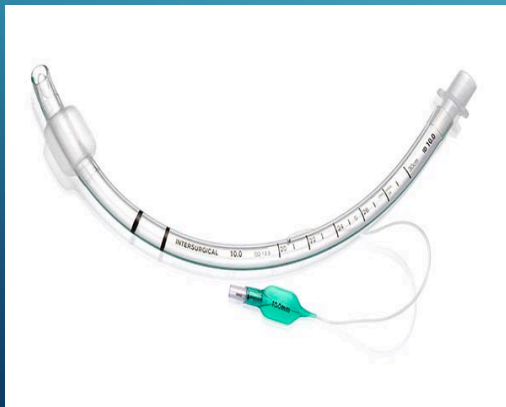
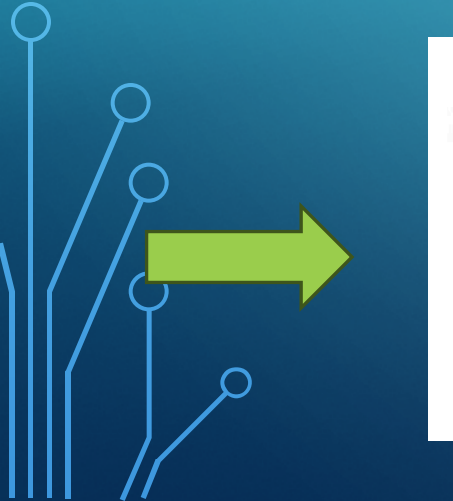


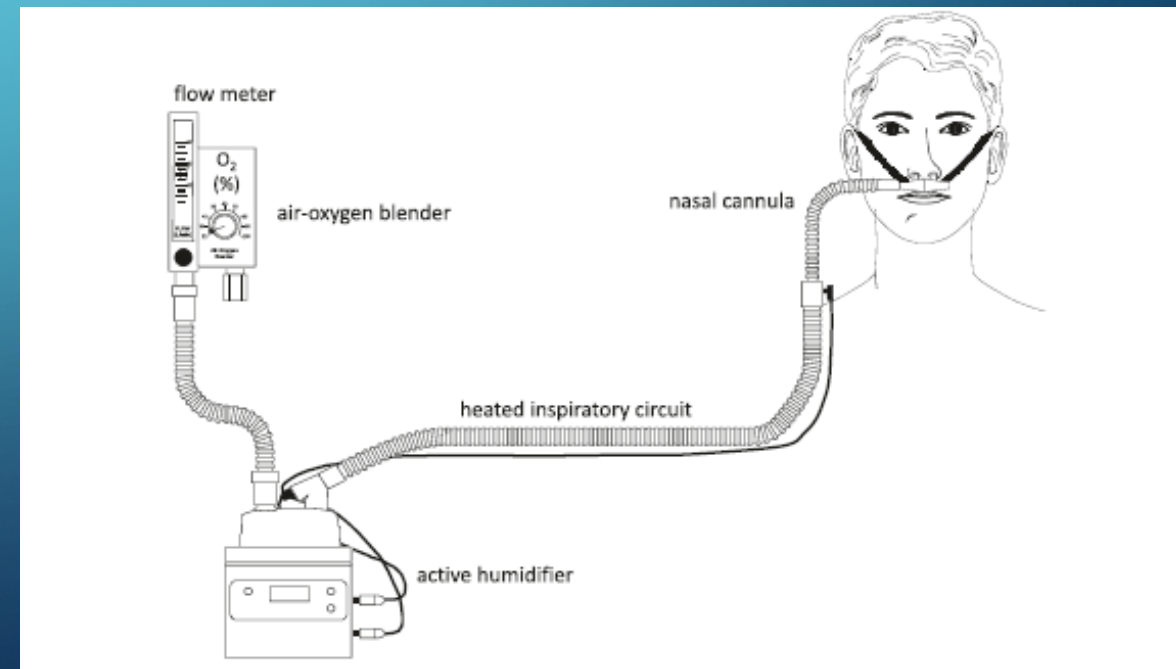


# NOVÉ FORMY VENTILAČNÍ PODPORY NA EMERGENCY

JIŘÍ KARÁSEK



- Forma dechové podpory (částečně alternativa nebo doplnění NIV)
- Průtoky 30-40l/min ( u dospělých až 60 l/min O<sub>2</sub>)
- Zvlhčená směs O<sub>2</sub>+vzduch
- Speciální nosní kanyla
- Nižší inspir.odpor/vyšší expirační odpor



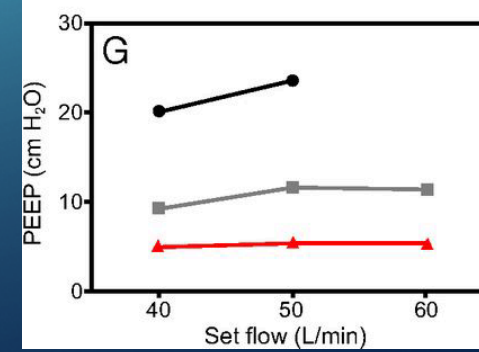
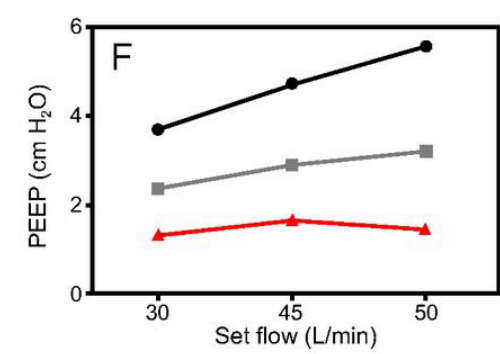
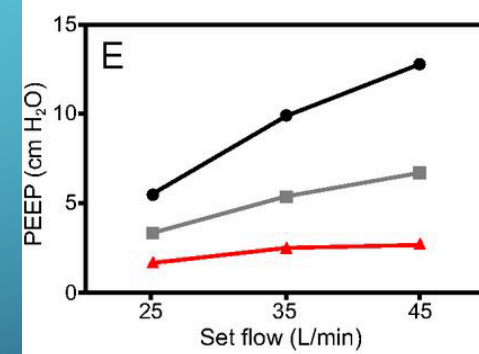
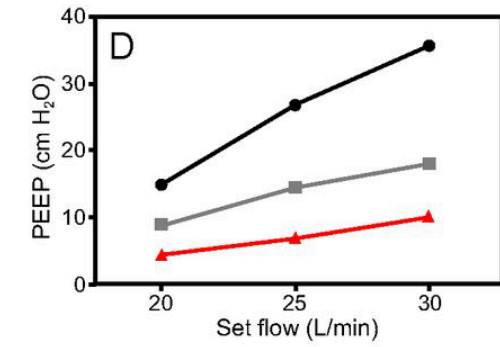
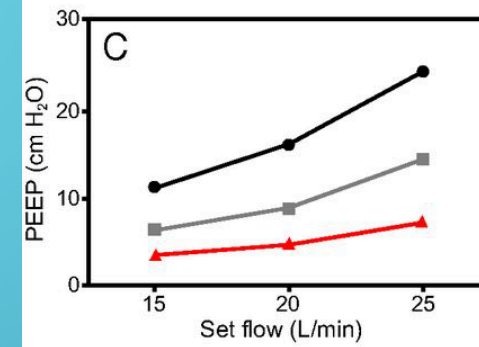
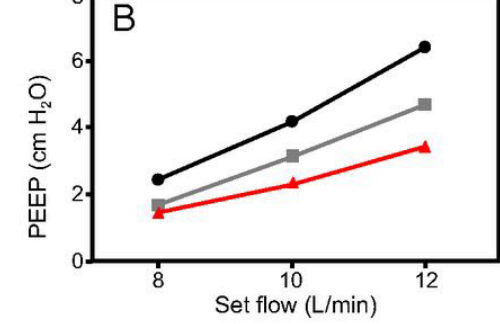
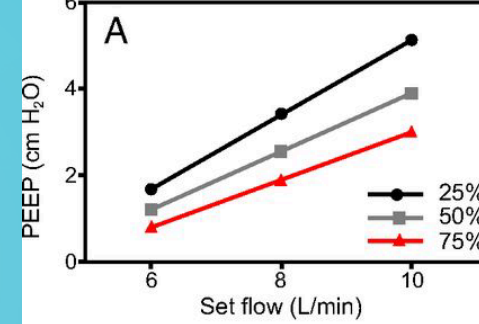
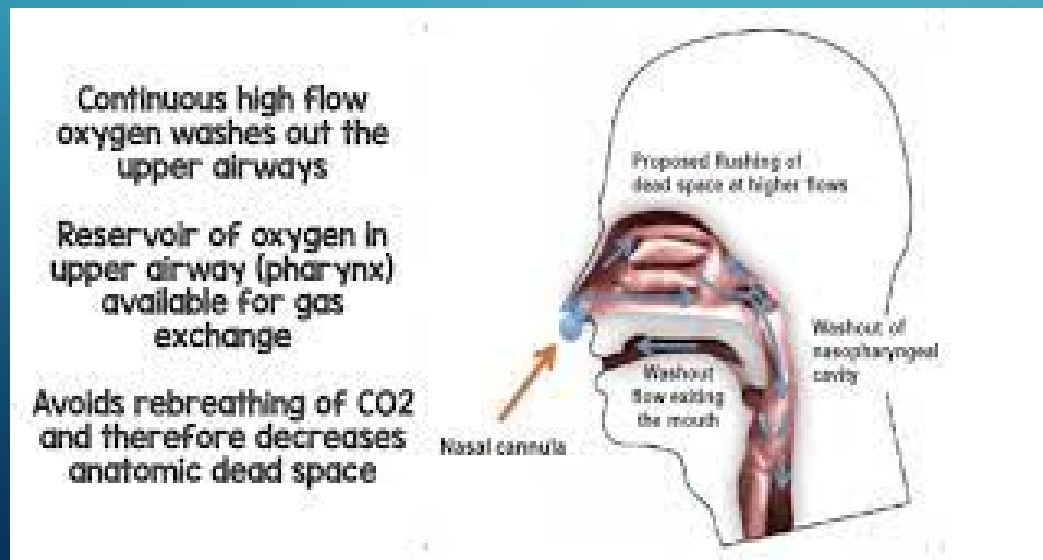


- Různé velikosti
- Varianta pro tracheostomii (weaning)
- Musí přiléhat k nosním dírkám



# FYZIOLOGIE

- Stabilní hodnota  $FiO_2$  0,2-1,0)
- Snížení dechového úsilí, „wash out“ mrtvého prostoru, pokles  $CO_2$
- Generuje přetlak (PEEP)- vysoký průtok převyšuje odpor v DC ( 40l/min...1,5 60 l/min....3,1 cm H<sub>2</sub>O)
- Zvlhčení a ohřátí-mukociliární transport a viskozita v DC



# INDIKACE

- Respir. Selhání I.typu-lehké a střední (pneumonie, inhal. trauma, srdeční selhání, CHOPN)
- Respir. Selhání II.typu (netoleruje nebo střídání s NIV)
- Postextubační období a weaning ( nižší riziko reintubace)
- Před rizikovou intubací a ICU intubací
- Invazivní výkony ?



