

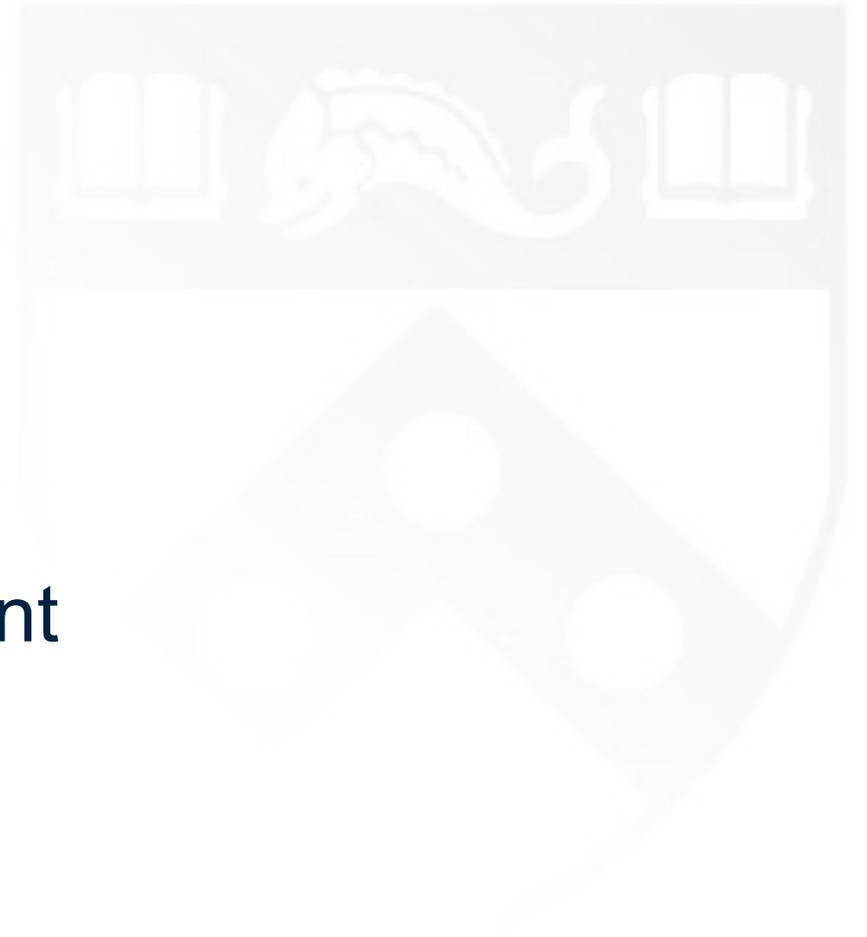


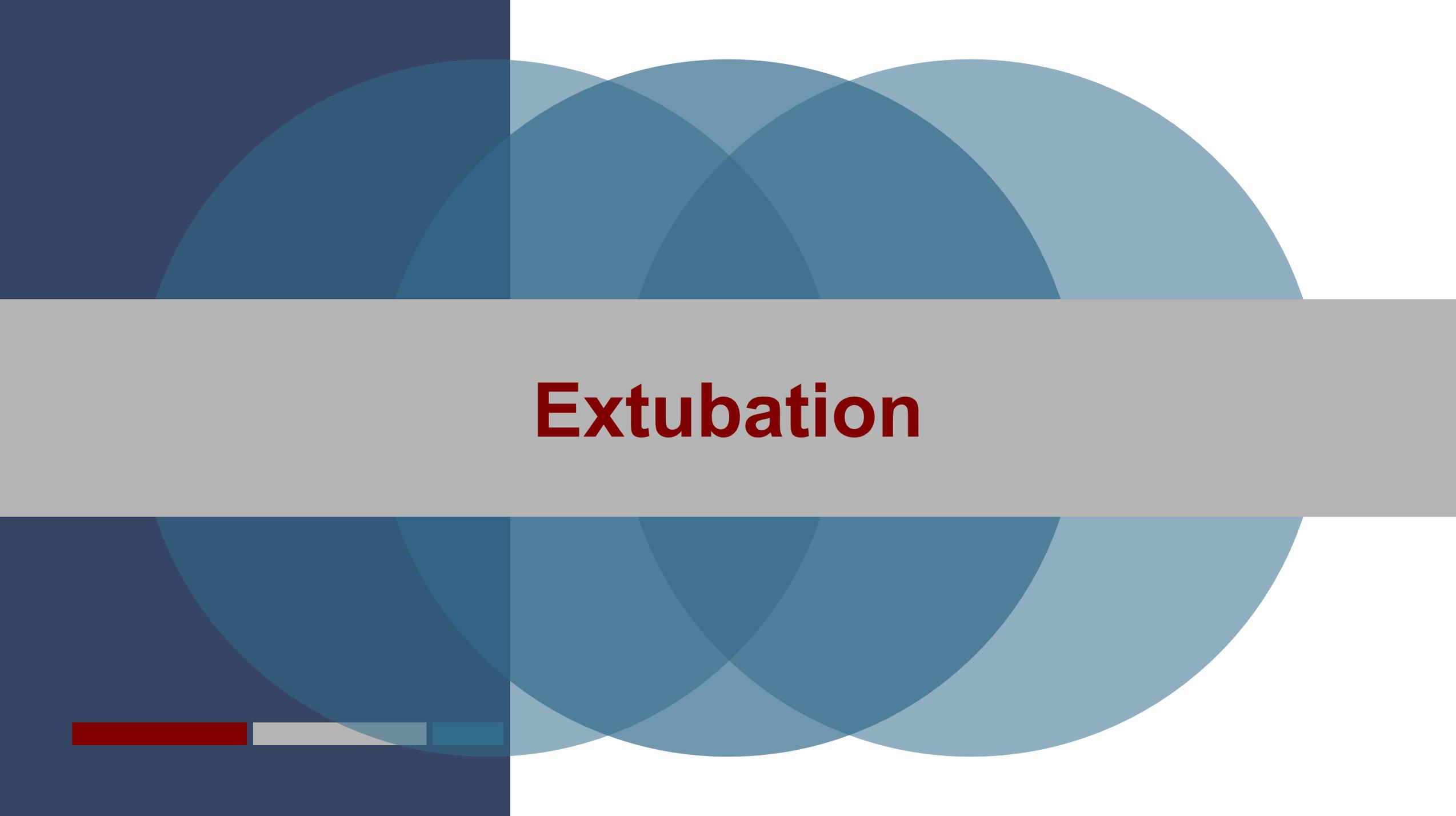
Division of Pulmonary and Critical Care Medicine

COVID-19 Bootcamp: Airway Management

Jen Ginestra, MD

April 21, 2020





Extubation



Penn Medicine COVID-19 Clinical Guide: Extubation

See complete SharePoint guideline for details – Updated 4/20/20 – Recommendations may evolve rapidly – Do not save file – If printed, update frequently – See latest version [here](#)



Anticipating Extubation

Discuss extubation plan with attending provider for patients with difficult or high-risk airway

VLP/SBT

- Use the Ventilator Liberation Protocol for all patients
- SBT @ PS 0-5 PEEP 5 for >2h
- If SBT & extubation screen passed, proceed to CLT

Steroids

- Start methylpred 40mg IV Q12h or dexamethasone 8mg IV Q12h for all patients to prevent airway edema

Baseline CLT

- Perform Cuff Leak Test
- Record baseline results

Proceed

- Proceed to extubation if repeat CLT passed ($\geq 110\text{mL}$) & usual extubation criteria met
- Consider trach if failed ($< 110\text{ml}$)

Repeat CLT

- Repeat Cuff Leak Test day of planned extubation



Attempting Extubation

Prepare

- Hold enteral feeds >1h
- Gather materials^a
- Consider anti-tussive meds^b

Pull ETT

- Turn off vent (PB) or place in "standby" (Servo, Hamilton)
- Deflate endotracheal cuff
- On inspiration, remove ETT into towel or plastic bag^d

Set Up

- Extubate in AIIR if available
- Anesthesia member present^c
- 1 RT 1 RN in room, 1 RN out
- Airborne/droplet/contact PPE

Drape Patient

- Drape patient's face & chest
- Remove oral enteral access
- Suction ETT & oral secretions

-48 to 24h

-24h

0h

Prepare

- Don airborne + droplet + contact precautions
- Drape patient's face with plastic sheet or towel

Cuff Up

- Place on AC/VC, VT 6-10ml/kg
- Record inhaled & exhaled Vt with ETT cuff inflated (should be <20mL difference)

