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Oxygénothérapie, Conventionnelle et à haut débit.

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COLLÈGE NATIONAL DE RÉANIMATION.

TUNIS, MARS 2023.

Introduction

- Joseph Priestley, 1774, l’air « déphlogistiqué ».
- Oxygène, Antoine Lavoisier.
- Plusieurs modalités d’administrations, conventionnelle, haut débit, invasive et non-invasive, hyperbare, extracorporelle…
- Les objectifs d’oxygénation doivent être bien définis pour chaque pathologie et individuellement pour chaque patient

Plan

1. Oxygénothérapie conventionnelle, moyens et limites.
2. Effet indésirables de l'oxygénation.
3. Cibles thérapeutiques.
4. Particularités physiopathologiques de l'oxygénothérapie à haut débit.
5. Principales indications de l'oxygénothérapie à haut débit.

Hypoxie, Hy

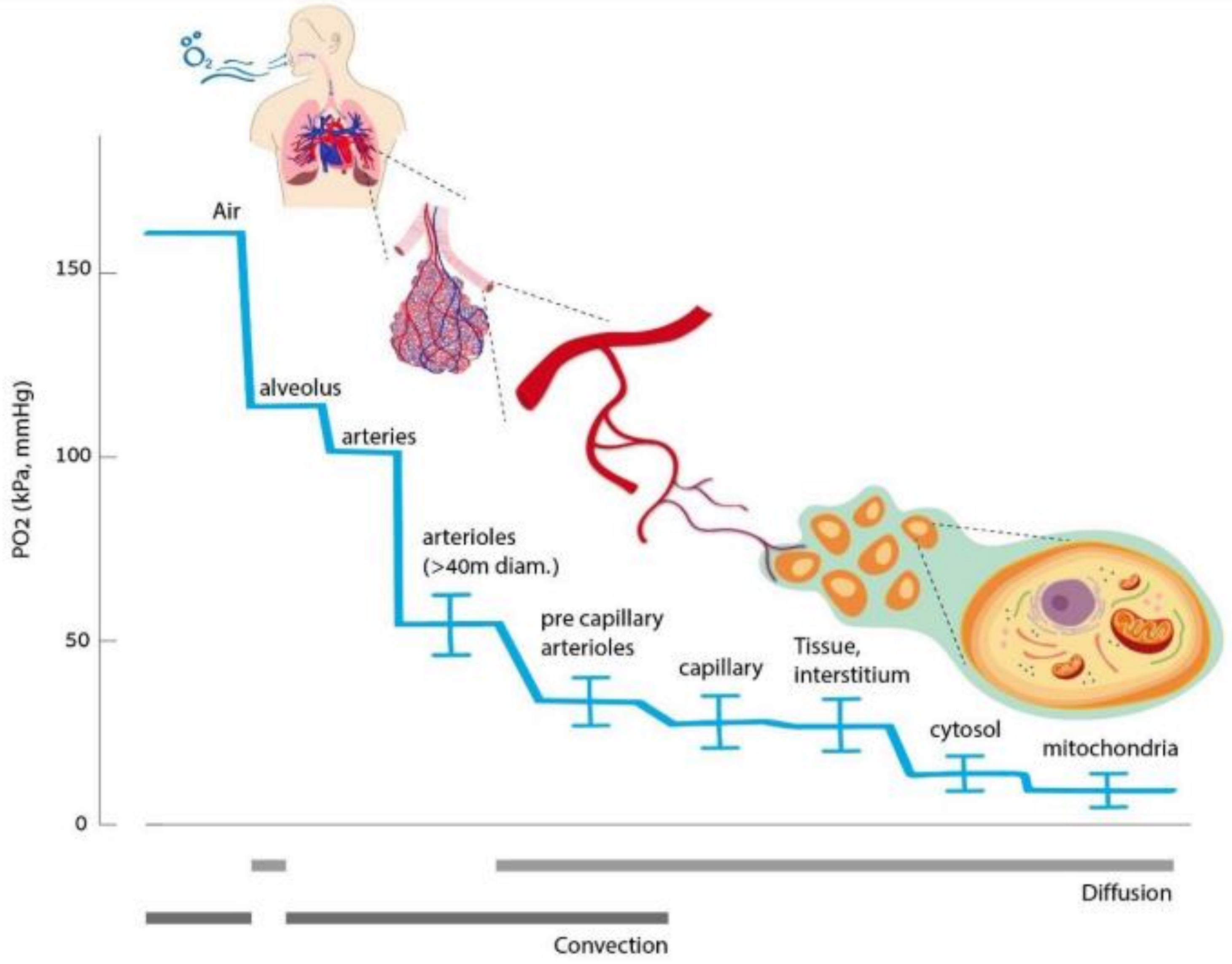


Figure 1. Oxygen delivery chain.

Hadanny et al. Biomolecules. 2020;10(6):958.

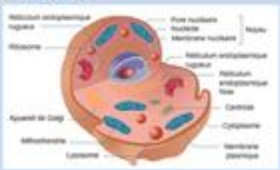
IRA, poumon sain

Grade	Polypnée	Dyspnée	Hypoxémie	O2, VM
1	+	Tirage intercostal	-	**O2/HFNC**
2	++	Tirage sus-clav./sus-stern.	Cyanose	**HFNC/VNI**
3	+++	Battement ailes nez, respiration abdominale	Troubles circulatoires/ neurologiques	**VM**
4	+/0	Épuisement musculaire, arrêt ventilatoire	Arrêt circulatoire	**VM**

IRA, poumon pathologique

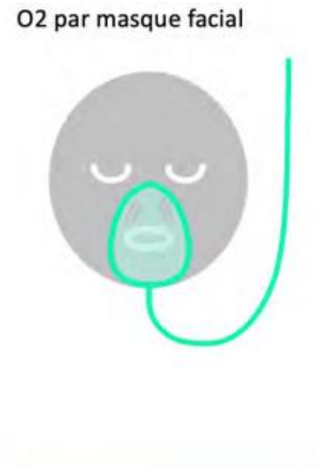
Grade	Troubles ventilatoires	Encéphalopathie respiratoire	Hypoxémie	O2, VM
1	Polypnée dyspnée ±	Troubles sommeil (+ astérixis)	-	**O2/HFNC/VNI**
2	Polypnée dyspnée ±	Troubles psychiques	-	**HFNC/VNI ± VM (si agité)**
3	Hypopnée bradypnée	Trouble conscience léger	Troubles circulatoires (collapsus, ICA)	**VM**
4	Arrêt ventilatoire	Trouble conscience profond	Arrêt circulatoire	**VM**

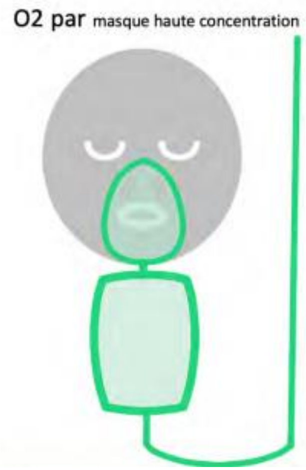
Hypoxie, sans IRA

Hypoxie	**Anémie aigue** **Intoxication au CO**	Transport **Hémoglobine** 
	Insuffisances circulatoires aigues	Distribution **appareil cardio-circulatoire** 
	Choc septique **Intoxication au cyanure**	Extraction **Cellule** 

O2 : *Moyens*

Débit inspiratoire et FiO2 délivrée





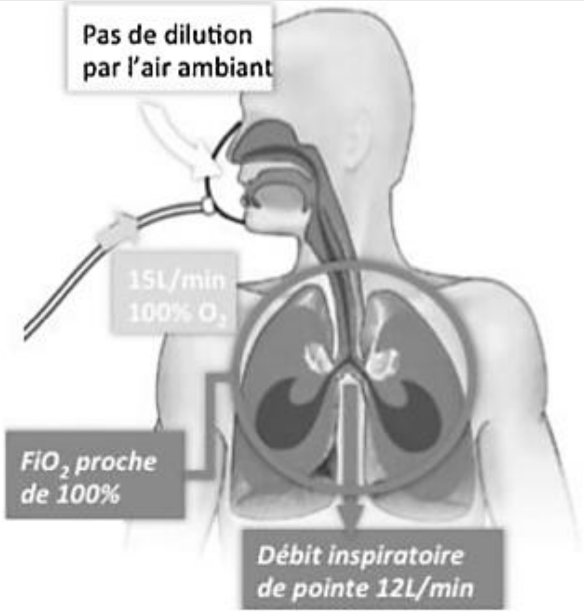
1-6 l/min	**4-8 l/min**	**8-15 l/min**
24-40%	**40-60%**	**40-90%**
Confortable	**Efficace si respiration buccale**	**Valves directionnelles, limitant la dilution par l'air ambiant**
Perte d'O2 si Haut débits Moins efficace si ouverture buccale	**Moindre confort, claustrophobie Ré inhalation de CO2**	**Inconfortable**

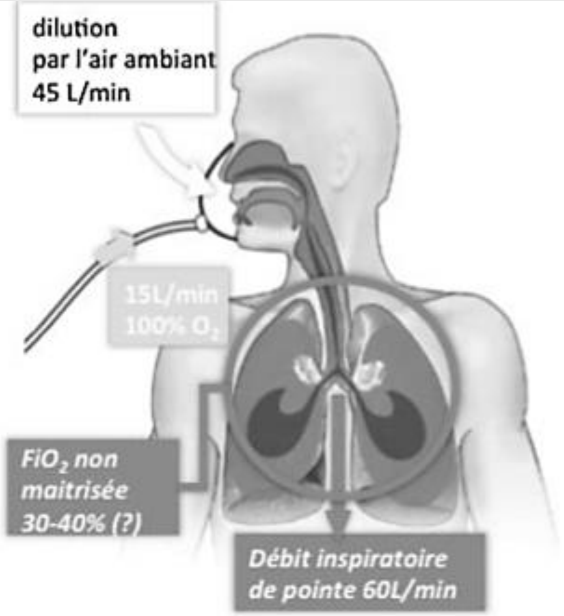
Débit inspiratoire et FiO2 délivrée

Limites

(IRA, débit inspiratoire >30 l/min **versus** débit maximal délivré 15 l/min)

- phénomène de dilution de la FiO2 délivrée avec l'air ambiant atmosphériques
- baisse de la FiO2 réellement inhalée



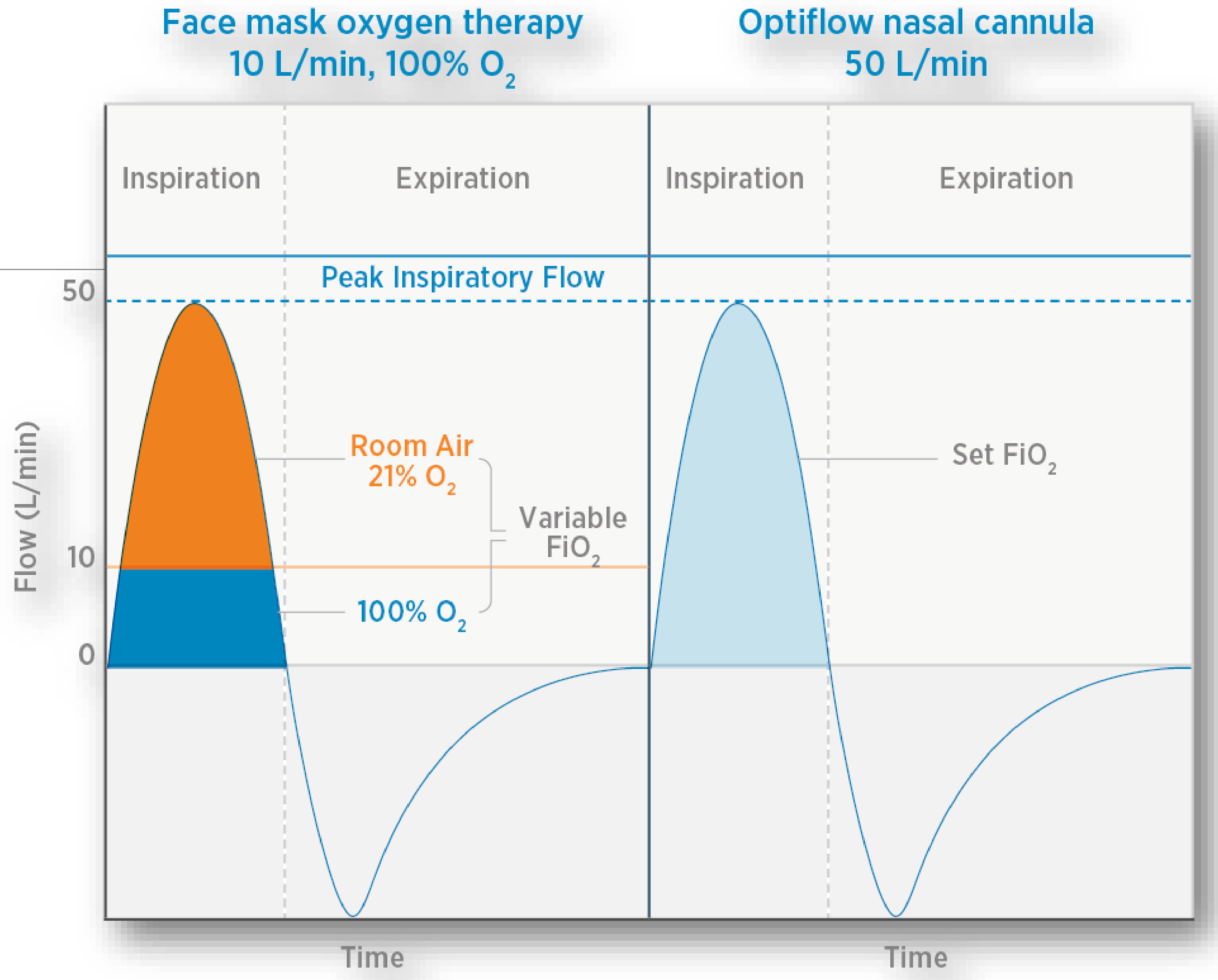


Situation de repos

Le débit inspiratoire du patient de 12 L/min environ est couvert par le débit d'oxygène administré de 15 L/min dans le masque. Ainsi la FiO_2 inhalée est proche de 100%.