# NASTAVENÍ

**Table 3** Practical recommendations.  $FI_{O_2}$ , fraction of inspired oxygen;  $Sa_{O_2}$ , arterial oxygen saturation; HFNO, high-flow nasal oxygen therapy

Settings	
Prongs	<ul style="list-style-type: none"><li>• Prongs should not totally occlude nostrils</li></ul>
Flow rate	<ul style="list-style-type: none"><li>• Start at 30-40 litres <math>\text{min}^{-1}</math> and increase to meet the patient's demand</li></ul>
Temperature	<ul style="list-style-type: none"><li>• Set at 37°C</li></ul>
$FI_{O_2}$	<ul style="list-style-type: none"><li>• Increase the <math>FI_{O_2}</math> until satisfactory <math>Sa_{O_2}</math> is achieved</li></ul>
Flow	<ul style="list-style-type: none"><li>• Increase the delivered flow until a reduction in respiratory rate and stable <math>Sa_{O_2}</math> is achieved</li></ul>
Water reservoir	<ul style="list-style-type: none"><li>• Place as high as possible above the humidifier</li></ul>
Monitoring	<ul style="list-style-type: none"><li>• Continuous monitoring of heart rate, respiratory rate, <math>Sa_{O_2}</math></li></ul>
Positive response and weaning	<ul style="list-style-type: none"><li>• Gas flow rate and <math>FI_{O_2}</math> adjusted according to the clinical response (expected within 1 h).</li><li>• Reduce <math>FI_{O_2}</math> by 5-10% and reassess after 1-2 h. Reduce the flow rate by 5 litres <math>\text{min}^{-1}</math> and reassess after 1-2 h.</li><li>• Consider weaning from HFNO with flow rates <math>\leq 25</math> litres <math>\text{min}^{-1}</math> and <math>FI_{O_2} &lt; 0.40</math>.</li></ul>
Ineffective response	<ul style="list-style-type: none"><li>• If there is no improvement after 60-120 min, treatment escalation must be considered.</li></ul>

ventilation.<sup>41</sup> They reported that early indicators of HFNO failure could be lack of improvement in oxygenation and persistence of tachypnoea, as defined by a respiratory rate higher than 30 breaths  $\text{min}^{-1}$  and thoraco-abdominal asynchrony 30 min after HFNO initiation.<sup>8,39</sup> Other factors associated with failure are shock requiring administration of vasopressors, a Sepsis-related Organ Failure Assessment (SOFA) score of 4 or more, an Acute Physiology and Chronic Health Evaluation II (APACHE II)  $\geq 12$  on admission and a  $Pa_{O_2}/FI_{O_2}$  ratio  $< 13.3$  kPa after 6 h of treatment.<sup>32,37</sup>



## High-Flow Oxygen through Nasal Cannula in Acute Hypoxemic Respiratory Failure

Jean-Pierre Frat, M.D., Arnaud W. Thille, M.D., Ph.D., Alain Mercat, M.D., Ph.D., Christophe Girault, M.D., Ph.D., Stéphanie Ragot, Pharm.D., Ph.D., Sébastien Perbet, M.D., Gwénael Prat, M.D., Thierry Boulain, M.D., Elise Morawiec, M.D., Alice Cottereau, M.D., Jérôme Devaquet, M.D., Saad Nseir, M.D., Ph.D., Keyvan Razazi, M.D., Jean-Paul Mira, M.D., Ph.D., Laurent Argaud, M.D., Ph.D., Jean-Charles Chakarian, M.D., Jean-Damien Ricard, M.D., Ph.D., Xavier Wittebole, M.D., Stéphanie Chevalier, M.D., Alexandre Herbland, M.D., Muriel Fartoukh, M.D., Ph.D., Jean-Michel Constantin, M.D., Ph.D., Jean-Marie Tonnelier, M.D., Marc Pierrot, M.D., Armelle Mathonnet, M.D., Gaëtan Béduneau, M.D., Céline Delétage-Métreau, Ph.D., Jean-Christophe M. Richard, M.D., Ph.D., Laurent Brochard, M.D., and René Robert, M.D., Ph.D., for the FLORALI Study Group and the REVA Network\*

- CRT: HFO vs. Stand.O2 vs. NIV k SpO2 92% a více

Incl: RR nad 25/min, oxygen.index 300 mm Hg a méně při O2 10l/min po 15 min  
Exl.: paCO2 nad 45 mm Hg, astma, CHOPN, plicní edém, vasopresory

- Primární outcome: OTI do 28 dnů

- Sekundární outcome: ICU mortalita, 90 denní mortalita, ventilátor free days

ening respiratory failure as defined by at least two of the following criteria: a respiratory rate of more than 40 breaths per minute, a lack of improvement in signs of high respiratory-muscle workload, the development of copious tracheal secretions, acidosis with a pH of less than 7.35, an SpO<sub>2</sub> of less than 90% for more than 5 minutes without technical dysfunction, or a poor response to oxygenation techniques (details of the criteria

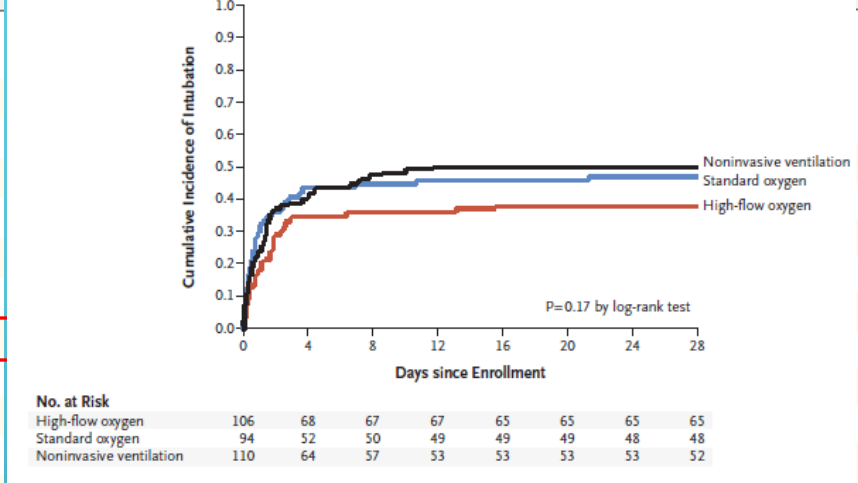


# 310 PTS.: 94 O2/106 HFO/110 NIV

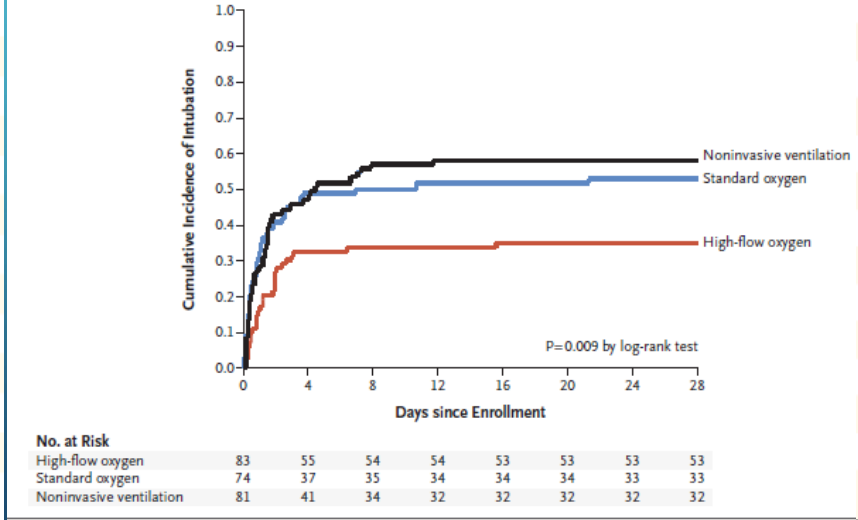
**Table 1. Characteristics of the Patients at Baseline, According to Study Group.\***

