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# Practical Guidance for Tracheal Intubation of Patients With COVID-19



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The novel coronavirus (COVID-19) pandemic has created an urgent need for pragmatic best-practice approaches that maximize safety for both patients and care providers during the tracheal intubation of patients who are suspected or confirmed to be infected. Literature reporting experiences during the severe acute respiratory syndrome (SARS) epidemic revealed that providers who engaged in tracheal intubation had a substantial increase in risk of viral transmission.<sup>1-3</sup> Longstanding principles of emergency airway management, including excellent preoxygenation and rapid sequence intubation techniques, apply to patients with suspected or confirmed COVID-19 infection. However, some accepted and common practices may also substantially increase the risks to health care providers in this setting: Specifically, droplet generation and aerosol generation before, during, and after tracheal intubation creates risk for the proceduralist.

We convened a multidisciplinary working group of acute care providers to develop a novel shared paradigm for tracheal intubation at Mayo Clinic Hospital during the COVID-19 pandemic. Our working group consisted of representatives from the specialties of anesthesiology, critical care medicine, emergency medicine, pediatric anesthesiology, pediatric critical care medicine, and pediatric emergency medicine. Our implementation of novel care processes, which was guided by existing empiric data and expert consensus, involved 3 discrete steps: multidisciplinary review and synthesis of current knowledge; development of novel

care processes and cognitive aids to assist providers at the bedside within our institution; and, most importantly, robust generation of a shared mental model of the novel paradigm of airway care during the COVID-19 pandemic. We were guided by 2 overarching goals—safe patient care during tracheal intubation and safety of the patient care team—and 3 core principles: minimize aerosol generation, maximize first attempt success, and minimize exposure of care providers.<sup>4-11</sup>

Our group used existing expert recommendations and supporting evidence to generate discrete and broadly applicable steps for providers to use during the tracheal intubation of patients with suspected or known COVID-19 (Table). We engaged in an iterative process to ensure that each step was applicable to each specialty group, avoiding a focus on niche interests that could create confusion in varied care settings. We paid particular attention to highlight areas in which processes were novel (eg, avoidance of positive pressure mask ventilation to decrease aerosol generation, the use of a viral filter, and limiting ventilation circuit disconnections) and differed from existing accepted tracheal intubation practices. We used this information to generate novel cognitive aids in the form of procedural checklists for adult and pediatric patients (Figures 1 and 2) for bedside use in our institution. We then employed webinars to conduct frequent informational sessions and discussions to facilitate the development of a robust shared mental model at our institution.



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**TABLE. Mayo Clinic Hospital COVID-19 Pandemic Intubation Guideline**

## Preparation

1. Don appropriate PPE: N95 mask + face shield or PAPR with bonnet, gown, double gloves, and booties, while a team member observes for proper technique.
2. Lean team: only necessary personnel during AGP.
3. Back-up provider with donned PPE outside, in communication with team (eg, speakerphone).
4. Call for help early if a difficult airway is anticipated.
5. Closed-loop, detailed communication of the intubation plan and back-up plan.
  - a. Prepare equipment for preoxygenation and first intubation attempt.
  - b. Ensure that back-up equipment is prepared in sealed bag, easily accessible in room.
6. Close the door, and hang "Procedure in Progress" sign during AGP.

## Procedure

7. Use an intubation checklist (Adult or Pediatric).
8. Intubation should be performed by an experienced provider.
9. Preoxygenation for 3 to 5 minutes with 100% O<sub>2</sub> with tight mask seal and viral filter.
  - a. Prioritize spontaneous patient breathing, avoiding deep breaths (may cause cough).
10. RSI technique with high-dose paralytic, unless contraindicated.
  - a. Young children may not tolerate apnea and may require careful mask ventilation.
11. Await full paralysis (45 to 60 seconds) and apnea before removing the preoxygenation device.
12. Video laryngoscopy is strongly preferred (but best device for provider should be used).
  - a. If performing direct laryngoscopy, maximize the provider face-to-patient face distance.
13. Consider use of early rescue SGA (Air-Q LMA [Salter Labs, Chicago, Illinois] or King LT [Eugene, Oregon]) if first attempt is unsuccessful.
14. Mask ventilate ONLY IF CRITICAL NEED (OPA, tight 2-hand seal, viral filter, low TV breaths).
15. Immediately inflate the ETT cuff (including children) before ventilating patient.
16. Remove outside pair of gloves, and use hand sanitizer on inner gloves.
17. Attach ventilator circuit.
  - a. Circuit with HME (ETT: in-line suction; HME/filter: capnography device, circuit).
  - b. Circuit without HME (ETT: in-line suction; capnography device, circuit).
18. Confirmation with visualization, waveform capnography, and bilateral chest rise.
  - a. When in question, auscultation, colorimetric capnography, or POCUS may be required.

