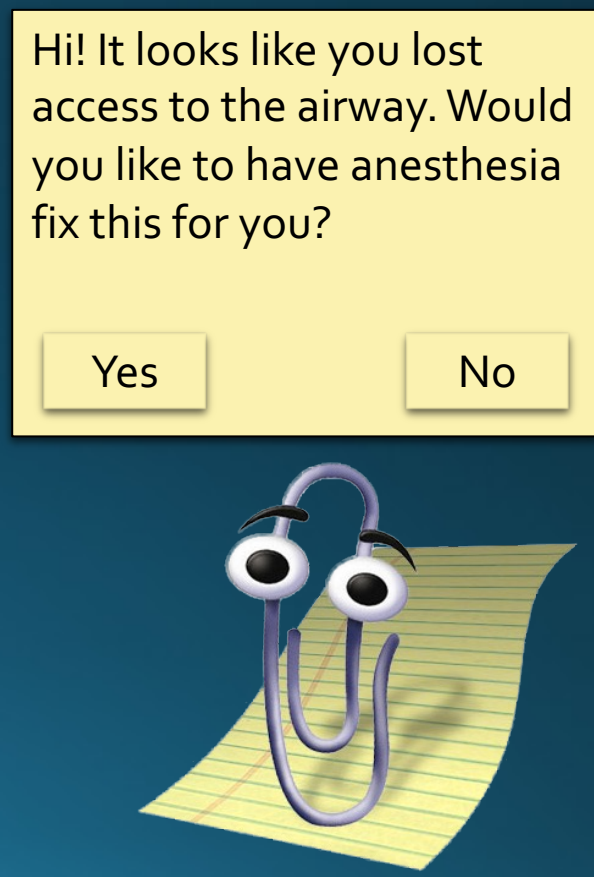
Presenter: Eric Tzeng, MD

# Emergency Airway Management

# Case Presentation

- Get paged for intubation in CCU
- 63m with STEMI who was intubated in ED and taken to cath lab (3 vessel disease)
- Endotracheal dislodged during transport
- RT bagging patient



# What is the urgency of the consult?

- **Elective or semi-elective**: you have ample time
  - needs an airway for a procedure
  - anticipated airway management for inhalation burn injury
- **Urgent**: many minutes to hours
  - altered mental status with mild hypoxia corrected by face mask
  - hypoxemia requiring high flow nasal cannula with increased work of breathing
- **Emergent**: handful of minutes
  - unintended self-Extubation
  - persistent hypoxemia or hypercapnia on BIPAP
- **Code**: patient is dying/dead

# Relevant history

- **A**irway / **B**reathing concerns
- **C**ardiovascular status
- **D**rugs and special considerations for induction
- **E**verything else: leave to the primary team!

# Back to the case: Intubation

- Per chart apparently took 3 attempts in ED and used a D blade
- Easy bag mask ventilation
- Grade 1 view with Mac 3 blade

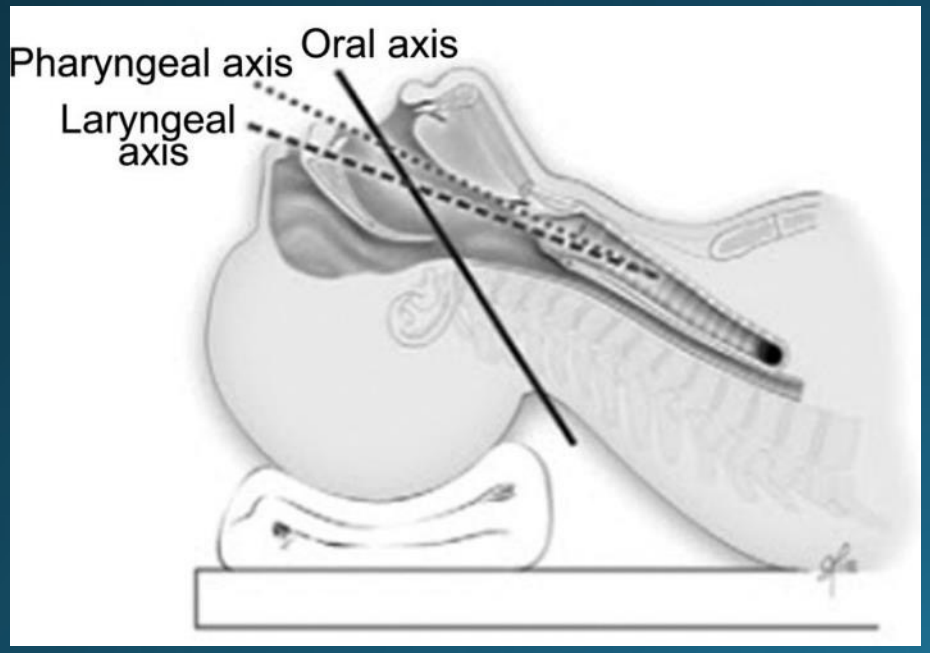

# Vitals

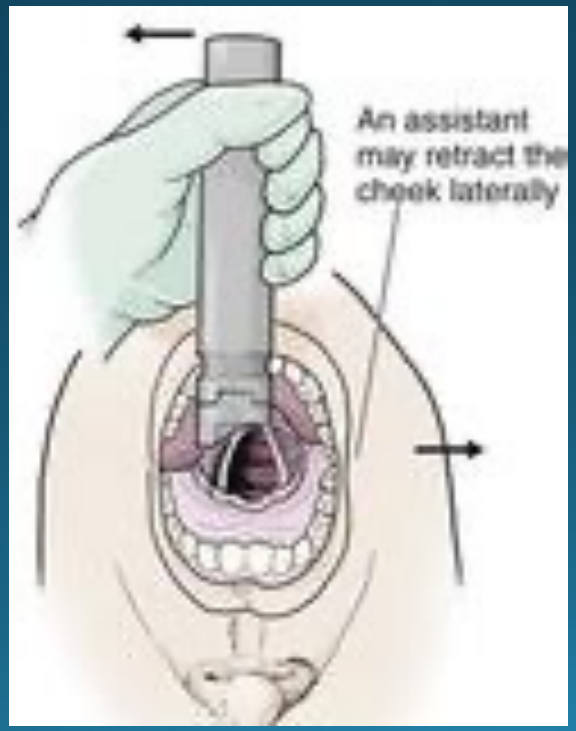
| Time: | 1511 | 1535 | 1540 | 1545 | 1547 | 1551 | 1553 | 1554 | 1555 | 1556 | 1557 | 1559 | 1600 | 1601 | 1602 | 1605 | 1609 | 1610 | 1611 | 1612 | 1615 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp | | 36.5 | | | | | | | | | | | | | | | | | | | |
| Heart Rate | 67 | 69 | | | 66 | 61 | 64 | 61 | 61 | 61 | 60 | | 64 | | 68 | 67 | 62 | 71 | 66 | 70 | 79 |
| Rhythm | | Sinus... | | | | | | | | | | | | | | | | | | | |
| Resp Rate | 17 | 16 | | | 11 | 13 | 15 | 21 | 16 | 7 | 7 | | 12 | | 16 | 20 | 10 | 13 | 15 | 13 | 18 |
| BP (Cuff) | | | | | 120/73 | | | | | | | | 78/51 | | 99/68 | 99/48 | 93/53 | 114/55 | | | 111/68 |
| MAP (Cuff) | | | | | 83 | | | | | | | | 58 | | 76 | 62 | 63 | 71 | | | 78 |
| GCS | | 9 | | | | | | | | | | | | | | | | | | | |
| Observations | | pt tr... | | | 2nd p... | | | | | troub... | | PCC t... | ambu ... | labs | anest... | | | | 20mg ... | 100m... | reint... |
| **Pain** | | | | | | | | | | | | | | | | | | | | | |
| **CPOT** | | | | | | | | | | | | | | | | | | | | | |
| **Pain/Sedation Drip** | | | | | | | | | | | | | | | | | | | | | |
| Fentanyl | | | 25 mc... | | | | | | | | | | | | | | | | | | |
| Midazolam | | | 2 mg/hr | | | | | | | | | | 4 mg/hr | | | | | | | | |
| **Oxygenation** | | | | | | | | | | | | | | | | | | | | | |
| SpO2 | 100 | 99 | | | 100 | 100 | 100 | | 100 | | | | 100 | | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| FiO2 (%) | 100 | | | | | | | | | | | | | | | | | | | | |
| **Vent Settings** | | | | | | | | | | | | | | | | | | | | | |
| ETCO2 (mmHg) | | | | | | | | 74 | 67 | 75 | 69 | | | | 65 | 55 | 60 | 61 | 44 | 21 | |
| Vent Mode | VC/C... | | | | | | | | | | | | | | | | | | | | |
| Set Rate (BPM) | 12 | | | | | | | | | | | | | | | | | | | | |
| Resp Rate Total (BPM) | 17 | | | | | | | | | | | | | | | | | | | | |
| Set TV (Control or Target) (ml) | 550 | | | | | | | | | | | | | | | | | | | | |
| Set PEEP (cmH2O) | 5 | | | | | | | | | | | | | | | | | | | | |
| PIP Observed (cm H2O) | 22 | | | | | | | | | | | | | | | | | | | | |
| Measured I:E Ratio | 1:2.6 | | | | | | | | | | | | | | | | | | | | |

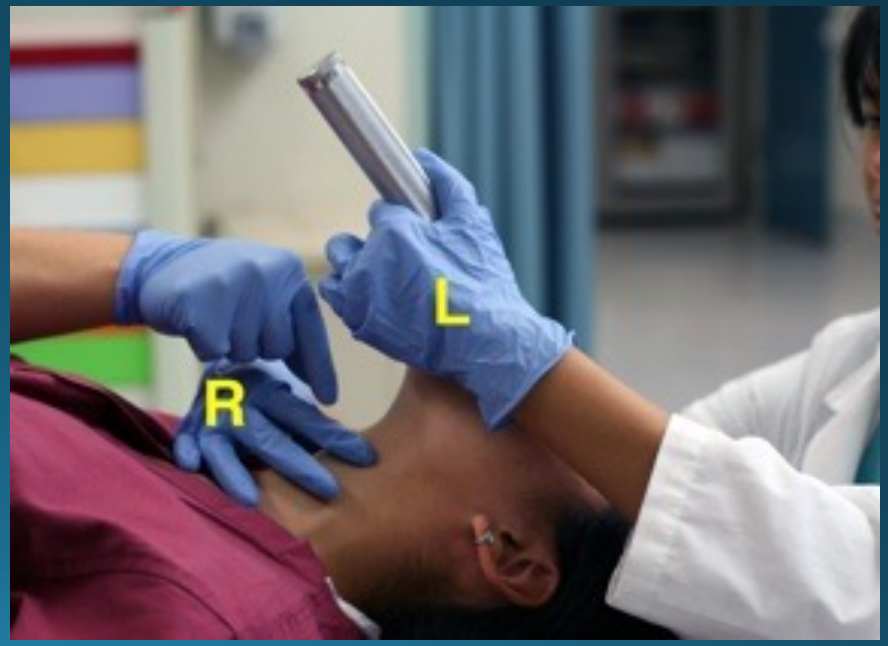
pt transfered from cath lab Cardiology text paged

# Optimal laryngoscopy

- Optimal position: flexion of neck on chest and extension of head on neck
- Complete tongue sweep to the left with laryngoscope flange
- External laryngeal manipulation

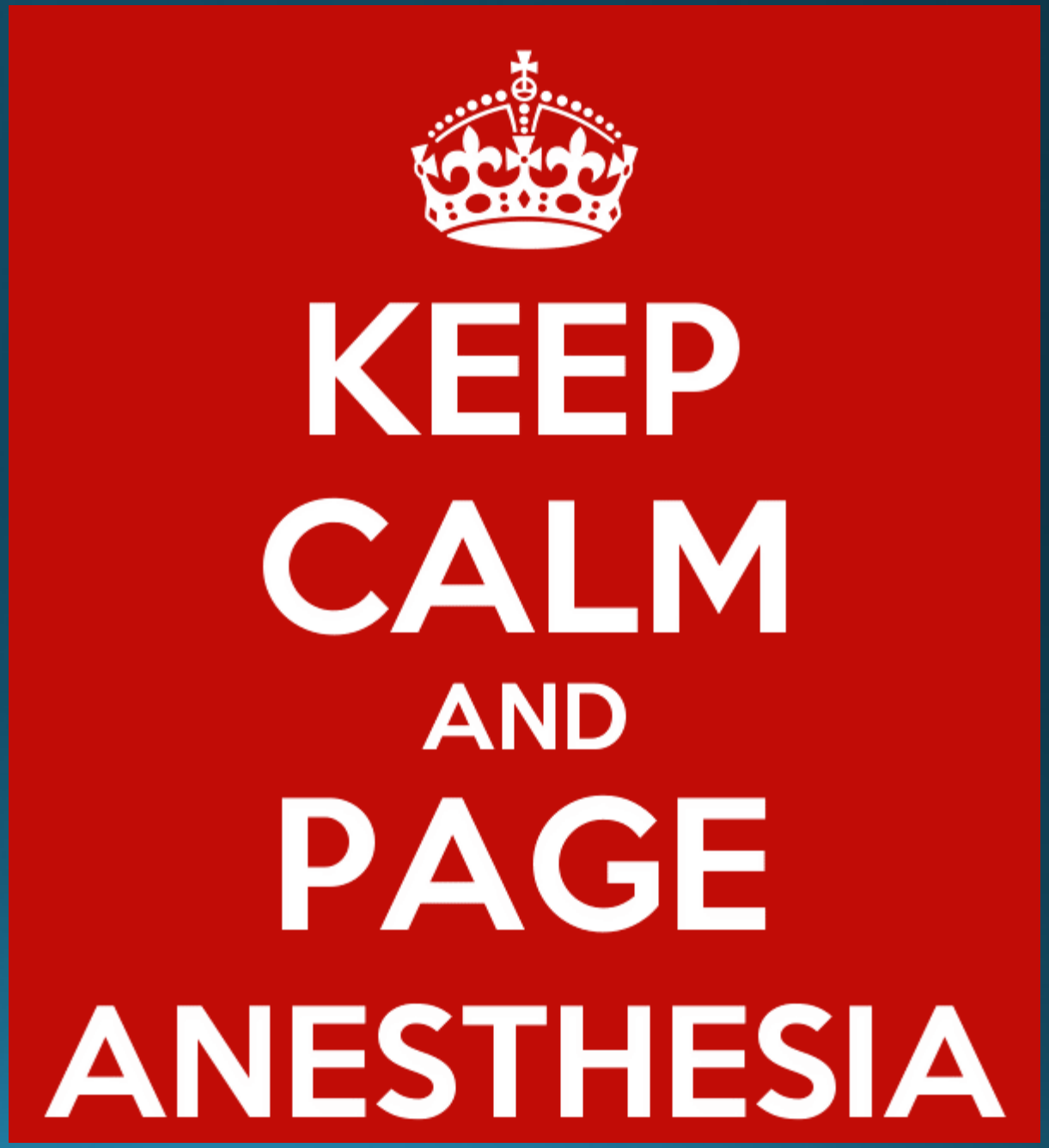


# Extubation…?

- Over 11 days, the patient's mental status improved and was extubated
- After thirty minutes of being extubated, the patient had evidence of increased work of breathing, splinting, and stridorous breath sounds with saturations in the low 90s on NRB mask.
  - 12-14% of planned extubations need to be reintubated in 2-3 days; 20-40% for neuro critical care patients
- Anesthesia was consulted for urgent re-intubation.

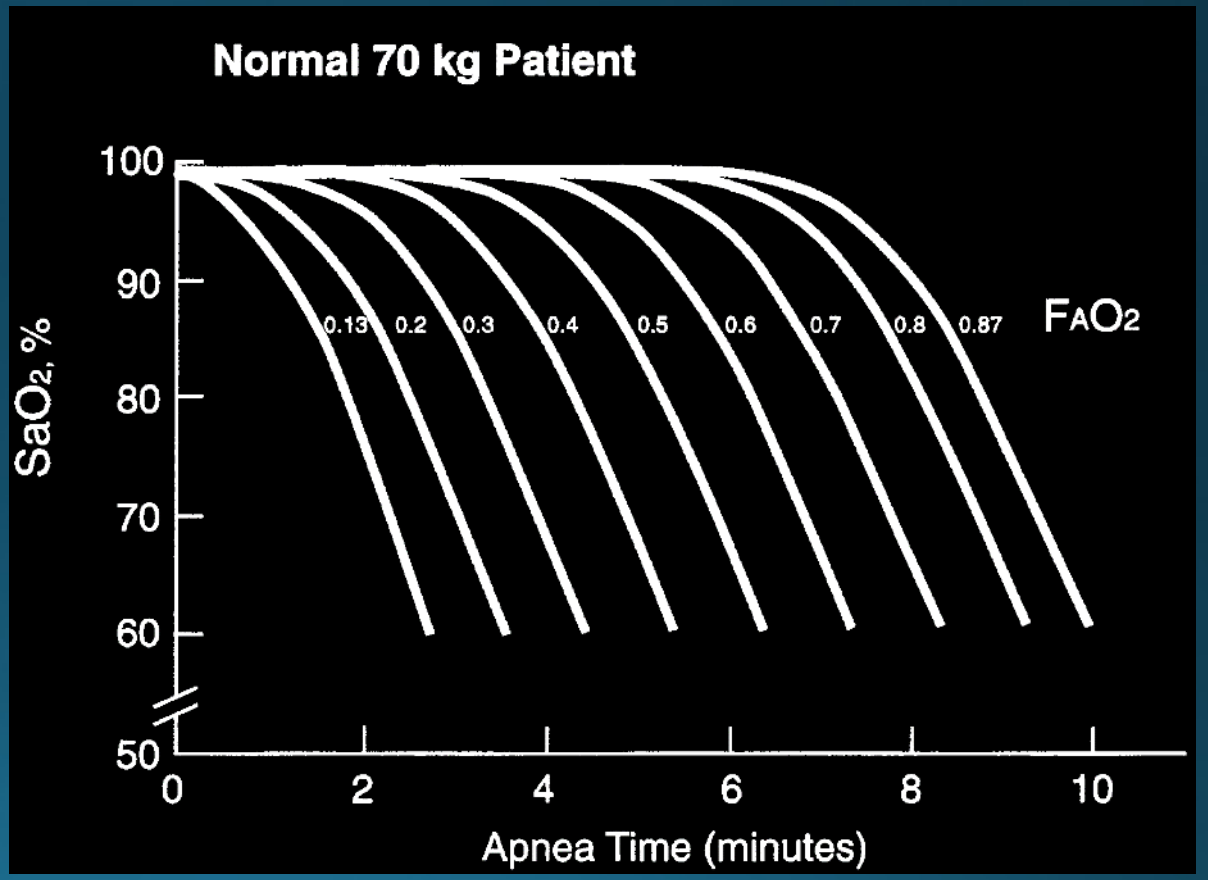


# Intubation: round 2

- A mapleson circuit and 100% Fio2 with bag-mask ventilation was used to assist spontaneous ventilation by the patient for about 5 minutes
- There is a vague, remote history of difficult intubation in the Emergency Department.
- There is a personal memory of an easy intubation 12 days prior without difficulty in bag mask ventilation.
- Thus, conventional direct laryngoscopy is a reasonable start.

