CREUF 2023

30 & 31 Mars 2023
MULHOUSE • ALSACE

# Modalités d'oxygénation

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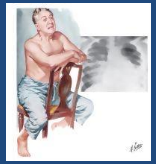
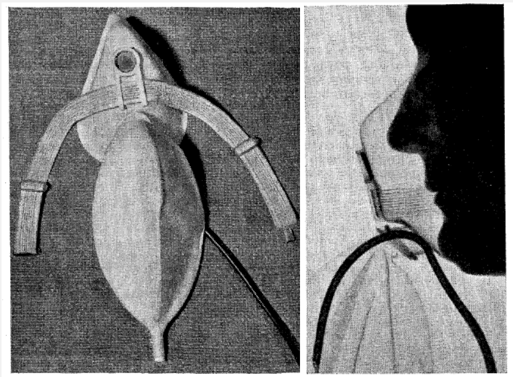
*Université de médecine de Poitiers*

# Liens d’intérêts

- Fisher & Paykel
- SOS oxygène

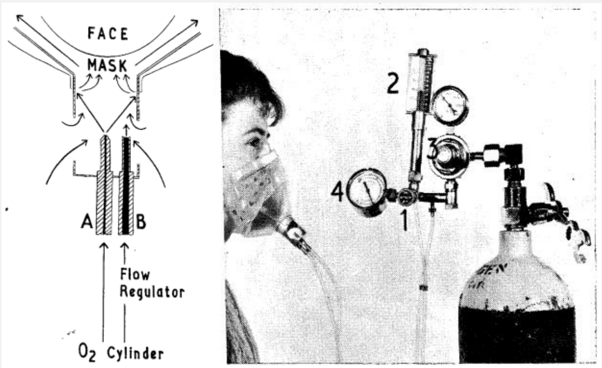
# Acute **hypoxemic** respiratory failure



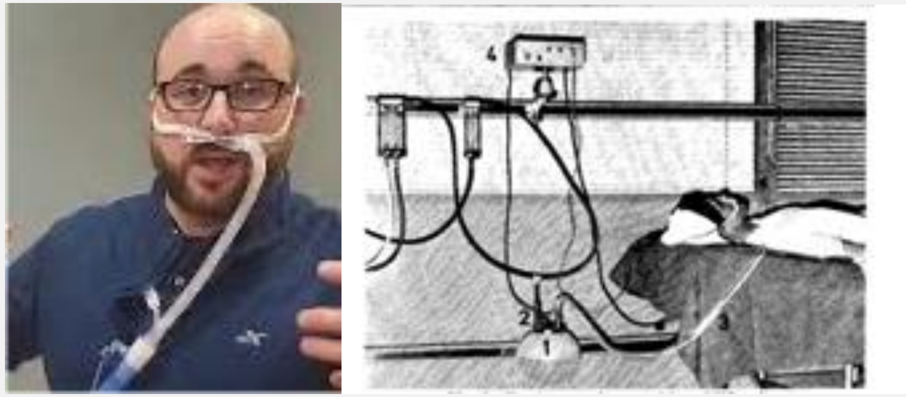


*Kent B. The Lancet 1946 ; 2 :380-381*

*Brochard et al. N Engl J Med 1995;333:817-22*




*E.J.M. Campbell The Lancet 1960 ; 2 :12-14*

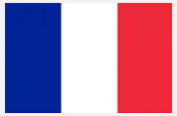



*Lomholt N. Lancet 1968*

# Non-invasive ventilation versus high-flow nasal cannula oxygen therapy with apnoeic oxygenation for preoxygenation before intubation of patients with acute hypoxaemic respiratory failure: a randomised, multicentre, open-label trial

*Jean-Pierre Frat, Jean-Damien Ricard, Jean-Pierre Quenot, Nicolas Pichon, Alexandre Demoule, Jean-Marie Forel, Jean-Paul Mira, Rémi Coudroy, Guillaume Berquier, Benoit Voisin, Gwenhaël Colin, Bertrand Pons, Pierre Eric Danin, Jérome Devaquet, Gwenael Prat, Raphaël Clere-Jehl, Franck Petitpas, Emmanuel Vivier, Keyvan Razazi, Mai-Anh Nay, Vincent Souday, Jean Dellamonica, Laurent Argaud, Stephan Ehrmann, Aude Gibelin, Christophe Girault, Pascal Andreu, Philippe Vignon, Laurence Dangers, Stéphanie Ragot, Arnaud W Thille, for the FLORALI-2 study group* and REVA network*

*Lancet RM 2019; 7: 303-12*



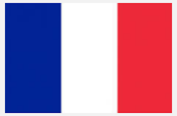
| | Non-invasive ventilation (n=142) | | High-flow nasal cannula oxygen therapy (n=171) |
|---|---|---|---|
| Oxygen device the last hour before inclusion | .. | | .. |
| Standard oxygen | 63 (44%) | **43%** | 73 (43%) |
| High-flow nasal cannula oxygen therapy | 48 (34%) | **34%** | 57 (33%) |
| Non-invasive ventilation | 31 (22%) | 23% | 41 (24%) |

RESEARCH **Open Access**

# Benefits and risks of noninvasive oxygenation strategy in COVID-19: a multicenter, prospective cohort study (COVID-ICU) in 137 hospitals

COVID-ICU group, for the REVA network, COVID-ICU investigators*

*Critical Care. 2021; 25:421*



Covid-ICU (n=1491)

Std $O_2$ : 51%
HFNC: **38%**
NIV : 11%

JAMA | Original Investigation

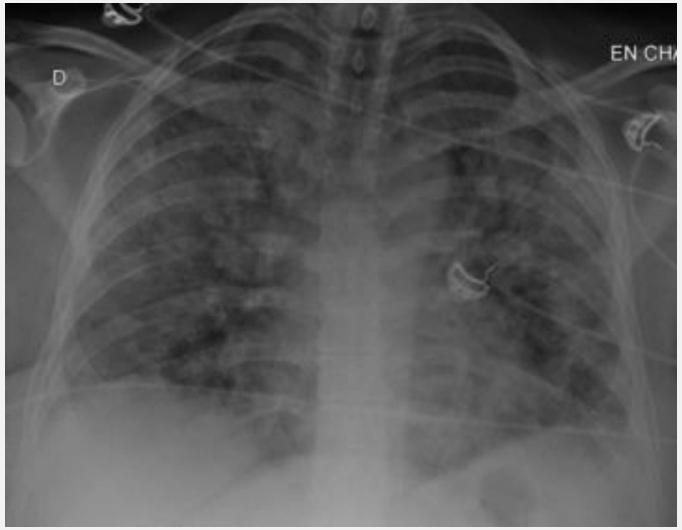
# Effect of Helmet Noninvasive Ventilation vs Usual Respiratory Support on Mortality Among Patients With Acute Hypoxemic Respiratory Failure Due to COVID-19
## The HELMET-COVID Randomized Clinical Trial

Yaseen M. Arabi, MD; Sara Aldekhyl, MD; Saad Al Qahtani, MD; Hasan M. Al-Dorzi, MD; Sheryl Ann Abdukahil, BSN; Mohammed Khulaif Al Harbi, MD; Eman Al Qasim, MSN; Ayman Kharaba, MD; Talal Albrahim, MD; Mohammed S. Alshahrani, MD; Abdulrahman A. Al-Fares, MD; Ali Al Bshabshe, MD; Ahmed Mady, MD; Zainab Al Duhailib, MBBS; Haifa Algethamy, MD; Jesna Jose, PhD; Mohammed Al Mutairi, BS; Omar Al Zumai, BS; Hussain Al Haji, MSc; Ahmed Alaqeily, BS; Zohair Al Aseri, MD; Awad Al-Omari, MD; Abdulaziz Al-Dawood, MD; Haytham Tlayjeh, MD; for the Saudi Critical Care Trials Group

*JAMA 2022; 368: 1063-72*

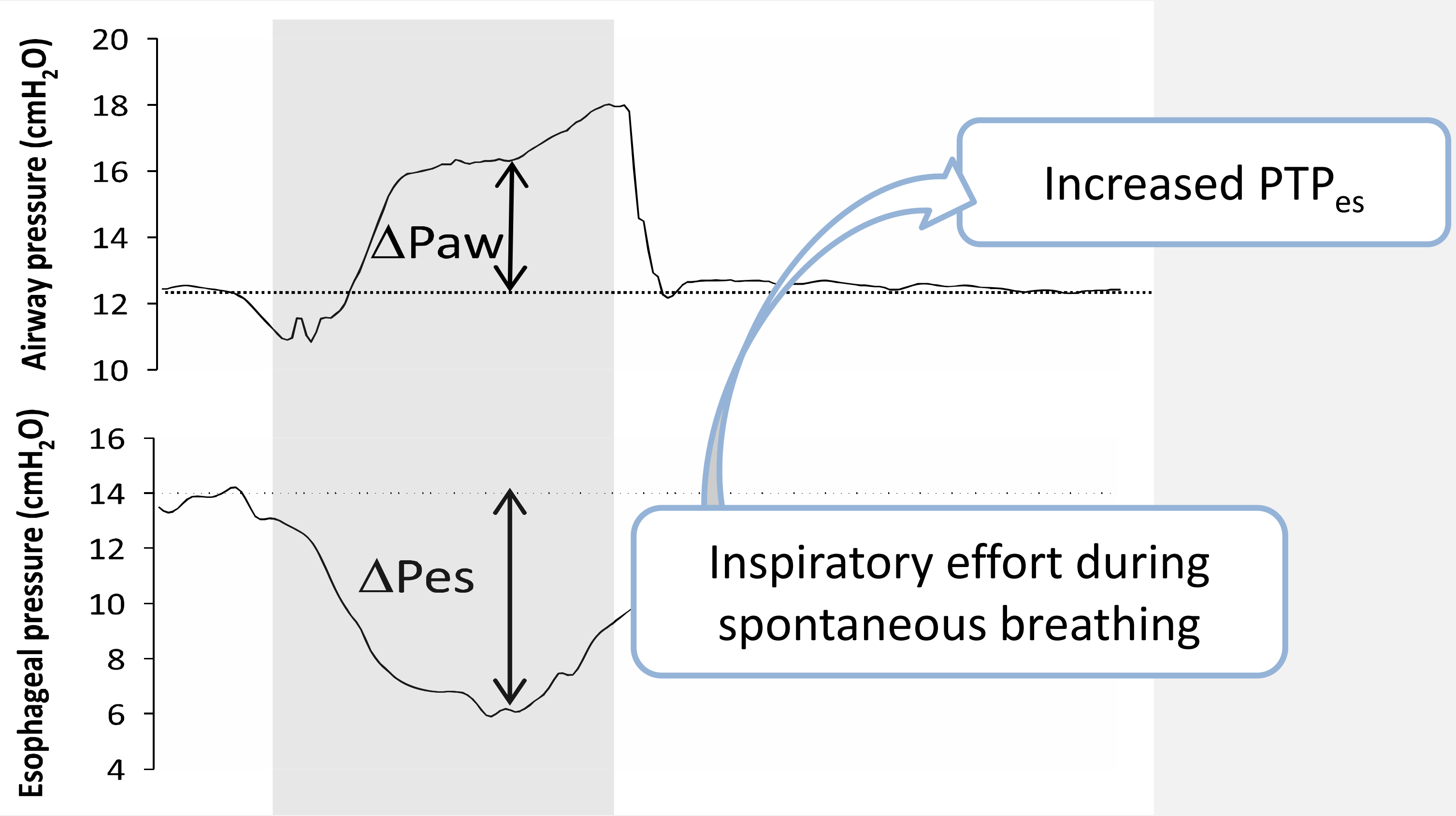
| | (n=161) | |
|---|---|---|
| Helmet or mask **NIV** | | |
| No. of patients | 111 (68.9) | **71%** |
| Duration of use, median (IQR), h | 14.0 (0-27) | |
| High-flow nasal oxygen | | |
| No. of patients | 122 (75.8) | 8% |
| Duration of use, median (IQR), h | 23 (4-39) | |
| Standard oxygen | | |
| No. of patients | 33 (20.5) | 21% |
| Duration of use, median (IQR), h | 0 (0-0) | |

# Inspiratory effort

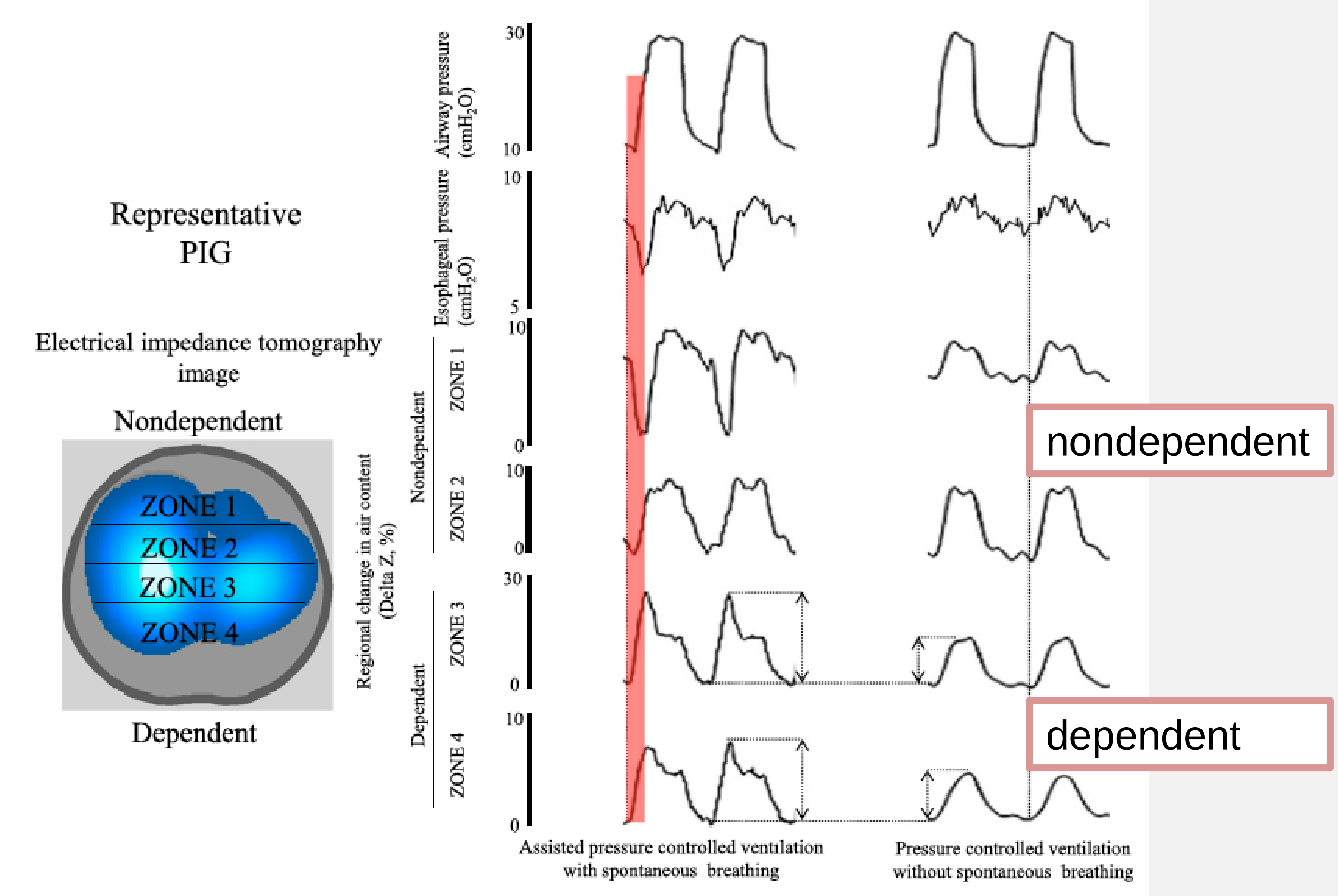



*The most frequent cause is* ***pneumonia***

*~~Cardiogenic pulmonary edema~~*
*~~exacerbation of chronic lung disease~~*



# “Pendelluft” during spontaneous breathing



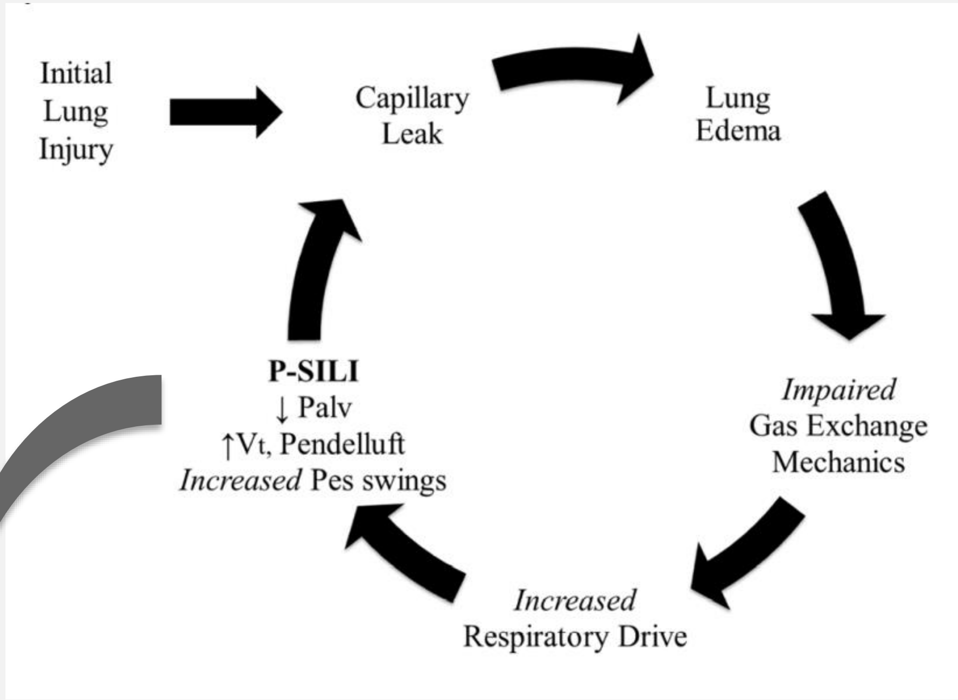

***First**, in the initial stages of the breath, spontaneous efforts caused **inflation of dependent** lung regions (red in zones 3 and 4), which was greater than with controlled breaths.*

