



Mise en place de la VNI chez l'enfant :

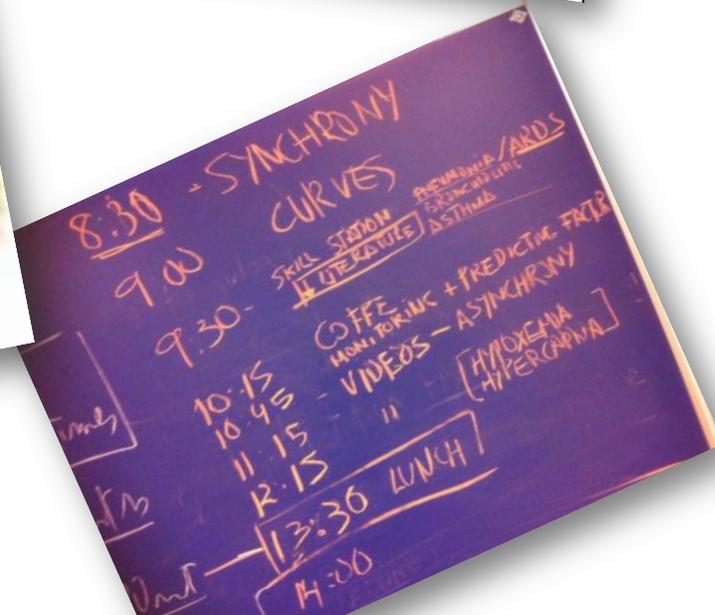
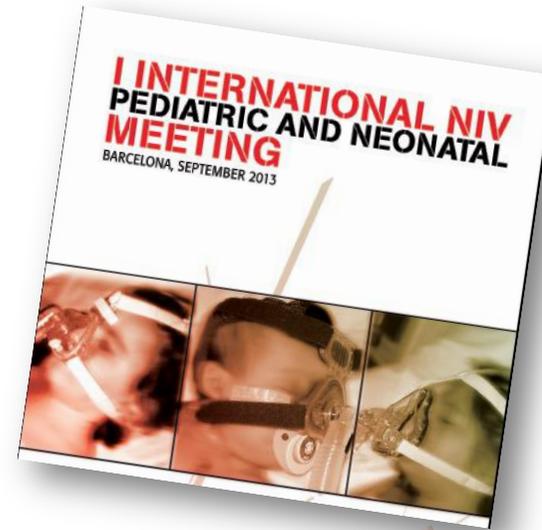
Christophe Milési; J.Baleine; G.Cambonie
Réanimation Pédiatrique MONTPELLIER

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Marti Pons
Alberto Medina



8:30 - SYNCHRONY
 9:00 CURVES
 SKILL STATION
 LITERATURE
 9:30 - COFFE MONITORING + PREDICTIVE FRAP
 10:45 - VIDEOS - ASYNCHRONY
 11:15 " [HYPOXEMIA /ARDS
 12:15 " [HYPERCAPNIA /HYPERCAPNIA]
 13:30 LUNCH
 14:00

Comment? Algorithme! “ICEMAN”

Indication: identification du type de DR

Contre indications (N, A, B, C)

Equipement

Interface (nasale/ faciale), à fuite/sans fuite.

Respirateur et tuyaux en fonction.

Mode

CPAP / AI

Installation pratique

Analyse

Efficacité et tolérance. (fuite, FR, Confort...)

Modif des réglage en fct des observation

Gestion des asynchronie

Gestion de O2 et CO2

Next steps

Arret?

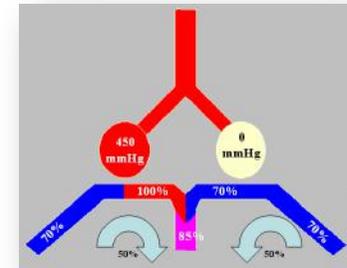
Sevrage



Classification (Teague 2003)

- **TYPE I: Ventilation/Perfusion alteration (shunt)**

- Pneumonie
- Oedeme Pulmonaire
- Traumatisme thoracique
- Mild/initial phase ARDS
- Maladie des membranes hyaline
- Bronchiolite



- **TYPE II: Hypoventilation Alvéolaire**

- Pathologie de la commande ventilatoire
- Obstruction de VA (asthme, bronchiolite...)
- Maladie Neuromusculaire
- Atteinte de la paroi thoracique (scoliose...)
- Obésité morbide

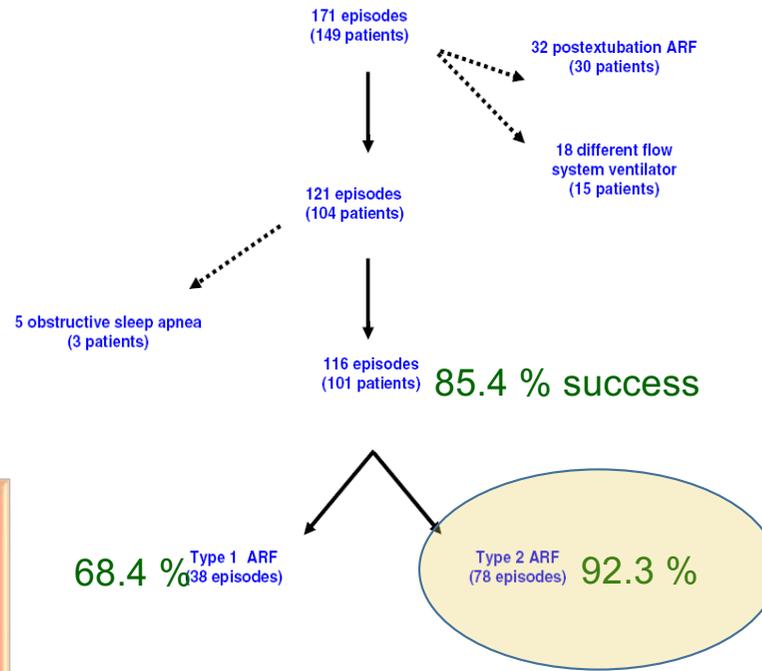


Juan Mayordomo-Columa
Alberto Medina
Corsino Rey
Juan José Díaz
Andrés Concha
María Los Arcos
Sergio Menéndez

Predictive factors of non invasive ventilation failure in critically ill children: a prospective epidemiological study



Quel patient?



Peut etre ...difficile

- Patho hypoxémiante
- ARDS, pneumonie...

Facile

- Travail respi ++
- Hyper CO2
- Myopathie
- Bronchiolites
- SAOS



Contre indications!

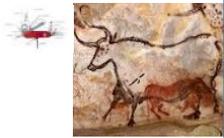


- **Neuro:** Coma (No airways protection)
- **A (airways) No protection**
- **B (breathing)**
 - ARDS (SaO_2/FiO_2) $PaO_2/FiO_2 < 150$.
 - PNO
- **C (cardiac) choc.**
- **Lack of experience**

Le bon matériel... le nerf de la guerre!!



