تهویه غیر تهاجمی بعد از جداسازی از دستگاه تهویه مکانیکی

NIV after liberation of) (mechanical ventilation

دکتر علیرضا باقری

فوق تخصص ریه، استادیار دانشگاه علوم پزشکی تهران

The use of NIV immediately following extubation

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Educational Objectives

- To learn about the clinical outcomes that may be improved by the use of non-invasive ventilation post-extubation.
- To become familiar with the population that may benefit from non-invasive ventilation following extubation.
- To understand the contraindications and risks to using non-invasive ventilation post-extubation.

Case Presentation

150/58 HR=99 RR=24 T=37.4

Intubated/sedated

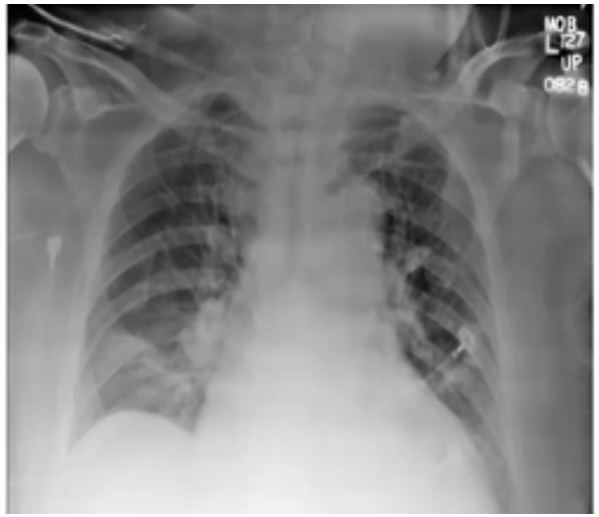
Cardiac rhythm irr. irr.

↓ breath sounds, + edema

Foley, ET tube, NG

PRVC, FiO2=0.4, set rate 12, PEEP=5

Passes SBT



Lab Test	Patient Value	Normal Range
Sodium	150 mmol/L	135-145 mmol/L
Potassium	4.0 mmol/L	3.5-5.0 mmol/L
Carbon dioxide	33 mmol/L	21-35 mmol/L
Creatinine	1.88 mg/dL	<1.13 mg/dL
ALT	518 IU/L	<40 IU/L
AST	284 IU/L	<35 IU/L
BNP	1091 pg/mL	<50 pg/mL
White blood count	6.3 K/uL	3.8-10.6 K/uL
Hemoglobin	12.8 g/dL	13.5-17.0 g/dL
Platelet count	140 K/uL	150-450 K/uL
pH	7.35	
pO_2	74 mm Hg (room air)	
PCO_2	58.2 mm Hg	

سوال ۱: استفاده از NIV بعد از اکستوباسیون لوله تراشه برای این بیمار با کدام عاقبت (outcome) همراه است؟

آ) عواقب و نتایج بالینی مهم با استفاده از **NIV** تغییری نمی کند.

ب) احتمال اینتوباسیون مجدد (re-intubation)کم می شود ولی مرگ و میر کوتاه مدت (short-term mortality) فرقی نمی کند.

پ) طول مدت بستری در آیسیو (ICU length) تغییری نمی کند ولی مرگ و میرکوتاه مدت کمتر می شود.

ت) احتمال اینتوباسیون مجدد کم می شود و مرگ و میر کوتاه مدت هم کمتر می شود.

Liberation From Mechanical Ventilation in Critically Ill Adults

Executive Summary of an Official American College of Chest Physicians/American Thoracic Society Clinical Practice Guideline

Gregory A. Schmidt, MD, FCCP; Timothy D. Girard, MD; John P. Kress, MD, FCCP; Peter E. Morris, MD, FCCP; Daniel R. Ouellette, MD, FCCP; Waleed Alhazzani, MD; Suzanne M. Burns, RN, MSN, ACNP, RRT; Scott K. Epstein, MD, FCCP; Andres Esteban, MD, PhD; Eddy Fan, MD, PhD; Miguel Ferrer, MD, PhD;

- *Question 1: In acutely hospitalized patients ventilated more than 24 h, should the spontaneous breathing trial (SBT) be conducted with or without inspiratory pressure augmentation?*
- *Question 2: In acutely hospitalized patients ventilated for more than 24 h, do protocols attempting to minimize sedation compared with approaches that do not attempt to minimize sedation impact duration of ventilation, duration of ICU stay, and short-term mortality (60 days)?*
- *Question 3: In high-risk patients receiving mechanical ventilation for more than 24 h who have passed an SBT,* ***does extubation to preventive noninvasive ventilation (NIV) compared with no NIV*** *have a favorable effect* ***on duration of ventilation, ventilator- free days, extubation success (liberation > 48 h), duration of ICU stay, short-term mortality (60 days), or long-term mortality****?*

CHEST 2017; 151(1)

- *Question 4: Should acutely hospitalized adults who have been mechanically ventilated for >24 h be subjected to protocolized rehabilitation directed toward early mobilization or no protocolized attempts at early mobilization?*

- *Question 5: Should acutely hospitalized adults who have been mechanically ventilated for > 24 h be managed with a ventilator liberation protocol or no protocol?*

- *Question 6: Should a cuff leak test (CLT) be performed prior to extubation of mechanically ventilated adults? Should systemic steroids be administered to adults who fail a CLT prior to extubation?*

CHEST

Liberation From Mechanical Ventilation in Critically Ill Adults

Executive Summary of an Official American College of Chest Physicians/American Thoracic Society Clinical Practice Guideline

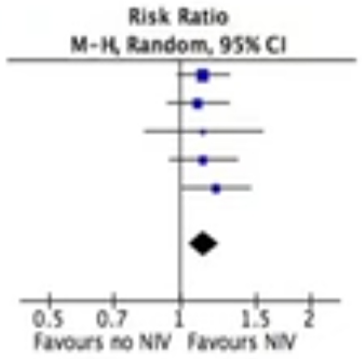
Liberation Guidelines: PICO Question #3

- **Population:**
  - High-risk patients receiving MV > 24 hours who have passed an SBT.
- **Intervention:**
  - Immediate NIV
- **Comparator:**
  - No NIV
- **Outcomes:**
  - Extubation success, ICU LOS, short- and long-term mortality

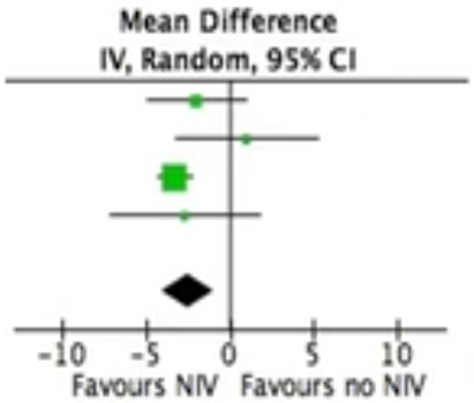
Ouellette et al. CHEST 2017; 151:166-180

عواقب و نتایج بالینی مهم با استفاده از **NIV** تغییری نمی کند.

