Indications et modalités d'utilisation de l'Optiflow

Dr Nejla Tilouche

Service de Réanimation Médicale

EPS Tahar Sfar Mahdia

Les objectifs

- Expliquer le mode de fonctionnement et les effets physiologiques de l'oxygénothérapie à haut débit.
- Discuter les différentes indications et modalités d'utilisation de l'Optiflow.

Inconvénients des moyens d'oxygénothérapie standards

- *Administration d'un air sec ou faiblement humidifié:*

- Sécheresse des muqueuses,
- douleur nasale,
- ↓clairance mucociliaire nasale,
- ↑Résistances des voies aériennes (mécanisme de protection)

➔**Intolérances**

Inconvénients des moyens d'oxygénothérapie standards

- Débit d'O2 maximal à 15 L/mn → faible débit inspiratoire
- Fio2 atteinte < Fio2 cible

La VNI

- IRA hypercapnique et OAP cardiogénique: Efficacité indiscutable
- IRA post extubation, pneumopathie de l'immunodéprimé…
  - Efficacité au cours des IRA hypoxémiques chez des patients non sélectionnés?
  - Problème d'intolérance du masque, sécheresse buccale et complications locales

Système

FiO2 de 0,21 à 1

Débit jusqu'à 60 L/mn

➔Tolérance ; confort; simplicité de mise en place

➔Un système ouvert: flux constant, pas de pression inspiratoire

Effets physiologiques

- ***Humidification et réchauffement de l'air délivré***
- Dépend du débit administré
- Mais condensation de la vapeur d'eau

➔↓ ***VC des voies aériennes, ↓ travail respiratoire***

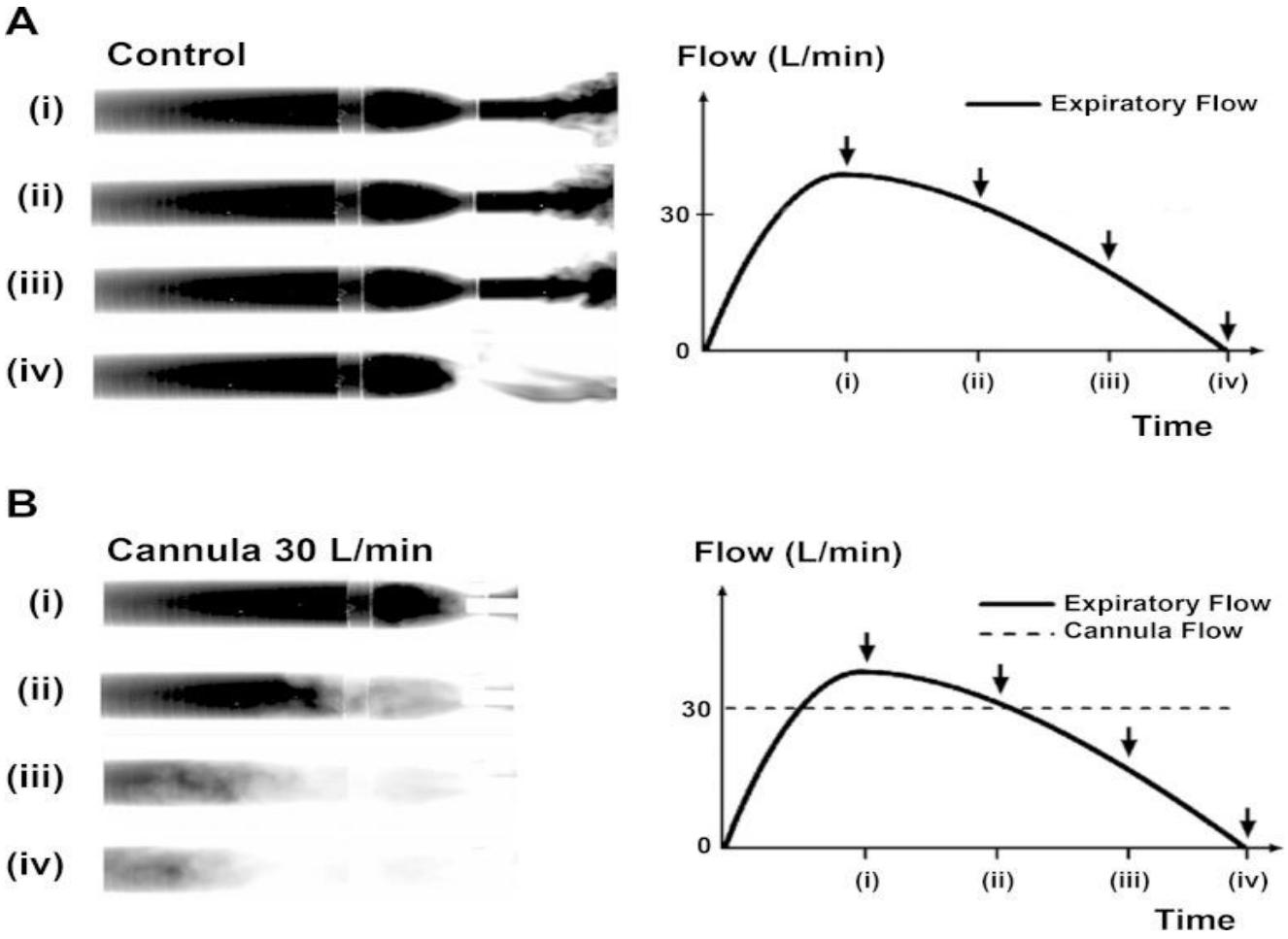
➔***Amélioration de la clairance mucociliaire***

Effets physiologiques

- ***Elimination du CO2***

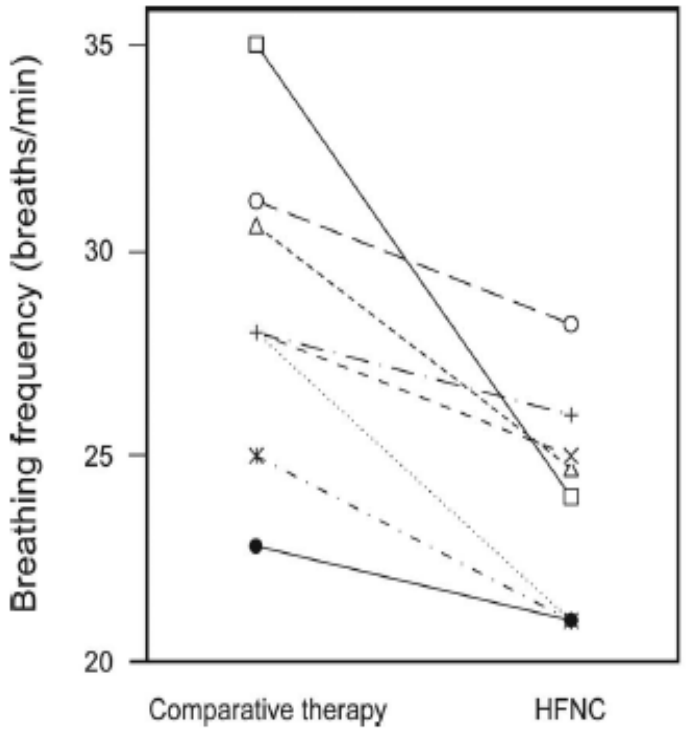
  - ***Lavage de l'espace mort anatomique***

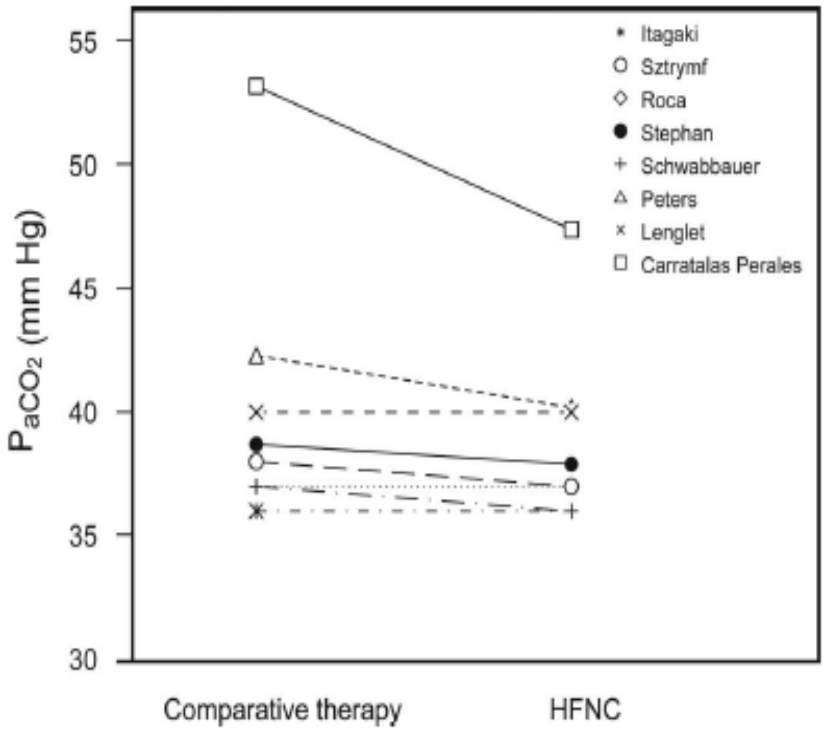
  - ***Amélioration de la ventilation alvéolaire***