Characteristic	High-Flow Oxygen (N=106)	Standard Oxygen (N=94)	Noninvasive Ventilation (N=110)
Age — yr	61±16	59±17	61±17
Male sex — no. (%)	75 (71)	63 (67)	74 (67)
Body-mass index†	25±5	26±5	26±6
SAPS II‡	25±9	24±9	27±9
Current or past smoking — no. (%)	34 (32)	36 (38)	40 (36)
Reason for acute respiratory failure — no. (%)			
Community-acquired pneumonia	71 (67)	57 (61)	69 (63)
Hospital-acquired pneumonia	12 (11)	13 (14)	12 (11)
Extrapulmonary sepsis	4 (4)	5 (5)	7 (6)
Aspiration or drowning	3 (3)	1 (1)	2 (2)
Pneumonia related to immunosuppression	6 (6)	4 (4)	10 (9)
Other	10 (9)	14 (15)	10 (9)
Bilateral pulmonary infiltrates — no. (%)	79 (75)	80 (85)	85 (77)
Respiratory rate — breaths/min	33±6	32±6	33±7
Heart rate — beats/min	106±21	104±16	106±21
Arterial pressure — mm Hg			
Systolic	127±24	130±22	128±21
Mean	87±17	89±15	86±16
Arterial blood gas			
pH	7.43±0.05	7.44±0.06	7.43±0.06
Pao <sub>2</sub> — mm Hg	85±31	92±32	90±36
Fio <sub>2</sub> §	0.62±0.19	0.63±0.17	0.65±0.15
Pao <sub>2</sub> :Fio <sub>2</sub> — mm Hg	157±89	161±73	149±72
Paco <sub>2</sub> — mm Hg	36±6	35±5	34±6

**A Overall Population**



**B Patients with a Pao<sub>2</sub>:Fio<sub>2</sub> ≤200 mm Hg**



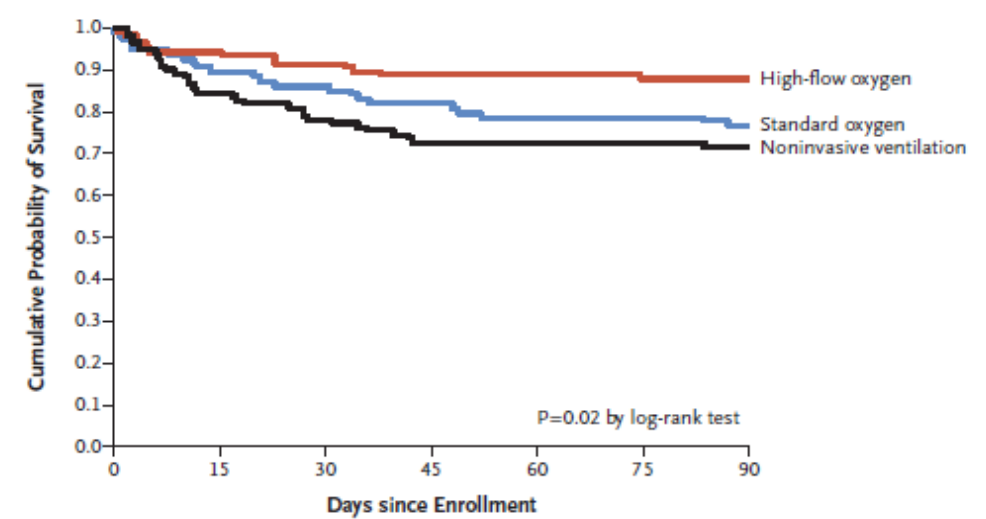
**Table 2. Primary and Secondary Outcomes, According to Study Group.\***

Outcome	Study Group			P Value†	Odds Ratio or Hazard Ratio (95% CI)	
	High-Flow Oxygen (N=106)	Standard Oxygen (N=94)	Noninvasive Ventilation (N=110)		Standard Oxygen vs. High-Flow Oxygen	Noninvasive Ventilation vs. High-Flow Oxygen
<b>Intubation at day 28</b>						
Overall population				0.18	1.45 (0.83–2.55)	1.65 (0.96–2.84)
No. of patients	40	44	55			
% of patients (95% CI)	38 (29–47)	47 (37–57)	50 (41–59)			
<b>Patients with Pao<sub>2</sub>:Fio<sub>2</sub> ≤200 mm Hg‡</b>						
Unadjusted analysis				0.009	2.07 (1.09–3.94)	2.57 (1.37–4.84)
No. of patients/total no.	29/83	39/74	47/81			
% of patients (95% CI)	35 (26–46)	53 (42–64)	58 (47–68)			
Adjusted analysis§	—	—	—	0.01	2.14 (1.08–4.22)	2.60 (1.36–4.96)
<b>Interval between enrollment and intubation — hr¶</b>						
Overall population				0.27	—	—
Median	27	15	27			
Interquartile range	8–46	5–39	8–53			
Patients with Pao <sub>2</sub> :Fio <sub>2</sub> ≤200 mm Hg				0.32	—	—
Median	26	17	27			
Interquartile range	11–46	5–41	7–52			
<b>Reason for intubation — no./total no. (%)  </b>						
Respiratory failure	36/51 (71)	43/58 (74)	49/67 (73)	0.24	—	—
Circulatory failure	7/51 (14)	5/58 (9)	5/67 (7)	0.46	—	—
Neurologic failure	8/51 (16)	10/58 (17)	13/67 (19)	0.91	—	—
<b>Ventilator-free days</b>						
Overall population	24±8	22±10	19±12	0.02	—	—
Patients with Pao <sub>2</sub> :Fio <sub>2</sub> ≤200 mm Hg	24±8	21±10	18±12	<0.001	—	—

**Table 2. (Continued.)**

Outcome	Study Group			P Value†	Odds Ratio or Hazard Ratio (95% CI)	
	High-Flow Oxygen (N=106)	Standard Oxygen (N=94)	Noninvasive Ventilation (N=110)		Standard Oxygen vs. High-Flow Oxygen	Noninvasive Ventilation vs. High-Flow Oxygen
<b>Death</b>						
<b>In ICU</b>						
Unadjusted analysis				0.047	1.85 (0.84–4.09)	2.55 (1.21–5.35)
No. of patients	12	18	27			
% of patients (95% CI)	11 (6–19)	19 (12–28)	25 (17–33)			
Adjusted analysis**	—	—	—	—	2.55 (1.07–6.08)	2.60 (1.20–5.63)
<b>At day 90</b>						
<b>Overall population</b>						
Unadjusted analysis				0.02	2.01 (1.01–3.99)	2.50 (1.31–4.78)
No. of patients	13	22	31			
% of patients (95% CI)	12 (7–20)	23 (16–33)	28 (21–37)			
Adjusted analysis**	—	—	—	—	2.36 (1.18–4.70)	2.33 (1.22–4.47)
<b>Intubated patients</b>				0.16		
No. of patients/total. no.	12/40	20/44	27/55			
% of patients (95% CI)	30 (18–46)	45 (32–60)	49 (36–62)			
<b>Cause of death — no./total no. (%)</b>						
Refractory shock	6/13 (46)	12/22 (55)	18/31 (58)	0.04		
Refractory hypoxemia	5/13 (38)	6/22 (27)	8/31 (26)	0.73		
Cardiac arrest	1/13 (8)	1/22 (5)	3/31 (10)	0.52		
Other	1/13 (8)	3/22 (14)	2/31 (6)	0.52		

or the reasons for intubation. In our study, non-invasive ventilation that was administered to patients with severe lung injury could have increased the incidence of ventilator-induced lung injury by increasing tidal volumes that exceeded 9 ml per kilogram of predicted body weight.<sup>32-34</sup>



**No. at Risk**

	0	15	30	45	60	75	90
High-flow oxygen	106	100	97	94	94	93	93
Standard oxygen	94	84	81	77	74	73	72
Noninvasive ventilation	110	93	86	80	79	78	77



# Can High-flow Nasal Cannula Reduce the Rate of Endotracheal Intubation in Adult Patients With Acute Respiratory Failure Compared With Conventional Oxygen Therapy and Noninvasive Positive Pressure Ventilation? A Systematic Review and Meta-analysis

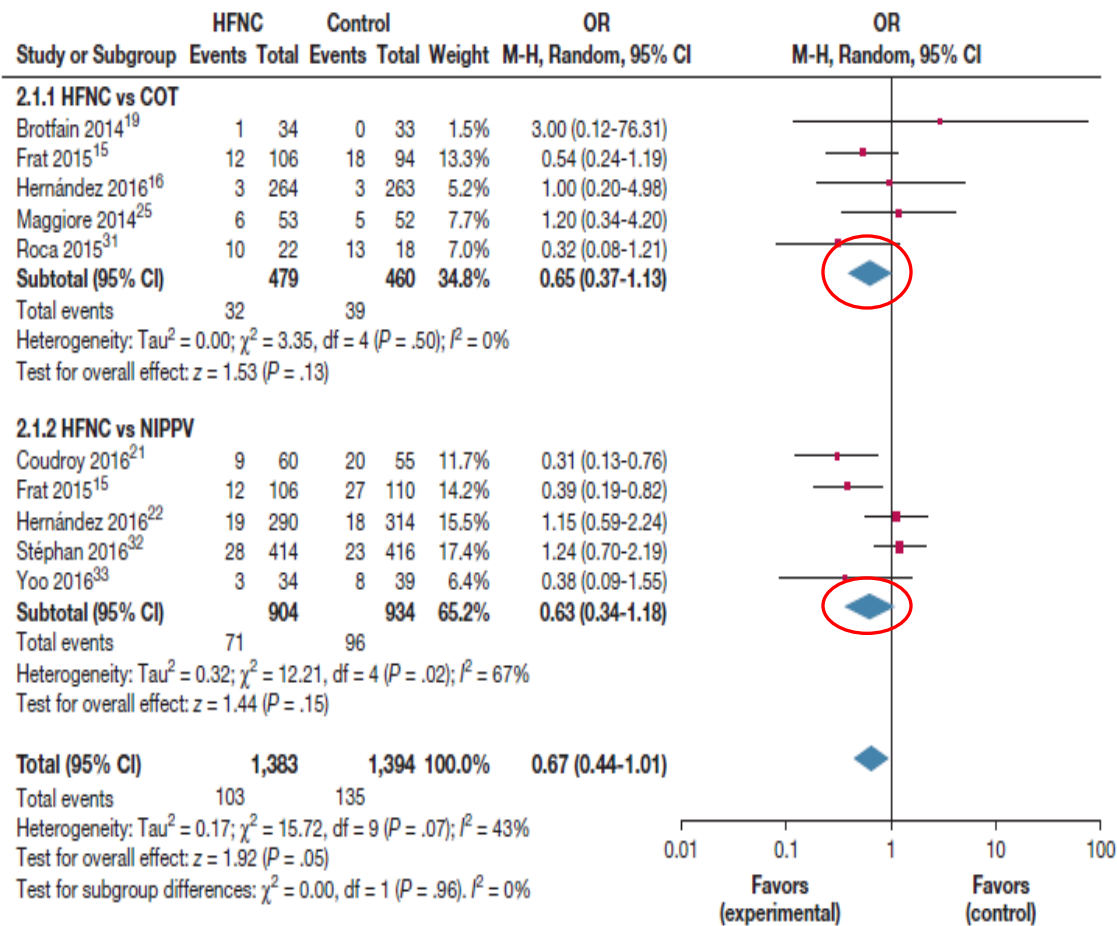


Figure 6 - ICU mortality. See Figure 4 and 5 legends for expansion of abbreviations.

