

Technical Protocol for Neonatologists

NEONATAL RESPIRATORY CARE and NON-INVASIVE SUPPORT



1. NON-INVASIVE RESPIRATORY SUPPORT

INTERFACES & INDICATIONS

Interface / Device	Primary Indications	Operational Parameters	Clinical Advantages	Bedside Complications & Mitigation
Nasal CPAP (nCPAP)	• Respiratory Distress Syndrome (RDS) in preterm infants [1, 3] • Post-extubation stabilization [1] • Apnea of prematurity (AOP)	• PEEP 5 - 8 cmH₂O • Gas Temp: 37 °C • Humidity: 100% RH (44 mg H₂O/L) [4]	• Maintains Functional Residual Capacity (FRC) • Reduces upper airway resistance • Stimulates lung growth & surfactant synthesis [1]	• <i>Nasal septal trauma / necrosis</i>: Alternate prongs & mask every 4-12 hrs [4] • Hydrocolloid barrier dressings [4] • Gastric distension (OGT venting required)
Nasal IPPV (NIPPV / SNIPPV)	• Severe RDS failing nCPAP; • Frequent/severe apnea despite CPAP [1, 3] • High-risk post-extubation weaning [1, 7]	• PIP: 14 - 25 cmH₂O • PEEP: 5 - 7 cmH₂O • Rate: 20 - 40 bpm • Ti: 0.3 - 0.5 sec [3]	• Delivers higher Mean Airway Pressure (MAP) [3] • Increases tidal volume & CO₂ clearance [3] • Reduces extubation failure rate vs nCPAP [7]	• Risk of gastric perforation (rare) • Asynchrony during un-synchronized NIPPV [7] • Fixation-induced nasal skin breakdown [4]
Heated Humidified High-Flow Nasal Cannula (HHHFNC)	• Primary support in RDS (>28 wks GA) • Post-extubation weaning • Step-down from nCPAP [3]	• Flow: 2 - 8 L/min • Outer prong diameter MUST be ≤50% of internal naris diameter [3] • Temp: 37 °C, 100% RH [4]	• Improved infant comfort & feeding tolerance; • Reduces nasal airway trauma vs prongs; • Flushes nasopharyngeal dead space [3]	• <i>Unmeasured PEEP risk</i>: Avoid naris occlusion (>50% ratio) to allow leak; • Nasal mucosal drying if unheated/unhumidified [3]
Laryngeal Mask Airway (LMA) [3]	• Resuscitation in infants >2,000 g (>34-35 wks GA) • Failed endotracheal intubation / difficult airway.	• Sizing: Size 1 (up to 5 kg) • Insertion without laryngoscopy; • Cuff inflation: 2-4 mL air [3]	• Rapid airway establishment (>90% success); • Minimal hemodynamic fluctuation vs ETT; • No risk of tracheal stenosis [2, 3]	• Not suitable for infants <2,000 g • Cannot perform intratracheal suctioning [3] • Unsealed gastric leak (requires OGT) [7]