Winfried Möller J Appl Physiol (1985). 2015 Jun 15

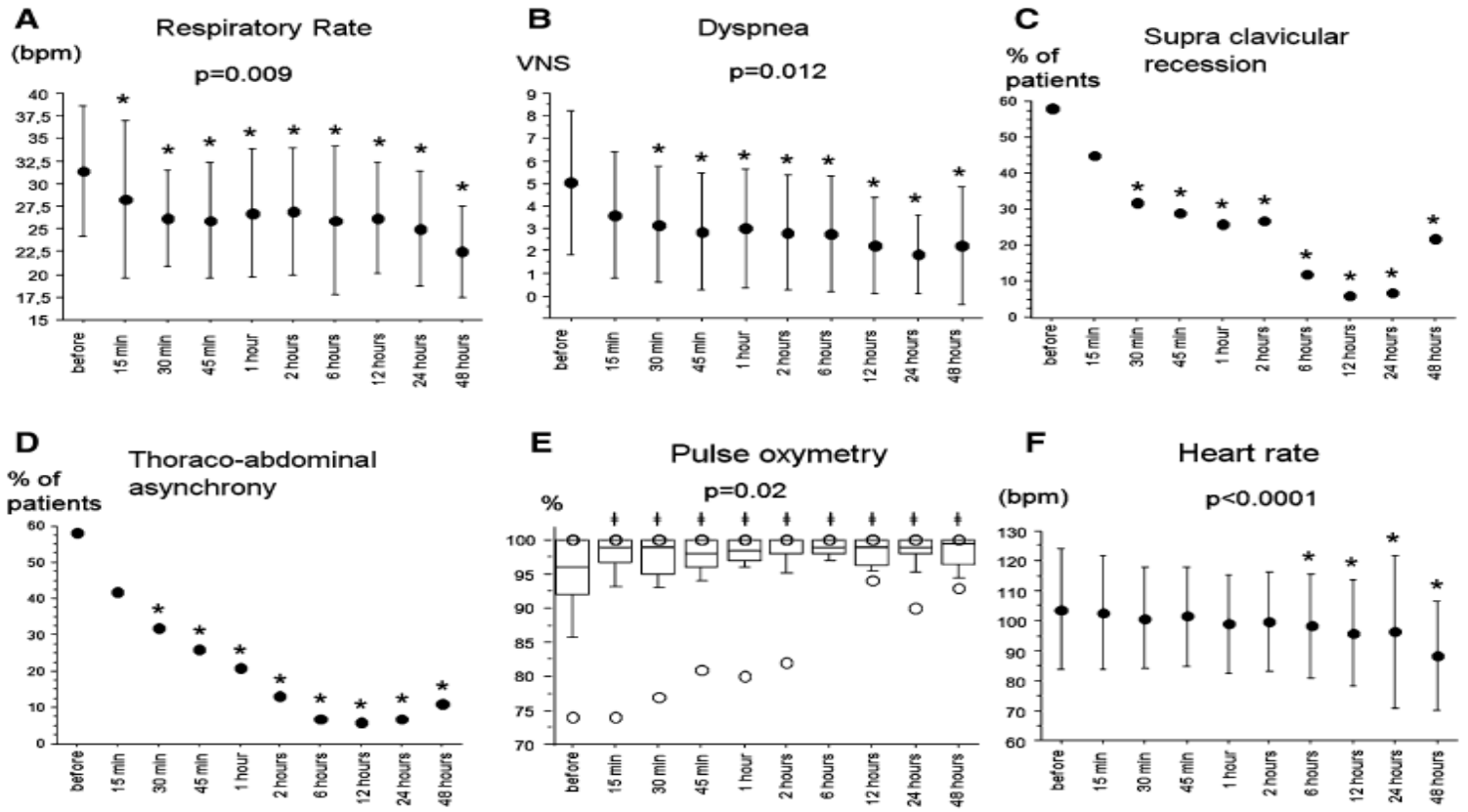
HFNC in Adults





Effets physiologiques

- ***Meilleure synchronie thoraco-abdominale***



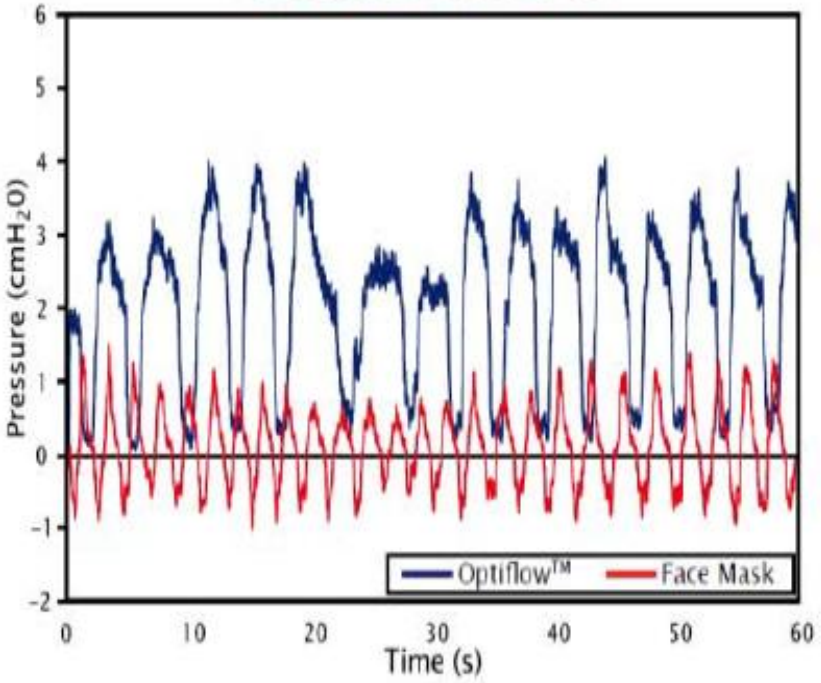
Sztrymf B et al. Intensive Care Med. 2011

Effets physiologiques

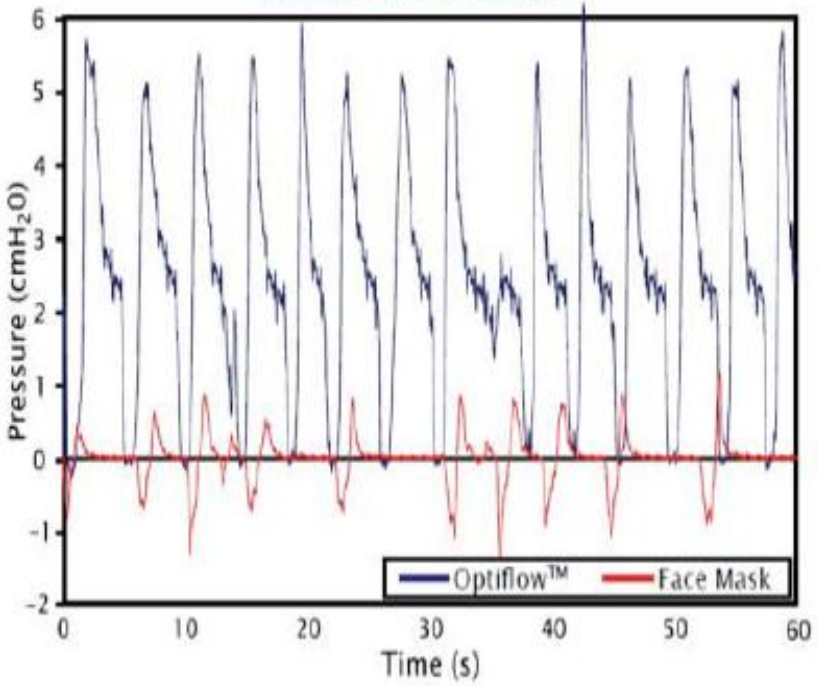
- ***Effet CPAP?***
- modéré, PEP ne dépasse pas 5 cmH_2O
- ***Flux d'air constant – résistance durant l'expiration***