***Second**, the early inflation in the dependent region was accompanied by concomitant (transient) **deflation of nondependent** region (red in zone 1)*

*indicating movement of gas from nondependent to dependent lung regions.*

*Yoshida et al. Am J Respir Crit Care Med 2013: 1420–1427*

# Patient Self-Inflicted Lung Injury: P-SILI concept
## *spontaneous breathing*




Worsening
pre-existing lung injury

*Brochard et al. Am J Respir Crit Care Med. 2017 15;195:438-442*

| Standard oxygen | Noninvasive ventilation | CPAP | High-flow nasal oxygen |
|---|---|---|---|

**Patient benefits**

- Blood gas improvement
- To unload inspiratory muscles
- Comfort

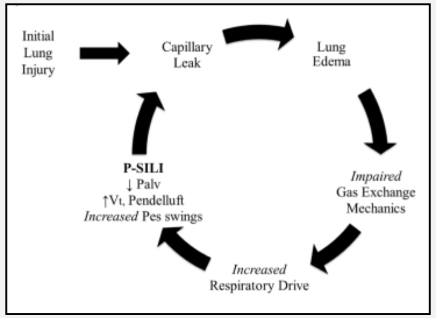
**To avoid intubation**

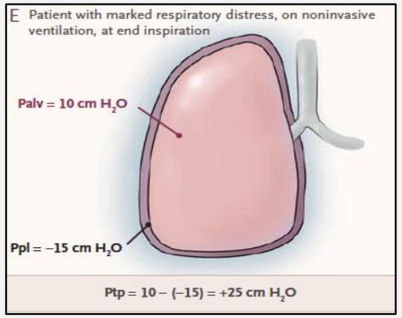
↓

**↘ Mortality**

To avoid worsening underlying pulmonary injury:
***Reduction of respiratory drive and Vt***

| P-SILI | VILI |
|---|---|

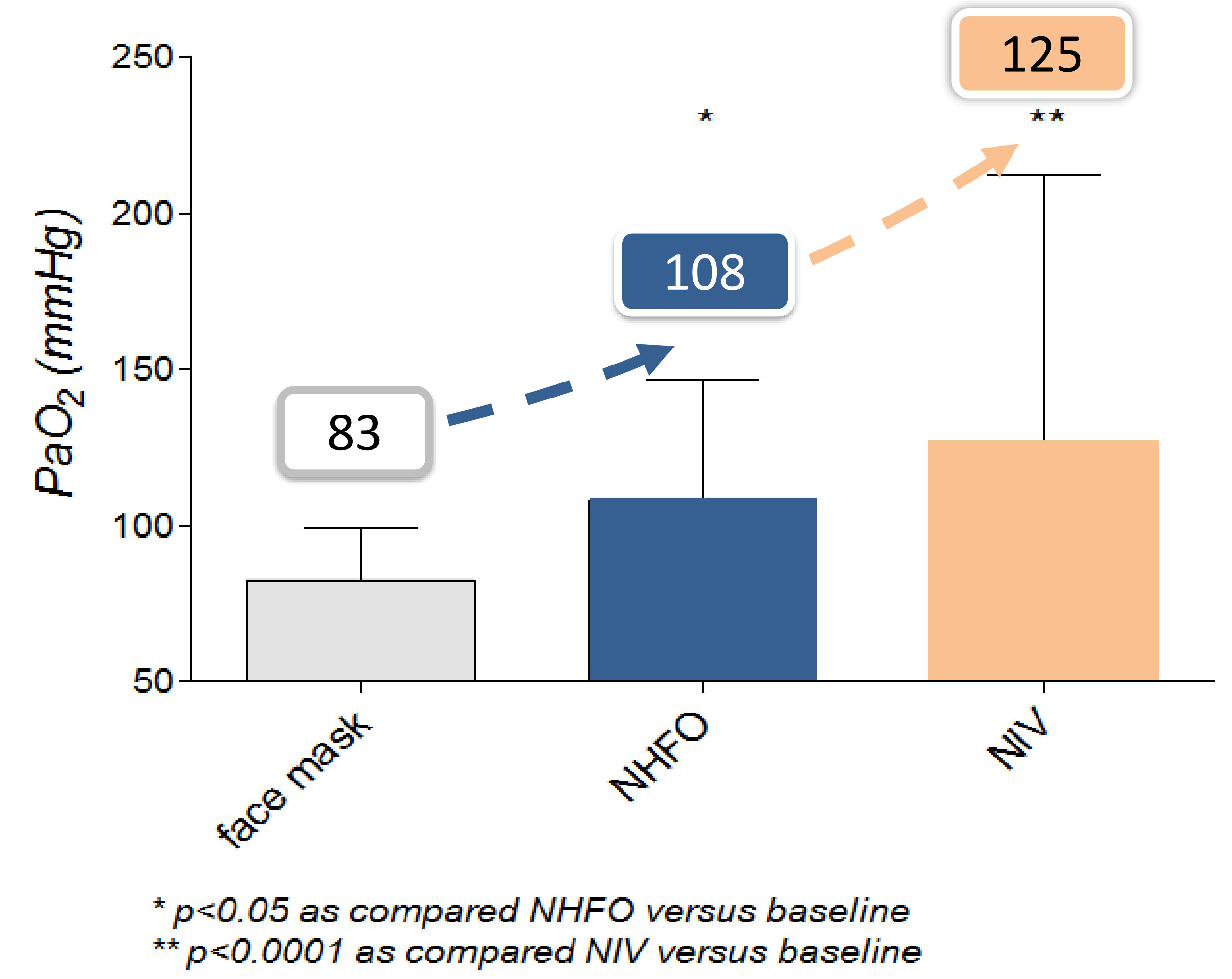



*Slutsky. NEJM 2013; 369: 2126-36*
*Brochard. Am J Respir Crit Care Med. 2017;195:438-42*

# Sequential Application of Oxygen Therapy Via High-Flow Nasal Cannula and Noninvasive Ventilation in Acute Respiratory Failure: An Observational Pilot Study

Jean-Pierre Frat MD, Benjamin Brugiere MD, Stéphanie Ragot PharmD PhD, Delphine Chatellier MD, Anne Veinstein MD, Véronique Goudet MD, Rémi Coudroy MD, Franck Petitpas MD, René Robert MD PhD, Arnaud W Thille MD PhD, and Christophe Girault MD PhD




NIV > high-flow > $O_2$

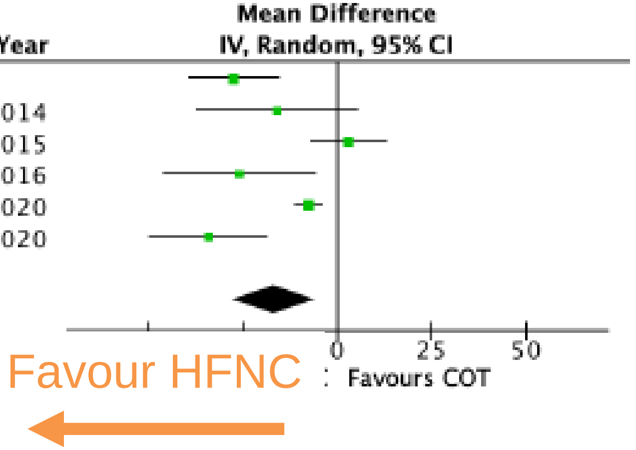
*Frat et al. Resp care 2015; 60: 170- 8*

# Oxygenation

**10. PaO2**

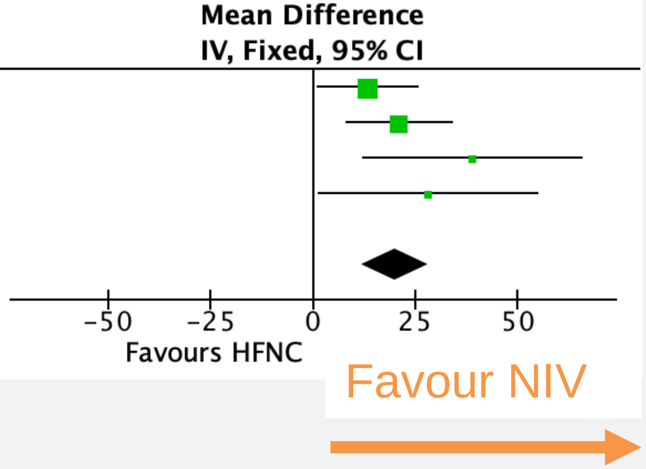
| Study or Subgroup | HFNC Mean | HFNC SD | HFNC Total | COT Mean | COT SD | COT Total | Weight | Mean Difference IV, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|---|---|
| Mauri 2017 | -97.4 | 23 | 17 | -70 | 9.6 | 17 | 17.9% | -27.40 [-39.25, -15.55] | |
| Schabbauer 2014 | -101 | 34 | 14 | -85 | 22 | 14 | 12.3% | -16.00 [-37.21, 5.21] | 2014 |
| Frat 2015 | -90 | 35 | 106 | -93 | 36 | 94 | 19.1% | 3.00 [-6.87, 12.87] | 2015 |
| Mauri 2016 | -98 | 39 | 15 | -72 | 5.2 | 15 | 13.0% | -26.00 [-45.91, -6.09] | 2016 |
| Geng 2020 | -94.73 | 4.43 | 16 | -86.98 | 6.42 | 20 | 22.1% | -7.75 [-11.30, -4.20] | 2020 |
| Ko 2020 | -107.47 | 44.15 | 34 | -73.25 | 13.02 | 33 | 15.6% | -34.22 [-49.71, -18.73] | 2020 |
| **Total (95% CI)** | | | **202** | | | **193** | **100.0%** | **-16.72 [-27.71, -5.74]** | |

Heterogeneity: $Tau^2 = 138.87$; $Chi^2 = 28.63$, df = 5 (P < 0.0001); $I^2 = 83\%$
Test for overall effect: Z = 2.98 (P = 0.003)




| Study or Subgroup | HFNC Mean | HFNC SD | HFNC Total | NIV Mean | NIV SD | NIV Total | Weight | Mean Difference IV, Fixed, 95% CI |
|---|---|---|---|---|---|---|---|---|
| Adi 2019 | -163.1 | 44.18 | 94 | -176.52 | 41.11 | 94 | 43.2% | 13.42 [1.22, 25.62] |
| Frat 2015 | -90 | 35 | 106 | -111 | 59 | 110 | 38.7% | 21.00 [8.12, 33.88] |
| Grieco 2020 | -69 | 21.5 | 15 | -108 | 48.1 | 15 | 9.0% | 39.00 [12.34, 65.66] |
| Schabbauer 2014 | -101 | 34 | 14 | -129 | 38 | 14 | 9.0% | 28.00 [1.29, 54.71] |
| **Total (95% CI)** | | | **229** | | | **233** | **100.0%** | **19.98 [11.97, 28.00]** |

Heterogeneity: $Chi^2 = 3.44$, df = 3 (P = 0.33); $I^2 = 13\%$
Test for overall effect: Z = 4.88 (P < 0.00001)




*Oczkowski et al. Eur Respir J. 2022; 59: 2101574*

Standard oxygen | **Noninvasive ventilation** | **CPAP** | **High-flow nasal oxygen**

## Patient benefits

- Blood gas improvement
- To unload inspiratory muscles
- Comfort

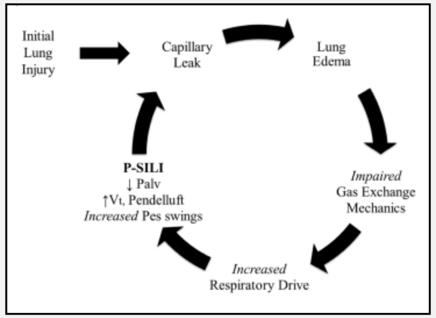
**To avoid intubation**

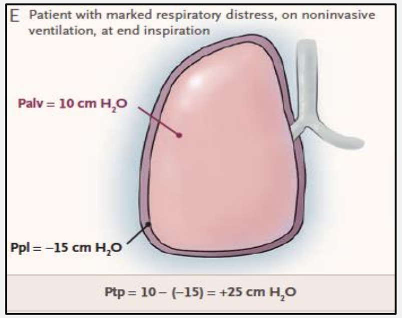
**↘ Mortality**

To avoid worsening underlying pulmonary injury:
***Reduction of respiratory drive and Vt***

P-SILI

VILI

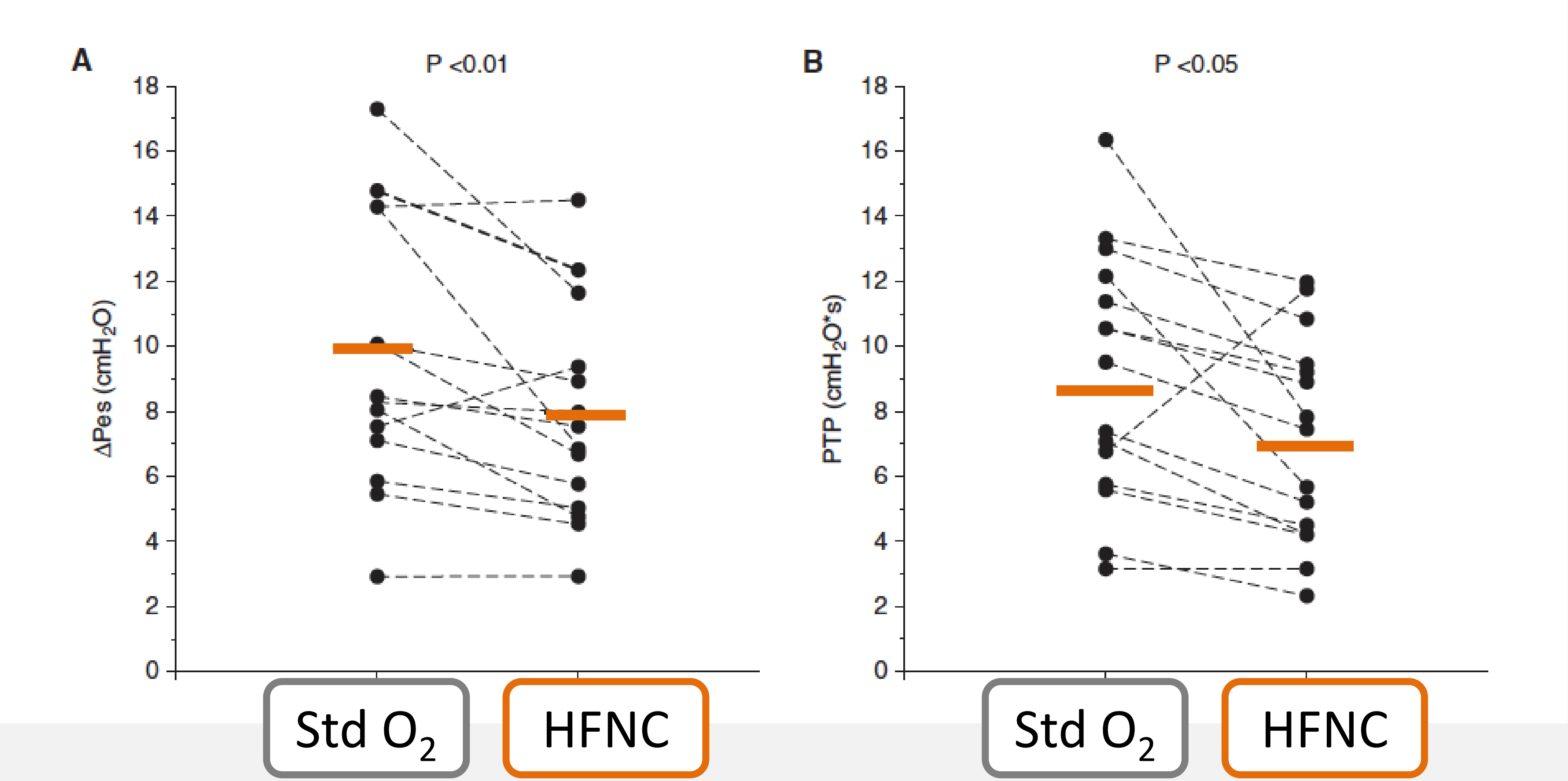



*Slutsky. NEJM 2013; 369: 2126-36*

*Brochard. Am J Respir Crit Care Med. 2017;195:438-42*

# Nasal high-flow vs standard $O_2$
# *inspiratory effort*

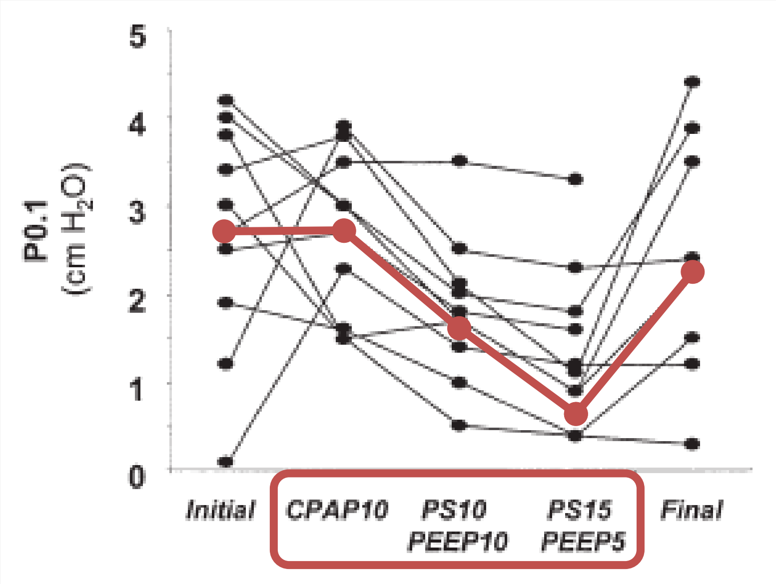



*Mauri et al. Am J Resp Crit Care Med 2017; 195; 1207-15*

# Effects of PS and PEEP

| Variable | Initial* | CPAP | PSV10/PEEP10 | PSV15/PEEP5 | Final[¶] |
|---|---|---|---|---|---|
| PTPes, cm $H_2O \cdot$ s/min | 180 ± 101 | 174 | 102 | 100 | 207 ± 127 |
| PTPdi, cm $H_2O \cdot$ s/min | 257 ± 144 | 216 ± 174 | 124 ± 103[‡∥] | 115 ± 102[‡∥] | 291 ± 202 |
| WOB/min, J/min (n = 8) | 12.8 ± 7.2 | 8.7 ± 6.9 | 6.5 ± 3.8[‡] | 7.7 ± 4.1[†] | 15.3 ± 10.0 |
| WOB/L, J/L (n = 8) | 0.85 ± 0.49 | 0.70 ± 0.42 | 0.45 ± 0.19[‡∥] | 0.44 ± 0.20[‡∥] | 0.93 ± 0.53 |
| PEEPi,dyn, cm $H_2O$ | 0.9 ± 1.0 | 0.3 ± 0.4[†] | 0.3 ± 0.4[‡] | 0.5 ± 0.8 | 0.8 ± 1.1 |
| Pdi, cm $H_2O$ | 11.0 ± 5.4 | 10.3 ± 7.1 | 5.8 ± 4.4[‡§] | 5.4 ± 4.4[‡§] | 12.0 ± 7.0 |
| $P_{0.1}$, cm $H_2O$ | 2.7 ± 1.5 | 2.6 | 1.6 | 0.6 | 2.4 ± 1.4 |

