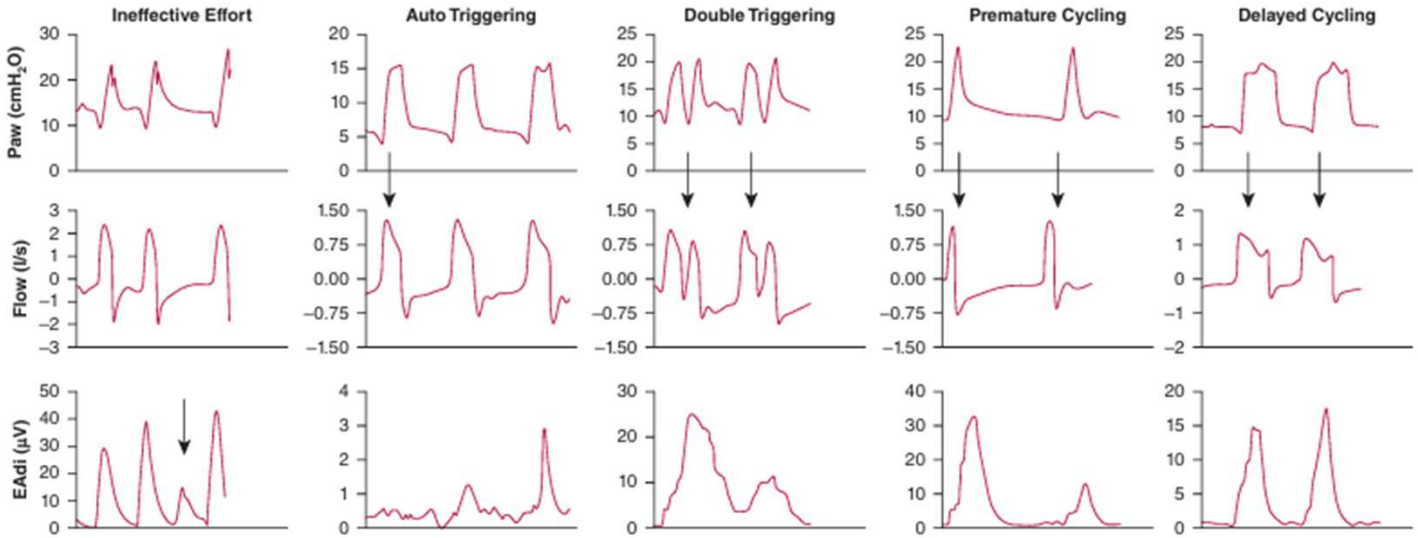


Figure 2 – *Noninvasive ventilation asynchrony. Arrows highlight the asynchronous events. Paw = airway pressure; EAdi = electrical activity of the diaphragm. Reprinted from Longhini et al.*[37] *doi:10.3389/fmed.2022.1119924.*

Longhini F, Bruni A, Garofalo E, Tutino S, Vetrugno L, Navalesi P, De Robertis E and Cammarota G. Monitoring the patient–ventilator asynchrony during non invasive ventilation. *Front. Med* 2023; 9: 1119924. doi: 10.3389/fmed.2022.1119924

O doente que não se adapta: como lidamos com as assincronias?

A desadaptação ventilatória por assincronia é um dos factores determinantes de falência da VNI

TABLE 4] Noninvasive Ventilation Asynchrony

Type of Asynchrony	What Is It?	What Causes It?	How Do You Treat It?
Ineffective triggering	Patient effort fails to trigger a breath	Weak respiratory effort High intrinsic PEEP Inappropriately set trigger sensitivity	Lower trigger sensitivity Check for autoPEEP
Auto triggering	Mechanical insufflation not triggered by any patient inspiratory effort	Wrongly sensed triggering efforts including: Disturbances in airway pressure Disturbances in flow Air leaks	Check sensitivity Check for air leak Check trigger type
Double triggering	Breath stacking = second breath taken before delivery of first breath completed	Most common in low tidal volume ventilation, and high minute ventilation requirements (metabolic acidosis, high dead space)	Increase tidal volume
Reverse triggering	Reflex contraction most often induced by mechanical ventilation	Entrainment of patient's intrinsic respiratory rhythm from the brainstem respiratory centers to periodic mechanical insufflations from NIV	Optimal treatment unknown Reduce sedation Increase or decrease set rate
Premature cycling	Interruption of the ventilator insufflation anticipating patient effort termination	Disproportionately shorter inspiratory time (I-time) of machine in comparison with patient neural I-time	Increase inspiratory time
Delayed cycling	Mechanical assistance is longer than patient effort and extends into patient expiration	Air leaks prevent achievement of expiratory trigger threshold and insufflation cycling-off	Identify source of air leak, ie, interface (mask), loose tubing
Flow asynchrony	Ventilator flow delivery insufficient to meet patient demands	Leaks Inappropriate rise time Inappropriate tidal volume Inappropriate PEEP	Correct air leaks Adjust rise time Increase flow Use NIV machine with leak compensation software Switch mode of ventilation
Auto-PEEP	Positive pressure remains in the alveoli at the end of the exhalation phase of respiratory cycle leading to increased lung volumes, reduced venous return, and potential hemodynamic compromise	Untreated obstructive lung disease Not enough time to exhale	Treat underlying obstruction Increase inspiratory flow Decrease respiratory rate Decrease tidal volume Apply extrinsic PEEP

NIV = noninvasive ventilation; PEEP = positive end-expiratory pressure.