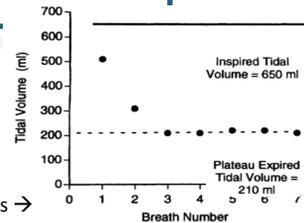
Cuff Down

- Suction ETT & oral secretions
- Deflate ETT cuff
- Record exhaled Vt for 6 breaths
- Re-inflate cuff
- Return to previous cc/kg Vt

Calculate Leak

- Note average of 3 lowest exhaled Vt (cuff down)
- Leak = inhaled Vt (cuff up) minus avg exhaled Vt (cuff down)

- ▶ **FAILED:** Leak $< 110\text{ mL}$ (do NOT extubate)
- ▶ **PASSED:** Leak $\geq 110\text{ mL}$ (+ airway patency)



Sequential expired Vt after cuff deflation: declines then plateaus →

Apply O2

- NC 2-6 LPM vs. NRB 10-12 LPM vs. HFNC 10-60 LPM up to 100% FiO2 vs. Helmet CPAP
- Cover patient with surgical mask over O2 device

Monitor Closely

- SaO2 goal 92-96%
- Observe for 20-30 min
- If \uparrow WOB or SaO2 $< 92\%$, consider reintubation

Follow Up Care

- Continue steroids for 24h post extubation
- Intubated >48h: consult SLP before PO; <48h: NPO x 4h → RN eval

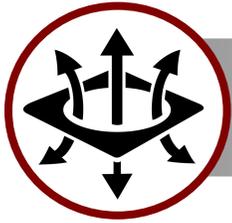
- a) Drape (surgical or clear plastic), towel or plastic bag (for ETT), O2 device
- b) Lidocaine via ETT, low dose opioid, dexmedetomidine, remifentanyl
- c) Recommend anesthesia team member present for all COVID extubations
- d) Sleeve bag/towel over ETT as it is removed, seal closed over entire ETT



