

## APRV (Airway Pressure Release Ventilation) Guideline

### Suggested uses

Alternative therapy for moderate/severe ARDS where standard lung protective ventilation and prone ventilation have either failed or cannot be implemented  
By ICM consultant request for a recognised indication

### Indications

Second line ventilatory strategy in patients with ARDS

First line strategy in those at high risk of developing ARDS

### Contra-indications

**No absolute contra-indications**

Relative contra-indications

- untreated pneumothorax
- severe haemodynamic instability
- significant emphysematous bullae disease
- untreated severe bronchospasm

### Advantages

Lower peak airway pressure compared with volume directed modes

Limited adverse effects on cardiovascular function

Spontaneous breathing possible throughout the cycle

Decreased use of sedation

Potential elimination of neuromuscular blockade

### Cautions

In conditions requiring deep sedation or neuromuscular blockade, the benefits of spontaneous breathing during APRV will be lost. It is best used in patients with maintained spontaneous respiratory drive and instituted early in the clinical course rather than as a rescue therapy.

Failure of therapy would be an inability to achieve an acceptable  $\text{PaO}_2$  with a reduced  $\text{FiO}_2$  within 12-24 hours of initiation OR unacceptable hypercapnia.

### Auto-release

Auto-release limits the expiratory time to a desired percentage of peak expiratory flow (PEF)  
- typically kept to between 25-75% PEF.

A high percentage will result in a shorter expiratory time. This will effectively increase the 'intrinsic PEEP' and mean airway pressure, improving oxygenation.

A low percentage will result in a longer expiratory time. This lowers the intrinsic PEEP but will increase minute volume and improve elimination of  $\text{CO}_2$ .

## Set-up

### Preparation

Cuffed ETT in situ  
Haemodynamic stability  
Avoid paralysis

### Initial settings

FiO<sub>2</sub>: same as current  
P(high): same as previous plateau airway pressure (usually 20-30cmH<sub>2</sub>O)  
P(low): always set at 0cmH<sub>2</sub>O  
T(high): 3s\*  
T(low) max: 1s  
Automatic tube compensation ON  
Auto-release function ON  
Expiratory flow to terminate at 75% of PEF

### Monitoring

Monitoring of airway pressures and FiO<sub>2</sub>  
Check measured T(low) – see appendix  
Check %MV<sub>spon</sub> – see appendix  
Optimise sedation  
Check ABG 20-30minutes after set up

### Weaning

Begins once a patient's spontaneous respiratory effort constitutes the majority of minute ventilation (%MV<sub>spon</sub>>50% of total minute ventilation) and FiO<sub>2</sub> <0.5

Decrease P(high) by 2cmH<sub>2</sub>O  
AND increase T(high) by 1s

Aim to reduce P(high) to 14cmH<sub>2</sub>O and increase T(high) to 12s.  
At this point, patient is essentially breathing spontaneously on CPAP and weaning can continue as per traditional CPAP.

**\*If using APRV as first-line ventilatory strategy, start with T(high) of 5s**

## Troubleshooting

### Hypoxaemia

Increase P(high) by 2cmH<sub>2</sub>O up to max 30cmH<sub>2</sub>O

OR increase FiO<sub>2</sub>

OR increase T(high) by 0.5-1.0s

OR if T(high) ≥10s, increase auto-release percentage of PEF up to max 75%

### Hypercapnia

Permissive hypercapnia is a normal strategy when using APRV. Consider altering settings before patient becomes acidaemic, GCS deteriorates or arrhythmias develop.

Ensure patient is not over-sedated. The patient should ideally be making spontaneous respiratory effort.

