

Table 10: Clinical Algorithm for Ventilator Weaning

<u>Step</u>	<u>Question</u>	<u>Implication</u>	<u>Therapeutic Approach</u>
1	Has the primary process resolved or improved? <input type="checkbox"/>	Original indication for ventilatory assistance is still present	Treat infection, bronchospasm, fluid overload, etc. as indicated
2	Is oxygenation acceptable? (e.g. $PO_2 \geq 80$ on $FIO_2 \leq 0.40$) <input type="checkbox"/>	Primary process insufficiently improved; indication for ventilatory assistance still present	Treat primary process; allow more time for improvement; consider PEEP or CPAP if problem severe
3	Is the demand for ventilation acceptable? (e.g. minute ventilation ≤ 10 -12 L/min) <input type="checkbox"/>	Primary process insufficiently improved; CO_2 production and/or dead space (VD/VT) too high	Treat primary process; if reason for high minute ventilation unclear, measure CO_2 production and VD/VT
4	Can the patient match the required V_E during spontaneous ventilation? (e.g. spontaneous $V_E \approx$ required V_E in absence of hypocapnia) <input type="checkbox"/>	Excessive work of breathing for patient's capability, and/or insufficient ventilatory drive	Assess spontaneous ventilatory parameters: vital capacity, rate, tidal volume, maximum inspiratory pressure, while momentarily off the ventilator

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5	Does the patient breathe spontaneously when taken off ventilator temporarily? (e.g. respiratory rate \geq 10-12 /min) <input type="checkbox"/>	Ventilatory drive may be depressed or insufficient	Discontinue or reduce narcotics and other respiratory depressants; check thyroid function
6	Can the patient adequately inflate lungs on command? (e.g. VC \geq 10 mL/kg) <input type="checkbox"/>	Risk for atelectasis, hypoxemia, fatigue, and pneumonia if weaned at this point	Check for muscle weakness or causes for pulmonary restriction (e.g. tight bandages, pleural effusion, pulmonary edema, etc.)
7	Is the patient's ventilatory muscle strength adequate? (e.g. maximum inspiratory pressure \geq 20-25 cm H ₂ O) <input type="checkbox"/>	Risk for atelectasis, hypoxemia, fatigue, and pneumonia if weaned at this point	Discontinue muscle relaxants; check nutritional status; check phosphate, magnesium, potassium levels, thyroid function, muscle enzymes;
8	Is the patient's breathing pattern acceptable? (e.g. f/VT \leq 100 while breathing spontaneously) <input type="checkbox"/>	Work of breathing exceeds patient's capabilities; risk of fatigue, atelectasis, hypoxemia, and pneumonia if weaned now	Check ventilator circuit for excessive imposed work; check for too-small endotracheal tube caliber; consider low-level pressure support trial or empirical extubation trial

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9	Can the patient adequately clear respiratory tract secretions? (e.g. adequate cough; secretions not inspissated or copious)	Risk of secretion retention, hypoxemia, pneumonia; will need special attention to secretion clearance if extubated	Suctioning as needed; empirical trial of postural drainage and percussion; consider mucolytic agents
	<input type="checkbox"/> Wean patient from ventilatory support (e.g. to T-piece, or to rate of zero, with or without 5 cm H₂O CPAP)		
	<input type="checkbox"/> Is patient tolerating weaning trial? (e.g. subjectively comfortable; respiratory rate \leq 30/min; heart rate \leq 100/min; saturation and PO ₂ adequate; arterial pH after 20-30 min \geq 7.30)	Possible explanations: bronchospasm; retained secretions; congestive heart failure; fatigue; anxiety	As indicated by clinical findings: vigorous bronchodilator therapy; airway clearance maneuvers; serial arterial blood gases; resume ventilatory support if deterioration continues and /or respiratory acidosis worsens
10	Can the patient adequately protect airway? (e.g. air leak around tube cuff when deflated; normal glottic function)	Risk for upper airway obstruction, if no air leak; risk for aspiration and pneumonia if glottic function impaired; may continue to need artificial airway after weaning	Wean patient from ventilator with artificial airway in place; if problem likely to be long-term may need tracheostomy for airway protection
	<input type="checkbox"/> Extubate patient		