

	RESPIRATORY SERVICES	DATE CREATED: May 2005 DATE REVIEWED/REVISED: December 2017
CLINICAL GUIDELINE	TITLE: <u>CRITICAL CARE</u> – Recruitment Maneuvers, Respiratory Therapy NUMBER: B-00-12-12046	RELATED DOCUMENTS:

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SITE APPLICABILITY:

ST. PAUL'S HOSPITAL
MOUNT SAINT JOSEPH HOSPITAL

POLICY STATEMENT:

The utility of recruitment maneuvers in clinical practice for patients with acute lung injury remains under investigation and therefore shall only be performed in specific circumstances on the order of a physician.

Orders for routine or regularly scheduled lung recruitment maneuvers will not be accepted. Each desired recruitment maneuver must be assessed for appropriateness on an as required basis.

GENERAL INFORMATION:

Documentation and charting must be done prior to the lung recruitment maneuver as well as when completed. It must include a full patient assessment with complete ventilator monitoring, as well as the specifics on the patient response and outcome to the recruitment maneuver. Any adverse event including early termination of the maneuver must be noted in the Respiratory Flowsheet and Kardex and the ordering physician notified. Whenever possible a second person should be present to assist with monitoring of the patient during the procedure.

Upon the successful completion of a recruitment maneuver the PEEP should be immediately increased by 2 cmH₂O above the pre-recruitment maneuver level. For example, if the baseline PEEP was 10, then at the end of the recruitment maneuver the new setting for PEEP should be 12.

CONTRAINDICATIONS:

Lung recruitment maneuvers should not be performed in the following situations:

- Mean arterial blood pressure less than 60 mmHg despite administration of fluids or vasopressors
- Active air leak through a chest tube
- Pneumothorax where a chest tube has not been inserted
- Subcutaneous or mediastinal emphysema where a chest tube has not been inserted
- Spontaneously breathing patients

EARLY TERMINATION OF RECRUITMENT MANEUVERS:

Early termination (less than 40 seconds in duration) should be considered if any of the following occurs:

- SpO₂ less than 84%
- Heart Rate less than 60 or greater than 140
- New dysrhythmia
- New air leak through a chest tube
- Mean arterial blood pressure less than 60 mmHg or a decrease of more than 20 mmHg

REQUIRED SUPPLIES & EQUIPMENT:

- Ventilator: PB840, AVEA, Servo-I, Servo-U
- Monitoring equipment

PROCEDURE USING THE PB840 VENTILATOR:

1. Adjust **Apnea Parameters**.
 - a) Set **APNEA INTERVAL** to 60 seconds.
 - b) Set **APNEA RR** to minimum value (2 bpm).
 - c) Set **APNEA Vt** to minimum value (25 mL).
 - d) Set **APNEA PEAK FLOW RATE** to minimum value (3 L/min).
2. Press **ACCEPT**.
3. Adjust **VENT SETUP**.
 - a) Change mode to **SPONTANEOUS**.
 - b) Select **MANDATORY TYPE** and choose **VC** and press **CONTINUE**.
 - c) Set **TIDAL VOLUME** to 1.5 L.
 - d) Set **FLOW RATE** to 80 L/min.
 - e) Ensure **PRESSURE SUPPORT** is 0.
 - f) Set **HIGH PRESSURE LIMIT** to 50 cmH₂O.
 - g) Increase **PEEP** to 40 cmH₂O.
 - h) Press **ACCEPT**.
4. Perform Recruitment Maneuver.
 - a) Press **MANUAL INSPIRATION**.
 - b) Time the maneuver for **40 SECONDS**. Observe the patient continuously while monitoring for signs of hypotension, desaturation and cardiac dysrhythmias.
5. Terminate the Recruitment Maneuver.
 - a) Press **VENT SETUP** then press **PREVIOUS SETTINGS**. Ensure the new **PEEP level is set 2**

cmH₂O higher than the pre-maneuver setting.

b) Press **ACCEPT**.

6. Adjust **APNEA PARAMETERS** to previous settings.
7. Change **HIGH PRESSURE LIMIT** to pre-RM value.
8. Monitor the patient and chart procedure in the patient record.

PROCEDURE USING THE AVEA VENTILATOR:

1. Ensure the patient is in **PRESSURE CONTROL** mode prior to beginning the maneuver.
2. Press **PATIENT SETUP** key and ensure that the **ARTIFICIAL AIRWAY COMPENSATION (ACC)** setting is **OFF**.
3. Press **ALARM LIMITS** to open the alarm limits screen.
 - a. Set **APNEA INTERVAL** to 60 seconds.
 - b. Set **HIGH PEAK PRESSURE** to 50 cmH₂O.
4. Press **MODE** to open the mode select screen.
 - a. Select **CPAP/PSV**.
 - b. Set **PEEP** to 40 cmH₂O.
 - c. Set **PRESSURE SUPPORT** to 0 cmH₂O.
5. Press **APNEA SETTINGS** and ensure **APNEA MODE** is set to **PRESSURE CONTROL**.