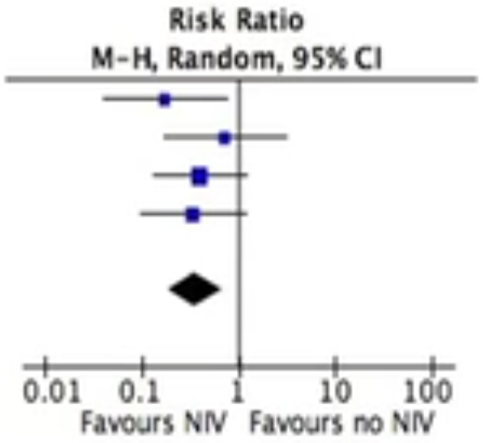
Outcome: Extubation



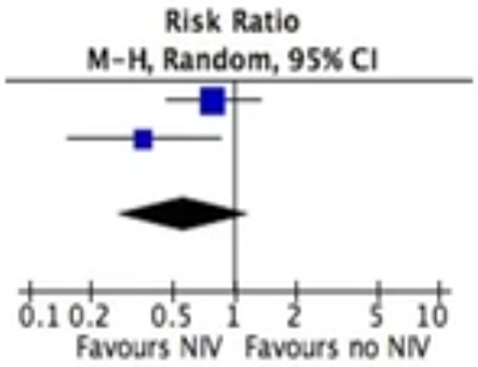
Outcome: ICU LOS



Outcome: Short-term Mortality



Outcome: Long-term Mortality



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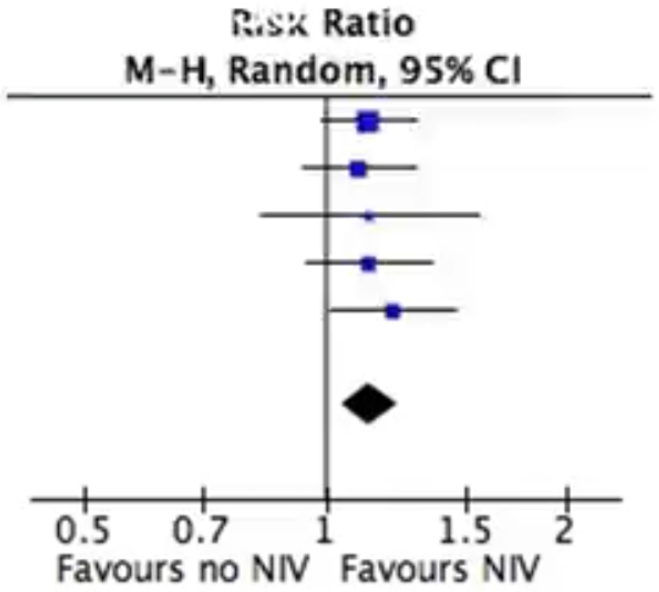
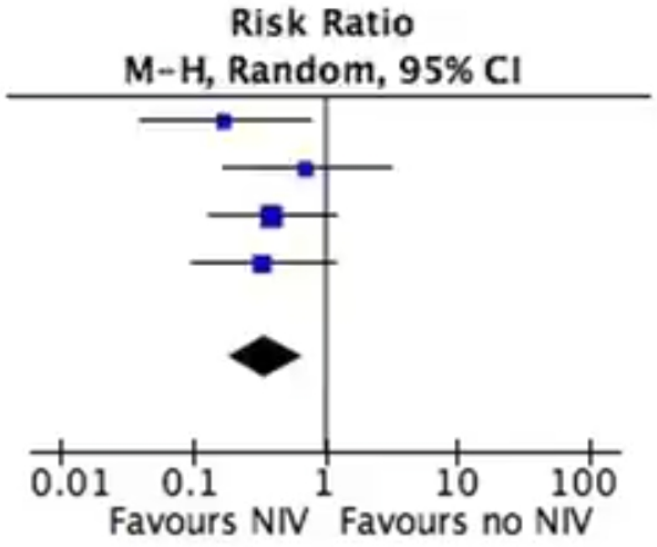
احتمال اینتوباسیون مجدد (re-intubation)کم می شود ولی مرگ و میر کوتاه مدت (short-term mortality) فرقی نمی کند.

Outcome: Extubation

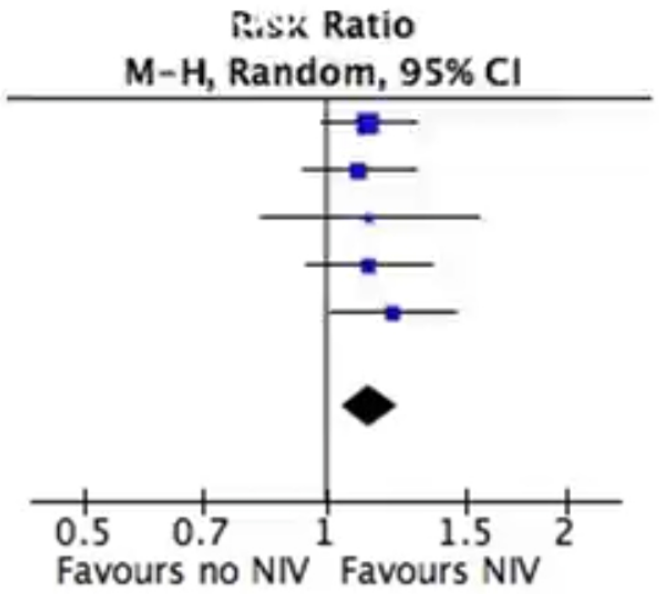


Outcome: Short-term Mortality

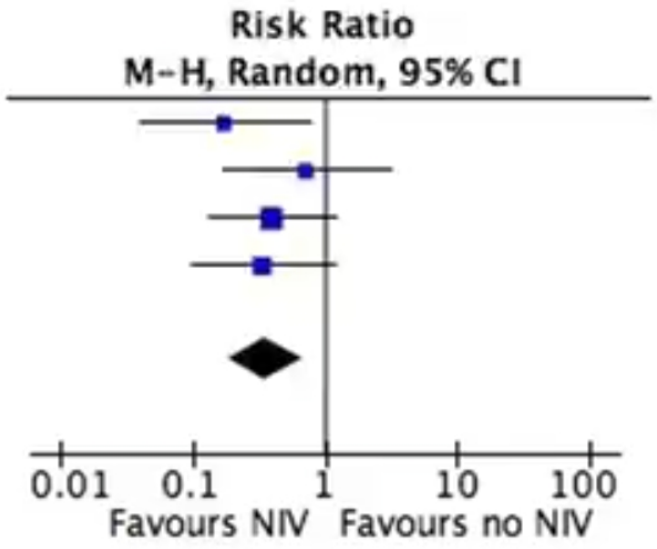


- ✓ احتمال اینتوباسیون مجدد (re-intubation)کم می شود و مرگ و میر کوتاه مدت (short-term mortality) هم کاهش می یابد.

Outcome: Extubation



Outcome: Short-term Mortality



سوال ۲: بهترین گزینه برای استفاده از NIV بعد از اکستوباسیون لوله تراشه کدام یک از موارد زیر است؟

آ) آقای ۷۰ ساله که ۷ روز قبل بدلیل تشدید حاد **COPD** اینتوبه شده، **spont Mode** را تحمل می کند و شرایط رهایی از ونتیلاتور را دارد.

ب) آقای ۳۰ ساله که ۴۸ ساعت قبل بدلیل نارسایی تنفسی حاد ناشی از مسمومیت با مواد مخدر اینتوبه شده است و شرایط رهایی از ونتیلاتور را دارد.

پ) خانم ۸۰ ساله که ۵ روز قبل بدلیل سپسیس و عفونت ادراری اینتوبه شده، فعلا سپسیس کنترل شده، هایپرکاپنه ندارد، **spont Mode** را تحمل می کند و شرایط رهایی از ونتیلاتور را دارد.

ت) خانم ٦۰ ساله که ۵ روز قبل بدلیل سپسیس و **COVID19** اینتوبه شده ، ادم و هایپرکاپنه ندارد و شرایط رهایی از ونتیلاتور را دارد.

following risk factors for respiratory failure after extubation: (*1*) age greater than 65 yr, (*2*) cardiac failure as the cause of intubation, or (*3*) increased severity, assessed by an Acute Physiology and Chronic Health Evaluation (APACHE)-II (16) score exceeding 12 on the day of extubation (1). Patients with tracheotomy were not screened for the study.

Ferrer et al. Am J Respir Crit Care Med 2006

with chronic respiratory disorders, intubated for 48 h or more, who tolerated a spontaneous breathing trial through a T-piece after recovery of their disease, with hypercapnic respiratory failure ($PaCO_2$ >45 mm Hg) on spontaneous breathing, were deemed eligible for the study. We did not

Ferrer et al. Lancet 2009

Other studies: "at risk", mean age 72, "COPD"

- In studies of preventive NIV, there was heterogeneity in defining the high-risk patient. Risk factors included:
  - ❖ *older age*
  - ❖ *comorbidities : COPD or CHF*
  - ❖ *hypercapnia during the SBT*

Studies heterogeneous for at risk population: Consider chronic respiratory acidosis, COPD, "CHF", severity of illness

سوال ۲: بهترین گزینه برای استفاده از NIV بعد از اکستوباسیون لوله تراشه کدام یک از موارد زیر است؟

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سوال ۳: کدام یک از گزینه های زیر در مورد خطرات و موارد منع استفاده از NIV بعد از اکستوباسیون لوله تراشه صحیح است؟

آ) در اسیدوز تنفسی استفاده از **NIV** منع شده است . (contraindication)

ب) در بیمارانی که همراهی و تحمل استفاده از **NIV** را ندارند (uncooperative)، با افزایش آرام بخشی (sedation) ممکن است درمان با **NIV** ادامه یابد .

