La VNI au cours de l'AAG : OUI

J. BEN KHELIL
Hôpital A. Mami-Ariana

Congrès ATR Nov 2015

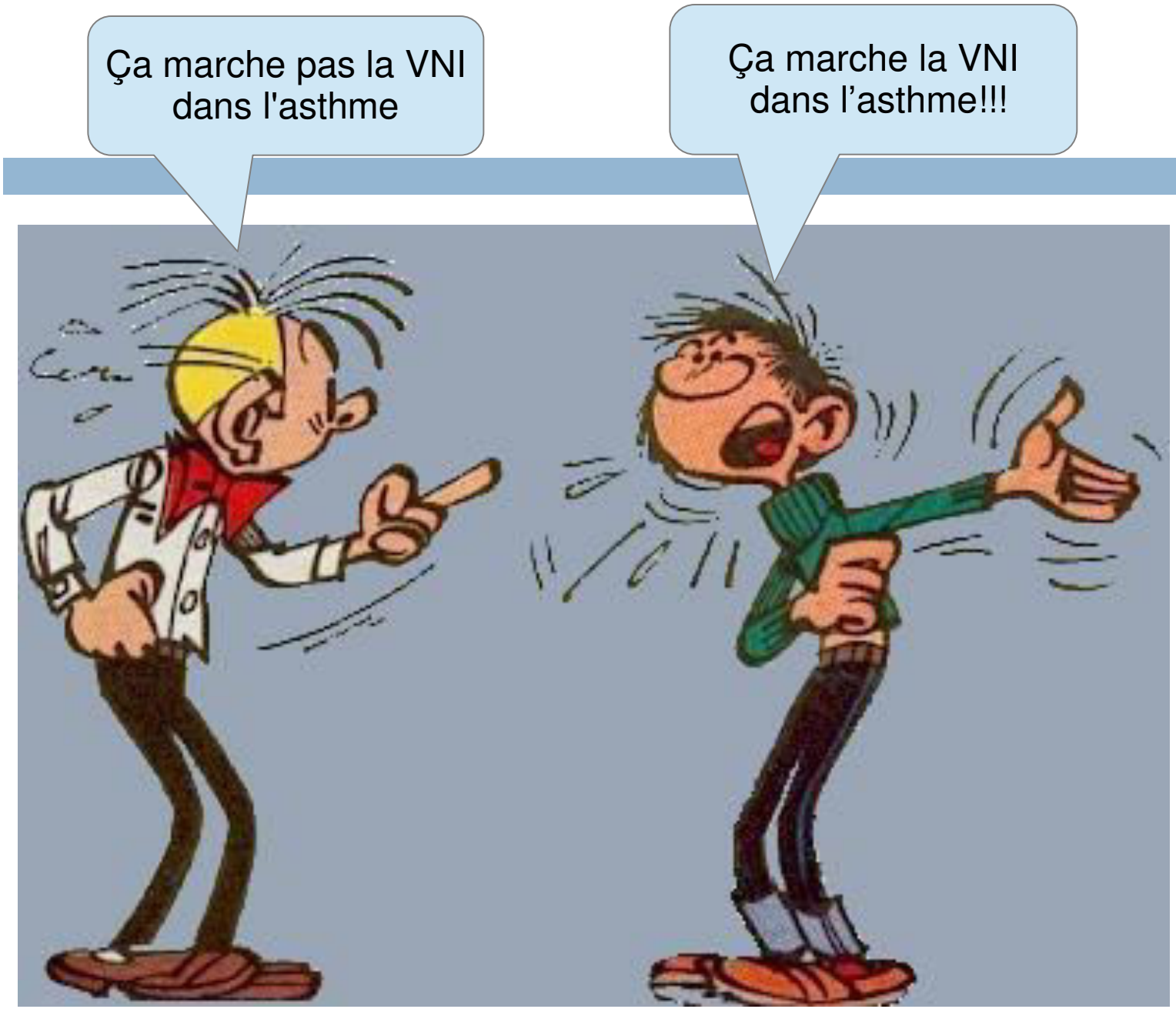
Introduction

- Au cours de l'asthme aigu :
  - 30% de réponses insuffisantes aux β-2-mimétiques
  - Le recours à un support ventilatoire est parfois nécessaire.
  - La ventilation invasive :
    - Est difficile à conduire
    - Nécessite une lourde sédation et
    - Est grevée d'une importante morbidité (barotraumatisme, neuromyopathie, complications hémodynamiques…)

Les différentes indications de la VNI sont résumées dans le tableau 2.

Tableau 2 – Niveaux de reccommandation pour les indications de la VNI

Intérêt certain Il faut faire (G1+)	Décompensation de BPCO OAP cardiogénique
Intérêt non établi de façon certaine Il faut probablement faire (G2+)	IRA hypoxémique de l'immunodéprimé Post-opératoire de chirurgie thoracique et abdominale Stratégie de sevrage de la ventilation invasive chez les BPCO Prévention d'une IRA post extubation Traumatisme thoracique fermé isolé Décompensation de maladies neuromusculaires chroniques et autres IRC restrictives Mucoviscidose décompensée *Forme apnéisante de la bronchiolite aiguë* *Laryngo-trachéomalacie*
Aucun avantage démontré Il ne faut probablement pas faire (G2-)	Pneumopathie hypoxémiante SDRA Traitement de l' IRA post-extubation Maladies neuromusculaires aiguës réversibles
Situations sans cotation possible	Asthme Aigu Grave Syndrome d'obésité-hypoventilation *Bronchiolite aiguë du nourrisson (hors forme apnéisante)*


Ça marche pas la VNI dans l'asthme
Ça marche la VNI dans l'asthme!!!

Mechanical Ventilation for Severe Asthma

CHEST 2015; 147(6):1671-1680

James Leatherman, MD

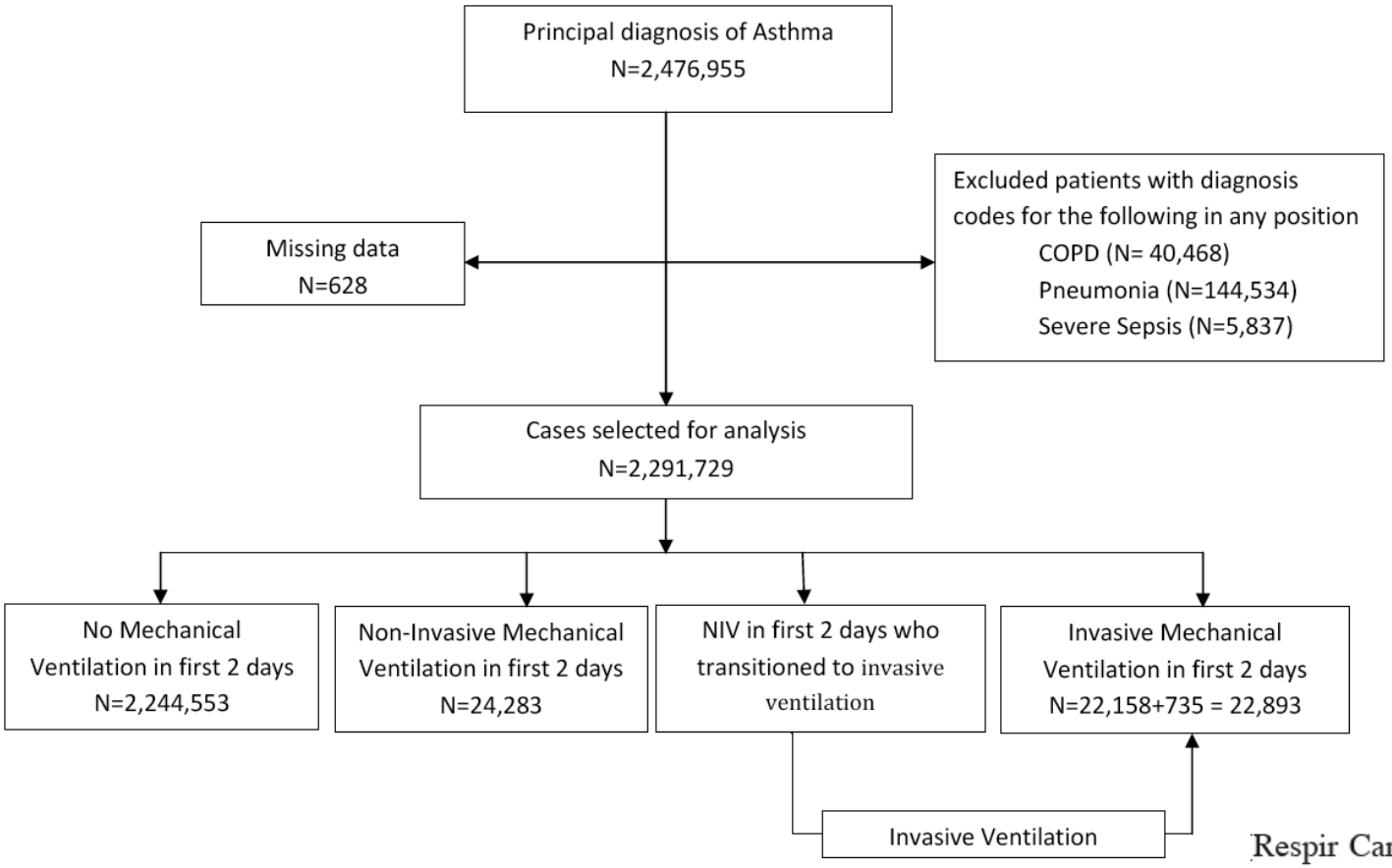
The role of noninvasive ventilation (NIV) in acute severe asthma is not well defined.[6-8] A review of NIV in respiratory failure found only level C evidence to support a role for NIV in asthma and recommended that its use be limited to a minority of patients who are carefully selected and monitored.[8] Nonetheless, a recent analysis of a national database documented increasing use of NIV for life-threatening asthma and a concomitant decrease in use of invasive mechanical ventilation.[9] Five studies have reported on the use of NIV for patients with asthma

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

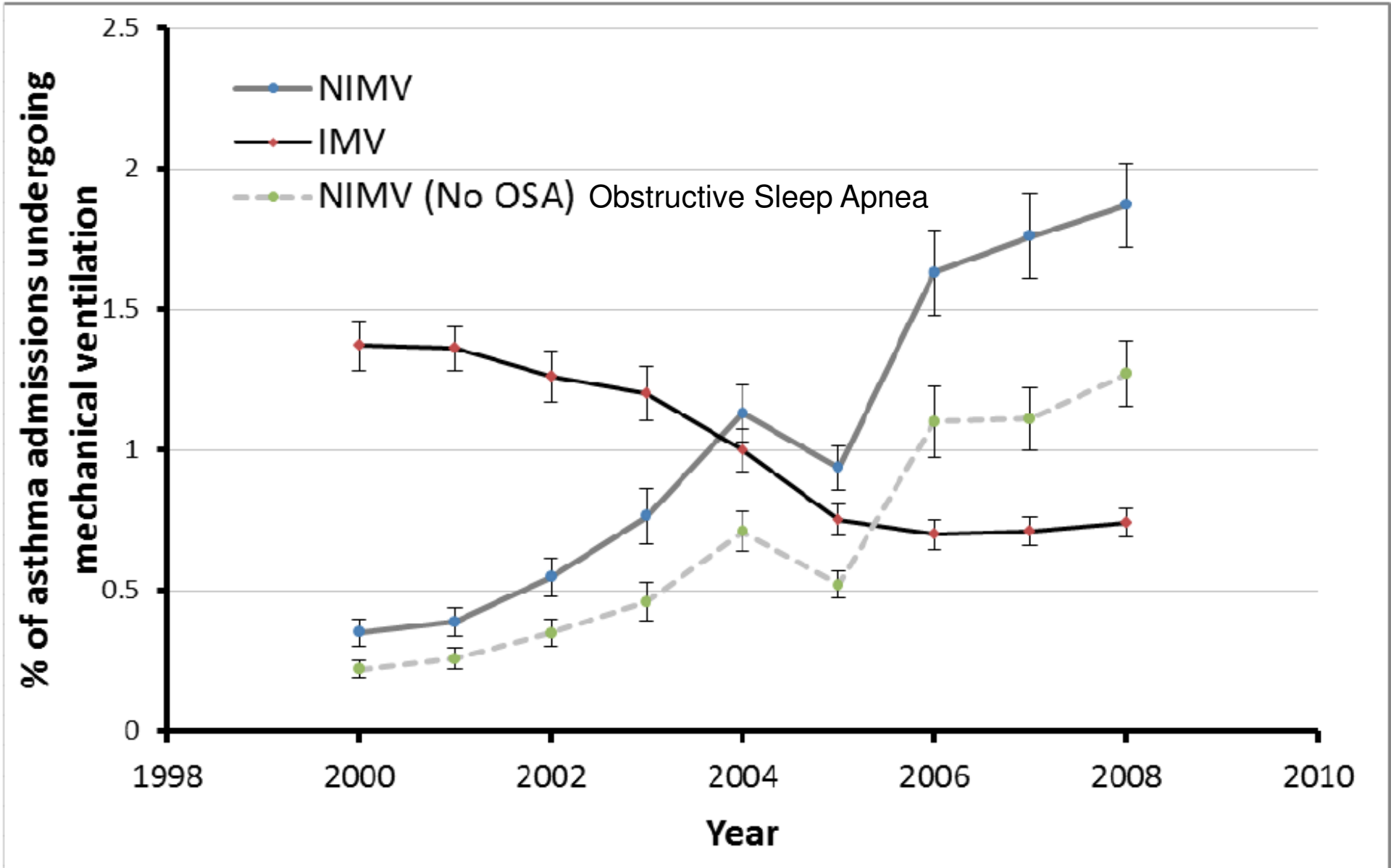
- Décrire les changements dans les habitudes de la VM des AAG (≥18 ans) entre 2000 et 2008

Figure 1: Selection of asthma cases for this study.



