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Jeudi 17 octobre

VNI et HFNC dans les DR de l'enfant Urgence/Réa/Transport

C.Milési. J.Baleine. G.Cambonie

Pediatric Critical Care

(*Crit Care Med* 2017; 45:1045–1053)

OPEN

Outcomes for Children Receiving Noninvasive Ventilation as the First-Line Mode of Mechanical Ventilation at Intensive Care Admission: A Propensity Score-Matched Cohort Study*

Jenny V. Morris, MSc[1]; Padmanabhan Ramnarayan, FFICM[2]; Roger C. Parslow, PhD[1]; Sarah J. Fleming, PhD[1]

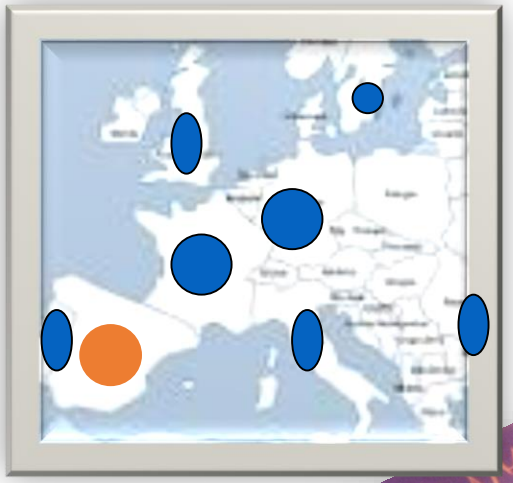
TABLE 2. Crude Outcomes for Patients Included in the Whole Cohort (*n* = 15,025) and Propensity Score-Matched Cohort (*n* = 6,002)

	Whole Cohort (*n* = 15,025)			Propensity Score Matching Cohort (*n* = 6,002)		
Outcome	Invasive Ventilation (*n* = 10,221)	NIV (*n* = 4,804)	*p*	Invasive Ventilation (*n* = 3,001)	NIV (*n* = 3,001)	*p*
PICU mortality (%)	9.6	4.4	< 0.001	8.5	5.9	< 0.001
Length of ventilation (d), median (IQR)	4 (2–7)	4 (2–7)	< 0.001	5 (3–9)	4 (2–7)	< 0.001
Length of stay (d), median (IQR)	5 (2–9)	5 (3–8)	< 0.001	6 (4–11)	5 (3–9)	< 0.001
VFD-28—all patients, median (IQR)	8 (0–24)	12 (0–22)	0.016	0 (0–16)	8 (0–22)	< 0.001
VFD-28—survivors only, median (IQR)	12 (0–24)	12 (0–22)	0.269	0 (0–16)	12 (0–22)	< 0.001
NIV failure rate, *n* (%)	NA	1,237 (25.7)	NA	NA	948 (33.3)	NA

IQR = interquartile range, NA = not applicable, NIV = noninvasive ventilation, VFD-28 = ventilation-free days at day 28.

A Wilcoxon rank-sum test was used to compare all continuous variables presented as mean (interquartile range), a two sample *t* test was used to compare continuous variables presented as mean (SD), and chi-square test of independence compared all categorical variables presented as *n* (%).

Marti Pons
Alberto Medina



ICEMAN

-Indication

identification du type de détresse respi: I ou II et SDRA?

Lieux (Service général, Urgence, réa, SMUR)

-Contre indications

(Neuro/A/B/C)

-Equipement

-respi /FiO2;

-Tubulure (double, simple);

-Interface (à fuite/ sans fuite) (Nasale/oro-nasale)

-Mode

HFNC / CPAP / Deux niveaux de pression.

-Analyse

Efficacité et tolérance

Adaptation / réponse patient

Identifier et traiter une assynchonie.

Traitement de l'hypoxie et hypercapnie.

-Next steps

Seuvrage

Non-invasive ventilation in acute respiratory failure

Lancet 2009; 374: 250–59

Stefano Nava, Nicholas Hill

***Panel 2:* Recommendations for NIV to treat acute respiratory failure**

Recommendations based on levels of evidence[21]

Level 1 evidence

Systematic reviews (with homogeneity) of RCTs and individual RCTs (with narrow CIs)

Evidence of use (favourable)

- COPD exacerbations
- Facilitation of weaning/extubation in patients with COPD
- Cardiogenic pulmonary oedema
- Immunosuppressed patients

Evidence of use (caution)

- None

Level 2

Systematic reviews (with homogeneity) of cohort studies—individual cohort studies (including low quality RCTs; eg, <80% follow-up)

Evidence of use (favourable)

- Do-not-intubate status
- End-stage patients as palliative measure
- Extubation failure (COPD or congestive heart failure) (prevention)
- Community-acquired pneumonia in COPD
- Postoperative respiratory failure (prevention and treatment)
- Prevention of acute respiratory failure in asthma

Evidence of use (caution)

- Severe community acquired pneumonia
- Extubation failure (prevention)

Level 3

Systematic reviews (with homogeneity) of case–control studies, individual case-control study

Evidence of use (favourable)

- Neuromuscular disease/kyphoscoliosis
- Upper airway obstruction (partial)
- Thoracic trauma
- Treatment of acute respiratory failure in asthma

Evidence of use (caution)

- Severe acute respiratory syndrome

Level 4

Case series (and poor quality cohort and case-control studies)

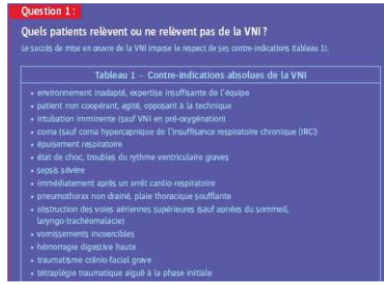
Evidence of use (favourable)

- Very old age, older than age 75 years
- Cystic fibrosis
- Obesity hypoventilation

Evidence of use (caution)

- Idiopathic pulmonary fibrosis

Contre-indications



Question 1 :

Quels patients relèvent ou ne relèvent pas de la VNI ?

Le succès de mise en œuvre de la VNI impose le respect de ses contre-indications (tableau 1).

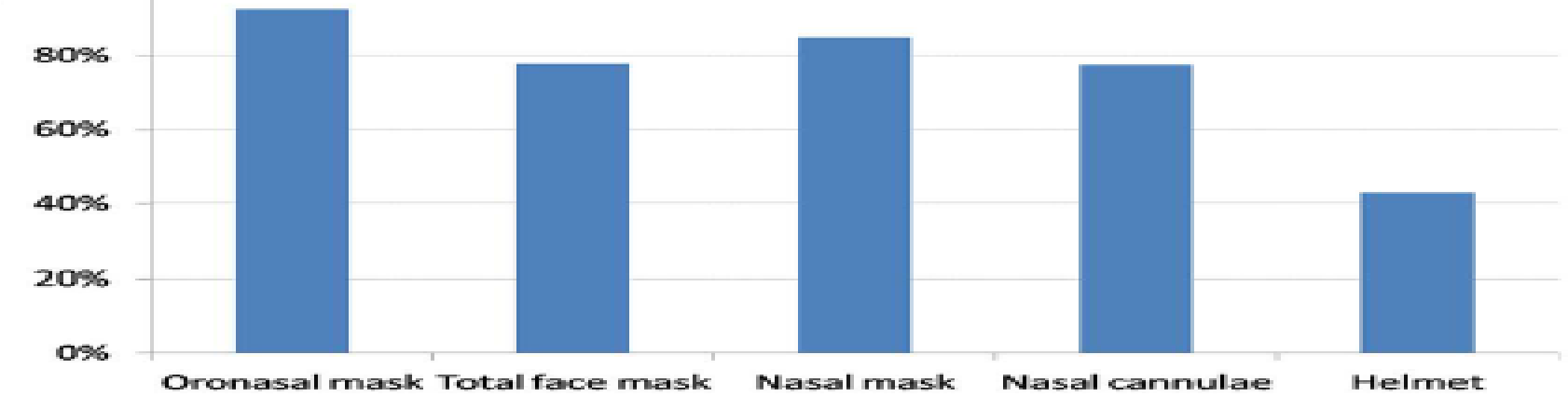
Tableau 1 – Contre-indications absolues de la VNI

- environnement inadapté, expertise insuffisante de l'équipe
- patient non coopérant, agité, opposant à la technique
- intubation imminente (sauf VNI en pré-oxygénation)
- coma (sauf coma hypercapnique de l'insuffisance respiratoire chronique (IRC))
- épuisement respiratoire
- état de choc, troubles du rythme ventriculaire graves
- sepsis sévère
- immédiatement après un arrêt cardio-respiratoire
- pneumothorax non drainé, plaie thoracique soufflante
- obstruction des voies aériennes supérieures (sauf apnées du sommeil, laryngo-trachéomalacie)
- vomissements incoercibles
- hémorragie digestive haute
- traumatisme crânio-facial grave
- tétraplégie traumatique aiguë à la phase initiale

- **Neuro:** Coma (absence de protection deS VAS)
- **A (airways)** Absence de protection des VAS.
- **B (breathing)**
  - SDRA (SaO2/FiO2) PaO2/FiO2 < 150.
  - **PNO**
- **C (cardiac)** choc décompensé.
- **MANQUE D'EXPERTISE DE l'EQUIPE (puer + medecin)**

Non-invasive ventilation practices in children across Europe

Juan Mayordomo-Colunga MD,PhD[1] | Martí Pons-Òdena MD,PhD[2] |
Alberto Medina MD,PhD[1] | Corsino Rey MD,PhD[1] | Christophe Milesi MD,PhD[3] |
Merja Kallio MD,PhD[4] | Andrea Wolfler MD,PhD[5] | Mireia García-Cuscó MD[6] |
Demet Demirkol MD[7] | Milagros García-López MD[8] | Peter Rimensberger MD,PhD[9]



Type	Advantages	Disadvantages
Nasal	Easy fitting	Mouth leaks
	Allows coughing, eating, talking, use of a pacifier	Not indicated if mouth breathing
	No risk of aspiration	Not indicated if nasal obstruction
	Low risk of claustrophobia	Skin pressure ulcers
	Less gastric distension	
	Low risk of asphyxia in case of ventilator malfunction	
Nasal prongs	Minimal contact interface	Not indicated if mouth breathing
	Comfortable	Not indicated if nasal obstruction
Oronasal mask	Improved gas exchange	Risk of aspiration
	Improved minute ventilation	Claustrophobia
	No mouth leaks	Gastric distension
		Limit eating, talking
Full face	Less pressure ulcers	Gastric distension
	Comfortable	Claustrophobia
		Higher dead space
		Risk of aspiration
Helmet	Allows eating, coughing, talking, pacifier	Higher dead space
	No pressure ulcers	Ventilator adaptation
	Less resistance to flow, better tolerance to high pressure	Difficult humidification
	More comfortable	Claustrophobia, noise

En urgence:

Enfants petits < 6 mois

Bronchiolite

Peu oxygénodépendant

En urgence:

Enfants Sévéres oxygénodépendants

Contents lists available at ScienceDirect

Paediatric Respiratory Reviews

Review

Interfaces for noninvasive ventilation in the acute setting in children

Guillaume Mortamet[1,2,3,*], Alessandro Amaddeo[3,4], Sandrine Essouri[2,5], Sylvain Renolleau[6], Guillaume Emeriaud[1,2], Brigitte Fauroux[3,4]

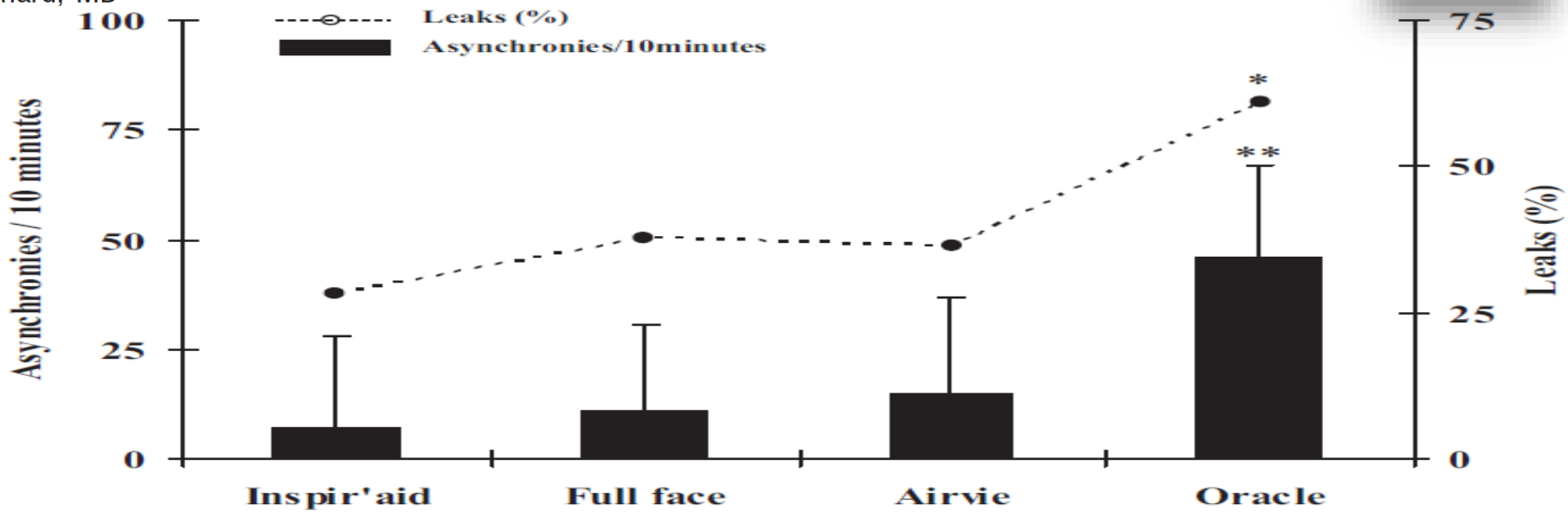
EDUCATIONAL AIMS

The reader will come to appreciate that in critically ill children:

- The ideal interface should be: small, inexpensive, comfortable, light-weight, easy to fit and remove.
- The interface should manufactured with non-allergenic material and have appropriate and well-adapted headgear.

Physiological effects of different interfaces during noninvasive ventilation for acute respiratory failure*

Amanda Tarabini Fraticelli, MD; François Lellouche, MD; Erwan L'Her, MD; Solenne Taillé, BioMedEng; Jordi Mancebo, MD; Laurent Brochard, MD

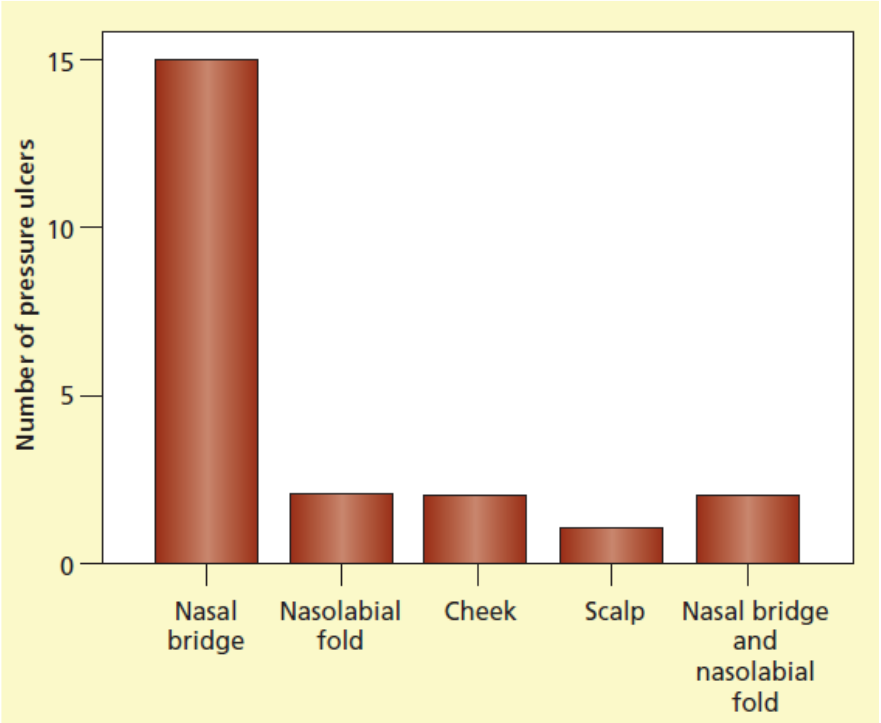


Blood gas	Baseline					p^a
Pco_2 (mm Hg)						
All	44 (33–58)	41 (32–52)	40 (32–55)	41 (31–53)	41 (32–56)	0.32
Hypercapnic	60 (48–74)	54 (46–70)	59 (45–72)	55 (46–70)	60 (45–71)	0.86
Hypoxemic	33 (32–35)	32 (32–36)	32 (31–36)	31 (31–35)	32 (31–33)	0.10

Pressure Ulcer Incidence in Patients Wearing Nasal-Oral Versus Full-Face Noninvasive Ventilation Masks

By Marilyn Schallom, RN, PhD, CCNS, CCRN, Lisa Cracchiolo, BA, RRT, AE-C, Antoinette Falker, RN, DNP, GCNS-BC, Jennifer Foster, RN, BSN, CNRN, CCRN, JoAnn Hager, RN, BSN, CWOCN, Tamara Morehouse, RN, BSN, CWCN, Peggy Watts, RRT, MS, Linda Weems, BA, RRT, and Marin Kollef, MD

	Nasal n=100	Total face n=100	p
Ulceres cutané	20%	2%	<0,001
Delai avant ulcere (h)	28 (19)	61 (51)	<0,001
Comfort	2,7 (1,2)	1,9 (1,1)	<0,001