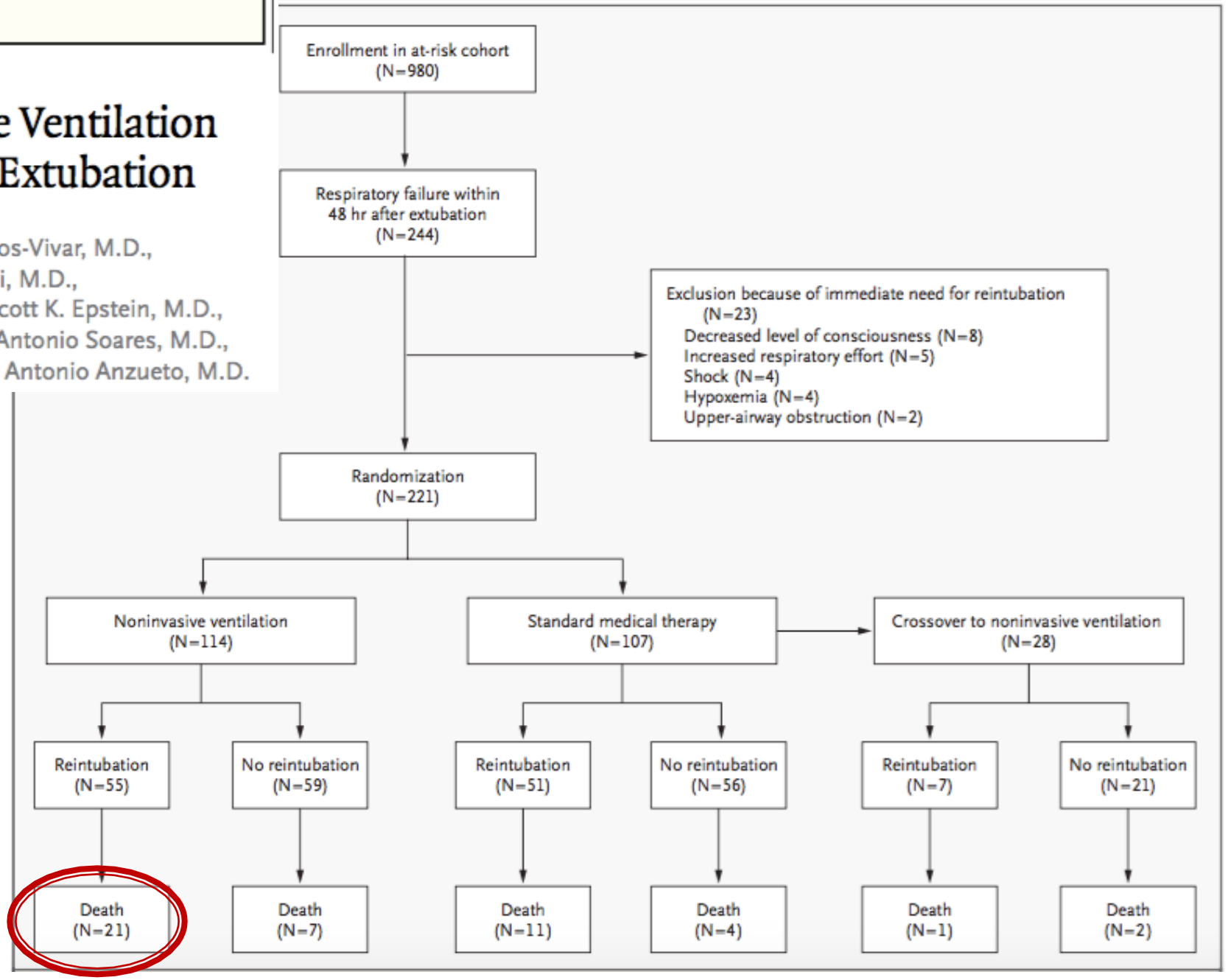
پ) در بیماران با شکستگی صورت، استفاده از **NIV** بعد از اکستوباسیون لوله تراشه با کمک ماسک های با مواد سیلیکون نرم قابل انجام است .

ت) تاخیر در استفاده از **NIV** بعد از اکستوباسیون لوله تراشه (شروع **NIV** از زمانیکه بیمار دیسترس تنفسی پیدا کند) به نسبت مراقبت های استاندارد (اکسیژن کمکی و ..) عواقب و نتایج بدتری خواهد داشت

ORIGINAL ARTICLE

Noninvasive Positive-Pressure Ventilation for Respiratory Failure after Extubation

Andrés Esteban, M.D., Ph.D., Fernando Frutos-Vivar, M.D., Niall D. Ferguson, M.D., Yaseen Arabi, M.D., Carlos Apezteguía, M.D., Marco González, M.D., Scott K. Epstein, M.D., Nicholas S. Hill, M.D., Stefano Nava, M.D., Marco-Antonio Soares, M.D., Gabriel D'Empaire, M.D., Inmaculada Alía, M.D., and Antonio Anzueto, M.D.



N Engl J Med 2004;350:2452-60

چرا NIV در این مطالعه موثر نبود؟

1) *experience of the health care team using the technique..*
2) *timing of the initiation of NIV..*
3) *study population ..*

Table 4. Reasons for Reintubation, as Defined in the Protocol Guidelines, According to Study Group.

Reason	Non-invasive Ventilation (N=55)	Standard Medical Therapy (N=51)	P Value
	no. (%)		
Lack of improvement in signs of muscle fatigue	25 (45)	23 (45)	0.97
Hypoxemia	9 (16)	15 (29)	0.11
Copious secretions	5 (9)	6 (12)	0.65
Lack of improvement in pH or partial pressure of carbon dioxide	8 (15)	3 (6)	0.13
Changes in mental status	4 (7)	2 (4)	0.45
Hypotension	4 (7)	2 (4)	0.45

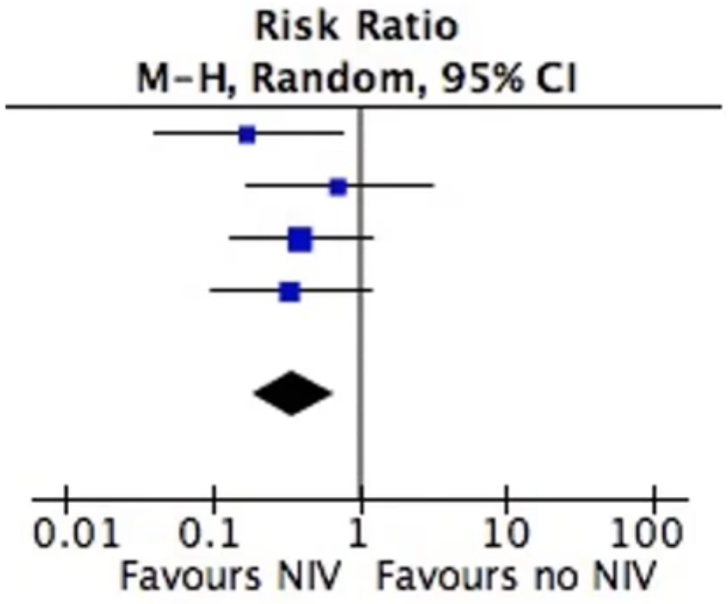
Table 1. Baseline Characteristics of the Patients, According to Study Group.*

Characteristic	Non-invasive Ventilation (N=114)	Standard Medical Therapy (N=107)	P Value
Age — yr	61±17	58±19	0.25
Female sex — no. (%)	47 (41)	47 (44)	0.68
Simplified Acute Physiology Score II on admission†	37±13	36±10	0.77
Reason for initiation of mechanical ventilation			0.65
Acute respiratory failure — no. (%)			
Pneumonia	28 (25)	20 (19)	
Postoperative respiratory failure	20 (18)	23 (21)	
Sepsis	13 (11)	11 (10)	
Trauma	11 (10)	7 (7)	
Cardiac failure	8 (7)	12 (11)	
Acute respiratory distress syndrome	4 (4)	8 (7)	
Other	12 (11)	10 (9)	
Acute-on-chronic respiratory failure — no. (%)			
Chronic obstructive pulmonary disease	14 (12)	9 (8)	
Asthma	1 (1)	3 (3)	
Neuromuscular disease — no. (%)	3 (3)	4 (4)	

N Engl J Med 2004;350:2452-60

استفاده فوری از NIV در برابر استفاده تاخیری از NIV:

Imm. NIV; 4 studies



Outcome: Short-term Mortality

Delayed; Esteban et al

- Mortality 25% in NIV versus 14% in standard therapy

موارد منع استفاده از تهویه غیر تهاجمی

- **منع مطلق:**
  - ✓**ایست تنفسی**
  - ✓**عدم امکان چفت کردن ماسک**

- **منع نسبی:**
  - ناپایداری بالینی:
    - شوک
    - ایسکمی قلبی یا آریتمی کنترل نشده
    - ترشحات تنفسی زیاد
    - خونریزی گوارشی فوقانی کنترل نشده
  - عدم همکاری بیمار، بیقراری
  - عدم امکان حفاظت از راه هوایی
  - اختلال بلع
  - نارسایی چند ارگان (دو یا بیشتر..)
  - جراحی اخیر راه هوایی یا گوارشی فوقانی

Lancet 2009

سوال ۳: کدام یک از گزینه های زیر در مورد خطرات و موارد منع استفاده از NIV بعد از اکستوباسیون لوله تراشه صحیح است؟

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Liberation Guidelines: PICO Question #3

- **Population:**
  - High-risk patients receiving MV > 24 hours who have passed an SBT.
- **Intervention:**
  - Immediate NIV
- **Comparator:**
  - No NIV
- **Outcomes:**
  - Extubation success, ICU LOS, short- and long-term mortality

Ouellette et al. CHEST 2017; 151:166-180

CHEST/ATS Recommendation

3. For patients at high risk for extubation failure who have been receiving mechanical ventilation for more than 24 h and who have passed an SBT, we recommend extubation to preventive NIV (Strong Recommendation, Moderate Quality Evidence).

