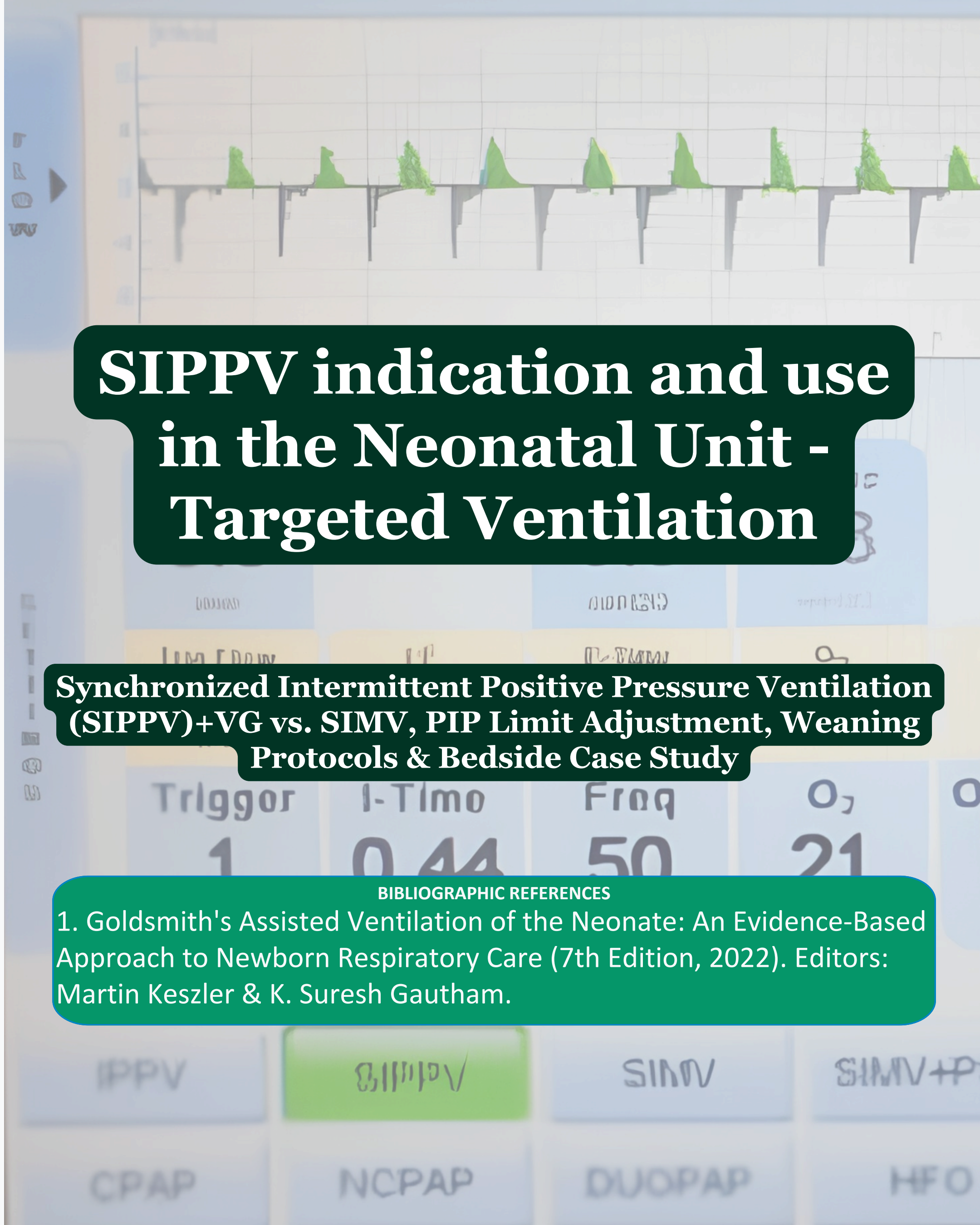




SIPPV indication and use in the Neonatal Unit - Targeted Ventilation

Synchronized Intermittent Positive Pressure Ventilation (SIPPV)+VG vs. SIMV, PIP Limit Adjustment, Weaning Protocols & Bedside Case Study

BIBLIOGRAPHIC REFERENCES

1. Goldsmith's Assisted Ventilation of the Neonate: An Evidence-Based Approach to Newborn Respiratory Care (7th Edition, 2022). Editors: Martin Keszler & K. Suresh Gautham.

Advantages of SIPPV+VG (A/C+VG) Over Conventional SIMV

100% Breath Support (Reduced WOB*)

Supports EVERY spontaneous effort that triggers the ventilator with a full target Vt breath. Prevents muscle fatigue seen in SIMV when infant breathes above backup rate without pressure support.

