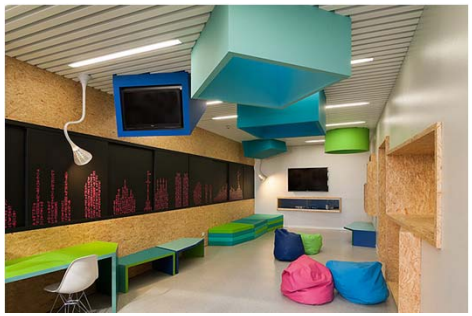
CÁNULAS DE ALTO FLUJO EN NEONATOLOGÍA

BCNATAL
SANT JOAN DE DÉU - CLÍNIC
CENTRO DE MEDICINA MATERNOFETAL Y NEONATAL BARCELONA

Dr. Julio Moreno.
Servicio Neonatología. H Sant Joan de Déu.
Barcelona.

HSJD



- Monográfico Materno-infantil - 350 camas.
- Universidad-Investigación
- Propiedad de la Comunidad HSJD.
- Concertación pública 80% . Sin ánimo de lucro.
- Nivel- C UCIN 23
  - ✓ Terapia fetal.
  - ✓ Cirugía Cardiovascular - ECMO.
  - ✓ Cirugía malformaciones.
  - ✓ Neurocríticos- HDC

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ASISTENCIA RESPIRATORIA NEONATAL

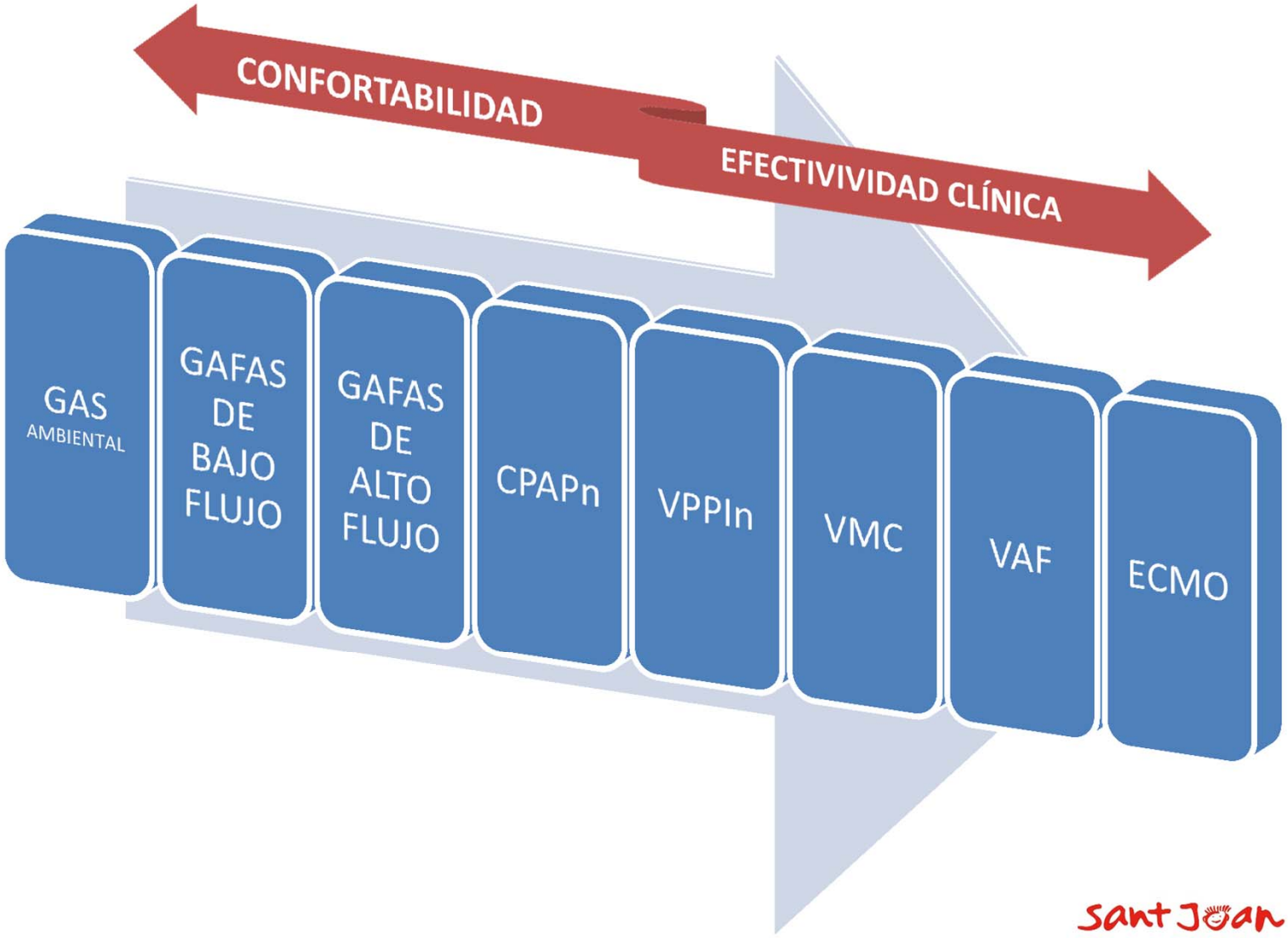
GAFAS NASALES DE ALTO FLUJO. REALIDAD ACTUAL

MANEJO CLÍNICO

EVIDENCIA

CONCLUSIONES

ASISTENCIA RESPIRATORIA NEONATAL



CPAPn - IPPVn

HFNC

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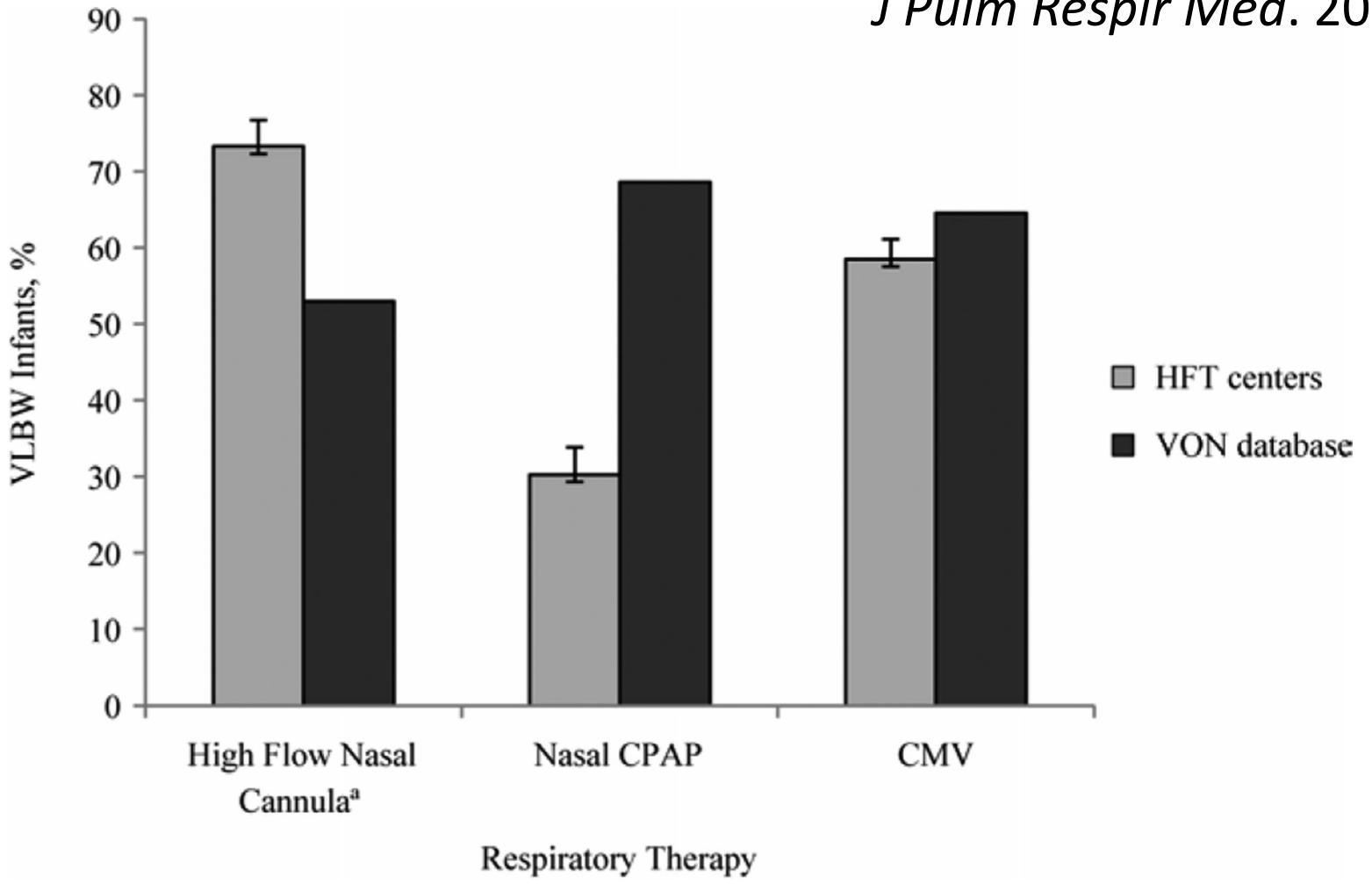
USO HFNC - MUNDIAL

VON	2009	?	65%
UK	2012	44	75%
AUSTRALIA-NUEVA ZELANDA	2010	27	63%
UNITED STATES	2010	58	69%
ESPAÑA	2010	86	40%

USO HFNC

J Pulm Respir Med. 2014



5 centros
- US
- UK
- Australia

Safety and Long Term Outcomes with High Flow Nasal Cannula Therapy in Neonatology: A Large Retrospective Cohort Study

