



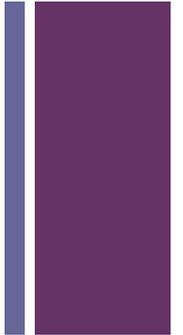
# Airway Management in the COVID-19 Patient

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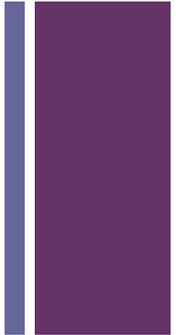
# About me...



- Global/Rural Emergency Medicine Fellow University of Washington
- Residency in Emergency Medicine at University of Rochester Medical Center, Rochester, NY
- Medical School in Spartanburg, SC
- No Conflicts



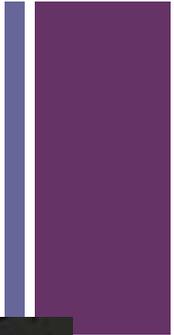
# Background



- Epicenter of outbreak began in Wuhan, Hubei Province, China
- Declared a pandemic by the WHO on March 11
- Cases have spread across the globe
- United States now has 3x the number of confirmed cases compared to the next country as of 4/9
- Information is changing constantly



# + Heat Map



# + Case



- A 24 yo female presents to the Emergency Department for cough, congestion, and SOB. She is in moderate respiratory distress. She has been practicing social distancing measures as much as possible and lives with her boyfriend who works at Walmart. She denies any PMH. She does smoke marijuana recreationally.
- Vitals:
  - HR-87 RR-20 BP-119/76 T-100 O2-86%
- Plan?

# + Case Cont.

- Patient is placed on 5L NC and her saturation improves to 95%
- The patient was placed in isolation with airbourne precautions
- Labwork, including COVID testing, is sent. X-ray is obtained:

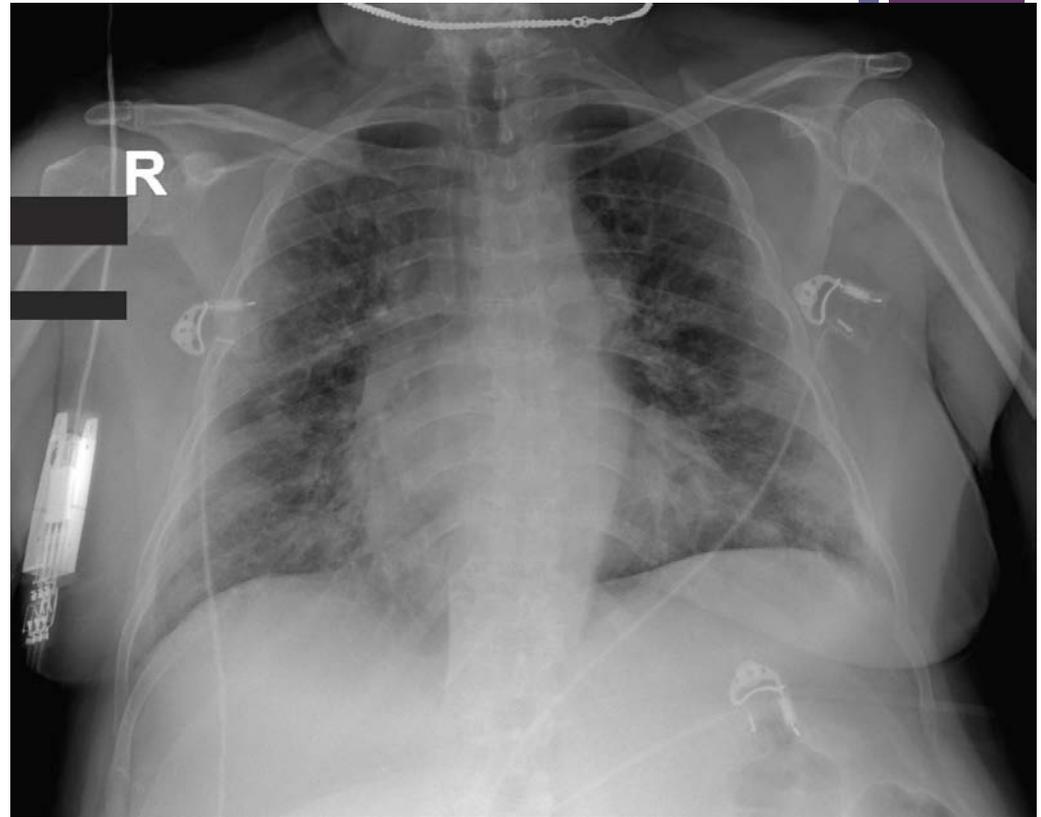
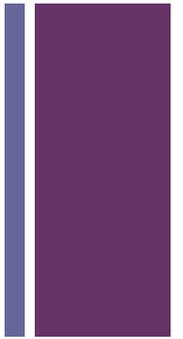


Image courtesy of Dr Yair Glick, Radiopaedia.org, rID: 75137



# Mild/Moderate/Severe Illness



## ■ Mild Illness

- Well appearance and no hypoxia (<94%) and no tachypnea (<22)

## ■ Moderate Illness

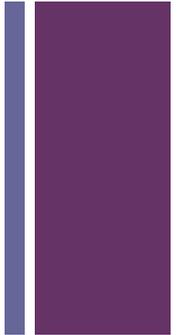
- Hypoxia <94% or tachypnea > 22 or unwell appearance + risk factors
  - Risk Factors: Age>50, HTN, DM, CVD, CKD, Lung Dz, Obesity, Immunosuppression.\*

## ■ Severe Illness

- Severe respiratory distress or shock



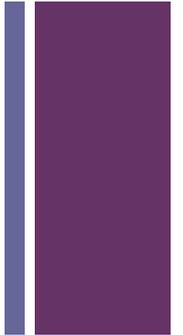
# Lab Values Associated with Progression to Severe Dz



- **D-dimer >1 ug/mL**
- CPK >2x ULN
- CRP > 100
- LDH > 245
- Transaminitis
- **Elevated Troponin**
- Absolute lymphocyte count <0.8
- Lactate >4



# Mild/Moderate Dz



- Provide Supplemental O<sub>2</sub> with nasal cannula (max 6 Lpm) and non-rebreather (max 15 Lpm)
- SpO<sub>2</sub> goal of 90-96%
- In chronic respiratory dz, shoot for 88-92%
- Admit or not Admit?
  - Hospital and capacity dependent
  - Social factors



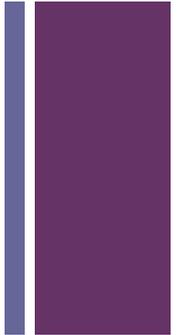
# Case Continued



- Our patient's labs have resulted. She is COVID + but other labs are WNL
- As admission orders are being placed, you hear an alarm going off from the patient's room. Her O2 sat is now 78%
- **You put on your PPE** and head to her room.
- She is lying flat in the bed and is hypoxic on the monitor.
- What now?



