SOCIEDAD ARGENTINA DE PEDIATRÍA

Dirección de Congresos y Eventos

Comité Nacional de Estudios Feto neonatales (CEFEN)

3º Congreso Argentino de Neonatología

9º Jornadas Interdisciplinarias de Seguimiento del Recién Nacido de Alto Riesgo

3º Jornada Nacional de Perinatología

3º Jornadas Argentinas de Enfermería Neonatal

VENTILACIÒN NO INVASIVA EN RECIEN NACIDOS

3º Congreso Argentino de Neonatología
9º Jornadas Interdisciplinarias de Seguimiento del Recién Nacido de Alto Riesgo
3º Jornada Nacional de Perinatología
3º Jornadas Argentinas de Enfermería Neonatal

Por un niño sano en un mundo mejor

Terapia de Alto Flujo en Recién Nacidos

Lic. Andrea Canepari

Coordinadora de Pediatría y Neonatología
Sección de Cuidados Respiratorios
Servicio de Kinesiología
Hospital Italiano de Buenos Aires

HOSPITAL ITALIANO
de Buenos Aires

Soporte ventilatorio

- Inicial
  - AVM
  - VNI
    - nIPPV
    - nCPAP
    - CAFO2
- Post extubación
  - VNI
    - nIPPV
    - nCPAP
    - CAFO2

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Nasal CPAP or Intubation at Birth for Very Preterm Infants

Colin J. Morley, M.D., Peter G. Davis, M.D., Lex W. Doyle, M.D., Luc P. Brion, M.D., Jean-Michel Hascoet, M.D., and John B. Carlin, Ph.D., for the COIN Trial Investigators*

EW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Early CPAP versus Surfactant in Extremely Preterm Infants

SUPPORT Study Group of the Eunice Kennedy Shriver NICHD Neonatal Research Network*

e NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Trial Comparing Noninvasive Ventilation Strategies in Preterm Infants

Haresh Kirpalani, B.M., M.Sc., David Millar, M.B., Brigitte Lemyre, M.D., Bradley A. Yoder, M.D., Aaron Chiu, M.D., and Robin S. Roberts, M.Sc., for the NIPPV Study Group*

High-Flow Nasal Cannulae in the Management of Apnea of Prematurity: A Comparison With Conventional Nasal Continuous Positive Airway Pressure

Con Sreenan, Robert P. Lemke, Ann Hudson-Mason and Horacio Osiovich

Pediatrics 2001;107;1081
DOI: 10.1542/peds.107.5.1081

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

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.

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

Zuzanna J. Kubicka, Joseph Limauro and Robert A. Darnall

Pediatrics 2008;121;82
DOI: 10.1542/peds.2007-0957

Definición

- La Terapia de Alto Flujo es un ***sistema abierto*** de entrega de una mezcla de aire y oxigeno calentado y humidificado, a través de una cánula nasal, que ***cubre las demandas de flujo inspiratorio*** del paciente, entregando una ***FiO2 conocida*** y constante.

*Se considera TAF a la entrega de **flujos ≥ 2 L/min hasta 8 L/min en neonatos**, ≥ a 4 L/min hasta 25 L/min en niños y ≥ 6 L/min hasta 70 L/min en adolescentes y adultos.*