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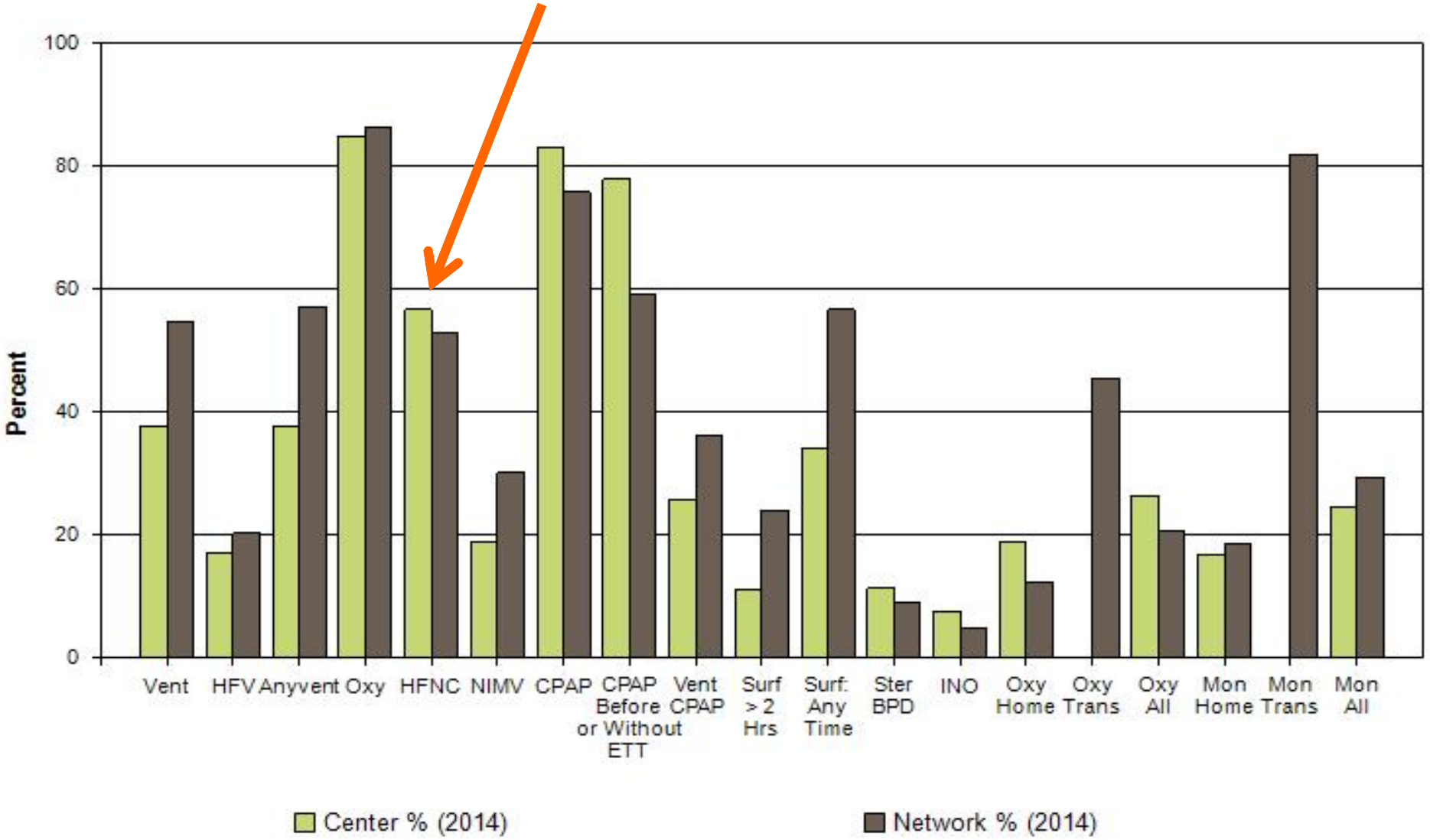
USO HFNC HSJD – VON 2014

HSJD 2014 -VON 2014
< 1500 gr o < 30 sem



INDICACIONES - CARACTERÍSTICAS

International survey on periextubation practices in extremely preterm infant

H Al-Mandari, W Shalish, E Dempsey, M Keszler, P G Davis, G Sant'Anna

Canadá - Irlanda – US – Australia

112 UCIN

HFNC tras extubación en < 28 semanas : **33%**

Arch Dis Child Fetal Neonatal Ed 2015;**100**:F428–F431.

INDICACIONES - CARACTERÍSTICAS

Use of heated humidified high-flow nasal cannula oxygen in neonates: a UK wide survey

Shalini Ojha, Eleanor Gridley, Jon Dorling (jon.dorling@nottingham.ac.uk)

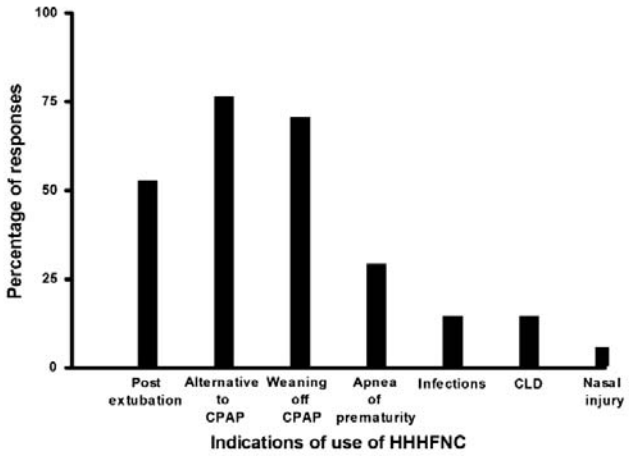
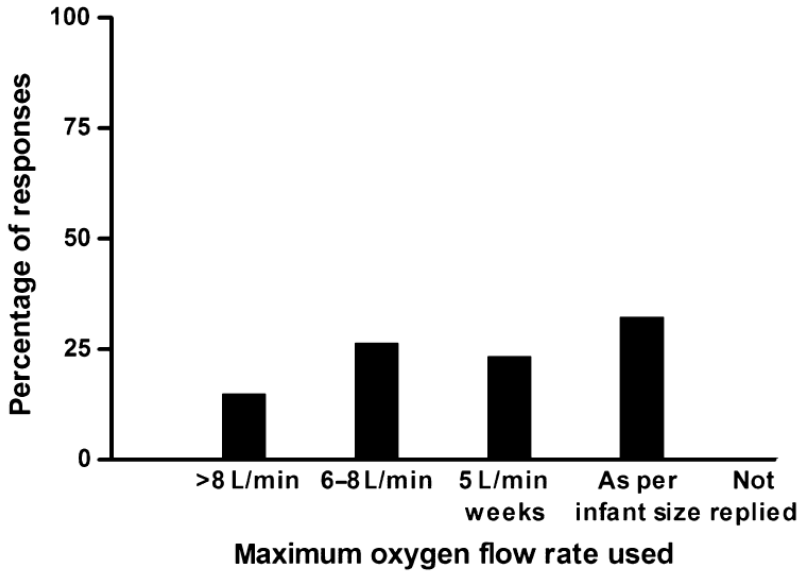


Figure 2 Indications for the use of HHHFNC in newborn infants in neonatal units in the UK; CLD, chronic lung disease.



Acta Pædiatrica 2013 **102**, pp. 249–253

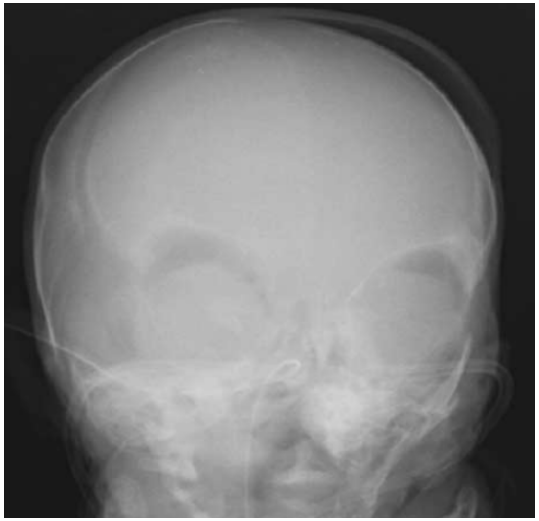
COMPLICACIONES

Serious Air Leak Syndrome Complicating High-Flow Nasal Cannula Therapy: A Report of 3 Cases

PEDIATRICS Volume 131, Number 3, March 2013

- 2 meses VRS NTX 8 l x min VPPI.
- 16 años Neumopatía PC Neumomediastino 20 l x min VPPI.
- 22 meses Postextubación (H Subdural) NTX 6 l xmin VPPI.