Interfaces



Respi spécifiques VNI

Respi lourd avec soft VNI



Pas de mélangeur
air/O2

Mélangeur air / O2

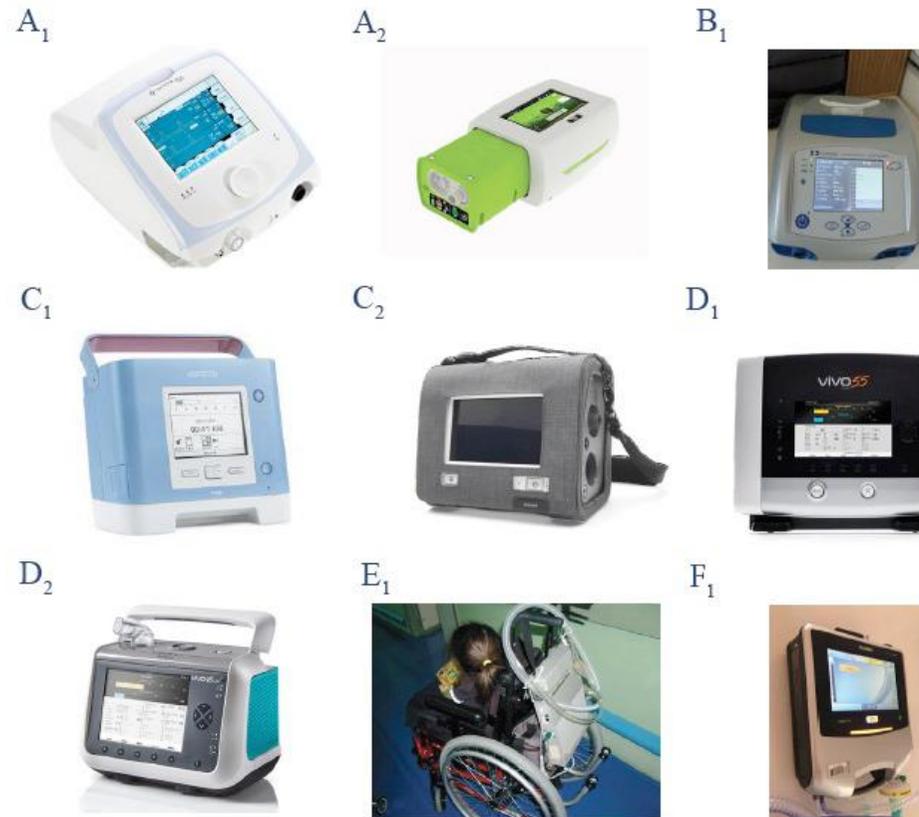


Figure 7. Several models of portable ventilators, to be used with NIV or tracheostomy cannula at hospital or home. They are small, light and easily attachable to the wheelchair. They have internal battery lasting several hours. **A₁** Monnal T50® and **A₂** Eove 150®, by Air Liquide; **B₁** Puritan Bennett 560®, by Covidien; **C₁** Trilogy® and **C₂** Trilogy Evo®, by Philips Respironics; **D₁** Vivo 50® and **D₂** Vivo 45 LS®, by Breas; **E₁** LTV1000®, by Pulmonetic Systems; **F₁** Astral 150®, by ResMed Limited.



CHEST

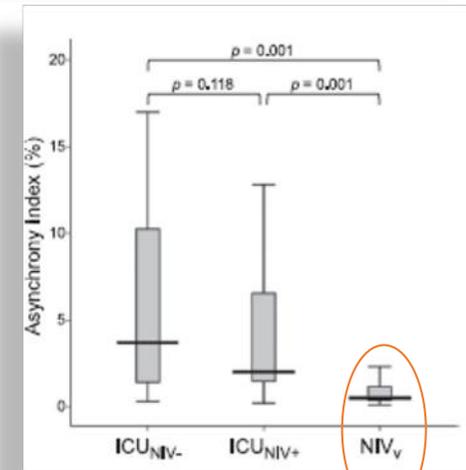
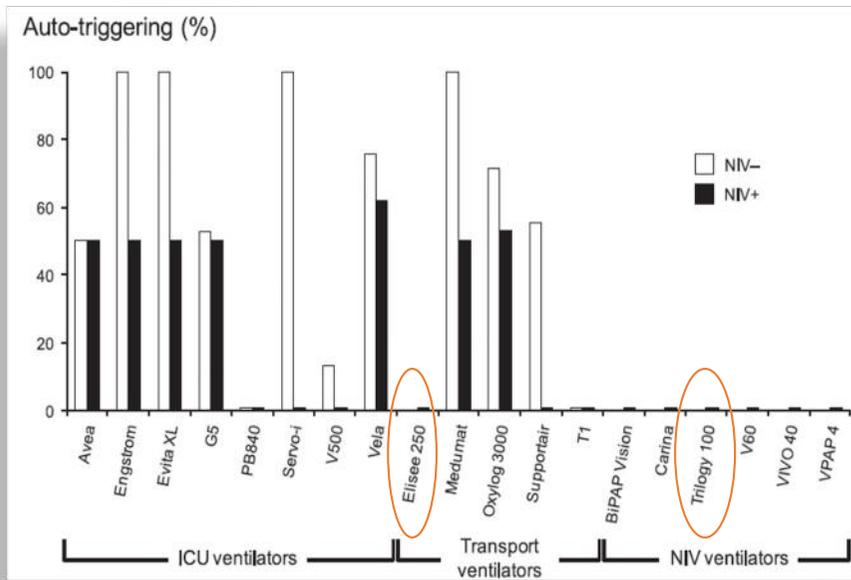
Original Research