2. AIRWAY EQUIPMENT SELECTION & INTUBATION SIZING PROTOCOLS

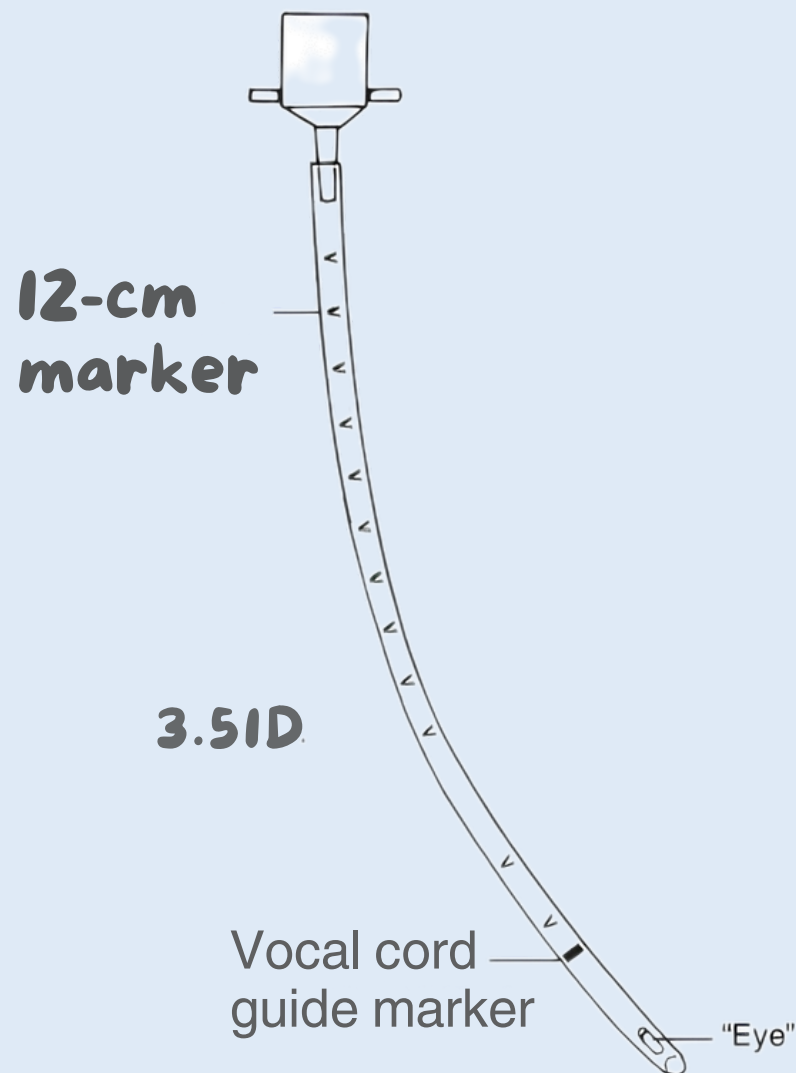
Endotracheal Tube & Blade Selection [2]

Weight (g)	Gestational Age	ETT Size (mm ID)	Laryngoscope Blade
< 1 Kg	< 28 weeks	2.5 mm	Miller 00 [2]
1 - 2 Kg	28 – 34 weeks	3.0 mm	Miller 0 [2]
2 - 3 kg	34 – 38 weeks	3.5 mm	Miller 0 or 1 [2]
> 3 kg	> 38 weeks	3.5 – 4.0 mm	Miller 1 [2]

Neonatal Resuscitator Comparison [1]

Device Type	Gas Source	FiO ₂ Delivery	CPAP/PEEP Capability	Clinical Notes
Flow-Inflating Bag	Required	21% - 100%	Yes (tail valve)	Requires high skill; variable PIP/PEEP [1].
Self-Inflating Bag	Not required	21% (no res) / 90-100%	Only with PEEP valve	Pop-off valve at 30–40 cmH ₂ O [1].
T-Piece (Neopuff)	Required	21% - 100%	Precise PEEP control	Gold standard; consistent PIP/MAP [1].

ETT Depth Rules & Verification [2]: Oral ETT Depth Formula: Insertion Depth at Lip (cm) = **Weight (kg) + 6 cm** (e.g., 1.0 kg infant = 7.0 cm at lip) [2]. | Nasal ETT Depth Formula: Nasal-Tragus Length (NTL) + 1 cm [2]. | **Verification:** Equal bilateral breath sounds, chest expansion, ETCO₂ colorimetric/capnography detection, and Chest X-ray (tip at T1–T2 level) [2].



Murphy-type endotracheal tube. The Murphy type is straight and relatively soft, with markings to show depth of insertion in the airway and in the trachea. An "eye" is present at the tip.

Selecting the Appropriate - Sized Suction Catheter

Endotracheal Tube Size
(Inside Diameter in mm)

Catheter Size (French)

2.5

5 or 6

3.0

6 or 8

3.5

8

4.0

8 or 10

(From Kattwinkel J, ed: Neonatal Resuscitation Textbook. 5th ed. Elk Grove Village, IL, American Academy of Pediatrics and the American Heart Association, 2006. Used with permission of the American Academy of Pediatrics.)

