Oxygénation à haut débit au bloc opératoire: Pour quoi et pour qui?

Dr Ségolène Mrozek, M.D, Ph.D, Anesthésiste-réanimateur

Equipe IADE: Julie Dechaud et Hoang-Minh Truong

Clinique Pasteur, Toulouse

Conflits d'intérêts

- Fisher and Paykel

REX

→Activité POLYVALENTE

CLINIQUE Pasteur TOULOUSE

- Chirurgie digestive, gynécologique, urologique, CMF, …

IOT difficile

Obèse

Fibroscopie vigile IOT

- Endoscopies digestives: FOGD, colonoscopie, CPRE, EUS, ponction, prothèse biliaire…
- Pneumologie, FBB, LBA, ponction
- Panendoscopie VAS (CMF)

Sédation procédurale

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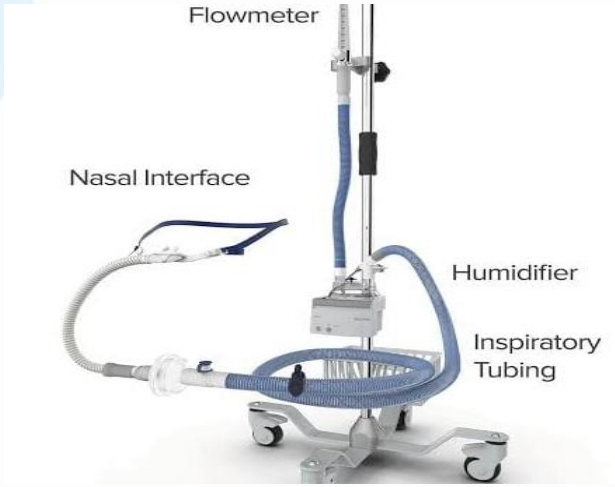
REX

Rationaliser et standardiser l'utilisation de l'oxygénothérapie à haut débit nasal

Sédation procédurale

IOT

Pour tous?



Sédations procédurales

REX

Inconfort et interdépendance
Sédation procédurale

- Anesthésiste
- Patient
- Opérateur

Sédations procédurales

Complications sédations procédurales

- Incidence de l'hypoxémie (SpO2 <90%) pour **endoscopies gastro-intestinales**: 26% à 85%

Carron et al, High-flow nasal oxygenation during gastrointestinal endoscopy.Systematic review and meta-analysis. BJA Open 2022

- Incidence de l'hypoxémie (SpO2 <90%) pour **Fibroscopies bronchiques diagnostiques ou thérapeutiques**: 33% à 69%

Su et al, High-flow cannula for reducing hypoxemic envents in patients undergoing bronchoscopy: A systematic review ans meta-analysis of randomized trials. Plos one 2021

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Complic

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Table 2 Type and frequency of minor complications

Type of minor complication	n	% relative to all minor complications (1.019)
Respiratory depression	338	33.17
Restlessness/difficult sedation	95	9.32
Aspiration event	71	6.97
Cardiac dysrhythmia (except bradycardia)	101	9.91
Hypotension	127	12.46
Vomiting	54	5.30
Laryngospasm	24	2.35
Sedation hangover	12	1.18
Bradycardia	20	1.96
Cramping	17	1.67
Extravasation	17	1.67
Paradoxical reaction	9	0.88
Allergic reactions	8	0.79
Nosebleed	5	0.49
Fall after mobilisation following endoscopy	1	0.10
Not specified	120	11.78
Total	1019	100

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

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Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

BJA

High-flow nasal oxygenation or standard oxygenation for gastrointestinal endoscopy with sedation in patients at risk of hypoxaemia: a multicentre randomised controlled trial (ODEPHI trial)

British Journal of Anaesthesia, 127 (1): 133–142 (2021)

Mai-Anh Nay[1,*], Lucie Fromont[2,†], Axelle Eugene[2,†], Jean-Louis Marcueyz[3], Willy-Serge Mfam[3], Olivier Baert[4], Francis Remerand[2], Céline Ravry[5], Adrien Auvet[5] and Thierry Boulain[1]

- RCT 4 centres
- Endoscopies gastrointestinales (hautes, basses ou combinées)
- Patients à risque hypoxémie

Gr standard O2

Preoxygénation FiO2 100%
masque 8L/min pdt 3min

Puis lunettes O2 ou masque ou canule nasopharyngée pour fiO2 50%

Gr OHD

Preoxygénation FiO2 100% avec 40L/min pdt 3min

Puis FiO2 50% avec 70L/min

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

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	High-flow nasal oxygen (N= 191)	Standard oxygen (N= 188)	Adjusted ARD, % (95% CI)*	P-value†	NNT (95% CI)‡
Primary outcome measure					
Lowest SpO_2 ≤92% (%)	18 (9.4)	63 (33.5)	−23.4 (−28.9 to −16.7)	<0.001	5 (4–6)
Secondary outcome measures					
Lowest SpO_2 ≤90% (%)	11 (5.8)	43 (22.9)	−18.6 (−25.9 to −10.9)	<0.001	6 (4–10)
Lowest SpO_2 ≤85% (%)	6 (3.1)	18 (9.6)	−7.6 (−16.9 to −1.6)	0.013	14 (6–61)
Prolonged hypoxaemia defined by SpO_2 ≤92% at least for 1 min (%)	14 (7.3)	28 (14.9)	−7.9 (−14.8 to −1.5)	0.017	13 (7–65)
Decrease of SpO_2 ≥5% (%)	25 (13.1)	64 (34.0)	−20.3 (−26.81 to −12.6)	<0.001	5 (4–8)

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

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	High-flow nasal oxygen (N=191)	Standard oxygen (N=188)	ARD* % (95% CI)	P-value†	NNT (95% CI)‡
Need for manoeuvres to maintain free upper airways (%)	21 (11.1)	61 (32.4)	−20.9 (−27.1 to −13.7)	<0.001	5 (4–8)
Increase of oxygen during procedure (%)	15 (7.9)	44 (23.4)	−16.3 (−23.9 to −8.5)	<0.001	7 (5–12)
Interruption of the endoscopy (%)	1 (0.5)	5 (2.7)	−2.2 (−4.9 to 0.4)¶	0.12§	–
Adverse events					
Apnoea or bradypnoea (%)	18 (9.5)	22 (11.9)	−2.4 (−8.5 to 3.3)	0.41	–
Bradycardia (%)	8 (4.2)	11(5.9)	−1.8 (−7.4 to 2.8)	0.45	–
Intubation (%)	1(0.5)	2(1.1)	−0.3 (−1.6 to 1.1)¶	0.62§	–
Noninvasive ventilation (%)	1 (0.5)	3 (1.6)	−0.5 (−2.0 to 0.9)¶	0.37§	–
Use of vasopressor (%)	6 (3.1)	11 (5.9)	−2.9 (−10.0 to 1.7)	0.21	–

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

SYSTEMATIC REVIEW/META-ANALYSIS

High-flow nasal oxygenation during gastrointestinal endoscopy. Systematic review and meta-analysis

Michele Carron[1,*], Enrico Tamburini[1], Bijan Safaee Fakhr[1], Alessandro De Cassai[2], Federico Linassi[3] and Paolo Navalesi[1]

BJA Open, 4 (C): 100098 (2022)

- RCT 2000-2021 endoscopies digestives hautes/basses/combinées
- OHD vs O_2 standard (lunettes nasales/masque)
- CJP: incidence des désaturations (SpO2)

Sous-groupes d'analyse:

✓ OHD débit minimal (< 40L/min) *vs* maximal (> 40L/min)

✓ Obèse (BMI ≥ 30 kg/m²) *vs* non-obèse

✓ Procédures courtes (≤ 10min) *vs* longues

✓ Sédation seule *vs* sédation + opoïdes

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OHD et sédations procédurales: Endoscopies digestives

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BJA Open, 4 (C): 100098 (2022)

6 RCTs n= 2867 patients

Study (yr)	Procedure	Anaesthetic drugs	Population (COT/HFNO)	COT	HFNO
Teng and colleagues[9] (2019)	OGDS	Propofol (TCI), midazolam, alfentanil	General (51/50)	5 L min^{-1} NC	100% FiO_2 flow rate 30 L min^{-1}
Lin and colleagues[10] (2019)	Gastroscopy	Propofol (push strategy)	General (1000/994)	2 L min^{-1} NC	100% FiO_2 flow rate 60 L min^{-1}
Riccio and colleagues[11] (2019)	Elective colonoscopy	Propofol	Obese (31/28)	4 L min^{-1} NC	36–40% FiO_2 flow rate 60 L min^{-1}
Nay and colleagues[12] (2021)	Gastrointestinal endoscopy (upper, lower, both)	Propofol, midazolam, opioids, ketamine,	General (188/191)	0.50 FiO_2 NC or mask	50% FiO_2 flow rate 70 L min^{-1}
Kim and colleagues[13] (2021)	ERCP (prone position)	Propofol, midazolam	General (36/36)	5 L min^{-1} NC	100% FiO_2 flow rate 50 L min^{-1}
Mazzeffi and colleagues[14] (2021)	OGDS	Propofol, midazolam, fentanyl	General (130/132)	6 L min^{-1} NC	100% FiO_2 flow rate 20 L min^{-1}

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

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BJA Open, 4 (C): 100098 (2022)

General population of patients*	HFNO n/N (%)	COT n/N (%)
Hypoxic events [9–14]	74/1431 (5.2)	391/1436 (27.2)
-hypoxic events (SpO_2 <90%) [9–13]	23/1299 (1.8)	165/1306 (12.6)
Hypoxic events with HFNO ≥40 L min^{-1} [10–13]	45/1249 (3.6)	337/1255 (26.9)
Hypoxic events with HFNO <40 L min^{-1} [9–14]	29/182 (15.9)	54/181(29.8)
Hypoxic events in short procedure [9,10]	17/1044 (1.6)	264/1051 (25.1)
-hypoxic events in short procedure (SpO_2 <90%) [9,10]	1/1044 (0.1)	101/1051 (9.6)
Hypoxic events in long procedure [11–14]	57/387 (14.7)	127/385 (33)
-hypoxic events in long procedure (SpO_2 <90%) [11–13]	22/255 (8.6)	64/255 (25.1)
Hypoxic events with sedation [10,11]	11/1022 (1.1)	104/1031 (10.1)
Hypoxic events with sedation and opioid [9,13]	1/86 (1.2)	18/87 (20.7)
Non-obese patients		
Hypoxic events [9,10,12,13]	27/1216 (2.2)	309/1226 (25.2)
-hypoxic events (SpO_2 <90%) [9,10,12,13]	5/1216 (0.4)	132/1226 (10.8)
Obese patients		
Hypoxic events [11,12]	19/83 (22.9)	39/90 (43.3)
-hypoxic events (SpO_2 <90%) [11,12]	18/83 (21.7)	33/90 (36.7)

Sédations procédurales

OHD et sédations procédurales: Endoscopies digestives

Meta-analysis comparing the efficiency of high-flow nasal cannula versus low-flow nasal cannula in patients undergoing endoscopic retrograde cholangiopancreatography

Mohamed Gamal, MBBCh candidate[a], Manar Ahmed Kamal, MBBCh candidate[b], Mohamed Abuelazm, MBBCh candidate[a], Amman Yousaf, MD[c,d] and Basel Abdelazeem, MD[c,d]

Baylor University Medical Center Proceedings April 1, 2022.

Table 2. Baseline characteristics of the included studies

Variable	Thiruvenkatarajan et al 2021[19]		Kim et al 2021[18]		Lee et al 2021[3]	
	HFNC	LFNC	HFNC	LFNC	HFNC	LFNC
Total propofol dose (mg): mean (SD)	402 (216)	440 (232)	110.3 (54)	90.6 (38.2)	66 (43)	60 (35)
Total fentanyl dose (μg): mean (SD)	75.4 (34.3)	69.2 (36.1)	107.2 (34.8)	99.2 (37.1)	–	–
Baseline oxygen saturation (%): mean (SD)	–	–	97.5 (1.7)	98.2 (1.6)	98 (2)	98 (2)
Fraction of inspired oxygen (%)	100	–	100	100	50	–
Oxygen flow rate (L/min)	50	8	50	5	50	5
Total procedure min: mean (SD)	34.5 (19.9)	35.9 (15.9)	17.5 (8.2)	15.3 (7.3)	17 (9)	16 (8)

Sédations procédurales

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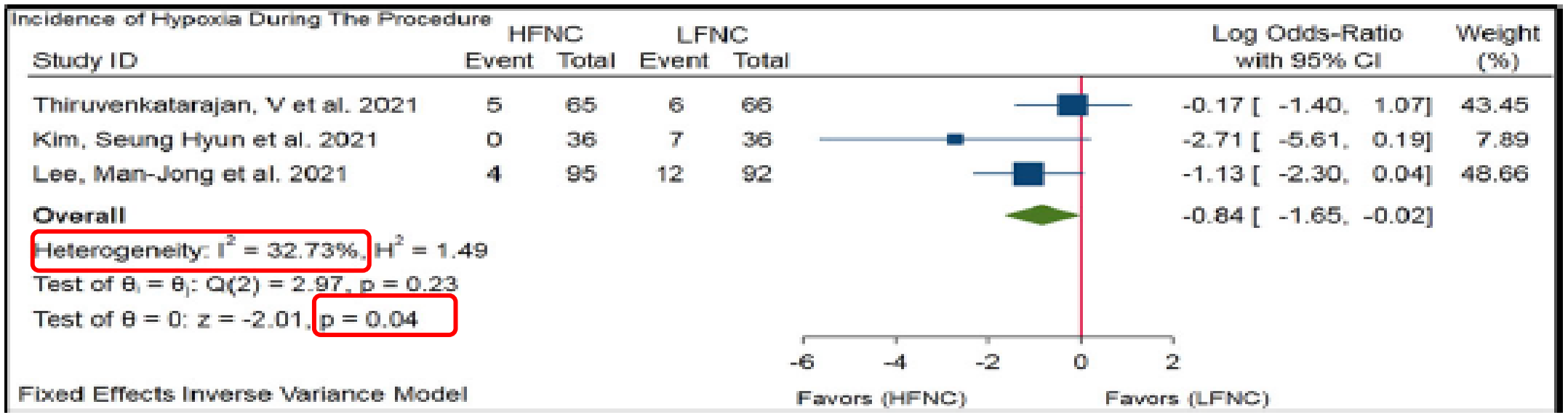

Figure 3. Forest plot comparing the effect of high-flow nasal cannula (HFNC) vs low-flow nasal cannula (LFNC) on the incidence of hypoxia during the procedure.

OHD et sédations procédurales: Endoscopies digestives

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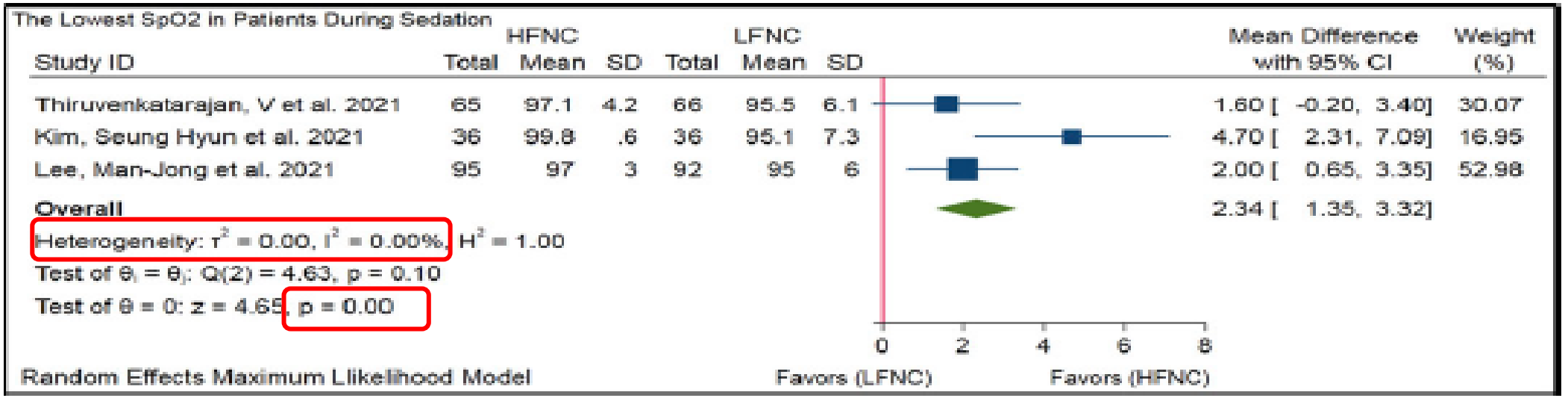


Figure 4. Forest plot comparing the effect of high-flow nasal cannula (HFNC) vs low-flow nasal cannula (LFNC) on the lowest oxygen saturation (SpO_2) in patients during sedation.

OHD et sédations procédurales: **REX**

Population à risque de désaturation pour les endoscopies digestives ?

OHD et sédations procédurales: **REX**

Population à risque de désaturation pour les endoscopies digestives ?

