COVID-19 ARDS Ventilator PEEP Titration Protocol

Purpose

- The purpose of this protocol initiated by an ordering provider, will allow the Licensed Respiratory Care Practitioner (LRCP) the ability to titrate rate, PEEP, tidal volume (Vt) and F_IO_2.
- Goal: PaO_2 55-80 mmHg and/or SpO_2 88-95% for patients with Adult Respiratory Distress Syndrome (ARDS) secondary to COVID-19 or other insult.

Policy

- The ordering provider will determine that the patient is appropriate for the PEEP titration protocol based on the diagnosis of ARDS as defined by:
  - $PaO_2/ F_IO_2 < 300$
  - Diffuse interstitial infiltrates
  - No clinical evidence of left atrial hypertension (volume overload, heart failure)

Contraindications/Adverse Reactions

- Contraindications for use of the PEEP Titration protocol may include the following: untreated pneumothorax, hypotension, elevated intracranial pressures, and pulmonary hypertension.
- Potential adverse reactions when utilizing the PEEP Titration protocol could include but are not limited to barotrauma including pneumothorax and or a reduction in cardiac output.

Procedure for Initial Settings

- Note the patient's current minute ventilation (MV).
- Adjust the Vt to a maximum of 6 ml/kg ideal body weight. For volume modes simply adjust the set or target Vt, for pressure modes adjust the Peak Pressure to achieve initial Vt. (NOTE: pressure modes are discouraged due to the need for frequent monitoring to maintain desired Vt).
- Adjust the set respiratory rate (RR) to approximate the MV prior to the above changes.
- The desired Vt will be calculated using the predicted body weight formula or by referencing the Ideal Body Weight (IBW) and Vt nomogram (included at end of document) or utilize the formula below:
  - Males = 50 + 2.3 [height (inches) - 60]
  - Females = 45.5 + 2.3 [height (inches) – 60]
- Set the initial PEEP to match approximate F_IO_2 based on the simplified PEEP Table below: (e.g. FiO2 of 0.55, PEEP of 13)

Simplified PEEP Table

FiO2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
PEEP	8	10	12	14	16	18	20	22

- Adjust the PEEP per F_IO_2 needed based on the PEEP Table to maintain the SpO_2 within 88-95%
- After changes have been completed, check the plateau pressure (P_{plat}). If the P_{plat} is >30 cm H_2O and driving pressure (P_{plat} minus PEEP) is >15 cm H_2O, decrease the Vt by 1ml/kg increments until the P_{plat} is less than or equal to 30 cm H_2O or driving pressure <15 cm H_2O (minimum Vt = 4 ml/kg).
- Contact the Critical Care team for initial and follow-up arterial blood gases.
- **Contact the ordering provider if breath stacking or dys-synchrony occurs**.

NOTE: Provider may determine and order Vt outside protocol guidelines (greater or less than the 4-6 mL/kg IBW) but still utilize the above PEEP titration with a fixed Vt. Document and make the provider aware of the initial P_{plat} as well as elevated P_{plat} >35 cm H_20 or driving pressure >15 cm H_20 as PEEP adjustments are made.

Protocol Management

PEEP increase may be made when:

- After 2 hours on set PEEP, the FiO2 has required a sustained increase to maintain a higher FiO2 to maintain adequate SpO2, then increase PEEP to the next level based on the PEEP table.
- **If the patient is requiring 20 cmH2O PEEP or more, notify the provider.**
- The LRCP will re-check the P_{plat} after each change in PEEP. If the P_{plat} is >30 cm H_20 and driving pressure >15 cm H_20, decrease the Vt. If the patient is already at the minimum Vt (4 ml/kg) and unable to achieve the desired PEEP as outlined in the table, contact the ordering provider.
- **NOTE:** Consider increasing the Vt up to a maximum of 6 ml/kg if the patient's RR increases to outside normal range while maintaining a P_{plat} and driving pressure goals.
- The LRCP will document and/or validate all changes in ventilator settings and patient's response to changes (e.g. RR, P_{plat}) in the ventilator flow sheet rows within the patient's electronic medical record.