Enregistrement des pressions nasopharyngées sur une minute à 35 l/min

Bouche ouverte



Bouche fermée



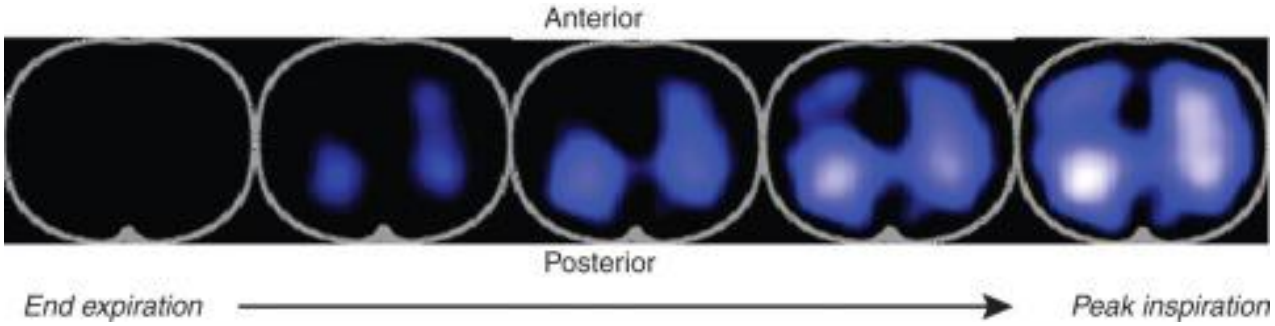
British Journal of Anaesthesia **107** (6): 998–1004 (2011)
Advance Access publication 9 September 2011 · doi:10.1093/bja/aer265

BJA

Oxygen delivery through high-flow nasal cannulae increase end-expiratory lung volume and reduce respiratory rate in post-cardiac surgical patients

A. Corley[1*], L. R. Caruana[1], A. G. Barnett[2], O. Tronstad[1] and J. F. Fraser[1]

- **Evaluation du volume pulmonaire par impédancemétrie**



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Variable	Low-flow oxygen [mean (SD)]	HFNC [mean (SD)]	Mean difference [mean (SD)]	95% confidence interval	*P*-value
End-expiratory lung impedance (units)	419 (212.5)	1936 (212.9)	1517 (46.6)	1425, 1608	<0.001
Mean airway pressure (cm H_2O)	−0.3 (0.9)	2.7 (1.2)	3.0 (1.3)	2.4, 3.7	<0.001
Respiratory rate (bpm)	20.9 (4.4)	17.5 (4.6)	−3.4 (2.8)	−2.0, −4.7	<0.001
Borg score					
0–10	2.7 (2.6)	1.9 (2.3)	−0.8 (1.2)	−0.1, −1.4	0.023
Tidal variation (units)	1512 (195.0)	1671 (195.1)	159 (21.6)	117, 201	<0.001
Pa_{O_2}/FI_{O_2} ratio (mm Hg)	160 (53.7)	190.6 (57.9)	30.6 (25.9)	17.9, 43.3	<0.001

British Journal of Anaesthesia **107** (6): 998–1004 (2011)
Advance Access publication 9 September 2011 · doi:10.1093/bja/aer265

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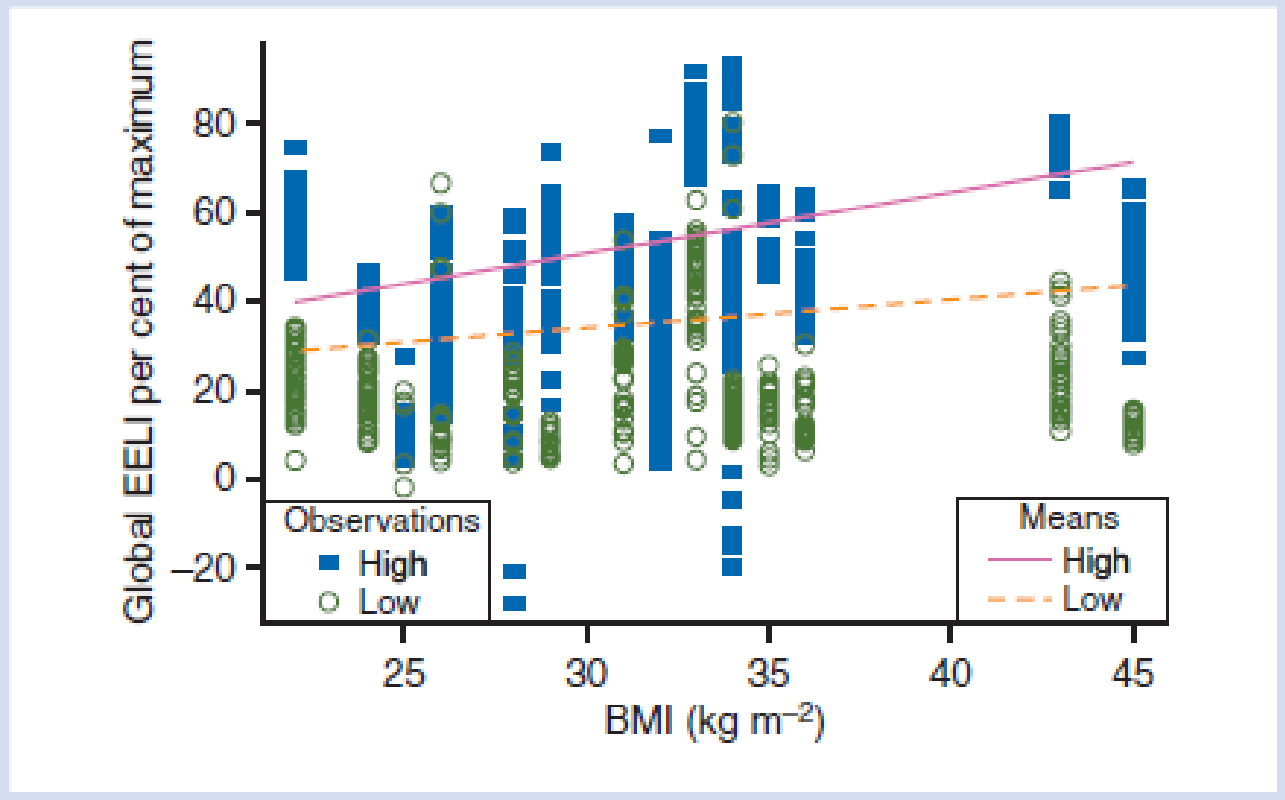

Indications

Insuffisance respiratoire aigue hypoxémique

Journal of Critical Care (2012) 27, 324.e9–324.e13

ELSEVIER

Journal of Critical Care

Impact of high-flow nasal cannula oxygen therapy on intensive care unit patients with acute respiratory failure: A prospective observational study☆,☆☆

Benjamin Sztrymf[a,b], Jonathan Messika[a,b,1], Thomas Mayot[a,1], Hugo Lenglet[a], Didier Dreyfuss[a,b], Jean-Damien Ricard[a,b,*]

- **20 patients: IRA avec hypoxie sévère: SpO2 < 96% sous FiO2 > 50%**

Patient characteristics		N = 20
Sex ratio (M/F)		10/10
Age (y)		59 (38-75)
SAPS2		33 (26.5-38)
Patient origin	Emergency department	14
	Prehospital setting	4
	Medical ward	2
Comorbidity	COPD	1
	Lung cancer	2
	Bronchiectasis	1
	Asthma	1
	HIV infection	1
	Active smoking	3
	History of pneumonia	4
Indications	Community-acquired pneumonia	11
	Pulmonary embolism	1
	COPD exacerbation	1
	TRALI	1
	Purulent pleural effusion	1
	Pulmonary contusion	1
	Cardiogenic pulmonary edema	1
	Postextubation ARF	1
	Other[a]	2