- ✓ BMI ≥ 30 kg/m^2
- ✓ SAOS appareillé ou patient à haut risque SAOS

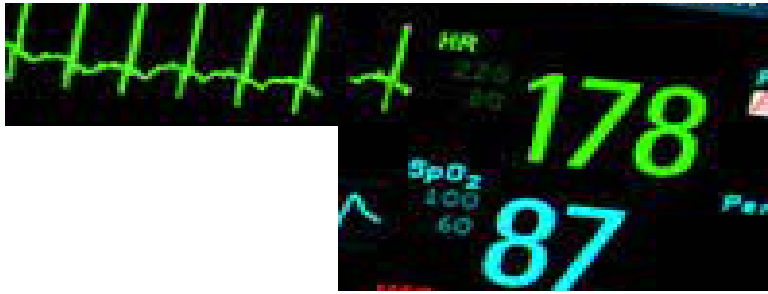
Assessment of the Berlin Questionnaire for evaluation of hypoxaemia risk in subjects undergoning deep sedation for screening gastrointestina endoscopye. Liou, Ther Clin Risk Manag 2018

A screening instrument for sleep apnea predict airway maneuvers in patients undergoing advanced endoscopic procedures. Côté, Clin Gastroenterology and Hepatology 2010

- ✓ Insuffisance rénale chronique DFG < 60L/min

Does propofol and alfentanil-induced sedation cause periodic apnoea in chronic renal failure patients? Lee, Int J Clin Pract 2010

OHD et sédations procédurales: **REX**



- ✓ Age? >60 ans, > 70 ans? Jeun
- ✓ ASA 3-4? → reproductibilité?
- ✓ Pathologie respiratoire chron
- ✓ Pathologie cardiovasculaire
- ✓ HTA++
- ✓ Diabète

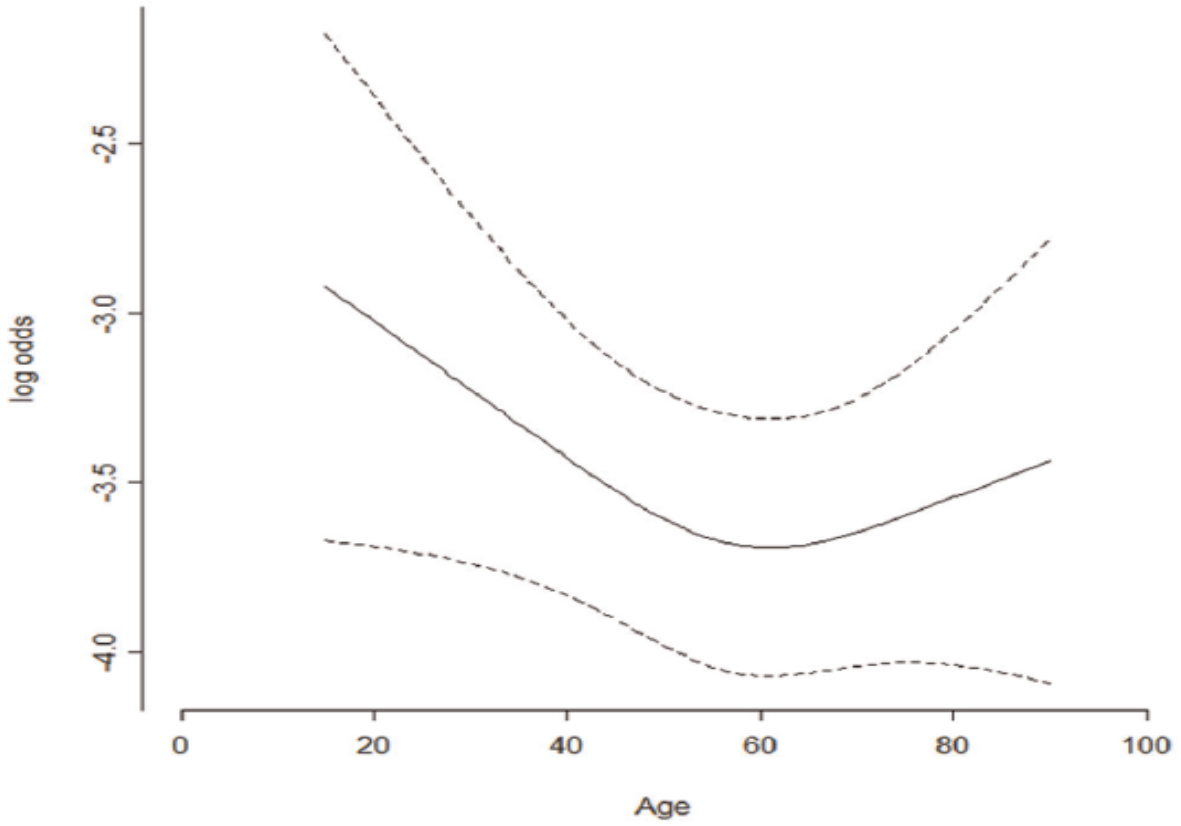
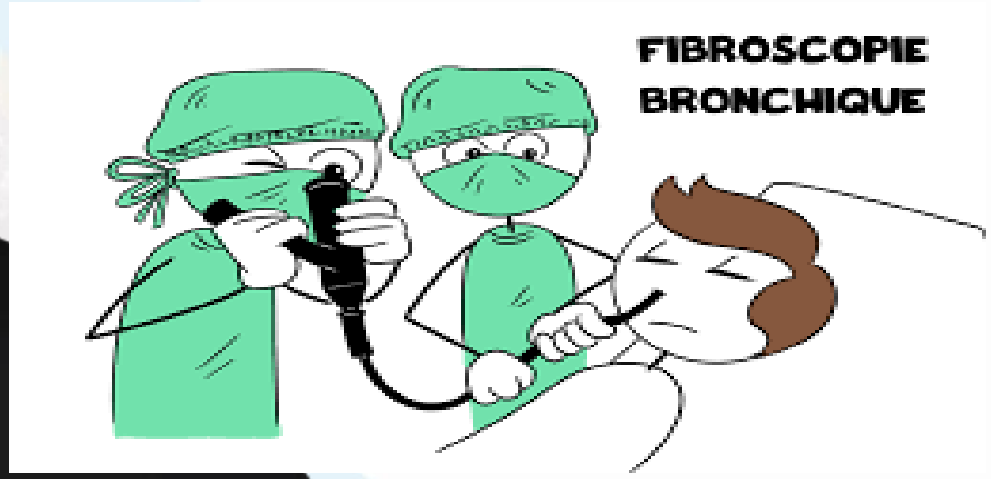


Figure 2. The relation between odd ratio of hypoxemia and patient age.

Pre-existing Disease of patie … . Long, Plos one 2012

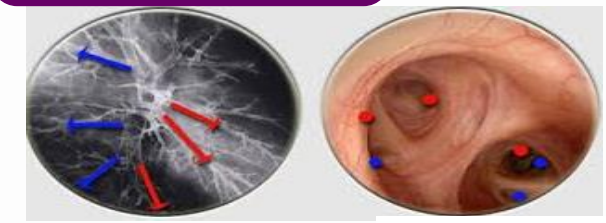
Effects of nasal high flow on ventilation in volunteers, COPD and idiopathic pulmonary fibrosis patients. Braunlich, Respiration 2013.

OHD et sédations procédurales: Fibro bronchiques



Sédations procédurales

OHD et sédations procédurales: Fibro bronchiques



PLOS ONE

High-flow nasal cannula for reducing hypoxemic events in patients undergoing bronchoscopy: A systematic review and meta-analysis of randomized trials

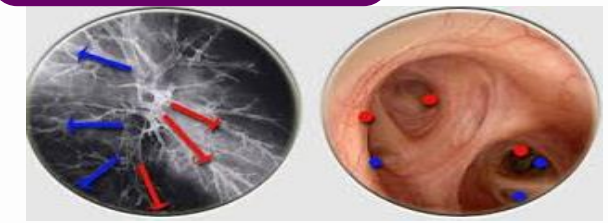
Chien-Ling Su[1,2☯], Ling-Ling Chiang[1☯], Ka-Wai Tam[3,4,5☯], Tzu-Tao Chen[1]*, Ming-Chi Hu[1]*

December 1, 2021

- RCTs OHD vs O_2 standard pour fibroscopies bronchiques
- CJP: incidence évènements hypoxémiques $SpO_2 < 90\%$

Sédations procédurales

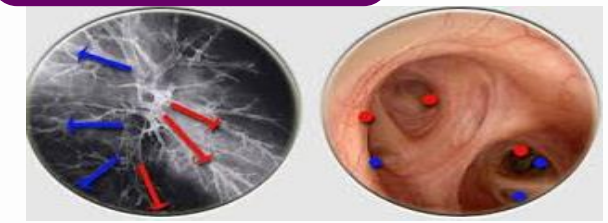
OHD et sédations procédurales: Fibro bronchiques



Study	Inclusion criteria	No. of patients (% male)	Age, years, mean ± SD	Baseline oxygenation	Sedative or anesthetic agents; duration of bronchoscopy (min)	Interventions
Ben-Menachem [13]	Age ≥ 18 years; lung transplant recipients; undergoing TBLB; able to provide informed consent; English speaking	H: 37 (40.5)	H: 54.9 ± 11.7	H: 98 (97–99)[†,a]	Local Topicalized anesthesia with nebulized 2% lidocaine and midazolam (1 to 3 mg) sedation with midazolam, propofol (321 mg in intervention group and 337 mg in control group) and alfentanil (586 mcg in intervention group and 691 mcg in control group) to keep ASA score II–III; H: 33 ± 10, C: 34 ± 8	H: FiO_2: 100%, flow rate: 30–50 LPM through the nasal cannula
		C: 39 (25.6)	C: 55.8 ± 11.9	C: 98 (97–99)[†,a]		C: Flow rate: 4–10 LPM through standard oxygen tubing
Douglas [14]	Age ≥ 18 years; able to provide informed consent; sedation planned; English speaking	H: 30 (63)	H: 62.8 ± 14.1	H: 96 (95–99)[†,a]	Topical 2% lignocaine to patient's nasopharynx and oropharynx Sedation with midazolam, opioids or propofol to keep MOAA/S = 4; I: 24 (26–28)[†], C: 21 (17–32)[†]	H: FiO_2: 100%, flow rate: 30–50 LPM (up to 70 LPM if necessary) through the nasal cannula
		C: 30 (63)	C: 63.4 ± 14.3	C: 96 (94–98)[†,a]		C: Flow rate: 10 LPM (up to 15 LPM if necessary) through the bite block
Irfan [15]	Age ≥ 18 years; SpO_2 ≥ 90%; able to breathe spontaneously throughout the procedure	H: 20 (60)	H: 61.9 ± 12	H: 98.4 ± 2.7[a]	Local anesthesia sedation with midazolam (5.6 mg in intervention group and 5.5 mg in control group) and alfentanil (300 mcg in intervention group and 287 mcg in control group) varied by assessing purposeful response to verbal and/or tactile stimuli while preserving spontaneous respiratory efforts; NI	H: FiO_2: 36%, flow rate: 30 LPM through the nasal cannula
		C: 20 (60)	C: 64.5 ± 14	C: 96.9 ± 1.9[a]		C: Nasal prong to maintain SpO_2 ≥ 94%

Sédations procédurales

OHD et sédations procédurales: Fibro bronchiques



Longhini [16]	Age ≥ 18 years; outpatients undergoing flexible bronchoscopy for bronchoalveolar lavage	H: 18 (83)	H: 61.9 ± NI	H: 10.8 (8.7–12.0)[†,b]	Topical Aanesthetic spray containing 10% lidocaine over tongue and nasopharynx; gargles with 10 mL of 2% lidocaine hydrochloride solution guaranteed further anesthesia of the oropharynx; H: 11 min 30 s ± NI, C: 12 min 50 s ± NI	H: FiO_2 set to reach SpO_2 ≥ 95%, flow rate: 60 LPM through the nasal cannula
		C: 18 (67)	C: 64.5 ± NI	C: 11.1 (10.5–12.1)[†,b]		C: Nasal cannula to keep SpO_2 ≥ 94%
Lucangelo [17]	Age ≥ 18 years; BMI ranging from 21 to 30	H60: 15 (47)	H60: 64 (63–70)[†]	H60: 350.9 (304.3–363.8)[†,c]	Anesthesia by nNebulized 2% lidocaine 2% through the mouth and nostrils to guarantee fully developed local anesthesia; 4mg midazolam in each group delivered as demanded by each patient, reaching a maximum dose of 0.1 mg/kg BW; H60: 15 (9–21)[†], H40: 15 (12–16)[†], C: 14 (10–16)[†]	H60: FiO_2: 50%, flow rate: 60 LPM through the nasal cannula
		H40: 15 (53)	H40: 70 (61–76)[†]	H40: 342.8 (295.7–371.9)[†,c]		H40: FiO_2: 50%, flow rate: 40 LPM through the nasal cannula
		C: 15 (60)	C: 68 (62–78)[†]	C: 322.4 (295.6–374.3)[†,c]		C: FiO_2: 50%, flow rate: 40 LPM through the venturi mask

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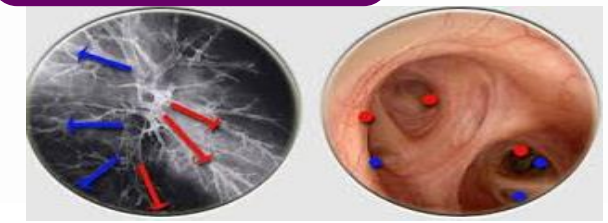
Sédations procédurales

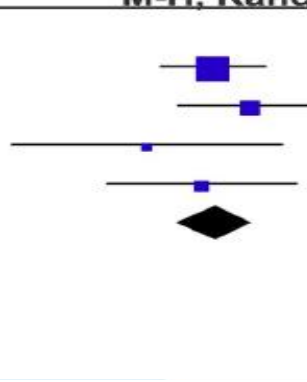
OHD et sédations procédurales: Fibro bronchiques



Study or Subgroup	HFNC Events	HFNC Total	COT Events	COT Total	Weight	Risk Ratio M-H, Random, 95% CI
2.1.1 Incidence of hypoxemic events during bronchoscopy						
Ben-Menachem 2020	6	37	27	39	50.1%	0.23 [0.11, 0.50]
Douglas 2018	4	30	10	30	26.7%	0.40 [0.14, 1.14]
Irfan 2020	1	20	11	20	7.6%	0.09 [0.01, 0.64]
Longhini 2021	2	18	10	18	15.5%	0.20 [0.05, 0.79]
Subtotal (95% CI)		**105**		**107**	**100.0%**	**0.25 [0.14, 0.42]**
Total events	13		58			

Heterogeneity: Tau² = 0.00; Chi² = 1.99, df = 3 (P = 0.57); I² = 0%

Test for overall effect: Z = 5.11 (P < 0.00001)



Study or Subgroup	HFNC Mean	HFNC SD	HFNC Total	COT Mean	COT SD	COT Total	Weight	Mean Difference IV, Random, 95% CI
Ben-Menachem 2020	94	5.19	37	86	6.67	39	24.2%	8.00 [5.32, 10.68]
Douglas 2018	97.5	3.7	30	92	5.19	30	28.8%	5.50 [3.22, 7.78]
Irfan 2020	97.5	3.5	20	88.3	5	20	24.2%	9.20 [6.53, 11.87]
Longhini 2021	95	1.48	18	89	5.93	18	22.7%	6.00 [3.18, 8.82]
Total (95% CI)			**105**			**107**	**100.0%**	**7.12 [5.39, 8.84]**

Heterogeneity: Tau² = 1.33; Chi² = 5.27, df = 3 (P = 0.15); I² = 43%

Test for overall effect: Z = 8.08 (P < 0.00001)

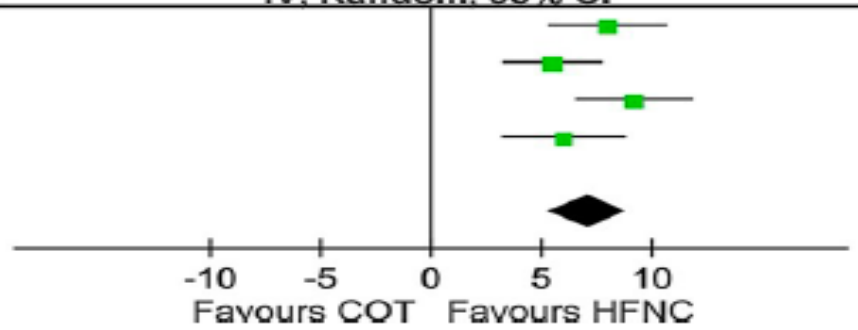


Fig 3. Forest plot for comparison: High-flow nasal cannula versus conventional oxygen therapy. Outcome: lowest SpO_2 during bronchoscopy. HFNC, high-flow nasal cannula; COT, conventional oxygen therapy; CI, confidence interval; SD, standard deviation.

OHD et sédations procédurales: **REX**

ENDOSCOPIE DIGESTIVE

PATIENTS PRESENTANT 1 OU PLUSIEURS CRITERES

- ❑ BMI ≥ 30 KG /M2
- ❑ HTA SEVERE (= 3 ANTIHYPERTENSEURS = ASA 3)
- ❑ CARDIOPATHIE ISCHIEMIQUE, RYTHMIQUE OU VALVULAIRE
- ❑ PATHOLOGIES RESPIRATOIRES BPCO, O2 PRE OP…
- ❑ SAOS (OU STOP BANG ≥ 3)
- ❑ EUS / CPRE (PROCEDURE LONGUE DUREE)

FIBROSCOPIE BRONCHIQUE

OUI

Protocole OPTIFLOW / AIVOC

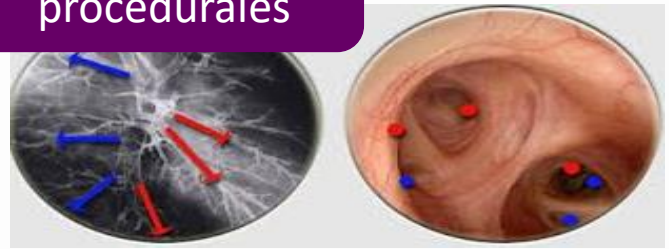
OPTIFLOW: **30L/min** en pré-oxygénation bouche fermée

50L/min perte de conscience

70L/min si nécessaire ou apnée

Sédations procédurales

OHD et sédations procédurales: **REX**



Sédations procédurales

OHD et sédations procédurales: **REX**

147 kg
186cm
BMI 42kg/m^2
Gastro/Colo

SpO_2 100%

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OHD et sédations procédurales: **REX**

- Protocole: propofol seul → bolus induction + AIVOC

ORIGINAL ARTICLE

Acute sedation-associated complications in GI endoscopy (ProSed 2 Study): results from the prospective multicentre electronic registry of sedation-associated complications

Behrens A, *et al*. *Gut* 2018

BMJ

What are the new findings?

- While confirming the low rate of acute sedation-related complications, the lowest risk was found with propofol monosedation.

