Ventilatory weaning strategy

PLEASE USE IN CONJUNCTION WITH THE SEDATION STRATEGY

STEP 1 - Is the patient ready to step down to a weaning area?

Essential criteria:

- **General**
  - no pyrexia >38.5˚C for 24 hours
  - down trending d-dimers / CRP / ferritin / LDH
  - low stable / down trending daily SOFA score
  - normal / improving biochemistry
- **Normal upper airway**
- **Respiratory -sustained for >12 hours**
  - established on a spontaneous breathing mode
  - PaO_2:FiO_2 >22.5kPa ***OR*** SpO_2 88-92% on FiO_2≤0.40 on a PEEP ≤8cmH_2O
  - RR <25bpm & MV <10L/min & inspiratory pressure support (iPS) ≤20 cmH_2O (in addition to PEEP)
  - $PaCO_2$ 5.0-7.0kPa & pH 7.30-7.45 ***OR*** $ETCO_2$ 4.0-6.0
  - spontaneous cough strength “good”
  - no significant ***OR*** significant increase in secretion load
- **CVS - stability sustained for >12 hours**
  - Euvolaemic with ≤”moderate” peripheral oedema
  - Noradrenaline <0.1mcg/kg/min

Desirable criteria:

- **Neuro**
  - RASS -4 to +1 with ≤2 “rescue” interventions in preceding 24 hours
  - GCS E≥2 & M≥5
  - Active long acting / bolus agent sedation wean in progress with increasing RASS over preceding 24 hours
  - PNS can raise arms off bed ≥shoulder height and hold them there for ≥5s

STEP 2 - Trial of weaning ventilator

Identify an available bed in a weaning area, and move the ventilator from that bed to the patient:

- Establish on weaning (domiciliary) ventilator with current settings
  NOTE IPAP usually = peak pressure NOT iPS
- Titrate IPAP to achieve
  - a comfortable patient (good synchrony)
  - RR ≤ 25 bpm
  - ***THERE IS NO TARGET*** ml/kg IBW tidal volume in spontaneously breathing patients
- THESE settings now = REST settings

STEP 3 - Move the patient to the weaning area and perform diagnostic assessments

1. PERFORM DIAGNOSTIC TRIAL OF MINIMAL (zero if machine allows) EPAP (PEEP)
   - maintain IPAP (inspiratory pressure support) at REST settings
   - observe for 15mins (maximum), but switch back to REST settings if one or more "FAILURE" criteria observed*
   - Record RR / Vt / MV / SpO_2 / $ETCO_2$ at beginning and end of trial
   - **Does the patient demonstrate EPAP (PEEP) dependency** (they do if their SpO_2 falls by ≤5% for the same FiO_2)?
   - REST for 45mins

2. PERFORM DIAGNOSTIC TRIAL OF CPAP at 5cmH_2O
   - observe for 15mins (maximum), but switch back to REST settings if one or more "FAILURE" criteria observed*
   - Record RR / Vt / MV / SpO_2 / $ETCO_2$ at beginning and end of trial
   - **Does the patient demonstrate fatigueability** (appears to work much harder to breath e.g. RR ≥30bpm &/or ≥10% increase in MV to maintain $ETCO_2$) and is therefore dependent upon IPAP (iPS)?
   - REST for 45mins

CONSIDER performing comprehensive cardiac assessment including echo pre and during / at end / immediately post both trials

"FAILURE" criteria for all types of trial

- **Respiratory**
  - SpO_2 falls by ≥5% (fixed FiO_2) ***OR*** FiO_2 increased by ≥10% to maintain SpO_2
  - RR ≥30bpm
  - $ETCO_2$ increases by ≥1.0kPa [compare values pre-trial with those measured when first placed back on REST settings]
- **CVS**
  - ≥20% increase in HR from baseline ***OR*** ≥140bpm
  - new arrhythmia
  - ≥20% increase in systolic ***OR*** ≥180mmHg ***OR*** <90mmHg
  - angina
- **General**
  - agitation / RASS ≥+2
  - sweaty / clammy
  - GCS (or RASS) falls
  - clinician determined "intolerance" [please document clearly]

STEP 4 - Weaning plans based upon type of ventilatory dependency

No.	EPAP dependent	IPAP dependent	PLAN
1	**NO**	**NO**	REST settings should be EPAP +4cmH_2O IPAP +5cmH_2O **STAGE 1:** PERFORM CUFF LEAK ASSESSMENT 1) On REST settings, deflate COETT cuff and listen for leak. If good leak present proceed to **STAGE 2** 2) If no audible leak; increase settings to EPAP +10cmH2O IPAP +15cmH2O If good leak present proceed to **STAGE 2** 3) If still no leak; re-inflate cuff and return to REST settings. 4) Request / perform flexible nasendoscopy (or visualise with Glidescope). Repeat cuff deflation under direct visualisation. If good leak present proceed to **STAGE 2** If has significant local swelling: a) Give Dexamethasone 8mg IV STAT then second dose at 6am the following morning. b) Repeat leak test between 8am and 10am as described above, with direct visualisation (if possible). If swelling persists, continue Dexamethasone 8mg IV 12 hourly and repeat the process the next morning (i.e. 48 hours of therapy). c) If swelling still present ***CONSIDER*** tracheostomy **STAGE 2:** Trials of VENTILATOR FREE BREATHING (VFB) 1) Disconnect from ventilator leaving closed suction + HMEF + ETCO2 attached 2) Cycle = 1 hour VFB ***THEN*** 1 hour REST ***THEN*** 1 hour VFB 3) If no FAILURE criteria ***THEN*** perform TRIAL OF EXTUBATION If FAILS VFB trials GOTO No. 4 4) POST TRIAL OF EXTUBATION Provide supplemental oxygen to maintain target SpO_2 Watch for increasing oxygen requirements; increasing work of breathing and inadequate secretion clearance. The same “FAILURE” criteria apply as for all other TRIALS If FAILS ***CONSIDER*** a maximum 1 hour TRIAL of NIV ***OR*** re-intubate If FAILURE criteria persist on NIV ***OR*** patient unable to tolerate intermittent NIV ***THEN*** re-intubate All ***CONSIDER*** decisions should be consultant led.

