

THE PROMETHEUS FACTOR: FIRE VICTIMS AND THE RT

Airway, Ventilation & Pulmonary Care in Burn
Patients

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Duration: 90 minutes | CEU: 1.5 Contact Hour

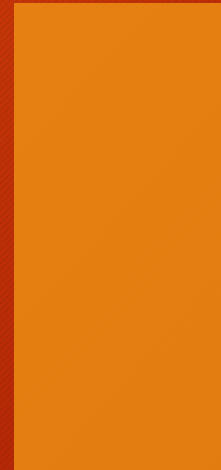


LEARNING OBJECTIVES

- Identify inhalation injury patterns
- Manage CO/cyanide poisoning
- Apply lung-protective ventilation
- RT strategies for mass casualty
- Discuss emerging therapies

THE PROMETHEUS MYTH

- Prometheus-The Ancient “God of Fire”
- Fire gave humanity progress; when it turns, it takes breath first
- Inhalation of smoke and toxic gases kills first and kills rapidly



DEGREES OF BURNS

1. First Degree Burn
 - Erythema
2. Second Degree Burn
 - Includes blistering
3. Third Degree Burn
 - Charring and more tissue destruction
 - Not painful-nerves are affected
4. Fourth Degree Burn
 - Deep tissue destruction
 - Sometimes including bone

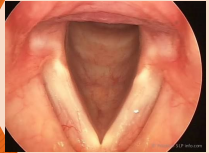
Type:	Looks Like:
1st-Degree (superficial)	
2nd-Degree (partial-thickness)	
3rd-Degree (full-thickness)	
4th-Degree (deep full-thickness)	



FIRE VICTIM ASSESSMENT

- Scene safety
- Mechanism
- Burn %TBSA
 - (Rule of 9's)
- Signs of inhalation injury

INHALATION INJURY RED FLAGS



Stridor, hoarseness



Soot, singed hair



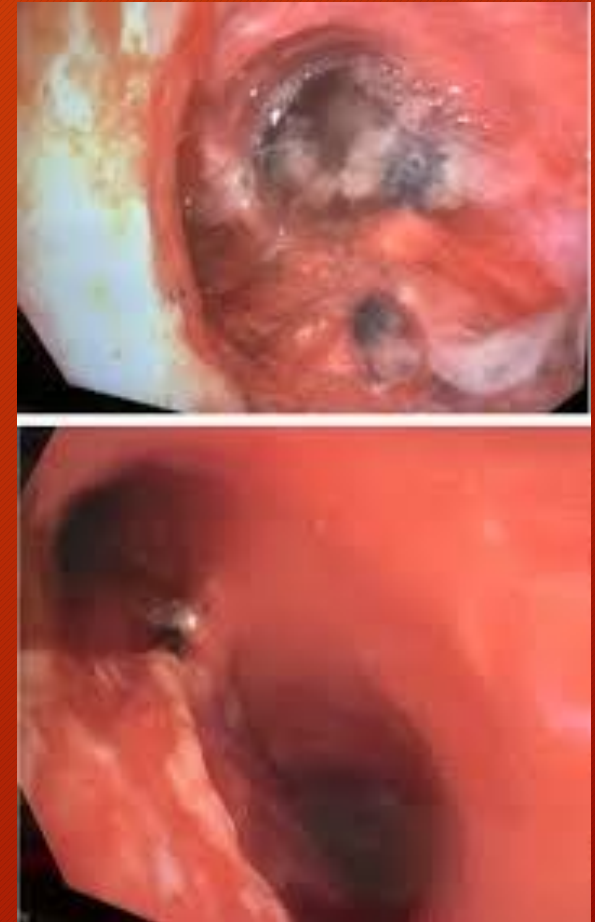
Confined fire



Altered Mental Status
(AMS)

CLASSIFICATIONS OF INHALATION INJURIES

- Upper airway thermal injury
 - Supraglottic region
- Cause
 - Inhaling extreme heated air or hot steam
- Key Signs
 - Hoarseness
 - Stridor
 - Facial burns
 - Singed nasal hairs
 - Rapid swelling of the throat



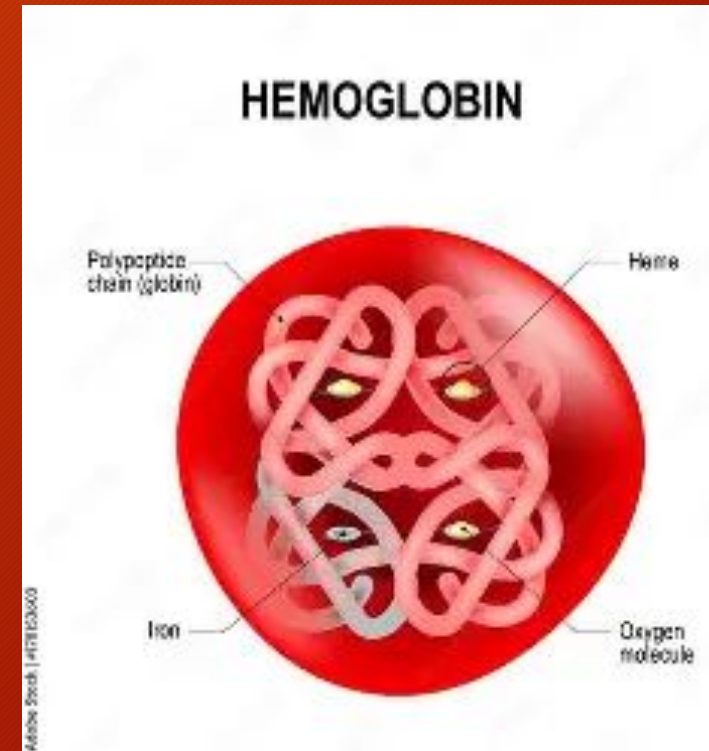
CLASSIFICATIONS OF INHALATION INJURIES (continued)



- Lower airway chemical injury
- Cause
 - Inhaling chemical irritants, particulate matter, and toxic byproducts of combustion found in smoke
- Key signs
 - wheezing
 - coughing
 - bronchospasm
 - carbonaceous (sooty sputum)
 - delayed pulmonary edema (sometimes >36 hours)