Sédations procédurales

OHD et sédations procédurales: **REX**

CLINIQUE Pasteur TOULOUSE

→Application de notre protocole sur 2 mois par MAR/IADE impliqués

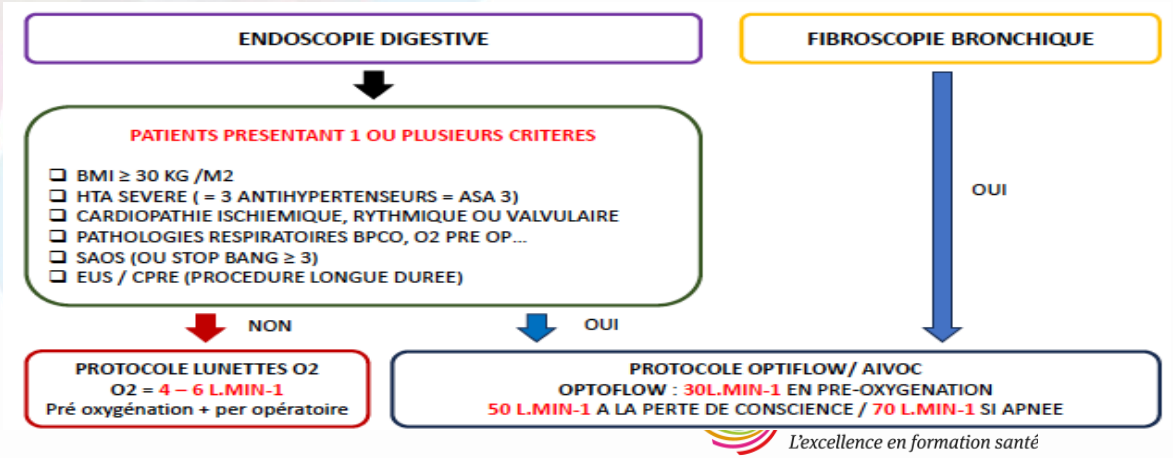
342 patients

✓ 141 endoscopies digestives **O2 standard**

✓ 163 endoscopies digestives sous **OHD** / 304 procédures endoscopies digestives (OHD+O2 standard)

→ **54% OHD**

✓ 38 endoscopies bronchiques OHD



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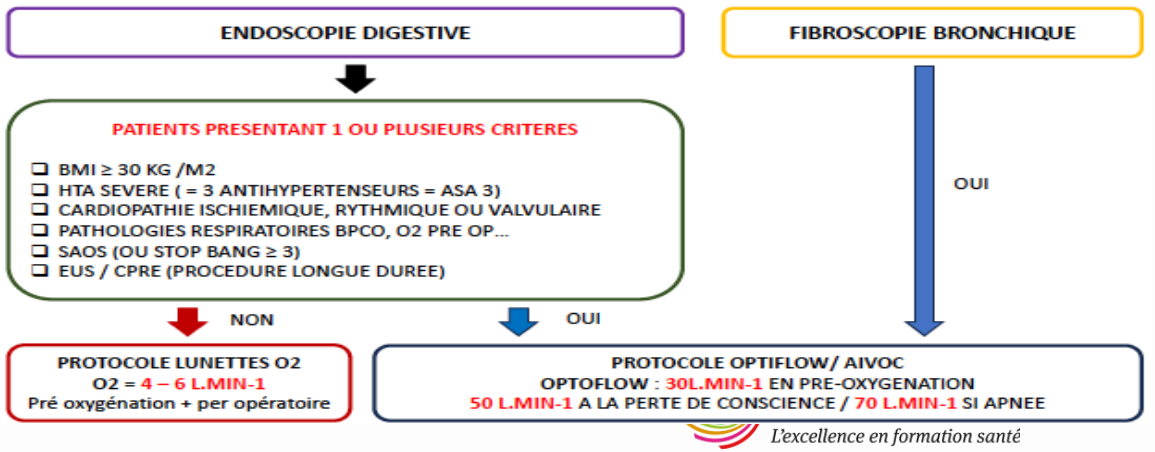
Sédations procédurales

OHD et sédations procédurales: **REX**

	Population totale endoscopies digestives N=304	Endoscopies digestives **O2 standard** N=141	Endoscopies digestives **OHD** N=163
Age (ans)	62±16	57±16	67±14
BMI (kg/m²)	26±6	23,7±4	28±6
ASA	2	2	3
ASA1 n(%)	30 (10%)	28 (20,6%)	2 (1%)
ASA2 n(%)	121 (41%)	78 (57,4%)	43 (27%)
ASA3 n(%)	144 (48%)	30 (22%)	114 (71%)
ASA4 n(%)	2 (1%)	0 (0%)	2 (1%)
Gastroscopie	46 (15,1%)	28 (19,8%)	18 (11%)
Coloscopie	98 (32,2%)	60 (42,6%)	38 (23,3%)
Gastroscopie + coloscopie	104 (34,2%)	53 (37,6%)	51 (31,3%)
Endoscopie interventionnelle (CPRE, EUS pancréas/prothèse biliaire…)	56 (18,4%)	0 (0%)	56 (34,4%)



Sédations procédurales

OHD et sédations procédurales: REX

	Endoscopies digestives O2 standard N=141	Endoscopies digestives OHD N=163	Endoscopies pulmonaires OHD N= 38
Age (ans)	57 ± 16	67 ± 14	65 ± 14
BMI (kg/m²)	23,7 ± 4	28 ± 6	23,5 ± 4
ASA	2	3	3
ASA1 n(%)	28 (20,6%)	2 (1%)	0 (0%)
ASA2 n(%)	78 (57,4%)	43 (27%)	10 (28,6%)
ASA3 n(%)	30 (22%)	114 (71%)	24 (68,6%)
ASA4 n(%)	0 (0%)	2 (1%)	1 (2,9%)
DID et DNID n(%)	11 (7,8%)	44 (27%)	1 (2,6%)
O_2 préop n(%)	0 (0%)	3 (1,8%)	5 (13,1%)
SpO_2 initiale (%)	99,8 ± 0,9	98 ± 2	95,6 ± 4
SAOS appareillé n(%)	0 (0%)	39 (24%)	4 (10,5%)
BPCO n(%)	0 (0%)	26 (16%)	9 (23,7%)
Autres pathologies respiratoires n(%)	0 (0%)	18 (11%)	19 (50%)
HTA n(%)	20 (14,2%)	35 (21,5%) HTA sévère	4 (10,5%)
Cardiopathie ischémique n(%)	0 (0%)	35 (21,5%)	3 (7,9%)
Cardiopathie rythmique n(%)	0 (0%)	32 (19,6%)	7 (18,4%)
Cardiopathie valvulaire n(%)	0 (0%)	12 (7,4%)	3 (7,9%)

Sédations procédurales

OHD et sédations procédurales: REX

	Endoscopies digestives O2 standard N=141	Endoscopies digestives OHD N=163	Endoscopies pulmonaires OHD N= 38
SpO_2 < 92% n(%)	7 (5%)	10 (6,1%)	3 (7,9%)
SpO_2 < 92% au moins 1 min n(%)	5 (3,5%)	6 (3,7%)	1 (2,6%)
SpO_2 < 90% n(%)	5 (3,5%)	5 (3%)	3 (7,9%)
SpO_2 < 85% n(%)	2 (1,4%)	4 (2,5%)	0 (0%)
Bradypnée < 6 c/min n(%)	3 (2,1%)	2 (1,2)	0 (0%)
Apnée n(%)	1 (0,7%)	4 (2,5)	1 (2,6%)
Bradycardie < 50 bpm n(%)	3 (2,1%)	5 (3)	0 (0)
PAS < 90mmHg n(%)	3 (2,1%)	8 (5)	1 (2,6%)
Modifications débit OHD ou O2 standard n(%)	1 (0,7%)	10 (6,1)	2 (5,2%)
Ventilation masque n(%)	4 (2,8%)	4 (2,5)	0 (0%)
Manoeuvres VAS n(%)	11 (7,8%)	12 (7,4)	1 (2,6%)
Durée examen (min)	16±9	22±13	13±7
Confort opérateur	10 [10-10]	10 [10-10]	10 [10-10]

Sédations procédurales

OHD et sédations procédurales:
Autres indications?

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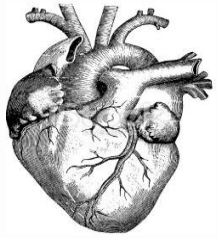
OHD et sédations procédurales:
Autres indications?

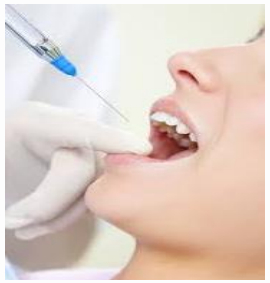


RESEARCH Open Access

High-flow nasal oxygen vs. standard oxygen therapy for patients undergoing transcatheter aortic valve replacement with conscious sedation: a randomised controlled trial

S. Scheuermann[1], A. Tan[1*], P. Govender[1], M. Mckie[2], J. Pack[1], G. Martinez[1], F. Falter[1], S. George[1] and A. A. Klein[1]

. Perioperative Medicine (2023) 12:11



A Nasal High-Flow System Prevents Hypoxia in Dental Patients Under Intravenous Sedation

Teppei Sago, DDS, PhD, * Nozomu Harano, DDS, PhD, † Yuki Chogyoji, DDS, ‡
Masahito Nunomaki, DDS, PhD, § Shunji Shiiba, DDS, PhD, ||
and Seiji Watanabe, MD, PhD ¶

J Oral Maxillofac Surg 73:1058-1064, 2015

RESEARCH ARTICLE Open Access

High-flow nasal cannula improves clinical efficacy of airway management in patients undergoing awake craniotomy

Ping Yi[1†], Qiong Li[2†], Zhoujing Yang[1], Li Cao[1], Xiaobing Hu[1] and Huahua Gu[1*]

BMC Anesthesiology (2020) 20:156

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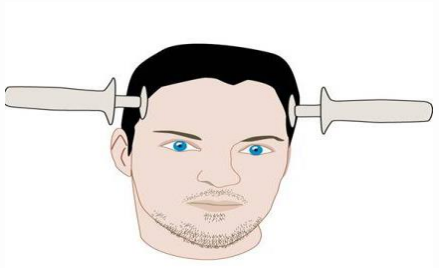
Sédations procédurales

OHD et sédations procédurales:
Autres indications?

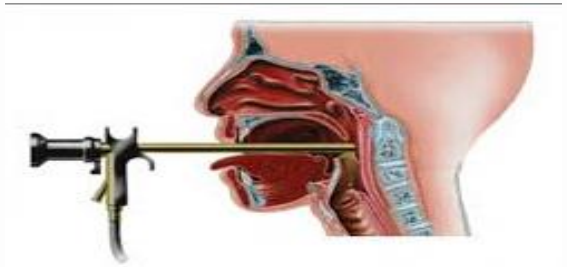


Effect of high-flow nasal cannula versus conventional facemask ventilation for patients undergoing modified electroconvulsive therapy

A randomised controlled, noninferiority trial

Yi Zhu*, Yin Kang*, Jinfeng Wei, Jiaqi Hu, Chunxiao Wang and Sheng Wang

Eur J Anaesthesiol 2019; **36:**303–313



CORRESPONDENCE

Comparison of the efficacy of high-flow nasal oxygenation and spontaneous breathing with face mask ventilation during panendoscopy

Clément Conti[1], Olivier Mauvais[2], Emmanuel Samain[1,3], Laurent Tavernier[2], Sébastien Pili Floury[1,3], Guillaume Besch[1,3] and David Ferreira[1,4,*]

June 2023

BJA

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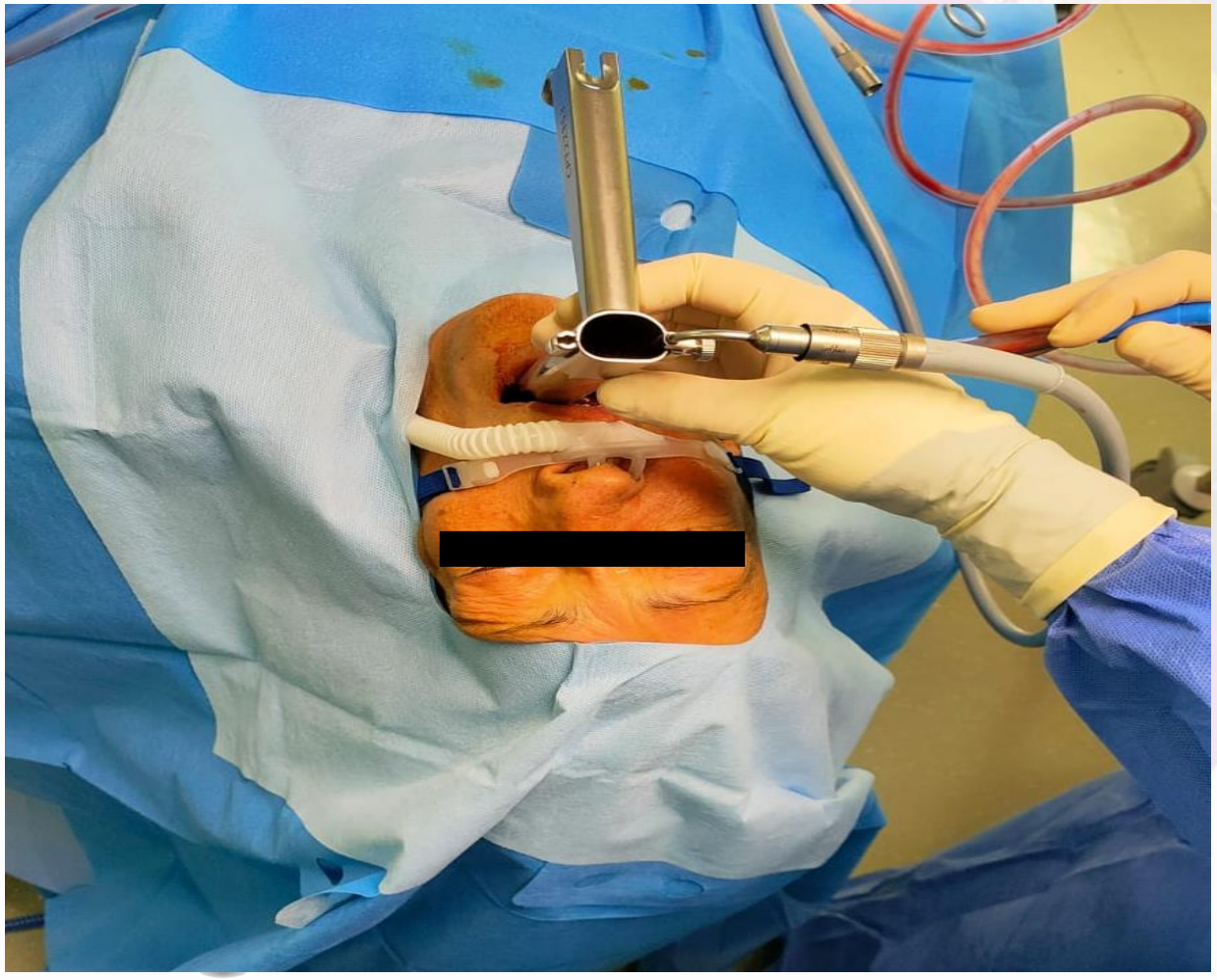
Sédations procédurales

OHD et sédations procédurales:
Autres indications?



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Sédations procédurales

OHD et sédations procédurales: Autres indications?

Effect of high-flow nasal oxygen on hypoxaemia during procedural sedation: a systematic review and meta-analysis

V. Thiruvenkatarajan,[1,2] V. Sekhar,[3] D. T. Wong,[4] J. Currie,[5] R. Van Wijk[2,6] and G. L. Ludbrook[7]

Anaesthesia 2023, 78, 81–92

- OHD *vs* O2 standard lors sédation procédurale
- CJP: survenue hypoxémie

→ **19 RCTs retenues avec 4121 patients**:

- ✓ 8 RCTs endoscopies digestives
- ✓ 5 RCTs bronchoscopies
- ✓ 3 RCTs cardiologie
- ✓ 2 RCTs chirurgie dentaire
- ✓ 1 RCT endovasculaire

Sédations procédurales

OHD et sédations procédurales: Autres indications?

Effect of high-flow nasal oxygen on hypoxaemia during procedural sedation: a systematic review and meta-analysis

V. Thiruvenkatarajan,[1,2] V. Sekhar,[3] D. T. Wong,[4] J. Currie,[5] R. Van Wijk[2,6] and G. L. Ludbrook[7]

→Patients gr OHD:

- ✓ 9 RCTs avec FiO2 100% et 9 RCTs FiO2 < 100%
- ✓ Débit : 30 à 70 L/min

→Patients gr standard O2:

- ✓ 14 RCTs O2 lunettes 1 à 10L/min
- ✓ 2 RCTs masque O2 5L/min
- ✓ 1 RCT Bite block O2 10-15L/min

OHD et sédations procédurales:
Autres indications?