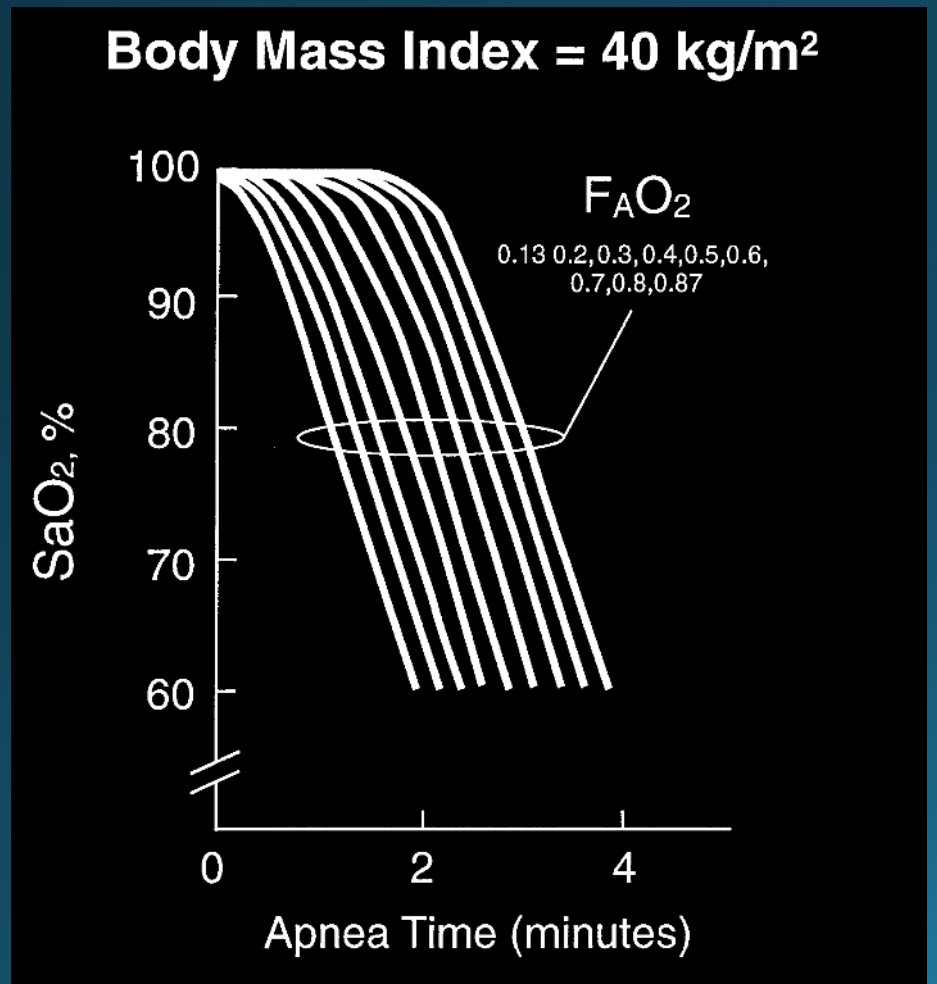
# Preoxygenation

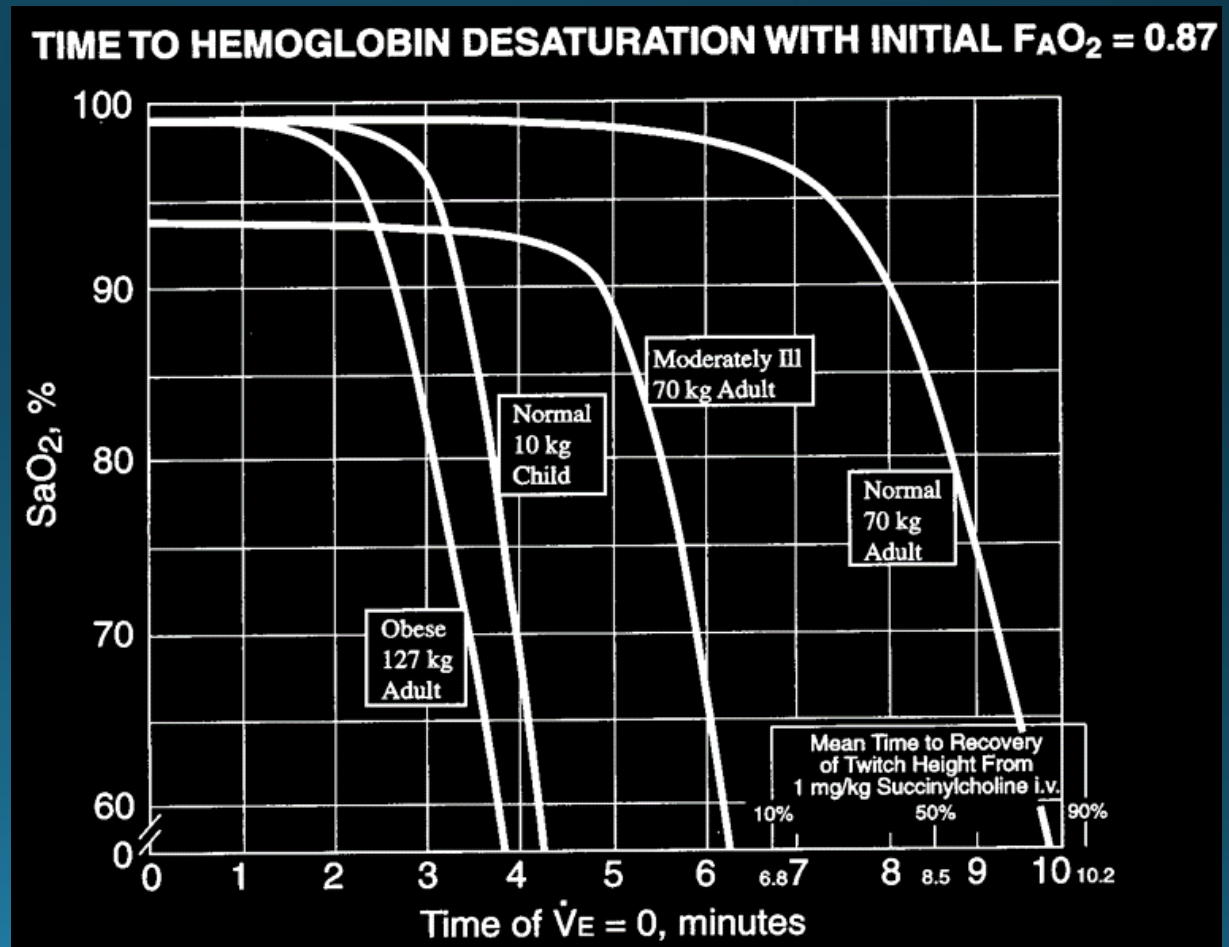
- Denitrogenating lungs
- In an apneic patient, oxygen reserve is present only in FRC
- Average FRC is 30cc/kg of IBW
- Under anesthesia, average O2 consumption is 3cc of O2 per kg per min.



# Preoxygenation

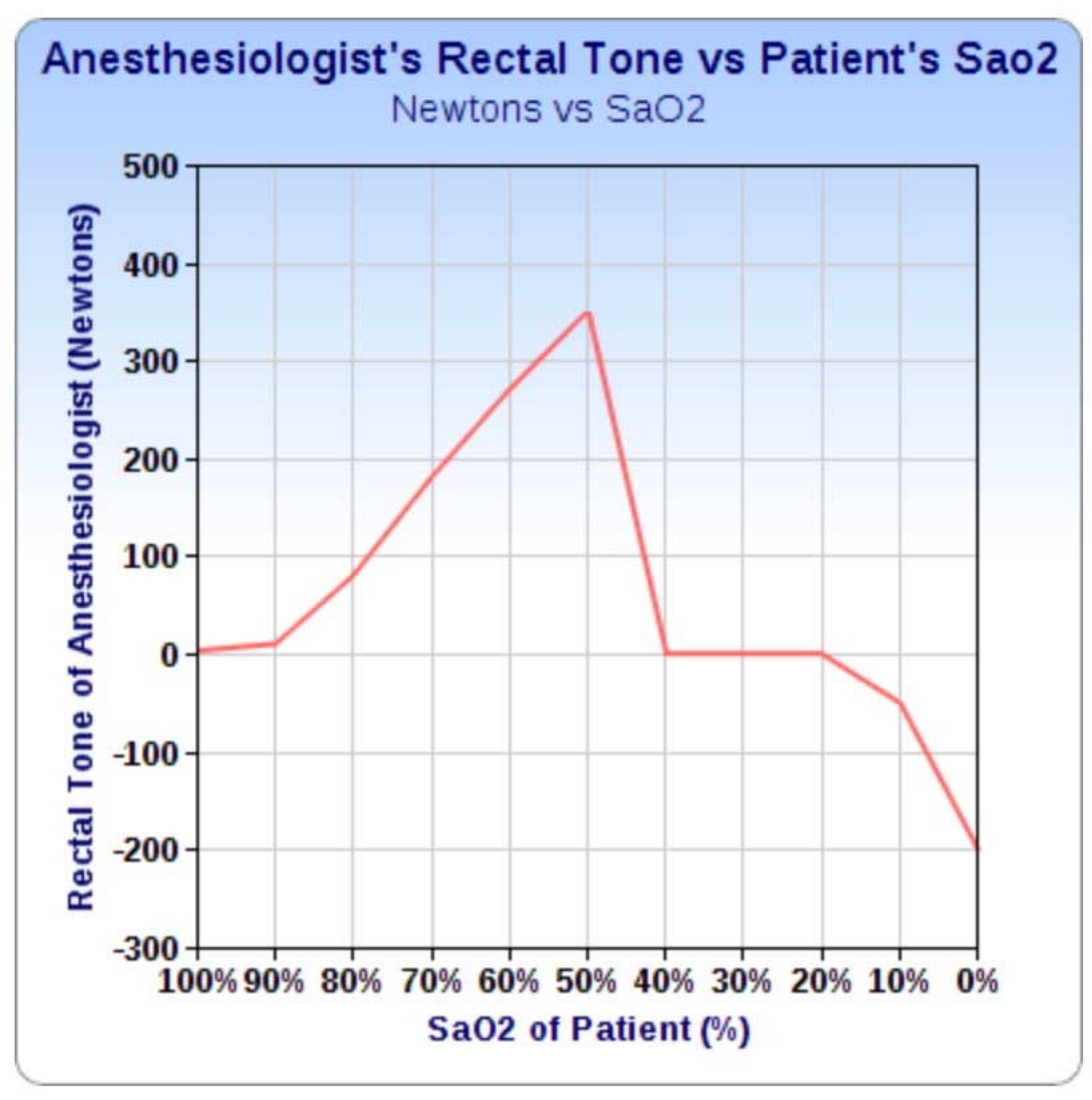
- Less time for obese patients or with lung disease

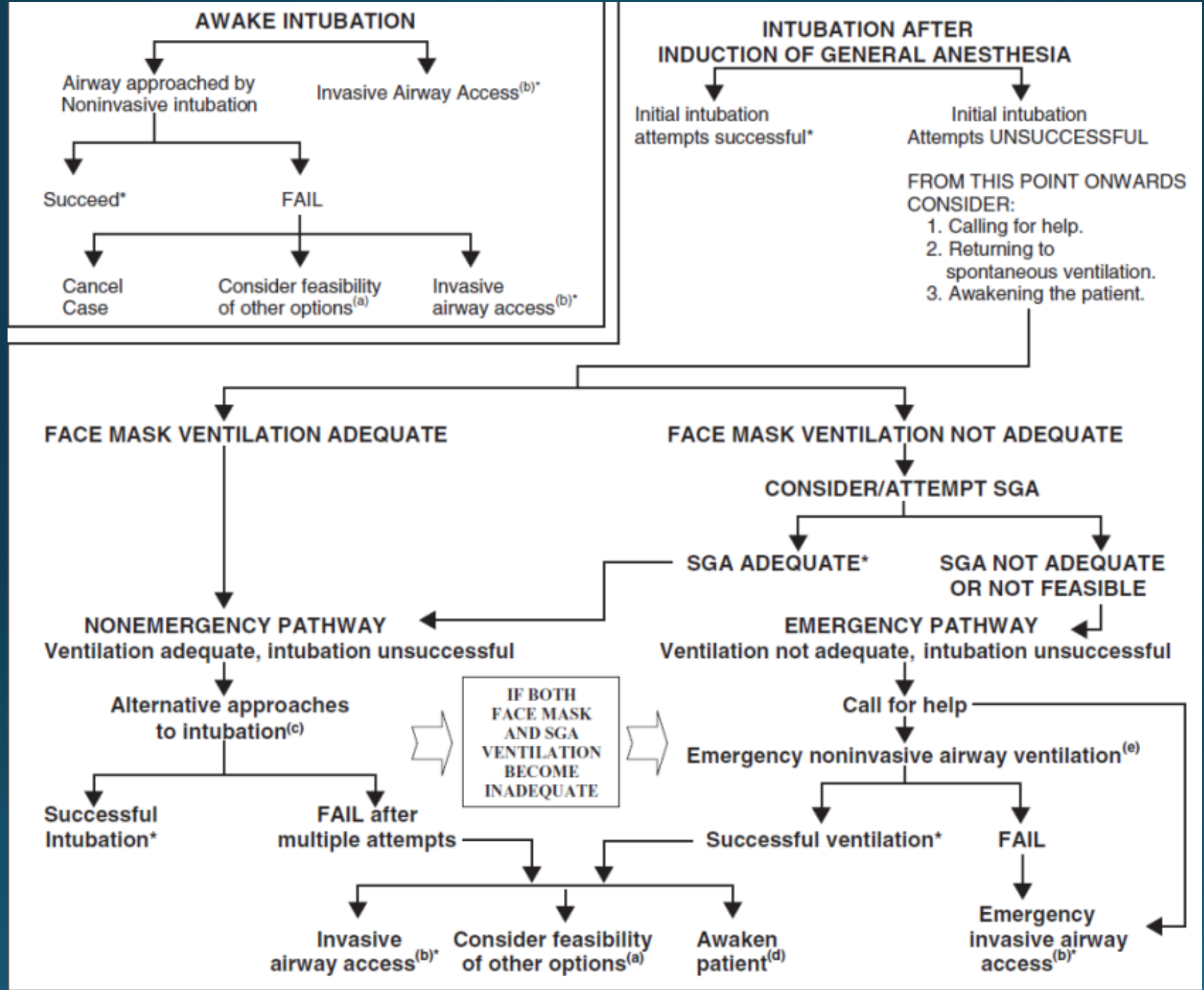


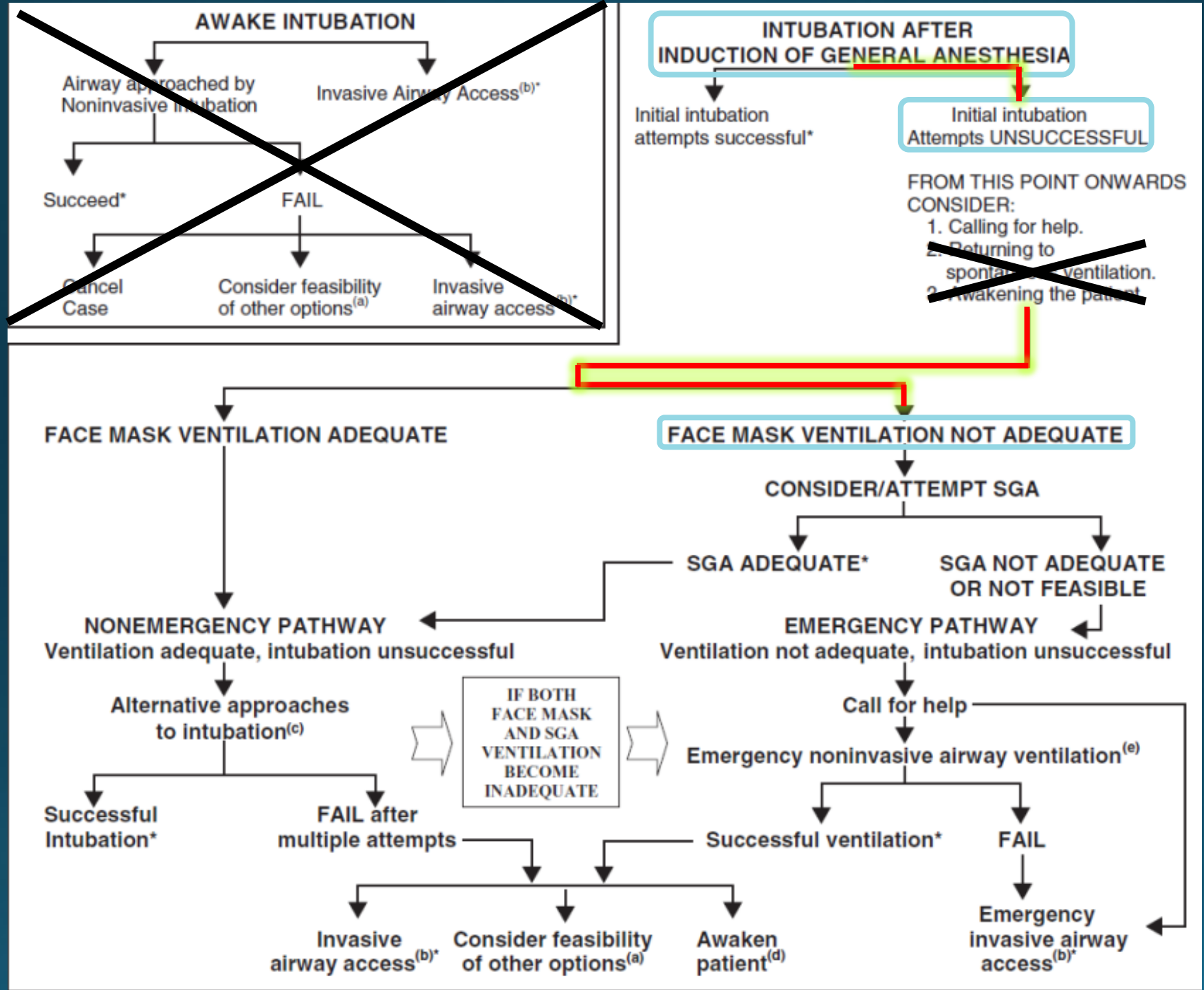



# Intubation: round 2

- Patient was paralyzed and sedated (RSI).
- Mac 3 blade: grade 3 view with edematous glottic structures.
- Blind attempt with gum-elastic bougie: esophageal intubation.
- Patient started desaturating.
- Unable to bag mask ventilate with two-provider ventilation.
- LMA 4.5 inserted and able to provide some ventilation to patient, with saturation improving from 4os to mid-9os.