Journal of Critical Care (2012) 27, 324.e9–324.e13

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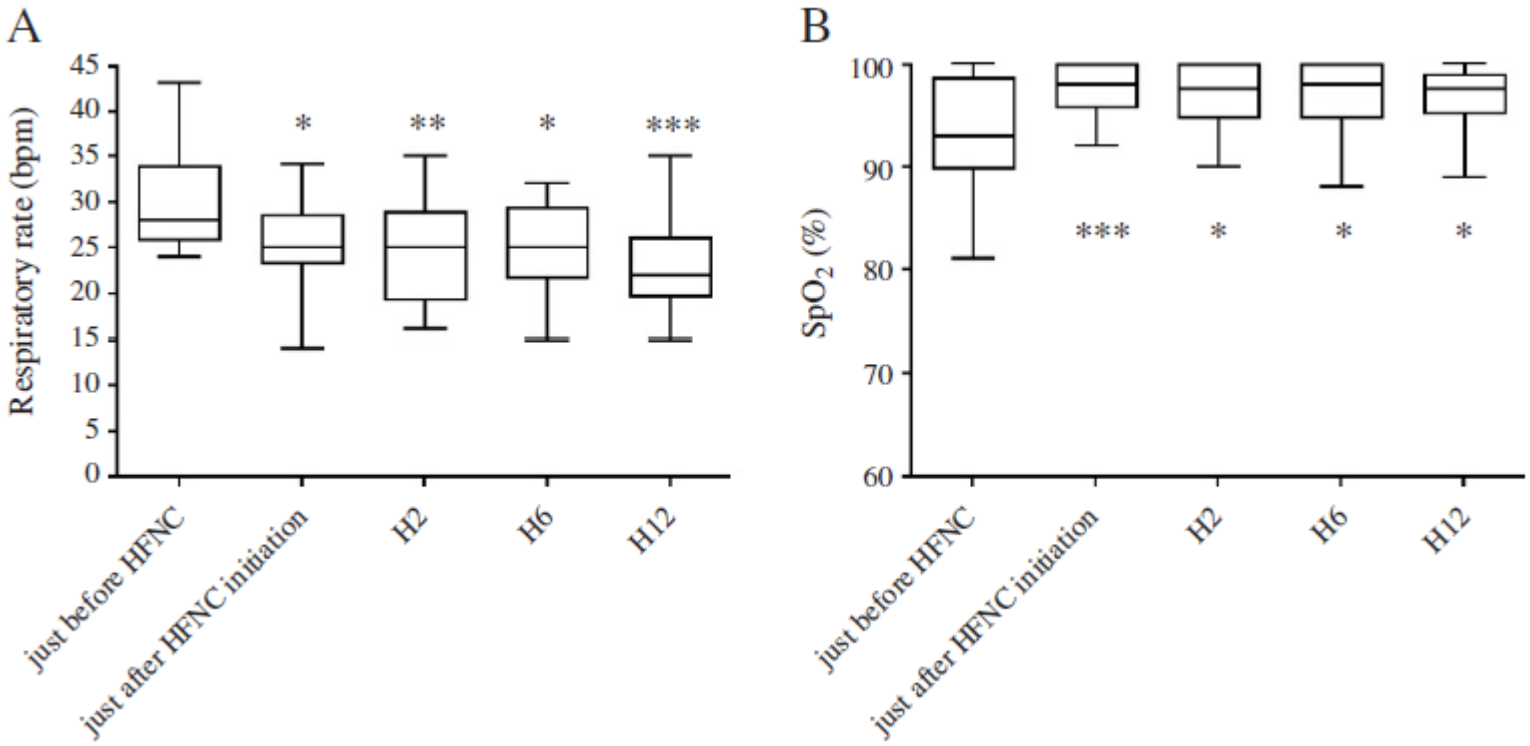


The NEW ENGLAND JOURNAL of MEDICINE

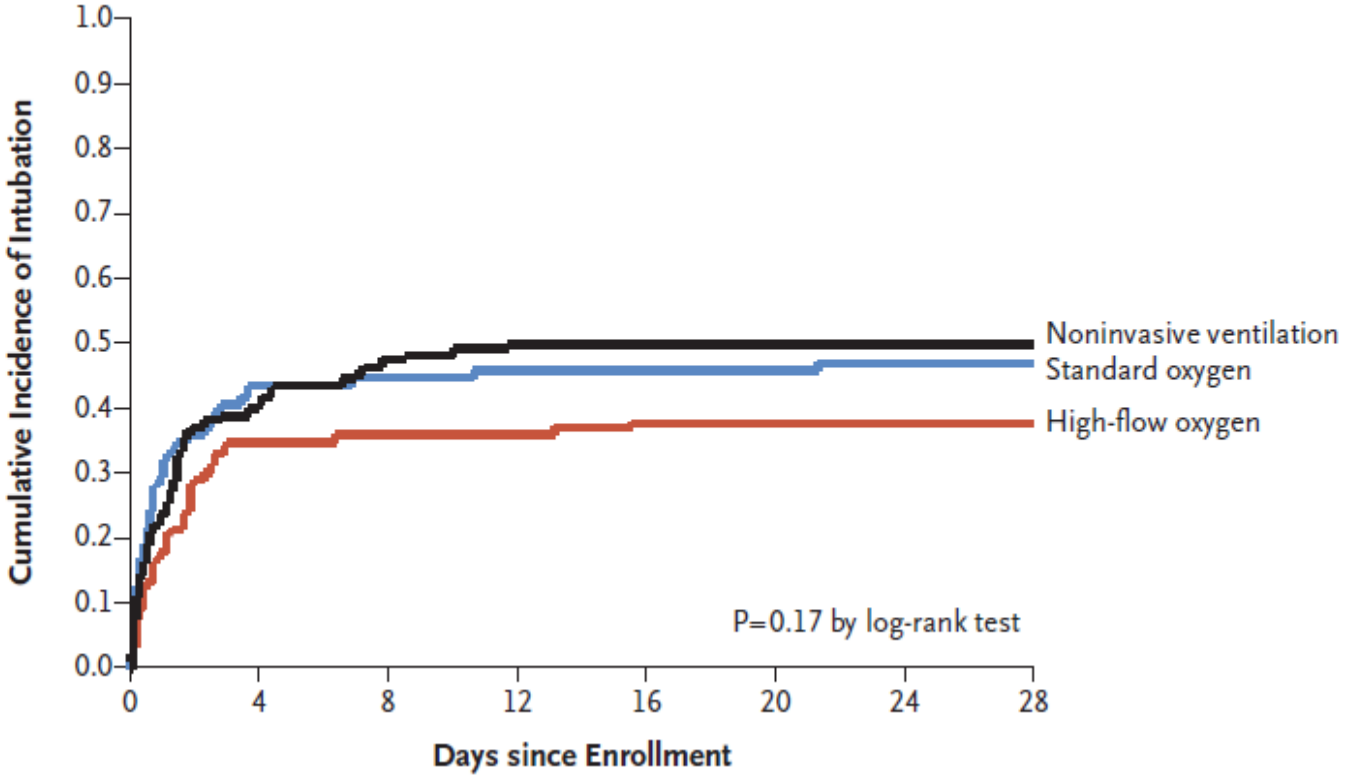
ESTABLISHED IN 1812 JUNE 4, 2015 VOL. 372 NO. 23

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

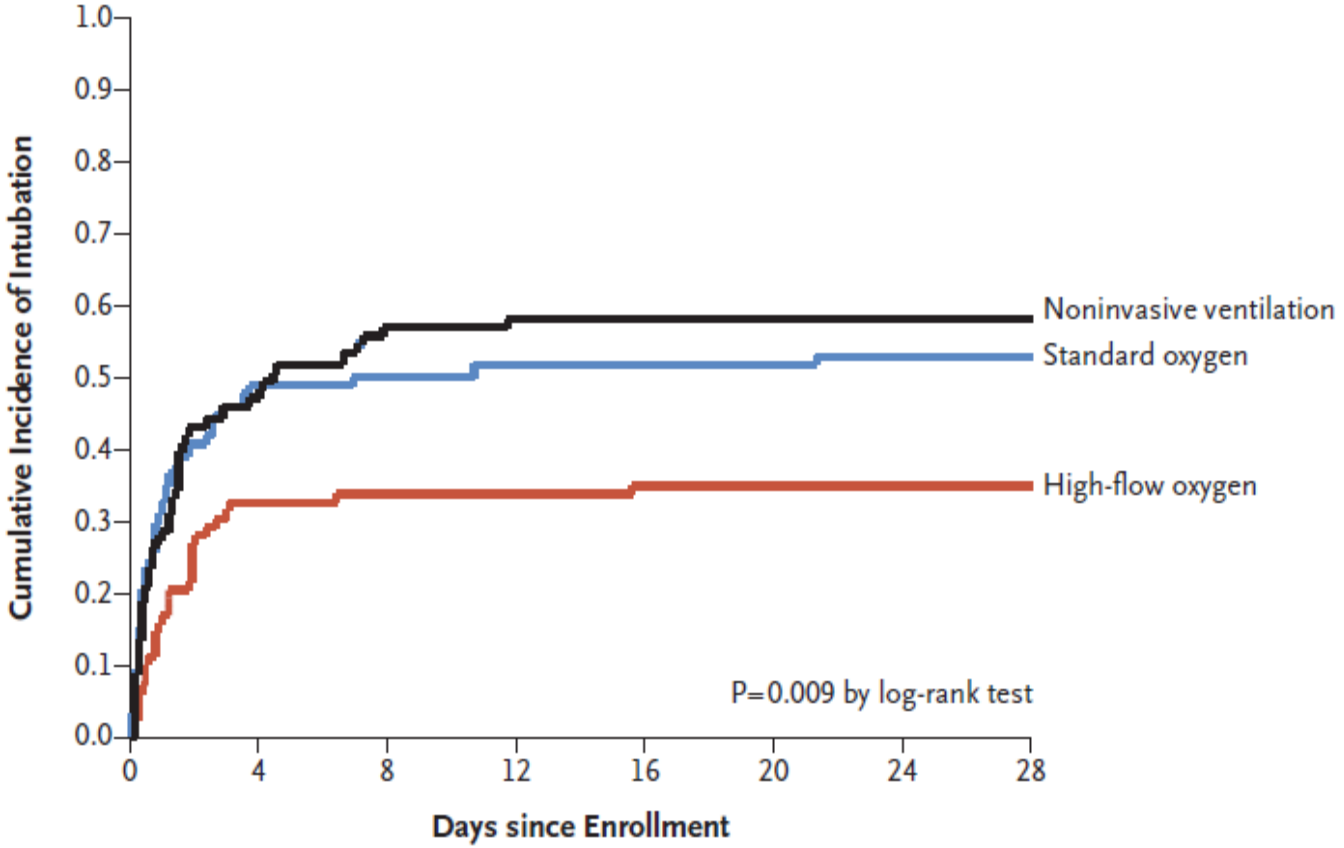
Jean-Pierre Frat, M.D., Arnaud W. Thille, M.D., Ph.D., Alain Mercat, M.D., Ph.D., Christophe Girault, M.D., Ph.D.,

