

# Simulation Scenario: Status Asthmaticus

## Section 1: Case Summary

<b>Scenario Title:</b>	<b>Status Asthmaticus</b>
Keywords:	Status, asthma, intubation, respiratory
Brief Description of Case:	30-year-old female with a history of complicated asthma presenting with an asthma exacerbation, not responding to usual treatments, ultimately requiring intubation and ECMO.

Goals and Objectives	
Educational Goal:	Proceed through the entire status asthmaticus pathway
Objectives: (Medical and CRM)	<ol style="list-style-type: none"><li>1. Construct a differential diagnosis for an adult with dyspnea</li><li>2. Identify a patient in status asthmaticus</li><li>3. Proceed through the asthma resuscitative algorithm, including specific medications and their doses</li><li>4. Identify the signs and symptoms of impending respiratory failure, and acknowledge the need for intubation</li><li>5. Have an approach to initial ventilator settings for intubated patients in status asthmaticus</li><li>6. Discuss treatment options for refractory status asthmaticus</li></ol>
EPAs Assessed:	Recognize a patient requiring emergent care, initiate appropriate management

Learners, Setting and Personnel					
Target Learners:	<input checked="" type="checkbox"/> Junior Learners		<input checked="" type="checkbox"/> Senior Learners		<input type="checkbox"/> Staff
	<input type="checkbox"/> Physicians	<input checked="" type="checkbox"/> Nurses	<input checked="" type="checkbox"/> RTs	<input type="checkbox"/> Inter-professional	
	<input type="checkbox"/> Other Learners:				
Location:	<input checked="" type="checkbox"/> Sim Lab		<input type="checkbox"/> In Situ		<input type="checkbox"/> Other:
Recommended Number of Facilitators:	Instructors: 1				
	Sim Actors: 1				
	Sim Techs: 1				

Scenario Development	
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Last Revision Date:	
Revised By:	
Version Number:	1.0



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## Section 2A: Initial Patient Information

A. Patient Chart					
Patient Name: Ana Smith		Age: 30		Gender: F	Weight: 70 kg
Presenting complaint: Dyspnea and cough					
Temp: 38.0C	HR: 125 bpm	BP: 115/70	RR: 30	O <sub>2</sub> Sat: 94% RA	FiO <sub>2</sub> :
Cap glucose: 5			GCS: 15 (E4 V5 M6)		
Triage note: Patient complaining of 3 days of increasing SOB and cough.					
Allergies: NKDA					
Past Medical History: Asthma Eczema			Current Medications: Flovent Ventolin prn		

## Section 2B: Extra Patient Information

A. Further History	
<p>The patient was brought to the ED by a friend, who was unable to stay; the only person able to provide a history is the patient (mannequin).</p> <p>History of Presenting Illness: Progressive productive cough, wheeze, and dyspnea x3 days; no other infectious symptoms (including fevers) noted; no chest pain.</p> <p>Past Medical History (only provide if specifically asked): History of asthma exacerbations requiring hospitalization, BiPAP and, on 2 occasions, intubation; last hospitalization was 4 months ago requiring BiPAP at that time, last intubation 2 years ago .</p> <p>Social History: Covid vaccine x1, one month ago; no flu shot this year; active smoker, but trying to cut down, currently at 6 cigarettes/day; lives in overcrowded transitional housing; multiple potential sick contacts from housing complex; no recent travel.</p>	
B. Physical Exam	
Cardio: Difficult to hear over wheeze; tachycardic but otherwise grossly normal	Neuro: Normal
Resp: Diffuse wheeze, suprasternal, intercostal, & subcostal retractions	Head & Neck: Normal; no swelling; uvula midline
Abdo: Normal	MSK/skin: Slightly diaphoretic; cap refill <2 seconds; warm
Other:	

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## Section 3: Technical Requirements/Room Vision