Sistema de alto flujo

FiO2 segura y conocida

Mezclador
De gases

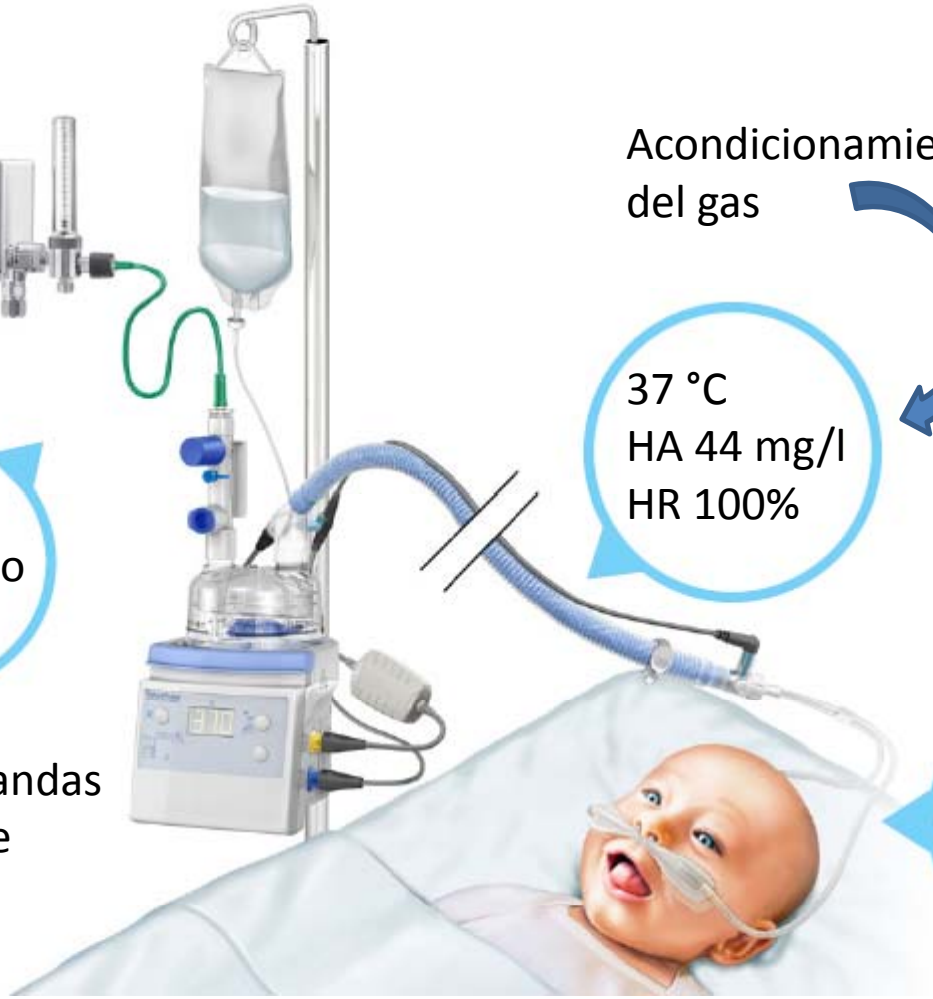
Acondicionamiento
del gas

37 °C
HA 44 mg/l
HR 100%

Alto Flujo

Flujo que cubre las demandas
inspiratorias del paciente

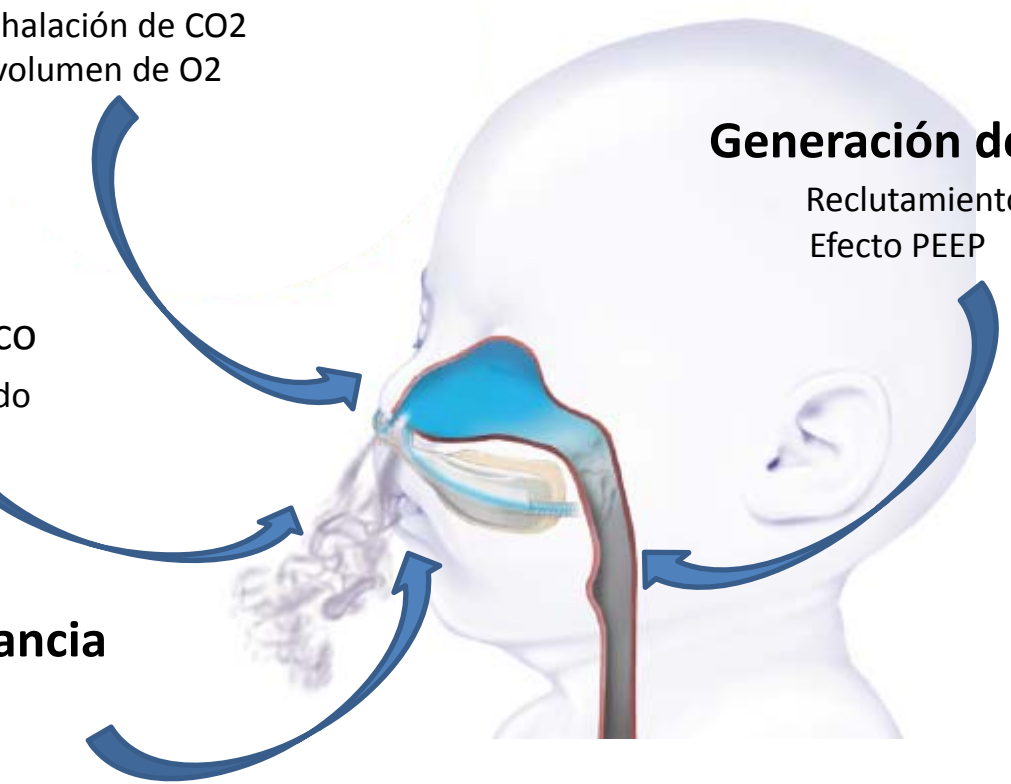
Sistema
abierto



Efecto fisiológico

Reducción del espacio muerto nasofaringeo (volumen VA extratoracica RN 3 ml/kg vs 0,8 ml/kg adulto)

Reduce la reinhalación de CO2
Aumento del volumen de O2



Generación de Presión

Reclutamiento alveolar
Efecto PEEP

Reducción del Gasto Metabólico

Acondicionamiento del gas inspirado

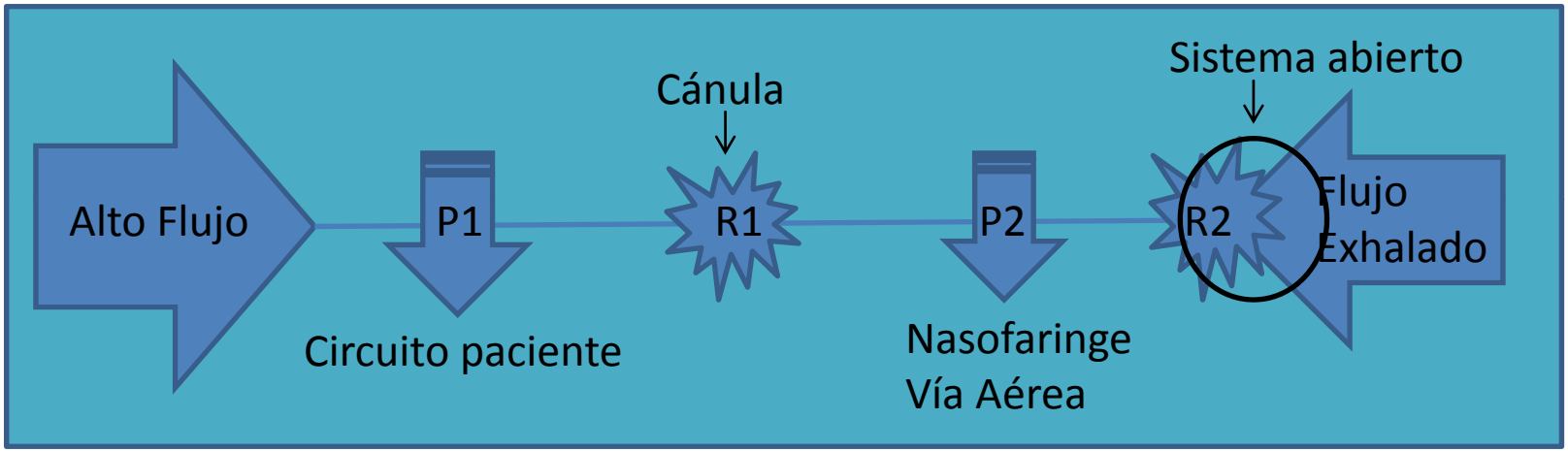
Aumento de la inductancia inspiratoria

Flujo Inspiratorio

Efecto sostén de la VA

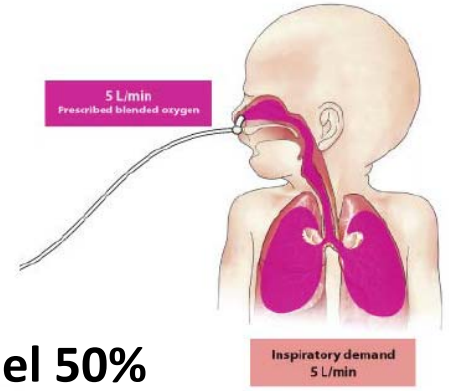
Dysart, K; Miller, T. “Research in high flow therapy:Mechanisms of action”. Respiratory Medicine (2009) XX, 1-6

Generación de presión



La presión en la nasofaringe depende

- Flujo seleccionado
- Dimensiones anatómicas de la vía aérea
- Pérdida a través de la cánula y la boca



Se recomienda una relación cánula-narina del 50%

Miller, T. "Vapotherm. Role of pressure in high flow therapy" Document#: 3010425 Rev New

Journal of Perinatology (2008) 28, 42–47

www.nature.com/jp

ORIGINAL ARTICLE

Pharyngeal pressure with high-flow nasal cannulae in premature infants

DJ Wilkinson[1,2], CC Andersen[1,3], K Smith[4] and J Holberton[1]

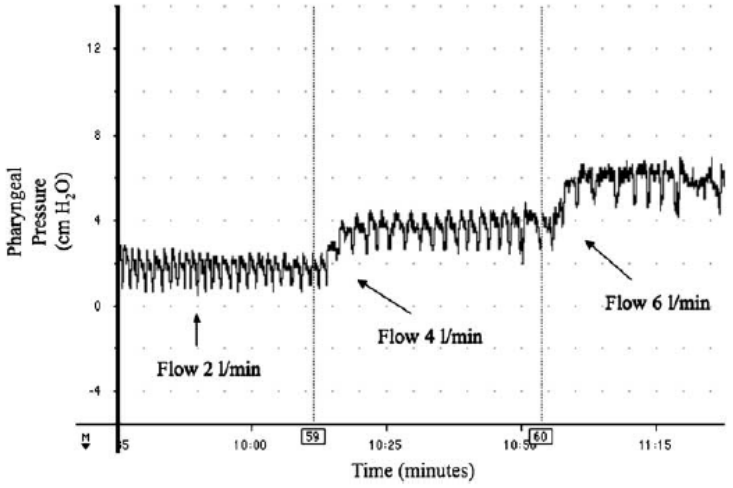
Objective: The aim of this study was to measure pharyngeal pressures in preterm infants receiving high-flow nasal cannulae.