# Case Continued



- In the room, the patient is hypoxic with a good waveform. Her respiratory rate is the same from initial presentation. She is able to speak in full sentences.
- A nonrebreather is placed on the patient at 10 Lpm and she is sat upright in the bed
- Her oxygen saturation improves to 100%



# + V/Q mismatch and Positioning

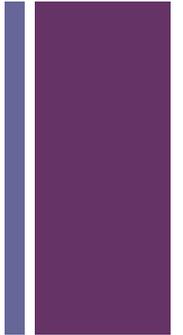


- Pulmonary shunting occurs when blood is flowing past alveoli but there is not gas exchange
- This can be the case in COVID patients because the alveoli are filled with fluid
- We can slightly manipulate the blood flow in the lungs to increase perfusion of the “good” alveoli



+

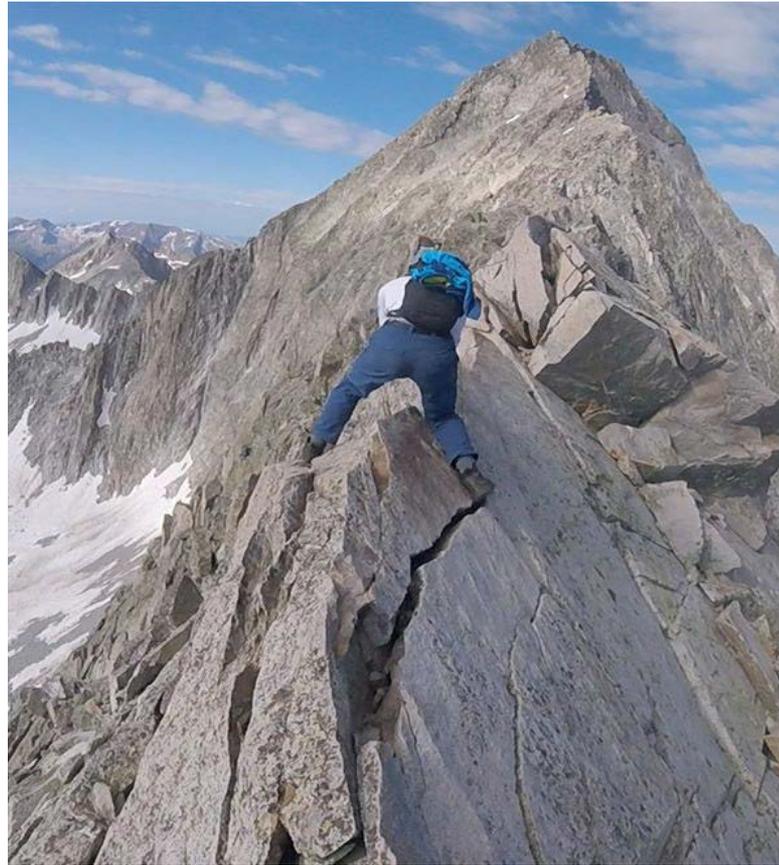
## Case #2



- **66yo** male presents with shortness of breath and cough. He had congestion for about one week and has been isolating at home because he was worried about COVID. His SOB has acutely worsened today. He has **COPD** history.
- He is visibly **tachypneic** with accessory muscle use. Vitals: HR-103 RR-24 BP-95/64 O2-82%
- Next steps?

# + Case 2 continued

- The patient's saturation improves to 88% on 6L NC with NRBM at 15 Lpm. However, he remains tachypneic.
- How would you classify this patient?
- How would you proceed?





# Support Beyond NC and NRBM

- NIPPV (CPAP and BiPAP)?
  - Consensus is try to avoid these if possible\*\*\*
  - The seal and circuit are where aerosolization occurs
  - Can possibly mitigate this with better seal and closed circuit with viral filter
- High Flow Nasal Cannula?

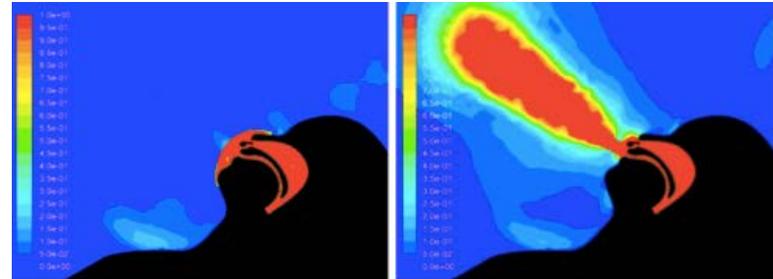


Figure 7. HVNI with Mask – velocity

Figure 8. HVNI without Mask - velocity

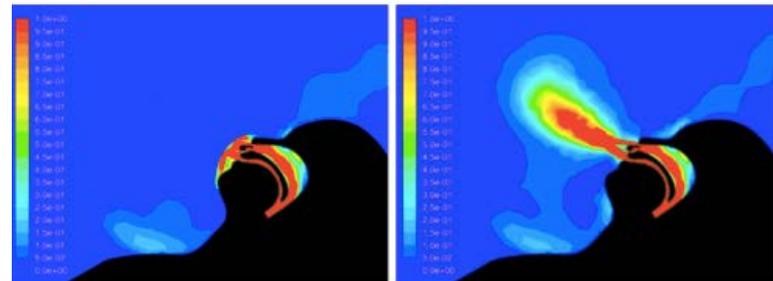


Figure 9. Low Flow Nasal Cannula with Mask – vel

Figure 10. Low Flow Nasal Cannula w/o Mask - vel

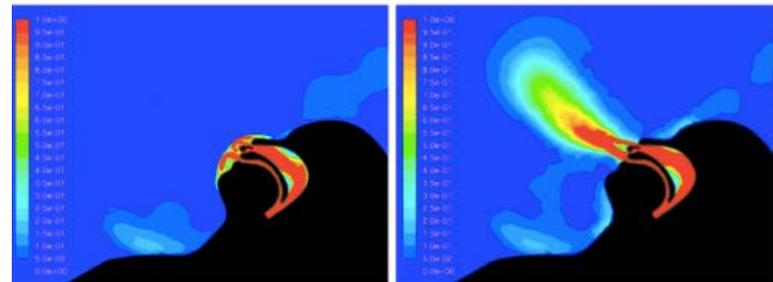
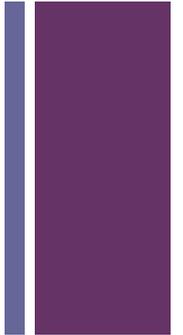