A. Patient
<input checked="" type="checkbox"/> Mannequin - <i>Adult</i>
<input type="checkbox"/> Standardized Patient
<input type="checkbox"/> Task Trainer
<input type="checkbox"/> Hybrid
B. Special Equipment Required
<ul style="list-style-type: none"><li>- Basic monitors in the room</li><li>- Supplies for obtaining IV access</li><li>- Nasal prongs, facemask, spacer</li><li>- Heliox tank (if feasible)</li><li>- BiPAP equipment</li><li>- Intubation equipment (laryngoscope, endotracheal tube, stylet, tape, suction, back-up equipment (glidescope, bougie, LMA))</li><li>- Ventilator (if feasible)</li></ul>
C. Required Medications
<ul style="list-style-type: none"><li>- Salbutamol MDI + nebs</li><li>- Ipratropium MDI + nebs</li><li>- Methylprednisolone IV</li><li>- Magnesium sulfate IV</li><li>- Salbutamol IV</li><li>- Epinephrine IM or SC</li></ul>
D. Moulage
None
E. Monitors at Case Onset
<input type="checkbox"/> Patient on monitor with vitals displayed
<input checked="" type="checkbox"/> Patient not yet on monitor
F. Patient Reactions and Exam
<ul style="list-style-type: none"><li>- Patient answering questions in ~5 word sentences at the beginning of the case, and appears generally somewhat uncomfortable</li><li>- Diffuse wheezes on auscultation of the lungs</li><li>- Accessory muscle use</li></ul>

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## Section 4: Sim Actor and Standardized Patients

Sim Actor and Standardized Patient Roles and Scripts	
Triage RN (SIM Instructor)	<p><u>Beginning of Case:</u></p> <ul style="list-style-type: none"><li>- Setting: Rural Emergency Department, single coverage, without any local specialists readily available</li><li>- Triage RN comes over to the Team Leader, and states that he is worried about a patient that was just dropped off by a friend in the waiting room; the patient appears quite dyspneic</li><li>- Asks where they should place the patient</li></ul>
Patient (mannequin)	<p><u>Beginning of Case:</u></p> <ul style="list-style-type: none"><li>- The patient is visibly dyspneic and slightly diaphoretic</li><li>- Initially able to respond to questions in 5-word sentences</li><li>- Patient is calm and cooperative with the assessment, but has limited ability to engage secondary to dyspnea</li></ul> <p><u>Case Progression:</u></p> <ul style="list-style-type: none"><li>- Despite any therapies provided, the patient will continue to deteriorate throughout the case and become increasingly fatigued from their dyspnea</li><li>- Consider prompting if the Team Leader stalls after attempting first-line severe asthma therapies (salbutamol, ipratropium, steroids), or if they proceed to intubation before trying less invasive therapies</li><li>- The patient deteriorates either after the Team Leader progresses through the entire asthma algorithm (including attempting BiPAP, magnesium sulfate, IV salbutamol, epinephrine, and/or heliox), if the Team Leader has stalled despite prompts to attempt these additional treatments, or if there is deviation from typical asthma treatments</li></ul>

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## Section 5: Scenario Progression

Scenario States, Modifiers and Triggers				
Patient State/Vitals	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State		Facilitator Notes
<b>1. Baseline State &amp; Immediate Patient Stabilization</b> Rhythm: Sinus HR: 125 BP: 115/70 RR: 30 O <sub>2</sub> SAT: 94% T: 38°C GCS: 15	The patient is alert, in mild-moderate respiratory distress, with SOB and accessory muscle use; ~5 word sentences	<u>Expected Learner Actions</u> <input type="checkbox"/> Direct to an Acute bed <input type="checkbox"/> Attach monitors <input type="checkbox"/> 2x large-bore IVs <input type="checkbox"/> Put the patient on O <sub>2</sub> by FM	<u>Modifiers</u> - None  <u>Triggers</u> - Completion of all Expected Learner Actions	If oxygen is not given, the patient desaturates to an O <sub>2</sub> sat of 90%, then further desaturates by 5% per every minute until O <sub>2</sub> is applied
<b>2. First-Line Treatments</b> Rhythm: Sinus HR: 125 BP: 115/70 RR: 30 O <sub>2</sub> SAT: 94% T: 38°C GCS: 15	Unchanged from above	<u>Expected Learner Actions</u> <input type="checkbox"/> Give Salbutamol MDI + neb <input type="checkbox"/> Give ipratropium MDI + neb <input type="checkbox"/> Give methylprednisolone IV <input type="checkbox"/> Take a basic history & exam <input type="checkbox"/> Order CXR <input type="checkbox"/> Order ABG & basic bloodwork	<u>Modifiers</u> - None  <u>Triggers</u> - Completion of all Expected Learner Actions	Prompt the Team Leader to consider first-line therapies if they appear to be moving towards immediate intubation Respiratory Therapist is not available if called If these first-line medications are not called for by three minutes, the patient desaturates to an O <sub>2</sub> sat of 88%, and RR increases to 35
<b>3. Second-Line Treatments</b> Rhythm: Sinus HR: 130 BP: 110/65 RR: 35 O <sub>2</sub> SAT: 91%	The patient continues to be in respiratory distress, now with 1-3 word sentences	<u>Expected Learner Actions</u> <input type="checkbox"/> Consider magnesium sulfate IV <input type="checkbox"/> Consider giving heliox <input type="checkbox"/> Consider IV salbutamol <input type="checkbox"/> Consider IM/SC epinephrine <input type="checkbox"/> Trial of BiPAP (+/- ketamine)	<u>Modifiers</u> - None  <u>Triggers</u> - Completion of at least two listed second-line treatment options	Voice that two rounds of salbutamol and ipratropium have now been given If no second-line agents are administered by three minutes (into this phase), the patient