Dynamic Volutrauma & Atelectrauma Protection

VG automatically adjusts PIP breath-by-breath as lung compliance changes (e.g., post-surfactant). Prevents over-distension during compliance improvement and collapse during deterioration.

Automatic Pressure Weaning

As the infant's spontaneous effort or lung compliance improves, the VG algorithm automatically reduces the applied PIP to deliver the exact target Vt, executing continuous auto-weaning.

PaCO₂ & Minute Ventilation Stability

Guarantees consistent Vt across all supported breaths, stabilizing minute ventilation. Eliminates wide PaCO₂ fluctuations, protecting against severe hypocapnia and periventricular leukomalacia (PVL).

*WOB: Work of Breathing

Setting and Adjusting the PIP Limit (Pmax) in VG

THE GOLDEN RULE FOR PIP LIMIT (Pmax)

Set PIP Limit = Working PIP + 5 cmH₂O (e.g., if working PIP required for target V_t is 18 cmH₂O, set PIP Limit to 23 cmH₂O). Re-evaluate regularly as lung mechanics evolve.

DANGER: Setting PIP Limit Too Low

- Premature Pressure Truncation: Ventilator hits PIP limit before delivering target V_t.
- Unintended Hypoventilation: Delivered V_t falls below physiological requirements.
- Frequent Alarms & Agitation: Nuisance alarms interrupt ventilation and disturb the infant.
- False Failure Perception: Leads clinicians to prematurely abandon VG mode thinking it failed.

DANGER: Setting PIP Limit Too High

- Loss of Barotrauma Ceiling: Eliminates safety barrier against sudden excessive pressures.
- Transient High PIP Exposure: Allows ventilator to spike to extreme PIP during crying or agitation.
- Risk of Air Leaks: Increases susceptibility to pneumothorax and pulmonary interstitial emphysema (PIE).
- Recommendation: Keep a tight +5 cmH₂O buffer rather than an arbitrary high default (e.g., 35-40 cmH₂O).

Bedside Clinical Case: Managing PIP Limit & Secretion Plug in RDS

1. Patient Baseline

28-wk preterm infant (1.0 kg) on SIPPV+VG for RDS.

- Target Vt: 4.5 mL/kg (4.5 mL)
- Working PIP: 18 cmH₂O
- PIP Limit (P_{max}): 23 cmH₂O (+5 buffer)
- PEEP: 5 cmH₂O | Backup Rate: 40 bpm

2. Acute Event

Ett Secretion Plug develops.

- Airway resistance rises rapidly & compliance drops.
- Ventilator increases PIP to deliver 4.5 mL, but hits the 23 cmH₂O PIP limit.
- Pressure truncates; delivered Vt drops to 3.1 mL.

3. Alarm & Diagnosis

Ventilator triggers 'Low Volume' & 'Low Vt' alarms.

- Waveform shows truncated pressure plateau at 23 cmH₂O.
- Clinician recognizes PIP Limit truncation due to obstruction rather than true VG failure.

4. Intervention & Recovery

Ett Suctioning Performed.

- Secretion plug cleared -> Resistance normalizes.
- Working PIP automatically drops back to 16 cmH₂O to deliver target 4.5 mL/kg.
- PIP Limit remains safe at 23 cmH₂O.

Volume Guarantee Weaning Protocol & Extubation Criteria

Step 1: Automated Pressure Auto-Weaning

As lung compliance improves (e.g., post-surfactant) or infant's own respiratory effort increases, the ventilator automatically lowers PIP to maintain target Vt.

Step 2: Maintain Physiological Target Vt

DO NOT reduce target Vt to sub-physiological levels during weaning. Keep Vt at 4.0–6.0 mL/kg. Lowering Vt increases work of breathing and causes atelectasis.

Step 3: Wean Ventilator Support Parameters

Wean FiO₂ for SpO₂ targets. Wean backup respiratory rate as spontaneous drive stabilizes. Adjust PEEP based on lung volume and oxygenation requirements.

Step 4: Direct Extubation Criteria

Extubate directly from VG mode when infant has robust spontaneous drive, target Vt is met with low required PIP (≤ 16 –20 cmH₂O), low FiO₂, and stable PEEP.

Key Bedside Rules & Clinical Takeaways

SIPPV+VG vs. SIMV

- Supports 100% of spontaneous efforts
- Significantly reduces work of breathing
- Stabilizes PaCO₂ & minute ventilation
- Protects against PVL & brain injury

PIP Limit Management

- Set PIP Limit = Working PIP + 5 cmH₂O
- Prevents premature volume truncation
- Guards against barotrauma during crying
- Re-evaluate buffer when compliance changes

Smart VG Weaning

- Allow automatic PIP reduction by machine
- Maintain physiological V_t (4.0-6.0 mL/kg)
- Wean backup rate, PEEP, and FiO₂
- Extubate directly when required PIP is low



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