Diuretics for CHF

Is That Smart Medicine??

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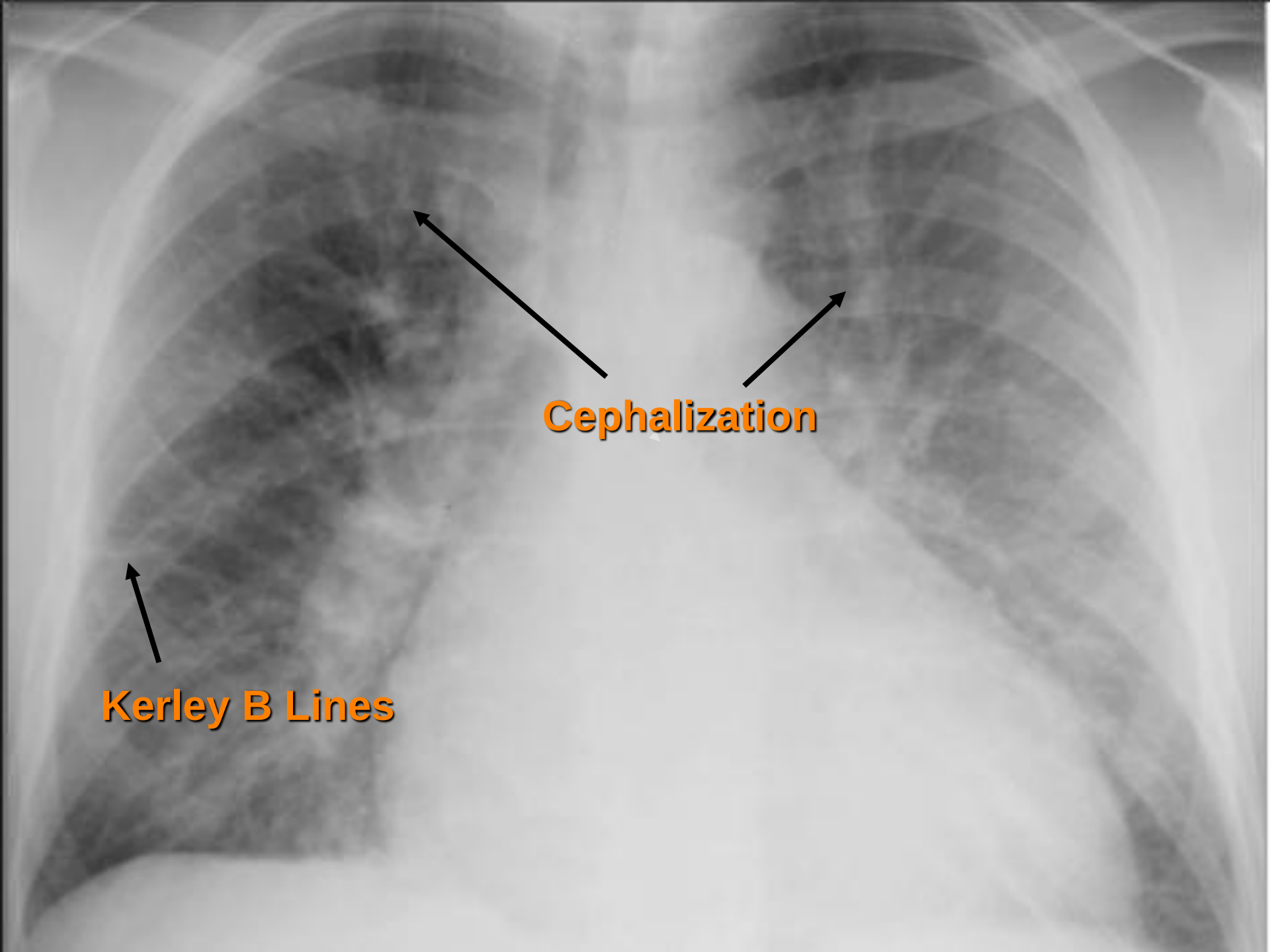
Case

- 65 yo. man presents with dyspnea
  - Developed over the past 6 hours
  - History of hypertension, tobacco use
  - Diaphoretic, normal mental status
  - Afebrile, HR 110, BP 180/110, RR 26, pox 88%
  - Lungs — crackles, JVD


Cephalization
Kerley B Lines

Case

- 100% NRB — pulse ox 93%
- Monitor, IV, ECG
  - Sinus tachycardia, no acute ST/T-wave abnormalities

Case

What is the typical treatment in the first 5-10 minutes??

a) Morphine
b) Furosemide
c) Nitroglycerin
d) ACE-Is?
e) Non-invasive ventilation

Case

What is the typical treatment in the first 5-10 minutes??

a) ~~Morphine~~
b) Furosemide
c) Nitroglycerin → high dose!
d) ACE-Is?
e) Non-invasive ventilation

FUROSEMIDE

Where's the debate??

