VANDERBILT UNIVERSITY MEDICAL CENTER

Guideline: BICU Ventilator Weaning

Revised Date: August 2024
Review Date: August 2026

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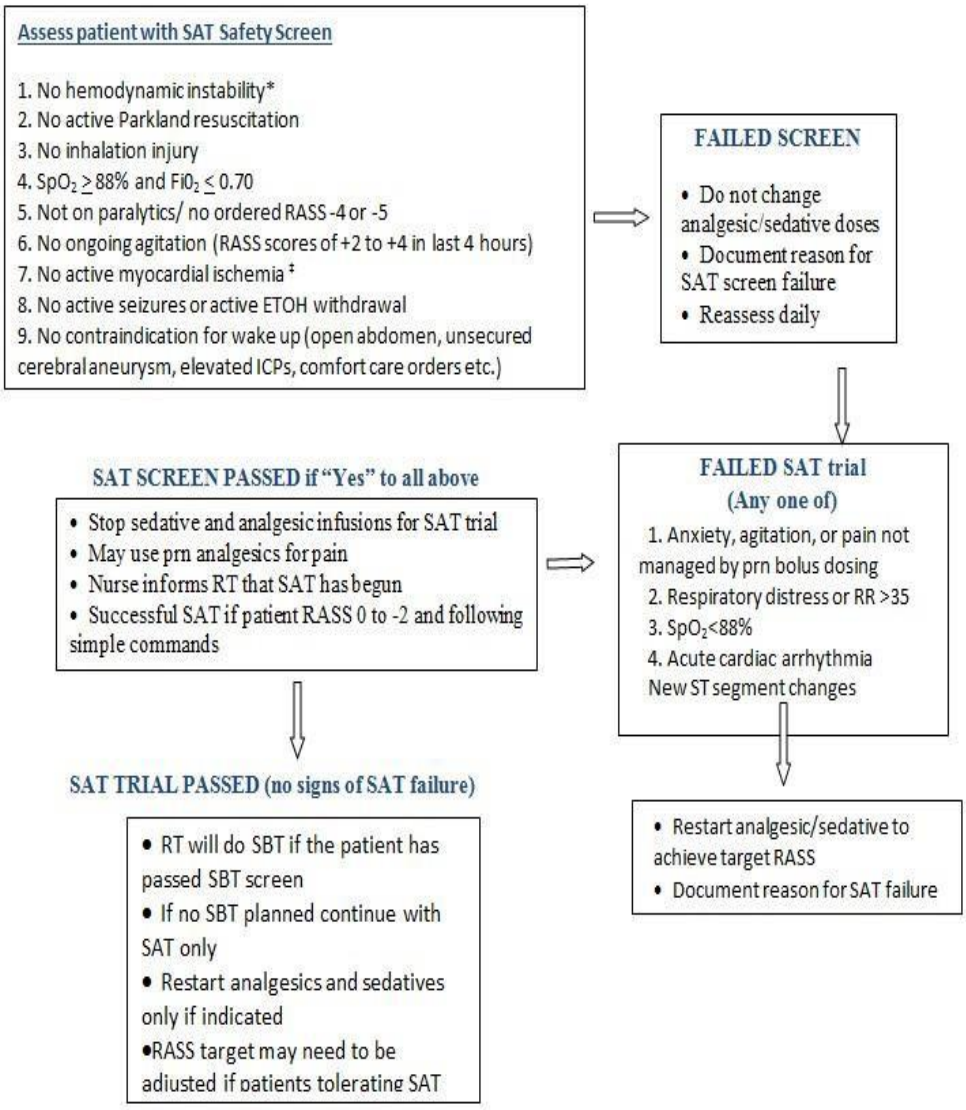
I. Population

The following protocol applies to all intubated patients in the Burn ICU.

II. Assessment/Intervention Algorithm

1. All changes to the ventilator will require communication with the ICU team. The protocol team members include the BICU attending, BICU fellow, patient's nurse, respiratory therapist.
2. Liberation from the ventilator requires 2 steps: readiness testing and weaning of support. All intubated patients should be assessed regularly for weaning and extubation. A SAT safety screen and if applicable, an SAT/SBT should be performed concurrently once daily.



III. Definitions

No active myocardial ischemia: defined as a troponin > 0.2 ng/L or increasing

*No hemodynamic instability in the previous 4-6 hours: defined as

- Use of 2 concurrent vasopressors/inotropes or
- > 7.5 mcg/min norepinephrine or escalating doses
- > 7.5 mcg/kg/min of dopamine or dobutamine
- Known right ventricular failure requiring inotropic support

IV. Required Documentation

1. Did the patient PASS at SAT Screen?
   - Yes
   - No

2. If No-why did the patient fail the SAT screen? (choose one of the following choices)
   - SAT Safety Screen
     - Hemodynamic instability in previous 4-6 hours*
     - Currently on Parkland Resuscitation
     - Inhalation injury
     - SpO2 < 88% and FiO2 > 0.70
     - On paralytics or patients' ordered RASS was -4 or -5
     - Ongoing agitation (RASS scores of +2 to +4 in last 4 hours)
     - Current myocardial ischemia
     - Active seizures or ETOH withdrawal
     - Other contraindication for wake up (e.g. open abdomen, unsecured cerebral aneurysm, elevated ICPs, comfort care orders, etc.)

