



Non-Invasive Ventilation

Non-invasive positive pressure ventilation involves the delivery of oxygen into the lungs without the need for endotracheal intubation. NIV in children presents unique challenges, including interface selection and fit, increased physiological susceptibility to respiratory decompensation, and the potential need for pharmacological support to manage anxiety or distress associated with interface use.

PEDIATRIC PHYSIOLOGY

Children are more susceptible to respiratory decompensation and respiratory failure:

- Greater airway resistance at baseline due to small diameter. At a greater risk for obstruction from inflammation and mucous
- Compliant chest walls. Predisposed to decreased FRC (functional residual capacity) and atelectasis (collapse or partial collapse of the lung)
- Higher rate of oxygen consumption due to higher metabolic and respiratory rate
- Smaller and fewer alveoli, limiting surface area for gas exchange
- Infants are obligatory nose breathers until 6 months of age

TYPES OF NIV

CPAP:

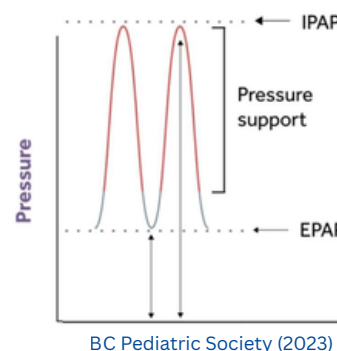
Continuous Positive Airway Pressure

- Provides a constant level of supportive airway pressure throughout all phases of respiration
- Improves oxygenation and assists in preventing atelectasis by acting as a “splint” to prevent collapsed or unstable alveoli from closing. Can also recruit (reopen) already collapsed alveoli
- Typical CPAP settings would begin with an EPAP (Expiratory Positive Airway Pressure) of 5 cmH₂O. PEEP (Positive End Expiratory Pressure) is interchangeable with EPAP

BiPAP:

Bi-level Positive Airway Pressure

- Provides respiratory support at two different pressure settings:
 - IPAP (Inspiratory Positive Airway Pressure)
 - EPAP (Expiratory Positive Airway Pressure)
- Pressure Support is the difference between IPAP and EPAP. This difference helps to assist with spontaneous breaths and augments Tidal Volume in each breath
- BiPAP is a higher level of support than CPAP
- Common initiation settings are IPAP of 10-12cmH₂O and EPAP of 5cmH₂O



-This is analogous to peak pressure
-Adjust to achieve adequate tidal volume or chest rise and CO₂ clearance
-Typical range is 10-12 to start

-This is analogous to PEEP
-Adjust with goal to optimize resting lung volume
-To support lung inflation in a more efficient manner
-Typical is 5-6 to start

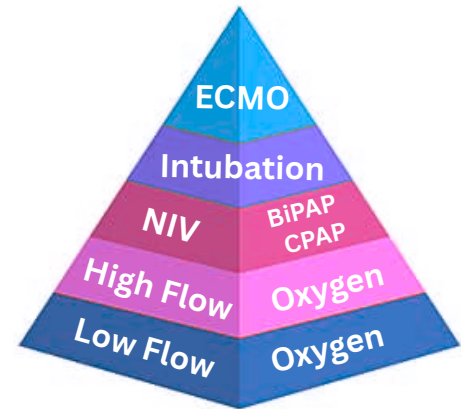
Note that by definition, IPAP is set independently of EPAP (ie: 12/6 offers a pressure gradient or pressure support of 6)

BC Pediatric Society (2023)

Non-Invasive Ventilation

CLINICAL INDICATIONS

- Bronchiolitis - failure to improve with HFNC
- Asthma
- Pneumonia
- Acute Respiratory Failure
- Acute Respiratory Distress Syndrome
- Post-Extubation Support
- Neuromuscular Disease