Détresse respiratoire aiguë

Le débit inspiratoire du patient est très augmenté, environ de 60 L/min, et n'est pas couvert par le débit d'oxygène administré de 15 L/min dans le masque. Ainsi, 45 L/min du débit inspiratoire sera pris dans l'air ambiant et finalement la FiO2 inhalée sera ainsi « diluée » pour n'être que d'environ 30-40%.



Adapted from Masclans et al. 2012

Humidification, réchauffement

Physiologiquement,

Au niveau de la carène, température (37°) et saturé (44 mg/L)

Gaz mural

Température, 0 °C ; hygrométrie, 0 % .

Débitmètre

Température, 15 °C ; hygrométrie, proche de 2 %.

Risques

- Inconfort
- Sécheresse nasale, buccale et pharyngée, altération de la fonction muco-ciliaire
- Augmentation des résistances des VAS, voire une bronchoconstriction

Effets indésirables

Hypercapnie induite

- Levée du stimulus hypoxique au niveau des centres respiratoires
- Hétérogénéité des rapports ventilation/perfusion par la levée de la vasoconstriction hypoxique puis secondairement l'augmentation du shunt et de l'espace mort
- Effet Haldane, où pour un même contenu en CO_2, la PCO_2 augmente quand la PO_2 augmente.

El,

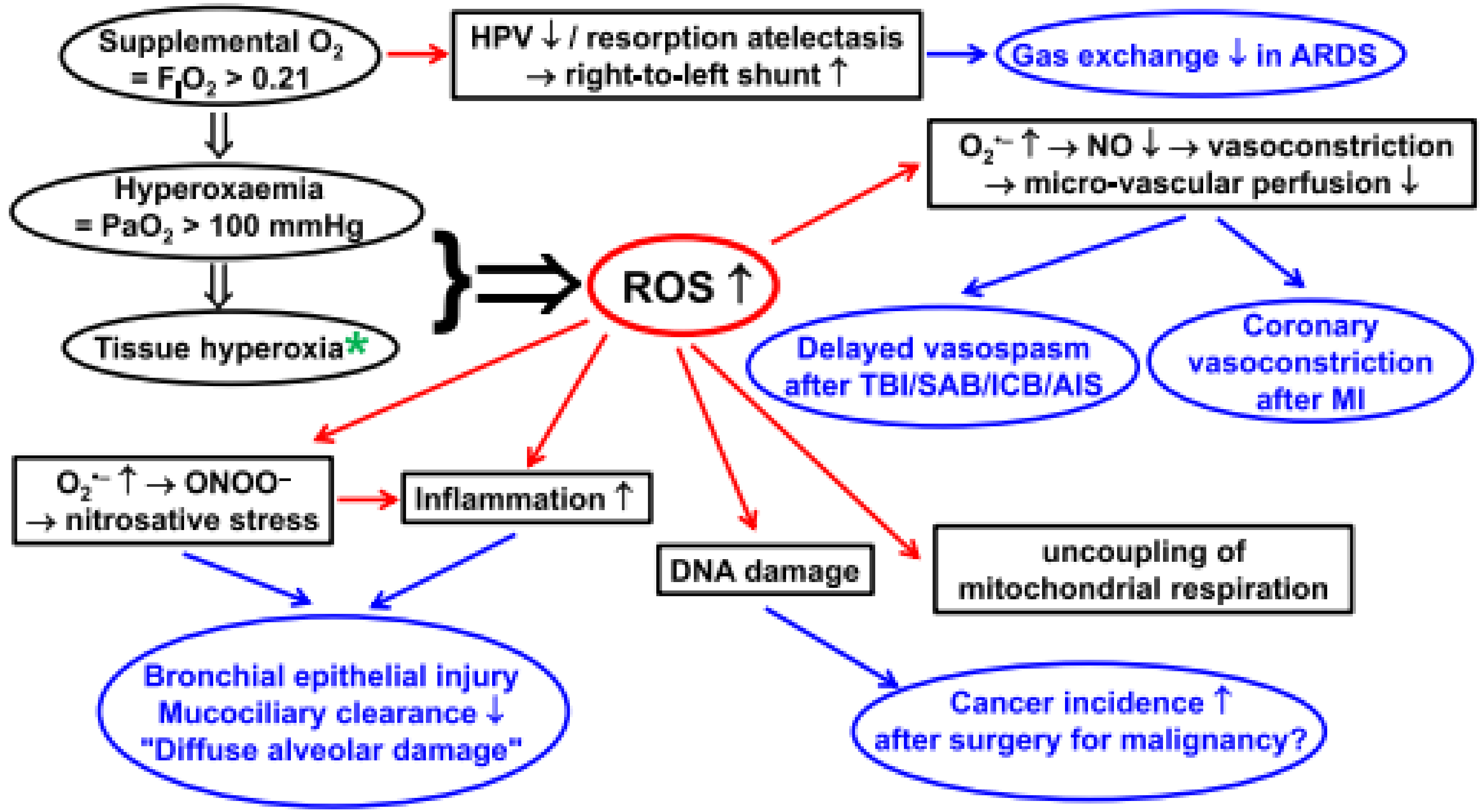
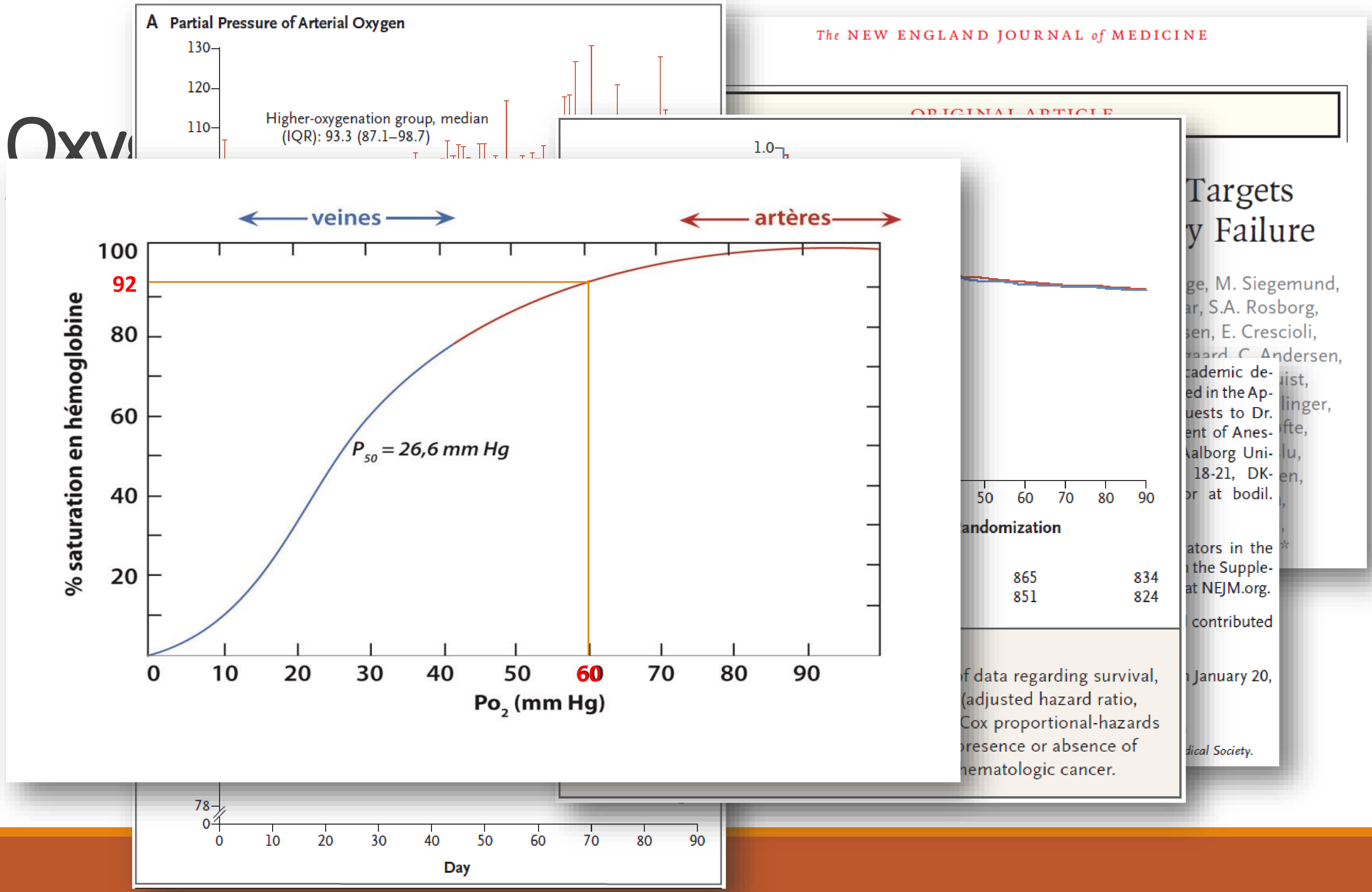


Fig. 1 Potential harm of hyperoxia. AIS acute ischaemic stroke; MI myocardial infarction; ARDS acute respiratory distress syndrome; F_IO_2 fraction of inspired O_2; HPV hypoxic pulmonary vasoconstriction; ICB intracranial bleeding; PaO_2 arterial O_2 partial pressure; NO nitric oxide; $ONOO^-$ peroxynitrite; $O_2^{\bullet-}$ superoxide anion; ROS reactive oxygen species; SAB subarachnoidal bleeding; TBI traumatic brain injury. * Note that while hyperoxia and hyperoxaemia are well defined as $F_IO_2 > 0.21$ and $PaO_2 > 100$ mmHg, respectively, there is no general threshold for "tissue hyperoxia", because the normal tissue PO_2 depends on the macro- and microcirculatory perfusion and the respective metabolic activity. Nevertheless, it is noteworthy that PO_2 levels as low as 0.3 – 0.7 mmHg suffice for correct functioning of the mitochondrial respiratory chain [17, 162]

Singer et al. Critical Care (2021) 25:440


A Partial Pressure of Arterial Oxygen
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120
110
Higher-oxygenation group, median
(IQR): 93.3 (87.1–98.7)
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0
0
10
20
30
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50
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The NEW ENGLAND JOURNAL of MEDICINE
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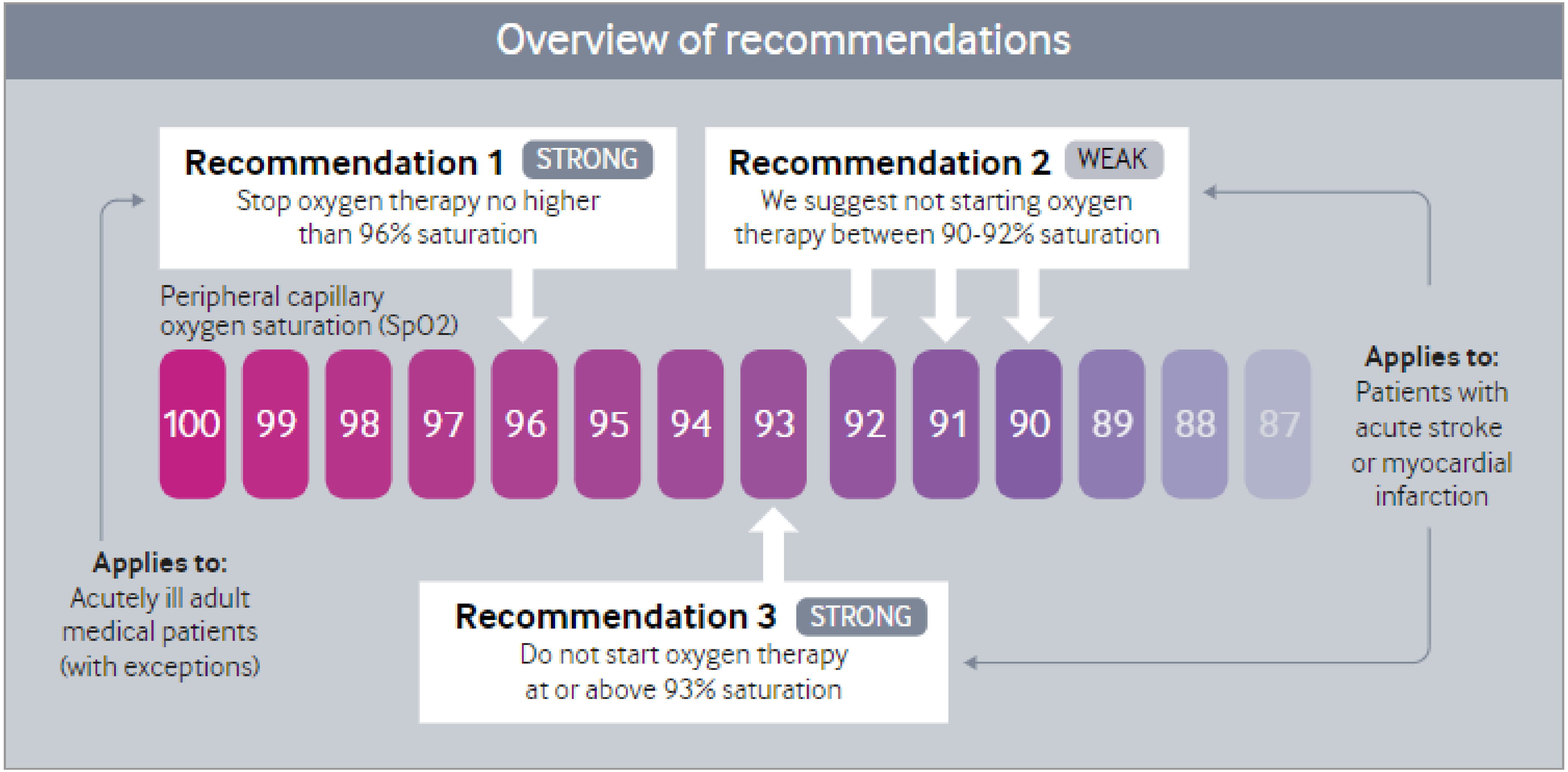
40
20
% saturation en hémoglobine
P50 = 26,6 mm Hg
0
10
20
30
40
50
60
70
80
90
Po2 (mm Hg)

