2. LF UK

FN MO

JAK VYBRAT SPRAVNOU OXYGENOTERAPI

JIŘÍ KARÁSEK

CÍLE OXYGENOTERAPIE

- Udržovat SpO2 92%-98%
- Zajištění dostatečné oxygenace manipulací s koncentrací kyslíku a průtokem směsi
- Zvážit zda je nutná i podpora alv. ventilace a dech. práce
- Vyhnout se toxickému účinku O2 na plicní tkáň (je funkcí koncentrace a délky aplikace)

PATOFYZIOLOGIE

- Respirační insuficience I.typu (parciální) PaO2<9 kPa
- porucha difúze -edém (kardiogenní i ARDS)
- restrikce-fibrózy
- nevzdušná plíce (plicní zkrat)
- atelektáza, pneumonie, těžký edém, PNO
- alveolární hypoventilace
- CNS-svaly-hrudník, ↑ mrtvého prostoru, obstrukce dýchacích cest
- ventilačně – perfúzní nerovnováha

INDIKACE OXYGENOTERAPIE

- **Akutní: :**

These acute indications refer to medical emergencies that require high concentrations of oxygen in all cases. These cases include:

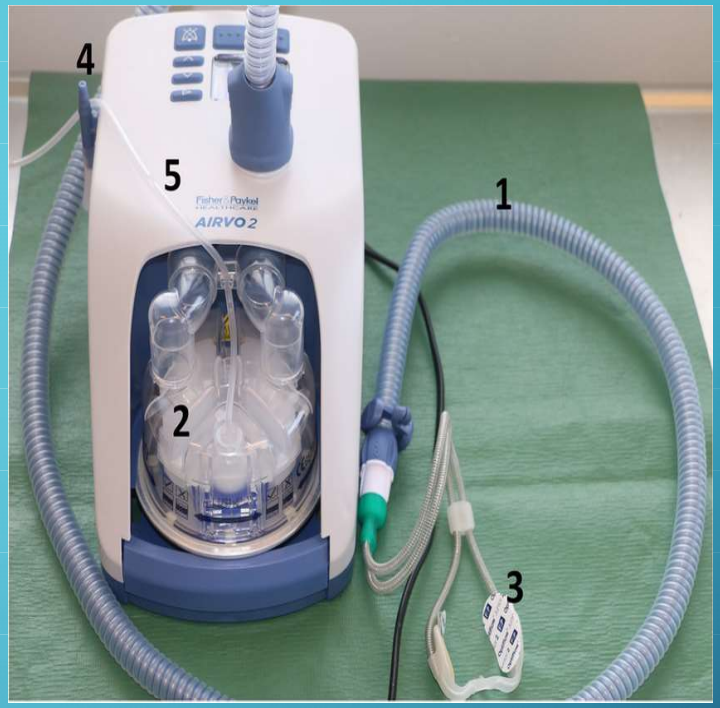
- **Shock**
- **Sepsis** (i.e., a possibly life-threatening condition caused by the body's response to an infection)
- **Major trauma, cardiac arrest and during resuscitation** (to provide adequate arterial oxyhemoglobin saturation)
- **Anaphylaxis** (which is a potentially life-threatening and severe allergic reaction)
- **Cyanide and carbon monoxide (CO) poisonings**
- **TRALI** (transfusion-related acute lung injury: which is a rare but serious syndrome which is characterized by sudden acute respiratory distress following transfusion).

These acute indications refer to medical emergencies that may or may not require oxygen administration. These cases include:

- **Asthma** (It causes repeated attacks of early morning or nighttime coughing, breathlessness, wheezing, and chest tightness).
- **Bronchitis** (It is caused when the airway of the lungs swell and produce mucus in the lungs).
- **Acute heart failure, or heart failure exacerbations**
- **Pulmonary embolism** (It is a sudden blockage in the lung artery).

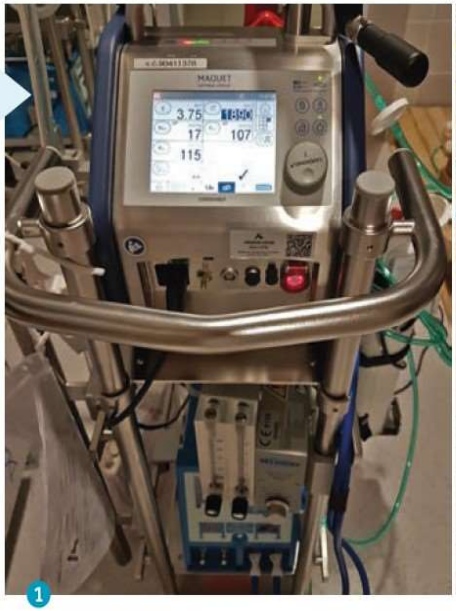
INDIKACE OXYGENOTERAPIE

- **Chronické:**
- **COPD** (chronic obstructive pulmonary disease). It refers to a group of diseases that cause breathing-related problems and airflow blockage. It has no cure but it can be treated
- **Pulmonary fibrosis** (which is caused by scarred tissues present deep in lungs. They become stiff and thick which can make it harder for the person to catch a breath and as result blood does not get properly oxygenated). Its symptoms include SOB, fatigue, clubbing, dry cough, aching muscles, and joints, etc.
- **Cystic fibrosis** (It is an inherited disease in which sticky, thick mucus buildup that can damage many of the organs of the body). Its symptoms include continuous damage to the respiratory system and chronic digestive system problems.
- **Sarcoidosis** (It is a disease characterized by the growth of a tiny group of inflammatory cells in different parts of the body. Most commonly in lymph nodes and lungs. But it can also affect the heart, skin, eyes, and other organs)



Obrázek 1
Přístroj Cardiohelp Maquet

Obrázek 2
Přístroj Cardiohelp Maquet – zadní strana



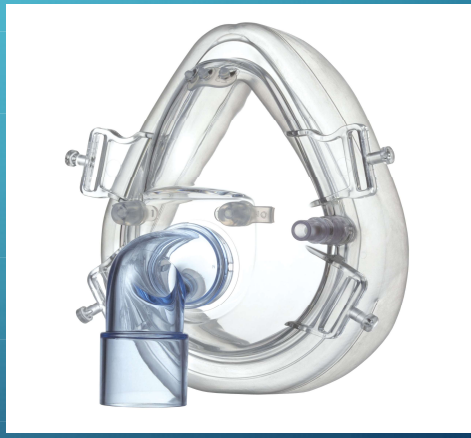
vé brýle, nosní katétr - zvýšení
u O_2 o 1 l/min zvyšuje inspirační
O_2 o 0,04

Otevřená maska – FiO2 do
0,35-0,65

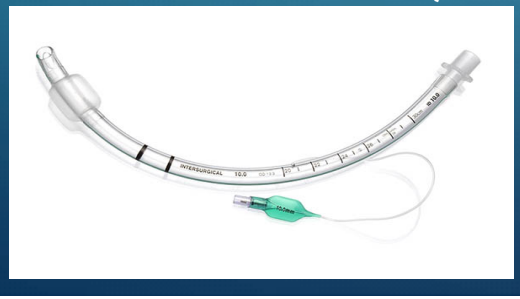
Maska s rezervoárem – FiO2 0,6 až 0,8

ho masky umožňují
t inspirační frakce
,28, 0,31, 0,35 a 0,4

CPAP-není UPV/ventilátor
FiO2, PEEP



NIV-BiPAP
FiO2, PEEP, PS



CPAP VS. NIV

- CPAP:
- možné zvýšení dech. práce
- zhoršení eliminace CO2, nevhodné při hyperkapnii
- horší zvlhčení
- Čistá podpora oxygenace
- Výhoda při tachypnoe

- NIV/BiPAP:
- Riziko asynchronie
- Limitováno tachypnoí
- Eliminace CO2

UPV

Porucha oxygenace a/nebo ventilace (zvrat hypoxémie, resp. acidózy a dech. tísně, prevence a zvrat atelektáz a sval. únavy, umožnění sedace a relaxace

Plicní mechanika (DF, Vt)

Převažuje UPV s poz. přetlakem (objemově/tlakově řízená)

DF Vt/PS, PEEP, FiO2

Je invazivní metoda (komplikace intubace, hemodyn.účinky, toxicita kyslíku, VILI, vyžaduje sedaci)

ECMO

V/VA/VAV

One or more of the following:

1) Hypoxemic respiratory failure (PaO_2/FiO_2 < 80 mm Hg)*, after optimal medical management, including, in the absence of contraindications, a trial of prone positioning.

2) Hypercapnic respiratory failure (pH < 7.25), despite optimal conventional mechanical ventilation (respiratory rate 35 bpm and plateau pressure [P_{plat}] ≤ 30 cm H_2O).