Subcutaneous scalp emphysema, pneumo-orbitis and pneumocephalus in a neonate on high humidity high flow nasal cannula



Journal of Perinatology (2008) 28, 779–781

26 sem . Destete VPPI – HFNC 2l x min

LFNC


VENTAJAS
COMODIDAD
MAL ACONDICIONAMIENTO DEL GAS
TEMPERATURA
HUMEDAD
CONCENTRACIÓN GAS
INCONVENIENTES

LFNC

Table 1 Hypopharyngeal oxygen concentrations (F_{HO_2}) generated with different methods of oxygen administration

Method	Reference	Weight (g)	Cannula/catheter diameter*	Oxygen flow (litres/min)	Mean F_{HO_2} (%)
Headbox					$F_{HO_2} = F_{IO_2}$ in box
Facemask					No data
Oxygen line to face					No data
Nasal prongs	Wilson *et al*[16]	932 (mean)	1 mm	0.2	42
			1 mm	0.3	40
			1 mm	0.5	45
	Finer *et al*[17]	590–1315	1 mm	0.2	83
		1580–4020	1 mm	0.2	47
	Vain *et al*[11]	1780–4090	1 mm	0.5	45 (SD 10)
			1 mm	1	65 (SD 9)
	Kuluz *et al*[14]	3000–10000	1 mm	0	20 (SE 0.4)
			1 mm	0.5	35 (SE 1.7)
			1 mm	1	45 (SE 1.8)
			1 mm	2	57 (SE 3.7)
			1 mm	3	70 (SE 2.5)
			1 mm	4	73 (SE 2.7)
	Fan & Voyles[33]	<3500	10 F	0.5	35†
		>3500	10 F	0.5	28†
			10 F	1	31†
			10 F	2	35†
Nasal catheter					No data
Nasopharyngeal catheter	Shann *et al*[34]	1400–1000	8 F	150 ml/kg	50†

*External diameter at distal portion of cannula/catheter; 1 mm cannula: Infant Nasal Cannula, Salter Labs, Arvin, California, USA.
†Indirect measurement (owing to positive end expiratory pressure production, the measured value may be higher than the real F_{HO_2}; see text).
SD, standard deviation; SE, standard error of mean.

DEFINICIÓN HFNC

NOMENCLATURA

HFNC – HHFNC – HHHFNC – HFT - GAF

- Flujos entre 1-8 L/min
- Flujos > 1L/min
- Flujos > 2 L/min
- Flujo que supera la demanda del paciente en respiración espontánea
- DOS CONDICIONES:
  - Flujo supera la demanda inspiratoria espontánea
  - Capacidad de lavar espacio muerto durante la espiración

MECANISMOS DE ACCIÓN

MECANISMO ACCIÓN	DESCRIPCIÓN
Lavado de espacio muerto	Reduce el espacio muerto con ventilación minuto mas eficiente
Reduce trabajo inspiratorio	Supera el flujo inspiratorio eliminando la resistencia nasal
Mejora la mecánica pulmonar	El gas caliente y humidificado da lugar a una mejora de la conductancia y compliance pulmonar
Elimina el consumo metabólico asociado al acondicionamiento de gases	Reduce la energía necesaria para el acondicionamiento de los gases
Presión de distensión variable	El flujo puede dar lugar a una presión de distensión pulmonar para reclutamiento pulmonar
Mejora de movilización de secreciones	El acondicionamiento de los gases da lugar a un mejor aclaramiento mucociliar.

ASPECTOS FISIOLÓGICOS

FLUJO

CONCENTRACIÓN DEL GAS

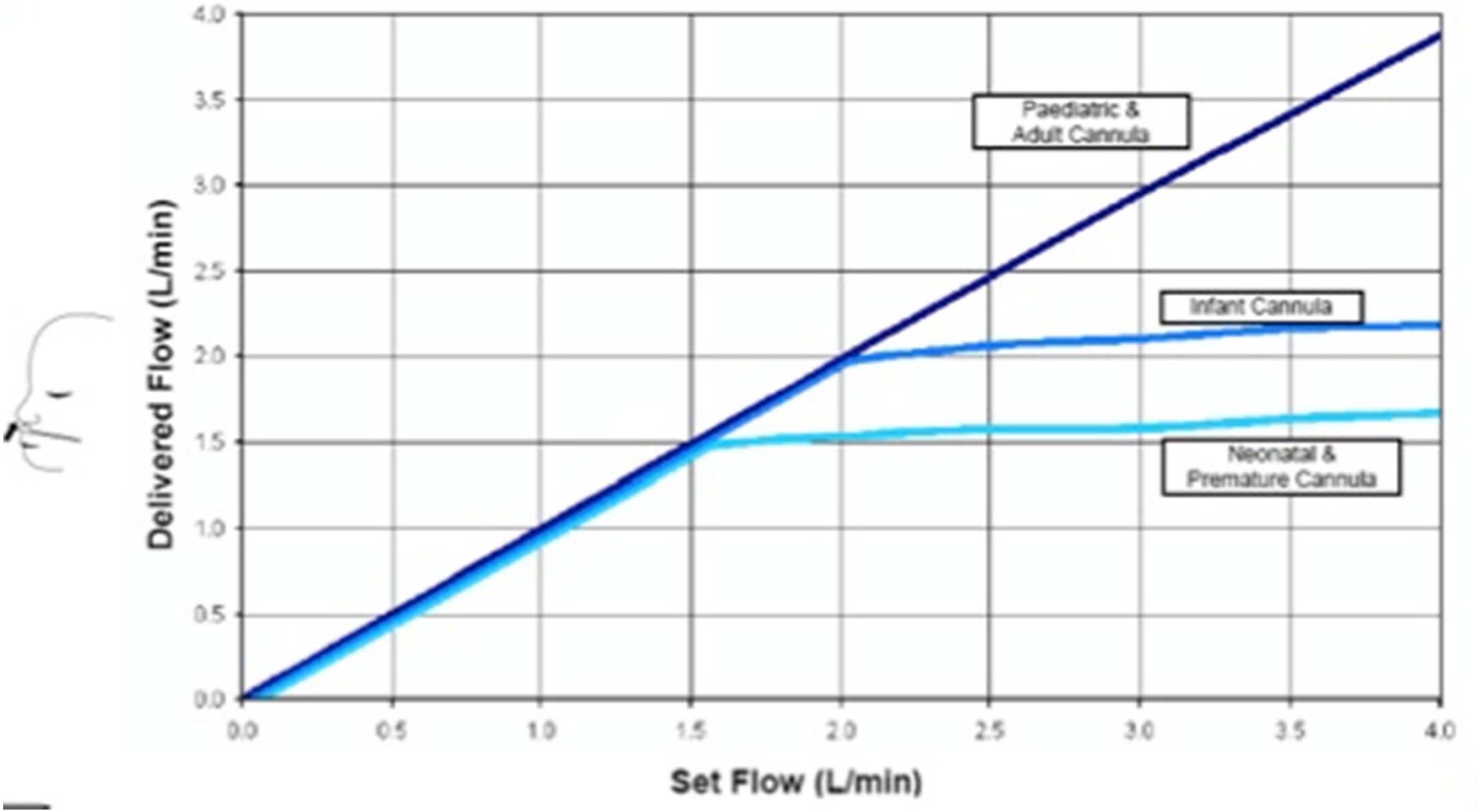
TEMPERATURA - RUIDO

HUMEDAD

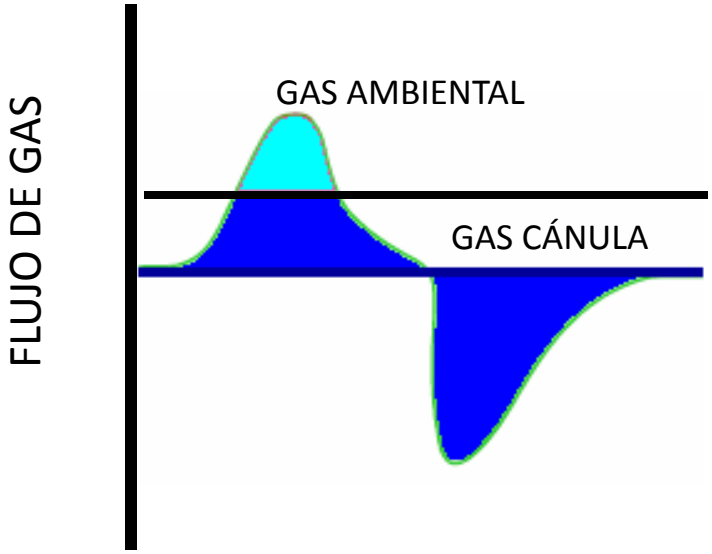
PRESIÓN

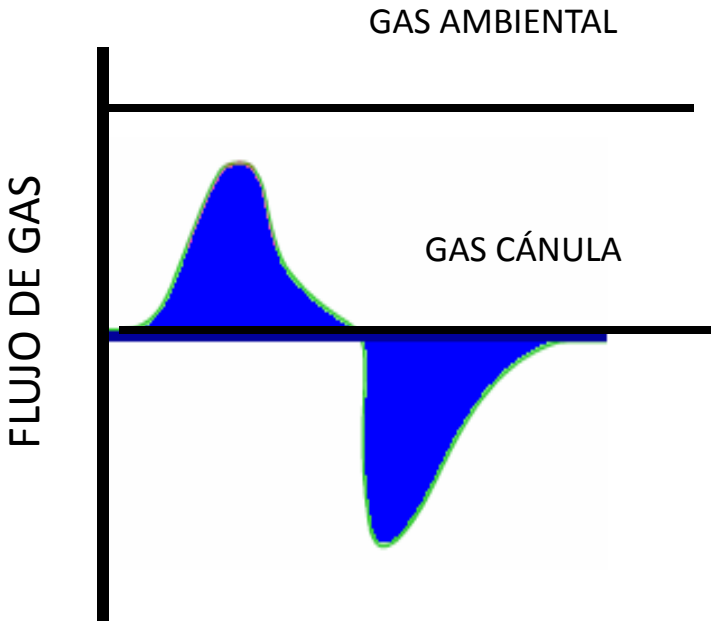
ESPACIO MUERTO VÍAS RESPIRATORIAS SUPERIORES

FLUJO

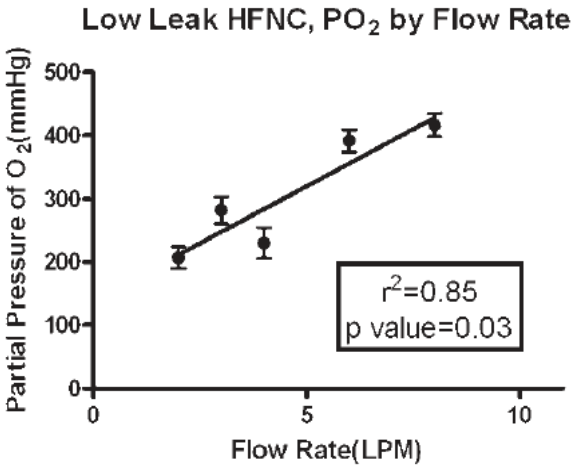

Delivered Flow (L/min)
Set Flow (L/min)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Paediatric & Adult Cannula
Infant Cannula
Neonatal & Premature Cannula