Figure 11. Ms. Thayer with Mask – vel

Figure 12. Ms. Thayer without Mask – vel



# Intubating the COVID patient



## ■ Similarities?

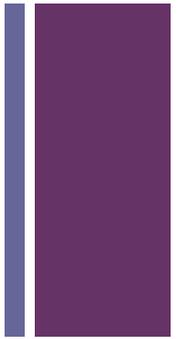
- Speed and first pass success
- The goal is to get the tube through the cords
- Minimize hypoxia and hypotension
- High pressure

## ■ Differences?

- Intubating in full PPE
- Not as much time or ability to preoxygenate
- If possible, all intubations should utilize RSI
- High pressure



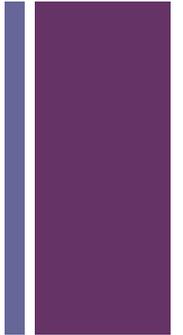
# Set Your Team up for Success



- Have a plan and practice it
- Consider putting together ready-made airway kits with anticipated equipment
- Every member of the team needs to be on the same page



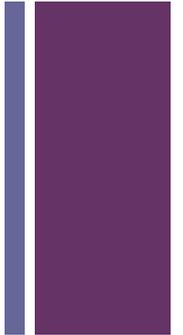
# Equipment Notes



- Everyone in the room needs full PPE for airbourne precautions
- PAPR hood and N95 if available for intubator
- Video Laryngoscopy is preferred
- Airway adjuncts *quickly* available inside or outside the room



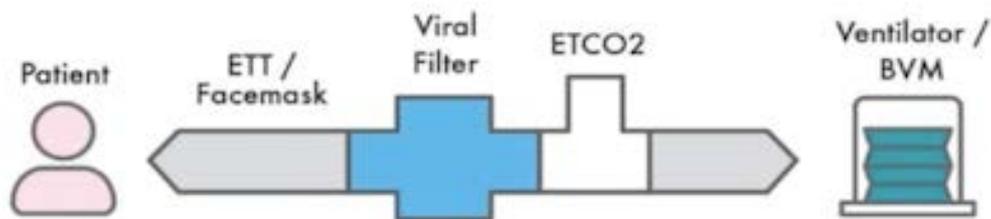
# Equipment for the Room



- Try to bring only what will be needed into the room (unused items are technically contaminated)
- Video Laryngoscope (if available)
  - Can assess for what blade size outside of the room
- ET tube
  - Consider going a half size down from what you would normally use
- BVM with EtCO<sub>2</sub> and Viral Filter
  - Can assess for what blade size outside of the room
- Consider bougie or other adjunct in the room
  - +/- LMA



## Circuit Setup



BVM with PEEP valve, ETCO2, viral filter, straps for apneic CPAP care of George Kovacs



### **Base Go-Pack**

- GVL Mac & HA sized *or*
- CMAC Mac 3 or 4 & D
- Evac TT 7.0,7.5
- Regular TT 7.5,8.0
- Stylets (2)
- Lubricant (2)
- OPA (sized)
- igel (sized)
- #10 blade
- Regular 6.0 TT
- 2 bougies (outside)
- Extra viral filter

### **Meds Go-Pack (labelled)**

- RSI: ketamine 1.0 mg/kg + Roc or sux 1.5 mg/kg
- Ketamine behaviour control
- Push dose pressor (Phen, epi or norepi)
- Norepinephrine infusion
- Post intubation bolus sedation/analgesia
- Post intubation sedation infusion

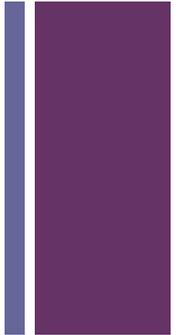
### **Pre-Ox Pack**

- BVM/PEEP/Monometer-Flex mount-WFCO2-Viral filter-Mask
- Non-rebreathing mask
- Nasal prongs
- Spare mask

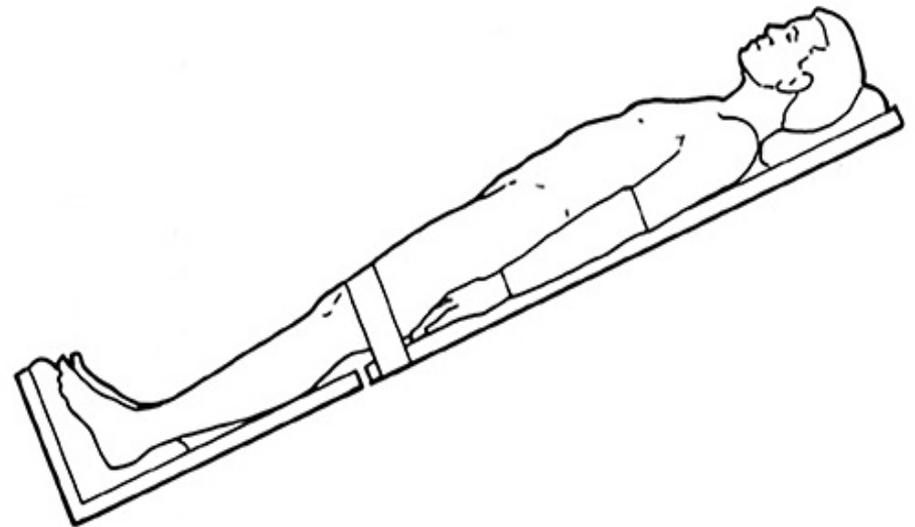


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# Pre-Intubation: Patient Prep

