



asthma is sexy

# Kiss My Asthma

Robert McCusker, NREMT-P, FP-C

# About You

- BLS
- ALS
- Advanced Care Providers
- Prehospital vs. Interfacility

# About Me

- Classically trained-began as volunteer
- FF/Paramedic-City of Fairfax Fire Department
- Neonatal/Pediatric CC Transport Paramedic-Children's National Medical Center

# Oh the Places You'll Go



# That Being Said...

- The statements contained in this presentation are not the views of my respective agencies. This is my interpretation of medical evidence. The information contained in this presentation should not supersede clinical judgment, scope of practice, agency policies, or standards of care.

- Brief epidemiology of asthma
- Normal structure and function
- Pathophysiology of asthma
- Pharmacotherapy
- How our tools apply to asthmatics

# WARNING

- I am a **HUGE** nerd (seriously, who enjoys pathophysiology and biochemistry?)
- I will try my best to not dive too deep...but it is necessary to a certain degree
- An 0830 class on a Saturday described as being “steeped in physiology and EBM” =Recipe for success!

# Why am I Teaching?

- “It is a thing of no great difficulty to raise objections against another man's oration, it is a very easy matter; but to produce a better in it's place is a work extremely troublesome.” -Plutarch

# “My” Philosophy

- Quality of care is independent of location
- “Bring Upstairs Care Downstairs” and “Resuscitatonist”-Dr. Scott Weingart
- Bring that care out of the hospital and into the back of your ambulance...within reason

# Components of Quality Care\*

Knowledge is  
power



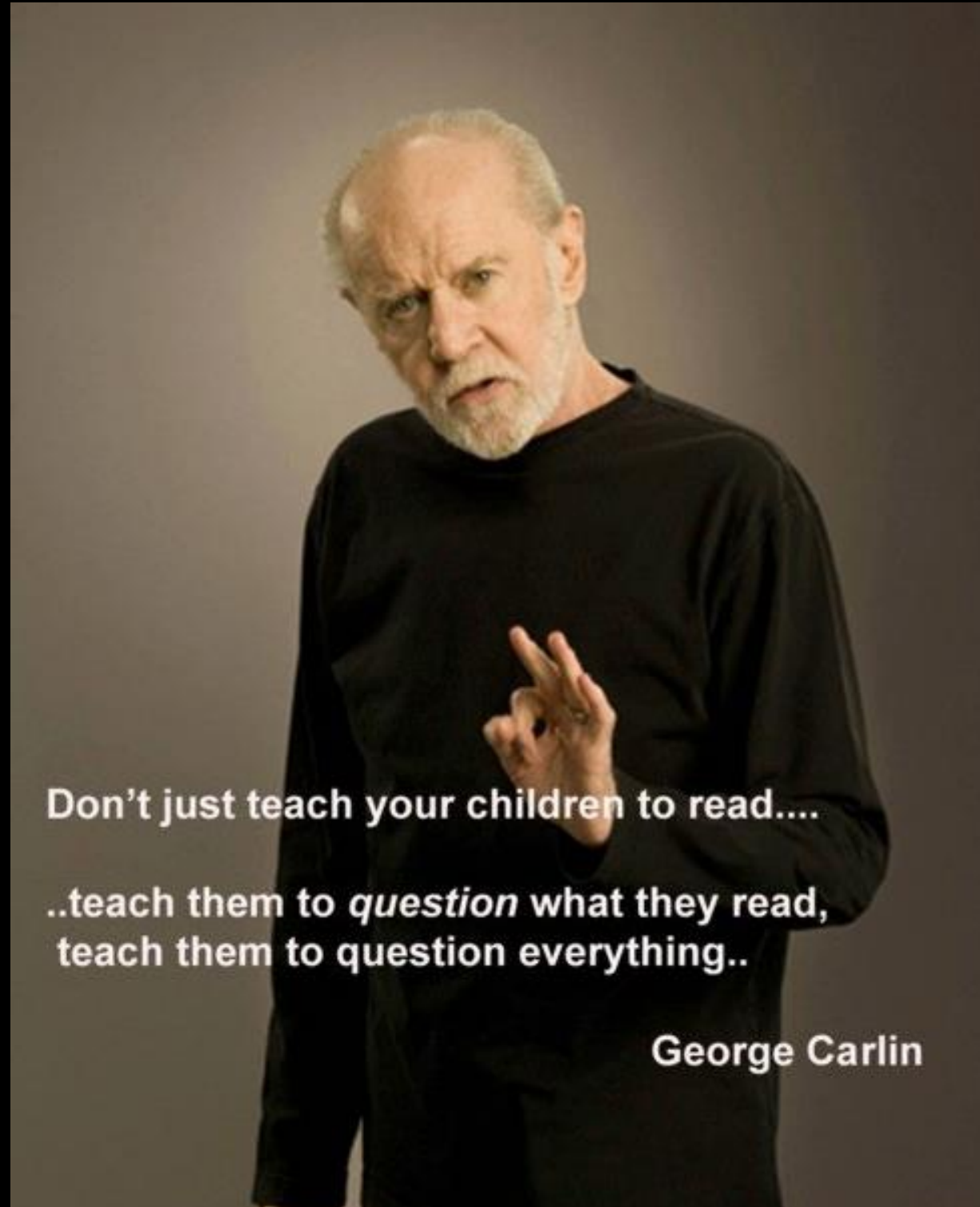
\*My opinion

# “Sciencey-ness”

- Dr. David Newman-Avoiding Avoidable Care Conference
- Google it\*, watch the 6 minute video
- Gist: EBM is **science**

\*Not now (please)

# Skepticism



Don't just teach your children to read....

..teach them to *question* what they read,  
teach them to question everything..

George Carlin

# Research

- Think critically
- Do not derive decisions from an abstract
  - Review methods, numbers enrolled
- *Statistical* significance vs. *clinical* significance

# EBM

From: [BMJ. 1999 December 18; 319\(7225\): 1618.](#)

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## Table

Basis of clinical practice

| Basis for clinical decisions | Marker                              | Measuring device                         | Unit of measurement          |
|------------------------------|-------------------------------------|------------------------------------------|------------------------------|
| Evidence                     | Randomised controlled trial         | Meta-analysis                            | Odds ratio                   |
| Eminence                     | Radiance of white hair              | Luminometer                              | Optical density              |
| Vehemence                    | Level of stridency                  | Audiometer                               | Decibels                     |
| Eloquence (or elegance)      | Smoothness of tongue or nap of suit | Teflometer                               | Adhesin score                |
| Providence                   | Level of religious fervour          | Sextant to measure angle of genuflection | International units of piety |
| Diffidence                   | Level of gloom                      | Nihilometer                              | Sighs                        |
| Nervousness                  | Litigation phobia level             | Every conceivable test                   | Bank balance                 |
| Confidence <sup>*</sup>      | Bravado                             | Sweat test                               | No sweat                     |

<sup>\*</sup>Applies only to surgeons.

