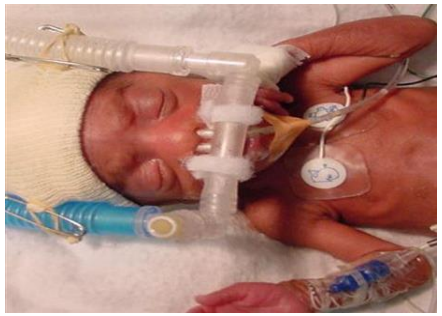


Non Invasive Ventilation :How to make it succeed

Dr Neelam Kler

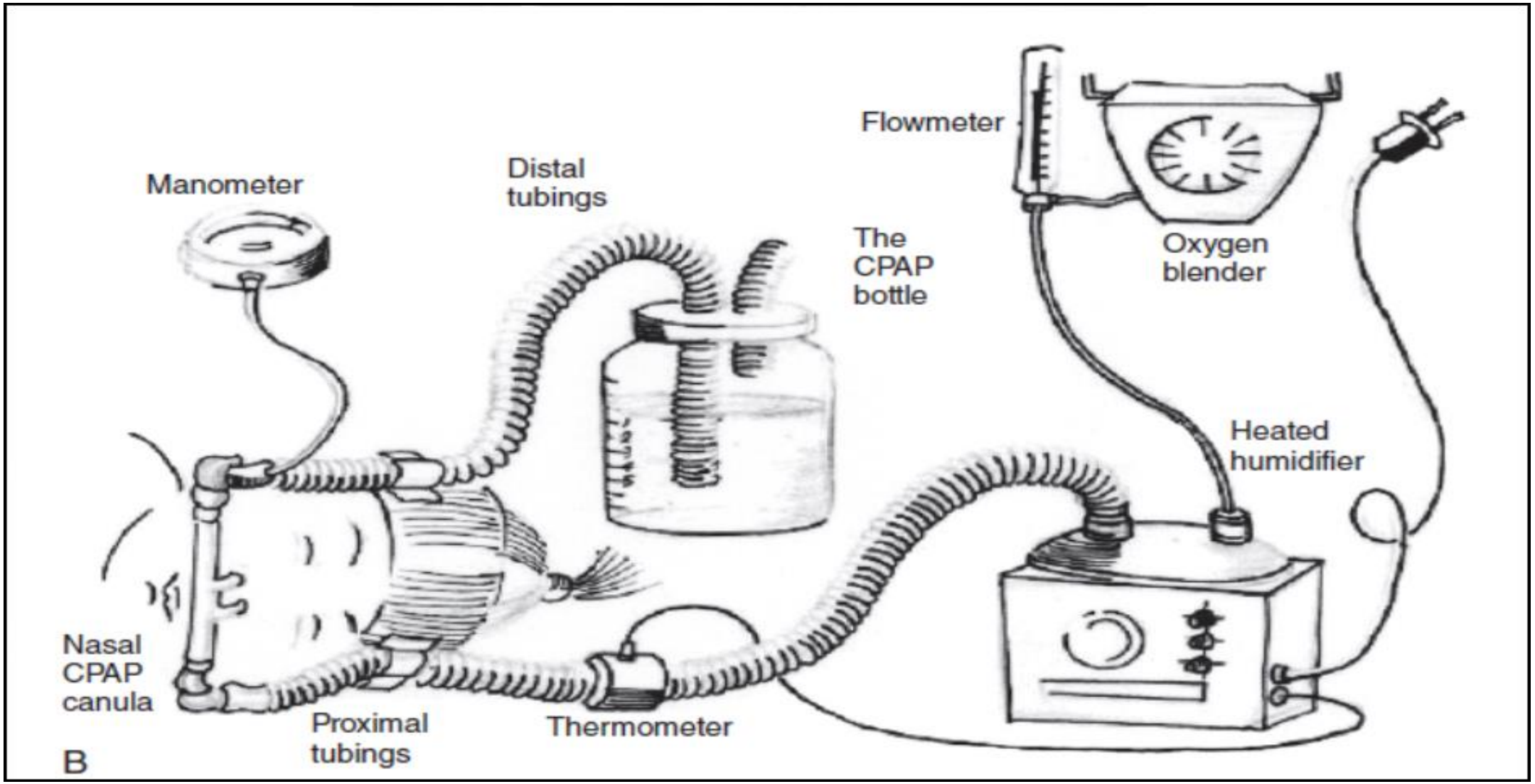
Introduction

- Prematurity is the leading cause of neonatal mortality, there is increase in incidence of preterm births over the past decades.
- Incidence of RDS- 12% among those born preterm.
- Mortality attributed to RDS is 10 times higher in LMIC compared to high income countries
- Administration of antenatal corticosteroids, surfactant therapy and respiratory support form the basis of the treatment for RDS
- One of the severe morbidities attributed to IMV is bronchopulmonary dysplasia (BPD). BPD itself has been associated with adverse outcomes such as pulmonary hypertension, increased susceptibility to respiratory infections during infancy, neurodevelopmental impairment and cerebral palsy