FLUJO-CONCENTRACIÓN DE GAS

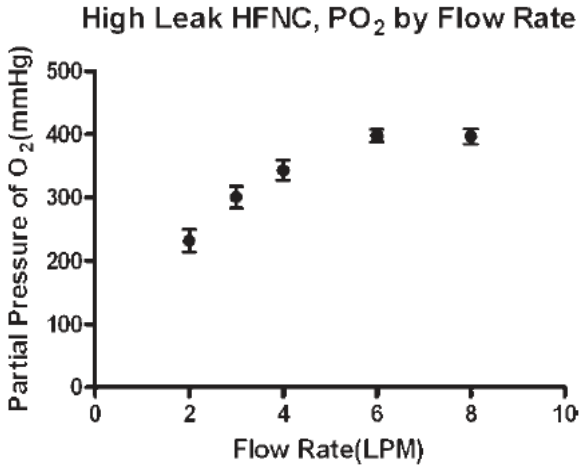




EFECTOS EN LA OXIGENACIÓN

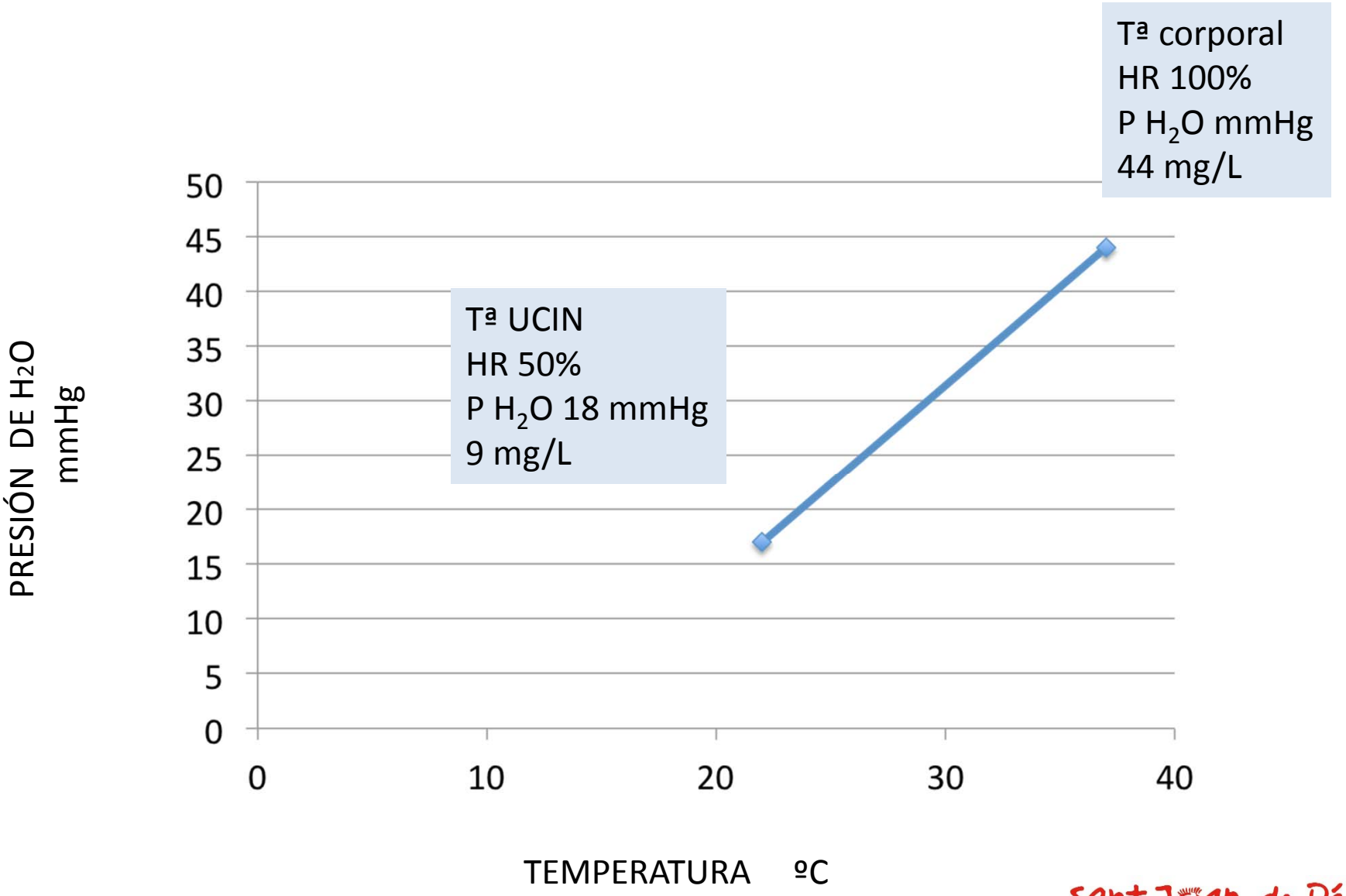


High-Flow Nasal Cannula: Impact on Oxygenation and Ventilation in an Acute Lung Injury Model



Pediatric Pulmonology 46:67–74 (2011)

TEMPERATURA-HUMEDAD



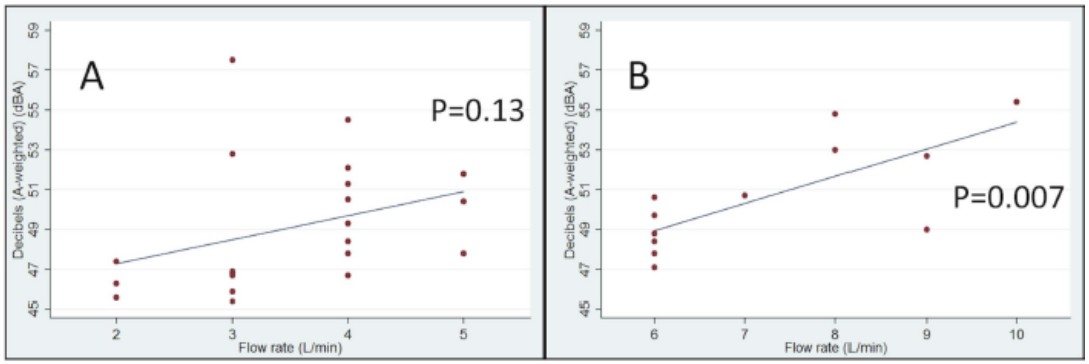
RUIDO

Are high flow nasal cannulae noisier than bubble CPAP for preterm infants?

Arch Dis Child Fetal Neonatal Ed 2014;**99**:F291–F296.

CONCLUSION

This study showed that at the gas flows studied, HFNC are not noisier than BCPAP for preterm infants. Both therapies produced noise levels >45 dBA. There was a trend towards noise increasing with higher HFNC gas flow, and this relationship was significant for BCPAP. There was no relationship between BCPAP set pressure and noise.