# Asthma is Poorly Understood

- Obstructive disease---is reversible
- Slow onset-vast majority of patients  
≈85% (resp infection)
- Rapid onset-≈15%  
(allergen/exercise/stress/medicines)

Wenzel S. Severe asthma in adults. Am J Respir Crit Care Med 2005; 172:149.

# Causes

|                      | Rapid Onset                                                                      | Slow Onset                  |
|----------------------|----------------------------------------------------------------------------------|-----------------------------|
| Frequency            | 8-14%                                                                            | 85-92%                      |
| Triggers             | Allergen Exposure<br>Fume/Irritant<br>Exposure or Emotional Stress<br>ASA/NSAIDs | Respiratory Tract Infection |
| Pathology            | Empty, dry airways                                                               | Mucous filled, wet airways  |
| Cause of Obstruction | Bronchoconstriction                                                              | Mucous pluggings and edema  |
| Recovery             | Rapid                                                                            | Less Rapid                  |

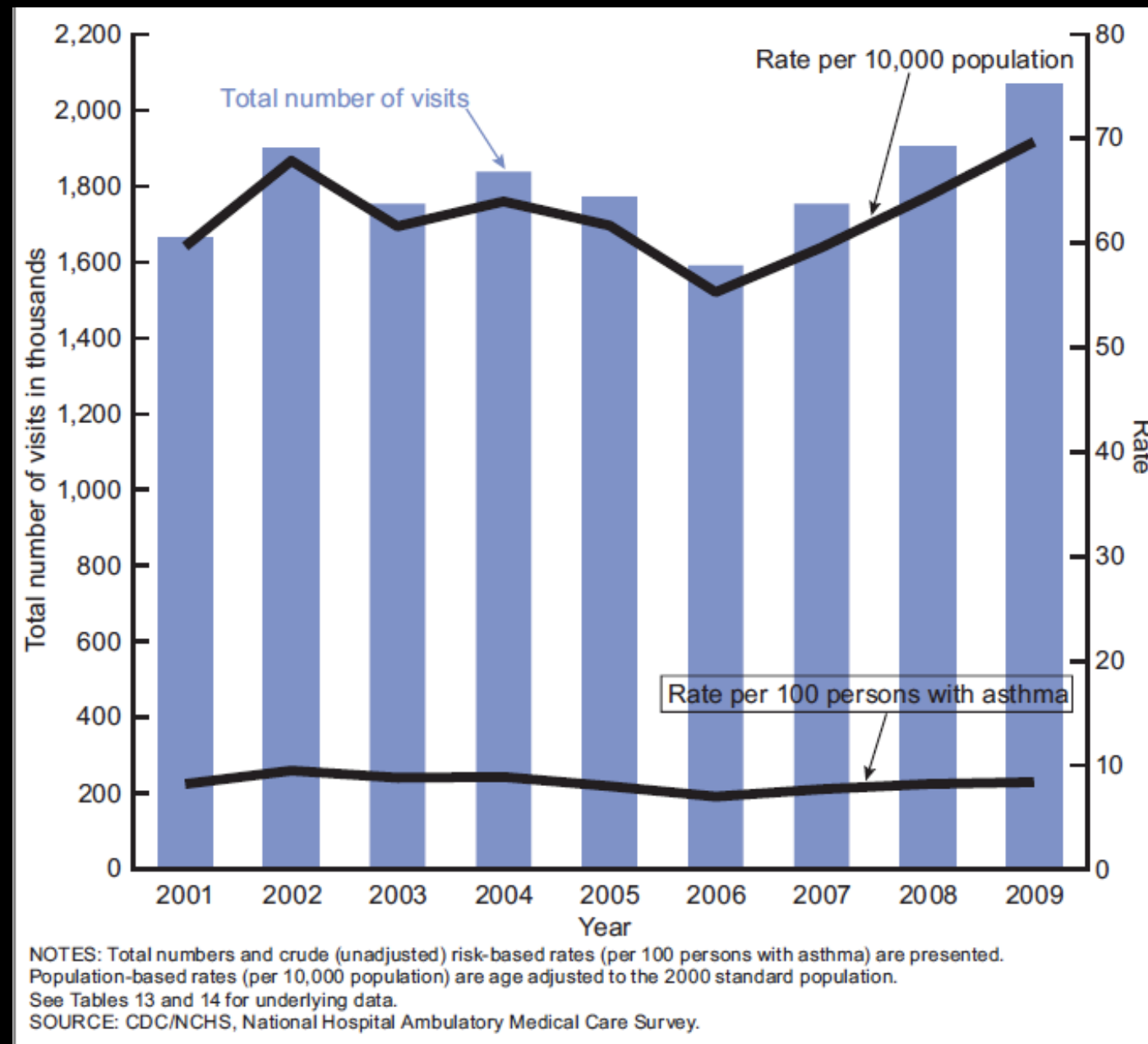
# Characterized as...