Study Design: A total of 18 infants were studied (median gestational age 34 weeks, weight 1.619 kg). A catheter-tip pressure transducer was introduced into the nasopharynx. Flow was sequentially increased to a maximum of 8 l min^{-1} and decreased to a minimum of 2 l min^{-1}.

Result: There was a strong association between pharyngeal pressure and both flow rate and infant weight ($P<0.001$, $r^2=0.61$), but not mouth closure. This relationship could be expressed as pharyngeal pressure (cm H_2O) $=0.7+1.1$ F (F = flow per kg in l min^{-1} kg^{-1}).

Conclusion: High-flow nasal cannulae at flow rates of 2 to 8 l min^{-1} can lead to clinically significant elevations in pharyngeal pressure in preterm infants. Flow rate and weight but not mouth closure are important determinants of the pressure transmitted.

Journal of Perinatology (2008) **28**, 42–47; doi:10.1038/sj.jp.7211879; published online 8 November 2007



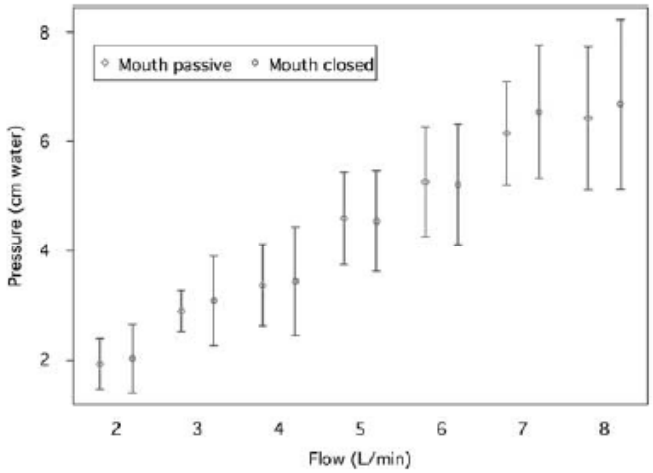


Figure 2 Mean pharyngeal pressure (with 95% confidence intervals) recorded at flow rates 2 to 8 l min^{-1}.

↑ 0,8 cmH2O por cada ↑l/min de flujo
↓ 1,4 cmH2= por cada ↑kg de peso

Selección del flujo

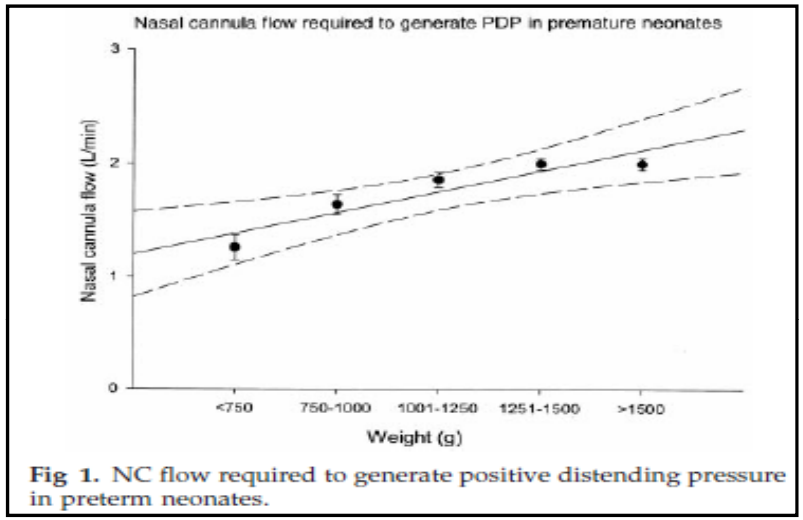


Fig 1. NC flow required to generate positive distending pressure in preterm neonates.

Flujo (L/min) = 0,92 + 0,68 x peso (kg)

Correlación=0,72

Sreenan, C; Lemke, R. "High-Flow Nasal Cannula in the Management of Apnea of Prematurity:A Comparison With Convencional Nasal Continuous Positive Airway Pressure"
Pediatrics 2001;107(5):1081-1083

Flujo Inspiratorio = (Volumen Corriente x Frecuencia Respiratoria) / Tiempo inspiratorio

Flujo inspiratorio 0,5 l/kg/min

Flujo Máximo 2 l/kg/min?

EJ: BB 1 kg FR 50 Ti 0,3
500ml/50=10ml de flujo inspiratorio por c/respiración
VT= flujo inspiratorio X TI
VT= 10 ml X 0,3 = 3 ml

Generadores de PEEP

- nCPAP (Presión constante y flujo variable)
  - Válvula espiratoria
  - Columna de agua (Bubble CPAP)
  - Pérdida

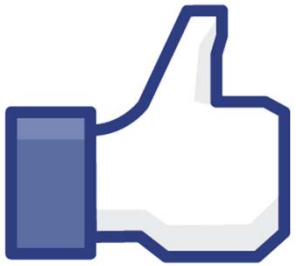
  } Mecánicos

- CAFO2 (Flujo constante y presión variable)
  - Flujo
  - Dimensiones de la VA
  - Pérdida

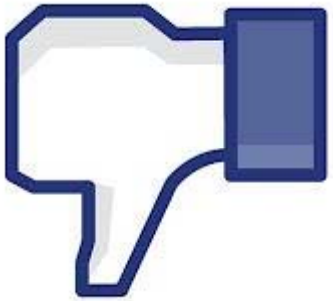
  } Anatómicos

La Presión de distención pulmonar generada por el Sistema de Alto Flujo es **dinámico** dependiendo de la fase del ciclo respiratorio

Evidencia



vs



Evidencia

Safety and Efficacy of High-Flow Nasal Cannula Therapy in Preterm Infants: A Meta-analysis

PEDIATRICS Volume 136, number 3, September 2015

Sarah J. Kotecha, BSc, SRD[a], Roshan Adappa, MRCPCH, MD[b], Nakul Gupta, MRCPCH[b], W. John Watkins, PhD[a], Sailesh Kotecha, FRCPCH, PhD[a], Mallinath Chakraborty, MRCPCH, PhD[ab]

BACKGROUND AND OBJECTIVE: High-flow therapy is the most recent, and popular, mode of respiratory support in neonates. However, the evidence supporting its efficacy and safety has not yet been established. We conducted a systematic review and meta-analysis of clinical trials comparing efficacy and safety of high-flow therapy compared with other modes of noninvasive ventilation (NIV) in preterm infants.