A : HFNC

B : BCPAP

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PRESIÓN

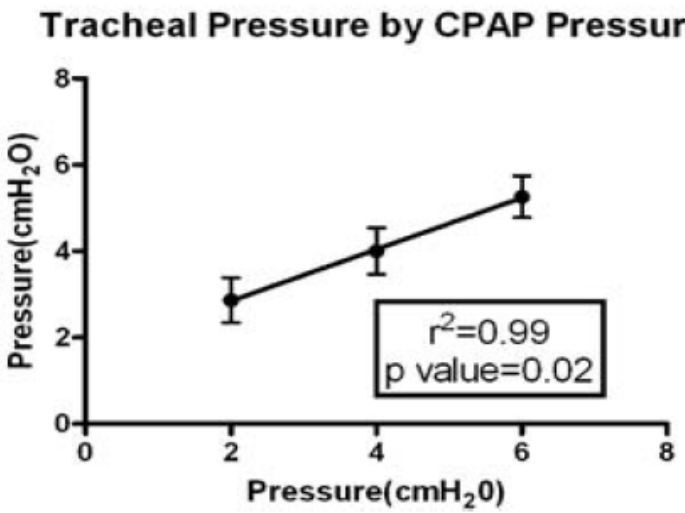
FACTORES QUE INFLUYEN

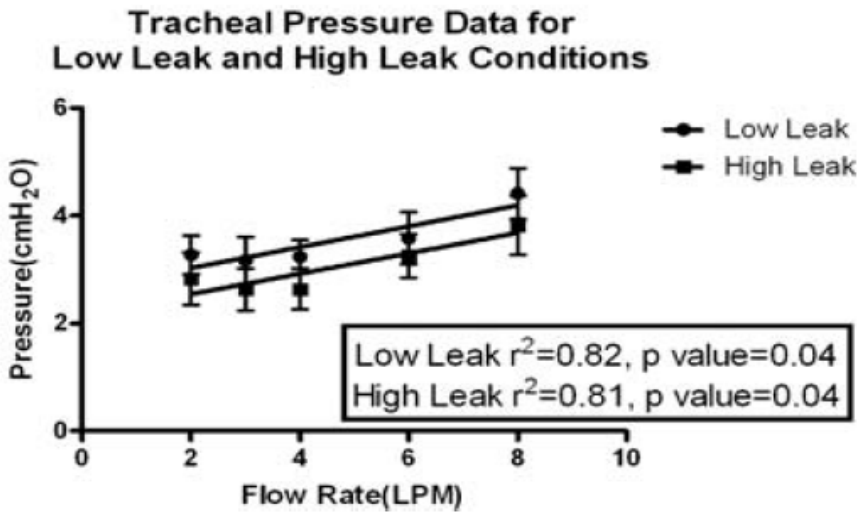
-Flujo

-Diámetro de cánulas

-Fuga nasal-oral

-Peso



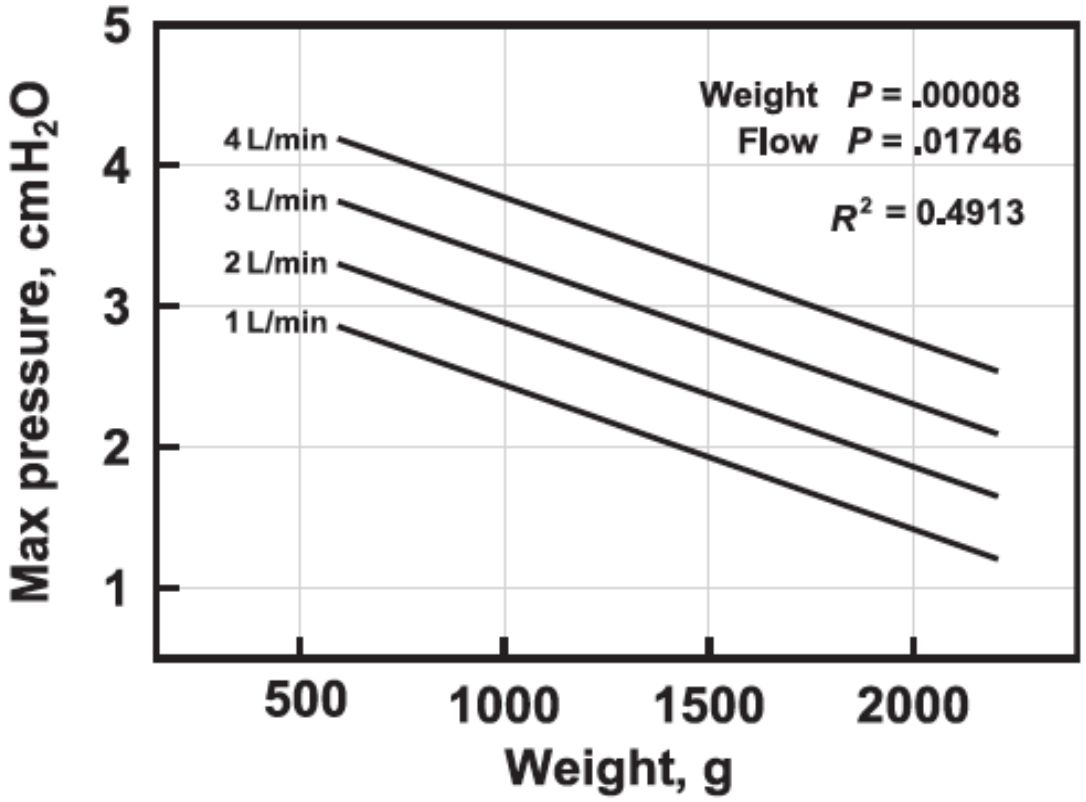


High-Flow Nasal Cannula: Impact on Oxygenation and Ventilation in an Acute Lung Injury Model

Pediatric Pulmonology 46:67–74 (2011)

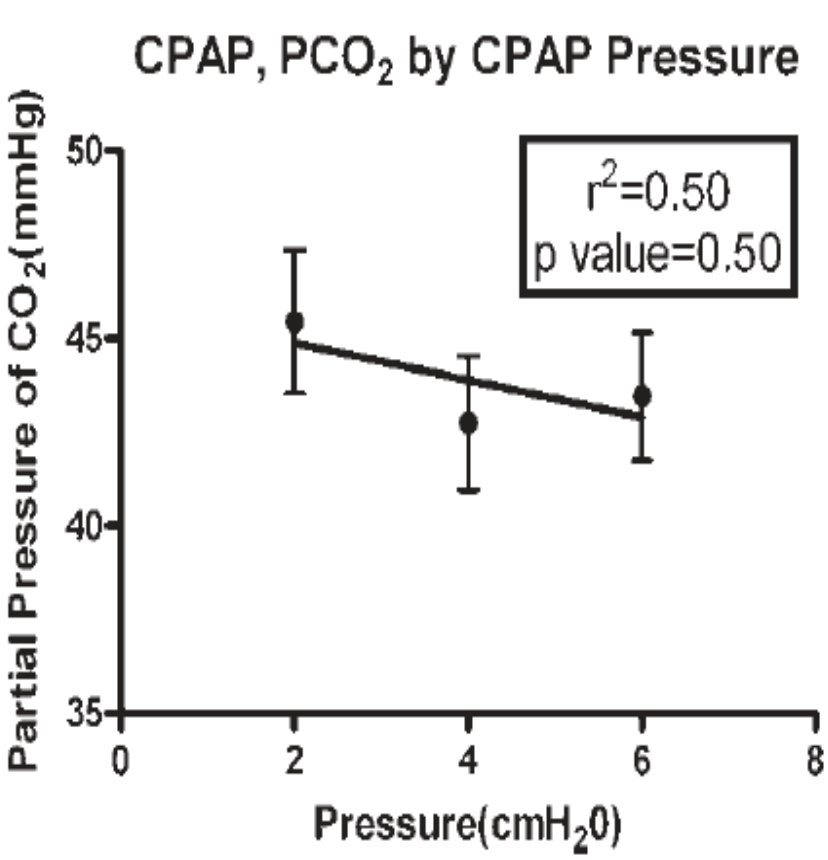
PRESIÓN

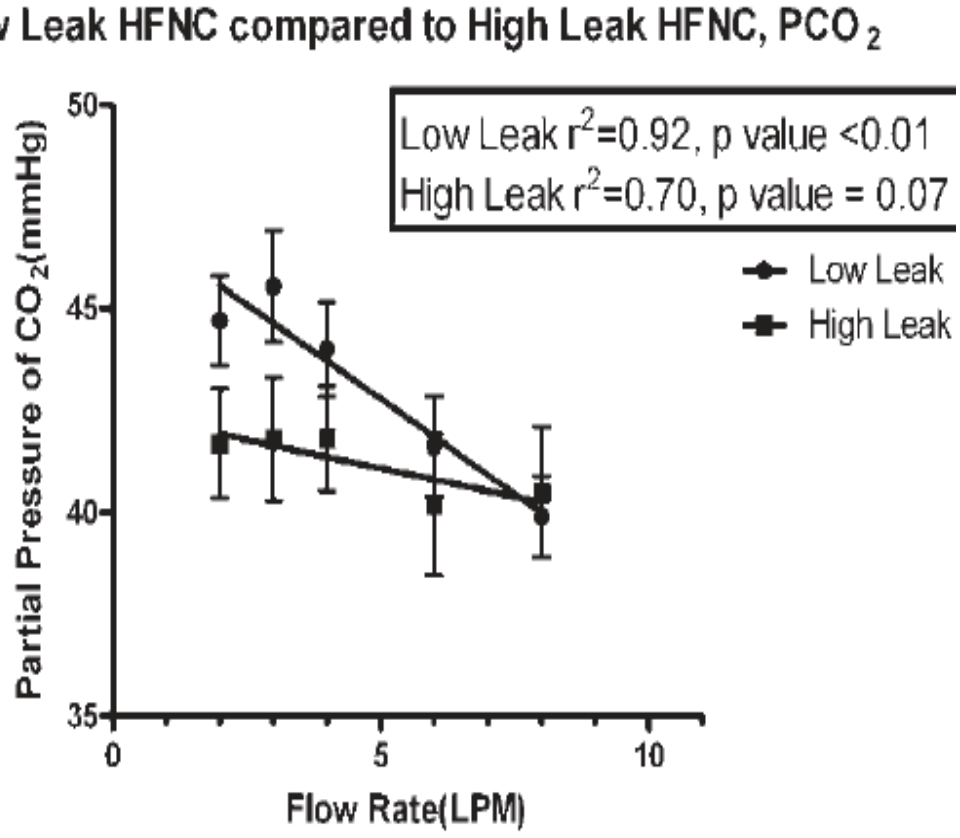
Heated, Humidified High-Flow Nasal Cannula Therapy: Yet Another Way to Deliver Continuous Positive Airway Pressure?