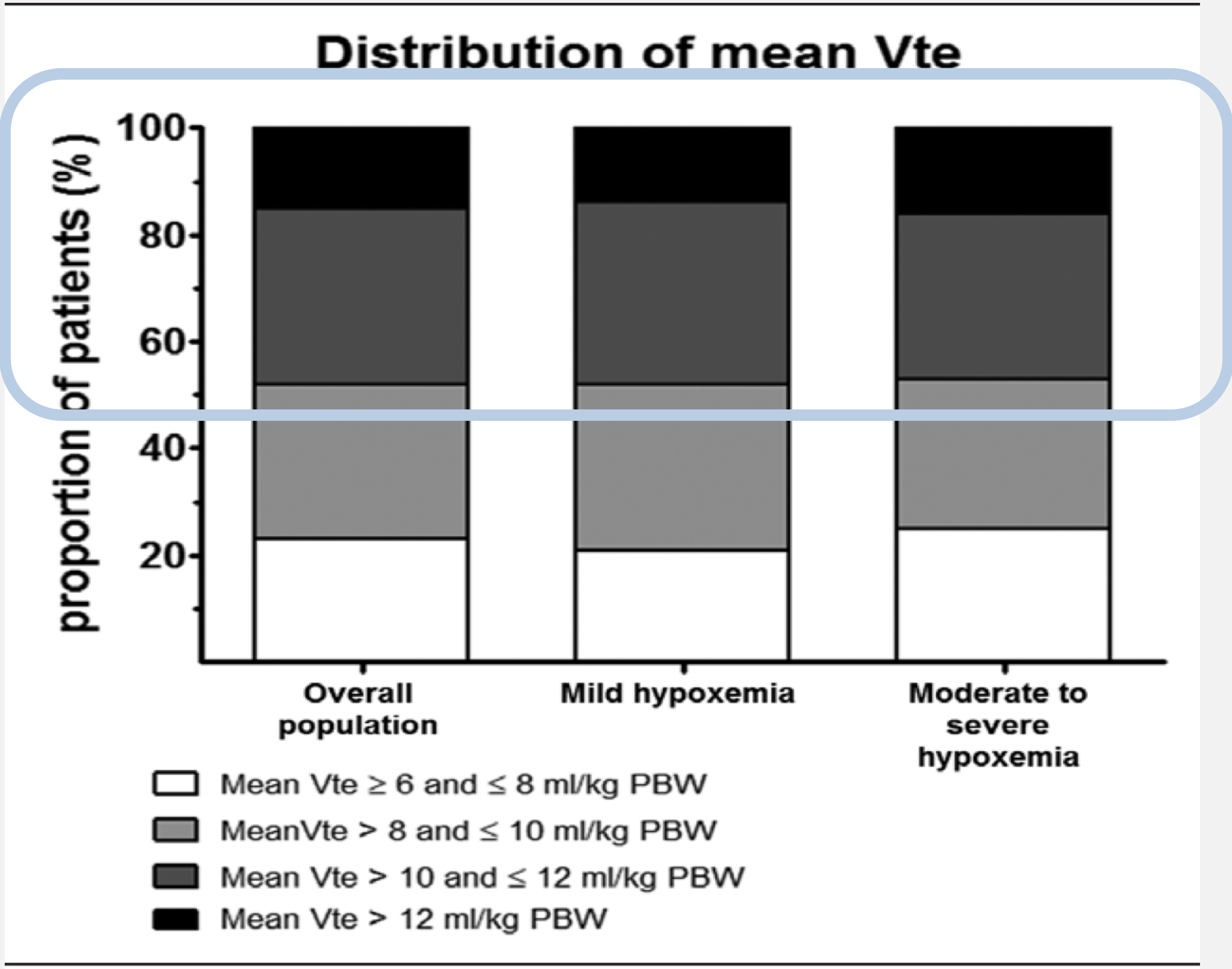
Diminution :
- Travail respiratoire, $PTP_{es}$
- Commande ventilatoire : P0.1




L'Her. Am J Resp Crit Med, 2005; 172:1112-18

# Failure of Noninvasive Ventilation for De Novo Acute Hypoxemic Respiratory Failure: Role of Tidal Volume

Guillaume Carteaux, MD[1,2,3]; Teresa Millán-Guilarte, MD[4]; Nicolas De Prost, MD, PhD[1,2,3]; Keyvan Razazi, MD[1,2,3]; Shariq Abid, MD, PhD[3]; Arnaud W. Thille, MD, PhD[5]; Frédérique Schortgen, MD, PhD[1,3]; Laurent Brochard, MD[3,6,7]; Christian Brun-Buisson, MD[1,2,8]; Armand Mekontso Dessap, MD, PhD[1,2,3]




$V_T$ > 10 ml/kg in 50% of patients

Increased risk of intubation $V_T$ > 9.5 ml/kg

*G. Carteaux et al., Crit Care Med 2016; 44:282-290.*

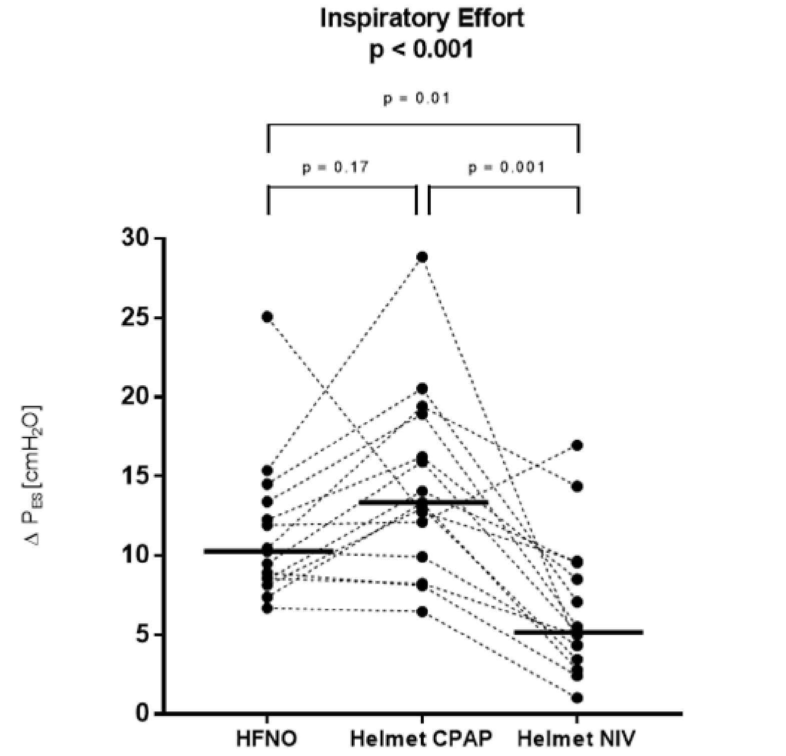
**Respective Effects of Helmet Pressure Support, Continuous Positive Airway Pressure and Nasal High-Flow in Hypoxemic Respiratory Failure: A Randomized Crossover Clinical Trial**

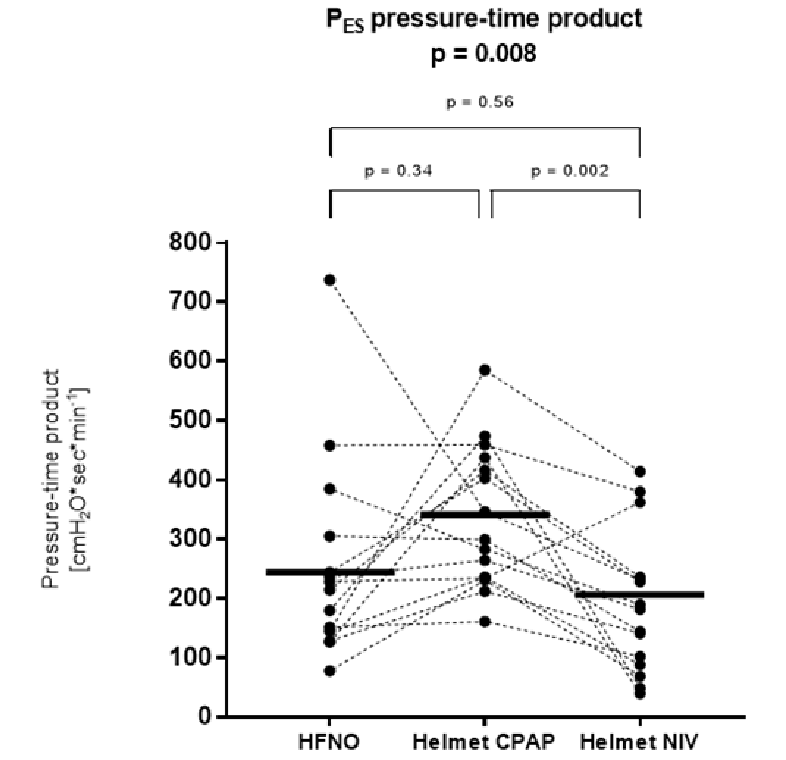
Luca S. Menga[1,2†]; Luca delle Cese[1,2†]; Tommaso Rosà[1,2]; Melania Cesarano[1,2]; Roberta Scarascia[1,2]; Teresa Michi[1,2]; Daniele G. Biasucci[1,2]; Ersilia Ruggiero[1,2]; Antonio M. dell'Anna[1,2]; Salvatore L. Cutuli[1,2]; Eloisa S. Tanzarella[1,2]; Gabriele Pintaudi[1,2]; Gennaro De Pascale[1,2]; Claudio Sandroni[1,2]; Salvatore Maurizio Maggiore[3,4]; Domenico L. Grieco[1,2]; Massimo Antonelli[1,2]


N=15
$PaO_2/FIO_2$ <200 mmHg

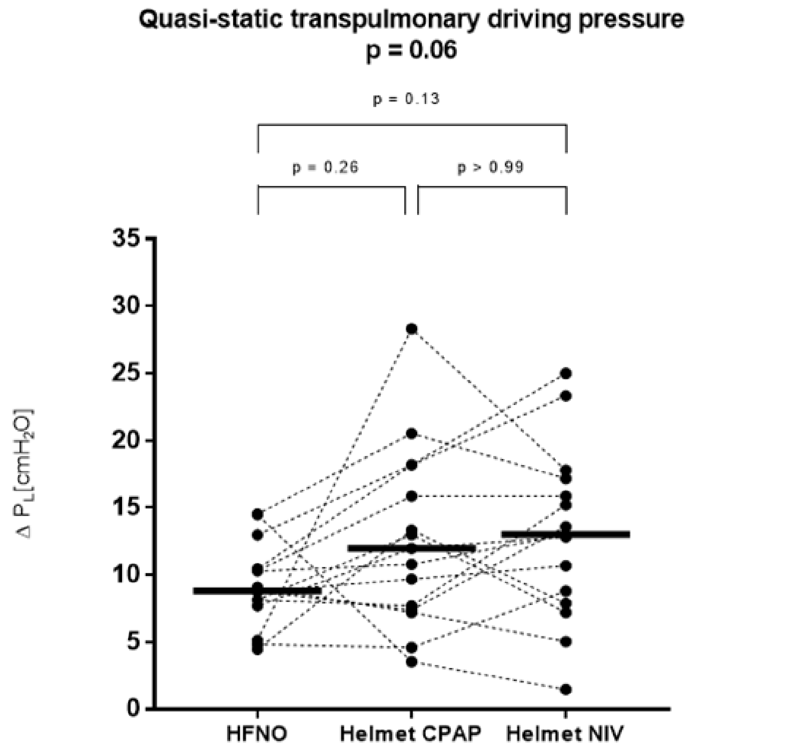
*Helmet NIV: PS 10-12, PEEP 14 $cmH_2O$*
*Helmet CPAP: PEEP 14 $cmH_2O$*
*HFNC: 60 L/min*