Respir Care 2014;59(5):644–653

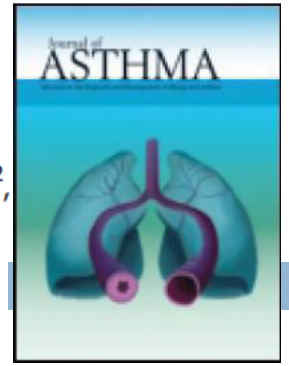
Figure 2. Utilization of invasive and non-invasive mechanical ventilation in asthma (Bars represent standard error)



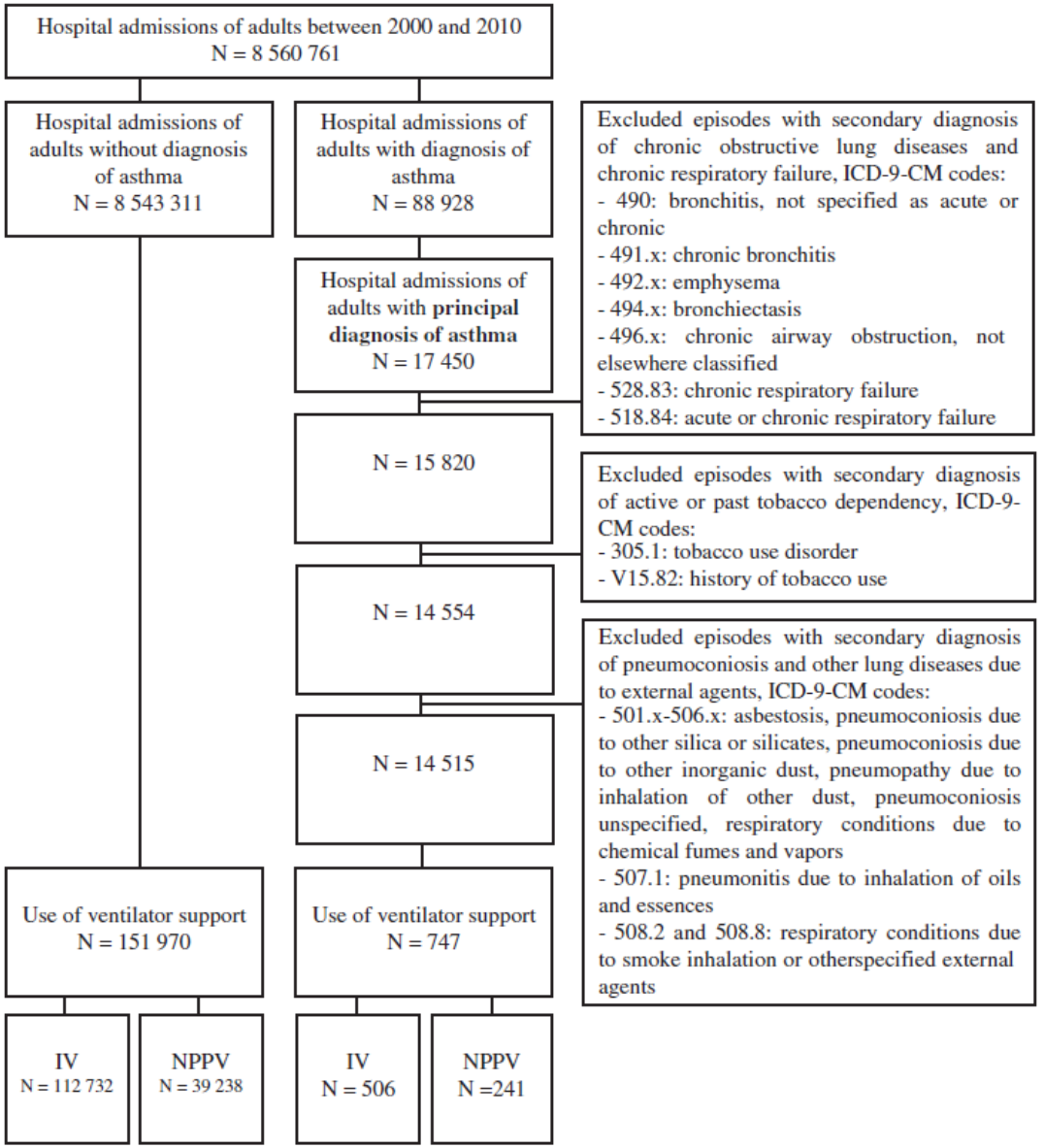
Increasing use of non-invasive ventilation in asthma: a long-term analysis of the Portuguese national hospitalization database

Daniela Alves, MD[1], Alberto S. Freitas, PhD[2], T. Jacinto, MSc[2,3], Manuel S. Vaz, MD[4], Fernando O. Lopes, MD[2], and João A. Fonseca, PhD[2,3]

J Asthma, 2014; 51(10): 1068–1075



- Objectif: décrire l'utilisation de la VM (VNI et VI) chez les adultes hospitalisés pour asthme aigu au Portugal.



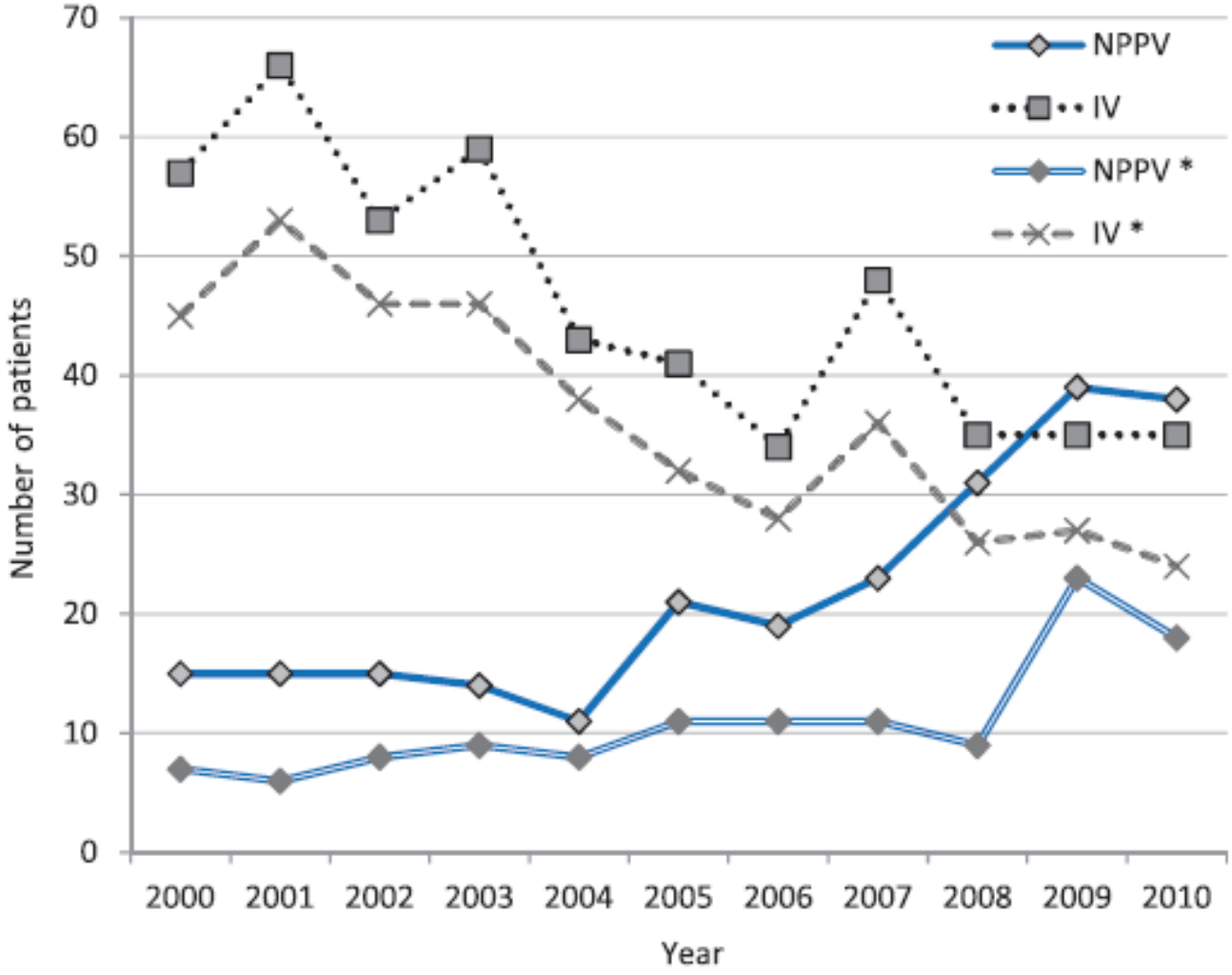


Figure 4. Non-invasive positive pressure ventilation (NPPV) use in adults with principal diagnosis of asthma after exclusion of secondary diagnoses such as obstructive sleep apnea, obesity hypoventilation syndrome, pneumonia and acute cardiogenic pulmonary edema (NPPV*): the increase in NPPV use continues to be observed, mainly after 2008.

Similarités physiopathologiques entre asthme aigu et IRA-BPCO

Obstruction Bronchique
(Inflammation – Hypersécrétion – Bronchospasme)

↑ Raw

Hyperinflation dynamique

Configuration défavorable des muscles respiratoires

PEPi

↑Rappel élastique

Faiblesse muscles respiratoires

Dyspnée

↑Wresp

Fatigue des muscles respiratoires

Acidose respiratoire

↓° V_T

↓ T_I, ↑° FR

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Fatigue des muscles respiratoires

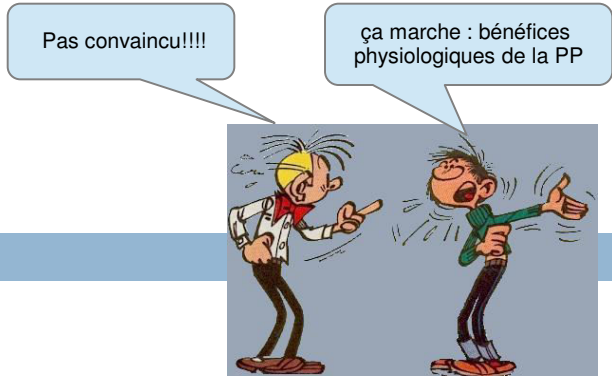
Acidose respiratoire

↓° V_T

↓° T_I, ↑° FR

AI

Propriétés broncho-dilatatrices de la pression positive



Barach AL, Swenson P.
Effect of gases under positive pressure on lumens of small and medium sized bronchi.

- 7 patients en asthme aigu
- CPAP 7 $cmH_2O \Rightarrow \nearrow^{\circ}$:
  - 1 mm du diamètre des bronches de petit calibre
  - 2 mm des bronches de calibre moyen

Arch Intern Med ***63:*** *946-948,* ***1939****.*

Treatment of Acute Bronchospasm With β-Adrenergic Agonist Aerosols Delivered by a Nasal Bilevel Positive Airway Pressure Circuit

ANNALS OF EMERGENCY MEDICINE 26:5 NOVEMBER 1995

Charles V Pollack Jr, MA, MD, FACEP*
Kenneth B Fleisch, MD*
Kat Dowsey, BS, RCP, RRT‡

Crises d'asthme de sévérité faible à modérée

d[illegible] de BiPAP

n = 60

IPAP = 10

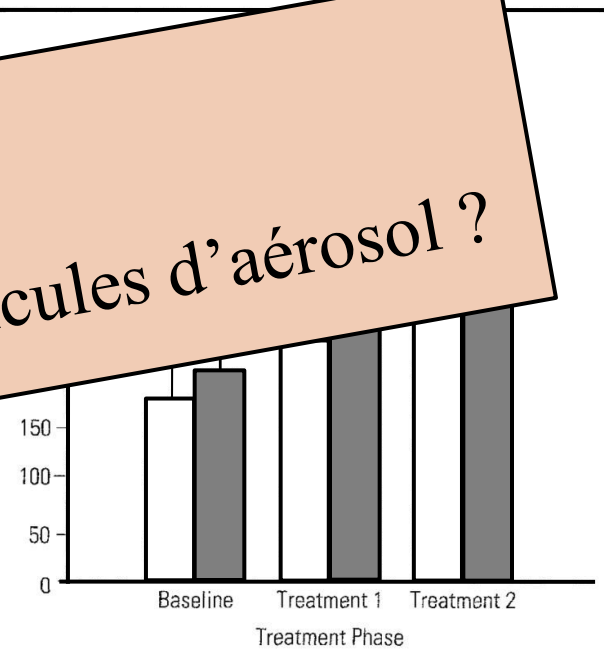
EPAP = 5

Amélioration significative du DEP

Pas d'effet sur FC, FR, et SpO_2

- Effet direct de la BiPAP ?
- Effet sur la déposition des particules d'aérosol ?

Figure.
Changes in peak expiratory flow rates.



Data expressed as mean±SD; *P* (RMANOVA)=.0001 for total from baseline to study conclusion. See Tables 1 and 2 for data.