PEDIATRICS Volume 121, Number 1, January 2008

ESPACIO MUERTO
LAVADO DE CO_2





High-Flow Nasal Cannula: Impact on Oxygenation and Ventilation in an Acute Lung Injury Model

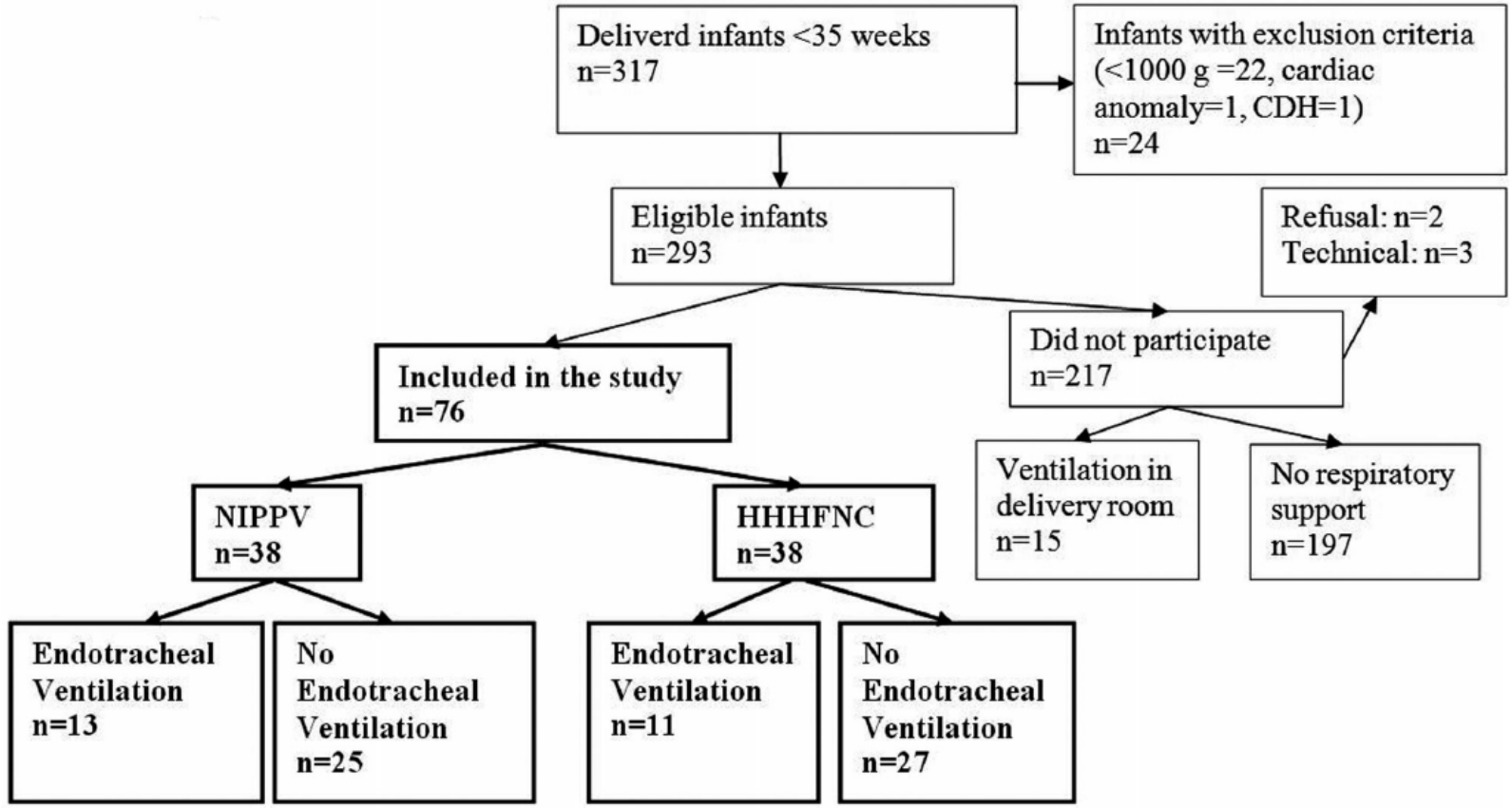
Pediatric Pulmonology 46:67–74 (2011)

INDICACIONES HFNC

- TRATAMIENTO SDR PREMATURO ???
- TRAS LA EXTUBACIÓN Y EVITAR LA REINTUBACIÓN
- ALTERACIONES EN EL PATRÓN RESPIRATORIO DEL PREMATURO
- DESTETE CPAPn
- DISPLASIA BRONCOPULMONAR
- OTRAS PATOLOGÍAS DEL NEONATO NO PREMATURO

A Randomized Pilot Study Comparing Heated Humidified High-Flow Nasal Cannulae with NIPPV for RDS

Amir Kugelman, MD, Arieh Riskin, MD, MHA, Waseem Said, MD, Irit Shoris, RN, BA, Frida Mor, RN, BA, and David Bader, MD, MHA



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Pediatric Pulmonology 50:576–583 (2015)

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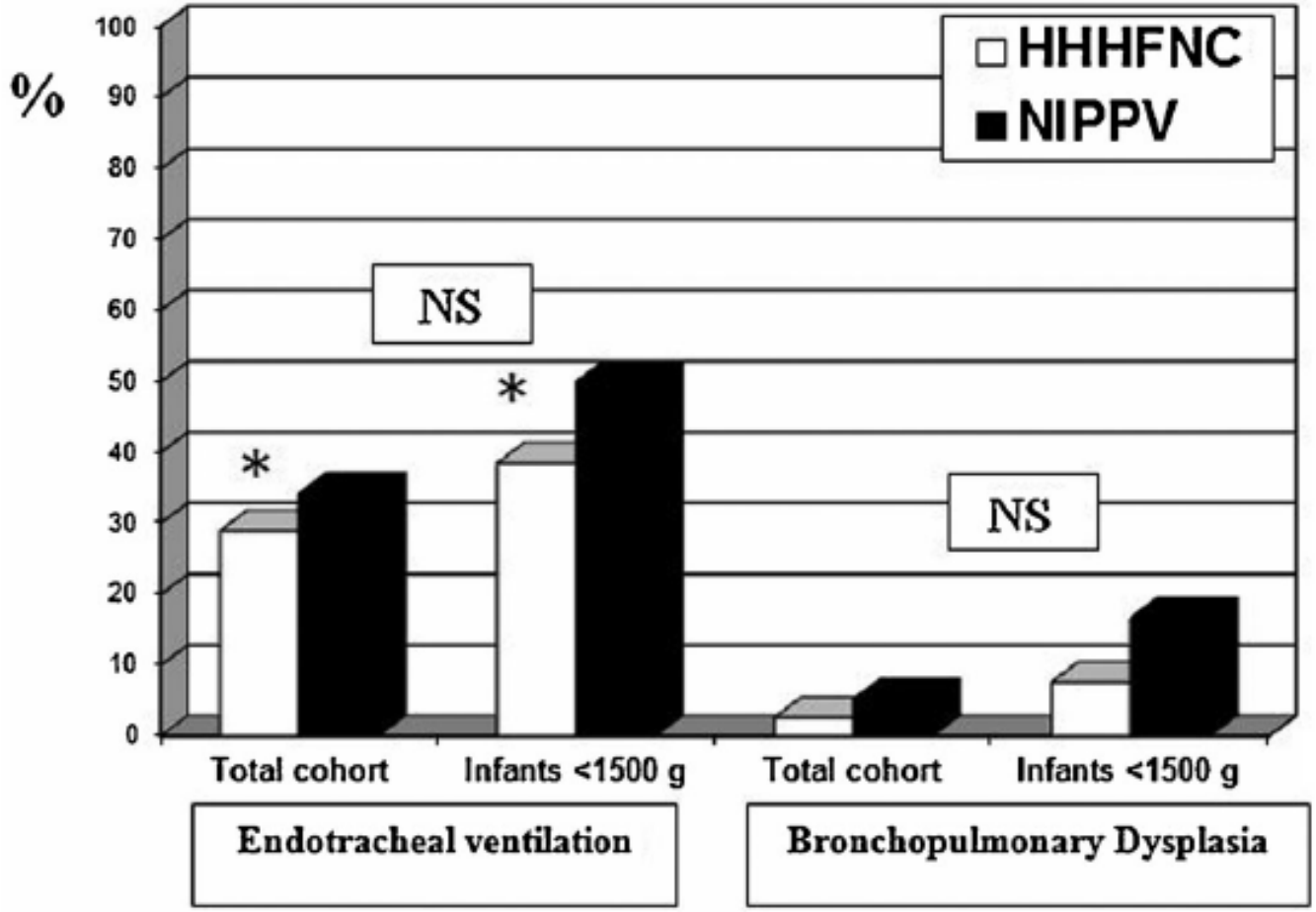

Pediatric Pulmonology 50:576–583 (2015)

TRATAMIENTO SDR PREMATURO

Heated, Humidified High-Flow Nasal Cannula Versus Nasal CPAP for Respiratory Support in Neonates

Bradley A. Yoder, Ronald A. Stoddard, Ma Li, Jerald King, Daniel R. Dirnberger and Soraya Abbasi

Pediatrics 2013;131;e1482; originally published online April 22, 2013;

Estudio prospectivo , randomizado. 8 centros.

Compara HHHFNC vs CPAPn en Insuficiencia respiratoria inicio y postextubación

N: 432 (28-42 semanas)

- **150 <32 s**

Outcome primario: Intubación 72h.

Exclusión < 1000 gr y < 28s

Dispositivos: HHHFNC (3)

CPAPPn : ventilador y específicos

TRATAMIENTO SDR PREMATURO

Manejo :

INICIO : Peso 1000-2000 gr 3 lpm
2000-3000 gr 4 lpm
> 3000 5 lpm

CAMBIOS: Aumento de 1 lpm (max 3 lpm sobre lpm iniciales):
- > 10% FiO2.
- > 10 mmHg PaCO2
- Aumento trabajo respiratorio
- Menor volumen pulmonar Rx

Destete : 0,5 – 1 lpm cada 4 horas hasta 2 lpm
- FiO2 < 30% con Sat O2 adecuadas
- PaCO2 adecuadas
- No signos de trabajo respiratorio
- Buen volumen pulmonar

Heated, Humidified High-Flow Nasal Cannula Versus Nasal CPAP for Respiratory Support in Neonates
Bradley A. Yoder, Ronald A. Stoddard, Ma Li, Jerald King, Daniel R. Dirnberger and Soraya Abbasi
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TRATAMIENTO SDR PREMATURO

TABLE 2 Demographic Characteristics of Infants Randomly Assigned to nCPAP or HHHFNC

	nCPAP (n = 220)	HHHFNC (n = 212)
Gestational age, mean ± SD, wk	33.2 ± 3.2	33.5 ± 3.6
<32 wk, n (%)	75 (34)	75 (35)
Birth weight, mean ± SD, g	2108 ± 782	2201 ± 816
<2000 g, n (%)	111 (50)	100 (47)
Male, n (%)	137 (62)	137 (65)
Antenatal steroids, n (%)	71 (32)	80 (38)
Respiratory distress syndrome, n (%)	162 (74)	156 (74)
Study start age, median (25%–75%), h	20 (7–54)	24 (8–62)
Start age <7 d, n (%)	201 (91)	194 (92)
Prestudy support mode, n (%)		
Ventilator	145 (66)	146 (69)
nCPAP	46 (21)	39 (18)
Other (NC, hood O_2, room air)	29 (13)	27 (13)
Prestudy surfactant, n (%)	129 (59)	142 (67)
Prestudy nitric oxide, n (%)	18 (8)	13 (6)
Prestudy caffeine, n (%)	66 (30)	58 (27)

$P > .05$ for all comparisons.