CLASSIFICATIONS OF INHALATION INJURIES (continued)

- Systemic Toxicity
 - toxic gases are absorbed through the lungs and enter the bloodstream
- CO-disrupts oxygen transport
- HCN (Cyanide)-disrupts oxygen utilization



GLOTTIC EDEMA

Peaks 12-36
hrs

1mm edema
= severe
obstruction

Hoarse =
intubate

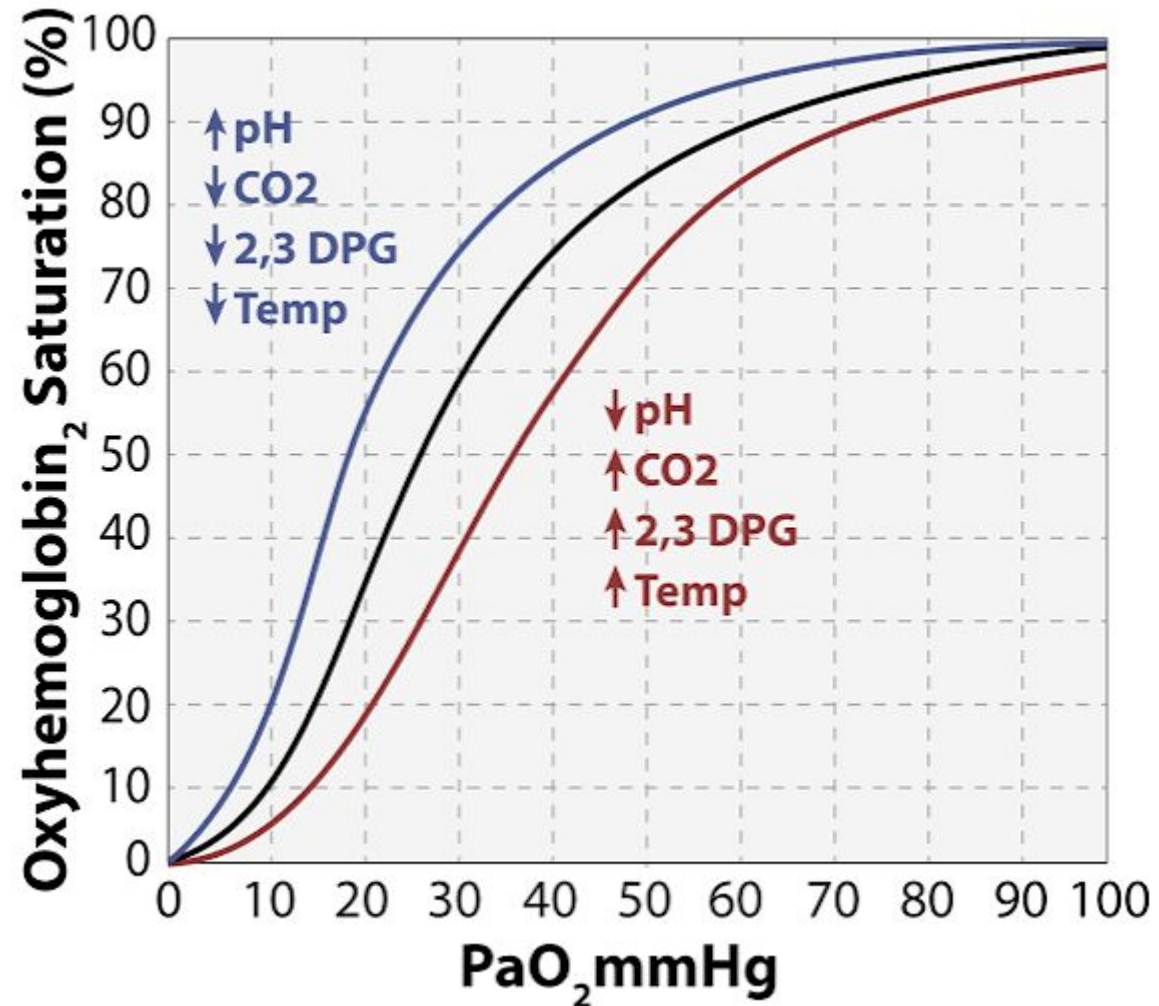
CO POISONING

- Blood Oxygen Levels (SpO2) unreliable
- COHb >5%
- 100% O2 or HBOT



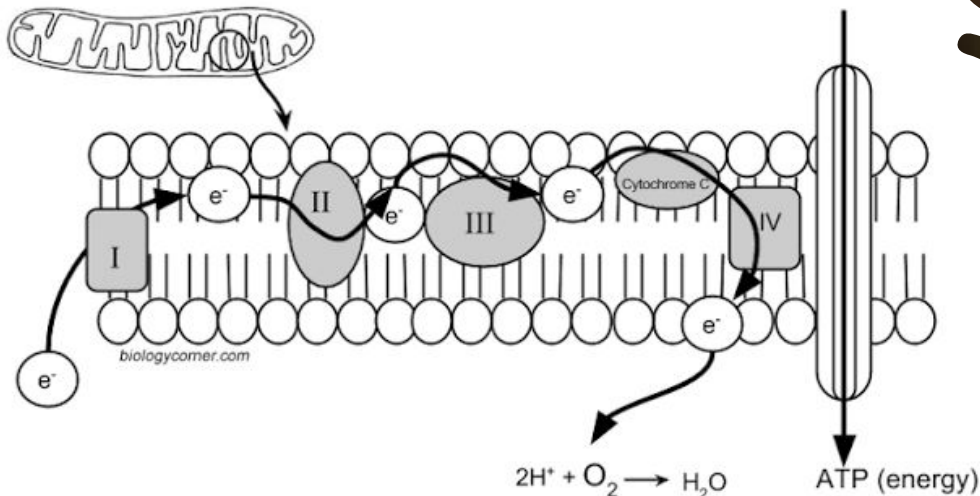
OXYHEMOGLOBIN DISSOCIATION CURVE

- CO binds with Hgb 250x faster than O₂
- CO deforms and shifts the curve to the left and downward
- Cyanide leaves the curve completely unaltered