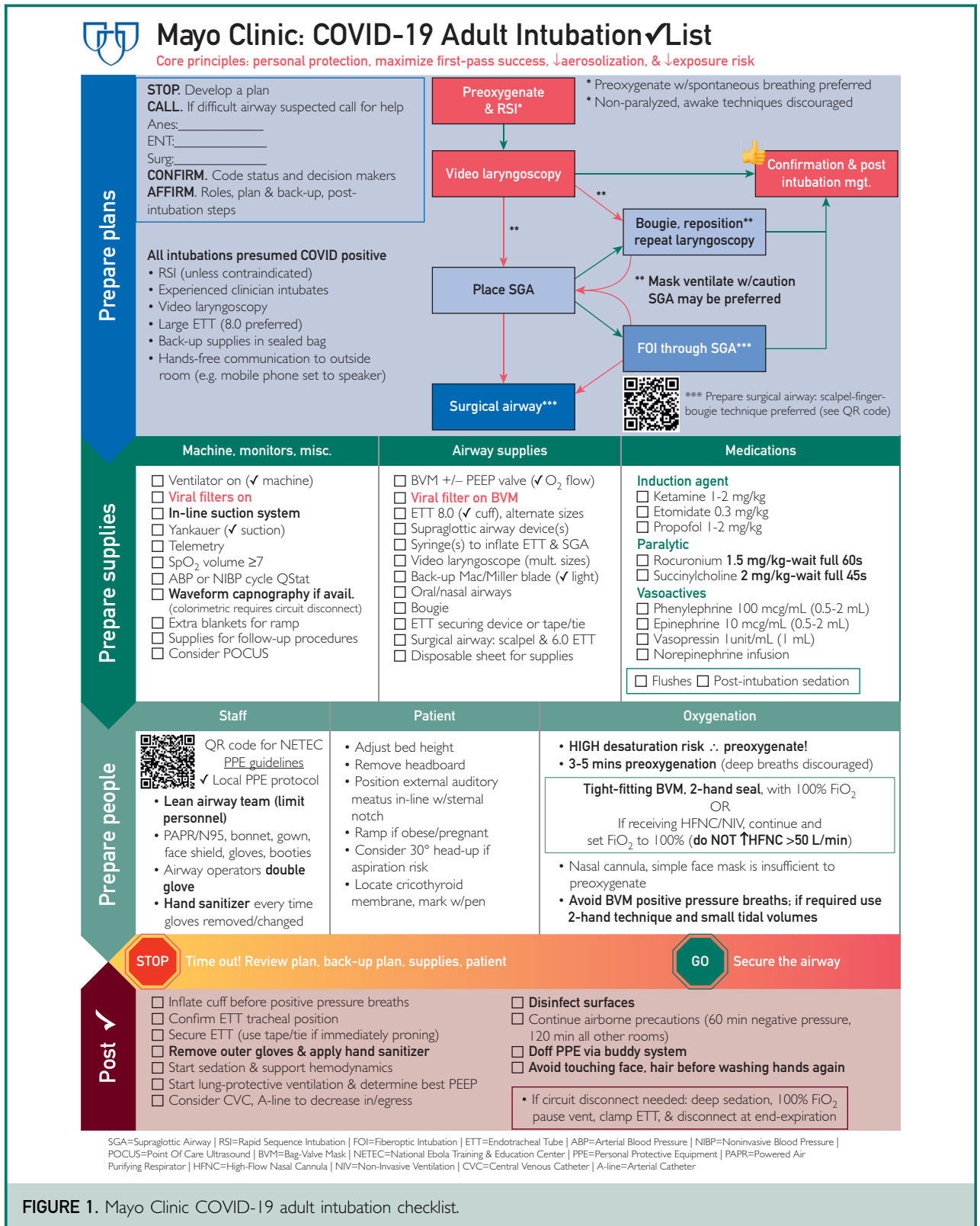
## Postprocedure

19. Limit disconnections of the ventilator circuit.
  - a. Ventilator paused at end expiration, excellent sedation/paralysis, and consider ETT clamp.
20. Dispose of all airway equipment immediately in a predesignated plastic bag.
21. Doff PPE while a team member observes for proper technique, avoiding contamination.
22. After intubation, note time on door when room may be entered without airborne PPE (varies by room and requires air turnover of at least 7 times).

AGP = aerosol-generating procedure; ETT = endotracheal tube; HME = heat and moisture exchanger; LMA = laryngeal mask airway; LT = laryngeal tube; OPA = oropharyngeal airway; PAPR = powered air purifying respirator; POCUS = point of care ultrasound; PPE = personal protective equipment; RSI = rapid sequence intubation; SGA = supraglottic airway; TV = tidal volume.

Multiple guidelines and resources have been published in recent months to provide conceptual guidance to providers as they navigate new paradigms of care during the COVID-19 pandemic. We believe it is imperative that each institution

employs a multidisciplinary approach to implement these principles effectively within their individual care settings. We share our novel cognitive aids here in the hope that they may serve as useful guides to others.