No.	EPAP dependent	IPAP dependent	PLAN	
2	**YES**	**NO**	REST settings	EPAP set to maintain SpO_2 88-92% with FiO_2 ≤40% IPAP set to +5cmH_2O [maintain RR<25bpm]
			WORK settings	VENTILATOR FREE BREATHING (see No. 1 above) Targets - SpO_2 88-92% (increase FiO_2 as required) / RR<40bpm
			CYCLE	8am to 8pm - 5mins per hour every hour WORK ***THEN*** 55mins REST 8pm to 8am - REST
			PROGRESSION	• Increase WORK periods progressively to 10 then 15mins per hour completing the remainder of the hour on REST settings, over a period of hours to days as tolerated. • If making progress, PERFORM CUFF LEAK ASSESSMENT. If passes, ***CONSIDER*** TRIAL of extubation onto mask CPAP and continue weaning regime. • If fails due to local swelling, follow Dexamethasone plan in No.1 ***AND*** continue vent weaning plan. • If extubated onto a TRIAL OF INTERMITTENT mask CPAP ***THEN*** the same "FAILURE" criteria apply as for all other TRIALS If FAILS re-intubate. Maximum time from FAILURE to re-intubation = 1 hour • If not making progress over 2-3 days ***CONSIDER*** tracheostomy ***OR*** persist with the above strategy for a further 1-3 days • If tracheotomised ***GOTO*** No.4 and adapt to the patient All ***CONSIDER*** decisions should be consultant led.

No.	EPAP dependent	IPAP dependent	PLAN	
3	**NO**	**YES**	REST settings	EPAP set to machine minimum [maintain SpO_2 88-92% with FiO_2 ≤40%] IPAP set to maintain RR<25bpm
			WORK settings	EPAP unchanged IPAP reduce by 50% from REST settings ***OR*** set at +5cmH_2O Targets - SpO_2 88-92% (increase FiO_2 as required) / RR<40bpm
			CYCLE	8am to 8pm - 15mins per hour every hour WORK ***THEN*** 45mins REST 8pm to 8am - REST
			PROGRESSION	• Increase WORK periods progressively to 30, then 60, then 120min alternating with REST periods of equal duration, over a period of hours to days as tolerated. • If making progress, PERFORM CUFF LEAK ASSESSMENT. If passes, ***CONSIDER*** extubation onto mask NIV and continue weaning regime. • If fails due to local swelling, follow Dexamethasone plan ***AND*** continue vent wean plan. • If extubated onto a TRIAL OF INTERMITTENT mask NIV ***THEN*** the same "FAILURE" criteria apply as for all other TRIALS If FAILS re-intubate. Maximum time from FAILURE to re-intubation = 1 hour • If not making progress over 2-3 days ***CONSIDER*** tracheostomy ***OR*** persist with the above strategy for a further 1-3 days • If tracheotomised ***GOTO*** No.4 and adapt to the patient All ***CONSIDER*** decisions should be consultant led.

No.	EPAP dependent	IPAP dependent	PLAN	
4	**YES**	**YES**	REST settings	EPAP set to maintain SpO_2 88-92% with FiO_2 ≤40% IPAP set to maintain RR<25bpm
			WORK settings	EPAP unchanged IPAP reduce by 50% from REST settings OR set at +5cmH_2O Targets - SpO_2 88-92% (increase FiO_2 as required) / RR<40bpm
			CYCLE	8am to 8pm - 15min per hour every hour WORK & 45min REST 8pm to 8am - REST
			PROGRESSION	• Increase WORK periods progressively to 30, then 60, then 120min alternating with REST periods of equal duration, over a period of hours to days as tolerated. • Once able to tolerate regular 60-120 minute periods at WORK settings, commence 15min trials of VENTILATOR FREE BREATHING (see No. 1). • Increase VFB periods progressively to 30, then 60min alternating with REST periods of equal duration, over a period of hours to days as tolerated. • If making progress, PERFORM CUFF LEAK ASSESSMENT. If passes, ***CONSIDER*** extubation onto mask NIV and continue weaning regime. • If fails due to local swelling, follow Dexamethasone plan ***AND*** continue vent wean plan. • If extubated onto a TRIAL OF INTERMITTENT mask NIV ***THEN*** the same "FAILURE" criteria apply as for all other TRIALS If FAILS re-intubate. Maximum time from FAILURE to re-intubation = 1 hour • If not making progress over 3-5 days ***CONSIDER*** tracheostomy ***OR*** persist with the above strategy for a further 1-3 days • If tracheotomised adapt this strategy to the patient All ***CONSIDER*** decisions should be consultant led.

Peer review of this strategy was provided by Susannah Leaver, Jon Aron and Nirav Shah.