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T: 38°C GCS: 14				desaturates to 85%, and her respiratory rate increases to 40 If 0-1 second-line agents are administered by five minutes, the patient desaturates to 80%, and her RR increases to 40
<b>4. Intubation</b> Rhythm: Sinus HR: 130 BP: 105/60 RR: 20 O <sub>2</sub> SAT: 88% T: 38°C GCS: 13	The patient appears diaphoretic and somewhat drowsy, difficult to engage in conversation due to LOC/SOB	<u>Expected Learner Actions</u> <input type="checkbox"/> Recognize need for intubation <input type="checkbox"/> Consider fluids or vasopressors pre-intubation, and/or having push-dose pressors prepared <input type="checkbox"/> Prepare for difficult intubation, including having a backup (glidescope, bougie) readily available, and calling for help <input type="checkbox"/> Proceed with intubation using RSI <input type="checkbox"/> Have an approach to initial ventilator settings for asthmatic intubations <input type="checkbox"/> Consult ICU and provide an appropriate handover/case summary	<u>Modifiers</u> - None  <u>Triggers</u> - Intubates patient and consults ICU	Respiratory Therapy/ Anesthesiology are unavailable at the time of intubation if called If no fluids or vasopressors are given, the patient becomes hypotensive (80/50) after intubation Note initial ventilator settings used for later discussion
<b>5. ECMO</b> Rhythm: Sinus HR: 110 BP: 110/65 Intubated, on ventilator O <sub>2</sub> SAT: 94% T: 37°C	Intubated and sedated	<input type="checkbox"/> Identify severe acidosis and hypercarbia persisting despite maximal therapies as indications for ECMO, and transfer the patient to the nearest ECMO center	<u>Modifiers</u> - None  <u>Triggers</u> - Consults nearest ECMO center	Although the referral center has accepted the patient for transfer, challenging weather conditions led to her remaining in your ED for the subsequent 24 hours. The ICU team have been helping titrate the ventilator throughout the night over the phone. Your nurse brings



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				you the patient's bloodwork for the morning, which includes a pH of 7.00, and a pCO2 of 75.
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## Appendix A: Laboratory Results

<u>CBC</u> WBC 10.5 Hgb 125 Plt 400  <u>Lytes</u> Na 135 K 4.0 Cl 100 HCO <sub>3</sub> 25 AG 10 Urea 5 Cr 80 Glucose 8.0  <u>VBG</u> pH 7.15 pCO <sub>2</sub> 60 HCO <sub>3</sub> 30 Lactate 3	<u>Cardiac/Coags</u> Trop 10 D-dimer 200 INR 1.0  <u>Other</u> B-HCG Neg
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## Appendix B: ECGs, X-rays, Ultrasounds and Pictures

*Paste in any auxiliary files required for running the session. Don't forget to include their source so you can find them later!*