3) Ventilatory support as a bridge to lung transplantation or primary graft dysfunction following lung transplant.

MO

ybrat správnou konfiguraci

vazivní metoda

utnost antikoagulace

mplikace: punkce, krvácení, infekce

Lancet. 2020 Sep 25;396(10257):1071–1078. doi: 10.1016/S0140-6736(20)32008-0

Extracorporeal membrane oxygenation support in COVID-19: an international cohort study of the Extracorporeal Life Support Organization registry

Ryan P Barbaro [a,*,*], Graeme MacLaren [d,*], Philip S Boonstra [b], Theodore J Iwashyna [e,f], Arthur S Slu
Fan [g], Robert H Bartlett [c], Joseph E Tonna [i], Robert Hyslop [j], Jeffrey J Fanning [k], Peter T Rycus [l], Stev
Marc M Anders [m], Cara L Agerstrand [n], Katarzyna Hryniewicz [o], Rodrigo Diaz [p], Roberto Lorusso [q,†], A
[r,s,†], Daniel Brodie [n,†]; Extracorporeal Life Support Organization[‡], for the

Table 3.

Outcomes

	Full cohort (n=1035)	ARDS cohort* (n=779)
Patient status at study completion		
Discharged alive to home or acute rehabilitation centre	311 (30%)	262 (34%)
Discharged alive to long-term acute care centre or unspecified location	101 (10%)	79 (10%)
Discharged to another hospital	176 (17%)	97 (12%)
Remain in the hospital (discharged from ICU)	11 (1%)	10 (1%)
Remain in the ICU	56 (5%)	40 (5%)
In-hospital death	380 (37%)	291 (37%)
Tracheostomy†	444 (44%)	353 (47%)

HFNO

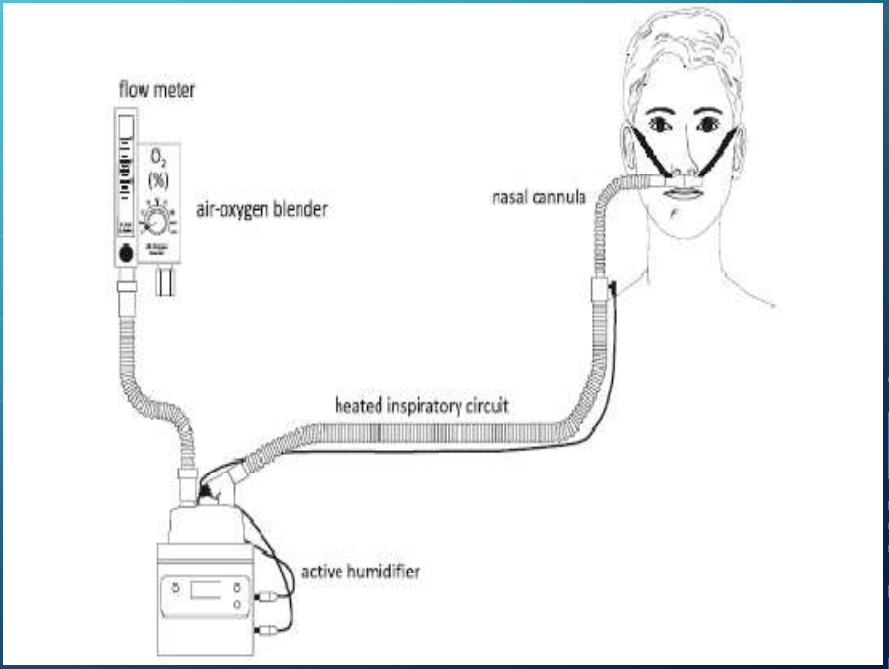
orma dechové podpory (částečně alternativa nebo oplnění NIV)

růtoky 30-40l/min (u dospělých až 60 l/min O2)

vlhčená směs O2+vzduch

peciální nosní kanyla

jižší inspir.odpor/vyšší expirační odpor



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

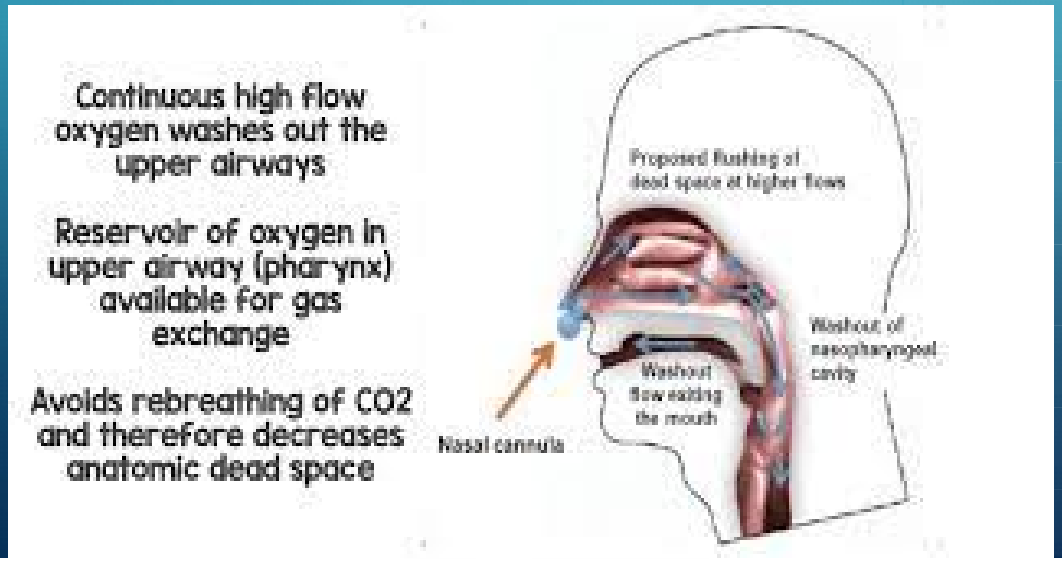
FYZIOLOGIE

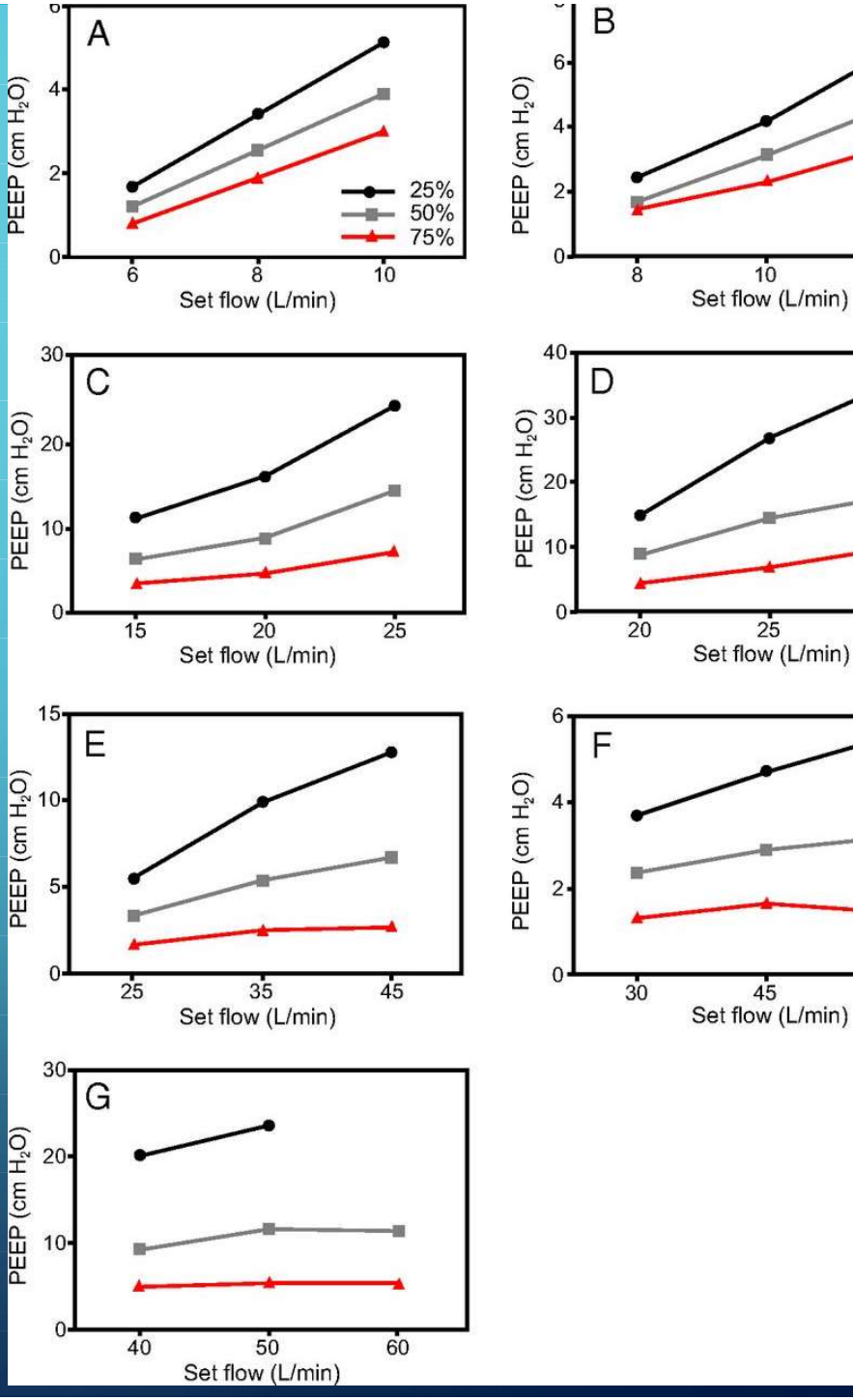
abilní hodnota FiO2 0,2-1,0)