CYANIDE

- Lactate >8
- Normal PaO₂
- Tx:
Hydroxocobalamin



CYANIDE GAS

is **35 times more** toxic
than carbon monoxide

ACID GASES/IRRITANT GASES

The burning of synthetics produces several acid gases



Examples include:

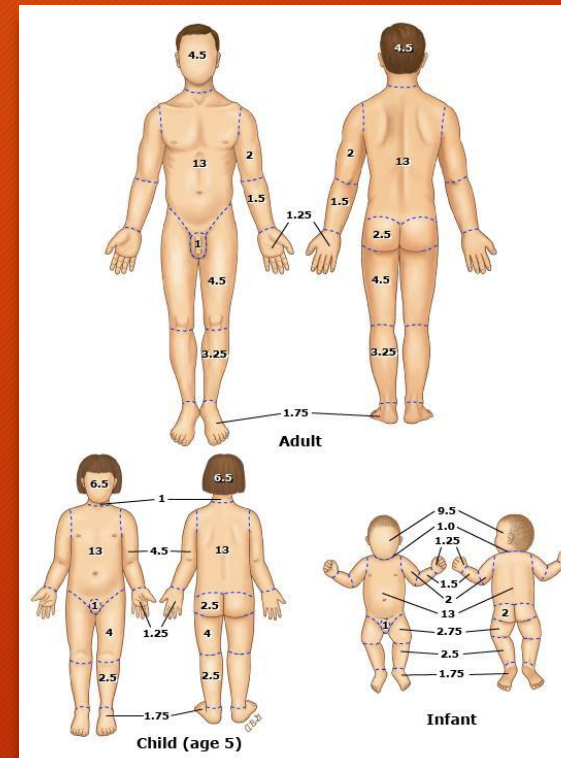
Chlorine

Phosgene

PFIB

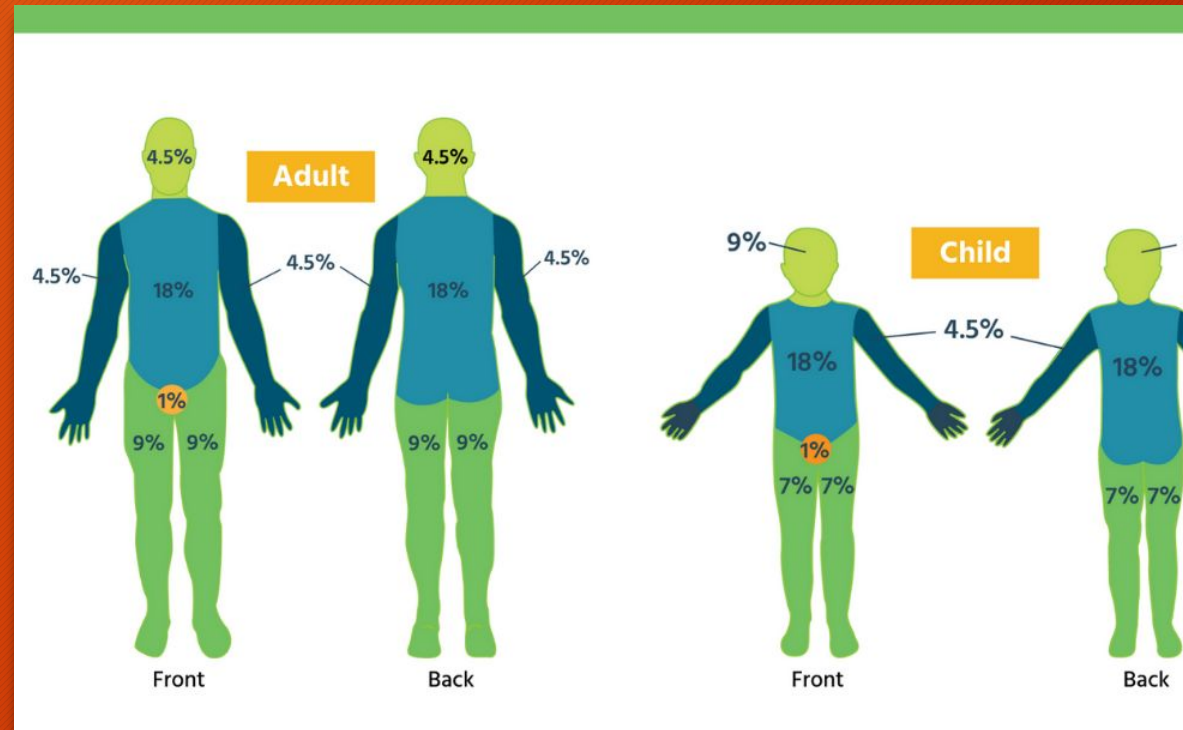
PEDIATRICS

- Higher edema risk
- Weight dosing
- Early intubation
- Kiddos are not adults!
- Unique anatomical and physiological characteristics