NOTE: Apnea settings should be set to the minimum parameters.
6. To begin the maneuver, ensure **CPAP/PSV** is highlighted and press **MODE ACCEPT**.
7. Observe the patient continually for **40 SECONDS**, watching specifically for changes in blood pressure/hypotension, oxygen desaturations, or dysrhythmias.
8. Terminate the recruitment maneuver after 40 seconds or if signs of intolerance are noted.
 - a. Select the pre-recruitment maneuver mode.
 - b. Ensure all the parameters excluding PEEP are set to the pre-recruitment maneuver settings. **Ensure the new PEEP level is set 2 cmH₂O higher than the pre-maneuver setting.**
 - c. Return the apnea interval to the pre-recruitment maneuver setting.
 - d. Return the high pressure limit to the pre-recruitment maneuver level.
9. Monitor the patient and chart the procedure and response into the patient record.

PROCEDURE USING THE SERVO-I VENTILATOR:

1. Press **MODE** key.
 - a. Select **PRESSURE SUPPORT/CPAP**.

- b. Adjust Back-up Ventilation parameters to appropriate settings.
 - c. Press **ACCEPT**.
 - d. Press **ALARM PROFILE**.
 - e. Set apnea alarm to 45 sec and Hi Pressure alarm to 50 cmH₂O.
 - f. Press **ACCEPT**.
2. Press **MODE** key.
- a. Select **PREVIOUS MODE**.
 - b. Press **ACCEPT**.
3. Press **MODE** key.
- a. Select **PREVIOUS MODE**.
 - b. Set **PS** to 0 cmH₂O and set **PEEP** to 40 cmH₂O. Set **FiO₂** to 1.0.
 - c. Press **ACCEPT** during inspiration when ready to begin the 40 second recruitment maneuver.
- NOTE:** If initiated during the expiratory phase, the Pressure Limit will be reached and subsequently released, resulting in auto-cycling.
- d. Press **ALARM SILENCE**.
 - e. Time the recruitment maneuver for **40 SECONDS**. Observe the patient continuously while monitoring for signs of hypotension, desaturation, and cardiac dysrhythmias.
4. Immediately after initiating the recruitment maneuver (during the 40 seconds) select **MODE** then **PREVIOUS MODE** and then **ACCEPT** to end maneuver (at the end of 40 seconds).
5. Terminate the maneuver after 40 seconds or earlier if signs of intolerance are noted.
- NOTE:** If at any time the need arises to decrease PEEP quickly, rotate the quick access knob located at the bottom of the ventilator screen.
6. Reset the **PS/CPAP** settings and **ALARMS** post procedure:
- a) Press **MODE** and select **PREVIOUS MODE**.
 - b) Adjust **PS**, **PEEP**, **FiO₂** to pre-recruitment maneuver levels.
 - c) Press **ACCEPT**.
 - d) Select **ALARM PROFILE**.
 - e) Adjust **HIGH PRESSURE** alarm and **APNEA TIME** to pre-recruitment levels.
 - f) Press **ACCEPT**.
 - g) Select **MODE** and select **PREVIOUS MODE**.
 - h) Press **ACCEPT**.
 - i) Monitor the patient and document the procedure and patient response into the patient record.

PROCEDURE USING THE SERVO-U VENTILATOR:

NOTE: The Servo-U ventilator requires the delivery of one breath before the previous mode settings will be saved and be accessible via the **PREVIOUS MODE** tab. Therefore, lung recruitment maneuvers should not be performed on **PSV/CPAP** when using the Servo-U ventilator.

1. Select **ALARM LIMITS**:

- a) Set the **PEAK PRESSURE** alarm to 5 cmH₂O above the pressure that you are performing the lung recruitment maneuver at (i.e. if you are performing the maneuver on 40 cmH₂O, set the alarm to 45 cmH₂O).

2. Select **MODE**:

- a) Select **BiVent/APRV**.
- b) Set **FiO₂** to **1.0**.
- c) Set **PEEP** at 2 cmH₂O below the pressure that you are performing the lung recruitment maneuver on (i.e. if you are performing the maneuver on 40 cmH₂O, set the **PEEP** to 38 cmH₂O).
- d) Set **P_{HIGH}** to the pressure that you are performing the lung recruitment on.
- e) Set **T_{PEEP}** to **0.1 seconds**.
- f) Set **PSV High** to **0**.
- g) Set **PSV Above PEEP** to **0**.
- h) Set **T_{INSP RISE}** to **0.0 seconds**.
- i) Set **TRIGGER** to **-2 cmH₂O** pressure.

3. Press **ALARM SILENCE**.

- 4. Select **ACCEPT MODE**. Pressure should rise to the **P_{HIGH}** setting for 3 seconds and then drop to the **PEEP** setting for 0.1 seconds. After this initial breath, the previous mode and ventilator settings will be accessible by selecting **PREVIOUS MODE** from the **MODE** tab.

- 5. Terminate the maneuver once the desired time for recruitment has been met or signs of intolerance are observed.

6. To terminate the maneuver:

- a) Select **MODE**.
- b) Press **PREVIOUS MODE**.
- c) Ensure your previous settings are present and press **ACCEPT**. The pressure should drop and return to the previous mode.

- 7. Monitor the patient and ensure that the alarm parameters are set appropriately for current mode.

- 8. Document the procedure and the patient response to the maneuver.

REFERENCES:

- 1. PB 840 User Manual
- 2. AVEA User Manual

3. Servo-I User Manual
4. Servo-U User Manual
5. Fan E1, Wilcox ME, Brower RG, Stewart TE, Mehta S, Lapinsky SE, Meade MO, Ferguson ND. 2008. "Recruitment maneuvers for acute lung injury: a systematic review." *Am J Respir Crit Care Med*. 178(11):1156-63.

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