- Hyperreactive airways and decreased airflow
- Heterogenous disease

# Some Numbers

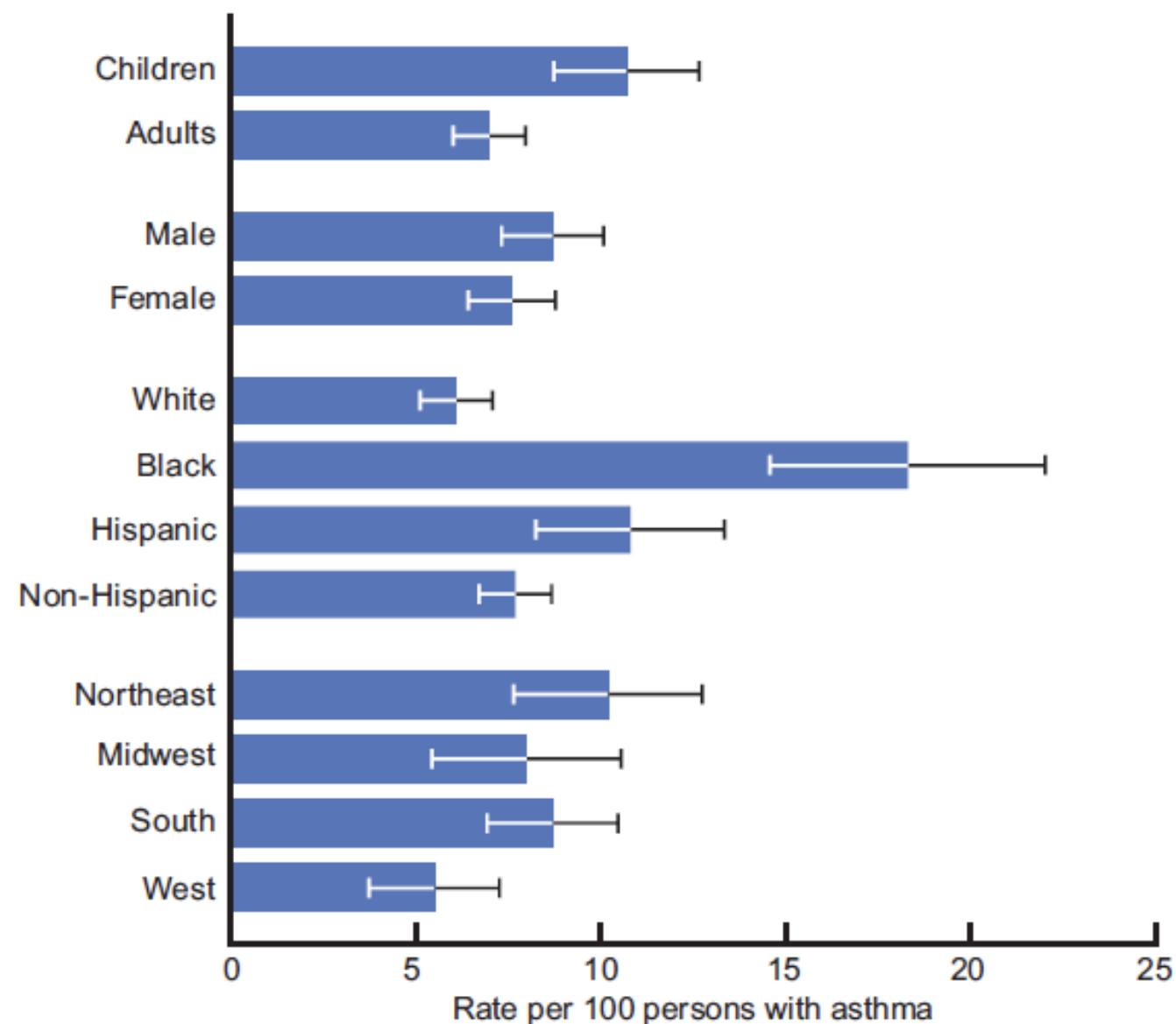
- Morbidity: 18 million adults, 7 million peds (2010)
- \$-17 million visits to ambulatory care (2009)
- \$\$-479,000 admitted to hospital (2009)
  - Avg LOS 4.3 days
- Mortality:  $\approx 3400$  (2009)  
*National Center for Health Statistics (CDC)*

# ED Visits 2001-2009



*National Hospital  
Ambulatory Medical  
Care Survey (2010)*

# Not a Pediatric Lecture



■ 95% confidence interval.

NOTES: Crude (unadjusted) risk-based rates are presented. See Table 15 for underlying data.

SOURCE: CDC/NCHS, National Hospital Ambulatory Medical Care Survey.

CDC/NCHS

“Amateurs talk strategy, experts  
talk logistics” -Military

- Dr. Reuben Strayer- “Usual State of Readiness”
  - The time to prepare is before the patient presents
- Dr. Scott Weingart “Mind of a Resuscitacionist”

# Set yourself up for Success

Do NOT seal drawers

Physically touch your equipment before every shift

Use medical apps (protocols/weight/drug dosing) programs enroute

Luscombe formula

**SIMULATE!!!!**



Lammers R et al. Root causes of errors in a simulated prehospital pediatric emergency. *Acad Emerg Med* 2012 Jan; 19:37.

# Not New to Us

- Recognition-Primed Decision Model (RPD)
- Match current situation with previous experiences
- Actions taken based upon prior successes or failures given setting

Klein, Gary A. "A recognition-primed decision (RPD) model of rapid decision making." Decision making in action: Models and methods 5.4 (1993): 138-147.

# Stephen Covey

- 2.3 Million ED visits results in 479,000 admissions
- The 7 Habits of Highly Successful People
  - #2-Begin with the end in mind

# Peter Safar (1924-2003)

- “Critical care is a continuum that begins with **out of hospital care**, continues with ED intervention, and culminates in ICU admission and management”

# The Same Page

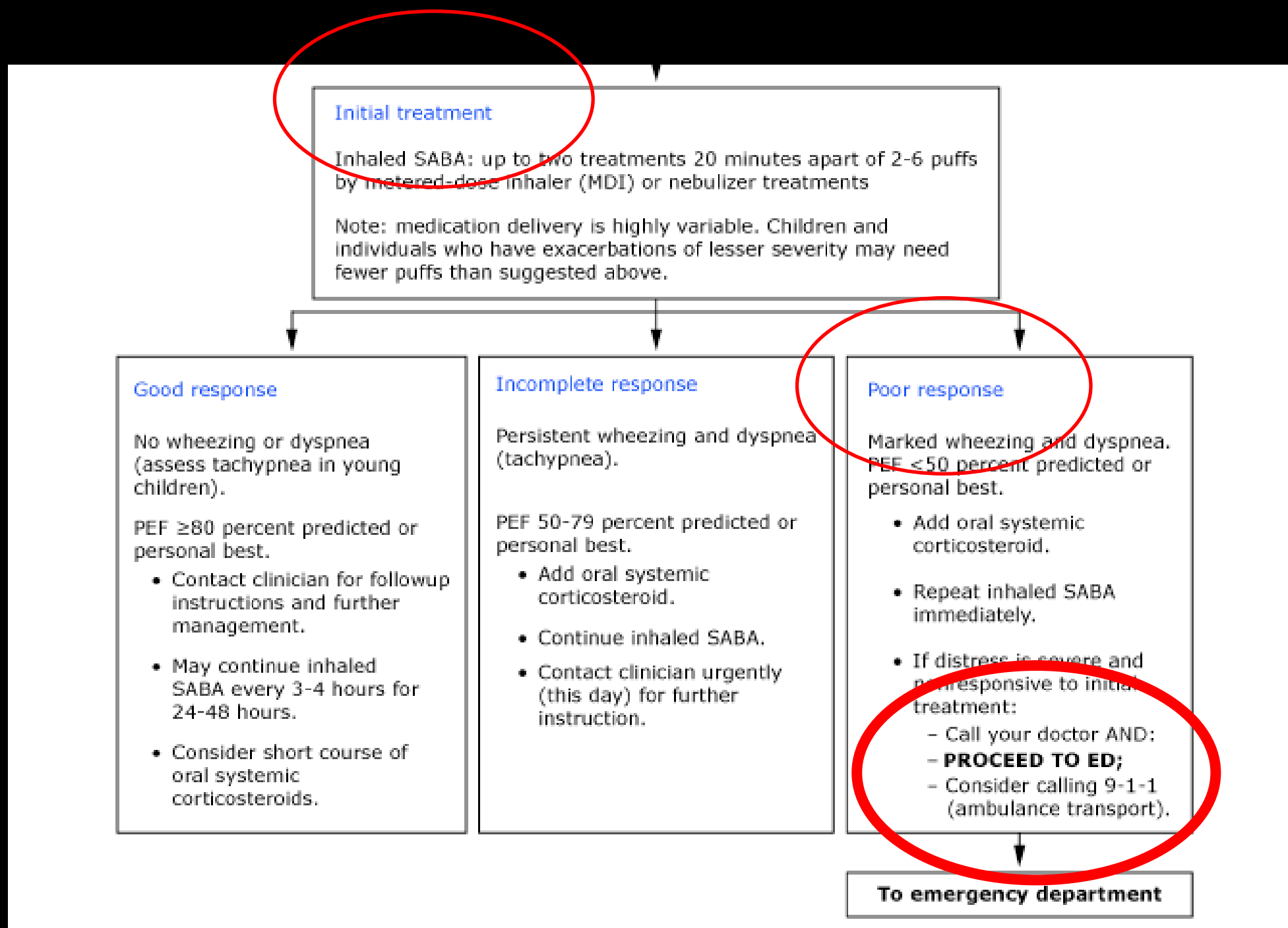
- Prehospital-Community Hospital-  
Interfacility Transport-Tertiary Care  
Facility