- 32 USI en France
- Patients en IRA avec P/F < 300 sous un débit > 10 L/mn
- IRA hypercapnique et OPA cardiogénique exclus
- Trois groupes:
  - Oxygénothérapie standard
  - HFNC
  - VNI en alternance avec HFNC

A Overall Population



B Patients with a PaO_2:FIO_2 ≤200 mm Hg



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
Death						
In ICU						
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)
At day 90						
Overall population						
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)

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

(insuffisance cardiaque, insuffisance respiratoire chronique, sevrage difficile ou prolongé…)

➔ VNI préventive ou curative

Contents lists available at ScienceDirect

Heart & Lung

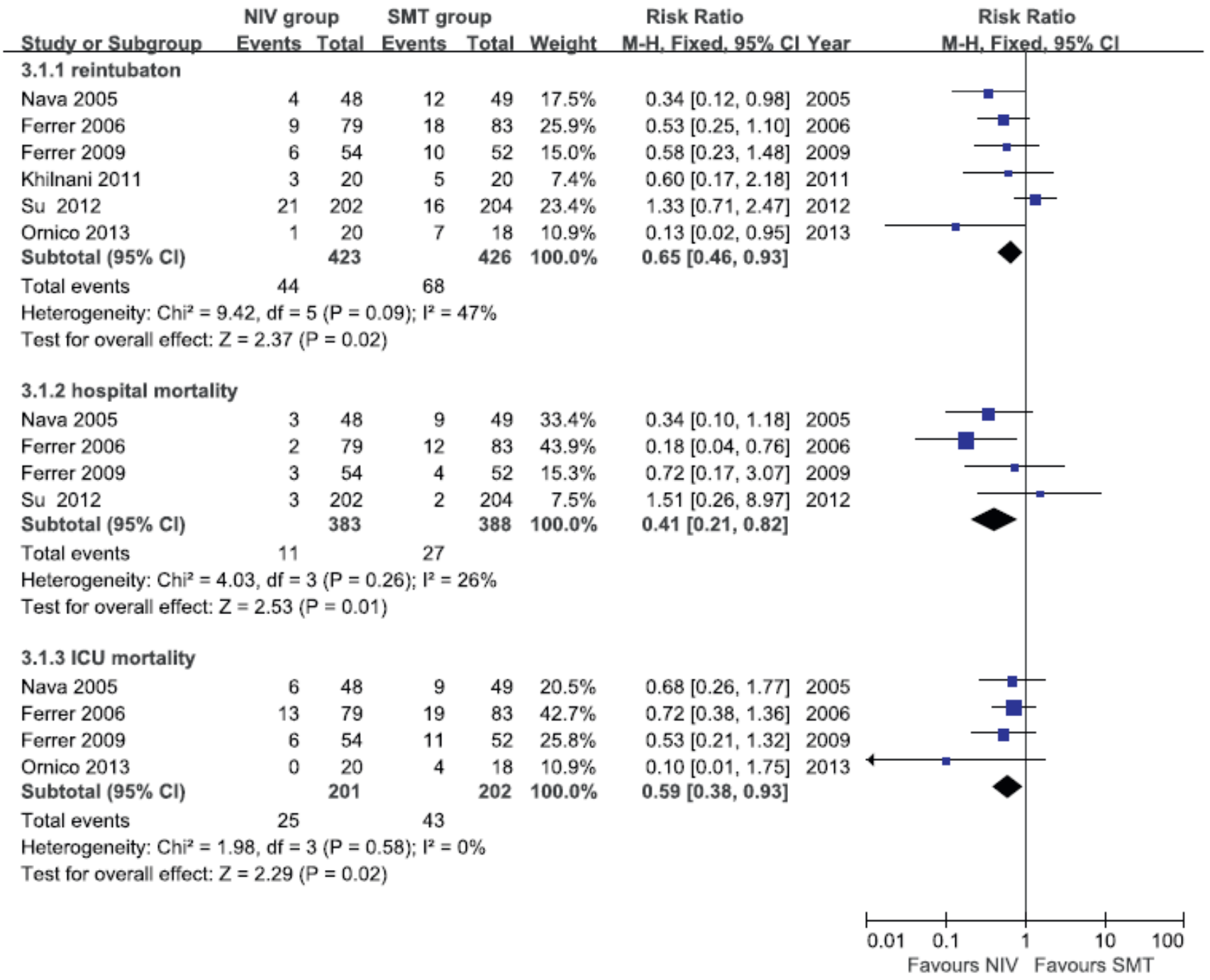
journal homepage: www.heartandlung.org

The efficacy of noninvasive ventilation in managing postextubation respiratory failure: A meta-analysis

Changyang Lin, Dr, Huapeng Yu, MD*, Huizhen Fan, Dr, Zhongli Li, Dr

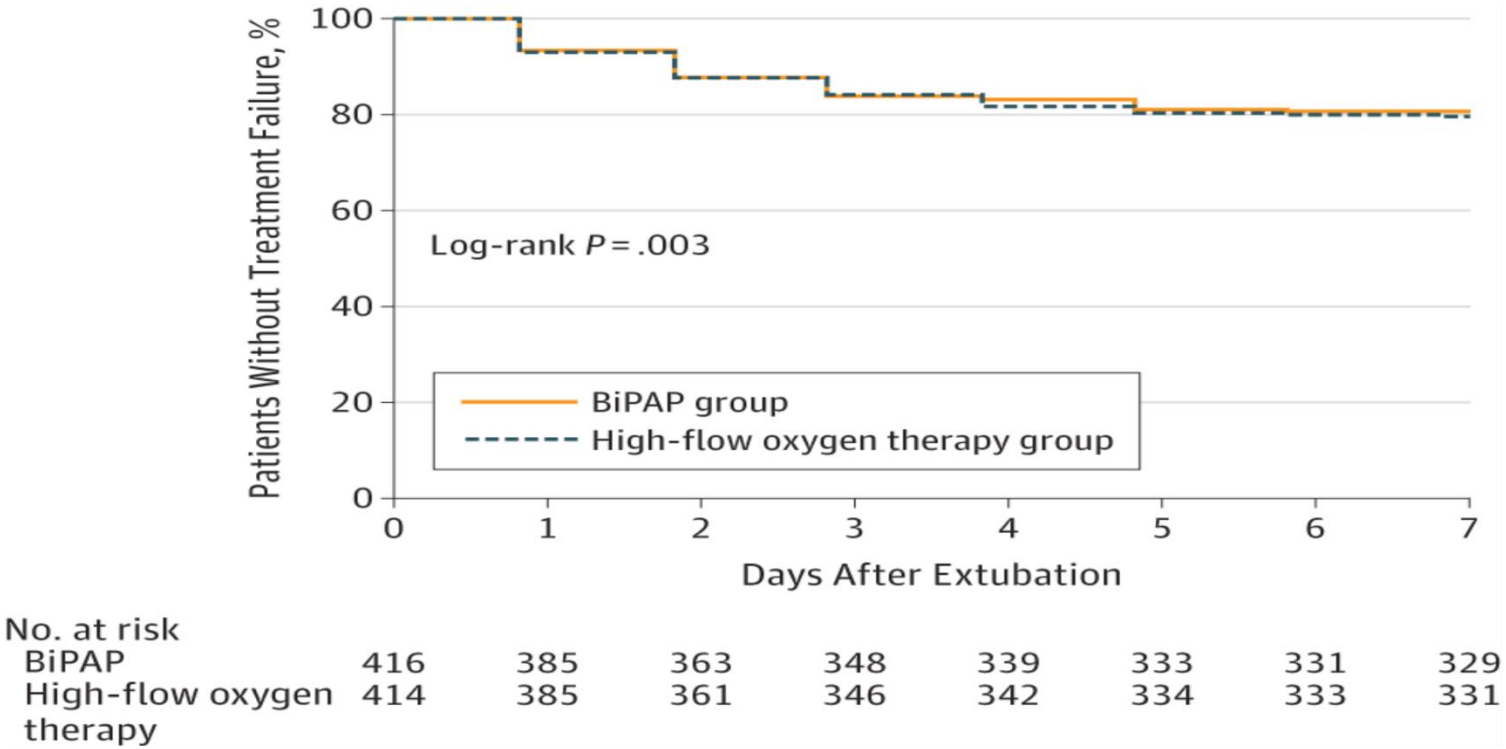
Department of Respiratory Disease, Zhujiang Hospital, Southern Medical University, 253 Gongye Avenue, Guangzhou, Guangdong, China