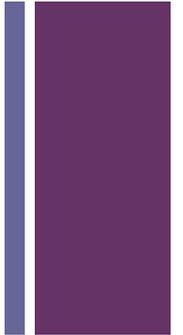


- Optimize with Pre-Oxygenation
  - NC 6L + NRBM 15 Lpm
- Place Patient in Reverse Trendelenburg
- Allow patient to speak with family if there is time
- Consider using tegaderm around the border of the patient's mouth if bearded





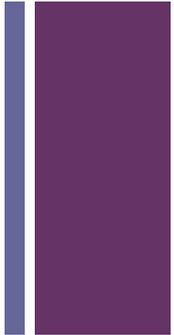
# + Tegaderm Seal



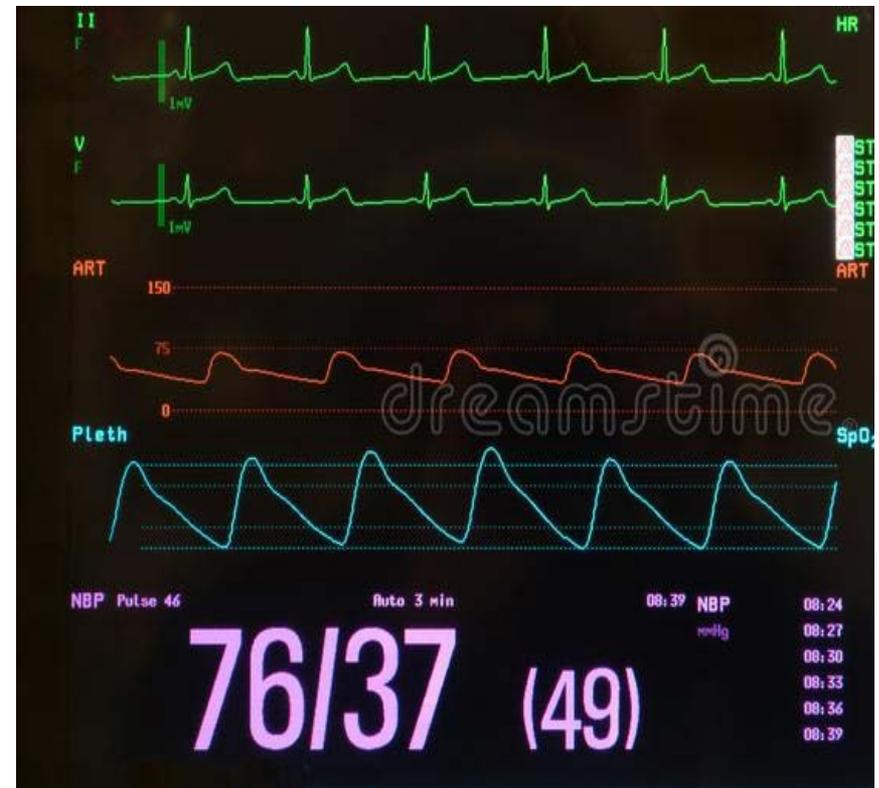
- A piece of large tegaderm or multiple small pieces placed around the mouth can help with mask seal
- Also could be considered to improve seal of CPAP mask