Effect of high-flow nasal oxygen on hypoxaemia during procedural sedation: a systematic review and meta-analysis

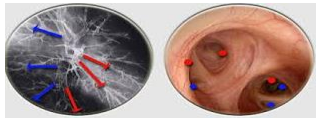
V. Thiruvenkatarajan,[1,2] V. Sekhar,[3] D. T. Wong,[4] J. Currie,[5] R. Van Wijk[2,6] and G. L. Ludbrook[7]

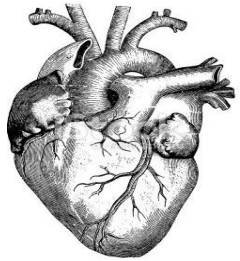
- Protocole: propofol, fentanyl, alfentanil, remifentanil, midazolam, kétamine, phencyclidine.
- 12 RCTs avec protocole standardisé
- 16 RCTs basées sur administration propofol (9 RCTs AIVOC / 7 RCTs boli)

Sédations

OHD et sédations procédurales:

Study or Subgroup	HFNO Events	HFNO Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
1.1.1 Gastrointestinal						
Kim [34]	0	36	7	36	1.9%	0.07 [0.00, 1.13]
Lee [22]	4	95	12	92	6.0%	0.32 [0.11, 0.96]
Lin [12]	0	994	84	1000	1.9%	0.01 [0.00, 0.10]
Mazzeffi [8]	28	132	43	130	9.1%	0.64 [0.43, 0.97]
Nay [9]	18	191	63	188	8.8%	0.28 [0.17, 0.46]
Riccio [35]	11	28	14	31	8.3%	0.87 [0.48, 1.59]
Teng [36]	1	50	11	51	3.1%	0.09 [0.01, 0.69]
Thiruvenkatarajan [37]	5	65	6	66	5.8%	0.85 [0.27, 2.64]
Subtotal (95% CI)		**1591**		**1594**	**45.0%**	**0.32 [0.15, 0.70]**
Total events	67		240			
Heterogeneity: $Tau^2 = 0.83$; $Chi^2 = 41.90$, df = 7 ($P < 0.00001$); $I^2 = 83\%$						
Test for overall effect: $Z = 2.87$ ($P = 0.004$)						
1.1.2 Bronchoscopy						
Ben-Menachem [11]	6	37	27	39	7.6%	0.23 [0.11, 0.50]
Douglas [38]	4	30	10	30	6.2%	0.40 [0.14, 1.14]
Irfan [39]	1	20	11	20	3.2%	0.09 [0.01, 0.64]
Sharluyan [26]	14	51	19	53	8.5%	0.77 [0.43, 1.36]
Ucar [24]	5	85	26	85	6.9%	0.19 [0.08, 0.48]
Subtotal (95% CI)		**223**		**227**	**32.4%**	**0.31 [0.15, 0.64]**
Total events	30		93			
Heterogeneity: $Tau^2 = 0.42$; $Chi^2 = 12.19$, df = 4 ($P = 0.02$); $I^2 = 67\%$						
Test for overall effect: $Z = 3.19$ ($P = 0.001$)						
1.1.3 Cardiology						
Conway [27]	8	61	7	65	6.7%	1.22 [0.47, 3.16]
Duan [21]	0	96	7	99	1.8%	0.07 [0.00, 1.19]
Scheuermann-Jahn [Preprint]	5	35	11	34	6.7%	0.44 [0.17, 1.14]
Subtotal (95% CI)		**192**		**198**	**15.2%**	**0.53 [0.16, 1.74]**
Total events	13		25			
Heterogeneity: $Tau^2 = 0.60$; $Chi^2 = 4.98$, df = 2 ($P = 0.08$); $I^2 = 60\%$						
Test for overall effect: $Z = 1.04$ ($P = 0.30$)						
1.1.4 Endovascular						
Vijitpavan [25]	5	18	13	18	7.4%	0.38 [0.17, 0.85]
Subtotal (95% CI)		**18**		**18**	**7.4%**	**0.38 [0.17, 0.85]**
Total events	5		13			
Heterogeneity: Not applicable						
Test for overall effect: $Z = 2.35$ ($P = 0.02$)						
Total (95% CI)		**2024**		**2037**	**100.0%**	**0.37 [0.24, 0.56]**
Total events	115		371			
Heterogeneity: $Tau^2 = 0.48$; $Chi^2 = 58.05$, df = 16 ($P < 0.00001$); $I^2 = 72\%$						
Test for overall effect: $Z = 4.62$ ($P < 0.00001$)						
Test for subgroup differences: $Chi^2 = 0.70$, df = 3 ($P = 0.87$), $I^2 = 0\%$						





REX

CLINIQUE Pasteur TOULOUSE

Rationaliser et standardiser l'utilisation de l'oxygénothérapie à haut débit nasal

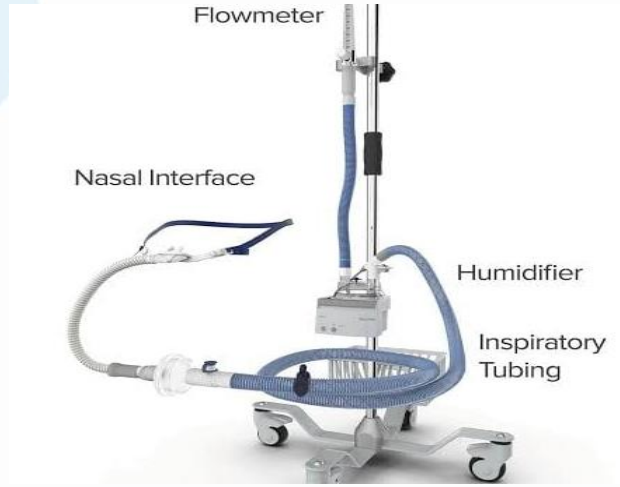
Sédation procédurale

Endoscopies pulmonaires

IOT

Sélection des patients
Endoscopies digestives

Extension domaines d'application



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IOT
Anesthésie générale

Préoxygénation et Oxygénation apnéique

IOT
Anesthésie générale

→ Amélioration Oxygénation

Kuo et al. Medicine (2022)

A comparison of high-flow nasal cannula and standard facemask as pre-oxygenation technique for general anesthesia

A PRISMA-compliant systemic review and meta-analysis

Hsien-Cheng Kuo, MD[a,b], Wan-Chi Liu, MD[a,b], Chun-Cheng Li, MD[a,b], Yih-Giun Cherng, MD, MSc[a,b], Jui-Tai Chen, MD, PhD[a,b], Hsiang-Ling Wu, MD[c,d], Ying-Hsuan Tai, MD, MSc[a,b,*]

- Méta-analyse

Comparaison préoxygénation HFNO FiO_2 100% > 30L/min vs. Préoxygénation standard au masque FiO_2 100%

- CJP: PaO_2 après préoxygénation

→ **16 RCT 1148 patients** (n=576 HFNO et n=572 Préoxy standard)

IOT
Anesthésie générale

→ Amélioration Oxygénation

Kuo et al. Medicine (2022)

Gr HFNO

Preoxygénation FiO_2 100% 30 à 70L/min

Apnée: 50 à 70 L/min

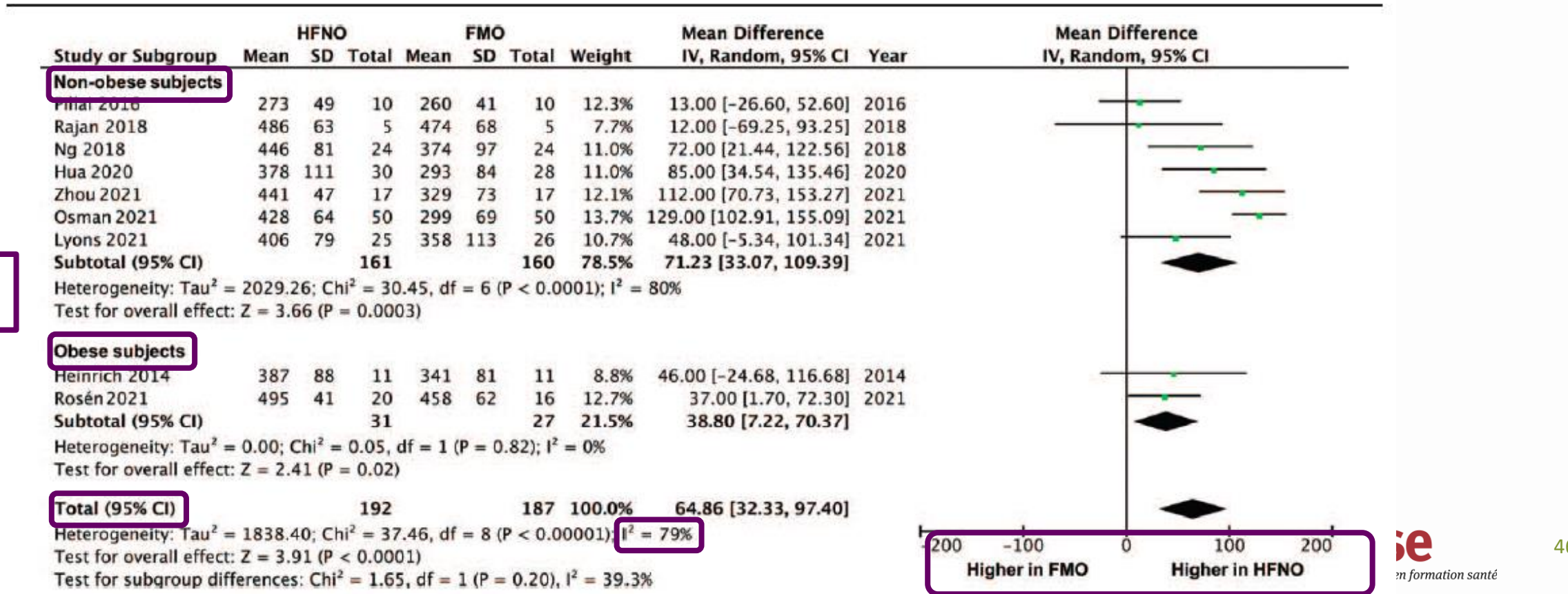
Gr 02 standard

Preoxygénation FiO_2 100% 6 à 15L/min

1 RCT Pression 10cmH_2O

1 RCT PEEP 7cmH_2O

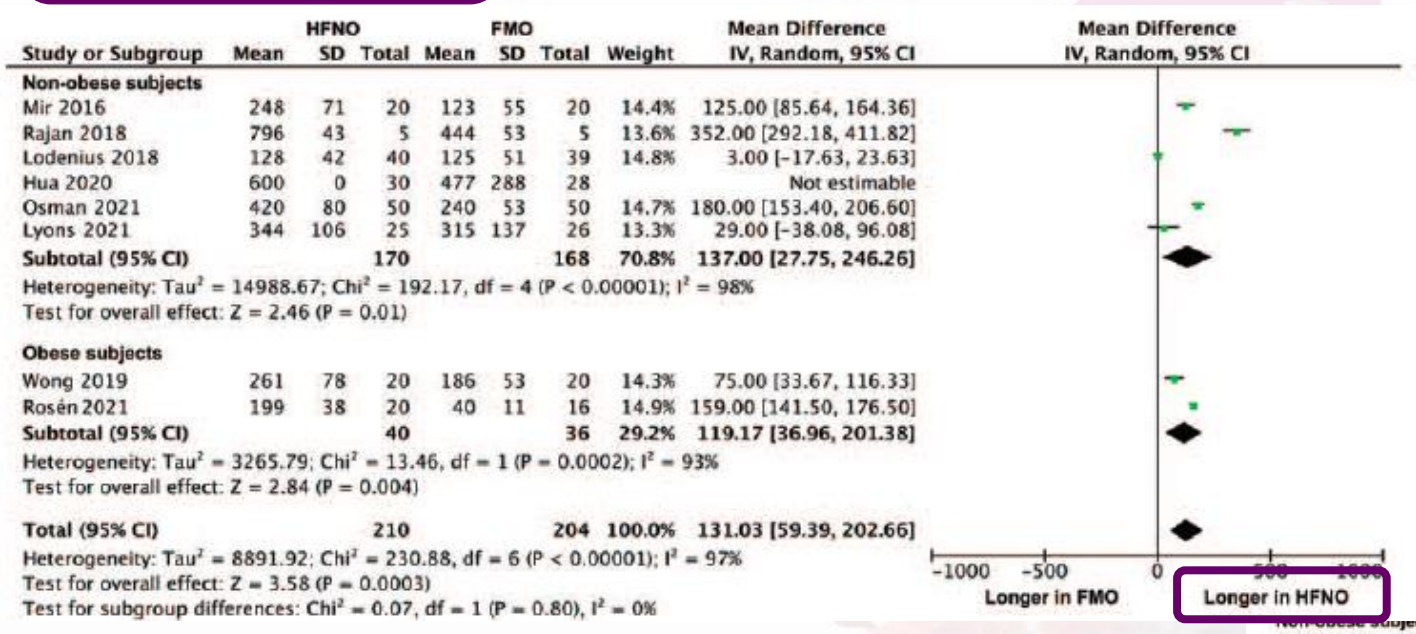
PaO_2



IOT
Anesthésie générale

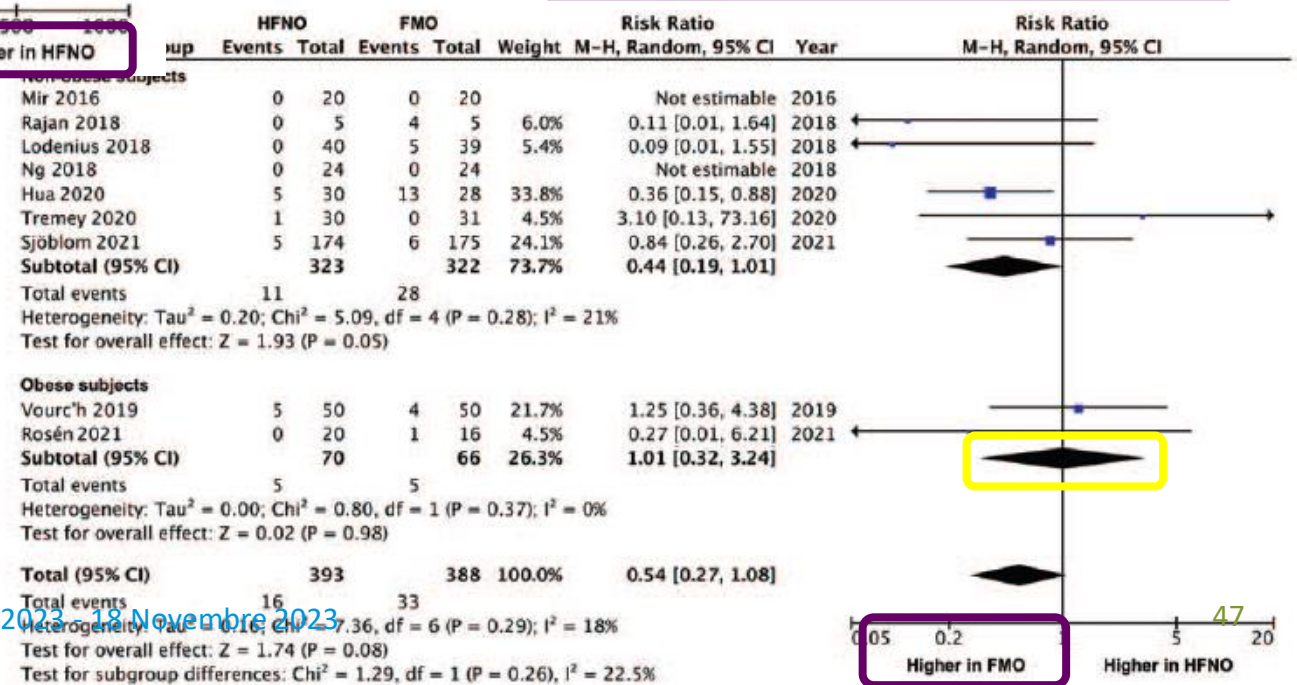
→ Temps d'apnée et désaturation

Kuo et al. Medicine (2022)



Temps d'apnée (s)