10 essais randomisés contrôlés


NIV group
SMT group
Risk Ratio
Risk Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI Year
M-H, Fixed, 95% CI
3.1.1 reintubaton
Nava 2005 4 48 12 49 17.5% 0.34 [0.12, 0.98] 2005
Ferrer 2006 9 79 18 83 25.9% 0.53 [0.25, 1.10] 2006
Ferrer 2009 6 54 10 52 15.0% 0.58 [0.23, 1.48] 2009
Khilnani 2011 3 20 5 20 7.4% 0.60 [0.17, 2.18] 2011
Su 2012 21 202 16 204 23.4% 1.33 [0.71, 2.47] 2012
Ornico 2013 1 20 7 18 10.9% 0.13 [0.02, 0.95] 2013
Subtotal (95% CI) 423 426 100.0% 0.65 [0.46, 0.93]
Total events 44 68
Heterogeneity: Chi² = 9.42, df = 5 (P = 0.09); I² = 47%
Test for overall effect: Z = 2.37 (P = 0.02)
3.1.2 hospital mortality
Nava 2005 3 48 9 49 33.4% 0.34 [0.10, 1.18] 2005
Ferrer 2006 2 79 12 83 43.9% 0.18 [0.04, 0.76] 2006
Ferrer 2009 3 54 4 52 15.3% 0.72 [0.17, 3.07] 2009
Su 2012 3 202 2 204 7.5% 1.51 [0.26, 8.97] 2012
Subtotal (95% CI) 383 388 100.0% 0.41 [0.21, 0.82]
Total events 11 27
Heterogeneity: Chi² = 4.03, df = 3 (P = 0.26); I² = 26%
Test for overall effect: Z = 2.53 (P = 0.01)
3.1.3 ICU mortality
Nava 2005 6 48 9 49 20.5% 0.68 [0.26, 1.77] 2005
Ferrer 2006 13 79 19 83 42.7% 0.72 [0.38, 1.36] 2006
Ferrer 2009 6 54 11 52 25.8% 0.53 [0.21, 1.32] 2009
Ornico 2013 0 20 4 18 10.9% 0.10 [0.01, 1.75] 2013
Subtotal (95% CI) 201 202 100.0% 0.59 [0.38, 0.93]
Total events 25 43
Heterogeneity: Chi² = 1.98, df = 3 (P = 0.58); I² = 0%
Test for overall effect: Z = 2.29 (P = 0.02)
0.01 0.1 1 10 100
Favours NIV Favours SMT

From: **High-Flow Nasal Oxygen vs Noninvasive Positive Airway Pressure in Hypoxemic Patients After Cardiothoracic SurgeryA Randomized Clinical Trial**

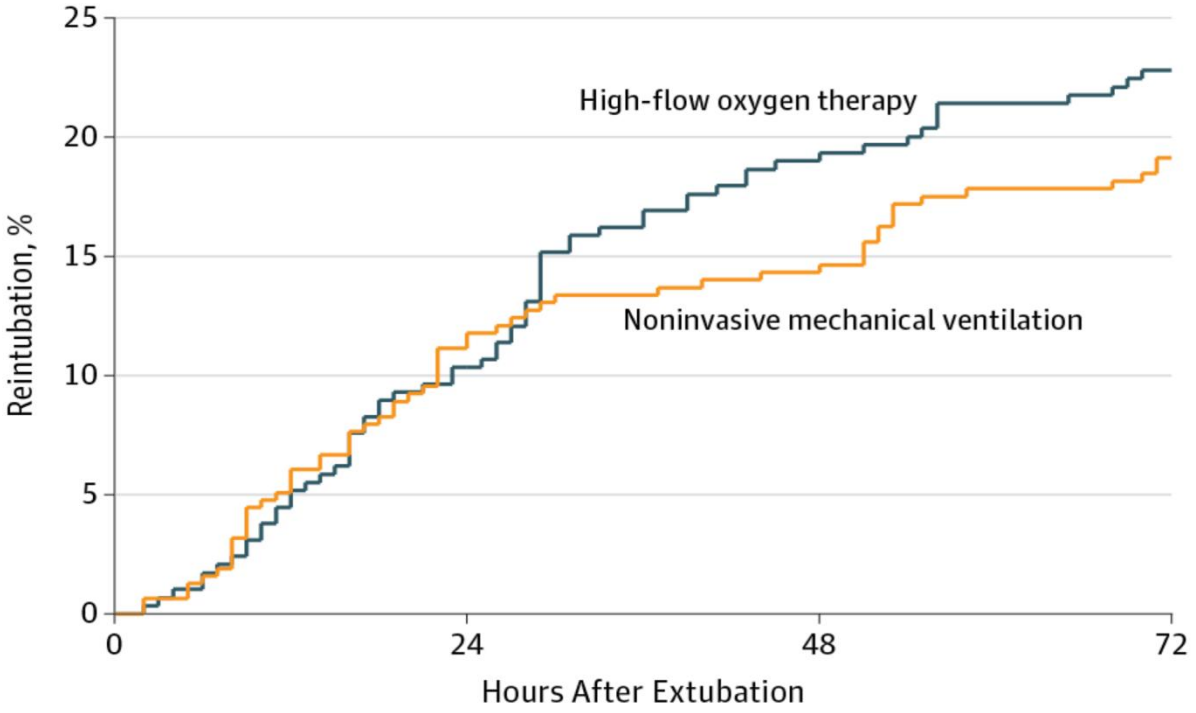
JAMA. 2015;313(23):2331-2339. doi:10.1001/jama.2015.5213



21%,Treatment failure was defined as reintubation for mechanical ventilation, switch to the other study treatment, or premature study treatment discontinuation (at the request of the patient or for medical reasons such as gastric distention).

From: **Effect of Postextubation High-Flow Nasal Cannula vs Noninvasive Ventilation on Reintubation and Postextubation Respiratory Failure in High-Risk PatientsA Randomized Clinical Trial**

JAMA. 2016;316(15):1565-1574. doi:10.1001/jama.2016.14194



No. at risk				
High-flow oxygen therapy	290	260	234	223
Noninvasive mechanical ventilation	314	279	269	253

Kaplan-Meier Analysis of Time From Extubation to Reintubation

Ni et al. BMC Pulmonary Medicine (2017) 17:142
DOI 10.1186/s12890-017-0491-6

BMC Pulmonary Medicine

RESEARCH ARTICLE Open Access

Can high-flow nasal cannula reduce the rate of reintubation in adult patients after extubation? A meta-analysis

Yue-Nan Ni[1†], Jian Luo[1†], He Yu[2], Dan Liu[2], Bin-Miao Liang[1], Rong Yao[3*] and Zong-An Liang[1*]