MONITORING

- Patients receiving NIV support require 1:1 observation
- Continuous cardiorespiratory monitoring
- Hourly vitals and skin integrity checks
- Ensure the interface is neither too tight nor too loose, both can cause leaks
- Ensure that nares are not obstructed by the mask and that the circuit is not causing traction on the face
- Monitor for signs of NIV failure - increasing WOB, persistent tachycardia/tachypnea, worsening gas exchange. Delayed recognition of unsuccessful NIV can postpone necessary escalation to invasive ventilation with an endotracheal tube

POTENTIAL COMPLICATIONS

- Large leaks around the interface can cause patient/machine desynchrony
- Eye irritation (leaks or pressure injury)
- Skin irritation and pressure ulcers
- Gastric irritation from excess flow from ill-fitting masks. Patients may require an NG/OG for gastric decompression
- Aspiration
- Pneumothorax
- Not tolerating NIV

PHARMACOLOGICAL SUPPORT

The purpose of pharmacological support is to make the interfaces more comfortable for patients, not to achieve deep levels of sedation.

- **Ketamine:** Respiratory sparing dissociative sedative. It is bronchodilatory (preferred in asthma). Increases HR, RR and can cause nausea or vomiting. Intranasal is short acting (lasts ~1 hr). Can also be given as a continuous infusion
- **Dexmedetomidine:** Respiratory sparing sedative. Causes hypotension and bradycardia. Intranasal lasts up to 2 hrs. Can be given as a continuous infusion (monitor HR, BP)
- **Chloral Hydrate:** Use with caution in neonates. Can cause respiratory depression at high doses

SickKids - Connected Care



Acute Non-Invasive Ventilation in Pediatrics

RCH Nursing Guidelines



Non-Invasive Ventilation

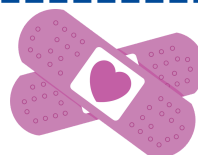
Nursing Grand Rounds

April 16th 1300 - 1400. Microsoft Teams
Maritime Child Health: Strengthening
Pediatric Care Through Regional
Collaboration in Nursing Practice
ID: 221 033 804 390 10
Passcode: h9d2gF29

Pediatric Grand Rounds

Every Wednesday morning 0900-1000
Microsoft Teams
ID: 264 377 837 697 98
Passcode: x73be3sz

Comfort Corner



The Youth in Pain: Solutions for Effective Opioid Use project was established in response to Health Canada's Action Plan for Pain in Canada (2021) and guided by SKIP's 2020 Opioids and Our Children national scoping meeting. The Youth in Pain initiative was guided by the diverse expertise of its National Advisory Group. The project aimed to share evidence-based solutions for the medical use of opioids to address short and long-term pain in youth. Through collaboration with a diverse group of partners, over 30 new tools and resources were created to promote safe, effective, and equitable opioid use for managing pediatric pain. These resources include an Opioids and Pain in Youth toolkit, modules on acute and chronic pain, factsheets and conversation guides, resources for sickle cell disease and resources for surgery. Access all the tools and resources [Here](#).



Youth in Pain
Solutions for Effective Opioid Use

References

Haut, C. (2015). *Pediatric Non-Invasive Ventilation*. *Journal of Pediatric Intensive Care*.
<https://pmc.ncbi.nlm.nih.gov/articles/PMC6513139/#JR1518-2>

RCH (2022). *Nursing Guidelines: Continuous Positive Airway Pressure (CPAP) and Non-Invasive Ventilation (NIV)*.
[https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Continuous_positive_airway_pressure_\(CPAP\)_and_non-invasive_ventilation_\(NIV\)](https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Continuous_positive_airway_pressure_(CPAP)_and_non-invasive_ventilation_(NIV))

Skippen, P., Retallack, D. & Chung, R. (2023). *Acute Noninvasive Ventilation in Pediatrics*. [PowerPoint Slides]. BC Pediatrics Society Journal Club. <https://www.bcpeds.ca/wp-content/uploads/2023/12/BCPS-CME-Dec-13-2023-BiPAP.pdf>

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