PEFR (L/minute)	%PPEFR
279.6±87.3 (251.7-307.5)*	57.2±21.0 (50.5-63.9)
357.9±108.2 (330.0-385.8)	68.8±18.9 (63.9-73.7)
.0001	.0011

Nebulization During Spontaneous Breathing, CPAP, and Bi-Level Positive-Pressure Ventilation: A Randomized Analysis of Pulmonary Radioaerosol Deposition

Juçara Gasparetto Maccari MD, Cassiano Teixeira MD PhD, Augusto Savi PT PhD, Roselaine Pinheiro de Oliveira MD PhD, André Sant'Ana Machado MD, Tulio Frederico Tonietto MD, Eduardo Ludwig, Paulo José Zimermann Teixeira MD PhD, and Marli Maria Knorst MD PhD

- 13 volontaires sains (10H/3 F)
- Bilevel (IPAP/EPAP 15/5 cmH2O), CPAP (10cmH2O) et respiration spontanée.
- Nébulisation d'un radioaerosol : 99m-Technetium (Tc)
- Évaluation de déposition du 99m-Tc : Scintigraphie pulmonaire après 10 minutes d'inhalation

Table 1. Age, Body Mass Index (BMI), Maximum Expiratory Pressure (P_{Emax}), Maximum Inspiratory Pressure (P_{Imax}), FVC, FEV_1, and Peak Expiratory Flow (PEF) for the Group of Subjects

Subject	Age (y)	BMI (kg/m^2)	P_{Emax} (cm H_2O)	P_{Imax} (cm H_2O)	FVC (L)	FVC (%)	FEV_1 (L)	FEV_1 (%)	FEV_1/FVC (%)	PEF (L/min)
1	27	21.3	85	80	3.54	87.4	2.88	83.4	82	400
2	34	23.8	150	125	5.2	107.8	4.62	114.9	88	820
3	27	21.4	150	125	4.2	92.3	3.52	90.2	84	660
4	30	25.3	145	150	4.87	97.9	4.16	100	85	700
5	39	29	150	130	4.11	73.6	3.74	99	90	630
6	26	19.8	110	100	5.03	89	4.25	91	83	600
7	32	21	90	100	4.2	120	3.8	120	90	850
8	30	23.5	150	120	5.6	98.4	4.86	104.5	86	730
9	34	24.9	110	80	4.99	110.3	3.83	100.5	76	900
10	30	20.5	100	90	5.4	92.7	4.44	93.9	82	595
11	30	22.8	120	110	4.99	100.4	4.25	104.1	85	700
12	39	23.3	150	150	5.91	105.1	4.59	101.5	78	800
13	31	25.2	140	140	4.87	95.8	4	96.3	82	700
Mean	31	23.3	126	115	4.83	97.75	4.07	100.56	83	698
SD	4	2.9	25	24	0.66	11.69	0.52	10.04	4	130

Table 2. Lung Calculated Ratio and Ratio Between Lung and Stomach or Mouth and All Values Using the Friedman Test (Repeated Measures)

	Median (Minimum–Maximum)			P*
	SB	Bi-Level	CPAP	
LCR	11.0 (3.9–35.9)	9.8 (2.4–19.4)	6.0 (1.9–12.2)	.6
(LL + RL)/stomach	14.7 (2.8–258)	4.9 (0.8–11.3)	16.6 (2.7–267)	.6
(LL + RL)/mouth	0.9 (0.4–2.3)	1.3 (0.7–5.0)	1.0 (0.4–10.1)	.6
(LL + RL)/(trachea + stomach + mouth)	0.6 (0.4–2.0)	0.8 (0.5–2.1)	0.6 (0.4–1.9)	.6

* Friedman test
SB = spontaneous breathing
Bi-level = bi-level positive-pressure ventilation
LCR = lung calculated ratio ([right lung + left lung]/trachea)
LL = left lung
RL = right lung

Table 3. Lung Calculated Ratio and Ratio Between Lung and Stomach or Mouth and All Values Using the [illegible]

	Bi-Level	CPAP	Bi-Level vs CPAP
LCR	.17	.26	.4
(LL + RL)/stomach	.06	.89	.03
(LL + RL)/mouth	.09	.57	.33
(LL + RL)/(trachea + stomach + mouth)	.86	.89	.48

* Wilcoxon rank-sum test
SB = spontaneous breathing
Bi-level = bi-level positive-pressure ventilation
LCR = lung calculated ratio ([right lung + left lung]/trachea)
LL = left lung
RL = right lung

There was no difference in lung regional deposition of radioaerosol delivered via nebulization to healthy individuals, during SB, Bilevel and CPAP.

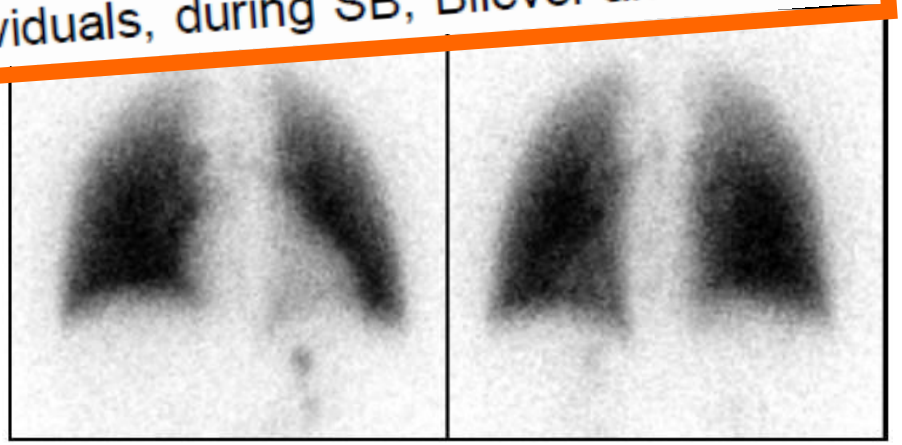


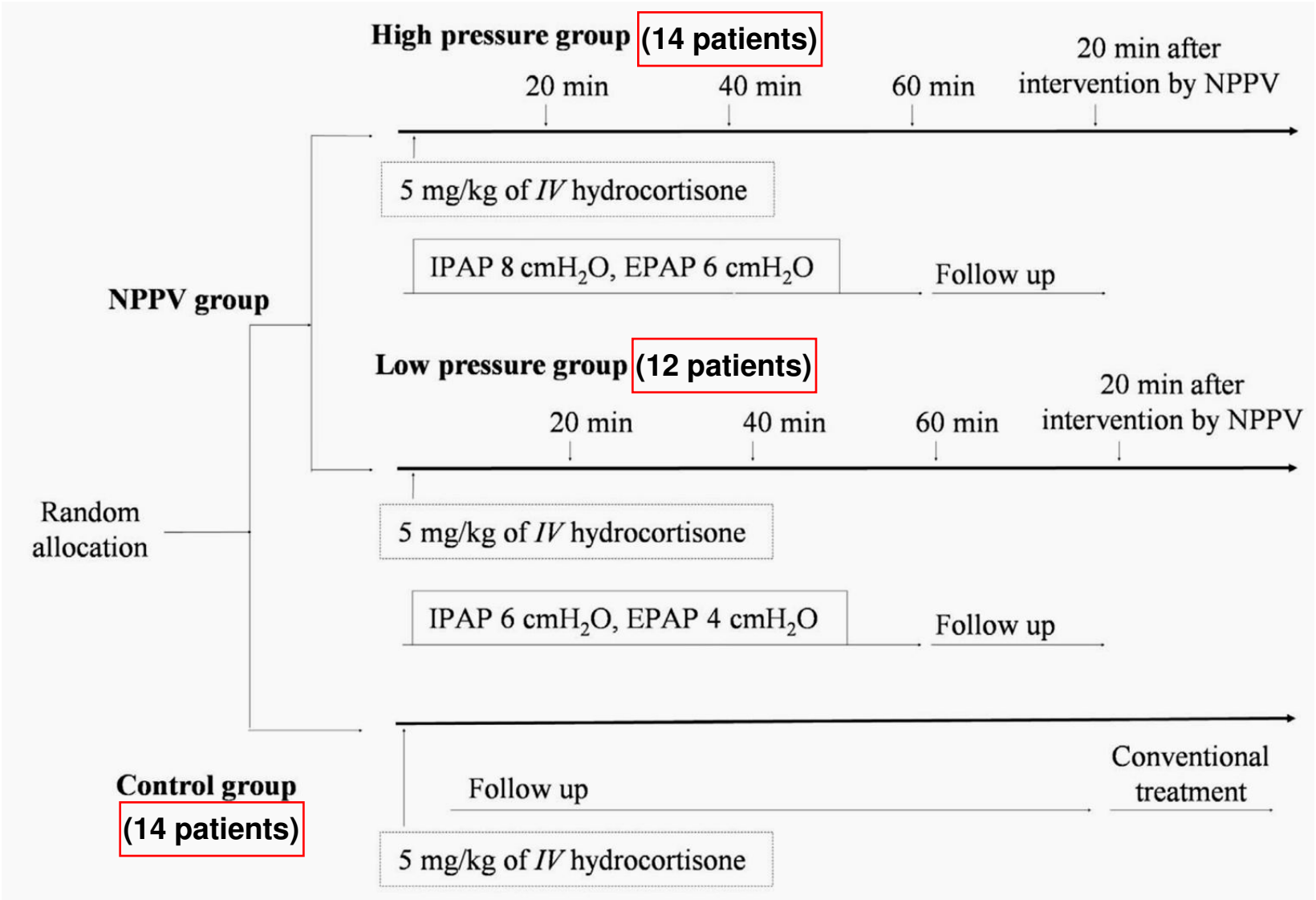
Fig. 2. Scintigraphy taken at the end of inhalation. Left: Anterior projection. Right: Posterior projection.

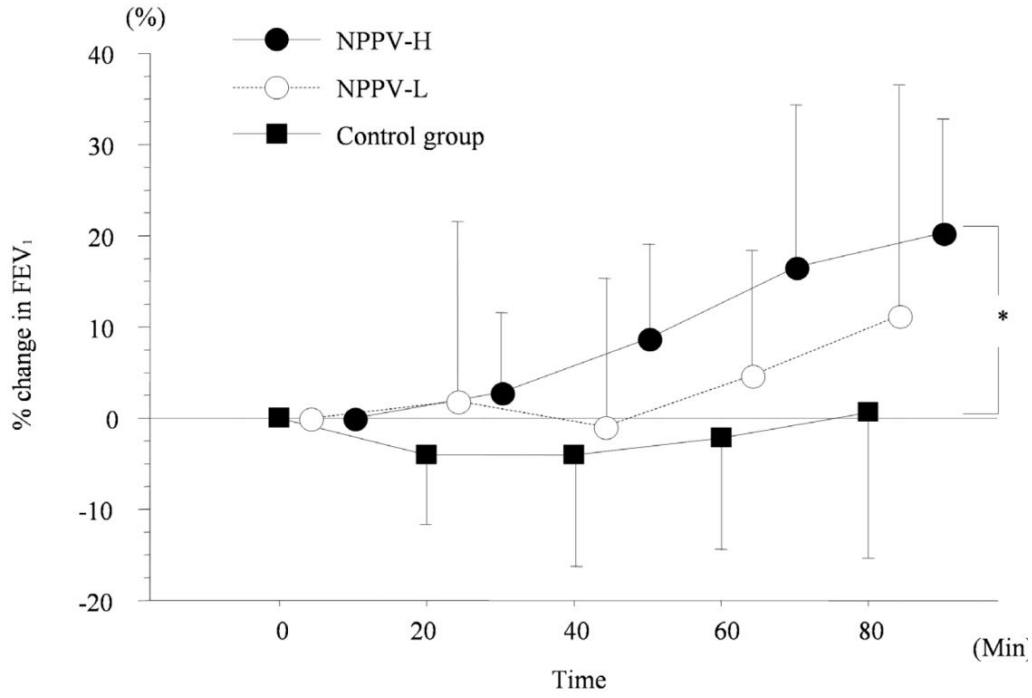
INTERNAL MEDICINE
ORIGINAL ARTICLE

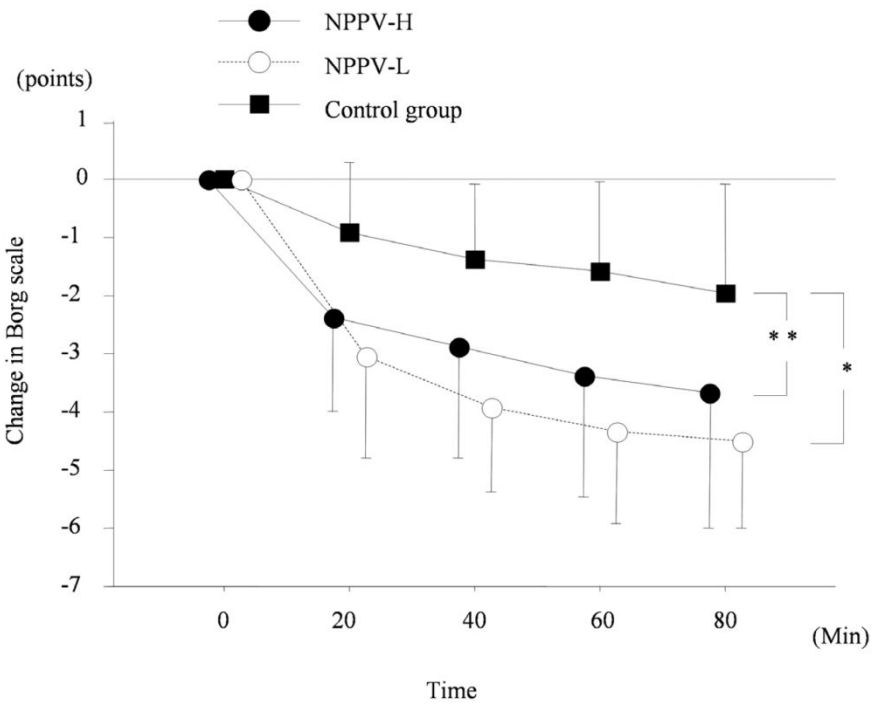
A Prospective and Randomized Study for Improvement of Acute Asthma by Non-invasive Positive Pressure Ventilation (NPPV)

Tomoyuki Soma[1], Mitsunori Hino[1], Kozui Kida[2] and Shoji Kudoh[2]

(Inter Med 47: 493-501, 2008)







- Broncho dilatation par effet mécanique ?