# Role of EMS in Asthma

- We as EMS providers play an important role
- Give a neb and a ride to the hospital?

# Why?

- Chronic disease
  - Mainly managed outside of hospital
- EMS is called when other methods don't work
- The patient has already “run the green line”



*National Heart, Blood, and Lung Institute Expert Panel Report 3 (EPR 3): Guidelines for the Diagnosis and Management of Asthma. NIH Publication no. 08-4051, 2007.*

# Back to Numbers

- Once they get to the hospital, they do very well
- 2/3 of fatalities occur outside of the hospital

Krishnan V, Diette GB, Rand CS, et al.  
Mortality in patients hospitalized for asthma exacerbations in the United States. Am J Respir Crit Care Med 2006; 174:633.

# Why Patients Die

- Failure to recognize the severity of the illness
- Need early, aggressive care

1. Rodrigo GJ, Rodrigo C, Hall JB. Acute asthma in adults: a review. Chest 2004; 125:1081.
2. Benatar SR. Fatal asthma. N Engl J Med 1986; 314:423.

# The Crashing Asthmatic

- We will cover the asthmatic that has the potential to crash
- That's every asthmatic we encounter!

1. Romagnoli M, Caramori G, Braccioni F, et al. Near-fatal asthma phenotype in the ENFUMOSA Cohort. Clin Exp Allergy 2007; 37:552.
2. Restrepo RD, Peters J. Near-fatal asthma: recognition and management. Curr Opin Pulm Med 2008; 14:13.

# Assessment is Crucial

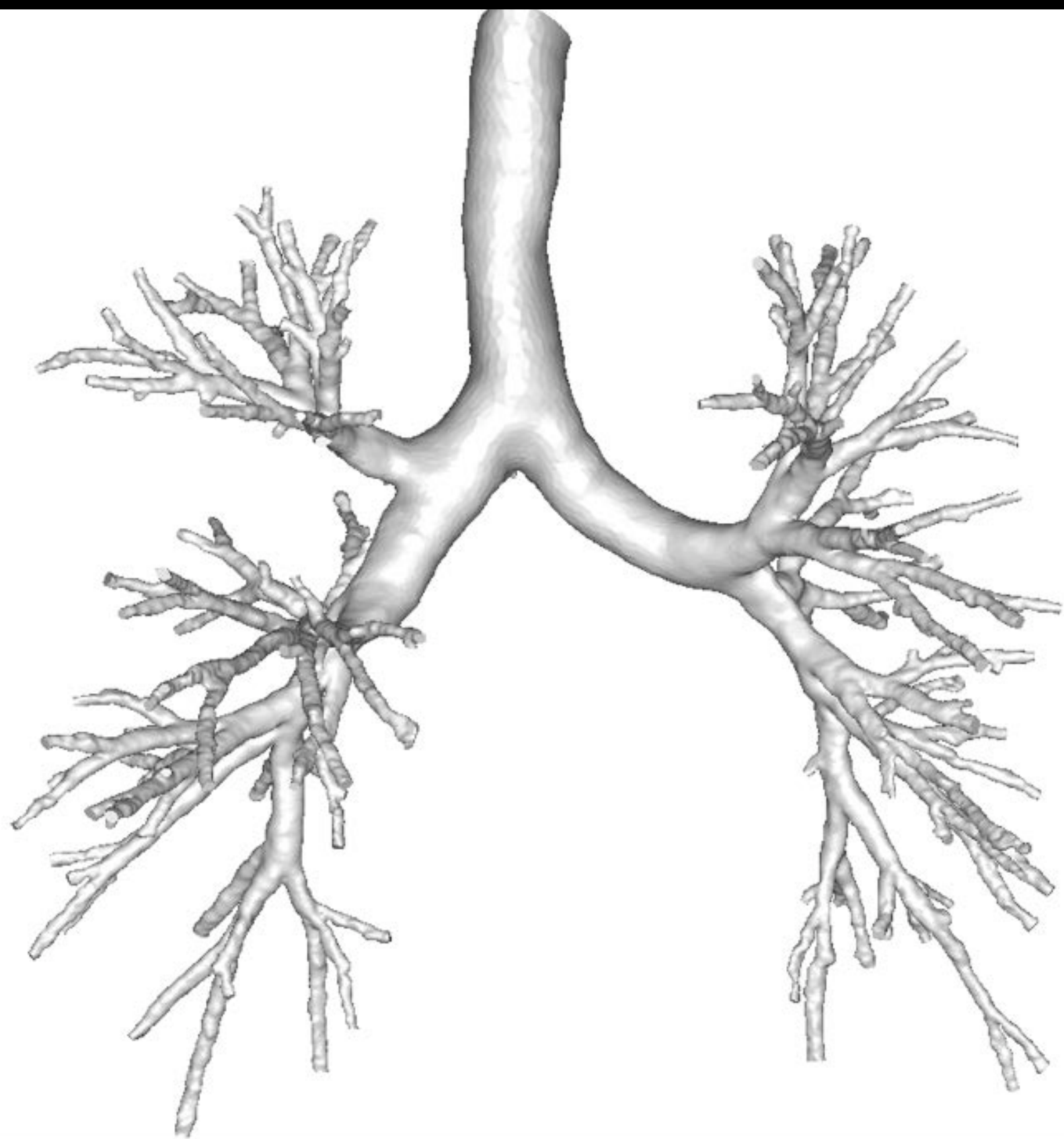
- If you don't find it, you can't treat it
- This is beaten to death at symposium, you should know this by now
- We will delve into the how and why, not the what

# Metabolic Needs of Body

- Everything we do is to meet the metabolic needs of the body
- Best way to make energy is with oxygen
  - Need  $\text{FiO}_2$ , blood, CO, cellular access
  - Remember, problem with bronchi not alveoli.