Matériel

Respirateurs

Respi spécifiques VNI

Respi lourd avec soft VNI

Pas de mélangeur air/O2

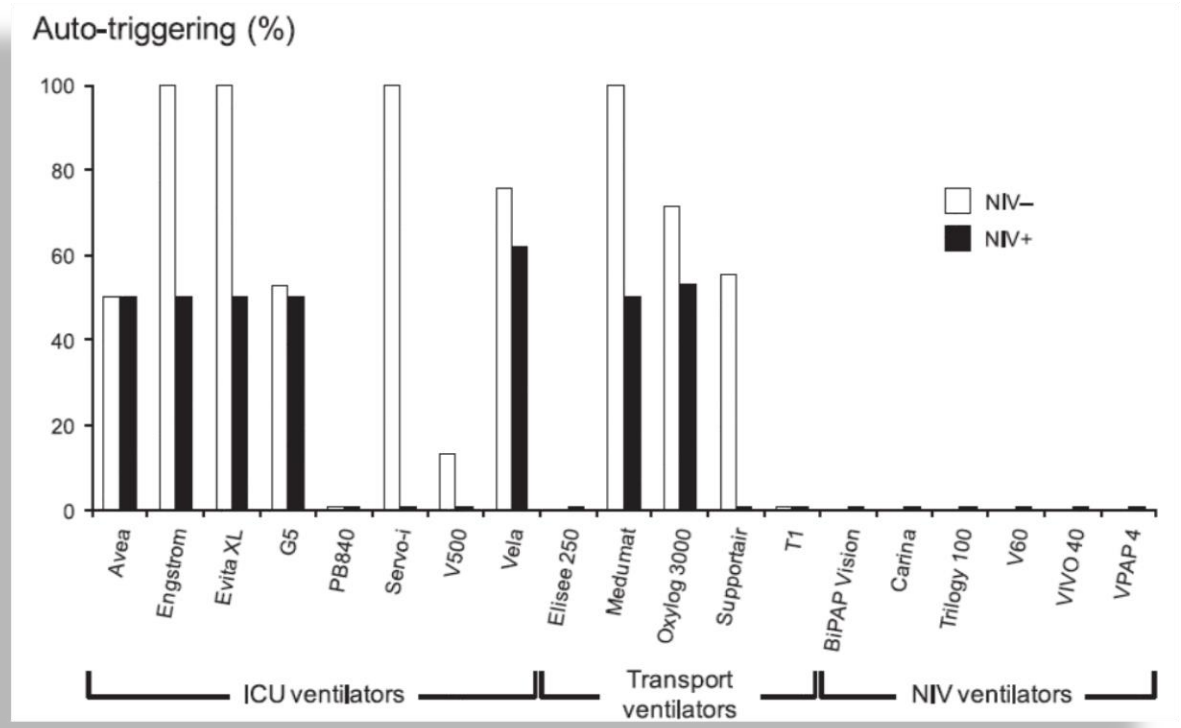
Mélangeur air / O2

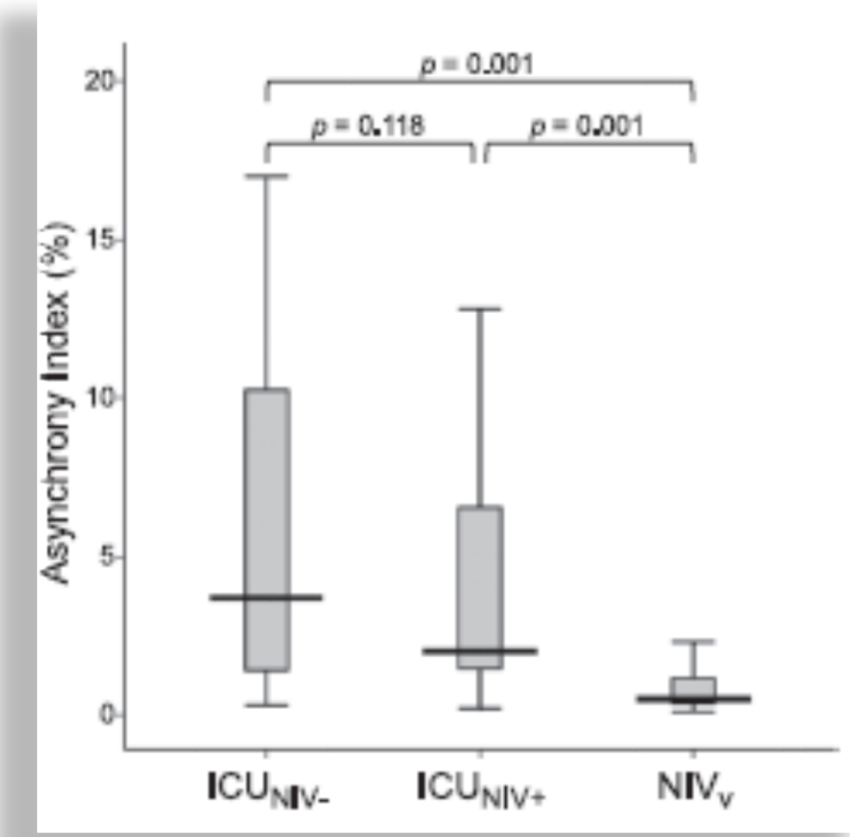
CHEST 2012; 142(2):367–376
Original Research
CRITICAL CARE

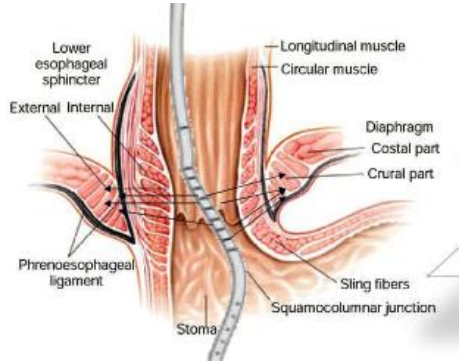
Patient-Ventilator Asynchrony During Noninvasive Ventilation

A Bench and Clinical Study

Guillaume Carteaux, MD; Aissam Lyazidi, PhD; Ana Cordoba-Izquierdo, MD; Laurence Vignaux; Philippe Jolliet, MD; Arnaud W. Thille, MD, PhD; Jean-Christophe M. Richard, MD, PhD; and Laurent Brochard, MD

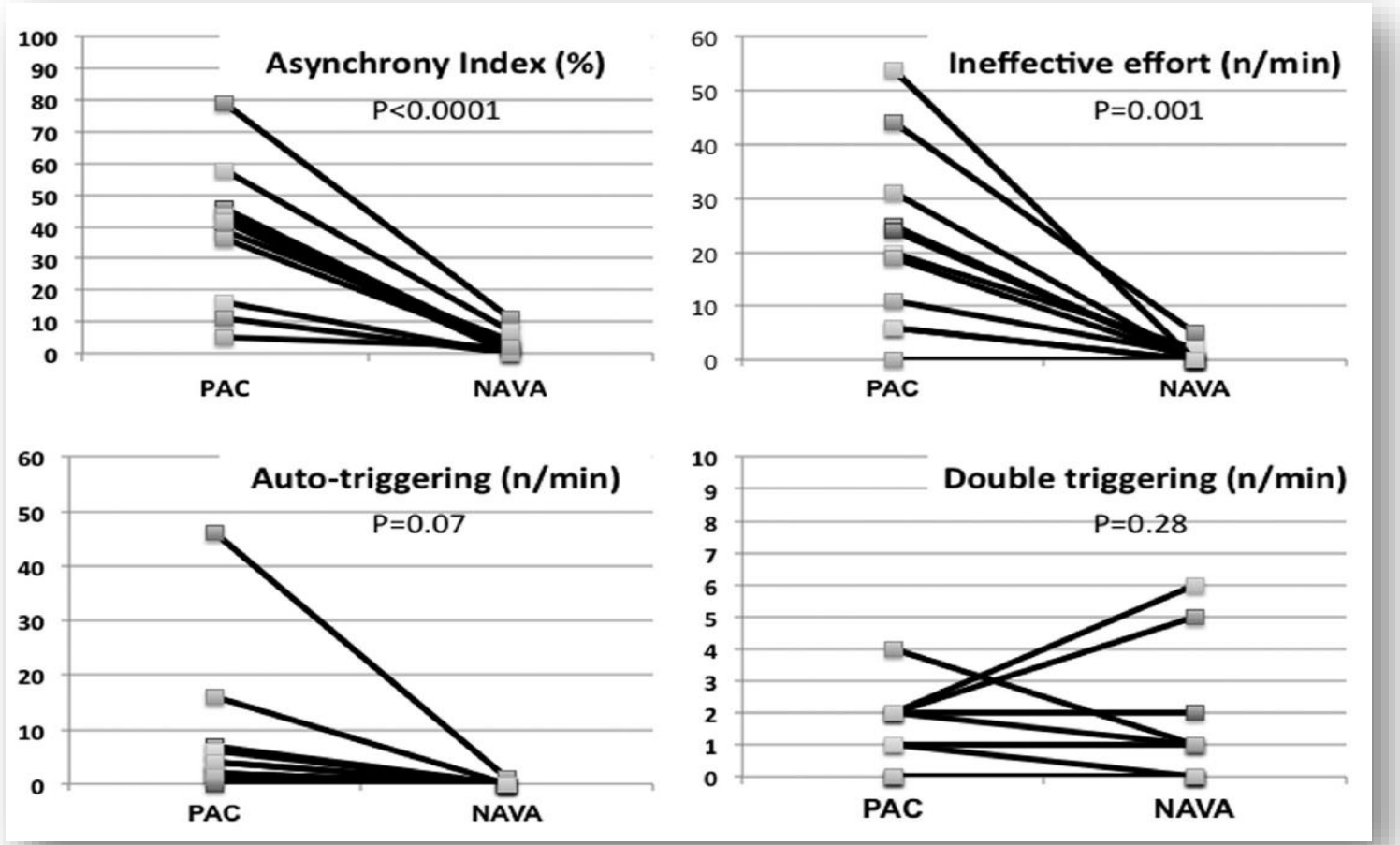


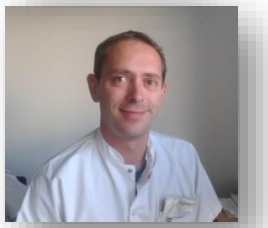




Neurally Adjusted Ventilator Assist (NAVA) Reduces Asynchrony During Non-Invasive Ventilation for Severe Bronchiolitis

Florent Baudin, MD,[1] Robin Pouyau, MD,[1] Fleur Cour-Andlauer, MD,[1,2] Julien Berthiller, MSc,[2,3] Dominique Robert, MD, PhD,[4] and Etienne Javouhey, MD, PhD[1,4]*





Mise en place

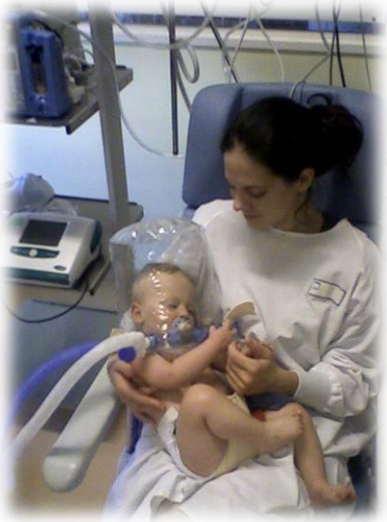
- Parents!!!!
- +/- les sédatifs
  - Midazolam
  - Hydroxyzine

1: Jeu avec interface

2: Application interface sans lien à 2 opérateurs ++++

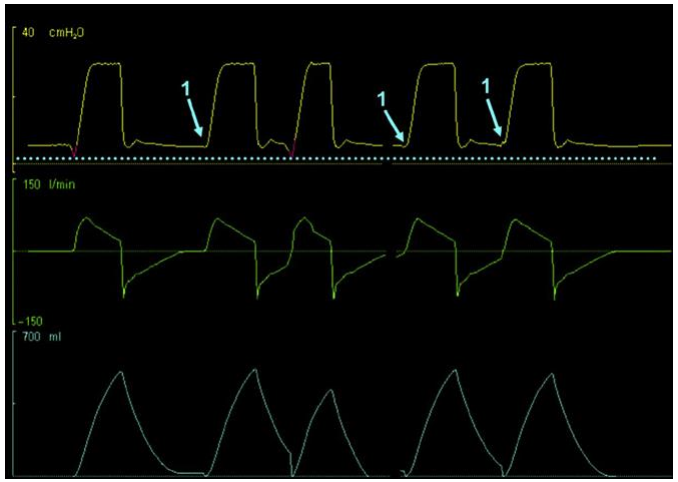
4:Branchement

3: Mise en place du harnais



Critéres de succés

- **Clinique**
  - **Confort**
  - **↓ FR**
  - **↓ travail respiratoire**
  - **↑ Volume (ampliation thoracique)**
  - **↑ Oxygénation**



- **Paramètre du respirateur (courbes)**
  - **Vt (5-8ml/kg)**
  - **Fuite (Vti-Vte)**
  - **Interaction patient/machine**

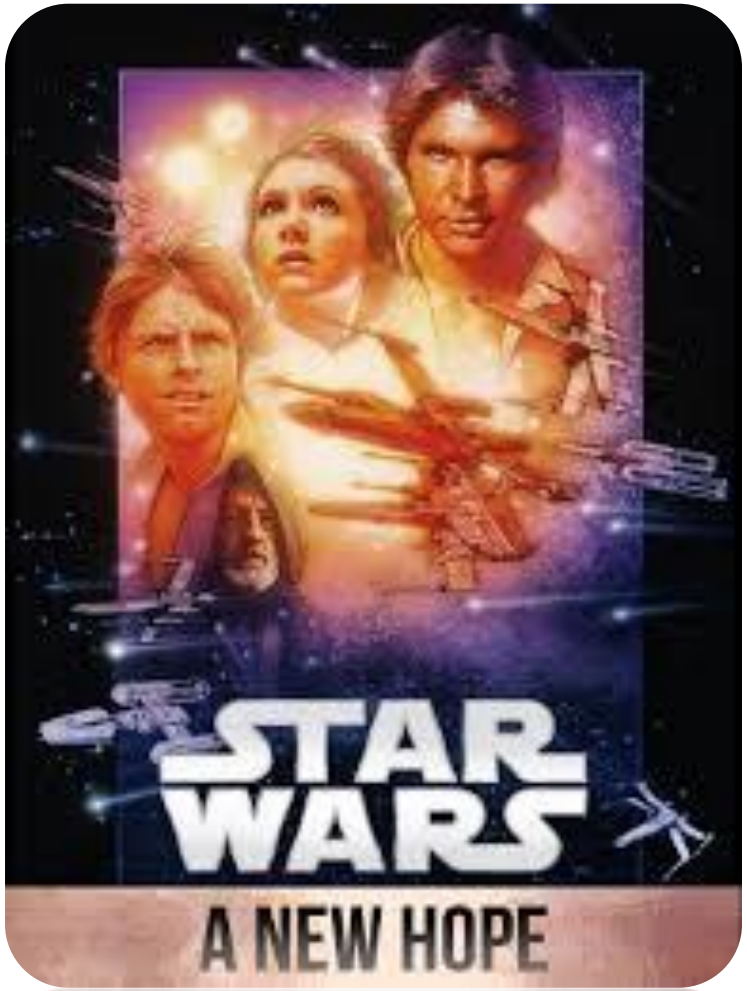
- **Gazométrie**
  - **saturation O2** **PaFi= (SaFi – 64) / 0.84**
  - **$EtCO_2$**
  - **Gaz capillaire(CO2 et pH) après 1 à 2h**

High Flow Nasal Cannula

- Bases physiologique: **Débit> DIP**
  - Gaz humidifié et réchauffé
  - Lavage de l'espace mort
  - « Gentle PEEP »
  - Diminution WOB

- Interet pratique:
  - Tolérance
  - Inhalation

Intérêt:
- Bronchiolites modérées
- Pathologie hypoxémiantes?
- Post extubation
- Pre-intubation
- Asthme?

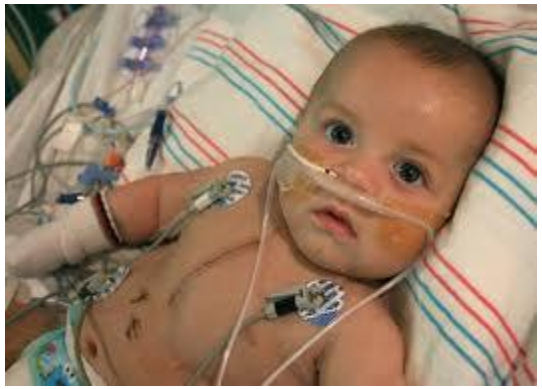


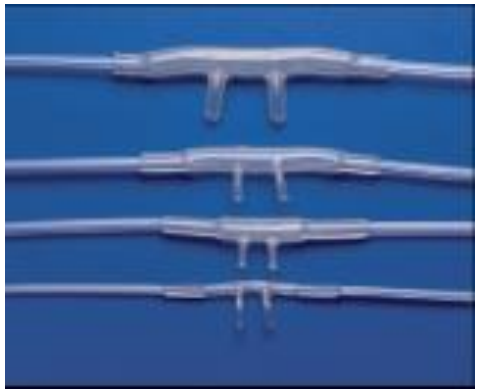
Roca et al. Respir Car 2010; Tiep et al. Respir Care 2002 ; Parke et al. Respir Care 2011

Matériel

Réglages:

1. Taille : (1/2 D narinaire)
2. FiO2
3. Humidificateur
4. Débit: 2l/min/kg

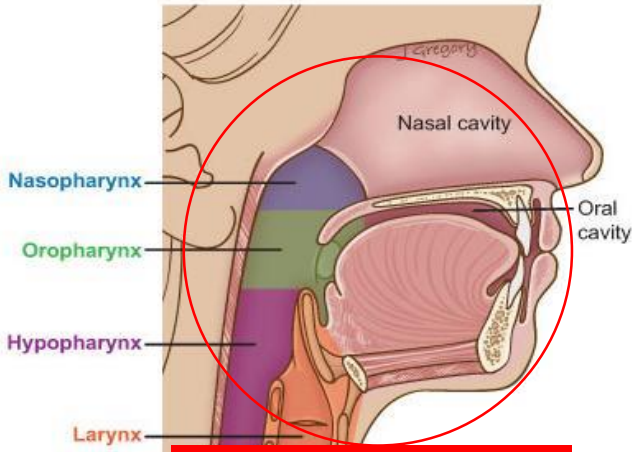




Lavage espace mort:
Oxygénation. CO2
HFNC > Masque HC

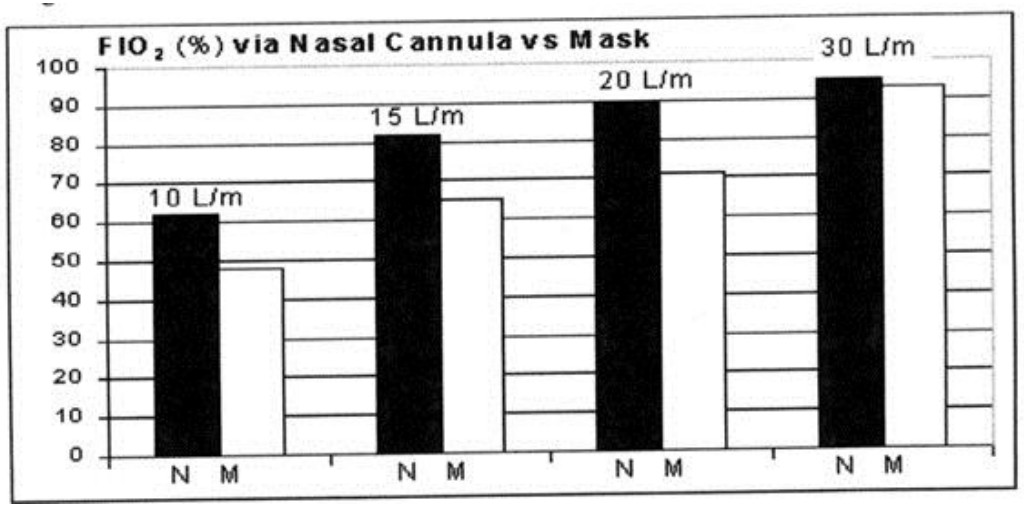
Débit sup débit insp: Lavage de l'espace mort de l'enfant (3ml/kg)

[AH.Numa. J Appl Physio1996]



Dead Space:
Children: **3** ml/kg
Adult: **0,8** ml/kg

[**A. H. Numa, Newth**
Journal of Applied Physiology 1996]



HFNC masque HC

[B.Tiep *Respir Care 2002*]

Milési et al. Annals of Intensive Care 2014, 4:29
http://www.annalsofintensivecare.com/content/4/1/29

Annals of Intensive Care
a SpringerOpen Journal

REVIEW Open Access

High-flow nasal cannula: recommendations for daily practice in pediatrics

Christophe Milési[1,3*], Mathilde Boubal[1], Aurélien Jacquot[1], Julien Baleine[1], Sabine Durand[1], Marti Pons Odena[2] and Gilles Cambonie[1]

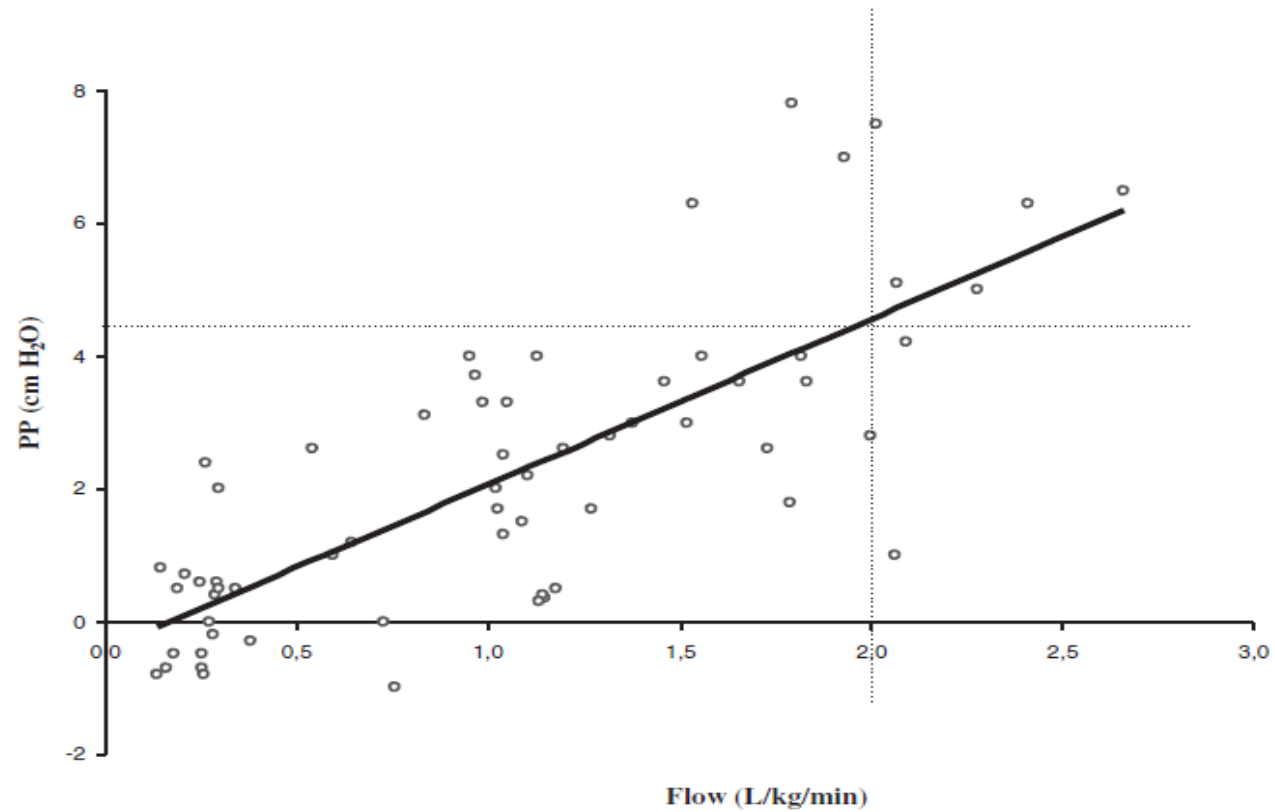


Figure 1 Pharyngeal pressure (PP) over the course of a gradual increase in flow. The flow is indexed to patient weight ($R = 0.77$, $p < 0.001$). A flow >2 L/kg/min is associated with mean pharyngeal pressure >4 cm H_2O (sensitivity 67%, specificity 96%, positive predictive value 75%, negative predictive value 94.5%). Adapted from Milési et al. [3].