AWAKE INTUBATION
Airway approached by Noninvasive intubation
Invasive Airway Access(b)*
Succeed*
FAIL
Cancel Case
Consider feasibility of other options(a)
Invasive airway access(b)*
INTUBATION AFTER INDUCTION OF GENERAL ANESTHESIA
Initial intubation attempts successful*
Initial intubation Attempts UNSUCCESSFUL
FROM THIS POINT ONWARDS CONSIDER:
1. Calling for help.
2. Returning to spontaneous ventilation.
3. Awakening the patient.
FACE MASK VENTILATION ADEQUATE
FACE MASK VENTILATION NOT ADEQUATE
CONSIDER/ATTEMPT SGA
SGA ADEQUATE*
SGA NOT ADEQUATE OR NOT FEASIBLE
NONEMERGENCY PATHWAY
Ventilation adequate, intubation unsuccessful
EMERGENCY PATHWAY
Ventilation not adequate, intubation unsuccessful
Alternative approaches to intubation(c)
IF BOTH FACE MASK AND SGA VENTILATION BECOME INADEQUATE
Call for help
Emergency noninvasive airway ventilation(e)
Successful Intubation*
FAIL after multiple attempts
Successful ventilation*
FAIL
Invasive airway access(b)*
Consider feasibility of other options(a)
Awaken patient(d)
Emergency invasive airway access(b)*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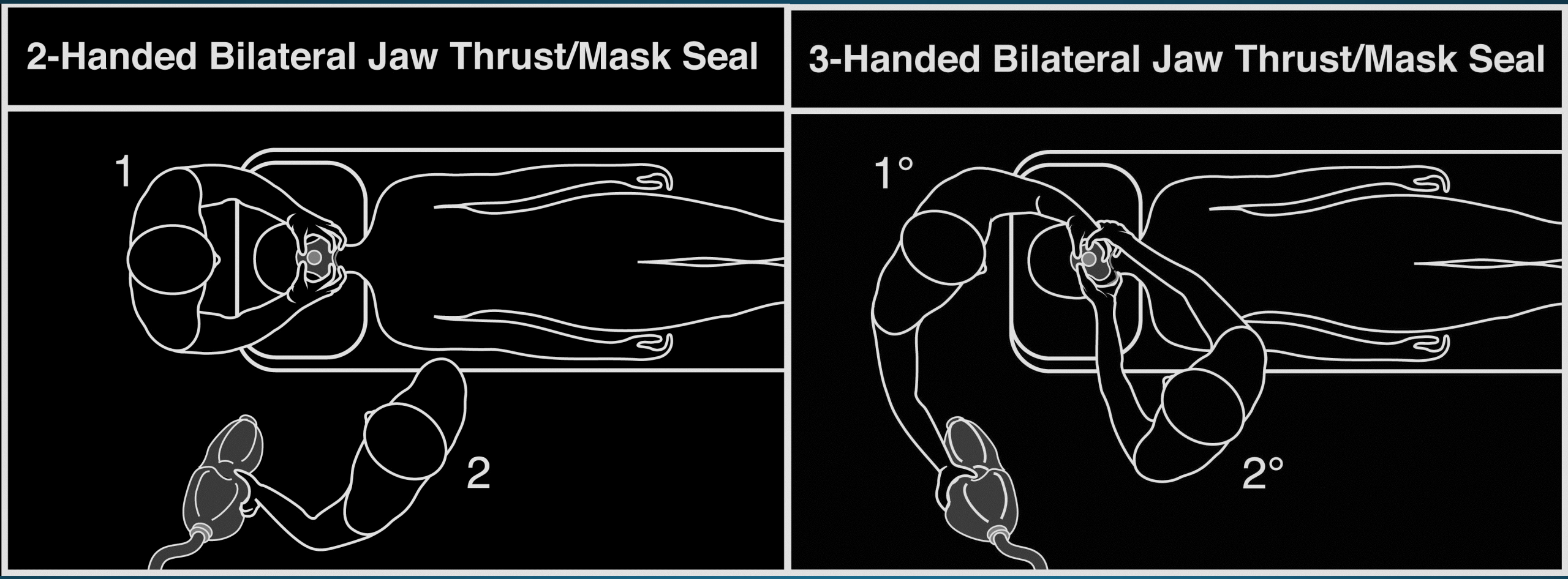
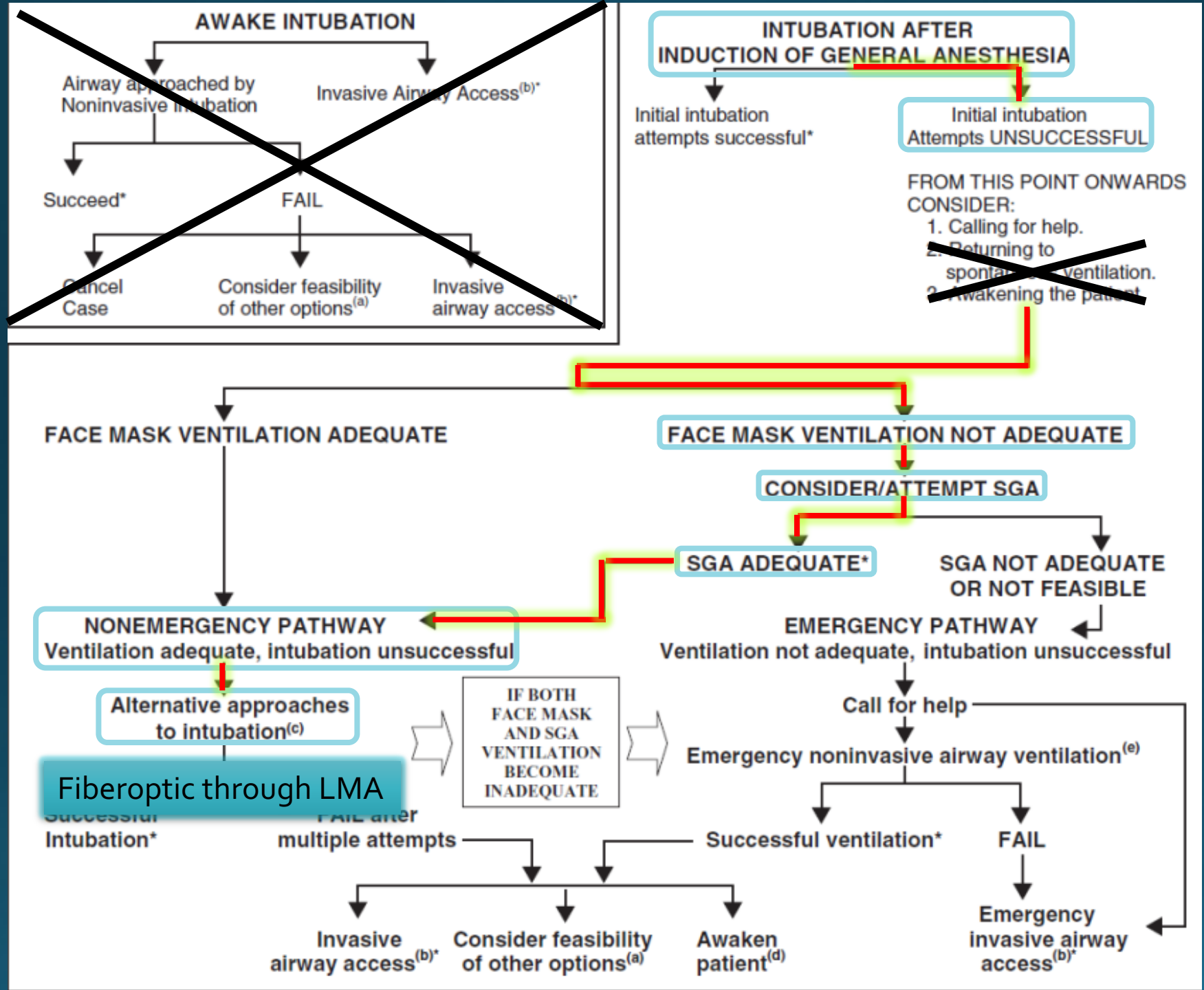
Awaken patient[d]
Emergency invasive airway access[b]*

# Optimal mask ventilation

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Call for help
Emergency noninvasive airway ventilation[e]
Fiberoptic through LMA
Intubation*
multiple attempts
Successful ventilation*
FAIL
Invasive airway access[b]*
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Awaken patient[d]
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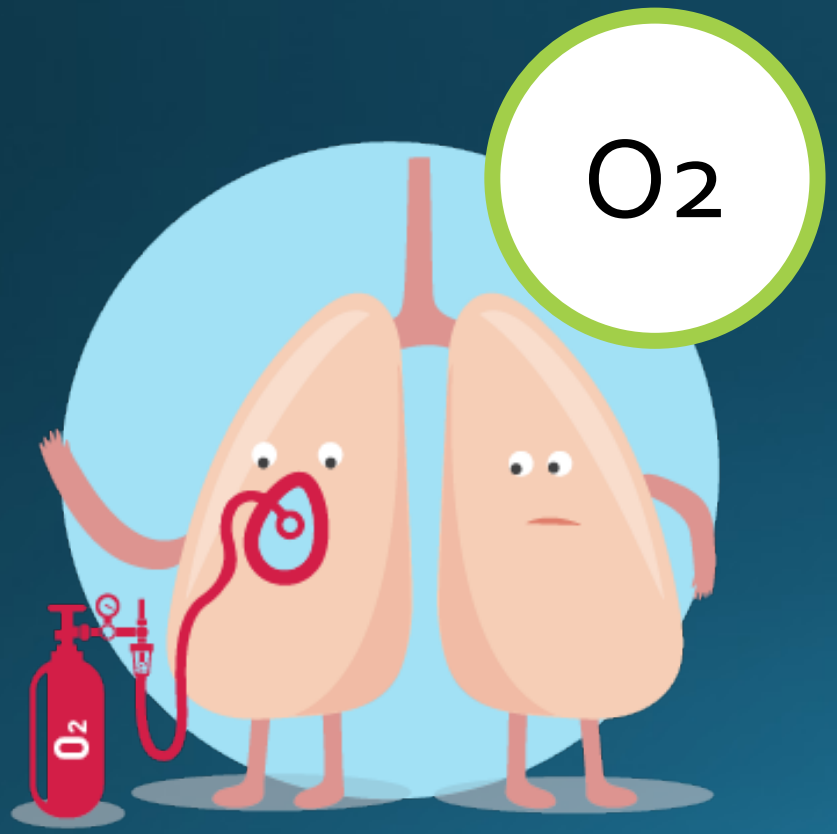
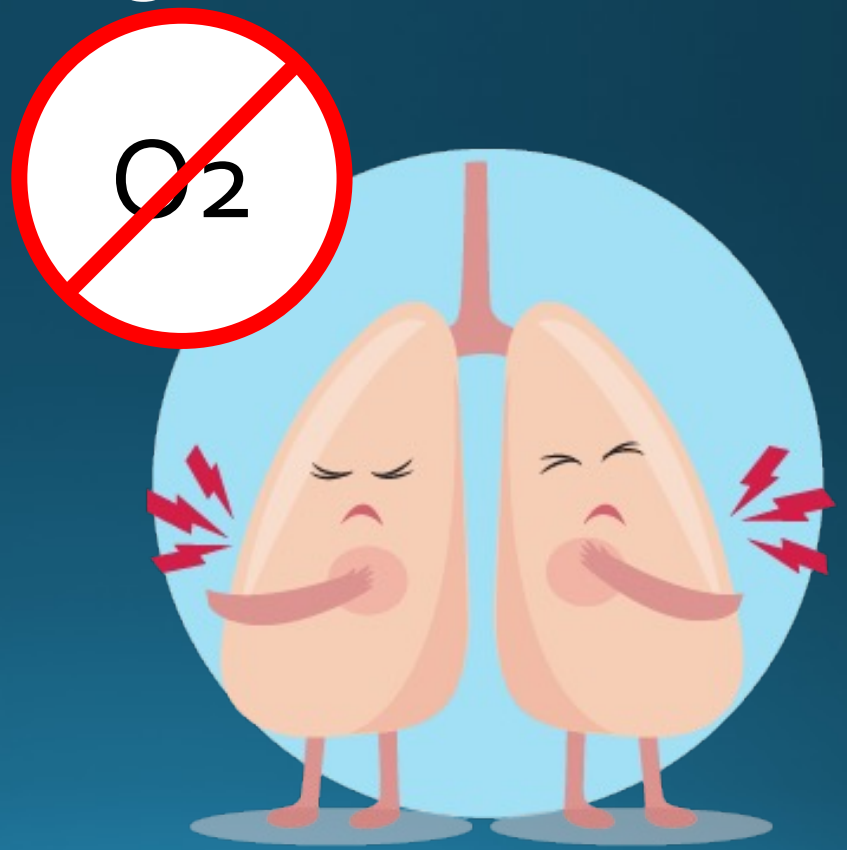
# Remember:

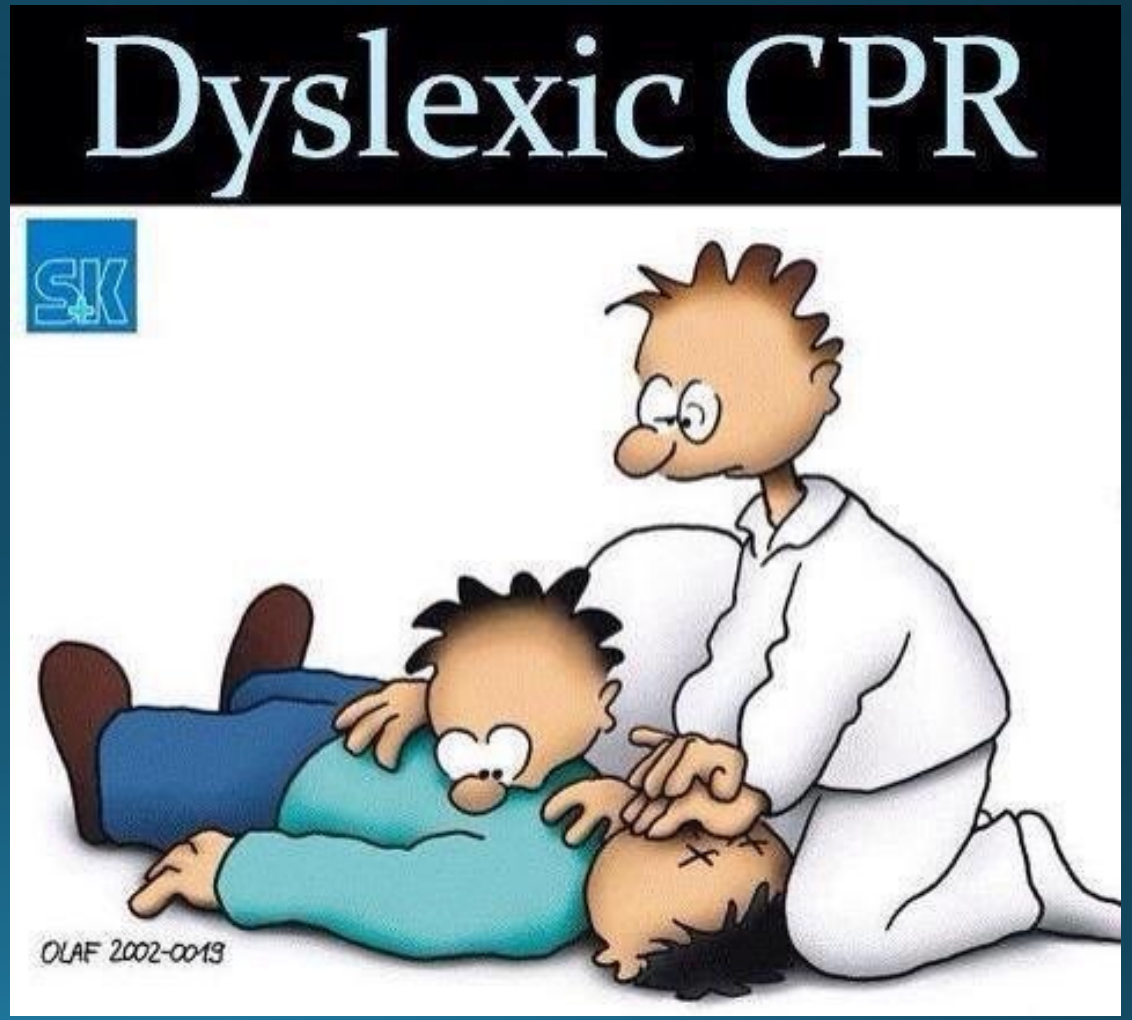
- Patients do not die from not being intubated.
- Patients do die from not being ventilated.



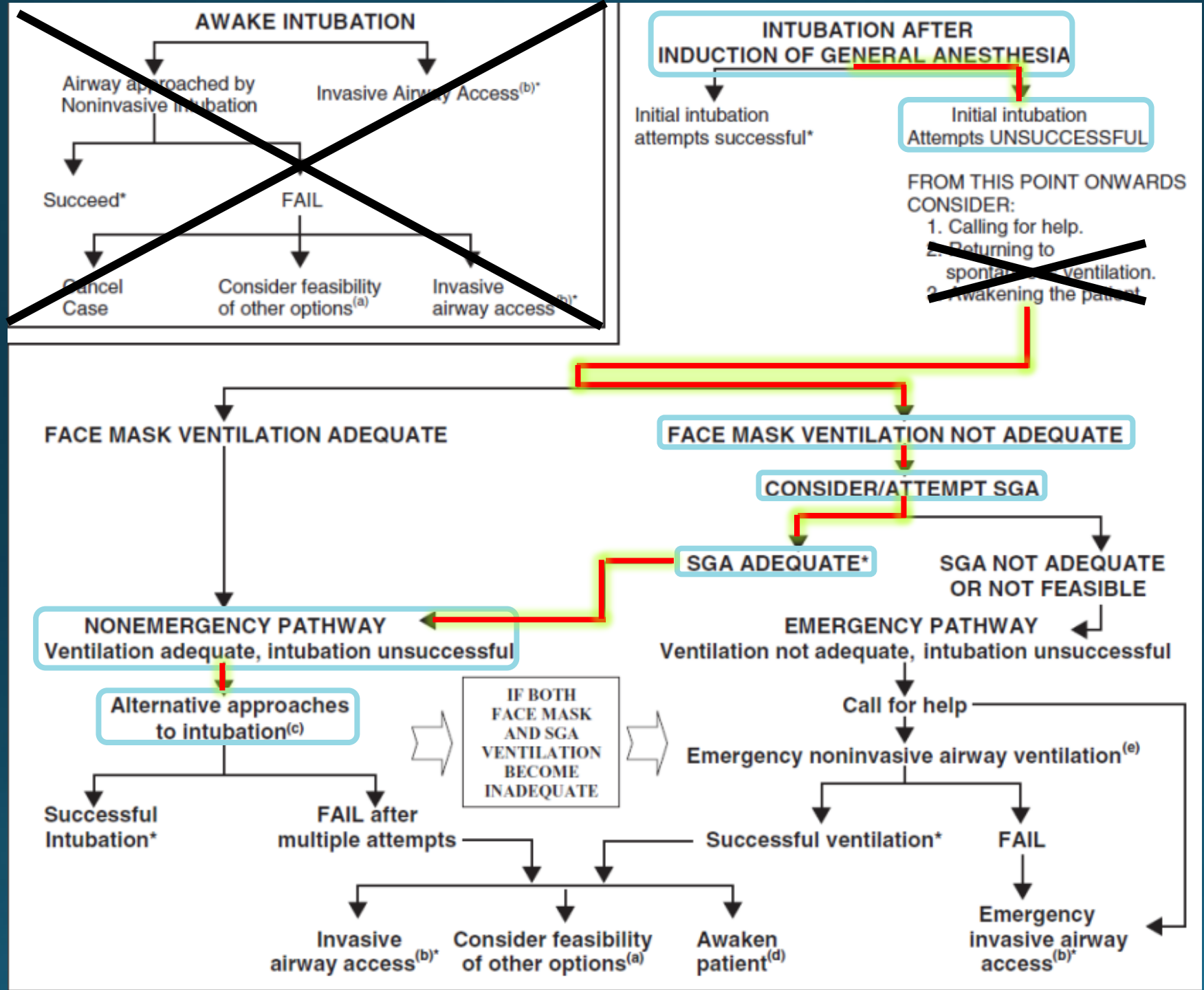
# Intubation: round 2.5… Difficult airway algorithm?

- LMA in, ventilating adequately.
- Multiple specialties present at bedside
- Glidescope at bedside, but no fiberoptic scope.
- LMA removed. Separate provider direct laryngoscopy, remains grade 3 view.
- Desaturation, loss of pulses, CPR started.
- With glidescope, remains grade 3 view.
- Bicarbonate 1 amp, epinephrine 1mg given per code team.
- Trauma surgeons in position for emergency cricothyroidotomy, which was aborted after blind and successful insertion of ETT.