3. ENDOTRACHEAL SUCTIONING PROTOCOLS & CLOSED SYSTEMS

Protocol Variable	Hodge Protocol [5]	Ragedale et al. Protocol [5]	Fletcher & MacDonald Protocol [5]	Standard NICU Recommendation
Irrigation / Normal Saline (NS)	Saline instillation not routine ; 0.1 – 0.2 mL/kg if needed.	Saline instillation not routine ; 0.25–0.5 mL/kg if needed.	Saline instillation restricted to thick secretions.	DO NOT USE ROUTINELY NS instillation increases bacterial colonization, desaturation and bronchospasm [4, 5].
Suction Catheter Size	•ETT 2.5 mm 5-6 Fr • ETT 3.0 mm 6-8 Fr	• ETT 3.5 mm 8 Fr • ETT 4.0 mm 8 -10 Fr	Catheter outer diameter <70% of ETT inner diameter.	Outer Diameter ≤50–70% of ETT ID. Prevents total airway occlusion & severe lung collapse during suction [2, 5].
Suction Pressure	60 – 80 mmHg	80 – 100 mmHg	Lowest effective pressure	80 – 100 mmHg (60–80 mmHg in ELBW). Minimizes mucosal trauma & invagination [4, 5].
Depth of Suctioning	Shallow (Length of ETT + 1 cm)	Shallow (Pre-measured ETT + adapter)	Shallow (Length of ETT + adapter)	Shallow Suctioning Preferred. Avoids carina collision, tracheal erosion, and mucosal necrosis [4, 5].
Duration & System	5 – 10 seconds pass max; closed system preferred.	5 – 10 seconds pass max; pre-oxygenation +10–20% FiO ₂ .	5 – 10 seconds pass max; closed system preferred.	Duration: 5–10s max. Closed Suctioning System (CSU) maintains PEEP/lung volume & lowers VAP risk [4, 5].

4. SURFACTANT REPLACEMENT THERAPY & ADMINISTRATION PROTOCOLS

Surfactant Preparation	Source / Origin	Phospholipid Conc. (mg/mL)	Initial Dose (mL/kg & mg/kg)	Repeat Dosing Protocol
Poractant alfa (Curosurf)	Porcine lung extract [6]	80 mg/mL [6]	200 mg/kg (2.5 mL/kg)	100 mg/kg (1.25 mL/kg) at 12-hr intervals (up to 2 repeat doses).
Beractant (Survanta)	Bovine lung extract [6]	25 mg/mL [6]	100 mg/kg (4.0 mL/kg)	100 mg/kg (4.0 mL/kg) every 6 hrs (up to 4 total doses).
Calfactant (Infasurf)	Calf lung lavage [6]	35 mg/mL [6]	100 mg/kg (3.0 mL/kg)	100 mg/kg (3.0 mL/kg) every 12 hrs (up to 3 total doses) [6].

Surfactant Administration Techniques & Bedside Precautions [6]:

- **Techniques:** Traditional ETT side-port bolus/aliquots OR Less Invasive Surfactant Administration (**LISA/MISA/InSuRE**) via thin vascular catheter into trachea while infant breathes spontaneously on nCPAP [6].
- **Post-Surfactant Restraint:** **WITHHOLD** endotracheal suctioning **for 1 to 6 hours** after surfactant instillation, unless airway occlusion occurs [5, 6].
- **Rapid Monitoring:** Rapid compliance improvement occurs within minutes — closely monitor SpO₂ and tidal volumes to rapidly down-titrate FiO₂ and PIP, preventing hyperoxia and volutrauma [6].