Oxygen therapy for acutely ill medical patients: a clinical practice guideline

BMJ 2018 ; 363 doi: https://doi.org/10.1136/bmj.k4169 (Published 24 October 2018)
Cite this as: *BMJ* 2018;363:k4169



Oxygénothérapie à haut débit

HFNO

Optiflow

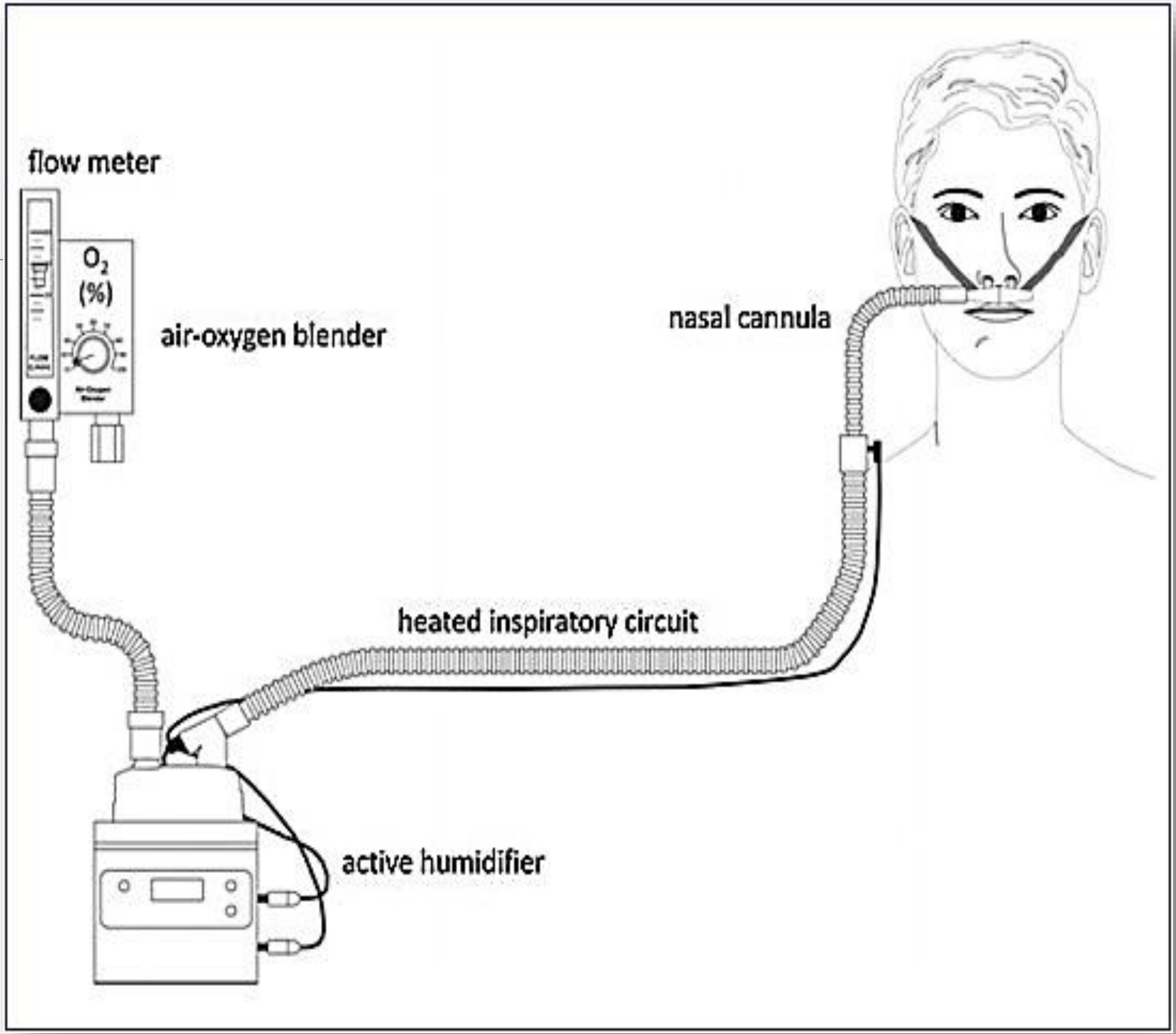
HFNC

HHFNC

HHHFNC

Caractéristique

- **Générateur de débit, associé à un mélangeur air-O2** Débits, de 10 à 70 L/min, FiO2 21 à 100 %
- **Humidificateur chauffant** installé sur le circuit inspiratoire
- **Interface simple** et confortable comprenant des canules nasales, 6-8 mm

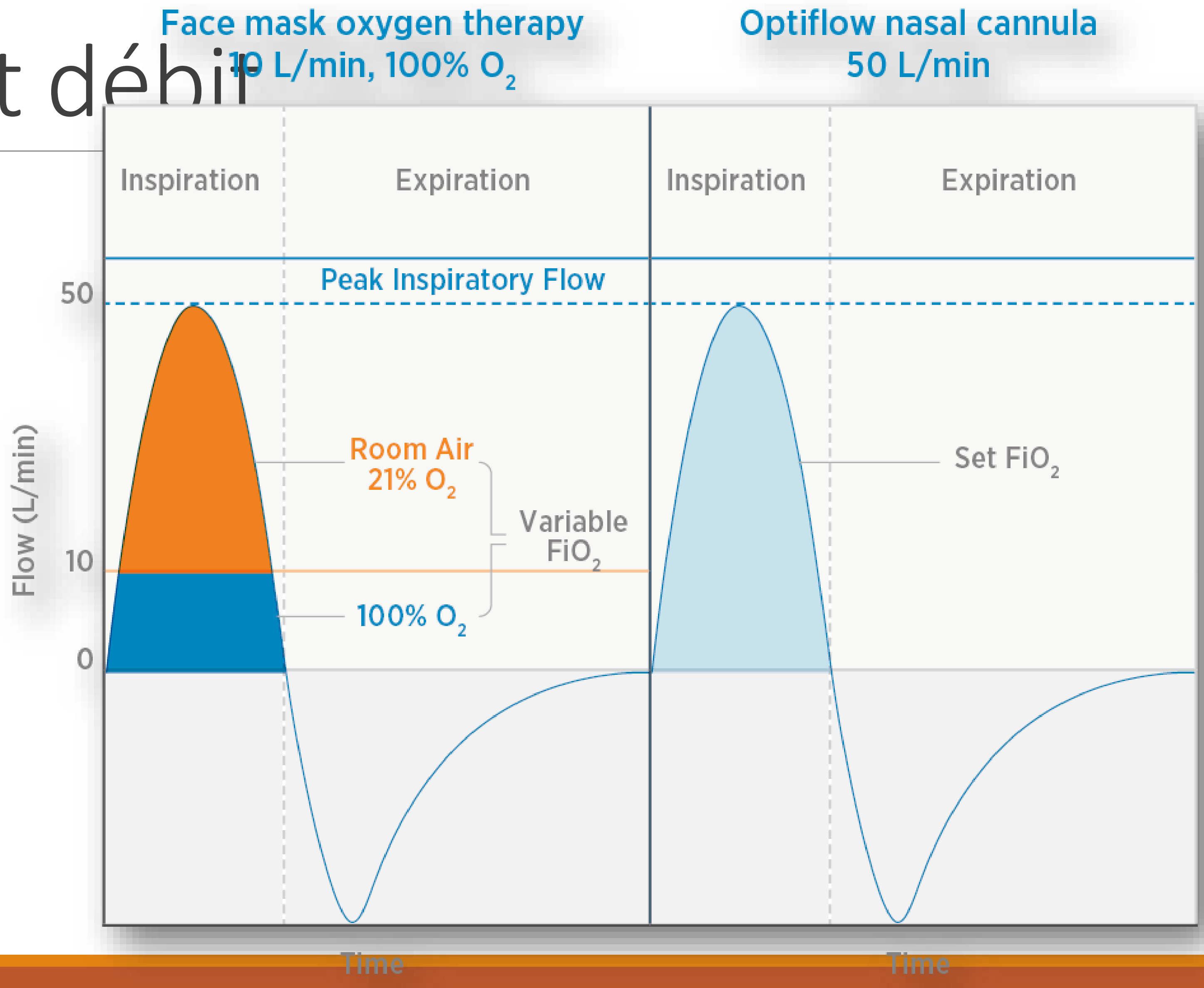


Physiologie, Particularités

1) Meilleure adéquation entre la demande ventilatoire d'un patient en IRA, débit instantané élevé
2) Le réchauffement et l'humidification
3) Effet pression expiratoire positive (PEP) et augmentation du volume pulmonaire de fin d'expiration
4) Réduction des résistances des voies aériennes
5) Lavage-rinçage de l'espace mort rhino-pharyngo-tracheal

Physiologie, Haut débit

Suppression du phénomène de dilution de l'O2 Fonction du débit de gaz délivré



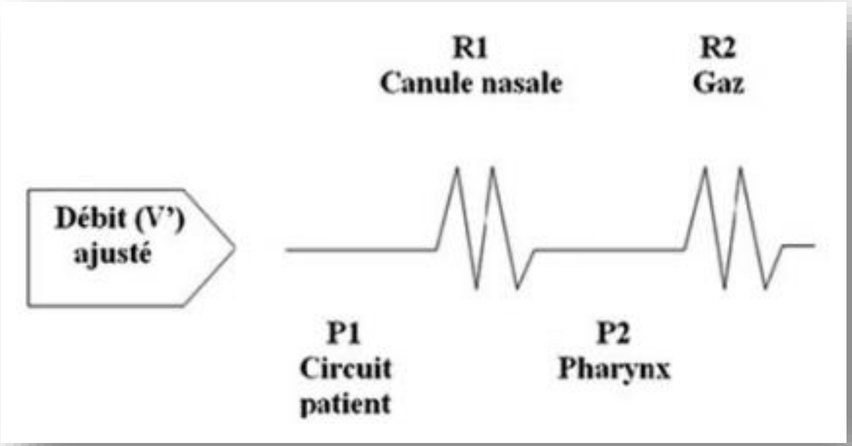
Adapted from Masclans et al. 2012

Physiologie, réchauffement et l'humidification

- **Compatibles avec la physiologie des voies aériennes**
- **L’air est humidifié à 100% et chauffé (température réglable entre 31 et 37 degrés Celsius)**
  - **Prévention de la sécheresse des muqueuses respiratoires**
  - **clairance muco-ciliaire en limitant l'assèchement des sécrétions trachéo-bronchiques, et de prévenir l'augmentation des résistances des VAS**
  - **améliorer le confort**

Physiologie, PEEP

- ❑ **HNF génère de faibles niveaux de pression positive (entre 2 à 7 cmH2O selon le débit inspiratoire)**
- ❑ **Il en résulte une pression alvéolaire en fin d'expiration**
  - **Liée à l'anatomie des voies aériennes**
  - **Augmente avec le débit de gaz délivré**
  - **Fonction de l'ouverture/fermeture de bouche et de la taille des canules nasales par rapport aux narines**