# Reintubation vitals

| Time: | 1000 | 1025 | 1026 | 1045 | 1050 | 1053 | 1100 | 1104 | 1106 | 1107 | 1108 | 1109 | 1120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Vitals** | | | | | | | | | | | | | |
| Temp | 37.4 | | | 37.4 | | | 37.5 | | | | | | |
| Temp Source | | | | | | | | | | | | | |
| Heart Rate | 76 | 79 | | 78 | 97 | 86 | 89 | 32 | 124 | 22 | 130 | 143 | 114 |
| Rhythm | | | | | | | | PEA | PEA | PEA | ST | | |
| Resp Rate | 9 | 18 | | 21 | 17 | 12 | 15 | 20 | 14 | | | | 20 |
| BP (Cuff) | 110/59 | | | 135/82 | | 80/52 | 128/61 | 120/90 | | 178/139 | 177/121 | 182/124 | |
| MAP (Cuff) | 71 | | | 92 | | | 73 | | | | | | |
| Observations | | | | | | | | | | | ROSC | | |
| **Pain** | | | | | | | | | | | | | |
| Pain Score | CPOT | | | | | | CPOT | | | | | | |
| **CPOT** | | | | | | | | | | | | | |
| Facial Expression | 0 | | | | | | 0 | | | | | | |
| Body Movement | 0 | | | | | | 0 | | | | | | |
| Compliance with Ventilator | 0 | | | | | | 0 | | | | | | |
| Vocalization (Non-ventilated) | 0 | | | | | | 0 | | | | | | |
| Muscle Tension | 0 | | | | | | 0 | | | | | | |
| CPOT Total Behaviors Present | 0 | | | | | | 0 | | | | | | |
| **Pain/Sedation Drip** | | | | | | | | | | | | | |
| Fentanyl | | | | | | | | | | | | | |
| **Oxygenation** | | | | | | | | | | | | | |
| SpO2 | 100 | 100 | 100 | 99 | 100 | 83 | 81 | 7 | | | 99 | 95 | 100 |
| O2 Device | | ETT | NC | | NC | | | | | | | | ETT |
| O2 Flow Rate (L/min) | | | 4 | | 4 | | | | | | | | |
| FiO2 (%) | 30 | 30 | | | | | | 100 | | 100 | | | 100 |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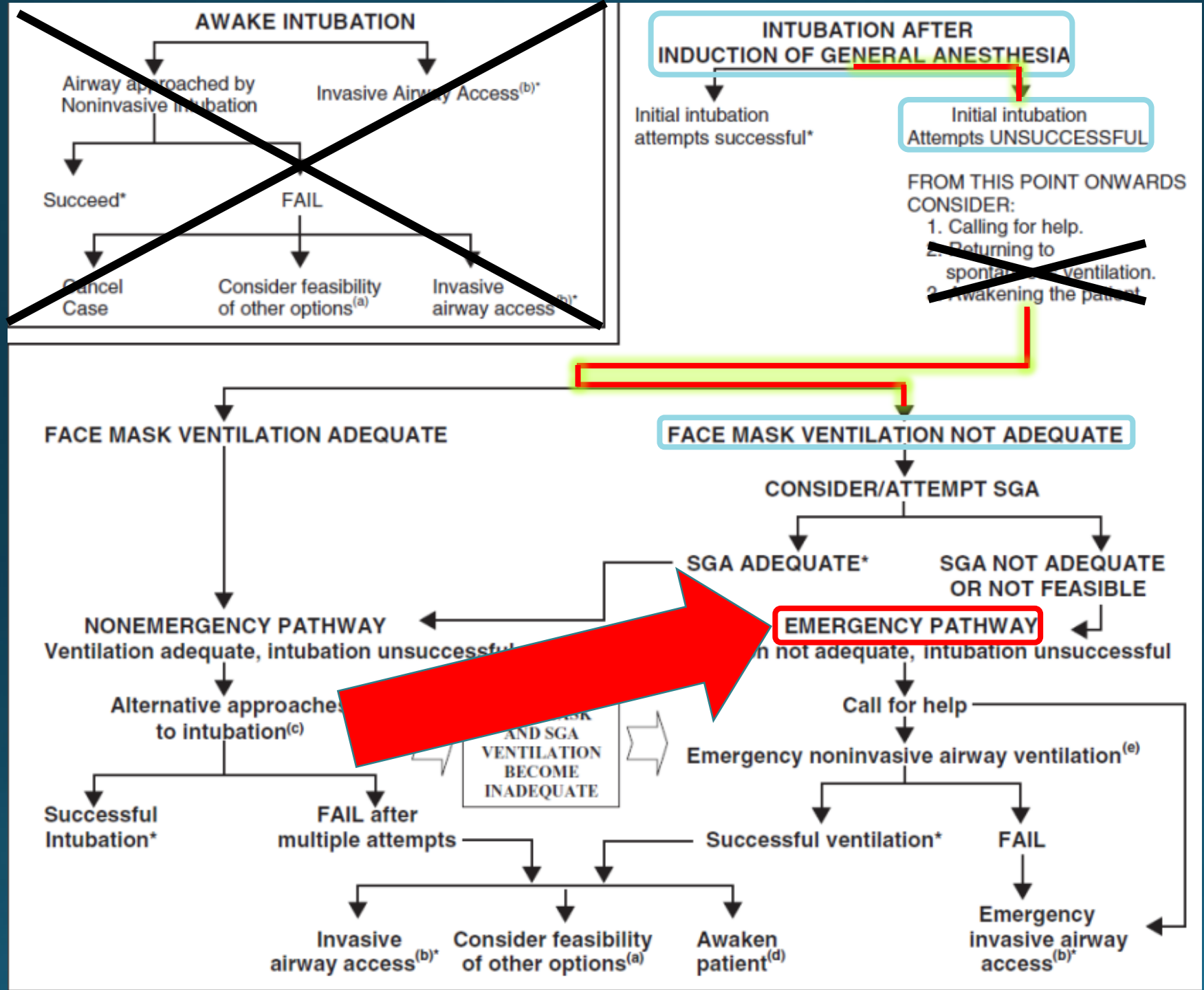
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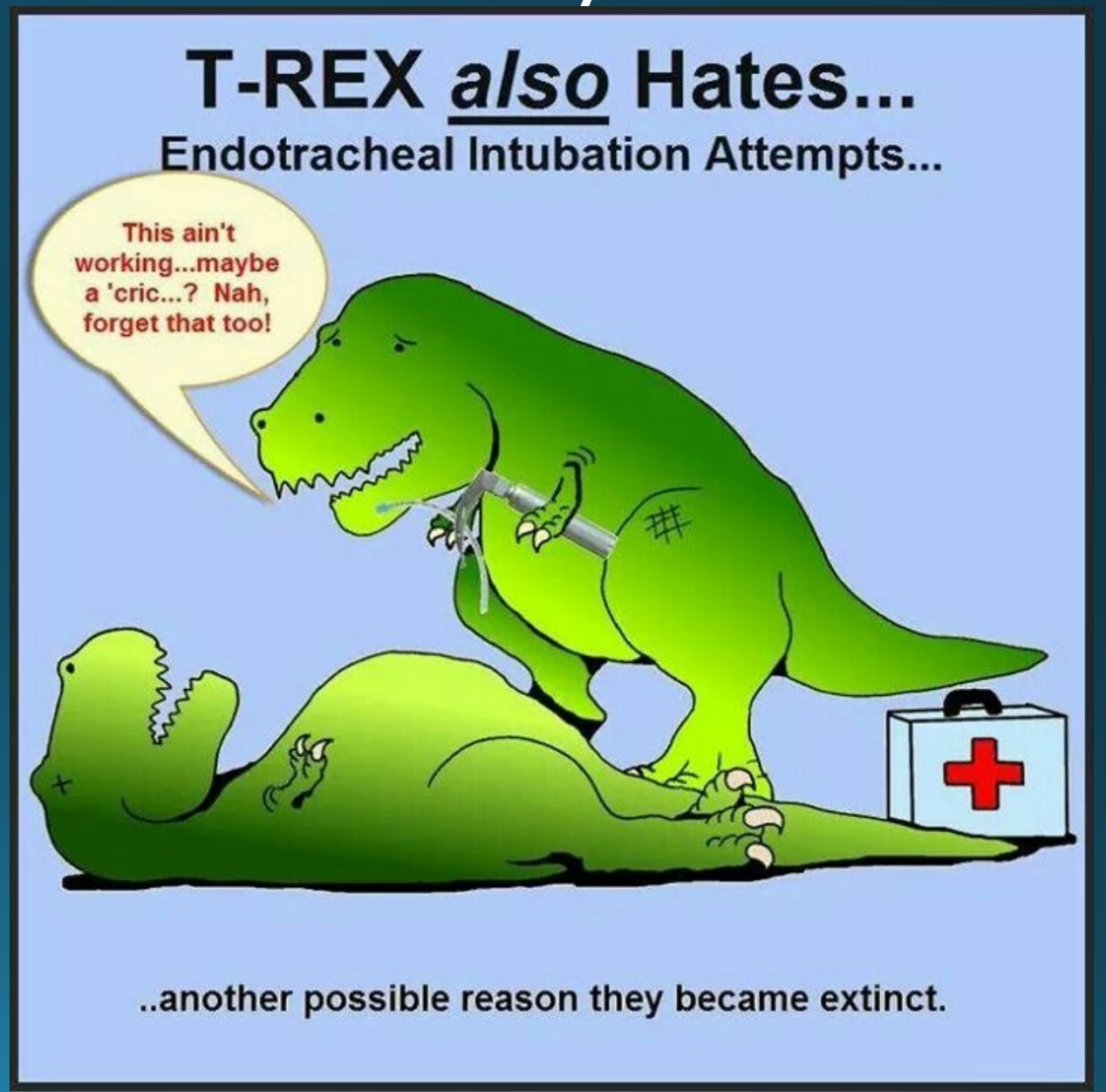
# Sometimes, it's better to be lucky than good…

- Patient had return of circulation after successful ventilation.
- Subsequent hospital course:
  - Open trach with ENT
  - IR-guided PEG tube
  - Transferred to LTAC on HD23
- Remained with depressed mental status (never followed commands, never tracked)



# Preparing for success

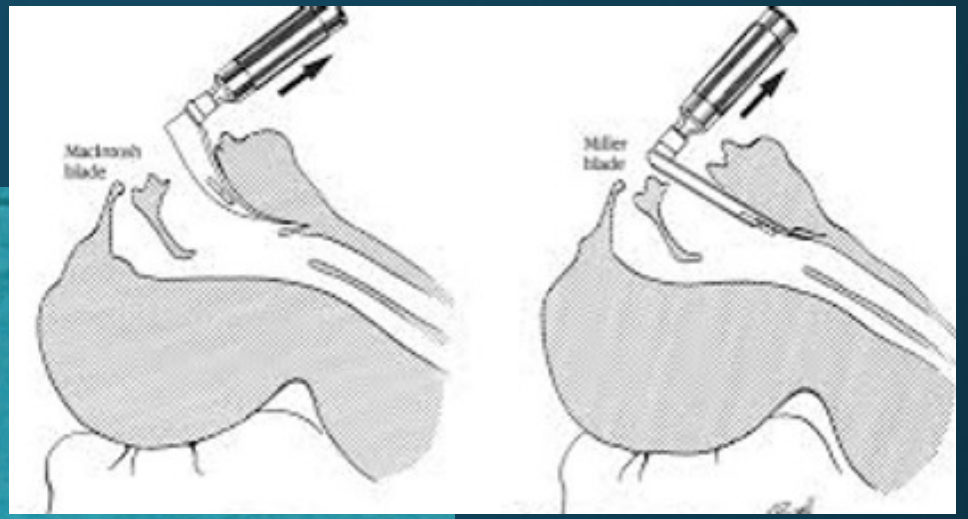
- Optimize your environment – "recreate the operating room environment"
- Make space for yourself
- Use a checklist!
  - M: machine (ventilator, appropriate IV pumps)
  - O: oxygen source for mapleson and ventilator
  - M: monitors (monitors on patient, with pulse ox sound on)
  - S: suction (make sure working, and may need a backup if high risk)
  - A: airway (know where all your airway supplies are)
  - I: IV / access
  - D: drugs (ensure that you have induction and post-induction drugs)
- **Prepare**: Preoxygenate and Position the Patient

# Positioning the obese patient

# Assume that nobody else knows anything

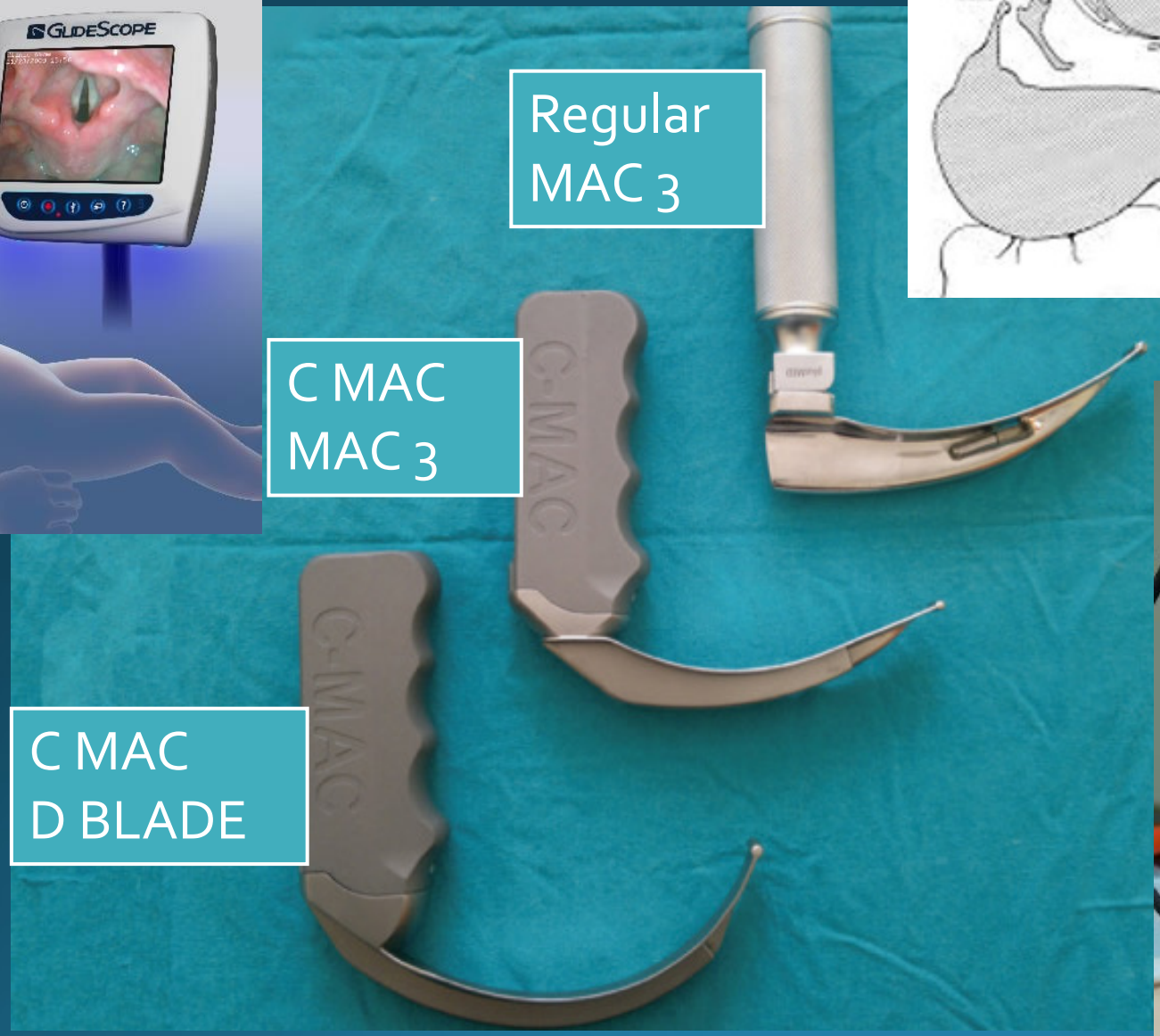
- In the out of OR environment, nobody is familiar with the things that YOU want or NEED in the case that something goes wrong
- Get organized and point out where things are to helpers
  - Suction (and backup suction)
  - Bag mask and adjuncts (oral or nasal airways)
  - Laryngoscopes and ETTs and stylets
  - Supraglottic airways of various sizes
  - Video laryngoscopes or bronchoscopes
  - Scalpel / surgical airway kits


# Blade choice?

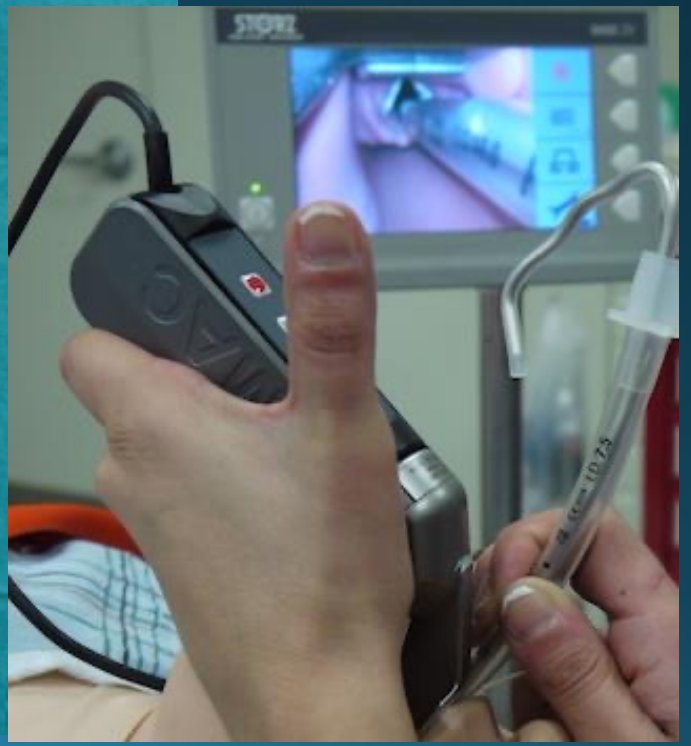




Regular MAC 3

C MAC MAC 3




C MAC D BLADE



# Impact of Macintosh blade size on endotracheal intubation success in intensive care units: a retrospective multicenter observational MacSize-ICU study

Thomas Godet[1,2,6*], Audrey De Jong[2], Côme Garin[1], Renaud Guérin[1], Benjamin Rieu[1], Lucile Borao[1], Bruno Pereira[3], Nicolas Molinari[4], Jean-Etienne Bazin[1], Matthieu Jabaudon[1,5], Gérald Chanques[2], Emmanuel Futier[1,5] and Samir Jaber[2]

**Results:** A total of 2139 intubations were collected, 629 with a Macintosh blade No3 and 1510 with a No4. Incidence of first-pass intubation after first DL was significantly higher with Macintosh blade No3 (79.5 vs 73.3%, $p = 0.0025$), despite equivalent Cormack–Lehane scores ($p = 0.48$). Complications rates were equivalent between groups. Multivariate analysis concluded to a significant impact of Macintosh blade size on first DL success in favor of blade No3 (OR 1.44 [95% CI 1.14–1.84]; $p = 0.0025$) without any significant center effect on the primary outcome ($p = 0.18$). Propensity scores and adjustment analyses concluded to equivalent results.

**Conclusion:** In the present study, Macintosh blade No3 was associated with improved first-passed DL in French ICUs. However, study design requires the conduct of a nationwide prospective multicenter randomized trial in different settings to confirm these results.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

# Video versus Direct Laryngoscopy for Tracheal Intubation of Critically Ill Adults

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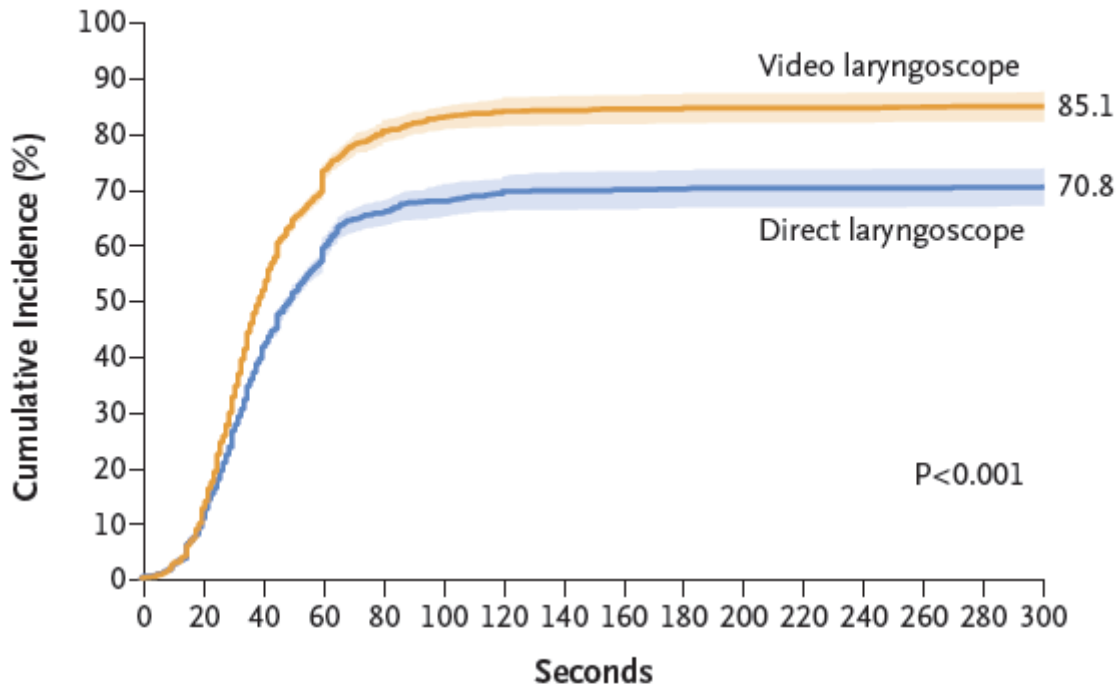



**Figure 1. Cumulative Incidence of Successful Intubation on the First Attempt.**

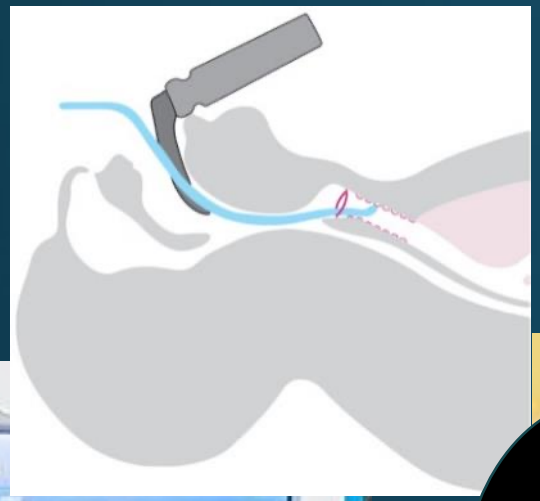
Shown are the cumulative incidence and 95% confidence intervals (shaded areas) for successful intubation on the first attempt among patients in each trial group relative to the time since the initial insertion of a laryngoscope blade into the mouth. Successful intubation on the first attempt occurred in 600 of 705 patients in the video-laryngoscope group and in 504 of 712 patients in the direct-laryngoscope group (absolute risk difference, 14.3 percentage points; 95% CI, 9.9 to 18.7; P<0.001 by the chi-square test).