## Inspiratory effort




## Lung inflation

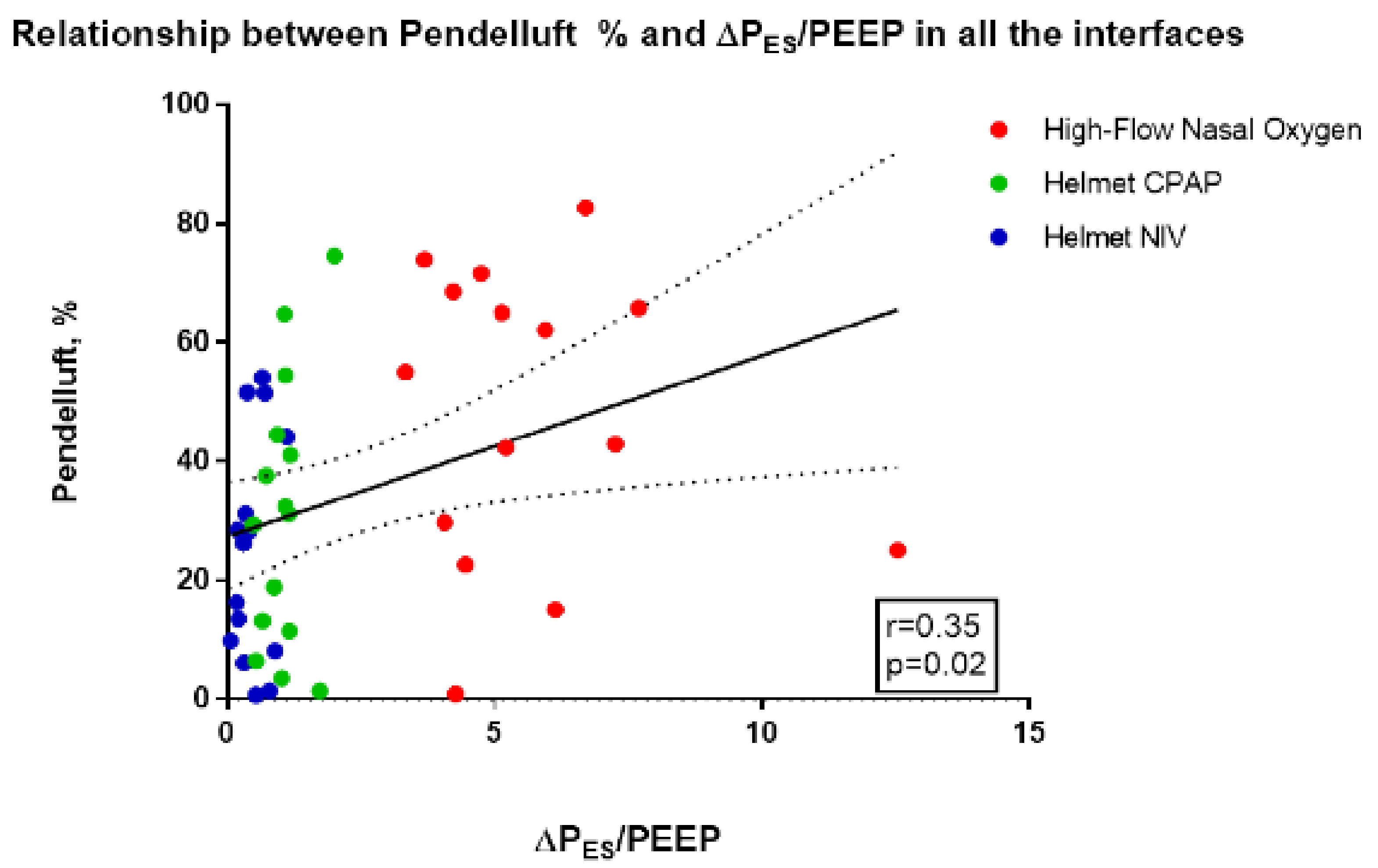



P=0.01

P=0.56

P=0.13

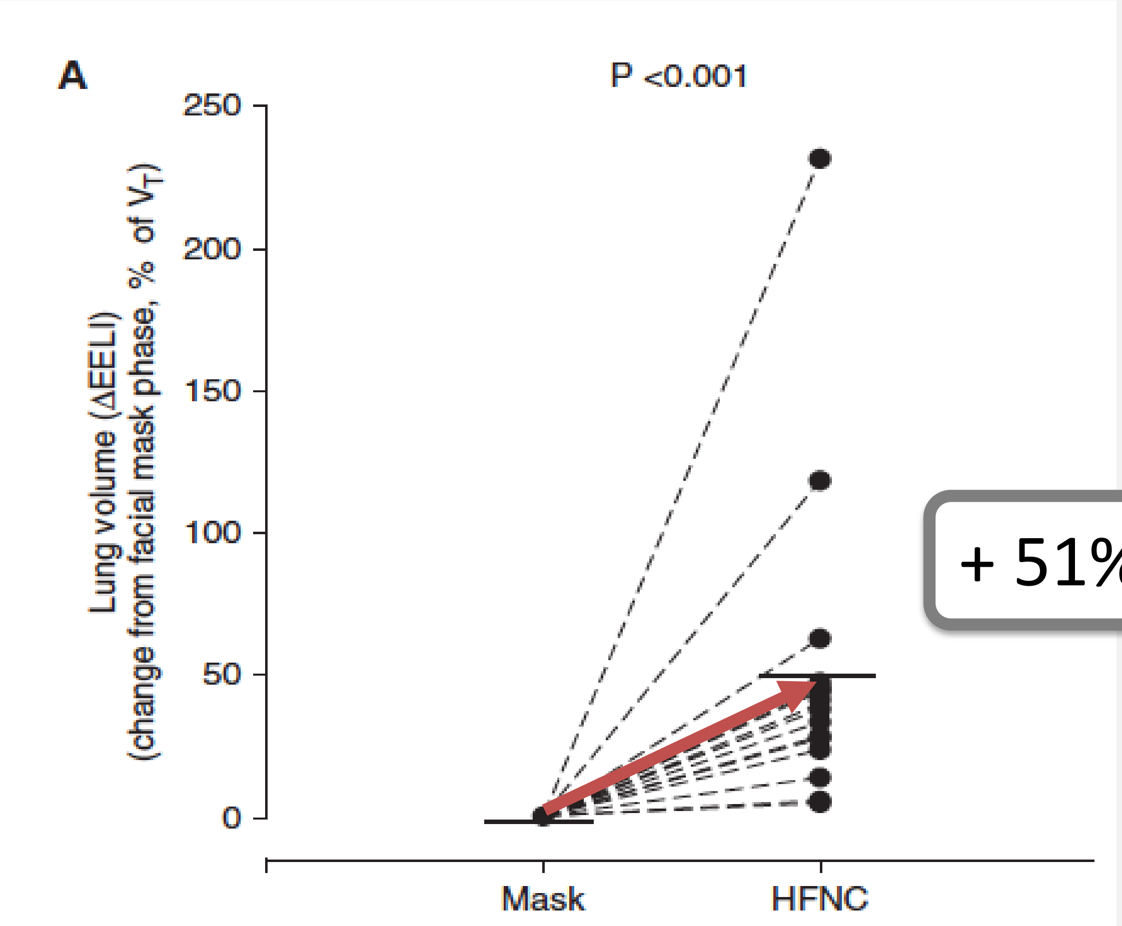
*Menga et al. AJRCCM 2022*



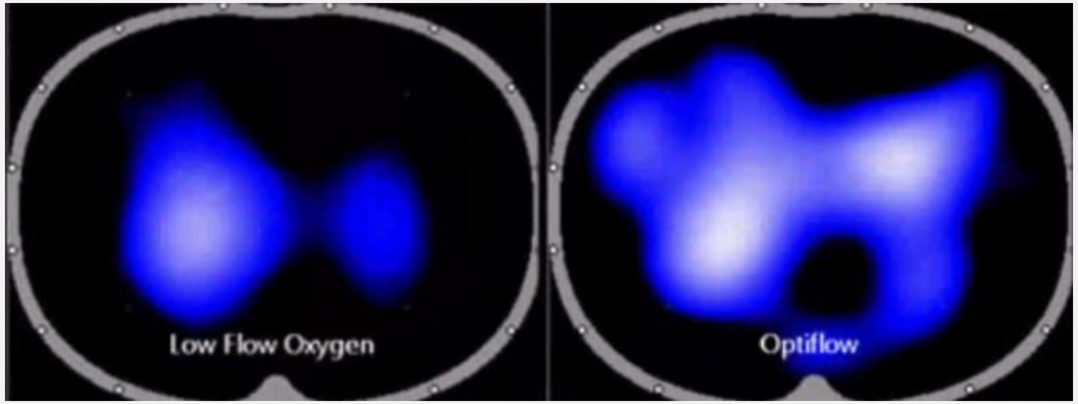

Pendelluft Increases with inspiratory effort and decreases with PEEP

*Menga et al. AJRCCM 2022*

# Nasal high-flow:
# *PEEP effect*




+ 51%



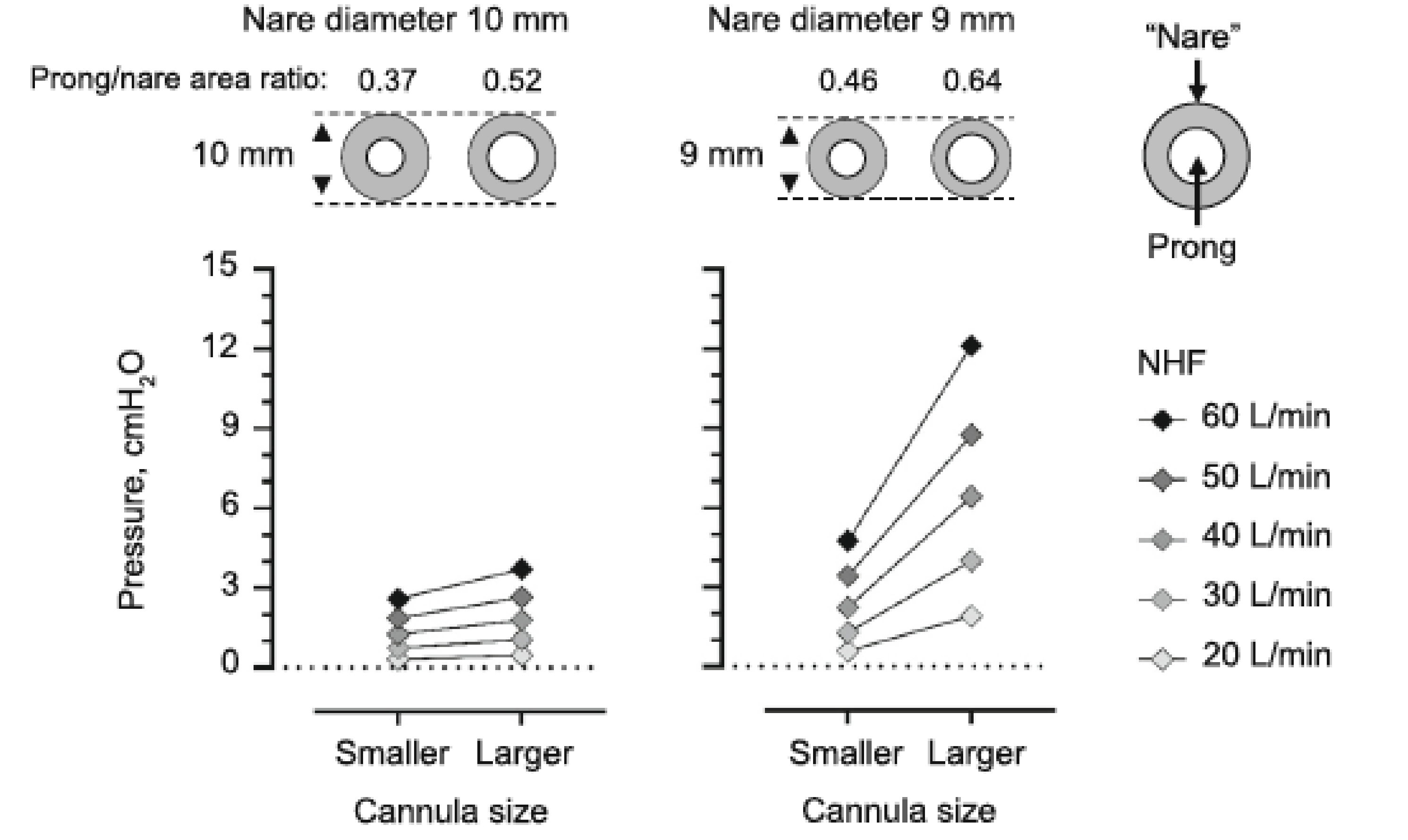

Increased end expiratory volume

*Mauri et al. Am J Resp Crit Care Med 2017; 195; 1207-15*

RESEARCH LETTER Open Access

# Effect of flow and cannula size on generated pressure during nasal high flow

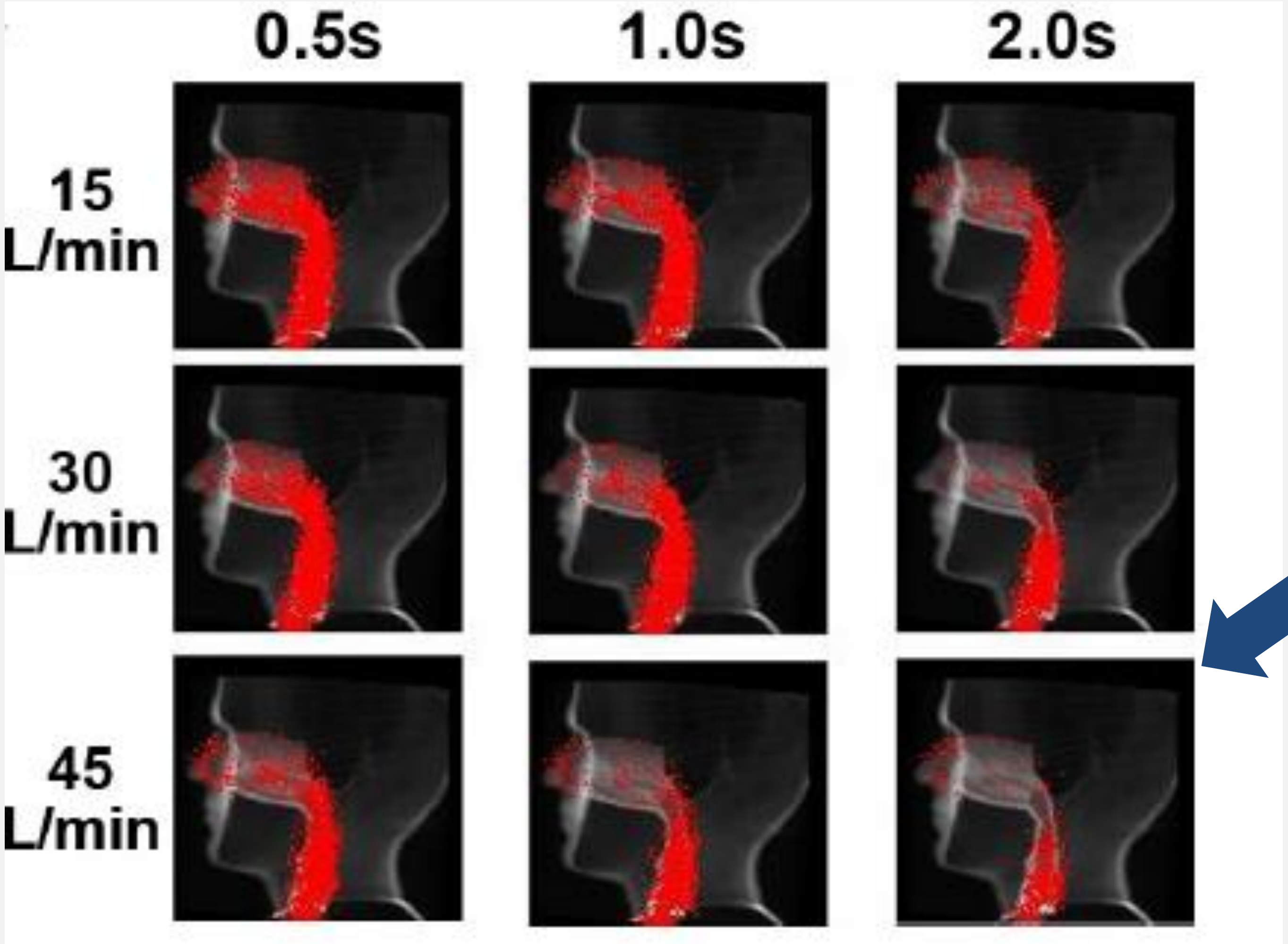
Maximilian Pinkham and Stanislav Tatkov*




The pressure rises with the increase of the cannula size and flow rate

*Tatkov Critical Care (2020) 24:248*

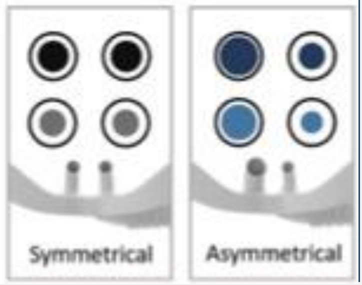
# Nasal high-flow:
# *wash out of anatomical dead space*

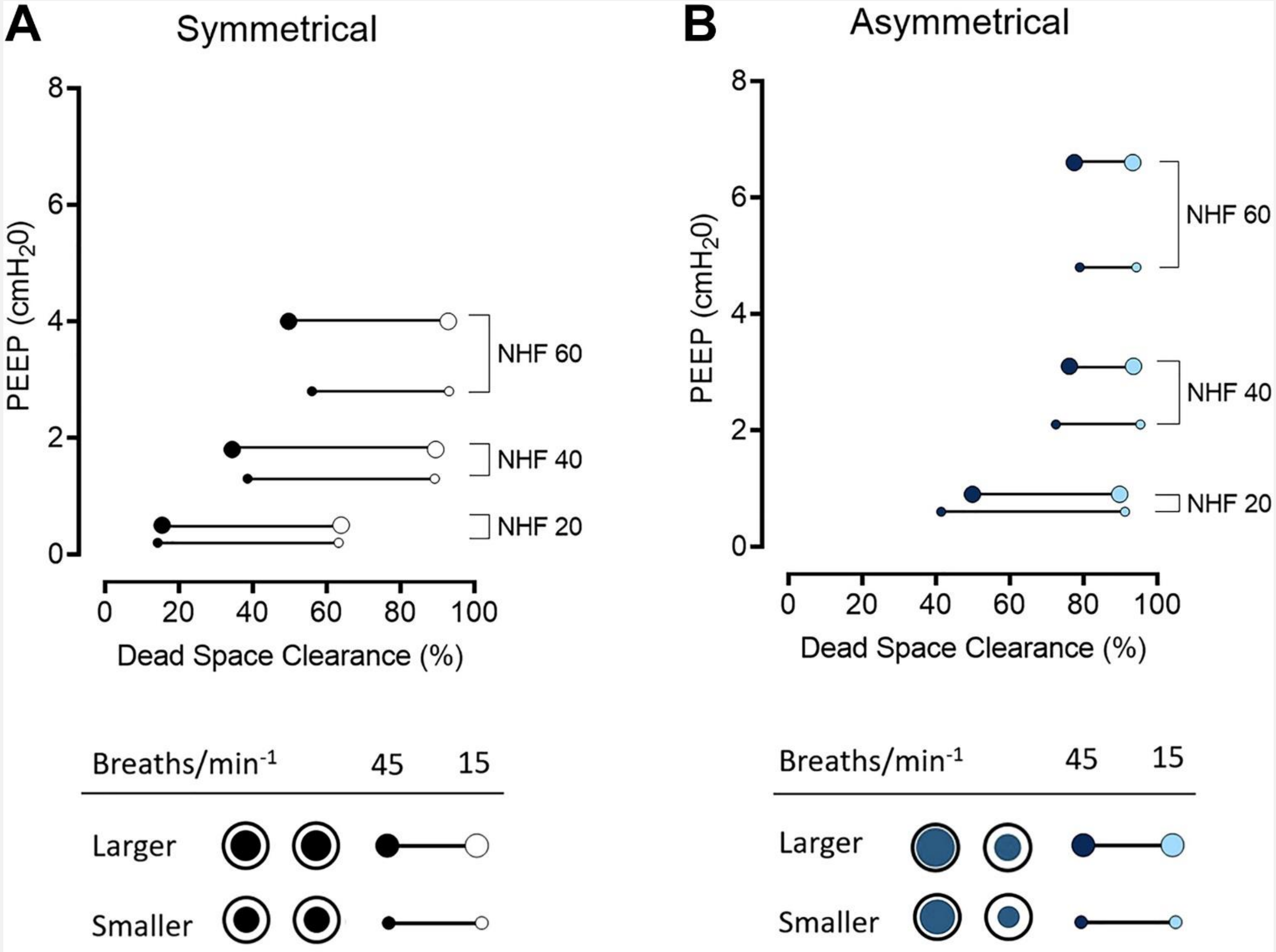


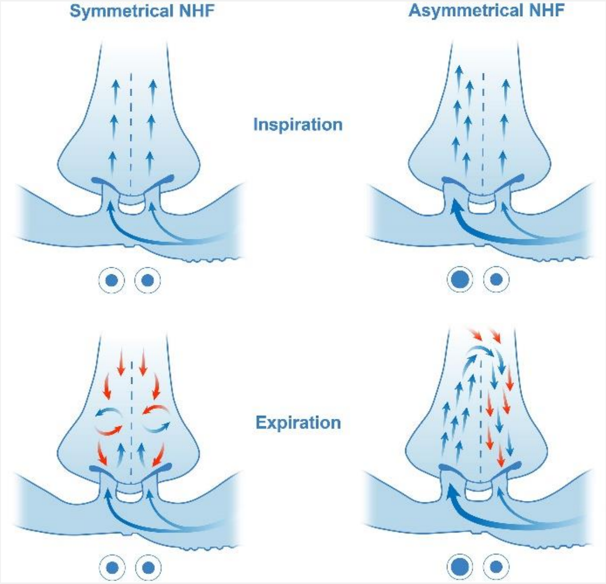

2 sec

*Möller. J appl Physiol 2015; 118:1525-32*

# Asymmetrical cannula:
# *dead space clearance and PEEP*




- The higher the larger and flow rate, the higher dead space clearance and PEEP level
- Asymmetrical cannula provide higher dead space clearance and PEEP level