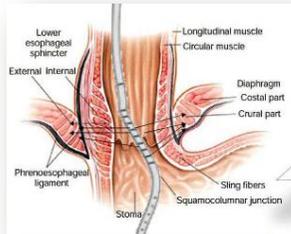
CRITICAL CARE

Patient-Ventilator Asynchrony During Noninvasive Ventilation

A Bench and Clinical Study

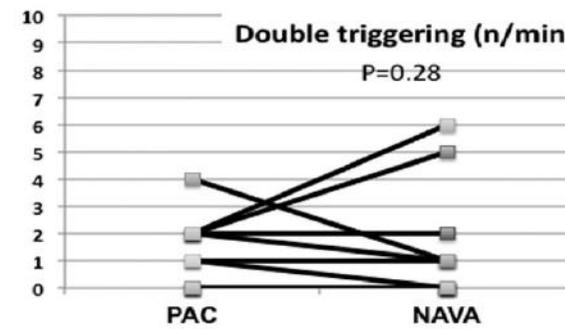
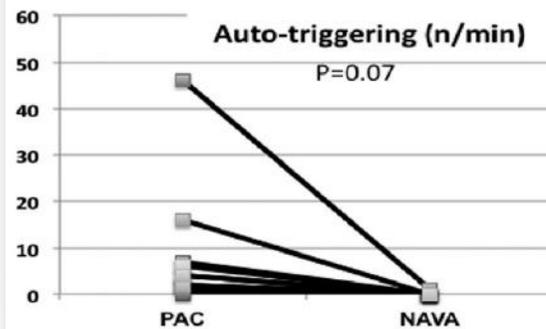
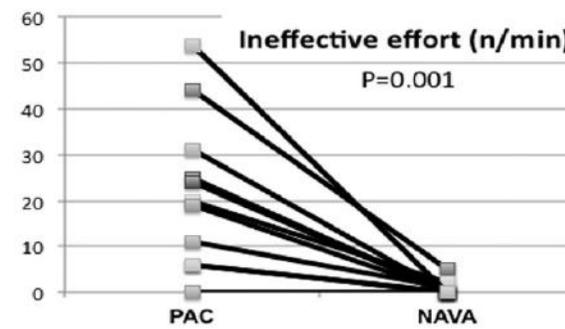
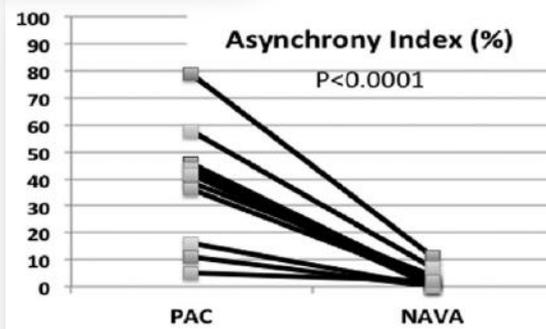
Guillaume Carteaux, MD; Aissam Ljajcic, PhD; Ana Cordoba-Esquivelo, MD; Laurence Vignaux; Philippe Jolliet, MD; Arnaud W. Thille, MD, PhD; Jean-Christophe M. Richard, MD, PhD; and Laurent Brochard, MD





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*}



Algorithme Détresse respiratoire Type I

Interface Oro-nasale sans fuite (masque facial, casque)

Respirateur: Respirateur avec mélangeur;



Réglage initial:

CPAP ePAP: 5 – 10 cm H₂O FiO₂: 50-100%



Absence d'amélioration: PS

iPAP: 7-8cm H₂O (*soit AI +2 au dessus de la PEEP*)

ePAP: 5-6cm H₂O

Pente: douce

Ti max: proche des besoins du pt.

Trigger insp: minimal (sans auto déclenchement)

Trigger exp: 40-80% (fct des fuite et Ti mesuré)

Absence d'amélioration

Δ iPAP: +2 cm H₂O toutes les 5 min en fct du VT

Δ ePAP: +1 (*en fct de FiO₂, eTCO₂ et Compliance dy*)

Δ pente: fct du confort et VT

OBJECTIFS:

1: Confort... puis

iPAP: 10-20 cm H₂O

ePAP: 5-8cm H₂O

VT: 8-10 ml/Kg

Algorithme Détresse respiratoire Type II

Interface Facial ou nasal

Respirateur: Respirateur



Absence d'amélioration: PS

iPAP: 5-7cm H₂O (*soit AI +2 au dessus de la PEEP*)

ePAP: 3-5cm H₂O

Pente: douce

Ti max: proche des besoins du pt.

Trigger insp: minimal (sans auto déclenchement)

Trigger exp: 40-80% (fct des fuite et Ti mesuré)



Absence d'amélioration

Δ iPAP: +2 cm H₂O toutes les 5 min en fct du VT

Δ ePAP: +1 (*en fct de FIO₂, eTCO₂ et Compliance dy*)

Δ pente: fct du confort et VT

OBJECTIFS:

Confort... puis

iPAP: 10-18 cm H₂O

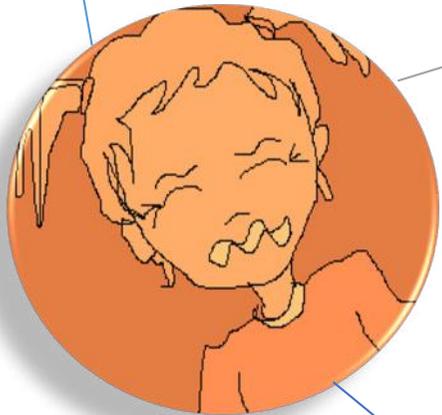
ePAP: 5-7Cm H₂O

VT: 8-10 ml/Kg

Sat: 92-96%



- Titration/ échelle
- Passage IN?
- (Dexdor, Hydroxyzine, MDZ...)



- **Parents / respect rythme.**
- Hypnose
- Toucher-massage
- Musicothérapie



Mise en place



- Dans les bras des **parents!!!!**
- 1 opérateur en face
- 1 opérateur sur le coté (harnais)

- Placer sans attache.
- Allumer... et envoyer les gaz
- Puis serrer attaches (1 doigt entre attache et peau)
- Optimiser les fuites



RESEARCH ARTICLE

Open Access

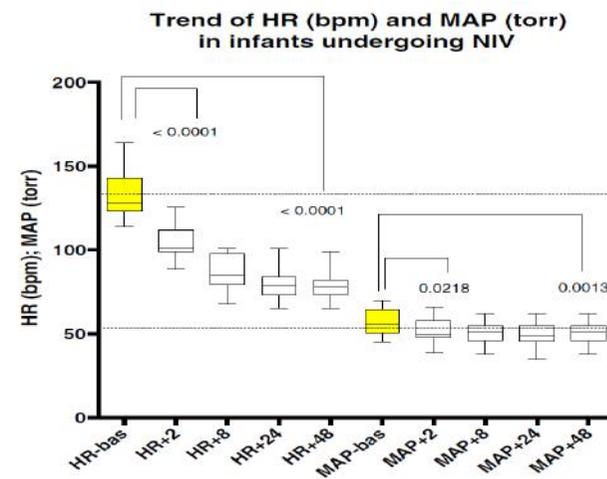
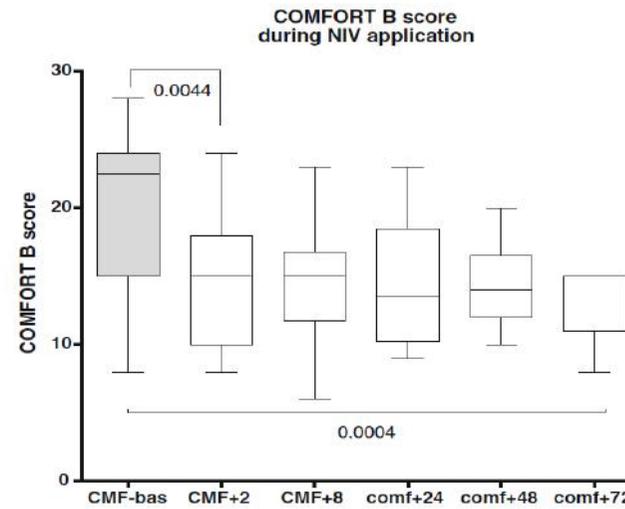
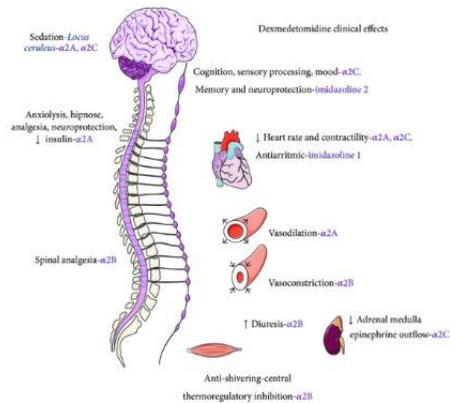
Dexmedetomidine is effective and safe during NIV in infants and young children with acute respiratory failure