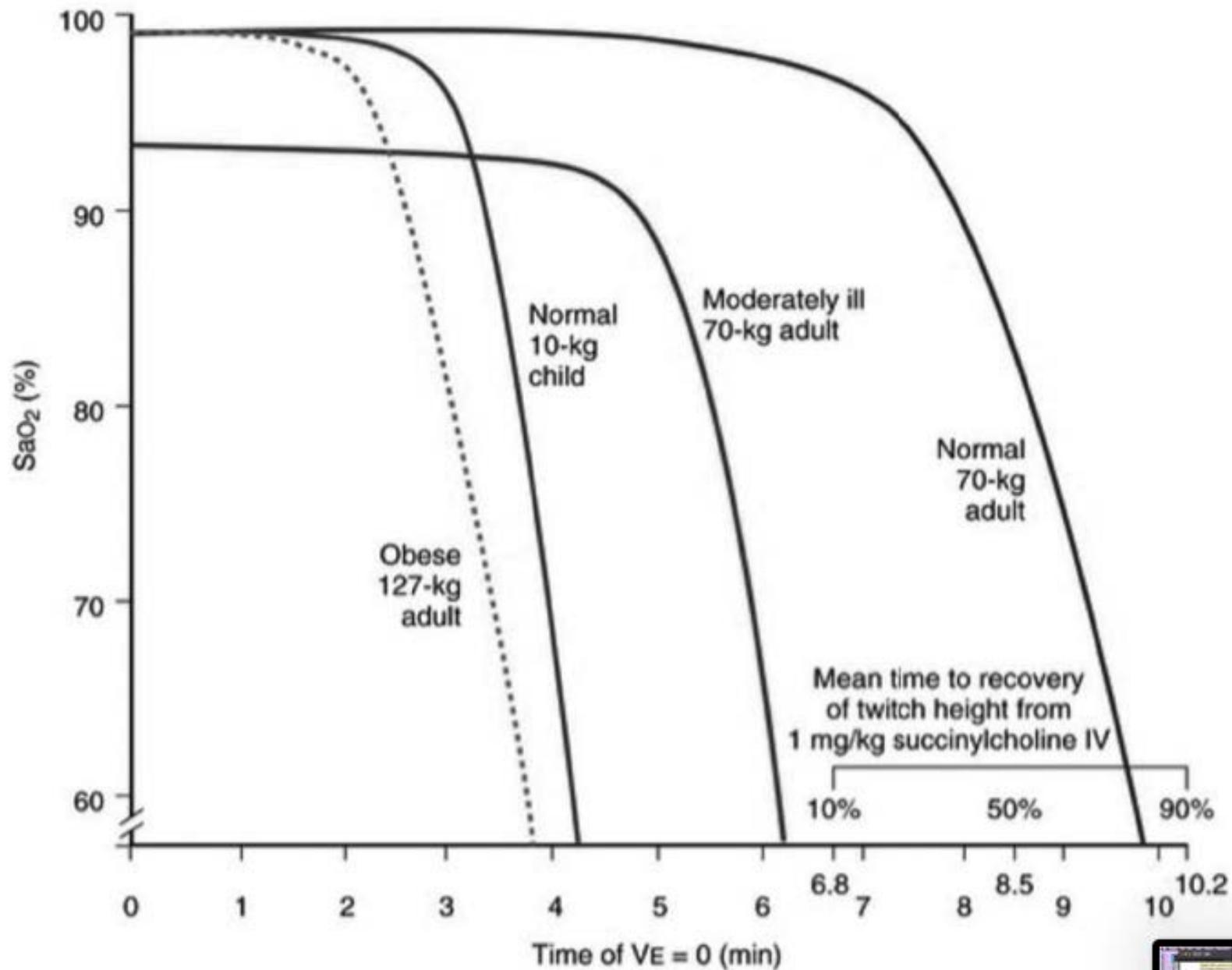
# + Pre-Intubation Patient Prep



- Have a low threshold for starting Vasopressors in the hypotensive COVID patient
- Patients are very easily fluid overloaded
- If not started pre-intubation, have vasopressors ready to go outside of the room

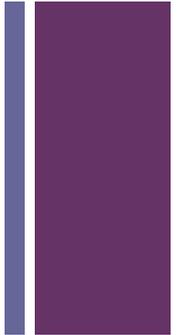


Time to hemoglobin desaturation with initial FAO<sub>2</sub> = 0.87





# Apneic CPAP Method of Pre-Ox



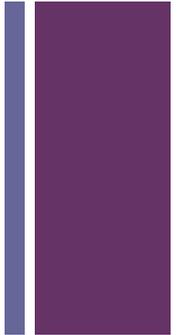
- Apneic “CPAP” with BVM and nasal cannula may be considered for preoxygenation
- Used in the period just before intubation after meds are given
- Using the BVM setup previously shown with Nasal cannula left in place
- BVM flow at 15Lpm; NC at 6 L; PEEP valve at 10-15
- BVM must provide O<sub>2</sub> flow without squeezing bag or without breath and mask must have a good seal to be effective



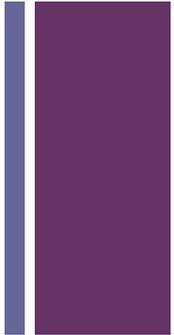
<http://www.aimeairway.ca/announcement/93/update-apneic-cpap>