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LE 2] Summary of Recommendations

Recommendation	Strength of Recommendation	Certainty of Evidence (ie, Quality of Evidence)
1. For acutely hospitalized patients ventilated more than 24 h, we suggest that the initial SBT be conducted with inspiratory pressure augmentation (5-8 cm H_2O) rather than without (T-piece or CPAP)	Conditional	Moderate certainty in the evidence
2. For acutely hospitalized patients ventilated for more than 24 h, we suggest protocols attempting to minimize sedation	Conditional	Low certainty in the evidence
3. For patients at high risk for extubation failure who have been receiving mechanical ventilation for more than 24 h and who have passed am SBT, we recommend extubation to preventive NIV	Strong	Moderate certainty in the evidence
4. For acutely hospitalized patients who have been mechanically ventilated for > 24 h, we suggest protocolized rehabilitation directed toward early mobilization	Conditional	Low certainty in the evidence
5. We suggest managing acutely hospitalized patients who have been mechanically ventilated for > 24 h with a ventilator liberation protocol	Conditional	Low certainty in the evidence
6a. We suggest performing a CLT in mechanically ventilated adults who meet extubation criteria and are deemed at high risk for PES	Conditional	Very low certainty in the evidence
6b. For adults who have failed a CLT but are otherwise ready for extubation, we suggest administering systemic steroids at least 4 h before extubation; a repeated CLT is not required	Conditional	Moderate certainty in the evidence

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)

Question 10: Should NIV be used in ARF following extubation from invasive mechanical ventilation?

- treating post-extubation respiratory failure ?

OR

- preventing respiratory failure from developing at all ?

Eur Respir J 2017; 50

Question 10a: Should NIV be used to prevent respiratory failure post-extubation?

The benefits of early application of NIV soon after extubation have been assessed in unselected patients (*i.e.* any patients after planned extubation) and in at-risk patients. For most included studies, at-risk included patients >65 years or those with underlying cardiac or respiratory disease.

Recommendations

We suggest that NIV be used to prevent post-extubation respiratory failure in high-risk patients post-extubation. (Conditional recommendation, low certainty of evidence.)

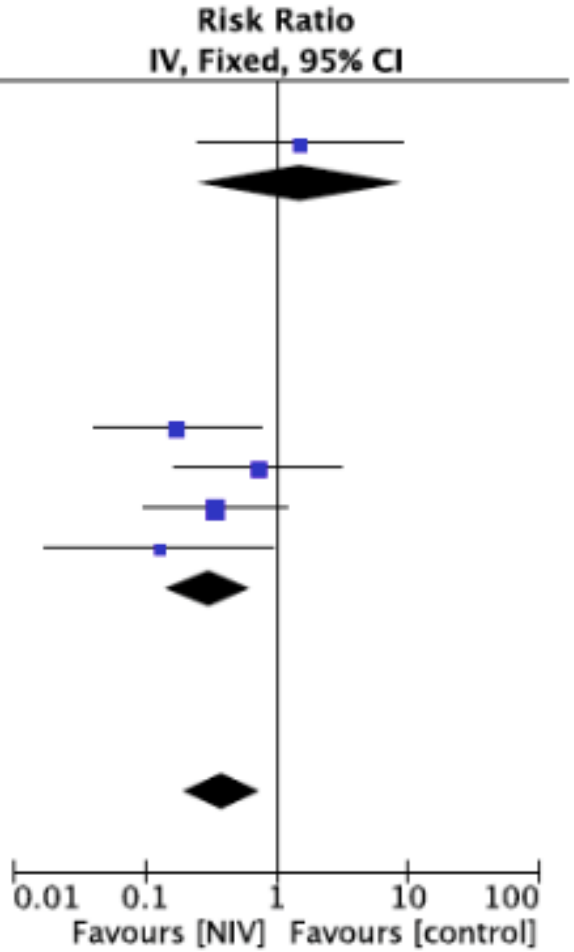
We suggest that NIV should not be used to prevent post-extubation respiratory failure in non-high-risk patients. (Conditional recommendation, very low certainty of evidence.)

some inconsistencies regarding the criteria for considering patients at high risk of extubation failure. Recent work reports that patients >65 years and with underlying cardiac or respiratory disease are at high risk for extubation failure with a re-intubation rate >30% if both comorbidities are present and >20% if one of the two is present [122]. Early NIV after planned extubation decreases both intubation rate and mortality in patients at high risk of extubation failure. Patients with an unplanned extubation are a higher risk group and further studies should specifically address the use of NIV in this group.

Question #10a: Should NIV be used in the prevention of respiratory failure post extubation?

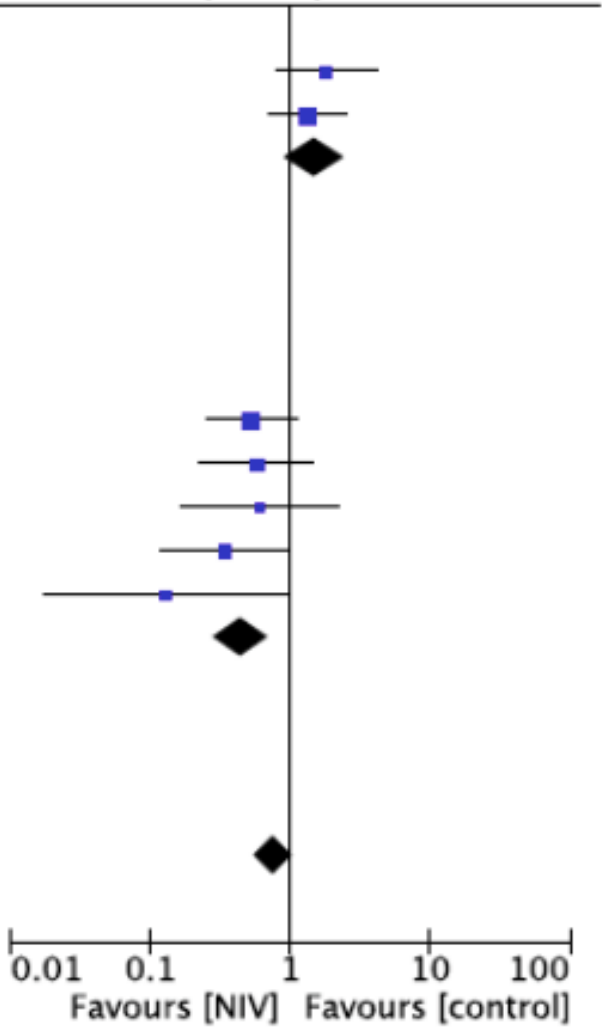
Mortality

Study or Subgroup	NIV Events	NIV Total	Control Events	Control Total	Weight	Risk Ratio IV, Fixed, 95% CI
1.2.1 Unselected Patients						
Su 2012	3	202	2	204	14.7%	1.51 [0.26, 8.97]
Subtotal (95% CI)		**202**		**204**	**14.7%**	**1.51 [0.26, 8.97]**
Total events	3		2			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.46 (P = 0.65)						
1.2.2 At Risk Patients						
Ferrer 2006	2	79	12	83	21.6%	0.18 [0.04, 0.76]
Ferrer 2009	3	54	4	52	22.1%	0.72 [0.17, 3.07]
Nava 2005	3	48	9	49	29.9%	0.34 [0.10, 1.18]
Ornico 2013	1	20	7	18	11.6%	0.13 [0.02, 0.95]
Subtotal (95% CI)		**201**		**202**	**85.3%**	**0.31 [0.15, 0.64]**
Total events	9		32			
Heterogeneity: $Chi^2 = 2.66$, df = 3 (P = 0.45); $I^2 = 0\%$						
Test for overall effect: Z = 3.15 (P = 0.002)						
Total (95% CI)		**403**		**406**	**100.0%**	**0.39 [0.20, 0.76]**
Total events	12		34			
Heterogeneity: $Chi^2 = 5.31$, df = 4 (P = 0.26); $I^2 = 25\%$						
Test for overall effect: Z = 2.73 (P = 0.006)						
Test for subgroup differences: $Chi^2 = 2.65$, df = 1 (P = 0.10), $I^2 = 62.3\%$						