Physiologie, PEEP

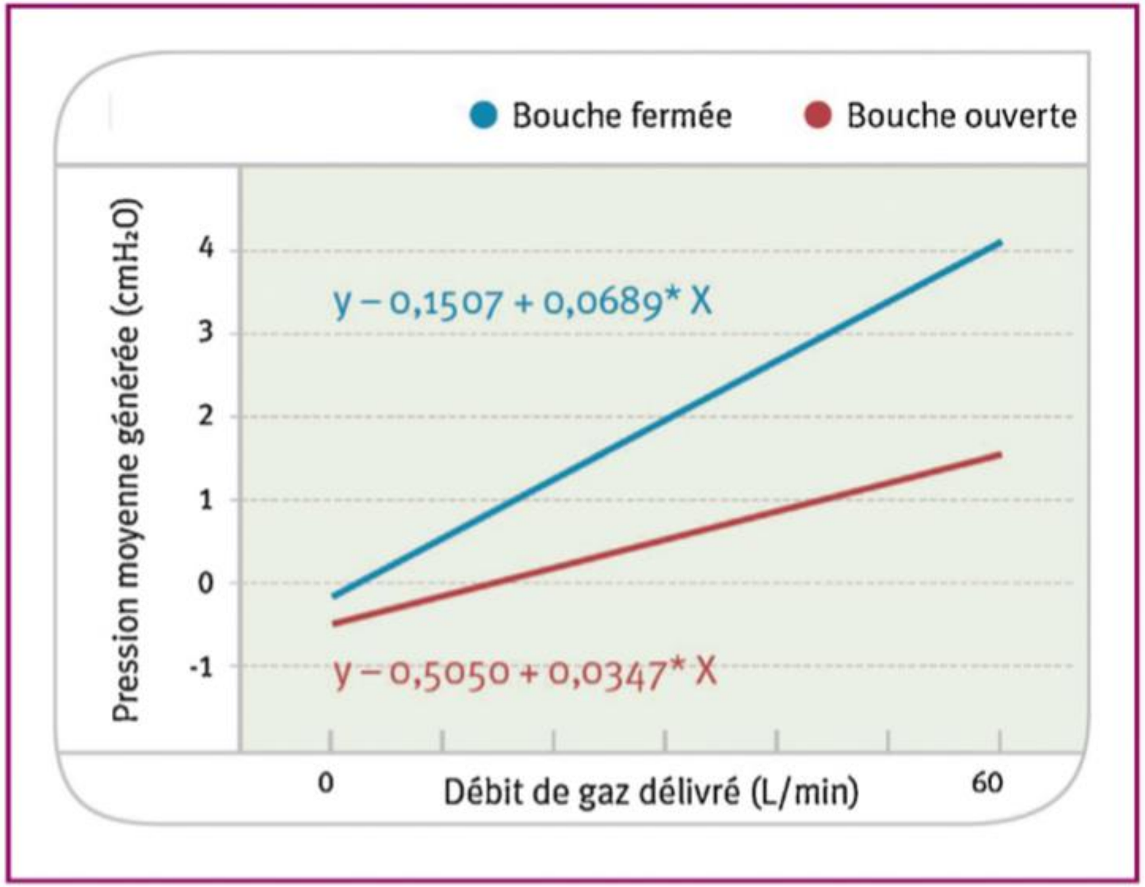


Figure 4. Pressions moyennes nasopharyngées générées sous oxygénothérapie à haut débit (OHD) en fonction du débit de gaz délivré et de l'ouverture de bouche.

Parke R, McGuinness S, Eccleston M. Nasal high-flow therapy delivers low level positive airway pressure. Br J Anaesth 2009;103:886—90.

Physiologie, PEEP

Australian Critical Care (2007) **20**, 126–1

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High flow nasal
pressure in adu

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Received 12 March 2007; received in revised form 7 July 2007; accepted 22 August 2007

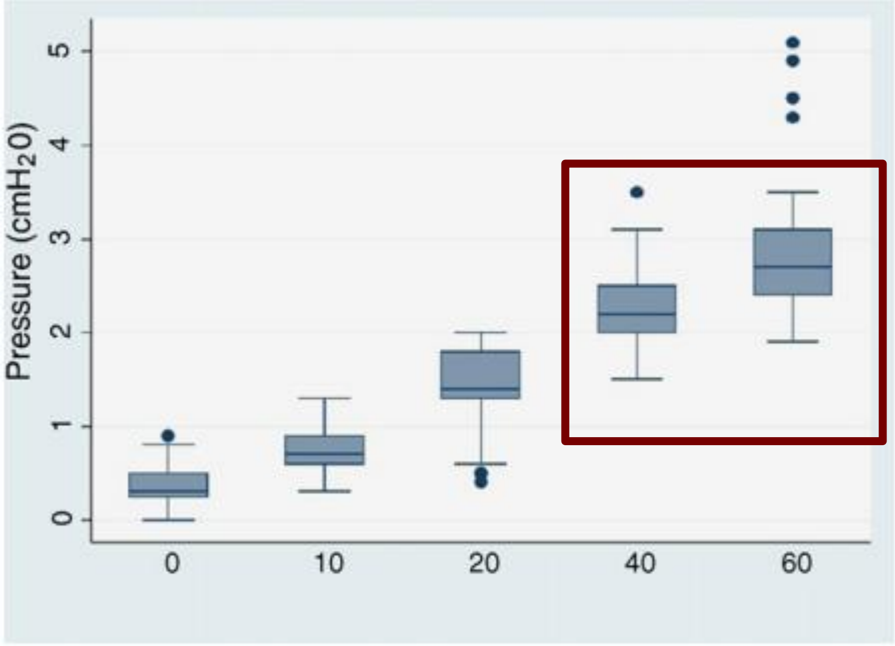


Figure 1 Expiratory Pharyngeal Pressure - Mouth Open.

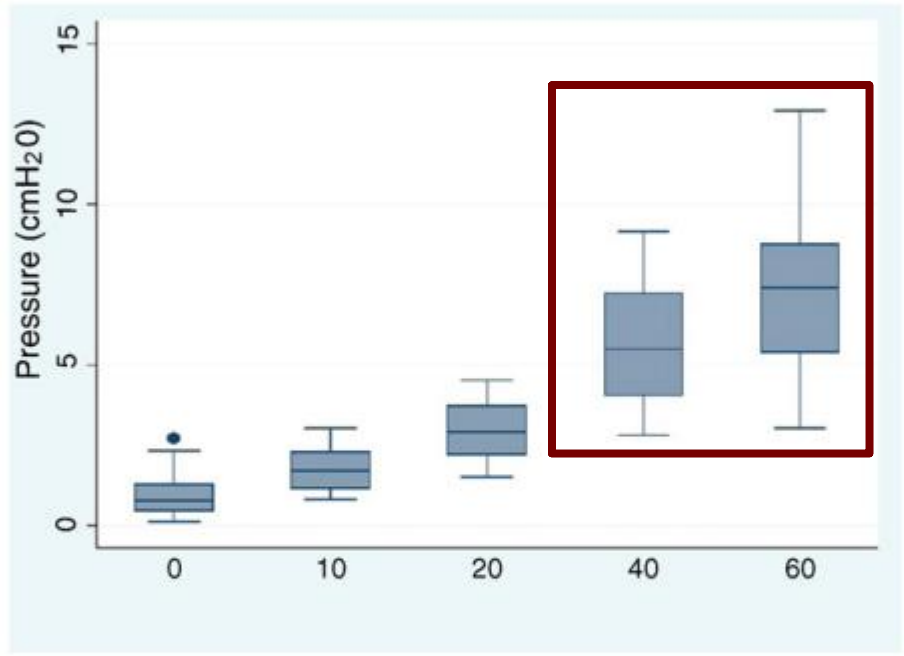


Figure 2 Expiratory Pharyngeal Pressure- Mouth Closed.

Physiologie, Collapsus

En situation normale, le pharynx demeure ouvert grâce à un équilibre entre deux différentes forces : celles qui tendent à fermer le pharynx et celles qui tendent à l'ouvrir

Le collapsus inspiratoire est fondé sur la perte d'équilibre entre les forces qui maintiennent le diamètre des voies aériennes et celles qui tendent à le réduire

Contrebalance le collapsus inspiratoire pharyngé au cours de l'effort inspiratoire

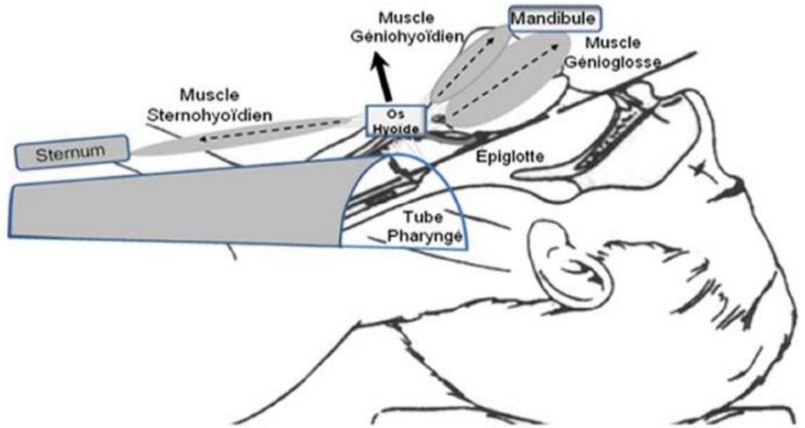


Fig. 1 Muscles dilatateurs du pharynx. La contraction des muscles sus-hyoïdiens exerce une traction sur l'os hyoïde qui lui assure une projection antérieure et par le fait même l'ouverture du tube respiratoire pharyngé. Figure adaptée de D'Honneur G. et al. [3]

Physiologie, non-rebreathing

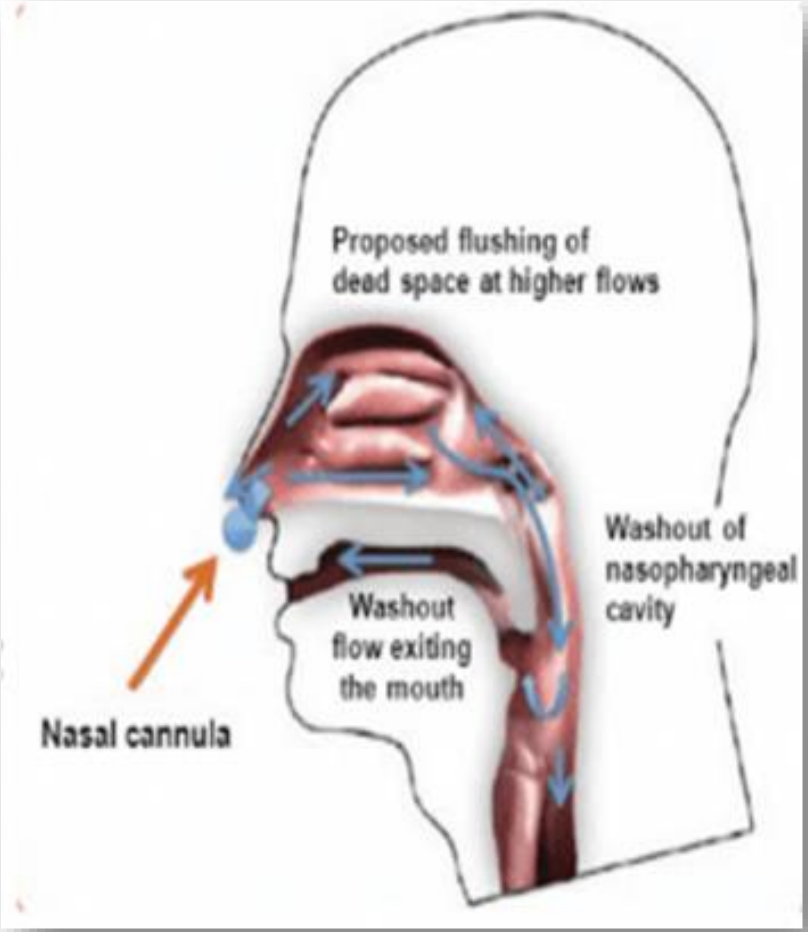
Lavage de l'espace mort nasopharyngé, induit grâce au débit généré supérieur à celui du patient