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Medicines

+

Amikacin

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Alfaporactant (Curosurf®) - surfactant

Ampicillin + Sulbactam (Unasyn®)

+

Beractanto (Survanta®) - surfactant

+

Calfactant (Infasurf®) - surfactant

+

Ferrous sulphate (Anemifer)

+

Gestational age at birth - DAYS

+

Postnatal age - DAYS

+

Desired dose (mg/kg/dose)

Additional information

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Medicines

+

Alfaporactant (Curosurf®) - surfactant

▼

TOT

80mg/mL Suspension

+

Weight (kg)

+

Desired dose (mL/kg/dose)

Additional information

Bibliographical references

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Please note: the information presented in this application is taken from bibliographical references and is for information purposes only. The doctor is solely responsible for prescribing, administering and making the necessary adjustments. This app does not replace medical guidelines or clinical judgment.

Most commonly used
surfactants available
in the app

When you enter the
weight, the suggested
dose will appear.

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Medicines

+

Beractanto (Survanta®) - surfactant

▼

TOT

25mg/mL

+

Weight (kg)

2

+

Desired dose (mg/kg/dose)

100

Suggested dose: 100 mg/kg/dose

Beractanto (Survanta®) - surfactant

TOT - 25mg/mL

Dose	200mg
Dose	8mL

Additional information

Bibliographical references

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Please note: the information presented in this application is taken from bibliographical references and is for information purposes only. The doctor is solely responsible for prescribing, administering and making the necessary

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Medicines

+

Calfactant (Infasurf®) - surfactant

▼

TOT

35mg of phospholipids/mL

+

Weight (kg)

2

+

Desired dose (mL/kg/dose)

3

Suggested dose: 3 mL/kg/dose

Calfactant (Infasurf®) - surfactant

TOT - 35mg of phospholipids/mL

Dose	6mL
Phospholipids	210mg
Interval	AMD

Note: can be repeated every 12 hours for a total of 3 doses. For premature infants under 29 weeks gestational age Infasurf® should preferably be administered within 30 minutes of birth. For rescue therapy, administer preferably within 2 hours of birth.

Additional information

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Suggested dosage aligned with international references.

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Medicines

Alfaporactant (Curosurf®) - surfactant

TOT

80mg/mL Suspension

Weight (kg)

2

Desired dose (mL/kg/dose)

2.5

Suggested dose: 2,5 mL/kg/dose

Alfaporactant (Curosurf®) - surfactant

TOT - 80mg/mL Suspension

Dose	5mL
Interval	AMD

Note: For rescue therapy, administer as soon as possible, preferably within 2 hours of birth. For prophylactic therapy, administer after initial resuscitation, within 10 to 30 minutes of birth. If necessary, you can administer up to 2 subsequent doses of 1.25 mL/kg/dose (100 mg/kg/dose) every 12 hours. Maximum total dose (sum of all doses): 5 mL/kg/day or 400 mg/kg.

Additional information

Bibliographical references

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5. AEROSOL DRUG DELIVERY SYSTEMS IN NEONATAL VENTILATION

Aerosol Generator	Key Advantages	Disadvantages & Limitations	In-Line Circuit Impact	Clinical Recommendation
Vibrating Mesh Nebulizer (VMN / Aerogen)	• High deposition efficiency (10–15%); • Minimal residual volume (<0.1 mL); • Does not alter tidal volume or PEEP.	• Higher unit capital cost; • Requires clean mesh maintenance to prevent clogging.	Zero additional gas flow. Preserves ventilator graphics, volume delivery, and triggers [7].	GOLD STANDARD in NICU. Highly recommended for mechanical ventilation, CPAP, & HFNC [7].
Jet Nebulizer	• Low equipment cost; • Widely available; • Can deliver wide variety of solutions.	• Poor efficiency (< 1 - 3% deposition); • Large dead volume (>1.0 mL); • Variable particle size distribution.	Adds unmeasured flow (6–8 L/min). Causes auto-PEEP, false triggering, and altered Vt [7].	Not ideal in mechanical ventilation. If used, must compensate for added flow or turn off bias flow.
pMDI + Valved Chamber (VHC)	• Consistent dose delivery; • Small particle sizeç • Low risk of bacterial contamination.	• Limited drug formulations (mostly bronchodilators). • Requires specialized circuit adapter [7]	Minimal volume impact during manual actuation [7].	Effective for bronchodilator delivery in intubated or CPAP infants [7].
Ultrasonic Nebulizer	• High aerosol output [7] • No extra gas flow added [7]	• Heat generation may denature proteins/biologics; • Risk of overhydration/fluid overload [7].	No extra gas flow added [7].	Infrequently used in modern NICU due to heat & fluid risks [7].