Cuff Leak Testing

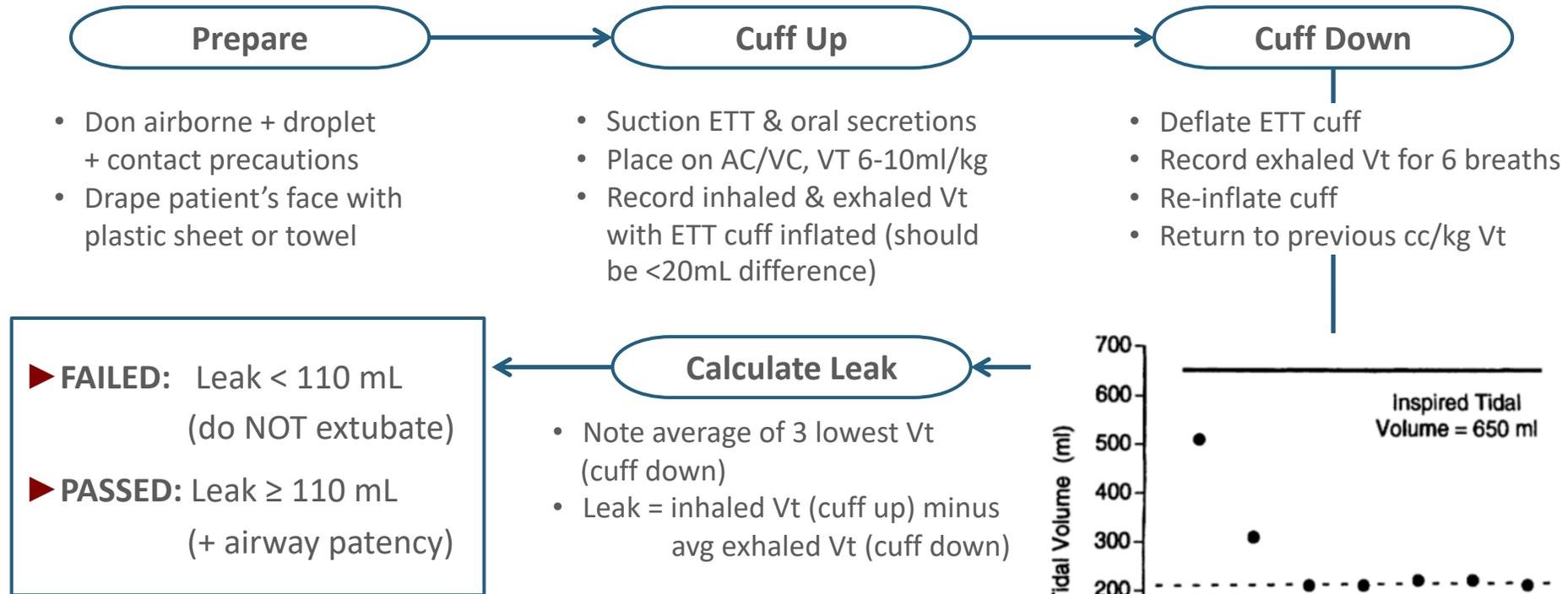


Post Extubation Care



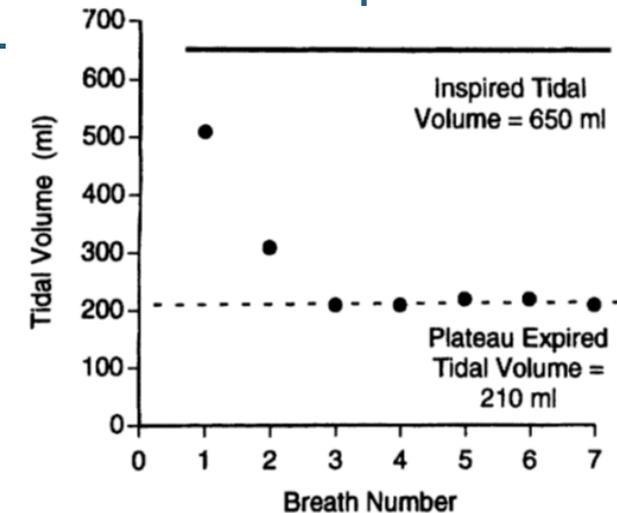
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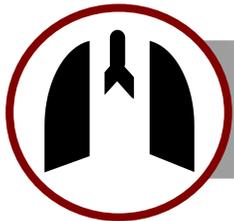
Failed CLT predicts risk of reintubation with 86% specificity, 63% sensitivity