FUROSEMIDE

FUROSEMIDE


SANTA CLAUS
1836 - 2000

OUTLINE

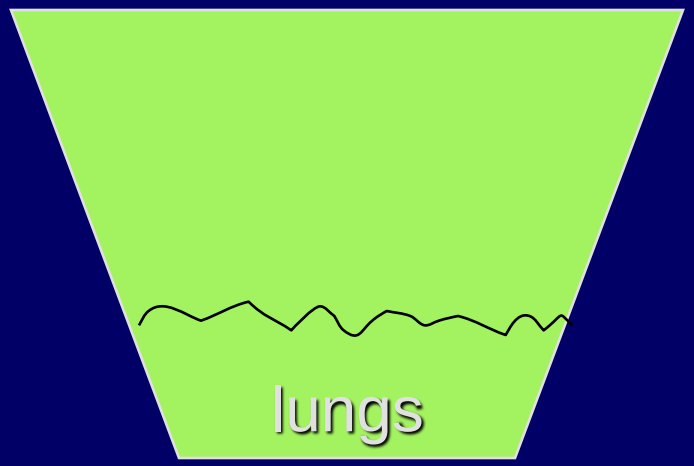
- Definition
- Pathophysiology
- Pharmacological management
  - Preload reduction
  - Afterload reduction
  - Inotropic support
- Noninvasive Positive Pressure Ventilation
- Prehospital Issues
- Summary

CARDIOGENIC PULMONARY EDEMA

- Definition:
  - Leakage of fluid from the pulmonary capillaries and venules into the alveolar space as a result of increased hydrostatic pressure
  - Inability of the LV to effectively handle its pulmonary venous return