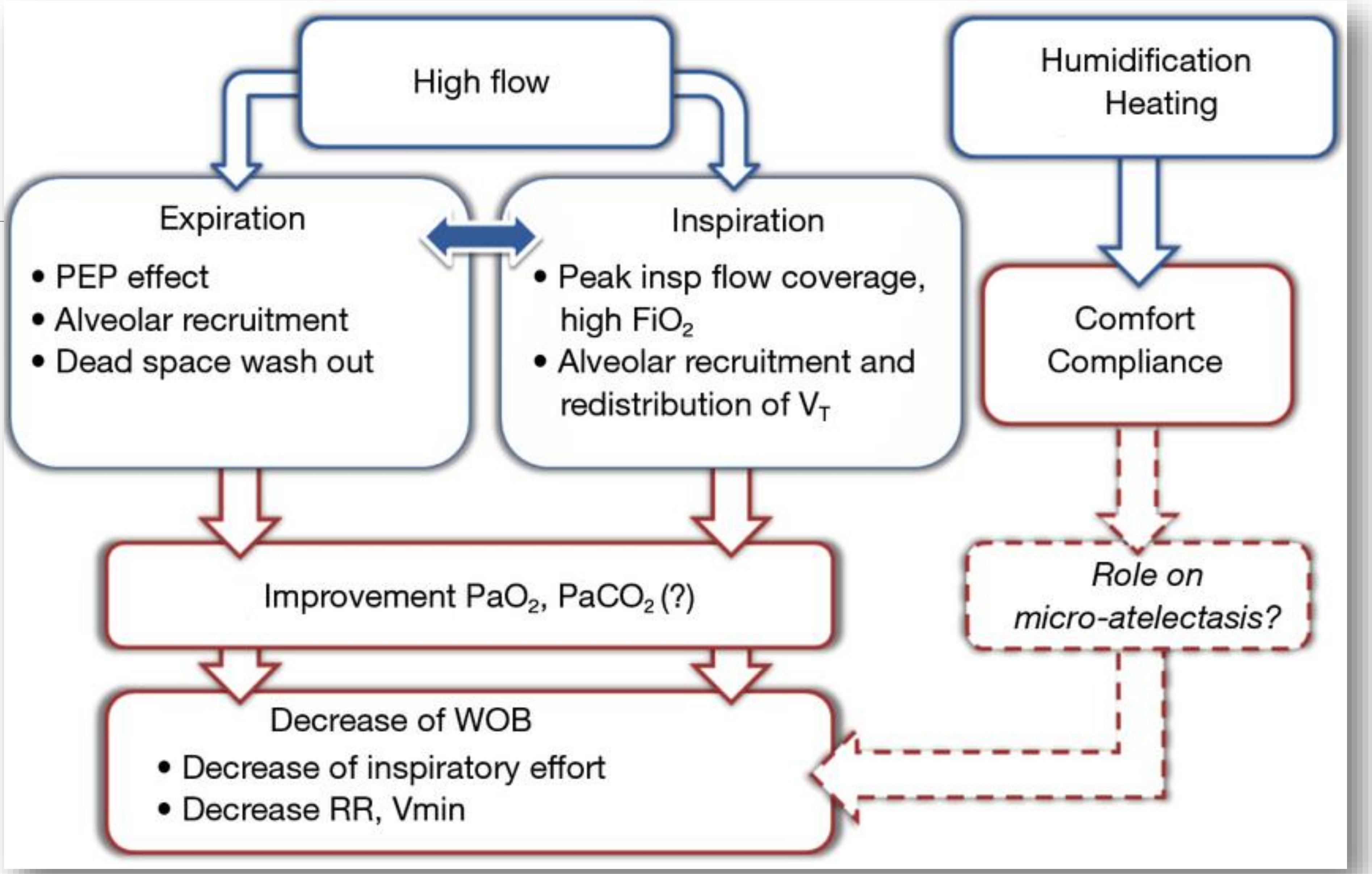
Diminuer la ré-inhalation du CO_2

Créer un réservoir de gaz frais disponible à chaque inspiration, ce qui réduit le volume de l'espace mort et augmente la proportion de Valv en rapport à la VMI.

VMI = Vt × FR

Valv = (Vt – ↓ Vespace mort) × FR





High flow
Humidification
Heating
Expiration
• PEP effect
• Alveolar recruitment
• Dead space wash out
Inspiration
• Peak insp flow coverage, high FiO_2
• Alveolar recruitment and redistribution of V_T
Comfort
Compliance
Improvement PaO_2, $PaCO_2$ (?)
Role on micro-atelectasis?
Decrease of WOB
• Decrease of inspiratory effort
• Decrease RR, Vmin

Assistance ventilatoire

Amélioration des échanges gazeux

Diminution du travail respiratoire (WOB)

(diminution du coût en oxygène de la ventilation)

Diminution du risque de VILI et de P-SILI

Améliorer l'inconfort

IRA hypoxémique pure

HFNC vs NIV

- Respecter les débits du patient
- Limiter interactions et sur-distension et donc des P-SILI
- Le Confort
- Diminuer le recours à la VMI

IRA hypoxémique modérée

Table 2 Main clinical stu

References	Study design
Hypoxemic ARF in the ICU	
[7]	Cohort, unselec oxygen
[20]	Cohort, unselec oxygen
[12]	HFNCO vs face r
[6]	Cohort study, HI
[26]	Cohort study (p
[24]	Observational, s
[22]	Multicenter, ope gen therapy (f
[83]	Retrospective b
[28]	Patients intubat
Hypoxemic ARF in the emerg	
[21]	Patients with AR tory distress)
[84]	RCT of HFNCO v

HFNC in Adults

Table 1. Application of High-Flow Nasal Cannula

Patients or Subjects, *n*	Underlying Conditions	Comparators	Flow, L/min	Main Results	First Author
Case reports					
1	Fiberoptic bronchoscopy in ICU				Diab[56]
1	Reperfusion pulmonary edema				Moriyama[57]
1	Pulmonary fibrosis and DNR				Boyer[58]
1	Dementia				Calvano[59]
1	ARF of neuromuscular origin				Diaz-Lobato[60]
Case series					
5	Acute cardiogenic pulmonary edema	VM 15 L/min	60	f decreased, dypnea improved	Carratalá Perales
5	Oxygenation during BAL				Miyagi[61]
Retrospective					
37	ARF in lung transplant recipients	SOT		ETI: SOT 89%, HFNC 59%	Roca[62]
45	ARF in hematologic malignancies			15: successful, 30: ETI	Lee[63]
67	Post-extubation	NRM		Re-intubation HFNC (1) < NRM (6)	Brotfain[64]
50	DNR/DNI order (hypoxemic RF)			HFNC was well-tolerated, duration 30 h (range 2–144)	Peters[37]
175	HFNC failure			Late failure worsened ICU mortality, extubation success, and VFDs	Kang[65]
Sequential intervention					
14	Hypoxemic ARF	NIV and VM	55	Dyspnea score, HFNC < VM < NIV, subject rating: HFNC > VM > NIV f HFNC < NIV, oxygenation NIV > HFNC > VM	Schwabbauer[36]
17	Severe COPD and hypercapnic RF	LFO		f decreased with HFNC	Nilius[66]
12	OSA		20	Apnea-hypopnea and arousal index decreased	McGinley[67]
20	Post-cardiac surgery	LFO		EELI increased, P_{aw} increased, f decreased, P/F increased	Corley[42]
10	Heart failure (NYHA III)		20/40	IVC reduced	Roca[68]
17	ARF in ER		40	8 discharged from ER, 9 admitted to ICU and among them 2 intubated	Lenglet[69]
RCT					
20	ARF	FM	20–30	f decreased, comfort and oxygenation were better with HFNC	Roca[41]
60	Mild-moderate hypoxemic ARF	FM	35	More HFNC succeeded. NIV: HFNC 3/29 (10%), FM 8/27 (30%)	Parke[12]
45	Indications for BFS	VM	40/60	HFNC at end of BFS S_{pO_2} was better than other 2 groups	Lucangelo[71]
155	Post-cardiac surgery, BMI ≥ 30	SOT	35–50	Respiratory support escalation 5 in standard, 3 in HFNC	Corley[72]
310	Hypoxemic RF	SOT and NIV	50	VFD increased, mortality improved, f	Frat[10]
830	After cardiothoracic surgery	BPAP	50	Treatment failure ns, ICU mortality ns, Skin breakdown: BiPAP>HFNC	Stephan[11]
105	Post-extubation	VM	50	LOS_ICU, ICU mortality ns, re-intubation 4% vs 21%, timing of re-intubation na	Maggiore[73]
340	Post-cardiac surgery, post-extubation	NC		LOS ICU ns, escalation of respiratory support 27.8% vs 45%	Parke[70]
124	Hypoxemic RF requiring ETI	FM	60	Lowest saturation, severe desaturation (<=80%) ns	Vourc'h[74]

IRA hypoxémique modérée

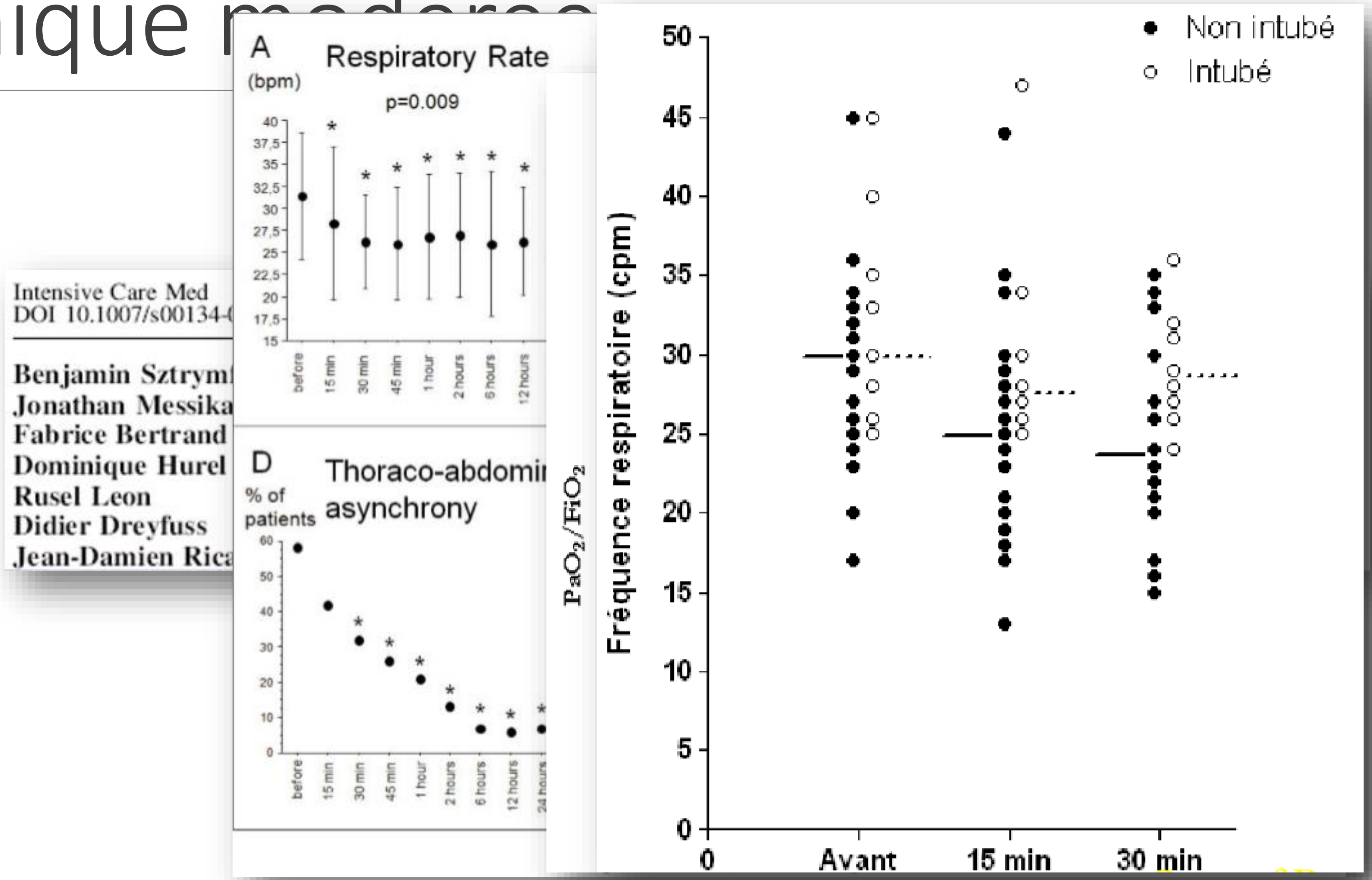
Critère d'inclusion: patients avec détresse respiratoire persistante malgré l'oxygénothérapie au masque à haute concentration.

Critère d'exclusion : patients nécessitant l'intubation immédiate.