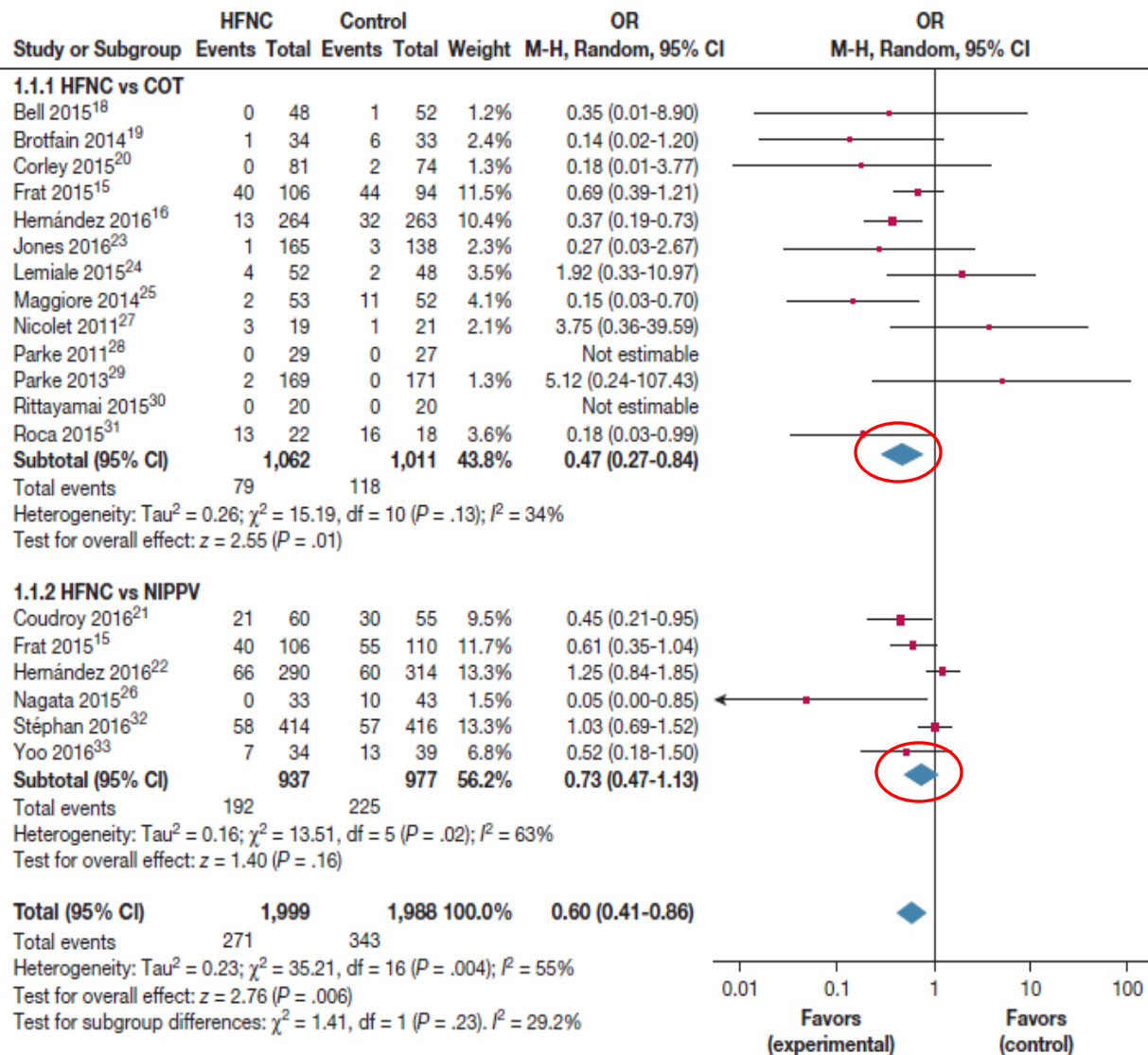


Figure 5 - Endotracheal intubation. M-H = Mantel-Haenszel. See Figure 4 legend for expansion of other abbreviations.



# Effect of Postextubation High-Flow Nasal Cannula vs Conventional Oxygen Therapy on Reintubation in Low-Risk Patients

## A Randomized Clinical Trial

Gonzalo Hernández, MD, PhD; Concepción Vaquero, MD; Paloma González, MD; Carles Subira, MD; Fernando Frutos-Vivar, MD; Gemma Rialp, MD; Cesar Laborda, MD; Laura Colinas, MD; Rafael Cuena, MD; Rafael Fernández, MD, PhD

criteria for low risk of reintubation: younger than 65 years<sup>4,5</sup>; absence of heart failure as the primary indication for mechanical ventilation<sup>4,5</sup>; absence of moderate-to-severe chronic obstructive pulmonary disease<sup>15</sup>; Acute Physiology and Chronic Health Evaluation (APACHE) II score less than 12 points on day of extubation<sup>4,5</sup>; body mass index less than 30 (calculated as weight in kilograms divided by height in meters squared)<sup>2,16</sup>; absence of airway patency problems, including high risk of developing laryngeal edema (eAppendix 2 in Supplement 2)<sup>5</sup>; ability to manage respiratory secretions (adequate cough reflex or suctioning <2 times within 8 hours before extubation)<sup>5,17</sup>; simple weaning (eAppendix 3 in Supplement 2)<sup>5</sup>; fewer than 2 comorbidities (eAppendix 4 in Supplement 2)<sup>5</sup>; and no prolonged mechanical ventilation, defined as longer than 7 days.<sup>18</sup>

High-flow oxygen therapy (Optiflow; Fisher & Paykel Healthcare) was applied immediately after extubation through nasal cannula. Flow was initially set at 10 L/min and titrated upward in 5-L/min steps until patients experienced discomfort. Temperature was initially set to 37°C, unless reported too hot by patients, and FIO<sub>2</sub> was regularly adjusted to target peripheral capillary oxygen saturation (SpO<sub>2</sub>) greater than 92%. After 24 hours, high-flow therapy was stopped and, if necessary, patients received conventional oxygen therapy.

Conventional oxygen therapy was applied continuously through nasal cannula or nonrebreather facemask, and oxygen flow was adjusted to maintain SpO<sub>2</sub> greater than 92%.

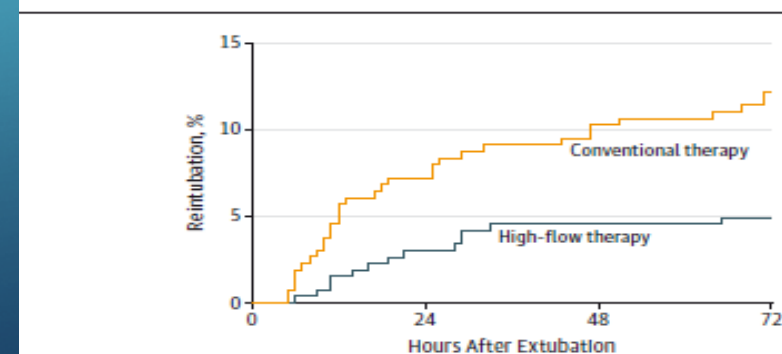
264 Included in primary analysis

263 Included in primary analysis

Table 2. Primary and Secondary Outcomes

Variable	Oxygen Therapy		Difference Between Groups (95% CI)	P Value
	High-Flow (n = 264)	Conventional (n = 263)		
<b>Primary Outcome</b>				
All-cause reintubation, No. (%)	13 (4.9)	32 (12.2)	7.2 (2.5 to 12.2)	.004 <sup>a</sup>
<b>Secondary Outcomes</b>				
Postextubation respiratory failure, No. (%)	22 (8.3)	38 (14.4)	6.1 (0.7 to 11.6)	.03 <sup>a</sup>
Respiratory infection, No. (%)	6 (2.3)	13 (4.9)	2.7 (-0.6 to 6.2)	.07 <sup>a</sup>
Ventilator-associated tracheobronchitis	3 (1.1)	7 (2.6)	1.5 (-1.0 to 4.4)	.22 <sup>a</sup>
Ventilator-associated pneumonia	3 (1.1)	6 (2.3)	1.2 (-1.3 to 3.9)	.31 <sup>a</sup>
<b>Causes of postextubation respiratory failure, No. (%)</b>				
Respiratory acidosis <sup>c</sup>	1 (4.5)	4 (10.5)		
Hypoxia <sup>c</sup>	7 (31.8)	6 (15.8)		
Unbearable dyspnea	9 (40.9)	14 (28.9)		.10 <sup>b</sup>
Decreased level of consciousness	2 (9)	0		
Inability to clear secretions	3 (13.6)	14 (36.8)		