Désaturation SpO_2



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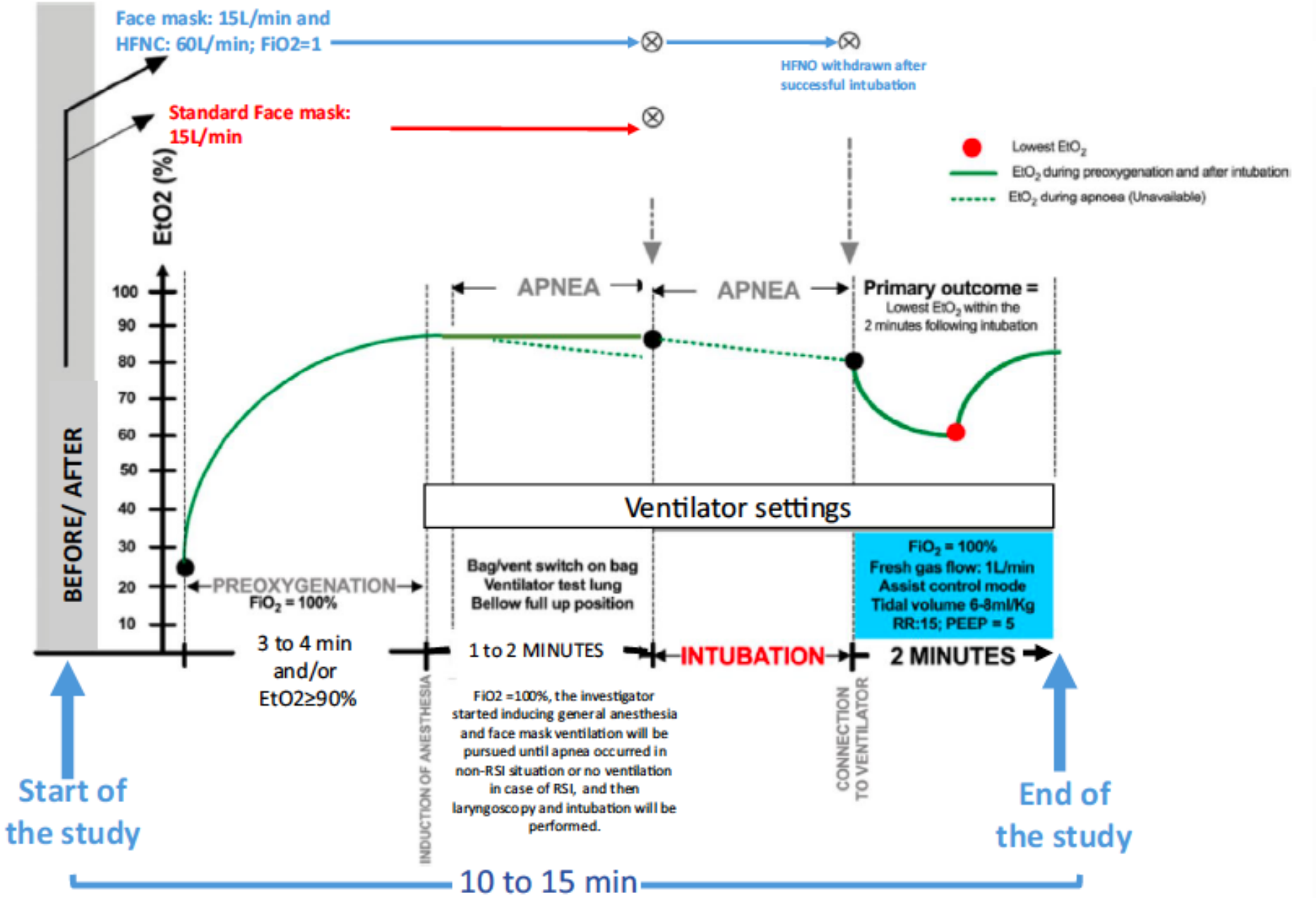
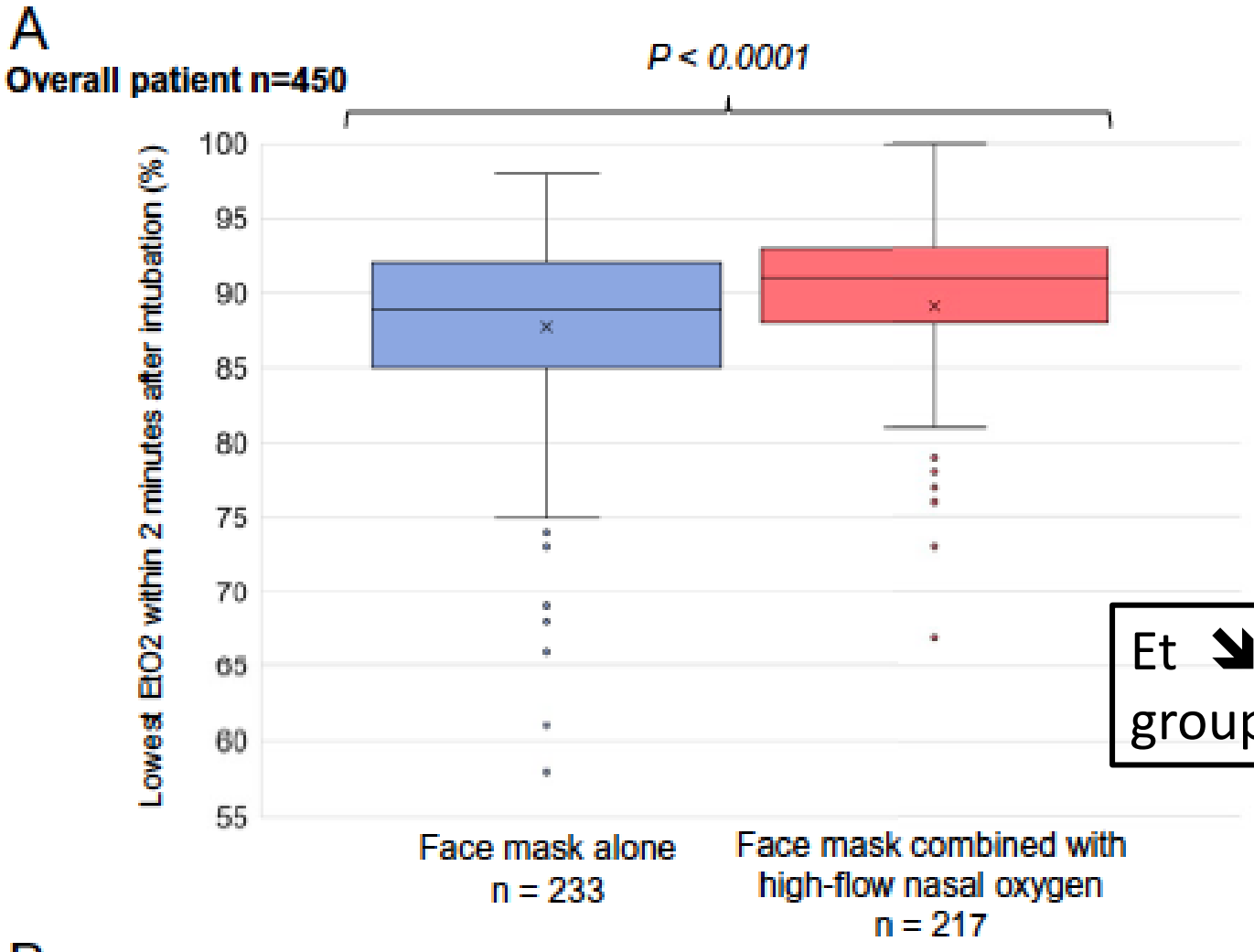
AFTER

BEFORE



→ Combinaison de techniques

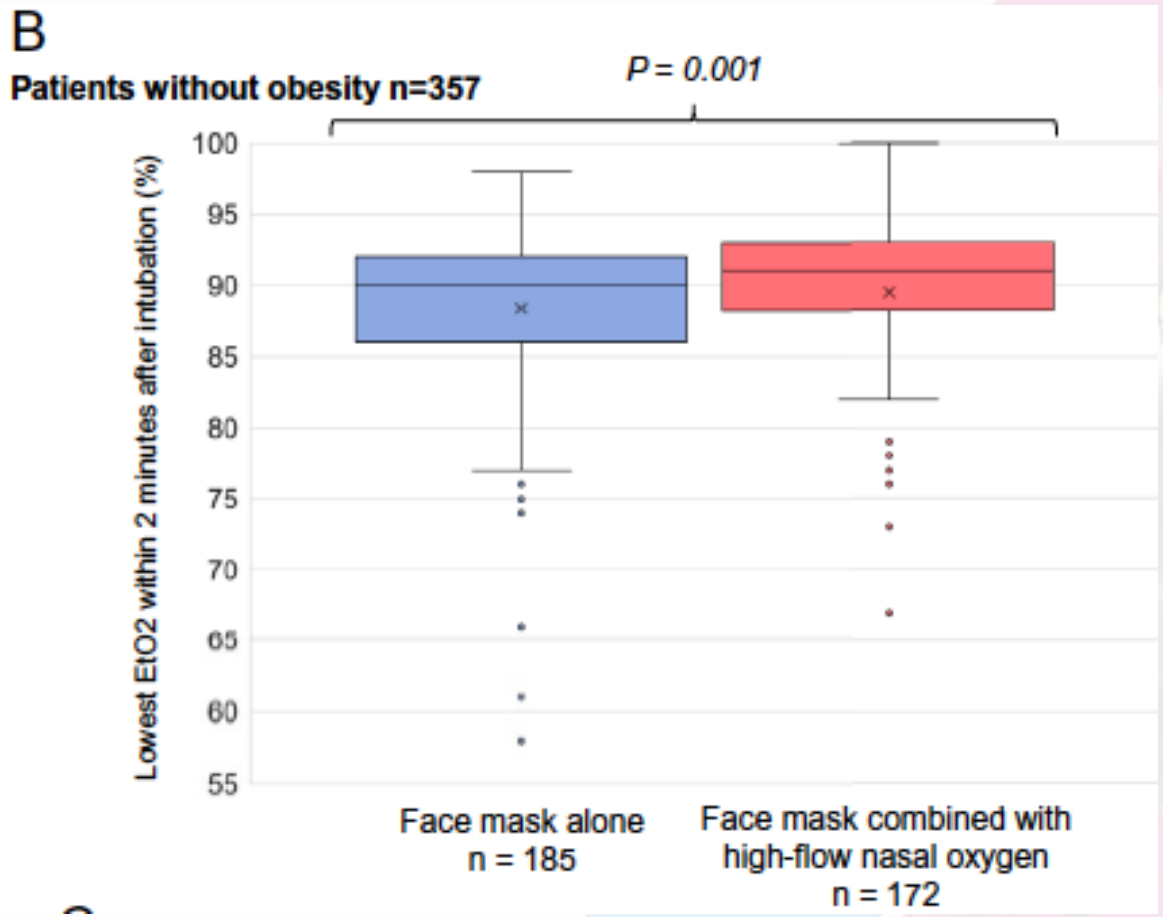


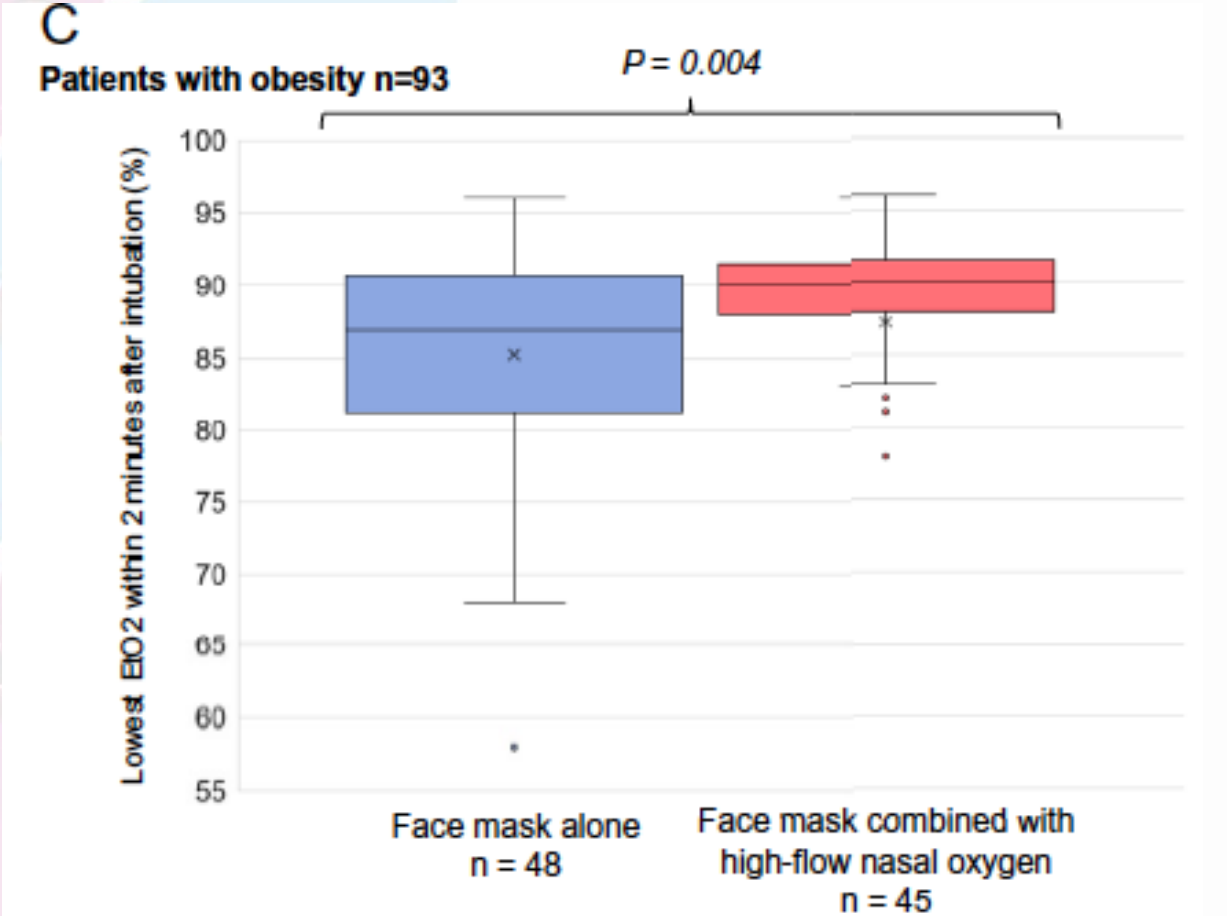
ask alone (*n* = 233)	Facemask combined with HFNO (*n* = 217)
59 (48–67)	62 (45–68)
19 (51.1)	99/216 (45.8)
25 (22–29)	25 (23–29)
48 (20.6)	45 (20.7)

Et ↘ désaturation (SpO2 < 95%) dans le groupe combinaison HFNO + masque

IOT
Anesthésie générale

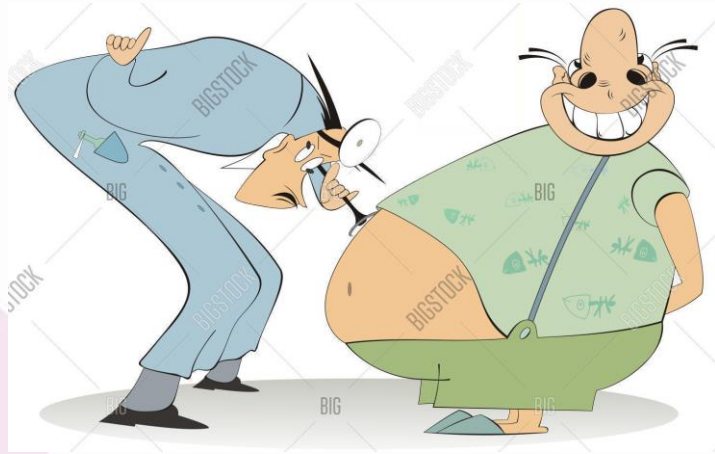
→ Combinaison de techniques





IOT
Anesthésie générale

→ Patients obèses



High-Flow Nasal Oxygen Improves Safe Apnea Time in Morbidly Obese Patients Undergoing General Anesthesia: A Randomized Controlled Trial

David T. Wong, MD,* Amelie Dallaire, MD,* Kawal Preet Singh, MD,* Poorna Madhusudan, MD,* Timothy Jackson, MD,† Mandeep Singh, MD,* Jean Wong, MD,* and Frances Chung, MBBS*

ANESTHESIA & ANALGESIA October 2019

- RCT
- BMI > 40 kg/m^2 chir programmée avec AG et IOT
- CJP: **temps d'apnée « safe »** (SpO2 < 95%) n=40

Gr HFNO

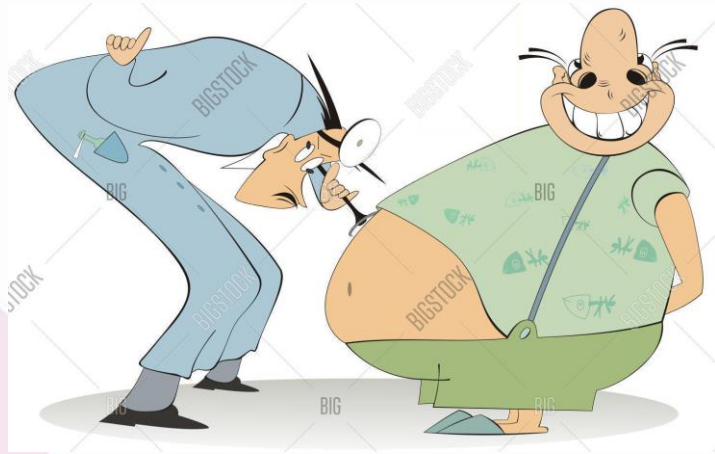
Preoxygénation 3 min Proclive 30°
FiO_2 100% 40 L/min
60 L/Min à la perte de conscience

Gr Standard

Preoxygénation FiO_2 100% 15 L/min
Masque standard
EtO_2 > 85%

IOT
Anesthésie générale

→ Patients obèses



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ANESTHESIA & ANALGESIA October 2019

Table 2. Study Outcomes: Safe Apnea Time, Minimum Spo_2, Plateau $ETco_2$, and Time to Regain Baseline Spo_2

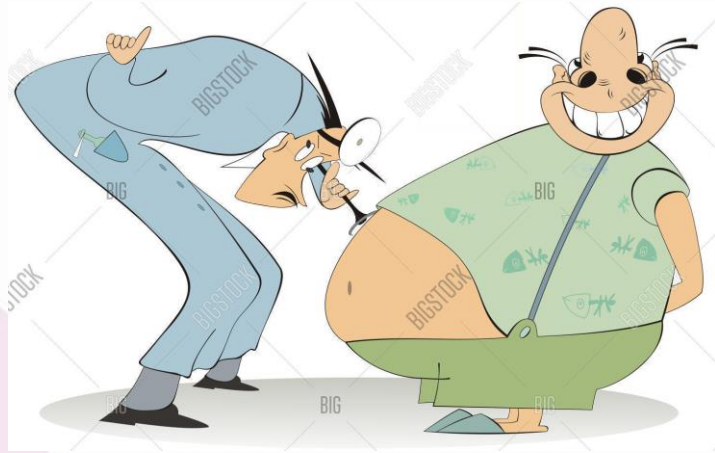
	Control Group (n = 20)	High-Flow Nasal Oxygenation Group (n = 20)	Mean Difference (95% CI)	P Value
Safe apnea time (s)	185.5 ± 53.0	261.4 ± 77.7	75.9 (33.3–118.5)	.001
Minimum Spo_2 (%)	87.9 ± 4.7	90.9 ± 3.5	3.1 (0.4–5.7)	.026
Plateau $ETco_2$ (mm Hg)	38.8 ± 2.5	37.9 ± 3.0	−0.8 (−2.6 to 0.9)	.33
Time to regain baseline Spo_2 (s)	49.6 ± 20.8	37.3 ± 6.8	−12.3 (−22.2 to −2.4)	.016

→ Patients obèses

BJA

Apnoeic oxygenation in morbid obesity: a randomised controlled trial comparing facemask and high-flow nasal oxygen delivery

John Schutzer-Weissmann[1,2,*], Thomas Wojcikiewicz[1,3], Anil Karmali[1,4], Asta Lukosiute[1,5], Ruoyi Sun[1], Rafiq Kanji[1,5], Ahmed R. Ahmed[1,6], Sanjay Purkayastha[1,6], Stephen J. Brett[1,6] and Jonathan Cousins[1]



British Journal of Anaesthesia, 130 (1): 103–110 (2023)