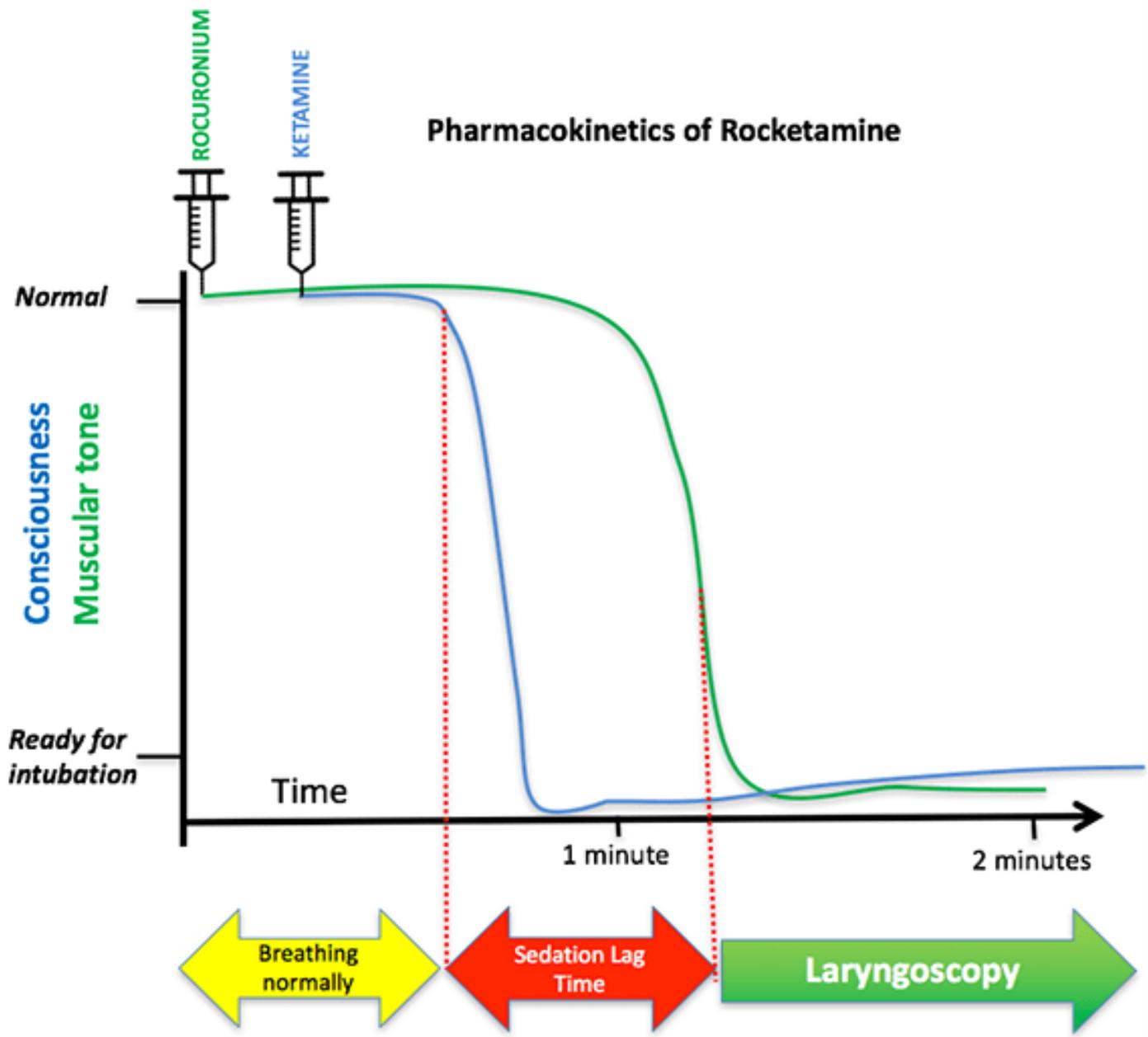
# Medications

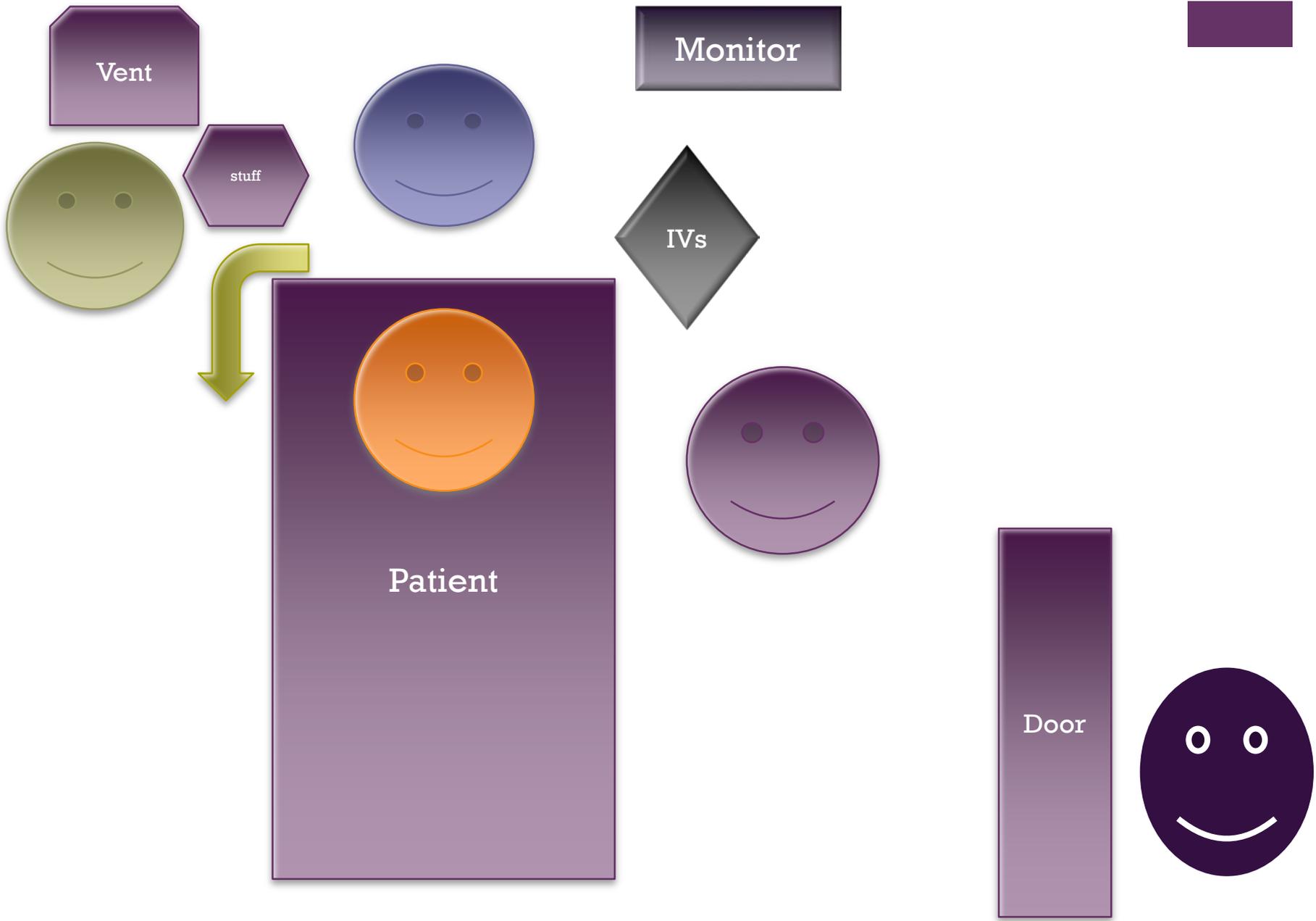


- RSI is the preferred method of intubation for these patients
  - Reduces risk of cough and gag
  - Increases first pass success
- Dealer's choice for meds
  - Ketamine 1 mg/kg IBW and Rocuronium 1.5 mg/kg preferred agents
- Have vasopressors available
- Sedation should be ready to go post intubation



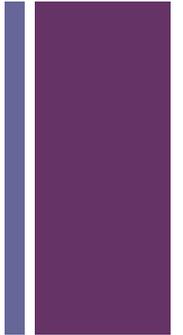
### Pharmacokinetics of Rocketamine





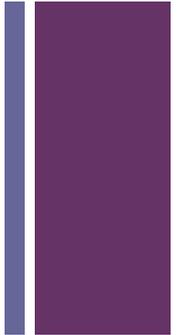
# + Back to Case #2...

- With a nonrebreather, nasal cannula, and in reverse Trendelenburg, the patient's O<sub>2</sub> has risen to 92%
- Intubation is performed using RSI
- Patient had a very brief episode of hypotension but improved with norepinephrine as well as slow 500cc bolus
- The patient's O<sub>2</sub> saturation is now 90%
- What now?





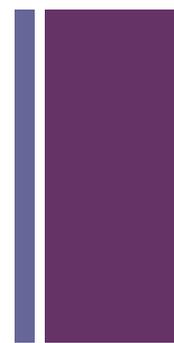
# + Initial Vent Settings



- ARDSnet protocol
- Low Tidal Volume
  - **4-6mL/kg IBW**
  - Usually translates to about 500mL for males and 400mL females
- SpO<sub>2</sub> goal is 88-95%
  - Set **FiO<sub>2</sub> to 100%** initially; titrate to O<sub>2</sub> goal
  - Want lowest possible to achieve sat goals
- Respiratory Rate
  - Initial **rate 16-20**
  - Adjusted off of BG; pH window of 7.25-7.3
- PEEP
  - Initial **PEEP of 10** increasing by increments of 2
  - Keep Plateau pressure needs to be <30cm H<sub>2</sub>O
- Mode
  - Whichever you are most comfortable with
  - **AC/VC mode**
  - **Note on APRV**



# + PEEP Ladder



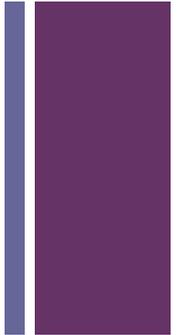
## Higher PEEP/lower FiO2

<b>FiO<sub>2</sub></b>	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
<b>PEEP</b>	5	8	10	12	14	14	16	16

<b>FiO<sub>2</sub></b>	0.5	0.5-0.8	0.8	0.9	1.0	1.0
<b>PEEP</b>	18	20	22	22	22	24



## Case #3



- 47yo male presents in respiratory distress suspected secondary to COVID. The patient is placed in isolation, given supplemental O<sub>2</sub>, and the decision is made to intubate
- RSI is performed. The ETT is unable to be passed and the patient's O<sub>2</sub> saturation is in the 70's
- Next steps?