Farmer MJS, Callahan CD, Hughes AM, Riska KL, Hill NS. Applying Noninvasive Ventilation in Treatment of Acute Exacerbation of COPD Using Evidence-Based Interprofessional Clinical Practice. Chest. 2024; 165(6): 1469-1480. doi: 10.1016/j.chest.2024.02.040. Epub 2024 Feb 28

Complicações associadas à VNI

- Úlceras de pressão
- Secura das mucosas
  - Epistáxis, congestão nasal, dor nos seios perinasais
  - Irritação ocular
  - Atelectasias por rolhões de secreções
- Distensão gástrica; aerocolia
- Claustrofobia
- Ansiedade
- *Delirium*
- Barotrauma

Muitas destas complicações podem ser evitadas com equipas treinadas e ventiladores específicos de VNI de última geração

VNI na EADPOC

O doente com grande dependência de suporte ventilatório

- VNI com humidificação
- Rotação de interfaces
- Procinéticos e fármacos para reduzir aerocolia
- RR intensiva nas pausas da VNI
- Alternância entre suportes (HFNO)
- Considerar sonda para alimentação

Pode a oxigenoterapia de alto fluxo (HFNO) ser uma opção na EADPOC com IRG descompensada?

- RCT *open-label* de não-inferioridade
- 225 doentes com EADPOC (1:1), pH 7.25-7.35 e $PaCO_2$ ≥50 mmHg
- Admissão em UCI
- Endpoint primário: falência do tratamento (IOT ou mudança de braço)

Falência de 25.7% (HFNO) versus 14.3% (VNI) (IC 95% 0.25-21.20, p=0.033)

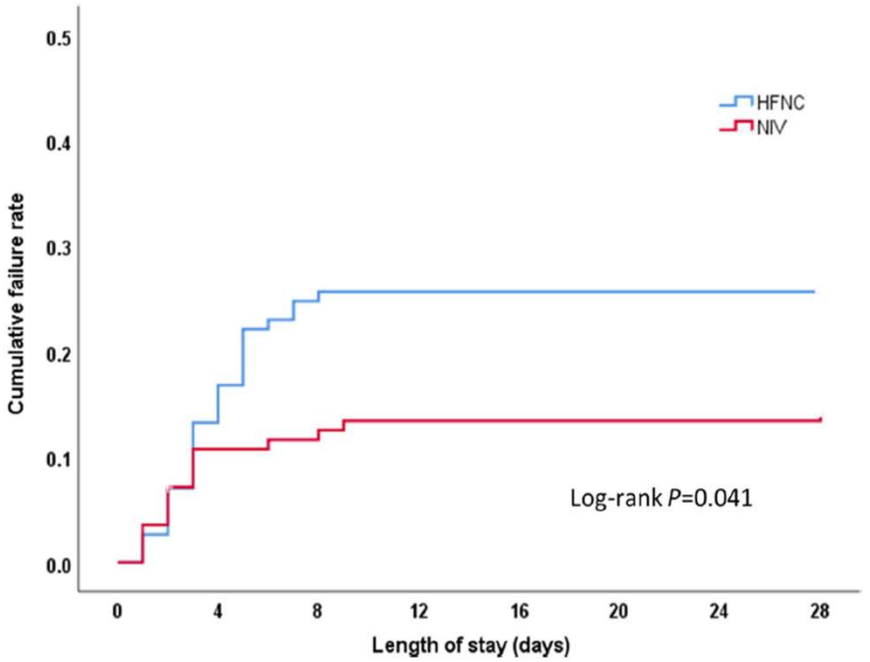


Fig. 2 Kaplan–Meier curve analysis for cumulative failure rate. HFNC: High-flow nasal cannula oxygen therapy; NIV: Non-invasive ventilation

Tan, D et al. High flow nasal cannula oxygen therapy versus non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease with acute-moderate hypercapnic respiratory failure: a randomized controlled non-inferiority trial. Critical Care 2024; 28. https://doi.org/10.1186/s13054-024-05040-9.

Pode a oxigenoterapia de alto fluxo (HFNO) ser uma opção na EADPOC com IRG descompensada?

