

Oxygenation and Ventilation of COVID-19 Patients

Module 4: Ventilation Management

In collaboration with



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KJ-1425

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To show skills clearly, the healthcare providers shown do not always use recommended personal protective equipment (such as gloves, masks, face shields).

GAP: Escalation to invasive ventilation

- **G: Gas exchange abnormality**

- COVID-19 respiratory failure is usually hypoxemic, not hypercarbic
- Worsening oxygenation: $\text{PaO}_2/\text{FiO}_2$ or $\text{SpO}_2/\text{FiO}_2 < 150$
- NIV with $\text{FiO}_2 > 0.6$ and can't maintain $\text{SpO}_2 > 90\%$
- Oxygenation unresponsive to HFNC therapy
- Hypercapnia with acidosis, $\text{pH} < 7.3$
- Increased work of breathing suggests deterioration of respiratory function

- **A: Airway protection**

- Altered mental status attributed to respiratory failure
- Neurological dysfunction

- **P: Pulmonary toilet**

- Increased airway secretions

Maintenance: Goals of therapy

Oxygenation

- $\text{PaO}_2 > 60$ / SpO_2 88-98%
- FIO_2 to maintain a SpO_2 of 88-98%
 - $\text{FIO}_2 < 0.6$
 - Try to avoid 100% oxygen, which favors de-nitrogenate atelectasis
 - Lower FIO_2 of 0.7-0.9 may not drastically change oxygenation due to high levels of shunt

Ventilation

- Tidal volumes of 4-8 mL/kg of PBW
- pH 7.25-7.42
- PaCO_2 40-65 / end-tidal carbon dioxide (ETCO_2) 35-60 mm Hg

FIO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7
PEEP	6	6	8	8	10	10	10
FIO_2	0.7	0.7	0.8	0.9	0.9	0.9	1
PEEP	12	14	14	14	16	18	18-24

ARDSNet low PEEP/ FIO_2



When to troubleshoot

- Peak airway pressure greater than 35 cm H₂O
 - Evaluate the need for suctioning
 - Check plateau pressure
 -

A90003>-893>0.6 <09006B>/T1_0 1 T20 2.00A60A90003>-073> <0055>-3.6 <004100>/T1_0 1 T266 <005

When to troubleshoot (cont.)

- $FIO_2 > 0.6$ with $SpO_2 < 88\%$
 - Increase PEEP to level indicated on chart: Monitor blood pressure with each PEEP increase
 - Consider positioning of patient (ie, proning)
 - Consider diuresis
- $pH < 7.25$
 - Assess whether acidosis is respiratory or metabolic
 - Adjust respiratory rate higher (usually 2-6/min per change) to lower CO_2 (max 35/min)
 - If you go higher than a respiratory rate of 30, you will need to decrease the inspiratory time to 0.8 to avoid an inverse inspiratory-to-expiratory ratio
 - Monitor for auto-PEEP
 - Evaluate and treat metabolic abnormalities (check anion gap, lactate)
- $pH > 7.42$
 - Adjust respiratory rate lower (usually 2-6/min per change) to increase CO_2

Call for help

- SpO₂ less than 88% on an Fio₂ of 1.0 for more than 15 minutes despite troubleshooting
- pH less than 7.25 for more than 2 blood gases
- pH less than 7.10
- PaO₂ less than 40
- SpO₂/Fio₂ or PaO₂/Fio₂ ratio of less than 150 for 2 hours