M. Piastra¹, A. Pizzi^{1*}, S. Gaddi¹, E. Luca¹, O. Genovese¹, E. Picconi¹, D. De Luca² and G. Conti¹

40 pediatric patient
COMFORT B and RASS
Agonist Alpha 2 adrenergic: inhibition
sympathic tone
Anxiolysis: R in locus coeruleus
Analgesia: R Spinal cort

Poso: 0,5-1,4 microg/kg/h





Sedation Intra-nasale!

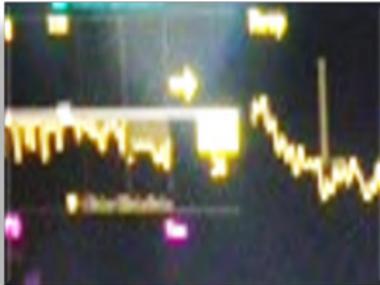
Indication	Médicament	Poso	Délai	EII
Analgésie	Fentanyl (50mcg/ml)	1-2 mcg/kg		Depression respi. Titration/15min
	Ketamine (10mg/ml)	2-4 mg/kg	15 -20min	
Sédation	Dexdetomidine	4mcg/kg	20-30 min	Bradycardie, HypoTA
	Midazolam (5mg/ml)	0,2-0,4mg/kg	15 min	Douleur lie au pH acide
Convulsion	Midazolam (5mg/ml)	0,2mg/kg	15 min	
Intox morphi	Naloxone (0,4mg/ml)	2mg	10 min	



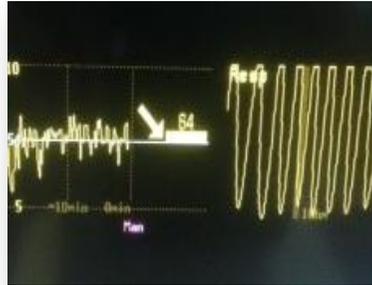
ANALYSE!: Efficacité: RR !!



1



2



3



ANALYSE: Efficacité: WOB... objectivité: Scores... films?

	Upper chest	Lower chest	Xiphoid retraction	Nares dilation	Expiratory grunt
Grade 0					
Grade 1					
Grade 2					

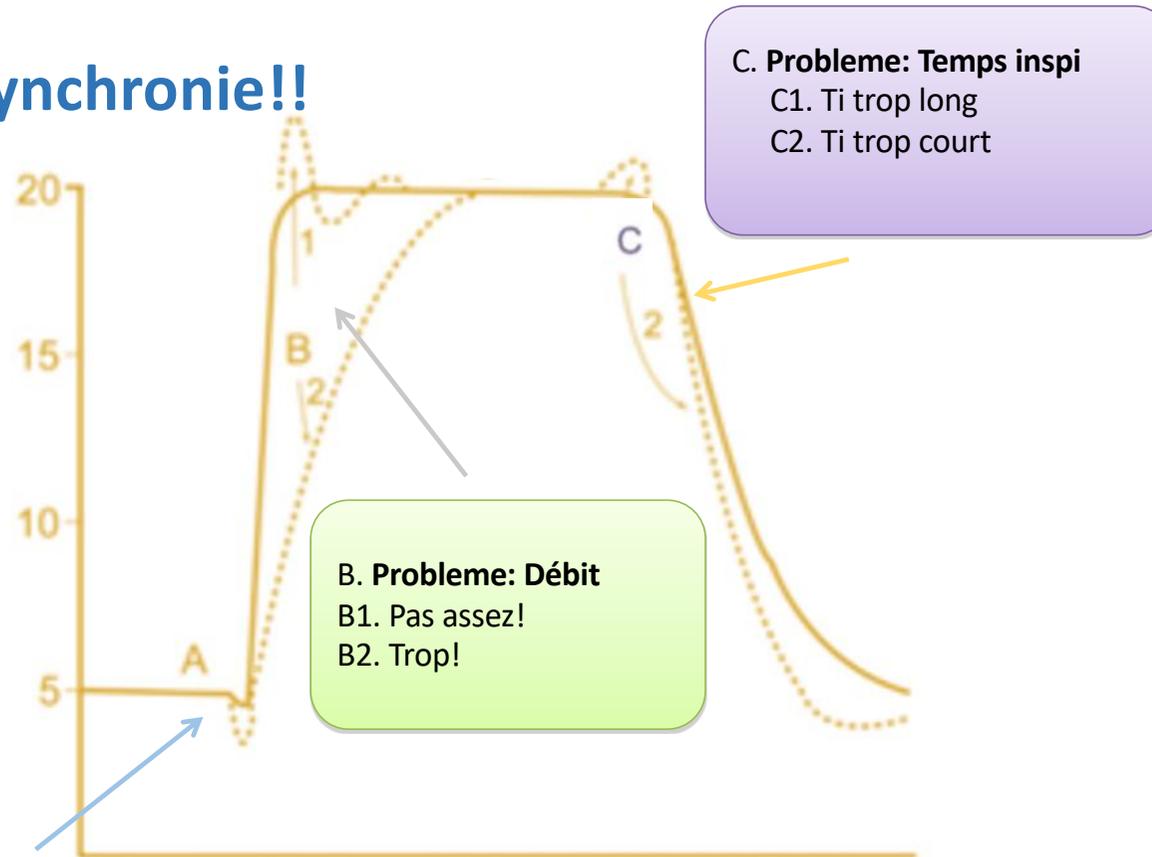
	0	1	2
Pao ₂ (torr) or 70-100 in 21% O ₂		<70 in 21% O ₂	<70 in 40% O ₂
Cyanosis	None	Normal	In 21% O ₂ In 40% O ₂
Inspiratory breath sounds	None	Unequal	Decreased to absent
Accessory muscles used	None	Moderate	Maximal
Expiratory wheezing	None	Moderate	Marked
Cerebral function	Normal	Depressed or anitated	Coma

Table 1. Wieg's clinical severity score. The score assigns a value between 0 and 5 to each variable. Higher scores indicate a worst condition.