Figure 2. Kaplan-Meier Analysis of Time From Extubation to Reintubation



No. at risk	0	24	48	72
Conventional therapy	263	244	236	231
High-flow therapy	264	256	252	251

# AECOPD

Tan et al. *Critical Care* (2024) 28:250  
<https://doi.org/10.1186/s13054-024-05040-9>

Critical Care

RESEARCH

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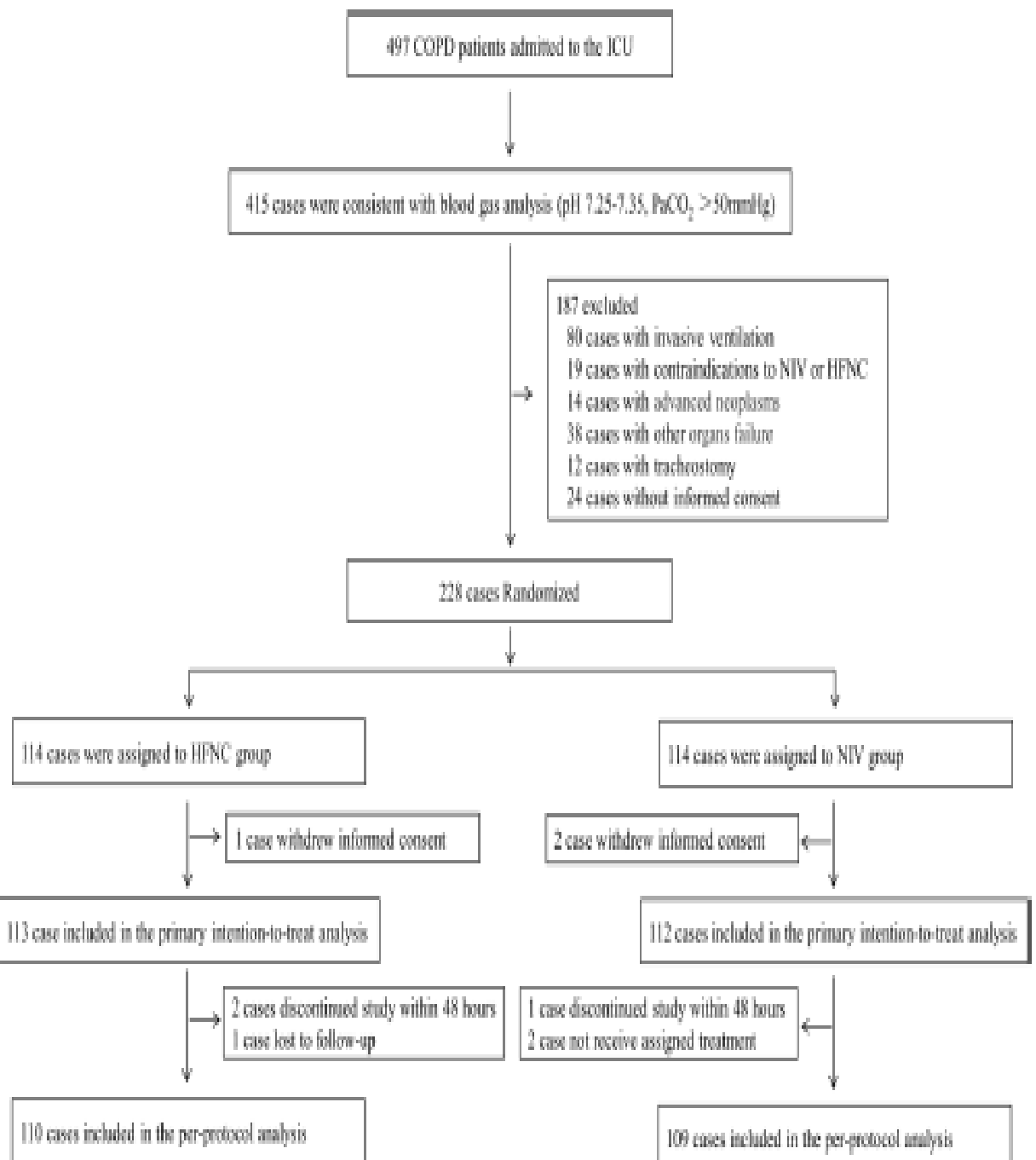
High flow nasal cannula oxygen therapy versus non-invasive ventilation for acute exacerbations of chronic obstructive pulmonary disease with acute-moderate hypercapnic respiratory failure: a randomized controlled non-inferiority trial



- Non-inferiority CRT : NIV vs. HFO u akutní exacerbace CHOPN se středně zvýšeným pCO<sub>2</sub>, unicentrická studie 2018-2022
- Inclusion:
  - ARF u COPD ( dle GOLD 2017)
  - pH 7,25-7,35, pCO<sub>2</sub>>50 mm Hg (6.7 kPa)
- Exclusion:
  - věk pod 18
  - OTI
  - PaO<sub>2</sub>/FiO<sub>2</sub><150 mm Hg
  - RR>40
  - GCS<8
  - Kontraindikace metody ( nízká sekrece sputa, trauma, hemodyn. Nestabilita)



- NIV: PS 8 cm H<sub>2</sub>O, PEEP 4 cm H<sub>2</sub>O k 6-8 ml/kg IBW, SpO<sub>2</sub> 88%-92% a RR<28 nejméně na 2 hodiny
- HFO: 40 l/min a FiO<sub>2</sub> k SpO<sub>2</sub> 88%-92%
- UPV: rostoucí pCO<sub>2</sub> k pH<7.2, pO<sub>2</sub> <50 mm Hg (6.6kPa) a RR>40/<8
- Primární endpoint: selhání metody (UPV nebo upgrade metody)
- Sekundární endpointy: UPV, fyziol. Parametry (RR, HR, MAP), krevní plyny (pH, pCO<sub>2</sub>, PaO<sub>2</sub>/FiO<sub>2</sub>) v H 1, 12 a 48, 28-denní mortalita, délka ICU a hospitalizace



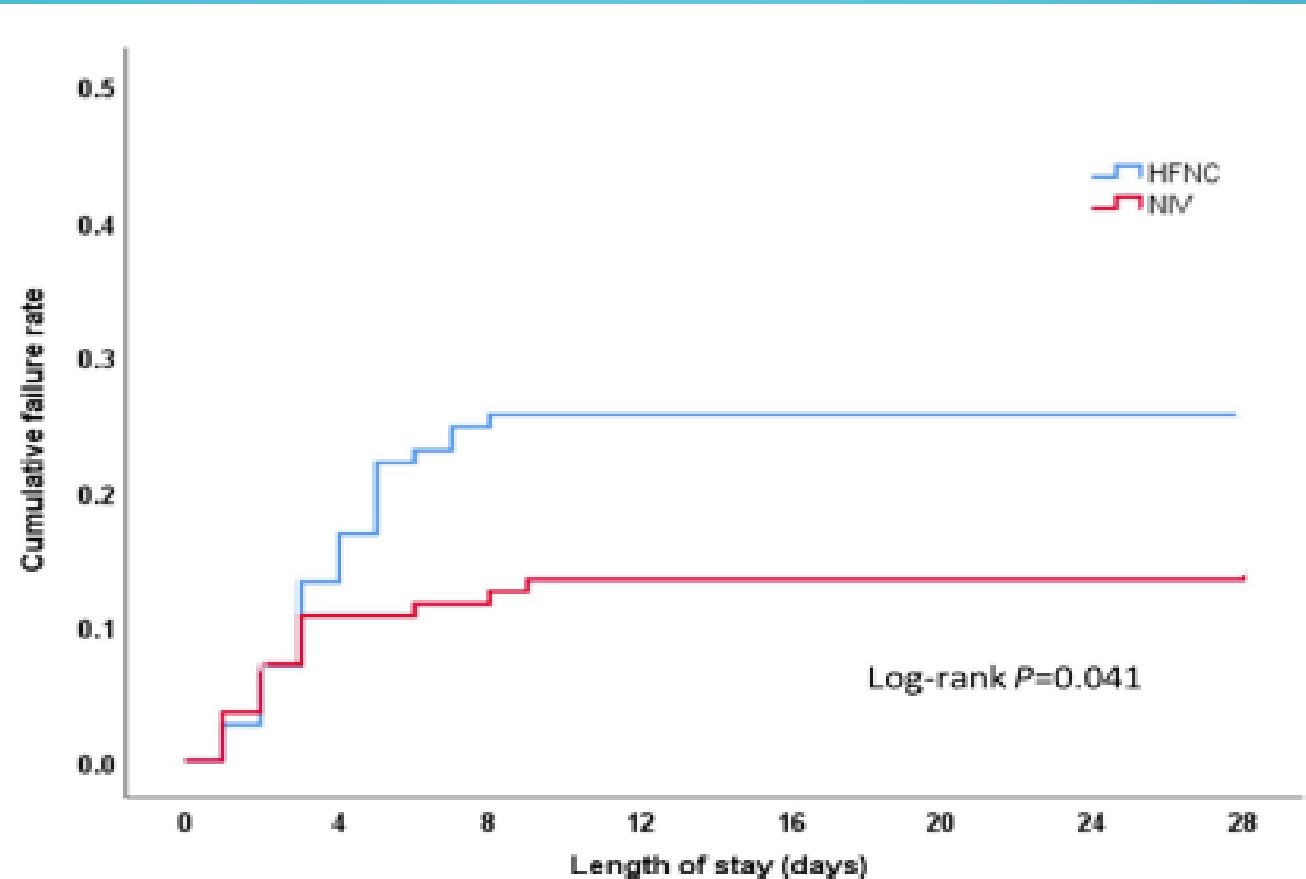
**Table 1** Baseline characteristics of selected patients