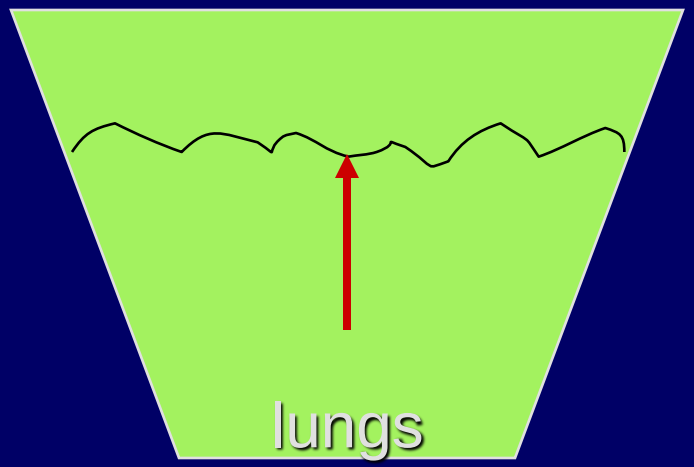
ANATOMY

Normal

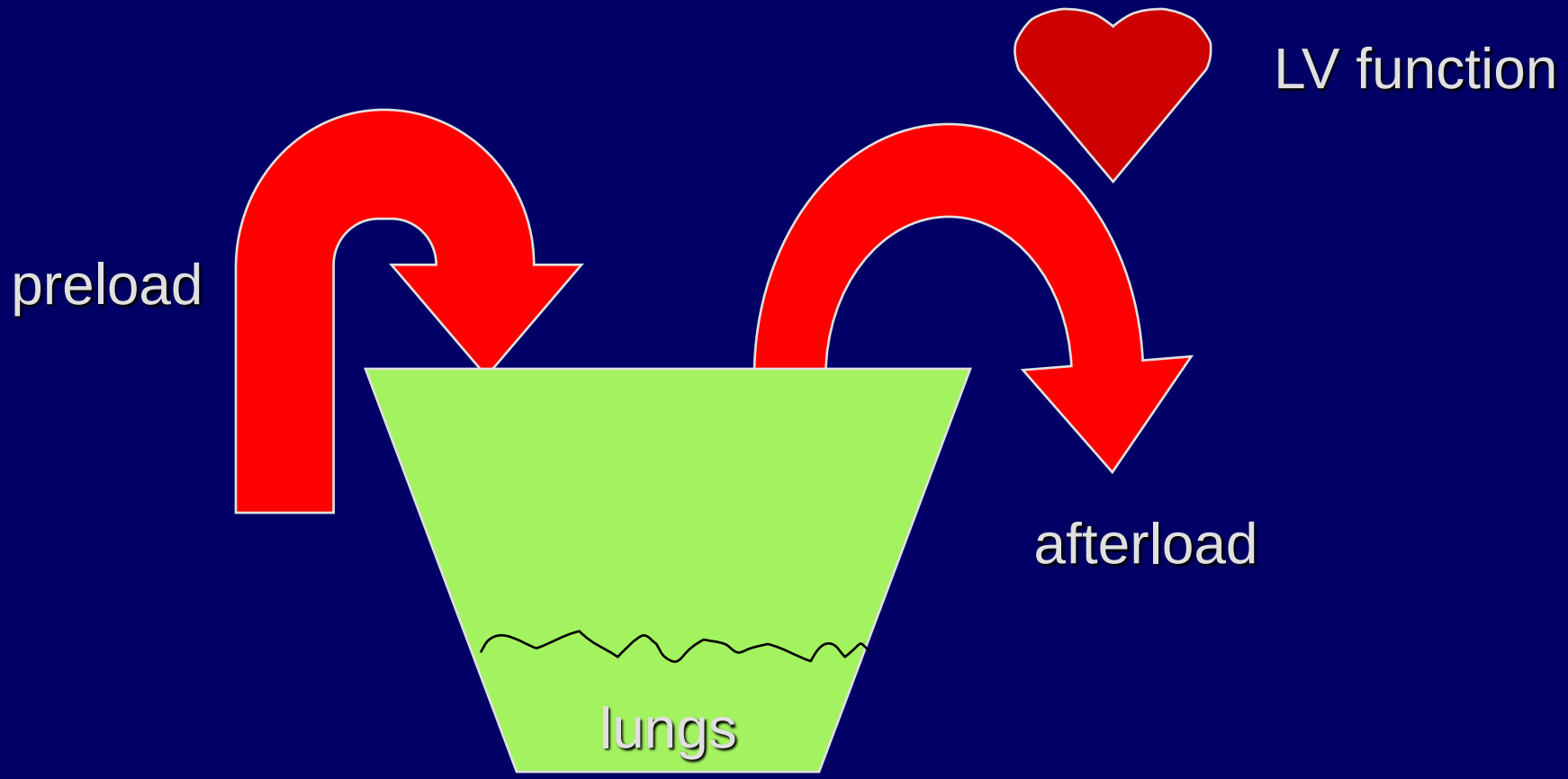