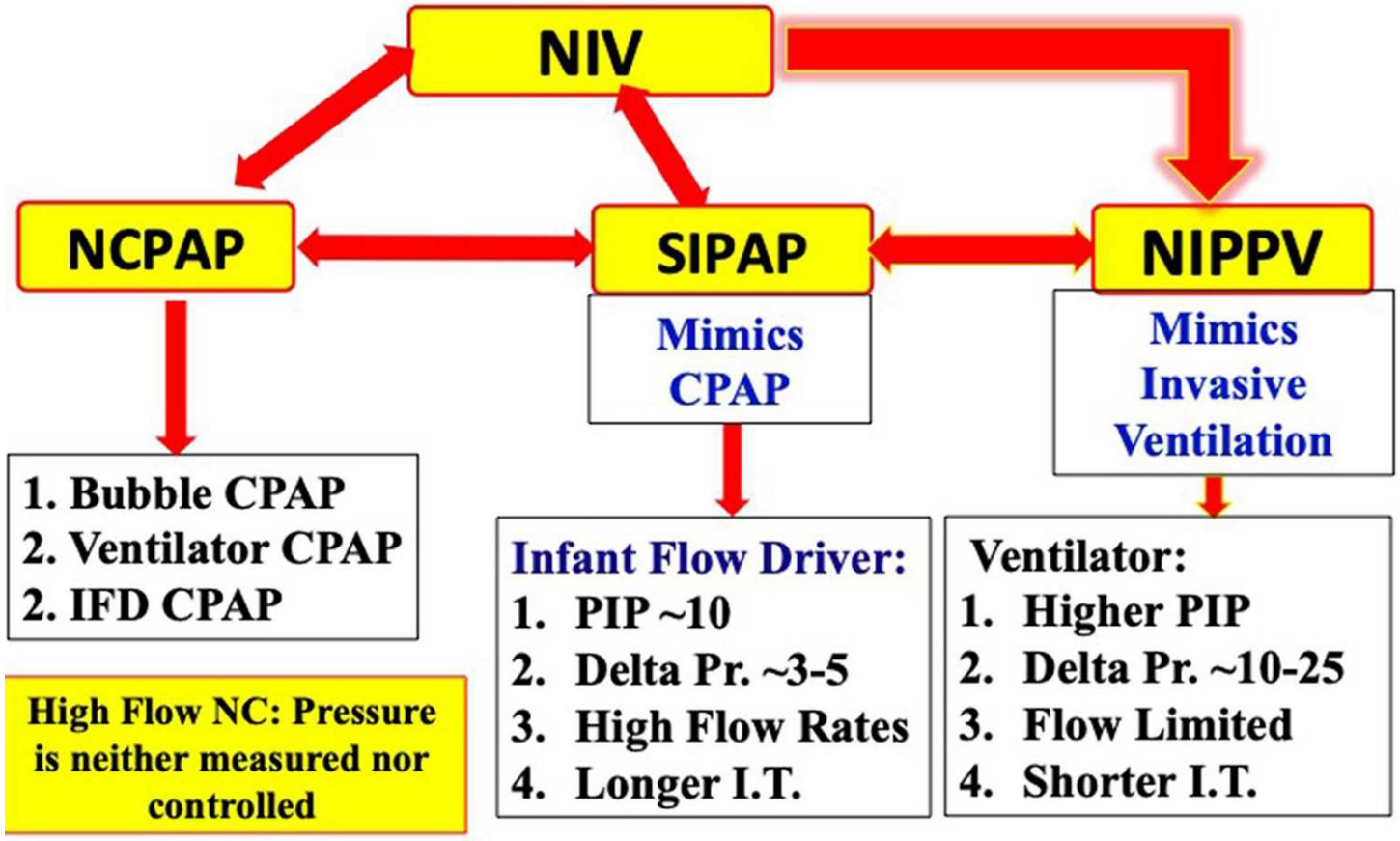
Non Invasive ventilation

- Intubation is the single major preventable risk factor contributing to BPD
- The delivery of mechanical ventilation to the lungs using techniques that do not require endotracheal intubation

- Basic layout of all the devices
  - Source of oxygen and airflow
  - Air oxygen blender
  - Servo controlled humidifier
  - Nasal interface


Flowmeter
Manometer
Distal tubings
The CPAP bottle
Oxygen blender
Heated humidifier
Nasal CPAP canula
Proximal tubings
Thermometer
B

Modes of Non Invasive ventilation



CPAP

- Application of positive pressure to the airway of a spontaneously breathing infant throughout the respiratory cycle

- How does it work?
  - Recruitment of alveoli- Improves the functional residual capacity
  - Splints the airway
  - Reduces work of breathing
  - Improves the pattern and regularity of respiration
  - Decreases the occurrence of apnea