PARKLAND FORMULA

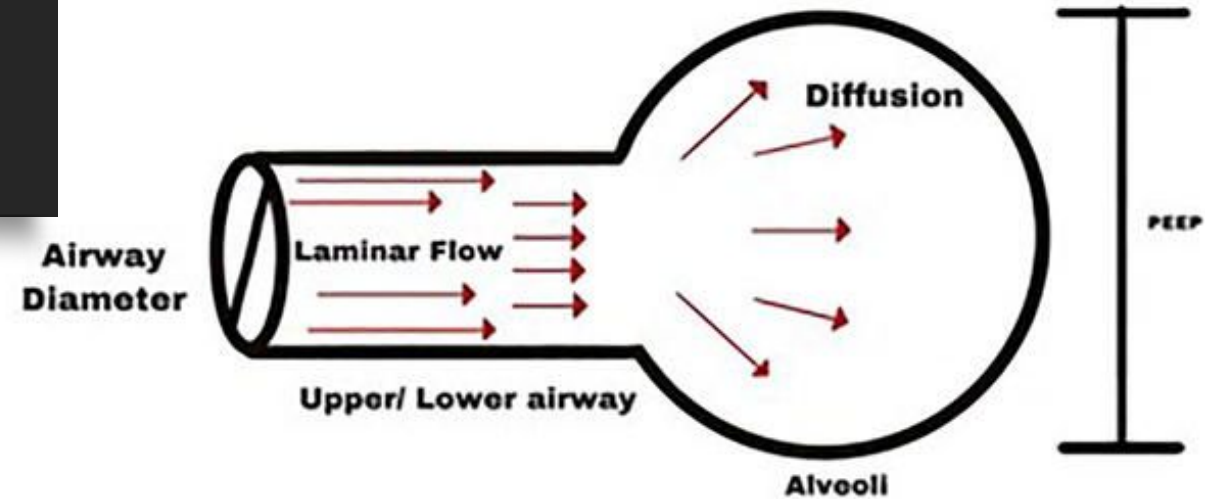
- $4\text{mL} \times \text{kg} \times \% \text{TBSA}$
- Half in 8h
- Next 16 hours, administer 50% of the remaining fluid
- Avoid overload
- Parkland Formula is composed of isotonic crystalloids, usually Lactated Ringer's solution
- Children-total 24 hour fluid = $3\text{mL} \times \text{Weight (Kg)} \times \text{TBSA}\%$



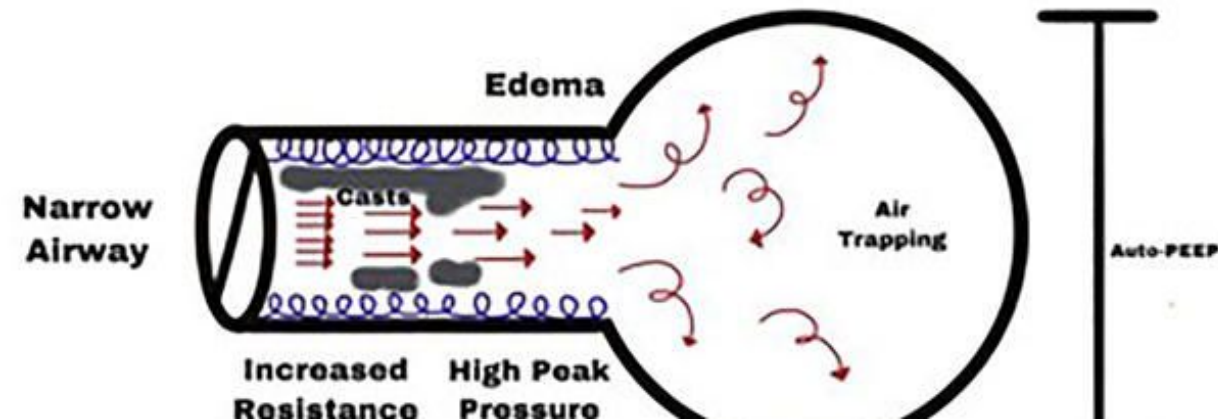
VENTILATOR SETTINGS

- 4-6 mL/kg
- PEEP 8-12
- FiO₂ 1.0 then wean/titrate
- Utilize lung protective strategies
- Low tidal V_t and limiting plateau pressures to minimize VILI

HEALTHY AIRWAY (A)



BURNED AIRWAY (B)



ESCHAROTOMY



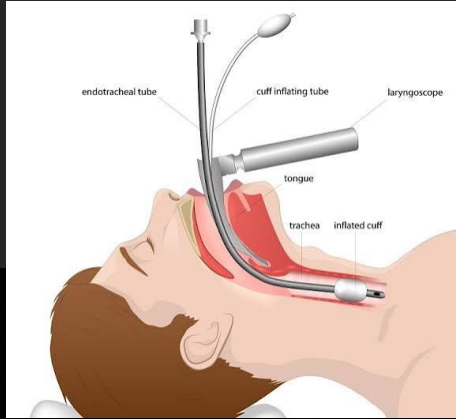
CHEST BURNS
RESTRICT VENTILATION



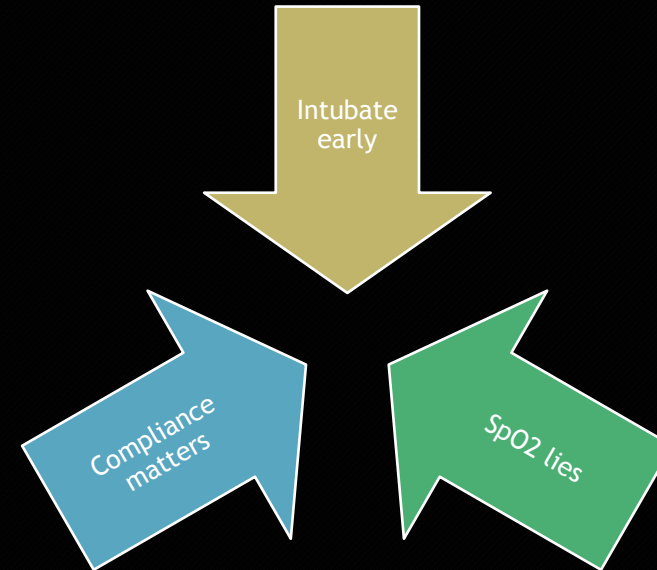
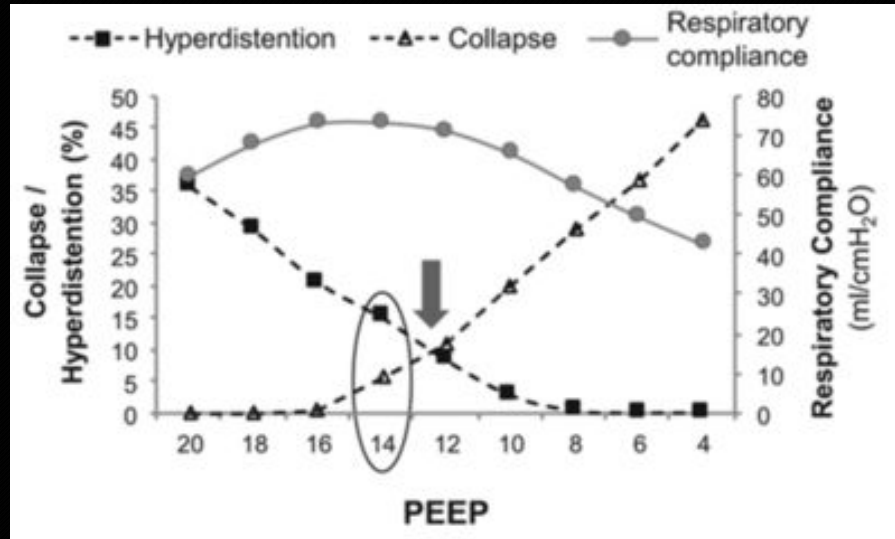
HIGH PIP, LOW
COMPLIANCE