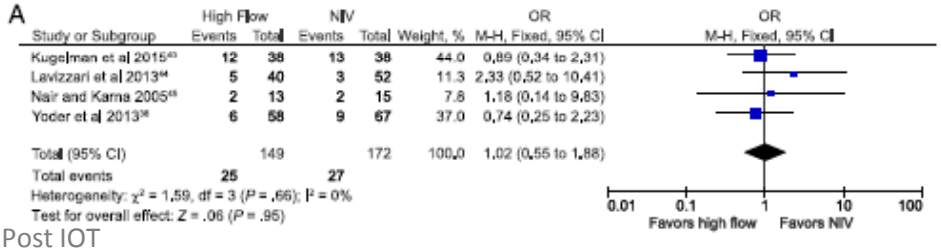
METHODS: Articles were indexed by using Medline, Embase, Scopus, OpenSIGLE, Health Management Information Consortium, and Cochrane Central Register of Controlled Trials. Randomized or quasi-randomized clinical trials involving preterm infants, comparing high-flow therapy with other modes of NIV, and reporting extractable data on relevant outcomes, were selected. Data on efficacy, safety, and other common neonatal outcomes were extracted on predesigned forms.

RESULTS: In this analysis, we included 1112 preterm infants, participating in 9 clinical trials. High-flow therapy was similar in efficacy to other modes of NIV in preterm infants when used as primary support (odds ratio of failure of therapy, 1.02 [95% confidence interval: 0.55 to 1.88]), as well as after extubation (1.09 [0.58 to 2.02]). There were no significant differences in odds of death (0.48 [0.18 to 1.24]) between the groups. Preterm infants supported on high-flow had significantly lower odds of nasal trauma (0.13 [0.02 to 0.69]).

CONCLUSIONS: High-flow therapy appears to be similar in efficacy and safety to other conventional modes of NIV in preterm infants. It is associated with significantly lower odds of nasal trauma. Caution needs to be exercised in extreme preterm infants because of the paucity of published data.

Objetivo 1rio: eficacia (falla de tratamiento)

Tratamiento inicial



Post IOT

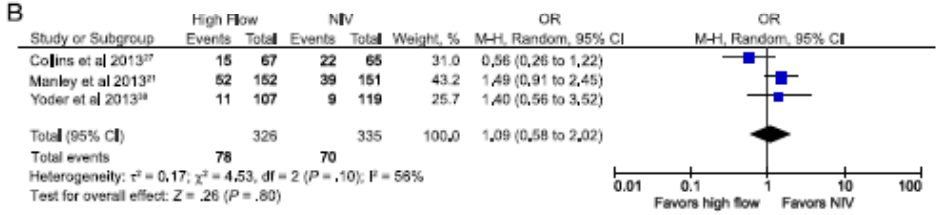


FIGURE 3
Pooled estimates of odds of failure of therapy of HHHFNC compared with other modes of NIV in preterm infants, when used as (A) primary mode of respiratory support, and (B) after extubation from MV.

Objetivo 1rio: efectividad (mortalidad, escape de aire, lesión nasal)

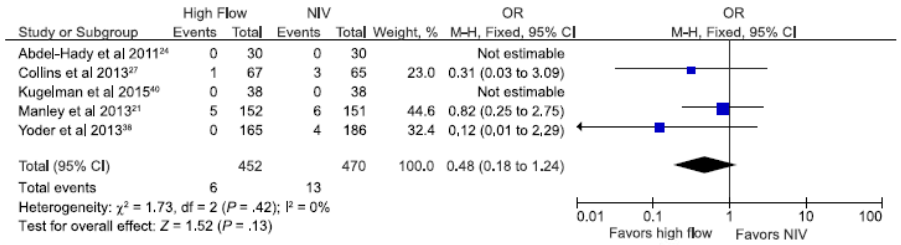


FIGURE 5
Pooled estimate of odds of death in preterm infants supported on HHHFNC compared with other modes of NIV.

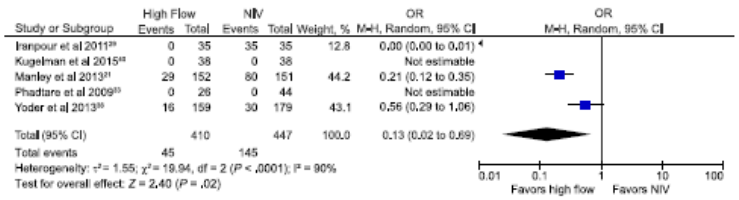


FIGURE 7
Pooled estimate of odds of nasal trauma in preterm infants supported on HHHFNC compared with other modes of NIV.

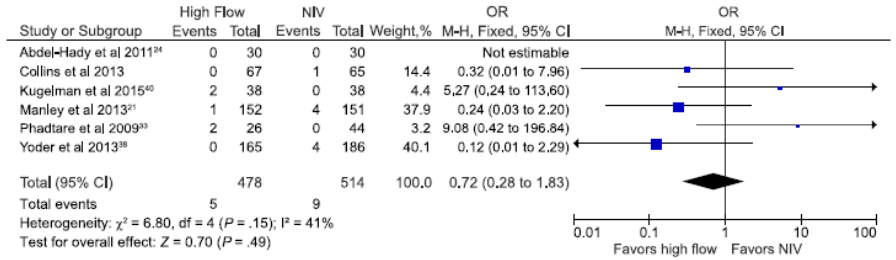


FIGURE 6
Pooled estimate of odds of pulmonary air leaks in preterm infants supported on HHHFNC compared with other modes of NIV.

Cochrane Library

Cochrane Database of Systematic Reviews

Cochrane Database of Systematic Reviews 2016, Issue 2. Art. No.: CD006405.
DOI: 10.1002/14651858.CD006405.pub3.

[Intervention Review]

High flow nasal cannula for respiratory support in preterm infants

Dominic Wilkinson[1,2], Chad Andersen[2,3], Colm PF O'Donnell[4], Antonio G De Paoli[5], Brett J Manley[6,7]

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.

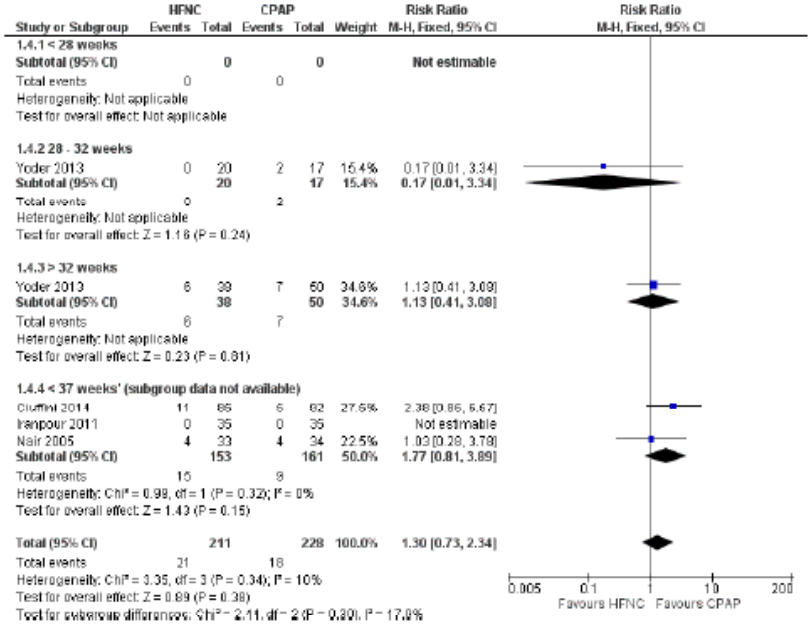


Figure 2. Forest plot of comparison: 3 HFNC versus CPAP to prevent extubation failure, outcome: 3.3 Death.