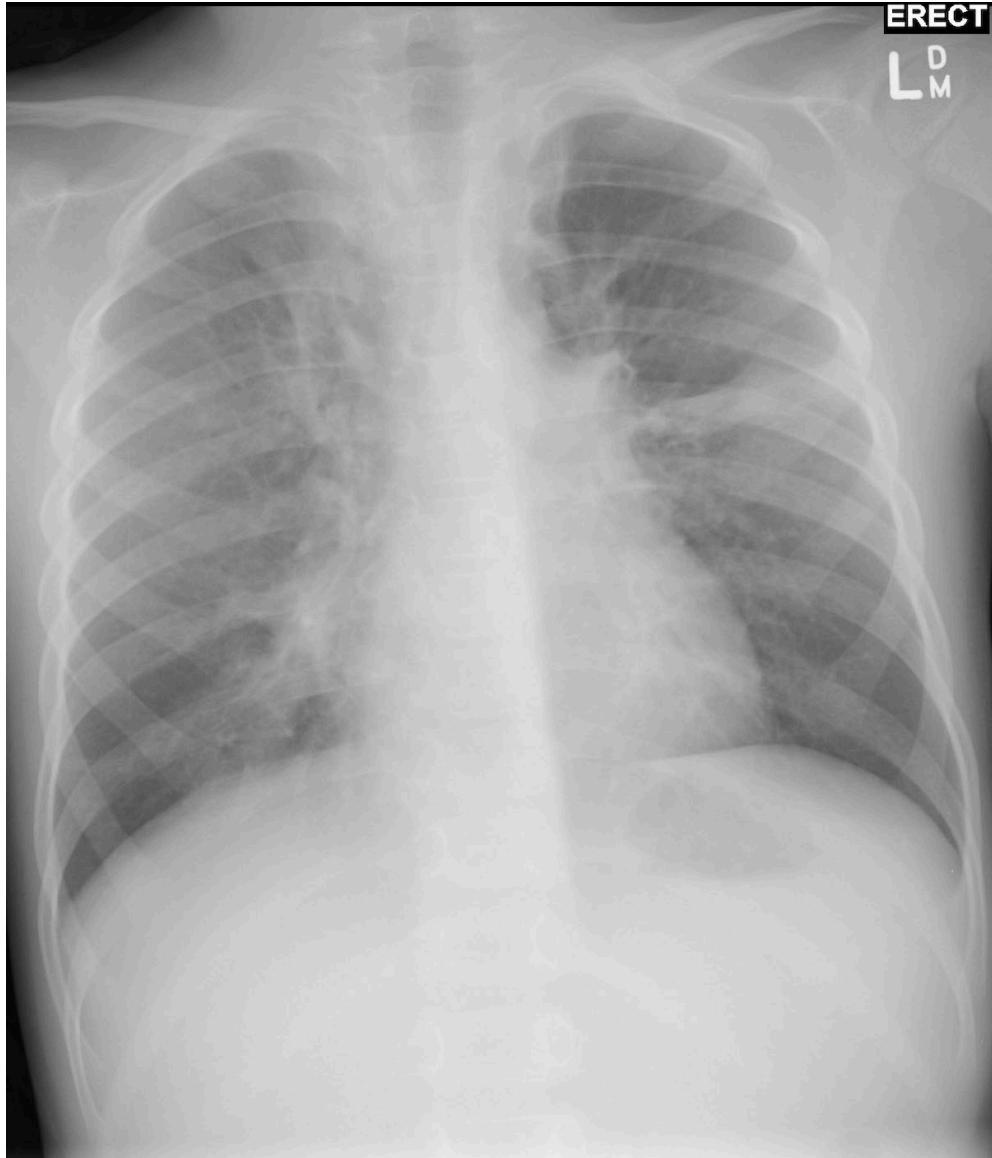


Image from: <https://radiopaedia.org/cases/asthma>

- Shows partial collapse of the RUL, segmental collapse of the RLL & LUL, lung hyperinflation – consistent with asthma with severe bronchial plugging