Asthme

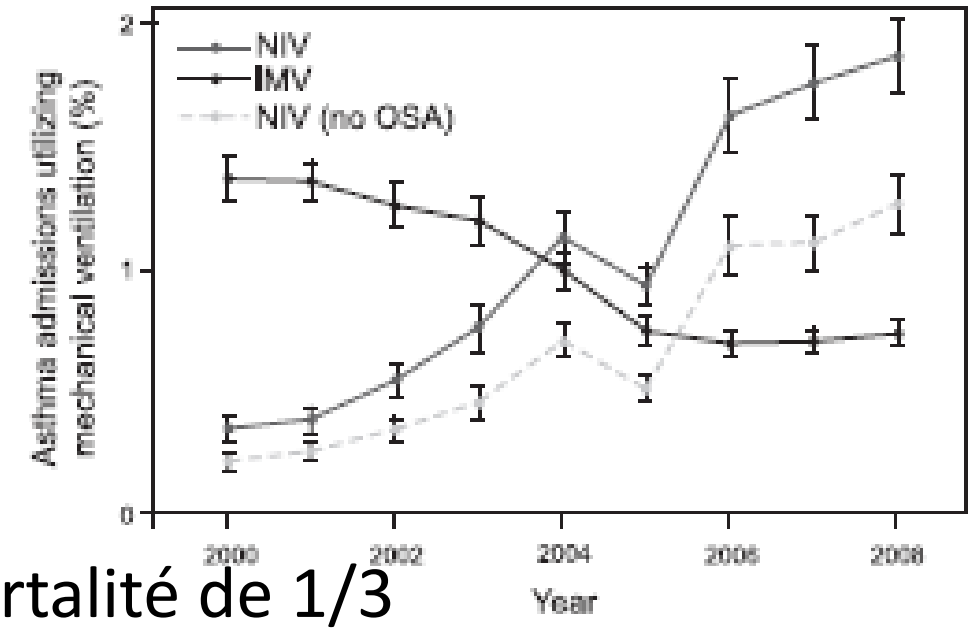
VNI en plein essor?

Utilization of Mechanical Ventilation for Asthma Exacerbations: Analysis of a National Database

Rahul Nanchal MD, Gagan Kumar MD, Tillotama Majumdar MD, Amit Taneja MD, Jayshil Patel MD, Gaurav Dagar MD, Elizabeth R Jacobs, and Jeff Whittle MD

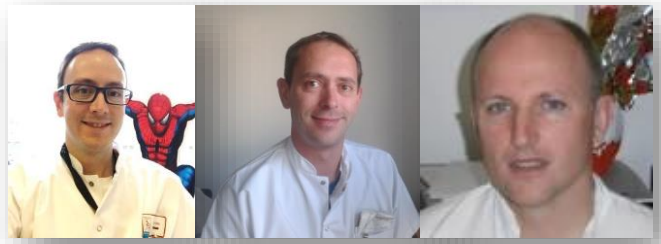
Respir Care 2014;59(5):644–653

- 8 ans
- Registre administratif
- VNI x5
- Ventilation x2
- Diminution risque de mortalité de 1/3



Baudin *et al. Ann. Intensive Care (2017) 7:55*
DOI 10.1186/s13613-017-0278-1

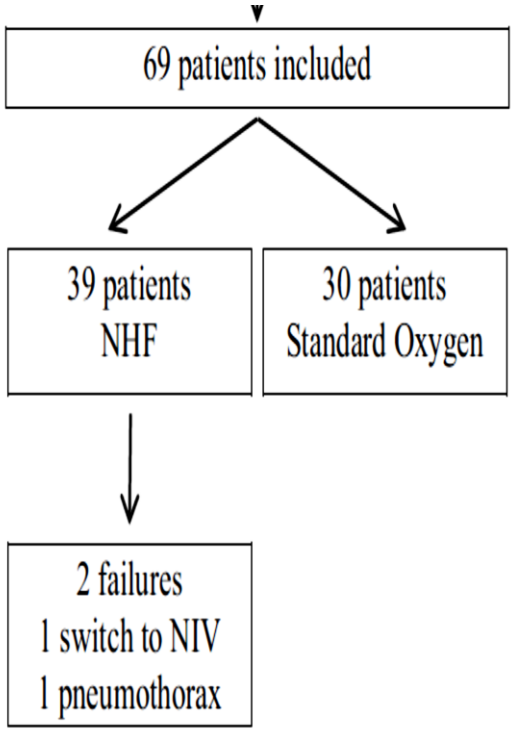
Annals of Intensive Care

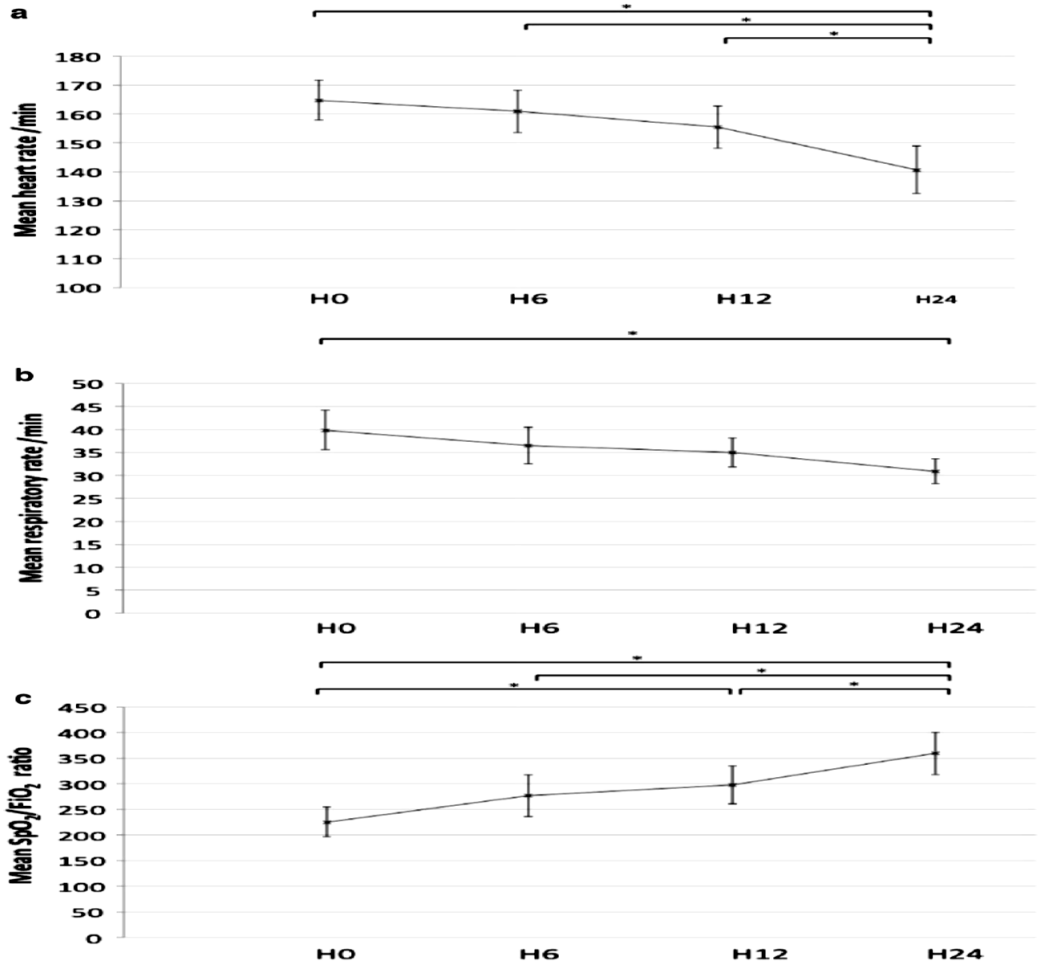


RESEARCH ARTICLE Open Access

Nasal high flow in management of children with status asthmaticus: a retrospective observational study

Florent Baudin[1,2*], Alexandra Buisson[1], Blandine Vanel[1], Bruno Massenavette[1], Robin Pouyau[1] and Etienne Javouhey[1,2]





	n = 39
NHF settings, median [IQR]	
Initial FiO_2 (%)	45 [31–55]
Initial flow (L/kg/min)	0.9 [0.75–1]
Maximum flow (L/kg/min)	1.0 [0.8–1.1]
Length of NHF (h), median [IQR]	28 [21–47]
NHF failure, *n* (%)	2 (6)

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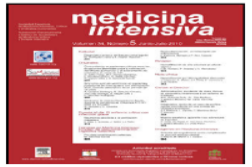
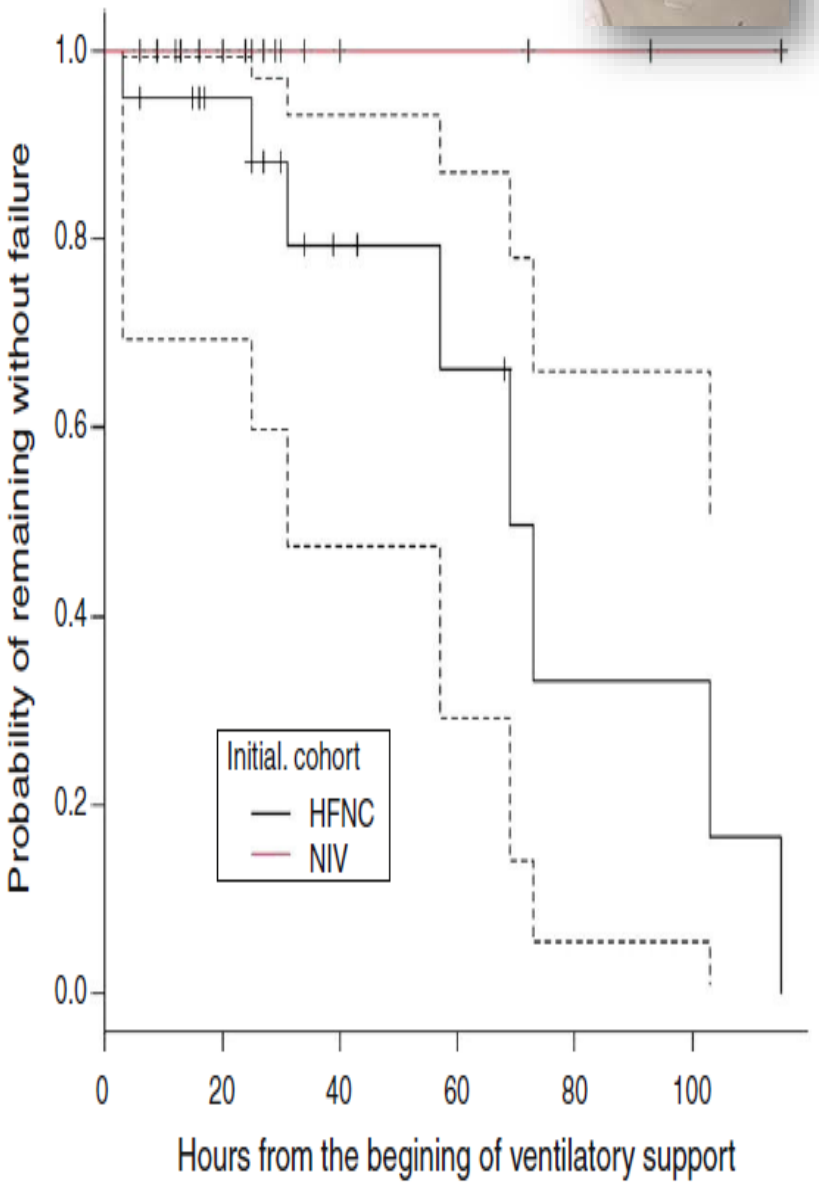


ORIGINAL ARTICLE

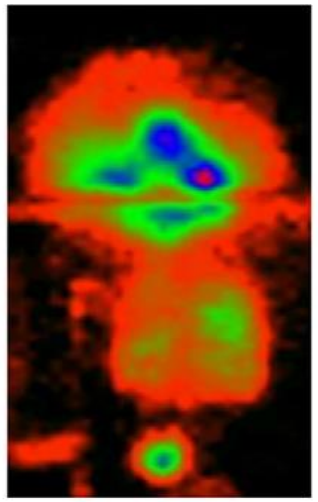
High-flow nasal cannula therapy versus non-invasive ventilation in children with severe acute asthma exacerbation: An observational cohort study

J. Pilar[a,*], V. Modesto i Alapont[b], Y.M. Lopez-Fernandez[a], O. Lopez-Macias[a], D. Garcia-Urabayen[a], I. Amores-Hernandez[a]

	HFNC	NIV	*p*-value (HFNC versus NIV)
N	20	22	
Age (years)	2.98 [1.52; 4.42]	3.74 [2.77; 6.47]	0.11
Sex (% men)	12/8 (60)	17/8 (77)	0.80
Weight (kg)	13.1 [10.53; 20]	16 [14.25; 21.5]	0.10
PRISM III	4 [1.75; 6]	3 [0.25, 4]	0.17
Wood-Downes score	8 [7; 9]	8 [7; 9.75]	0.67
Heart rate (bpm)	164 [141; 167]	146 [136; 156]	**0.009**
Respiratory rate (rpm)	48 [37; 57]	42 [33; 50]	0.12
P_{CO2} *(mmHg)*	48 [41; 51.5]	42 [39; 47.75]	0.33
F_{IO2}	0.6 [0.4; 0.83]	0.55 [0.35; 0.8]	0.38
S_{pO2} *(%)*	98 [96,100]	97 [96; 99]	0.44
Time in ED (h)	6.5 [4.75; 10.5]	5 [3; 12]	0.58
HFNC in ED (%)	2 (10)	4 (18.18)	0.66
Outcomes			
Treatment failure (%)	8 (40)	0 (0)	**0.001**
Time on VS (h)*	30.5 (16-57)	24 (16-30)	0.45
LOS in PICU (days)*	2 (1-3)	1 (1-)	0.79

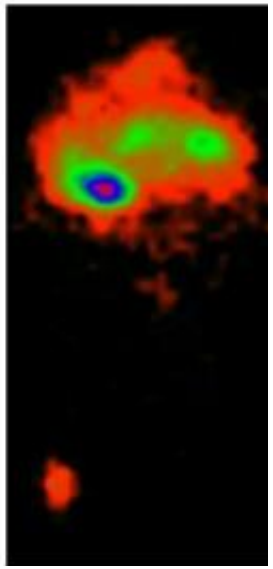


[F.ReminIac Peidatric Pulmonology 2017]



6 L/min

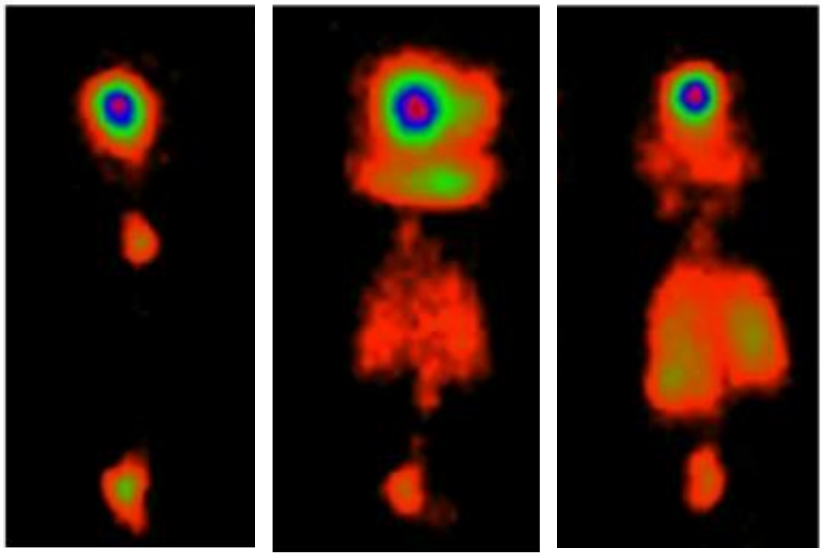
CONTROL
aerosol mask
jet nebulization



within NHF
circuit

Vibrating mesh nebulization

8 L/min 4 L/min 2 L/min



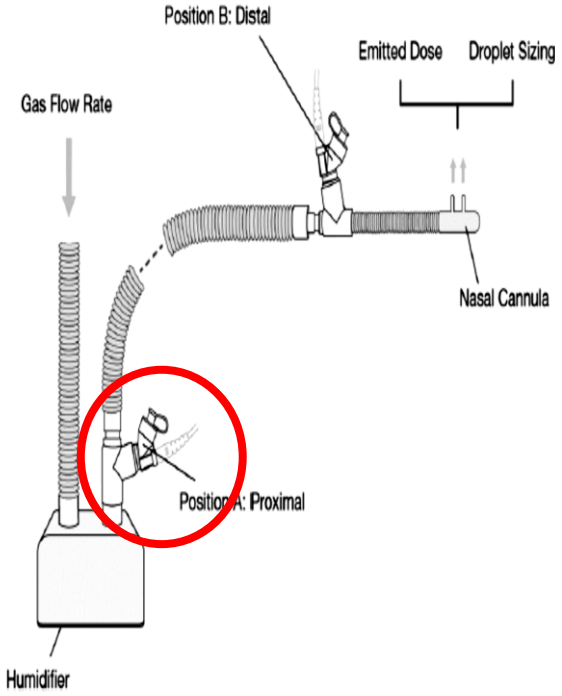
Nebuliszation

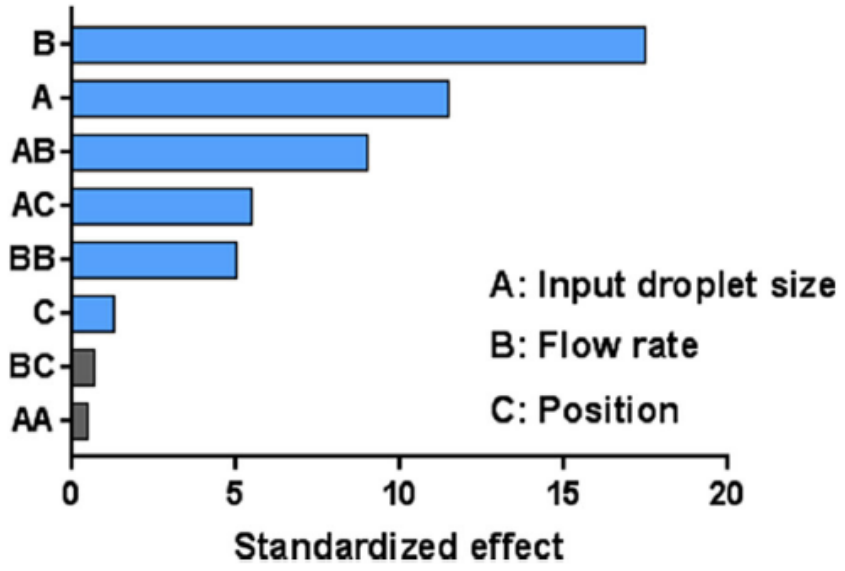
Pulm Ther (2018) 4:73–86
https://doi.org/10.1007/s41030-018-0054-x