- Chir bariatrique BMI > 40 kg/m2
- Proclive 45°
- CJP: Temps pour SpO_2 < 92%

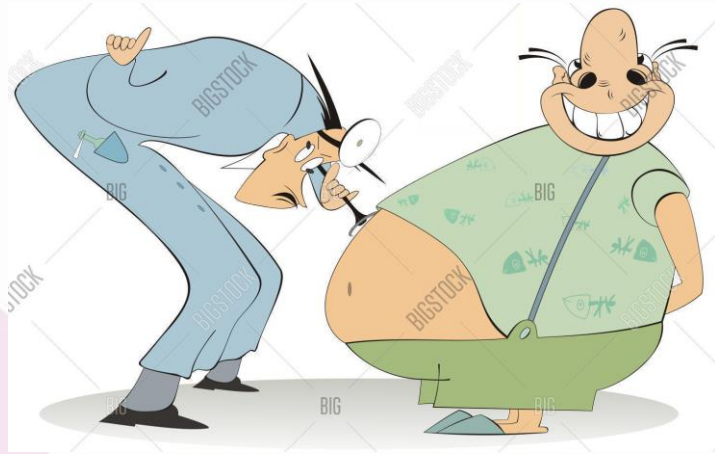
Gr HFNO n=41
Preoxygénation 3 min
FiO_2 100% et 35 L/min pdt 1 min
Puis 50-70L/Min pdt 2min
Oxygénation apnéique 70L/min

Gr O2 standard n=39
Preoxygénation 3 min
Masque 15L/min

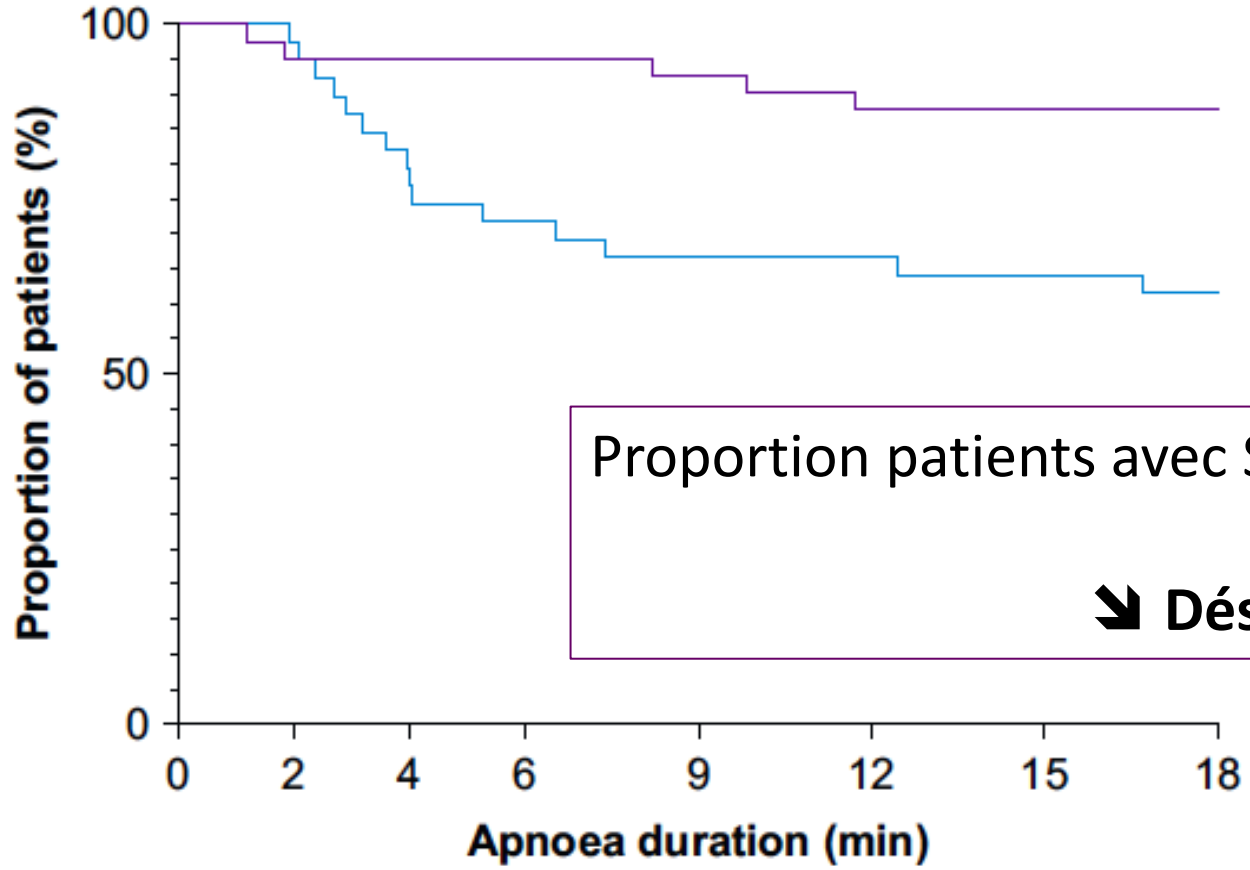
IOT
Anesthésie générale

→ Patients obèses

BJA



British Journal of Anaesthesia, 130 (1): 103–110 (2023)



At risk	TA	TA+2	TA+4	TA+6	TA+9	TA+12	TA+15	TA+18
HFNO	41	39	39	39	38	36	36	36
FM	39	38	30	28	26	26	25	24

Proportion patients avec SpO2 < 92% durant l'apnée (18 min)

↘ **Désaturation** gr HFNO

→ Patients obèses: VNI?

High-flow Nasal Cannulae Versus Non-invasive Ventilation for Preoxygenation of Obese Patients: The PREOPTIPOP Randomized Trial

Mickael Vourc'h [a], Gabrielle Baud [a], Fanny Feuillet [b,c], Claire Blanchard [d], Eric Mirallie [d], Christophe Guitton [e], Samir Jaber [f], Karim Asehnoune [a,*]

EClinicalMedicine 13 (2019) 112–119

- RCT
- BMI > 35 kg/m² chir programmée avec AG et ISR
- CJP: **EtO_2 la plus basse 2min** après IOT

Gr HFNO n=50
Preoxygénation 4 min
FiO_2 100% et 60 L/min
Oxygénation apnéique

Gr VNI n=50
Preoxygénation 4 min
FiO_2 100% PEEP 5 cmH2O et AI 10cmH2O

IOT
Anesthésie générale

→ Patients obèses: VNI?

High-flow Nasal Cannulae Versus Non-invasive Ventilation for Preoxygenation of Obese Patients: The PREOPTIPOP Randomized Trial

	High-Flow nasal cannulae n = 50	Non-invasive ventilation n = 50	p	Relative risk or mean difference (IC 95%)
Primary outcome, median [IQR], %				
Lowest EtO_2, *ITT analysis*	76 [66–82]	88 [82–90]	< 0·0001	11·4 [7·7–15·1]
Lowest EtO_2, [min-max]	[37–87]	[53–94]		
Secondary outcomes				
Preoxygenation				
4 min or more, n (%)	50 (100%)	50 (100%)	–	–
SpO_2 at the end, median [IQR], %	100 [100–100]	100 [100–100]	0.70	0·02 [−0·08–0·12]
Patient discomfort, n (%)[a]	2 (4%)	14 (28%)	0·001	0·1 [0·03–0·6]
Intubation				
Cormack III or IV exposure, n (%)	8 (16%)	7 (14%)	0·78	1·1 [0·5–2·9]
Difficult intubation, n (%)[b]	2 (4%)	1 (2%)	0·99	2 [0·2–21·4]
Two or more operators, n (%)	7 (14%)	4 (8%)	0·33	1·8 [0·5–5·6]
IDS score, median [IQR][c]	3 [2–5]	2·5 [2–5]	0·71	0·3 [−0·5–1·2]
Length, median [IQR], seconds[d]	60 [30–120]	60 [30–120]	0·13	25·3 [−7·6–58·2]
Successful intubation, n (%)	50 (100%)	50 (100%)	–	–
Mask ventilation for SpO_2 < 90%, n (%)	1 (2%)	0	0·99	
Lowest SpO_2, median [IQR], %	98 [93–99]	99 [97–100]	0·03	1·8 [−0·3–3·8]
SpO_2 < 95%, n (%)	15 (30%)	6 (12%)	0·03	2·5 [1·1–5·9]
SpO_2 < 90%, n (%)	5 (10%)	4 (8%)	0·99	1·3 [0·4–4·4]
Highest $EtCO_2$, median [IQR], %	4·2 [3·5–4·8]	3·9 [3·3–4·4]	0·09	1·9 [−1·5–5·2]

→ ISR

Anaesthesia 2018, 73, 564–571

Transnasal humidified rapid-insufflation ventilatory exchange (THRIVE) vs. facemask breathing pre-oxygenation for rapid sequence induction in adults: a prospective randomised non-blinded clinical trial

Å. Lodenius,[1,2] J. Piehl,[3] A. Östlund,[1,2] J. Ullman[4,5] and M. Jonsson Fagerlund[4,5]

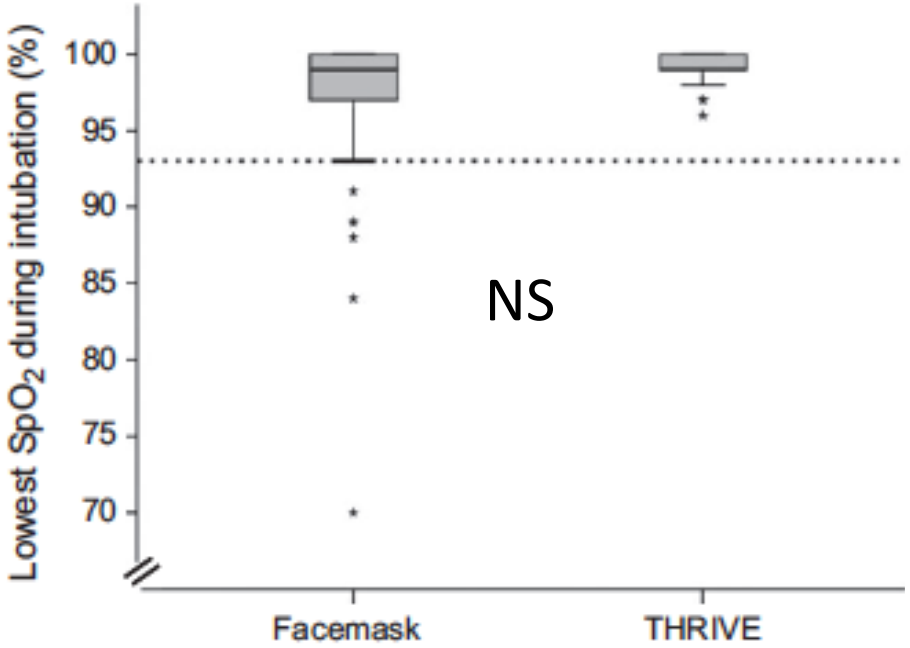
- Patient chir urgente avec ISR
- Exclusion: BMI > 35 kg/m²
- CJP: SpO_2 la plus basse

Gr HFNO n=40
Preoxygénation 3min
FiO_2 100% et 40 L/min
70L/min pdt IOT

Gr O2 standard n=39
Preoxygénation 3 min
FiO_2 100% 10L/min circuit clos

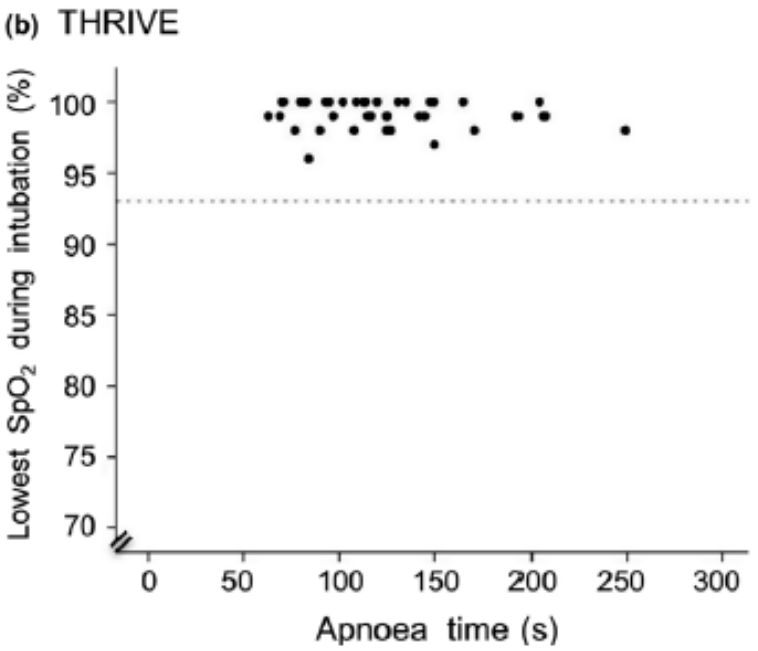
IOT
Anesthésie générale

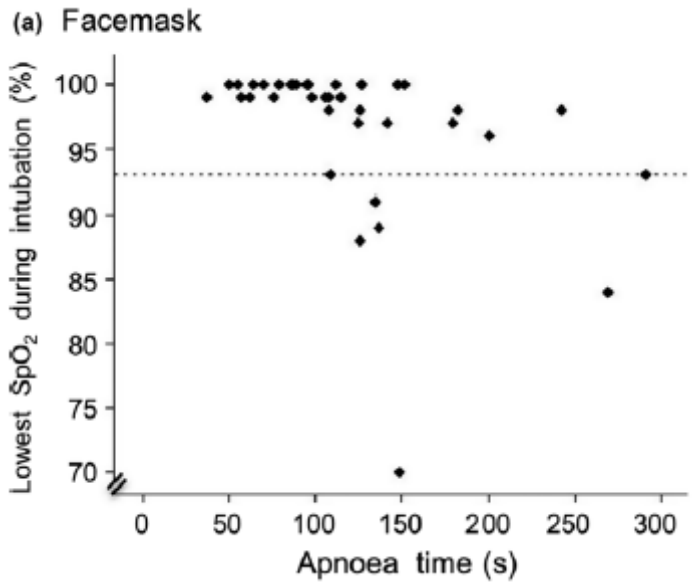
→ ISR



NS

Anaesthesia 2018, 73, 564–571





SpO_2 < 93% :

12,5% O_2 standard *vs.*
0% HFNO

→ IOT fibroscopie vigile

BJA

Optimizing oxygenation and intubation conditions during awake fibre-optic intubation using a high-flow nasal oxygen-delivery system

S. Badiger, M. John, R. A. Fearnley and I. Ahmad*

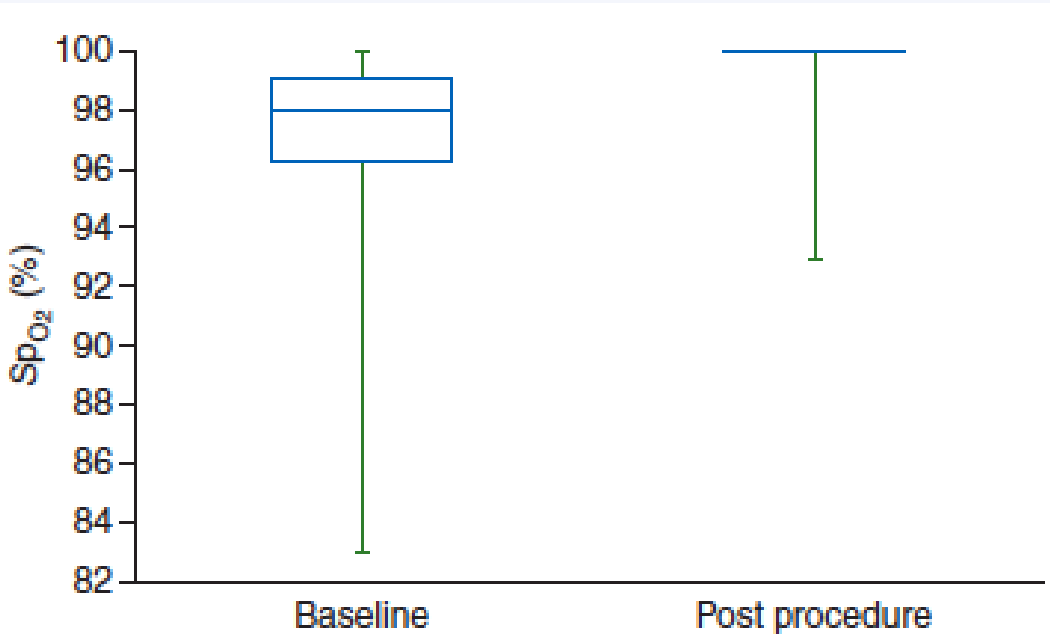
British Journal of Anaesthesia, 115 (4): 629–32 (2015)

- Etude descriptive 50 patients IOT en fibroscopie vigile (IOT difficile prévue)
- HFNO 50 à 70 L/min FiO2 100%
- Propofol et remifentanil AIVOC

→ IOT fibroscopie vigile

BJA

- Temps moyen de préoxygénation 2,2±1,6 min et temps moyen d'oxygénation transnasale 17,9± 4,3min
- Aucune désaturation



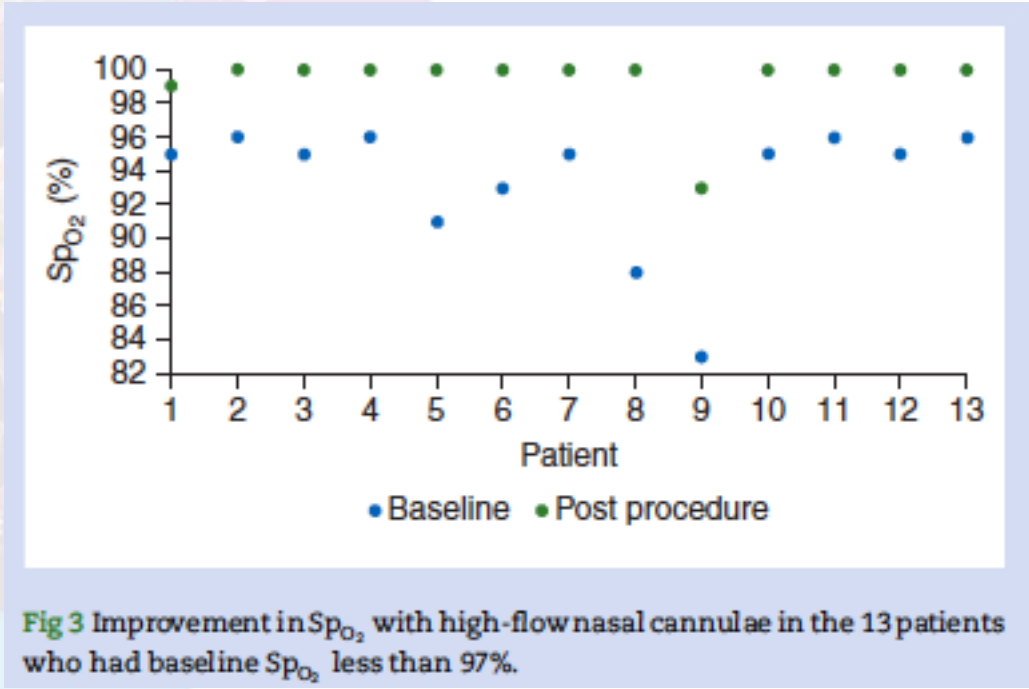


Fig 3 Improvement in Sp_{O_2} with high-flow nasal cannulae in the 13 patients who had baseline Sp_{O_2} less than 97%.