PATHOLOGY

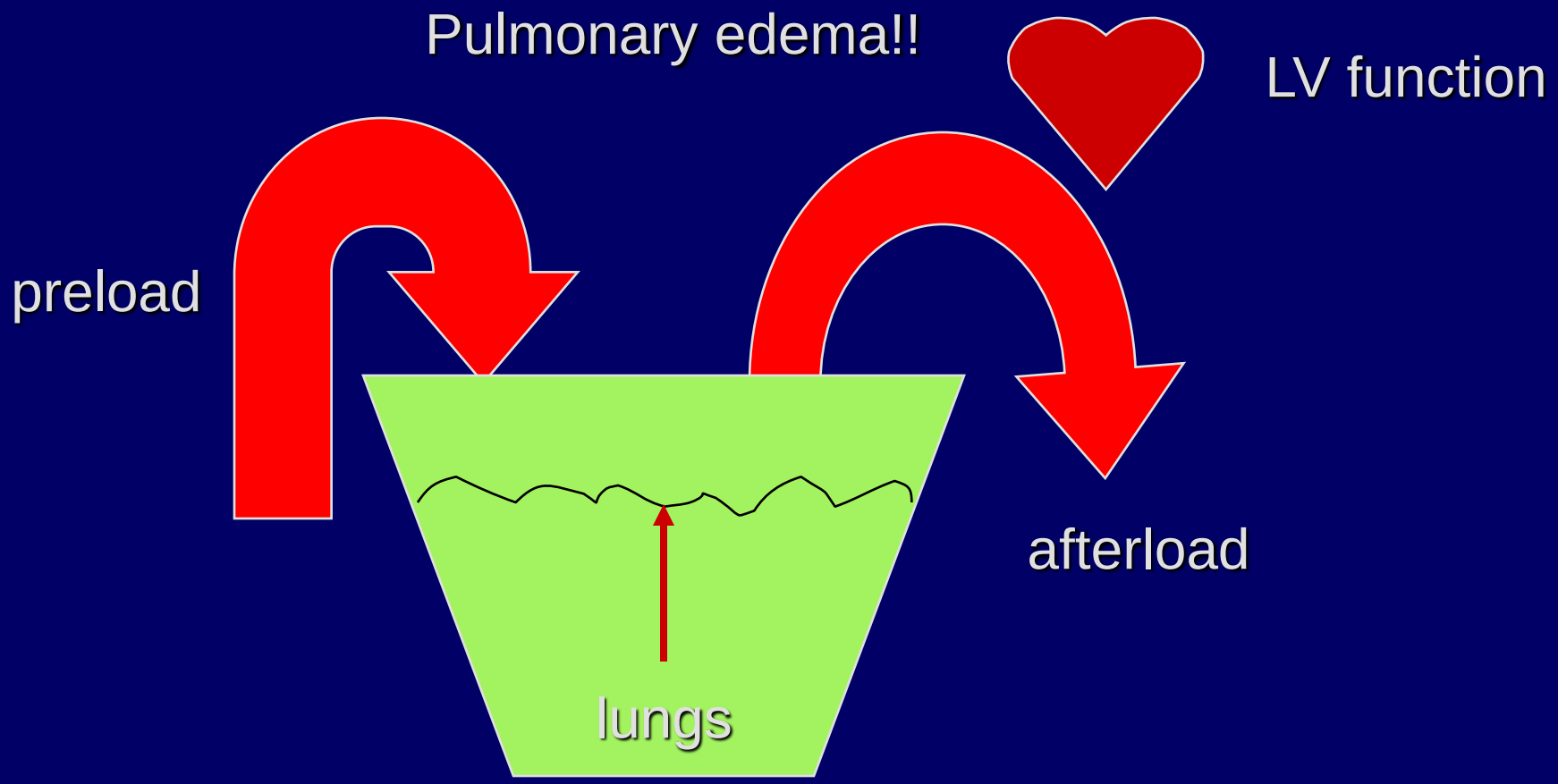
Pulmonary edema!!