Variables	0	1	2	3
Respiratory rate, breaths/min	<30	31-45	46-60	>60
	None	Intermittent expiratory or only with stethoscope	Excrete expiratory or audible on expiration without stethoscope	Inspiration and expiration without stethoscope
	None	Intercostal only	Tachycardiac	Spontaneous with nasal flaring
	Normal			Irritable, lethargic, poor feeding



ANALYSE: Asynchronie!!

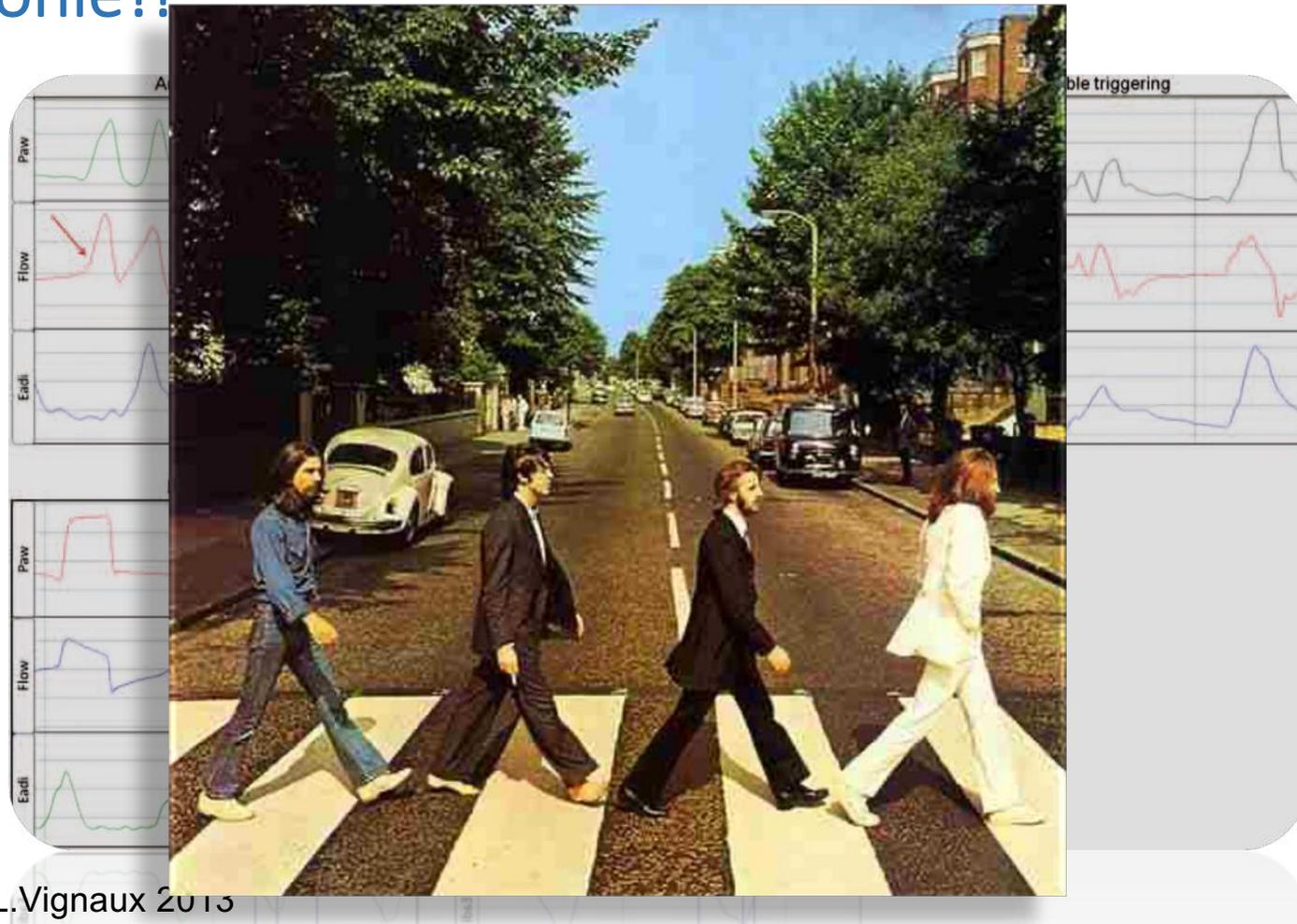


A. Probleme: Trigger inspiratoire
1. Inefficace (fuite, autoPEEP, sensi)
2. Auto-triggering (fuite, eau, sens)

B. Probleme: Débit
B1. Pas assez!
B2. Trop!

C. Probleme: Temps inspi
C1. Ti trop long
C2. Ti trop court

Asynchronie!!



L.Vignaux 2013

Quand arrêter

STOP before it's too late

-Element le plus difficile!!

-**EVALUATION**: Aspect dynamique!





Bronchiolite



History!

The New England Journal of Medicine

Copyright, 1971, by the Massachusetts Medical Society

Volume 284

JUNE 17, 1971

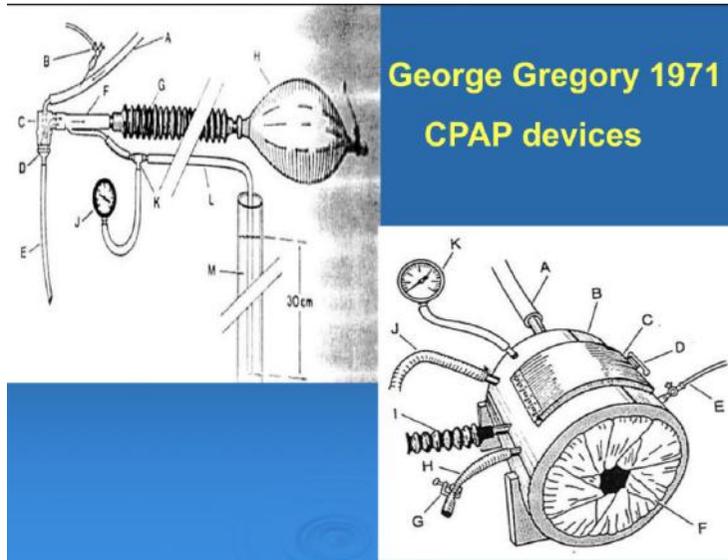
Number 24

TREATMENT OF THE IDIOPATHIC RESPIRATORY-DISTRESS SYNDROME WITH CONTINUOUS POSITIVE AIRWAY PRESSURE*

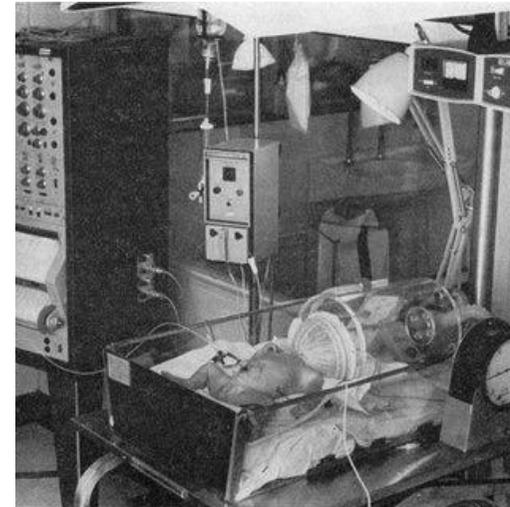
GEORGE A. GREGORY, M.D., JOSEPH A. KITTERMAN, M.D., RODERIC H. PHIBBS, M.D.,
WILLIAM H. TOOLEY, M.D., AND WILLIAM K. HAMILTON, M.D.