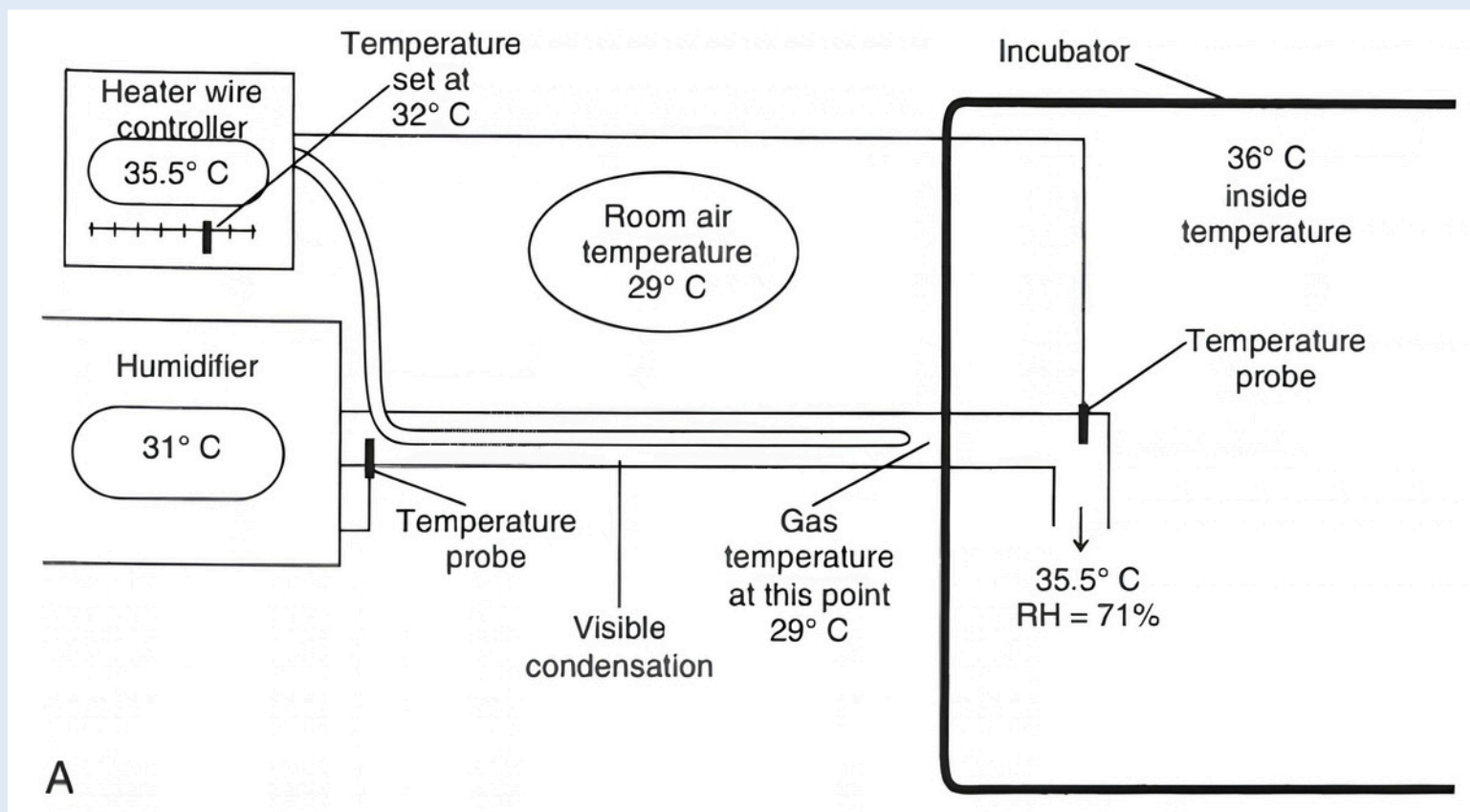
Connect with the patient