3. If yes, was a SAT performed?
   - Yes
   - No

4. Did the patient pass SAT?
   - Yes
   - No

5. If No-reason for failed SAT
   - Anxiety, agitation, or pain
   - Respiratory distress or RR > 35
   - SpO2 < 88%
   - Acute cardiac arrhythmia
   - New ST segment changes

V. Initial Ventilator Settings

A. **Mode**: PRVC (Pressure regulated volume control) with SIMV (synchronized intermittent mandatory ventilation) is the preferred mode of ventilation. Alternative modes of ventilation such as VDR or APRV may be used in the case of inhalation injury, ARDS, need due to patient acuity, and familiarity of the team

B. **Tidal Volume**: 6-7ml/kg (IBW) initially and insure the Pplat is < 30 cmH2O. If Pplat is > 30, decrease Vt by 1ml/kg to a minimum of 4-5ml/kg. Notify BICU Attending and Fellow should you have to reduce the tidal volume to decrease Pplat.
   - Use IBW to determine tidal volume:
     i. Females IBW (kg) = (height in inches-60) * 2.3 + 45.5
     ii. Males IBW (kg) = (height in inches – 60) * 2.3 + 50

C. **Rate**: Titrate rate to maintain a normal range of pH 7.35-7.45. Will allow permissive hypercapnia to a pH of 7.2 if the patient has ARDS or severe inhalation injury and has no contraindications. Contact BICU Attending or Fellow if unable to maintain a normal pH.

D. **Pressure Support**: if a patient has a spontaneous tidal volume, titrate to maintain tidal volume minimum of 4-5 ml/kg

E. **FiO2**: initiate at 0.6 and titrate FiO2 to maintain SpO2 > 93%, or determined by patient condition (COPD, etc).

F. **PEEP**: in an effort to increase surface area for gas exchange, start all patients with 8cm H2O PEEP and FiO2 of 0.6. Please reference ARDSnet PEEP table for weaning. Weaning PEEP should also utilize compliance measurements to guide appropriate changes in PEEP in conjunction with FiO2 changes without compromising compliance.

G. Goal is to wean patient to FiO2 0.4 and PEEP 5cmH2O while maintainingSpO2 > 94%. Goal SpO2 > 93%.

H. ARDSnet PEEP Table:

Lower PEEP/higher FiO2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

VI. Spontaneous Breathing Trial (SBT)

1. Initiate SBT (Spontaneous Breathing Trial/CPAP Trial) – 30-minute trial, but can be up to 120 minutes if the patient has been on mechanical ventilation for a prolonged period
    - Maintain current FiO2
    - CPAP – 5 cmH2O and PS (pressure support) – 5cm H2O

2. Evaluate patient during SBT, successful if:
    - Respiratory rate < 30 BPM
    - HR within 20% of baseline
    - No complaints of respiratory distress
    - No anxiety of diaphoresis
    - Contact BICU attending or fellow with results of SBT; continue on SBT settings

3. Weaning and/or SBT success

Contact BICU Attending or Fellow for extubation order if patient meets the following criteria:

- Passed SAT & SBT
- RSBI < 105 (RSBI =RR/Liters of TV)
- Positive Cuff Leak

4. Weaning and/or SBT Failure

If any of the following occur, document SBT failure and place the patient back on previous ventilator settings. Document reason for SBT failure:

- RR greater than 30 (less than or equal to 5 minutes at RR greater than 35 may be tolerated)
- Minute volume greater than 10 l/m
- SpO2 less than 90% saturation
- Systolic blood pressure greater than 180 or less than 90 mmHg
- Respiratory distress
- HR greater than 120% of baseline HR (less than 5 min of increased HR may be tolerated)
- Marked use of accessory muscles
- Abdominal paradox
- Diaphoresis
- Marked subjective dyspnea
- Apnea

5. Weaning: there is evidence that daily SBT concurrent with daily SAT results in the fastest time to liberation. However, it is reasonable to reduce ventilatory support in a stepwise fashion of the patient does not qualify for SBT or has failed.

- Assess for causes of failure (secretions, infection, volume overload, anxiety, etc) and attempt to correct.
- The optimal weaning strategy is currently unknown (PSV vs multiple SBTs per day).
- Weaning by progressive decreases in the level of pressure support (2 to 4 cm H2O) during SPV is a reasonable alternative for patients who do not tolerate SBTs.
- IMV alone should NOT be used for weaning
- Discussion should be had with the BICU attending or fellow about level of support needed overnight
- Continue to drop PS (pressure support) level by increments of 2 cmH2O as long as patient maintains adequate minute volume (70% baseline on previous mode) and a respiratory rate <35 bpm.
- If a patient's respiratory rate > 35 bpm increase PS level to previous setting. If patient's respiratory rate remains > 35 bpm change back to PRVC or previous mode and notify BICU fellow.

VII. Post Extubation Protocol

- Start IS q1hour x 4 hours. Extubation to HFNC or CPAP/BIPAP may be used in high risk patients.
- After 8 hours if IS < 10 ml/kg IBW, begin Acapella Therapy q4hours
- If patient unable to perform effective airway clearance, consider IPPB.