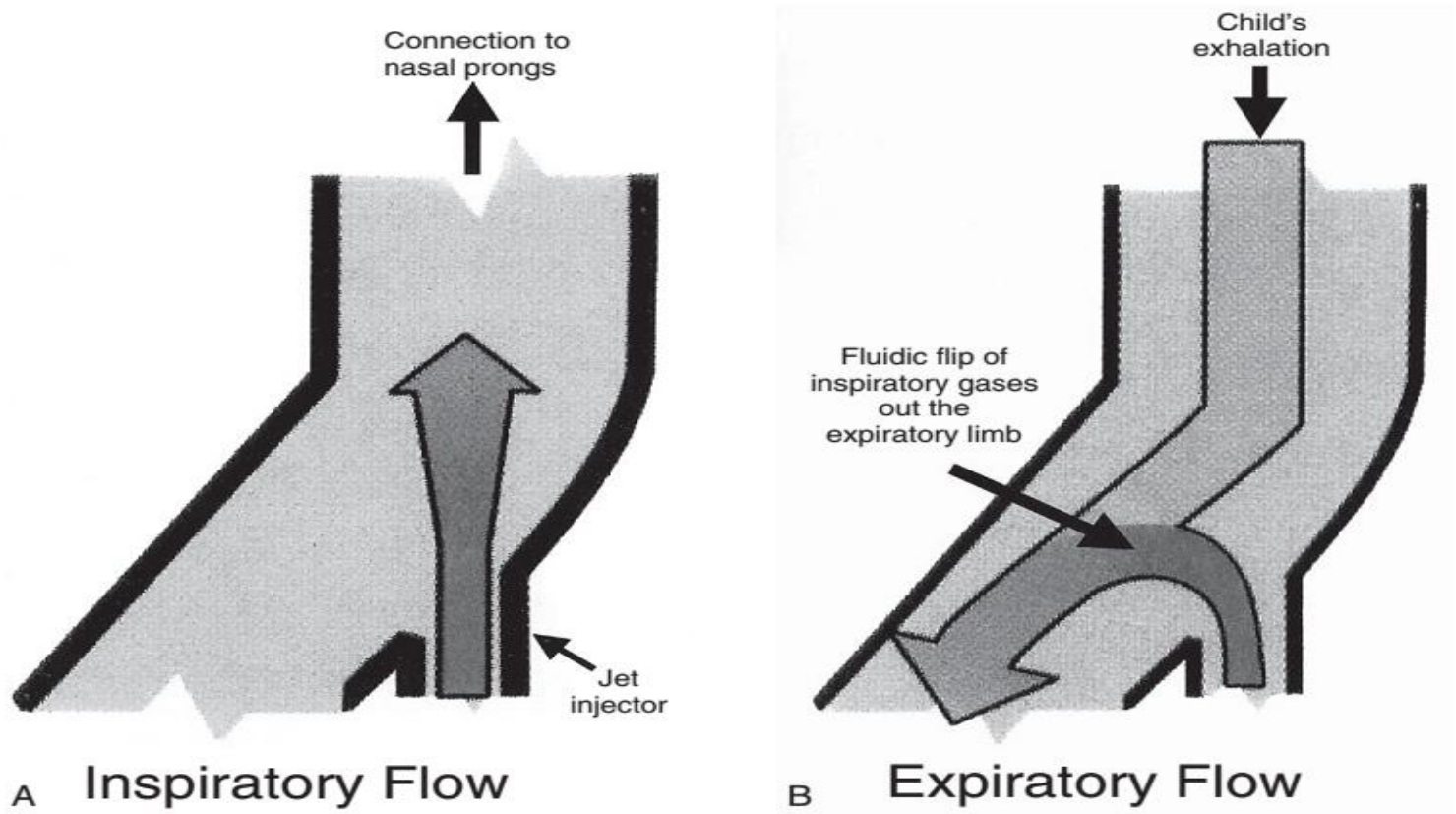


Figure 8-9 ■ Schematic representations of the "fluid flip" of the variable-flow CPAP device, the Infant Flow Driver. **A,** During the child's inspiration, the Bernoulli effect directs gas flow toward each nostril to maintain a constant pressure. **B,** During the child's exhalation, the Coanda effect causes inspiratory flow to "flip" and leave the generator chamber via the expiratory limb. As such, the child does not have to exhale against high inspiratory flow, and work of breathing is decreased compared to continuous-flow CPAP. The residual gas pressure enables stable levels of CPAP to be delivered to the child. (Courtesy Electro Medical Equipment, Ltd., Brighton, England.)

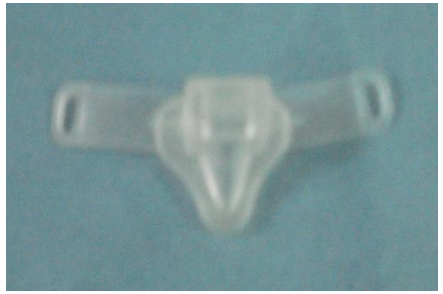
Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Absolute effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with ventilator or Infant Flow Driver CPAP	Risk with bubble CPAP				
Treatment failure	215 per 1000	163 per 1000 (129 to 204)	RR 0.76 (0.60 to 0.95)	52 per 1000 fewer (11 to 86 fewer per 1000)	1230 (13 studies)	⨁⨁⊖⊖ Low[a,b]
All-cause mortality before hospital discharge	78 per 1000	72 per 1000 (50 to 106)	RR 0.93 (0.64 to 1.36)	6 per 1000 fewer (28 fewer to 28 more per 1000)	1189 (10 studies)	⨁⨁⊖⊖ Low[a,b]
Neurodevelopmental impairment	Not assessed in any included trials					
Pneumothorax	31 per 1000	23 per 1000 (13 to 42)	RR 0.73 (0.40 to 1.34)	8 per 1000 fewer (18 fewer to 11 more per 1000)	1340 (14 studies)	⨁⨁⊖⊖ Low[a,b]
Moderate-severe nasal injury	48 per 1000	109 per 1000 (65 to 182)	RR 2.29 (1.37 to 3.82)	61 per 1000 more (17 to 134 more per 1000)	753 (8 studies)	⨁⨁⨁⊖ Moderate[a]
Bronchopulmonary dysplasia	167 per 1000	127 per 1000 (89 to 184)	RR 0.76 (0.53 to 1.10)	40 per 1000 fewer (78 fewer to 17 more per 1000)	603 (7 studies)	⨁⨁⊖⊖ Low[a,b]

Prakash R, De Paoli AG, Davis PG, Oddie SJ, McGuire W. Bubble devices versus other pressure sources for nasal continuous positive airway pressure in preterm infants. Cochrane Database of Systematic Reviews 2023, Issue 3. Art. No.: CD015130.

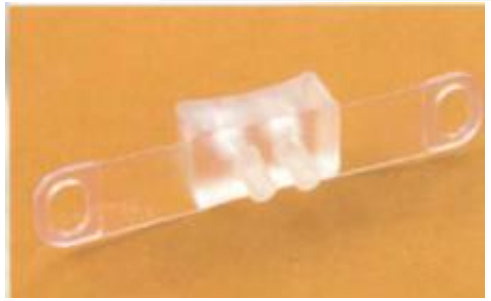
Airway Interface

- Long nasal prongs
- Short binasal prongs
- Nasal masks
- Nasal cannula (RAM cannula)