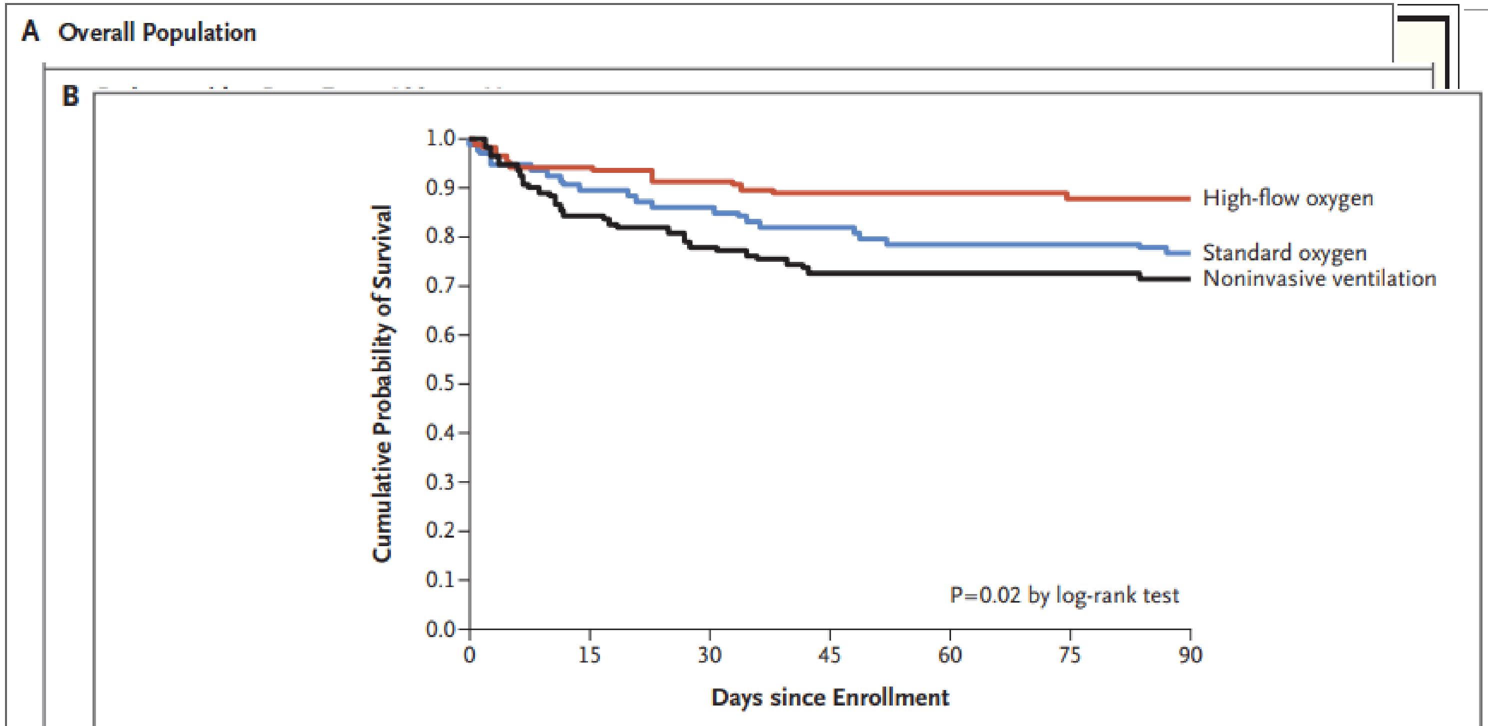
Mise en place de l'Optiflow®:

FiO2 = 100%; débit = 50l/min

38 Patients



FLORALI Study



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

Figure 3. **Kaplan–Meier Plot of the Probability of Survival from Randomization to Day 90.**

2015

Multicenter, randomized open-label trial

310 ICU patients, hypoxemic

Limits

low PEEP (mean 5 cmH2O)

low duration of the intervention (8 h)

possible lack of humidification

IRA hypoxémique pure

Genecand et al. 10.3389/fmed.2022.1068327

TABLE 4 Recommendations comparing high-flow nasal oxygen with non-invasive ventilation in acute hypoxemic respiratory failure.

Society	Recommendation
European Respiratory Society (ERS) (3)	The ERS task force suggests the use of HFNO over NIV in ARHF. (Conditional recommendation, very low certainty of evidence)
American College of Physicians (4)	Compared to NIV, HFNO may reduce intubation, all-cause mortality, and hospital-acquired pneumonia, and improve patient comfort in initial AHRF management.
Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock (64)	For adults with sepsis-induced hypoxemic respiratory failure, we suggest the use of HFNO over NIV. Weak recommendation, low quality of evidence

AHRF, acute hypoxemic respiratory failure; HFNO, high-flow nasal oxygen; NIV, non-invasive ventilation.

IRA hypercapnique

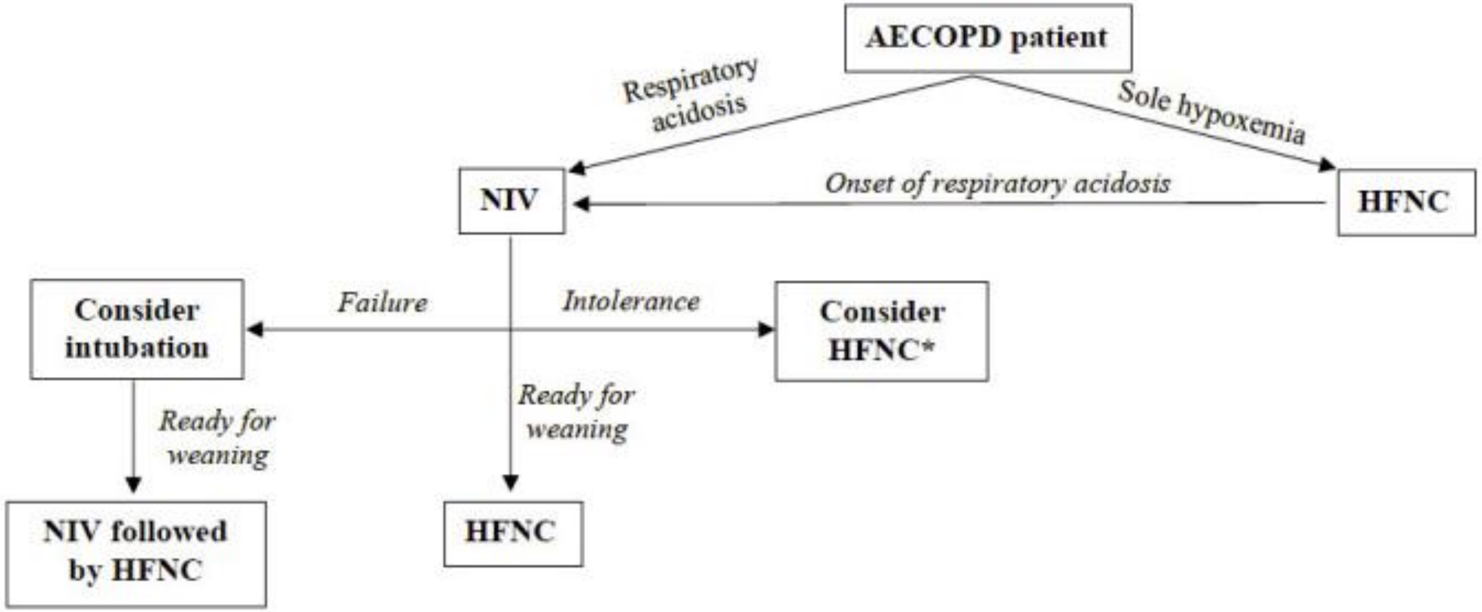


Figure 1. Flowchart of possible use of HFNC in AECOPD patients. * if clinical conditions and gas exchange are not deteriorating. AECOPD, Acute Exacerbation of Chronic Obstructive Pulmonary Disease; NIV, Non-Invasive Ventilation; HFNC, High Flow through Nasal Cannula.

Respiration

Clinical Investigations

Respiration
DOI: 10.1159/000505583

Clinical Evidence of Nasal High-Flow Therapy in Chronic Obstructive Pulmonary Disease Patients

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University of Groningen, Groningen, The Netherlands; [b]Groningen Research Institute for Asthma and C
University of Groningen, Groningen, The Netherlands

NHFT in COPD care		
Long-term use	AECOPD	Exercise therapy
Suggested indication		
Hypoxemic patients with recurrent exacerbations and chronic hypercapnic patients who do not tolerate NIV	Moderately acidotic patients who do not tolerate NIV	Stable patients whose endurance time is insufficient for an adequate training effect
Suggested settings		
Flow: 20–30 L/min FiO_2: SpO_2 based Temp: 37°C	Flow: 25–60 L/min FiO_2: ±30%, SpO_2 based Temp: 37°C	Flow: 50–60 L/min FiO_2: ±30–40%, SpO_2 based Temp: 37°C
Remarks		
• Increase flow in hypercapnia • Only 1 RCT performed in hypoxemia, and 3 cross-over trials in hypercapnia	• Consider higher flow during high inspiratory demand • Based on mostly observational studies and 1 RCT with low quality	• Only studies performed during exercise tests, not during pulmonary rehabilitation

Inter-séances de VNI

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Journal of Critical Care
Volume 48, December 2018, Pages 418-425

Pulmonary

High-flow nasal therapy vs standard oxygen during breaks off noninvasive ventilation for acute respiratory failure: A pilot randomized controlled trial

Giulia Spoletini [a] [1], Chiara Mega [a] [2], Lara Pisani [a] [3], Mona Alotaibi [a] [4], Alia Khoj
Lori Lyn Price [b] [c], Francesco Blasi [d], Stefano Nava [e], Nicholas S. Hill [a]

Conclusion

Compared to SO, HFNT did not reduce time on NIV. However, it was more comfortable and the increase in RR and dyspnea seen with SO did not occur with HFNT. Therefore, HFNT could be a suitable alternative to SO during breaks off NIV.

Pré-oxygénation

Maintenir un **débit d'oxygène élevé, FIO2 élevée** et une **pression positive dans les VAS**, durant **toutes les phases de la procédure d'intubation**

- la pré-oxygénation,
- la phase d'apnée et d'exposition laryngée **+++**

Cependant, **Controverses** quant aux bénéfices du HFNC en pré-Oxygénation, par rapport aux méthodes habituelles

Pré-oxygénat

Fong *et al. Critical Care* (2019) 23:319
https://doi.org/10.1186/s13054-019-2596-1

RESEARCH

Preoxygenation before intub
patients with acute hypoxem
failure: a network meta-analy
randomized trials

Ka Man Fong*, Shek Yin Au and George Wing Yiu Ng

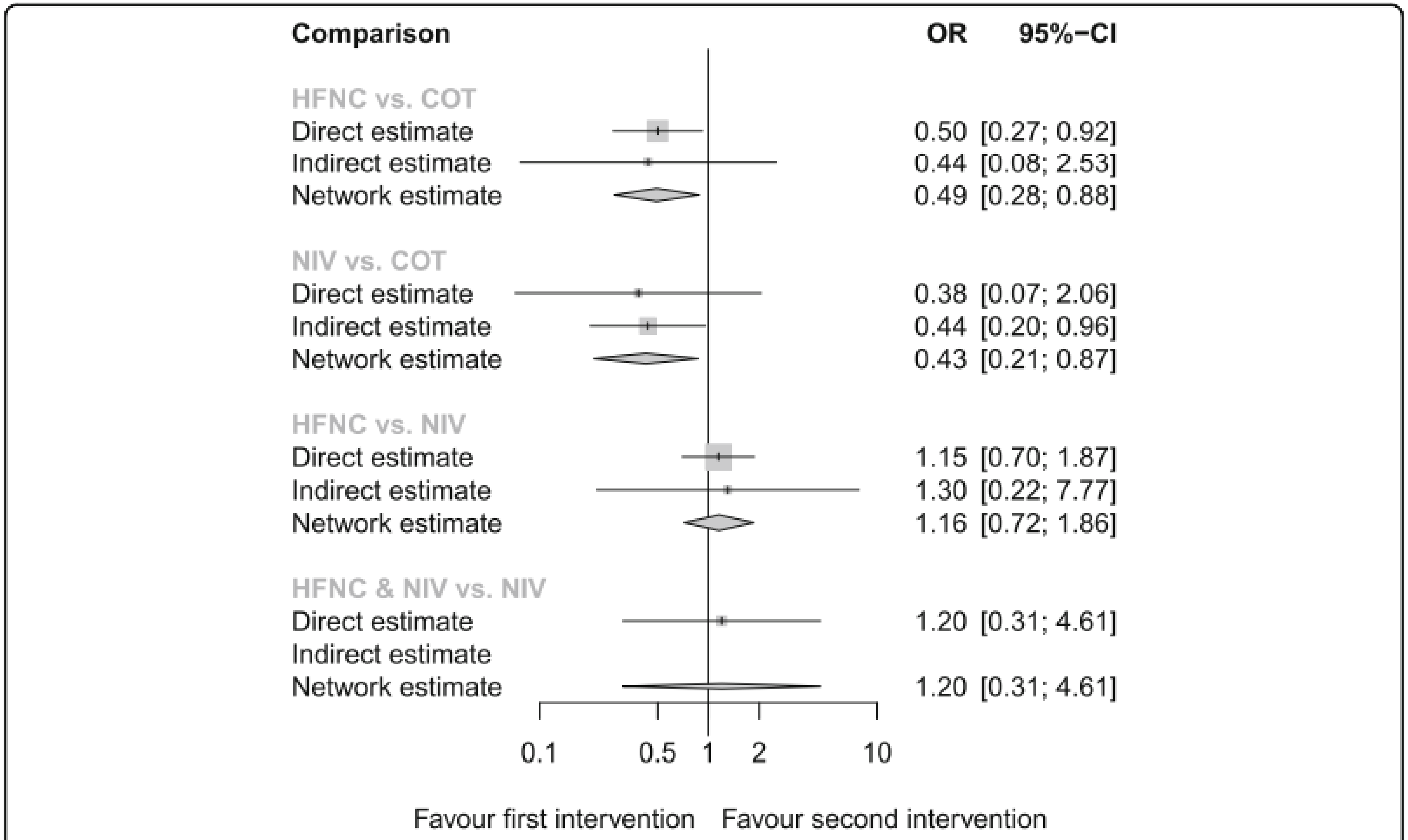

Fig. 5 Forest plot of intubation-related complications. $I^2 = 0\%$. *Q*-statistics for heterogeneity (within designs) and inconsistency (between designs). Total: $p = 0.978$, within designs: $p = 0.914$, between designs: $p = 0.892$. Intubation-related complications were defined as aspiration or new infiltrate on post-intubation chest radiograph, hemodynamic instability, and cardiac arrest. COT, conventional oxygen therapy (bag-valve mask or facial mask); HFNC, high-flow nasal cannula; NIV, noninvasive ventilation; OR, odds ratio; NMA, network meta-analysis

Post-Extubatic

International Journal of Chr

Open Access Full Text Article

High-Flow Nasal ... Non-Invasive Ven... After Extubation: ... and Meta-Analysi... Trials

Zhouzhou Feng, Lu Zhang, Haich

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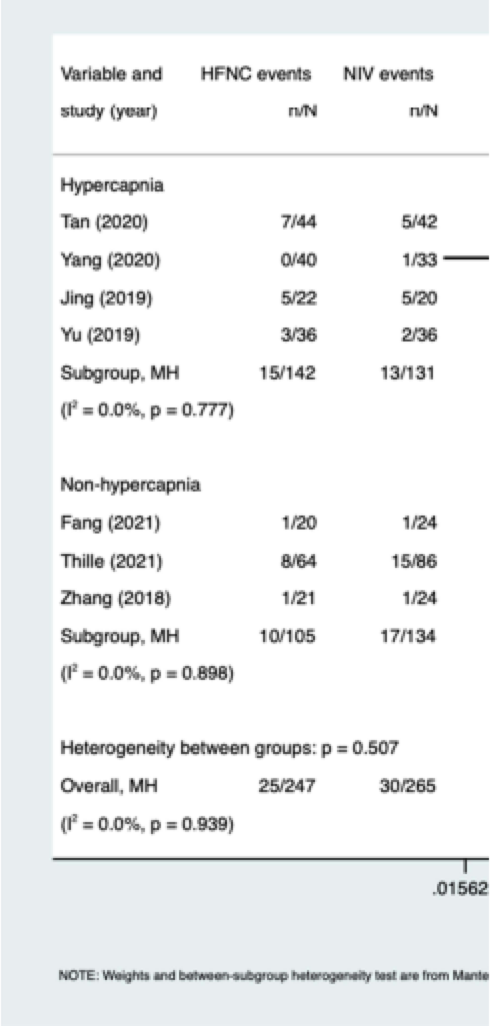


Figure 3 Forest plot of mortality, subgroup analysis was p...