- Diminuer la charge des muscles respiratoires

Noninvasive positive pressure ventilation in status asthmaticus

GU Meduri, TR Cook, RE Turner, M Cohen and KV Leeper

Chest 1996;110;767-774

Table 1—*Demographic and Physiologic Parameters at Presentation*

Parameter*	NPPV	ETI/MV	Others
No. of episodes	17	4	7
Age, yr	35±11	44±7	46±16
Female/male	10/7	2/2	5/2
Recent use of corticosteroids	6	0	2
Duration of symptoms, h	94±97	32±35	48±20
Mean BP, mm Hg	116±23	120±34	128±21
HR, beats/min	121±17	129±32	136±28
RR, breaths/min	29±5	NA	33±4
Dyspnea score†	4±1	NA	NA
Silent chest on auscultation†	3	1	0
Accessory muscle use†	11	NA	5
pH	7.25±.07	7.07±.16	7.26±.05
$PaCO_2$, mm Hg	65±11	98±38	58±9
PaO_2: FIo_2	311±154	381±243	364±173
APACHE II score	14±4	24±13	16±4
Predicted mortality§	12±11	54±45	25±11
Prior episode of ARF‖	8	0	2

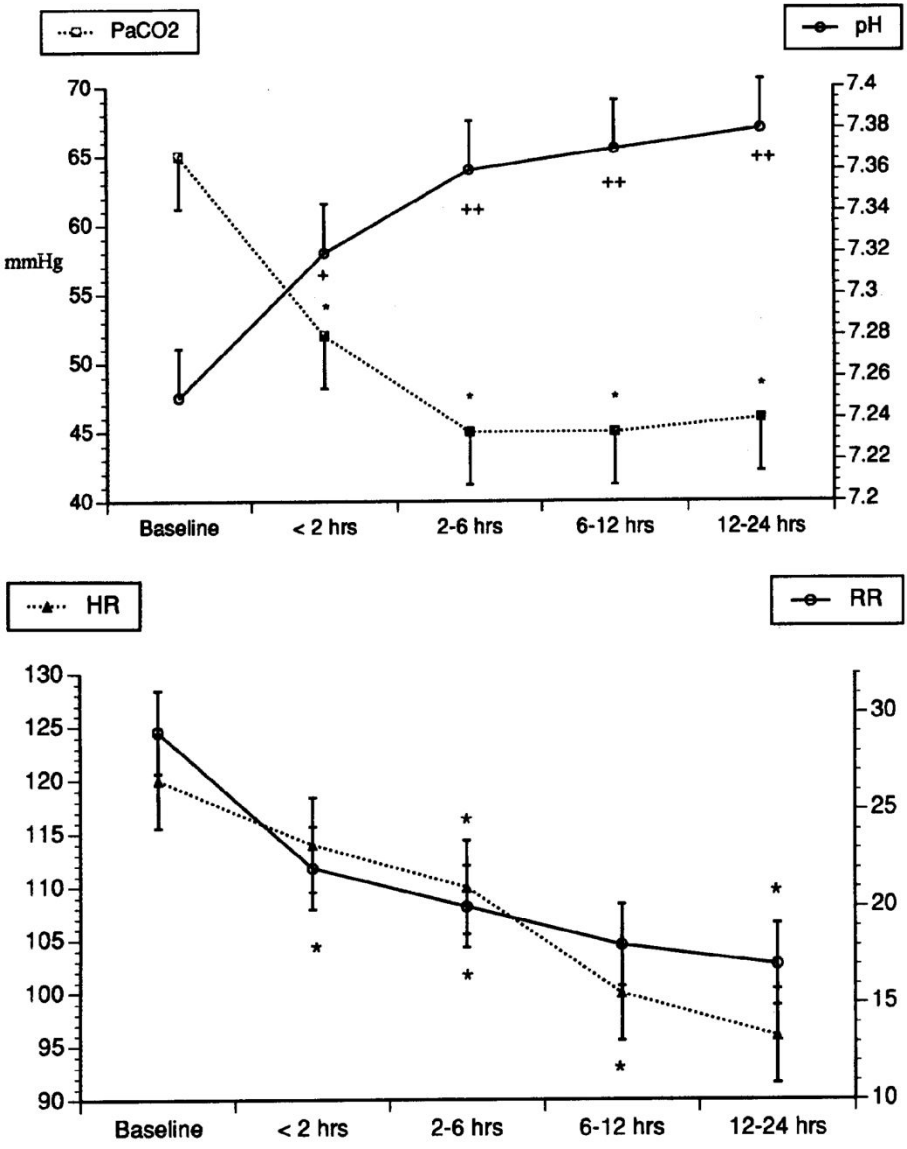
17 AAG hypercapniques

Mode utilisé = AI + PEP.

Table 3—*Response to Treatment*

Parameter*	NPPV (n=17)	ETI/MV (n=4)	Others (n=7)
Correction of hypercarbia†	15	4	7
Duration of MV, h	16±21	208±326	—
Sedation during MV‡	2	4	0
Complications§	0	1	0
Duration of ICU stay, h	51±73	240±369	19±15
Duration of hospital stay, d	5±4	12±17	4±2

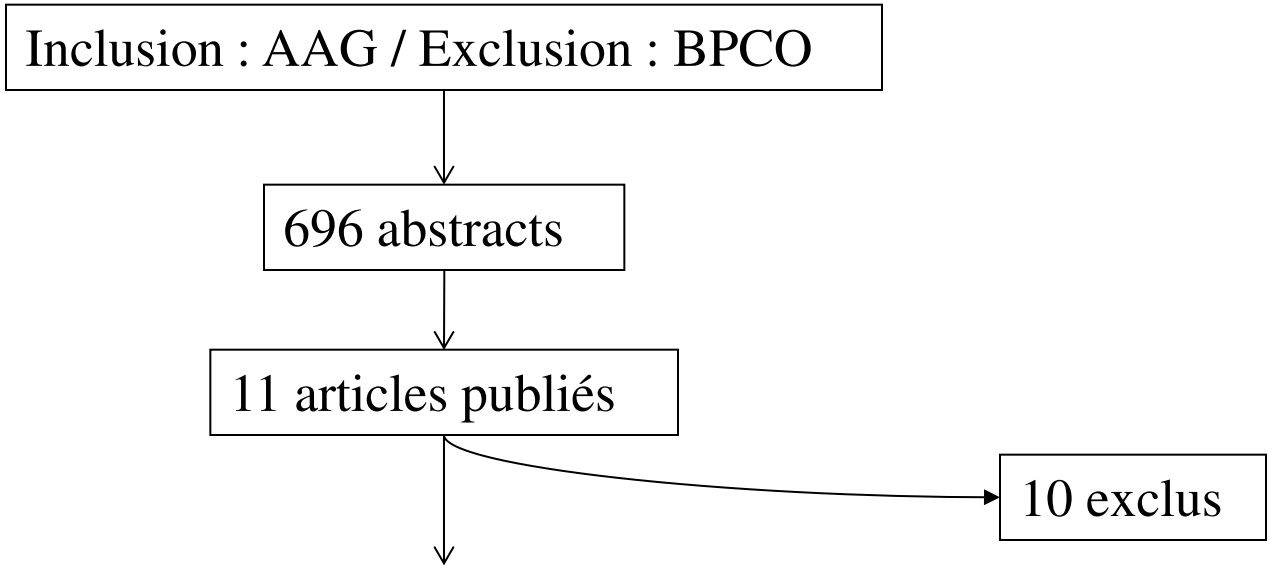
VNI bien tolérée chez 17 patients
Normalisation rapide 15 PaCO2 et de FR.
Limites : absence de groupe témoin.



Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma (Review)

Ram FSF, Wellington SR, Rowe B, Wedzicha JA

Cochrane Database of Systematic Reviews 2005, Issue 3.



CHEST ONLINE

A Pilot Prospective, Randomized, Placebo-Controlled Trial of Bilevel Positive Airway Pressure in Acute Asthmatic Attack*

Arie Soroksky, David Stav and Isaac Shpirer

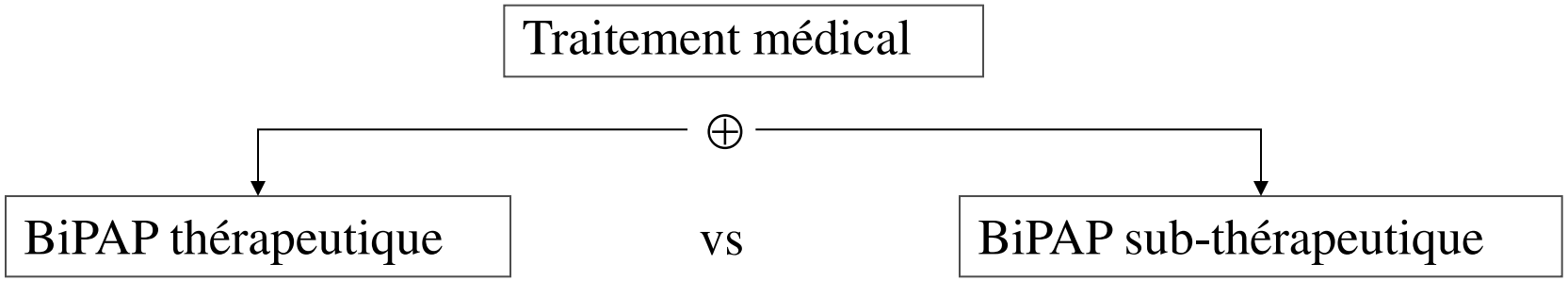
Chest 2003;123;1018-1025

A Pilot Prospective, Randomized, Placebo-Controlled Trial of Bilevel Positive Airway Pressure in Acute Asthmatic Attack*

Arie Soroksky, MD; David Stav, MD; and Isaac Shpirer, MD

CHEST / 123 / 4 / APRIL, 2003

- Type d'étude : prospective, randomisée, placébo-contrôle
- Lieu : service des urgences
- Intervention :



A Pilot Prospective, Randomized, Placebo-Controlled Trial of Bilevel Positive Airway Pressure in Acute Asthmatic Attack*

Arie Soroksky, MD; David Stav, MD; and Isaac Shpirer, MD

CHEST / 123 / 4 / APRIL, 2003

	BiPAP Thérapeutique	BiPAP subthérapeutique	*p*
Nb de malades	15	15	
VEMS, % prédit	37.27 ± 10.69	33.8 ± 10.18	ns
DEP, % prédit	38 ± 11.95	34 ± 11.2	ns
pH	7.41 ± 0.04	7.40 ± 0.02	ns
PaCO2, mmHg	33.59 ± 3.48	34.29 ± 5.41	ns

↑VEMS(>50%) à H4	12	3	< 0.004
Mdes hospitalisés	3	10	0.013

L'addition de la VNI au traitement conventionnel permet une amélioration plus rapide de la crise d'asthme, du VEMS et une réduction du nombre d'hospitalisations

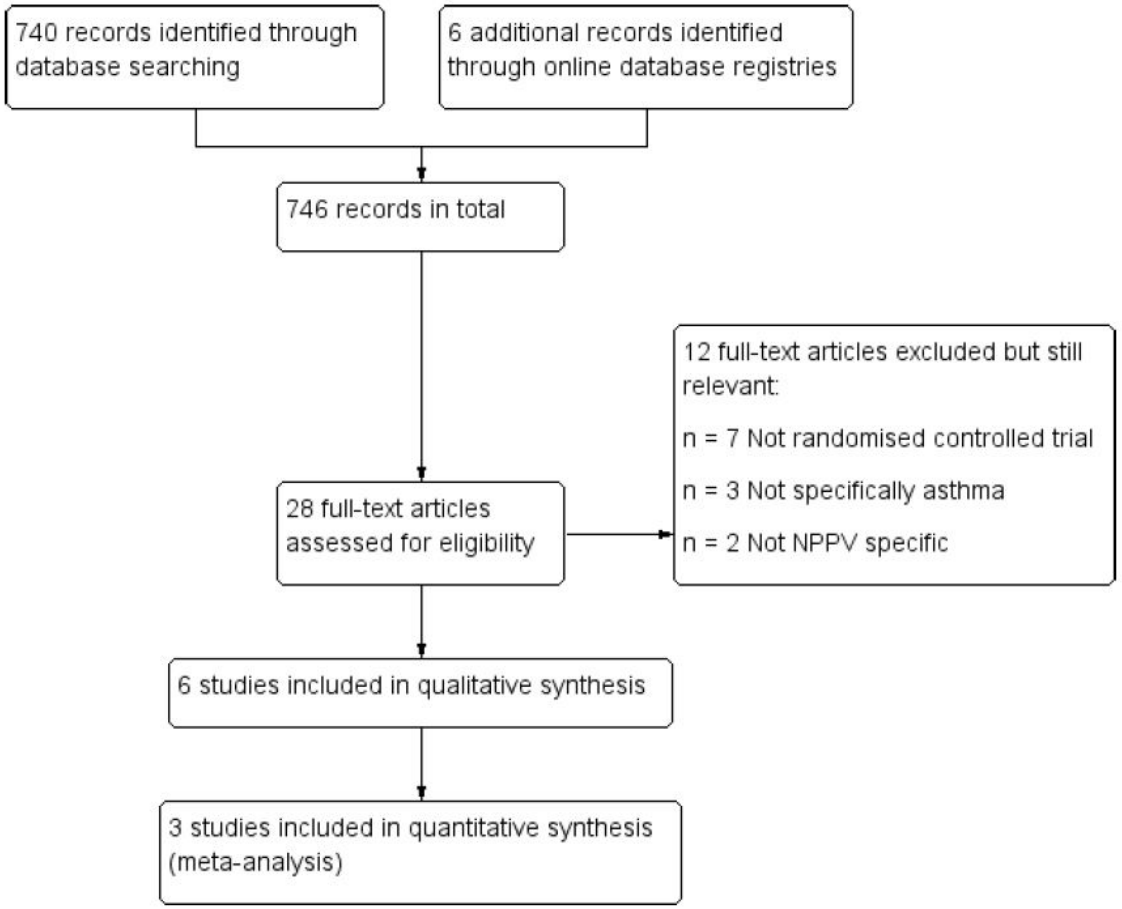
Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma (Review)

Lim WJ, Mohammed Akram R, Carson KV, Mysore S, Labiszewski NA, Wedzicha JA, Rowe BH, Smith BJ

The Cochrane Library
2012, Issue 12

Randomised controlled clinical trials (RCTs) that compared the treatment of asthma with usual medical care plus NPPV versus usual medical care alone.

