

Evidence-Based Clinical Pathway: Mechanical Ventilation for the Intubated Patient (Lung-Protective Strategy)

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Primary Sources: 1) The ARDSnet authors. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *N Engl J Med* 2000;342:1301-8;
2) Association between use of lung-protective ventilation with lower tidal volumes and clinical outcomes among patients without ARDS – A meta-analysis. *JAMA*. 2012;308(16):1651-1659

Pathway applicability: Patients who are intubated (see checklist at right) on mechanical ventilation who do not have obstructive pathology (e.g. COPD or asthma)

Post-intubation checklist:

- Head of bed >30°
- Gastric tube
- Analgesia/sedation
- CXR
- ETT cuff pressure < 30cm H₂O
- Continuous ETCO₂ monitoring

Initial Settings:

Mode: Assist Control (AC)
Tidal Volume (V_T): 8 mL/kg (use ideal/predicted body weight)
Respiratory Rate (RR): 16/min
Inspiratory Flow Rate (IFR): 60 L/min
Positive End-Expiratory Pressure (PEEP): 5 cm H₂O
Fraction of Inspired Oxygen (F_IO₂): 100%

Ideal/predicted body weight

Males = 50 + 2.3 [height (inches) - 60]
Females = 45.5 + 2.3 [height (inches) - 60]

Assess and manage airway pressures:

- 1) P_{plateau} (plateau pressure)
 - Assess: press inspiratory hold button for 0.5 seconds
 - Target: P_{plateau} < 30 cm H₂O
 - Action if above target: decrease V_T by 1 mL/kg
 - Recheck/readjust: every 5 minutes until reach target
- 2) PIP (peak inspiratory pressure)
 - Assess: read off of vent display
 - Target: PIP < 35 cm H₂O
 - Action if above target: check P_{plateau} and act as needed

Causes of high P_{plateau} (↓ Compliance):

- PTX
- ARDS or pulmonary edema
- auto-PEEP (breath-stacking)
- pleural effusion
- chest wall rigidity
- abdominal distention

Causes of high PIP:

- circuit problem: kink/obstruction
- ETT problem: kinking or biting of ETT, blood/FB/mucous plug
- lung problem: bronchospasm

Causes of low PIP:

- circuit problem: leak
- ETT problem: extubation

Wait 5 minutes

Manage oxygenation:

- 1) Decrease F_IO₂ to 40%
- 2) Assess whether oxygenation is within target range: S_aO₂ 88-95% or P_aO₂ 55-80
- 3) Increase PEEP/F_IO₂ together (see ARDSnet table below) to maintain oxygenation target range
- 4) Consult intensivist if unable to reach oxygenation target range or if oxygenation target range is reachable only by use of high levels of PEEP (> 10) or F_IO₂ (>80%)

Manage ventilation:

- 1) Check arterial or venous blood gas
- 2) If pCO₂ >40, increase RR by 1-2 breaths/min (to max RR 35)
- 3) If pCO₂ <40, decrease RR by 1-2 breaths/min
- 4) Consult intensivist if unable maintain pH above 7.15

Ongoing assessment:

- 1) Assessment intervals for oxygenation and ventilation depend on individual patient circumstances
- 2) Check P_{plateau} at least once every 30 minutes
- 3) Check blood gases at least every 2 hours (and 5-10 minutes after any ventilator adjustment)

ARDSnet PEEP/F_IO₂ adjustment table (N.B. Any patient requiring > 8 cm H₂O PEEP should be transported with PEEP valve)

F _I O ₂	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18-24