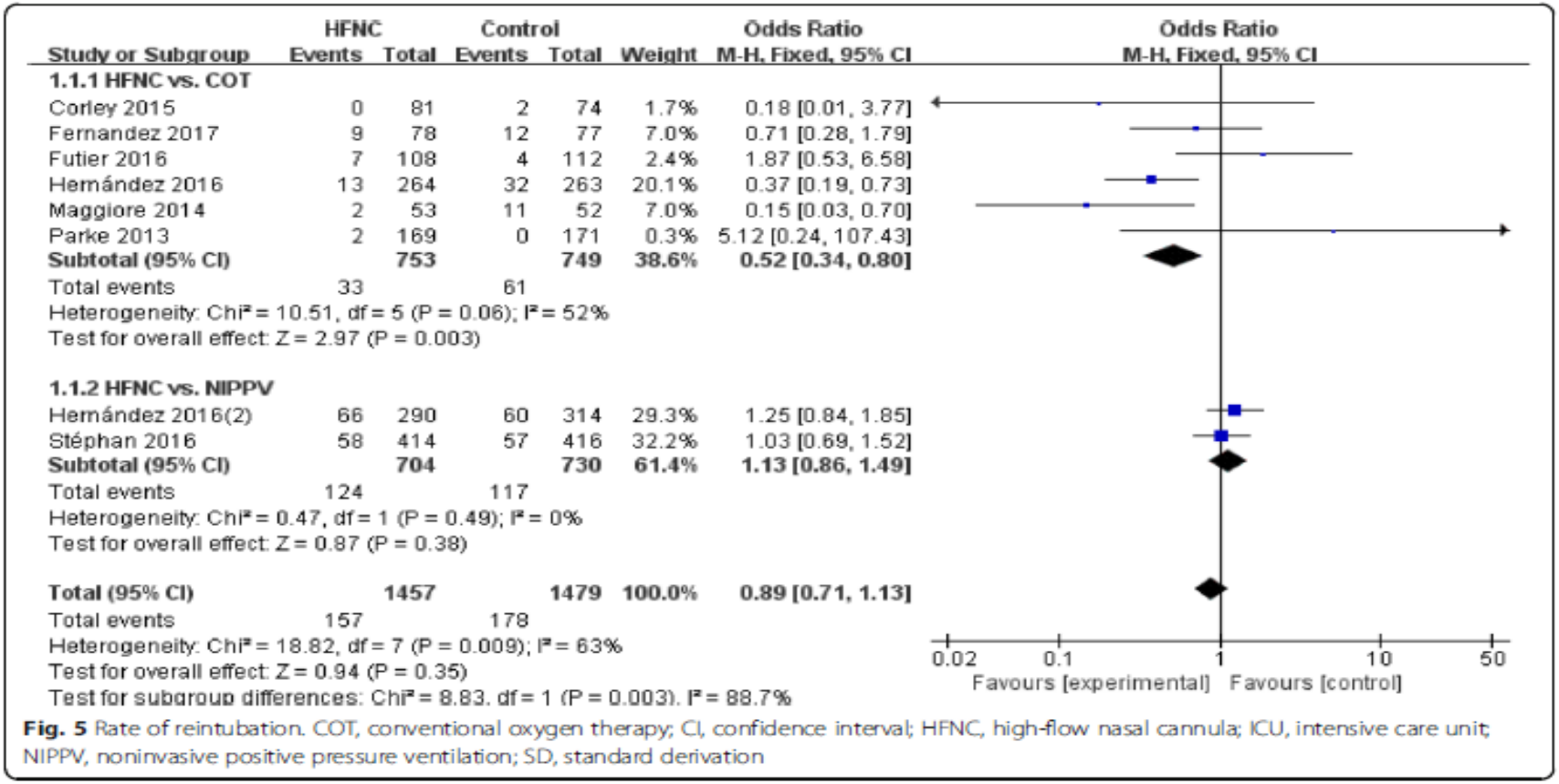


Fig. 5 Rate of reintubation. COT, conventional oxygen therapy; CI, confidence interval; HFNC, high-flow nasal cannula; ICU, intensive care unit; NIPPV, noninvasive positive pressure ventilation; SD, standard derivation

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

En pré intubation

Intensive Care Med (2016) 42:1877–1887
DOI 10.1007/s00134-016-4588-9

SEVEN-DAY PROFILE PUBLICATION

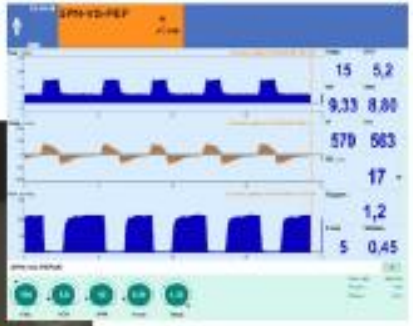
Apnoeic oxygenation via high-flow nasal cannula oxygen combined with non-invasive ventilation preoxygenation for intubation in hypoxaemic patients in the intensive care unit: the single-centre, blinded, randomised controlled OPTINIV trial

Samir Jaber[1,2*], Marion Monnin[1], Mehdi Girard[1], Matthieu Conseil[1], Moussa Cisse[1], Julie Carr[1], Martin Mahul[1], Jean Marc Delay[1], Fouad Belafia[1], Gérald Chanques[1,2], Nicolas Molinari[3] and Audrey De Jong[1,2]

FLOW = 60 L/min to the patient
FiO2 = 100 %

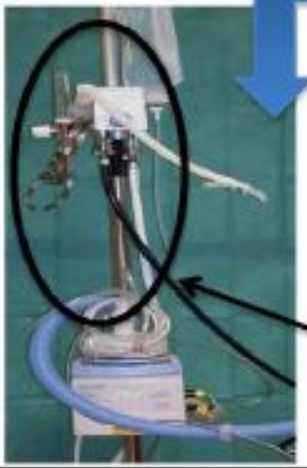
A. Interventional group =
Real HFNC + NIV
(patient received 4 min HFNC oxygen flow = 60 L/min)

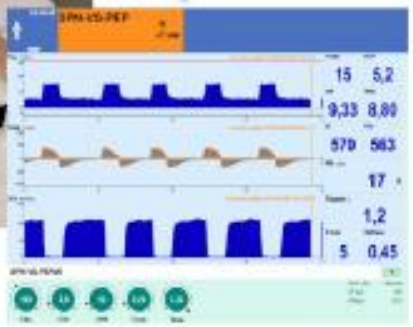
PS = 10 cm H2O
PEEP = 5 cm H2O
FiO2=100%