ORIGINAL RESEARCH

In Vitro Determination of the Main Effects in the Design of High-Flow Nasal Therapy Systems with Respect to Aerosol Performance

Gavin Bennett · Mary Joyce · Louise Sweeney · Ronan MacLoughlin





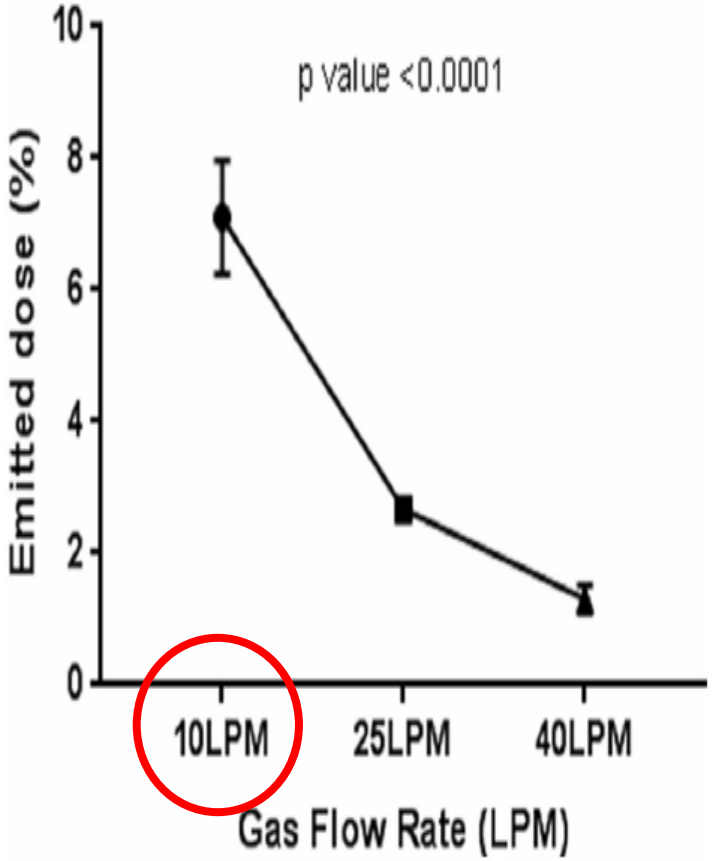
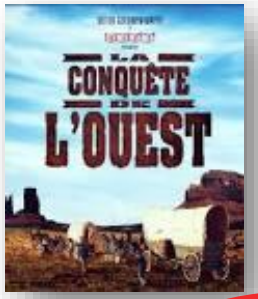


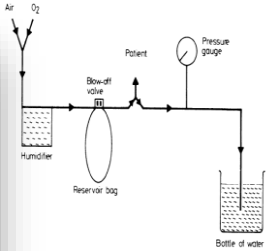
Fig. 3 Effect of gas flow rate on emitted dose

Bronchiolite

Travail respiratoire

1981 Pioneer!

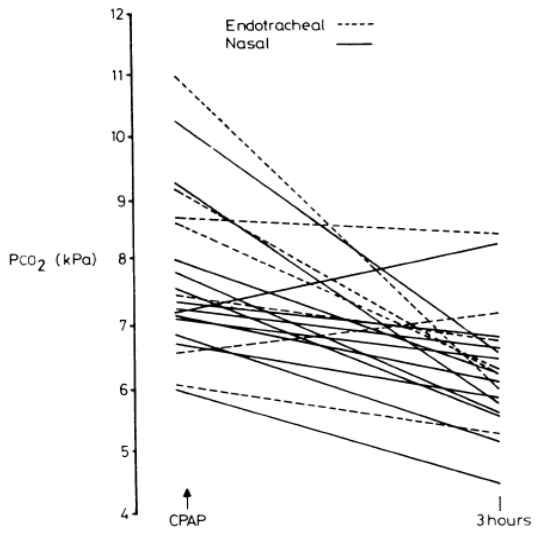


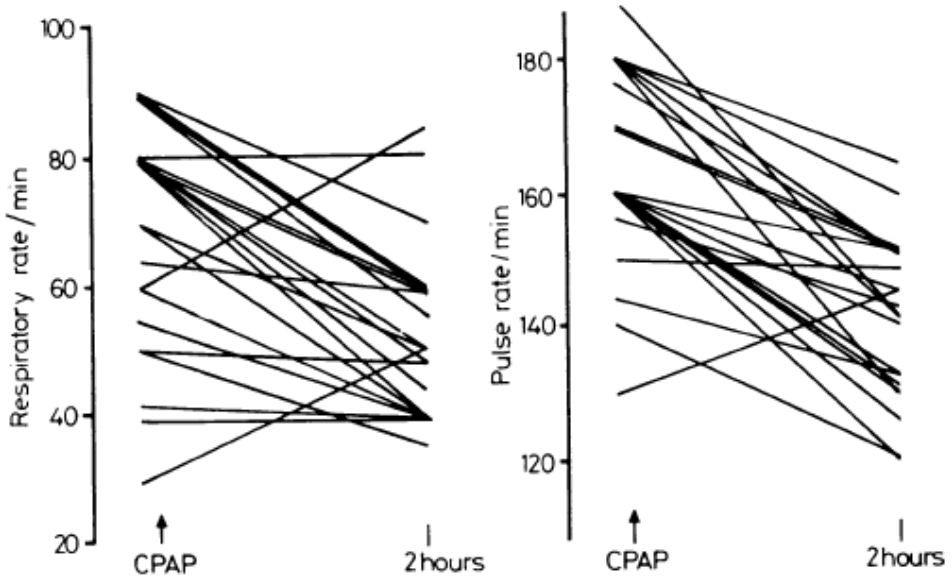


1506 BRITISH MEDICAL JOURNAL VOLUME 283 5 DECEMBER 1981

Continuous positive airway pressure in bronchiolitis

JENNIFER M BEASLEY, SUSAN E F JONES



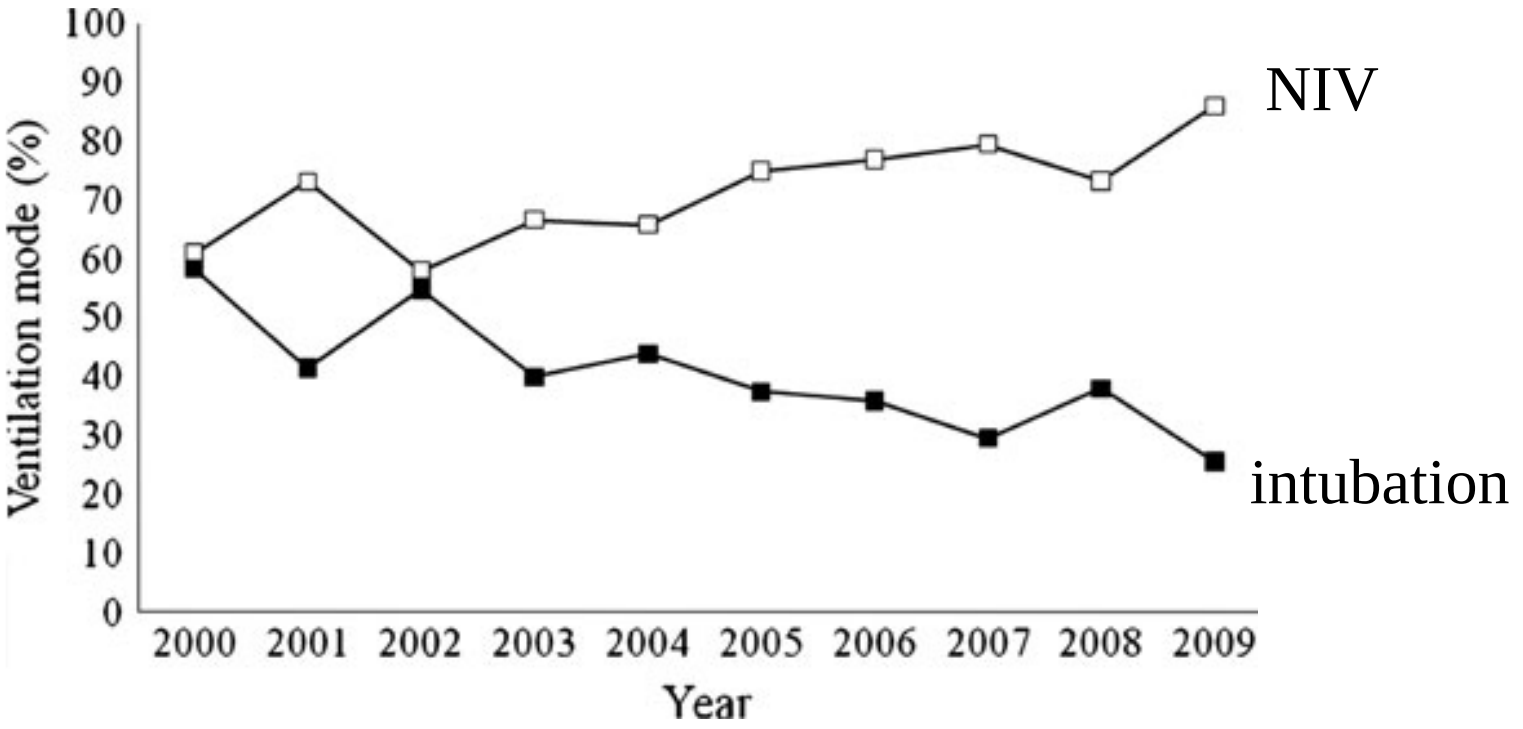


Intensive Care Med (2012) 38:1177–1183
DOI 10.1007/s00134-012-2566-4

ORIGINAL

Subodh Suhas Ganu
Anil Gautam
Barry Wilkins
Jonathan Egan

Increase in use of non-invasive ventilation for infants with severe bronchiolitis is associated with decline in intubation rates over a decade



NIV

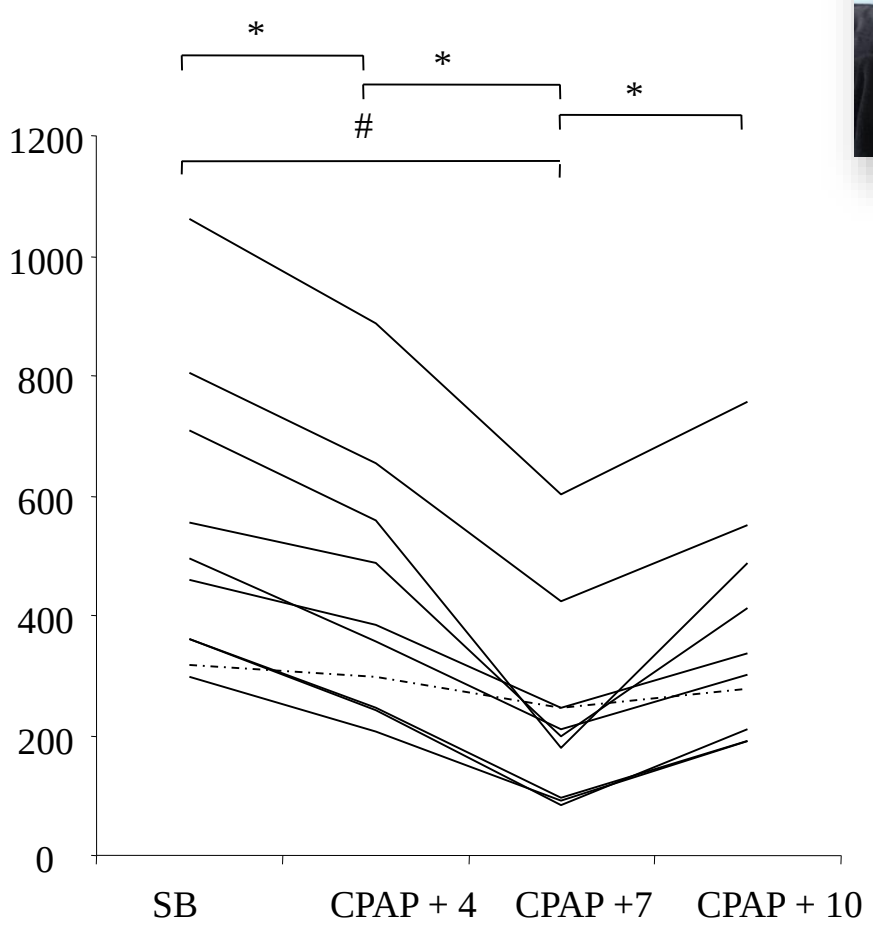
intubation

Intensive Care Med (2011) 37:2002–2007
DOI 10.1007/s00134-011-2372-4

PEDIATRIC ORIGINAL

Sandrine Essouri
Philippe Durand
Laurent Chevret
Laurent Balu
Denis Devictor
Brigitte Fauroux
Pierre Tissières

Optimal level of nasal continuous positive airway pressure in severe viral bronchiolitis

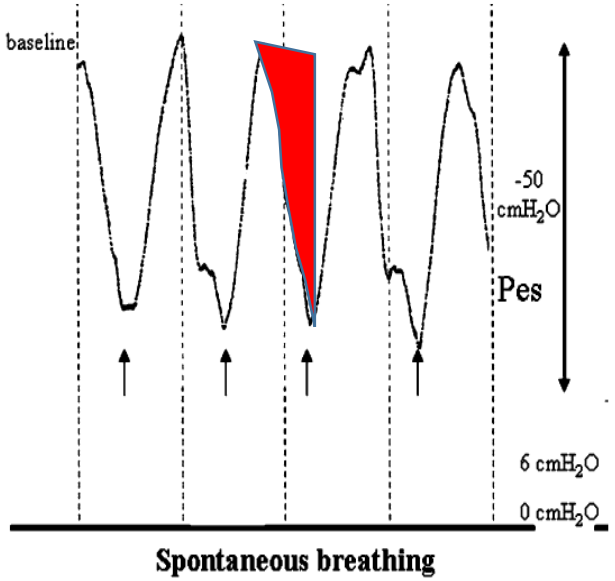


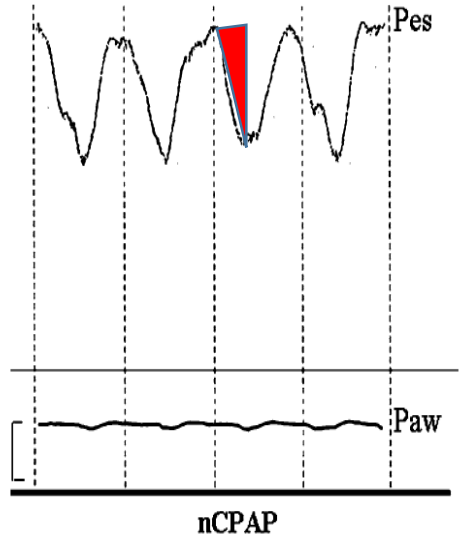
Intensive Care Med
DOI 10.1007/s00134-008-1201-x

PEDIATRIC ORIGINAL

Gilles Cambonie
Christophe Milési
Samir Jaber
Francis Amsallem
Eric Barbotte
Jean-Charles Picaud
Stefan Matecki

Nasal continuous positive airway pressure decreases respiratory muscles overload in young infants with severe acute viral bronchiolitis

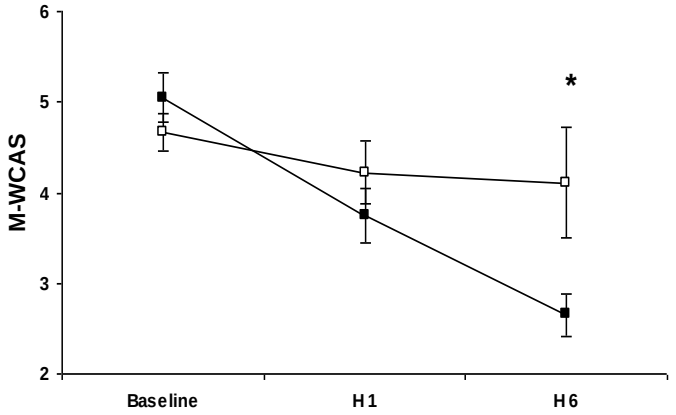


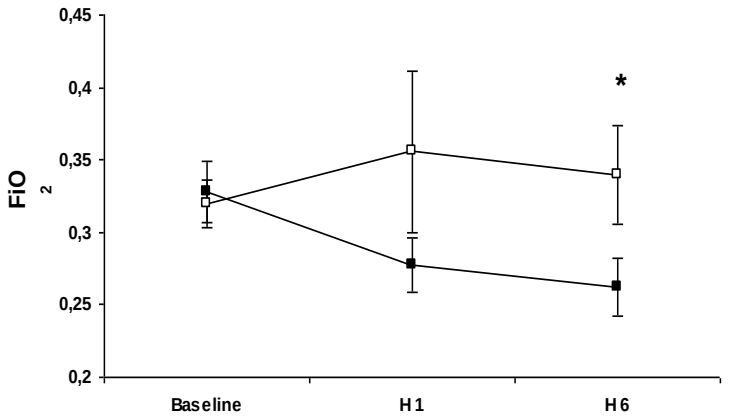


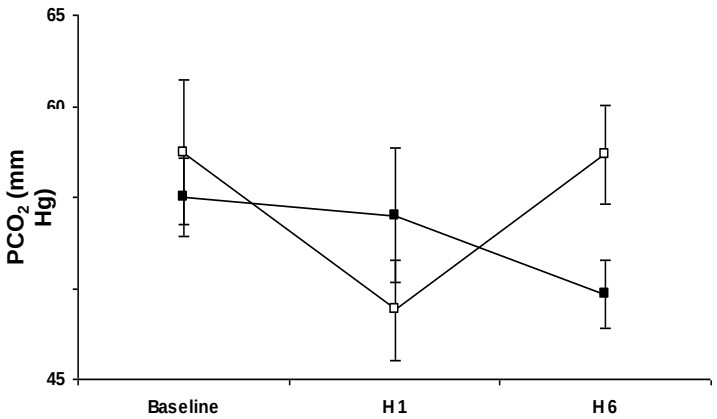
6 cmH_2O Continuous Positive Airway Pressure Versus Conventional Oxygen Therapy in Severe Viral Bronchiolitis: A Randomized Trial

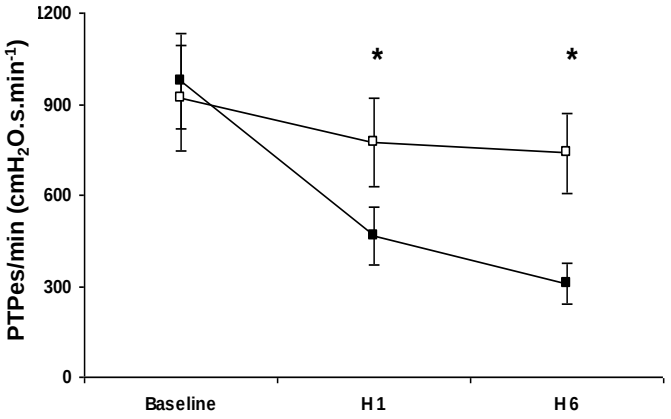
Christophe Milési, MD,[1] Stefan Matecki, MD, PhD,[2,3] Samir Jaber, MD, PhD,[3,4]
Thibaut Mura, MD,[5] Aurélien Jacquot, MD,[1] Odile Pidoux, MD,[1] Nathalie Chautemps, MD,[1]
Aline Rideau Batista Novais, MD,[1] Clémentine Combes, MS,[1] Jean-Charles Picaud, MD, PhD,[1]
and Gilles Cambonie, MD, PhD[1]*

Pediatric pulmonology 2012









Interface

Nasal Prong

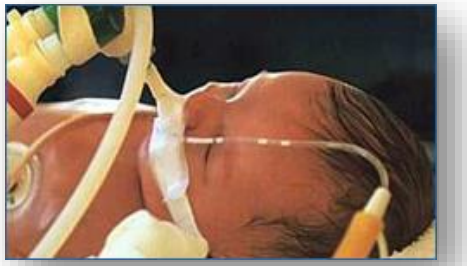
-Martinon Torres 2008

-Cambonie 2008

-Campion 2008

-Essouri 2011

-Milesi 2012



NasoPharingeal tube

-Beasley 1981

-Pons 2013

-Brink 2013

Helmet

-Mayordomo 2010

-Coddazi

-Chidini

-Milesi 2010

HFNC

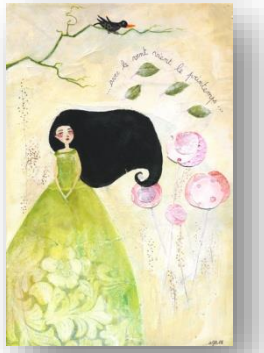
-Spenzas 2009

-Mc Kiernan 2010

-Abboud 2012

-Milesi 2013

-Brink 2013



HFNC ?