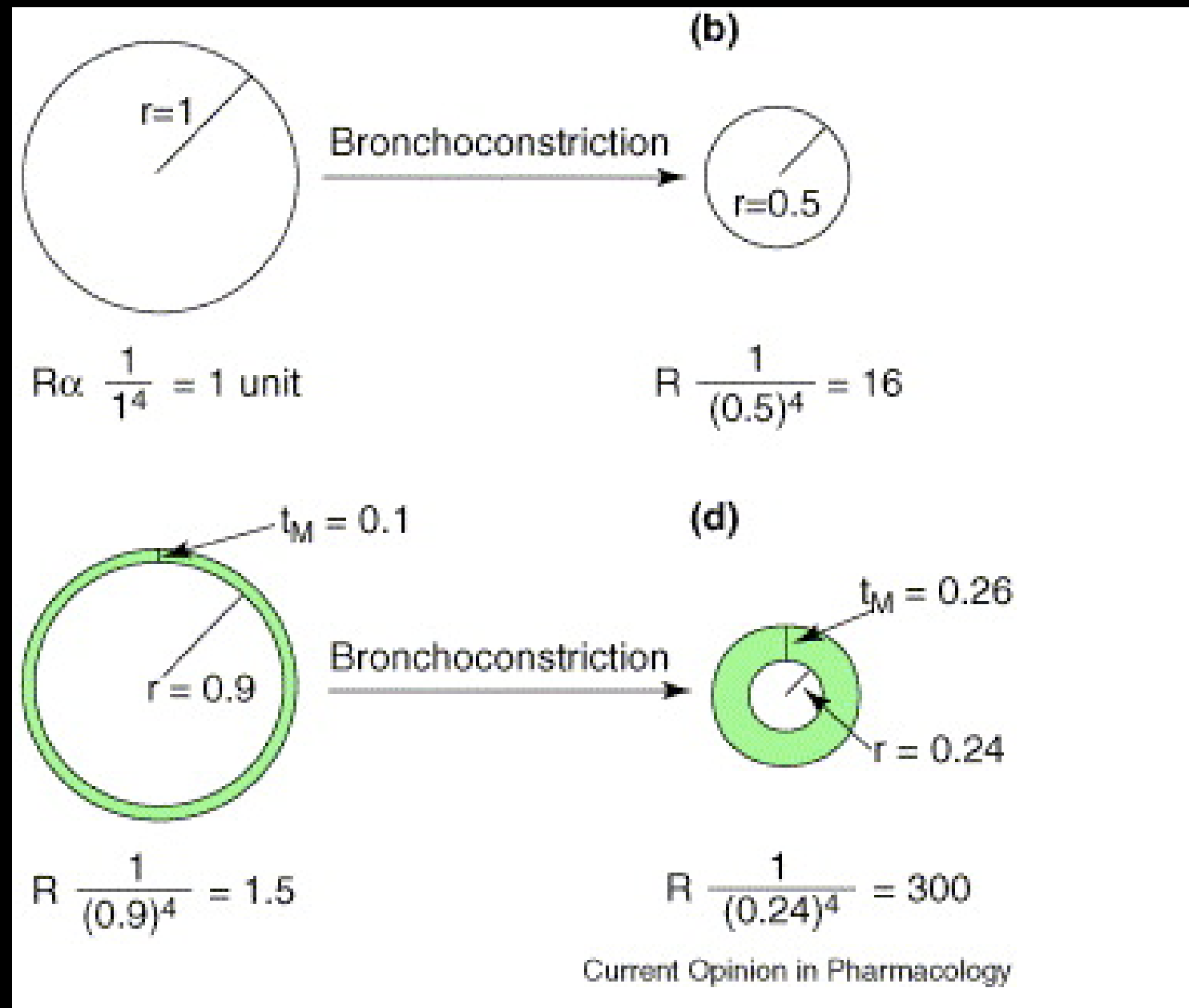
# What's Normal?

- Oxygen moves in, CO<sub>2</sub> out
- Blood carries these products
- Heart moves it round and round