Table 3 Secondary endpoints in the HFNC and NIV groups

	HFNC (n = 113)	NIV (n = 112)	*p* value
Invasive ventilation	16 (14.2)	6 (5.4)	0.026
Treatment switch	13 (11.5)	10 (8.9)	0.524
Length of stay in ICU, days	7 (6–9)	9 (6–11)	0.059
Length of stay in hospital, days	10 (8–13)	11 (9–13)	0.228
28-day mortality, n (%)	11 (9.7)	8 (7.1)	0.485

HFNC High-flow nasal cannula oxygen therapy; *NIV* Non-invasive ventilation; *ICU* Intensive care unit

Table 5 Other characteristics in the HFNC and NIV groups

	HFNC (n = 113)	NIV (n = 112)	*P* value
Duration of HFNC or NIV (hours)	85.9 ± 30.5	78.7 ± 33.8	0.312
Day 1 (hours)	13.2 ± 4.5	9.9 ± 3.5	< 0.001
Day 2 (hours)	16.3 ± 4.1	12.8 ± 3.9	0.005
Day 3 (hours)	15.9 ± 6.4	14.8 ± 8.6	0.068
Day 4 (hours)	14.9 ± 6.5	13.6 ± 8.5	0.075
Day 5 (hours)	12.8 ± 4.9	11.4 ± 7.9	0.125
Dyspnea score	2 (2–4)	2 (1–3)	0.085
Airway care interventions, per day	5 (3–7)	8 (6–10)	< 0.001
Comfort score	7 (6–8)	6 (5–7)	< 0.001
Treatment intolerance	1 (0.9)	5 (4.5)	0.210
Nasal facial skin breakdown, n (%)	3 (2.7)	10 (8.9)	0.044

HFNC High-flow nasal cannula oxygen therapy; *NIV* Non-invasive ventilation; *ICU* Intensive care unit

Tan, D et al. High flow nasal cannula oxygen therapy versus non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease with acute-moderate hypercapnic respiratory failure: a randomized controlled non-inferiority trial. Critical Care 2024; 28. https://doi.org/10.1186/s13054-024-05040-9.

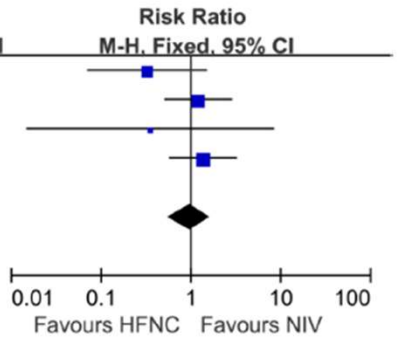
A HFNO é inferior à VNI no doente com EADPOC grave e IRG descompensada

MORTALIDADE POR TODAS AS CAUSAS

A

Study or Subgroup	HFNC Events	HFNC Total	NIV Events	NIV Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Cortegiani 2020	2	40	6	39	26.6%	0.33 [0.07, 1.51]
Maia 2024	8	35	8	42	31.8%	1.20 [0.50, 2.87]
Pantazopoulos 2024	0	51	1	54	6.4%	0.35 [0.01, 8.46]
Tan 2024	11	113	8	112	35.2%	1.36 [0.57, 3.26]
Total (95% CI)		**239**		**247**	**100.0%**	**0.97 [0.56, 1.68]**
Total events	21		23			

Heterogeneity: Chi² = 3.14, df = 3 (P = 0.37); I² = 5%
Test for overall effect: Z = 0.11 (P = 0.91)

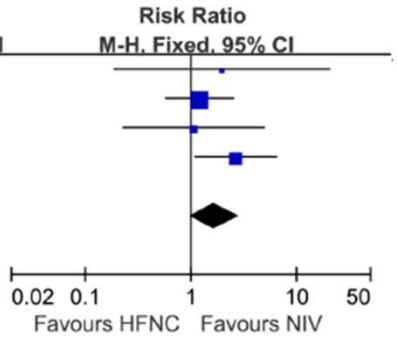


TAXA DE IOT

B

Study or Subgroup	HFNC Events	HFNC Total	NIV Events	NIV Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Cortegiani 2020	2	40	1	39	5.3%	1.95 [0.18, 20.64]
Maia 2024	10	35	10	42	47.7%	1.20 [0.57, 2.55]
Pantazopoulos 2024	3	51	3	54	15.3%	1.06 [0.22, 5.01]
Tan 2024	16	113	6	112	31.6%	2.64 [1.07, 6.51]
Total (95% CI)		**239**		**247**	**100.0%**	**1.67 [0.99, 2.83]**
Total events	31		20			

Heterogeneity: Chi² = 2.09, df = 3 (P = 0.55); I² = 0%
Test for overall effect: Z = 1.93 (P = 0.05)



Qin, J., Wang, G., Liao, Y., Shang, W., & Han, D. High flow nasal therapy versus noninvasive ventilation for AECOPD with acute hypercapnic respiratory failure: a meta-analysis of randomized controlled trials. Annals of Intensive Care 2025; 15. https://doi.org/10.1186/s13613-025-01480-w.