Intensive Care Med (2011) 37:847–852
DOI 10.1007/s00134-011-2177-5

PEDIATRIC ORIGINAL

A. Schibler
T. M. T. Pham
K. R. Dunster
K. Foster
A. Barlow
K. Gibbons
J. L. Hough

Reduced intubation rates for infants after introduction of high-flow nasal prong oxygen delivery

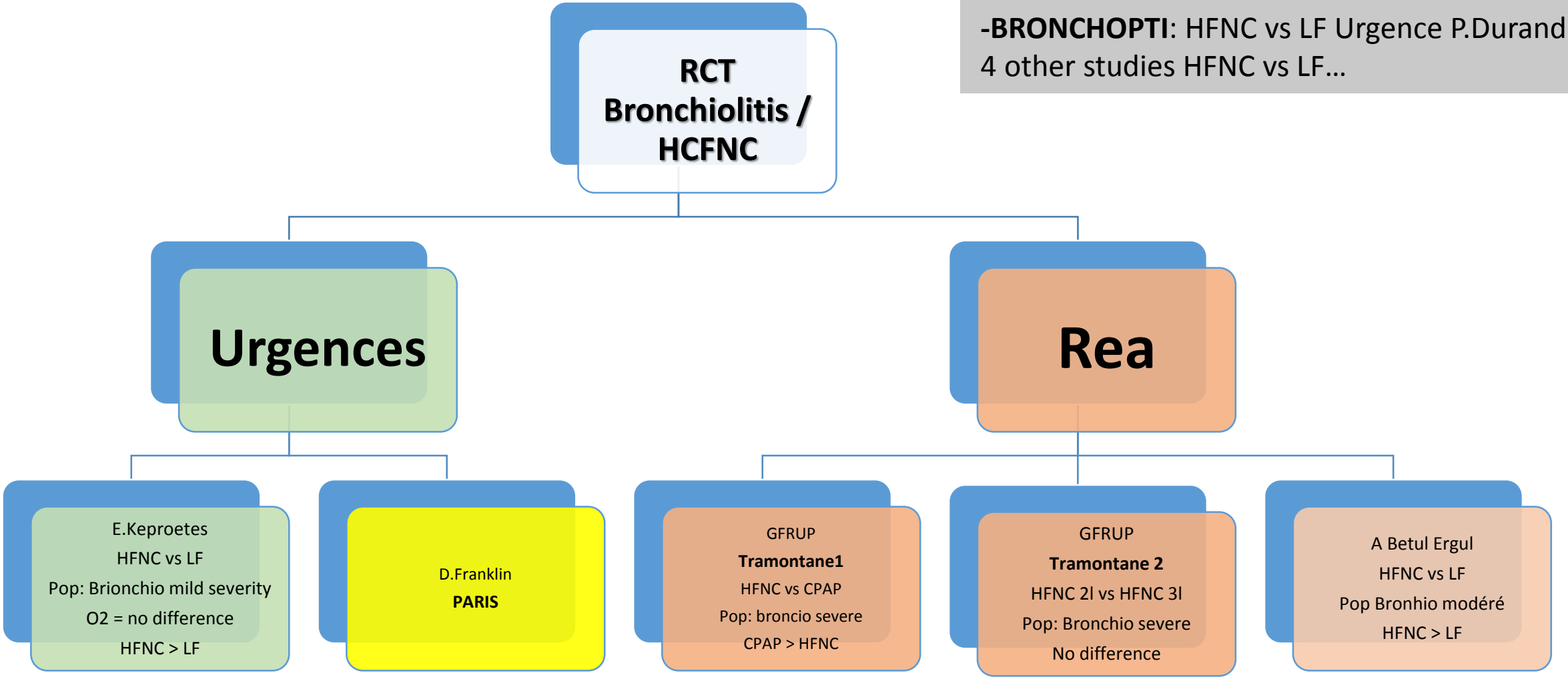
Table 3 Infants with viral bronchiolitis listed by year

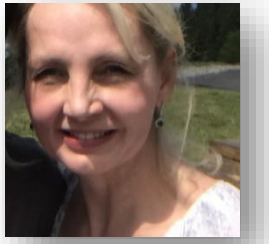
Year	Total BRONCH	HF and HF + N	Total intubated
2005	52	7 (13%)	19 (37%)
2006	72	32 (44%)	21 (29%)
2007	49	23 (46%)	15 (31%)
2008	90	56 (62%)	12 (13%)
2009	67	44 (66%)	5 (7%)

To come:

NIH U.S. National Library of Medicine
ClinicalTrials.gov

-BRONCHOPTI: HFNC vs LF Urgence P.Durand.
4 other studies HFNC vs LF…





Population: 17 ER
-Age < 12 month
-O2 requirement (Sat 92-98%)
-No Pressure support.

Failure (≥3 signs)

-**HR**: idem
-HR: increase
-RR: idem
-RR: increase
-FiO2> 0,4

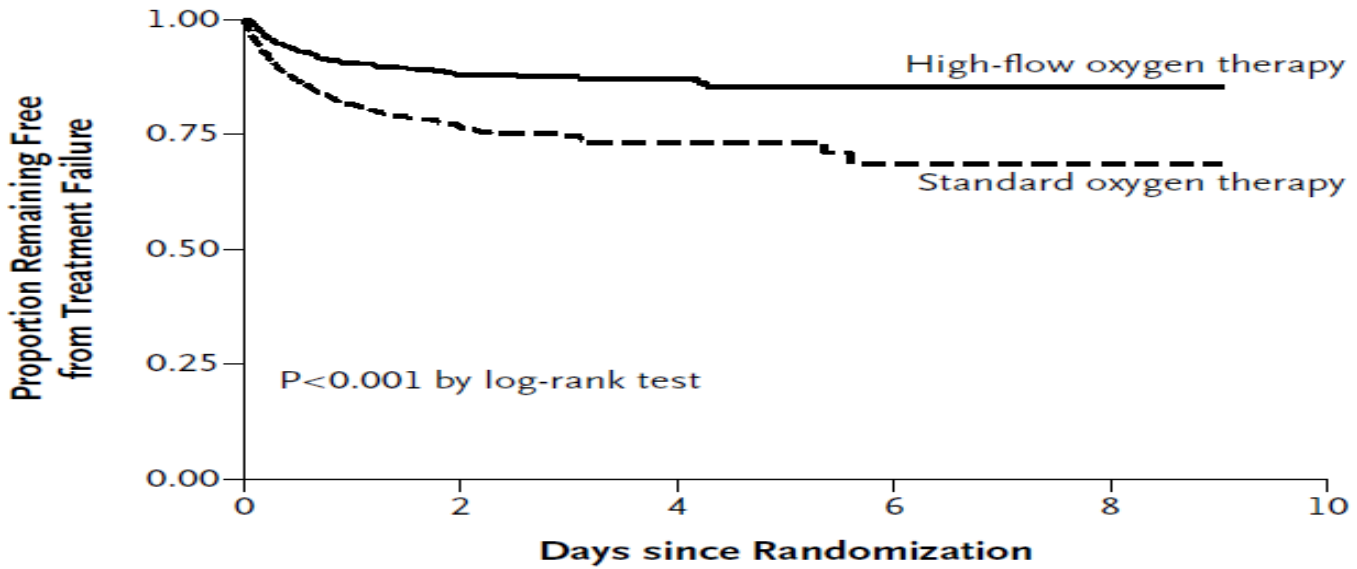
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis

Donna Franklin, B.N., M.B.A., Franz E. Babl, M.D., M.P.H.,

N ENGL J MED 378;12 NEJM.ORG MARCH 22, 2018



No. at Risk

High-flow oxygen	739	382	115	25	14	6
Standard oxygen	733	264	74	21	7	4

NNT: Nombre de Sujet à Traiter: **9** ttt pour prévenir 1 escalade ttt (95%CI 7-14)

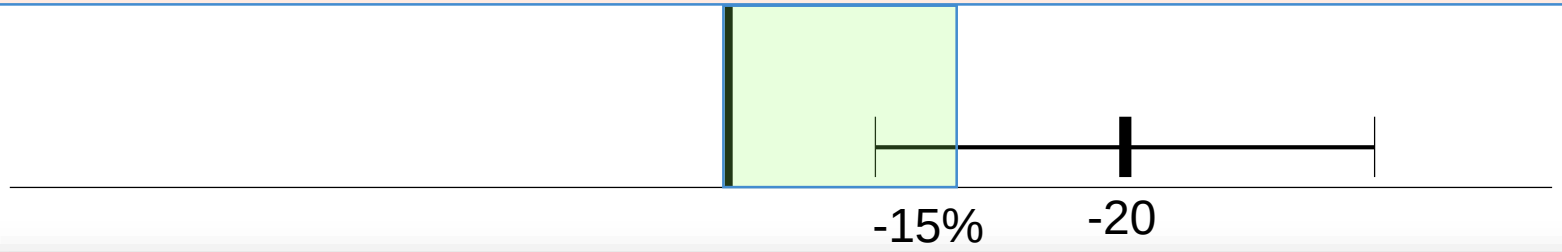
Intensive Care Med
DOI 10.1007/s00134-016-4617-8

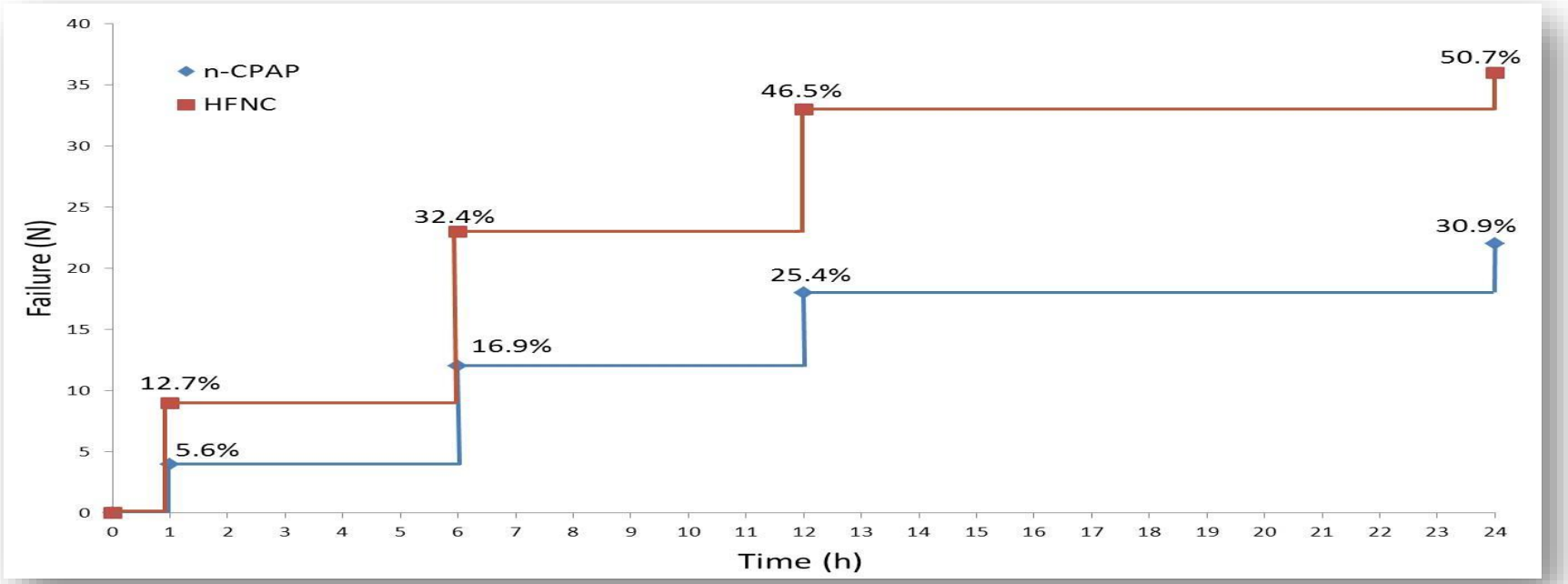
ORIGINAL

High flow nasal cannula (HFNC) versus nasal continuous positive airway pressure (nCPAP) for the initial respiratory management of acute viral bronchiolitis in young infants: a multicenter randomized controlled trial (TRAMONTANE study)

Christophe Milési[1], Sandrine Essouri[2], Robin Pouyau[3], Jean-Michel Liet[4], Mickael Afanetti[5], Aurélie Portefaix[3,6], Julien Baleine[1], Sabine Durand[1], Clémentine Combes[1], Aymeric Douillard[7], Gilles Cambonie[1*] and Groupe Francophone de Réanimation et d'Urgences Pédiatriques (GFRUP)

CPAP < HFNC | CPAP = HFNC | CPAP > HFNC





Sponsor: University Hospital Center of Montpellier (Grant: research contract 2012-2015)

NCT02602678

Multicenter randomised controlled trial of 3 L/kg/min versus 2 L/kg/min high flow nasal cannula flow rate in young infants with severe viral bronchiolitis (TRAMONTANE 2)

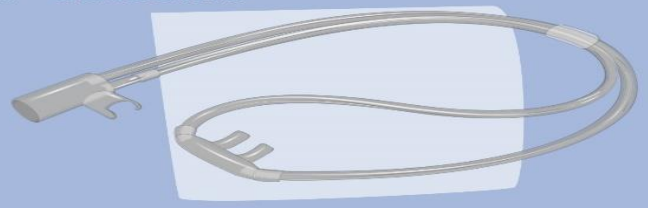
Is a 3 L/kg/min high flow nasal cannula flow rate more efficient than 2 for infants with acute viral bronchiolitis?

286 infants
with Acute Viral Bronchiolitis (AVB)
RCT

→ **142** 2L group

→ **144** 3L group

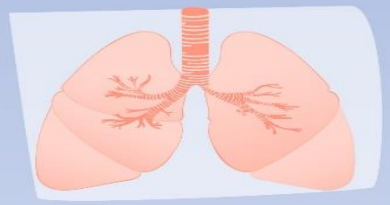
1° outcome



No difference in failure rates

2L group:	3L group:
38.7% p=0.98	**38.9%** p=0.98

2° outcome



No difference in intubation rates and duration of ventilation between groups

2L group:	3L group:
2.8% intubation rate p=0.17	**6.9%** intubation rate p=0.17
0.2 invasive days p=0.10	**0.5** invasive days p=0.10
1.4 noninvasive days p=0.97	**1.6** noninvasive days p=0.97

2° outcome

More discomfort and longer pediatric ICU stay in the 3L group

2L group:	3L group:
16% discomfort p=0.002	**43%** discomfort p=0.002
5.3 stay days p=0.048	**6.4** stay days p=0.048

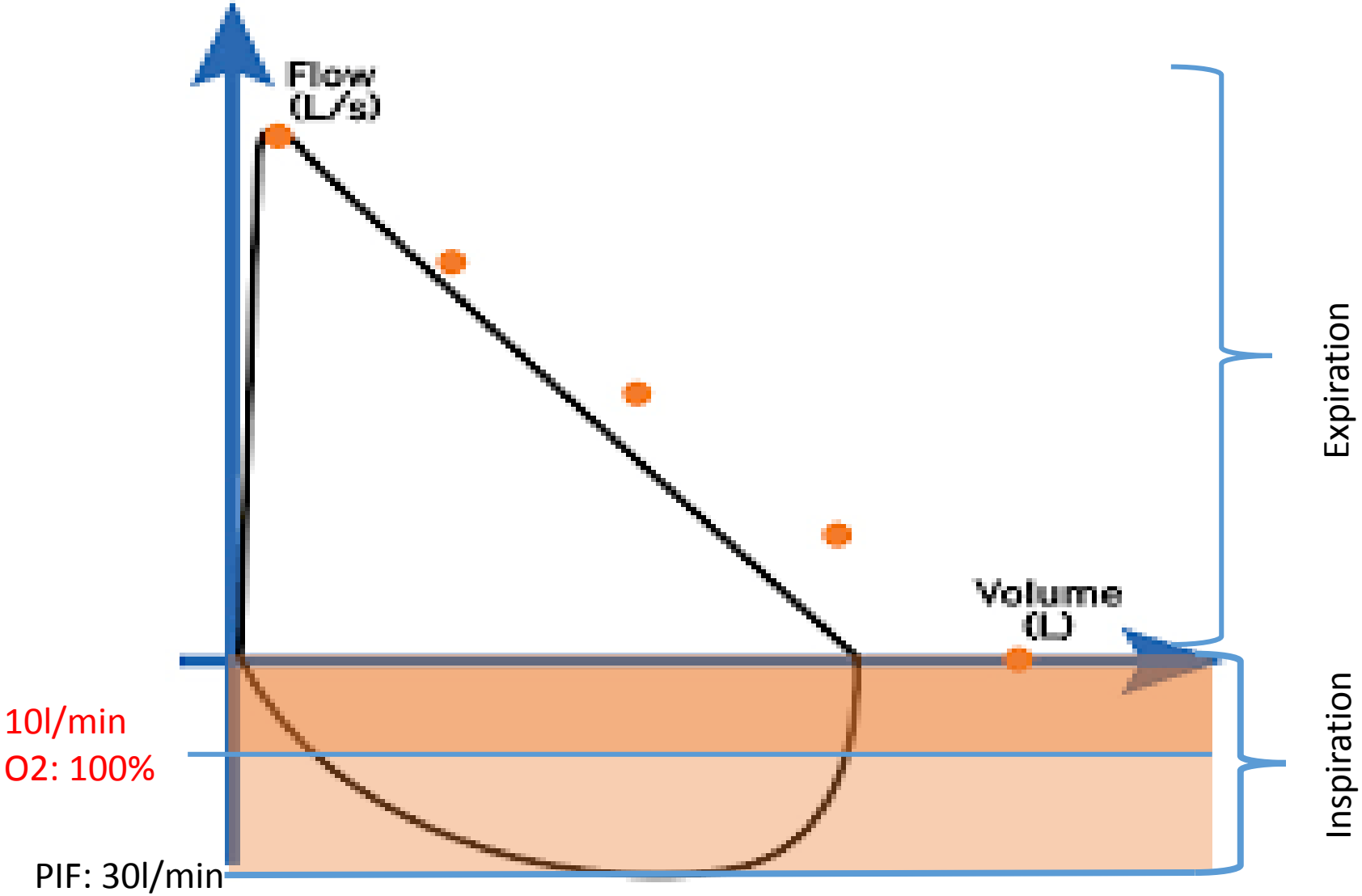
A flow rate of 3 L/kg/min is not superior to 2 L/kg/min. 2 L/kg/min was better tolerated by the patients.

icm INTENSIVE CARE MEDICINE

Milési C. et al. ICM 2018

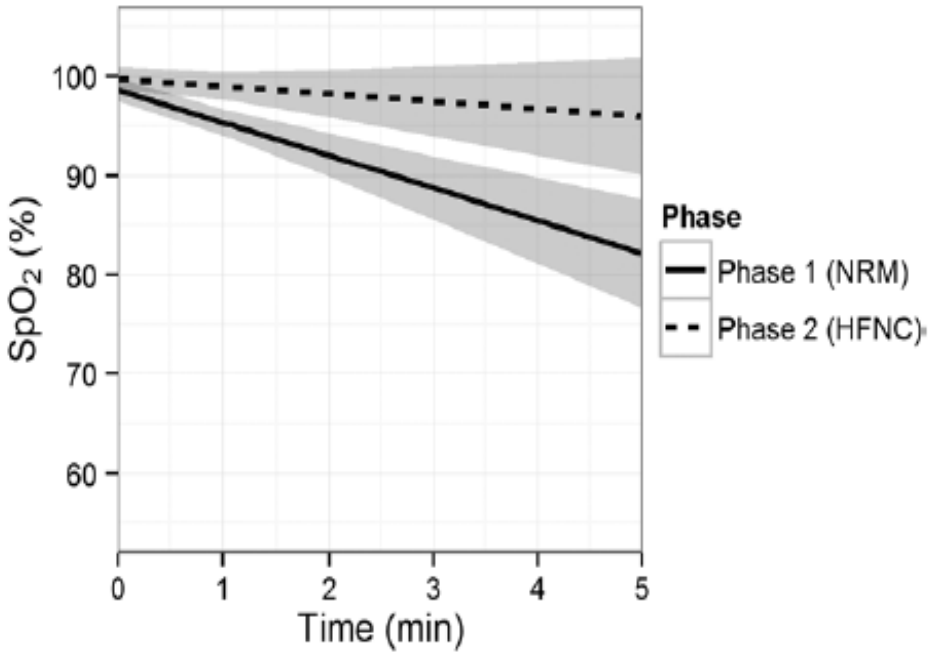
Oxygénation
Intubation
SDRA

Adult patient: Oxygen mask 10l of oxygen
What is the real FiO2?