Figure 1. Study flow diagram.



- Mortality,
- Tracheal intubation,
- Changes in blood gases
- Hospital length of stay.

Analysis 1.1. Comparison 1 NPPV versus usual care, Outcome 1 Mortality during hospital admission.

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

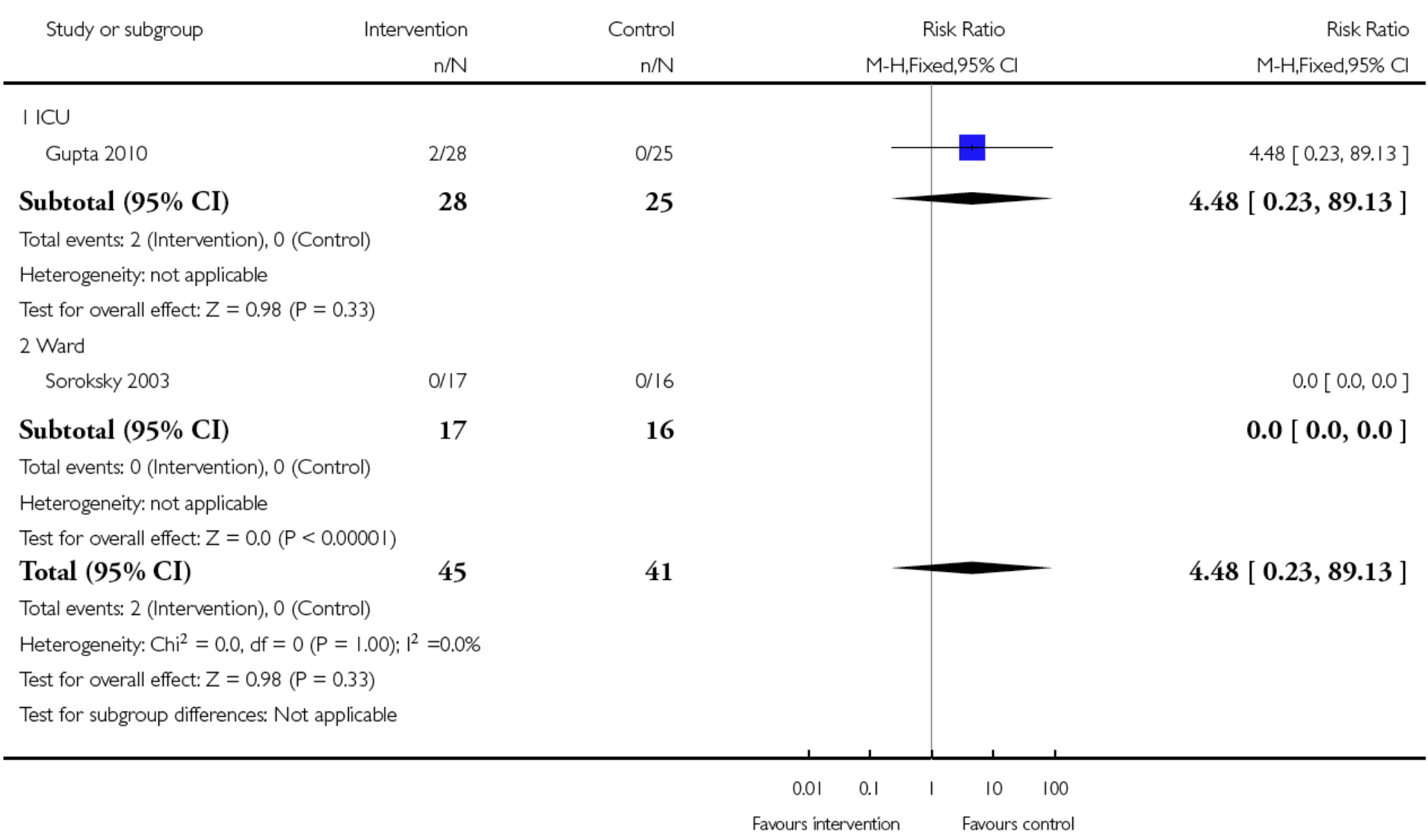
Comparison: 1 NPPV versus usual care

Outcome: 1 Mortality during hospital admission

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
1 ICU				
Gupta 2010	0/28	0/25		0.0 [0.0, 0.0]
Subtotal (95% CI)	**28**	**25**		**0.0 [0.0, 0.0]**
Total events: 0 (Intervention), 0 (Control)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
2 Ward				
Soroksky 2003	0/17	0/16		0.0 [0.0, 0.0]
Subtotal (95% CI)	**17**	**16**		**0.0 [0.0, 0.0]**
Total events: 0 (Intervention), 0 (Control)				
Heterogeneity: not applicable				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Total (95% CI)	**45**	**41**		**0.0 [0.0, 0.0]**
Total events: 0 (Intervention), 0 (Control)				
Heterogeneity: Chi^2 = 0.0, df = 0 (P<0.00001); I^2 =0.0%				
Test for overall effect: Z = 0.0 (P < 0.00001)				
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%				

Comparison: 1 NPPV versus usual care

Outcome: 2 Endotracheal intubation



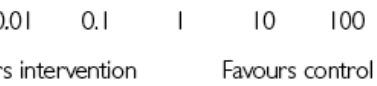
Analysis 1.3. Comparison 1 NPPV versus usual care, Outcome 3 Number of hospital admissions.

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

Outcome: 3 Number of hospital admissions

Study or subgroup	Intervention n/N	Control n/N	Risk Ratio M-H,Fixed,95% CI	Risk Ratio M-H,Fixed,95% CI
Soroksky 2003	3/17	10/16		0.28 [0.09, 0.84]



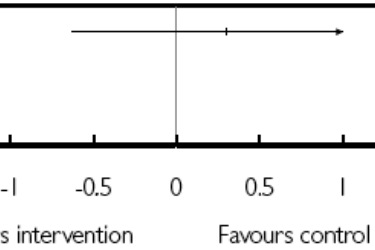
Analysis 1.4. Comparison 1 NPPV versus usual care, Outcome 4 Length of ICU stay (hours).

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

Outcome: 4 Length of ICU stay (hours)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Soroksky 2003	15	5.9 (1.3)	15	5.6 (1.3)		0.30 [-0.63, 1.23]



Analysis 1.7. Comparison 1 NPPV versus usual care, Outcome 7 PEF (% predicted).

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

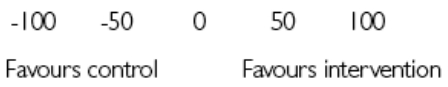
Outcome: 7 PEF (% predicted)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Brandao 2009	24	42.92 (5.05)	12	22.37 (8.64)		87.8 %	20.55 [15.26, 25.84]
Soroksky 2003	15	59.9 (20.4)	15	44.1 (19.3)		12.2 %	15.80 [1.59, 30.01]
Total (95% CI)	**39**		**27**			**100.0 %**	**19.97 [15.01, 24.93]**

Heterogeneity: $Chi^2 = 0.38$, df = 1 (P = 0.54); $I^2 = 0.0\%$

Test for overall effect: Z = 7.90 (P < 0.00001)

Test for subgroup differences: Not applicable



Analysis 1.8. Comparison 1 NPPV versus usual care, Outcome 8 FVC (% predicted).

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

Outcome: 8 FVC (% predicted)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Brandao 2009	24	53.79 (7.57)	12	41.26 (17.35)		59.0 %	12.53 [2.26, 22.80]
Soroksky 2003 (1)	15	70 (14.3)	15	58.1 (19.7)		41.0 %	11.90 [-0.42, 24.22]
Total (95% CI)	**39**		**27**			**100.0 %**	**12.27 [4.38, 20.16]**

Heterogeneity: Chi^2 = 0.01, df = 1 (P = 0.94); I^2 =0.0%

Test for overall effect: Z = 3.05 (P = 0.0023)

Test for subgroup differences: Not applicable

Analysis 1.9. Comparison 1 NPPV versus usual care, Outcome 9 FEV1 (% predicted).

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

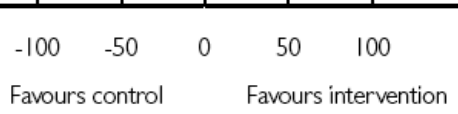
Outcome: 9 FEV1 (% predicted)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Brandao 2009	24	49.72 (5.91)	12	35.51 (12.26)		73.8 %	14.21 [6.88, 21.54]
Soroksky 2003 (1)	15	57.4 (17.7)	15	43.9 (16.7)		26.2 %	13.50 [1.19, 25.81]
Total (95% CI)	**39**		**27**			**100.0 %**	**14.02 [7.73, 20.32]**

Heterogeneity: $Chi^2 = 0.01$, df = 1 (P = 0.92); $I^2 = 0.0\%$

Test for overall effect: Z = 4.36 (P = 0.000013)

Test for subgroup differences: Not applicable



Analysis 1.13. Comparison 1 NPPV versus usual care, Outcome 13 ABG - $PaCO_2$ (mmHg).

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

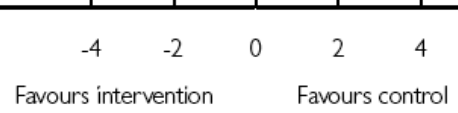
Outcome: 13 ABG - $PaCO_2$ (mmHg)

Study or subgroup	Intervention N	Mean(SD)	Control N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
Gupta 2010	28	35.3 (7.7)	25	34.8 (4.4)		100.0 %	0.50 [-2.83, 3.83]
Total (95% CI)	**28**		**25**			**100.0 %**	**0.50 [-2.83, 3.83]**

Heterogeneity: not applicable

Test for overall effect: Z = 0.29 (P = 0.77)

Test for subgroup differences: Not applicable



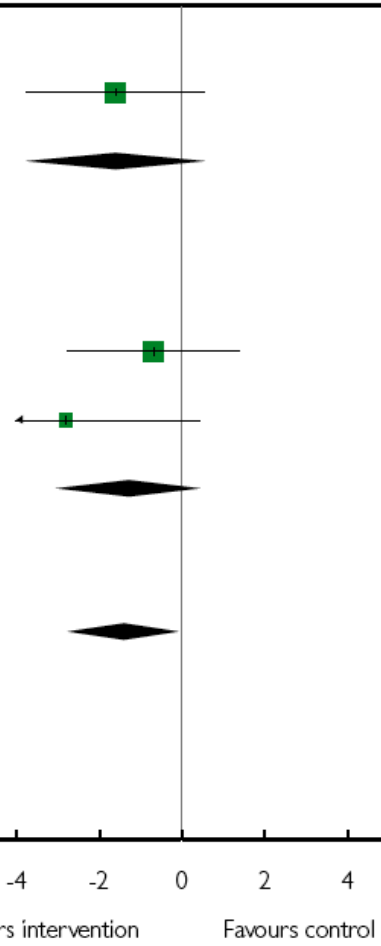
Analysis 1.15. Comparison 1 NPPV versus usual care, Outcome 15 Respiratory rate.

Review: Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe acute exacerbations of asthma

Comparison: 1 NPPV versus usual care

Outcome: 15 Respiratory rate

Study or subgroup	Intervention N	Intervention Mean(SD)	Control N	Control Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 ICU							
Gupta 2010 (1)	28	21.7 (2.8)	25	23.3 (4.8)		39.7 %	-1.60 [-3.75, 0.55]
Subtotal (95% CI)	**28**		**25**			**39.7 %**	**-1.60 [-3.75, 0.55]**
Heterogeneity: not applicable							
Test for overall effect: Z = 1.46 (P = 0.14)							
2 Ward							
De Miranda 2004	42	17.12 (3.76)	21	17.8 (4.05)		42.7 %	-0.68 [-2.75, 1.39]
Soroksky 2003 (2)	15	20.4 (4.6)	15	23.2 (4.4)		17.7 %	-2.80 [-6.02, 0.42]
Subtotal (95% CI)	**57**		**36**			**60.3 %**	**-1.30 [-3.04, 0.44]**
Heterogeneity: Chi^2 = 1.18, df = 1 (P = 0.28); I^2 =15%							
Test for overall effect: Z = 1.46 (P = 0.14)							
Total (95% CI)	**85**		**61**			**100.0 %**	**-1.42 [-2.77, -0.07]**
Heterogeneity: Chi^2 = 1.22, df = 2 (P = 0.54); I^2 =0.0%							
Test for overall effect: Z = 2.06 (P = 0.040)							
Test for subgroup differences: Chi^2 = 0.05, df = 1 (P = 0.83), I^2 =0.0%							



A Prospective Randomized Controlled Trial on the Efficacy of Noninvasive Ventilation in Severe Acute Asthma

RESPIRATORY CARE • MAY 2010 VOL 55 NO 5

Dheeraj Gupta MD DM, Alok Nath MD DM, Ritesh Agarwal MD DM, and Digamber Behera MD

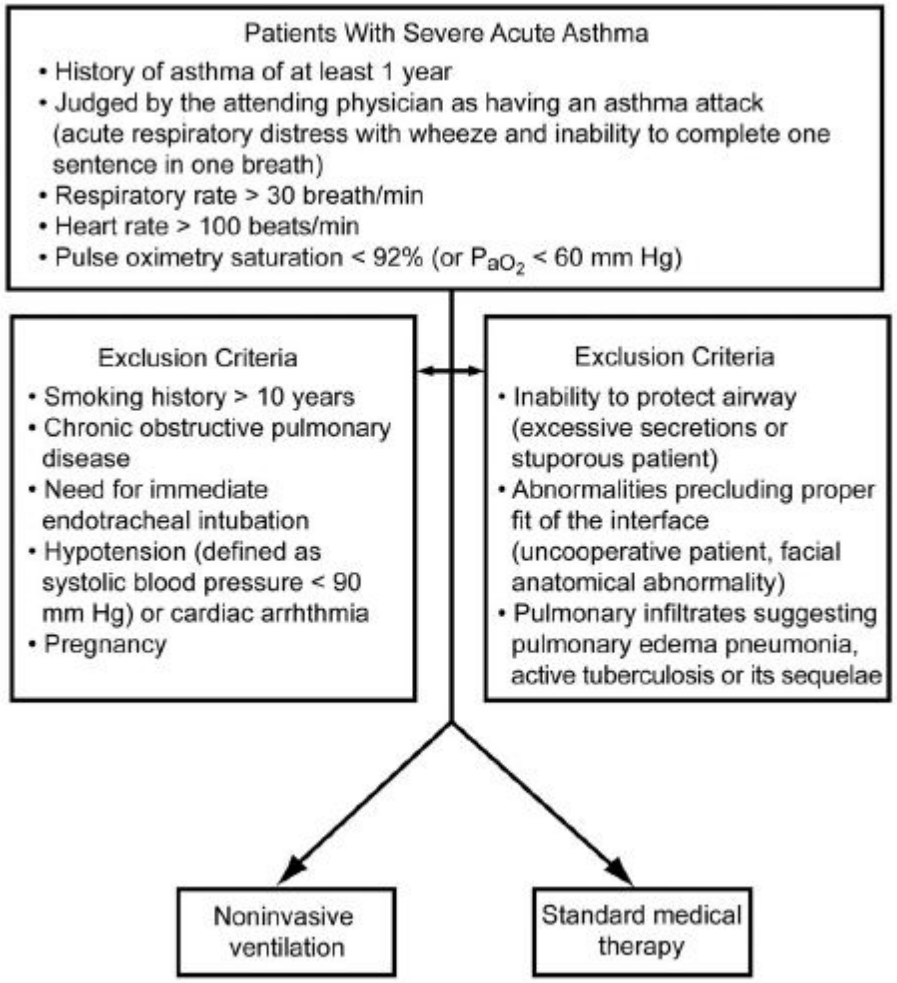


Fig. 1. Flowchart of inclusion and exclusion process.