| | | |
|---|---|---|
| **Operator*** | | |
| Clinical specialty — no. (%) | | |
| Emergency medicine | 496 (70.4) | 497 (69.8) |
| Critical care medicine | 177 (25.1) | 182 (25.6) |
| Anesthesiology | 18 (2.6) | 25 (3.5) |
| Other† | 14 (2.0) | 8 (1.1) |
| Level of training — no. (%) | | |
| Resident physician | 513 (72.8) | 502 (70.5) |
| Fellow physician | 164 (23.3) | 173 (24.3) |
| Attending physician | 9 (1.3) | 18 (2.5) |
| Other clinician‡ | 19 (2.7) | 19 (2.7) |
| Median no. of previous intubations performed (IQR) | 50 (25–90) | 50 (26–99) |
| Proportion of previous intubations performed with a video laryngoscope — no./total no. (%)§ | | |
| <0.25 | 44/704 (6.2) | 34/711 (4.8) |
| 0.25 to 0.75 | 398/704 (56.5) | 429/711 (60.3) |
| >0.75 | 262/704 (37.2) | 248/711 (34.9) |

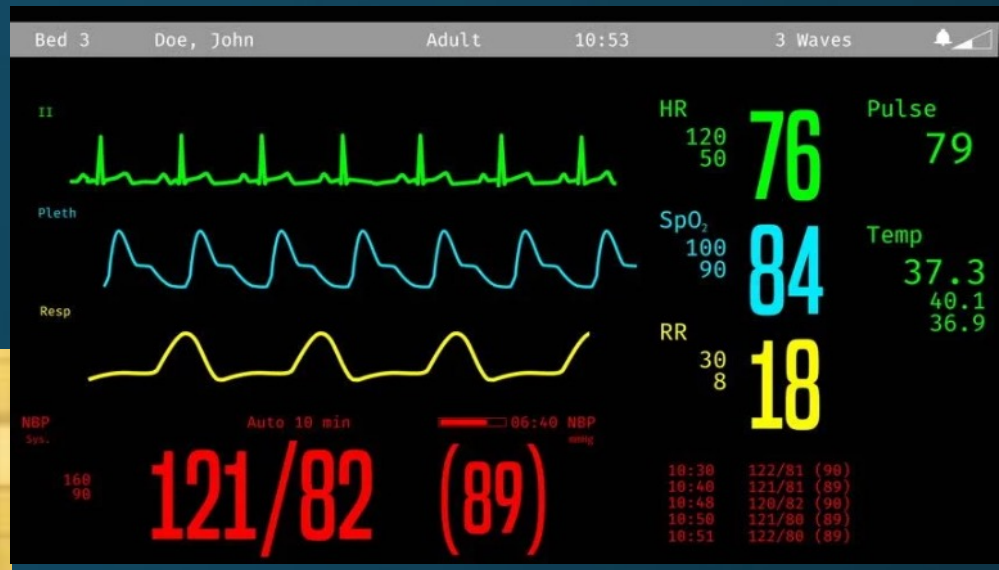
# Airway Time Out

- Before you proceed with any airway, have a plan A, B, C, and D
- For example…
- "Hi before we proceed, I'd like to perform an airway timeout"
- Plan A: Direct laryngoscopy with a mac 3 blade
  - Identify where a mac4 blade is to the room
- Plan B: Bag mask ventilation
  - Identify the oral and nasal airways that you might need
- Plan C: Video laryngoscopy and / or bougie
  - Identify where these are located (or if someone needs to call for them)
- Plan D: LMA
  - Identify which size you intend to use
- Plan E: front of the neck airway

# My setup



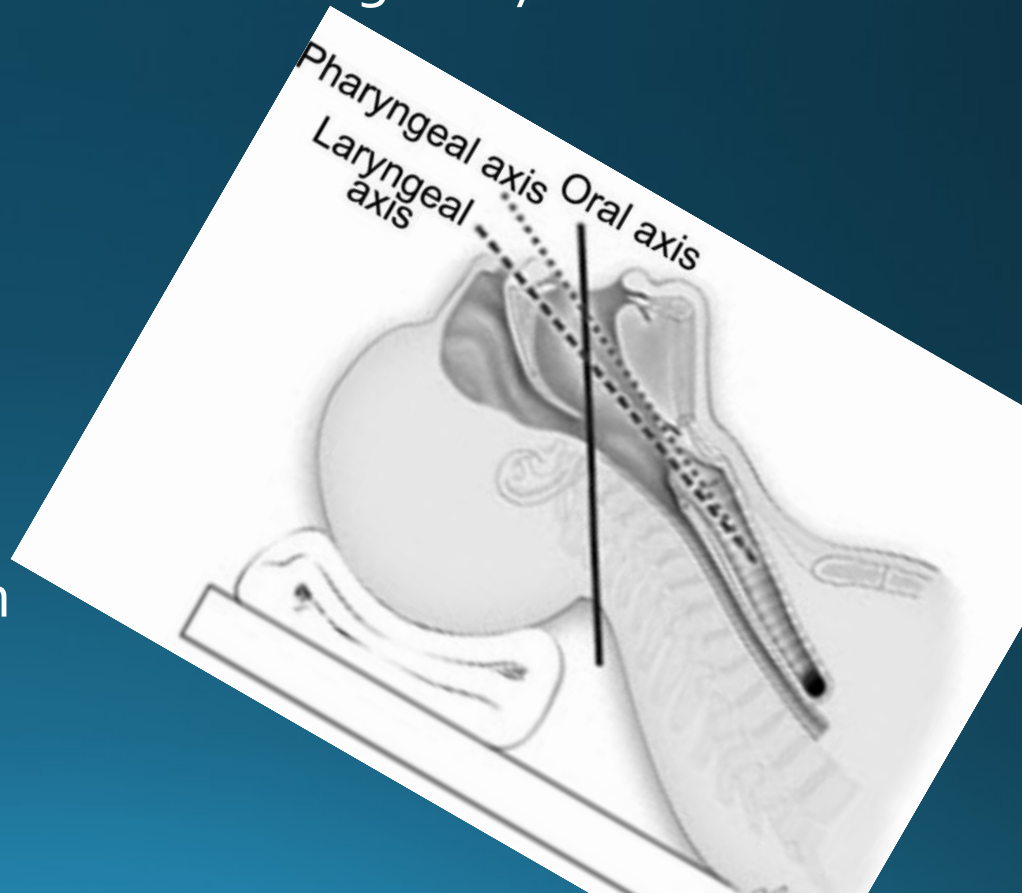

CPAP/PS


Bed 3
Doe, John
Adult
10:53
3 Waves
II
Pleth
Resp
HR
120
50
76
Pulse
79
SpO2
100
90
84
Temp
37.3
40.1
36.9
RR
30
8
18
NBP
Auto 10 min
06:40 NBP
160
90
121/82
(89)
10:30 122/81 (90)
10:40 121/81 (89)
10:48 120/82 (90)
10:50 121/80 (89)
10:51 122/80 (89)

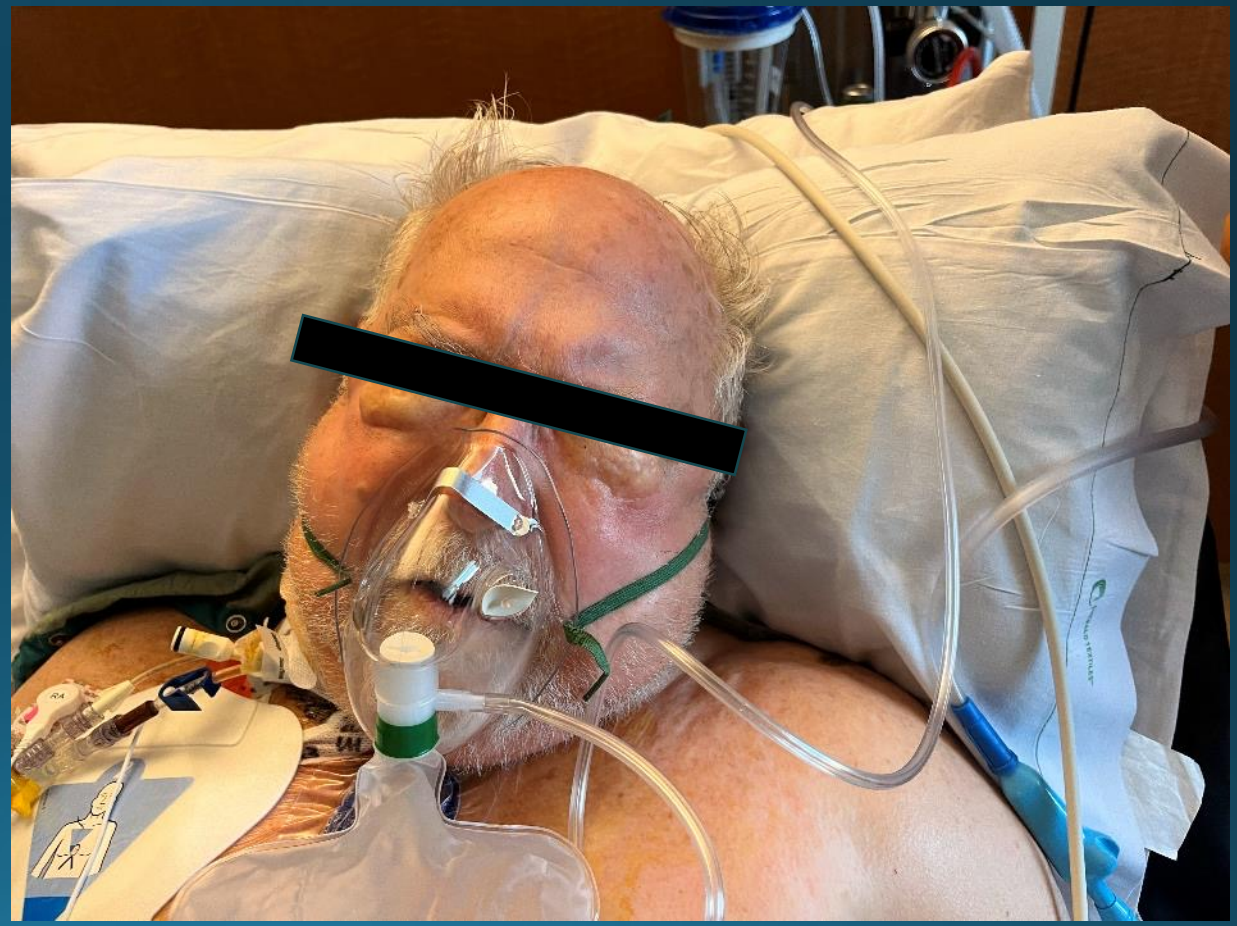

BD Alaris™ PCU
HEPARIN
DOPAMINE
INSULIN

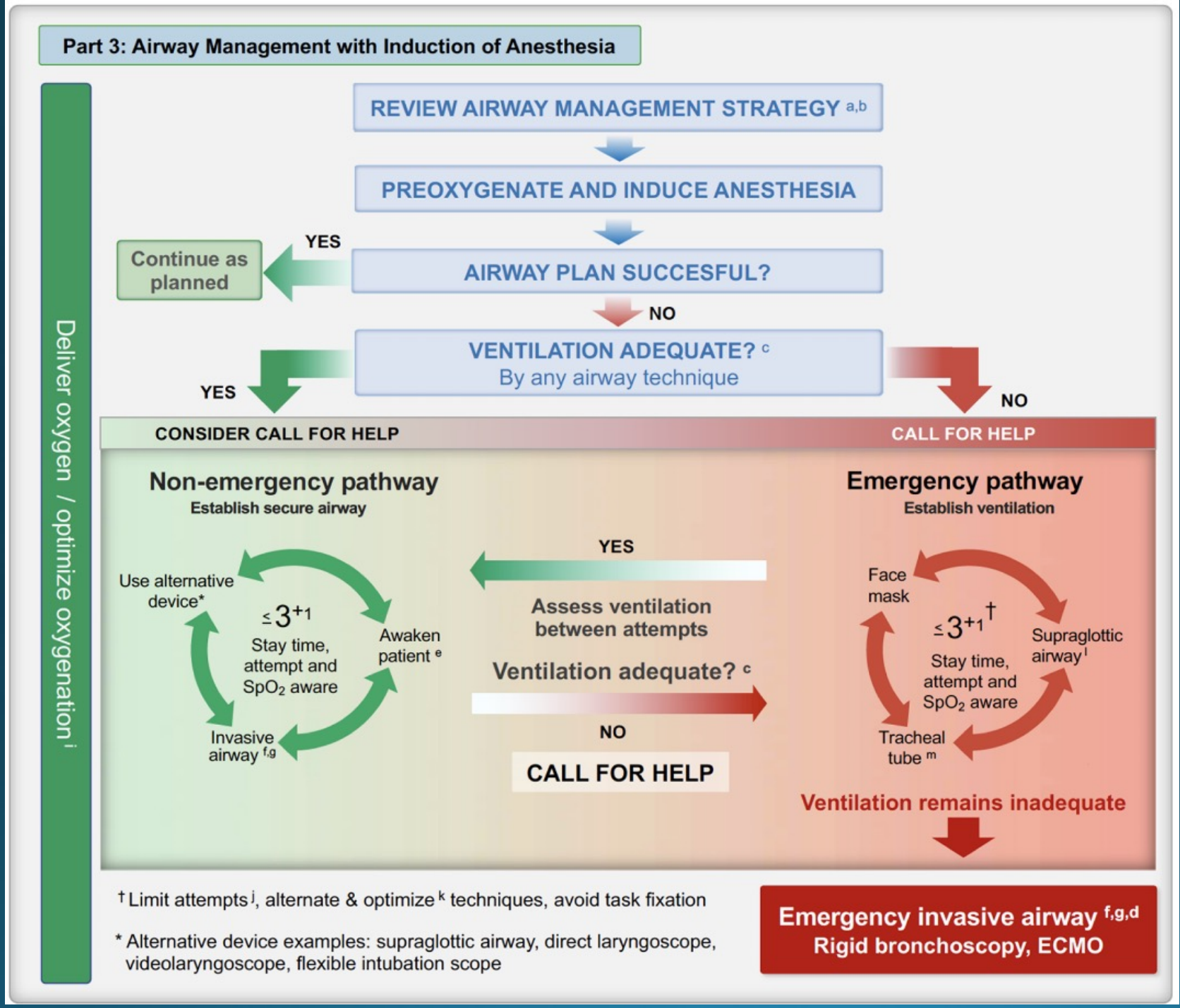
# Advantages of Elevated Head of Bed

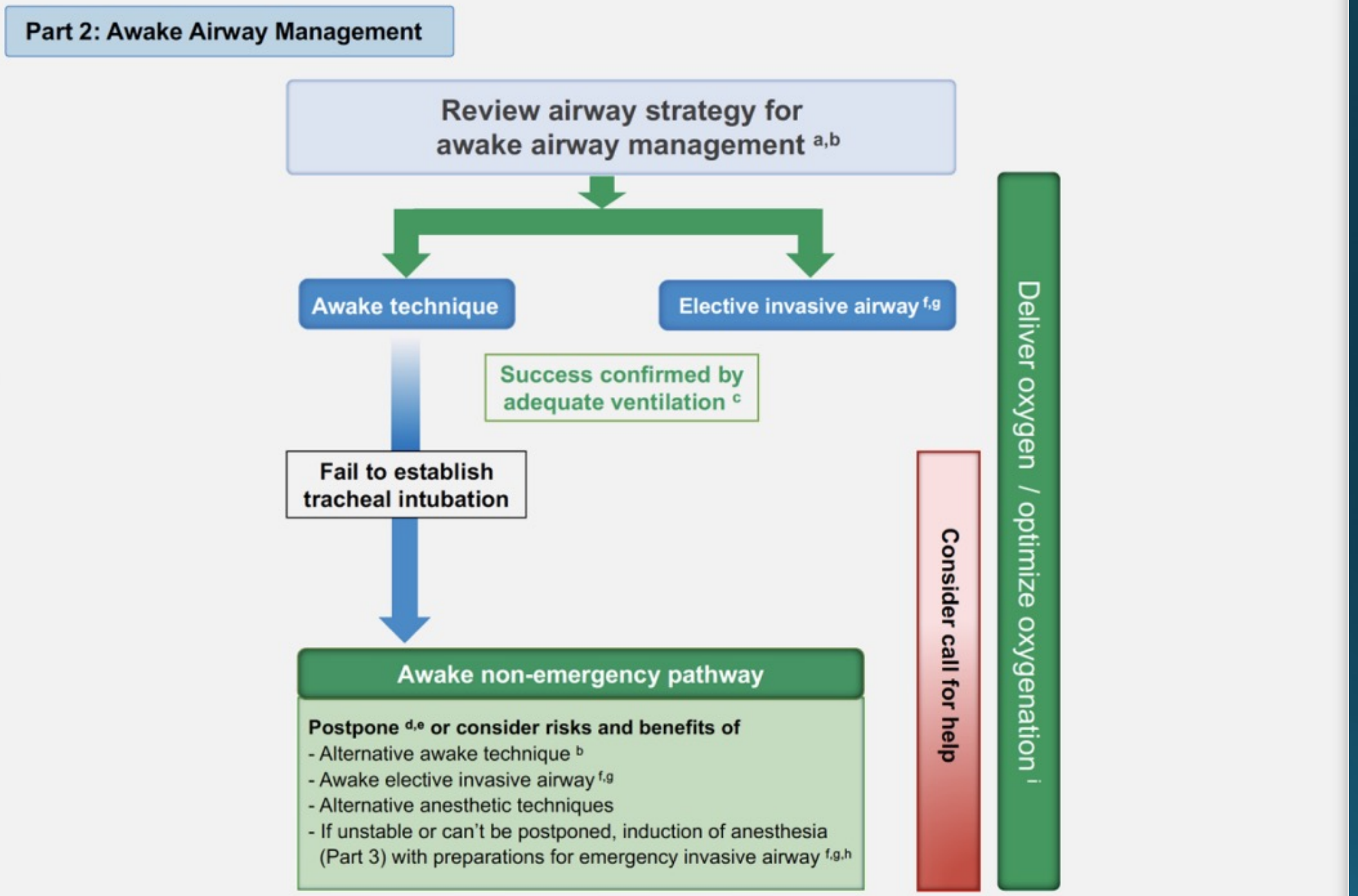
- Decreased aspiration risk
  - Pressure gradient from lower esophageal sphincter from gravity
- Increased oxygen reserve
  - Increased functional reserve capacity
  - More time until desaturation
- Oftentimes easier alignment of laryngotracheal axes
  - May be easier to extend the neck
  - Less gravity-related pharyngeal obstruction
  - Downside: can hurt your back



# S/p cardiothoracic surgery…

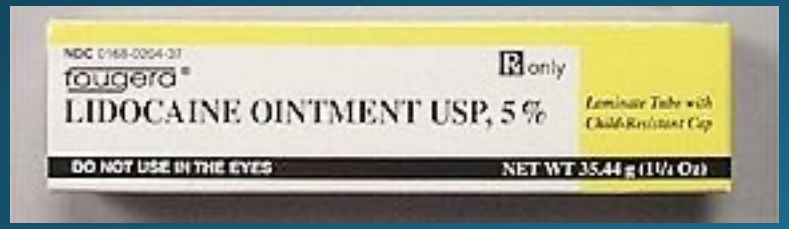




Part 3: Airway Management with Induction of Anesthesia
Deliver oxygen / optimize oxygenation i
REVIEW AIRWAY MANAGEMENT STRATEGY a,b
PREOXYGENATE AND INDUCE ANESTHESIA
AIRWAY PLAN SUCCESFUL?
YES
Continue as planned
NO
VENTILATION ADEQUATE? c
By any airway technique
YES
NO
CONSIDER CALL FOR HELP
CALL FOR HELP
Non-emergency pathway
Establish secure airway
Use alternative device*
≤ 3+1
Stay time, attempt and SpO2 aware
Awaken patient e
Invasive airway f,g
YES
Assess ventilation between attempts
Ventilation adequate? c
NO
CALL FOR HELP
Emergency pathway
Establish ventilation
Face mask
≤ 3+1 †
Stay time, attempt and SpO2 aware
Supraglottic airway l
Tracheal tube m
Ventilation remains inadequate
† Limit attempts j, alternate & optimize k techniques, avoid task fixation
* Alternative device examples: supraglottic airway, direct laryngoscope, videolaryngoscope, flexible intubation scope
Emergency invasive airway f,g,d
Rigid bronchoscopy, ECMO