Characteristics	HFNC (n= 113)	NIV (n= 112)	P value
Male, n (%)	71 (62.8)	62 (55.4)	0.254
Age, years	73 (65–78)	69 (63–76)	0.082
History of COPD, years	8 (6–12)	8 (6–11)	0.490
Smoking history, n (%)			
Current	12 (10.6)	7 (6.3)	0.239
Former smoker	36 (31.9)	49 (43.8)	0.066
Comorbidities, n (%)			
Diabetes mellitus	25 (21.1)	31 (27.7)	0.335
Coronary artery disease	49 (43.4)	38 (33.9)	0.146
Chronic liver disease	9 (8.0)	15 (13.4)	0.187
Chronic kidney disease	24 (21.2)	15 (13.4)	0.120
Cerebrovascular disease	11 (9.7)	19 (17.0)	0.111
Malignancy	13(11.5)	16 (14.3)	0.534
Medication before exacerbation, n (%)			
Inhaled corticosteroids	21 (18.6)	33 (29.5)	0.056
Beta adrenoceptor agonist	50 (44.2)	44 (39.3)	0.451
Anticholinergics	23 (20.4)	32 (28.6)	0.152
Home oxygen therapy, n (%)			
NCO	23 (20.4)	18 (16.1)	0.405
NIV	9 (8.0)	12(10.7)	0.478
Pulmonary function class, n (%)	35	44	
II	14 (40.0)	17 (38.6)	0.902
III	19 (54.3)	24 (54.5)	0.982
IV	2 (5.7)	3 (6.8)	0.841
Mean length from acute attack to ICU admission, days	5 (3–8)	4 (3–7)	0.118
On admission to ICU			
APACHE II score	14 (11–17)	12 (10–16)	0.067
SAPS II score	32 (26–37)	29 (26–34)	0.201
Heart rate, beats/min	92 (85–101)	96 (85–103)	0.148
Respiratory frequency, /min	28 (25–30)	29 (26–32)	0.061
Mean arterial pressure, mmHg	88 (82–93)	84 (77–93)	0.090
Arterial pH	7.31(7.29–7.33)	7.30(7.28–7.32)	0.342
PaCO <sub>2</sub> , mmHg	63 (59–68)	61 (58–65)	0.130
PaO <sub>2</sub> /FIO <sub>2</sub> , mmHg	175 (167–199)	184 (167–202)	0.170

**Table 2** Primary endpoint and cause analysis

	HFNC	NIV	Risk difference, % (95% CI)	P value
Treatment failure, n (%)				
Intention-to-treat analysis	29/113 (25.7)	16/112 (14.3)	11.38 (0.25 – 21.20)	0.033
Per-protocol analysis	28/110 (25.5)	15/109 (13.8)	11.69 (0.48 – 22.60)	0.029
Analysis of treatment failure, n (%)				
Aggravation of respiratory distress	9/29 (31.0)	6/16 (37.5)	-6.47 (-37.06 – 22.64)	0.660
Aggravation of hypoxemia	7/29 (24.1)	4/16 (25.0)	-0.86 (-31.41 – 25.68)	0.949
Aggravation of carbon dioxide retention	13/29 (44.8)	6/16 (37.5)	7.33 (-24.74 – 35.94)	0.373

HFNC High flow nasal cannula oxygen therapy; NIV on-invasive ventilation





**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

HODNOTY KREVNÍCH PLYNŮ SE NELIŠILY KROMĚ PCO<sub>2</sub> V H48 (NIŽŠÍ NIV)

NEBYL ROZDÍL V DÉLCE UŽITÍ METODY

# AKUTNÍ SRDEČNÍ SELHÁNÍ

Study	Study population	Intervention/Experimental group	Control group	Outcome
Ko et al. [36] (Randomized controlled trial)	Patient suspected of pulmonary edema due to heart failure	HFNC (n = 36)	COT (n = 33)	Significant difference in respiratory rate, SpO <sub>2</sub> at 30 and 60 minutes (improved in HFNC group) Significant difference in ABG parameters (PaO <sub>2</sub> and SpO <sub>2</sub> ) at 30 and 60 minutes (improved in HFNC group)
Makdee et al. [37] (Randomized controlled trial)	ED patients with cardiogenic pulmonary edema	HFNC (n = 63)	COT (n = 65)	60-minute respiratory rate significantly lower in HFNC group Lower respiratory rate at 15 and 30 minutes in HFNC group
Sener et al. [4] (Prospective observational study)	Patients with hypertensive pulmonary edema	HFNC (n = 62)	COT (n = 50)	HFNC shortens the length of stay in both emergency and intensive care unit HFNC shows better results in terms of heart rate, respiratory rate, and ABG parameters
Chang et al. [38] (Cohort study)	Post-extubated patients with heart failure with ejection fraction <50%	HFNC (n = 58)	NIPPV (n = 46)	No significant difference in treatment failure between two groups in 72 hours

HFNC, high-flow nasal cannula, COT, conventional oxygen therapy; NIPPV, non-invasive positive-pressure ventilation; ABG, arterial blood gas; SpO<sub>2</sub>, oxygen saturation; PaO<sub>2</sub>, partial pressure of oxygen; n, number of participants; ACPE, acute cardiogenic pulmonary edema



Article

## Benefits of High-Flow Nasal Cannula Therapy for Acute Pulmonary Edema in Patients with Heart Failure in the Emergency Department: A Prospective Multi-Center Randomized Controlled Trial

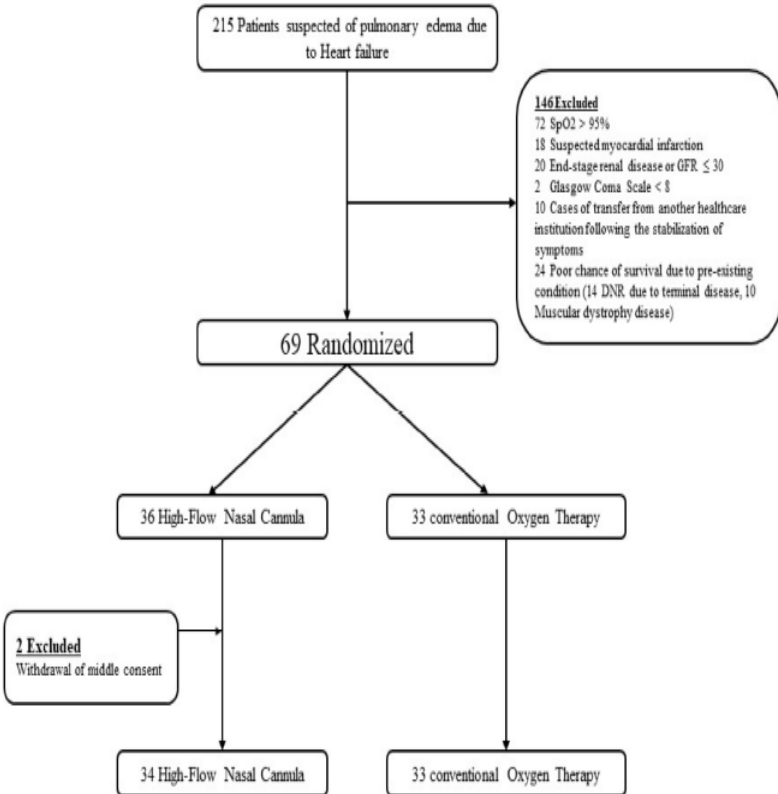
Dong Ryul Ko <sup>1,2,†</sup>, Jinho Beom <sup>1,†</sup>, Hye Sun Lee <sup>3</sup>, Je Sung You <sup>1,\*</sup>, Hyun Soo Chung <sup>1,\*</sup> and Sung Phil Chung <sup>1</sup>

- Incl: AHF s plicním edémem na RTG Excl.:AHF de novo, GCS 8, susp. AIM, CHD, CHRI 4,5
- Primární outcome: změny RR, ABR a laktát clearance
- Sekundární outcome: intubace do 24h, ICU, 28 denní mortalita

In the conventional oxygen therapy group, oxygen therapy was commenced using a conventional nasal cannula at a flow rate of  $>2$  L/min. The flow rate was continuously adjusted within the conventional nasal cannula or face mask to maintain an  $SpO_2$  of  $>93\%$ . In the HFNC group, oxygen therapy was applied using large-bore binasal prongs and a heated humidifier (MR850, Fisher & Paykel Healthcare Limited, Auckland, New Zealand) with a flow rate of 45 L/min and fraction of inspired oxygen ( $FiO_2$ ) of 1.0 at initiation (Optiflow, Fisher and Paykel Healthcare, Auckland, New Zealand). The  $FiO_2$  (from 21% to 100%) and flow rate (up to 60 L/min) in the system were adjusted to maintain an  $SpO_2$  of  $>93\%$ . In the study protocol, all patients had to undergo treatment with the assigned modality

oxygen therapy with either the conventional nasal cannula or HFNC. Early termination criteria included failure to tolerate the therapy (respiratory rate  $> 35$  breaths/min,  $SpO_2 < 90\%$ ,  $PaO_2/FiO_2 < 200$  mmHg, pulse rate  $> 120$  beats/min or a  $> 30\%$  increase above the baseline and a noninvasively measured pre-intervention mean arterial pressure  $> 30\%$  higher than that at the baseline or signs of respiratory distress (e.g., tachypnea, use of accessory muscles of respiration, and abdominal paradox), and clinician judgements (when immediate intervention was required due to worsening of the levels of anxiety, agitation, and consciousness compared to those at the pre-intervention timepoint). If one or





Variable	Total (n = 72)	Conventional O <sub>2</sub> Therapy Group	High-Flow Nasal Cannula Group	p-Value
	Mean ± SD or n (%)	(n = 33, 49.3%)	(n = 34, 50.7%)	
<b>Respiratory rate (bpm)</b>				
Initial	26.78 ± 3.99	25.18 ± 3.51	28.32 ± 3.86	0.001 *
30 min	23.75 ± 3.50	24.85 ± 3.19	22.68 ± 3.49	0.010 *
60 min	22.79 ± 3.72	24.30 ± 3.55	21.32 ± 3.32	0.001 *
<b>SpO<sub>2</sub> (%)</b>				
Initial	91.41 ± 5.89	92.55 ± 3.78	90.31 ± 7.29	0.120
30 min	95.69 ± 3.31	94.15 ± 3.26	97.18 ± 2.65	<0.001 *
60 min	95.94 ± 3.27	94.12 ± 3.25	97.71 ± 2.14	<0.001 *

Table 2. Cont.