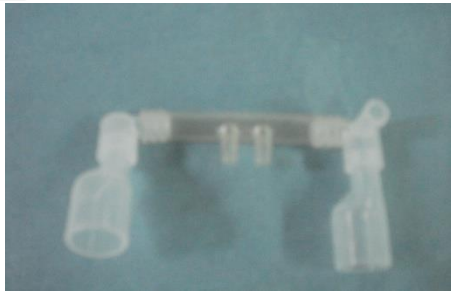
CPAP INTERFACES



Nasal Mask



Draeger Nasal prongs



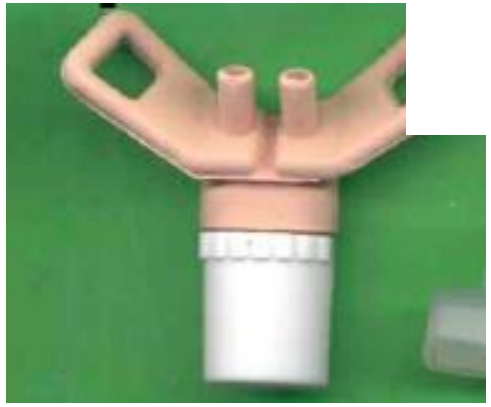
Hudson prongs

Nasopharyngeal tube

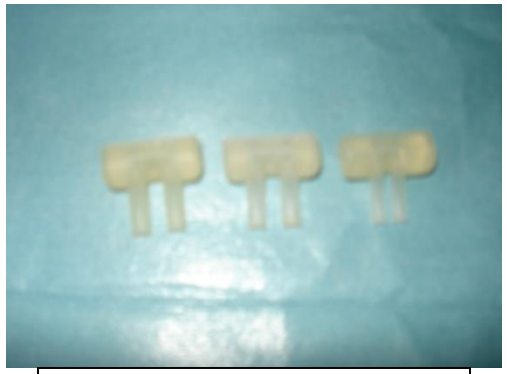
Appropriate Size of NCPAP Interface

Hudson prongs

Size 0	for < 700 g
Size 1	for 700-1000 g
Size 2	for 1000-2000 g
Size 3	for 2000-3000 g
Size 4	for 3000-4000
Size 5	for > 4000 g



Argyl's Nasal prongs



FP Nasal prongs

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Assessment of heterogeneity
	Risk with prongs	Risk with mask				
Treatment failure	**Study population**		**RR 0.72** (0.58 to 0.90)	919 (8 studies)	⨁⨁◯◯ **Low**[a,b]	Heterogeneity: I^2 = 25%
	295 per 1000	212 per 1000 (171 to 266)				
All-cause mortality	**Study population**		**RR 0.83** (0.56 to 1.22)	814 (7 studies)	⨁⨁◯◯ **Low**[a,b]	Heterogeneity: I^2 = 0%
	120 per 1000	100 per 1000 (67 to 147)				
Neurodevelopmental impairment	Not assessed in any included trials					
Pneumothorax	**Study population**		**RR 0.93** (0.45 to 1.93)	625 (5 studies)	⨁⨁◯◯ **Low**[a,b]	Heterogeneity: I^2 = 0%
	45 per 1000	42 per 1000 (20 to 87)				
Moderate–severe nasal injury	**Study population**		**RR 0.55** (0.44 to 0.71)	1058 (10 studies)	⨁⨁◯◯ **Low**[a,c]	Heterogeneity: I^2 = 73% Subgroup difference by: • bubble vs ventilator CPAP: P < 0.001
	248 per 1000	136 per 1000 (109 to 176)				

Prakash R, De Paoli AG, Oddie SJ, Davis PG, McGuire W. Masks versus prongs as interfaces for nasal continuous positive airway pressure in preterm infants. Cochrane Database of Systematic Reviews 2022, Issue 11. Art. No.: CD015129.

Landmark Trials on CPAP support

Trial	COIN trial	SUPPORT
Journal year Investigator	NEJM 2008 February Colin J Morley , Peter G .Davis et al	NEJM 2010 may NICHD (Eunice Kennedy)
Subjects	25 +0 weeks to 28+6 weeks Spontaneous breathing at 5min	24 +0 weeks to 27+6 weeks
Primary objective	1. Rate of death 2. BPD (need of oxygen 36 weeks gest. age)	1. Rate of death 2. BPD
Secondary objective	1. Incidence of intubation 2. Reasons for intubation 3. Oxygen treatment at 28 days 4. FiO2 at 36 weeks Gest age 5. Air leaks 6. IVH 7. Duration of ventilation 8. No of days in hospital	1. BPD -as any O_2 at 36 weeks 2. Pneumothorax 3. IVH 4. PDA req surgery 5. NEC 6. Post natal steroids –BPD 7. Mech vent.- no of days
Study	**RCT :** CPAP or intubation at 5 min after birth CPAP = 8 cm of water	**RCT** : CPAP OR intub. Within 1 hr CPAP = 5 cm of H_2O
No:	610	1316
Results	**36 weeks** :death and rate of BPD same {0.80 (0.58-1.12) P=0.19} **28 days** : lower death and need for O2 {0.63 (0.46-0.88) p=0.006)}. Incidence of pneumothorax {9% vs 3 %}	**36 weeks** :death and rate of BPD same {0.95 (0.85-1.05) P=0.30} **CPAP group-** Fewer days of MV(P=0.03) less frequently required postnatal corticosteroids(P<0.001)

HHHFNC

Heated Humidified High Flow Nasal Cannula in neonates

HHHFNC

- Provides inhaled gases at a flow higher than the neonates innate inspiratory flow (>1 L/min)
- Mechanism of action:
  - Supports inspiration thereby reducing the work of breathing
  - Maintains functional residual capacity
  - Washes out CO2 from nasopharyngeal dead space
  - Reduced metabolic work of gas conditioning
- Heated water humidification is needed to avoid drying of nasal secretions and also for maintaining optimal nasociliary function
- Nasal cannula should occupy less than 50% of nares unlike CPAP where a tight seal is required

HHHFNC- Primary respiratory support?

Review > Cochrane Database Syst Rev. 2023 May 5;5(5):CD006405.
doi: 10.1002/14651858.CD006405.pub4.