Part 2: Awake Airway Management
Review airway strategy for awake airway management a,b
Awake technique
Elective invasive airway f,g
Success confirmed by adequate ventilation c
Fail to establish tracheal intubation
Awake non-emergency pathway
Postpone d,e or consider risks and benefits of
- Alternative awake technique b
- Awake elective invasive airway f,g
- Alternative anesthetic techniques
- If unstable or can't be postponed, induction of anesthesia (Part 3) with preparations for emergency invasive airway f,g,h
Consider call for help
Deliver oxygen / optimize oxygenation i

# Awake fiberoptic intubation

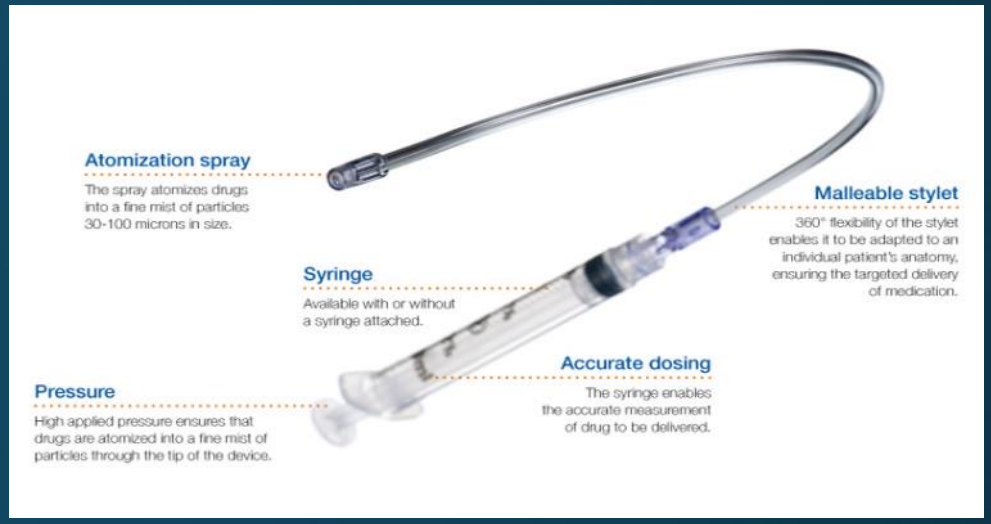
1. Psychological buy in
2. Glycopyrrolate
3. Lidocaine topicalization
4. +/- minimal sedation
5. Fiberoptic through vocal cords
6. Endotracheal tube into trachea



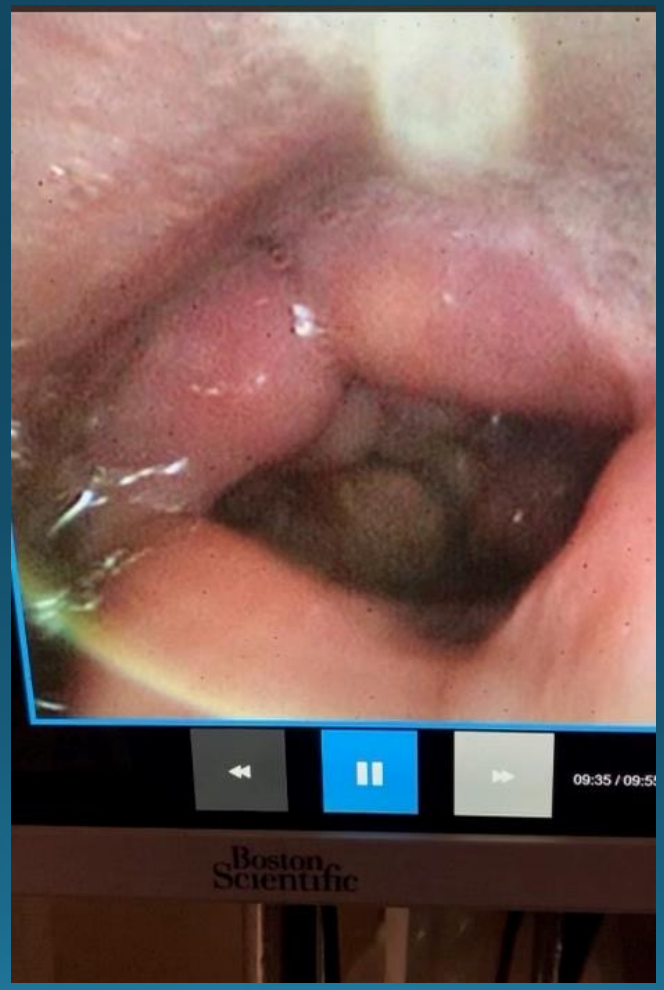
# Topicalization

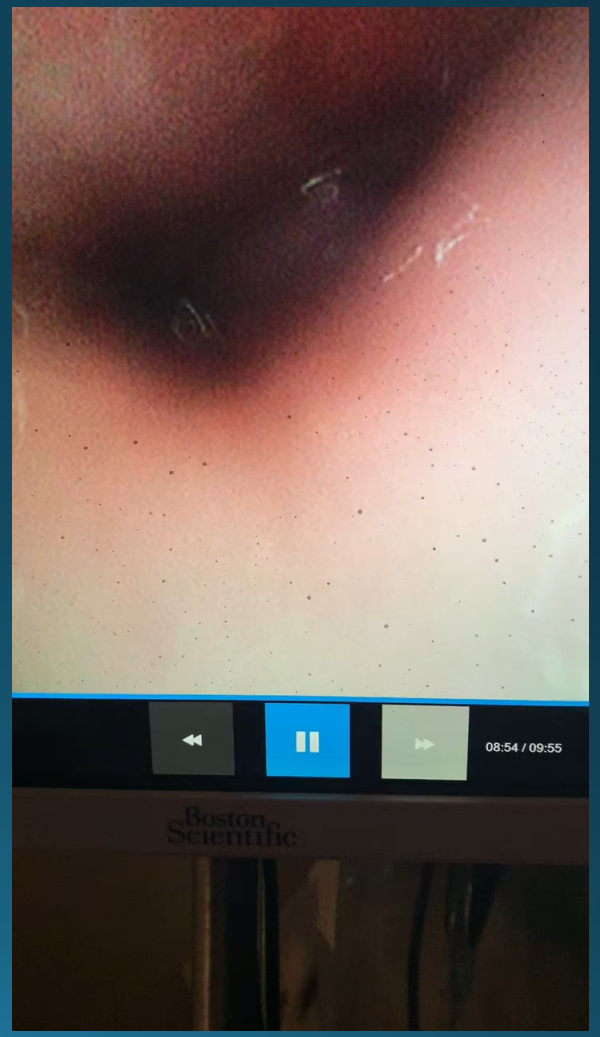
- Lidocaine atomizer (LTA or Madgic)
- Lidocaine ointment lollipops
- Nebulized lidocaine inhaler
- Direct nerve blocks
- Lidocaine sprayed through brochoscope




# Bonus case

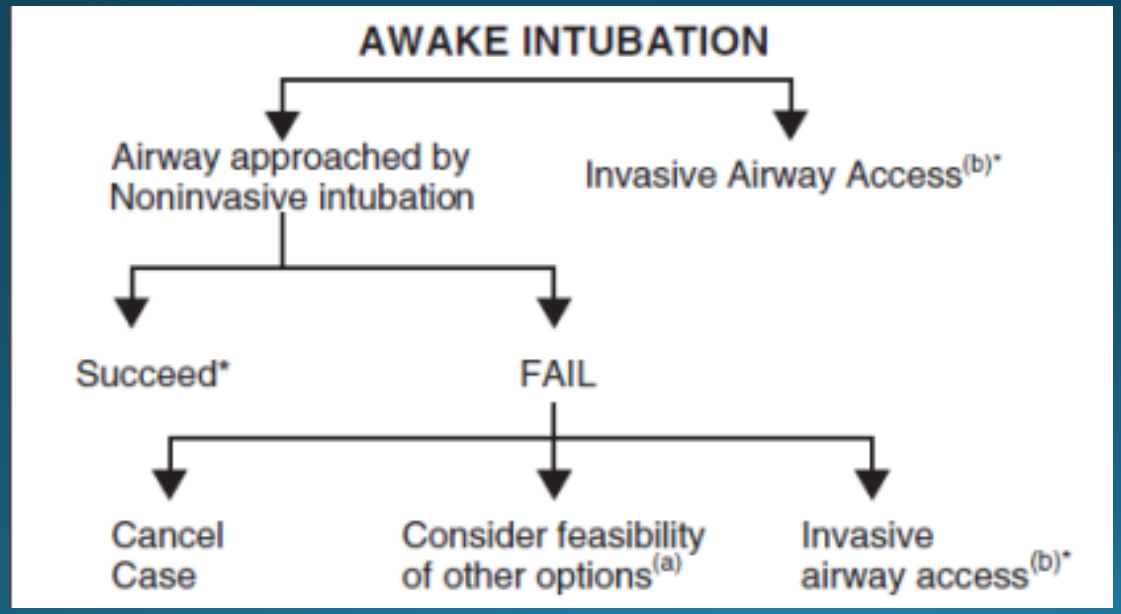
- 27-year-old male with Down syndrome with productive cough, stridor, and hoarse voice for five months
- Associated night sweats and fever
- Imaging significant for right cavitary lung lesion and epilogottis…



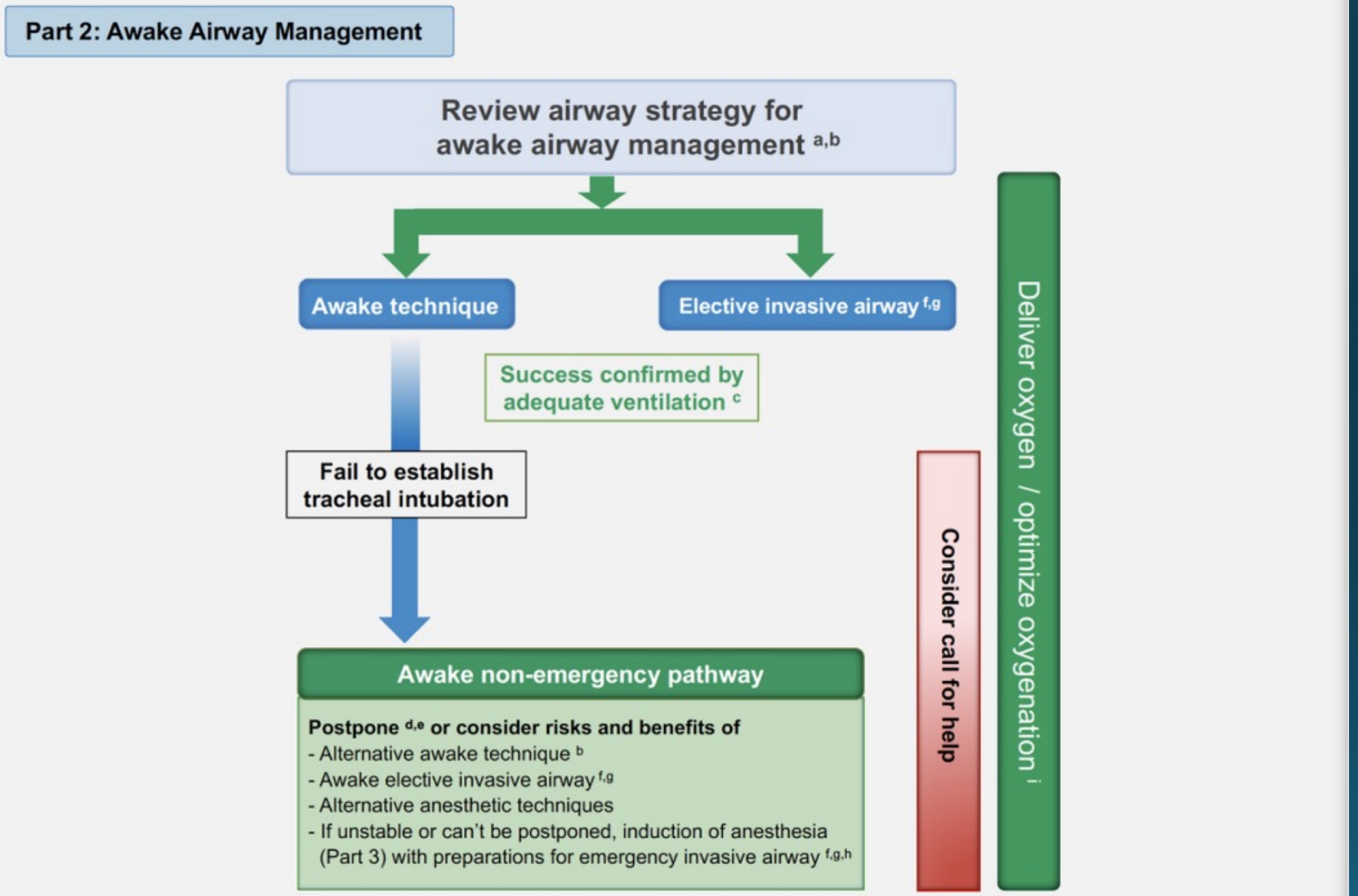
# Management?

- Awake tracheostomy in the operating room
- Only topicalization and coaching throughout procedure
- Diagnosis of likely laryngeal tuberculosis



# Recap

- Ask the consulting physician directly what the problem is and what time frame is necessary.
- Optimize the location of intubation: if things are truly bad then you go to the operating room or ICU; otherwise recreate the operating room environment for yourself.
- Take adequate time to prepare for disaster / backup plans.
- Educate ancillary staff so they can be prepared to help you.
- Anticipate post-airway concerns and address them ahead of time for the primary team.
- Communicate with the primary team after successful intubation.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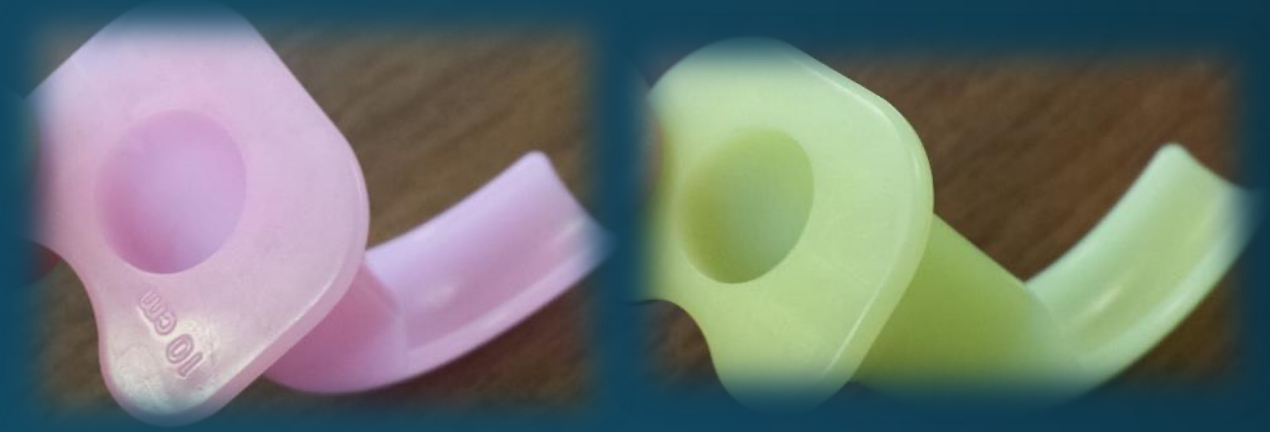
- Alternative anesthetic techniques
- If unstable or can't be postponed, induction of anesthesia (Part 3) with preparations for emergency invasive airway f,g,h
Consider call for help
Deliver oxygen / optimize oxygenation i

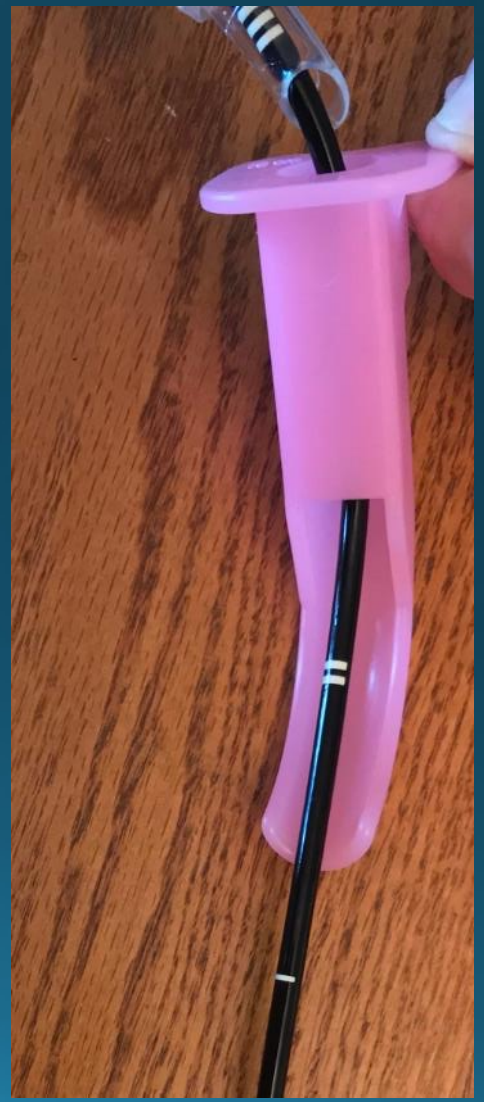
# Can maintain high degree of oxygenation while securing airway


# Some reference numbers

- Pink airway: 10cm long, admits 8.0 ett
- Yellow airway: 9cm long, admits 7.0 ett
- Aintree: 4.9mm ID, 6.0mmm OD, 56cm length
- Pediatric scope: 3.0 mm
- Intermediate scope: 4.0mm
- Large scope: 5.0 mm
- Circuit adaptor: 15 mm




# FOB without an Aintree (+rubber band)



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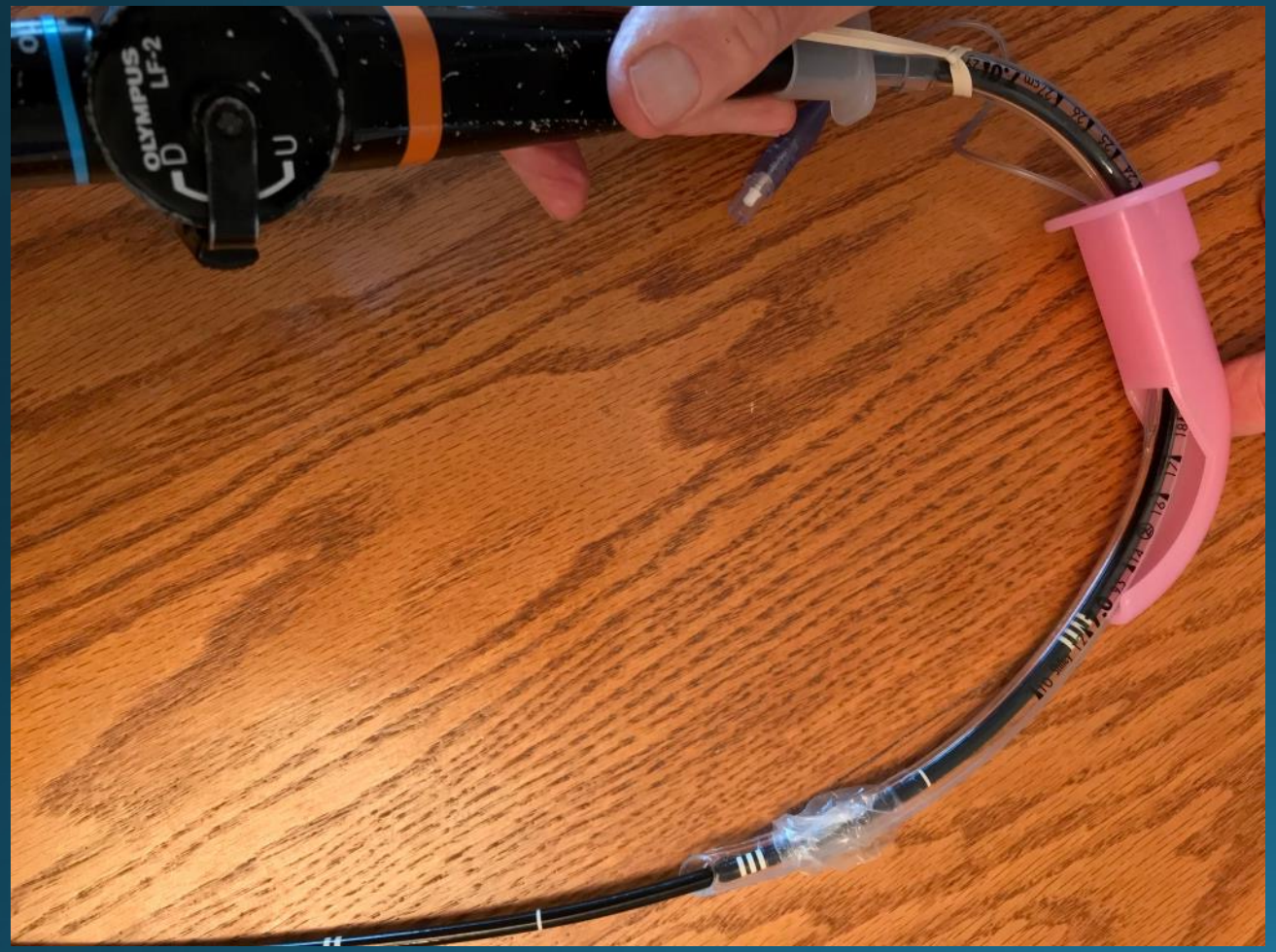