ížení dechového úsilí, „wash out“ mrtvého ostoru, pokles CO2

eneruje přetlak (PEEP)- vysoký průtok převyšuje dpor v DC (40l/min…1,5 60 l/min….3,1 cm H2O)

lhčení a ohřátí-mukociliární transport a viskozita v C





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

actical recommendations. FI_{O_2}, fraction of inspired oxygen; Sa_{O_2}, arterial oxygen saturation; HFNO, high-flow nasal oxygen

	• Prongs should not totally occlude nostrils
	• Start at 30-40 litres min^{-1} and increase to meet the patient's demand
ture	• Set at 37°C
	• Increase the FI_{O_2} until satisfactory Sa_{O_2} is achieved
	• Increase the delivered flow until a reduction in respiratory rate and stable Sa_{O_2} is achieved
servoir	• Place as high as possible above the humidifier
ng	• Continuous monitoring of heart rate, respiratory rate, Sa_{O_2}
esponse	• Gas flow rate and FI_{O_2} adjusted according to the clinical response (expected within 1 h).
eaning	
	• Reduce FI_{O_2} by 5-10% and reassess after 1-2 h. Reduce the flow rate by 5 litres min^{-1} and reassess after 1-2 h.
	• Consider weaning from HFNO with flow rates ≤25 litres min^{-1} and FI_{O_2} <0.40.
ve response	• If there is no improvement after 60-120 min, treatment escalation must be considered.

ventilation.[41] 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 min^{-1} and thoraco-abdominal asynchrony 30 min after HFNO initiation.[8,39] 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) ≥12 on admission and a Pa_{O_2}/FI_{O_2} ratio <13.3 kPa after 6 h of treatment.[32,37]

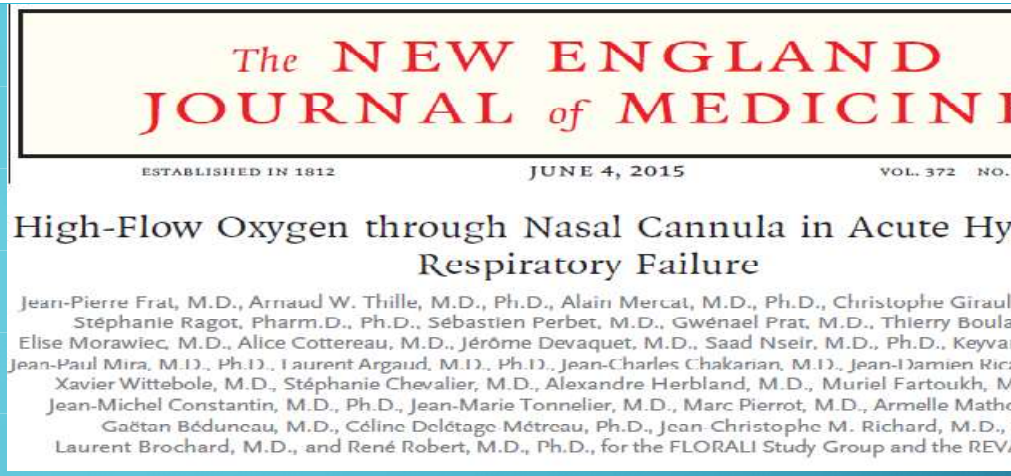
T: HFO vs. Stand.O2 vs. NIV k SpO2 92% a více

: RR nad 25/min, oxygen.index 300 mm Hg a méně při O2 10l/min po 15

Exl.: paCO2 nad 45 mm Hg, astma, CHOPN, plicní edém, vasopresory

márnní outcome: OTI do 28 dnů

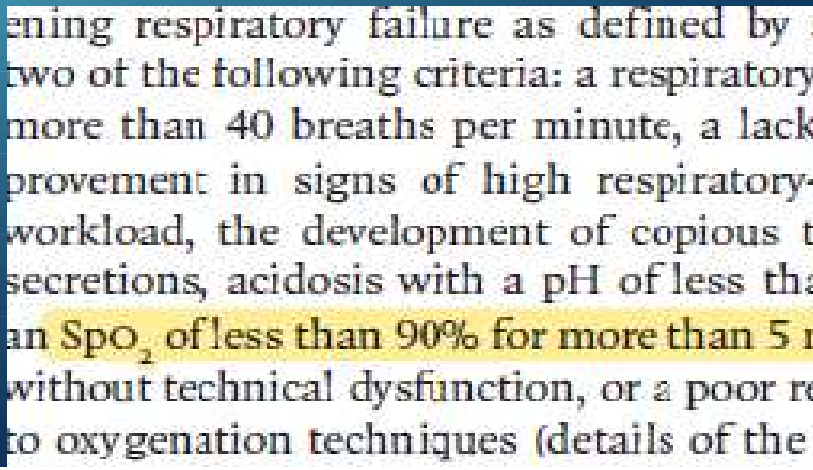
undární outcome: ICU mortalita, 90 denní mortalita, ventilátor free days


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 4, 2015 VOL. 372 NO.

High-Flow Oxygen through Nasal Cannula in Acute Hy
Respiratory Failure

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

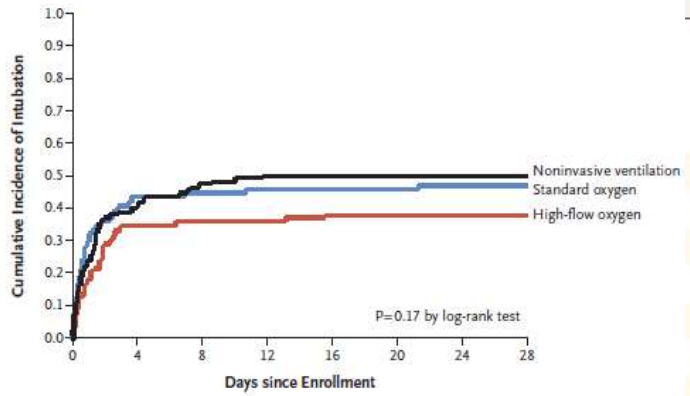

ening respiratory failure as defined by
two of the following criteria: a respiratory
more than 40 breaths per minute, a lack
provement in signs of high respiratory-
workload, the development of copious t
secretions, acidosis with a pH of less tha
an SpO_2 of less than 90% for more than 5
without technical dysfunction, or a poor re
to oxygenation techniques (details of the