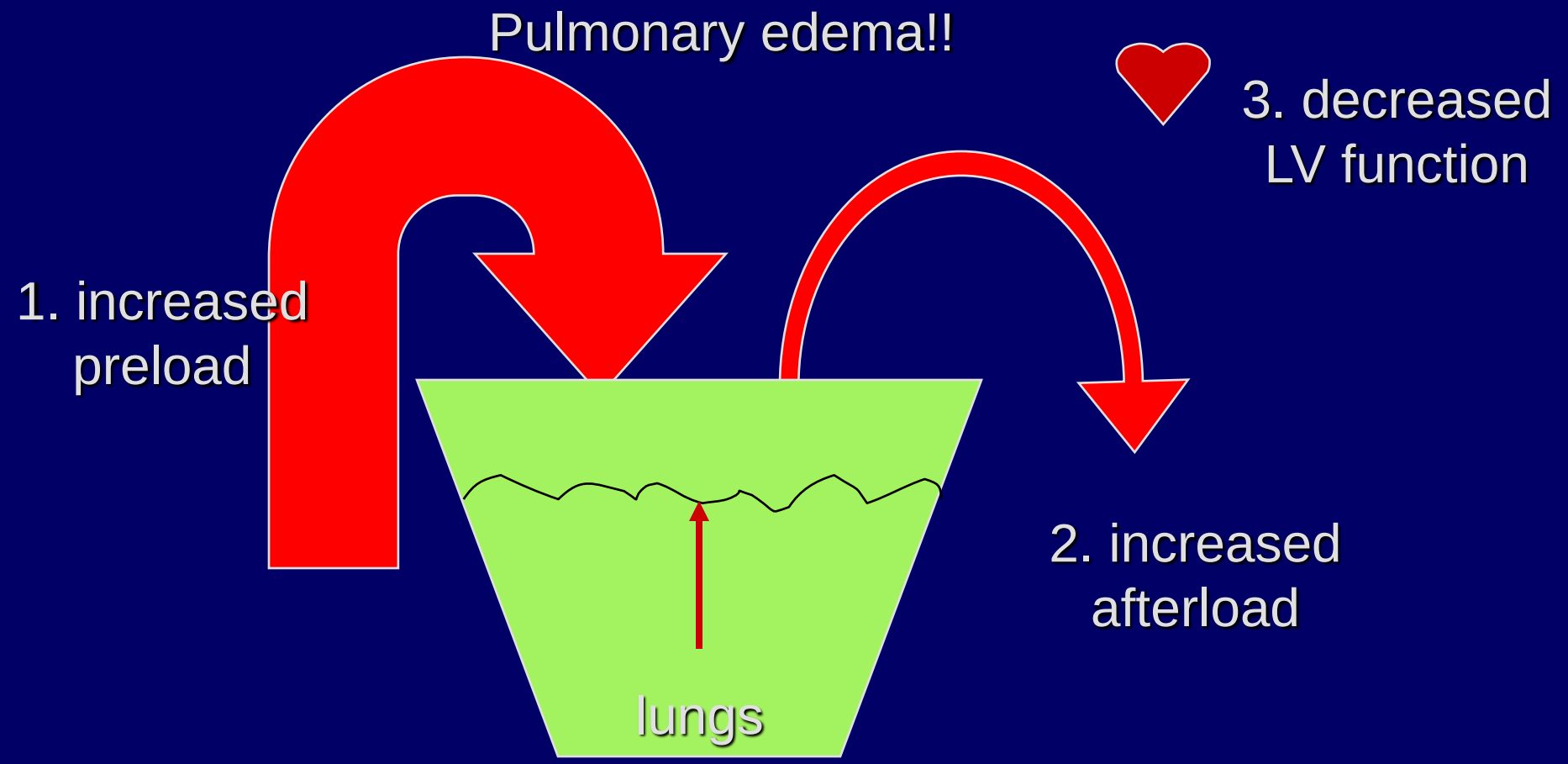
PHYSIOLOGY



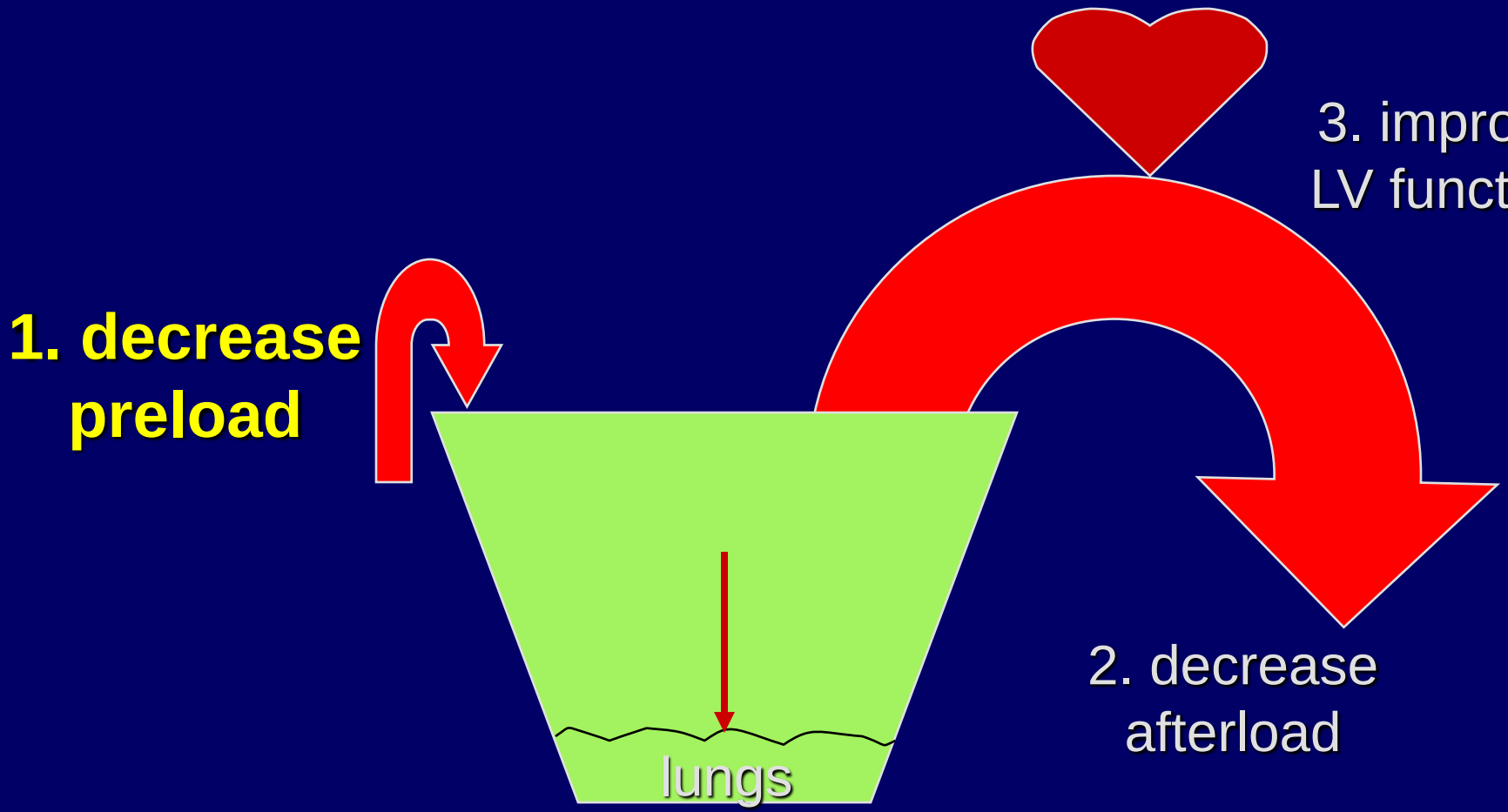