Abstract We applied a continuous positive airway pressure to 20 infants (birth weight 930 to 3800 g) severely ill with the idiopathic respiratory-distress syndrome. They breathed spontaneously. Pressure, up to 12 mm of mercury, was delivered through an endotracheal tube to 18 infants and via a pressure chamber around the infant's head to two. Arterial oxygen tension rose in all, permitting us to lower

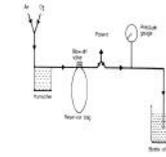
the inspired oxygen an average of 37.5 per cent within 12 hours. Minute ventilation decreased with increased continuous positive airway pressure, but this had little effect on arterial carbon dioxide tension, pH, arterial blood pressure and lung compliance. Sixteen infants survived, including seven of 10 weighing less than 1500 g at birth.



George Gregory 1971
CPAP devices



1981 Pioneer!

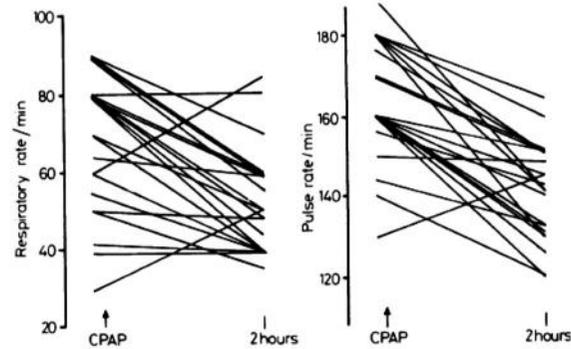
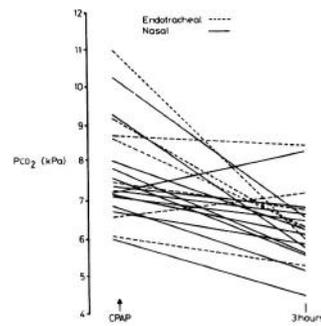


1506

BRITISH MEDICAL JOURNAL VOLUME 283 5 DECEMBER 1981

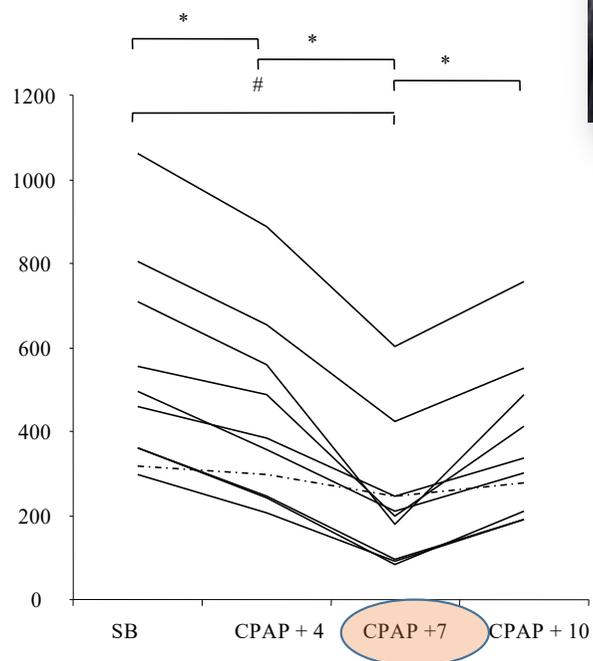
Continuous positive airway pressure in bronchiolitis

JENNIFER M BEASLEY, SUSAN E F JONES



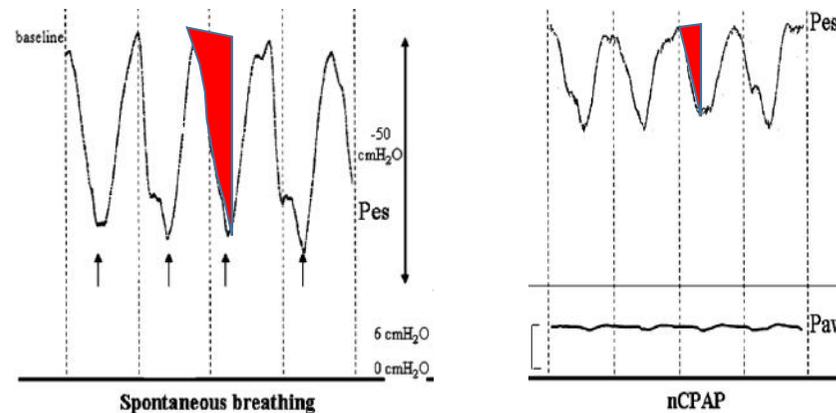
Sandrine Essouri
Philippe Durand
Laurent Chevret
Laurent Balu
Denis Devictor
Brigitte Fauroux
Pierre Tissières

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



Gilles Cambonie
Christophe Milsé
Samir Jabber
Francis Amsalle
Eric Barbotte
Jean-Charles Picaud
Stefan Matecki

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



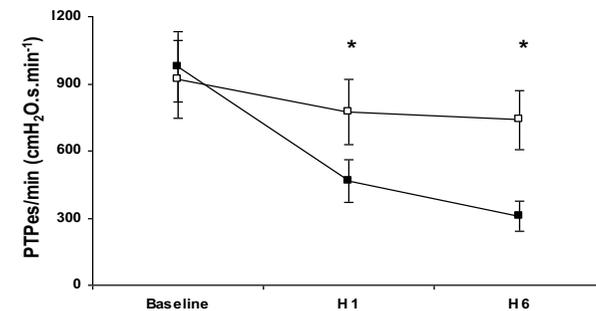
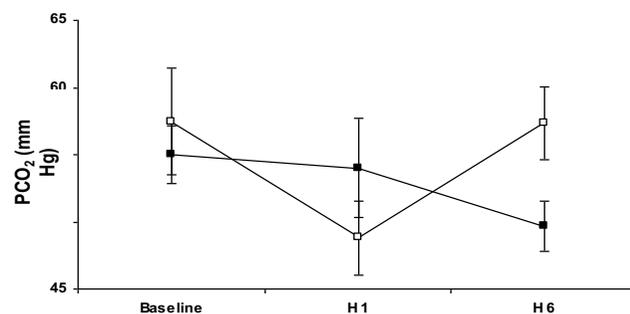
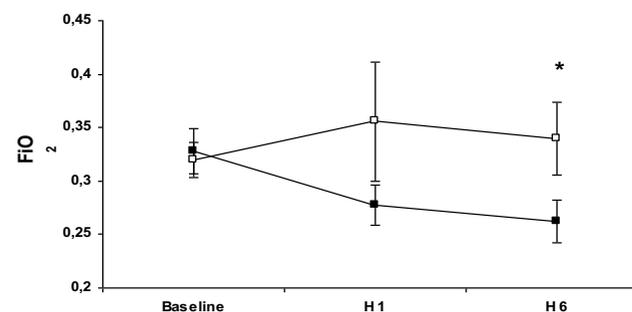
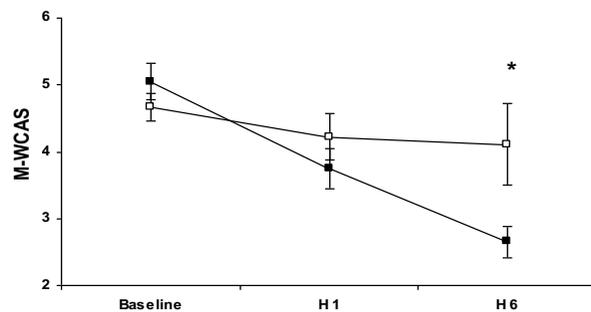