Table 1. Baseline Characteristics

	Standard Medical Treatment (n = 25)	NIV (n = 28)	All Subjects (n = 53)	P
Age (mean ± SD y)	41.6 ± 12.5	46.2 ± 16.2	44.1 ± 14.6	.26
Female (n, %)	20 (80)	22 (78.6)	42 (79.2)	.91
Body mass index (mean ± SD kg/m^2)	24.3 ± 4.3	22.9 ± 3.3	23.6 ± 3.8	.19
Duration of asthma (median and IQR y)	6 (4–10)	10 (3.5–20)	8 (4–15)	.03
Duration of exacerbation (mean ± SD d)	3.2 ± 2.2	3.4 ± 2.2	3.3 ± 2.2	.91
Respiratory rate (median and IQR breaths/min)	38 (32–42)	36 (32–40)	36 (32–41)	.60
Heart rate (mean ± SD beats/min)	117.1 ± 13.7	120.7 ± 12.8	119 ± 13.3	.58
Systolic blood pressure (median and IQR mm Hg)	140 (126–165)	130 (124.5–140)	130 (126–150)	.09
Diastolic blood pressure (median and IQR mm Hg)	90 (80–98)	84 (80–90)	86 (80–90)	.26
Pulsus paradoxus (mean ± SD mm Hg)	21.9 ± 11.1	19.6 ± 5.3	20.7 ± 8.5	.33
FEV_1 (mean ± SD L)	0.56 ± 0.3	0.48 ± 0.2	0.51 ± 0.3	.25
FEV_1 (mean ± SD % predicted)	24.4 ± 12.3	21.6 ± 10.3	22.9 ± 11.3	.67
pH (mean ± SD)	7.43 ± 0.04	7.42 ± 0.06	7.43 ± 0.05	.70
P_{aO_2}/F_{IO_2} (mean ± SD mm Hg)	298 ± 63	281 ± 65	289 ± 64	.33
P_{aCO_2} (mean ± SD mm Hg)	35.1 ± 8.8	37 ± 7.9	36.1 ± 8.3	.41
Number of GINA criteria (median and IQR)*	8 (7–9)	8 (8–9)	8 (7–9)	.64

* The Global Initiative for Asthma (GINA) criteria are: breathlessness at rest, can speak only in short sentences, respiratory rate > 30 breaths/min, use of accessory muscles of respiration, loud wheeze, heart rate > 120 beats/minute, pulsus paradoxus > 25 mm Hg, peak expiratory flow < 60% of predicted or < 100 L/min, P_{aO_2} < 60 mm Hg.

IQR = interquartile range

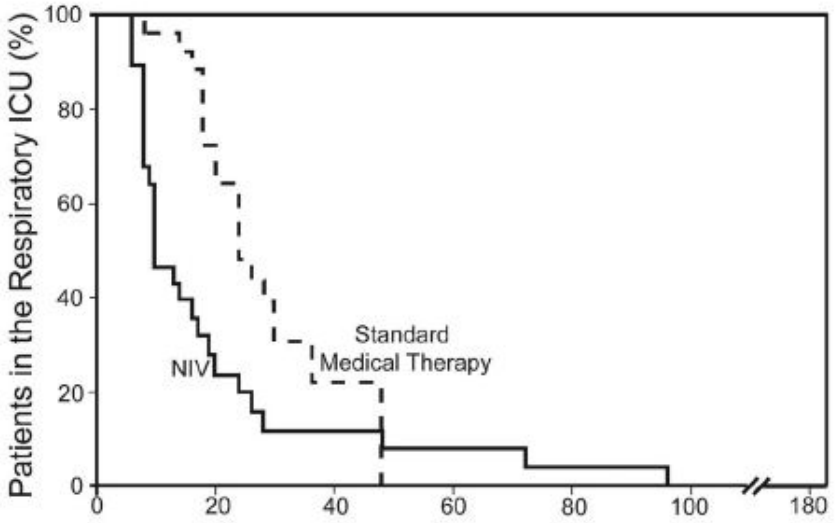
FEV_1 = forced expiratory volume in the first second

F_{IO_2} = fraction of inspired oxygen

Table 3. Outcomes

	Standard Medical Therapy (n = 25)	NIV (n = 28)	P
Primary Outcomes			
≥ 50% improvement in FEV_1 over baseline (n, %)			
At 1 h	11 (44)	10 (36)	.62
At 2 h	12 (48)	15 (54)	.70
At 4 h	16 (64)	24 (86)	.08
ICU stay (median and IQR h)	24 (18–36)	10 (8–20)	.01
Hospital stay (median and IQR h)	54 (48–72)	38 (24–48)	.01
Secondary Outcomes			
Time to disappearance of accessory muscle use (mean ± SD h)	3.2 ± 1.7	2.3 ± 1.4	.06
Dose of inhaled salbutamol (mean ± SD mg)	42.8 ± 10.4	31.2 ± 14.5	.008
Dose of inhaled ipratropium (mean ± SD mg)	7.6 ± 2.2	5.2 ± 2.8	.007
Failure of primary therapy (n, %)	4 (16)	2 (7)	.35

FEV_1 = forced expiratory volume in the first second
IQR = interquartile range



no mortality in either of the arms. CONCLUSION: In patients with severe acute asthma, the addition of NIV to standard medical therapy probably accelerates the improvement in lung function, decreases the inhaled bronchodilator requirement, and shortens the ICU and hospital stay, but a larger study is required to settle this issue. (Clinicaltrials.gov registration NCT00510991.) *Key*

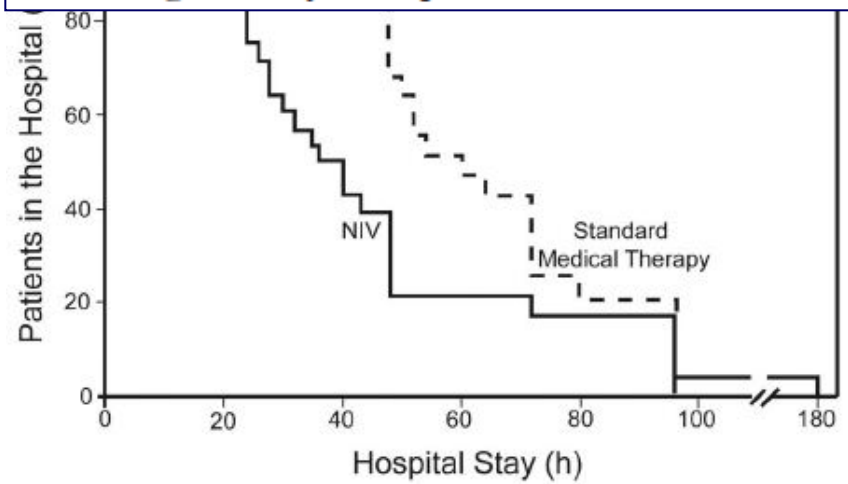


Fig. 2. Kaplan-Meier curves of the probability of discharge from the respiratory intensive care unit (ICU) and the hospital. ICU and hospital stay were significantly shorter in the noninvasive ventilation (NIV) group than in the standard-medical-therapy group.

Official Journal of the Asian Pacific Society of Respirology
Respirology

The use of non-invasive ventilation for life-threatening asthma attacks: Changes in the need for intubation

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Respirology (2010) **15**, 714–720

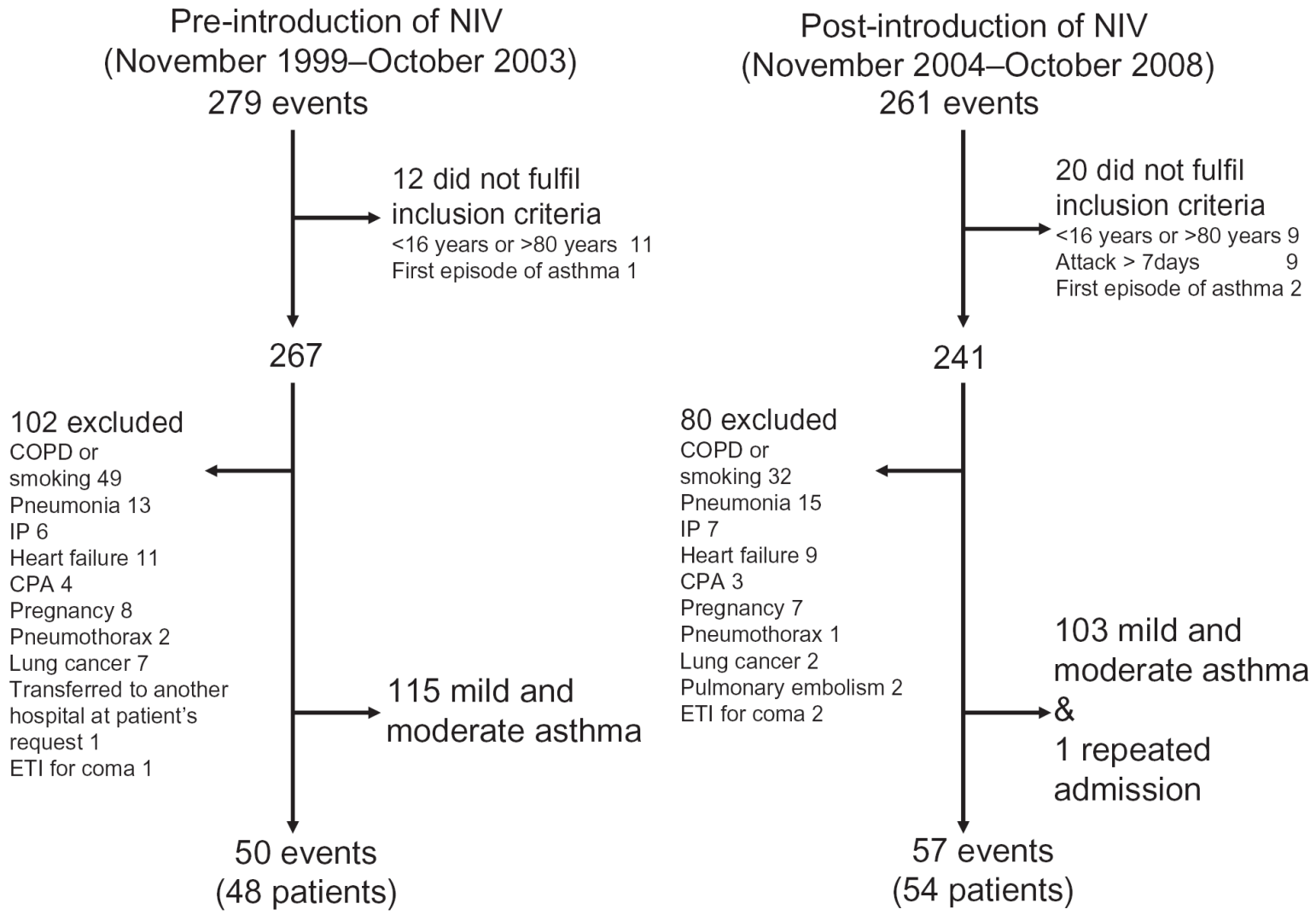


Table 1 Baseline characteristics of patients experiencing severe attacks of asthma, pre- and post-introduction of NIV

	Pre-introduction of NIV ($n = 50$)	Post-introduction of NIV ($n = 57$)	*P*-value
Age, years	45.6 ± 20.0	52.0 ± 17.9	0.08
Women, *n* (%)	32 (64)	42 (74)	0.28
Duration of asthma, years	13.1 ± 11.7	12.1 ± 10.7	0.65
Duration of attack, days	2.38 ± 1.71	1.84 ± 1.08	0.05
Systolic arterial blood pressure, mm Hg	135.1 ± 27.9	139.6 ± 28.0	0.43
Heart rate, beats/min	109.3 ± 19.8	111.4 ± 19.0	0.58
Respiratory rate, breaths/min	30.2 ± 6.18	27.9 ± 8.69	0.39
PaO_2/FiO_2 ratio	218.8 ± 111.0	204.7 ± 99.1	0.49
$PaCO_2$, mm Hg	57.6 ± 27.4	56.5 ± 25.5	0.84
pH	7.29 ± 0.16	7.30 ± 0.15	0.92
Use of accessory muscles, *n* (%)	27 (54)	38 (67)	0.18
GCS	14.7 ± 0.9	14.7 ± 1.0	0.93
Long-term use of inhaled corticosteroids, *n* (%)	14 (28)	28 (49)	0.02
Long-term use of inhaled LABA, *n* (%)	2 (4)	19 (33)	<0.0001
Long-term use of systemic corticosteroids, *n* (%)	4 (8%)	3 (5%)	0.57

Table 3 Clinical outcomes in patients experiencing severe attacks of asthma, pre- and post-introduction of NIV

	Pre-introduction of NIV ($n = 50$)	Post-introduction of NIV ($n = 57$)	*P*-value
MV (NIV and/or MV with ETI), *n* (%)	9 (18)	17 (30)	0.15
ETI, *n* (%)	9 (18)	2 (2)[†] (4)	0.01
NIV, *n* (%)	0 (0)	17 (30)	<0.0001
Hospital stay, days	10.8 ± 6.4	7.9 ± 4.1	<0.01
Stay in ICU or intermediate care unit, h	32.1 ± 29.0	26.3 ± 29.4	0.30

- VNI = alternative à l'IET

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

Pediatr Pulmonol. 2011;46:949–955.