Increase P(high) by 2cmH<sub>2</sub>O up to max 30cmH<sub>2</sub>O

OR decrease auto-release percentage of PEF (NOTE this may worsen oxygenation, never lower below 25%)

OR decrease T(high) 0.2-0.5s (NOTE this may worsen oxygenation)

### Hypocapnia

Increase T(high) by 0.2-0.5s

OR decrease P(high) by 2cmH<sub>2</sub>O (NOTE this may worsen oxygenation)

OR increase auto-release percentage of PEF up to max 75%

### Failure

Uncontrolled worsening hypercapnia may occur early

- More likely in patients with inadequate spontaneous respiratory effort
- Consider ending trial of APRV and re-attempting when sedation can be optimised to facilitate greater spontaneous respiratory effort

No improvement in oxygenation

- Improvement in P/F ratio typically seen in 12-24 hours
- Failure to see this should warrant consideration of continuing or ending trial of APRV

## References

Frawley PM, Habashi NM. Airway Pressure Release Ventilation Theory and Practice. *AACN Clin Issues* 2001; 12(2):234-246

Habashi NM. Other approaches to open-lung ventilation: Airway Pressure Release Ventilation. *Crit Care Med* 2005; 33(Supp): S228-40

APRV network. Setting APRV using the TCAV Method as a Rescue Strategy. <https://www.aprvnetwork.org/>. Accessed April 2020

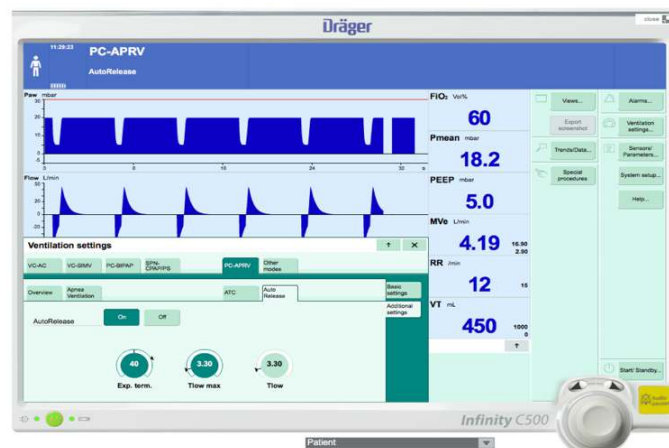
## Appendix

### Auto-release

Auto-release sets the expiratory time to a desired percentage of peak expiratory flow.

A high percentage will result in a shorter expiratory time. This effectively increases the 'intrinsic PEEP' and mean airway pressure. A low percentage results in a longer expiratory time, lowering intrinsic PEEP but increasing minute ventilation and CO<sub>2</sub> elimination.

1. In Additional settings, select auto-release
3. Select on and confirm
4. Select 75% initially (this can then be adjusted from 25-75%)



### Monitoring values

#### **T(low)**

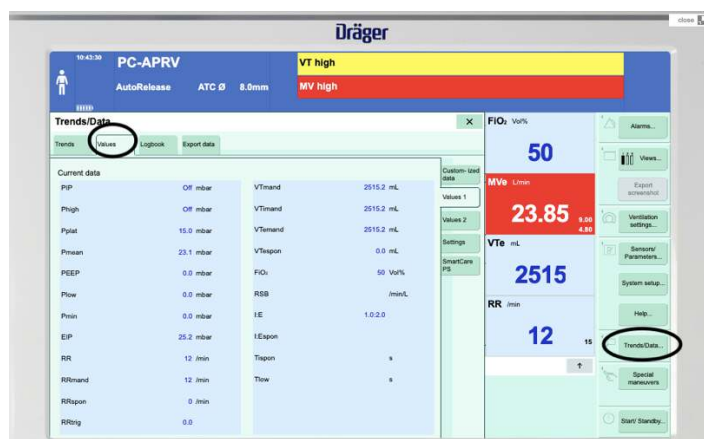
With auto-release on we recommend keeping T(low) max at 1s. Delivered T(low) is measured by the ventilator and can be found under 'Values' tab. If delivered T(low) matches T(low) max then lowering auto-release PEF will have no impact. To extend T(low) time further, T(low) max will need to be increased.

**If this is required, patient should be examined to ensure there is no significant bronchospasm or obstruction to expiration.**

#### **%MV<sub>spon</sub>**

Spontaneous respiration is possible and beneficial in APRV. In the 'Values' tab you can see the measured percentage of minute ventilation which is a result of spontaneous breathing.

If safe to do so, sedation should be optimised to maximise this value. Weaning ideally requires %MV<sub>spon</sub>>50%.



**Critical Care Guidelines  
FOR CRITICAL CARE USE ONLY**

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