CALL SURGERY



RT MANTRA



MASS CASUALTY

- Mobilize surge ventilators
- Pressure limited disposable vents should not be used due to low compliance and increased airway resistance
- Triage
- MDI vs nebs



MOBILE RESPIRATORY TREATMENT UNIT-FDNY

Capable of providing oxygen therapy and aerosolized medications (NEB) for up to 32 patients



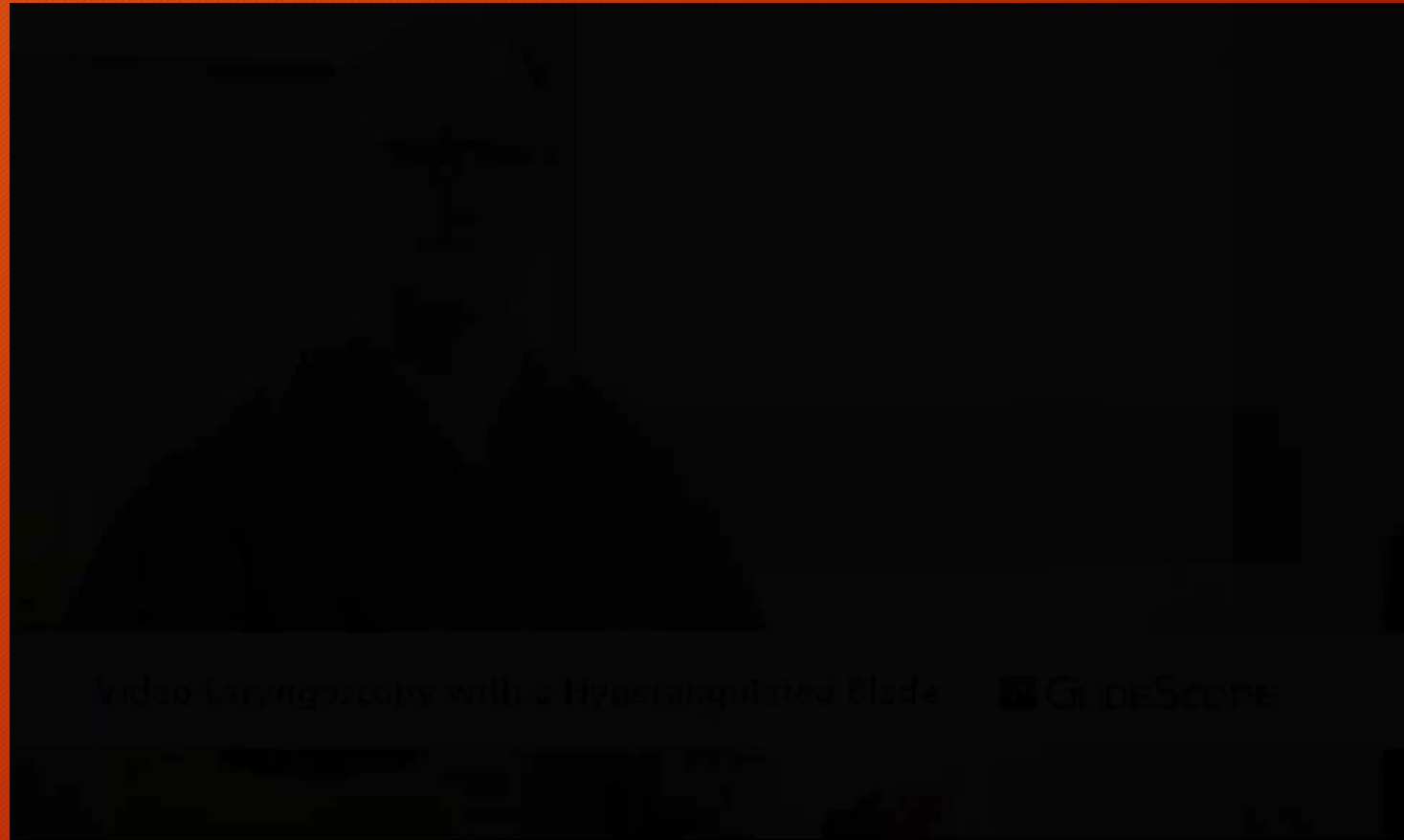
HBOT



- 100% O₂ >1 atm
- Severe CO/cyanide
- Reduce COHb

ADVANCED AIRWAY MANAGEMENT

- Video laryngoscopy
- Cric ready
- Anticipate edema
- Early intubation due to glottic edema



Video Laryngoscopy with a Hyperangulated Blade

Gi deScope

GRADING OF ADVERSE EFFECTS

- Grade 1-4
- Erythema to necrosis
- Bronchoscopy



ADVERSE EVENT GRADING (CTCAE)

A standardized way to describe the severity of side effects

GRADE
1

MILD

- Asymptomatic or mild symptoms
- No intervention required
- No limitation of daily activities (work)

EXAMPLES: mild nausea, slight headache



GRADE
2

MODERATE

- Noticeable symptoms
- Minimal or local intervention needed
- Some limitation of daily activities

EXAMPLES: vomiting requiring antiemetics, moderate pain



GRADE
3

SEVERE

- Medically significant
- Hospitalization may be required
- Significant limitation of self-care