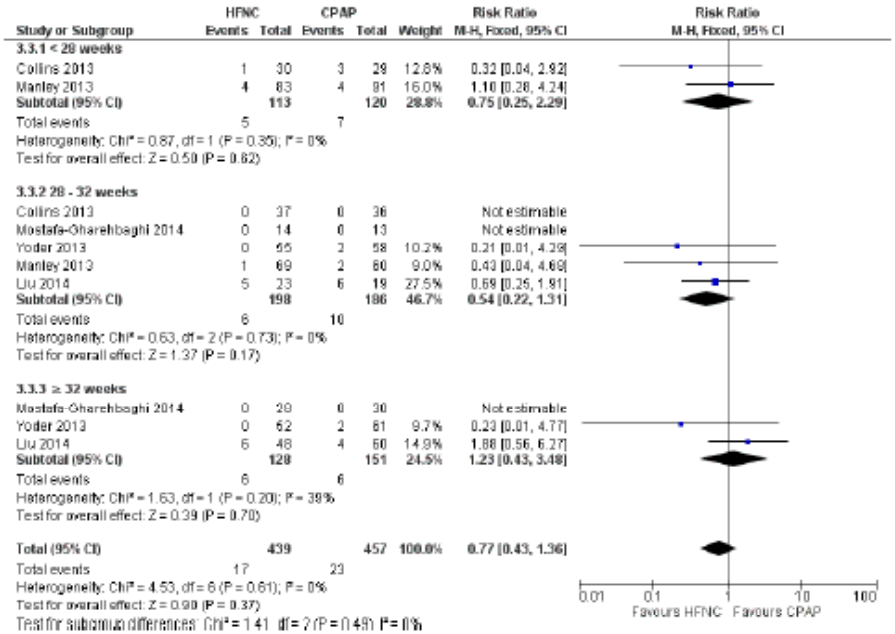
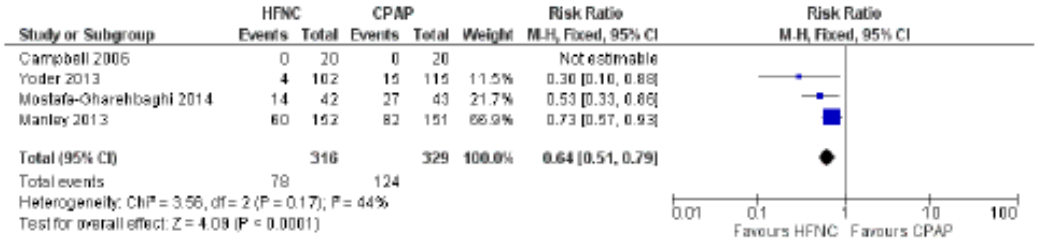


Figure 6. Forest plot of comparison: 3 HFNC versus CPAP to prevent extubation failure, outcome: Nasal trauma.



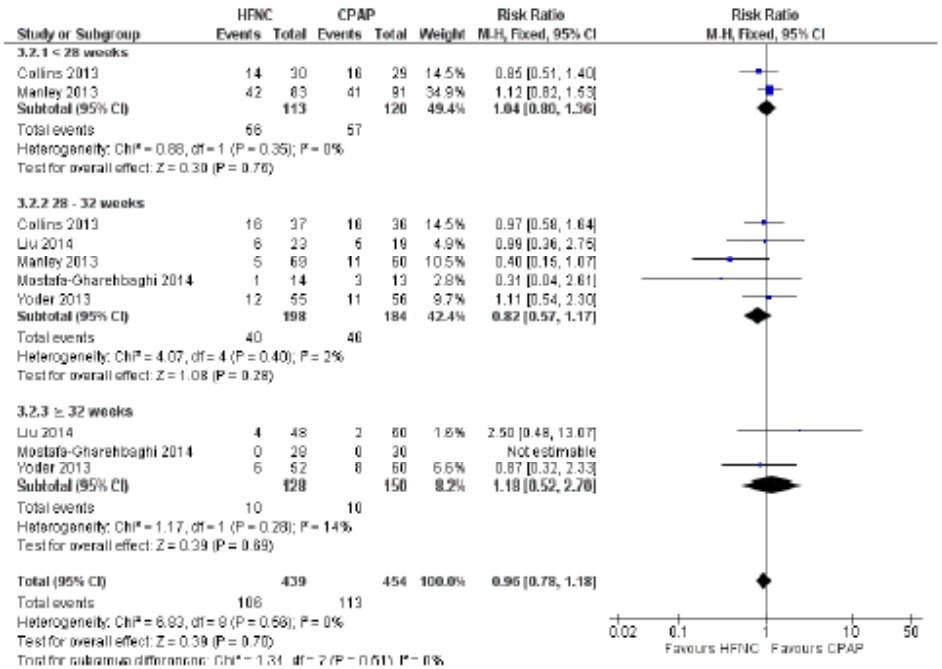
Cochrane Library
Cochrane Database of Systematic Reviews

[Intervention Review]

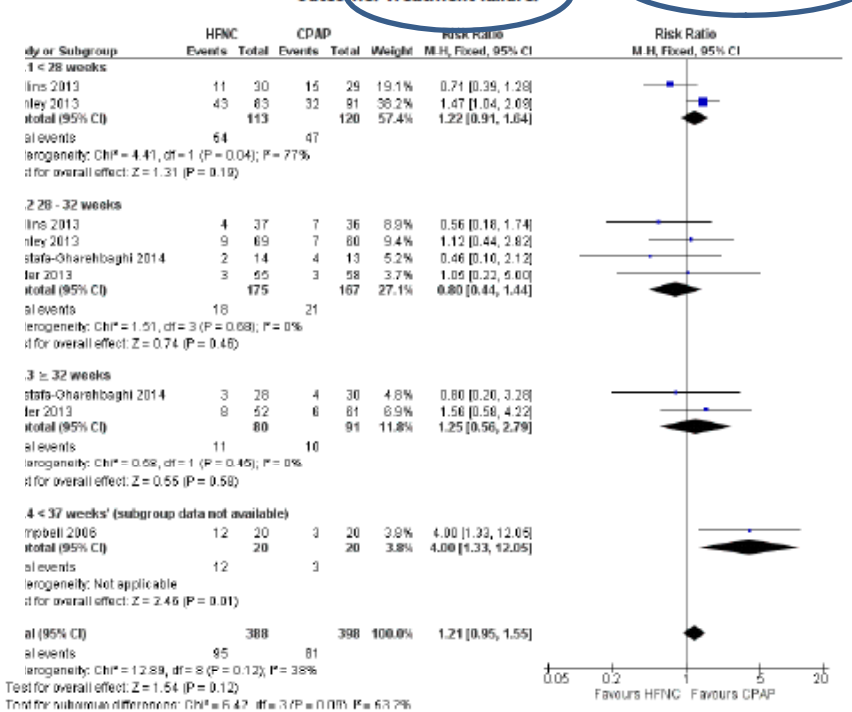
High flow nasal cannula for respiratory support in preterm infants

Dominic Wilkinson[1,2], Chad Andersen[2,3], Colm PF O'Donnell[4], Antonio G De Paoli[5], Brett J Manley[6,7]

Figure 3. Forest plot of comparison: 3 HFNC versus CPAP to prevent extubation failure, outcome: 3.2 CLD.