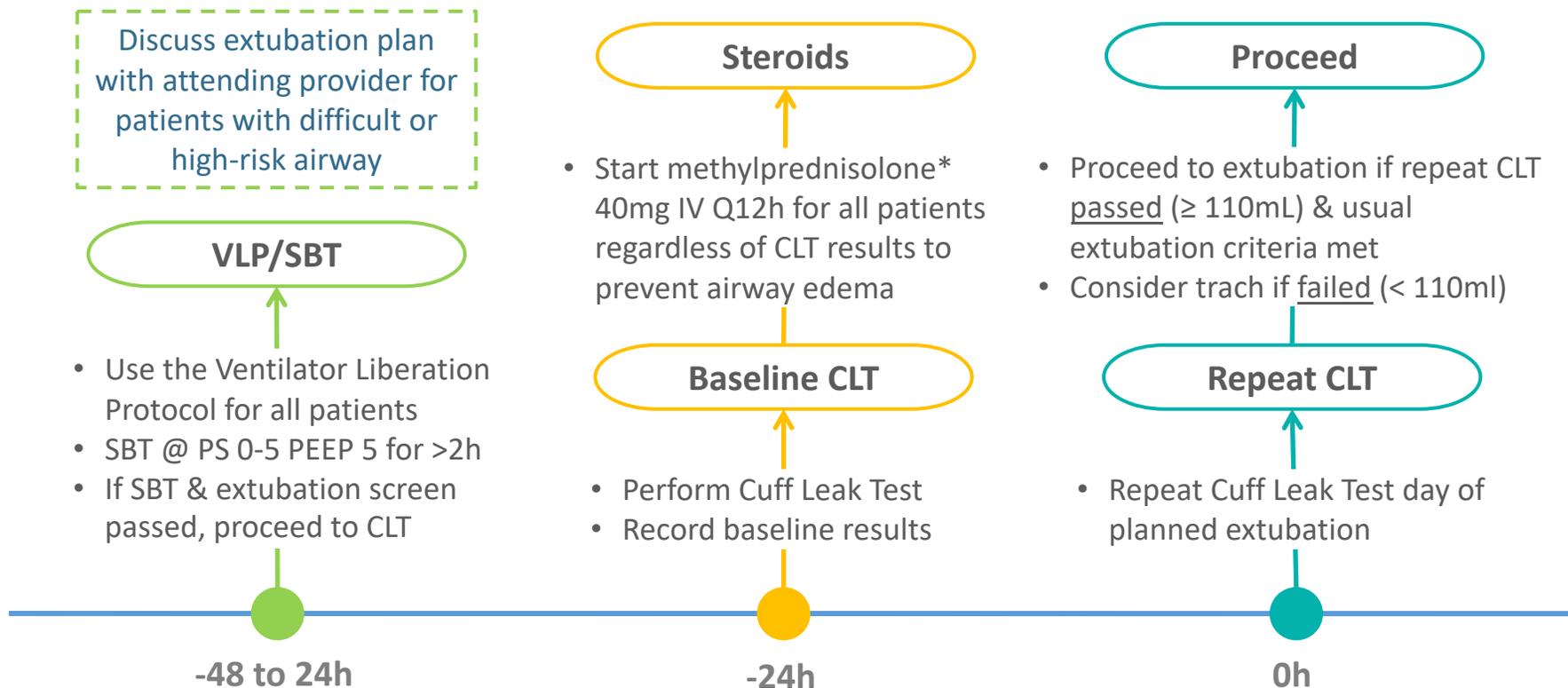
Note: Some studies also use >10% of the inhaled VT, or audible leak as additional criteria for positive leak. However, we would caution reliance on these criteria alone, especially in the era of low tidal volume ventilation.