*Tatkov et al. Appl Physiol 134: 365–377, 2023.*

Standard oxygen | Noninvasive ventilation | CPAP | **High-flow nasal oxygen**

**Patient benefits**

Blood gas improvement

To unload inspiratory muscles

Comfort

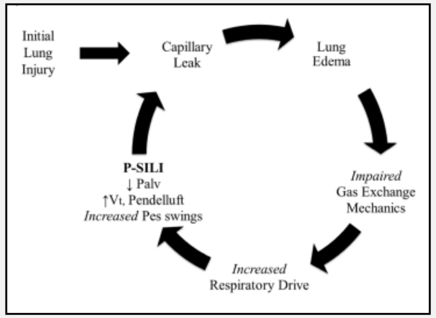
**To avoid intubation**

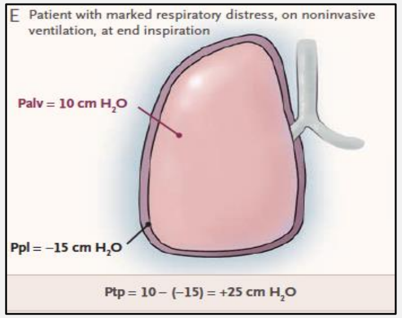
**↘ Mortality**

To avoid worsening underlying pulmonary injury:
***Reduction of respiratory drive and Vt***

P-SILI

VILI




*Slutsky. NEJM 2013; 369: 2126-36*
*Brochard. Am J Respir Crit Care Med. 2017;195:438-42*

**Table S5. Assessment of tolerance to the oxygenation strategy at inclusion and 1 hour after inclusion ***

| | High-Flow Oxygen group (n=106) | Standard Oxygen group (n=94) | NIV group (n=110) | P Value |
|---|---|---|---|---|
| Respiratory patient-discomfort at inclusion – mm † | 38±31 | 44±29 | 46±30 | 0.20 |
| Respiratory patient-discomfort at H1– mm † | 29 | 40 | 43 | <0.01 |
| Grade of dyspnea at H1‡ | | | | <0.001 |
| Marked improvement – no. (%) | 19 (22.1) | 5 (6.8) | 13 (14.3) | |
| Slight improvement– no. (%) | 46 (53.5) | 26 (35.1) | 40 (44.0) | |
| No change– no. (%) | 18 (20.9) | 33 (44.6) | 23 (25.3) | |
| Slight deterioration – no. (%) | 3 (3.5) | 9 (12.2) | 8 (8.8) | |
| Marked deterioration – no. (%) | 0 (0.0) | 1 (1.3) | 7 (7.7) | |
| Respiratory rate– breaths/min | | | | |
| H1 | 28±7 | 31±7 | 31±8 | <0.01 |
| H6 | 27±7 | 29±8 | 29±7 | 0.13 |

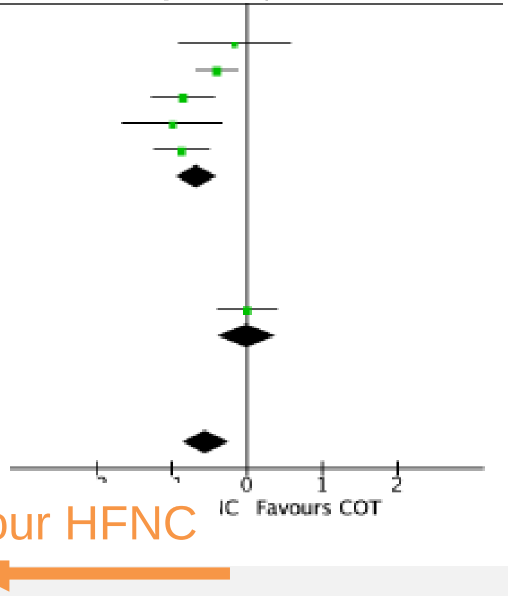
76% 42% 58%

*Frat et al. N Engl J Med. 2015;372:2185-96*

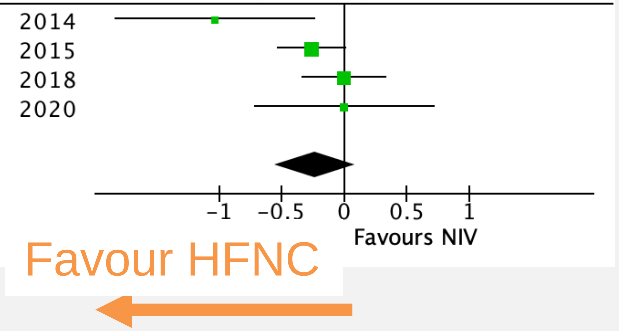
# Comfort

**7. Patient comfort (various rating systems)**

| Study or Subgroup | HFNC Mean | HFNC SD | HFNC Total | COT Mean | COT SD | COT Total | Weight | Std. Mean Difference IV, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|---|---|
| **1.8.1 Immunocompetent** | | | | | | | | | |
| Schabbauer 2014 | 2.7 | 1.8 | 14 | 3.1 | 2.8 | 14 | 10.7% | -0.16 [-0.91, 0.58] | 2014 |
| Frat 2015 | 29 | 26 | 106 | 40 | 29 | 94 | 21.4% | -0.40 [-0.68, -0.12] | 2015 |
| Bell 2015 | 3 | 1.5 | 48 | 4 | 0.74 | 52 | 18.0% | -0.85 [-1.26, -0.44] | 2015 |
| Rittayamai 2015 | 1.6 | 1.7 | 20 | 3.7 | 2.4 | 20 | 12.2% | -0.99 [-1.65, -0.33] | 2015 |
| Makdee 2017 | -8.1 | 2 | 63 | -6.4 | 1.9 | 65 | 19.2% | -0.87 [-1.23, -0.50] | 2017 |
| **Subtotal (95% CI)** | | | **251** | | | **245** | **81.5%** | **-0.66 [-0.94, -0.39]** | |
| Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 7.98$, df = 4 (P = 0.09); $I^2 = 50\%$ | | | | | | | | | |
| Test for overall effect: Z = 4.66 (P < 0.00001) | | | | | | | | | |
| **1.8.2 Immunocompromised** | | | | | | | | | |
| Lemaile 2015 | 3 | 3 | 52 | 3 | 3.7 | 48 | 18.5% | 0.00 [-0.39, 0.39] | 2015 |
| **Subtotal (95% CI)** | | | **52** | | | **48** | **18.5%** | **0.00 [-0.39, 0.39]** | |
| Heterogeneity: Not applicable | | | | | | | | | |
| Test for overall effect: Z = 0.00 (P = 1.00) | | | | | | | | | |
| **Total (95% CI)** | | | **303** | | | **293** | **100.0%** | **-0.54 [-0.86, -0.23]** | |
| Heterogeneity: $Tau^2 = 0.10$; $Chi^2 = 16.27$, df = 5 (P = 0.006); $I^2 = 69\%$ | | | | | | | | | |
| Test for overall effect: Z = 3.35 (P = 0.0008) | | | | | | | | | |
| Test for subgroup differences: $Chi^2 = 7.31$, df = 1 (P = 0.007), $I^2 = 86.3\%$ | | | | | | | | | |




| Study or Subgroup | HFNC Mean | HFNC SD | HFNC Total | NIV Mean | NIV SD | NIV Total | Weight | Std. Mean Difference IV, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|---|---|
| Schabbauer 2014 | 2.7 | 1.8 | 14 | 5.4 | 3.1 | 14 | 12.5% | −1.03 [−1.83, −0.24] | 2014 |
| Frat 2015 | 38 | 31 | 106 | 46 | 30 | 110 | 38.8% | −0.26 [−0.53, 0.01] | 2015 |
| Doshi 2018 | 2 | 3 | 72 | 2 | 3.7 | 69 | 34.0% | 0.00 [−0.33, 0.33] | 2018 |
| Grieco 2020 | 5 | 3 | 15 | 5 | 3 | 15 | 14.7% | 0.00 [−0.72, 0.72] | 2020 |
| **Total (95% CI)** | | | **207** | | | **208** | **100.0%** | **−0.23 [−0.55, 0.09]** | |
| Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 6.13$, df = 3 (P = 0.11); $I^2 = 51\%$ | | | | | | | | | |
| Test for overall effect: Z = 1.40 (P = 0.16) | | | | | | | | | |




*Oczkowski et al. Eur Respir J. 2022; 59: 2101574*

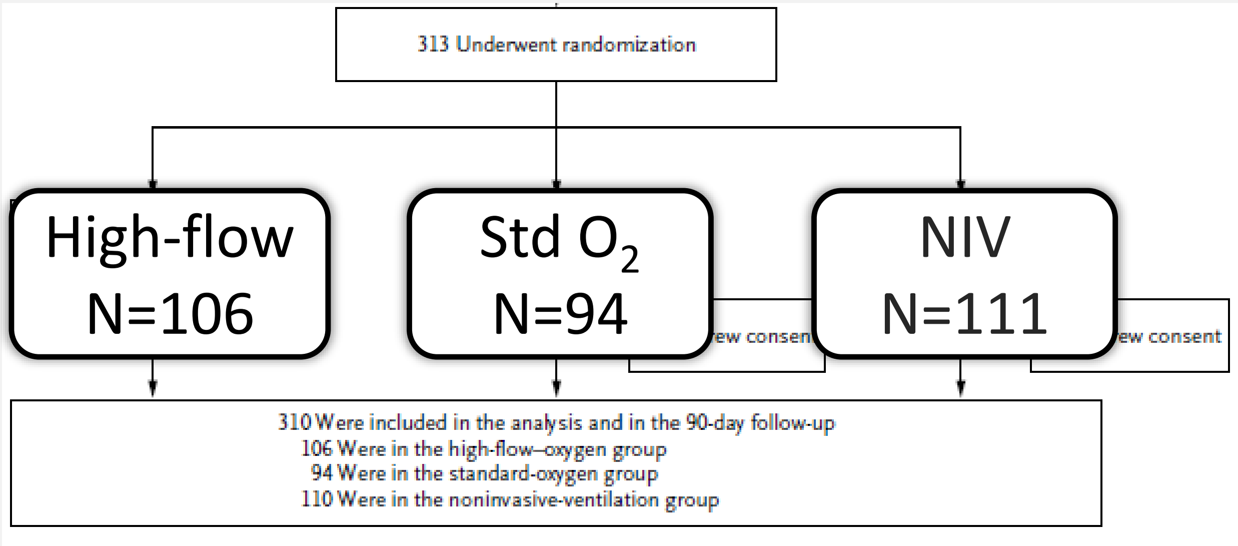
Insuffisance respiratoire aiguë hypoxémique : *« avant la COVID-19 »*

ORIGINAL ARTICLE

# 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.,

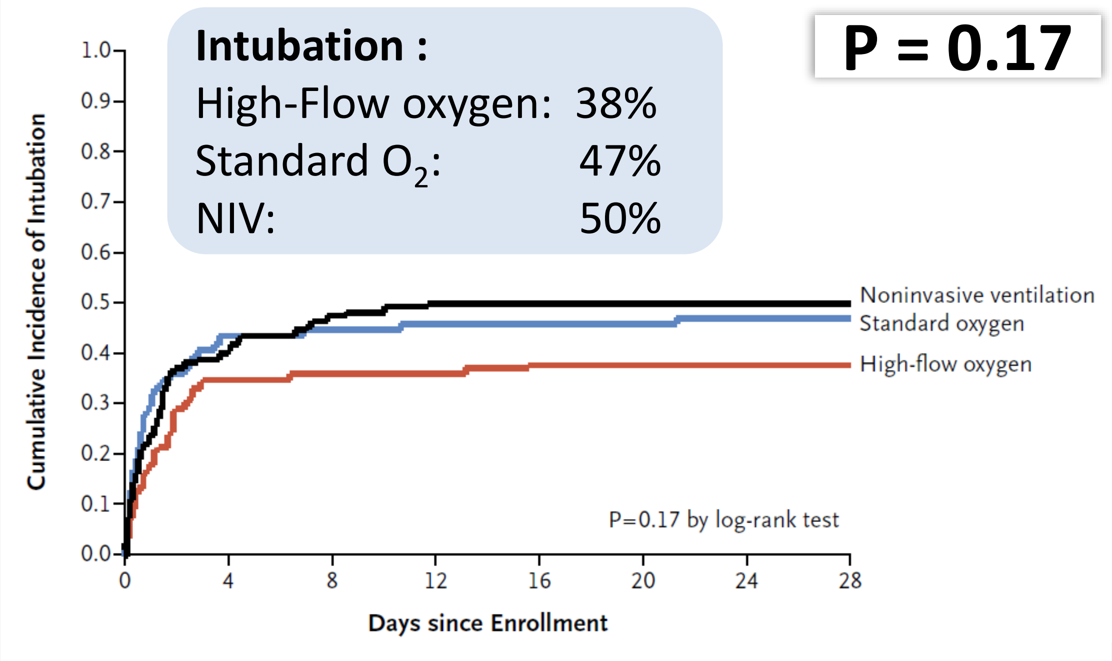
**Inclusion criteria**
Acute hypoxemic respiratory failure
$PaO_2/FiO_2$ <300 mm Hg
Respiratory rate > 25 breaths/min
Signs of respiratory distress

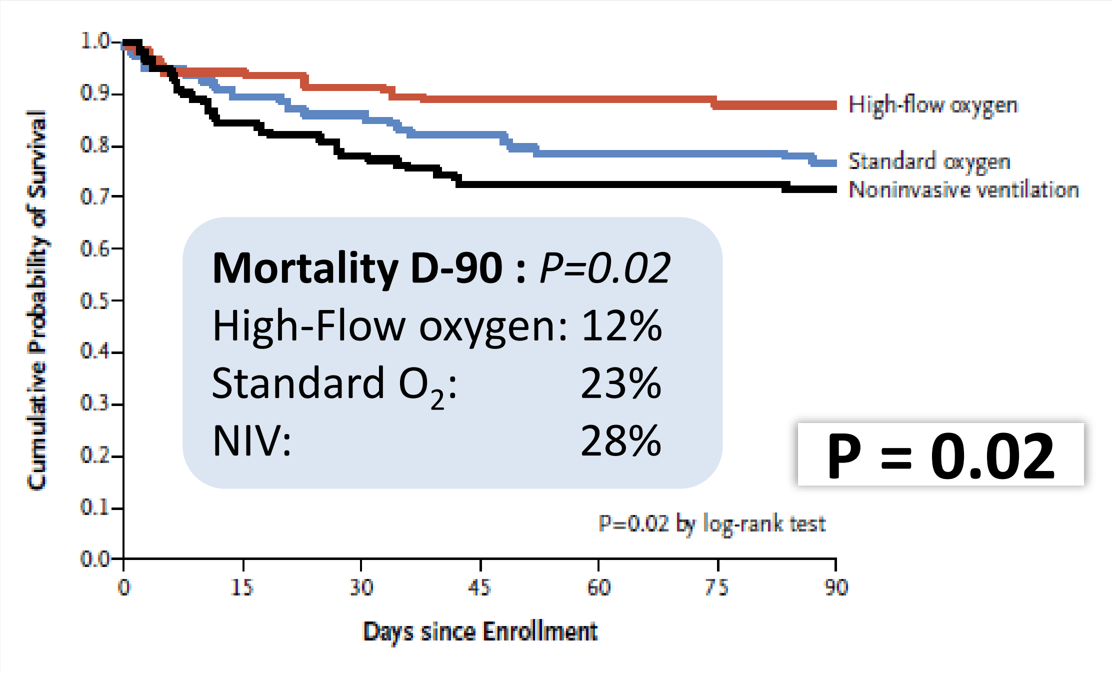



**Exclusion criteria**
Hypercapnia >45 mm Hg,
exacerbation of chronic respiratory disease,
cardiogenic pulmonary edema
Glasgow score <12 points…

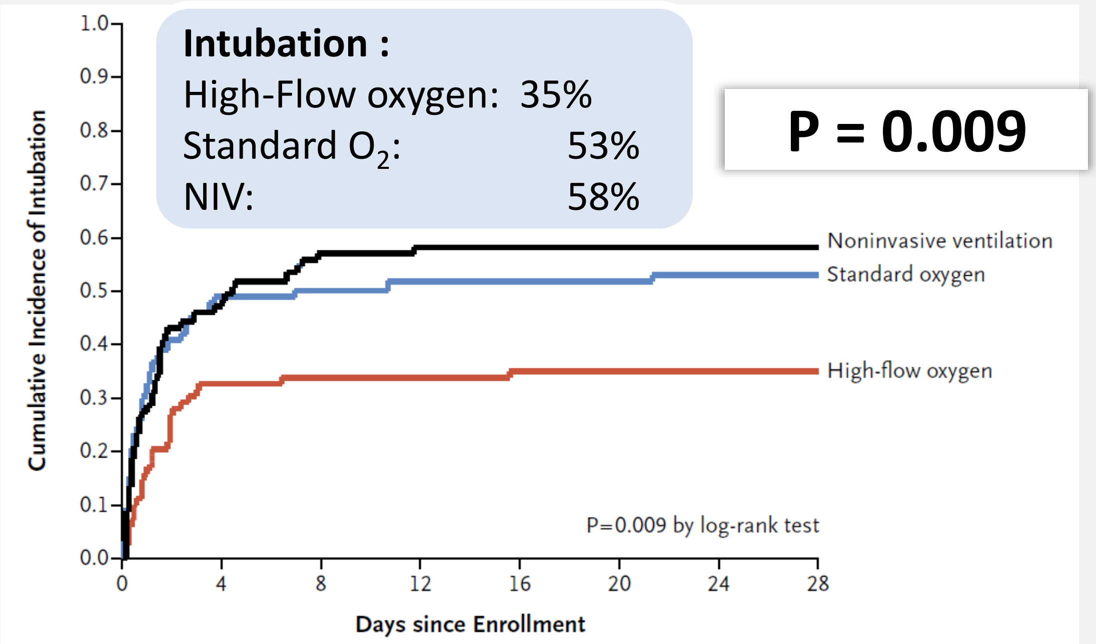
Prespecified criteria of intubation

*N Engl J Med. 2015;372:2185-96*




**Post-hoc analysis**
**$PaO_2/FiO_2 \leq 200$ mm Hg**



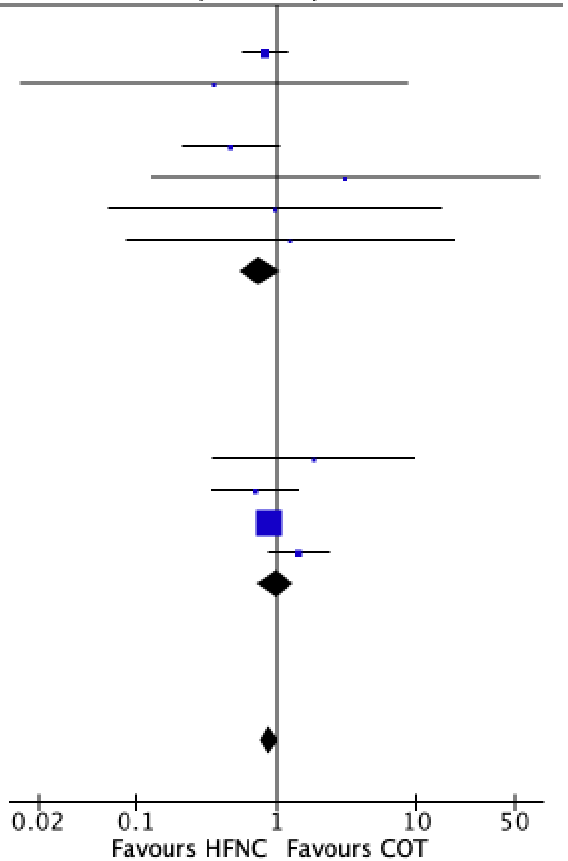

*Frat et al. N Engl J Med. 2015;372:2185-96*

ERS clinical practice guidelines: high-flow nasal cannula in acute respiratory failure