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

ics of the Patients at Baseline, According to Study Group.*

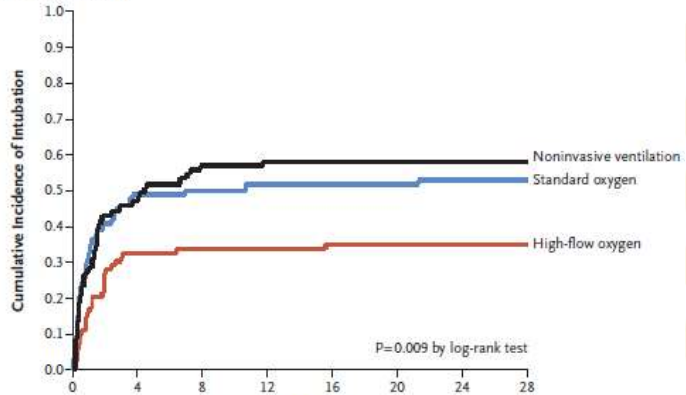
	High-Flow Oxygen (N=106)	Standard Oxygen (N=94)	Noninvasive Ventilation (N=110)
	61±16	59±17	61±17
	75 (71)	63 (67)	74 (67)
	25±5	26±5	26±6
	25±9	24±9	27±9
king no. (%)	34 (32)	36 (38)	40 (36)
piratory failure — no. (%)			
uired pneumonia	71 (67)	57 (61)	69 (63)
d pneumonia	12 (11)	13 (14)	12 (11)
sepsis	4 (4)	5 (5)	7 (6)
owning	3 (3)	1 (1)	2 (2)
ed to immunosuppression	6 (6)	4 (4)	10 (9)
	10 (9)	14 (15)	10 (9)
infiltrates — no. (%)	79 (75)	80 (85)	85 (77)
breaths/min	33±6	32±6	33±7
min	106±21	104±16	106±21
mm Hg			
	127±24	130±22	128±21
	87±17	89±15	86±16
	7.43±0.05	7.44±0.06	7.43±0.06
	85±31	92±32	90±36
	0.62±0.19	0.63±0.17	0.65±0.15
Hg	157±89	161±73	149±72
	36±6	35±5	34±6

A Overall Population



No. at Risk								
High-flow oxygen	106	68	67	67	65	65	65	65
Standard oxygen	94	52	50	49	49	49	48	48
Noninvasive ventilation	110	64	57	53	53	53	53	52

B Patients with a Pao_2:Fio_2 ≤200 mm Hg



No. at Risk								
High-flow oxygen	83	55	54	54	53	53	53	53
Standard oxygen	74	37	35	34	34	34	33	33
Noninvasive ventilation	81	41	34	32	32	32	32	32

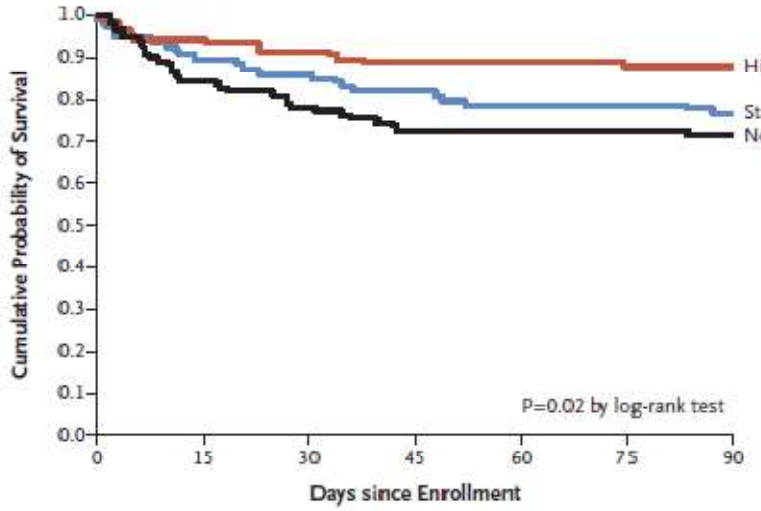
Table 2. Primary and Secondary Outcomes, According to Study Group.*

Outcome	Study Group			P Value‡	Odds Ratio
	High Flow Oxygen (N=106)	Standard Oxygen (N=94)	Noninvasive Ventilation (N=110)		Standard Oxygen / High-Flow O
Intubation at day 28					
Overall population				0.13	1.45 (0.83–
No. of patients	40	44	55		
% of patients (95% CI)	38 (29–47)	47 (37–57)	50 (41–59)		
Patients with Pao_2:Fio_2 ≤200 mm Hg‡					
Unadjusted analysis				0.009	2.07 (1.09–
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
Interval between enrollment and intubation — hr¶					
Overall population				0.27	—
Median	27	15	27		
Interquartile range	8–46	5–39	8–53		
Patients with Pao_2:Fio_2 ≤200 mm Hg				0.32	—
Median	25	17	27		
Interquartile range	11–46	5–41	7–52		
Reason for intubation — no./total no. (%)‖					
Respiratory failure	36/51 (71)	43/58 (74)	49/67 (73)	0.74	—
Circulatory failure	7/51 (14)	5/58 (9)	5/67 (7)	0.45	—
Neurologic failure	8/51 (16)	10/58 (17)	13/67 (19)	0.91	—
Ventilator-free days					
Overall population	24±8	22±10	19±12	0.02	—
Patients with Pao_2:Fio_2 ≤200 mm Hg	24±8	21±10	18±12	<0.001	—

tinued.)

	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
justed analysis				0.047	1.85 (0.84–4.09)	2.55 (1.21–5.35)
o. of patients	12	18	27			
of patients (95% CI)	11 (6–19)	19 (12–28)	25 (17–33)			
ted analysis**	—	—	—	—	2.55 (1.07–6.08)	2.60 (1.20–5.63)
ll population						
nadjusted 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)			
djusted analysis**	—	—	—	—	2.36 (1.18–4.70)	2.33 (1.22–4.47)
ated patients				0.16		
o. of patients/total. no.	12/40	20/44	27/55			
of patients (95% CI)	30 (18–46)	45 (32–60)	49 (36–62)			
death — no./total no. (%)						
ctory shock	6/13 (46)	12/22 (55)	18/31 (58)	0.04		
ctory hypoxemia	5/13 (38)	6/22 (27)	8/31 (26)	0.73		
ac arrest	1/13 (8)	1/22 (5)	3/31 (10)	0.52		
	1/13 (8)	3/22 (14)	2/31 (6)	0.52		

or the reasons for intubation. In our study
invasive ventilation that was administe
patients with severe lung injury could ha
creased the incidence of ventilator-induce
injury by increasing tidal volumes that ex
9 ml per kilogram of predicted body weig



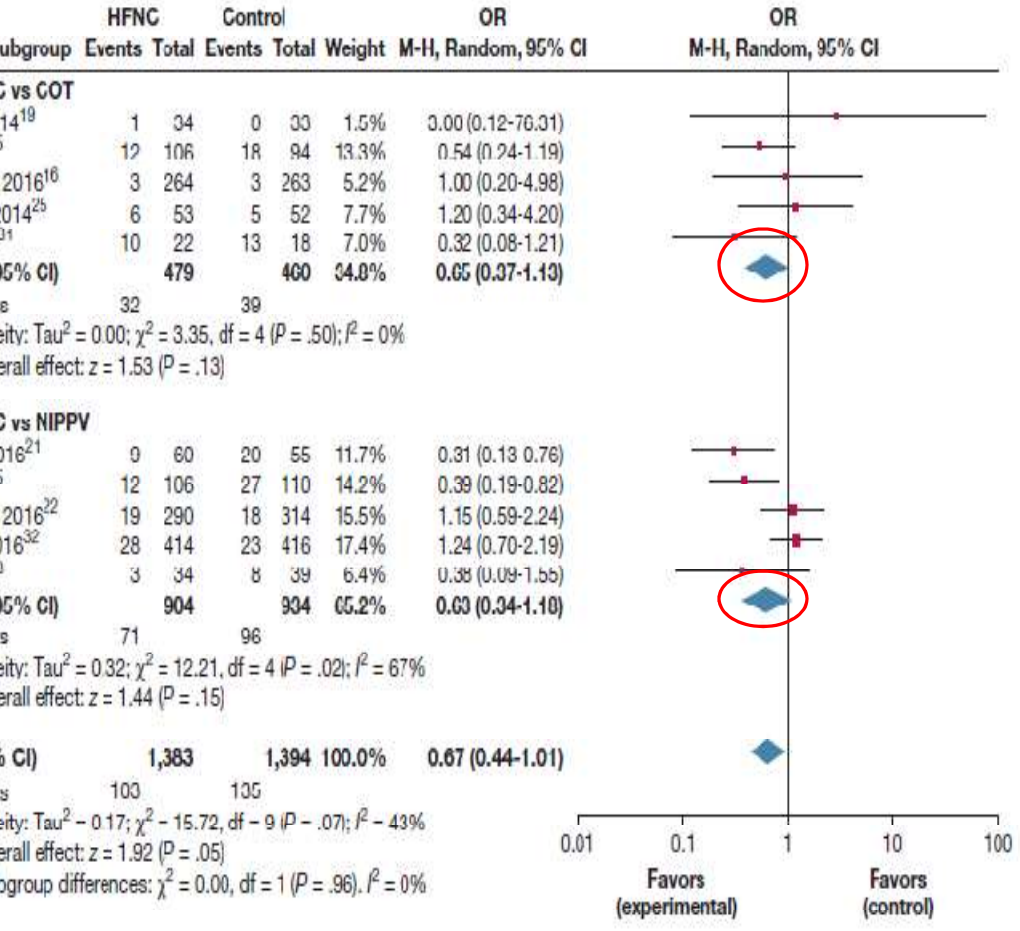
No. at Risk

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

CHEST

High-flow Nasal Cannula Reduce ate of Endotracheal Intubation in Patients With Acute Respiratory e Compared With Conventional n Therapy and Noninvasive ve Pressure Ventilation?

natic Review and Meta-analysis



U mortality. See Figure 4 and 5 legends for expansion of abbreviations.