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



Authors' conclusions

HFNC has similar rates of efficacy to other forms of non-invasive respiratory support in preterm infants for preventing treatment failure, death and CLD. Most evidence is available for the use of HFNC as post-extubation support. Following extubation, HFNC is associated with less nasal trauma, and may be associated with reduced pneumothorax compared with nasal CPAP. Further adequately powered randomised controlled trials should be undertaken in preterm infants comparing HFNC with other forms of primary non-invasive support after birth and for weaning from non-invasive support. Further evidence is also required for evaluating the safety and efficacy of HFNC in extremely preterm and mildly preterm subgroups, and for comparing different HFNC devices.

ORIGINAL ARTICLES

www.jpeds.com • THE JOURNAL OF PEDIATRICS

High Flow Nasal Cannula Use Is Associated with Increased Morbidity and Length of Hospitalization in Extremely Low Birth Weight Infants

Dalal K. Taha, DO[1], Michael Kornhauser, MD[2], Jay S. Greenspan, MD[3], Kevin C. Dysart, MD[1], and Zubair H. Aghai, MD[3]

Objective To determine differences in the incidence of bronchopulmonary dysplasia (BPD) or death in extremely low birth weight infants managed on high flow nasal cannula (HFNC) vs continuous positive airway pressure (CPAP).

Study design This is a retrospective data analysis from the Alere Neonatal Database for infants born between January 2008 and July 2013, weighing ≤1000 g at birth, and received HFNC or CPAP. Baseline demographics, clinical characteristics, and neonatal outcomes were compared between the infants who received CPAP and HFNC, or HFNC ± CPAP. Multivariable regression analysis was performed to control for the variables that differ in bivariate analysis.

Results A total of 2487 infants met the inclusion criteria (941 CPAP group, 333 HFNC group, and 1546 HFNC ± CPAP group). The primary outcome of BPD or death was significantly higher in the HFNC group (56.8%) compared with the CPAP group (50.4%, $P < .05$). Similarly, adjusted odds of developing BPD or death was greater in the HFNC ± CPAP group compared with the CPAP group (OR 1.085, 95% CI 1.035-1.137, $P = .001$). The number of ventilator days, postnatal steroid use, days to room air, days to initiate or reach full oral feeds, and length of hospitalization were significantly higher in the HFNC and HFNC ± CPAP groups compared with the CPAP group.

Conclusions In this retrospective study, use of HFNC in extremely low birth weight infants is associated with a higher risk of death or BPD, increased respiratory morbidities, delayed oral feeding, and prolonged hospitalization. A large clinical trial is needed to evaluate long-term safety and efficacy of HFNC in preterm infants. *(J Pediatr 2016;173:50-5)*.

Table I. Demographics and baseline clinical characteristics of the study population (mean ± SD)

	CPAP (941)	HFNC (333)	HFNC ± CPAP (1546)
GA (wk)	26.7 ± 2.1	26.5 ± 1.9	26.3 ± 1.8*
BW (g)	787 ± 145	776 ± 149	773 ± 146*
Male sex (%)	436 (46.3)	143 (42.9)	753 (48.7)
Caucasian race (%)	318 (33.8)	114 (34.2)	553 (35.8)
Chorioamnionitis (%)	42 (4.5)	10 (3.0)	92 (5.9)
Prenatal steroids (any dose) (%)	426 (45.3)	147 (44.1)	741 (47.9)
5-min Apgar <5 (%)	127 (13.5)	53 (15.9)	290 (18.7)*
Ventilated d 1 (%)	686 (72.9)	234 (70.3)	1195 (77.3)*
Ventilated any time (%)	799 (84.9)	284 (85.3)	1387 (89.7)*
Surfactant (%)	612 (65.0)	212 (63.6)	1089 (70.4)*

*$P < .05$ CPAP vs HFNC ± CPAP.

Table II. Respiratory and other neonatal outcomes in infants who received CPAP vs HFNC and CPAP vs HFNC ± CPAP

	CPAP (941)	HFNC (333)	HFNC ± CPAP (1546)
CPAP d (median, IQR)	15 (5-28)		7 (1-19)
HFNC d (median, IQR)		14 (5-25)	13 (6-23)
HFNC ± CPAP (median, IQR)	15 (5-28)	14 (5-25)	26 (14-39)†
BPD or death (%)	474 (50.4)	189 (56.8)†	950 (61.5)†
BPD (%)	397 (42.2)	174 (52.2)†	912 (59.0)†
Multiple ventilation courses (%)	481 (51.1)	177 (53.1)	1088 (64.7)†
More than 3 ventilation courses (%)	166 (17.6)	70 (21.0)	454 (29.4)†
Ventilator d (median, IQR)	18 (5-42)	25 (6-52)†	30 (10-58)§
Postnatal steroids (%)	115 (12.2)	71 (21.3)†	387 (25.0)†
D to room air (median, IQR)	62 (39-90)	76 (51-103)†	72 (51-96)*
Discharge home on oxygen (%)	201 (21.4)	70 (21.0)	432 (27.9)¶
Severe IVH (grade 3/4) (%)	79 (8.4)	31 (9.3)	170 (11.0)¶
PDA requiring medical therapy	445 (47.3)	145 (43.5)	797 (51.5)¶
NEC Bell's stage 2 or higher	74 (7.7)	30 (9.0)	126 (8.1)
ROP requiring laser	81 (8.6)	36 (10.8)	208 (13.4)¶

High-Flow Nasal Cannulae as Primary Respiratory Support for Preterm Infants – An International, Multi-Center, Randomized, Controlled, Non-Inferiority Trial

