



NIH NHLBI ARDS Clinical Network Mechanical Ventilation Protocol Summary

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 any ventilator mode
3. Set ventilator settings to achieve initial $V_T = 8 \text{ ml/kg PBW}$
4. Reduce V_T by 1 ml/kg at intervals ≤ 2 hours until $V_T = 6 \text{ ml/kg PBW}$.
5. Set initial rate to approximate baseline minute ventilation (not $> 35 \text{ bpm}$).
6. Adjust V_T and RR to achieve pH and plateau pressure goals below.

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

Use a minimum PEEP of 5 cm H_2O . Consider use of incremental FiO_2/PEEP combinations such as shown below (not required) to achieve goal.

Lower PEEP/higher FiO_2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO_2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

PLATEAU PRESSURE GOAL: $\leq 30 \text{ cm H}_2\text{O}$

Check Pplat (0.5 second inspiratory pause), at least q 4h and after each change in PEEP or V_T .

If Pplat $> 30 \text{ cm H}_2\text{O}$: decrease V_T by 1 ml/kg steps (minimum = 4 ml/kg).

If Pplat $< 25 \text{ cm H}_2\text{O}$ and $V_T < 6 \text{ ml/kg}$, increase V_T by 1 ml/kg until Pplat $> 25 \text{ cm H}_2\text{O}$ or $V_T = 6 \text{ ml/kg}$.

If Pplat < 30 and breath stacking or dys-synchrony occurs: may increase V_T in 1 ml/kg increments to 7 or 8 ml/kg if Pplat remains $\leq 30 \text{ cm H}_2\text{O}$.

pH GOAL: 7.30-7.45

Acidosis Management: (pH < 7.30)

If pH 7.15-7.30: Increase RR until pH > 7.30 or PaCO₂ < 25
(Maximum set RR = 35).

If pH < 7.15: Increase RR to 35.

If pH remains < 7.15, V_T may be increased in 1 ml/kg steps until pH > 7.15 (Pplat target of 30 may be exceeded).

May give NaHCO₃

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

I: E RATIO GOAL: Recommend that duration of inspiration be ≤ duration of expiration.

PART II: WEANING

A. Conduct a SPONTANEOUS BREATHING TRIAL daily when:

1. FiO₂ ≤ 0.40 and PEEP ≤ 8 OR FiO₂ ≤ 0.50 and PEEP ≤ 5.
2. PEEP and FiO₂ ≤ 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.
5. No neuromuscular blocking agents or blockade.

B. SPONTANEOUS BREATHING TRIAL (SBT):

If all above criteria are met and subject has been in the study for at least 12 hours, initiate a trial of UP TO 120 minutes of spontaneous breathing with FiO₂ ≤ 0.5 and PEEP ≤ 5:

1. Place on T-piece, trach collar, or CPAP ≤ 5 cm H₂O with PS ≤ 5
2. Assess for tolerance as below for up to two hours.
 - a. SpO₂ ≥ 90: and/or PaO₂ ≥ 60 mmHg
 - b. Spontaneous V_T ≥ 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 for at least 30 minutes, consider extubation.
4. If not tolerated resume pre-weaning settings.

**Definition of UNASSISTED BREATHING
(Different from the spontaneous breathing
criteria as PS is not allowed)**

1. Extubated with face mask, nasal prong oxygen, or room air, OR
2. T-tube breathing, OR
3. Tracheostomy mask breathing, OR
4. CPAP less than or equal to 5 cm H₂O **without pressure support or IMV assistance.**