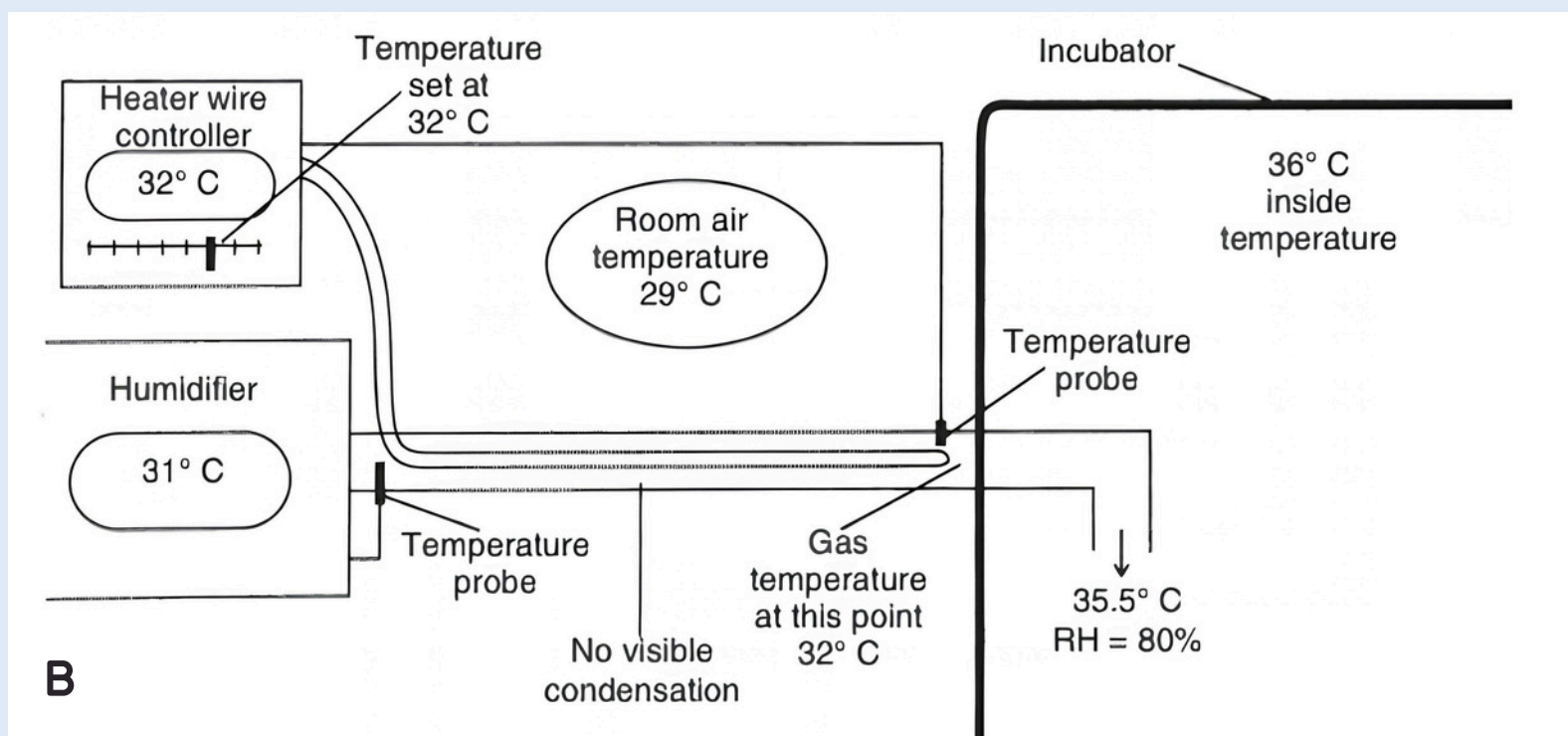
Vibrating Mesh Nebulizer (VMN / Aerogen)