PATHOPHYSIOLOGY



PATHOPHYSIOLOGY



GOALS OF TREATMENT



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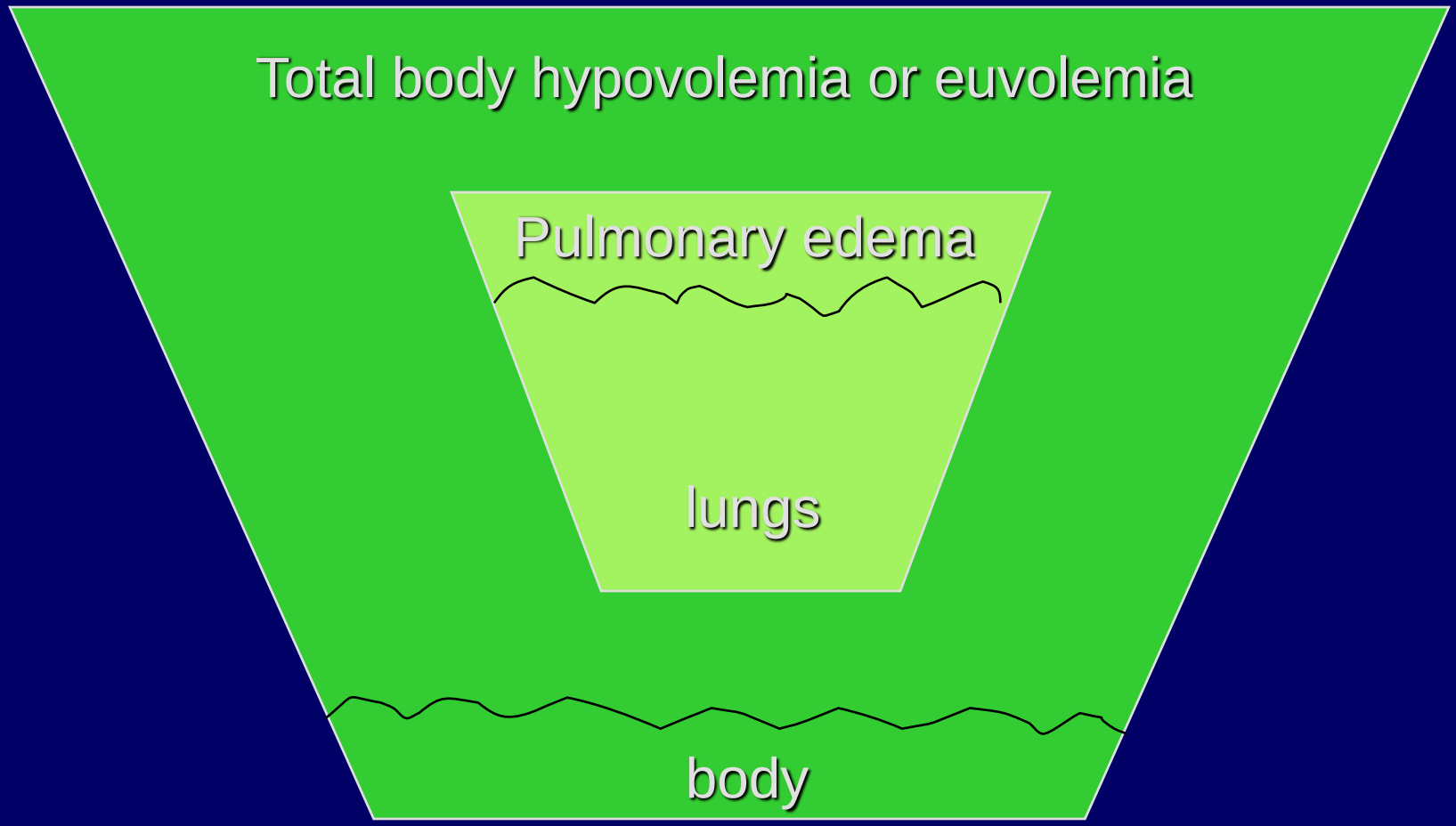
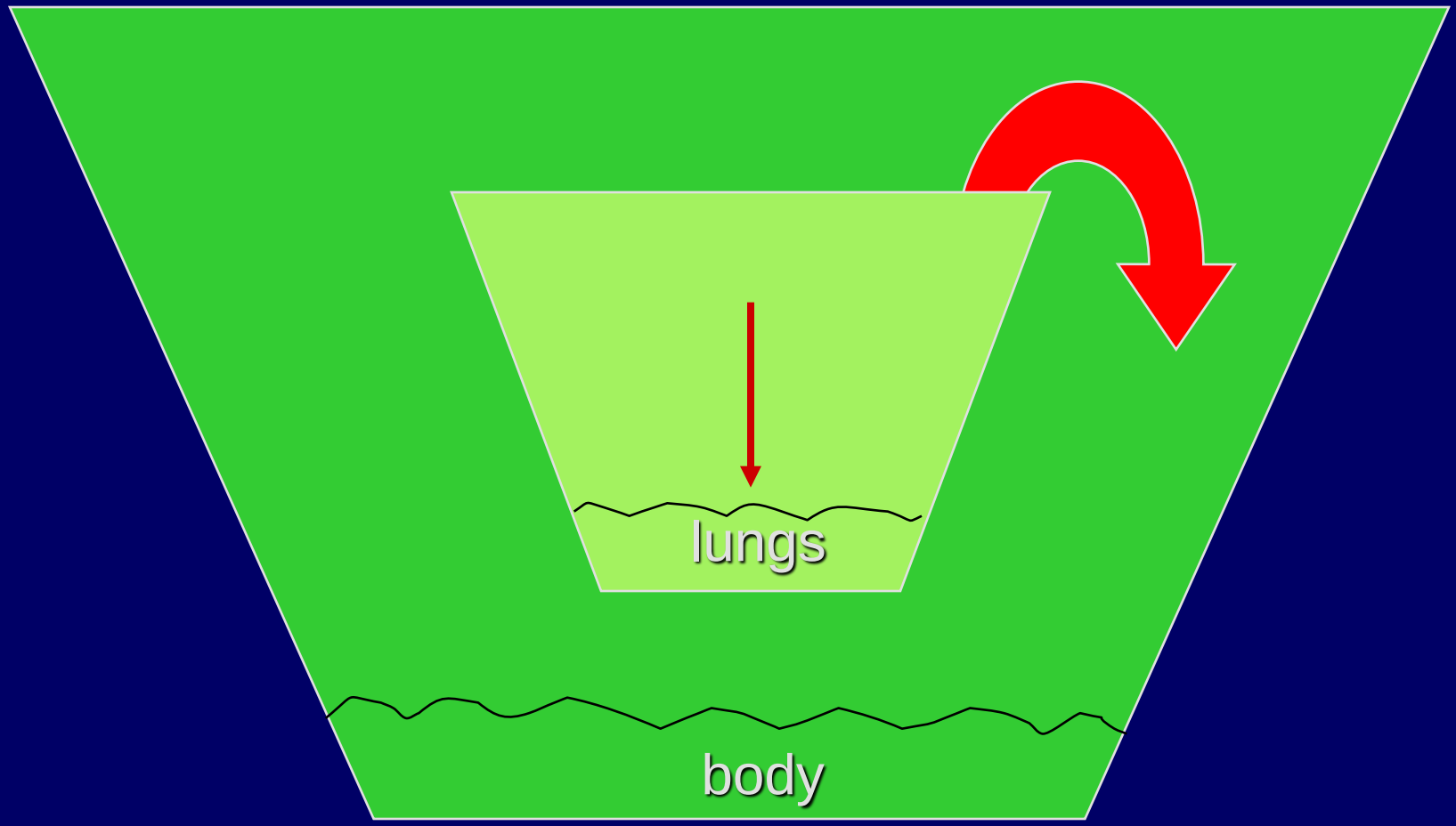