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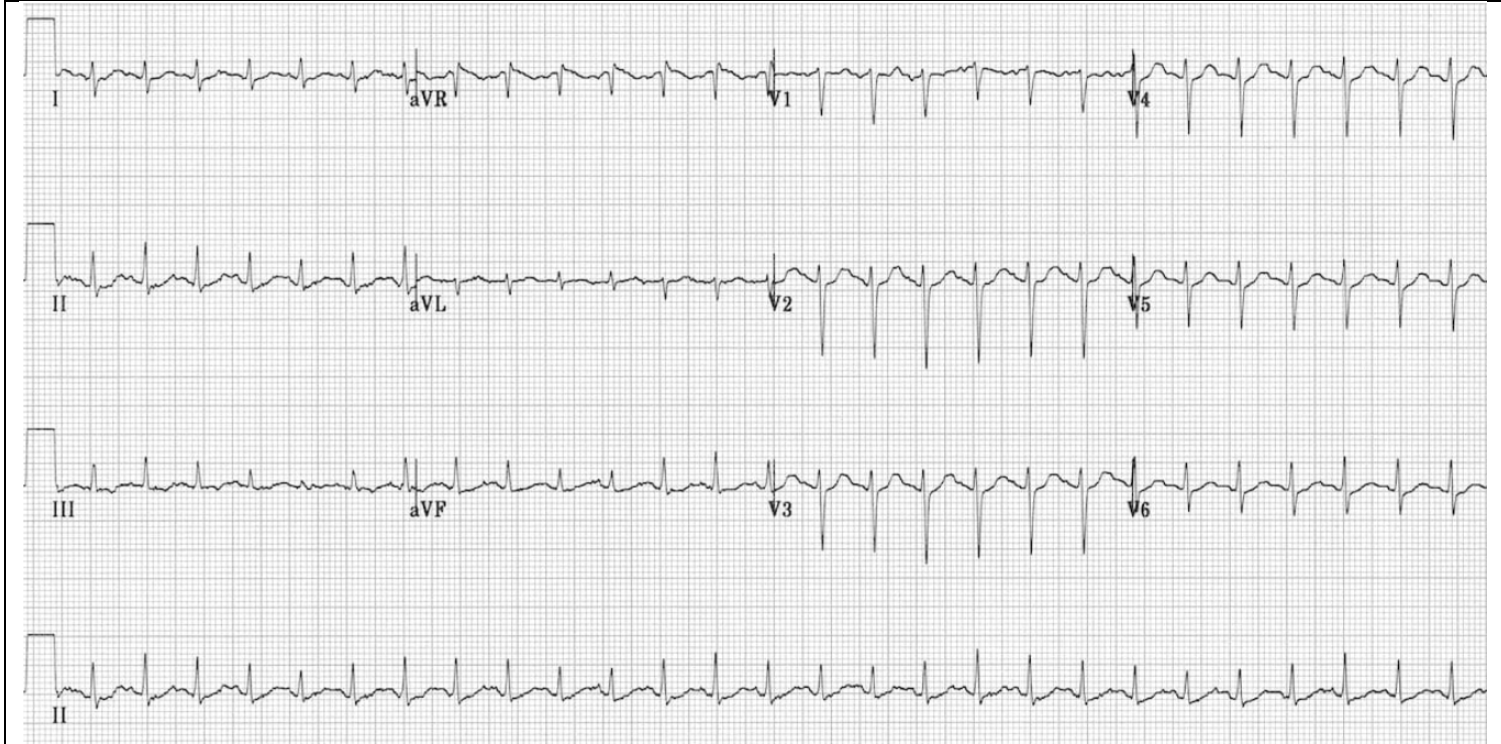


Image from: <https://litfl.com/sinus-tachycardia-ecg-library/>

- Sinus tachycardia with HR ~150

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## Appendix C: Facilitator Cheat Sheet & Debriefing Tips

### Differential Diagnosis for Dyspnea &/or Wheeze

- Respiratory causes: COPD exacerbation, asthma exacerbation, pneumothorax, CHF exacerbation, flash pulmonary edema, pneumonia, viral (including Covid)
- Other: Foreign body, pneumothorax, altitude, anxiety, thyroid concerns, anemia, epiglottitis
- In kids: Also consider bronchiolitis, tracheomalacia, trachea-esophageal fistula, ASD/VSD, cystic fibrosis

### Management of Severe Asthma Exacerbation/Status Asthmaticus

Vancouver Coastal Health & Providence Health Care



Physician's Order

### ACUTE ASTHMA EXACERBATION: **ADULT** – CTAS LEVEL 1

**CTAS LEVEL 1** Place patient in resuscitation area immediately. Notify physician and RT if available.

- Obtain peak flow if possible
- Oxygen to maintain SpO<sub>2</sub> > 92%
- Continuous salbutamol 5 mg + ipratropium 0.5 mg by nebulizer until improvement
- Initiate Normal Saline IV at \_\_\_\_\_ mL/hour
- Cardiac monitor
- Pulse oximetry
- Assess for intubation need (suggested medications below) Patient weight \_\_\_\_\_ kg

- ☐ Consider pretreatment: Lidocaine 1.5 mg/kg (\_\_\_\_\_ mg) IV once
- ☐ Ketamine 1-2 mg/kg (\_\_\_\_\_ mg) IV once
- ☐ Succinylcholine 1.5 mg/kg (\_\_\_\_\_ mg) IV once

- Methylprednisolone 125 mg IV once
- Portable chest x-ray to rule out pneumothorax/ alternate diagnosis
- If severe exacerbation and poor or no response, consider
  - ☐ Magnesium 2 g IV in 50 mL Normal Saline over 15 minutes
- CBC, lytes, urea, Cr and glucose, 12-lead ECG
- ABG after intubation and PRN