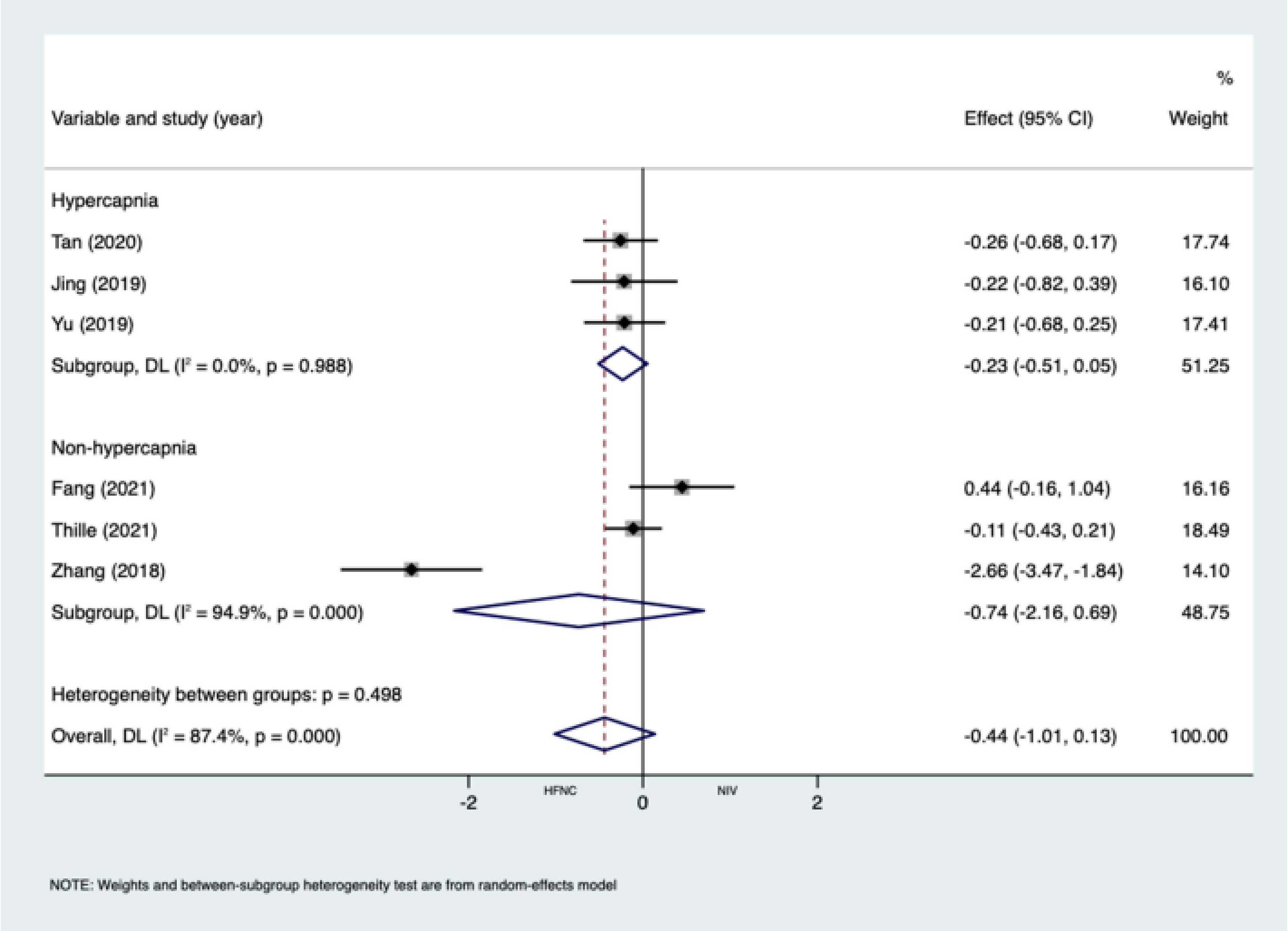


Figure 4 Forest plot of ICU length of stay, subgroup analysis was performed according to variable of hypercapnia and non-hypercapnia.

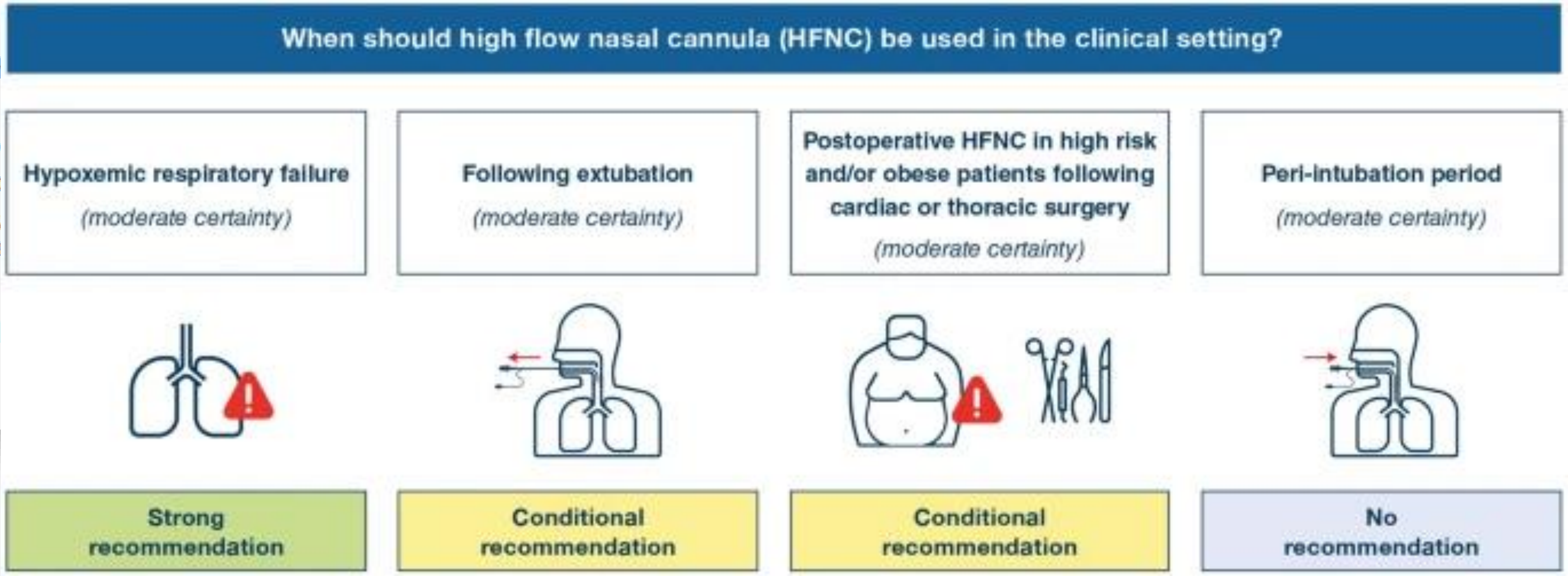
non-hypercapnia.

Intensive Care Med (2020) 46:2226–2237
https://doi.org/10.1007/s00134-020-06312-y

CONFERENCE REPORTS AND EXPERT PANEL

The role for high flow nasal cannula as a respiratory support strategy in adults: a clinical practice guideline

Bram Rochwerg[1,2], Sharon Einav[3,4], Dipayan Cl
Yigal Helviz[3], Ewan C. Goligher[8,9], Samir Jaber[1
Oriol Roca[14,15], Massimo Antonelli[16,17], Salvato
Carol L. Hodgson[21,22], Alain Mercat[23], M. Elizab
Elie Azoulay[24], Lamia Ouanes-Besbes[25,26], Gild
Armand Dessap-Mekontso[29,30], John Fraser[31,3
Gonzalo Hernandez[35], Sameer Jog[36], Antonio
Renee D. Stapleton[41], Daniel Talmor[42], Arnaud



EUROPEAN RESPIRATORY JOURNAL
ERS OFFICIAL DOCUMENTS
S. OCZKOWSKI ET AL.

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

Simon Oczkowski[1,2,26], Begüm Ergan[3,26], Lieuwe Bos[4,5], Michelle Chatwin[6], Mi
Cesare Gregoretti[8,9], Leo Heunks[10], Jean-Pierre Frat[11,12], Federico Longhini[13], Ste
Paolo Navalesi[16,17], Aylin Ozsancak Uğurlu[18], Lara Pisani[14,15], Teresa Renda[19], Ar
João Carlos Winck[20], Wolfram Windisch[21], Thomy Tonia[22], Jeanette Boyd[23], Giov
Raffaele Scala[25]

Summary of recommendations

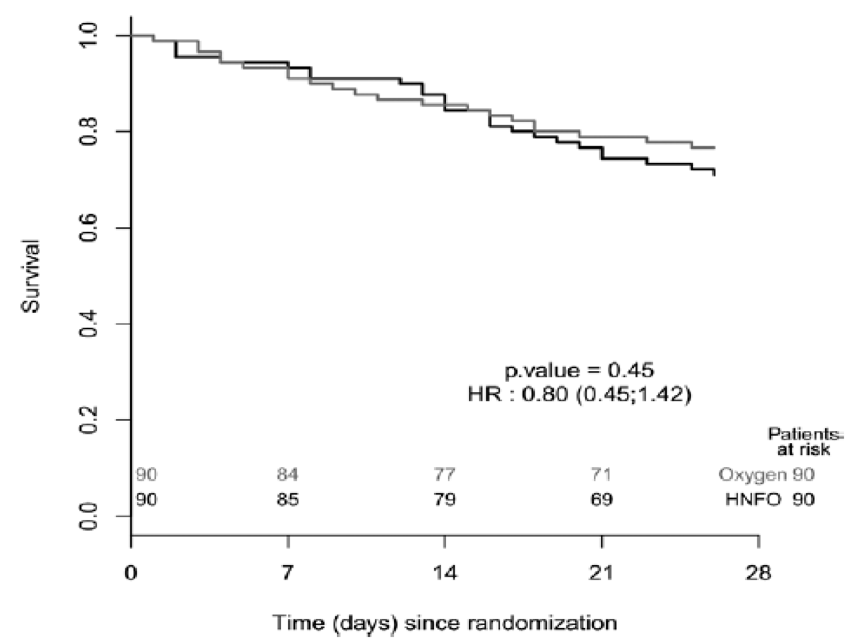
Acute hypoxemic respiratory failure	We suggest the use of HFNC over COT in adults acute hypoxemic respiratory failure (conditional recommendation, moderate certainty of evidence).	✓
	We suggest the use of HFNC over NIV in patients with acute hypoxemic respiratory failure (conditional recommendation, very low certainty of evidence).	✓
	We suggest use of HFNC over COT during breaks from NIV in patients with acute hypoxemic respiratory failure (conditional recommendation, low certainty of evidence)	✓
Post-operative	We suggest the use of either COT or HFNC in postoperative patients at low risk of respiratory complications (conditional recommendation, low certainty of evidence).	≈
	We suggest either HFNC or NIV in post-operative patients at high risk of respiratory complications (conditional recommendation, low certainty of evidence).	≈
Post-extubation in non-surgical patients	We suggest HFNC over COT in non-surgical patients after extubation at low or moderate risk of extubation failure. (conditional recommendation, low certainty of evidence).	✓
	We suggest the use of NIV over HFNC after extubation for patients at high risk of extubation failure unless there are relative or absolute contraindications to NIV (conditional recommendation, moderate certainty of evidence).	✗
Hypercapnic respiratory failure	We suggest a trial of NIV prior to use of HFNC in patients with COPD and acute hypercapnic respiratory failure (conditional recommendation, low certainty of evidence).	✗