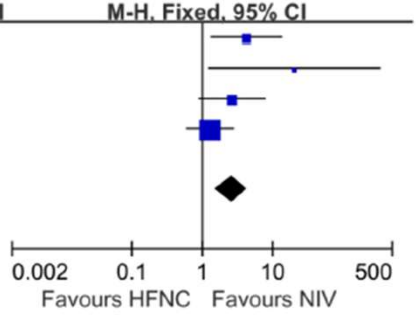
A HFNO é inferior à VNI no doente com EADPOC grave e IRG descompensada

MUDANÇA DE TRATAMENTO

C

Study or Subgroup	HFNC Events	HFNC Total	NIV Events	NIV Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Cortegiani 2020	13	40	3	39	17.4%	4.22 [1.30, 13.69]
Maia 2024	8	35	0	42	2.6%	20.31 [1.21, 339.84]
Pantazopoulos 2024	10	51	4	54	22.3%	2.65 [0.89, 7.91]
Tan 2024	13	113	10	112	57.6%	1.29 [0.59, 2.82]
Total (95% CI)		**239**		**247**	**100.0%**	**2.60 [1.54, 4.38]**
Total events	44		17			

Heterogeneity: Chi² = 5.80, df = 3 (P = 0.12); I² = 48%
Test for overall effect: Z = 3.59 (P = 0.0003)

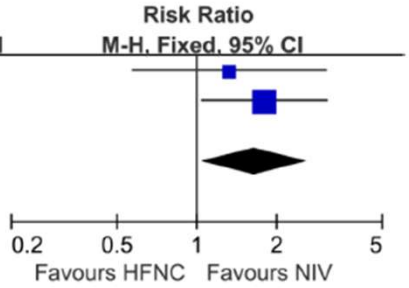


FALÊNCIA DE TRATAMENTO

D

Study or Subgroup	HFNC Events	HFNC Total	NIV Events	NIV Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Pantazopoulos 2024	10	51	8	54	32.6%	1.32 [0.57, 3.09]
Tan 2024	29	113	16	112	67.4%	1.80 [1.03, 3.12]
Total (95% CI)		**164**		**166**	**100.0%**	**1.64 [1.04, 2.60]**
Total events	39		24			

Heterogeneity: Chi² = 0.35, df = 1 (P = 0.55); I² = 0%
Test for overall effect: Z = 2.11 (P = 0.03)



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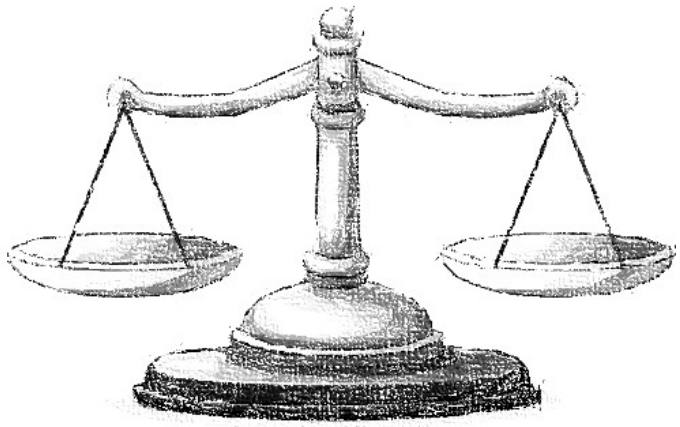
VNI em alternância com HFNO: o melhor de dois mundos



VNI

↓↓↓ WoB
Recrutamento alveolar +++
Correcção mais eficaz da $PaCO_2$ e pH
Aquecimento e humidificação (*equipamentos específicos*)

HFNO

Maior conforto
Facilidade de utilização
Aquecimento e humidificação
Promoção da *clearance* de secreções, prevenção de atelectasias (em conjunto com RR)

Recrutamento alveolar +
↓WoB
↓Espaço morto

Prevenção de úlceras de pressão
Drenagem brônquica mais eficaz
Melhor tolerância

VNI na EADPOC: Mensagens finais

- A VNI nas exacerbações graves de DPOC com acidémia respiratória reduz a mortalidade e a necessidade de IOT *versus* terapêutica *standard of care* optimizada
- É uma intervenção efectiva em vários cenários se aplicada precocemente e de forma apropriada
  - SU, enfermaria e UCI
- O sucesso da VNI implica a selecção do doente adequado, início atempado e monitorização por uma equipa experiente
- As equipas multidisciplinares treinadas garantem uma implementação com elevado nível de qualidade

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