HEIGHT	PBW	4 ml	5 ml	6 ml	7 ml	8 ml
4' 0" (48)	17.9	72	90	107	125	143
4' 1" (49)	20.2	81	101	121	141	162
4' 2" (50)	22.5	90	113	135	158	180
4' 3" (51)	24.8	99	124	149	174	198
4' 4" (52)	27.1	108	136	163	190	217
4' 5" (53)	29.4	118	147	176	206	235
4' 6" (54)	31.7	127	159	190	222	254
4' 7" (55)	34	136	170	204	238	272
4' 8" (56)	36.3	145	182	218	254	290
4' 9" (57)	38.6	154	193	232	270	309
4' 10" (58)	40.9	164	205	245	286	327
4' 11" (59)	43.2	173	216	259	302	346
5' 0" (60)	45.5	182	228	273	319	364
5' 1" (61)	47.8	191	239	287	335	382
5' 2" (62)	50.1	200	251	301	351	401
5' 3" (63)	52.4	210	262	314	367	419
5' 4" (64)	54.7	219	274	328	383	438
5' 5" (65)	57	228	285	342	399	456
5' 6" (66)	59.3	237	297	356	415	474
5' 7" (67)	61.6	246	308	370	431	493
5' 8" (68)	63.9	256	320	383	447	511
5' 9" (69)	66.2	265	331	397	463	530
5' 10" (70)	68.5	274	343	411	480	548
5' 11" (71)	70.8	283	354	425	496	566
6' 0" (72)	73.1	292	366	439	512	585
6' 1" (73)	75.4	302	377	452	528	603
6' 2" (74)	77.7	311	389	466	544	622
6' 3" (75)	80	320	400	480	560	640
6' 4" (76)	82.3	329	412	494	576	658
6' 5" (77)	84.6	338	423	508	592	677
6' 6" (78)	86.9	348	435	521	608	695
6' 7" (79)	89.2	357	446	535	624	714
6' 8" (80)	91.5	366	458	549	641	732
6' 9" (81)	93.8	375	469	563	657	750
6' 10" (82)	96.1	384	481	577	673	769
6' 11" (83)	98.4	394	492	590	689	787
7' 0" (84)	100.7	403	504	604	705	806

PBW and Tidal Volume for Females

HEIGHT	PBW	4 ml	5 ml	6 ml	7 ml	8 ml
4' 0" (48)	22.4	90	112	134	157	179
4' 1" (49)	24.7	99	124	148	173	198
4' 2" (50)	27	108	135	162	189	216
4' 3" (51)	29.3	117	147	176	205	234
4' 4" (52)	31.6	126	158	190	221	253
4' 5" (53)	33.9	136	170	203	237	271
4' 6" (54)	36.2	145	181	217	253	290
4' 7" (55)	38.5	154	193	231	270	308
4' 8" (56)	40.8	163	204	245	286	326
4' 9" (57)	43.1	172	216	259	302	345
4' 10" (58)	45.4	182	227	272	318	363
4' 11" (59)	47.7	191	239	286	334	382
5' 0" (60)	50	200	250	300	350	400
5' 1" (61)	52.3	209	262	314	366	418
5' 2" (62)	54.6	218	273	328	382	437
5' 3" (63)	56.9	228	285	341	398	455
5' 4" (64)	59.2	237	296	355	414	474
5' 5" (65)	61.5	246	308	369	431	492
5' 6" (66)	63.8	255	319	383	447	510
5' 7" (67)	66.1	264	331	397	463	529
5' 8" (68)	68.4	274	342	410	479	547
5' 9" (69)	70.7	283	354	424	495	566
5' 10" (70)	73	292	365	438	511	584
5' 11" (71)	75.3	301	377	452	527	602
6' 0" (72)	77.6	310	388	466	543	621
6' 1" (73)	79.9	320	400	479	559	639
6' 2" (74)	82.2	329	411	493	575	658
6' 3" (75)	84.5	338	423	507	592	676
6' 4" (76)	86.8	347	434	521	608	694
6' 5" (77)	89.1	356	446	535	624	713
6' 6" (78)	91.4	366	457	548	640	731
6' 7" (79)	93.7	375	469	562	656	750
6' 8" (80)	96	384	480	576	672	768
6' 9" (81)	98.3	393	492	590	688	786
6' 10" (82)	100.6	402	503	604	704	805
6' 11" (83)	102.9	412	515	617	720	823
7' 0" (84)	105.2	421	526	631	736	842

PBW and Tidal Volume for Males

Selección de volumen corriente (Vt) en relación a peso ideal (IBW*)