Use of High-Flow Nasal Cannula Oxygen Therapy to Prevent Desaturation During Tracheal Intubation of Intensive Care Patients With Mild-to-Moderate Hypoxemia*

Romain Miguel-Montanes, MD[1]; David Hajage, MD[2]; Jonathan Messika, MD[1,3,4]; Fabrice Bertrand, MD[1]; Stéphane Gaudry, MD[1,3,4]; Cédric Rafat, MD[1]; Vincent Labbé, MD[1]; Nicolas Dufour, MD[1,3,4]; Sylvain Jean-Baptiste, MD[1]; Alexandre Bedet, MD[1]; Didier Dreyfuss, MD[1,3,4]; Jean-Damien Ricard, MD, PhD[1,3,4]

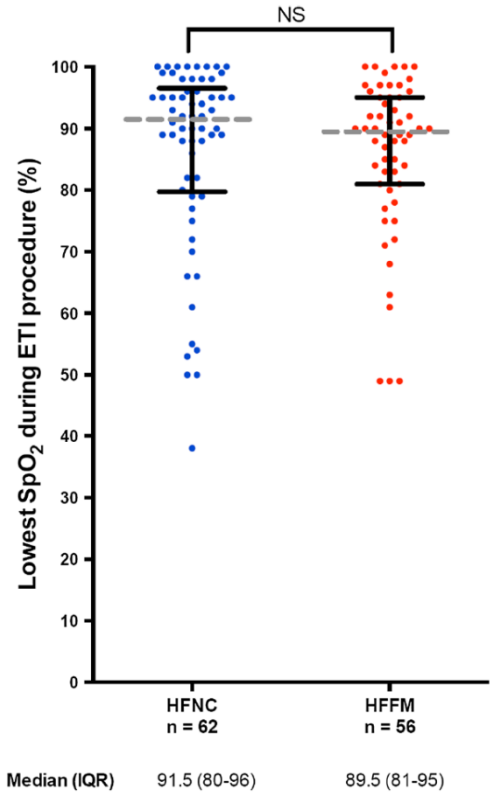


Intensive Care Med (2015) 41:1538–1548
DOI 10.1007/s00134-015-3796-z

SEVEN-DAY PROFILE PUBLICATION

Mickaël Vourc'h
Pierre Asfar
Christelle Volteau
Konstantinos Bachoumas
Noëmie Clavieras
Pierre-Yves Egreteau
Karim Asehnoune

High-flow nasal cannula oxygen during endotracheal intubation in hypoxemic patients: a randomized controlled clinical trial



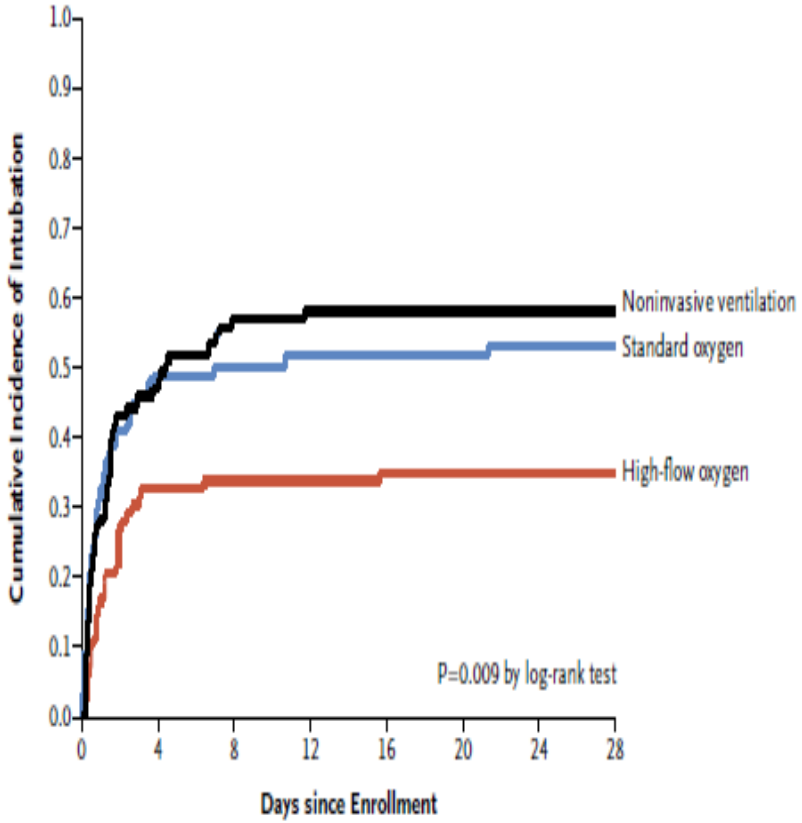
The NEW ENGLAND JOURNAL of MEDICINE

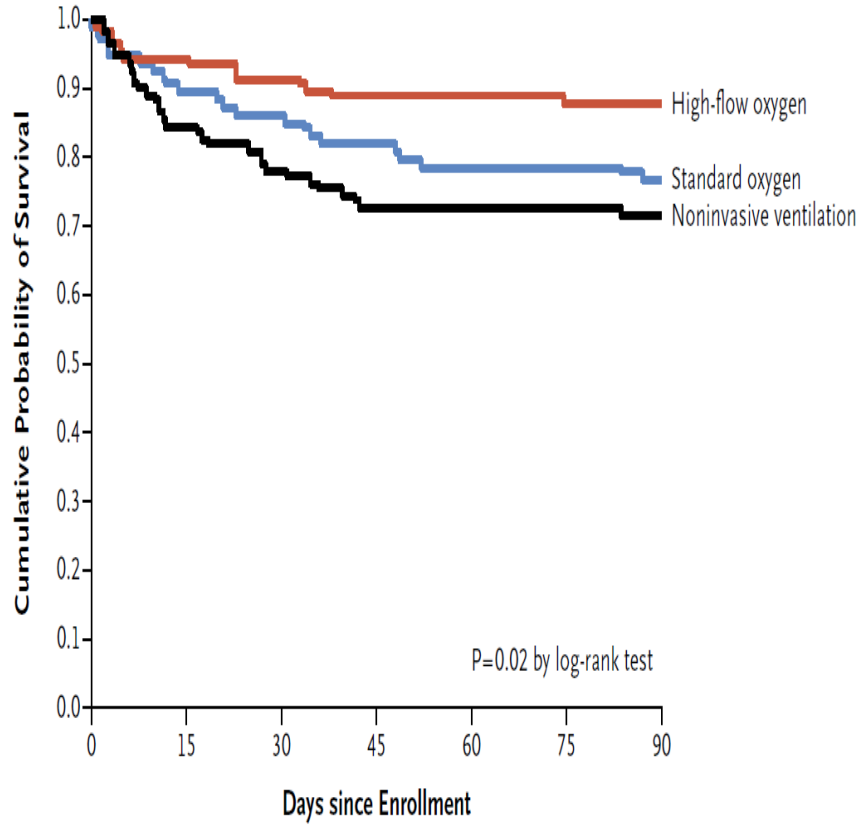
ORIGINAL ARTICLE

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

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

B Patients with a PaO_2:FIO_2 ≤200 mm Hg





Bubble continuous positive airway pressure for children with severe pneumonia and hypoxaemia in Bangladesh: an open, randomised controlled trial

Mohammod J Chisti, Mohammed A Salam, Jonathan H Smith, Tahmeed Ahmed, Mark A C Pietroni, K M Shahunja, Abu S M S B Shahid, Abu S G Faruque, Hasan Ashraf, Pradip K Bardhan, Sharifuzzaman, Stephen M Graham, Trevor Duke

Lancet 2015; 386: 1057–65

	Bubble CPAP therapy (n=79)	High-flow oxygen therapy (n=79)	Bubble CPAP vs high-flow oxygen therapy	
			RR (99·7% CI)	p value
Total treatment failure*	5 (6%)	10 (13%)	0·50 (0·11–2·29)	0·175
Intubation or mechanical ventilation	5 (6%)	10 (13%)	0·50 (0·11–2·29)	0.175
Deaths	3 (4%)	10 (13%)	0·30 (0·09–1·05)	0·082

HFNC: 2l/min/kg Age: 7(3,8-13) months

Noninvasive Support and Ventilation for Pediatric Acute Respiratory Distress Syndrome: Proceedings From the Pediatric Acute Lung Injury Consensus Conference (*Pediatr Crit Care Med* 2015

Sandrine Essouri, MD, PhD[1]; Christopher Carroll, MD, MS[2]; for the Pediatric Acute Lung Injury Consensus Conference Group

- Solid **physiological rationale** for the use of *NIV and PARDS.*
- Can improve **gas exchange** and prevent **intubation and MV**.
- **Not indicated in severe** PARDS.
- Should be performed only in **acute care** setting with **experienced team**
- Patient-ventilator **synchrony** is crucial for success.
- **Oro-nasal interface** provides superior support

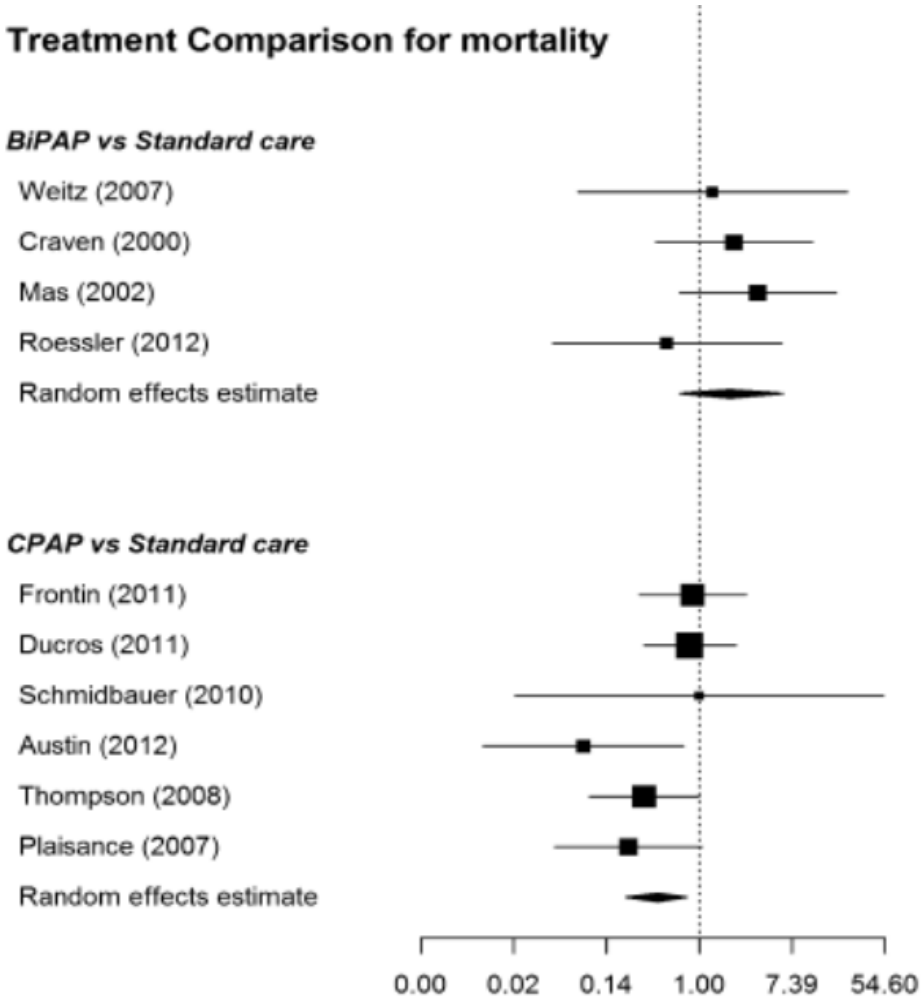
SAMU

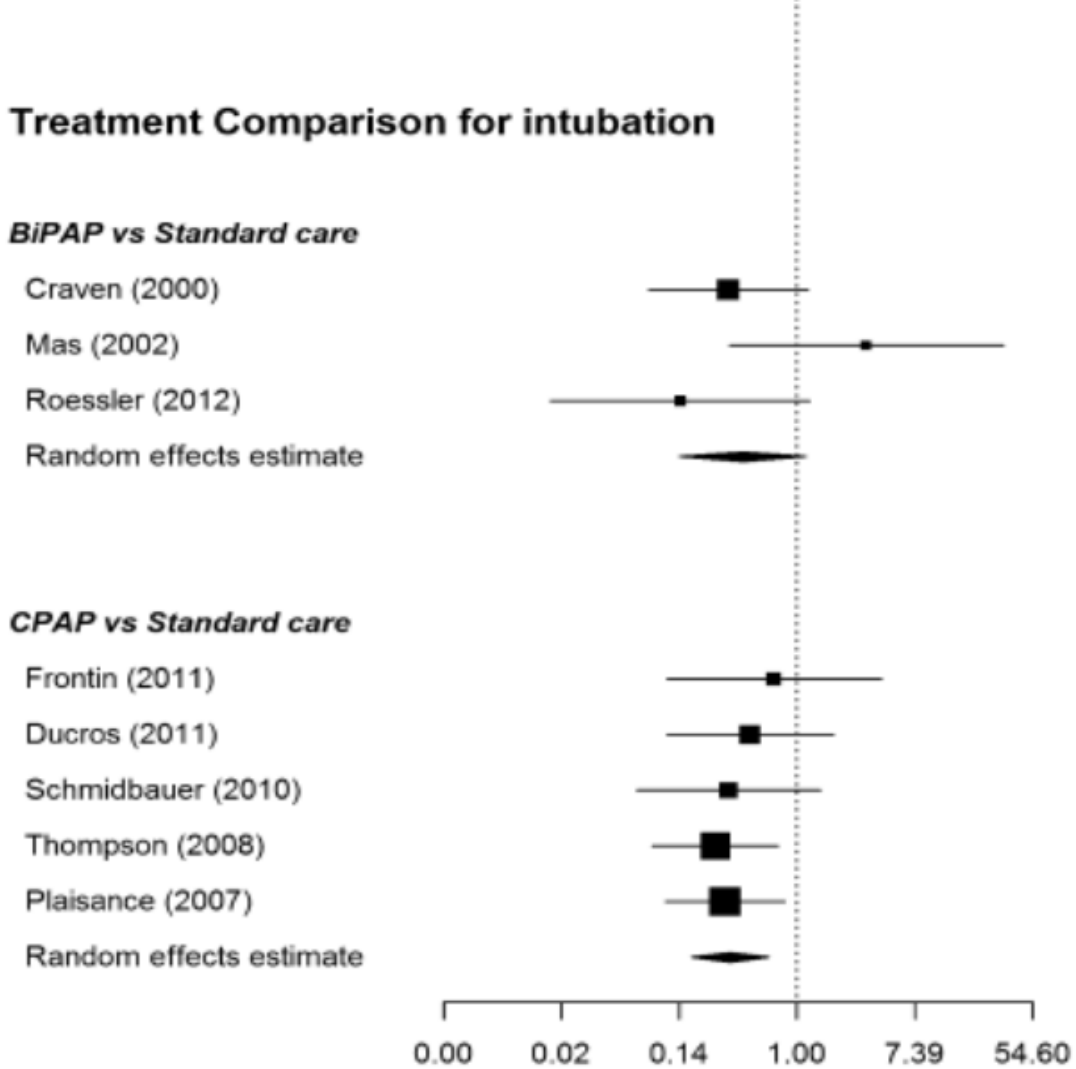
Transport: CPAP / BiPAP?

Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine
PROGRESSIVE CLINICAL PRACTICE

Prehospital Noninvasive Ventilation for Acute Respiratory Failure: Systematic Review, Network Meta-analysis, and Individual Patient Data Meta-analysis

Steve Goodacre, PhD, John W. Stevens, PhD, Abdullah Pandor, MSc, Edith Poku, MBChB, Shijie Ren, PhD, Anna Cantrell, MA, Vincent Bounes, PhD, Arantxa Mas, MD, Didier Payen, PhD, David Petrie, MD, Markus Soeren Roessler, PhD, Gunther Weitz, MD, Laurent Ducros, MD, and

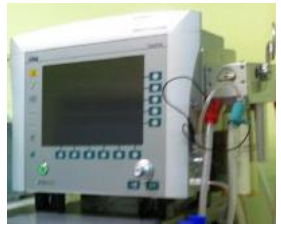




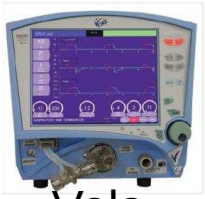
Quel respirateur?

