



NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

www.ardsnet.org
revised 25Jan05

INCLUSION CRITERIA: Acute onset of

1. $\text{PaO}_2/\text{FiO}_2 \leq 300$ (corrected for altitude)
2. Bilateral (patchy, diffuse, or homogeneous) infiltrates consistent with pulmonary edema
3. No clinical evidence of left atrial hypertension

PART I: VENTILATOR SETUP AND ADJUSTMENT

1. Calculate predicted body weight (PBW)
Males = $50 + 2.3 [\text{height (inches)} - 60]$
Females = $45.5 + 2.3 [\text{height (inches)} - 60]$
2. Select Assist Control Mode
3. Set initial TV to 8 ml/kg PBW
4. Reduce TV by 1 ml/kg at intervals ≤ 2 hours until TV = 6ml/kg PBW.
5. Set initial rate to approximate baseline VE (not > 35 bpm).
6. Adjust TV and RR to achieve pH and plateau pressure goals below.
7. Set inspiratory flow rate above patient demand (usually > 80L/min)

OXYGENATION GOAL: PaO_2 55-80 mmHg or SpO_2 88-95%

Use incremental FiO_2 /PEEP combinations below to achieve goal. Higher PEEP options (lower row) will decrease FiO_2 and may be preferred in patients with high FiO_2 who can tolerate higher PEEP (stable blood pressure, no barotrauma). Survival is similar with both PEEP approaches.

FiO₂	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5 12-14	5 14	8 16	8 16	10 18-20	10 20	10 20	12 20

FiO₂	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0
PEEP	14 20	14 20-22	14 22	16 22	18 22	20 22	22 22	24 24

PLATEAU PRESSURE GOAL: ≤ 30 cm H₂O

Check Pplat (0.5 second inspiratory pause), SpO_2 , Total RR, TV and pH (if available) at least q 4h and after each change in PEEP or TV.

If Pplat > 30 cm H₂O: decrease TV by 1 ml/kg steps (minimum = 4 ml/kg).

If Pplat < 25 cm H₂O: TV < 6 ml/kg, increase TV by 1 ml/kg until Pplat > 25 cm H₂O or TV = 6 ml/kg.

If Pplat < 30 and breath stacking occurs: may increase TV in 1 ml/kg increments (maximum = 8 ml/kg).

pH GOAL: 7.30-7.45

Acidosis Management: (pH < 7.30)

If pH 7.15-7.30: Increase RR until pH > 7.30 or $\text{PaCO}_2 < 25$ (Maximum RR = 35).

If RR = 35 and $\text{PaCO}_2 < 25$, may give NaHCO_3 .

If pH < 7.15: Increase RR to 35.

If pH remains < 7.15 and NaHCO_3 considered or infused, TV may be increased in 1 ml/kg steps until pH > 7.15 (Pplat target may be exceeded).

Alkalosis Management: (pH > 7.45) Decrease vent rate if possible.

I:E RATIO GOAL: 1:1.0 - 1:3 Adjust flow rate to achieve goal.

If $\text{FiO}_2 = 1.0$ and PEEP = 24 cm H₂O, may adjust I:E to 1:1.

PART II: WEANING

A. Conduct a CPAP Trial daily when:

1. $\text{FiO}_2 \leq 0.40$ and PEEP ≤ 8 or, if using the higher PEEP scale and $\text{FiO}_2 \leq 0.3$ and PEEP 12-14, slowly reduce PEEP to 8 and increase FiO_2 to .4 for 30 min.
2. PEEP and $\text{FiO}_2 \leq$ values of previous day
3. Patient has acceptable spontaneous breathing efforts. (May decrease vent rate by 50% for 5 minutes to detect effort.)
4. Systolic BP ≥ 90 mmHg without vasopressor support.

CONDUCTING THE TRIAL:

Set CPAP = 5 cm H₂O, $\text{FiO}_2 = 0.50$

If RR ≤ 35 for 5 min.: advance to Pressure Support Weaning below:

If RR > 35 in < 5 min.: may repeat trial after appropriate intervention (e.g., suctioning, analgesia, anxiolysis)
If CPAP trial not tolerated: return to previous A/C settings

B. PRESSURE SUPPORT (PS) WEANING PROCEDURE

1. Set PEEP = 5, and $\text{FiO}_2 = 0.50$
2. Set initial PS based on RR during CPAP trial:
 - a. **If CPAP RR < 25 :** set PS = 5 cm H₂O and go to step 3d.
 - b. **If CPAP RR = 25-35:** set PS = 20 cm H₂O then reduce by 5 cm H₂O at ≤ 5 min. intervals until RR = 26-35 then go to step 3a.
 - c. **If initial PS not tolerated:** return to previous A/C settings.
3. **REDUCING PS:** (No reductions made after 1700 hours)
 - a. Reduce PS by 5 cm H₂O q1-3 hr.

- b. If PS ≥ 10 cm H₂O not tolerated, return to previous A/C settings (Reinitiate last tolerated PS level next AM and go to step 3a)
- c. If PS = 5 cm H₂O not tolerated, return to PS = 10 cm H₂O. If tolerated, 5 or 10 cm H₂O may be used overnight with further attempts at weaning the next morning
- d. If PS = 5 cm H₂O tolerated for ≥ 2 hours assess for ability to sustain unassisted breathing below.

C. UNASSISTED BREATHING TRIAL:

1. Place on T-piece, trach collar, or CPAP ≤ 5 cm H₂O
2. Assess for tolerance as below for two hours.
 - a. $\text{SpO}_2 \geq 90$: and/or $\text{PaO}_2 \geq 60$ mmHg
 - b. Spontaneous TV ≥ 4 ml/kg PBW
 - c. RR ≤ 35 /min
 - d. pH ≥ 7.3
 - e. No respiratory distress (distress = 2 or more)
 - HR $> 120\%$ of baseline
 - Marked accessory muscle use
 - Abdominal paradox
 - Diaphoresis
 - Marked dyspnea
3. If tolerated consider extubation.
4. If not tolerated resume PS 5 cm H₂O.

COMPLETE PROTOCOL ONLINE: www.ardsnet.org or from National Auxiliary Publications Service (NAPS). To order 15 pages of supplementary material, contact NAPS, c/o Microfiche Publications, 248 Hempstead Tpk., West Hempstead, NY 11552 Document # 05542

NEJM 2000 342:1301-1308 and NEJM 2004; 351:327-336
© ARDS Network 2005