Nasal high flow therapy for primary respiratory support in preterm infants

Kate A Hodgson [1 2], Dominic Wilkinson [3 4], Antonio G De Paoli [5], Brett J Manley [1 2]

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with CPAP	Risk with nHF				
Death (before hospital discharge) or BPD (supplemental oxygen/respiratory support at 36 weeks' postmenstrual age if born < 32 weeks' gestation, or 28 days if born ≥ 32 weeks' gestation)	47 per 1000	52 per 1000 (35 to 76)	**RR 1.09** (0.74 to 1.60)	1830 (7 RCTs)	⊕⊕◯◯ **Low**[a,b]	nHF may result in little to no difference in death or BPD.
Death (before hospital discharge)	23 per 1000	18 per 1000 (10 to 31)	**RR 0.78** (0.44 to 1.39)	2009 (9 RCTs)	⊕⊕◯◯ **Low**[a,b]	nHF may result in little to no difference in death.
BPD (supplemental oxygen/respiratory support at 36 weeks' postmenstrual age if born < 32 weeks' gestation, or 28 days if born ≥ 32 weeks' gestation)	33 per 1000	37 per 1000 (24 to 58)	**RR 1.14** (0.74 to 1.76)	1917 (8 RCTs)	⊕⊕◯◯ **Low**[a,b]	nHF may result in little to no difference in BPD.
Treatment failure within 72 hours of trial entry	131 per 1000	223 per 1000 (185 to 270)	**RR 1.70** (1.41 to 2.06)	2042 (9 RCTs)	⊕⊕⊕◯ **Moderate**[c]	nHF likely results in an increase in treatment failure within 72 hours of trial entry.
Mechanical ventilation within 72 hours of trial entry	118 per 1000	122 per 1000 (96 to 154)	**RR 1.04** (0.82 to 1.31)	2042 (9 RCTs)	⊕⊕⊕◯ **Moderate**[d]	nHF likely does not increase mechanical ventilation within 72 hours of trial entry.
Pneumothorax (during assigned treatment)	34 per 1000	22 per 1000 (14 to 37)	**RR 0.66** (0.40 to 1.08)	2094 (10 RCTs)	⊕⊕⊕◯ **Moderate**[a,e]	nHF likely results in a reduction in pneumothorax.
Nasal trauma (during assigned treatment)	125 per 1000	61 per 1000 (45 to 85)	**RR 0.49** (0.36 to 0.68)	1595 (7 RCTs)	⊕⊕⊕◯	nHF likely results in a reduction in nasal trauma.

HHHFNC-Post Extubation support

- **Most of the meta-analysis conducted in the last 5 years suggest no difference in extubation failure rates, mortality or BPD.**
- **A decreased risk of nasal injury with HHHFNC as a post-extubation respiratory support modality when compared to CPAP has been reported by most of these meta-analyses**

Author year	Study population (*n*)	Intervention	Outcomes					
			Extubation failure at 72 h (RR, 95% CI)	Extubation failure at 7 days (RR, 95% CI)	BPD (RR, 95% CI)	Mortality (RR, 95% CI)	Air leak or Pneumothorax (RR, 95% CI)	Nasal Injury (RR, 95% CI)
Martins et al. 2022 (84)	1,044 neonates 7 studies All GA included	HHHFNC vs. CPAP	1.33 (0.67–2.63)[b]	1.18 (0.73–1.89)[b]	1.25 (0.59–2.65)	0.83 (0.45–1.53)	0.24 (0.03–2.25) 0.81 (0.23–2.86)	0.21 (0.08–0.52)
Hong et al. 2021 (81)	1,378 neonates 10 studies <37 w	HHHFNC vs. CPAP	—	1.23 (1.01–1.50)[b]	0.87 (0.71–1.07)	0.84 (0.50–1.43)	— 0.34 (0.12–0.91)	0.64 (0.52–0.78)
Brito et al. 2021 (83)	1,064 neonates 6 studies <37 w	HHHFNC vs. CPAP	—	—	1.08 (0.87–1.34)[b]	—	— —	—
Junior et al. 2020 (86)	645 neonates 4 studies <37 w	HHHFNC vs. CPAP	9% (−1% to 13%)[a,b]	—	0.81 (0.57–1.16)	—	— 0.33 (0.05–2.11)	0.21 (0.13–0.35)
Fleeman et al. 2019 (84)	1,201 neonates 10 studies <37 w	HHHFNC vs. CPAP	1.24 (0.81–1.89)[b]	0.84 (0.63–1.12)[b]	0.86 (0.70–1.06)	0.71 (0.31–1.60)	0.29 (0.11–0.76)	0.35 (0.27–0.46)
Wilkinson et al. 2016 (87)	934 neonates 6 studies <37 w	HHHFNC vs. CPAP	1.21 (0.95–1.55)	—	0.96 (0.78–1.18)[b]	0.77 (0.43–1.36)[b]	— 0.35 (0.11–1.06)	0.64 (0.51–0.79)

HIPSTER Trial:

(**HI**gh flow nasal cannula as **P**rimary **S**upport in **T**reatment of **E**arly **R**espiratory distress Trial)

- International, multicentre, non-inferiority RCT
- >28 weeks of gestation with early respiratory distress within 24 hours
- 10% difference for non-inferiority margin
- Primary Outcome: Treatment failure within 72hours after randomization
- For Treatment Failure:

  On High flow therapy – receive rescue CPAP

  On CPAP Failure – intubation & ventilation

Roberts CT, Owen LS, Manley BJ, Frøisland DH, Donath SM, Dalziel KM, Pritchard MA, Cartwright DW, Collins CL, Malhotra A, Davis PG; HIPSTER Trial Investigators: Nasal high-flow therapy for primary respiratory support in preterm infants. N Engl J Med 2016; 375: 1142–1151

RESULTS

Table 2. Primary Outcome, Intubation within 72 Hours, and Outcomes in the Subgroup and Per-Protocol Analyses.

Outcome	High-Flow Group (N=278)	CPAP Group (N=286)	Risk Difference (95% CI)*	P Value
	no./total no. (%)		*percentage points*	
Primary intention-to-treat analysis				
Treatment failure within 72 hr	71/278 (25.5)	38/286 (13.3)	12.3 (5.8 to 18.7)	<0.001
Gestational age <32 wk	46/140 (32.9)	27/149 (18.1)	14.7 (4.8 to 24.7)	0.004
Gestational age ≥32 wk	25/138 (18.1)	11/137 (8.0)	10.1 (2.2 to 18.0)	0.01
Intubation within 72 hr	43/278 (15.5)	33/286 (11.5)	3.9 (–1.7 to 9.6)	0.17
Gestational age <32 wk	30/140 (21.4)	24/149 (16.1)	5.3 (–3.7 to 14.3)	0.25
Gestational age ≥32 wk	13/138 (9.4)	9/137 (6.6)	2.9 (–3.5 to 9.3)	0.38
Per-protocol analysis				
Treatment failure within 72 hr	64/264 (24.2)	36/279 (12.9)	11.3 (4.8 to 17.8)	<0.001
Intubation within 72 hr	39/264 (14.8)	33/279 (11.8)	2.9 (–2.8 to 8.7)	0.31

* Positive values favor the CPAP group, and negative values favor the high-flow group. Apparent discrepancies in some of the risk differences are due to rounding.

