CANADIAN SOCIETY OF RESPIRATORY THERAPISTS
SOCIÉTÉ CANADIENNE DES THÉRAPEUTES RESPIRATOIRES

CSRT Rapid Response Return to Practice Toolkit – Mechanical Ventilation

CSRT Review Courses: Mechanical Ventilation:

- Part 1: Review of basic theory, pressure gradients, lung mechanics, adverse effects, and indications: CSRT Mechanical Ventilation Review Part 1
- Part 2: Ventilator settings and modes: CSRT Mechanical Ventilation Review Part 2
- Part 3: Alarms, titrating the ventilator, weaning: CSRT Mechanical Ventilation Review Part 3

Clinical Practice Guidelines/Review Articles:

- European Respiratory Society/American Thoracic Society (2017): Click here
- Noninvasive Ventilation: Piraino. T. Respiratory Care May 2017, 62 (5) 623-628. Click here

Other Online Resources:

- Prone positioning video (Mount Sinai): Click here
- Review videos (includes basic respiratory therapy procedures and set up of various ventilator models, delivered by NAIT RT instructor, George Onyschuk, RRT): Click here
- APRV Network: Click here

Industry-Developed Resources:

- Advanced Pressure Control Ventilation (APRV) (Medtronic): Click here
- APRV information (Draeger): Click here
- COVID-19 information (Draeger): Click here
- Interpretation of Ventilator Waveforms (Medtronic): Click here
- Mechanical ventilation and ventilators educational resources (Hamilton): Click here
- Noninvasive ventilation (Philips): Click here
- Optimizing the Patient-Ventilator Interaction Part 1 (Asynchrony) (Medtronic): Click here
- Optimizing the Patient-Ventilator Interaction Part 2 (Asynchrony) (Medtronic): Click here
- Ventilator modes (Draeger): Click here
- Ventilator Training Alliance app download (multi-vendor library of training and product information): Click here

The CSRT Rapid Response Refresher Resource is intended to provide respiratory therapists with review materials. For information specific to the management of Coronavirus disease, please refer to the CSRT COVID-19 resource page: https://www.csrt.com/csrt-novel-coronavirus-resources/.

Ventilator-Specific Resources

- Bellavista 1000 video: Click here
- Carefusion Avea guide and modes of ventilation: Click here
- Draeger online training resources (Evita, Oxylog, V500, VN500): Click here
- Draeger training videos: Click here
- EOVE 150 Guide de poche : Cliquez ici
- EOVE 150 Guide d'utilisateur : Cliquez ici
- EOVE 150 Pocket Guide: Click here
- EOVE 150 User's manual: Click here
- EOVE Battery pack (guide): Click here
- EOVE Pack batterie (guide d'utilisation) : Cliquez ici
- GE CARESCAPE R860 resources: Click here
- GE CARESCAPE R860 Quick Reference Guide: Click here
- GE CARESCAPE R860 User's Reference Manual: Click here
- Hamilton C3, C6, G5: Click here
- LTV ventilator educational resources: Click here
- Maquet Servo-i manual: Click here
- Maquet Servo-i modes and NAVA: Click here
- Maquet Servo-u learning guide: Click here
- Monnal T60 manuel utilisateur : Cliquez ici
- Monnal T60 user manual: Click here
- Medtronic PB 980 ventilator training: Click here
- Medtronic PB 980 manuals and addenda / manuels et addenda: Click here / Cliquez ici
- Medtronic PB 840 ventilator training: Click here
- Medtronic PB 840 manuals addenda / manuels et addenda: Click here / Cliquez ici
- Medtronic PB 560 manual: Click here
- MOVES SLC training hub: Click here
- MOVES SLC operator's manual: Click here

Ventilator Adjunct Resources:

- Aerogen nebulizer: Click here (various resources) or here (manual)
    - List of ventilators with Aerogen modules Click here
- Draeger PulmoVista: Click here
- Fisher & Paykel 850 resources: Click here
- Flusso bypass adapter: Click here

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Formulas

Ideal body weight (female, lb): 105 + 5(height [inches]-60) (divide by 2.2 to get kg)
Ideal body weight (male, lb): 106 + 6(height [inches]-60) (divide by 2.2 to get kg)
(If height is measured in cm, divide by 2.54 cm/inch)

Static compliance $C_{st} = \frac{\text{Effective tidal volume}}{P_{plat} - PEEP}$