6 cmH₂O Continuous Positive Airway Pressure Versus Conventional Oxygen Therapy in Severe Viral Bronchiolitis: A Randomized Trial

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

	nCPAP, n = 10	Controls, n = 9
Age (week)	6.8 (0.9)	8.2 (1.7)
Weight (kg)	4.5 (0.5)	4.1 (0.2)
CRIB	1.9 (0.2)	2.4 (0.5)
m-WCAS	5 (0.2)	4.7 (0.2)
RR (breaths/min)	51 (4.5)	49 (3.5)
SpO ₂ (%)	97 (1)	95 (1.6)
FiO ₂ (%)	33 (2)	32 (1.6)
HR (beats/min)	165 (3)	162 (4)
MAP (mmHg)	66 (6)	68 (8)
PCO ₂ (torr)	55 (2)	57 (4)
PTPes _{insp} /breath (cmH ₂ O/s)	14.6 (0.9)	14.6 (1)
PTPes _{insp} /min (cmH ₂ O/s/min)	975 (169)	918 (172)



Continuous positive airway pressure (CPAP) for acute bronchiolitis in children (Review)



Cochrane Database of Systematic Reviews

Jat KR, Mathew JL

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Milési 2013	?	?	?	?	?	?	?
Thia 2008	?	?	?	?	?	?	?

Figure 4. Forest plot of comparison: 1 Outcome measures between CPAP group and control group, outcome: 1.1 Proportion of patients requiring mechanical ventilation.

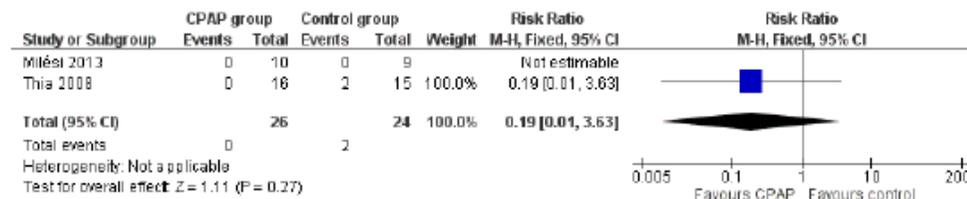
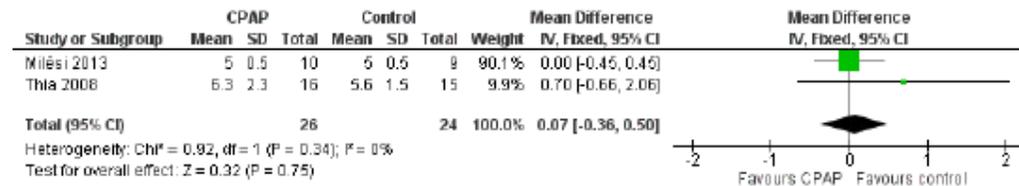


Figure 6. Forest plot of comparison: 2 Secondary outcomes, outcome: 2.4 Duration of hospital stay (days).



Asthme

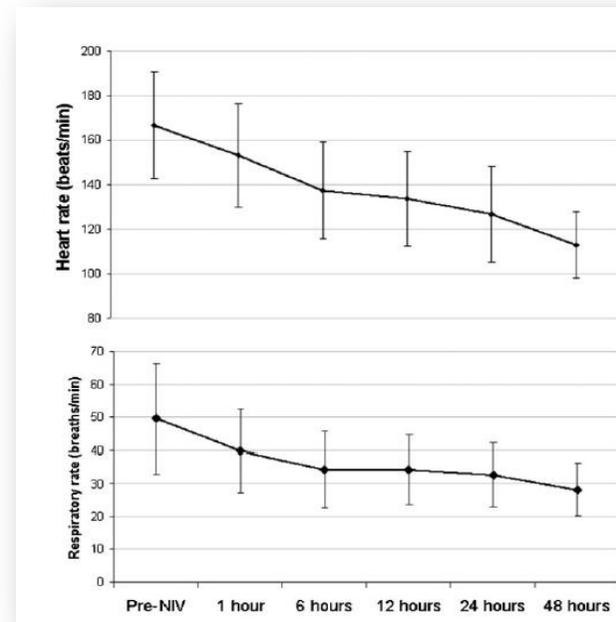
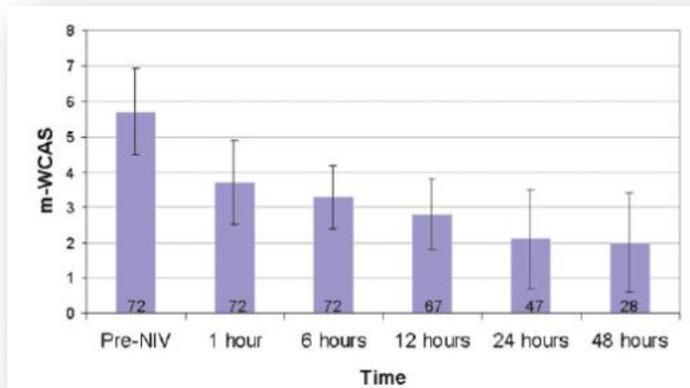




Non-Invasive Ventilation in Pediatric Status Asthmaticus: A Prospective Observational Study

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)

Biblio synthèse



- Adulte



Auteur / année	n	étude	mode	résultats
Méduri 1996	17	Observ prosp	CPAP	CO2 amélioré
Fernandez 2001	33	Observ retros	CPAP +/- AI	CO2 amélioré
Soroksky 2003	30	RCT	Nasal AI 3+8	FEV1
De miranda 2004	42	RCT	Facial CPAP	0
Soma 2008	44	RCT	AI	FEV1
Filho 2009	21	RCT	AI 5+12	FEV1; FR
Gupta 2010	28	RCT	Facial AI 4+8	O2; LOS