Pre-oxygenate in designated area/PPE Check/Team briefing/Checklist

Optimized suggested primary approach (Macintosh blade VL with bougie)

**Failed first attempt**

Can oxygenation be maintained (Apneic CPAP, FMV or SGD)?

**Yes - Can maintain oxygenation:**  
you **have time** for other options

**No - Can't maintain oxygenation:**  
you have **NO TIME** for other options!

**One further intubation attempt:**

- Untried optimization with same device
- Hyperangulated VL device
- or, proceed directly to exit strategy

**Failed intubation (but still oxygenated)**

**Exit Options**

- Place SGD, wait for help and then...
- Consider intubating via SGD with flexible intubating scope or...
- Perform a bougie-assisted cricothyrotomy

**Failed oxygenation**



Consider  
1 attempt at SGD  
or 2-person FMV

**Fails**

Bougie Assisted  
Cricothyrotomy

Succeeds

**'Plan A'**  
Primary approach

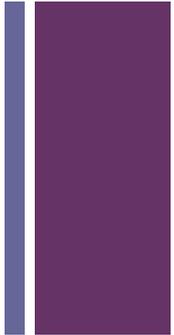
**'Plan B'**  
Alternative approach

**'Plan C'**  
Exit strategy

**'Plan D'**  
Emergency strategy

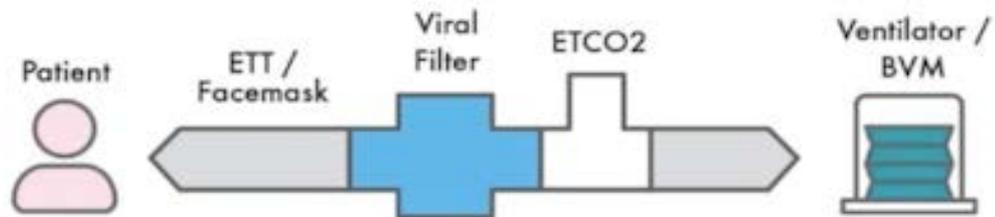
# + Rescue BVM

- Somewhat risky secondary to aerosolization of virus
- Risk can be partially mitigated with good seal and viral filter present
- 2 hand grip is a must
- Easy, smooth bagging





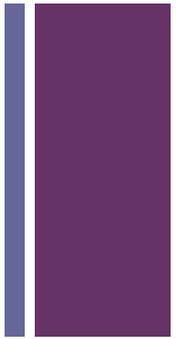
## Circuit Setup



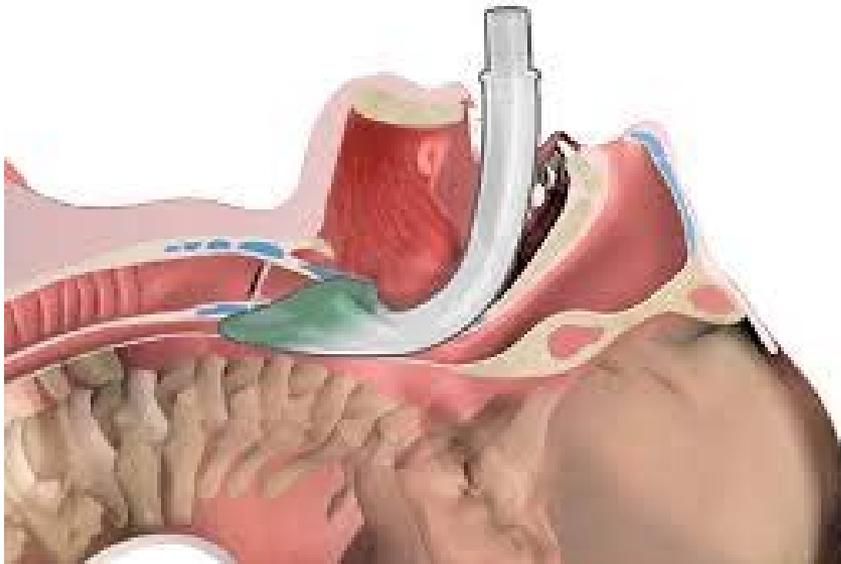
BVM with PEEP valve, ETCO2, viral filter, straps for apneic CPAP care of George Kovacs



# + Supraglottic Device



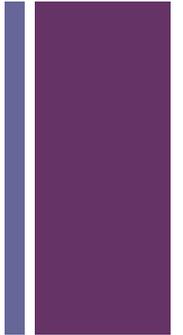
- Can be placed rapidly
- Can be used in place of BVM to reoxygenate between intubation attempts or left in place
- Have a low threshold for its use in these patients