The ERS task force suggests the use of HFNC over COT in patients with acute hypoxaemic respiratory failure (conditional recommendation, moderate certainty of evidence)

**High flow oxygen** | **Standard $O_2$** | **Intubation**

| Study or Subgroup | HFNC Events | HFNC Total | COT Events | COT Total | Weight | Risk Ratio M-H, Random, 95% CI | Year |
|---|---|---|---|---|---|---|---|
| **1.4.1 Immunocompetent** | | | | | | | |
| Frat 2015 | 32 | 80 | 31 | 64 | 14.4% | 0.83 [0.57, 1.19] | 2015 |
| Bell 2015 | 0 | 48 | 1 | 52 | 0.2% | 0.36 [0.02, 8.64] | 2015 |
| Rittayamai 2015 | 0 | 20 | 0 | 20 | | Not estimable | 2015 |
| Jones 2016 | 9 | 165 | 16 | 138 | 3.2% | 0.47 [0.21, 1.03] | 2016 |
| Makdee 2017 | 1 | 63 | 0 | 65 | 0.2% | 3.09 [0.13, 74.55] | 2017 |
| Ko 2020 | 1 | 34 | 1 | 33 | 0.3% | 0.97 [0.06, 14.88] | 2020 |
| Geng 2020 | 1 | 16 | 1 | 20 | 0.3% | 1.25 [0.08, 18.46] | 2020 |
| **Subtotal (95% CI)** | | **426** | | **392** | **18.5%** | **0.76 [0.55, 1.05]** | |
| Total events | 44 | | 50 | | | | |
| Heterogeneity: Tau² = 0.00; Chi² = 2.80, df = 5 (P = 0.73); I² = 0% | | | | | | | |
| Test for overall effect: Z = 1.65 (P = 0.10) | | | | | | | |
| **1.4.2 Immunocompromised** | | | | | | | |
| Lemaile 2015 | 4 | 52 | 2 | 48 | 0.7% | 1.85 [0.35, 9.63] | 2015 |
| Frat 2017 | 8 | 26 | 13 | 30 | 3.9% | 0.71 [0.35, 1.44] | 2017 |
| Azoulay 2018 | 150 | 388 | 170 | 388 | 68.9% | 0.88 [0.75, 1.04] | 2018 |
| Mendil 2019 | 24 | 51 | 16 | 49 | 7.9% | 1.44 [0.88, 2.37] | 2019 |
| **Subtotal (95% CI)** | | **517** | | **515** | **81.5%** | **0.99 [0.73, 1.35]** | |
| Total events | 186 | | 201 | | | | |
| Heterogeneity: Tau² = 0.04; Chi² = 4.58, df = 3 (P = 0.21); I² = 35% | | | | | | | |
| Test for overall effect: Z = 0.07 (P = 0.94) | | | | | | | |
| **Total (95% CI)** | | **943** | | **907** | **100.0%** | **0.89 [0.77, 1.02]** | |
| Total events | 230 | | 251 | | | | |
| Heterogeneity: Tau² = 0.00; Chi² = 8.44, df = 9 (P = 0.49); I² = 0% | | | | | | | |
| Test for overall effect: Z = 1.64 (P = 0.10) | | | | | | | |
| Test for subgroup differences: Chi² = 1.32, df = 1 (P = 0.25), I² = 24.3% | | | | | | | |




*Oczkowski et al. Eur Respir J 2022; 59: 2101574*

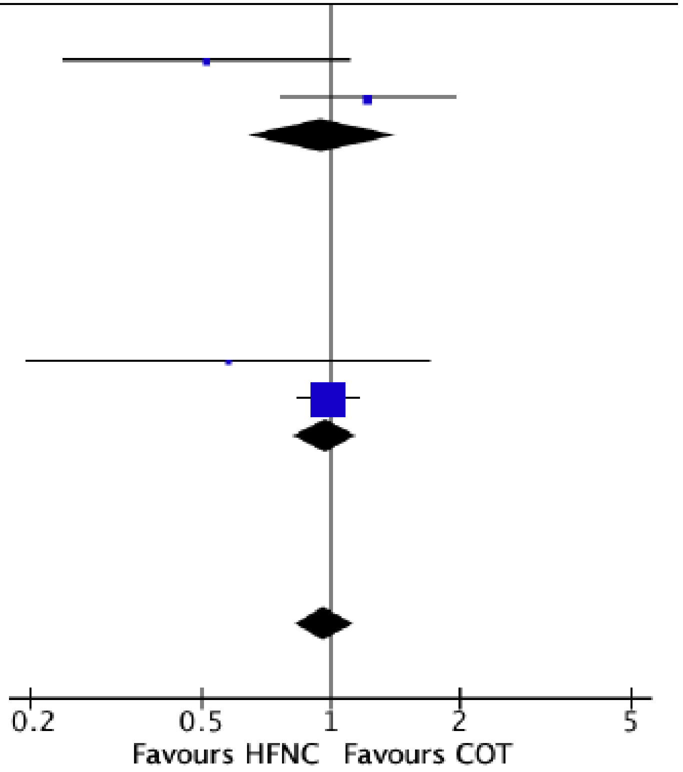
**ERS clinical practice guidelines: high-flow nasal cannula in acute respiratory failure**

The ERS task force suggests the use of HFNC over COT in patients with acute hypoxaemic respiratory failure (conditional recommendation, moderate certainty of evidence)

**Mortality**

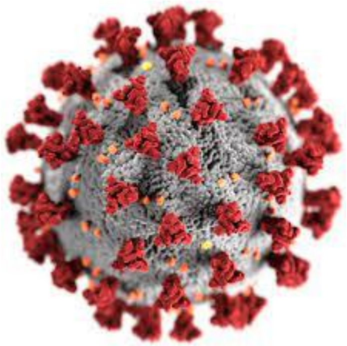
| Study or Subgroup | High flow oxygen Events | High flow oxygen Total | Standard $O_2$ Events | Standard $O_2$ Total | Weight | Risk Ratio M-H, Fixed, 95% CI | Year |
|---|---|---|---|---|---|---|---|
| **1.1.1 Immunocompetent** | | | | | | | |
| Frat 2015 | 9 | 80 | 14 | 64 | 7.4% | 0.51 [0.24, 1.11] | 2015 |
| Jones 2016 | 35 | 165 | 24 | 138 | 12.4% | 1.22 [0.76, 1.95] | 2016 |
| **Subtotal (95% CI)** | | **245** | | **202** | **19.7%** | **0.96 [0.65, 1.42]** | |
| Total events | 44 | | 38 | | | | |
| Heterogeneity: $Chi^2$ = 3.53, df = 1 (P = 0.06); $I^2$ = 72% | | | | | | | |
| Test for overall effect: Z = 0.22 (P = 0.82) | | | | | | | |
| **1.1.2 Immunocompromised** | | | | | | | |
| Frat 2017 | 4 | 26 | 8 | 30 | 3.5% | 0.58 [0.20, 1.70] | 2017 |
| Azoulay 2018 | 160 | 388 | 162 | 388 | 76.7% | 0.99 [0.84, 1.17] | 2018 |
| **Subtotal (95% CI)** | | **414** | | **418** | **80.3%** | **0.97 [0.82, 1.14]** | |
| Total events | 164 | | 170 | | | | |
| Heterogeneity: $Chi^2$ = 0.94, df = 1 (P = 0.33); $I^2$ = 0% | | | | | | | |
| Test for overall effect: Z = 0.37 (P = 0.71) | | | | | | | |
| **Total (95% CI)** | | **659** | | **620** | **100.0%** | **0.97 [0.83, 1.13]** | |
| Total events | 208 | | 208 | | | | |
| Heterogeneity: $Chi^2$ = 4.47, df = 3 (P = 0.22); $I^2$ = 33% | | | | | | | |
| Test for overall effect: Z = 0.43 (P = 0.67) | | | | | | | |
| Test for subgroup differences: $Chi^2$ = 0.00, df = 1 (P = 0.95), $I^2$ = 0% | | | | | | | |

Risk Ratio M-H, Fixed, 95% CI




*Oczkowski et al. Eur Respir J 2022; 59: 2101574*

# Insuffisance respiratoire aiguë et COVID-19



Virus ou bactérie, j'espère que l'OHD fait le job ?

Research

JAMA | Original Investigation

# Effect of Noninvasive Respiratory Strategies on Intubation or Mortality Among Patients With Acute Hypoxemic Respiratory Failure and COVID-19

## The RECOVERY-RS Randomized Clinical Trial

Gavin D. Perkins, MD; Chen Ji, PhD; Bronwen A. Connolly, PhD; Keith Couper, PhD; Ranjit Lall, PhD; J. Kenneth Baillie, PhD; Judy M. Bradley, PhD; Paul Dark, PhD; Chirag Dave, MD; Anthony De Soyza, PhD; Anna V. Dennis, MBBS; Anne Devrell, BPhil; Sara Fairbairn, MB, BCh; Hakim Ghani, MSc; Ellen A. Gorman, MB, BCh; Christopher A. Green, DPhil; Nicholas Hart, PhD; Siew Wan Hee, PhD; Zoe Kimbley, MB, ChB; Shyam Madathil, MD; Nicola McGowan, MRes; Benjamin Messer, MA; Jay Naisbitt, MB, ChB; Chloe Norman, PGCE; Dhruv Parekh, PhD; Emma M. Parkin, MSc; Jaimin Patel, PhD; Scott E. Regan, BA; Clare Ross, MBBS; Anthony J. Rostron, PhD; Mohammad Saim, MBBS; Anita K. Simonds, MD; Emma Skilton, BSc; Nigel Stallard, PhD; Michael Steiner, MD; Rama Vancheeswaran, PhD; Joyce Yeung, PhD; Daniel F. McAuley, MD; for the RECOVERY-RS Collaborators

| | CPAP N=380 | HFNC N=418 | $O_2$ N=475 |
|---|---|---|---|
| Treatment period, No. (%) | | | |
| Before July 2020 | 47 (12.4) | 44 (10.5) | 47 (9.9) |
| July 2020-January 2021 | 262 (69.0) | 289 (69.1) | 331 (69.7) |
| After January 2021 | 71 (18.7) | 85 (20.3) | 97 (20.4) |
| Age, mean (SD), y | 56.7 (12.5) | 57.6 (13.0) | 57.6 (12.7) |
| Sex, No. (%) | | | |
| Male | 260 (68.4) | 272 (65.1) | 312 (65.7) |
| Female | 120 (31.6) | 146 (34.9) | 163 (34.3) |
| **Respiratory rate** | (n = 377); 24 (21-30) | **24** 20-29) | **23** 20-28) |
| $FiO_2$, median (IQR) | (n = 363); 0.60 (0.40-0.80) | (n = 404); 0.60 (0.40-0.80) | (n = 459); 0.60 (0.40-0.80) |
| $SpO_2$, median (IQR), % | (n = 378); 94.0 (92.0-95.0) | (n = 409); 93.0 (91.0-95.0) | (n = 470); 94.0 (92.0-95.0) |
| Ratio of $SpO_2$ to $FiO_2$, median (IQR), % | (n = 363); 155.0 (110.6-232.5) | (n = 399); 156.7 (113.8-232.5) | (n = 457); 156.7 (115.0-230.0) |
| $PaO_2$, median (IQR), mm Hg | (n = 238); 67.5 (60.0-77.3) | **66** (59.3-74.3) | **67** (58.5-80.3) |
| Ratio of $PaO_2$ to $FiO_2$, median (IQR), mm Hg | (n = 229); 112.5 (80.0-161.3) | (n = 284); 115.0 (80.9-168.4) | (n = 308); 113.8 (84.8-150.9) |
| $PaCO_2$, median (IQR), mm Hg | (n = 252); 33.0 (30.0-36.8) | (n = 306); 33.0 (30.0-36.0) | (n = 331); 33.8 (30.8-36.8) |

- Adaptive RCT
  - CPAP vs $O_2$
  - HFNC vs $O_2$
- inclusion criteria:
  - Admission in **hospital** for hypoxemic ARF
  - **$SpO_2$ <94%, $FiO_2$ >40%**

- **Not only** critically-ill patients
- **No prespecified criteria of intubation**
- Recruitment **trial stopped** prematurely
- **Switch** of treatment: 17%

*Perkins et al., JAMA 2022, January 24*

# Recovery-RS
# *HFNC vs. $O_2$*

| | High-flow N=415 | $O_2$ N=368 | |
|---|---|---|---|
| **Primary composite outcome** | | | |
| Tracheal intubation or mortality within 30 d, No./total (%) | 184/415 (44.3) | 166/368 (45.1) | |
| **Secondary outcomes** | | | |
| Individual components of the primary composite | | | |
| **intubation** | **41%** | **42%** | **P=0.72** |
| Mortality within 30 d | 78/416 (18.8) | 74/370 (20.0) | |
| Tracheal intubation rate, No./total (%)[d] | 169/415 (40.7) | 154/368 (41.8) | |
| **Admission in ICU** …l (%) | **62%** | **59%** | |
| Duration of invasive mechanical ventilation after tracheal intubation, median (IQR), d[e] | (n = 169) 15.0 (8.0 to 26.0) | (n = 154) 12.0 (6.0 to 23.0) | |
| Time to event, median (IQR), d | | | |
| Tracheal intubation[f] | (n = 169) 1.0 (0 to 3.0) | (n = 154) 1.0 (0 to 3.0) | |
| Death[g] | (n = 88) | (n = 85) | |
| **Mortality in ICU** | **29% (72/251)** | **30% (65/214)** | **NS** |
| During hospital stay | 86/405 (21.2) | 80/359 (22.3) | |
| Length of stay, mean (SD), d | | | |
| Intensive care unit[h] | (n = 407) 10.5 (15.6) | (n = 361) 9.6 (14.1) | |
| Hospital[i] | (n = 405) 18.3 (20.0) | (n = 359) 17.1 (18.0) | |

# Recovery-RS
# *CPAP vs. $O_2$*

| CPAP N=377 | $O_2$ N=356 | |
|---|---|---|
| 137/377 (36.3) | 158/356 (44.4) | |
| **33%** | **41%** | **P=0.02** |
| 126/377 (33.4) | 147/356 (41.3) | |
| 63/378 (16.7) | 69/359 (19.2) | |
| 126/377 (33.4) | 147/356 (41.3) | |
| 204/368 (55.4) | 219/348 (62.9) | |
| (n = 126) 15.0 (8.0 to 25.0) | (n = 147) 11.0 (6.0 to 23.0) | |
| (n = 126) 2.0 (1.0 to 4.0) | (n = 147) 1.0 (0 to 4.0) | |
| (n = 74) | (n = 79) 17.… | |
| **30% (62/204)** | 66/… **30% (66/219)** | **NS** |
| 72/364 (19.8) | 78/346 (22.5) | |
| (n = 368) 9.5 (15.6) | (n = 348) 9.6 (13.6) | |
| (n = 364) 16.4 (17.5) | (n = 346) 17.3 (18.1) | |

Research

JAMA | Original Investigation

# Effect of High-Flow Oxygen Therapy vs Conventional Oxygen Therapy on Invasive Mechanical Ventilation and Clinical Recovery in Patients With Severe COVID-19