Note: Can be falsely negative due to secretions around ETT, or large caliber ETT.





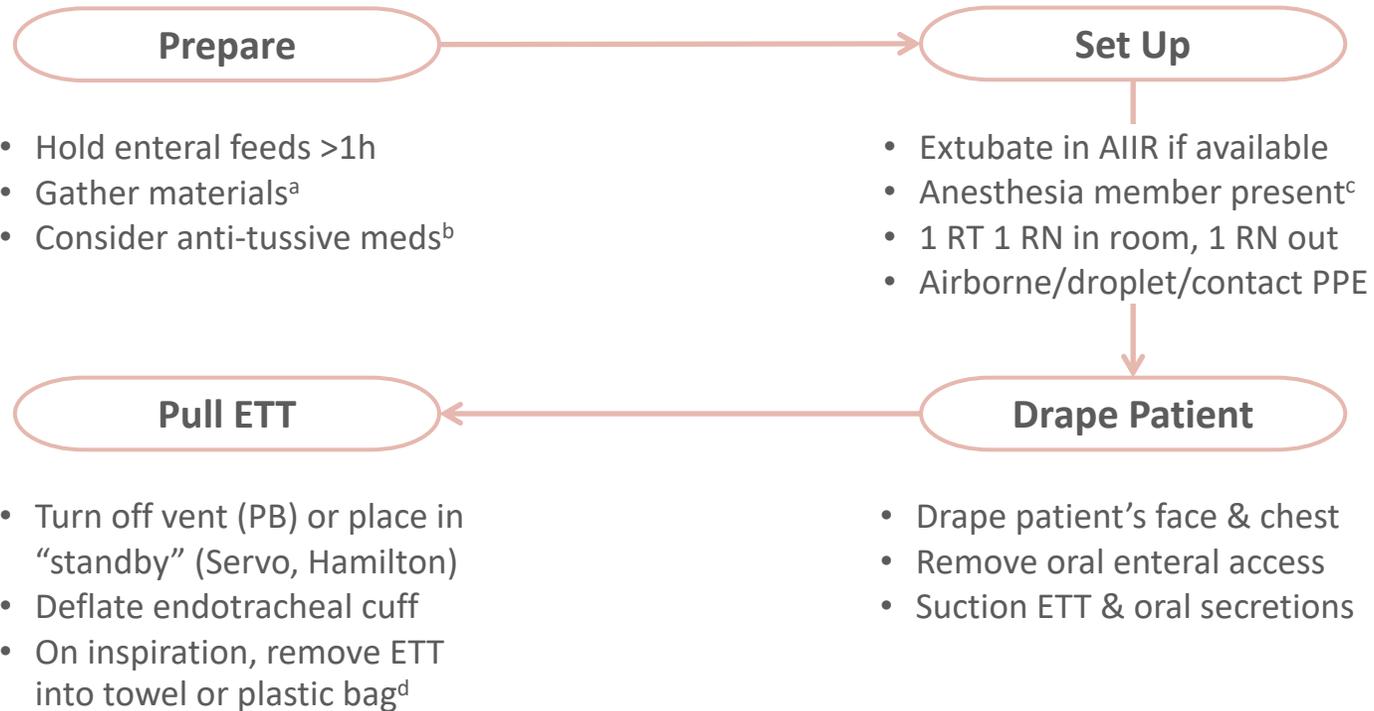
Anticipating Extubation



*Can also consider dexamethasone 8mg Q12



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Post Extubation Care

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- NC 2-6 LPM vs. NRB 10-12 LPM vs. HFNC 10-60 LPM up to 100% FiO₂, or helmet CPAP
- Cover patient with surgical mask over O₂ device

Monitor Closely

- SaO₂ goal 92-96%
- Observe for 20-30 min
- If ↑ WOB or SaO₂ <92%, consider reintubation

Follow Up Care

- Continue steroids to complete 48-hour regimen
- Intubated >48h: consult SLP before PO
- Intubated <48h: NPO x 4h → RN eval

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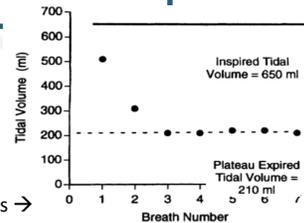
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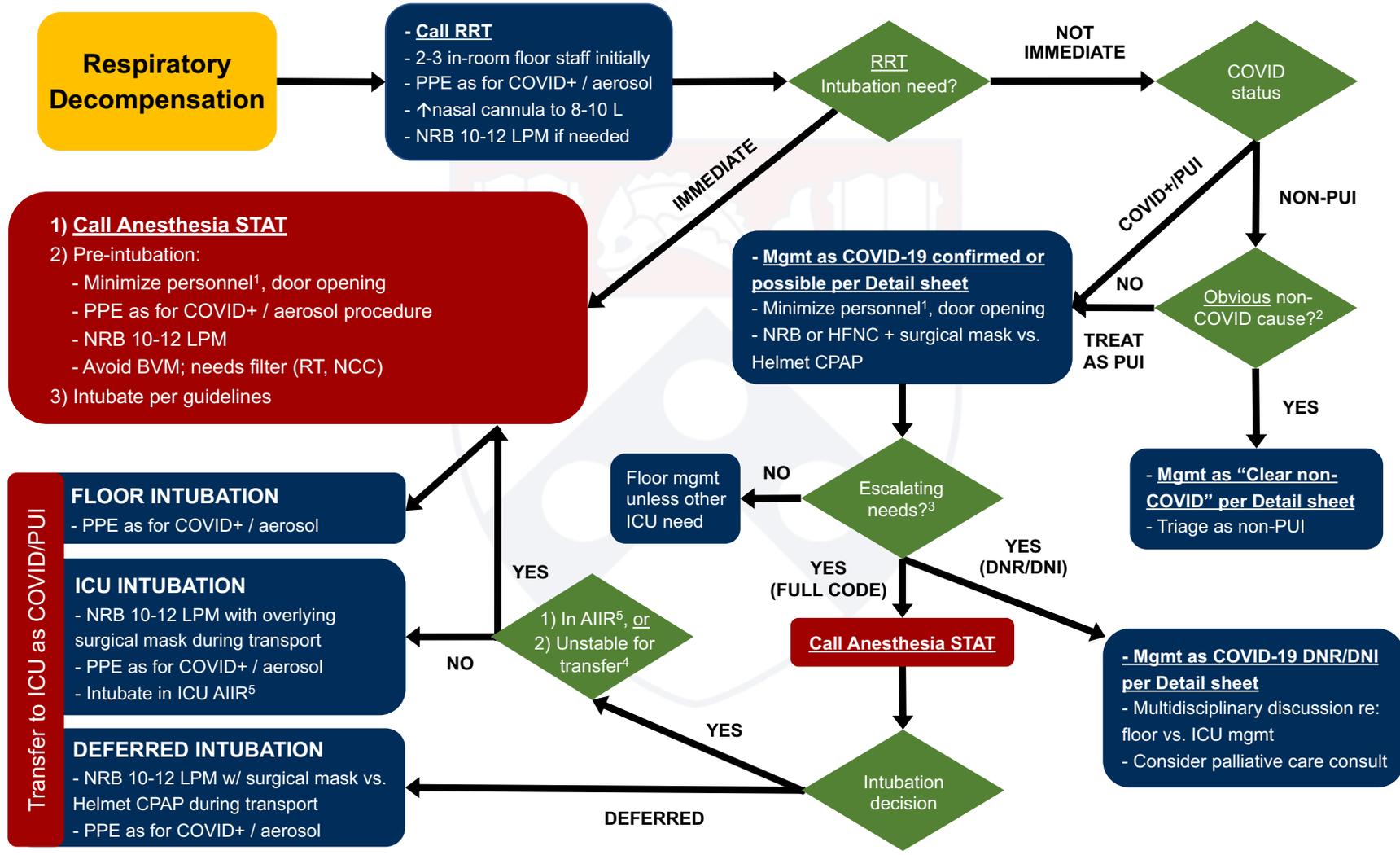