Autres indications possibles

- **Oxygénation entre séances de VNI**
- **Oxygénothérapie préintubation**
- **IRA chez le patient immunodéprimé**
- **En post-extubation**
- **SAS**
- **Périopératoire**
- **Au cours d’acte de bronchoscopie**
- **BPCO stable**

IRA des immunodéprimés

374 patients
Score de propension
HFNC vs oxygène



778 patients
Randomisé
80% patients hématologie
HFNC vs oxygène

End Points	No. (%) High-Flow Oxygen Therapy (n = 388)	Standard Oxygen Therapy (n = 388)	Mean Difference, % (95% CI)[b]	Relative Difference (95% CI)	*P* Value
Primary					
All-cause day-28 mortality	138 (35.6)	140 (36.1)	−0.5 (−7.3 to 6.3)	HR, 0.98 (0.77 to 1.24)	.94
Secondary					
Invasive mechanical ventilation[c]	150 (38.7)	170 (43.8)	−5.1 (−12.3 to 2.0)	HR, 0.85 (0.68 to 1.06)[d]	.17
ICU-acquired infection	39 (10.0)	41 (10.6)	−0.6 (−4.6 to 4.1)	HR, 1.01 (0.96 to 1.06)[d]	.91
ICU mortality	123 (31.7)	122 (31.4)	0.3 (−6.3 to 6.8)	RR, 1.01 (0.82 to 1.24)	.64
Hospital mortality	160 (41.2)	162 (41.7)	−0.5 (−7.5 to 6.4)	RR, 0.99 (0.84 to 1.17)	.77
Length of stay, median (IQR), d					
ICU	8 (4-14)	6 (4-13)	0.6 (−1.0 to 2.2)	NA[e]	.07
Hospital	24 (14-40)	27 (15-42)	−2 (−7.3 to 3.3)	NA[e]	.60

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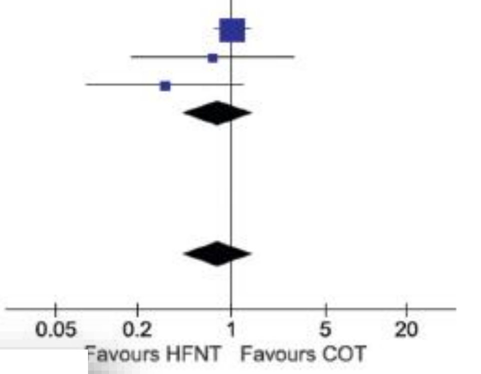
ELSEVIER

High flow nasal therapy in immunoc respiratory failure: A systematic revi

Andrea Cortegiani [a,*], Claudia Crimi [b], Filippo Sa
Cesare Gregoretti [a], Antonino Giarratano [a]

(a)

Study or Subgroup	HFNT Events	HFNT Total	COT Events	COT Total	Weight	Odds Ratio M-H, Random, 95% CI
1.5.1 ICU mortality						
Azoulay et al. 2018	123	388	122	388	68.5%	1.01 [0.75, 1.37]
Frat et al. 2016	4	26	6	30	15.2%	0.73 [0.18, 2.92]
Roca et al. 2015	10	22	13	18	16.3%	0.32 [0.08, 1.21]
Subtotal (95% CI)		**436**		**436**	**100.0%**	**0.80 [0.44, 1.45]**
Total events	137		141			
Heterogeneity: Tau² = 0.11; Chi² = 2.87, df = 2 (P = 0.24); I² = 30%						
Test for overall effect: Z = 0.74 (P = 0.46)						
Total (95% CI)		**436**		**436**	**100.0%**	**0.80 [0.44, 1.45]**
Total events	137		141			
Heterogeneity: Tau² = 0.11; Chi² = 2.87, df = 2 (P = 0.24); I² = 30%						
Test for overall effect: Z = 0.74 (P = 0.46)						



Study or Subgroup	HFNT Events	HFNT Total	COT Events	COT Total	Weight	Odds Ratio M-H, Random, 95% CI
Azoulay et al. 2018	150	388	170	388	69.4%	0.81 [0.61, 1.08]
Frat et al. 2016	8	26	13	30	6.5%	0.58 [0.19, 1.75]
Lemiale et al. 2017	40	90	48	90	21.3%	0.70 [0.39, 1.26]
Roca et al. 2015	13	22	16	18	2.8%	0.18 [0.03, 0.99]
Total (95% CI)		**526**		**526**	**100.0%**	**0.74 [0.55, 0.98]**
Total events	211		247			
Heterogeneity: Tau² = 0.01; Chi² = 3.23, df = 3 (P = 0.36); I² = 7%						
Test for overall effect: Z = 2.11 (P = 0.03)						

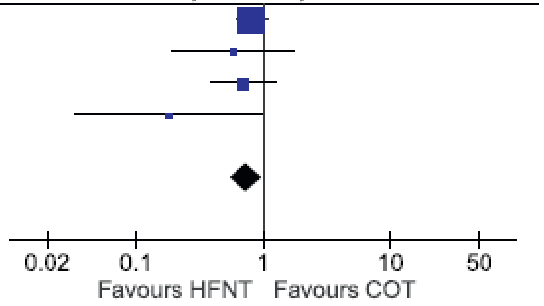
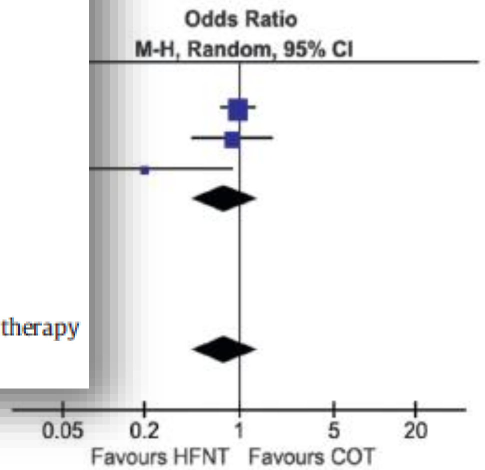


Fig. 4. Forest plot analyzing the risk of intubation in immunocompromised patients with acute respiratory failure treated high flow nasal therapy (HFNT) or conventional oxygen therapy (COT).



Heterogeneity: Tau² = 0.13; Chi² = 4.18, df = 2 (P = 0.12); I² = 52%
Test for overall effect: Z = 0.84 (P = 0.40)
Test for subgroup differences: Not applicable

Fig. 2. Forest plot analyzing the risk of ICU mortality (a - upper) and 28-day mortality (b - lower) in immunocompromised patients with acute respiratory failure treated high flow nasal therapy (HFNT) or conventional oxygen therapy (COT).

Study	HFNC Events	HFNC Total	Control Events	Control Total	Weight, %	Risk Ratio M-H, Random, 95% CI
Azoulay 2017	78	187	272	649	96.9	1.00 (0.82–1.21)
Frat 2016	4	26	8	30	3.1	0.58 (0.20–1.70)
Total (95% CI)		213		679	100	0.98 (0.81–1.18)
Total events	82		280			

Heterogeneity: Tau² = 0.00; Chi² = 0.96, df = 1 (*P* = .33); I² = 0%
Test for overall effect: Z = 0.70 (*P* = .82)

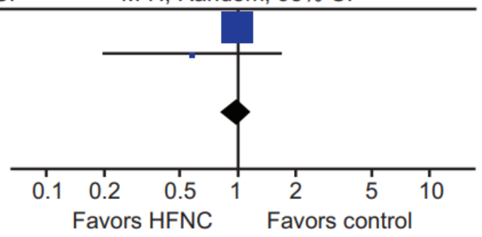


Fig. 4. Forest plot showing the effect of high-flow nasal cannula (HFNC) on 90-d mortality of immunocompromised subjects with acute respiratory failure.

Study	HFNC Events	HFNC Total	Control Events	Control Total	Weight, %	Risk Ratio M-H, Random, 95% CI
Azoulay 2017	39	388	41	388	57.7	0.95 (0.63–1.44)
Lemiale 2016	21	90	28	90	42.3	0.75 (0.46–1.22)
Total (95% CI)		478		478	100	0.86 (0.63–1.18)
Total events	60		69			

Heterogeneity: Tau² = 0.00; Chi² = 0.54, df = 1 (*P* = .46); I² = 0%
Test for overall effect: Z = 0.94 (*P* = .35)

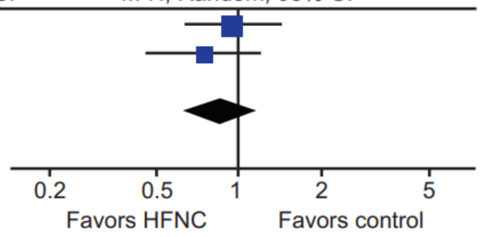
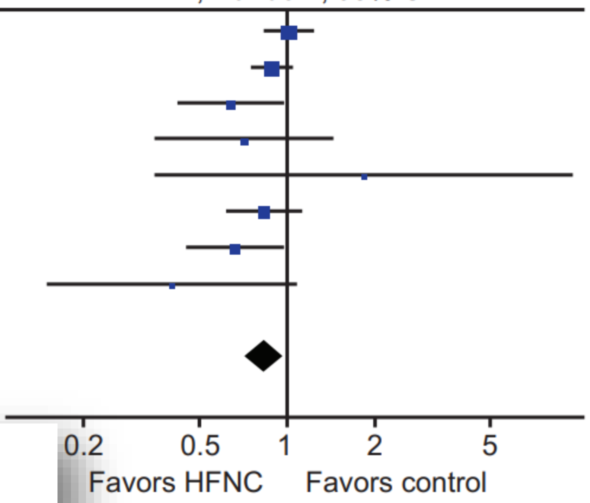
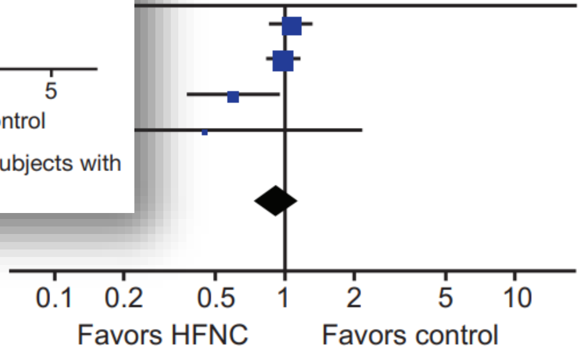


Fig. 5. Forest plot showing the effect of high-flow nasal cannula (HFNC) on ICU-acquired infections of immunocompromised subjects with acute respiratory failure.

Weight, %	Risk Ratio M-H, Random, 95% CI
26.2	1.02 (0.84–1.23)
29.6	0.88 (0.75–1.04)
9.9	0.64 (0.42–0.98)
4.0	0.71 (0.35–1.44)
0.8	1.85 (0.35–9.63)
16.1	0.83 (0.62–1.13)
11.4	0.66 (0.45–0.98)
2.1	0.40 (0.15–1.08)
100	0.83 (0.72–0.97)

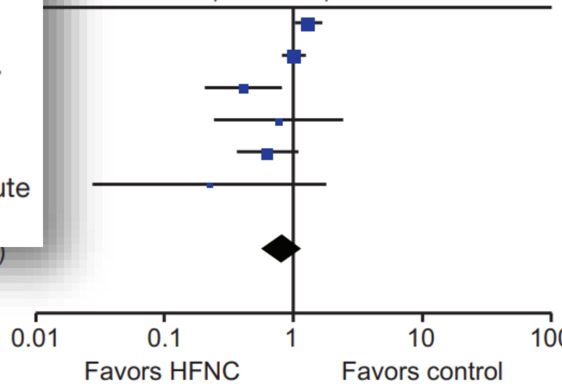


...nocompromised subjects with acute respi-



Total events 242 405
Heterogeneity: Tau² = 0.02; Chi² = 5.86, df = 3 (*P* = .12); I² = 49%
Test for overall effect: Z = 0.70 (*P* = .48)

Fig. 3. Forest plot showing the effect of high-flow nasal cannula (HFNC) on in-hospital mortality of immunocompromised subjects with acute respiratory failure.



Total (95% CI) 703 1158 100 0.82 (0.58–1.17)
Total events 202 311
Heterogeneity: Tau² = 0.10; Chi² = 15.15, df = 5 (*P* = .01); I² = 67%
Test for overall effect: Z = 1.08 (*P* = .28)

Fig. 2. Forest plot showing the effect of high-flow nasal cannula (HFNC) on ICU mortality of immunocompromised subjects with acute respiratory failure.

F... Immunocompromised Su...

Hanyujie Kang

Take-Home messages

- L’oxygène doit être administré **en urgence** devant tout patient en IRA.
- L’oxygène simple peut être suffisant dans les IRA minime à modérée, mais il existe un phénomène de dilution de l’oxygène, quand le **débit inspiratoire du patient en IRA est élevé**.
- La principale indication du HFNC est **l’IRA hypoxémique**.
- Les objectifs d’oxygénation doivent être bien définis, et il faut viser les SpO2 et les PaO2 minimales.