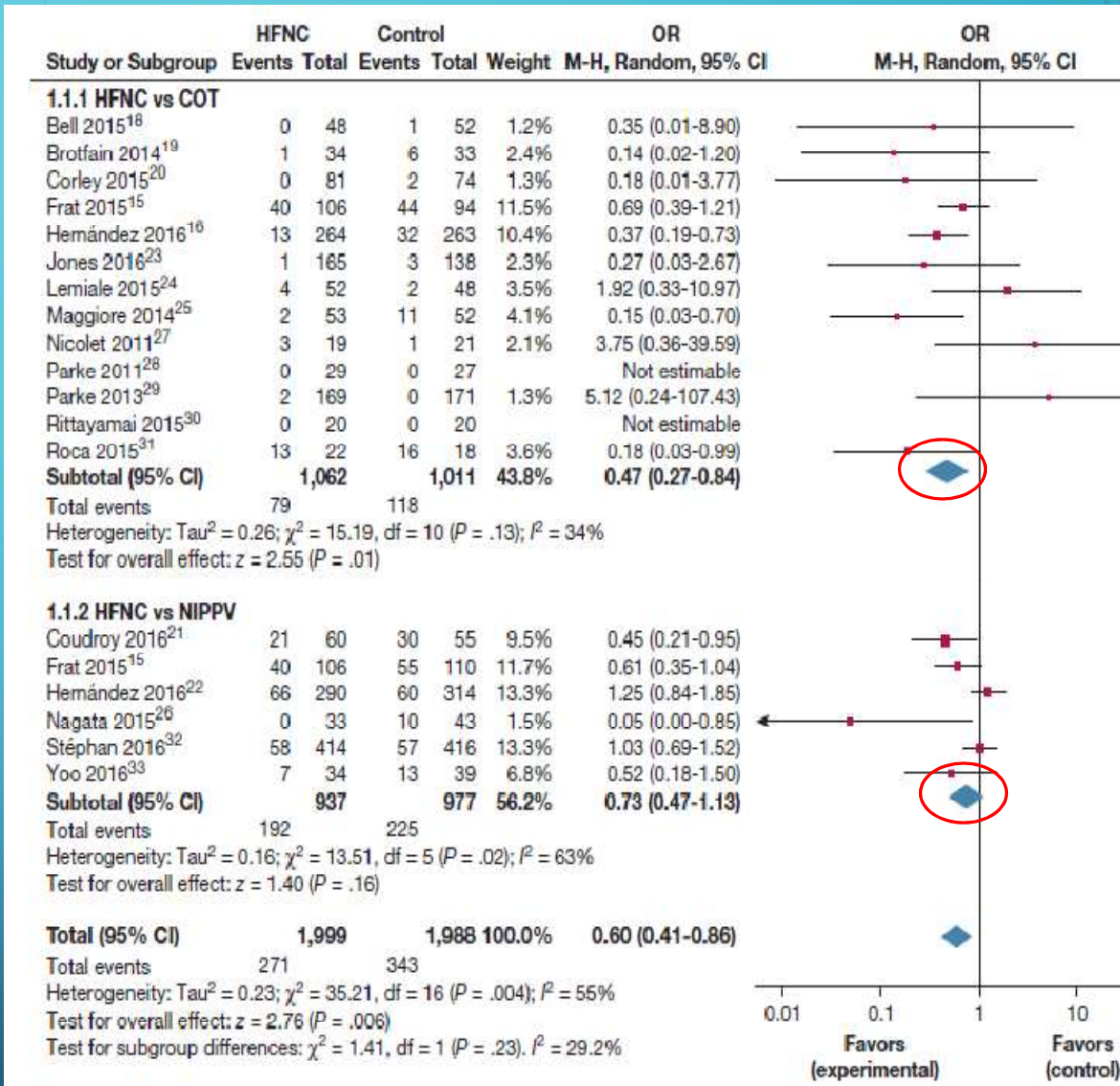


Figure 5 – *Endotracheal intubation. M-H = Mantel-Haenszel. See Figure 4 legend for expansion of other abbreviations.*

# of Postextubation High-Flow Nasal Cannula ventional Oxygen Therapy on Reintubation -Risk Patients

domized Clinical Trial

dez, MD, PhD; Concepción Vaquero, MD; Paloma González, MD; Carles Subira, MD; Fernando Frutos-Vivar, MD; D; Cesar Laborda, MD; Laura Colinas, MD; Rafael Cuena, MD; Rafael Fernández, MD, PhD

or low risk of reintubation: younger than 65 years[4,5]; of heart failure as the primary indication for mechani- lation[4,5]; absence of moderate-to-severe chronic ob- pulmonary disease[15]; Acute Physiology and Chronic valuation (APACHE) II score less than 12 points on day ation[4,5]; body mass index less than 30 (calculated as kilograms divided by height in meters squared)[2,16]; of airway patency problems, including high risk of de- laryngeal edema (eAppendix 2 in Supplement 2)[5]; abil- nage respiratory secretions (adequate cough reflex or ng <2 times within 8 hours before extubation)[5,17]; eaning (eAppendix 3 in Supplement 2)[5]; fewer than pidities (eAppendix 4 in Supplement 2)[5]; and no pro- echanical ventilation, defined as longer than 7 days.[18]

ow oxygen therapy (Optiflow; Fisher & Paykel re) was applied immediately after extubation through nnula. Flow was initially set at 10 L/min and titrated in 5-L/min steps until patients experienced discom- nperature was initially set to 37°C, unless reported too atients, and FIO_2 was regularly adjusted to target al capillary oxygen saturation (SpO_2) greater than 92%. hours, high-flow therapy was stopped and, if neces- ients received conventional oxygen therapy.

ventional oxygen therapy was applied continuously nasal cannula or nonrebreather facemask, and oxy- was adjusted to maintain SpO_2 greater than 92%.

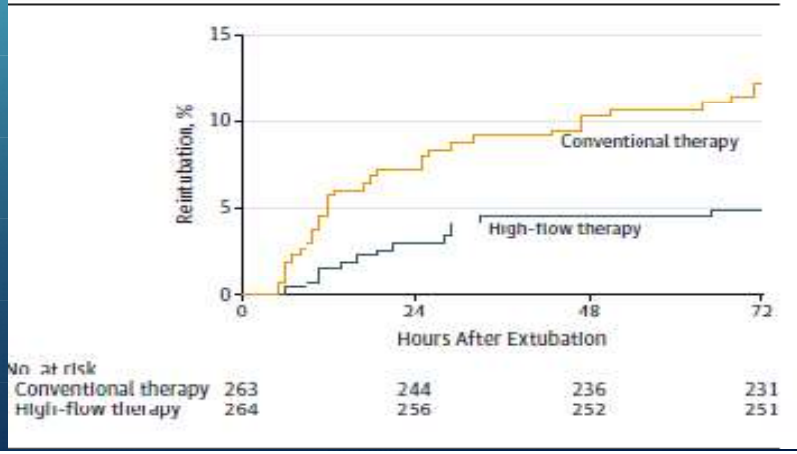
264 included in primary analysis

263 included in primary analysis

Table 2. Primary and Secondary Outcomes

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



AECOPD

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Critical Care

RESEARCH Open Access

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 pCO2, unicentrická studie 2018-2022
- Inclusion:
- ARF u COPD (dle GOLD 2017)
- pH 7,25-7,35, pCO2>50 mm Hg (6.7 kPa)
- Exclusion:
- věk pod 18
- OTI
- PaO2/FiO2<150 mm Hg
- RR>40
- GCS<8
- Kontraindikace metody (nízká sekrece sputa, trauma, hemodyn. Nestabilita)

- NIV: PS 8 cm H2O, PEEP 4 cm H2O k 6-8 ml/kg IBW, SpO2 88%-92% a RR<28 nejméně na 2 hodiny
- HFO: 40 l/min a FiO2 k SpO2 88%-92%
- UPV: rostoucí pCO2 k pH<7.2, pO2 <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, pCO2, PaO2/FiO2) v H 1, 12 a 48, 28-denní mortalita, délka ICU a hospitalizace