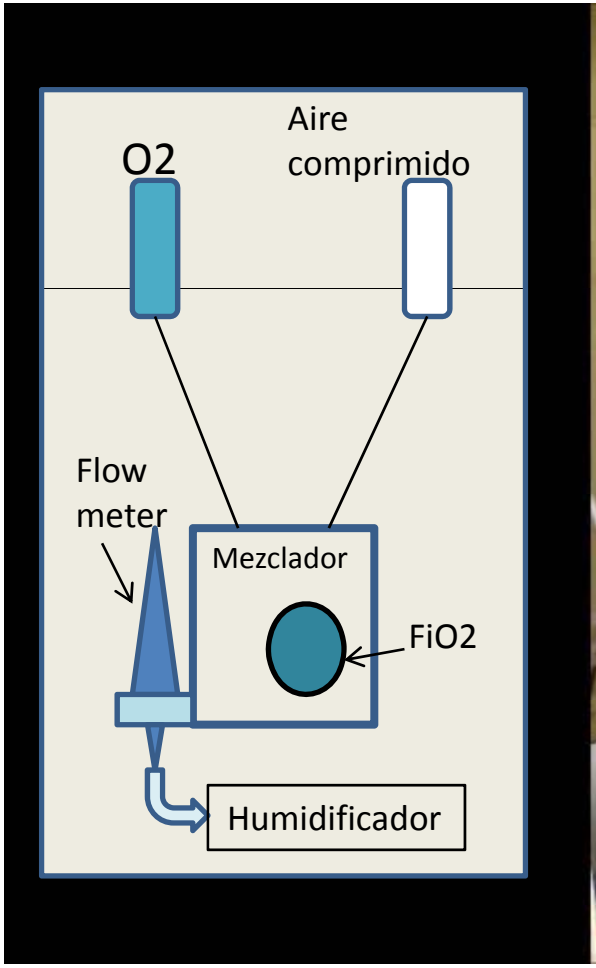
C.T. Roberts, L.S. Owen, B.J. Manley, D.H. Froisland, S.M. Donath, M.A. Pritchard, D.W. Cartwright, C.L. Collins, A. Malhotra, P.G. Davis. Neonatal Services and Newborn Research Centre, The Royal Women's Hospital, Melbourne, Victoria, Australia

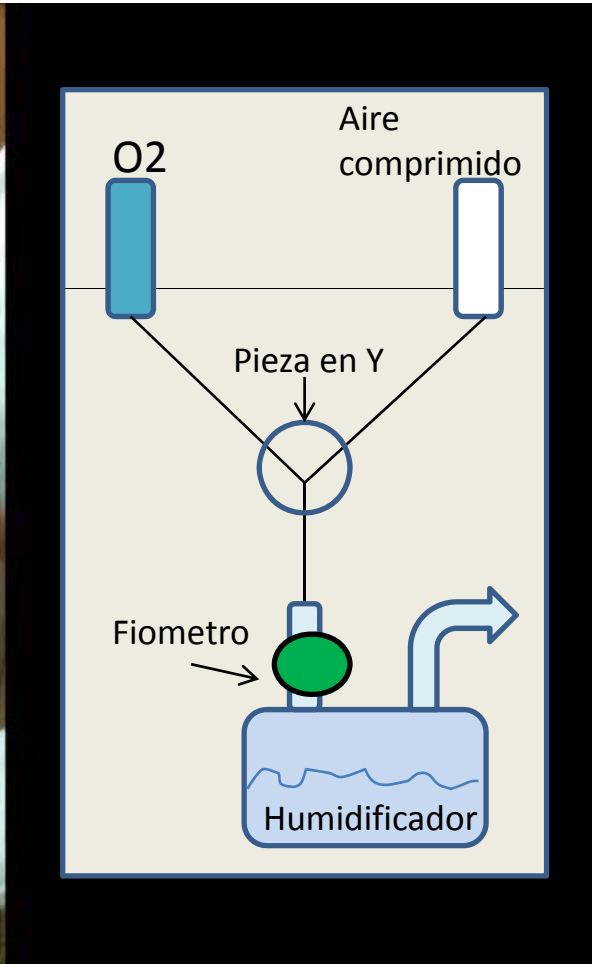
- OBJECTIVE: To assess whether HFNC are **non-inferior** to CPAP in **preventing treatment failure** when used as **primary respiratory support** for **preterm** infants.
- Eligible participants were **preterm infants ≥28 weeks' gestational age (GA), <24 hours old, in whom non-invasive support was commenced for respiratory distress, without prior surfactant treatment.** Infants were randomized **to HFNC (6-8 L/min) or CPAP (6-8 cm H_2O)**.
- **Primary outcome was treatment failure within 72 hours**, defined by pre-specified oxygen requirement, blood gas, or apnea criteria whilst on maximal support (HFNC 8 L/min or CPAP 8 cm H_2O), or by urgent intubation. Infants in the HFNC group with treatment failure could receive 'rescue' CPAP 7-8 cm H_2O.
- A sample size of **750 infants** was required to demonstrate non-inferiority of HFNC with 90% power. The primary outcome was analyzed by intention-to-treat.

	CAFO2	nCPAP
EG/Peso nacimiento	31 SEG/ 1737 gr	31 SEG/1751 gr
Falla tratamiento	25,5%	13,3%
IOT < 72 hs	15,5%	11,5%

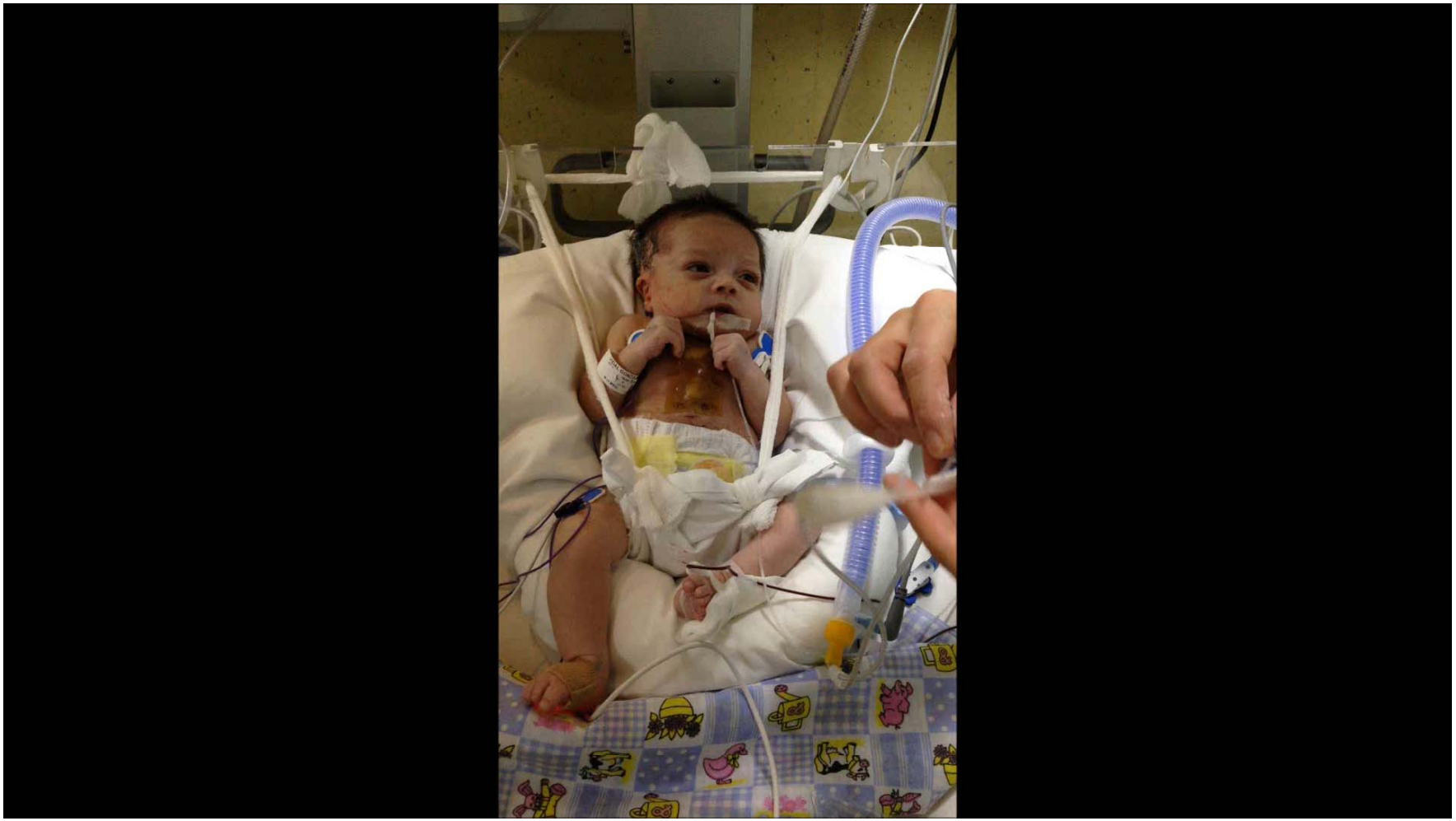
N=564 el comité de seguridad suspende el trial