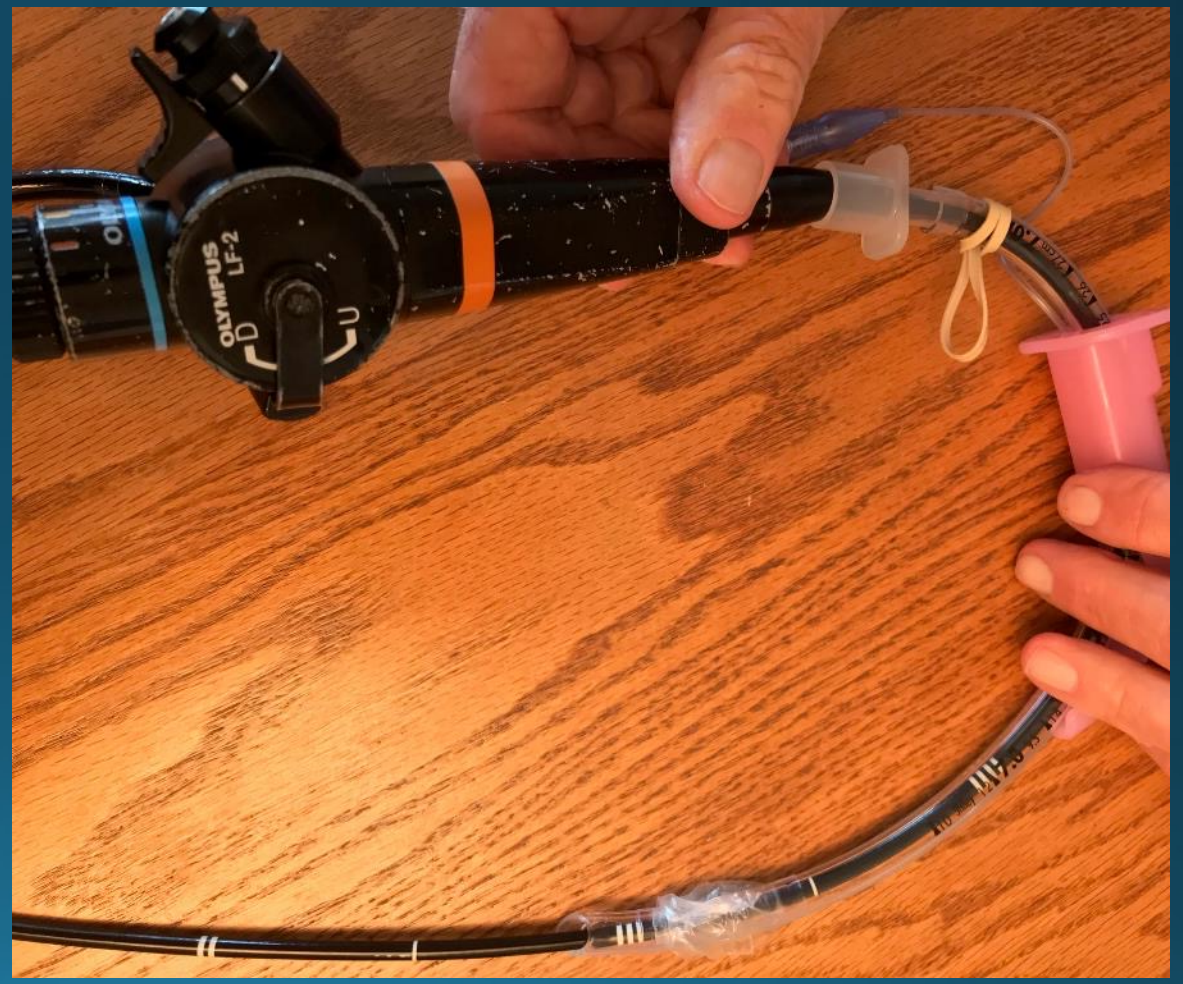

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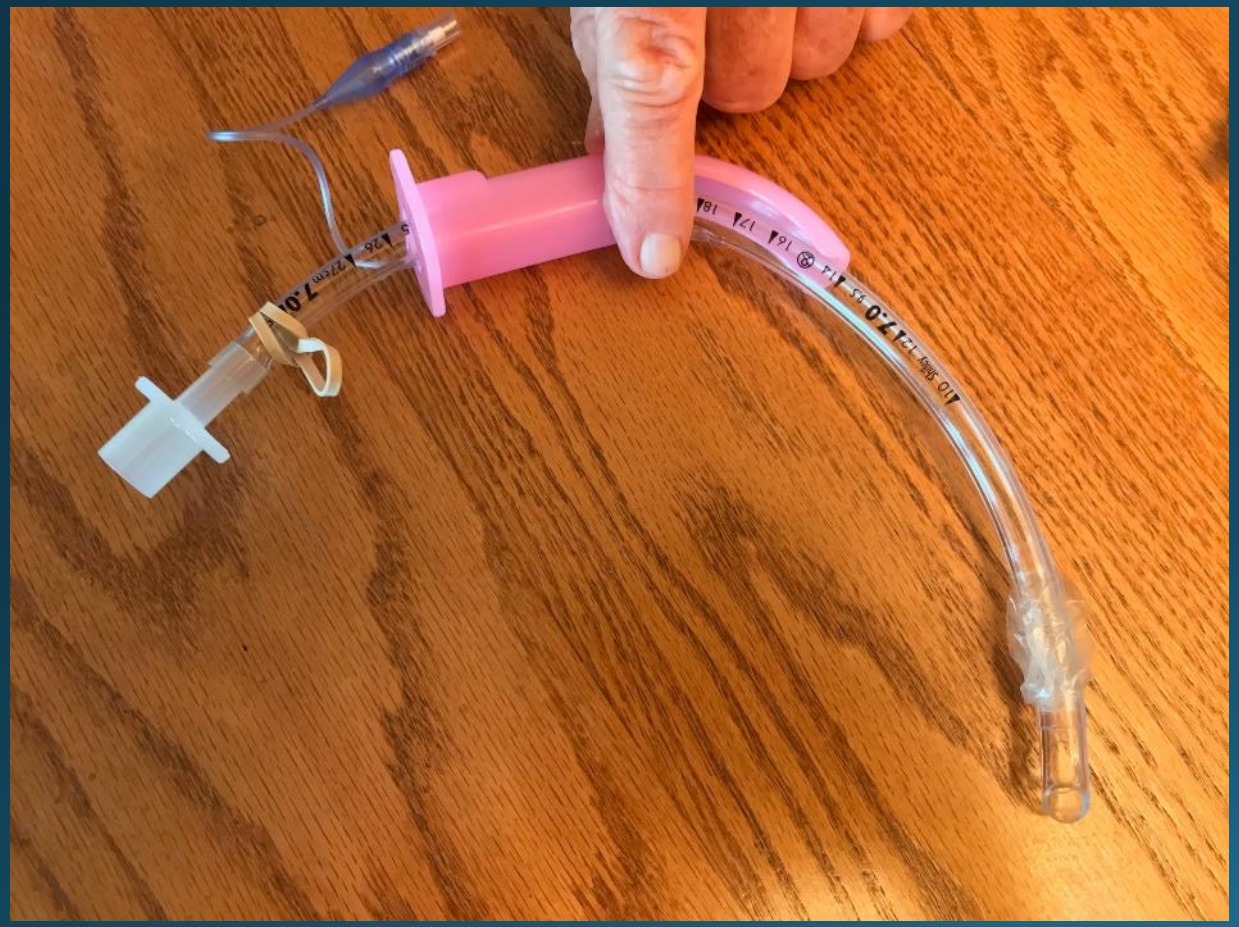
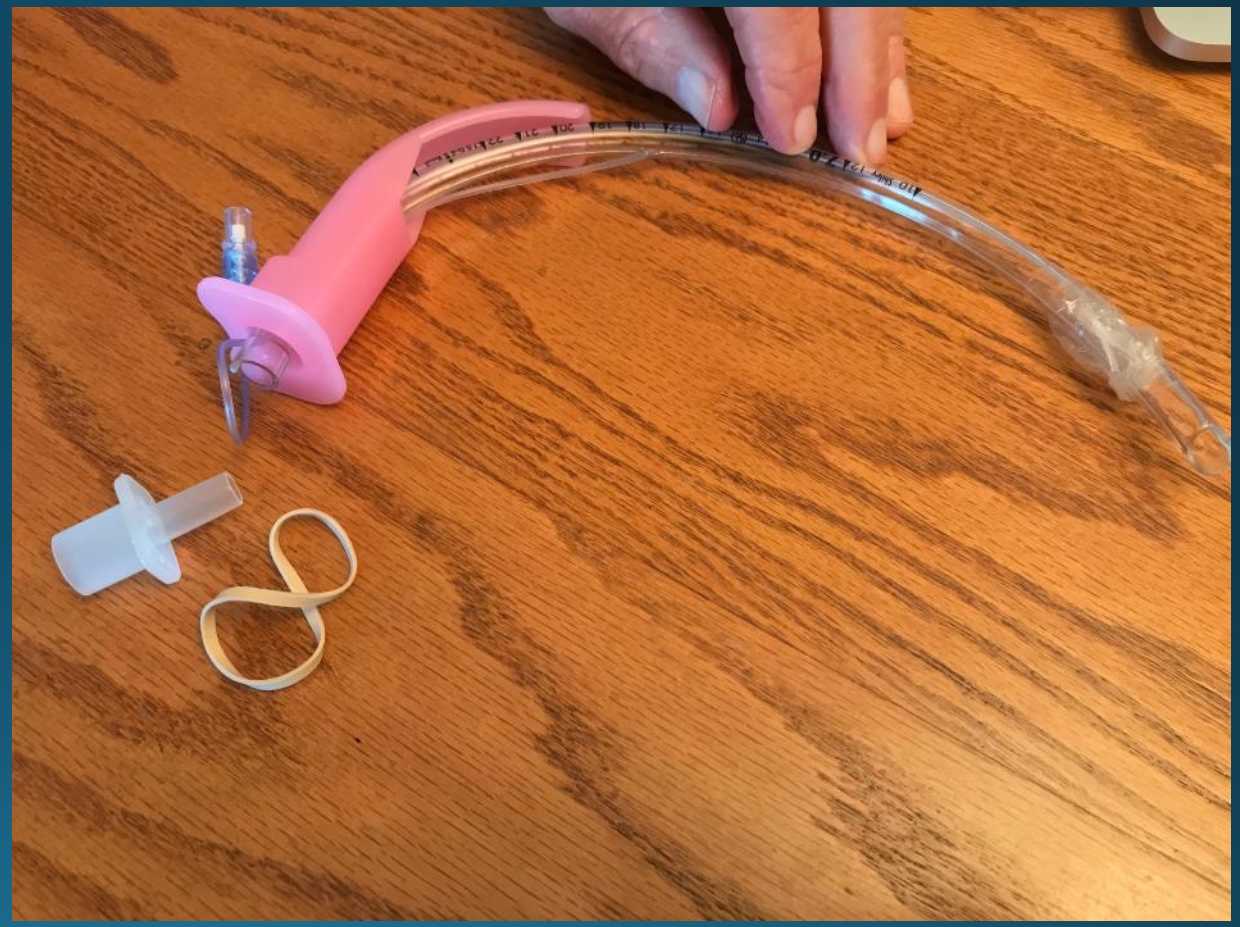
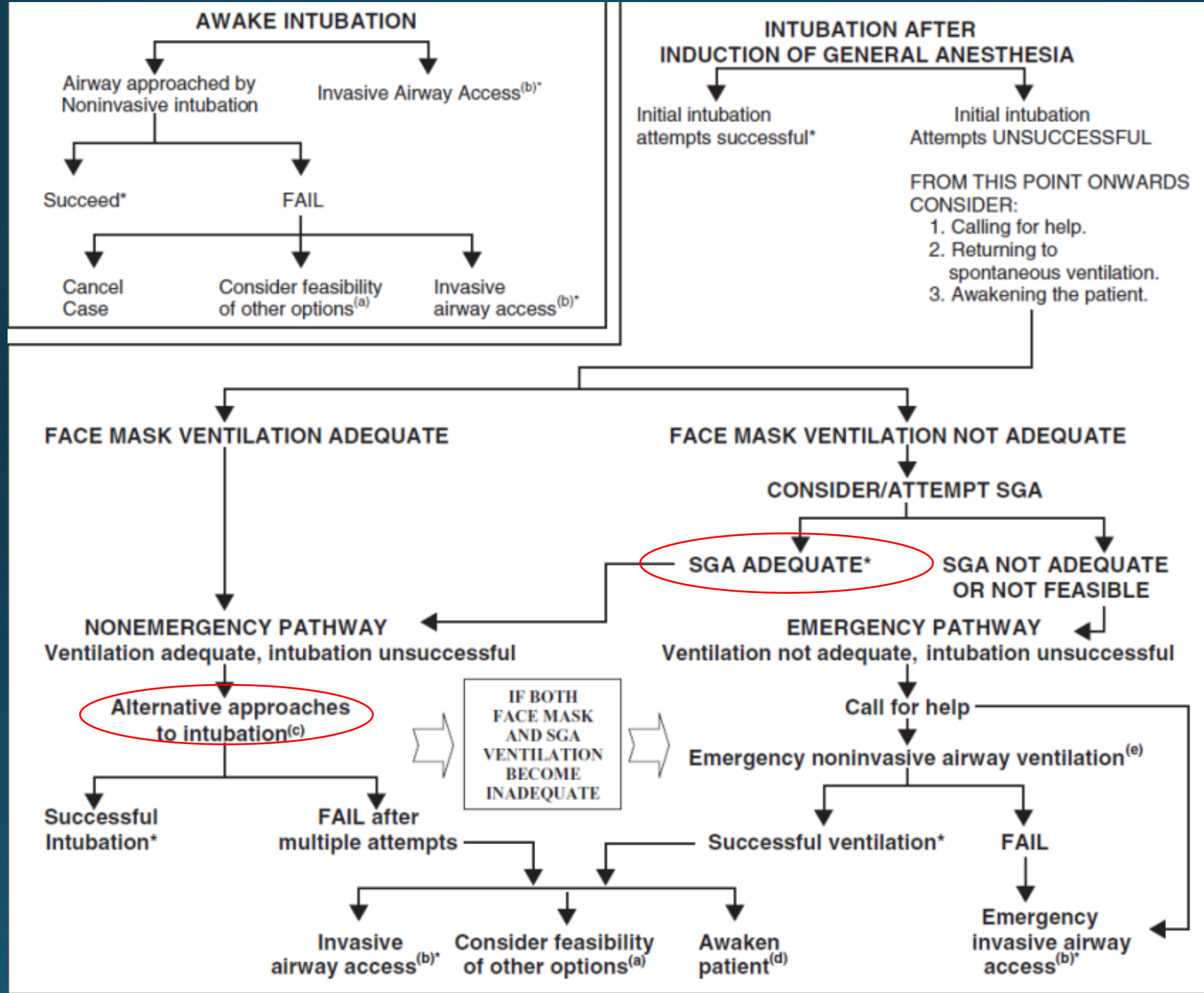
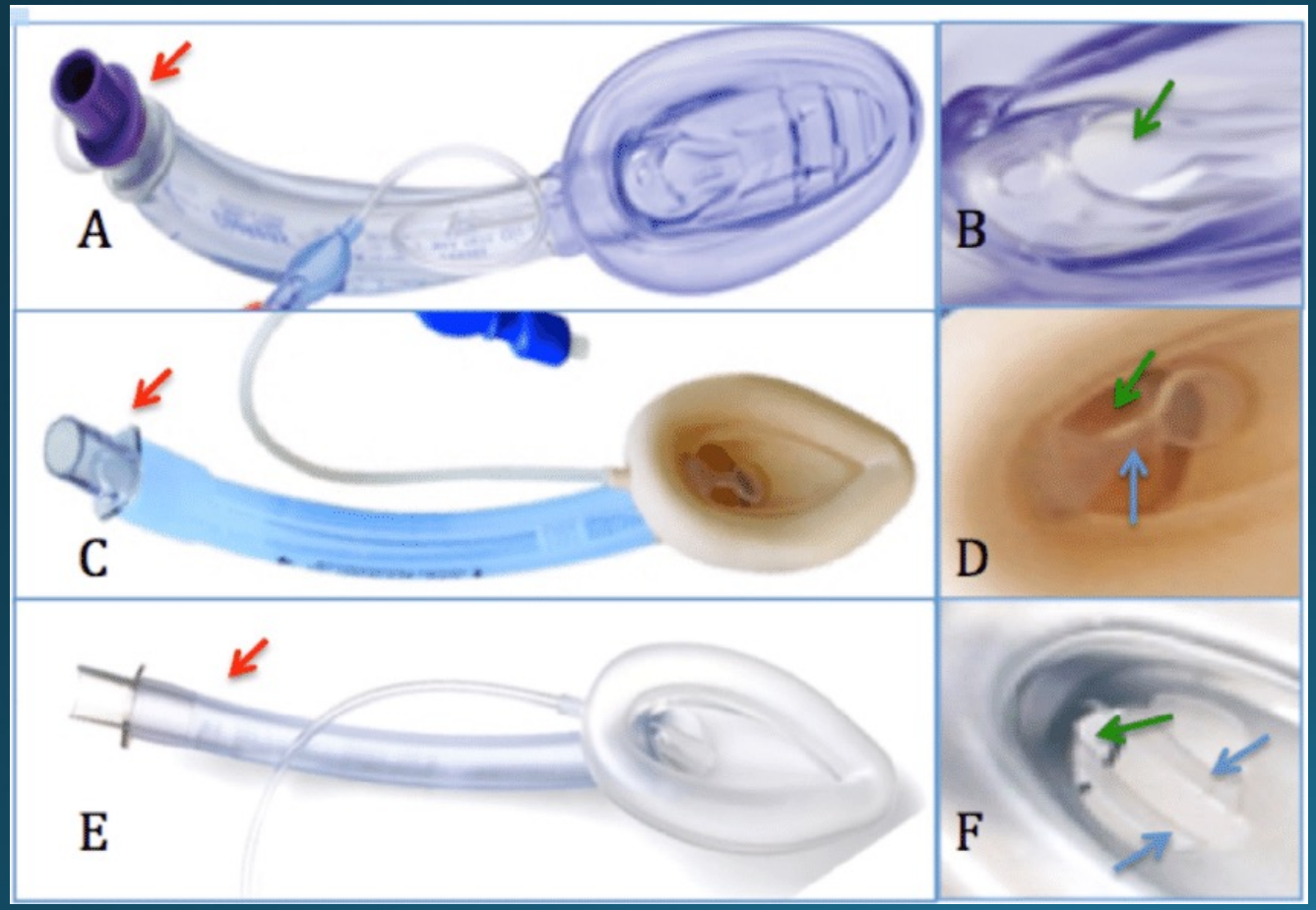