## A Randomized Clinical Trial

Gustavo A. Ospina-Tascón, MD, PhD; Luis Eduardo Calderón-Tapia, MD; Alberto F. García, MD, MSc; Virginia Zarama, MD; Freddy Gómez-Álvarez, MD; Tatiana Álvarez-Saa, MD; Stephania Pardo-Otálvaro, MD; Diego F. Bautista-Rincón, MD; Mónica P. Vargas, MD; José L. Aldana-Díaz, MD; Ángela Marulanda, MD; Alejandro Gutiérrez, MD; Janer Varón, MD; Mónica Gómez, MD; María E. Ochoa, MD; Elena Escobar, MD; Mauricio Umaña, MD; Julio Díez, MD; Gabriel J. Tobón, MD, PhD; Ludwig L. Albornoz, MD; Carlos Augusto Celemín Flórez, MD; Guillermo Ortiz Ruiz, MD, PhD; Eder Leonardo Cáceres, MD; Luis Felipe Reyes, MD, PhD; Lucas Petri Damiani, MSc; Alexandre B. Cavalcanti, MD, PhD; for the HiFLo-Covid Investigators

| Characteristics | HFNC (n=99) | $O_2$ (n=100) |
|---|---|---|
| Age, median (IQR), y | 60 (50-69) | 59 (49-67) |
| Sex, No. (%) | | |
| Female | 28 (28) | 37 (37) |
| Male | 71 (72) | 63 (63) |
| Time from symptom onset to randomization, median (IQR), d | 10 (7-11) | 8 (7-11) |
| Time from admission to randomization, median (IQR), d | 1 (0-1) | 1 (0-1) |
| SOFA score at randomization, median (IQR)[g] | 4 (3-4) | 4 (3-4) |
| **Respiratory rate /min** | **28** | **28** |
| **$PaO_2$ mm Hg** | **78** | **73** |
| $PaCO_2$, median (IQR), mm Hg | 32 (30-35) | 32 (30-36) |
| $PaO_2/FIO_2$ ratio, median (IQR) | 104 (85-132) | 105 (85-141) |
| Seven-category ordinal scale score at randomization, No. (%)[h] | | |
| Hospitalized and receiving supplemental oxygen (score of 4) | 18 (18) | 20 (20) |
| Hospitalized in ICU and receiving oxygen supplementation (score of 5) | 81 (82) | 80 (80) |

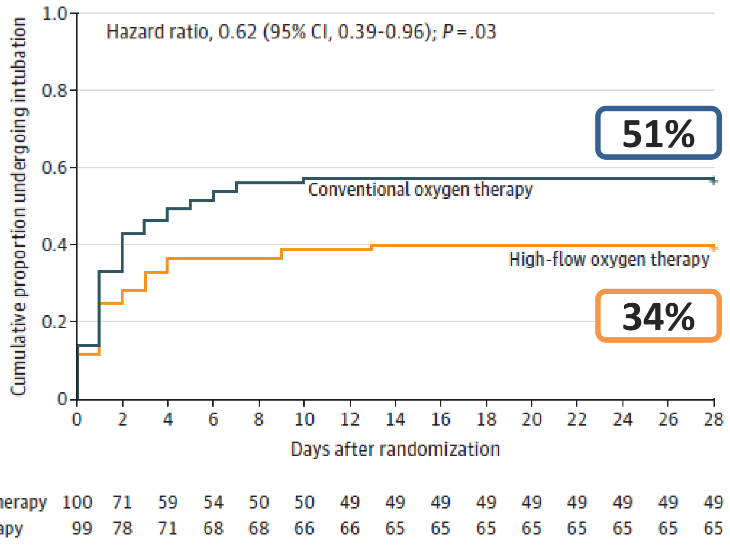
**Inclusion criteria**

- Patients with COVID-19
- $PaO_2/FiO_2$ <200 mm Hg,
- RR > 25/min
- Clinical signs of respiratory distress

- **Predetermined** criteria of intubation
- **Adherence to treatment: 99%**

*Ospina et al., JAMA. 2021;326:2161-21*

# Intubation D-28




| Outcomes | High-flow oxygen therapy (n = 99) | Conventional oxygen therapy (n = 100) | Unadjusted absolute difference (95% CI) | Effect estimate, OR or HR (95% CI)[a] | P value |
|---|---|---|---|---|---|
| **Primary outcomes** | | | | | |
| **Intubation D-28** | **34%** | **51%** | −16.7 (−30.2 to −3.1)[b] | HR, 0.62 (0.39-0.96)[c] | **P=0.03** |
| Clinical recovery within 28 d, No. (%) | 77 (77.8) | 71 (71.0) | 6.8 (−5.3 to 18.9)[b] | HR, 1.39 (1.00-1.92)[d] | .047 |
| Time to clinical recovery, median (IQR), d[e] | 11 (9-14) | 14 (11-19) | −3.0 (−7.5 to 1.0)[f] | | |
| Mortality at day 14, No. (%) | 6 (6.1) | 6 (6.0) | 0.1 (−6.6 to 6.7)[b] | HR, 0.93 (0.29-2.93)[c] | .90 |
| **Mortality D-28** | **8%** | **16%** | −7.9 (−16.9 to 1.1)[b] | HR, 0.49 (0.21-1.16)[c] | **P=0.11** |

Research

JAMA | Original Investigation

# Effect of High-Flow Nasal Cannula Oxygen vs Standard Oxygen Therapy on Mortality in Patients With Respiratory Failure Due to COVID-19

## The SOHO-COVID Randomized Clinical Trial

Jean-Pierre Frat, MD, PhD; Jean-Pierre Quenot, MD, PhD; Julio Badie, MD; Rémi Coudroy, MD, PhD; Christophe Guitton, MD, PhD; Stephan Ehrmann, MD, PhD; Arnaud Gacouin, MD; Hamid Merdji, MD; Johann Auchabie, MD; Cédric Daubin, MD; Anne-Florence Dureau, MD; Laure Thibault, MD; Nicholas Sedillot, MD; Jean-Philippe Rigaud, MD, PhD; Alexandre Demoule, MD, PhD; Abdelhamid Fatah, MD; Nicolas Terzi, MD, PhD; Marine Simonin, MD; William Danjou, MD; Guillaume Carteaux, MD, PhD; Charlotte Guesdon, MD; Gaël Pradel, MD; Marie-Catherine Besse, MD; Jean Reignier, MD, PhD; François Beloncle, MD, PhD; Béatrice La Combe, MD; Gwénaël Prat, MD; Mai-Anh Nay, MD; Joe de Keizer, MSc; Stéphanie Ragot, PharmD, PhD; Arnaud W. Thille, MD, PhD; for the SOHO-COVID Study Group and the REVA Network

| Characteristic | HFNC (n=357) | $O_2$ (n=354) |
|---|---|---|
| Age, mean (SD), y | 61 (12) | 61 (12) |
| Sex, No. (%) | | |
| Male | 250 (70) | 247 (70) |
| Female | 107 (30) | 107 (30) |
| Confirmed COVID-19, No. (%)[c] | 354 (99) | 350 (99) |
| Interval between symptom onset and ICU admission, median (IQR), d | 10 (7-12) | 10 (8-12) |
| Interval between hospital and ICU admission, median (IQR), d | 2 (1-3) | 2 (1-3) |
| Use of glucocorticoids, No. (%) | 338 (95) | 335 (95) |
| Clinical parameters | | |
| Respiratory rate /min | **28** | **29** |
| Respiratory rate ≤25 breaths/min, No. (%) | 79 (22) | 67 (19) |
| Heart rate, mean (SD), beats/min | 81 (15) | 81 (17) |
| Systolic arterial pressure, mean (SD), mm Hg | 134 (20) | 134 (20) |
| Mean arterial pressure, mean (SD), mm Hg | 94 (13) | 93 (14) |
| Bilateral pulmonary infiltrates, No. (%)[d] | 348 (99) | 342 (98) |
| Arterial blood gas, mean (SD)[e] | | |
| pH | 7.46 (0.04) | 7.46 (0.05) |
| $PaO_2$ mm Hg | **73** | **76** |
| $FIO_2$[f] | 0.58 (0.08) | 0.58 (0.07) |
| $PaO_2$:$FIO_2$ ratio, mm Hg | 128 (31) | 132 (31) |
| $PaCO_2$, mm Hg | 35 (5) | 35 (4) |

**Inclusion criteria**

- Patients with COVID-19
- $PaO_2/FiO_2$ <200 mm Hg, despite $O_2$ >10 L/min

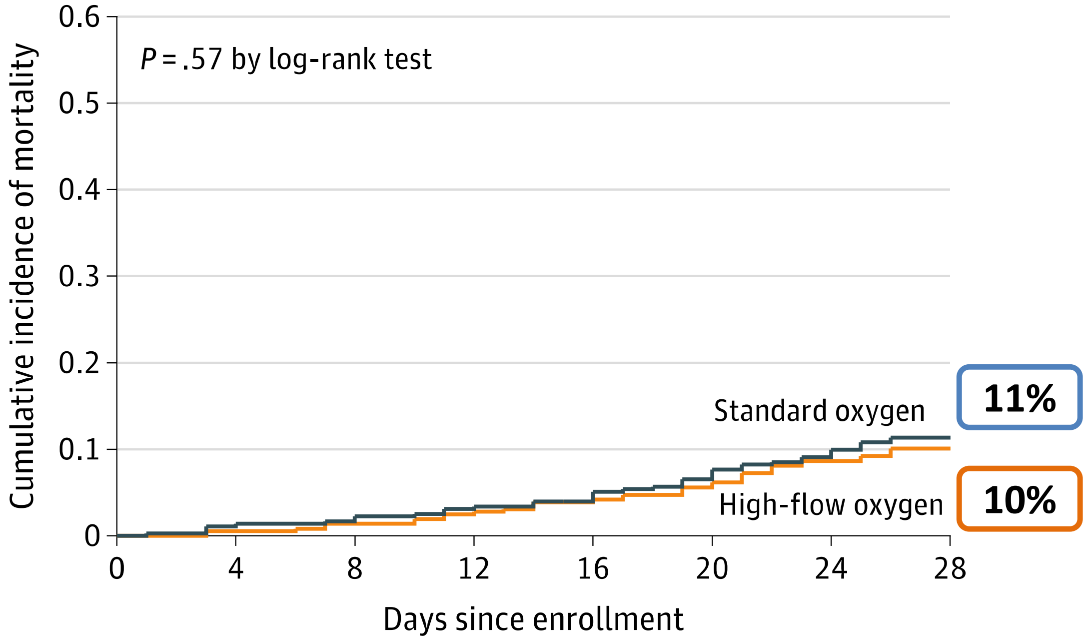
- **Predetermined** criteria of intubation
- **Adherence to treatment:**
  HFNC group: 6% switched to std $O_2$
  Std $O_2$: 3% switched to HFNC

*JAMA online 27 sept 2022*

Mortality

Intubation

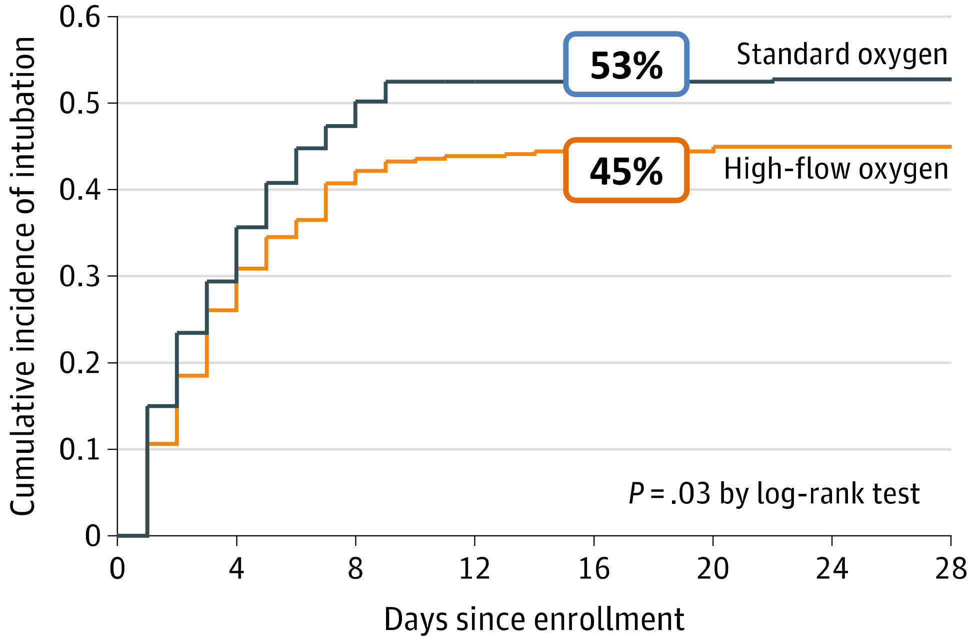
**A** Cumulative incidence of mortality (primary outcome)




No. at risk

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| High-flow oxygen | 357 | 355 | 352 | 348 | 343 | 337 | 326 | 321 |
| Standard oxygen | 354 | 349 | 347 | 342 | 337 | 328 | 319 | 311 |

**B** Cumulative incidence of intubation (secondary outcome)




No. at risk

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| High-flow oxygen | 357 | 262 | 210 | 199 | 197 | 195 | 193 | 193 |
| Standard oxygen | 354 | 248 | 185 | 165 | 164 | 164 | 163 | 163 |

Time to intubation (P=0.10)
High-flow oxygen: 36 h
Standard oxygen: 26 h

# High-flow oxygen vs. standard $O_2$

**Bénéfice probable de l'OHD**

## Intubation

| Study | HFNO Events | HFNO Total | O2 Events | O2 Total | Risk Ratio | RR | 95%-CI | Weight |
|---|---|---|---|---|---|---|---|---|
| **COVID** | | | | | | | | |
| *Ospina-Tacson-2021* | 34 | 99 | 51 | 100 | | 0.67 | [0.48; 0.94] | |
| *Perkins-2022* | 170 | 415 | 153 | 368 | | 0.99 | [0.83; 1.16] | |
| *Frat-2022* | 160 | 357 | 186 | 354 | | 0.85 | [0.73; 0.99] | |
| **Total** | **364** | **871** | **390** | **822** | | **0.86** | **[0.73; 1.03]** | |

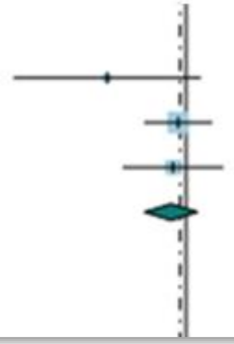
Heterogeneity: $I^2 = 54\%$ [0%; 87%], $\tau^2 = 0.0122$, $p = 0.11$
Test for effect in subgroup: $z = -1.67$ ($p = 0.094$)

**Bénéfice non prouvé**

## Mortality

28_30-day mortality

| Study | HFNO Events | HFNO Total | O2 Events | O2 Total | Risk Ratio | RR | 95%-CI | Weight |
|---|---|---|---|---|---|---|---|---|
| **COVID** | | | | | | | | |
| *Ospina-Tacson-2021* | 8 | 99 | 16 | 100 | | 0.51 | [0.23; 1.13] | |
| *Perkins-2022* | 78 | 415 | 74 | 368 | | 0.93 | [0.70; 1.24] | |
| *Frat-2022* | 36 | 357 | 40 | 354 | | 0.89 | [0.58; 1.37] | |
| **Total** | **122** | **871** | **130** | **822** | | **0.88** | **[0.70; 1.10]** | |

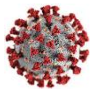


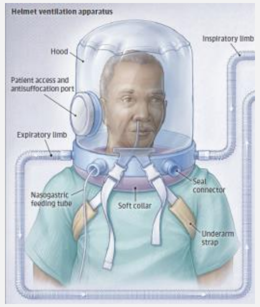
Heterogeneity: $I^2 = 1\%$ [0%; 90%], $\tau^2 = < 0.0001$, $p = 0.36$
Test for effect in subgroup: $z = -1.12$ ($p = 0.262$)

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

# Effect of Helmet Noninvasive Ventilation vs High-Flow Nasal Oxygen on Days Free of Respiratory Support in Patients With COVID-19 and Moderate to Severe Hypoxemic Respiratory Failure
## The HENIVOT Randomized Clinical Trial

Domenico Luca Grieco, MD; Luca S. Menga, MD; Melania Cesarano, MD; Tommaso Rosà, MD; Savino Spadaro, MD, PhD; Maria Maddalena Bitondo, MD; Jonathan Montomoli, MD, PhD; Giulia Falò, MD; Tommaso Tonetti, MD; Salvatore L. Cutuli, MD; Gabriele Pintaudi, MD; Eloisa S. Tanzarella, MD; Edoardo Piervincenzi, MD; Filippo Bongiovanni, MD; Antonio M. Dell'Anna, MD; Luca Delle Cese, MD; Cecilia Berardi, MD; Simone Carelli, MD; Maria Grazia Bocci, MD; Luca Montini, MD; Giuseppe Bello, MD; Daniele Natalini, MD; Gennaro De Pascale, MD; Matteo Velardo, PhD; Carlo Alberto Volta, MD; V. Marco Ranieri, MD; Giorgio Conti, MD; Salvatore Maurizio Maggiore, MD, PhD; Massimo Antonelli, MD; for the COVID-ICU Gemelli Study Group

