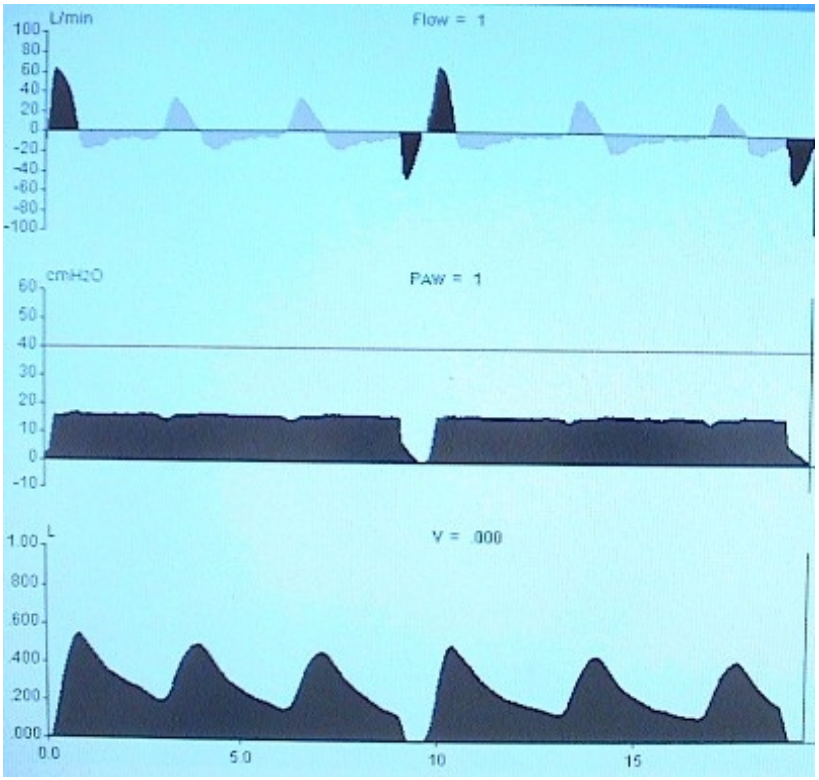
Airway Pressure Release Ventilation

Airway Pressure Release Ventilation is a time cycled mode of ventilation conceived to minimise ventilatory induced lung injury. It is perhaps best described as CPAP plus. Like CPAP, a continuous distending pressure is delivered (P_{high}) with the addition of regular releases to washout dead space gas. The number or releases per minute (similar too but distinctly different from respiratory rate) are determined by setting a T_{high} (the time between airway releases). The duration of each release is determined by setting T_{low}. The duration of the release (T_{low}) should be set to achieve a maximum expired volume of 6ml/kg and minimum of 150ml (estimated anatomical dead space in an adult. Ideally, T_{low} should permit <50% of passive expiration, best determined by watching the expiratory flow curve, the idea being that <50% of the area under the curve elapses before the return to P_{high}. Note, the area under the curve is not the same as the duration, remember that the curve is exponential. P_{low} should always be set at zero.

APRV is most efficacious when the patient makes some spontaneous breathing effort. Even if this effort generates very small tidal volumes, their efforts create valuable intrapulmonary gas mixing and dependent area recruitment and retention. Although no inspiratory pressure support is set, the ventilator will provide up to maximal inspiratory flow to maintain the set pressure. The airway releases washout dead space, thereby reducing the work of breathing. APRV can be used as a mandatory mode in patients making no spontaneous effort. It can also be used to provide a safe recruitment manoeuvre. It is very well tolerated by patients, and therefore, unlike alternative modes, doesn't in itself require analgesia / sedation.



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TYPICAL PARAMETER SETTINGS

P_{high} 10-30 cmH_2O

Start at 25-30 cmH_2O / recruit then perform a decremental trial (*see* **weaning** section below). ***CAUTION*** sustained high airway pressures may compromise pulmonary perfusion, and right ventricular function with consequent reduction in left sided filling and systemic hypotension. If this occurs, consider a fluid bolus and / or alternative modes of ventilation.

P_{low} ALWAYS ZERO

T_{high} 4 - 6 seconds ($60 \div T_{high}$ = no. of releases per minute)

T_{low} 0.2 - 0.8 seconds

Start at too low a setting and increase gradually, up to a maximum of 50% of the area under the expiratory flow curve

To improve oxygenation

Recruitment manoeuvre: set **P_{high}** to 30 cmH_2O & **T_{high}** to 30s for 2-5mins ***see CAUTION above***. Then perform decremental **P_{high}** trial to a level above previous settings.

OR Increase **P_{high}** & / or Increase **T_{high}**. ***REMEMBER*** to reduce **T_{low}** so as not to exceed 6ml/kg during an airway release.

(Increase FiO_2 as needed)

To improve CO_2 clearance

Decrease **T_{high}** i.e. increase the number of releases per minute

Reduce analgesia / sedation to increase spontaneous breathing efforts

Add "automatic tube compensation" (ATC on Draeger) *OR* inspiratory pressure support, in order to increase the tidal volume of spontaneous breaths

as a last resort

Increase **T_{low}** to **maximum** of 75% of expiratory flow (area under the curve)

WEANING

As oxygenation improves: reduce **P_{high}** and FiO_2. **REMEMBER** to reassess and reduce T_{low} every time you reduce **P_{high}**. Employ a decremental trial by reducing the level of **P_{high}** in a stepwise fashion (e.g. 2 cmH_2O every 15mins) until SpO_2 is seen to fall, then go back 1 - 2 steps (with or without a recruitment manoeuvre).

As spontaneous tidal volume / $PaCO_2$ improves: increase **T_{high}** to reduce the number of airway releases, ultimately aiming for CPAP

PARAMETERS TO RECORD

Settings **FiO_2 P_{high} T_{high} T_{low}**

Measurements Minute volume

Spontaneous respiratory rate which = total resp. rate - ($60 \div T_{high}$)

Review article:
Myers, T. R. and N. R. MacIntyre (2007). "Respiratory controversies in the critical care setting. Does airway pressure release ventilation offer important new advantages in mechanical ventilator support?" Respir Care 52(4): 452-60