Re-Intubation

Study or Subgroup	NIV Events	NIV Total	Control Events	Control Total	Weight	Risk Ratio M-H, Fixed, 95% CI
1.1.1 Unselected Patients						
Jiang 1999	13	47	7	46	9.4%	1.82 [0.80, 4.14]
Su 2012	21	202	16	204	21.2%	1.33 [0.71, 2.47]
Subtotal (95% CI)		**249**		**250**	**30.7%**	**1.48 [0.90, 2.42]**
Total events	34		23			
Heterogeneity: $Chi^2 = 0.36$, df = 1 (P = 0.55); $I^2 = 0\%$						
Test for overall effect: Z = 1.54 (P = 0.12)						
1.1.2 At Risk Patients						
Ferrer 2006	9	79	18	83	23.4%	0.53 [0.25, 1.10]
Ferrer 2009	6	54	10	52	13.6%	0.58 [0.23, 1.48]
Kihlnani 2011	3	20	5	20	6.7%	0.60 [0.17, 2.18]
Nava 2005	4	48	12	49	15.8%	0.34 [0.12, 0.98]
Ornico 2013	1	20	7	18	9.8%	0.13 [0.02, 0.95]
Subtotal (95% CI)		**221**		**222**	**69.3%**	**0.44 [0.28, 0.70]**
Total events	23		52			
Heterogeneity: $Chi^2 = 2.43$, df = 4 (P = 0.66); $I^2 = 0\%$						
Test for overall effect: Z = 3.50 (P = 0.0005)						
Total (95% CI)		**470**		**472**	**100.0%**	**0.76 [0.55, 1.05]**
Total events	57		75			
Heterogeneity: $Chi^2 = 14.06$, df = 6 (P = 0.03); $I^2 = 57\%$						
Test for overall effect: Z = 1.67 (P = 0.09)						
Test for subgroup differences: $Chi^2 = 12.29$, df = 1 (P = 0.0005), $I^2 = 91.9\%$						



Question 10b: Should NIV be used in the treatment of respiratory failure that develops post-extubation?

Following the positive findings of case series and case–control studies, two RCTs compared NIV with conventional treatment (oxygen therapy) in patients who developed respiratory failure after planned extubation [123, 124].

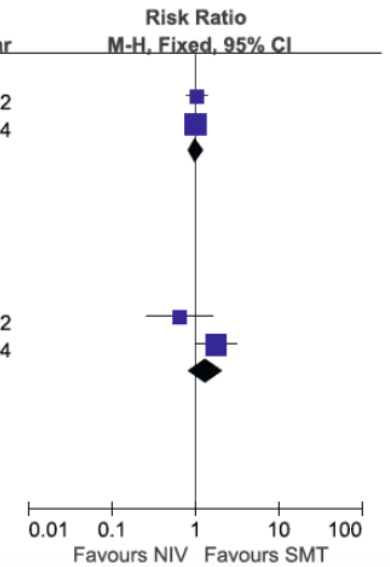
Recommendation

We suggest that NIV should not be used in the treatment of patients with established post-extubation respiratory failure. (Conditional recommendation, low certainty of evidence.)

Question #10b: Should NIV be used in the treatment of respiratory failure post extubation?

Mortality & Re-intubation

Study or Subgroup	NIV group Events	Total	SMT group Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI	Year
1.1.1 reintubation							
Keenan 2002	28	39	29	42	34.7%	1.04 [0.78, 1.38]	2002
Esteban 2004	55	114	51	107	65.3%	1.01 [0.77, 1.33]	2004
Subtotal (95% CI)		**153**		**149**	**100.0%**	**1.02 [0.83, 1.25]**	
Total events	83		80				
Heterogeneity: Chi² = 0.02, df = 1 (P = 0.89); I² = 0%							
Test for overall effect: Z = 0.21 (P = 0.84)							
1.1.2 ICU mortality							
Keenan 2002	6	39	10	42	38.4%	0.65 [0.26, 1.61]	2002
Esteban 2004	28	114	15	107	61.6%	1.75 [0.99, 3.09]	2004
Subtotal (95% CI)		**153**		**149**	**100.0%**	**1.33 [0.83, 2.13]**	
Total events	34		25				
Heterogeneity: Chi² = 3.30, df = 1 (P = 0.07); I² = 70%							
Test for overall effect: Z = 1.18 (P = 0.24)							



Eur Respir J 2017; 50

- NIV s a strategy to allow earlier extubation in selected patients : acute-on-chronic respiratory failure (hypercapnic RF or AECOPD).
- But with considerations :

Table 4. Subjects Deemed at Risk for Extubation Failure in the Studies by Nava et al[21] and Ferrer et al[22]

Nava	Ferrer
Hypercapnia	Age > 65 y
Congestive heart failure	Cardiac failure as the cause of intubation
Ineffective cough	Increased severity, assessed by an APACHE-II score > 12 on the day of extubation
Excessive tracheobronchial secretions	
More than 1 failed SBT	
More than 1 comorbid condition	
Upper-airway obstruction	

The Role of Noninvasive Ventilation in the Ventilator Discontinuation Process

Dean R Hess PhD RRT FAARC

- The criteria to initiate an SBT must be satisfied.
- The upper airway should be patent.
- The patient should be able to clear secretions (with or without assistance).
- The patient should be a good candidate for NIV; able to tolerate the interface.
- The patient should be able to breathe spontaneously long enough to allow mask and ventilator adjustments.
- *Extubation to NIV is discouraged if the patient would be technically difficult to reintubate.*

Respir Care 2012;57(10)

Noninvasive ventilation for prevention of post-extubation respiratory failure in obese patients

2006
NY, US

A.A. El Solh*, A. Aquilina*, L. Pineda*, V. Dhanvantri*, B. Grant*,# and P. Bouquin*

- 62 (***BMI > 35***) , after SBT:
  1) BiPAP (initial I: 12 E:4 titrated to RR < 25 & SpO2> 90%)
  2) O2 + physiotherapy ..

- Respiratory failure: > 1h ..
  - pH < 7.35 & ↑ PCO2 > 20%
  - SpO2 < 90%
  - ↓ consciousness
  - respiratory muscle fatigue
  - Sever deliriun, agitation
  - Secretion not cleared

	NIV	Conventional therapy	p-value
Subjects n	62	62	
Respiratory failure	6 (10)	16 (26)	0.03
Reintubation	6 (10)	13 (21)	0.14
Causes of respiratory failure			
Hypoxia	2 (3)	3 (5)	
Hypercapnia	2 (3)	9 (15)	
Respiratory muscle fatigue	1 (2)	2 (3)	
Haemodynamic instability	0	1 (2)	
Inability to clear secretions	0	1 (2)	
Delirium	1 (2)	0	
Hospital-acquired pneumonia	3 (5)	9 (15)	0.13
Bloodstream infection	2 (3)	5 (8)	0.44
ICU stay days	11.8±7.9	18.2±11.2	<0.001
Hospital stay days	20.6±10.6	26.0±11.3	0.007
Hospital mortality	8 (13)	15 (24)	0.17

Eur Respir J 2006; 28

Effect of Postextubation High-Flow Nasal Oxygen With Noninvasive Ventilation vs High-Flow Nasal Oxygen Alone on Reintubation Among Patients at High Risk of Extubation Failure