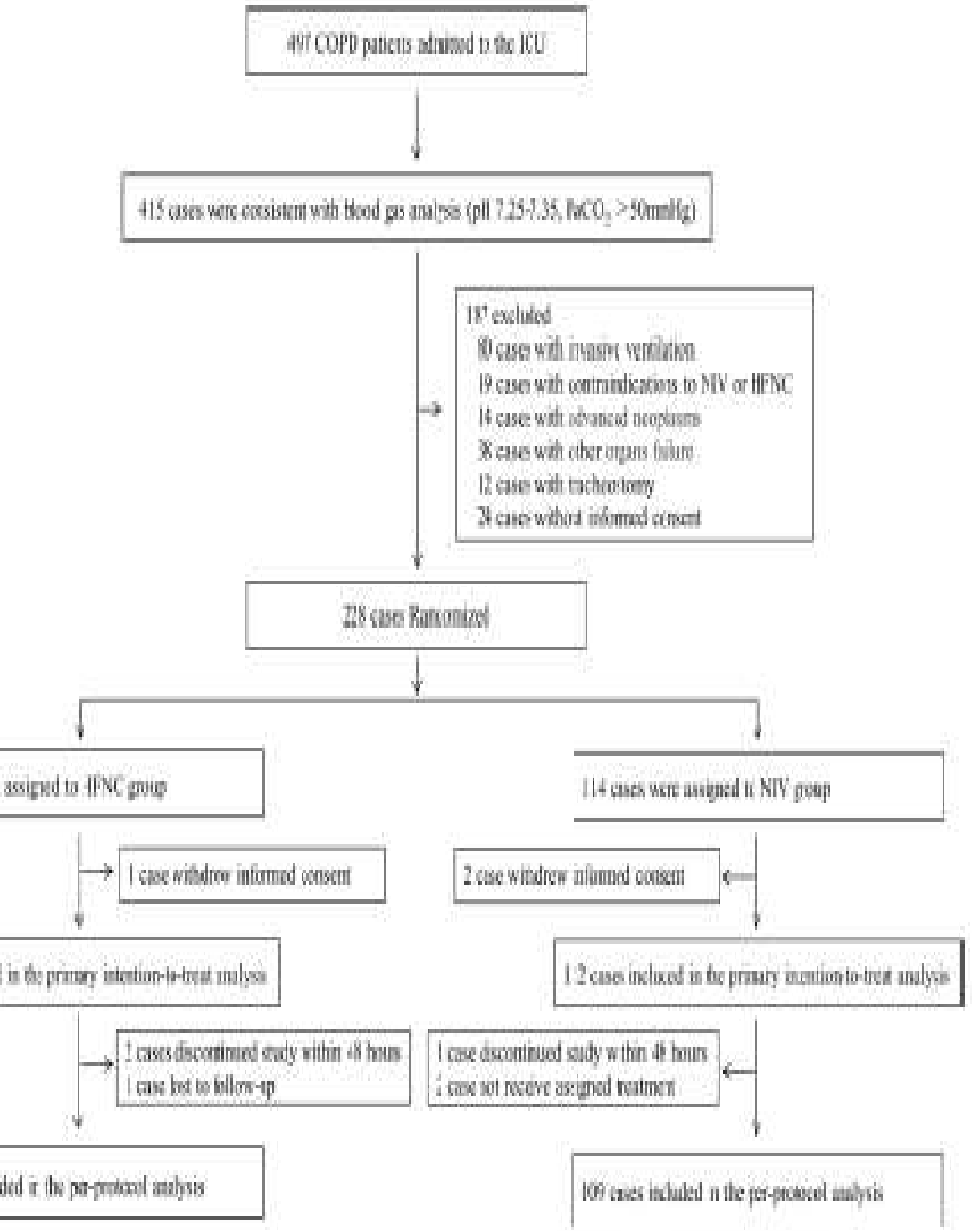

Table 1 Baseline characteristics of selected patients

Characteristics		HFNC (n = 113)	NIV (n = 112)
Male, n (%)	71 (62.8)		62 (55.4
Age, years	73 (65–78)		69 (63–76)
History of COPD, years	8 (6–12)		8 (6–11)
Smoking history, n (%)			
Current	12 (10.6)		7 (6.3)
Former smoker	36 (31.9)		49 (43.8)
Comorbidities, n (%)			
Diabetes mellitus	25 (21.1)		31 (27.7
Coronary artery disease	49 (43.4)		38 (33.9
Chronic liver disease	9 (8.0)		15 (13.4
Chronic kidney disease	24 (21.2)		15 (13.4
Cerebrovascular disease	11 (9.7		19 (17.0
Malignancy	13 (11.5)		16 (14.3
Medication before exacerbation, n (%)			
Inhaled corticosteroids	21 (18.6)		33 (29.5
Beta adrenoceptor agonist	50 (44.2)		44 (39.3
Anticholinergics	23 (20.4)		32 (28.6
Home oxygen therapy, n (%)			
NCO	23 (20.4)		18 (16.1
NIV	9 (8.0)		12 (10.7)
Pulmonary function class, n (%)	35		44
II	14 (40.0)		17 (38.6
III	19 (54.3)		24 (54.5
IV	2 (5.7)		3 (6.8)
Mean length from acute attack to ICU admission, days	5 (3–8)		4 (3–7)
On admission to ICU			
APACHE II score	14 (11–17)		12 (10–16)
SAPS II score	32 (26–37)		29 (26–34)
Heart rate, beats/min	92 (85–101)		96 (85–103)
Respiratory frequency, /min	28 (25–30)		29 (26–32)
Mean arterial pressure, mmHg	88 (82–93)		84 (77–93)
Arterial pH	731 (7.29–7.33)		7.30 (7.28–7.32)
$PaCO_2$, mmHg	63 (59–68)		61 (58–65)
PaO_2/FIO_2, mmHg	175 (167–199)		184 (167–202)

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

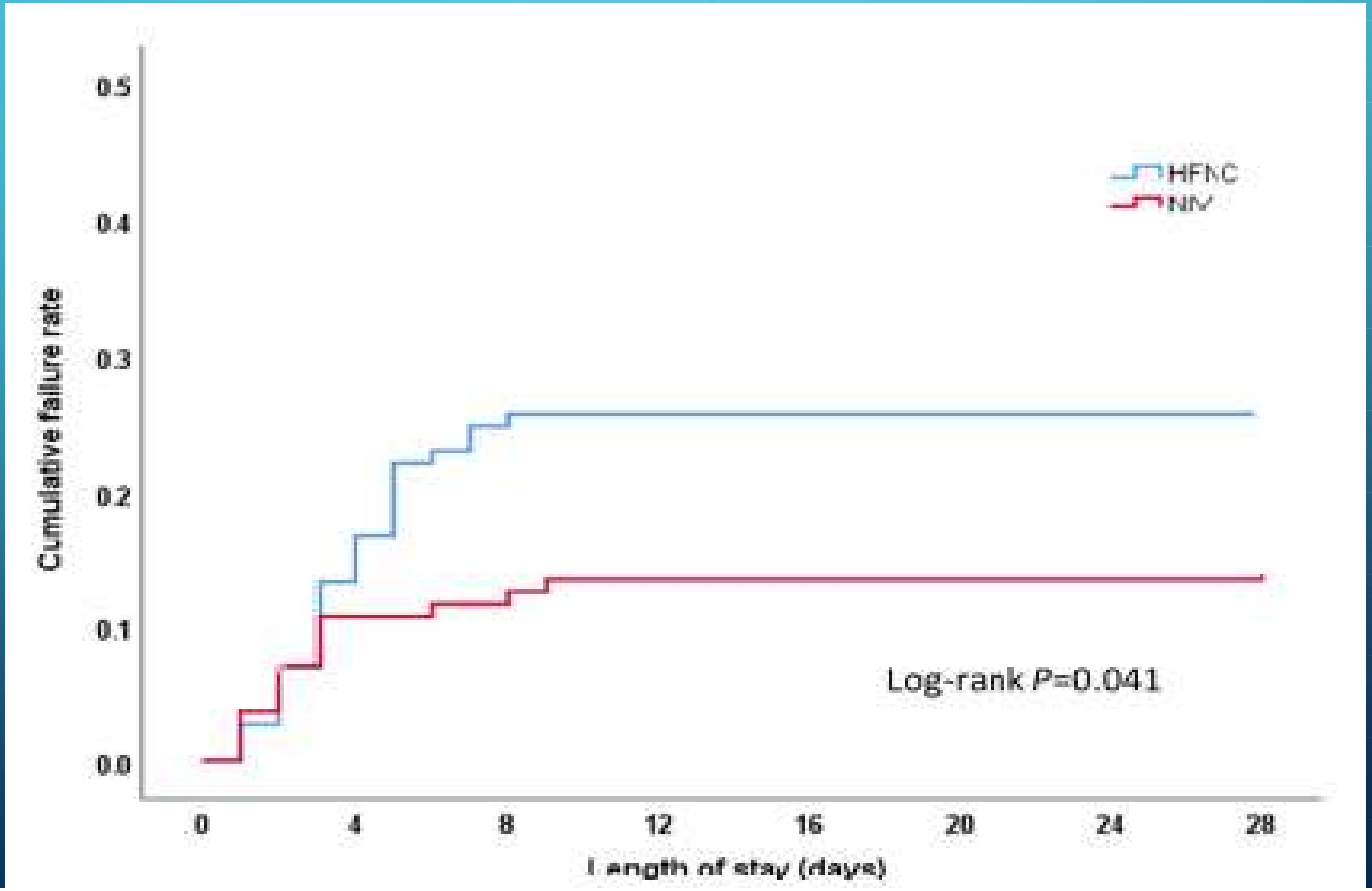

Table 3 Secondary endpoints in the HFNC and NIV groups

	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 PCO2 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_2 at 30 and 60 minutes (improved in HFNC group) Significant difference in ABG parameters (PaO_2 and SpO_2) 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