# Fizziks

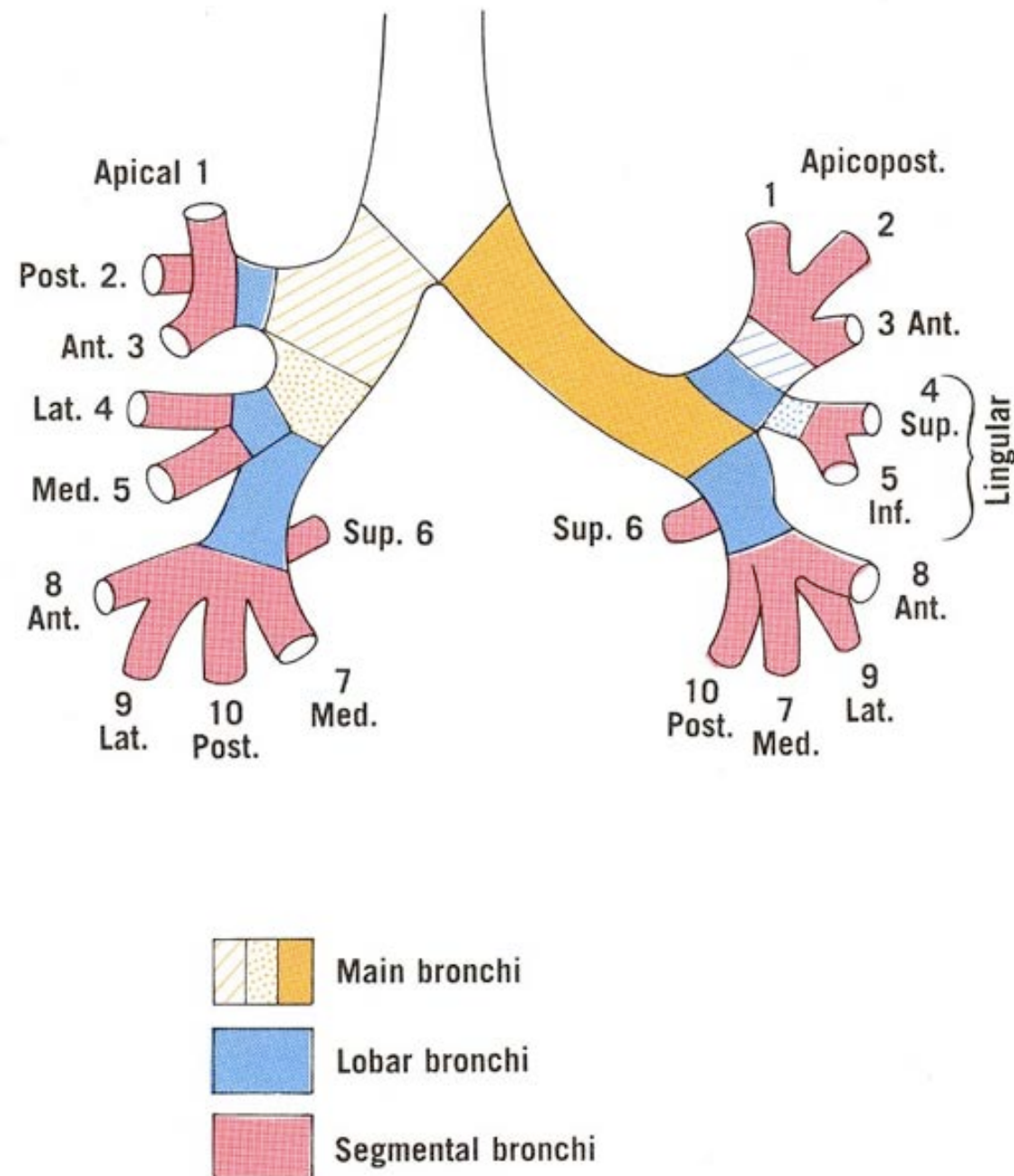
- Airflow is dynamic process
- Resistance determines how well air flows
- Based upon
  - Principles of laminar and turbulent flow
  - Size of airways is most important factor



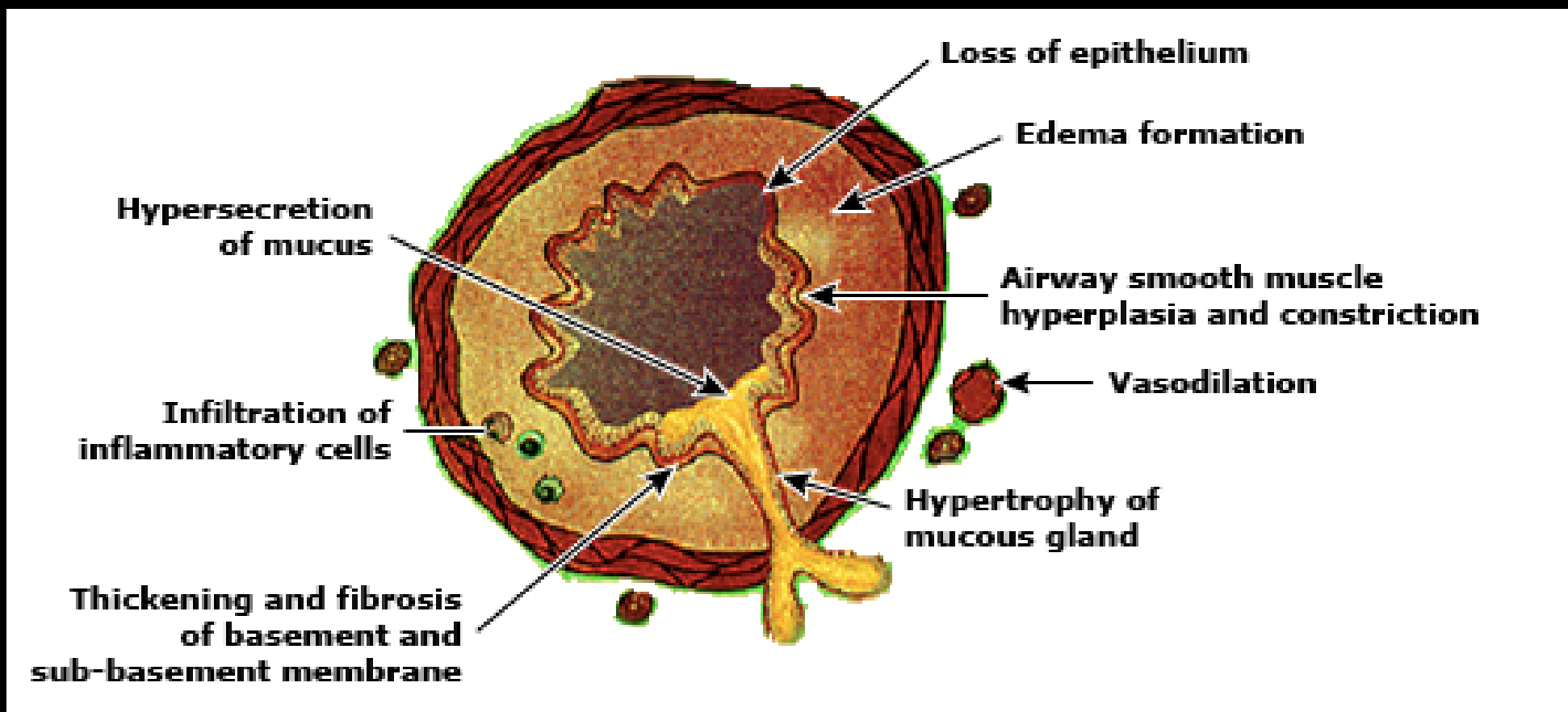
# Pathophysiology of Asthma

- Chronic airway inflammation
  - Sputum analysis (sexy) demonstrates significant amounts of
    - eosinophils-precursor to IgE, inflammatory cell
    - leukotrienes-contraction of muscles lining trachea

# Pathology of Fatal Asthma



# That Sucks...



-Up To Date

# Assessment

- Appearance
- WOB
- Lung sounds

# Pharmacotherapy

- Good news: generally responds well to drugs
- Difference between asthma and COPD:  
**reversible**

# What is Used

- Inhaled beta agonists
- Roids
- Mag Sulfate
- Epi/Terbutaline
- *Fluid bolus*
- Ketamine
- Volatile anesthetic gasses

# Albuterol

- Bronchial smooth muscle relaxation through beta 2 activation
- 2.5-5mg...to begin
  - Need A LOT of albuterol
  - Continuous nebs over an hour 15-20mg

# Ipratropium

- Blocks acetylcholine at parasympathetic sites in bronchial smooth muscle
- 0.25-0.5mcg/dose max 3 doses
- Best if used in conjunction with albuterol
- 15% of dose reaches lower airways

In chronic obstructive pulmonary disease, a combination of ipratropium and albuterol is more effective than either agent alone. An 85-day multicenter trial. COMBIVENT Inhalation Aerosol Study Group. Chest 1994; 105:1411.