EXAMPLES: severe diarrhea requiring IV fluids



GRADE
4

LIFE-THREATENING

- Immediate risk of death
- Urgent medical intervention required
- Critical condition

EXAMPLES: respiratory failure, anaphylactic shock



GRADE
5

DEATH

- Death related to an adverse event



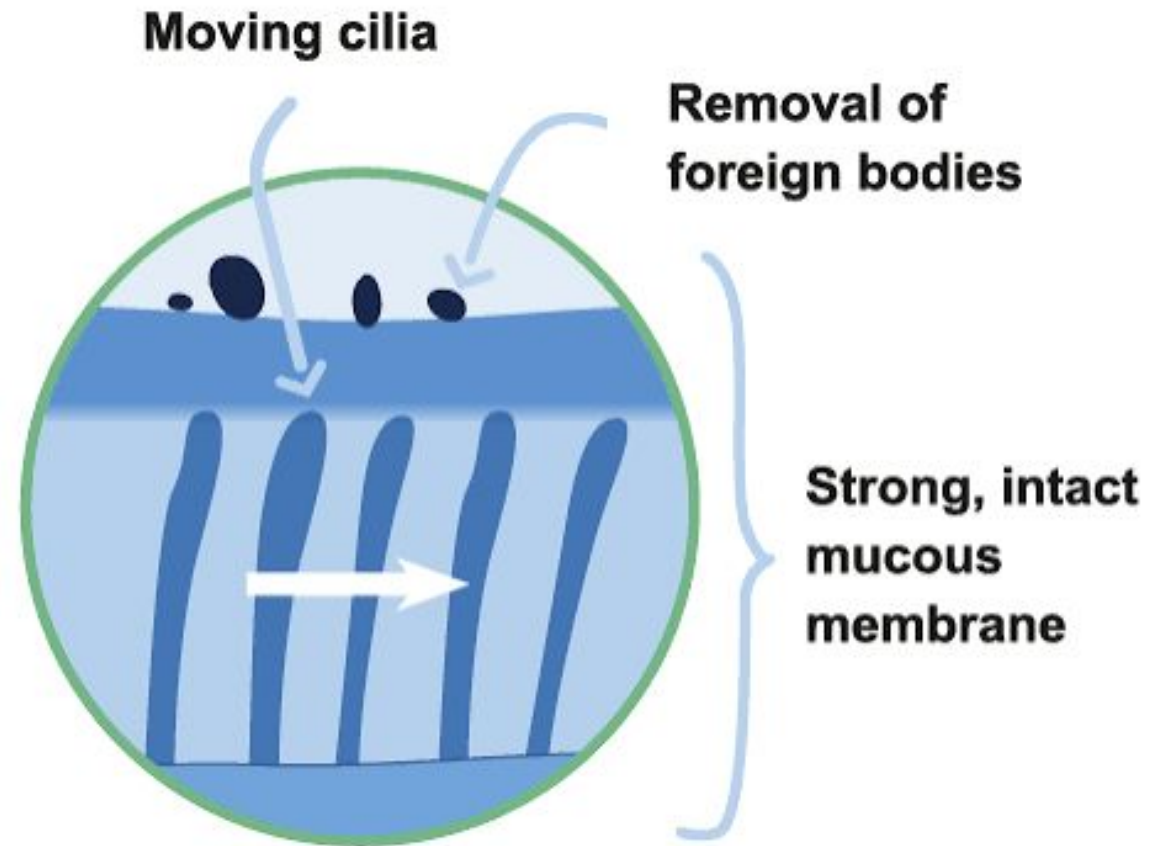
Mild → Moderate → Severe → Life-threatening → Death

Understanding severity helps guide treatment, ensure patient safety, and improve clinical outcomes.

Post by SimhadriAshok

MUCOCILIARY FUNCTION

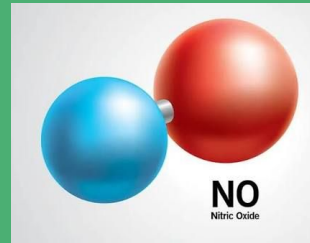
- Cilia destroyed
- Airway casts
- Heparin + NAC
- Secretion and cast mobilization and clearance are essential



EMERGING THERAPIES



ECMO



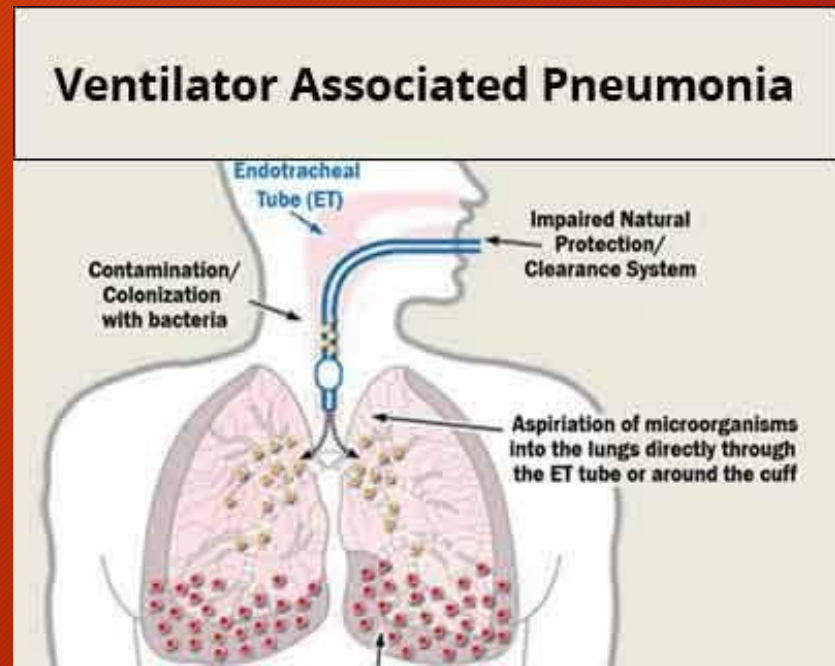
NITRIC OXIDE



NO PROPHYLACTIC
ANTIBIOTICS

VENT COMPLICATIONS

- Abdominal Compartment Syndrome (ACS)
 - Sustained Intra Abdominal Pressure (IAP) >20mm Hg
- Fluid overload
- VAP
- VILI