Implementación

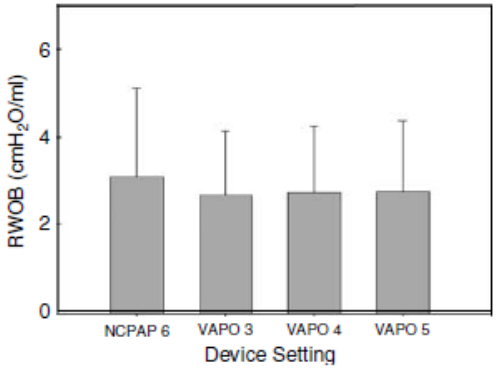




Implementación



Monitoreo



Journal of Perinatology (2006) 26, 476–480

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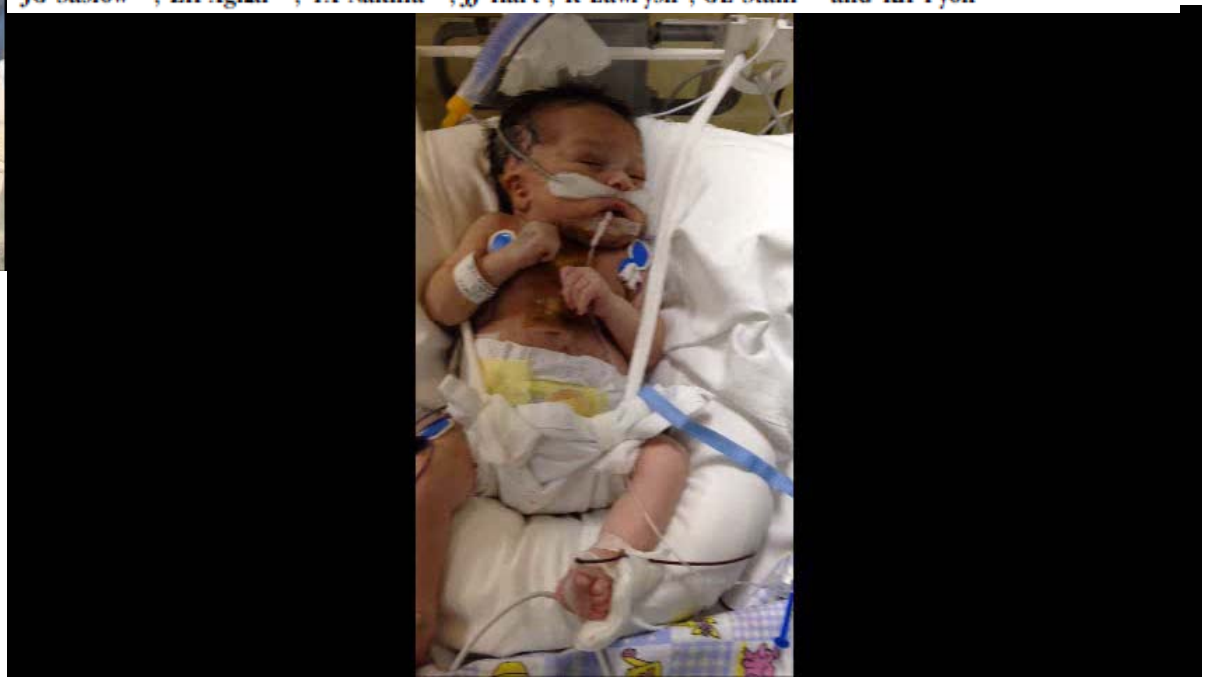
ORIGINAL ARTICLE

Work of breathing using high-flow nasal cannula in preterm infants

JG Saslow[1,2], ZH Aghai[1,2], TA Nakhla[1,2], JJ Hart[1], R Lawrysh[1], GE Stahl[1,2] and KH Pyon[1,2]



Monitoreo

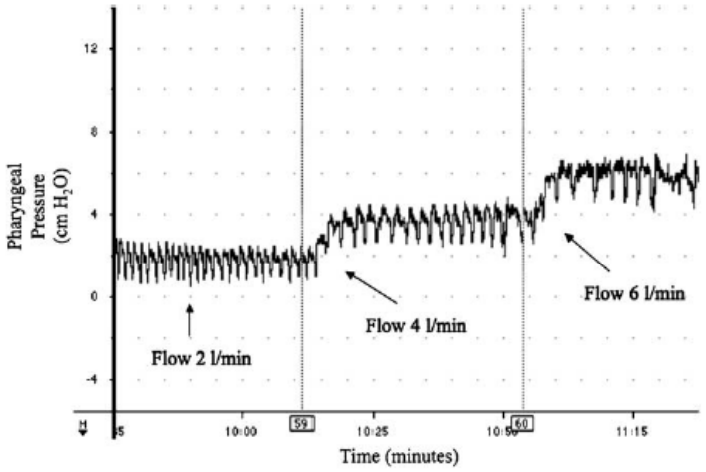
Journal of Perinatology (2008) 28, 42–47

www.nature.com/jp

ORIGINAL ARTICLE

Pharyngeal pressure with high-flow nasal cannulae in premature infants

DJ Wilkinson[1,2], CC Andersen[1,3], K Smith[4] and J Holberton[1]



Gracias!

HOSPITAL ITALIANO
de Buenos Aires

andrea.canepari@hospitalitaliano.org.ar