REX

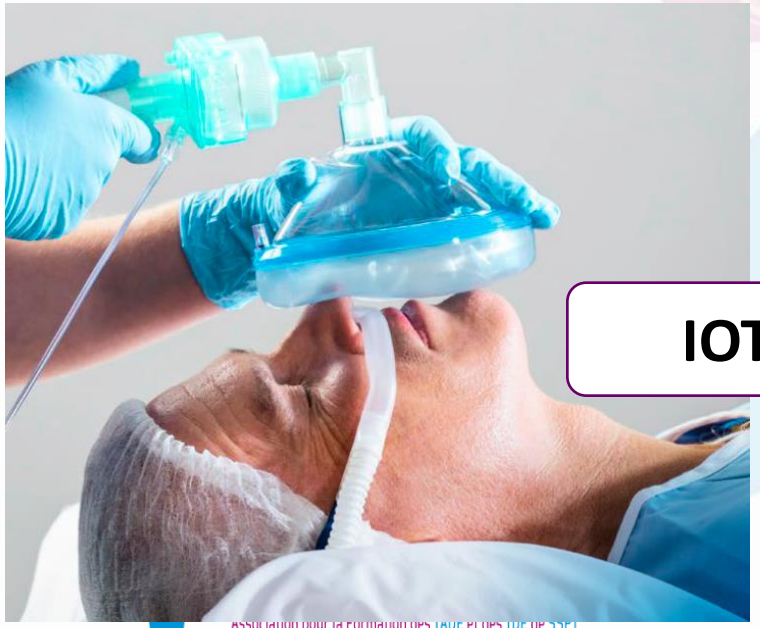
Rationaliser et standardiser l'utilisation de l'oxygénothérapie à haut débit nasal

IOT

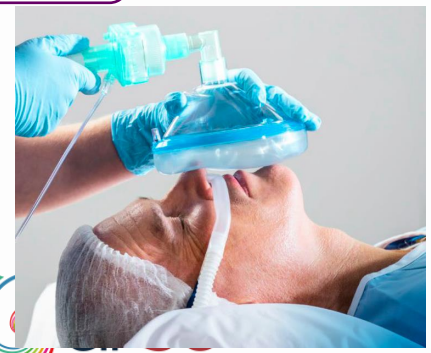
Fibro vigile

Pour tous?

Obèse



IOT difficile



Conclusion
Take home message

- OHD a toute sa place au bloc opératoire
- Meilleur confort patient/opérateur/anesthésiste

IOT difficile

Obèse

Fibroscopie vigile IOT

Sédation procédurale

- Capnie? **Surveillance au moins clinique ++**

Sédations procédurales

OHD et sédations procédurales:
ET la capnie?

- ✓ Principale crainte: hypercapnie sans monitorage
- ✓ Apnée plus fréquente
- ✓ FiO_2 100% chez Insuffisant respiratoire chronique (bonchoscopie)

Sédations procédurales

OHD et sédations procédurales:
ET la capnie?

EJA

Eur J Anaesthesiol 2018; **35**:6–24

GUIDELINES

European Society of Anaesthesiology and European Board of Anaesthesiology guidelines for procedural sedation and analgesia in adults

Jochen Hinkelbein, Massimo Lamperti, Jonas Akeson, Joao Santos, Joao Costa, Edoardo De Robertis, Dan Longrois, Vesna Novak-Jankovic, Flavia Petrini, Michel M.R.F. Struys, Francis Veyckemans, Thomas Fuchs-Buder* and Robert Fitzgerald†

2k. v. Capnography: by facilitating early detection of ventilation problems: should be used in all patients undergoing procedural sedation (very good consensus: level of evidence A: grade of recommendation strong)

Sédations procédurales

OHD et sédations procédurales: ET la capnie?

Effect of high-flow nasal oxygen on hypoxaemia during procedural sedation: a systematic review and meta-analysis

V. Thiruvenkatarajan,[1,2] V. Sekhar,[3] D. T. Wong,[4] J. Currie,[5] R. Van Wijk[2,6] and G. L. Ludbrook[7]

Anaesthesia 2023, 78, 81–92

- OHD vs O2 conventionnel lors sédation procédurale
- C
- 1

2 RCTs : $TcCO_2$ → 393 patients

- *Mazzefi et al.*, FOGD, propofol
- *Thiruvenketarajan et al.*, CPRE à risque de désaturation, AIVOC propofol

Hypercapnie: ↗ CO_2> 2,66 kPa (20 mmHg)

✓ 1 RCT endovasculaire

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Sédations procédurales

OHD et sédations procédurales:
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Effect of high-flow nasal oxygen on hypoxaemia during procedural sedation: a systematic review and meta-analysis

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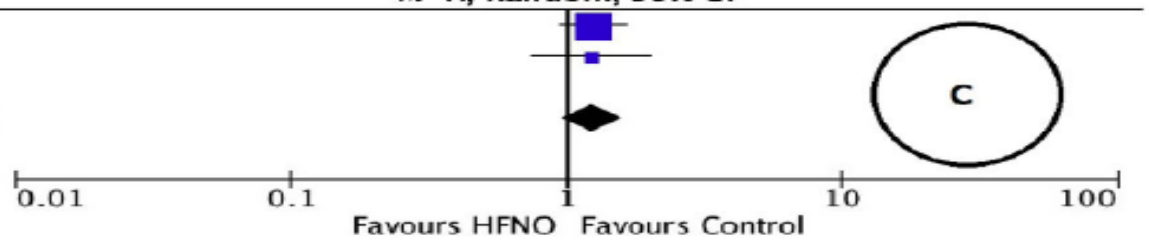
Anaesthesia 2023, 78, 81–92

Study or Subgroup	Experimental Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Mazzeffi [8]	63	132	50	130	76.1%	1.24 [0.94, 1.64]
Thiruvenkatarajan [37]	23	65	19	66	23.9%	1.23 [0.74, 2.03]
Total (95% CI)		**197**		**196**	**100.0%**	**1.24 [0.97, 1.58]**
Total events	86		69			

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.00$, $df = 1$ ($P = 0.97$); $I^2 = 0\%$

Test for overall effect: $Z = 1.71$ ($P = 0.09$)



risk of hypercarbia

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Sédations procédurales

OHD et sédations procédurales:
ET la capnie?

PLOS ONE

High-flow nasal cannula for reducing hypoxemic events in patients undergoing bronchoscopy: A systematic review and meta-analysis of randomized trials

Chien-Ling Su[1,2☯], Ling-Ling Chiang[1☯], Ka-Wai Tam[3,4,5☯], Tzu-Tao Chen[1]*, Ming-Chi Hu[1]*

December 1, 2021

5 RCTs OHD vs O_2 standard pour fibroscopies bronchiques

- 2 RCTs avec $PaCO_2$ en fin de procédure
- 2 RCTS avec $EtCO_2$ en fin de procédure

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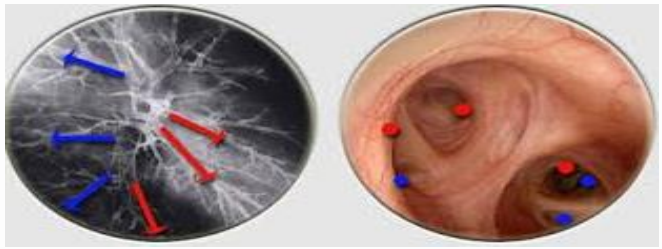
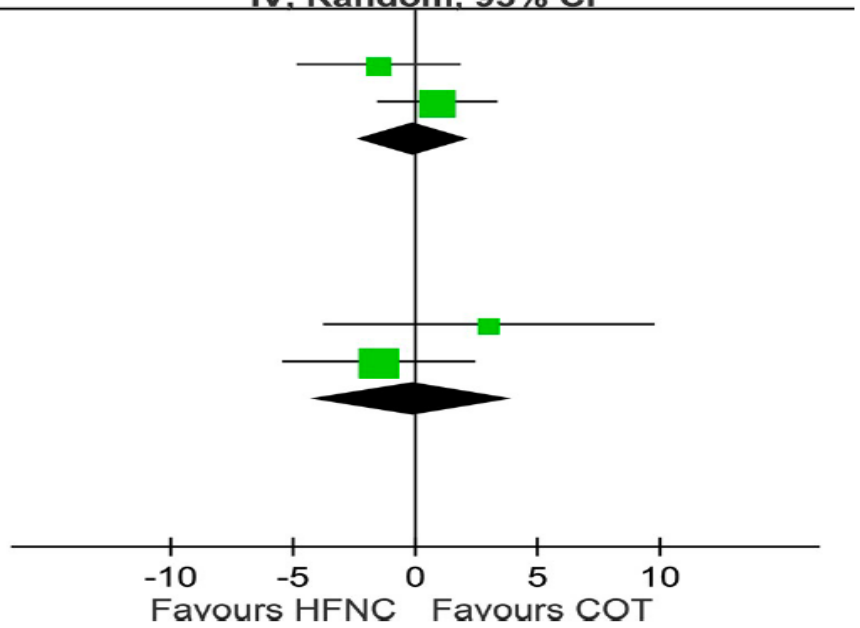
Sédations procédurales

OHD et sédations procédurales:
ET la capnie?



Study or Subgroup	HFNC Mean	HFNC SD	HFNC Total	COT Mean	COT SD	COT Total	Weight	Mean Difference IV, Random, 95% CI
5.1.1 PaCO2								
Longhini 2021	41.25	6.11	18	42.75	3.89	18	38.3%	-1.50 [-4.85, 1.85]
Lucangelo 2012	43.6	4.15	15	42.7	2.52	15	61.7%	0.90 [-1.56, 3.36]
Subtotal (95% CI)			**33**			**33**	**100.0%**	**-0.02 [-2.31, 2.27]**
Heterogeneity: Tau² = 0.64; Chi² = 1.28, df = 1 (P = 0.26); I² = 22%								
Test for overall effect: Z = 0.02 (P = 0.99)								
5.1.2 EtCO2								
Douglas 2018	40	16.3	30	37	9.63	30	30.6%	3.00 [-3.77, 9.77]
Irfan 2020	35.25	6.75	20	36.75	6	20	69.4%	-1.50 [-5.46, 2.46]
Subtotal (95% CI)			**50**			**50**	**100.0%**	**-0.12 [-4.19, 3.94]**
Heterogeneity: Tau² = 2.11; Chi² = 1.26, df = 1 (P = 0.26); I² = 21%								
Test for overall effect: Z = 0.06 (P = 0.95)								



Outcomes: $PaCO_2$ and $EtCO_2$ at the end of the procedure.

Oxygénothérapie à haut débit nasal (OHD)

Effets physiologiques:

- Amélioration échanges gazeux
- Réduction dyspnée et travail inspiratoire
- Amélioration confort patient

- Amélioration oxygénation trachéale
- « Effet PEP » par ↗ résistances expiratoires, conditionné par occlusion buccale
- Effet lavage espace mort anatomique
- Amélioration clairance muco-ciliaire
- Epargne énergétique due conditionnement gaz

Pensier et al., Oxygénothérapie à haut débit en périopératoire: quelles données? Perioperative high-flow oxygenothérapy: What data? Anesthésie-Réanimation March 2021

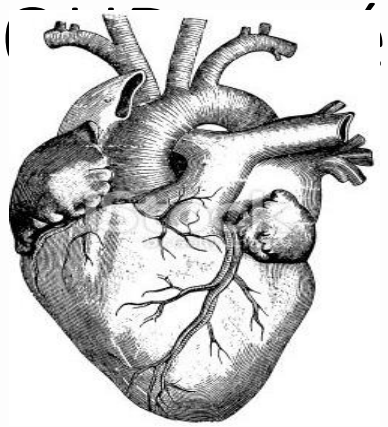
IOT
Anesthésie générale

VS.

VS.

VS.

Recommandations procédurales



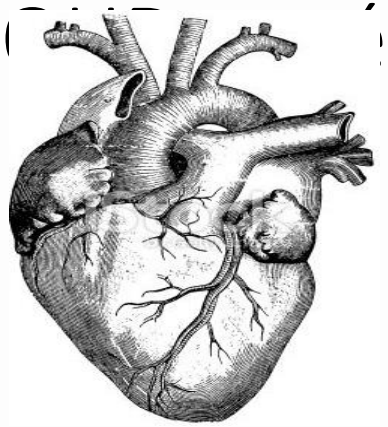
RESEARCH Open Access

High-flow nasal oxygen vs. standard oxygen therapy for patients undergoing transcatheter aortic valve replacement with conscious sedation: a randomised controlled trial

Table 2 Intra-operative blood gas analysis in patients randomly allocated to high-flow nasal oxygen therapy (HFNT) or standard oxygen therapy (SOT) during sedation for transcatheter aortic valve replacement. Values are median (IQR [range])

Variable	Oxygen therapy	Baseline	30 min	*p* value
pO_2, kPa	Standard oxygen therapy	15.45 (12.17–19.33 [9.2–22.8])	14.20 (11.80–19.40 [9.7–35.1])	0.69
	High-flow nasal oxygen therapy	12.10 (10.05–15.22 [7.2–29.8])	13.69 (10.85–18.38 [8.5–32.3])	0.067

Recommandations procédurales



RESEARCH Open Access

High-flow nasal oxygen vs. standard oxygen therapy for patients undergoing transcatheter aortic valve replacement with conscious sedation: a randomised controlled trial

Variable	High-flow nasal oxygen therapy $n = 36$	Standard oxygen therapy $n = 36$	p value
Number of desaturations			0.027
0	31 (86.1%)	24 (66.7%)	
1	4 (11.1%)	3 (8.3%)	
> 1	1 (2.8%)	9 (25.0%)	
Comfort level			< 0.001
Excellent	17 (48.3%)	3 (8.6%)	
Good	13 (37.1%)	10 (28.6%)	
Fair	5 (14.3%)	19 (54.3%)	
Poor	0	3 (8.6%)	

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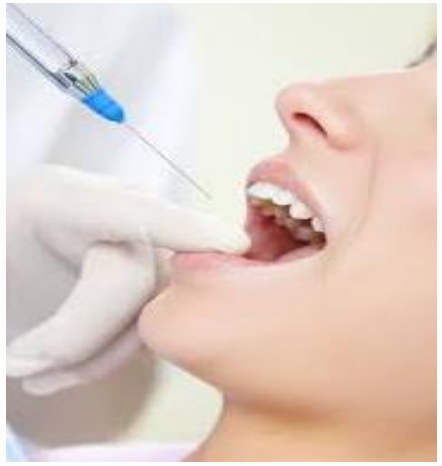
OHD et sédations procédurales



A Nasal High-Flow System Prevents Hypoxia in Dental Patients Under Intravenous Sedation

ki Chogyoji, DDS,‡
DDS, PhD,‖

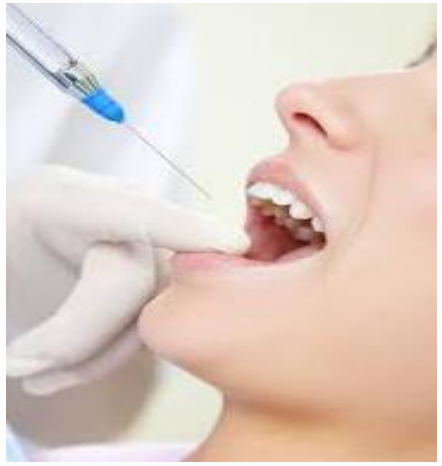
g 73:1058-1064, 2015

- Patients soins
- Exclusion: BMI

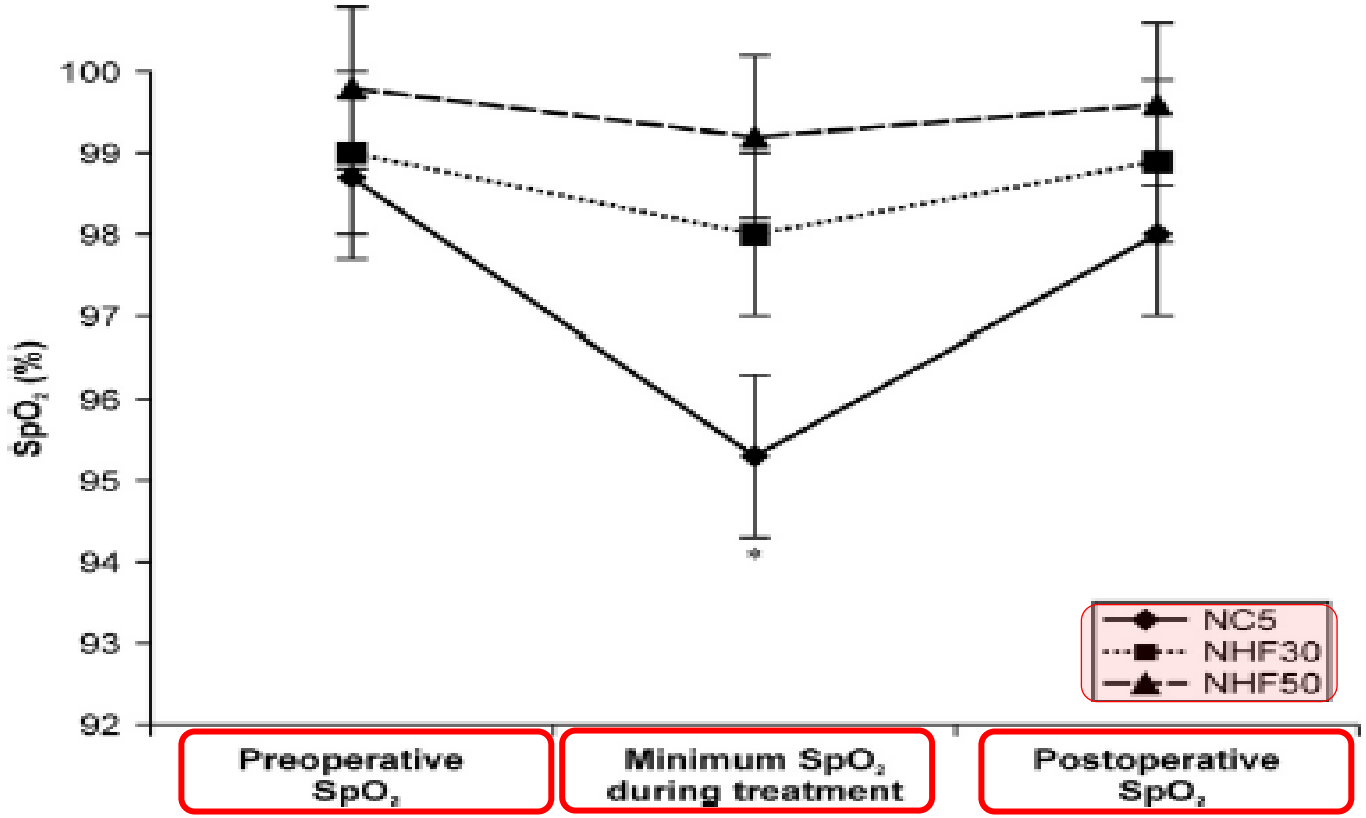
Gr standard O	**Gr OHD 50**
lunettes O2 5L/min (≈FiO_2 44%)	0% et 50L/min