# Why Should We Give Steroids

- Charcoal administration
  - Study 1-mean time to administration in ED-81 minutes
  - Study 2-EMS administration within 5 minutes, ED-51

1. Wax PM, Cobaugh DJ. Prehospital gastrointestinal decontamination of toxic ingestions: a missed opportunity. *Am J Emerg Med* 1998;16:114-6.

2. Crockett R, et al. Prehospital use of activated charcoal: a pilot study. *J Emerg Med* 1996;14(3):335-8.

# Early Administration is Critical!

- 1 in 8 patients treated with steroids within 1 hour of presenting to ED had an admission prevented

Rowe BH et al. Cochrane Database Syst Rev.  
2001;(1):CD002178.

# Methylprednisolone

- 2mg/kg-Peds, 125mg-Adult
- Suppresses leukocytes, decreases inflammation
- Varied time to onset of action/peak serum

# Dexamethasone

- 0.6mg/kg, max 16mg-Peds, 0.75-9mg/day, divided dose-Adult
- Decreases airway inflammation, suppresses neutrophils, decreases capillary leakage
- Oral administration: time to peak serum 1-2 hours

# Prednisolone



# Magnesium

- 25-75mg/kg-Peds, 2g-adults
  - Slow administration, 10-20mins
  - DILUTE, DILUTE, DILUTE
- Relaxation of bronchial smooth muscle by inhibiting calcium influx
- Rapid IV onset

# Why Mag?

- 1 in 3 *severe* asthmatics had admission prevented
- 0 harmed

# Epinephrine

- 0.01mg/kg max 0.3mg-peds, 0.3-0.5mg IM
- Nonselective alpha and beta agonist
- Rapid onset

# Terbutaline

- 0.005-0.001mg/kg sq-peds, 0.25mg sq adults
- More selective to beta 2 receptors than epi, similar mechanism of action
- Takes longer for onset but also lasts longer

# IV Fluids

- Normal fluid loss through respiration is increased due to tachypnea
- Supplement K in maintenance fluids
- 20ml/kg-peds, 500-1000cc-adult
  - 1/3 of fluid translates to intravascular volume repletion

# Ketamine

- Conscious sedation/RSI
- 2mg/kg IV, 4mg/kg IM-both
- Causes bronchial dilation
- Dissociative anesthetic, retain airway reflexes
  - True emergence is rare, as is laryngospasm

# Inhaled Volatile Gases

- Really?
- Used in ICU, administered for intubated patients

# Heliox

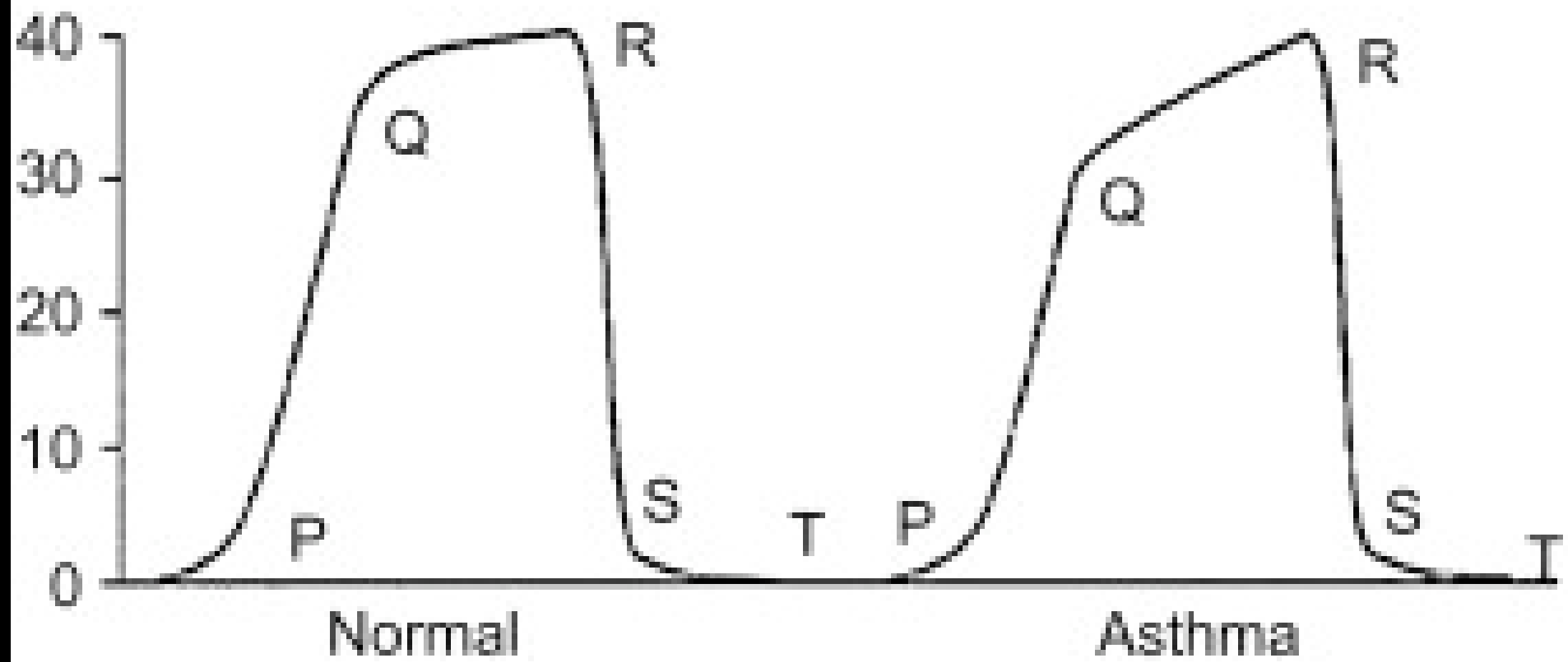
- 80/20 or 70/30 concentration
- Inspired flow rate is dependent upon the density of the inhaled gas
- Heliox buys you time for beta agonists to work

1.Otis A, Bembower W. Effect of gas density on resistance to respiratory gas flow in man. J Appl Physiol. 1949;2:300–306.