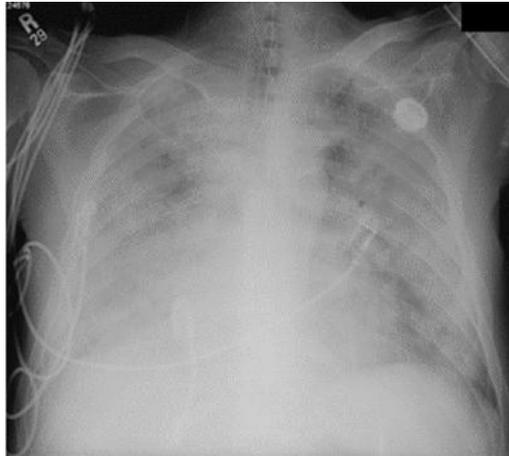
- Pédiatrique

FEV: capacité vitale forcée

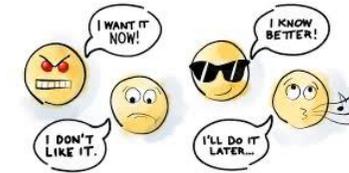


Auteur / année	n	étude	mode	résultats
Thill 2004	20	RCT	Nasal AI 5+10	FR; score de détresse
Carol 2006	5	Observ	AI	FR; score de détresse
Mayordomo 2011	72	Observ	Nasal AI 5+7	FR; score de détresse
Basnet 2012	20	RCT	AI	FR, score de détresse; O2

ARDS



ARDS... Difficult!!!



- ARDS definition (PEEP 5 cm): Possible 1 to 2h!
- Mild (SaFi > 264 ou OSI <7,5): **YES.** Severe (OSI>12): **NO.**
- Moderate (OSI:7,5-12): **???????**
 - Yes if SAFI improved within 2 hours (and > 160).
 - No if bad synchrony and huge WOB (P transD +++ et Vol +++)

Timing	Within 7 days of known clinical insult			
Origin of Edema	Respiratory failure not fully explained by cardiac failure or fluid overload			
Chest Imaging	Chest imaging findings of new infiltrate(s) consistent with acute pulmonary parenchymal disease			
Oxygenation	Non Invasive mechanical ventilation	Invasive mechanical ventilation		
	PARDS (No severity stratification)	Mild	Moderate	Severe
	Full face-mask bi-level ventilation or CPAP ≥ 5 cm H ₂ O ²	4 \leq OI < 8	8 \leq OI < 16	OI ≥ 16
	PF ratio ≤ 300 SF ratio ≤ 264 ¹	5 \leq OSI < 7.5 ¹	7.5 \leq OSI < 12.3 ¹	OSI ≥ 12.3 ¹



Paediatric acute respiratory distress syndrome incidence and epidemiology (PARDIE): an international, observational study



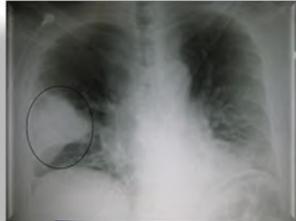
Robinder G Khemani, Lincoln Smith, Yolanda M Lopez-Fernandez, Jeni Kwok, Rica Morzov, Margaret J Klein, Nadir Yehya, Douglas Willson, Martin CJ Kneyber, Jon Lillie, Analia Fernandez, Christopher J L Newth, Philippe Jouvret, Neal J Thomas, on behalf of the Pediatric Acute Respiratory Distress Syndrome Incidence and Epidemiology (PARDIE) Investigators* and the Pediatric Acute Lung Injury and Sepsis Investigators (PALISI) Network

OSI: FiO₂ X Pmoy / Sat
SaFi: Sat / FiO₂

- Mild and moderate: mortality 10-15%
- Severe mortality 33%
- NIV: Intubation rate /2

BUT

If failure (mild and moderate) (50%) : Mortality 25%



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

Mohammad J Chisti, Mohammed A Salam, Jonathan H Smith, Tahmeed Ahmed, Mark A C Pietroni, KM 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



	Total (n=225)	Bubble CPAP therapy (n=79)	Low-flow oxygen therapy (n=67)	High-flow oxygen therapy (n=79)
Total treatment failure*	31 (14%)	5 (6%)	16 (24%)	10 (13%)
Intubation or mechanical ventilation	26 (12%)	5 (6%)	11 (16%)	10 (13%)
Deaths	23 (10%)	3 (4%)	10 (15%)	10 (13%)

HFNC: 2l/min/kg

Age: 7(3,8-13) months

Conclusion

Take Home message

- Easy to start... follow the algorithm.... Learn when to stop!!
- **Bronchiolitis**
 - Severe: (mWCAS>4) probably... **CPAP 7 cm H2O**
 - Moderate (mWCAS<4) probably **HFNC 2l/kg/min**
 - Mild (mWCAS <3) probably ... **O2 low flow.**
- **Asthma:**
 - Severe: Probably CPAP, if exhausted NIV
 - Moderate: Maybe HFNC... decrease the flow if nebulization
- **ARDS**
 - **Mild:** Yes,
 - **Severe:** **NO**
 - **Moderate:**... Maybe... but if no improvement after 2hours: Intubate!



**Lieu: Maison de la Réanimation 48 Av
Vellefaux ; 75000 Paris**

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Dr Robin Pouyau :
robin.pouyau@chu-lyon.fr

Inscriptions et règlement sur le site du GFRUP :

<https://gfrup.sfpediatrie.com/congres-et-formations/formations-du-gfrup/agenda-du-gfrup>

Inscription **avant le 1 octobre 2020**
Nombre de participants limité à 30

Frais d'inscription :

Infirmières membres du GFRUP :	25 €
Infirmières / kiné non-membres du GFRUP :	50 €
Institutions Paramédicaux :	150 €
Médecins membres Jeunes du GFRUP :	50 €
Internes non-membres du GFRUP :	100 €
Médecins membres du GFRUP :	150 €
Médecins non-membres du GFRUP :	250 €
Institutions Médecins :	250 €

Apprentissage par e-learning 1 mois avant la journée.

Apprentissage par atelier le 22 octobre 2021.

- ↓ J. Guichoux (Bordeaux)
- ↓ R. Pouyau (Lyon)
- ↓ N. Joram (Nantes)
- ↓ C. Genier (Nantes)
- ↓ C. Milesi (Montpellier)
- ↓ M. Pons (Barcelone)

Objectifs Pédagogiques:

- Mettre en route une ventilation non invasive chez un enfant en situation aigüe.
- Adapter les paramètres de ventilation et le matériel en fonction du monitoring de l'efficacité et de la tolérance.



**Groupe Francophone de Réanimation
et d'Urgences Pédiatriques (GFRUP)**



**Ventilation Non Invasive
Population Pédiatrique
Mise en place en urgence**



(Enfant prématuré exclu)

**Vendredi 22 octobre 2021
8h30**

Maison de la réanimation SRLF ; Paris