- Treatment failure was significantly more common in the high-flow group than in the CPAP group both among infants with a gestational age of less than 32 weeks and among those with a gestational age of 32 weeks or greater at randomization

Nasal high flow therapy in special care nurseries (HUNTER trial)

Table 2. Primary Outcome in the Intention-to-Treat and Per-Protocol Analyses.*

Outcome	All Patients	High-Flow Group (N=381)	CPAP Group (N=373)	Risk Difference (95% CI)†	
				Univariate Analysis	Adjusted Analysis‡
	no.	*no./total no. (%)*			
Intention-to-treat analysis					
Treatment failure within 72 hr after randomization	754	78/381 (20.5)	38/373 (10.2)	10.3 (5.2 to 15.4)§	9.2 (3.9 to 14.5)
Gestational age <34 wk	140	20/72 (27.8)	12/68 (17.6)	10.1 (−3.6 to 23.9)	8.7 (−5.8 to 23.1)
Gestational age ≥34 wk	614	58/309 (18.8)	26/305 (8.5)	10.3 (4.9 to 15.6)§	8.3 (2.7 to 14.0)
Per-protocol analysis					
Treatment failure within 72 hr after randomization	677	49/339 (14.5)	27/338 (8.0)	6.5 (1.7 to 11.2)	5.5 (0.5 to 10.4)
Gestational age <34 wk	129	14/65 (21.5)	10/64 (15.6)	5.9 (−7.5 to 19.3)	6.0 (−8.0 to 19.9)
Gestational age ≥34 wk	548	35/274 (12.8)	17/274 (6.2)	6.6 (1.7 to 11.5)	5.5 (0.2 to 10.7)

* P=0.99 for the interaction in the intention-to-treat analysis and P=0.93 for the interaction in the per-protocol analysis (both unadjusted). On the basis of a noninferiority margin of 10 percentage points, high-flow therapy was not noninferior to CPAP in all analyses. CI denotes confidence interval.
† Apart from the primary analysis (univariate intention-to-treat analysis for all infants), other differences in risk are secondary outcomes that were not adjusted for multiple outcomes, and inferences drawn from these intervals may not be reproducible.
‡ The analysis was adjusted for stratification variables (gestational-age group and trial center) and prespecified confounders (birth weight, exposure to antenatal glucocorticoids, and sex). Data from hospitals with a low incidence of treatment failure were aggregated before controlling for trial center in all per-protocol analyses and for the intention-to-treat analysis involving infants younger than 34 weeks of gestational age; different levels of aggregation were used in each analysis (see Section 6 and Table S3 in the Supplementary Appendix).
§ P<0.001.

- Incidence of MV & transfer to with higher tertiary units did not differ.
- HF was non inferior to CPAP with higher treatment failures.

Manley BJ, Arnolda GR, Wright IM, Owen LS, Foster JP, Huang L, et al Nasal high-flow therapy for newborn infants in special care nurseries. New England Journal of Medicine. 2019 May ;380:2031-40.

NIPPV

- Provides PEEP similar to CPAP , delivers PIP also resulting in a higher mean airway pressure- better recruitment of alveoli
- Better CO2 remo
- 2 forms- synchro nised (nsNIPPV)
- Positive pressure uous distending pressure by nasal