- CPAP – BiPAP – invasive - HFNC
- Trigger ++
- FiO2: 21-100%
- Turbine > pneumatic (trigger, VT, FiO2)

Sophie



Fabian 2 or 3



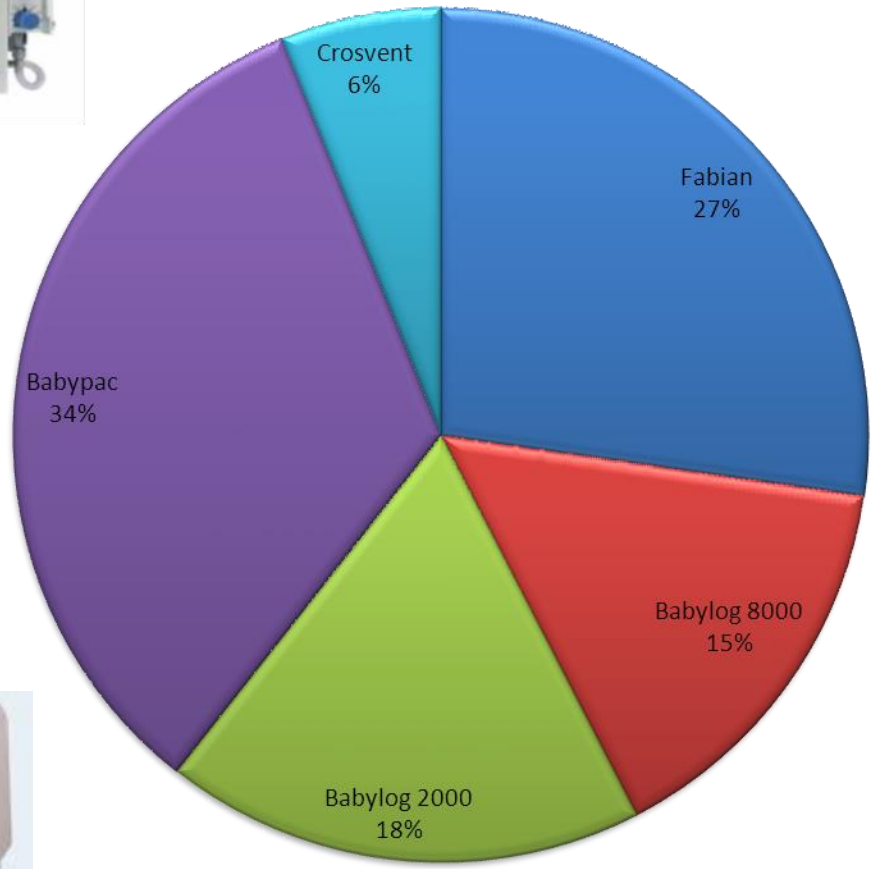
Vela

Leoni 2

Crossvent

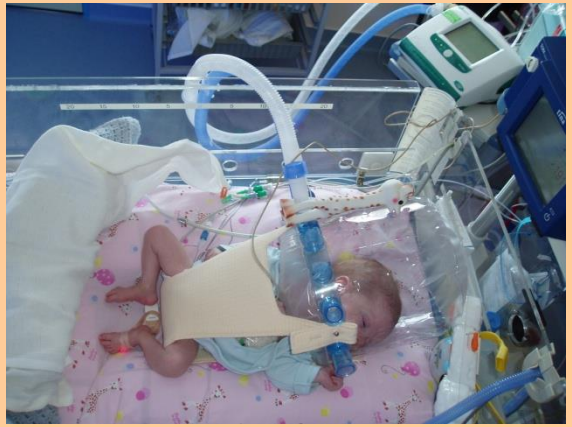
France.

N.Lodé

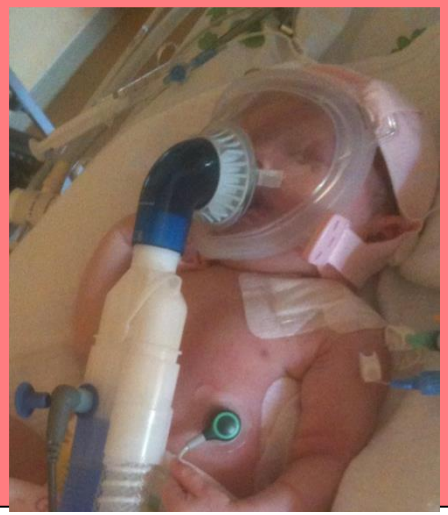


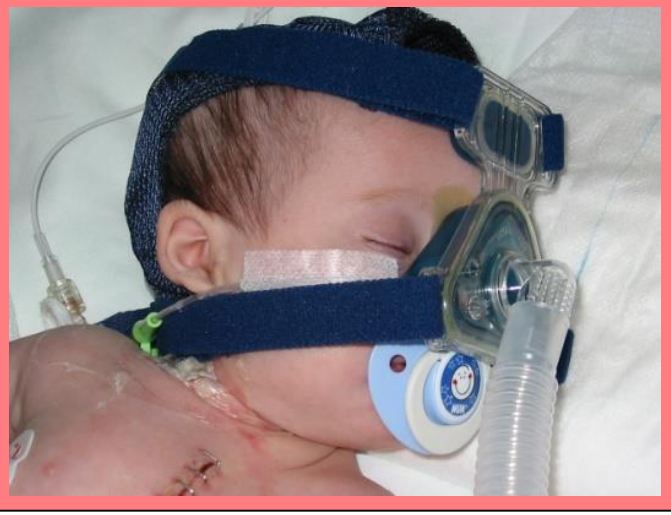
Les nouveaux!

CPAP / NIPPV



2 levels P

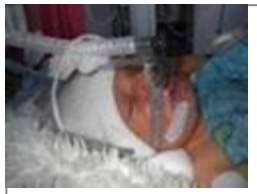


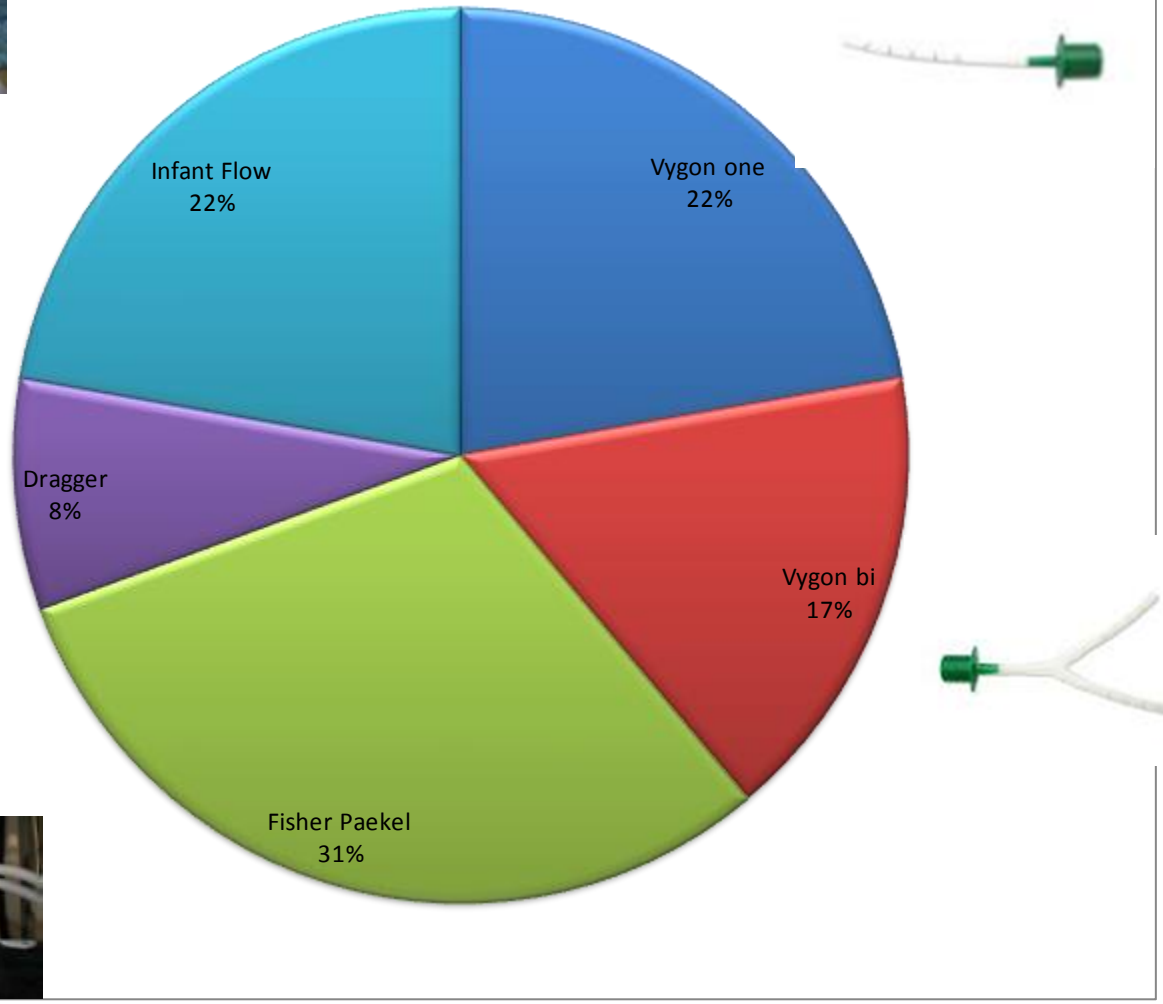


France: Interface

N.Lodé

Les
« chouchous »

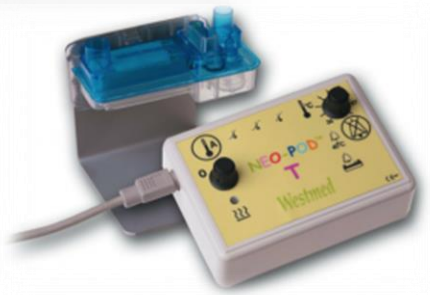




Bench marking

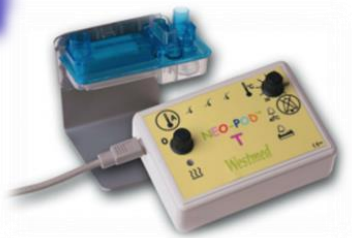
	Humid-Vent Mini HME	Fisher Paykel MR850 Humidifier	Westmed Neo-pod T Humidifier
Weight (excluding circuit)	4 grams	2,800 grams	200 grams
Power Supply	N/A	AC	DC or AC
Temperature and humidity (manufacturer's data)	Hum[illegible]0mg H_2[illegible] a tidal v[illegible] of 20mL	Humidity >33mg H_2O/L Chamber 35.5-42°C Airway 35-40°C	No humidity data in product information. Chamber 30-38°C
Additional circuit dead-space	.4mL	N/A	N/A

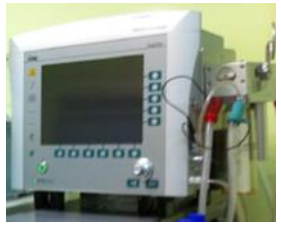
NO if CPAP !

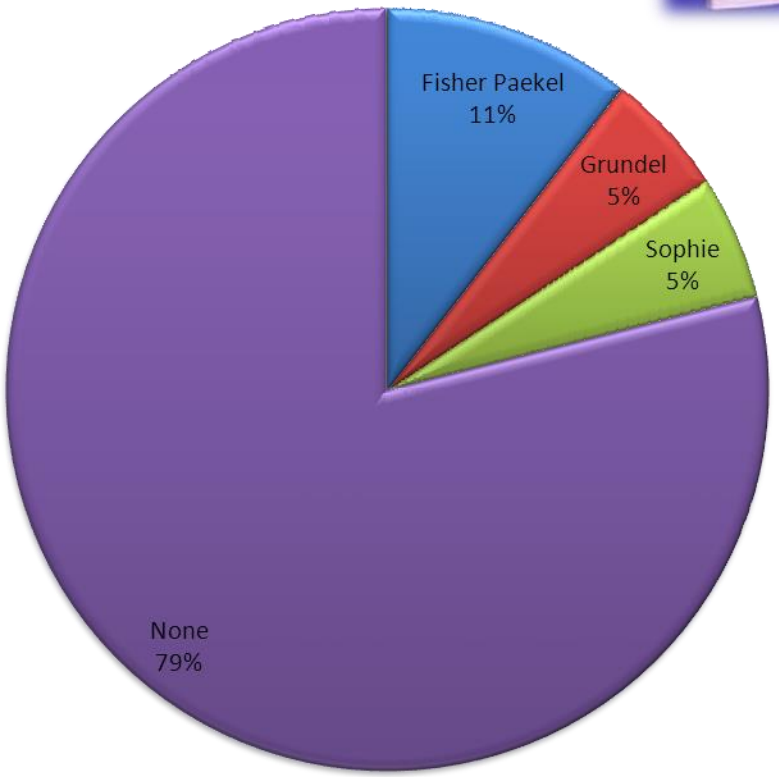


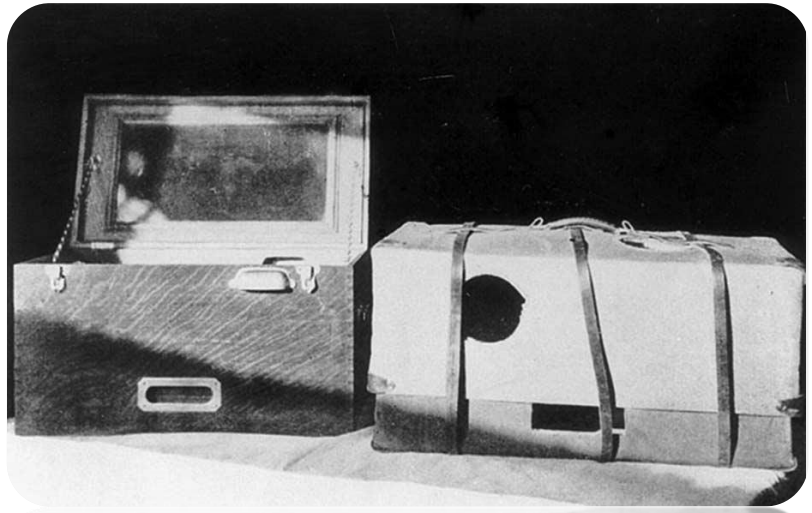
France: Humidificateur

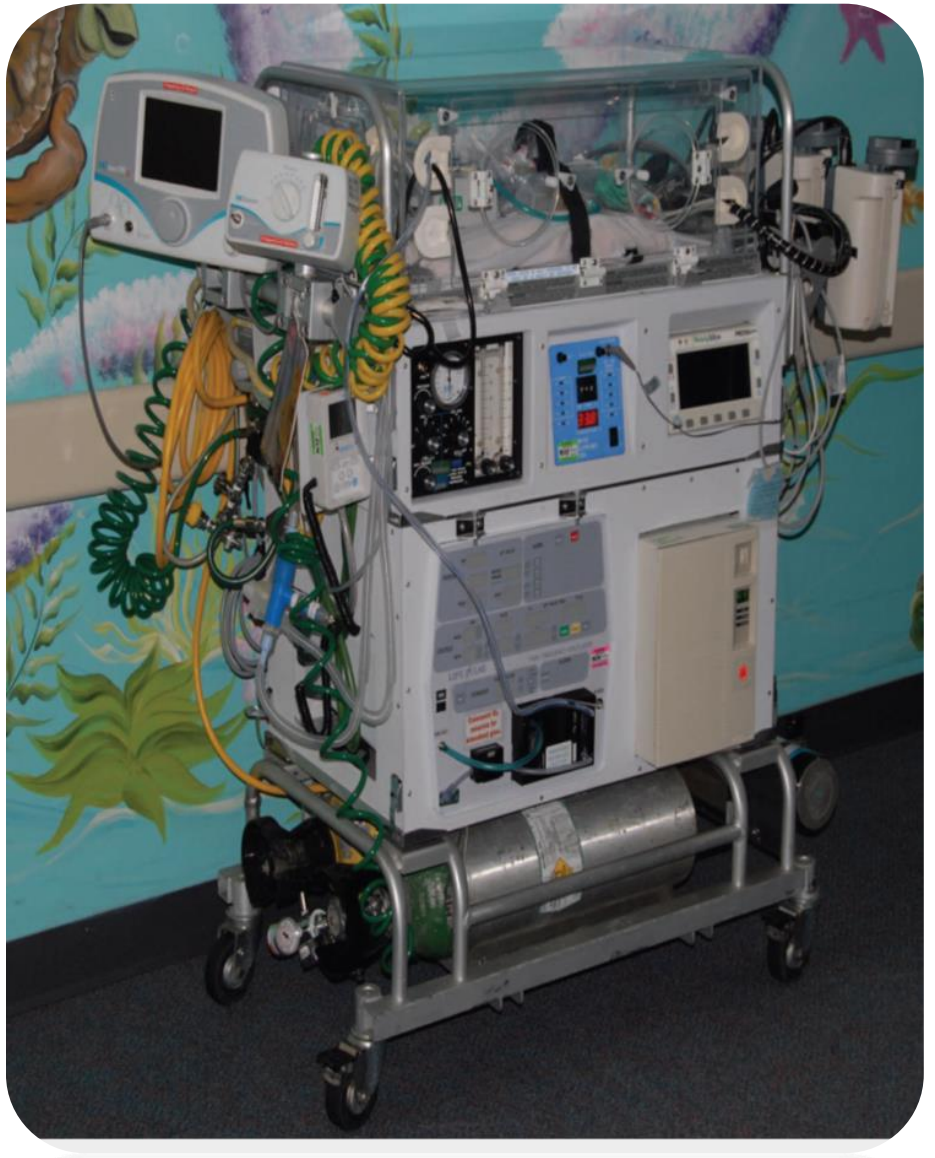
N.Lodé

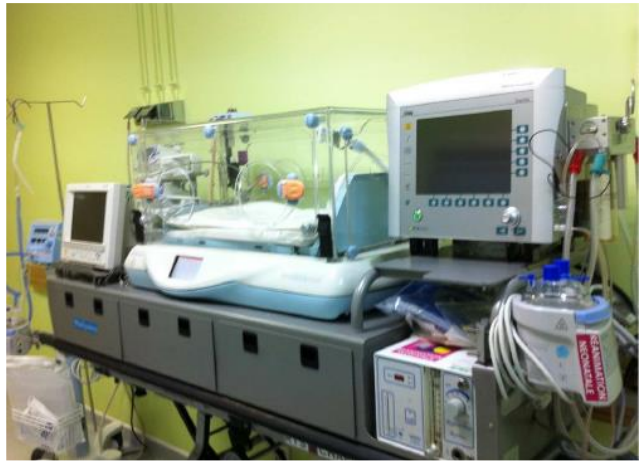












Lilles

Lyon

Montpellier

Robert Debré

Conclusion : ICEMAN

Indication: DR: différentier

-Type 1: O2: difficile, échec, surveillance+++
-Type 2: CO2: moins d'échec.

Algorithme:

-interface: aigue **total face**.
-Ventilateur: en fonction des besoin en O2
-CPAP si type 1.
-AI si Type 2.
-**Parents présents** +++

Surveillance:

-**Confort,** synchronie.
-Efficacité. **FR** et (O2, CO2, WOB)

Bronchiolite:

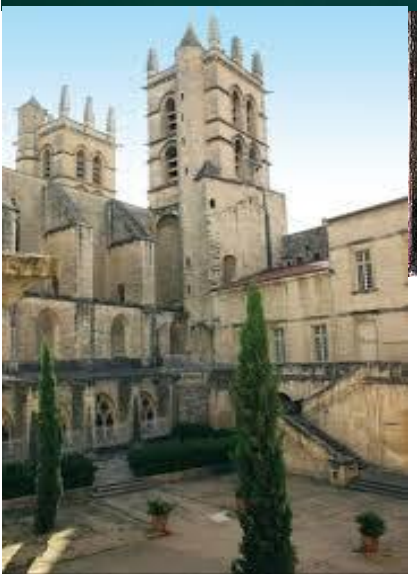
-**CPAP 7 cm H2O**
-Si modérément grave: HFNC possible.