Post Extubation Care

Penn Medicine COVID-19 Clinical Guide: Respiratory Clinical Emergencies

See accompanying Detailed Respiratory Therapy Escalation sheet

See complete SharePoint guideline for details – Updated 4/20/20 – Recommendations may evolve rapidly – Do not save file – If printed, update frequently – See latest version [here](#)



¹Anesthesia (1-2); Nurse (1); RT (1); RRT provider (1) ²E.g. witnessed aspiration ³Persistent higher O₂ needs, ↑work of breathing ⁴Plan for ↑ transport time for PUIs
⁵Airborne Infection Isolation Room, i.e. negative pressure room

Penn Medicine COVID-19 Clinical Guide: Detail Respiratory Therapy Escalation

See accompanying Decision Pathway for Respiratory Clinical Emergencies

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COVID-19 STATUS					
Clear Non-COVID Etiology	<table border="1"> <tr> <td>COVID-19 Possible / PUI</td> <td>COVID-19 Confirmed</td> </tr> </table>	COVID-19 Possible / PUI	COVID-19 Confirmed		
COVID-19 Possible / PUI	COVID-19 Confirmed				
Upgrade to droplet + contact PPE	Upgrade to airborne + contact PPE given the likelihood of aerosol-generating interventions				
HYPOXEMIA (↑WOB or SaO ₂ <92% on 6L LPM)					
Normal Management (HFNC, NRB, etc.)	Consider Early Intubation <i>given risk of rapidly progressive respiratory failure</i>				
	<table border="1"> <tr> <td>Trial HFNC Flow: 10-60 LPM – FiO₂: up to 100%</td> <td rowspan="3">Place surgical mask over nose/mouth & O2 delivery device</td> </tr> <tr> <td>-or- Temporize with NRB Flow: 10-12 LPM</td> </tr> <tr> <td>-or- Trial Helmet CPAP Flow: 50 LPM – FiO₂: up to 60% – PEEP: 5-10 HFNC as needed for breaks (e.g. during sleep)</td> </tr> </table>	Trial HFNC Flow: 10-60 LPM – FiO ₂ : up to 100%	Place surgical mask over nose/mouth & O2 delivery device	-or- Temporize with NRB Flow: 10-12 LPM	-or- Trial Helmet CPAP Flow: 50 LPM – FiO ₂ : up to 60% – PEEP: 5-10 HFNC as needed for breaks (e.g. during sleep)
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	-or- Trial Helmet CPAP Flow: 50 LPM – FiO ₂ : up to 60% – PEEP: 5-10 HFNC as needed for breaks (e.g. during sleep)				
Consider ICU transfer (see accompanying Decision Pathway)					
If trial without intubation, REASSESS within 1 HR					
HYPERCAPNIA					
Trial NPPV* Healthcare workers wear N95 + face shield & minimize door opening until COVID testing neg (Call ID for expedited COVID testing)	Consider Early Intubation <i>given risk of rapidly progressive respiratory failure</i>				
	Trial NPPV* PS 5-10 – PEEP: 8-10 – FiO ₂ : 60% (SaO ₂ goal 88-92%)				
	Consider ICU transfer				
*Call NIV team for approval on medical floors (approval not needed in ED or ICU) Use non-vented mask + active ventilation circuit w/ exhalation filter Avoid patient transport on NPPV					
REASSESS → usual management	If trial, REASSESS within 1 HR				

