Airway Pressure Release Ventilation (APRV) Management

**Definition:**
Airway Pressure Release Ventilation: An elevated CPAP level with timed pressure releases. This mode allows for spontaneous breathing.

**Indications:**
1. Acute lung injury (ALI)/ARDS
2. Diffuse pneumonia
3. Atelectasis requiring >.50 FiO₂
4. Tracheo-esophageal fistula

**Initial settings:** (see Figure 1)
1. \( P_{\text{high}} \) at the \( P_{\text{plateau}} \)
   (or desired \( P_{\text{mean}} + 3 \text{ cmH}_2\text{O} \))
   Try to keep \( P_{\text{high}} \) below 35 cmH₂O
2. \( T_{\text{high}} \) at 4.5-6 seconds
3. \( P_{\text{low}} \) at 0 (to optimize expiratory flow)
4. \( T_{\text{low}} \) at 0.5 to 0.8 second (see Waveforms)
5. Automatic tube compensation (ATC): on if spontaneously breathing

**Observation:**
APRV should help rest the inspiratory muscles and utilize the diaphragm. Once the initial settings are applied, look for the anterior chest muscles to be used much less and the diaphragm to be doing the majority of the work. This should occur within hours after placement on APRV. The patient should be breathing more comfortably as recruitment occurs.

**Note:**
The earlier APRV is used, the more effective it is in recruiting the lung and the more likely it is to be tolerated. If initiating APRV late in the course of ARDS, patients sometimes will not look comfortable despite optimal APRV settings, and they may need an alternate mode.

**Waveforms:**
It is important to observe the Flow -Time waveform to optimize the settings. During the pressure release phase, the patient will exhale passively. Adjust the \( T_{\text{low}} \) to cut off the expiratory flow during a release at about 50% (25-75%) of peak expiratory flow rate (PEFR) (see Figure 2)

- Never allow the termination of expiratory flow to go <25% of the PEFR! This intentional intrinsic peep allows \( P_{\text{low}} \) to be set at 0 cmH₂O without causing de-recruitment.
- Generally, the \( T_{\text{low}} \) can be as short as 0.3 seconds (closer to 75% of the PEFR) in restrictive diseases and as long as 1.5 seconds (closer to 25% of the PEFR) in obstructive states.

**Adjustments:**

- **Increased inspiratory effort trying to increase FRC**
Adjustments continued:

1. If the patient is consistently inhaling forcefully with accessory muscles, he/she may need alveolar recruitment (see Figure 3). Options are:
   - Increase $P_{\text{high}}$, this will elevate the $P_{\text{mean}}$ and encourage recruitment.
   - Decrease $T_{\text{low}}$ only if you can maintain the flow during the release phase <75% of PEFR and the $PaCO_2$ and pH are acceptable.

2. If the patient seems to be exhaling forcefully, over-inflation may be present (see Figure 4). Options are:
   - Decrease the $P_{\text{high}}$ in 1-2 cmH2O increments and increase $T_{\text{high}}$ (to maintain the same $P_{\text{mean}}$) and/or:
   - Increase the $T_{\text{low}}$ (allowing more time to exhale) only if you can maintain the flow during the release phase >25% of PEFR
   - CXR should be monitored for lung over-inflation

3. Increase $T_{\text{low}}$ to allow more time for alveolar emptying, but only if the expiratory flow of a release doesn’t drop below 25% of the PEFR.

4. If further increases in $T_{\text{high}}$ fail to drop $PaCO_2$, you may need to do the opposite: Decrease $T_{\text{high}}$ (to increase the rate of releases). This will decrease the $P_{\text{mean}}$ and oxygenation. Therefore, also increase $P_{\text{high}}$ to maintain the $P_{\text{mean}}$. Maximize $P_{\text{high}}$ and release rate up to 30 (more like PC-IRV)

5. If unable to manage the acidosis with APRV, the mode may be changed to PCV attempting to maintain the same rate and $P_{\text{mean}}$.

Respiratory Alkalosis Options:

1. Decrease $P_{\text{high}}$ (SpO2 may decrease)
2. Increase $T_{\text{high}}$ to decrease the release rate
3. Turn ATC off if no spontaneous respirations

Weaning:

When FiO2 is titrated below .50, recruitment is maximized, and the patient is breathing spontaneously, a continuous gradual wean can begin by:

- Decreasing the $P_{\text{high}}$ by 1-2 cmH2O and increasing the $T_{\text{high}}$ by 0.5 seconds for every 1 cmH2O drop in $P_{\text{high}}$. This is referred to as “drop and stretch”.
- “Drop and stretch” should be done every two hours or more if tolerated. As you “drop and stretch” the $P_{\text{mean}}$ is gradually lowered, so you will need to monitor SpO2. Changing to CPAP or dropping $P_{\text{mean}}$ too quickly will possibly de-recruit alveoli.
- Throughout the weaning process, the patient should be closely monitored for increasing work of breathing, tachypnea, or a drop in SpO2. If this occurs, return to the previous settings.
- When the $P_{\text{high}}$ reaches 10 cmH2O and the $T_{\text{high}}$ reaches 12-15 seconds, change the mode to CPAP with PEEP at 10 and PS at 5-10 (ATC off). Slowly wean CPAP as tolerated.

The patient should be spontaneously breathing throughout this process, therefore, it is not necessary to do spontaneous breathing trials.