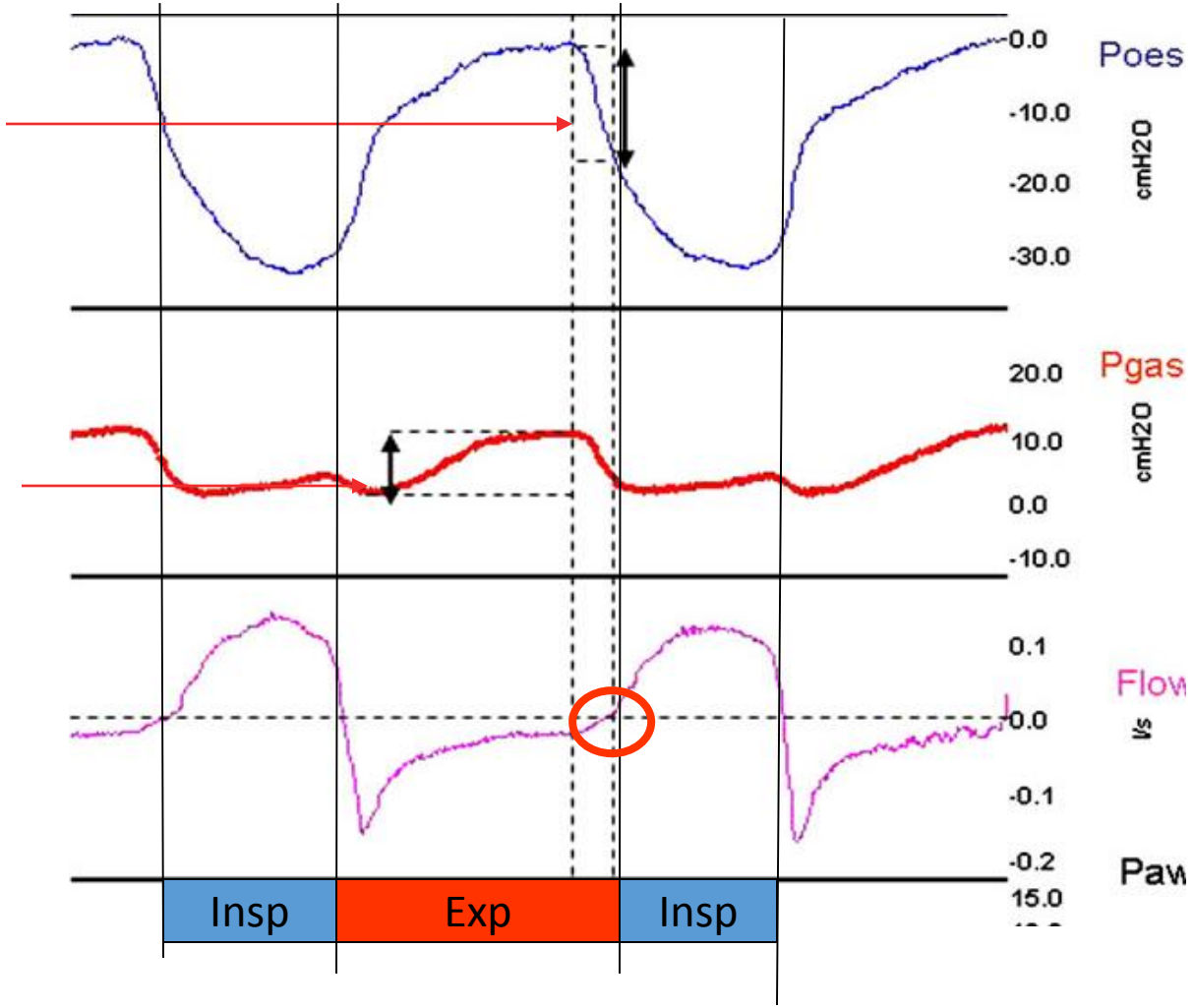




Auto PEEP, expiration active

Auto PEEP

Active expiration



L.Giovannini-Chani ICM 2012

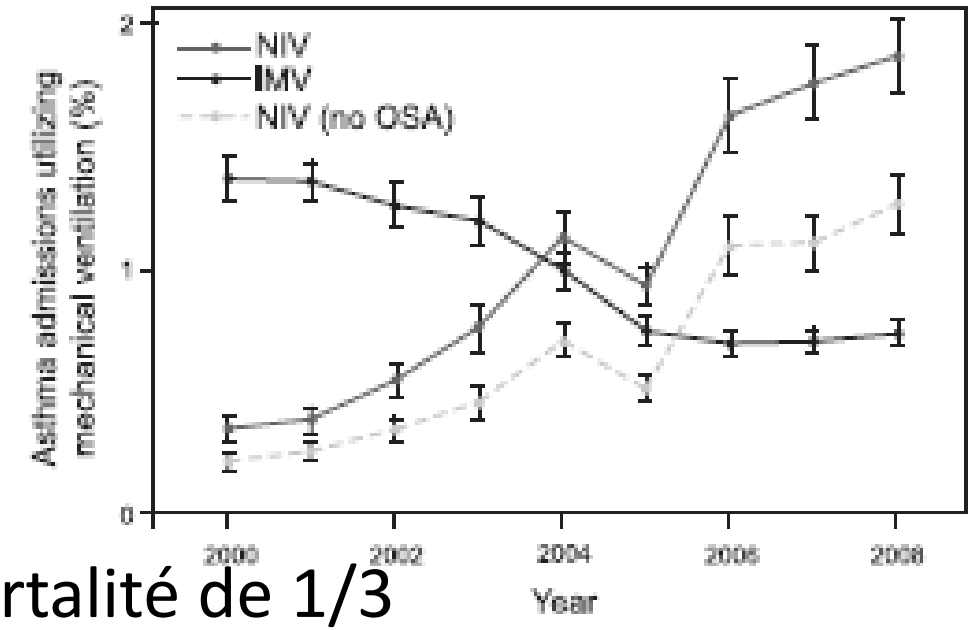
VNI en plein essor?

Utilization of Mechanical Ventilation for Asthma Exacerbations: Analysis of a National Database

Rahul Nanchal MD, Gagan Kumar MD, Tillotama Majumdar MD, Amit Taneja MD, Jayshil Patel MD, Gaurav Dagar MD, Elizabeth R Jacobs, and Jeff Whittle MD

Respir Care 2014;59(5):644–653

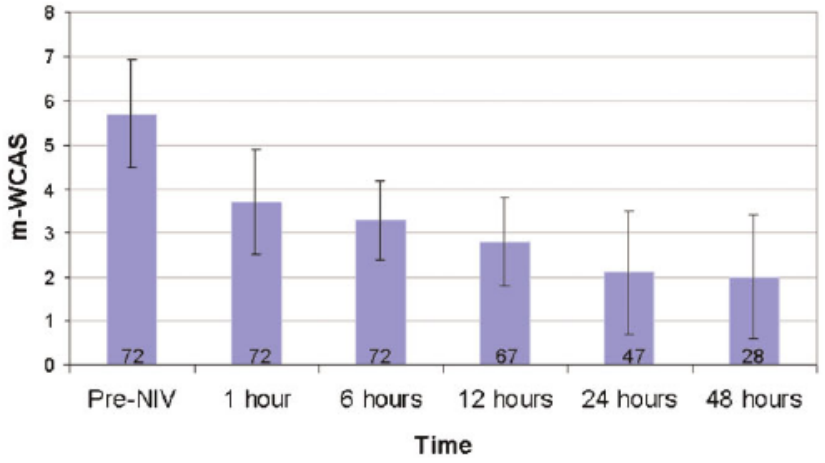
- 8 ans
- Registre administratif
- VNI x5
- Ventilation x2
- Diminution risque de mortalité de 1/3



Non-Invasive Ventilation in Pediatric Status Asthmaticus:
A Prospective Observational Study

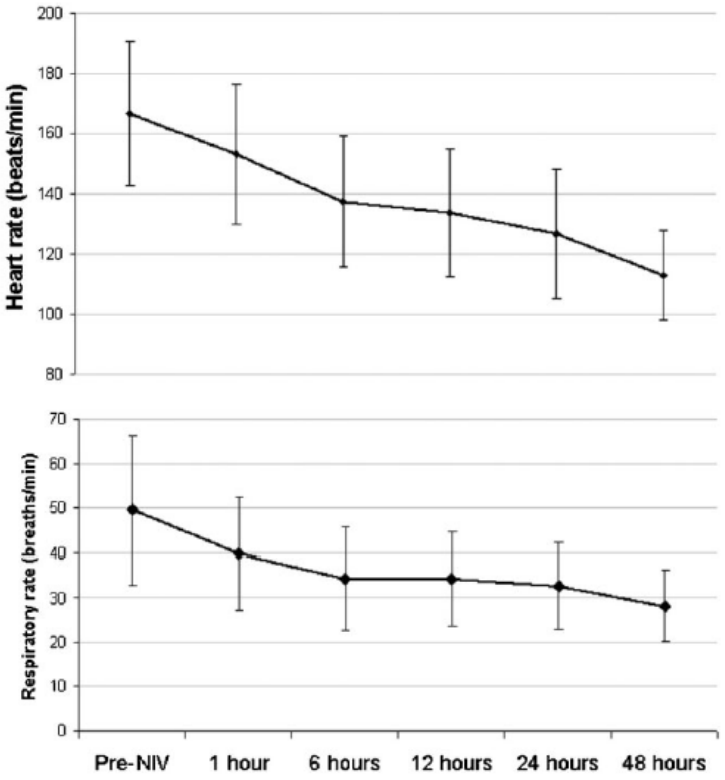
Juan Mayordomo-Colunga, MD,* Alberto Medina, MD, Corsino Rey, MD,
Andrés Concha, MD, Sergio Menéndez, MD, Marta Los Arcos, MD, and Ana Vivanco-Allende, MD

Pediatric Pulmonology 46:949–955 (2011)



72 enfants masque nasal AI (5+7)

5 (7%) echecs (intubé pour détresse respi)



Noninvasive ventilation in status asthmaticus in children: levels of evidence

Rev Bras Ter Intensiva. 2015;27(4):390-396

Table 3 - GRADE system for quality of evidence

Author	High	Moderate	Low	Very low
Basnet et al.[17]	X			
Thill et al.[18]	X			
Needleman et al.[19]		X		
Williams, et al.[20]			X	
Beers et al.[21]			X	
Mayordomo-Colunga et al.[4]			X	
Carroll et al.[10]				X
Akingbola et al.[22]				X
Haggenmacher et al.[23]				X

CONCLUSION

The results suggest that noninvasive ventilation is applicable for the treatment of status asthmaticus in most pediatric patients unresponsive to standard treatment. However, the available evidence cannot be considered as conclusive, as further high-quality research is likely to have impacts on and change the estimates of effects.

Basnet et al.[17]	RCT, prospective, non-blinded	20 patients; PICU; 1 - 18 years old - SA, from January 2009 to January 2010; CAS 3 to 8 after initial pharmacological treatment. Excluded patients without UA protective reflexes or respiratory drive, lesions in or procedures involving the face. No demographic differences between the groups at baseline.	10 patients randomized to receive NIV + standard treatment (GNIV) and 10 patients standard treatment only (Gstandard); BIPAP through nasal or full-face mask, 8 X 5 for VT 6 to 9 mL/kg; bronchodilator through the circuit as needed; evaluation at 2, 4 - 8, 12 - 16 and 24 hours after onset of intervention by respiratory therapist (not involved in the study) → CAS, RR, HR, need for oxygen and associated treatments.	GNIV: greater improvement on CAS at all time-points of evaluation ($p < 0.1$), greater ↓ RR and oxygen requirement after 2 hours ($p = 0.1$ and $p = 0.3$); children had less need for adjunct therapies (statistically non-significant) and ↓ HR (at 12-16 hours, statistically significant); 9 out the 10 children tolerated NIV (in 1 NIV was discontinued due to persistent cough); all the children attained VT 6 to 9mL/kg with 8 X 5 except for 1 - required full-face mask. Length of stay at PICU similar in both groups.	Early initiation of NIV along with short acting bronchodilators and systemic steroids can be safe, well tolerated and effective in the management of children with SA.
Thill et al.[18]	Prospective, crossover randomized	20 children aged 2 months to 14 years old, admitted to PICU along 6 months, with lower airway obstruction and CAS > 3 - < 8; children with tracheostomy, absent airway protection reflexes, abnormalities in or procedures involving the face were excluded; no significant differences between the groups at baseline; no patient with severe hypercapnia.	Patients randomized to receive either 2 hours of NIV followed by crossover to 2 hours of standard treatment alone (G1) or vice-versa (G2). BIPAP through nasal mask, spontaneous mode, backup RR 10, initial parameters 10 X 5, bronchodilator through circuit as per need. Patients independently assessed by principal investigator and respiratory therapist 2 and 4 hours after onset of treatment by means of CAS.	4 patients did not complete the study: 3 OTIs (1 from G1 and 2 from G2); NIV discontinued in 1 patient due to discomfort; no deaths or adverse events; no significant difference between the principal investigator's and respiratory therapist's assessments; ↓ RR, CAS while under NIV in both groups; NIV did not change HR in either group; no significant difference in oxygen saturation or transcutaneous CO_2; required FiO_2 + ↓ in the patients under NIV; no child was given sedatives or anxiolytics.	NIV can be an effective treatment for children with acute lower airway obstruction.

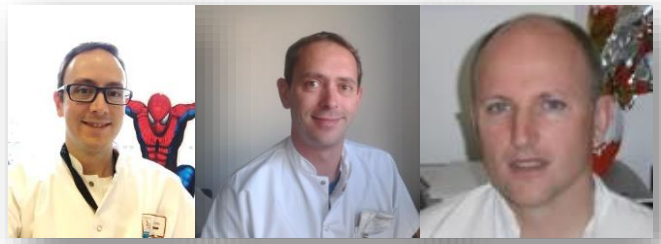
VNI: Sélection de patient

- Tachypnée FR>25/min
- Tachycardie FC>110/min
- Mise en jeu des muscles accessoires
- Hypercapnie PaCO2<60mmHg
- FEV_1<50%
- Diminution de la parole
- Sat <92% malgrés O2 à 10l/min

Soroksky Eur Resp Rev 2010

Baudin *et al. Ann. Intensive Care (2017) 7:55*
DOI 10.1186/s13613-017-0278-1

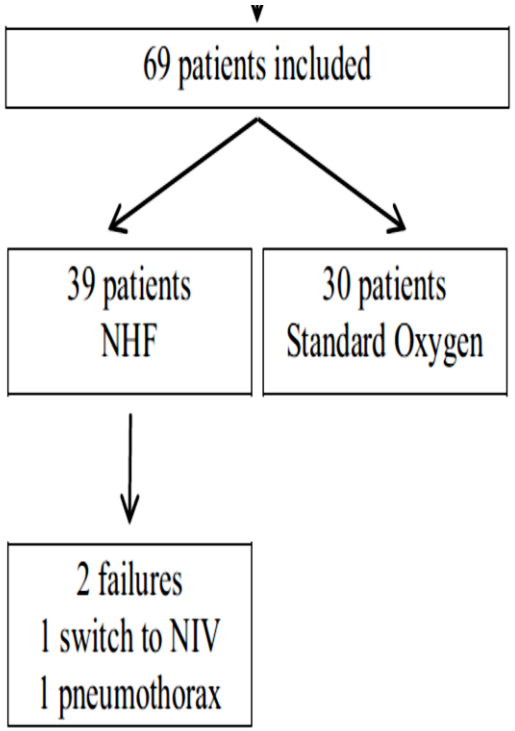
Annals of Intensive Care

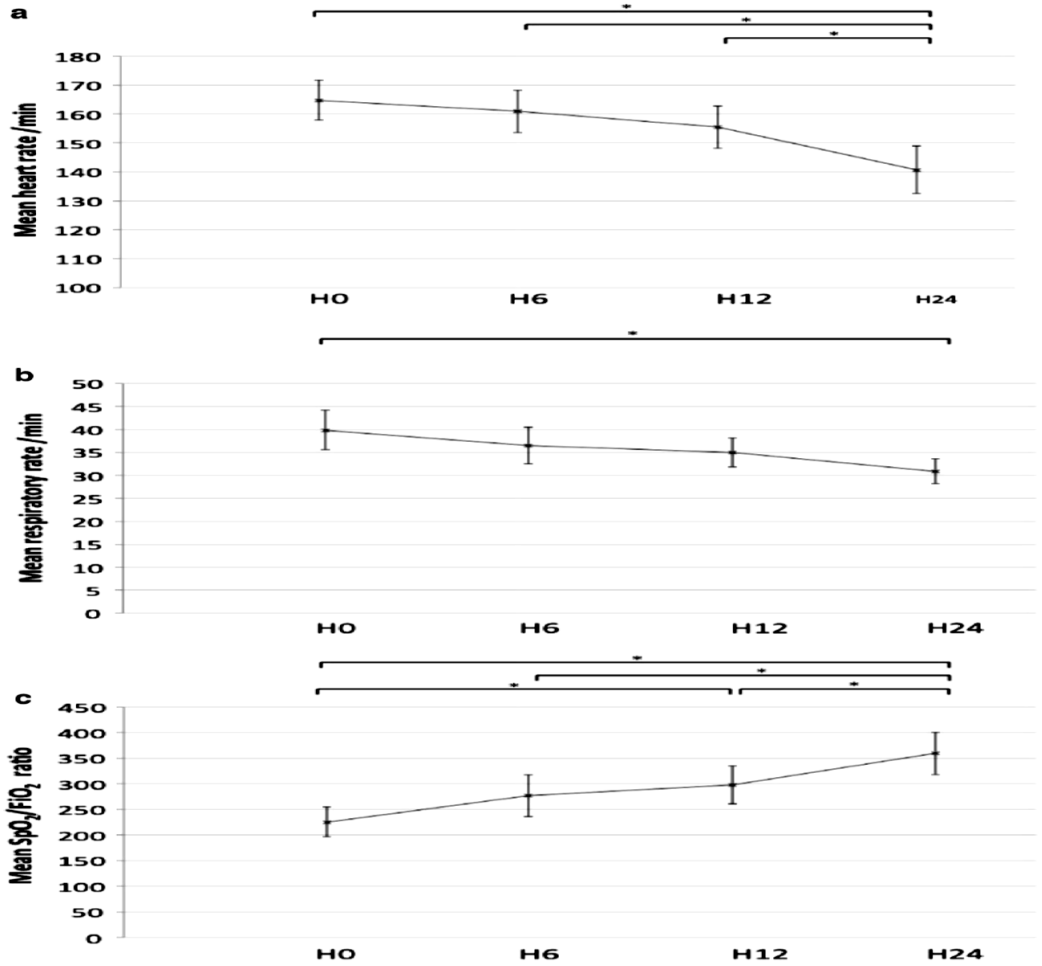


RESEARCH ARTICLE Open Access

Nasal high flow in management of children with status asthmaticus: a retrospective observational study

Florent Baudin[1,2*], Alexandra Buisson[1], Blandine Vanel[1], Bruno Massenavette[1], Robin Pouyau[1] and Etienne Javouhey[1,2]





	n = 39
NHF settings, median [IQR]	
Initial FiO_2 (%)	45 [31–55]
Initial flow (L/kg/min)	0.9 [0.75–1]
Maximum flow (L/kg/min)	1.0 [0.8–1.1]
Length of NHF (h), median [IQR]	28 [21–47]
NHF failure, *n* (%)	2 (6)

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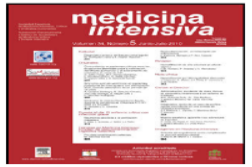
www.elsevier.es/medintensiva



ORIGINAL ARTICLE

High-flow nasal cannula therapy versus non-invasive ventilation in children with severe acute asthma exacerbation: An observational cohort study

J. Pilar[a,*], V. Modesto i Alapont[b], Y.M. Lopez-Fernandez[a], O. Lopez-Macias[a], D. Garcia-Urabayen[a], I. Amores-Hernandez[a]

	HFNC	NIV	*p*-value (HFNC versus NIV)
N	20	22	
Age (years)	2.98 [1.52; 4.42]	3.74 [2.77; 6.47]	0.11
Sex (% men)	12/8 (60)	17/8 (77)	0.80
Weight (kg)	13.1 [10.53; 20]	16 [14.25; 21.5]	0.10
PRISM III	4 [1.75; 6]	3 [0.25, 4]	0.17
Wood-Downes score	8 [7; 9]	8 [7; 9.75]	0.67
Heart rate (bpm)	164 [141; 167]	146 [136; 156]	**0.009**
Respiratory rate (rpm)	48 [37; 57]	42 [33; 50]	0.12
P_{CO2} *(mmHg)*	48 [41; 51.5]	42 [39; 47.75]	0.33
F_{IO2}	0.6 [0.4; 0.83]	0.55 [0.35; 0.8]	0.38
S_{pO2} *(%)*	98 [96,100]	97 [96; 99]	0.44
Time in ED (h)	6.5 [4.75; 10.5]	5 [3; 12]	0.58
HFNC in ED (%)	2 (10)	4 (18.18)	0.66
Outcomes			
Treatment failure (%)	8 (40)	0 (0)	**0.001**
Time on VS (h)*	30.5 (16-57)	24 (16-30)	0.45
LOS in PICU (days)*	2 (1-3)	1 (1-)	0.79