CARDIOGENIC PULMONARY EDEMA

- **Note:** up to 50% of patients with cardiogenic pulmonary edema are euvolemic!!
- Treatment should be based not necessarily on fluid *removal*, but on fluid *redistribution*.

GOALS OF TREATMENT



CARDIOGENIC PULMONARY EDEMA

- Causes
  - Excessive venous return (preload)
  - Excessive SVR (afterload)
  - LV dysfunction
    - disorders of contractility
    - disorders of rate and rhythm

PRELOAD REDUCTION

- Traditional treatment
  - ~~Morphine~~
  - Furosemide
  - Nitrates

FUROSEMIDE

- Preload reduction
  - Diuresis
    - increased afterload causes decreased RBF
    - delayed effect: 30 – 120 minutes
  - Direct vasoactivity
    - venodilation — little evidence
    - does this correlate with decreased preload?

FUROSEMIDE

- Pickkers P, et al (*Circulation*, 1997)
  - Direct vascular effects of furosemide on the human forearm vascular bed and dorsal hand vein
    - local administration of furosemide resulted in dose-dependent venodilaton
  - Does this correlate with decreased preload?

FUROSEMIDE

- Kiely, et al (*Circulation*, 1973)
  - Post-AMI CHF
  - Furosemide administered to 15 patients
  - Significant reductions in filling pressures *only in patients that had diuresis*

FUROSEMIDE

- Ikram, et al (*Clin Sci,* 1980)
  - IV furosemide administration in acute CHF
  - Significant reductions (17%) in CO during first 90 minutes
  - CO gradually returned to baseline with diuresis

FUROSEMIDE

- Nelson, et al (*Eur Heart J*, 1983)
  - IV furosemide (1 mg/kg) administration in AMI patients with LV failure
  - Initial adverse hemodynamic effects
    - decreases in CO and SV during initial 90 minutes
  - Parameters returned to baseline over next 60 – 90 minutes

FUROSEMIDE

- Francis, et al (*Ann Intern Med,* 1985)
  - Class III or IV CHF patients given IV furosemide
  - Early adverse hemodynamic effects
    - 20 minutes after administration
      - significant increase in HR, SVR (afterload)
      - significant decrease in SV
  - Gradual return to baseline with diuresis

FUROSEMIDE

- Kraus, et al (*Chest,* 1990)
  - Effects of IV furosemide on PCWP over 1 hour in patients receiving nitrates and/or captopril
  - Furosemide alone or furosemide plus nitrates
    - increase in PCWP over initial 15 minutes
    - then decrease PCWP with diuresis
  - If *premedicated* with nitrates plus captopril
    - immediate and sustained decrease PCWP

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FUROSEMIDE

- Biddle, et al (*Am J Cardiol,* 1979)
  - Hemodynamic studies carried out in patients with post-MI LV failure
  - "Despite a prompt diuresis, the reduction in lung water is delayed for at least several hours after the administration of furosemide..."

SUMMARY — FUROSEMIDE

- Decreases preload through diuresis
  - Delayed effect
- No consistent data regarding immediate direct preload reducing effect
- Initial adverse hemodynamic effects
  - Increased SVR
  - Decreased SV, CO
- Initial activation of renin-angiotensin system

CONCLUSION — FUROSEMIDE

Furosemide should be considered a *third-line medication* in the treatment of cardiogenic pulmonary edema!

FUROSEMIDE

So what's the problem with just giving it anyway and waiting…?

PREHOSPITAL TREATMENT

- Differential diagnosis for severe dyspnea and hypoxia is vast
  - Common in older adult patients
    - CHF/pulmonary edema
    - pneumonia
    - asthma
    - COPD exacerbation
    - pulmonary embolus

PREHOSPITAL TREATMENT

- Difficult to accurately diagnose in the field
  - How reliable is prehospital diagnosis?
  - Is empiric treatment safe? With which drugs?

PREHOSPITAL TREATMENT

- Hoffman, et al (*Chest*, 1987)
  - Compared NTG, furosemide, morphine in patients with presumed pulmonary edema
  - Best outcome with nitroglycerin
  - Adverse effects in patients receiving furosemide
    - > 25% later required fluid *repletion,* some hypotensive
    - significant electrolyte abnormalities

PREHOSPITAL TREATMENT

- Hoffman, et al (cont.)
  - 23% of patients were misdiagnosed and didn't have pulmonary edema, inappropriately treated
    - worse outcome in patients receiving furosemide and/or morphine
    - no adverse effects in patients receiving NTG alone

PREHOSPITAL TREATMENT

- Wuerz, et al (*Ann Emerg Med*, 1992)
  - Evaluated outcomes in 599 prehospital presumed decompensated CHF patients
    - 18% misdiagnosed, inappropriately treated
      - most had asthma, COPD, pneumonia, bronchitis
      - patients receiving NTG alone — 2.2% mortality
      - patients receiving morphine and/or furosemide (± NTG) — 22% mortality

PREHOSPITAL TREATMENT

- Jaronik, et al (*Prehosp Emerg Care*, 2006)
  - Evaluated 144 prehospital presumed decompensated CHF patients given furosemide
    - 42% had a final diagnosis that was *not* CHF, furosemide considered "inappropriate"
    - 17% diagnosed with sepsis, dehydration, or pneumonia (without CHF), furosemide "potentially harmful"
    - 7/9 deaths in furosemide group

CONCLUSION — PREHOSPITAL TREATMENT

Prehospital misdiagnosis is common.

If patients are misdiagnosed and inappropriately treated for pulmonary edema with furosemide, morbidity and mortality increase.

SUMMARY

- Up to 50% of patients with severe AHF are not fluid overloaded
  - These patients don't need diuretics and may be harmed
- If a patient is misdiagnosed and receives diuretics, there can be significant harm
- Diuretics don't work quickly in AHF anyway, so…

SUMMARY

- …why rush to give the diuretics??

- My practice → no diuretics until…
  - I'm sure that the patient has AHF
  - I'm sure that the patient is total-body fluid overloaded (usually by history and exam)
  - In the meantime, I focus on fluid redistribution rather than removal

REMEMBER…

- Up to 50% of patients with cardiogenic pulmonary edema are euvolemic!!
- Treatment should be based not necessarily on fluid *removal,* but on fluid *redistribution*.

Thanks! questions:

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Slides: lectures.umem.org/Mattu