high-flow nasal cannula, COT, conventional oxygen therapy; NIPPV, non-invasive positive-pressure ventilation; ABG, arterial blood g
oxygen saturation; PaO_2, partial pressure of oxygen; n, number of participants; ACPE, acute cardiogenic pulmonary edema

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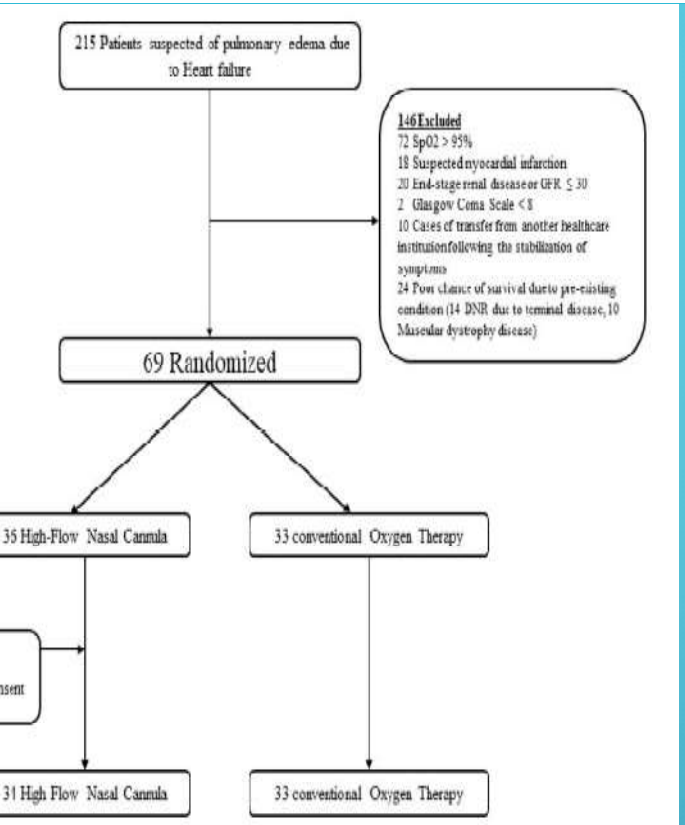
fits of High-Flow Nasal Cannula Therapy for e Pulmonary Edema in Patients with Heart re in the Emergency Department: A Prospective i-Center Randomized Controlled Trial

l Ko [1,2,†], Jinho Beom [1,†], Hye Sun Lee [3], Je Sung You [1,*], Hyun Soo Chung [1,*]
Phil Chung [1]

- Incl: AHF s plicním edémem na RTG Excl.:AHF d 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

the conventional oxygen therapy group, oxygen therapy was commenced using a conventional cannula at a flow rate of >2 L/min. The flow rate was continuously adjusted within the ntional nasal cannula or face mask to maintain an SpO_2 of >93%. In the HFNC group, oxygen y was applied using large-bore binasal prongs and a heated humidifier (MR850, Fisher & Paykel ncare Limited, Auckland, New Zealand) with a flow rate of 45 L/min and fraction of inspired n (FiO_2) of 1.0 at initiation (Optiflow, Fisher and Paykel Healthcare, Auckland, New Zealand). O_2 (from 21% to 100%) and flow rate (up to 60 L/min) in the system were adjusted to maintain an of >93%. In the study protocol, all patients had to undergo treatment with the assigned modality

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



Total (n = 72)	Conventional O_2 Therapy Group	High-Flow Nasal Cannula Group	p-Value
Mean ± SD or n (%)	(n = 33, 49.3%)	(n = 34, 50.7%)	
Respiratory rate (bpm)			
26.78 ± 3.99	25.18 ± 3.51	28.32 ± 3.86	0.001 *
23.75 ± 3.50	24.85 ± 3.19	22.68 ± 3.49	0.010 *
22.79 ± 3.72	24.30 ± 3.55	21.32 ± 3.32	0.001 *
SpO_2 (%)			
91.41 ± 5.89	92.55 ± 3.78	90.31 ± 7.29	0.120
95.69 ± 3.31	94.15 ± 3.26	97.18 ± 2.65	<0.001 *
95.94 ± 3.27	94.12 ± 3.25	97.71 ± 2.14	<0.001 *

Table 2. *Cont.*

Variable	Total (n = 72)	Conventional O_2 Therapy Group	High-Flow Nasal Cannula Group	p-Value
	Mean ± SD or n (%)	(n = 33, 49.3%)	(n = 34, 50.7%)	
Arterial Blood Gas Analysis				
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_2, initial	70.86 ± 17.32	71.91 ± 19.78	69.84 ± 14.79	0.629
PaO_2 30 min	87.79 ± 34.46	75.23 ± 19.87	99.98 ± 41.00	0.003 *
PaO_2 60 min	90.62 ± 36.79	73.25 ± 13.02	107.47 ± 44.15	<0.001 *
$PaCO_2$, initial	32.85 ± 10.44	30.89 ± 6.18	34.76 ± 13.17	0.129
$PaCO_2$, 30 min	31.97 ± 8.21	32.61 ± 7.13	31.35 ± 9.20	0.532
$PaCO_2$, 60 min	31.91 ± 7.22	32.30 ± 6.22	31.54 ± 8.14	0.670
SpO_2 (%), initial	92.69 ± 3.79	92.55 ± 4.01	92.83 ± 3.63	0.765
SpO_2, 30 min	95.30 ± 3.55	93.86 ± 3.38	96.71 ± 3.17	0.001 *
SpO_2, 60 min	95.71 ± 3.07	93.99 ± 2.64	97.38 ± 2.51	<0.001 *
Lactate (mmol/L)				
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
Echocardiography After ED visit				
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_2: partial pressure of oxygen, $PaCO_2$: partial pressure of carbon dioxide, SpO_2: peripheral oxygen saturation.

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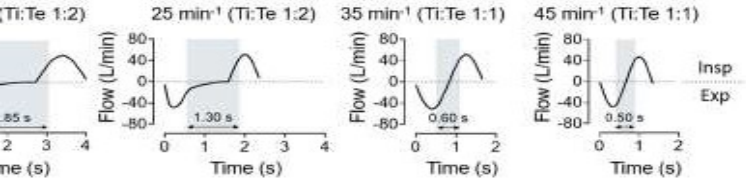
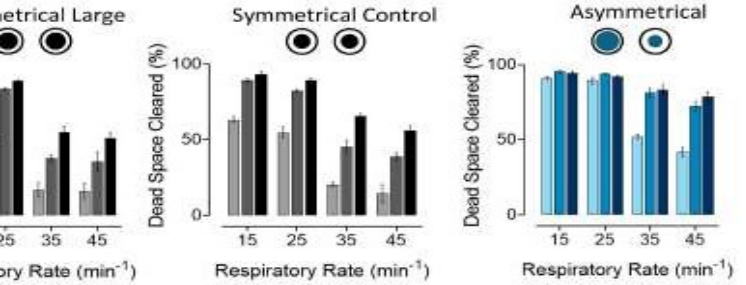
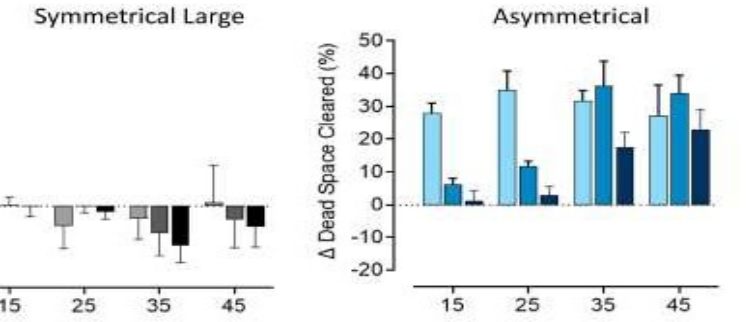
H ARTICLE

rical nasal high flow ventilation improves clearance of CO_2 from the al dead space and increases positive airway pressure

av Tatkov,[1] Monique Rees,[1] Anton Gulley,[1] Lotte G. T. van den Heuij,[1] and Georg Nilius[2,3]
Paykel Healthcare Ltd., Auckland, New Zealand; [2]Evang. Kliniken Essen-Mitte GmbH, Essen, Germany; and
ät Witten/Herdecke, Witten, Germany