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

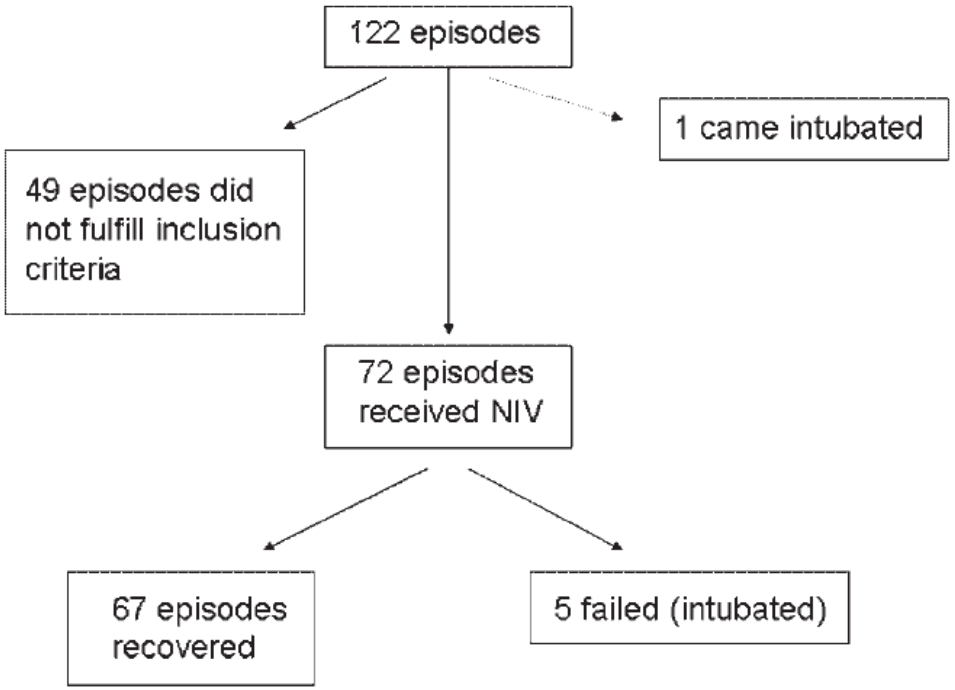


Fig 1. Diagram showing the evolution of patients admitted to the PICU with acute severe asthma. NIV, non-invasive ventilation.

- Séléction :
  - Astme sévère ne repondant pas au ttt conventionnel
  - Score clinique de Wood modifié (m-WCAS) 4
  - Augmentation du travail respiratoire.
- Methodologie:
  - Patients sous VNI +.
  - Nébulisation continue de Salbutamol
  - ipratropium bromide tous les 2 h
  - Methyl-prednisolone 1–2 mg/kg/6h.
  - Variables cliniques mesurées à l'admission, 1, 6, 12, 24, and 48 hr

TABLE 1—Baseline Characteristics of the Sample

Patients' characteristics	
Age (months)	39.2 (15.4–72.2)
Males (%)	69.4
Weight (kg)	15 (10.3–20.7)
m-WCAS	5.7 ± 1.2
PRISM III score	5 (2–6)
HR (beats/min)	166.7 ± 23.9
RR (breaths/min)	49.5 ± 16.8
FiO_2 (%)	45.3 ± 18.8
PCO_2 (mmHg)[1]	42 (36–48)
pH[1]	7.33 (7.26–7.39)

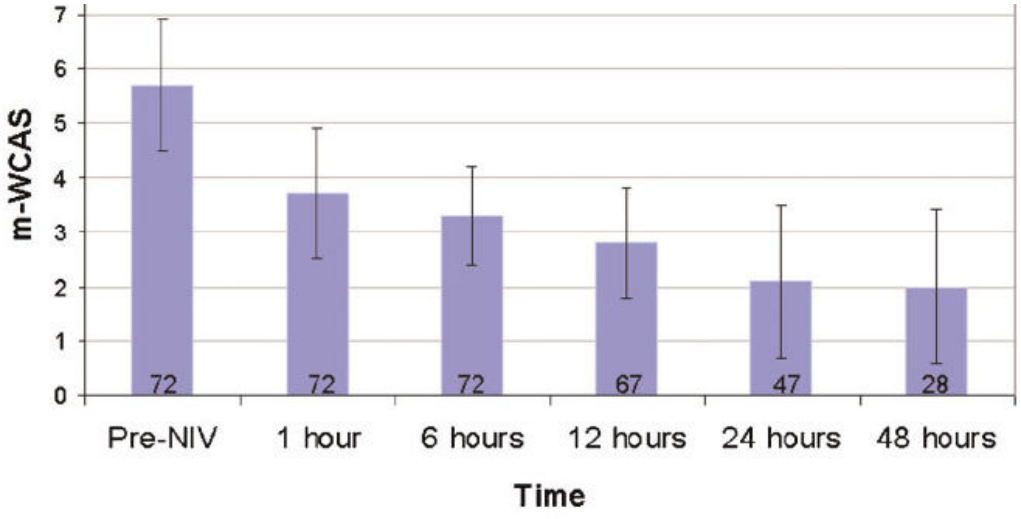


Fig 2. Evolution of the clinical score (m-WCAS) over the first 48 hr of NIV therapy expressed as mean and standard deviation. Changes during this period were all statistically significant, except for differences between m-WCAS at 24 and 48 hr. The number in the bars refers to the number of patients receiving NIV at that moment.

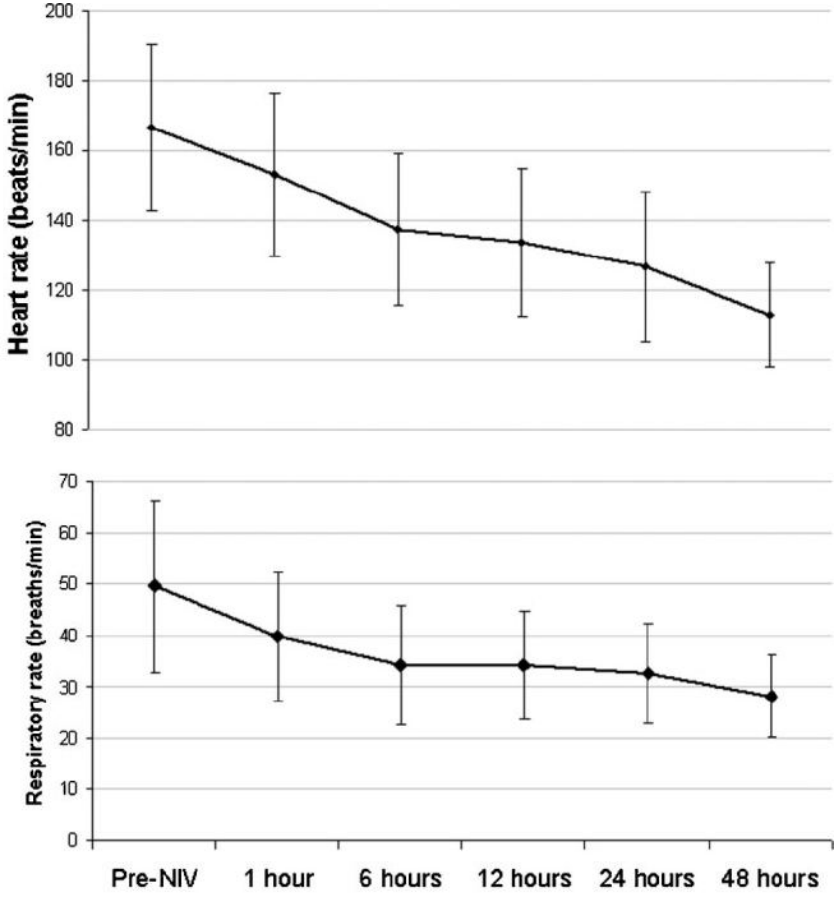


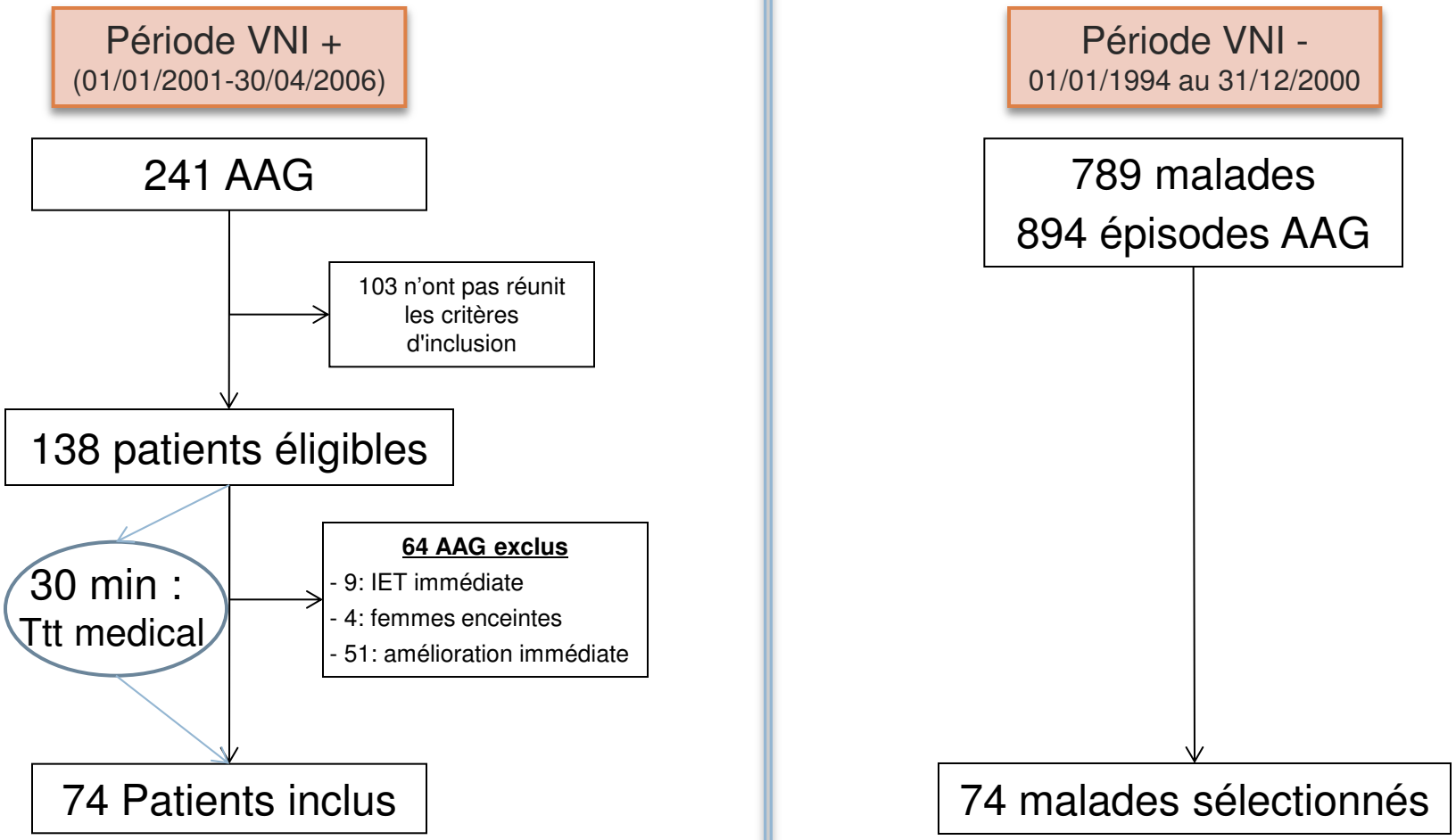
Fig 3. Changes in heart rate (top of the figure) and respiratory rate (bottom) over the first 48 hr of NIV therapy expressed as mean and standard deviation. Changes in heart rate and respiratory rate during this period were all statistically significant, except for differences between respiratory rate at 6 and 12 hr.

CONCLUSIONS

Our data show the feasibility of NIV in pediatric SA refractory to conventional pharmacological treatment. Further studies are needed to confirm our results and assess other issues, such as the optimal timing of intervention, the early detection of non-responders, the ideal ventilator setting, and the duration of treatment.