#### Upon Discharge:

- Provide patient with an Asthma Patient Discharge Package
- Provide referral to Asthma Clinic/Educator
- The following recommended medications are being prescribed on discharge:
  - ☐ Inhaled Salbutamol      ☐ Inhaled Ipratropium      ☐ Oral corticosteroid
  - ☐ Inhaled corticosteroid      ☐ Other \_\_\_\_\_

Time/  
RN initial

- In addition to the above, second-line therapeutic options include IV salbutamol, heliox, epinephrine, and BiPAP (+/- ketamine)

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- Contraindications to BiPAP include: Uncooperative patient, excess respiratory secretions, inability to protect their airway (ex. poor cough, altered level of consciousness), concurrent pneumothorax, hypotension
- Heliox = helium blended with oxygen; this results in a substance with a density one-third that of air, decreasing the resistance associated with gas flow through the airways and decreasing respiratory muscle work, ideally enough to carry bronchodilators to the distal airways and allow other agents time to take effect; it also increases CO<sub>2</sub> diffusion; Heliox is of uncertain benefit in asthma, but can be considered if available
- Magnesium sulfate side effects = hypotension and neuromuscular blockade (monitor BP and deep tendon reflexes)
- Ketamine is a potent bronchodilator
- Methylxanthines (ex. aminophylline) have largely fallen out of favor

## Indications for Intubation in Asthma

- Cardiac or respiratory arrest
- Altered level of consciousness
- Progressive exhaustion (this patient)
- Refractory hypoxemia despite maximal oxygen delivery (this patient)
- Failure to reverse severe respiratory acidosis despite intensive therapy

## Considerations with Intubating the Asthmatic Patient

- Ideal pre-oxygenation is impossible
- Ventilation doesn't relieve any airflow obstruction, but can help decrease work of breathing and allow the patient to rest while any airflow obstruction resolves
- RSI with ketamine is preferred for induction, for its bronchodilatory and sympathetic stimulatory properties
- A large ETT (8.0+ for adults) facilitates airway suctioning, mucous plug removal, and bronchoscopy
- Side effects of intubating and ventilating asthmatic patients include:
  - Potential high peak airway pressures with subsequent barotrauma and hemodynamic impairment (ex. decreased preload)
  - Intrathoracic pressure increases after RSI
  - Mucous plugging is common, causing increased airway resistance, atelectasis, and obstructive pneumonia
  - The severity of airflow obstruction during early treatment may cause the tidal volume to be larger than the returned volume, leading to air trapping and increasing residual volume (ie intrinsic PEEP)
- The ventilatory strategy should focus less on correcting hypercarbia and acidosis, and more on decreasing hyperinflation, high airway pressure, barotrauma, and systemic hypotension:
  - Low Tidal Volume of 5-8 mL/kg (prevents excess increases of auto-PEEP, ventilation stacking, and barotrauma)
  - Low ventilation rate 6-10 breaths/min (allows prolonged expiratory time)
  - High inspiratory flow rate >60 L/min (allows prolonged expiratory time)
  - Long expiratory time (I:E ratio >1:2)
  - FiO<sub>2</sub> 1.0, titrate to keep SpO<sub>2</sub> >94%
  - Minimal PEEP (<5 cm H<sub>2</sub>O)
  - Limit PIP to <40 cm H<sub>2</sub>O
  - Target plateau pressure <20 cm H<sub>2</sub>O
  - Ensure effective humidification

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- Other ways to minimize risk:
  - Consider a fluid bolus before intubation
  - Consider starting a vasopressor infusion or having a push-dose pressor available
  - Permissive hypercapnia is encouraged

## Considerations for ECMO

- ECMO can serve as an adjunctive pulmonary support for intubated patients who remain severely acidotic and hypercarbic despite aggressive conventional therapy, and can be considered as an early treatment in patients with status asthmaticus whose gas exchange cannot be satisfactorily maintained by conventional therapy
- This allows for further protective lung ventilation as well as lung rest; it can decrease FiO<sub>2</sub>, PIP, mean airway pressures, and driving pressure
- Weaning success rates are cited between 86.7-100%, with rates of survival to hospital discharge of 83.5-100% (4-5)
- The most common complications include hemorrhage, renal injury, and cardiovascular complications (5)

## References

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