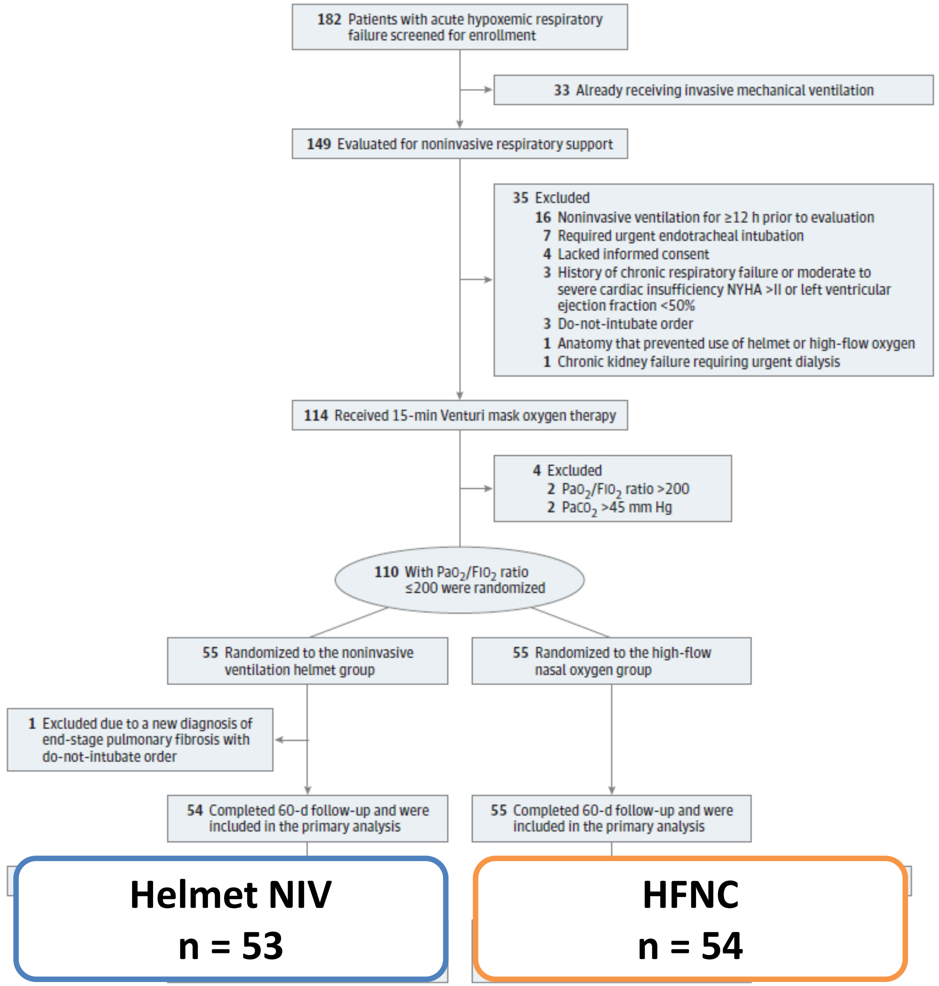


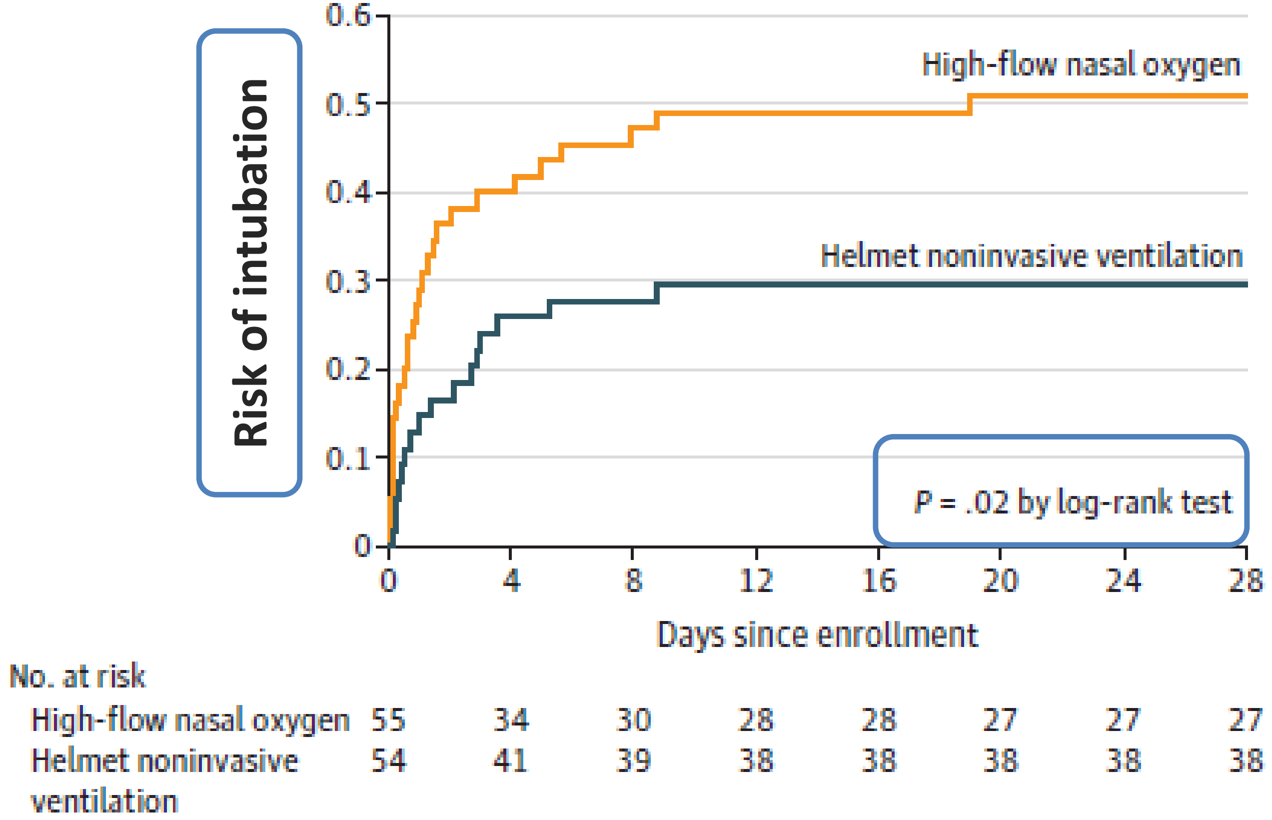



**Helmet NIV:**

- PS: 10 cm H2O (10-12)
- PEEP 12 cm H2O (10-12)

**HFNC :** 60 L/Min (60-60)




*Grieco et al. JAMA. 2021; 325:1731-1743*

# HENIVOT trial

| Outcome | No. (%) Helmet noninvasive ventilation (n = 54)[a] | High-flow nasal oxygen (n = 55)[a] | Absolute or mean difference (95% CI)[b] | Odds ratio (95% CI) | P value[c] |
|---|---|---|---|---|---|
| **Primary outcome** | | | | | |
| Respiratory support-free days, median (IQR)[d] | 20 (0 to 25) | 18 (0 to 22) | 2 (−2 to 6) | | .26 |
| **Secondary outcomes** | | | | | |
| **Intubation** … enrollment | **30%** | **51%** | −21 (−38 to −3) | 0.41 (0.18 to 0.89) | P=0.03 |
| Intubation within 28 d from enrollment, after adjudication of intubation criteria by external experts | 15 (28) | 28 (51) | −23 (−39 to −5) | 0.37 (0.17 to 0.82) | .02 |
| Invasive ventilation-free days, median (IQR) | | | | | |
| 28 d | 28 (13 to 28) | 25 (4 to 28) | 3 (0 to 7) | | .04 |
| 60 d | 60 (43 to 60) | 57 (19 to 60) | 6 (−3 to 15) | | .07 |
| **Mortality** | | | | | |
| 28 d | **15%** | **18%** | −3 (−17 to 11) | 0.78 (0.28 to 2.16) | NS |
| 60 d | 13 (24) | 12 (22) | 2 (−13 to 18) | 1.14 (0.46 to 2.78) | |
| In-intensive care unit mortality | 11 (20) | 14 (25) | −5 (−21 to 11) | 0.75 (0.30 to 1.84) | .65 |
| In-hospital mortality[e] | 13 (24) | 14 (25) | −1 (−17 to 15) | 0.93 (0.39 to 2.22) | >.99 |
| Duration of stay, median (IQR), d | | | | | |
| Intensive care unit | 9 (4 to 17) | 10 (5 to 23) | −6 (−13 to 1) | | .22 |
| Hospital | 21 (14 to 30) | 22 (13 to 44) | −6 (−14 to 1) | | .47 |

*Grieco. JAMA. 2021; 325:1731-1743*

Research

JAMA | Original Investigation

# Effect of Helmet Noninvasive Ventilation vs Usual Respiratory Support on Mortality Among Patients With Acute Hypoxemic Respiratory Failure Due to COVID-19

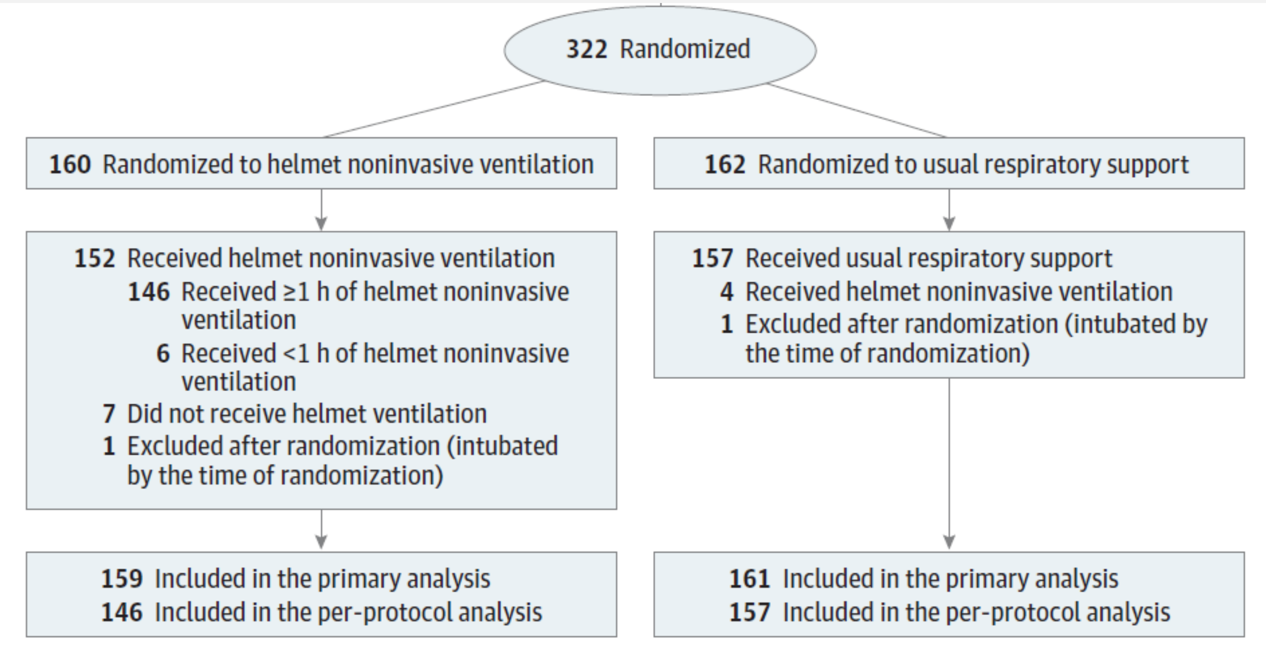
## The HELMET-COVID Randomized Clinical Trial

Yaseen M. Arabi, MD; Sara Aldekhyl, MD; Saad Al Qahtani, MD; Hasan M. Al-Dorzi, MD; Sheryl Ann Abdukahil, BSN; Mohammed Khulaif Al Harbi, MD; Eman Al Qasim, MSN; Ayman Kharaba, MD; Talal Albrahim, MD; Mohammed S. Alshahrani, MD; Abdulrahman A. Al-Fares, MD; Ali Al Bshabshe, MD; Ahmed Mady, MD; Zainab Al Duhailib, MBBS; Haifa Algethamy, MD; Jesna Jose, PhD; Mohammed Al Mutairi, BS; Omar Al Zumai, BS; Hussain Al Haji, MSc; Ahmed Alaqeily, BS; Zohair Al Aseri, MD; Awad Al-Omari, MD; Abdulaziz Al-Dawood, MD; Haytham Tlayjeh, MD; for the Saudi Critical Care Trials Group

**Inclusion criteria**

- Patients with COVID-19
- $PaO_2/FiO_2$ <200 mm Hg, despite $O_2$ >10 L/min

- **Helmet-NIV :** PS 8 cm $H_2O$ and PEEP 10 cm $H_2O$
- **Usual respiratory support:** NIV via mask, HFNC, standard $O_2$



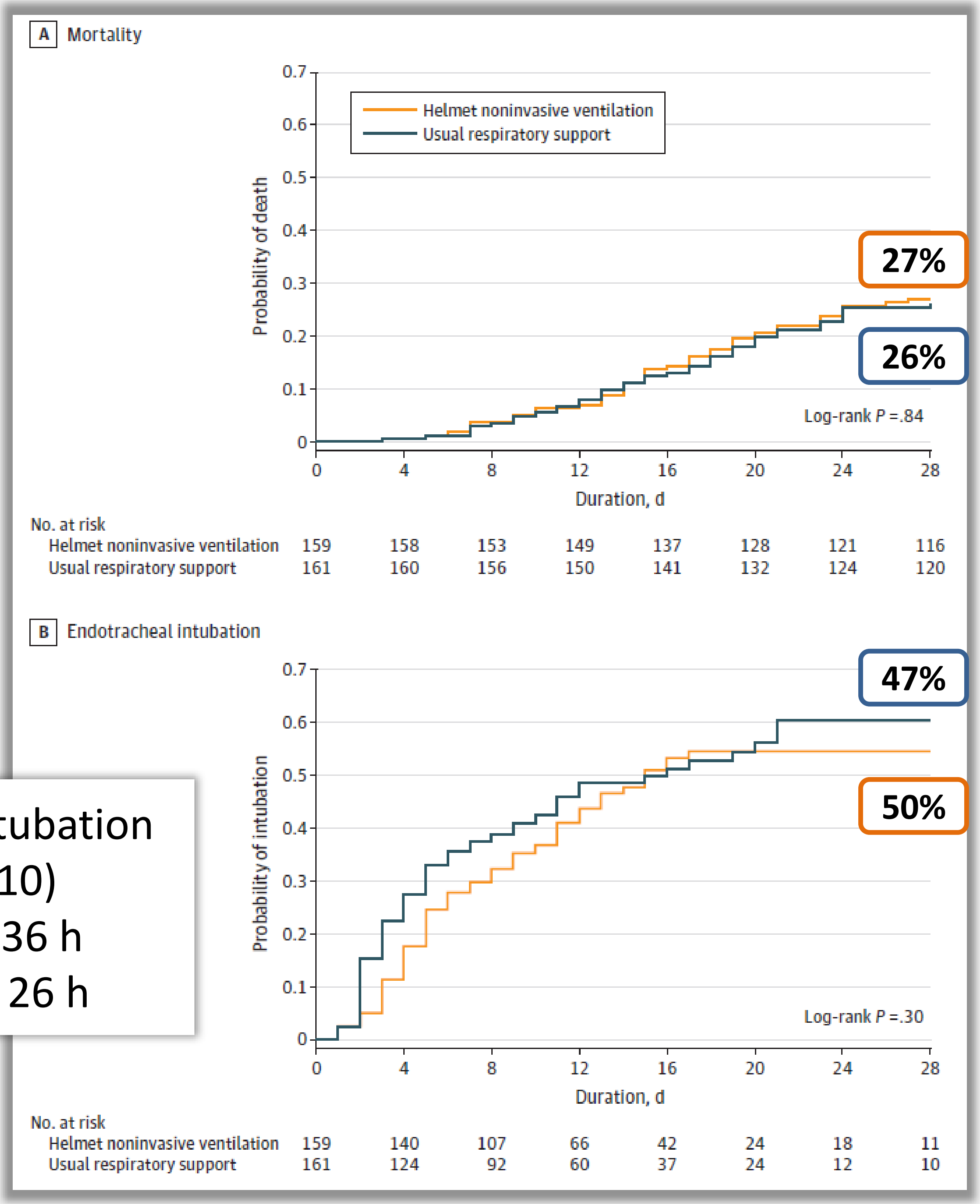

| | No. (%) | |
|---|---|---|
| Characteristic[a] | Helmet noninvasive ventilation (n = 159) | Usual respiratory support (n = 161) |
| Respiratory rate, median (IQR), breaths/min | 31 | 30 |
| $PaO_2$, mm Hg | 60 | 60 |
| $FIO_2$ | 80 (70-100) | 80 (60-100) |
| $PaO_2$:$FIO_2$ ratio | 73 (60-93) | 76 (61-111) |
| $PCO_2$, mm Hg | 36 (32-39) | 35 (32-39) |
| $HCO_3$, mEq/L | 24 (22-26) | 24 (22-26) |
| pH | 7.43 (7.40-7.46) | 7.43 (7.40-7.46) |

*JAMA. 2022;328:1063-1072*

| Variable[a] | No. (%) Helmet noninvasive ventilation (n = 159) | No. (%) Usual respiratory support (n = 161) |
|---|---|---|
| Helmet NIV use during the 28-d study period | | |
| No. of patients | 152 (95.6) | 4 (2.5) |
| Total duration of helmet use, median (IQR), h | 43 (19.5-70.5) | 0 (0-0) |
| **Noninvasive respiratory support in the first 48 h** | | |
| Helmet NIV | | |
| No. of patients | 95% | 3 (1.9) |
| Duration of use, median (IQR), h | 34 | 0 (0-0) |
| Mask NIV | | |
| No. of patients | 43 (27.0) | 69% |
| Duration of use, median (IQR), h | 0 (0-5) | 14 |
| Helmet or mask NIV | | |
| No. of patients | 154 (96.9) | 69% |
| Duration of use, median (IQR), h | 40 (24-48) | 14.0 (0-27) |
| High-flow nasal oxygen | | |
| No. of patients | 91 (57.2) | 76% |
| Duration of use, median (IQR), h | 3 (0-15) | 23 (4-39) |
| Standard oxygen | | |
| No. of patients | 25 (15.7) | 20% |
| Duration of use, median (IQR), h | 0 (0-0) | 0 (0-0) |
| **Noninvasive ventilation settings (via helmet or mask), day 1** | | |
| Highest pressure support level, median (IQR) [No.], cm $H_2O$ | 8 (8-10) [152] | 8 (0-10) [102] |
| Highest PEEP, median (IQR) [No.], cm $H_2O$ | 10 (10-10) [152] | 10 (8-10) [102] |

**Helmet NIV**

**Mask NIV**




Time to intubation
(P=0.10)
HFNC: 36 h
Std $O_2$: 26 h

# Conclusion

- Dans **l'insuffisance respiratoire hypoxémique**, l'OHD est une alternative à l'$O_2$ standard pour diminuer le risque d'intubation, cependant l'effet sur la mortalité n'est pas certain.
- La VNI avec helmet ou CPAP ne peuvent pas être encore recommandées, en raison du faible nombre d'essais réalisés.