Étude personnelle

- Type de l'étude : case-control avec appariement (matching 1:1)
- Critères d'inclusion :
  - Asthme défini selon les critères de la BTS
  - AAG, résistant au bout d'½ heure au ttt habituel (O2, corticoïdes, aérosols de ß2) avec :
    - PP ≥ 20 mmHg,
    - FC ≥ 120 Batt/min,
    - RR ≥ 30 b/min,
    - DEP ≤ 150 l/min
  - Et une Hypercapnie ($PaCO_2 \geq 45$ mmHg)
- Critères de non inclusion :
  - Femme enceinte
  - Pathologie respiratoire intriquée (BPCO)
  - Instabilité hémodynamique,
  - IVG
  - Nécessité d'une intubation immediate
  - Pneumopathie infectieuse
  - Pneumothorax
  - Altération de l'état de conscience
  - Contre indication à la VNI



Critères d'appariement		
•Age (± 1 an)	•Sévérité de l'asthme (GINA)	•Score de Salmeron (± 1),
•Sexe	•$PaCO_2$ (± 5 mmHg)	•Score clinique (± 1) (SCM, parole, sibilants, conscience)

Caractéristiques démographiques des malades

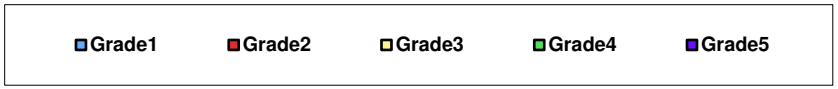
	VNI (n=74)	Non VNI (n=74)	p
Age *(ans)*	38.6 ± 12.9	38.6 ± 13.1	*0.98*
Sexe *(H/F)*	35/39	35/39	*1*
Sévérité de la maladie			
Intermittent *(n, %)*	42 (56.7)	42 (56.7)	
Persistant léger *(n, %)*	16 (21.6)	16 (21.6)	*0.37*
Persistant modéré *(n, %)*	5 (6.8)	5 (6.8)	
Persistant sévère *(n, %)*	11 (14.9)	11 (14.9)	
Ancienneté *(ans)*	16 ± 11.7	14 ± 9.5	*0.25*
Nb hospitalisations antérieures *(n)*	4.4 ± 4.3	4.1 ± 4	*0.76*

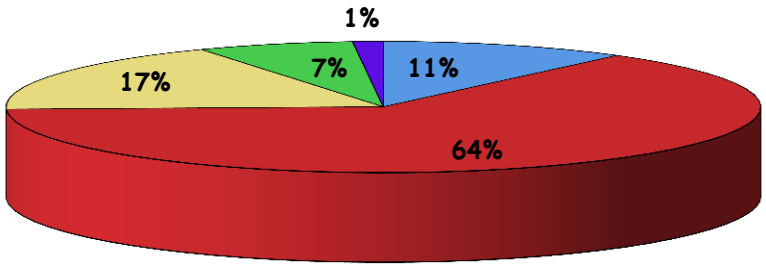
Caractéristiques cliniques des malades à l'inclusion

	VNI (n=74)	Non VNI (n=74)	p
FC_0 *(batt/min)*	129 ± 19	123 ± 29	*0.14*
FR_0 *(c/min)*	28 ± 8	29 ± 8	*0.38*
DEP_0 (l/min)	68 ± 84	82 ± 81	0.32
pH	7.24 ± 0.125	7.25 ± 0.136	*0.75*
$PaCO_{2_0}$ *(mmHg)*	59.9 ± 18.1	59 ± 25	*0.52*
Score clinique	8.4 ± 2	8.1 ± 2	*0.41*
Score Salmeron	9.5 ± 1.7	9.1 ± 2.1	*0.2*

Caractéristiques de la VNI

- Début : 2,2 ± 1,05 heures
- Paramètres ventilatoires
  - Niveau d'AI : 14,4 ± 2,6 cmH_2O
  - PEP : 3,6 ± 0,8 cmH_2O
  - FiO_2 : 48,6 ± 13,8 %
- Durée totale : 15 ± 9,87 h
- Nombre de séances : 4,87 ± 1,92





Compliance à la VNI

Évolution de la FR, du DEP et de la $PaCO_2$

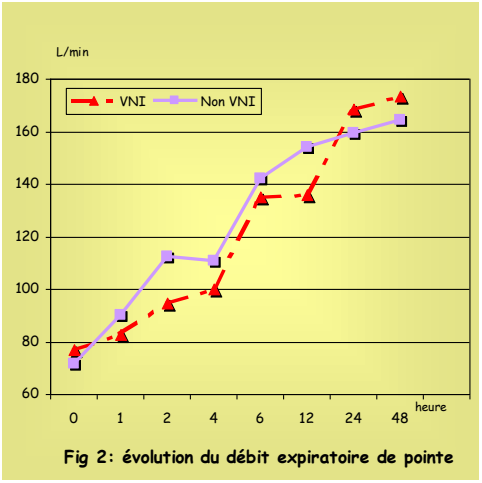


Fig 2: évolution du débit expiratoire de pointe

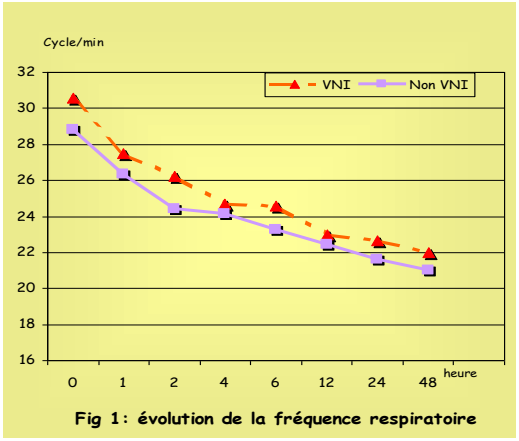


Fig 1: évolution de la fréquence respiratoire

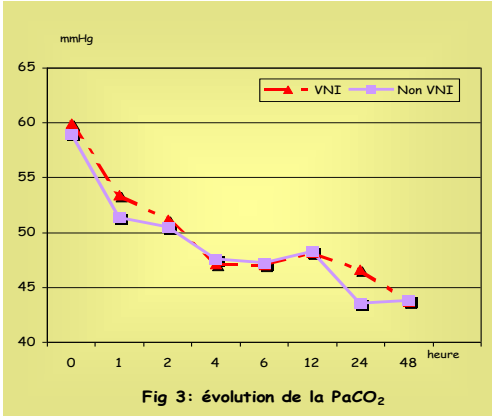


Fig 3: évolution de la $PaCO_2$

Escalade thérapeutique

	VNI (n =74)	Non VNI (n =74)	P
IET *n(%)*	5 (6.8)	17 (23)	*0.01*
Recours au Bricanyl IV *n(%)*	13 (17.6)	19 (25.7)	*0.28*
Recours à l'adrénaline IV *n(%)*	4 (5.4)	13 (17.6)	*0.02*

Évolution

	VNI (n =74)	Non VNI (n =74)	P
Durée de séjour *(j)*	5.47 ± 3.87	5.48 ± 4.19	*0.9*
Complications *n(%)*	13 (17.6)	20 (27)	*0.24*
Complications infectieuses *n(%)*	1 (1.4)	5 (6.8)	*0.125*
Complications métaboliques *n(%)*	3 (4)	10 (13.5)	*0.06*
Complications hémodynamiques *n(%)*	0	7 (9.5)	*0.013*
Mortalité *n(%)*	2 (2.7)	4 (5.4)	*0.68*

VNI au cours de l'AAG hypercapnique est une technique ventilatoire **efficace, bien tolérée** avec **moindre risque de complications hémodynamiques**

- Diminue le recours à l'IET

A proposer en première intention dans la prise en charge des AAG hypercapniques

RESPIRATORY CARE • MAY 2010 VOL 55 NO 5

Noninvasive Ventilation in Severe Acute Asthma? Still Far From the Truth

Raffaele Scala MD

Table 1. Favorable Physiologic Effects of Noninvasive Ventilation in Severe Acute Asthma

Abnormality	Corrective Effect	Type of NIV
↑ Work of breathing	↓ intrinsic PEEP	CPAP, NIV
	↓ resistive load	NIV
↑ Bronchial hyper-reactivity	↓ exercise-induced bronchoconstriction	PEEP
	↓ methacholine-induced bronchoconstriction	CPAP
↑ Airway resistance	↑ β_2-agonist-induced bronchodilation	PEP, CPAP, PEEP, NIV
Atelectasis from mucus plugging	Collateral re-inflation	PEEP, CPAP
Gas-exchange impairment	↓ ventilation-perfusion mismatch	PEEP
	↑ P_{aO_2}	NIV
	↓ P_{aCO_2}	
	↑ pH	
Pulsus paradoxus	↓ negative inspiratory intrathoracic pressure	CPAP

NIV = noninvasive ventilation
CPAP = continuous positive airway pressure
PEP = positive expiratory pressure therapy
PEEP = positive end-expiratory pressure

What Are the Goals for Noninvasive Ventilation in Severe Acute Asthma?

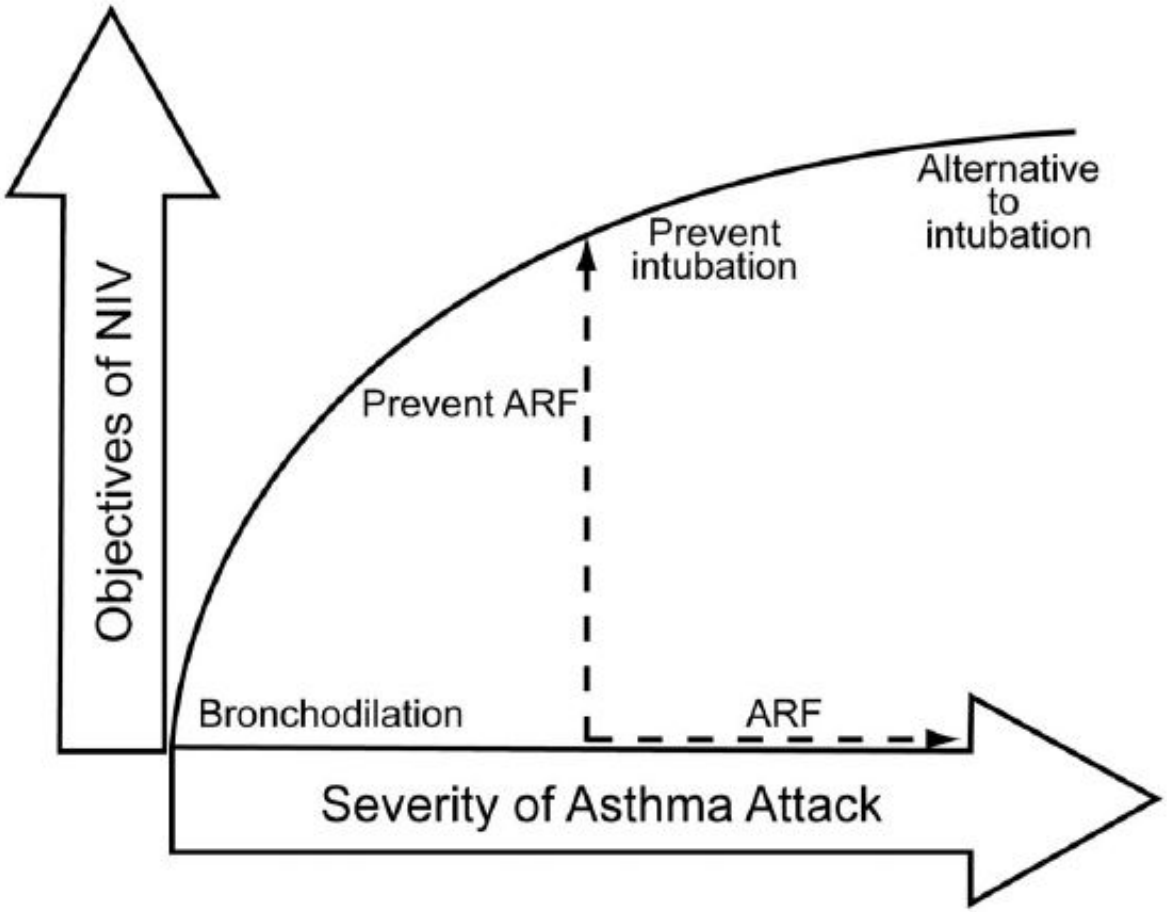


Fig. 1. Potential goals of noninvasive ventilation (NIV) in severe acute asthma. ARF = acute respiratory failure.

Noninvasive positive pressure ventilation in acute asthmatic attack

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TABLE 2 Risk factors and diagnostic criteria of severe asthma exacerbation

Patients at risk for respiratory
Diagnostic criteria of severe a
Use of accessory muscles
Paradoxical pulse >25 mmHg
*f*C >110 beats·min^{-1}
Respiratory rate >25–30 breat
Limited ability to speak
PEF or FEV_1 <50% pred
Arterial oxygen saturation <91
Risk factors for severe asthm
Recent hospitalisation
Prior ICU admission with mecl
Poor adherence to therapy
High allergen exposure

NPPV: noninvasive positive pres
peak expiratory flow; FEV_1: fo
predicted; ICU: intensive care u

TABLE 4 Criteria for use of noninvasive positive pressure ventilation (NPPV)

Criteria for selecting sev
Tachypnea with respiratory
Tachycardia with *f*C >110
Use of accessory muscles
Hypoxia with a $Pa,O_2/FI,O_2$ r
Hypercapnia with Pa,CO_2 <
FEV_1 <50% pred[¶]

*f*C: cardiac frequency; Pa,C
fraction; Pa,CO_2: arterial car
in 1 s; % pred: % predicted
presence of at least one cri
pred after at least two cor
ipratropium 0.25 mg.

TABLE 3 Absolute and relative contraindications for noninvasive positive pressure ventilation (NPPV) trial

Contraindications for NPPV trial
Absolute contraindications
Need for immediate endotracheal intubation
Decreased level of consciousness
Excess respiratory secretions and risk of aspiration
Past facial surgery precluding mask fitting
Relative contraindications
Haemodynamic instability
Severe hypoxia and/or hypercapnia, $Pa,O_2/FI,O_2$ ratio of <200 mmHg, Pa,CO_2 >60 mmHg
Poor patient cooperation
Severe agitation
Lack of trained or experienced staff

Pa,O_2: arterial oxygen tension; Pa,CO_2: arterial carbon dioxide tension; FI,O_2: inspiratory oxygen fraction.


Ça marche pas la VNI dans l'asthme
Je vous ai bien dit que ça marche la VNI dans l'asthme !!!