# Capnography

- Quantitative and qualitative
  - ETCO<sub>2</sub> has a gradient
  - Remember, numbers are relative
    - ETCO<sub>2</sub> of 40 with a RR of 40?

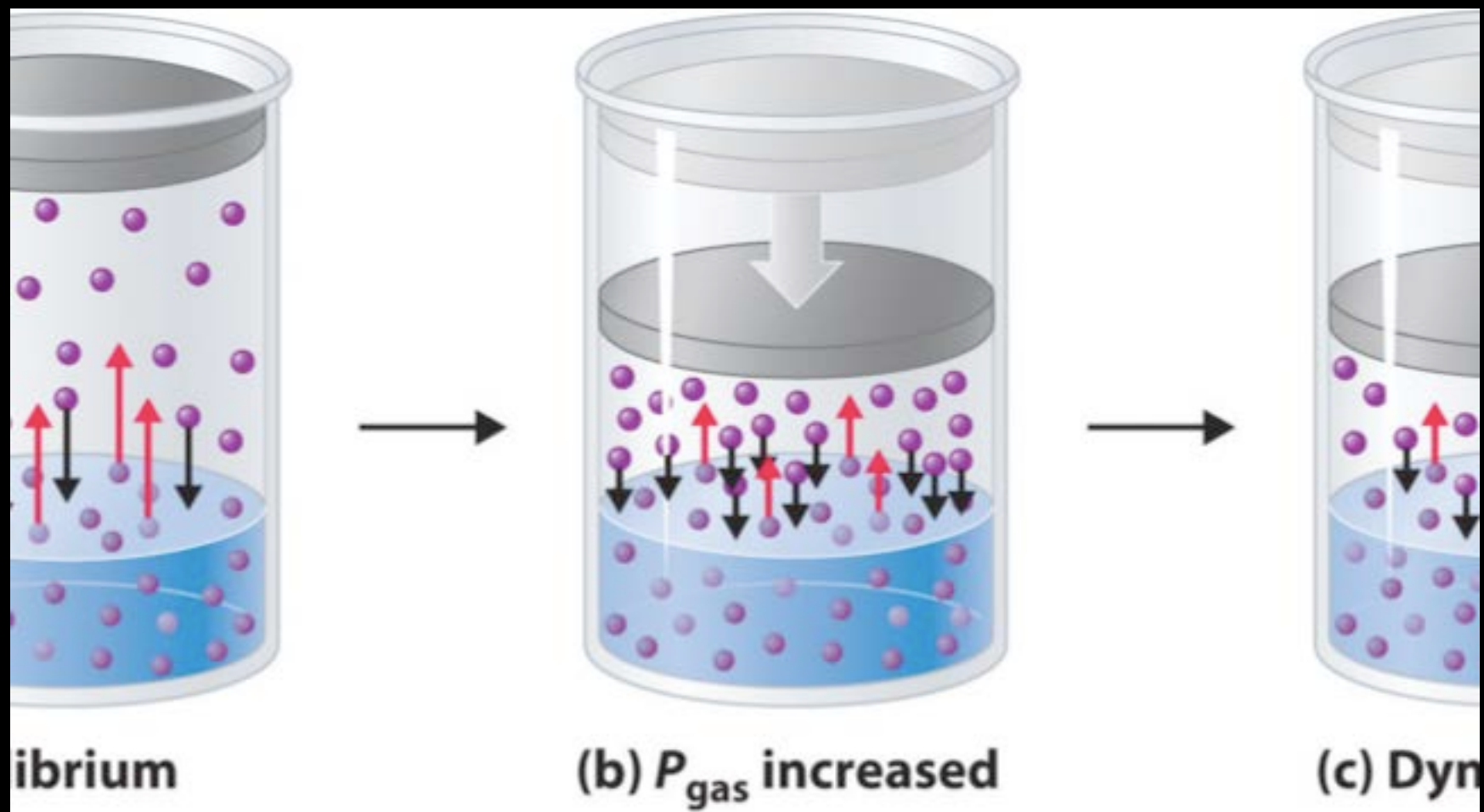
# Pressure of Expired CO<sub>2</sub> (mm Hg)



# More Fizziks-Henry's Law

- The quantity of gas dissolved in 1 cc of liquid is directly proportional to the partial pressure of the gas in contact with the liquid

???



# Manipulating Henry's Law

- 1-Increase concentration of gas particles-FiO<sub>2</sub>
- 2-Increase pressure that we deliver gas-NIV/PPV
- 3-Increase surface area to diffuse gas-PEEP

# CPAP

- Asthma is not a problem with alveoli
- PEEP recruits more alveoli
- Limited studies, questionable efficacy
- Wouldn't use higher than 3cm H<sub>2</sub>O if you do it

# BiPAP

- Adjustable inspiratory flow, expiratory flow
- Helps relieve work of breathing by providing inspiratory assist
- Preferred over CPAP
- IPAP-8, EPAP-2/3

# Ventilatory Management

- AC mode-let them rest, recuperate
- LOW tidal volumes, 6-7cc/kg
- LOW rate, less than 10 breaths per minute
- Tolerate hypercapnia----snow them with fentanyl (or better yet, ketamine)

# Vent Management

- Increase inspiratory flow (normal around 60lpm, want closer to 100lpm)
- It's about peak plateau not mean airway pressures
- I:E ratio at least 1:5
- Constantly MONITOR
  - DOPES

# Whew!

- Treat aggressively and early
- Nebbs, steroids, fluids, epi, mag
- Know your enemy (pathphysiology)
- Know how your drugs work (pharmacotherapy)
- Don't psych yourself out over kids

# #FOAMed

- If you want to know how we practiced medicine 5 years ago, read a textbook.

If you want to know how we practiced medicine 2 years ago, read a journal.

If you want to know how we practice medicine now, go to a (good) conference.

If you want to know how we will practice medicine in the future, listen in the hallways and use FOAM.

- Joe Lex

# #FOAMed

- Blogs/Podcasts worth following: EMCrit, Life in the Fast Lane, MDAware, PHARM, UMEM Pearls, Amal Mattu's Weekly EKG Videos, Emergency Medicine Ireland, Surgery ICU Rounds, Academic Life in Emergency Medicine...the list goes on
- Get on Twitter

# Thank You

- For your time

# Wake Up, You Need to be Scanned Soon

- Questions?
- Contact:  
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- @VPIMedic