PEEP decrease may be made when:

- After 24 hours stability, if FiO2 is maintained <0.6, PEEP may be reduced by 1 cm H_20 q12 hours.
- If FiO2 need increases consistently >0.1 from prior value with PEEP wean, revert back to prior PEEP.
- The LRCP will re-check the P_{plat} and driving pressure prior to and after each change in PEEP. If the P_{plat} is >30 cm H_20 and driving pressure >15 cm H_20, decrease the Vt by 1 mL/kg. If the patient is already at the minimum Vt (4 mL/kg) and unable achieve the desired PEEP as outlined in the table, contact the ordering provider.
- **NOTE:** Consider increasing the Vt up to a maximum of 6 mL/kg if the patient's RR increases to outside normal range while maintaining a P_{plat} <30 cmH_20
- The LRCP will document and/or validate all changes in ventilator settings and patient's response to changes (e.g. RR, P_{plat}) in the ventilator flow sheet rows within the patient's electronic medical record.

NIH PREDICTED BODY WEIGHT (PBW) / TIDAL VOLUME CHART

MALES								FEMALES							
HEIGHT		PBW	4	5	6	7	8	HEIGHT		PBW	4	5	6	7	8
Feet	Inches	Male	ml/kg	ml/kg	ml/kg	ml/kg	ml/kg	Feet	Inches	Female	ml/kg	ml/kg	ml/kg	ml/kg	ml/kg
4' 10"	58	45.4	180	230	270	320	360	4' 7"	55	34	140	170	200	240	270
4' 11"	59	47.7	190	240	290	330	380	4' 8"	56	36.3	150	180	220	250	290
5' 0"	60	50	200	250	300	350	400	4' 9"	57	38.6	150	190	230	270	310
5' 1"	61	52.3	210	260	310	370	420	4' 10"	58	40.9	160	200	250	290	330
5' 2"	62	54.6	220	270	330	380	440	4' 11"	59	43.2	170	220	260	300	350
5' 3"	63	56.9	230	280	340	400	460	5' 0"	60	45.5	180	230	270	320	360
5' 4"	64	59.2	240	300	360	410	470	5' 1"	61	47.8	190	240	290	330	380
5' 5"	65	61.5	250	310	370	430	490	5' 2"	62	50.1	200	250	300	350	400
5' 6"	66	63.8	260	320	380	450	510	5' 3"	63	52.4	210	260	310	370	420
5' 7"	67	66.1	260	330	400	460	530	5' 4"	64	54.7	220	270	330	380	440
5' 8"	68	68.4	270	340	410	480	550	5' 5"	65	57	230	290	340	400	460
5' 9"	69	70.7	280	350	420	490	570	5' 6"	66	59.3	240	300	360	420	470
5' 10"	70	73	290	370	440	510	580	5' 7"	67	61.6	250	310	370	430	490
5' 11"	71	75.3	300	380	450	530	600	5' 8"	68	63.9	260	320	380	450	510
6' 0"	72	77.6	310	390	470	540	620	5' 9"	69	66.2	260	330	400	460	530
6' 1"	73	79.9	320	400	480	560	640	5' 10"	70	68.5	270	340	410	480	550
6' 2"	74	82.2	330	410	490	580	660	5' 11"	71	70.8	280	350	420	500	570
6' 3"	75	84.5	340	420	510	590	680	6' 0"	72	73.1	290	370	440	510	580
6' 4"	76	86.8	350	430	520	610	690	6' 1"	73	75.4	300	380	450	530	600
6' 5"	77	89.1	360	450	530	620	710	6' 2"	74	77.7	310	390	470	540	620
6' 6"	78	91.4	370	460	550	640	730	6' 3"	75	80	320	400	480	560	640

References

NIH NHLBI Clinical Network, Mechanical Ventilation Protocol Summary, July 2008
ARDSNet.org

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