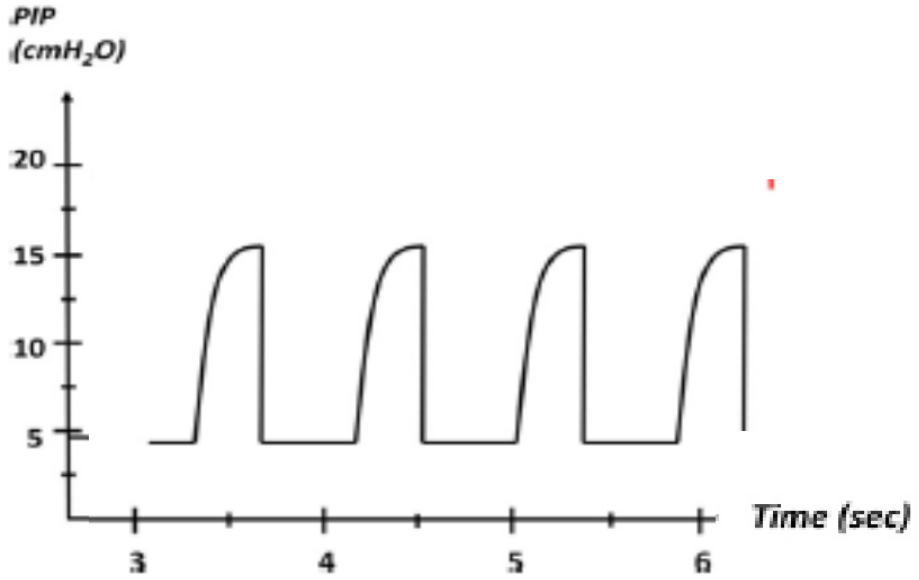


Table 2. Primary Outcome.*

Outcome	Nasal IPPV	Nasal CPAP	Odds Ratio	Odds Ratio Adjusted for Strata (95% CI)	P Value	Odds Ratio Adjusted for Strata and Baseline Covariates (95% CI)†
	no./total no. (%)					
Primary outcome: death at <36 wk of post-menstrual age or BPD	191/497 (38.4)	180/490 (36.7)	1.07	1.09 (0.83–1.43)‡	0.56	1.05 (0.80–1.39)
Components of primary outcome						
Death at <36 wk of postmenstrual age	34/504 (6.7)	41/503 (8.2)	0.82	0.81 (0.51–1.31)§	0.39	0.77 (0.48–1.24)
Survival with BPD	157/463 (33.9)	139/449 (31.0)	1.14	1.17 (0.86–1.57)‡	0.32	1.14 (0.84–1.54)
Death at <36 wk of postmenstrual age or BPD according to older NIH criteria in 20 infants	197/504 (39.1)	193/503 (38.4)	1.03	1.03 (0.79–1.35)‡	0.82	1.00 (0.76–1.31)
Subgroup analyses						
Prior intubation						
No	72/241 (29.9)	72/252 (28.6)	1.07	1.08 (0.72–1.62)¶	0.70	1.05 (0.70–1.57)
Yes	119/256 (46.5)	108/238 (45.4)	1.05	1.04 (0.73–1.50)¶	0.81 Interaction 0.85	1.02 (0.70–1.46)
Birth weight						
<750 g	93/161 (57.8)	79/158 (50.0)	1.37	1.35 (0.87–2.10)‖	0.18	1.30 (0.83–2.04)
750–999 g	98/336 (29.2)	101/332 (30.4)	0.94	0.92 (0.66–1.29)‖	0.64 Interaction 0.15	0.90 (0.64–1.26)

* BPD denotes bronchopulmonary dysplasia, CI confidence interval, and NIH National Institutes of Health.
† Baseline covariates were sex, antenatal receipt or nonreceipt of glucocorticoids, and use or nonuse of caffeine treatment.
‡ Odds ratios were adjusted for center, birth-weight stratum, and prior-intubation status.
§ Odds ratios were adjusted for birth-weight stratum and prior-intubation status but not for center because event rates were too low for satisfactory adjustment.
¶ Odds ratios were adjusted for birth-weight stratum.
‖ Odds ratios were adjusted for prior-intubation status.

Kirpalani H, Millar D, Lemyre B, Yoder BA, Chiu A, Roberts RS. A trial comparing noninvasive ventilation strategies in preterm infants. New England Journal of Medicine. 2013 Aug 15;369(7):611-20.

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with NCPAP	Risk with NIPPV				
Respiratory failure	Study population		RR 0.65 (0.54 to 0.78)	1958 (17 RCTs)	⨁⨁⨁◯ Moderate[a]	Risk of bias: unblinded intervention OIS: 330
	230 per 1000	149 per 1000 (124 to 179)				
Need for endotracheal tube ventilation	Study population		RR 0.67 (0.56 to 0.81)	1848 (16 RCTs)	⨁⨁⨁◯ Moderate[a]	Risk of bias: unblinded intervention OIS: 399
	226 per 1000	152 per 1000 (127 to 183)				
Mortality during study period	Study population		RR 0.82 (0.62 to 1.10)	1958 (17 RCTs)	⨁⨁◯◯ Low [a, b]	Risk of bias: unblinded intervention Imprecision: did not meet OIS (6624)
	86 per 1000	71 per 1000 (53 to 95)				
Chronic lung disease	Study population		RR 0.70 (0.52 to 0.92)	1284 (12 RCTs)	⨁⨁◯◯ Low[a, b]	Risk of bias: unblinded intervention Imprecision: did not meet OIS (764)
	152 per 1000	106 per 1000 (79 to 140)				

Lemyre B, Deguise M-O, Benson P, Kirpalani H, Ekhaguere OA, Davis PG. Early nasal intermittent positive pressure ventilation (NIPPV) versus early nasal continuous positive airway pressure (NCPAP) for preterm infants. Cochrane Database of Systematic Reviews 2023, Issue 7. Art. No.: CD005384.

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Certainty of the evidence (GRADE)	Comments
	Risk with NCPAP	Risk with NIPPV				
Respiratory failure postextubation	**Study population**		**RR 0.75** (0.67 to 0.84)	2738 (19 studies)	**Moderate**[a]	—
	364 per 1000	273 per 1000 (243 to 306)				
Endotracheal reintubation	**Study population**		**RR 0.78** (0.70 to 0.87)	2608 (17 studies)	**Moderate**[a]	—
	356 per 1000	278 per 1000 (249 to 310)				
Gastrointestinal perforation	**Study population**		**RR 0.89** (0.58 to 1.38)	1478 (8 studies)	**Low**[a,b]	—
	55 per 1000	49 per 1000 (32 to 76)				
Necrotising enterocolitis	**Study population**		**RR 0.86** (0.65 to 1.15)	2069 (10 studies)	**Moderate**[a]	—
	88 per 1000	76 per 1000 (57 to 101)				
Chronic lung disease (oxygen supplementation at 36 weeks)	**Study population**		**RR 0.93** (0.84 to 1.05)	2001 (9 studies)	**Moderate**[a]	—
	381 per 1000	354 per 1000 (320 to 400)				
Pulmonary air leak	**Study population**		**RR 0.57** (0.37 to 0.87)	2404 (13 studies)	**Low**[a,b]	—
	45 per 1000	26 per 1000 (17 to 39)				

Lemyre B, Deguise M-O, Benson P, Kirpalani H, De Paoli AG, Davis PG. Nasal intermittent positive pressure ventilation (NIPPV) versus nasal continuous positive airway pressure (NCPAP) for preterm neonates after extubation. Cochrane Database of Systematic Reviews 2023, Issue 7. Art. No.: CD003212.

- Compared to NCPAP, NIPPV likely reduces the risk of respiratory failure after extubation and reintubation.

- Compared to NCPAP, NIPPV may reduce leaks of air from the air spaces in the lungs.