HFNC
device blinded

NIV
screen/
ventilator



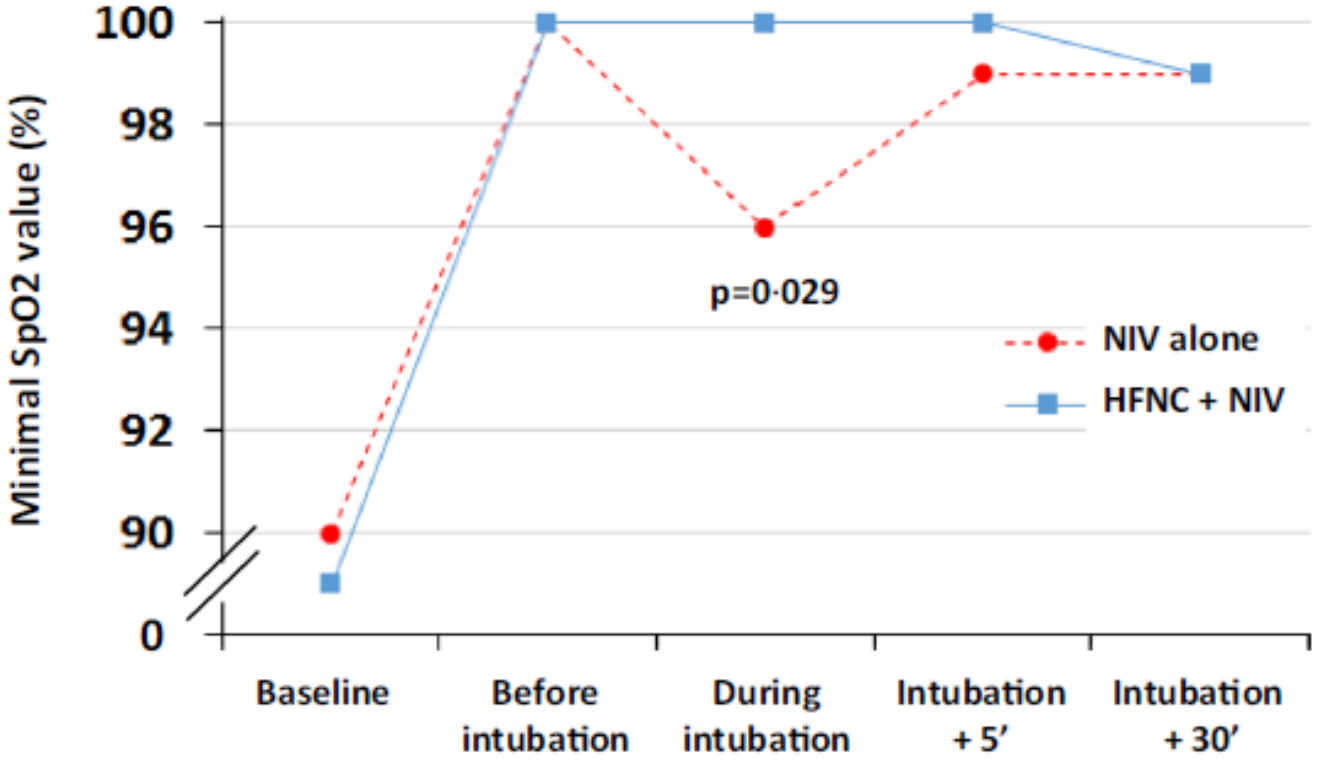


B. Reference group =
Sham HFNC + NIV
(patient received 4 min HFNC oxygen flow = 0 L/min)

FLOW = 60 L/min to the
room atmosphere
FiO2 = 100 %

PS = 10 cm H2O
PEEP = 5 cm H2O
FiO2=100%

	Total ($n = 49$)	Interventional group ($n = 25$)	Reference group ($n = 24$)
Intubation procedure			
Time from induction to secured airway (s)	101 (60–120)	120 (60–120)	60 (60–120)
Cormack III or IV grade of view	6 (12 %)	3 (12 %)	3 (13 %)
Number of alternative management devices			
None	44 (90 %)	21 (84 %)	23 (96 %)
One	4 (8 %)	3 (12 %)	1 (4 %)
Two or more	1 (2 %)	1 (4 %)	0 (0 %)
Number of attempts			
One	36 (73 %)	18 (72 %)	18 (75 %)
Two or more	13 (27 %)	7 (28 %)	6 (25 %)
Intervention of another skilled operator	6 (12 %)	3 (12 %)	3 (13 %)
Successful intubation	49 (100 %)	25 (100 %)	24 (100 %)
IDS score	0 (0–2)	0 (0–2)	0 (0–2)
Capnography use	49 (100 %)	25 (100 %)	24 (100 %)


Minimal SpO2 value (%)
100
98
96
94
92
90
0
p=0·029
NIV alone
HFNC + NIV
Baseline
Before intubation
During intubation
Intubation + 5'
Intubation + 30'

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

En pré intubation

En per endoscopie bronchique ou au cours des LBA chez les patients hypoxémiques

- Moins de désaturation

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

En pré intubation

En per endoscopie bronchique ou au cours des LBA chez les patients hypoxémiques

IRA hypercapnique

Respiratory Regulation - Clinical Advances

Effects of Nasal Insufflation on Arterial Gas Exchange and Breathing Pattern in Patients with Chronic Obstructive Pulmonary Disease and Hypercapnic Respiratory Failure

Georg Nilius,Karl-Josef Franke, Ulrike Domanski, KarlHeinz Rühle,
Jason P. Kirkness,Hartmut Schneider

- HFNC (20 L/min) pendant 45 min
- Réduction de la FR de 19.8 ± 4.2 à l'état de base à 18.0 ± 4.7 ($p < 0.008$)
- Pas d'aggravation de l'hypercapnie

The use of high-flow nasal oxygen therapy in the management of hypercarbic respiratory failure

Jonathan Millar, Stuart Lutton and Philip O'Connor

- **HFNC 50L/mn, FiO2 28%**

	Arrival	30 minutes	60 minutes	6 hours
pH	7.31	7.33	7.35	7.36
P_aCO_2 (kPa)	9.2	8.3	7.7	7.3
P_aO_2 (kPa)	7.7	7.9	8.0	9.1
Base excess (mmol/l)	5.6	4.6	4.6	4.3
SO_2 (%)	87.6	90.2	90.8	92.7

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

En pré intubation

En per endoscopie bronchique ou au cours des LBA chez les patients hypoxémiques

IRA hypercapnique

SAS

Indications

Sd d'apnée du sommeil (SAS)

- CPAP traitement de choix, mais observance non optimale
- HFNC: diminue l'obstruction des VA supérieures, diminue l'index apnée hypopnée et améliore la qualité du sommeil

McGineley et al. Am J respir Crit Care Med 2007

Haba Rubio Sleep Breath 2015

Indications

Insuffisance respiratoire aigue hypoxémique

En post extubation chez les malades à haut risque

En pré intubation

En per endoscopie bronchique ou au cours des LBA chez les patients hypoxémiques

IRA hypercapnique

SAS

SDRA

SDRA

- Critères de Berlin non applicables → PEEP ≥ 5 cmH_2O
- SDRA non sévère – monitorage strict

La VNI est-elle plus invasive que l'Optiflow?

Optiflow: bonne indication? bon réglage? Bon positionnement?

Alors NON

Facteurs prédictifs de succès

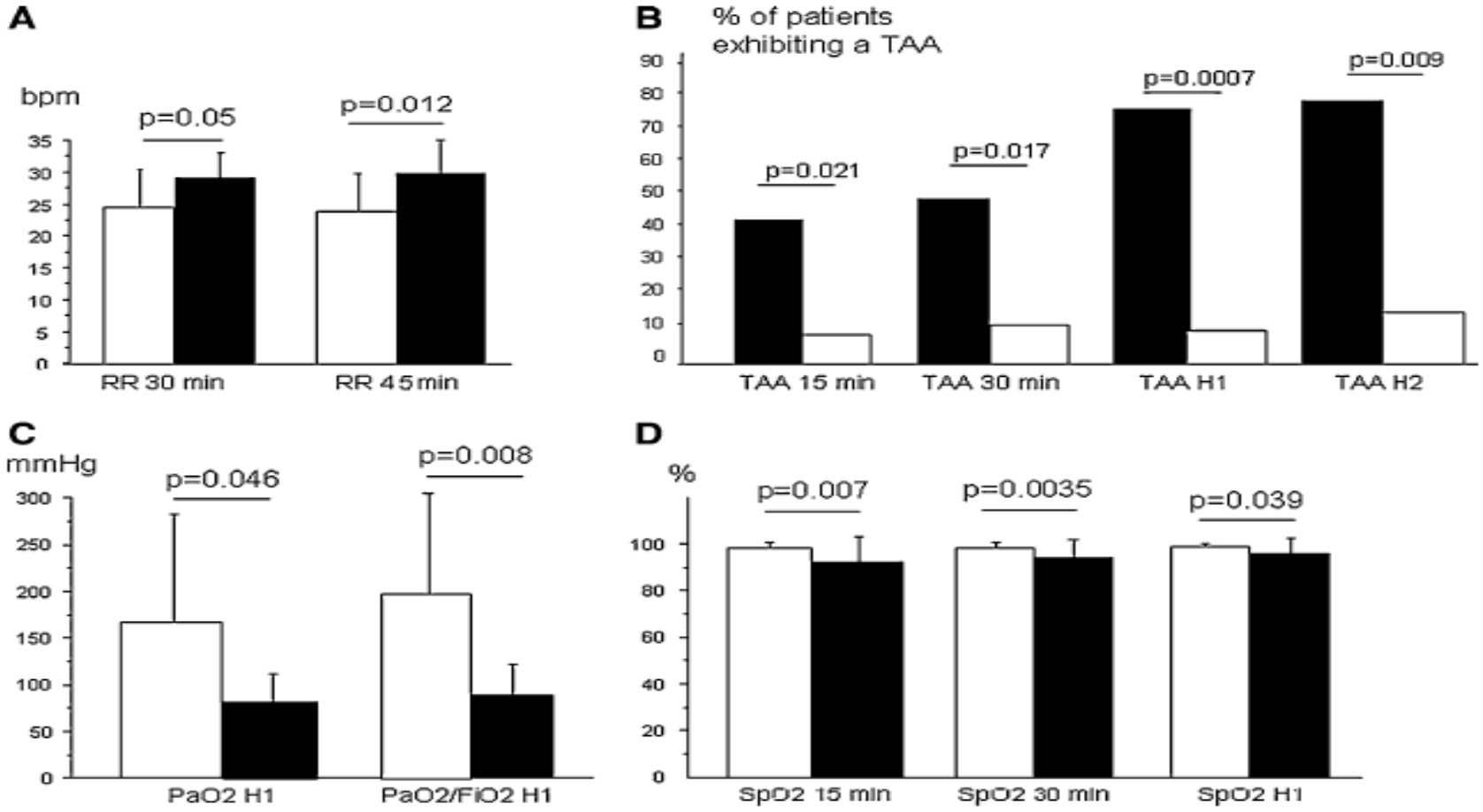
Littérature:

- L'absence de baisse de la fréquence respiratoire
- La persistance de l'asynchronie thoraco-abdominale
- PaO2/FiO2 basse à H1
- L'état de choc

➔ **Plus de recours à la VMI !!**

Benjamin Sztrymf
Jonathan Messika
Fabrice Bertrand
Dominique Hurel
Rusel Leon
Didier Dreyfuss
Jean-Damien Ricard

Beneficial effects of humidified high flow nasal oxygen in critical care patients: a prospective pilot study



CONCLUSION

- ✓ *Effet établi au cours des IRA hypoxémiques et pendant le sevrage de la VM*
- ✓ *Prometteur au cours de l'IRA hypercapnique quand la VNI est mal tolérée*
- ✓ *Meilleur atout: la tolérance et le confort*
- ✓ *Ne pas retarder l'intubation !!*
- ➢ *Sevrage?*

HFNC: ***« the road is open but don’t drive too fast »***