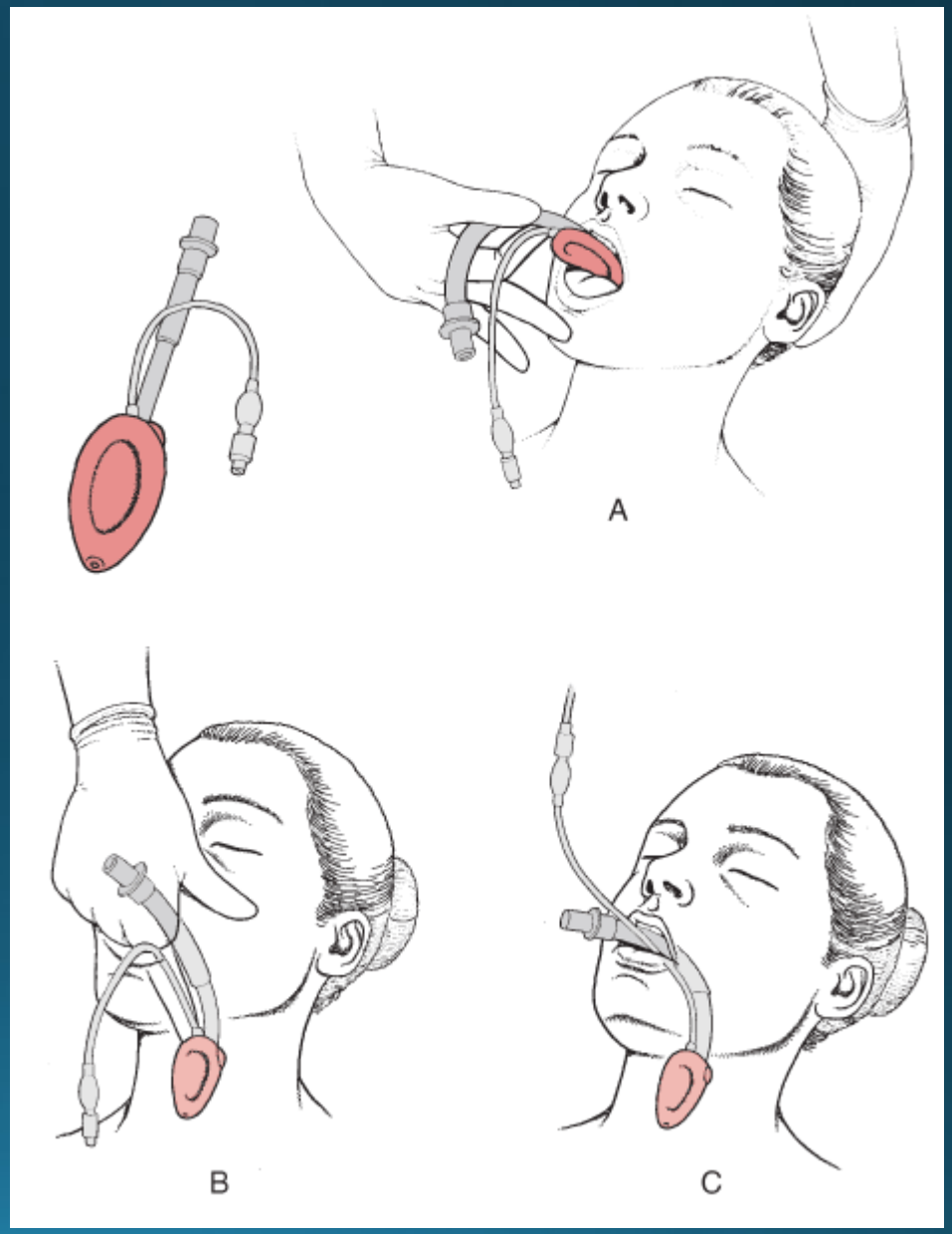

AWAKE INTUBATION
Airway approached by Noninvasive intubation
Invasive Airway Access(b)*
Succeed*
FAIL
Cancel Case
Consider feasibility of other options(a)
Invasive airway access(b)*
INTUBATION AFTER INDUCTION OF GENERAL ANESTHESIA
Initial intubation attempts successful*
Initial intubation Attempts UNSUCCESSFUL
FROM THIS POINT ONWARDS CONSIDER:
1. Calling for help.
2. Returning to spontaneous ventilation.
3. Awakening the patient.
FACE MASK VENTILATION ADEQUATE
FACE MASK VENTILATION NOT ADEQUATE
CONSIDER/ATTEMPT SGA
SGA ADEQUATE*
SGA NOT ADEQUATE OR NOT FEASIBLE
NONEMERGENCY PATHWAY
Ventilation adequate, intubation unsuccessful
EMERGENCY PATHWAY
Ventilation not adequate, intubation unsuccessful
Alternative approaches to intubation(c)
IF BOTH FACE MASK AND SGA VENTILATION BECOME INADEQUATE
Call for help
Emergency noninvasive airway ventilation(e)
Successful Intubation*
FAIL after multiple attempts
Successful ventilation*
FAIL
Invasive airway access(b)*
Consider feasibility of other options(a)
Awaken patient(d)
Emergency invasive airway access(b)*

# Supraglottic airway (laryngeal mask airway aka lazy man's airway)




# How to insert an LMA

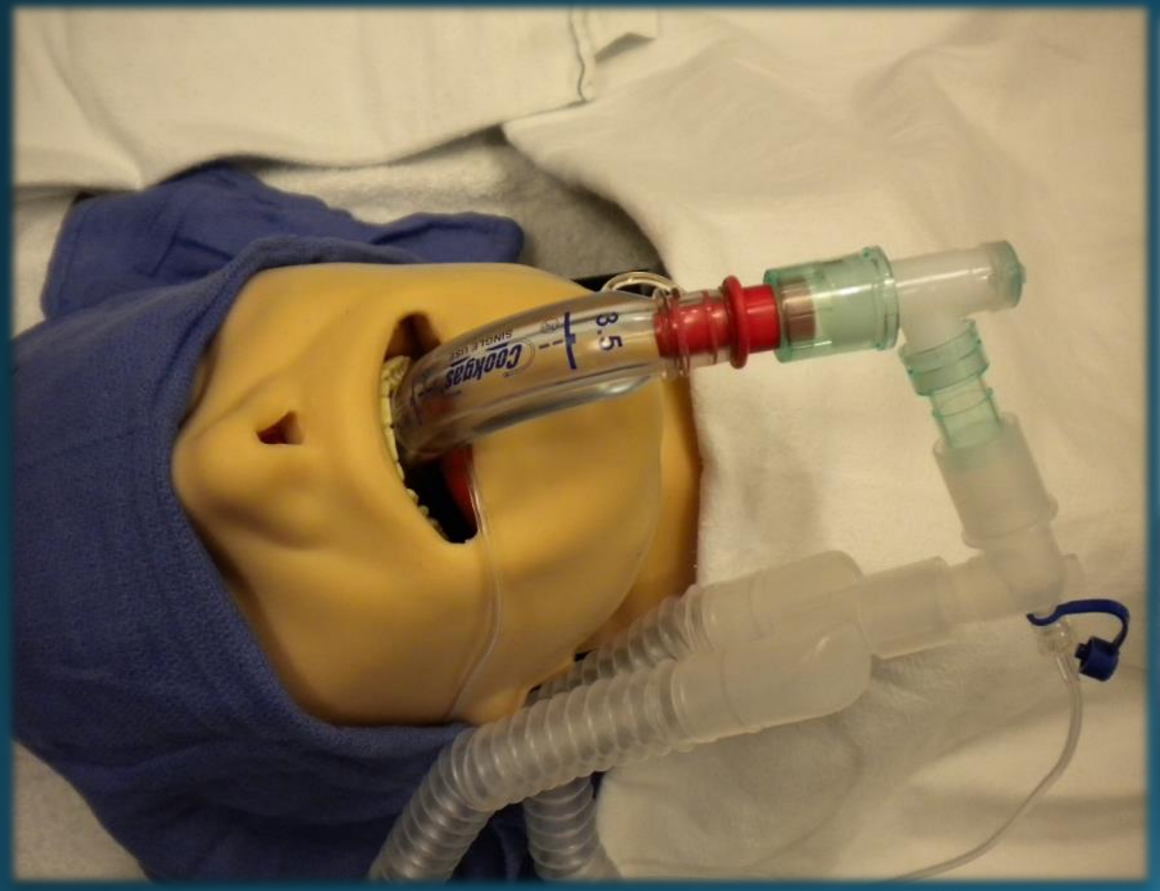
- Resist the urge to ram it blindly in
  - Tip can curl back or forward, leading to obstruction
  - Unnecessary trauma leading to more edema
- Size appropriately, deflate slightly, apply lubricant
- Scissor open with right hand
- Insert with left like laryngoscope
- Follow and guide the bowl with your right hand to ensure it does not bend
- Gently inflate cuff until no audible leak at 20 cm H2O

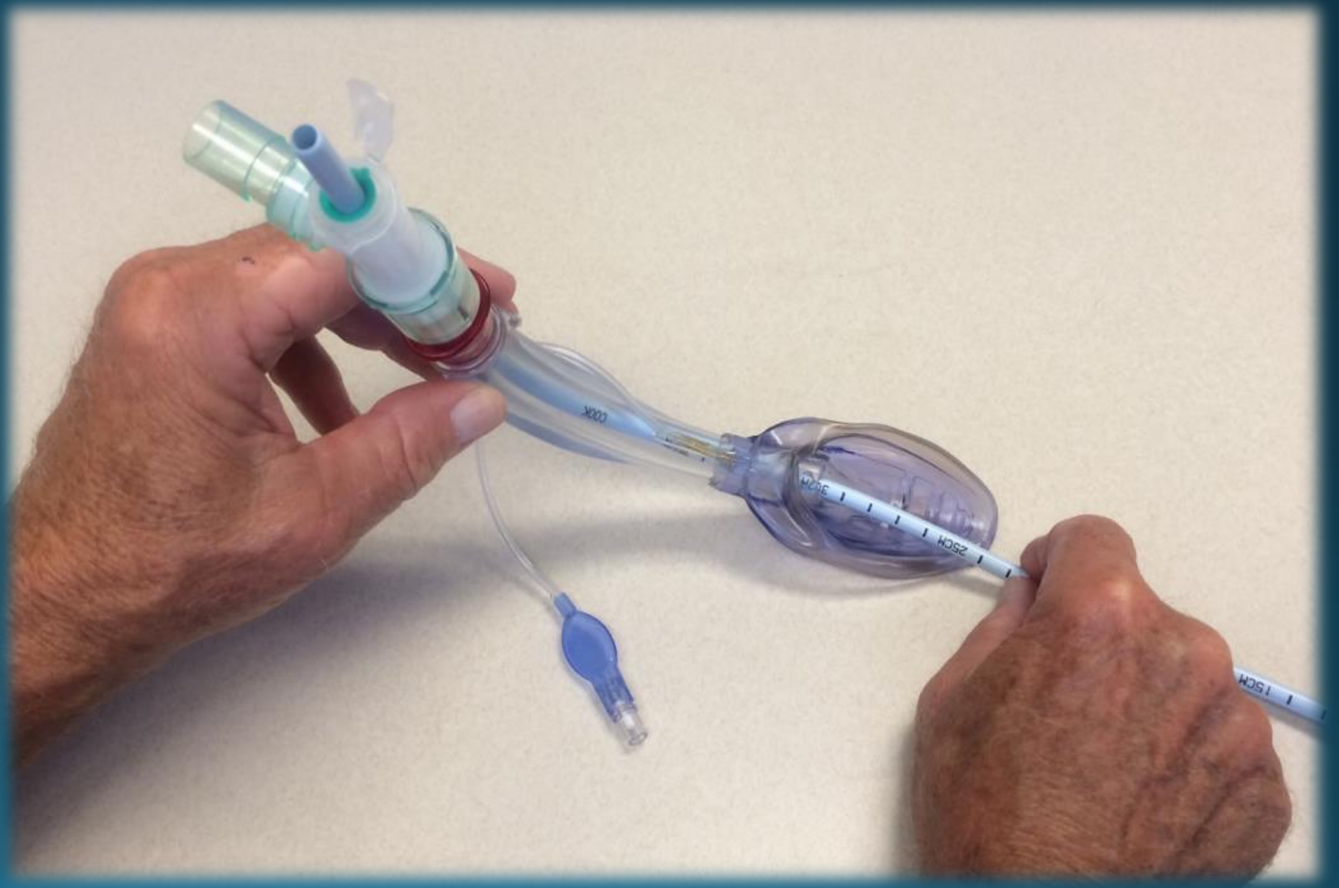


# Intubation through LMA

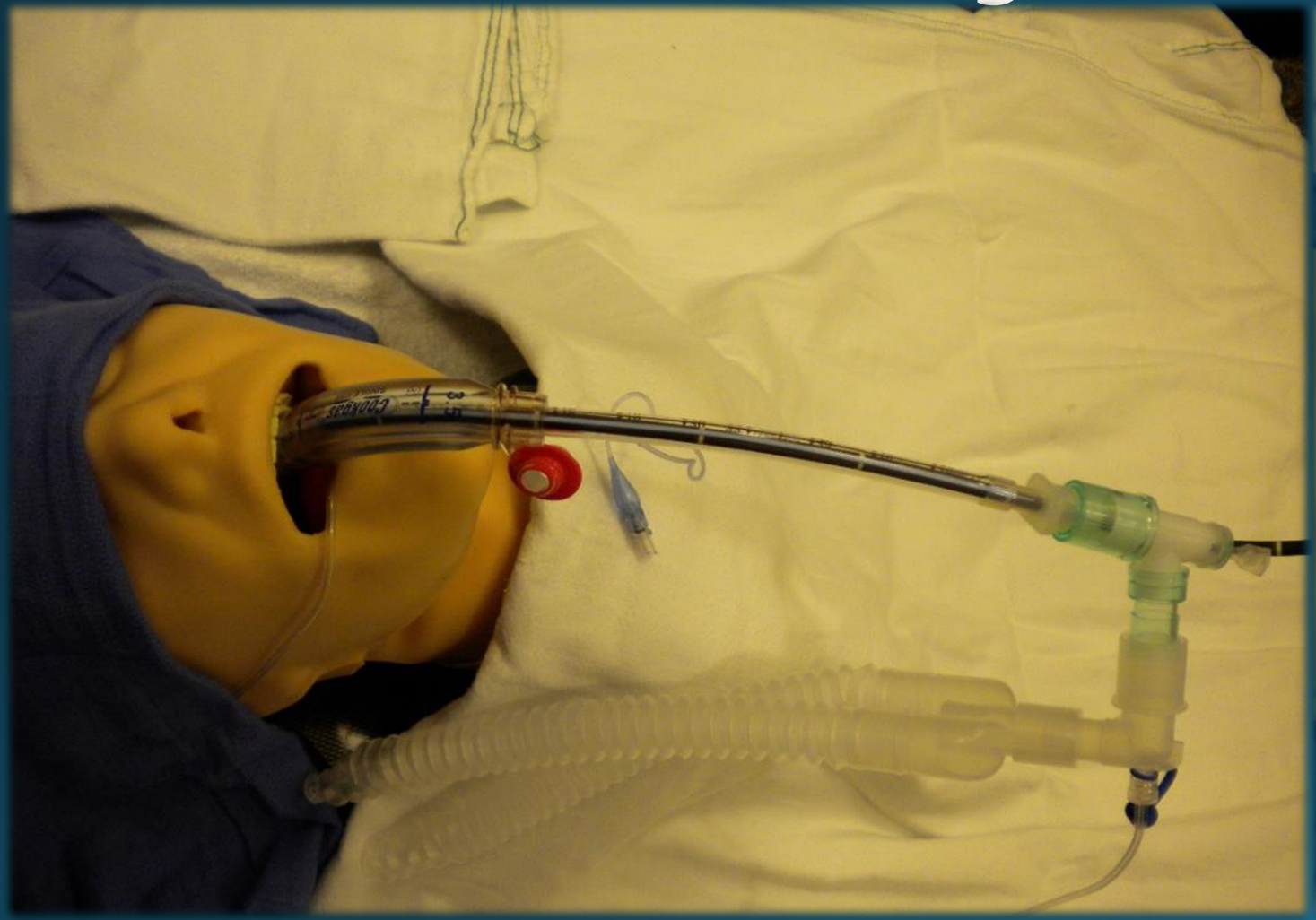
- Aintree vs. tube pusher (LMA Removal Stylet)
- Entirely possible to do either of these without giving up ventilation

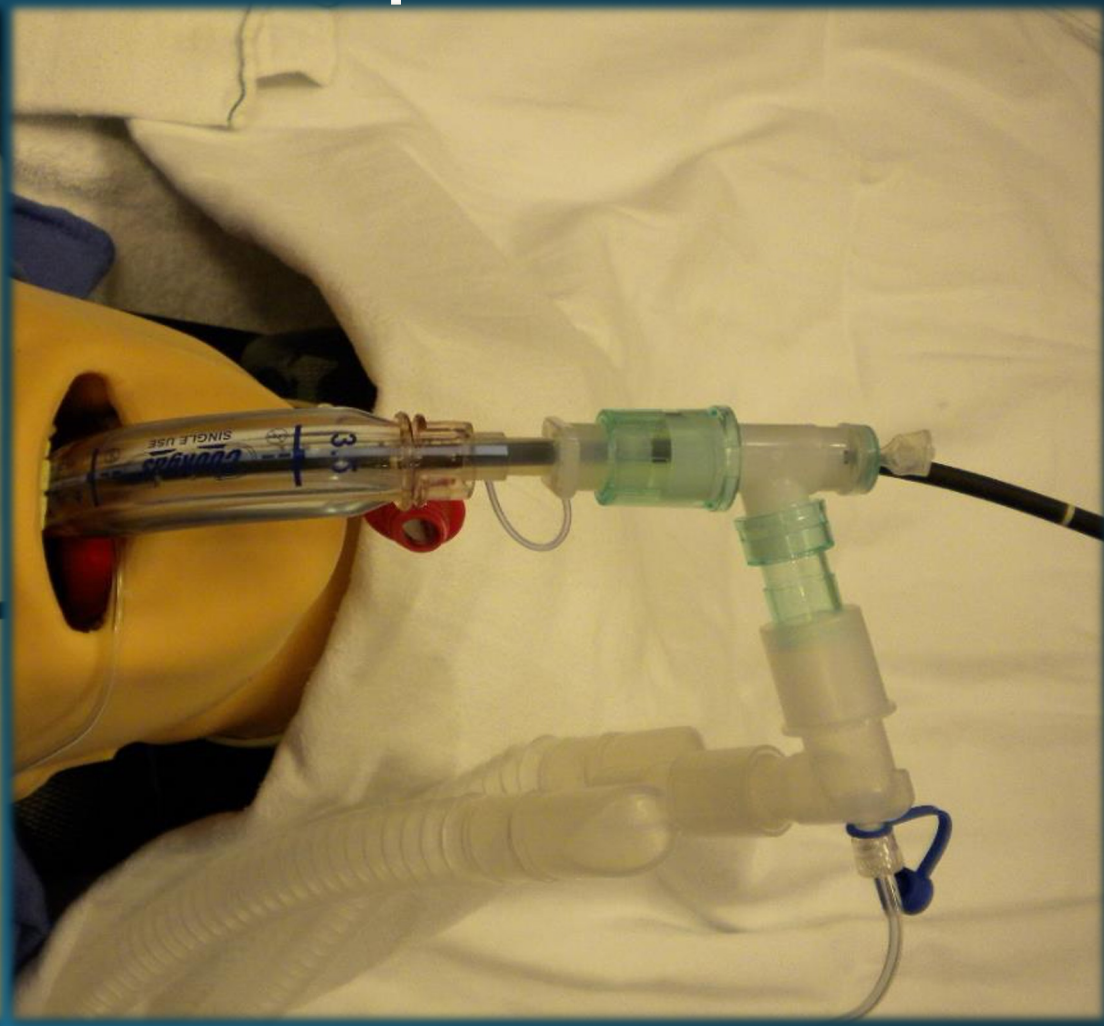
# Intubation through LMA: Aintree



# Intubation through LMA: tube pusher





# Intubation through LMA: tube pusher