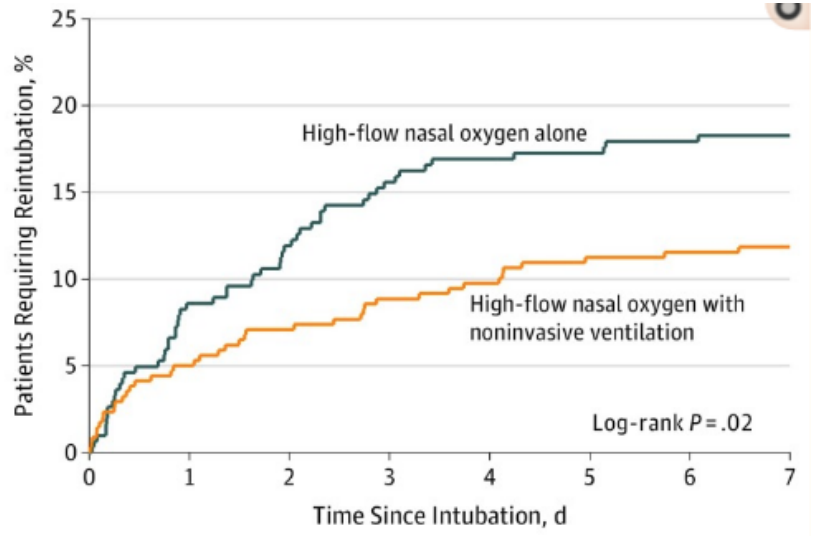
A Randomized Clinical Trial

Arnaud W. Thille, MD, PhD,[1,2] Grégoire Muller, MD,[3] Arnaud Gacouin, MD,[4] Rémi Coudroy, MD,[1,2] Maxens Decavèle, MD,[5] Romain Sonneville, MD, PhD,[6] François Beloncle, MD,[7] Christophe Girault, MD,[8] Laurence Dangers, MD,[9] Alexandre Lautrette, MD, PhD,[10] Séverin Cabasson, MD,[11] Anahita Rouzé, MD,[12] Emmanuel Vivier, MD,[13] Anthony Le Meur, MD,[14] Jean-Damien Ricard, MD, PhD,[15] Keyvan Razazi, MD,[16] Guillaume Barberet, MD,[17] Christine Lebert, MD,[18] Stephan Ehrmann, MD, PhD,[19] Caroline Sabatier, MD,[20] Jeremy Bourenne, MD,[21] Gael Pradel, MD,[22] Pierre Bailly, MD,[23] Nicolas Terzi, MD, PhD,[24] Jean Dellamonica, MD, PhD,[25] Guillaume Lacave, MD,[26] Pierre-Éric Danin, MD,[27] Hodanou Nanadoumgar, MD,[28] Aude Gibelin, MD,[29] Lassane Zanre, MD,[30] Nicolas Deye, MD, PhD,[31] Alexandre Demoule, MD, PhD,[5] Adel Maamar, MD,[4] Mai-Anh Nay, MD,[3] René Robert, MD, PhD,[1,2] Stéphanie Ragot, PharmD, PhD,[2] and Jean-Pierre Frat, MD[1,2], for the HIGH-WEAN Study Group and the REVA Research Network

2019
France

- 641(out of 3121) high risk reintubation (> 65 y, chronic heart or lung)
  1) HFNO: flow> 50 l/m, SpO2> 92%, > 2d
  2) Immediately PSV:5 + PEEP: 5-10, >12h/d

AND HFNO in intervals



No. at risk

High-flow nasal oxygen Alone	302	276	265	253	248	246	244	243
With noninvasive ventilation	339	321	314	308	305	294	292	291

	HFNO	*NIV +HFNO*		
Primary Outcome				
Reintubation at day 7	55 (18)	40 (12)	−6.4 (−12.0 to −0.9)	.02
Secondary Outcomes				
Postextubation respiratory failure at day 7	88 (29)	70 (21)	−8.5 (−15.2 to −1.8)	.01
Reintubation				
At 48 h	36 (12)	24 (7)	−4.8 (−9.6 to −0.3)	.04
At 72 h	47 (16)	30 (9)	−6.7 (−11.9 to −1.7)	.009
Up until ICU discharge	59 (20)	41 (12)	−7.4 (−13.2 to −1.8)	.009
Length of stay, median (IQR), days				
In ICU	11 (7 to 19)	12 (7 to 19)	0.5 (−1.6 to 2.6)	.55
In hospital	23 (15 to 39)	25 (15 to 42)	2.3 (−1.4 to 6.1)	.31
Mortality				
In ICU	26 (9)	21 (6)	−2.4 (−6.7 to 1.7)	.25
In hospital	46 (15)	54 (16)	0.7 (−5.0 to 6.3)	.80
At day 28	33 (11)	39 (12)	0.6 (−4.4 to 5.5)	.82
At day 90	65 (21)	62 (18)	−3.2 (−9.5 to 2.9)	.30
Exploratory Outcomes				
Patients meeting reintubation criteria during ICU stay	65 (22)	49 (14)	−7.1 (−13.1 to −1.1)	.02
Mortality or reintubation in ICU	64 (21)	51 (15)	−6.2 (−12.2 to −0.2)	.04
Mortality of reintubated patients	21/59 (36)	11/41 (27)	−8.8 (−25.7 to 9.9)	.35

Effect of Postextubation High-Flow Nasal Oxygen With Noninvasive Ventilation vs High-Flow Nasal Oxygen Alone on Reintubation Among Patients at High Risk of Extubation Failure

A Randomized Clinical Trial

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2019
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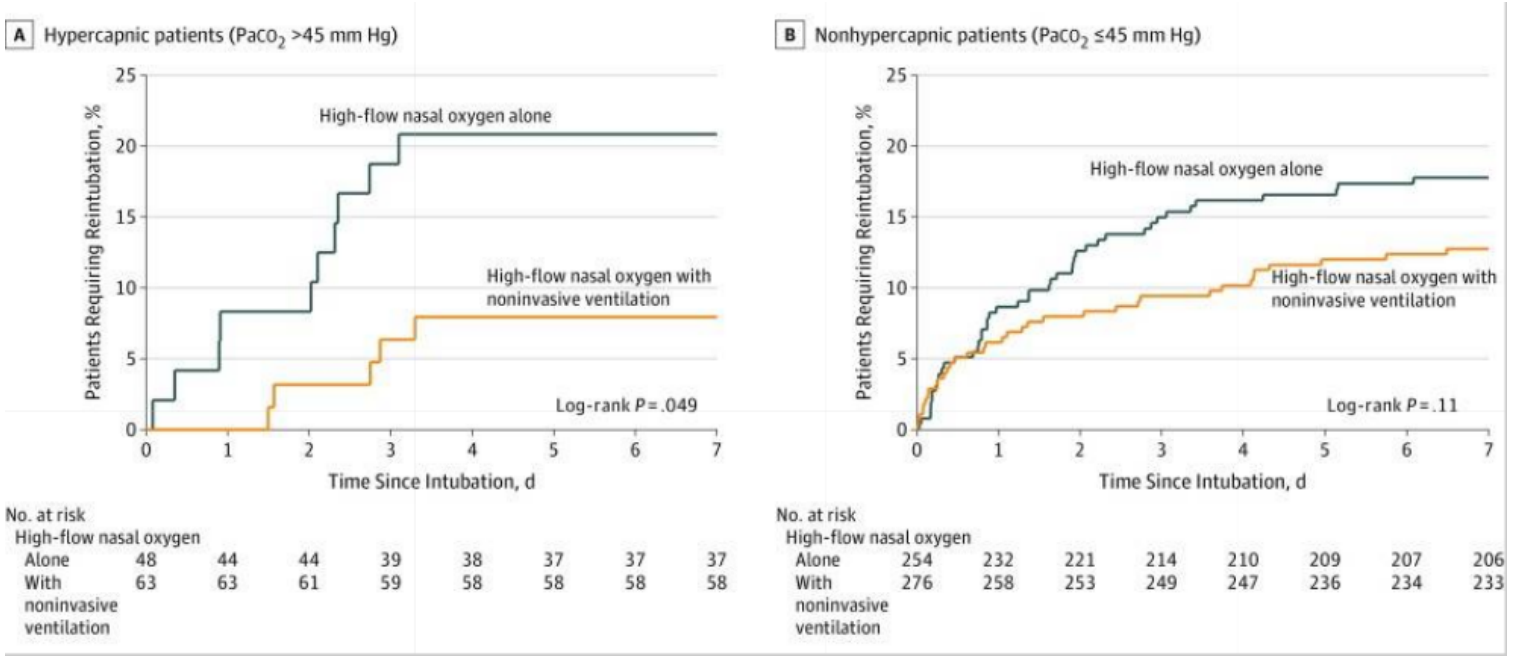
- 641(out of 3121) high risk reintubation (> 65 y, chronic heart or lung)
  1) HFNO: flow> 50 l/m, SpO2> 92%, > 2d
  ✓ 2) Immediately PSV:5 + PEEP: 5-10, >12h/d AND HFNO in intervals