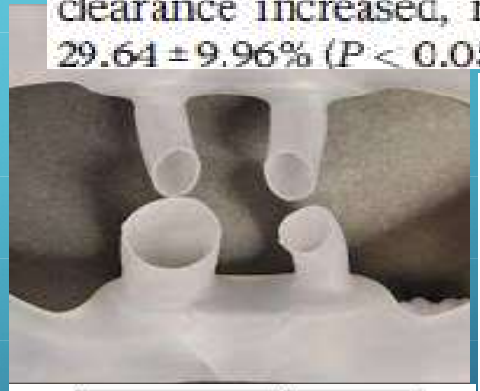


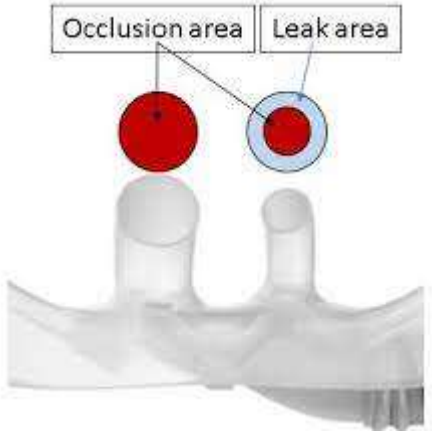


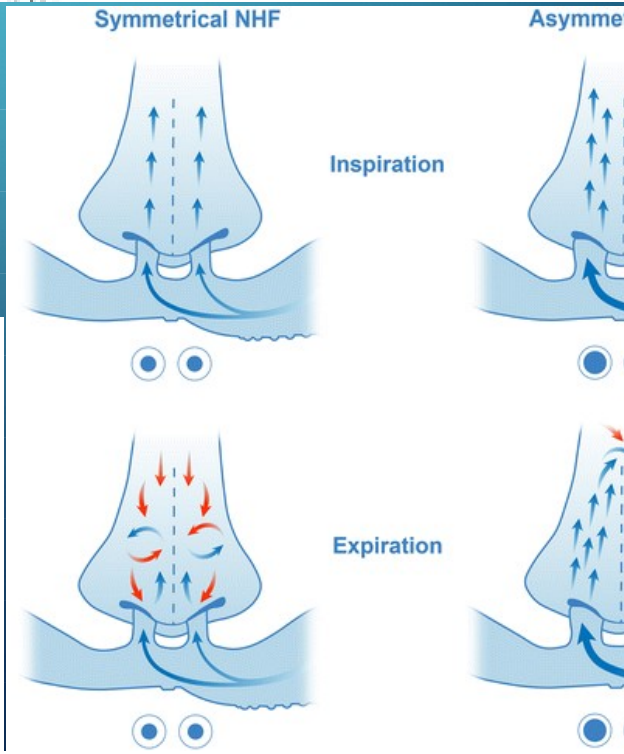
	25	35	45
.00	p=0.01	p=0.27	p=0.99
.99	p>0.99	p<0.01	p=0.21
.99	p=0.91	p<0.01	p=0.01

	15	25	35	45
NHF 20	p<0.01	p<0.01	p<0.01	p<0.01
NHF 40	p=0.01	p<0.01	p<0.01	p<0.01
NHF 60	p=0.97	p=0.35	p<0.01	p<0.01

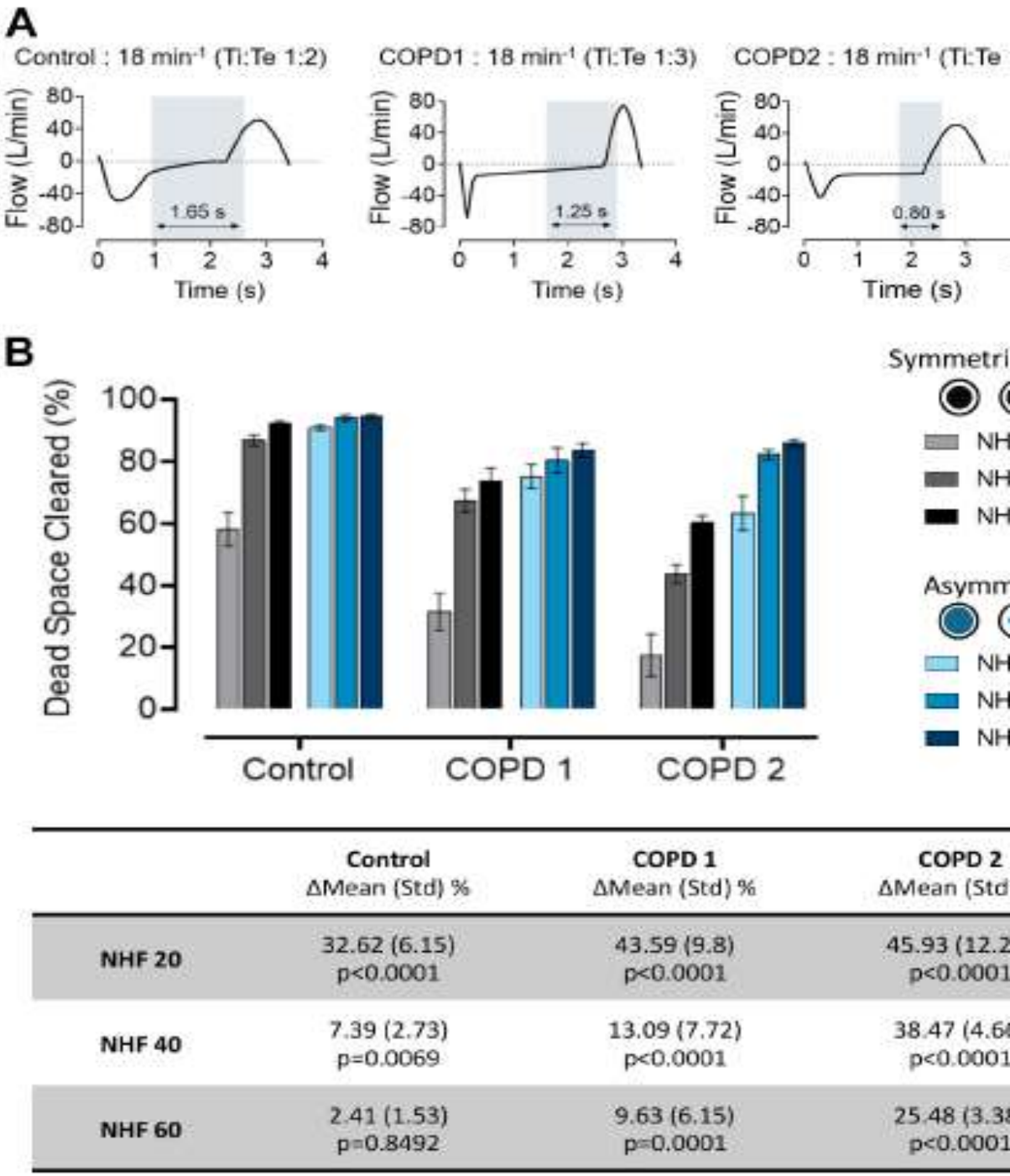
Fig. 2C. Note that increased symmetrical nare occ
does not improve dead-space clearance, and signif
worsens it at higher RRs ($P < 0.05$). However, a
increase in nare occlusion with the AI signif
improves dead-space clearance ($P < 0.05$). The dead
cleared at a RR of 15 min^{-1} and NHF 60 L/min w
significantly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







1 with a prolonged expiration (Ti:Te 1:3) and COPD 2
1:2) with intrinsic PEEP, characterized by a higher ex-
ry flow just before expiration ended. A normal breath-
ttern (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 (12.2 p<0.0001
NHF 40	7.39 (2.73) p=0.0069	13.09 (7.72) p<0.0001	38.47 (4.64 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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