Variable	Total (n = 72)	Conventional O <sub>2</sub> Therapy Group	High-Flow Nasal Cannula Group	p-Value
	Mean ± SD or n (%)	(n = 33, 49.3%)	(n = 34, 50.7%)	
<b>Arterial Blood Gas Analysis</b>				
pH, initial	7.36 ± 0.09	7.38 ± 0.07	7.34 ± 0.11	0.063
pH, 30 min	7.39 ± 0.07	7.39 ± 0.06	7.39 ± 0.07	0.788
pH, 60 min	7.40 ± 0.06	7.40 ± 0.06	7.40 ± 0.06	0.595
PaO <sub>2</sub> , initial	70.86 ± 17.32	71.91 ± 19.78	69.84 ± 14.79	0.629
PaO <sub>2</sub> 30 min	87.79 ± 34.46	75.23 ± 19.87	99.98 ± 41.00	0.003 *
PaO <sub>2</sub> 60 min	90.62 ± 36.79	73.25 ± 13.02	107.47 ± 44.15	<0.001 *
PaCO <sub>2</sub> , initial	32.85 ± 10.44	30.89 ± 6.18	34.76 ± 13.17	0.129
PaCO <sub>2</sub> , 30 min	31.97 ± 8.21	32.61 ± 7.13	31.35 ± 9.20	0.532
PaCO <sub>2</sub> , 60 min	31.91 ± 7.22	32.30 ± 6.22	31.54 ± 8.14	0.670
SpO <sub>2</sub> (%), initial	92.69 ± 3.79	92.55 ± 4.01	92.83 ± 3.63	0.765
SpO <sub>2</sub> , 30 min	95.30 ± 3.55	93.86 ± 3.38	96.71 ± 3.17	0.001 *
SpO <sub>2</sub> , 60 min	95.71 ± 3.07	93.99 ± 2.64	97.38 ± 2.51	<0.001 *
<b>Lactate (mmol/L)</b>				
Initial	2.39 ± 2.02	2.01 ± 1.78	2.77 ± 2.20	0.126
60 min	1.82 ± 1.31	1.89 ± 1.55	1.75 ± 1.04	0.666
<b>Echocardiography After ED visit</b>				
Ejection fraction (%)	40.15 ± 13.12	40.36 ± 15.23	39.94 ± 10.92	0.896
Valve disease	18(26.87)	8(24.24)	10(29.41)	0.633
Intubation	2(2.99)	1(3.03)	1(2.94)	0.999
ICU admission	18(26.87)	8(24.24)	10(29.41)	0.633

\* p < 0.05, PaO<sub>2</sub>: partial pressure of oxygen, PaCO<sub>2</sub>: partial pressure of carbon dioxide, SpO<sub>2</sub>: peripheral oxygen saturation.

RESEARCH ARTICLE

**Asymmetrical nasal high flow ventilation improves clearance of CO<sub>2</sub> from the anatomical dead space and increases positive airway pressure**

Stanislav Tatkov,<sup>1</sup> Monique Rees,<sup>1</sup> Anton Gulley,<sup>1</sup> Lotte G. T. van den Heuvel,<sup>1</sup> and Georg Nilius<sup>2,3</sup>  
<sup>1</sup>Fisher & Paykel Healthcare Ltd., Auckland, New Zealand; <sup>2</sup>Evang. Kliniken Essen-Mitte GmbH, Essen, Germany; and  
<sup>3</sup>Universität Witten/Herdecke, Witten, Germany

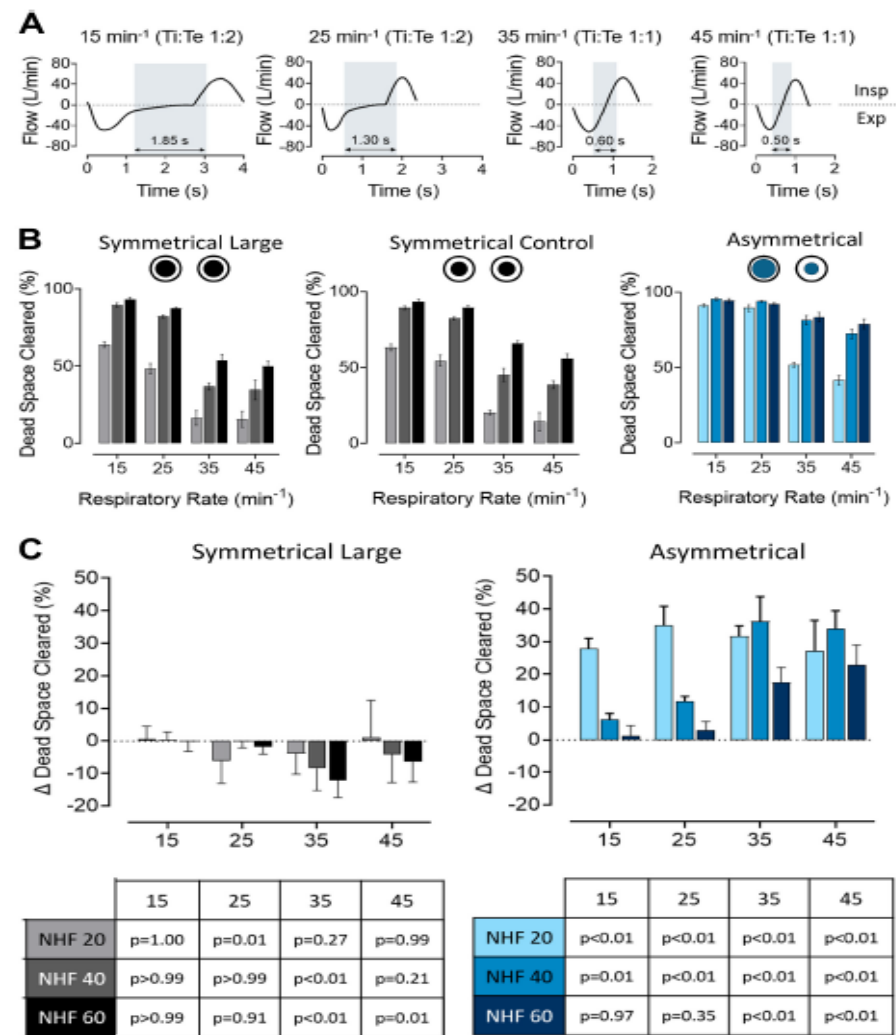
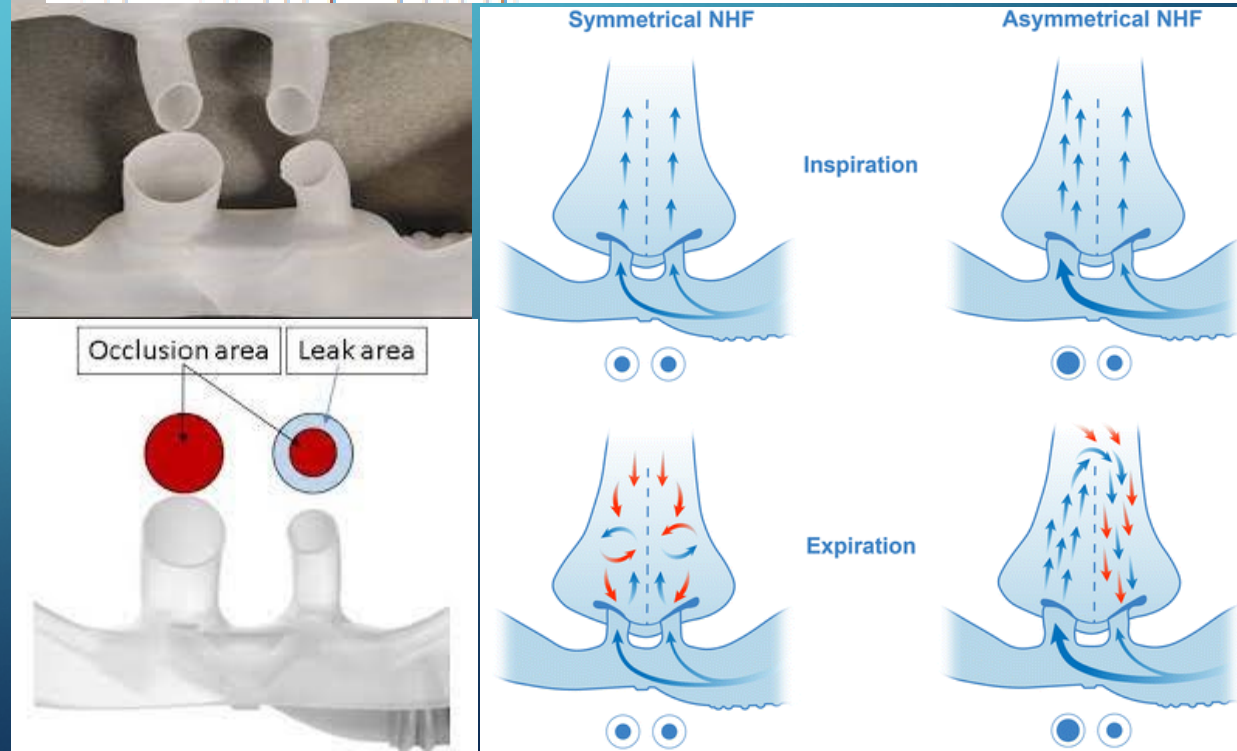
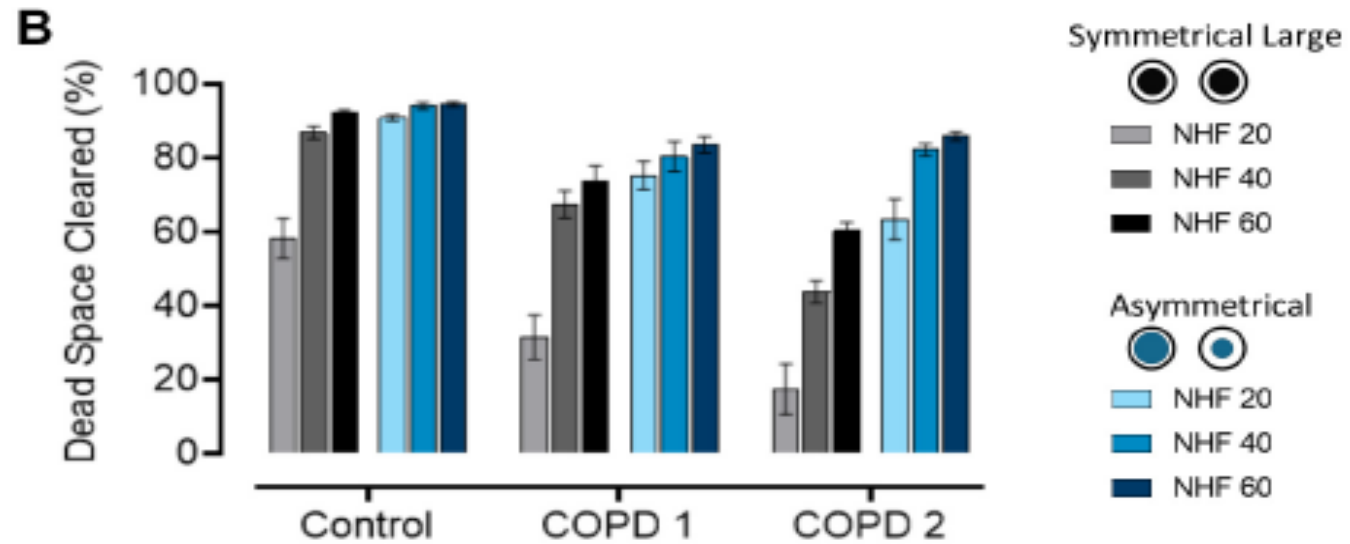
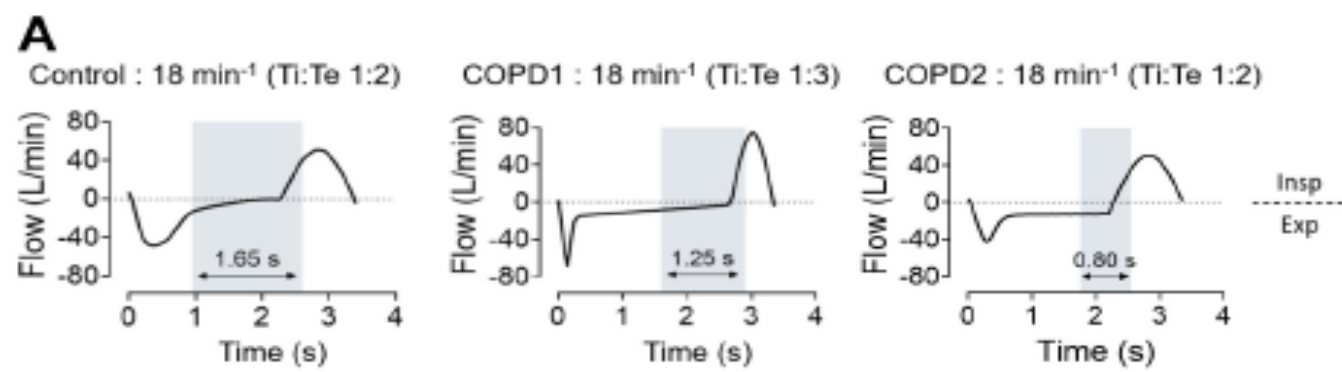