$PCO_2 > 45$ **$PCO_2 \leq 45$**



ORIGINAL ARTICLE

Protocolized Postextubation Respiratory Support to Prevent Reintubation

A Randomized Clinical Trial

Jonathan D. Casey[1], Erin M. Vaughan[1], Bradley D. Lloyd[2], Peter A. Billas[3], Karen E. Jackson[1], Eric J. Hall[4], Alexandra H. Toporek[4], Kevin G. Buell[4], Ryan M. Brown[1], Roger K. Richardson[2], J. Craig Rooks[2], Reagan B. Buie[5], Li Wang[6], Christopher J. Lindsell[6], E. Wesley Ely[1,7,8], Wesley H. Self[9], Gordon R. Bernard[1], Todd W. Rice[1], and Matthew W. Semler[1]; for the Vanderbilt Learning Healthcare System and the Pragmatic Critical Care Research Group

- The PROPER trial was a prospective, unblinded, pragmatic, cluster–crossover trial
- October 1, 2017, and March 31, 2019, in the medical ICU of Vanderbilt University Medical Center in Nashville, Tennessee
- All adults (age >18 yr) undergoing extubation from invasive mechanical ventilation in the study ICU immediately..

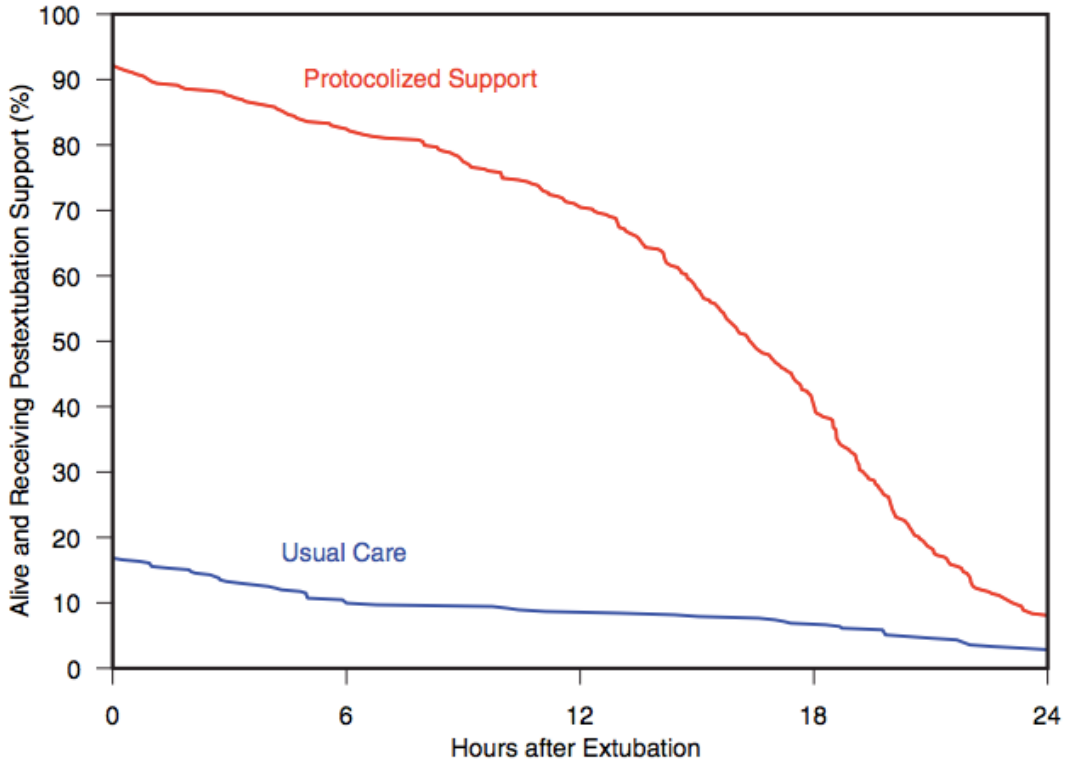
Intervention:

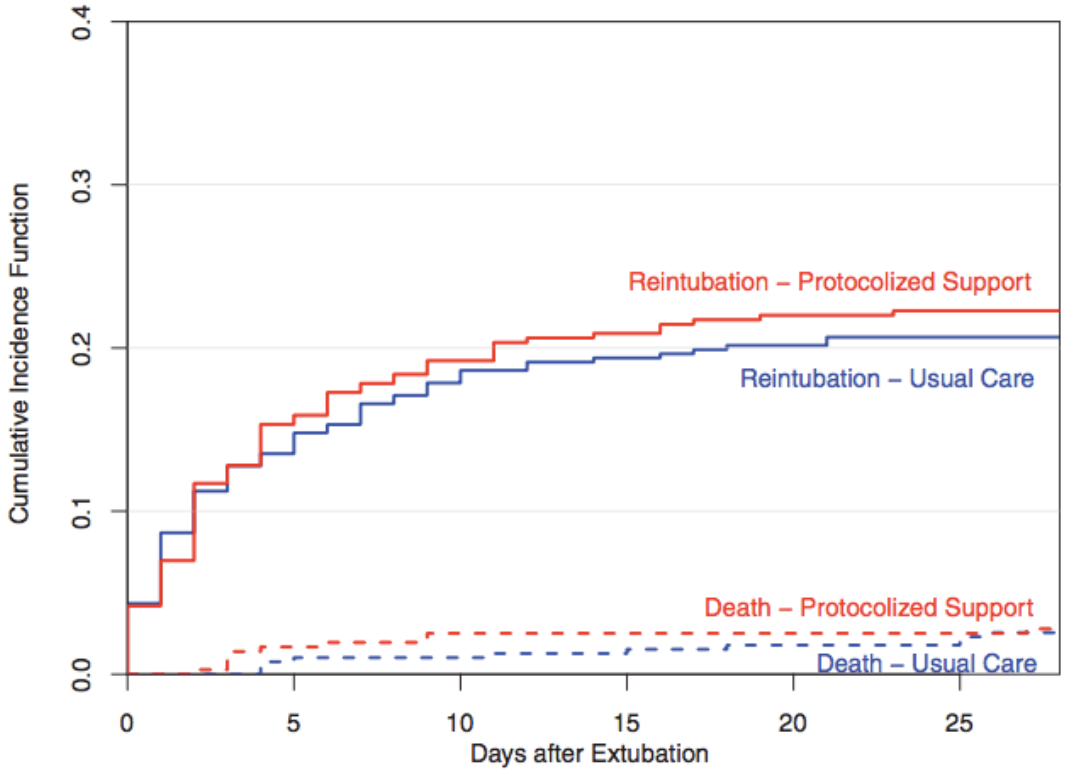
- NIV for
  - AECOPD
  - chronic hypercapnic respiratory failure
  - obesity hypoventilation syndrome
  - PCO2 > 45 mm Hg on an ABG during a spontaneous breathing trial
- HFNO :
  - All others

- Control group: usual care determined by treating clinicians

Am J Respir Crit Care Med Vol 204, Iss 3, pp 294–302, Aug 1, 2021

PROPER Trial results





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Patient Characteristic	Protocolized Support (*n* = 359)	Usual Care (*n* = 392)
Age, median (IQR), yr	56 (43–66)	57 (42–66)
Sex, M, *n* (%)	204 (56.8)	205 (52.3)
White race*, *n* (%)	287 (81.3)	317 (81.7)
Body mass index†, median (IQR), kg/m^2	26.6 (23.0–31.7)	28.0 (23.2–33.8)
Chronic respiratory comorbidity‡, *n* (%)	138 (38.4)	163 (41.6)
Chronic obstructive pulmonary disease	58 (16.2)	87 (22.2)
Asthma	21 (5.8)	18 (4.6)
Obstructive sleep apnea	39 (10.9)	47 (12.0)
Pulmonary malignancy	14 (3.9)	16 (4.1)
Indications for intubation‡, *n* (%)		
Airway protection for decreased level of consciousness	180 (50.1)	168 (42.9)
Hypoxemic respiratory failure	141 (39.3)	175 (44.6)
Hypercarbic respiratory failure	42 (11.7)	65 (16.6)
Preprocedural	45 (12.5)	36 (9.2)
Duration of invasive mechanical ventilation before extubation, d, median (IQR)	3.0 (2.0–5.0)	3.0 (2.0–4.0)
Unplanned extubation	17 (4.7%)	27 (6.9%)
APACHE II score at ICU admission§, median (IQR)	19 (12–24)	18 (13–24)
APACHE II score at extubation§, median (IQR)	17 (13–22)	17 (12–22)
Active medical conditions‡, *n* (%)		
Sepsis or septic shock	136 (37.9)	146 (37.2)
Pneumonia	135 (37.6)	135 (34.4)
Acute respiratory distress syndrome	23 (6.4)	21 (5.4)
Aspiration	44 (12.3)	57 (14.5)
Gastrointestinal bleeding	45 (12.5)	42 (10.7)
Altered mental status	190 (52.9)	204 (52.0)
Vasopressors in the 6 h before extubation, *n* (%)	47 (13.1)	48 (12.2)
Failed one or more spontaneous breathing trial, *n* (%)	83 (23.1)	80 (20.4)
Highest respiratory rate on a spontaneous breathing trial‖	22 (17–28)	22 (18–28)
At least one risk factor for reintubation¶	316 (88.0)	350 (89.3)