Heated, Humidified High-Flow Nasal Cannula Versus Nasal CPAP for Respiratory Support in Neonates

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TRATAMIENTO SDR PREMATURO

	CPAPn (n:220)	HHHFNC (N:212)	RR (95%CI)
FRACASO todos	18 (8,2%)	23 (10,8%)	1,37 (0,7-2,6)
< 32s	5/75 (6,7%)	3/75(4%)	0,58(0,1-2,5)
SIN LESIÓN NASAL	180 (84%)	187 (91%)	P<0,05

Heated, Humidified High-Flow Nasal Cannula Versus Nasal CPAP for Respiratory Support in Neonates

Bradley A. Yoder, Ronald A. Stoddard, Ma Li, Jerald King, Daniel R. Dirnberger and Soraya Abbasi

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Nasal High Flow as Primary Respiratory Support for Preterm Infants HIPSTER Trial

28- 36.6 s

Tras estabilización inicial (No IT-No surf)

Criterio de inicio de VNI

HFNC : 6-8 l/m - 2 dispositivos

CPAPn : 6-8 cmH_20 – Diferentes generadores
y prongs binasal cortos o mascarilla nasal

Manejo : < 1250 gr cafeina en primeras 24 h.
Cambios de 1l/m o cmH_2O.
Destete tras $FiO_2 \leq 30\%$ y flujos 4l/min o 5 cmH_2O
Si fracasa HFNC pasa a CPAPn

Fracaso: HFNC > 8l/m o CPAPn > 8 cmH_2O
$FiO_2 > 40\%$- pH ≤ 7.20 $PCO_2 > 60$ mmHg
Apnea requiere PPIn o > 6 /6 h

TRATAMIENTO SDR PREMATURO

Nasal High Flow as Primary Respiratory Support for Preterm Infants HIPSTER Trial

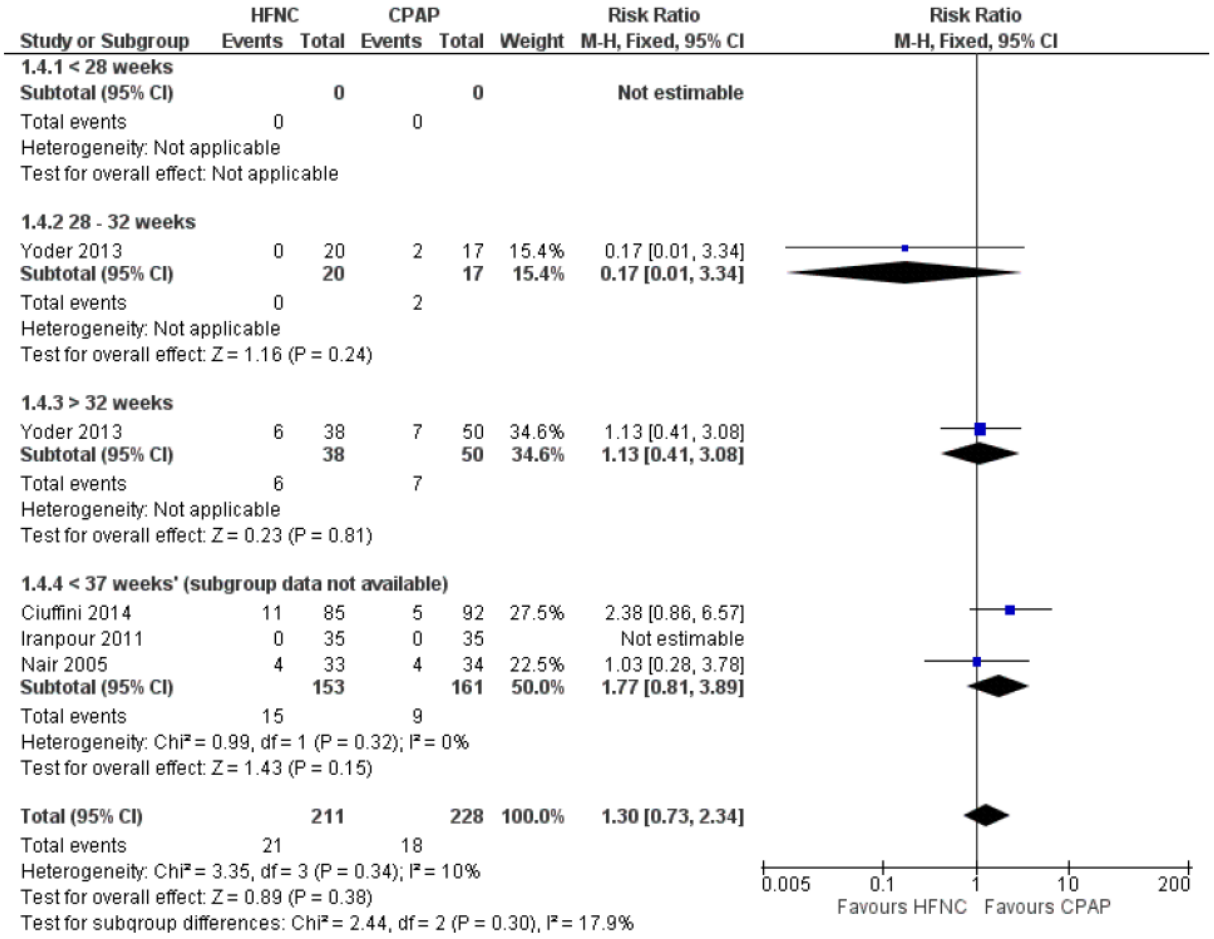
N =564

RESULTADOS	HFNC	CPAPn	*P* value
FRACASO estrategia inicial	71/278 25.5 %	38/286 13.3 %	< 0.001
VPPI	43/278 15.5%	33/286 11.5%	P= 0.17
LESIONES NASALES	8.3%	18.5%	< 0.001
NTX	0%	2.1%	0.02
O2 SUPLEMENTARIO	78.1 %	69.6%	0.02
DÍAS SOPORTE	4	3	0.005

High flow nasal cannula for respiratory support in preterm infants (Review)

Wilkinson D, Andersen C, O'Donnell CPF, De Paoli AG, Manley BJ

Figure 1. Forest plot of comparison: 1 HFNC versus CPAP soon after birth for treatment or prophylaxis of RDS, outcome: 1.4 Treatment failure within 7 days of trial entry.



High-Flow Nasal Cannulae in Very Preterm Infants after Extubation

Brett J. Manley, M.B., B.S., Louise S. Owen, M.D., Lex W. Doyle, M.D.,
Chad C. Andersen, M.B., B.S., David W. Cartwright, M.B., B.S.,
Margo A. Pritchard, Ph.D., Susan M. Donath, M.A., and Peter G. Davis, M.D.

A multicenter,randomized,non-inferiority trial **HIPERSPACE-TRIAL**

Dr Manley Brett

< 32 S N: 303 HFNC 5-6 L/min vs NCPAP 7 cm H_2O

Outcome primario : fracaso a los 7 días

Inferioridad se define > 20%

N Engl J Med 2013;369:1425-33.

TRAS LA EXTUBACIÓN DEL PREMATURO

High-Flow Nasal Cannulae in Very Preterm Infants after Extubation

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Chad C. Andersen, M.B., B.S., David W. Cartwright, M.B., B.S.,
Margo A. Pritchard, Ph.D., Susan M. Donath, M.A., and Peter G. Davis, M.D.

TODOS	HFNC	NCPAP
FRACASO	52/152 34%	39/151 26%

DIFERENCIA DE 8% 95% CI (-2,19) %

> 26 S	HFNC	NCPAP
FRACASO	26/120 22%	20/120 17%

DIFERENCIA DE 5%

< 26 S	HFNC	NCPAP
FRACASO	26/32 81%	19/31 61%

DIFERENCIA DE 20% 95% CI (-2,42) %

A Randomized Controlled Trial to Compare Heated Humidified High-Flow Nasal Cannulae with Nasal Continuous Positive Airway Pressure Postextubation in Premature Infants

Clare L. Collins, MBChB, FRACP[1], James R. Holberton, MBBS, FRACP[1], Charles Barfield, MBBS, FRACP[1], and Peter G. Davis, MD, FRACP[2]

J Pediatr 2013

N:132 < 32 s

HHHFNC vs NCPAP

Fracaso : VPPI < 7 d.