- Protocole: midazolam + AIVOC propofol (GDSa à la fin)

OHD et sédations procédurales



A Nasal High-Flow System Prevents Hypoxia in Dental Patients Under Intravenous Sedation



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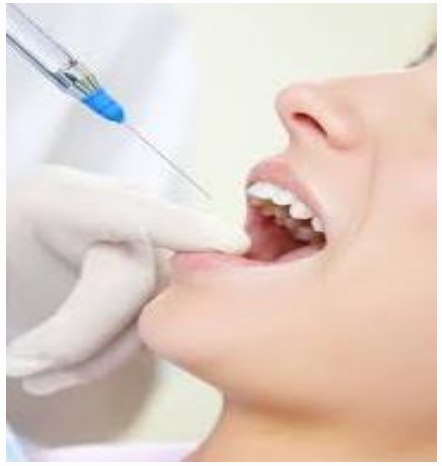

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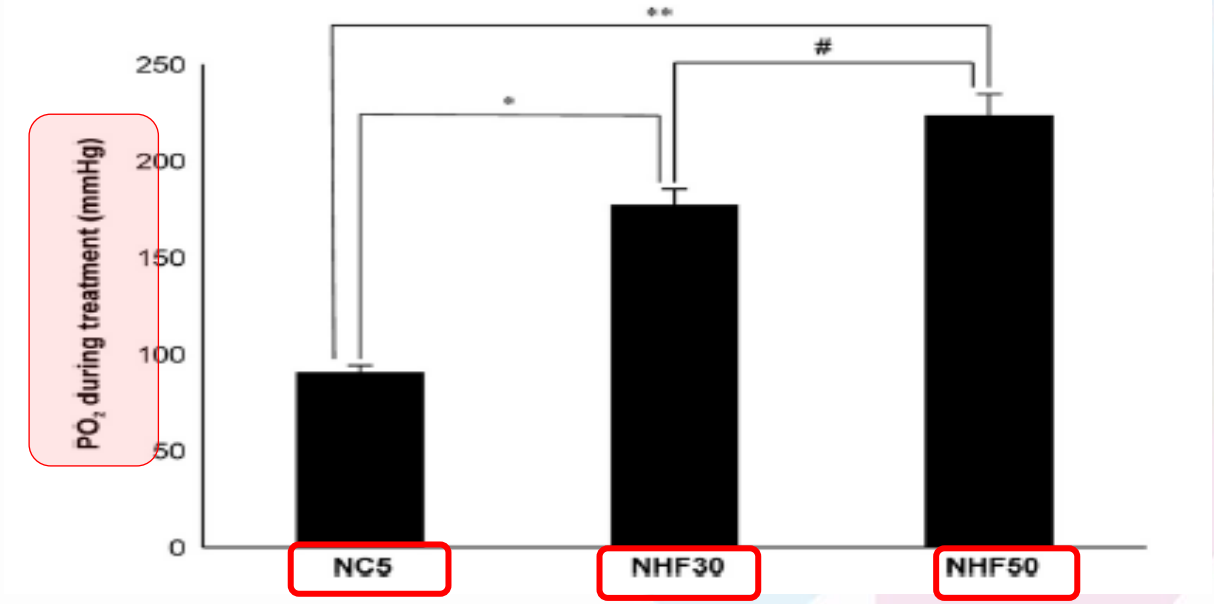

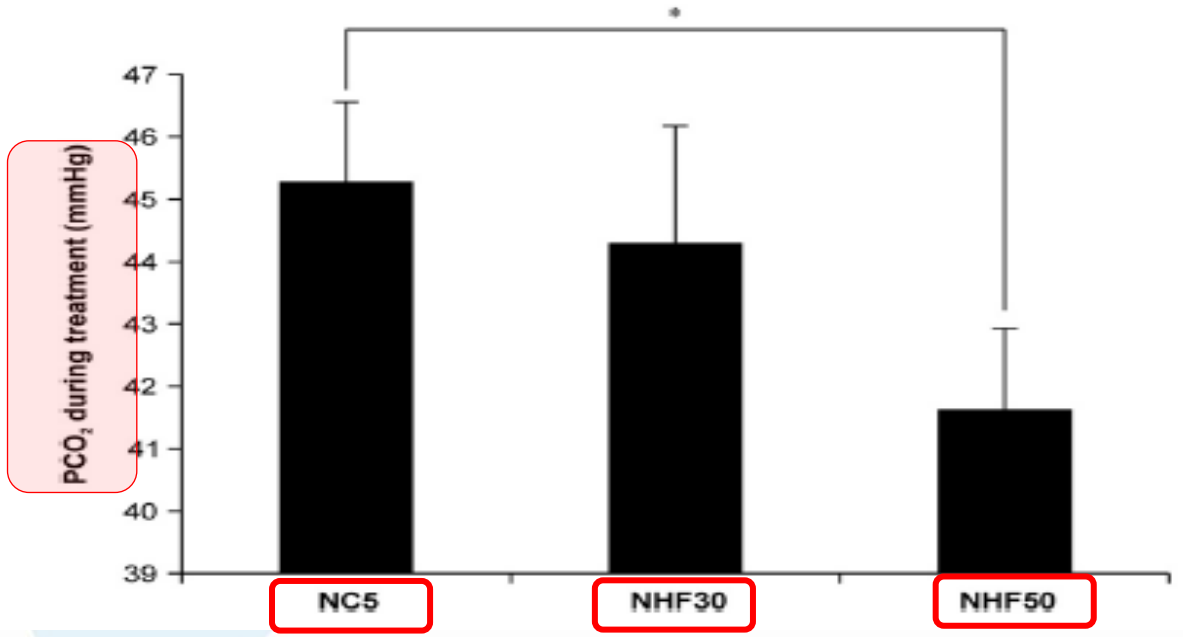

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RESEARCH ARTICLE Open Access

High-flow nasal cannula improves clinical efficacy of airway management in patients undergoing awake craniotomy

Ping Yi[1†], Qiong Li[2†], Zhoujing Yang[1], Li Cao[1], Xiaobing Hu[1] and Huahua Gu[1*]

BMC Anesthesiology (2020) 20:156

- RCT monocentrique
- Patients 14-70ans, indication chir éveillée (tumeur ou lésions épileptique dans aire parole, ASA 1 ou 2

Gr 1 OHD 40 (n=22)	**Gr 2 OHD 60**(n=20)	**Gr 3 NPA(n=23)**
FiO_2 60% 40L/min	FiO2 60% 60L/min	Canule nasophar. 6L/min FiO2 60%

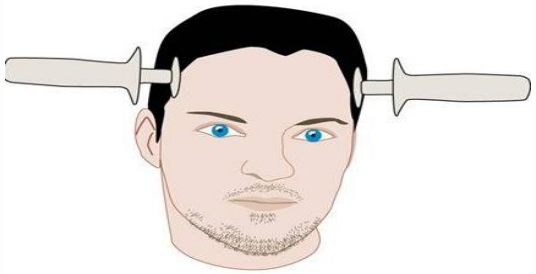
OHD et sédations procédurales

RESEARCH ARTICLE Open Access

High-flow nasal cannula improves clinical efficacy of airway management in patients undergoing awake craniotomy

Variables	Sample collection time point	HFNC 40 ($n = 22$)	HFNC 60 ($n = 20$)	NPA ($n = 23$)
SpO_2	Before induction of anesthesia	98.2 ± 1.4	97.4 ± 2.0	97.5 ± 1.2
	15 min after induction of anesthesia	99.4 ± 1.0	99.6 ± 0.5	99.8 ± 0.4
	15 min after achieving position	99.6 ± 0.7	99.5 ± 0.6	99.7 ± 0.6
	End of dura suspension	99.6 ± 0.7	99.6 ± 0.5	99.8 ± 0.4
	Cortical functional mapping	99.5 ± 0.8	99.8 ± 0.3	99.9 ± 0.2
	15 min after re-induction	99.7 ± 0.7	99.6 ± 0.6	99.7 ± 0.5
$PaCO_2$	Before induction of anesthesia	39.4 ± 3.7	38.6 ± 4.7	39.5 ± 4.9
	15 min after induction of anesthesia	46.2 ± 4.6	45.8 ± 7.3	49.6 ± 6.6
	15 min after achieving position	48.0 ± 4.3	47.9 ± 6.3	50.7 ± 6.2
	End of dura suspension	50.2 ± 4.1	49.2 ± 6.1	51.7 ± 6.2
	Cortical functional mapping	44.1 ± 2.8	42.3 ± 4.9	43.6 ± 5.9
	15 min after re-induction	47.0 ± 4.3	46.0 ± 5.0	48.3 ± 5.4
PaO_2/FiO_2	Before induction of anesthesia	451.8 ± 69.4	421.9 ± 112.7	447.8 ± 64.9
	15 min after induction of anesthesia	475.5 ± 81.7	496.00 ± 80.54	332.1 ± 115.0*#
	15 min after achieving position	500.5 ± 93.6	499.45 ± 73.21	376.9 ± 92.1*#
	End of dura suspension	477.6 ± 103.8	464.2 ± 90.8	384.3 ± 98.6*#
	Cortical functional mapping	475.0 ± 106.1	465.4 ± 78.0	275.1 ± 92.8*#
	15 min after re-induction	488.1 ± 100.4	494.7 ± 81.0	315.6 ± 93.9*#

OHD et sédations procédurales



Effect of high-flow nasal cannula versus conventional facemask ventilation for patients undergoing modified electroconvulsive therapy

A randomised controlled, noninferiority trial

Eur J Anaesthesiol 2019; **36**:303–313

Yi Zhu*, Yin Kang*, Jinfeng Wei, Jiaqi Hu, Chunxiao Wang and Sheng Wang

Table 2 The primary outcome and secondary outcomes

	Group C, *n* = 75	Group H, *n* = 75	*P*
Lowest intra-operative SpO_2	97.6 ± 2.5	97.4 ± 2.4	
Average SpO_2	99.0 ± 0.8	98.8 ± 0.8	0.173
T1 SpO_2	98.3 ± 1.3	98.0 ± 1.3	
T2 SpO_2	99.1 ± 1.1	99.3 ± 1.0	
T3 SpO_2	99.5 ± 1.1	99.4 ± 1.1	
T4 SpO_2	99.0 ± 1.7	98.6 ± 2.1	
Gastric volume (ml)	16.6 ± 29.1	11.1 ± 20.5	0.184
Seizure duration (s)	40.6 ± 15.2	41.2 ± 14.7	0.806
Stimulus intensity (mC)	175.5 ± 49.0	183.3 ± 47.3	0.330
Stimulus time (s)	3.3 ± 0.4	3.4 ± 0.4	0.082

OHD et sédations procédurales

CORRESPONDENCE

Comparison of the efficacy of high-flow nasal oxygenation and spontaneous breathing with face mask ventilation during panendoscopy

Clément Conti[1], Olivier Mauvais[2], Emmanuel Samain[1,3], Laurent Tavernier[2], Sébastien Pili Floury[1,3], Guillaume Besch[1,3] and David Ferreira[1,4,*]

BJA
June 2023

- ✓ Étude rétrospective groupe O2 masque faciale (MF) (2015-2016) vs groupe OHD (2018-2019)
- ✓ Patients avec panendoscopie seule

Gr MF

Préoxygénation VS FiO_2 100%

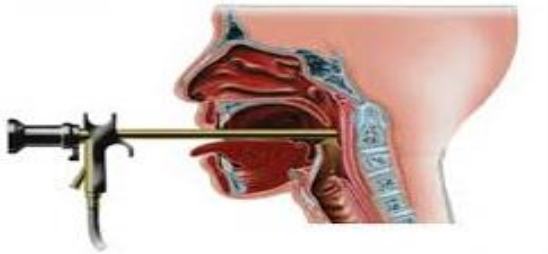
Puis ventilation intermittente selon l'anesth

Gr OHD

Préoxygénation 30-50L/min FiO2 100% ou MF en VS FiO2 100%

Puis 70L/min FiO2 100%

OHD et sédations procédurales



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BJA
June 2023

- Ventilation possible durant la procédure au masque à la discrétion de l'anesthésiste
- Anesthésie IV mais protocole?
- CJP: taux d'hypoxémie sévère SpO2 < 90% de + de 60 sec

N=251 gr MF et N= 215 gr OHD

OHD et sédations procédurales

CORRESPONDENCE

Comparison of the efficacy of high-flow nasal oxygenation and spontaneous breathing with face mask ventilation during panendoscopy

	FMV group, *n* (%)		HFNO group, *n* (%)	
Panendoscopy, *n*=466 (100%)	251	(54)	215	(46)
Oesophagoscopy, *n* (%)	211	(84)	154	(72)
Patients characteristics				
Sex (male), *n* (%)	183	(73)	156	(73)
Age, yr, mean (SD)	63.1	(11.4)	64.8	(11.3)
BMI, kg m^{-2}, mean (SD)	23.9	(5.4)	24.9	(5.2)

	FMV group, *n* (%)		HFNO group, *n* (%)		P-value
Main outcome					
SpO_2<90%, *n* (%)	50	(20)	53	(25)	NS
Secondary outcomes					
Lowest SpO_2, mean (SD)	93.0	(5.5)	91.3	(8.5)	<0.001
Recourse to oxygenation with FMV					
1 Time per procedure, *n* (%)	86	(34)	44	(20)	< 0.001
2 Times per procedure, *n* (%)	58	(23)	9	(4)	< 0.001
≥3 Times per procedure, *n* (%)	36	(14)	4	(2)	< 0.001
Orotracheal intubation per procedure, *n* (%)	211	(84)	75	(35)	< 0.001
Duration of surgery (min), mean (days)	50.1	(23.1)	40.0	(23.5)	< 0.001

→ Augmentation temps d'apnée

Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE): a physiological method of increasing apnoea time in patients with difficult airways

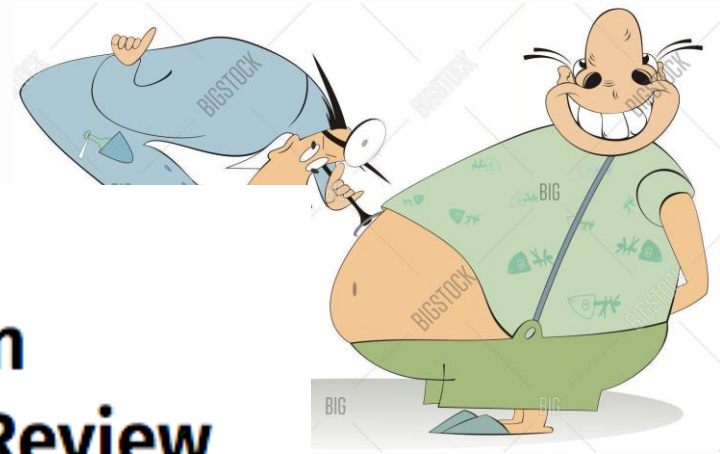
A. Patel[1,2] and S. A. R. Nouraei[3]

Anaesthesia 2015, 70, 323–329

- Patient à risque d'IOT difficile (n=25)
- Chir ORL. BMI 30[18–52] kg/m^2
- Préoxygénation 40° à 70L/Min pdt 10 min

- Temps d'apnée médian 14 [5–65] minutes
- Aucune désaturation SpO_2 <90%

→ Patients obèses



REVIEW ARTICLES: META-ANALYSIS

High-Flow Nasal Cannula for Apneic Oxygenation in Obese Patients for Elective Surgery: A Systematic Review and Meta-Analysis

Bright, Matthew R. MD[*,†]; Harley, William A. MD[†,‡]; Velli, Gina MInfoMgt[§]; Zahir, Syeda Farah PhD[‖]; Eley, Victoria PhD[*,+]

136(3):p 483-493, March 2023.

ANESTHESIA & ANALGESIA

- Méta-analyse 6 RCT 351 patients
- CJP: désaturation SpO2 < 92% (induction → IOT)
- CJS: PaO2, temps d'apnée « safe », inconfort patient …

- NS pour désaturation et PaO2
- Gr HFNO ↗ **temps d'apnée « safe »** (MD -124,20 95% CI -200 to – 47, p= 0,001) vs masque standard