Fig. 2C. Note that increased symmetrical nare occlusion does not improve dead-space clearance, and significantly worsens it at higher RRs ( $P < 0.05$ ). However, a similar increase in nare occlusion with the AI significantly improves dead-space clearance ( $P < 0.05$ ). The dead space cleared at a RR of 15  $\text{min}^{-1}$  and NHF 60 L/min was not significantly different between the SI and the AI [ $-1.40 \pm 6.25\%$  ( $P > 0.05$ )]. Nevertheless, at an RR of 35  $\text{min}^{-1}$  the SI clearance decreased compared with the control, and the AI clearance increased, resulting in a significant difference of  $29.64 \pm 9.96\%$  ( $P < 0.05$ ).



COPD 1 with a prolonged expiration (Ti:Te 1:3) and COPD 2 (Ti:Te 1:2) with intrinsic PEEP, characterized by a higher expiratory flow just before expiration ended. A normal breathing pattern (Ti:Te 1:2) was taken as the control. The time to



	Control ΔMean (Std) %	COPD 1 ΔMean (Std) %	COPD 2 ΔMean (Std) %
NHF 20	32.62 (6.15) p<0.0001	43.59 (9.8) p<0.0001	45.93 (12.21) p<0.0001
NHF 40	7.39 (2.73) p=0.0069	13.09 (7.72) p<0.0001	38.47 (4.66) p<0.0001
NHF 60	2.41 (1.53) p=0.8492	9.63 (6.15) p=0.0001	25.48 (3.38) p<0.0001





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# 25. výročí Oddělení urgentního příjmu FN Motol

26. 9. 2024 • 9:00-17:00 - PROGRAM



**Pořadatel:** Oddělení urgentního příjmu dospělých FN Motol  
**Odborný garant:** prim. MUDr. Jiří Karásek, Ph.D., UOPD FN Motol  
Vzdělávací akce je pořádána podle Stavovského předpisu ČLK č. 16,  
tato akce je hodnocena 6 kredity.

## 25. výročí Oddělení urgentního příjmu FN Motol - přednáškový den

Posluchárna 2. LF UK, přízemí budovy ředitelství, 26.9.2024 9:00-17:00 - PROGRAM

### Workshopy:

- 10:00 – 13:00 Zajištění dýchacích cest (3x5 osob po 60 min.) M. Truelle (Praha)  
10:00 – 13:00 Simulace akutních stavů (3x5 osob po 60 min.) M. Kroftová (Praha)

### Odborný program:

- 9:00 - 9:20 Úvod a historie vzniku Urgentního příjmu FN Motol  
M. Babjuk, J. Nováková, J. Karásek, L. Vacková, J. Zíka

**Urgentní medicína - koncepce oboru a vzdělávací systém - 9:30 - 10:30**  
Předsedající: O. Buda (Praha), M. Pisár (Zlín)

- 9:30 - 9:50 Team urgentního příjmu-co má všechno urgentista umět? (J.Chvojka, Plzeň)  
9:50 - 10:10 Vzdělávací systém UM-potřebujeme reformu? (J.Kočí, Hradec Králové)  
10:10 - 10:30 Koncepce oboru urgentní medicína pro ČR v 21. století (M.Pisár, Zlín)  
10:30 - 11:00 Coffee break

**Nové postupy v urgentní medicíně a aplikace nových informačních technologií - 11:00 - 13:00**  
Předsedající: R. Sýkora (Plzeň), M. Durila (Praha)

- 11:00 - 11:30 Rescue postupy u polytraumat (M. Durila, Praha)  
11:30 - 12:00 High flow oxygenoterapie/bisekvenční defibrilace (J. Karásek, Praha)  
12:00 - 12:30 Telemedicína a nové informační technologie v urgentní medicíně (R. Sýkora, Plzeň)  
13:00 - 14:00 Oběd

**Neobvyklé hromadné neštěstí-střelba na filosofické fakultě - 14:00 - 15:00**  
Předsedající: J. Karásek (Praha), P. Kolouch (Praha)

- 14:00 - 14:20 průběh zásahu na místě z pohledu PČR (P. Pavlovič, Praha)  
14:20 - 14:40 průběh zásahu na místě z pohledu záchranné služby (P. Kolouch, Praha)  
14:40 - 15:00 průběh ošetření na Urgentním příjmu (J. Šípek, Praha)

**Sesterská sekce - 15:00 - 16:00**  
Předsedající: L. Vacková (Praha), J. Karásek (Praha)

- 15:00 - 15:20 Sestra urgentního příjmu: univerzální voják (M. Večeřa, T. Doškářová a kol. - Praha)  
15:20 - 15:40 ECMO program na urgentním příjmu z pohledu sestry (E. Procházková a kol. - Praha)  
15:40 - 16:00 Polytrauma na urgentním příjmu z pohledu sestry (P. Pokorný a kol. - Praha)

**Výzvy v urgentní medicíně- 16:00 - 17:00**  
Předsedající: J. Zíka (Praha), M. Trojánek (Praha)

- 16:00 - 16:20 Geriatrický pacient na UP (J. Zíka, Praha)  
16:20 - 16:40 Paliativní péče v urg. medicíně (L. Kozlíková, Praha)  
16:40 - 17:00 Sepse na UP a ambulantní doporučení ATB terapie (M. Trojánek/M. Štefan, Praha)  
17:00 Závěr programu - možnost exkurze na OUPD

Registraci na workshopy a odborný program, prosím, zašlete na mail [sarka.humlova@fnmotol.cz](mailto:sarka.humlova@fnmotol.cz)