Stable Chronic Hypercapnia

Regardless of COVID-19 Status
OSA only: No NPPV allowed for this indication
COPD, OHS, NMD: contact NIV team for recs

***NIV Team Phone Numbers**

HUP: 215-964-7480 CCH: 610-731-9736
 PMC: 267-591-3767 MCP: 732-672-6450
 PAH: 610-529-5171 chronic LGH: 412-491-7603
 215-498-6357 acute

COVID-19 DNR/DNI

Patients with **restorative** goals

Mgmt same as per table with the following modifications:

Opioid PO or IV PRN first line symptom mgmt

Engage multidisciplinary discussion to consider whether patient can be safely managed on floor despite high FiO₂

Do NOT intubate

Patients with **comfort measures only** goals

Supplemental O₂ via NC up to 6 LPM
 Opioid PO or IV PRN first line symptom mgmt

INTUBATION

All intubations, including ICU intubations should be called **overhead STAT**

See accompanying **Decision Pathway** for intubation, triage, and ICU transfer processes

For most patients, use **Low Stretch Protocol for ARDS**

SaO₂ < 92% or pH < 7.3
despite maximal interventions

Questions? Front Line Experience?

Penn Medicine COVID-19 Clinical Guide: Endotracheal Tube Obstruction

Updated 4/20/20 – Recommendations may evolve rapidly – Do not save file – If printed, update frequently – Check for latest version [here](#)

Signs of Loss of ETT Patency

AC/VC	PSV/PC
↑ Peak airway pressures (Paw) Prolonged exp times	PSV: Prolonged insp/exp times PC: Prolonged exp times
<i>Note: Vt may not fall until near complete occlusion¹</i>	
Mechanics	Patient
↑ Airway resistance (Raw) ↓ Compliance Progressive auto-PEEP	Difficulty passing suction catheter Retractions/increased WOB Resp efforts fail to trigger breaths

ETT Obstruction Overview

↑ Incidence in COVID-19, especially with non-humidified vent circuits

- Small decreases in ETT diameter result in large increases in resistance
- Unexplained asynchrony or difficulty tolerating spont modes warrant evaluation
- Progressive autoPEEP & ↑ Paw/Raw on AC/VC square wave warrant urgent mgmt

Suction Catheter RED FLAGS:
Difficulty passing → urgent intervention; Inability to pass → emergent intervention

Monitoring Resistance

	Normal Lungs	ARDS	COPD
Resistance (cmH2O/L/s)	10 – 15	10 – 15	10 – 30
Compliance (ml/cmH2O)	> 60	10 – 50	> 60
Peak Airway Pressure (cmH2O)	< 20	< 35	20-60

Raw > 15 is abnormal

Measure Q12h & with clinical/ventilator changes warranting reassessment

Place patient on AC/VC square wave flow pattern to measure

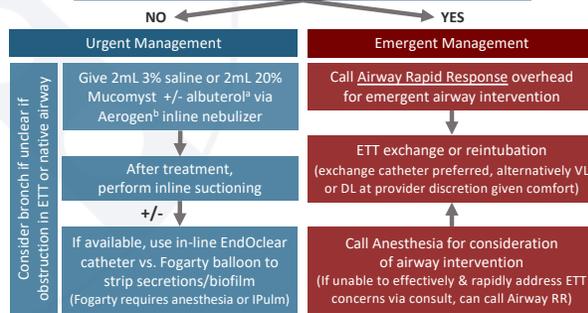
Patient must be passive for accurate measurement; if high concern for obstruction, consider temporary sedation +/- paralysis to obtain accurate vent mechanics



On AC/VC Square Wave
On flow 60L/min:
Raw = PIP – Plat
Other flow rates:
Raw = (PIP – Plat) / Flow (L/s)
(Vent will calculate & display Raw)

Treating & Reversing ETT Obstruction

Clinical Instability and/or Inability to Pass Suction Catheter?



Concern for persistent ETT obstruction

NOTE: Airway Rapid Response previously used for emergent airway loss
Now can be called for unstable airway with risk of impending airway loss

- To prevent bronchospasm
- If Aerogen not available, directly instill medication into ETT, DO NOT use open nebs

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Cuff Leak Testing



Post Extubation Care

¹Tung. Anesth Analog. 2002

Created by Jen Ginestra, MD, Pulmonary & Critical Care Medicine; Adapted from UPHS Critical Care Committee Guidelines

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