Varones

Talla (cm)	Peso ideal (kg)	Vt (ml/kg IBW)			
		4	6	8	10
145	43.3	173	260	346	433
146	44.2	177	265	353	442
147	45.1	180	271	361	451
148	46.0	184	276	368	460
149	46.9	188	281	375	469
150	47.8	191	287	383	478
151	48.7	195	292	390	487
152	49.6	199	298	397	496
153	50.5	202	303	404	505
154	51.5	206	309	412	515
155	52.4	209	314	419	524
156	53.3	213	320	426	533
157	54.2	217	325	433	542
158	55.1	220	331	441	551
159	56.0	224	336	448	560
160	56.9	228	341	455	569
161	57.8	231	347	463	578
162	58.7	235	352	470	587
163	59.6	239	358	477	596
164	60.6	242	363	484	606
165	61.5	246	369	492	615
166	62.4	250	374	499	624
167	63.3	253	380	506	633
168	64.2	257	385	514	642
169	65.1	260	391	521	651
170	66.0	264	396	528	660
171	66.9	268	402	535	669
172	67.8	271	407	543	678
173	68.7	275	412	550	687
174	69.7	279	418	557	697
175	70.6	282	423	565	706
176	71.5	286	429	572	715
177	72.4	290	434	579	724
178	73.3	293	440	586	733
179	74.2	297	445	594	742
180	75.1	300	451	601	751
181	76.0	304	456	608	760
182	76.9	308	462	615	769
183	77.8	311	467	623	778
184	78.8	315	473	630	788
185	79.7	319	478	637	797
186	80.6	322	483	645	806
187	81.5	326	489	652	815
188	82.4	330	494	659	824
189	83.3	333	500	666	833
190	84.2	337	505	674	842

* Peso ideal varones = $50 + 0.91(\text{altura[cm]} - 152.4)$

Mujeres

Talla (cm)	Peso ideal (kg)	Vt (ml/kg IBW)			
		4	6	8	10
140	34.2	137	205	274	342
141	35.1	141	211	281	351
142	36.0	144	216	288	360
143	36.9	148	222	296	369
144	37.9	151	227	303	379
145	38.8	155	233	310	388
146	39.7	159	238	317	397
147	40.6	162	244	325	406
148	41.5	166	249	332	415
149	42.4	170	254	339	424
150	43.3	173	260	347	433
151	44.2	177	265	354	442
152	45.1	181	271	361	451
153	46.0	184	276	368	460
154	47.0	188	282	376	470
155	47.9	191	287	383	479
156	48.8	195	293	390	488
157	49.7	199	298	397	497
158	50.6	202	304	405	506
159	51.5	206	309	412	515
160	52.4	210	314	419	524
161	53.3	213	320	427	533
162	54.2	217	325	434	542
163	55.1	221	331	441	551
164	56.1	224	336	448	561
165	57.0	228	342	456	570
166	57.9	232	347	463	579
167	58.8	235	353	470	588
168	59.7	239	358	478	597
169	60.6	242	364	485	606
170	61.5	246	369	492	615
171	62.4	250	375	499	624
172	63.3	253	380	507	633
173	64.2	257	385	514	642
174	65.2	261	391	521	652
175	66.1	264	396	529	661
176	67.0	268	402	536	670
177	67.9	272	407	543	679
178	68.8	275	413	550	688
179	69.7	279	418	558	697
180	70.6	282	424	565	706
181	71.5	286	429	572	715
182	72.4	290	435	579	724
183	73.3	293	440	587	733
184	74.3	297	446	594	743
185	75.2	301	451	601	752

* Peso ideal mujeres = $45.5 + 0.91(\text{altura[cm]} - 152.4)$

Si Pa/FiO2 >200, prefiera Vt 6-8 ml/kg IBW. Si Pa/FiO2 <200, prefiera Vt 6 ml/kg IBW.
 Limite Pmes <30-35 cmH2O y Vt <10 ml/kg IBW. Si presión distensión (Pmes-PEEP) >20, disminuya Vt