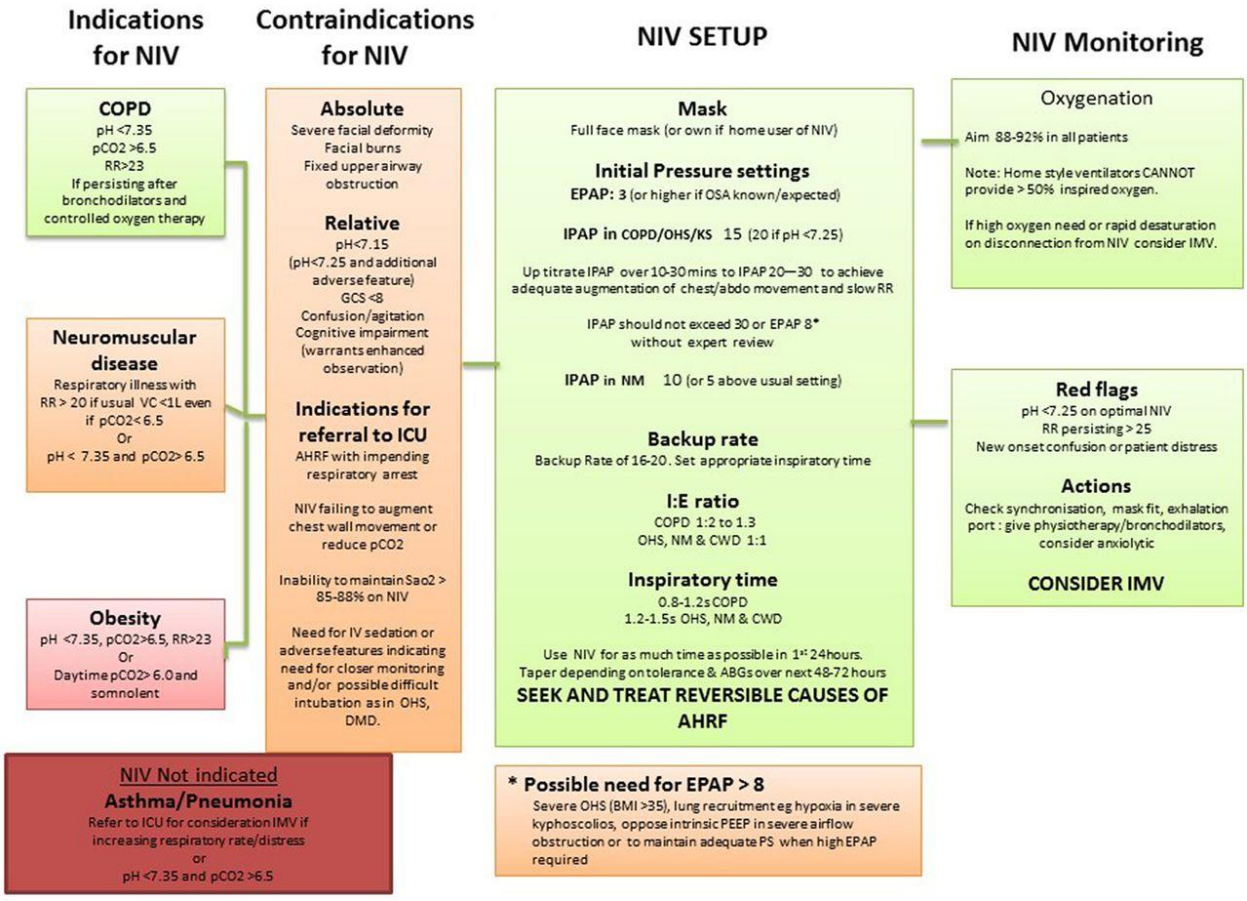
Resistance $R_{aw} = \frac{PIP - P_{plat}}{\text{Flow (L/sec)}}$

To adjust **minute volume** to achieve a desired $PaCO_2$: Current minute volume x $\frac{\text{Current } PaCO_2}{\text{Desired } PaCO_2}$

Effective (Delivered) Tidal Volume = Set tidal volume – volume lost to the ventilator circuit

- **Volume lost to the ventilator circuit** = PIP-PEEP x tubing comp factor (from packaging)
- If you must calculate the tubing comp factor: Dial the maximum P limit to max [so the ventilator doesn't pressure cycle], occlude the outlet of the patient wye, manually deliver a breath and note the achieved PIP and exhaled VT. From there, tubing compliance is calculated at volume/PIP.

Summary for providing acute non-invasive ventilation



(From Davidson AC, Banham S, Elliott M, *et al* BTS/ICS guideline for the ventilatory management of acute hypercapnic respiratory failure in adults. *Thorax* 2016;71:ii1-ii35. https://thorax.bmj.com/content/71/Suppl_2/ii1 [Accessed April 5, 2020.])

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Some notes on passive humidification (HMEs) versus active humidification (heated humidity, HH)

Restrepo and Walsh (2012)[1] notes that heat and moisture exchangers (HMEs) are contraindicated when the patient has copious thick or frank bloody secretions, when the exhaled tidal volume is less than 70% of the delivered tidal volume, when low tidal volumes are used, when the patient's temperature is less than 32°C, when the spontaneously breathing patient has a high minute volume (greater than 10 lpm) or in NIV with a large leak. A recent Cochrane review (Gillies *et al.*, 2017)[2] comparing HMEs to HH noted no increase in pneumonia, airway blockage or mortality in patients using HMEs versus HH.

Some, but not all, HMEs are also filters. The efficiency of these filters varies, so it is wise to verify the filtration efficiency of any HME prior to using it.

HMEs are better suited to short-term ventilation (less than 96 hours)[1] and should be changed as per manufacturers' recommendations, or if they have become contaminated with secretions. HMEs should not be left in-line when delivering aerosolized medications.

1. Restrepo, RD., Walsh, BK. Humidification during invasive and noninvasive mechanical ventilation. Respir Care 2012;57(5):782-788.
2. Gillies, D., *et al.* Heat and moisture exchangers versus heated humidifiers for mechanically ventilated adults and children. Cochrane Database of Systematic Reviews 2017; Issue 9. Art. No.:CD004711.