6. AIRWAY HUMIDIFICATION & CHEST PHYSIOTHERAPY PROTOCOLS

Clinical Domain	Target Parameters / Protocol	Physiological Rationale & Evidence
Airway Humidification & Heating	- Core Gas Temp: 37 °C at patient Y-piece [4] - Humidity: 100% Relative Humidity (44 mg H₂O/L) [4] - Dual wire heated circuits to eliminate condensation (*rainout*) [4].	Cold, dry medical gases cause airway mucosal desiccation, ciliary dyskinesia, thick mucus plugging, and airway inflammation [4].
Chest Physiotherapy (CPT)	NOT RECOMMENDED ROUTINELY in VLBW/ELBW preterms (<30 wks) [5]. - Reserved strictly for focal atelectasia or massive secretion accumulation [5].	Percussion and vibration in fragile premature infants induce pain, hypoxemia, fluctuations in cerebral blood flow, and increased risk of Intraventricular Hemorrhage (IVH) [5].
Postural Drainage	- Position changes every 2–4 hours (supine, side-lying, prone) [5]. Avoid Trendelenburg positioning in preterms [5].	Trendelenburg position significantly increases intracranial pressure (ICP) and aggravates gastroesophageal reflux in premature infants [5].



(A) Temperature probe located inside a heated field tends to indicate a heat representative of the heated field rather than of the inspiratory gas before entry into the field. The humidifier does not provide the heat that is being detected by the wire controller. The heat source is particularly difficult to assess because most heated wire circuits operate with humidifiers that do not provide a display of the temperature of the gas immediately after it leaves the humidifier.



(B) Proper placement of the probe. If the probe is only slightly outside a radiant warmer field, it may need to be shielded, particularly if phototherapy is in use. RH, Relative humidity. (From Chatburn RL: Principles and practice of neonatal and pediatric mechanical ventilation. Respir Care 36:560, 1991.)

7. BEDSIDE TROUBLESHOOTING & EXTUBATION READINESS PROTOCOLS

Clinical Scenario / Objective	Bedside Assessment / Protocol	Action Plan & Interventions
Acute Deterioration / Desaturation (DOPE Mnemonic)	Systematic evaluation of acute respiratory distress in intubated neonates [1, 2].	D: Displacement (check ETT depth/lip mark, auscultate bilateral sounds). O: Obstruction (suction shallowly with pre-measured catheter). P: Pneumothorax (transillumination / chest ultrasound / urgent needle thoracocentesis). E: Equipment failure (disconnect and manually ventilate with T-Piece) [1, 2].
Extubation Readiness Criteria	Evaluation for transition from invasive MV to non-invasive support (nCPAP/NIPPV) [3, 7].	• Spontaneous breathing effort with acceptable work of breathing. • Blood Gas: pH >7.25, PaCO₂ <55–60 mmHg, PaO₂ >50–70 mmHg on FiO₂ ≤0.30–0.35 [1, 3]. • Ventilator parameters: MAP ≤7–8 cmH₂O, PIP ≤16–18 cmH₂O, Rate ≤15–20 bpm [3, 7].
Post-Extubation Failure Mitigation	Preventing re-intubation in premature infants (<1,250 g) [1, 3].	• Immediate placement on NIPPV or nCPAP (6–8 cmH₂O) [1, 3]. • Administer loading dose Caffeine Citrate (20 mg/kg IV) prior to extubation [3]. • Maintain strict neutral thermal environment & continuous SpO₂ monitoring [4].

8. BIBLIOGRAPHIC REFERENCES & EVIDENCE BASE

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- [2] American Academy of Pediatrics & American Heart Association. Endotracheal Intubation Equipment and Tube Selection Criteria. In: *Textbook of Neonatal Resuscitation (NRP)*, 8th Edition. Elk Grove Village, IL; 366-368.
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