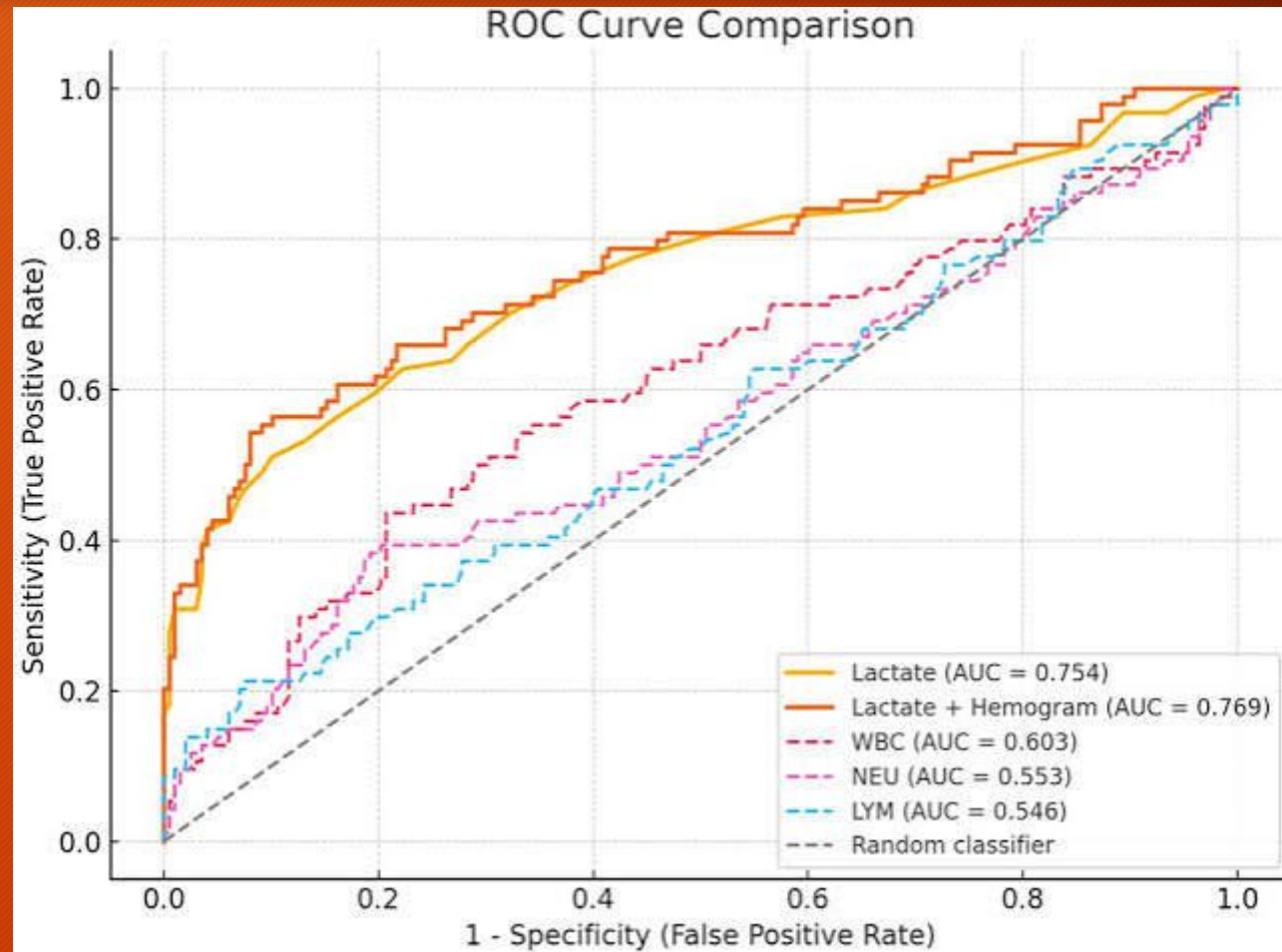
WEANING

- SBT criteria-Follow Institutional Protocols/TDP
 - Underlying cause improved or resolved
 - Oxygenation
 - Hemodynamic stability
 - Neurostatus
 - Ventilation metrics (RSBI <105)
- Cuff leak
- Edema recurrence



DOCUMENTATION OF TREATMENT

- Burn time
- COHb/lactate
- Vent trends



DISASTER TRIAGE

- Triage “to sort”
- **S**imple **T**riage **A**nd **R**apid **T**reatment
- **START** RPMs
 - Respirations, Perfusion, Mental Status
- COHb checks
- Pedi surge