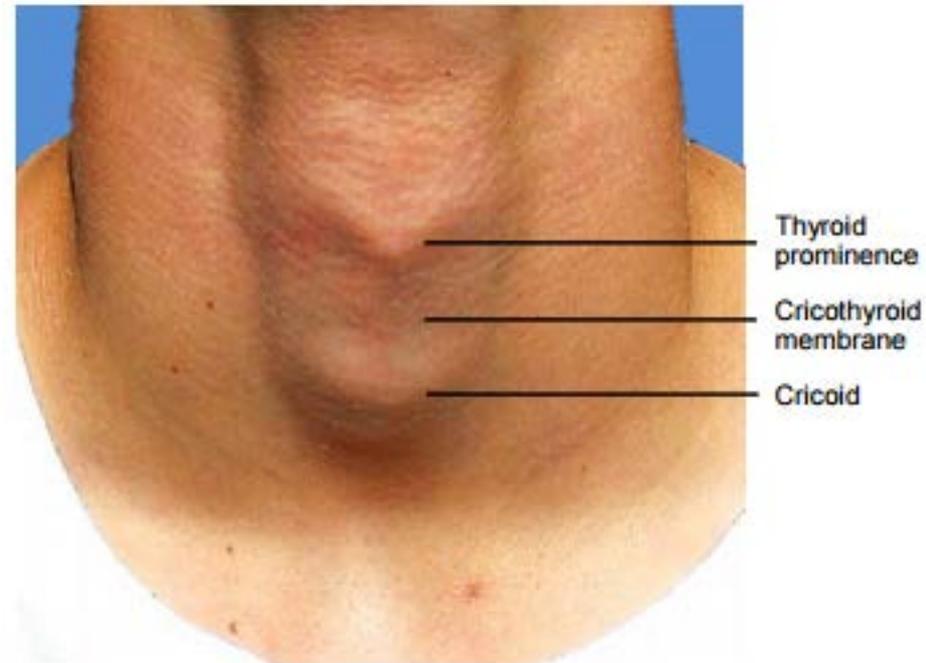
Do not be afraid to lift the tongue  
and  
mandible up and out of the way



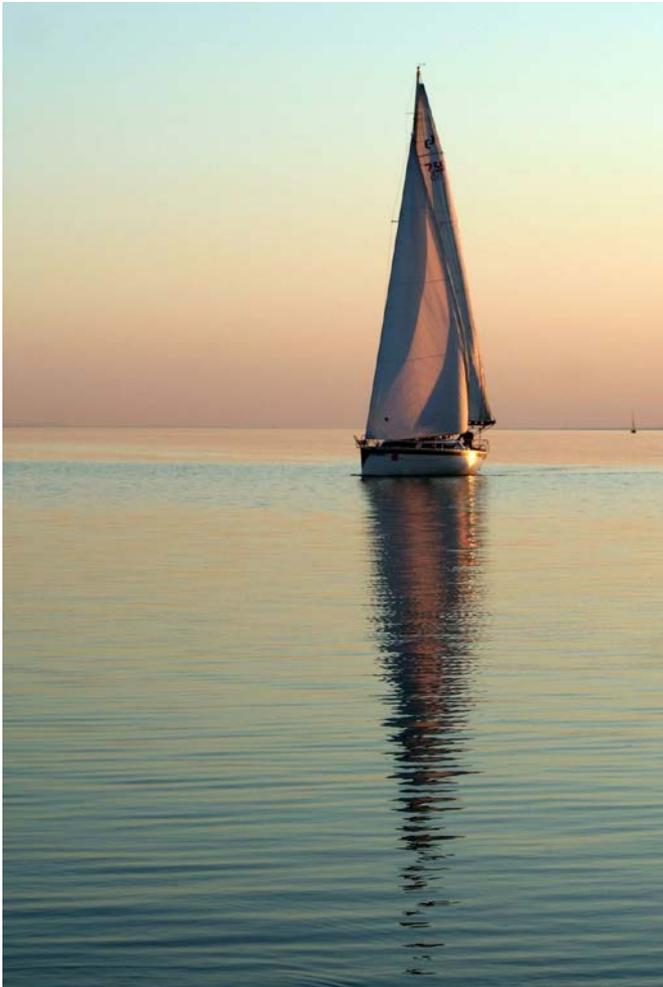
# Cricothyrotomy



- Can't Ventilate/Can't Oxygenate Scenarios
- Scalpel->Finger->Bougie->Tube
- 6-0 ett, scalpel, bougie
- Make a habit of palpating the cricothyroid membrane before **EVERY** intubation



# + Mental Steps for Success



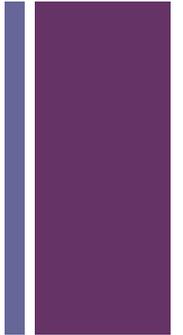
- Have a plan A, B, C, D....
- Practice and Practice more.
- Think about and mentally walk through scenerios
- Tactical Breathing before and during procedure

+

# Slow is Smooth, and Smooth is Fast...

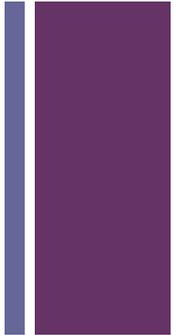


# + Summary



- No matter how sick the patient presents, you and your team have time to put on PPE
- Hypoxia, tachypnea, and certain lab values can be signs of clinical deterioration
- Initial oxygenation with Nasal cannula at 6 L max and Non-rebreather max 15Lpm (place surgical mask over patient if only on NC)
- Consider patient driven position changes including self-proning to improve V/Q mismatch
- Reverse Trendelenburg or HOB upright during preoxygenation

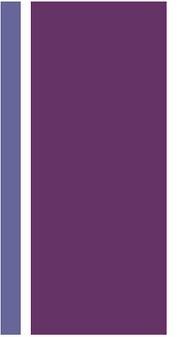
# + Summary



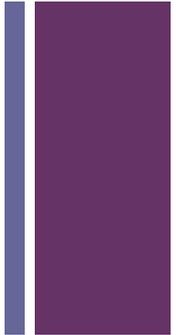
- Ketamine 1mg/kg and Rocuronium 1.5mg/kg for RSI. Have post-intubation sedation ready
- Low threshold for vasopressors. Be judicious with IV fluids
- Initial Vent Settings: TV- 4-6mL/kg IBW; RR- 16-20; FiO<sub>2</sub>- 100%; PEEP-10; AC Mode
- Quick trigger for SGD
- Scalpel->Finger->Bougie->Tube
- Slow is Smooth; Smooth is Fast

# + Thank you! Questions?

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- @dan\_ballew



# + Resources



- <http://www.aimeairway.ca>
  - [Great resource for all things airway](#)
- <https://litfl.com/surgical-cricothyroidotomy/>
  - [Cric videos](#)
- <https://emergencymedicinecases.com/covid-19-protected-intubation/>
  - COVID intubation
- [http://www.ardsnet.org/files/ventilator\\_protocol\\_2008-07.pdf](http://www.ardsnet.org/files/ventilator_protocol_2008-07.pdf)
  - ARDSnet protocol
- <https://litfl.com/coronavirus-disease-2019-covid-19/>
  - Covid resource
- <https://www.emguidewire.com/global-em.html>
  - ARDS lecture