	HHHFNC (N:67)	NCPAP (N:65)	*P* value
FRACASO	15 22%	22 34%	.14
≥ 28 s	4/37 (11%)	7/36 (19%)	.30
< 28 s	11/30 (37%)	15/29 (52%)	.24
		10 lesiones nasales pasaron a HHHFNC	

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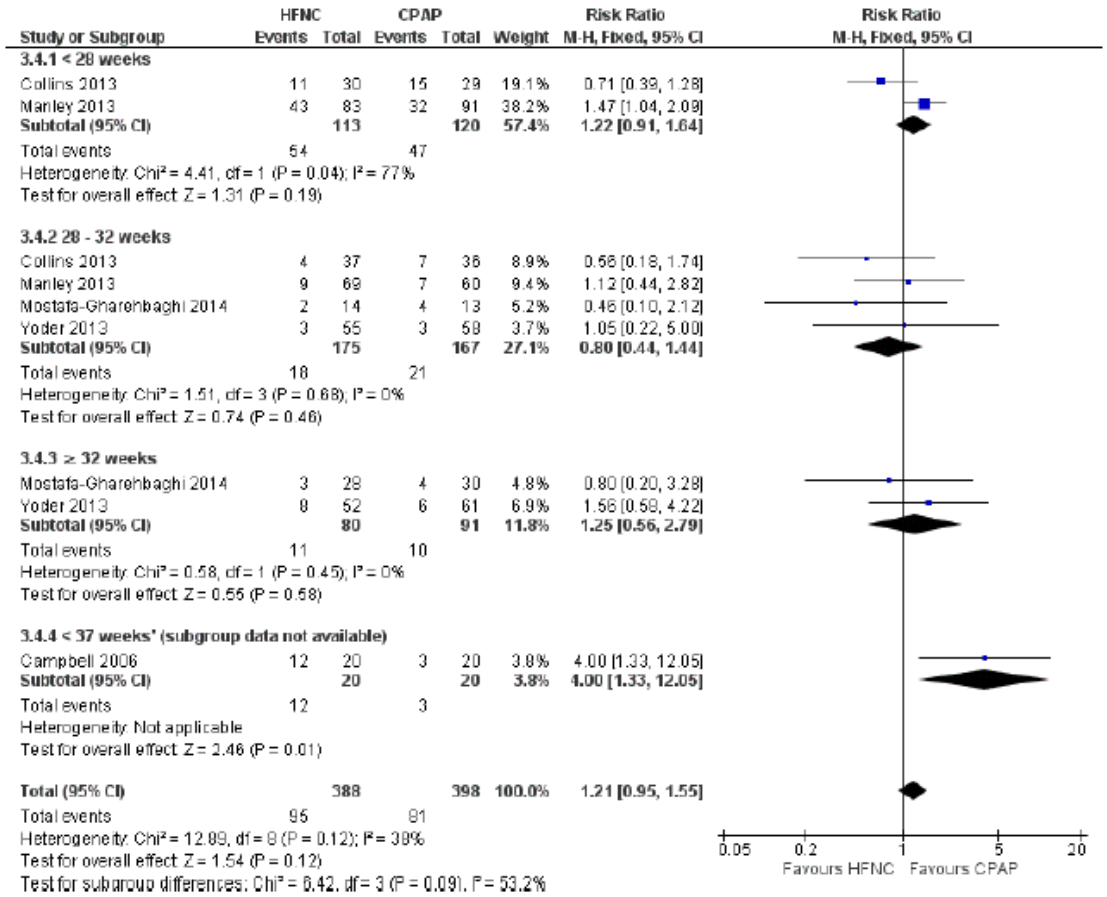
TRAS LA EXTUBACIÓN DEL PREMATURO

High flow nasal cannula for respiratory support in preterm infants (Review)

Wilkinson D, Andersen C, O'Donnell CPF, De Paoli AG, Manley BJ

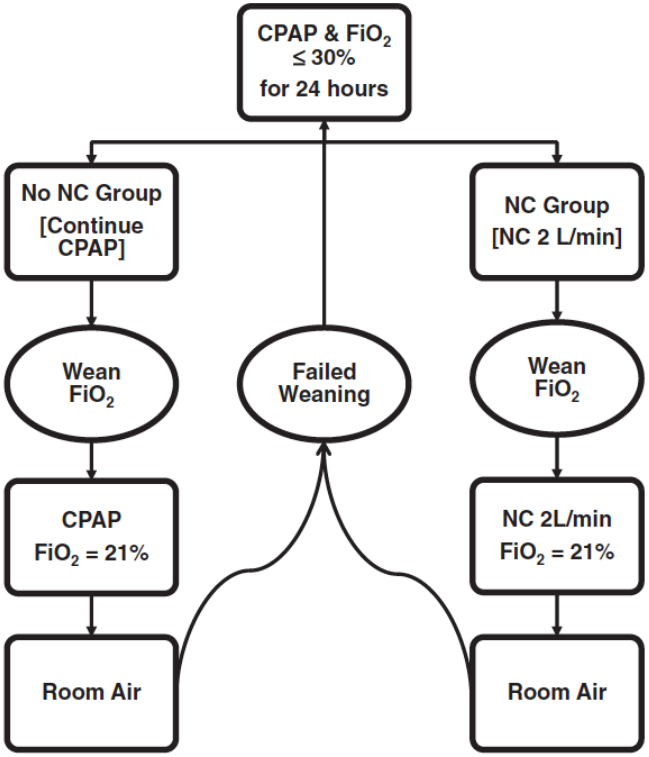
Figure 4. Forest plot of comparison: 3 High Flow Nasal Cannula versus CPAP to prevent extubation failure, outcome: Treatment failure.



HFNC
< trauma nasal
< NTX

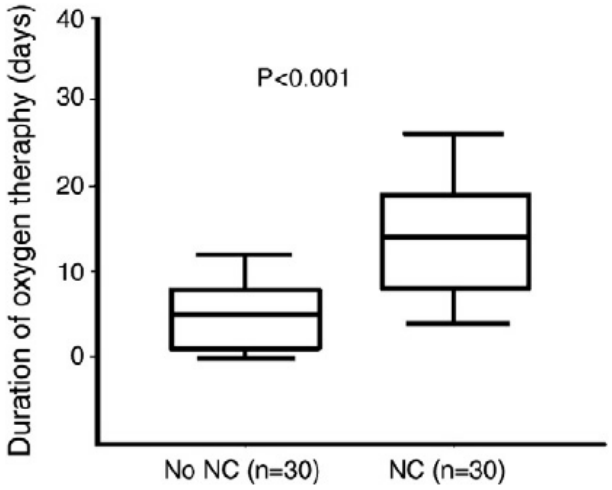
sant Joan de Déu
HOSPITAL MATERNOINFANTIL - UNIVERSITAT DE BARCELONA

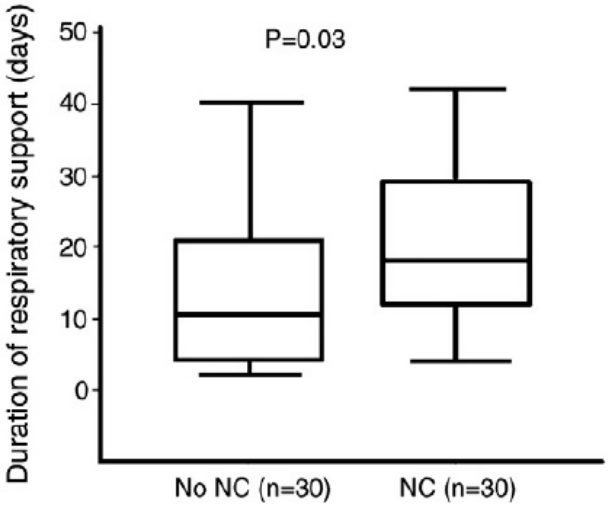
DESTETE DEL CPAPN



Early weaning from CPAP to high flow nasal cannula in preterm infants is associated with prolonged oxygen requirement: A randomized controlled trial

Early Human Development 87 (2011) 205–208





Randomised controlled trial of weaning strategies for preterm infants on nasal continuous positive airway pressure

Tang *et al. BMC Pediatrics* (2015) 15:147

Table 4 Outcomes of combined abrupt versus gradual NCPAP wean groups (data from randomisation; n (%) or median (IQR) unless specified)

	Abrupt NCPAP wean *n* = 30	Gradual NCPAP wean *n* = 30	*p*-value
CLD at 36 weeks	7 (23 %)	9 (30 %)	0.6
Days respiratory support	24 (13, 34)	28 (17, 34)	0.4
Days hospital stay	52 (41, 63)	61 (48, 69)	0.1
Days to full suck feeds	46.5 (35, 58)	54.5 (41, 65)	0.2
Days NCPAP	11 (1, 26)	17 (10, 29)	0.02
Gestational age off NCPAP	33.1 (31.0, 34.6)	34.6 (31.8, 36.1)	0.05
Days HFNC from start of treatment	15 (7, 24)	30 (20, 34)	0.003
Days pressure support	22 (9, 28)	28 (17, 34)	0.04
Gestational age off pressure support	33.9 (32.6, 35.4)	34.9 (32.7, 36.7)	0.2
Gestational age off respiratory support	34.4 (33.1, 35.9)	34.9 (32.7, 36.7)	0.7
Gestational age at full suck feeds	37.1 (36.4, 39.1)	38.7 (36.8, 39.9)	0.1
Gestational age at discharge	37.8 (37.1, 39.4)	38.7 (37.4, 41.0)	0.2

CONCLUSIONES

- HFNC necesita mas estudios con metodología correcta y diferentes indicaciones

- Aunque su uso y difusión ha sido incontrolado, parece ser que se han descrito pocos efectos indeseables.

- La confortabilidad y su indicación en los cuadros de insuficiencia respiratoria leve- moderada dan lugar al uso generalizado.

- Flujos entre 4-8 L/min parecen seguros y eficaces en el neonato.

CONCLUSIONES

- Hay que ser cauteloso en el uso en la fase aguda del SDR del prematuro principalmente en menores 28 semanas.

- Tras la extubación del prematuro > 26 semanas la eficacia no es inferior al CPAPn.

- En < 26 semanas tras la extubación hay que ser prudentes y seleccionar adecuadamente al paciente.

- La retirada del HFNC requiere experiencia y mas estudios.

MUCHAS GRACIAS