Received: 6 June 2020 | Accepted: 5 August 2020

DOI: 10.1002/ppul.25011

ORIGINAL ARTICLE: NEONATAL LUNG DISEASE

PEDIATRIC PULMONOLOGY WILEY

Efficacy of noninvasive respiratory support modes for primary respiratory support in preterm neonates with respiratory distress syndrome: Systematic review and network meta-analysis

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Evidence for NIPPV

- Primary support: NIPPV = BiPAP > CPAP > HFNC
- Post-extubation: S-NIPPV > NS-NIPPV > BiPAP = VFCPAP = HFNC > CFCPAP

Ramaswamy VV, More K, Roehr CC, Bandiya P, Nangia S. Efficacy of noninvasive respiratory support modes for primary respiratory support in preterm neonates with respiratory distress syndrome: systematic review and network meta-analysis. Pediatr Pulmonol. 2020 Nov; 55(11): 2940–63.

Evidence for NIPPV

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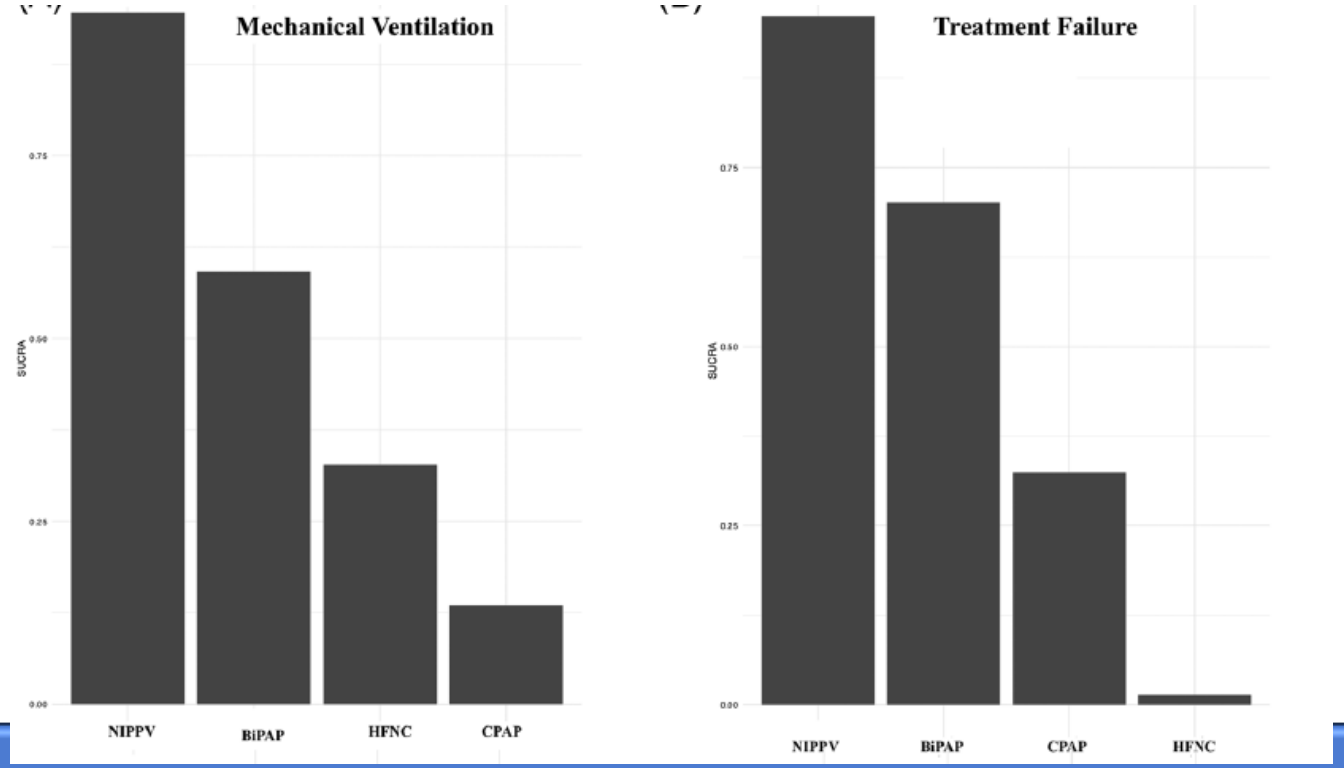

The SUCRA for NIPPV, BiPAP, HFNC, and CPAP were 0.95, 0.59, 0.32, and 0.13 - IMV
The SUCRA for NIPPV, BiPAP, CPAP, and HFNC were 0.96, 0.70, 0.32, and 0.01- Rx failure

Titration

- PIP Adjustments: If no chest rise or $PaCO_2$ increases, increase PIP in steps of 1 cm H_2O to a maximum of 20-22 cm H_2O
- PEEP Adjustments: If chest retractions persist, increase PEEP in steps of 1 cm H_2O to a maximum of 7-8 cm H_2O.
- FiO_2 Adjustments: If FiO_2 requirements increase, adjust in steps of 5% to maintain saturation between 90-95%.

HHHFNC during endotracheal intubation

- HF during endotracheal intubation has been compared to standard care (no nasal high flow or use of supplemental oxygen)
- With the data derived from 251 intubations in 202 infants, the likelihood of successful intubation on the first attempt without physiological instability was significantly higher in the HHHFNC group compared to standard one

(50.0% vs. 31.5%, adjusted RD, 17.6 percentage points; 95% CI, 6.0–29.2) with the number needed to treat (NNT) being 6 (95% CI, 4–17)

Hodgson KA, Owen LS, Kamlin COF, Roberts CT, Newman SE, Francis KL, et al. Nasal high-flow therapy during neonatal endotracheal intubation. N Engl J Med. (2022) 386(17):1627–37. doi: 10.1056/NEJMoa2116735

Conclusion

- sNIPPV seems to be the most efficacious, and HHHFNC being associated with the least likelihood of nasal injury.
- There is no single NIV modality that universally suits all. Hence, the choice of NIV for a neonate should be individualized based on its efficacy, the disease pathology, resource settings, clinician's familiarity and parental values.
- A holistic approach is needed in the care of preterm neonates to improve their short- and long-term outcomes. NIV is one of the most important components of preterm respiratory care.

Thanks.


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