Adult Triage



S.T.A.R.T. Simple Triage And Rapid Treatment Algorithm

Able to walk on command and no major injuries. ☐ **MINOR**

No respirations after head tilt. ☐ **DECEASED**

Respirations after head tilt. ☐ **IMMEDIATE**
- Skip if already breathing -

Respirations: Over 30 per min. ☐ **IMMEDIATE**

OR

Perfusion: Radial pulse absent.
(Control bleeding) ☐ **IMMEDIATE**

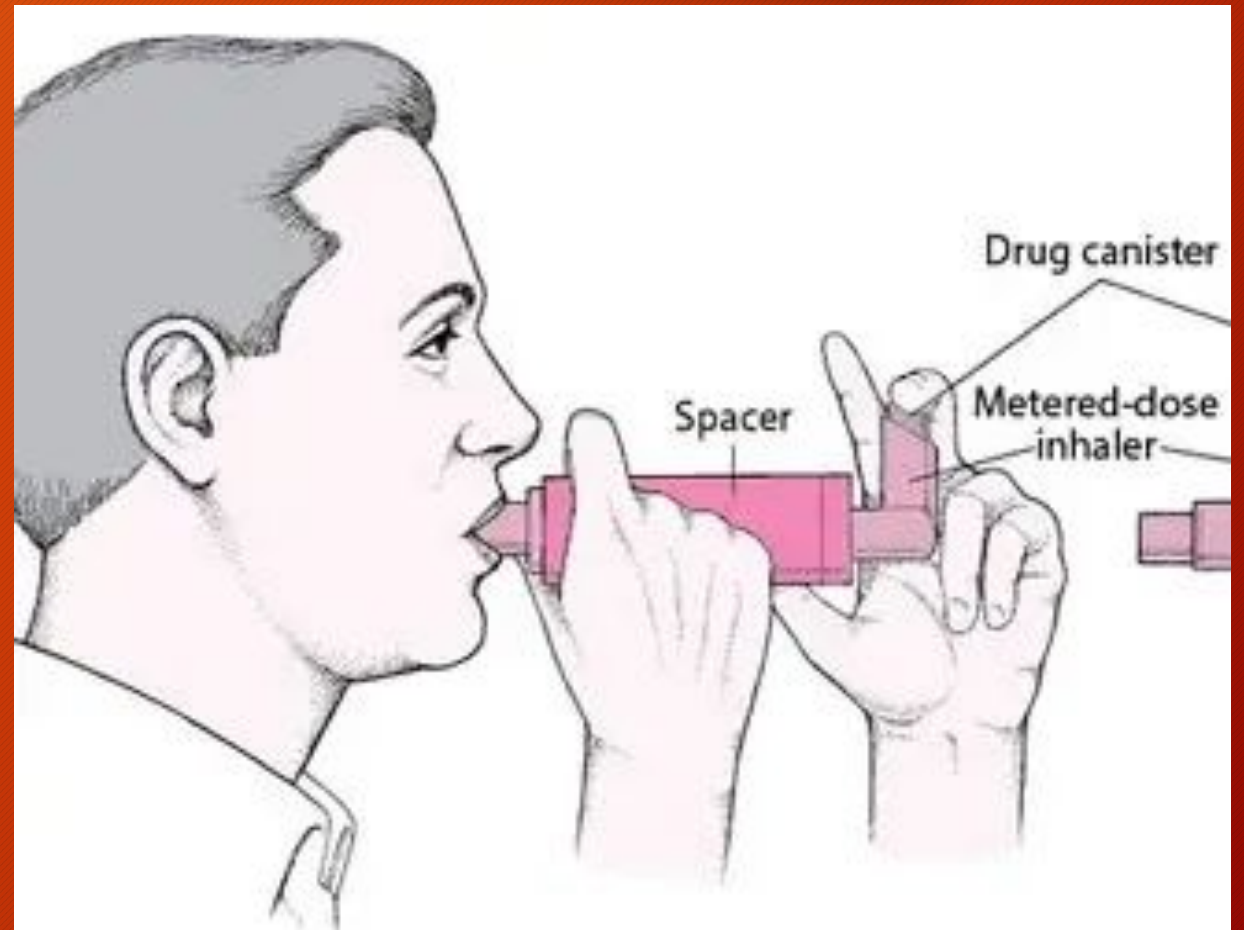
OR

Mental status: Unable to follow simple commands. ☐ **IMMEDIATE**

All others. ☐ **DELAYED**

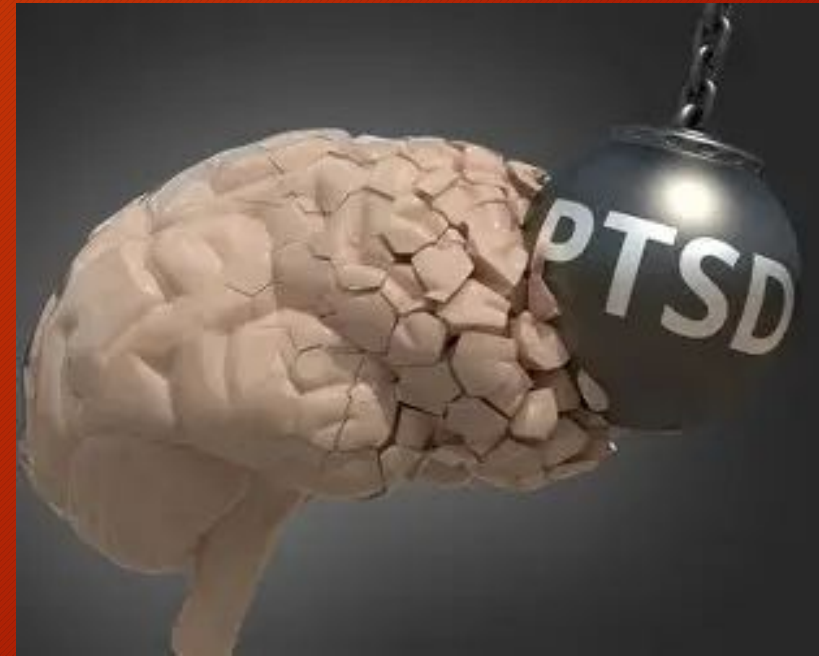
NEB SHORTAGE

- Use MDI spacers
- Dose equivalents
- Save nebs



PSYCHOSOCIAL

- PTSD Psychological footprint of a disaster is often larger than the physical consequences
- CISM Critical Incident Stress Management (For first responders and health care staff)
- Communication
- Family updates



QA/QI

- When dealing with quality assurance issues and clinical outcomes, these are some of the factors to consider:
 - Time to intubation
 - Vent days
 - HBOT use



RESEARCH 2026

Bronchoscopy early

Heparin/NAC data

ECMO survival

CHEAT SHEET

Intubate early

SpO₂ lies

CO/Cyanide tx

Vent strategy

FINAL TAKEAWAYS

Intubate early

Trust COHb

Monitor compliance

Plan surge

RT saves breath

FINAL THOUGHT...



LEARN NOT TO BURN!!!!!!!!!!!!

- <https://www.ameriburn.org/>



- <https://www.nfpa.org/>



- https://worldburn.org/american_burn_association.aspx



ISBI
INTERNATIONAL SOCIETY
FOR BURN INJURIES

- <https://nabsociety.org/>



THANK YOU

Questions?



Contact Me



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