# Mayo Clinic: COVID-19 Pediatric Intubation ✓List (age<18yr)

Core principles: personal protection, maximize first-pass success, ↓aerosolization, & ↓exposure risk

Prepare plans

**STOP.** Develop a plan  
**CONFIRM.** Code status & decision makers  
**CALL.** If difficult airway suspected call for help  
 Anes: \_\_\_\_\_  
 ENT: \_\_\_\_\_  
 Surg: \_\_\_\_\_  
**AFFIRM.** Roles, plan & back-up, post-intubation steps

**All intubations presumed COVID positive**

- RSI (unless contraindicated)
- Experienced clinician intubates
- Use cuffed ETT
- Back-up supplies in sealed bag
- Calculate ETT, SGA size & insertion depth

^ **Use preferred intubation technique** (maximize 1st-pass success)  
 • Video laryngoscopy recommended if experienced  
 • Direct laryngoscopy acceptable

\* Preoxygenate w/spontaneous breathing preferred  
 \* Infants/young children may not tolerate RSI & may require mask ventilation before laryngoscopy  
 \* Non-paralyzed techniques are highly discouraged

\*\* Mask ventilate w/caution  
 Excellent mask seal  
 Two-hand technique

Prepare supplies

**ETT, machine & monitors**

- ETT (cuffed) size: (Age/4)+3
- ETT depth (cm)=ETT I.D.x3
- Ventilator on (✓ machine)
- Viral filters on**
- In-line suction system**
- Yankauer (✓ suction)
- Telemetry
- SpO<sub>2</sub> volume ≥7
- ABP or NIBP cycle QStat
- Waveform capnography if avail.** (colorimetric requires circuit disconnect)
- Stethoscope for ETT placement (designate assistant to auscultate)

**Airway supplies**

- BVM +/- PEEP valve (✓ O<sub>2</sub> flow)
- Viral filter on BVM** (ventilation as required for dead space)
- ETT (✓ cuff), alternate sizes
- Mac/Miller/Phillips blade (✓ light)
- Supraglottic airway device(s)
- Syringe(s) to inflate ETT & SGA
- Video laryngoscope (mult. sizes)
- Oral/nasal airways
- +/- Bougie (older children)
- ETT securing device or tape/tie
- Disposable sheet for supplies
- Blankets for positioning

**Medications**

**Induction agent**

- Etomidate 0.3 mg/kg
- Ketamine 1-2 mg/kg
- Propofol 1-2 mg/kg

**Paralytic (wait for complete paralysis)**

- Rocuronium 1.5 mg/kg
- Succinylcholine 2 mg/kg\*

\*Consider atropine 0.01 mg/kg

**Vasoactives**

- Ephedrine 0.1 mg/kg
- Epinephrine 1 mcg IV PRN
- Dopamine 5-15 mcg/kg/min

Flushes     Post-intubation sedation

Prepare people

**Staff**

QR code for NETEC PPE guidelines  
 ✓ Local PPE protocol

- **Lean airway team (limit personnel)**
- PAPR/N95, bonnet, gown, face shield, gloves, booties
- Airway operators **double glove**
- **Hand sanitizer** every time gloves removed/changed

**Patient**

- Adjust bed height
- Remove headboard
- <2 yrs: consider shoulder roll
- ≥2 yrs: position external auditory meatus in-line w/ sternal notch
- Ramp if obese (older children)

**Oxygenation**

- **HIGH desaturation risk ∴ preoxygenate!**
- **3-5 mins preoxygenation** (deep breaths discouraged)

**Tight-fitting BVM, 2-hand seal, with 100% FiO<sub>2</sub>**  
 OR  
 If receiving HFNC/NIV, continue and set FiO<sub>2</sub> to 100% (do NOT ↑HFNC >50 L/min)

- Age/developmental status may preclude preoxygenation
- **If BVM breaths required: use 2-hand technique & small tidal volumes**

Post ✓

**STOP** Time out! Review plan, back-up plan, supplies, patient

- Inflate cuff before positive pressure breaths
- Confirm ETT tracheal position
- Secure ETT
- Remove outer gloves & apply hand sanitizer**
- Start sedation & support hemodynamics
- Start lung-protective ventilation & determine best PEEP
- Consider CVC, art-line to decrease in/egress
- Disinfect surfaces**

**GO** Secure the airway

- Continue airborne precautions (60min negative-pressure, 120min all other rooms)
- Doff PPE via buddy system**
- Avoid touching face, hair before washing hands again**

- If circuit disconnect needed: deep sedation, 100%FiO<sub>2</sub> pause vent, clamp ETT, & disconnect at end-expiration

SGA=Supraglottic Airway | RSI=Rapid Sequence Intubation | FOI=Fiberoptic Intubation | ETT=Endotracheal Tube | I.D.=Internal Diameter | ABP=Arterial Blood Pressure | NIBP=Noninvasive Blood Pressure | POCUS=Point Of Care Ultrasound | BVM=Bag-Valve Mask | NETEC=National Ebola Training & Education Center | PPE=Personal Protective Equipment | PAPR=Powered Air Purifying Respirator | HFNC=High-Flow Nasal Cannula | NIV=Non-Invasive Ventilation | CVC=Central Venous Catheter | A-line=Arterial Catheter

FIGURE 2. Mayo Clinic COVID-19 pediatric intubation checklist.

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