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Outcomes	Protocolized Support ($n = 359$)	Usual Care ($n = 392$)	Odds Ratio (95% Confidence Intervals)
Primary outcome*			
Reintubation in the 96 h after extubation, *n* (%)	57 (15.9)	52 (13.3)	1.23 (0.82–1.84)
Indication for reintubation†, *n* (%)			
Hypoxemic respiratory failure	25 (43.9)	24 (46.2)	—
Hypercapnic respiratory failure	5 (8.8)	2 (3.8)	—
Hypercapnic, hypoxemic respiratory failure	5 (8.8)	7 (13.5)	—
Altered mental status	6 (10.5)	5 (9.6)	—
Procedure	7 (12.3)	8 (15.4)	—
Other	3 (5.3)	6 (11.5)	—
Death without reintubation	6 (10.5)	0 (0.0)	—
Secondary outcome			
ICU-free days, median (IQR)	26 (23–26)	26 (22–26)	0.96 (0.81–1.13)
Exploratory outcomes‡			
Highest respiratory rate within 6 h after extubation§, median (IQR), breaths per minute	23 (20–28)	24 (21–28)	0.77 (0.60–0.98)
Lowest Sa_{O_2} within 6 h after extubation‖, median (IQR), %	94 (91–97)	93 (90–95)	1.85 (1.44–2.39)
Highest F_{IO_2} within 6 h after extubation¶, median (IQR)	0.40 (0.36–0.45)	0.33 (0.27–0.41)	2.61 (1.67–4.07)
Reintubation within 28 d¶, *n* (%)	80 (22.3)	82 (20.9)	1.07 (0.79–1.45)
Time from extubation to reintubation, median (IQR), h	56 (21–147)	47 (18–163)	—
Ventilator-free days, median (IQR)	28 (28–28)	28 (28–28)	1.21 (0.91–1.62)
Died before hospital discharge, *n* (%)	29 (8.1)	41 (10.5)	0.76 (0.53–1.08)

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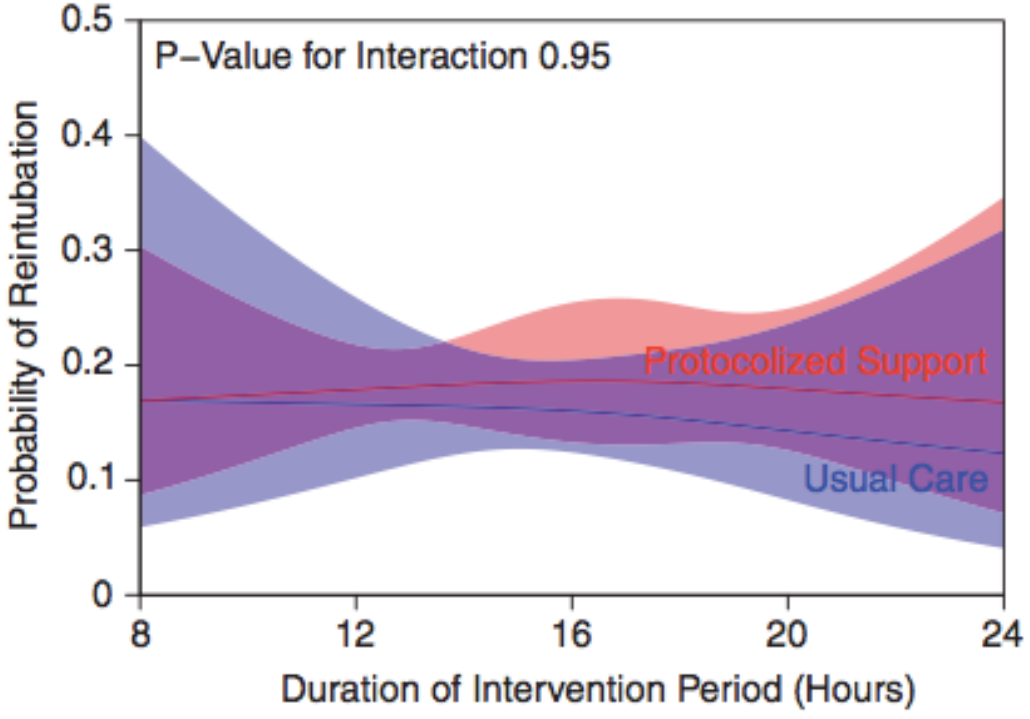
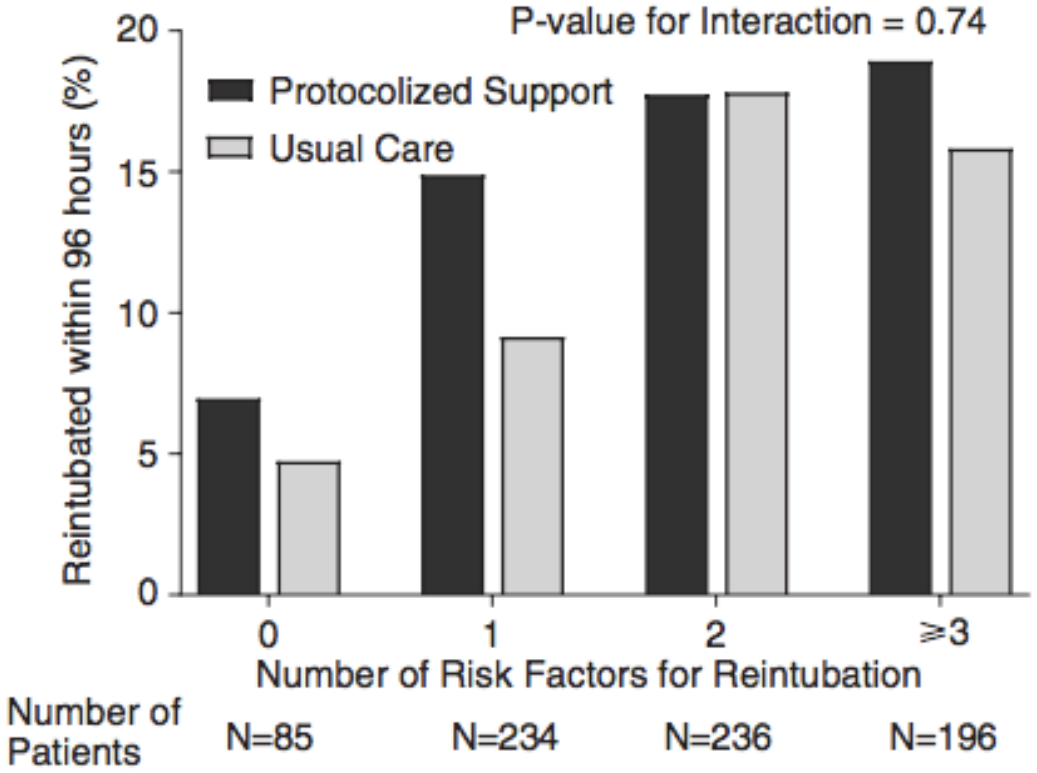
PROPER Trial results





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نتیجه گیری

آ) استفاده از **NIV** بعد از اکستوباسیون ممکن است (***may***) عواقب و نتایج بالینی را در گروه مشخصی از بیماران (*selected*) بهتر کند.

ب) استفاده از **NIV** باید بلافاصله بعد از اکستوباسیون (immediately) بکار گرفته شود و نیاز به مراقبت از نزدیک دارد.

پ) آموزش مداوم پرسنل آیسیو و تجربه بیشتر استفاده از **NIV** در نتیجه گیری نهایی تاثیرگذار است.

ت) همه بیماران از این مداخله سود نمی برند.


با تشکر از توجه شما.
سلامت باشید.