The Evaluation and Management of *The Patient with Shortness of Breath*

The medical and ethical performance of EMS professionals has never been more important than it is today

The emerging of a profession:

The End of the Beginning

- Innocence is over
- You are COMPLETELY accountable for what you do
- Becoming a professional requires you to always be able to explain your actions
- EMS is ONLY and ALWAYS about patient care

Critical Care Evaluation and Management

The Essence of what Makes a Paramedic a Critical Care Technician

EMS is a great deal about critical care medicine

Part of excellence in critical care is performing superior medical histories and physical exams

“See what you see!”

“People look, but they don’t see”

…A. Fowler, Jr.

Alertness?
Level of distress?
Noises?
Respirations?
The pulse rate?
Skin?
Obvious things (bleeding)

The Order of Assessment of the Critically ill

As we assess patients, we must quickly determine fundamental parameters of their respiratory and circulatory status.

The Primary Survey

Scene Survey/Mechanism/# pts.

LOC/Airway/Cspine

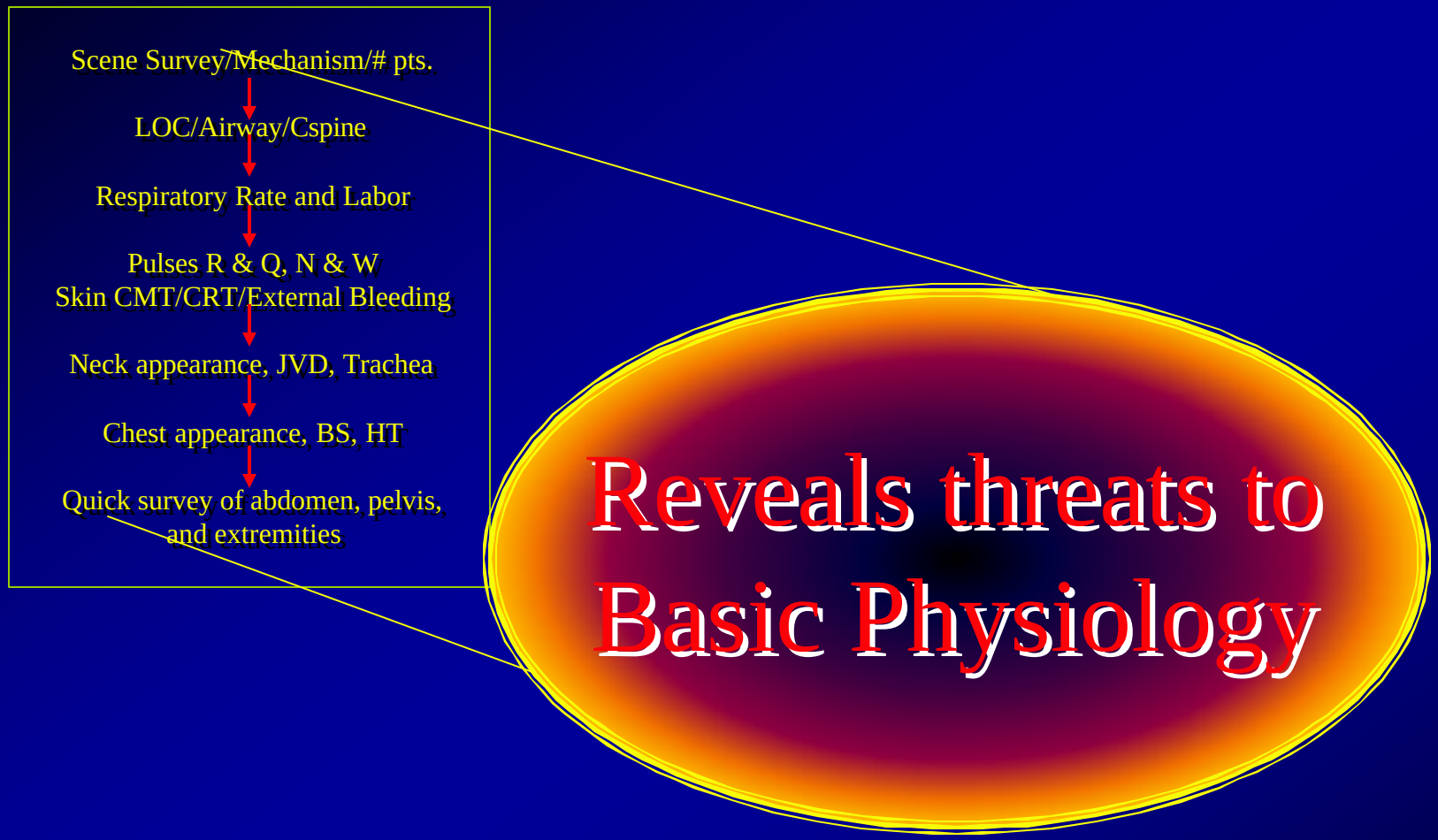
Respiratory Rate and Labor

Pulses R & Q, N & W
Skin CMT/CRT/External Bleeding

Neck appearance, JVD, Trachea

Chest appearance, BS, HT

Quick survey of abdomen, pelvis,
extremities, and back



. . .the vital elements of the Primary Survey

Respiratory Assessment

Rate and Quality

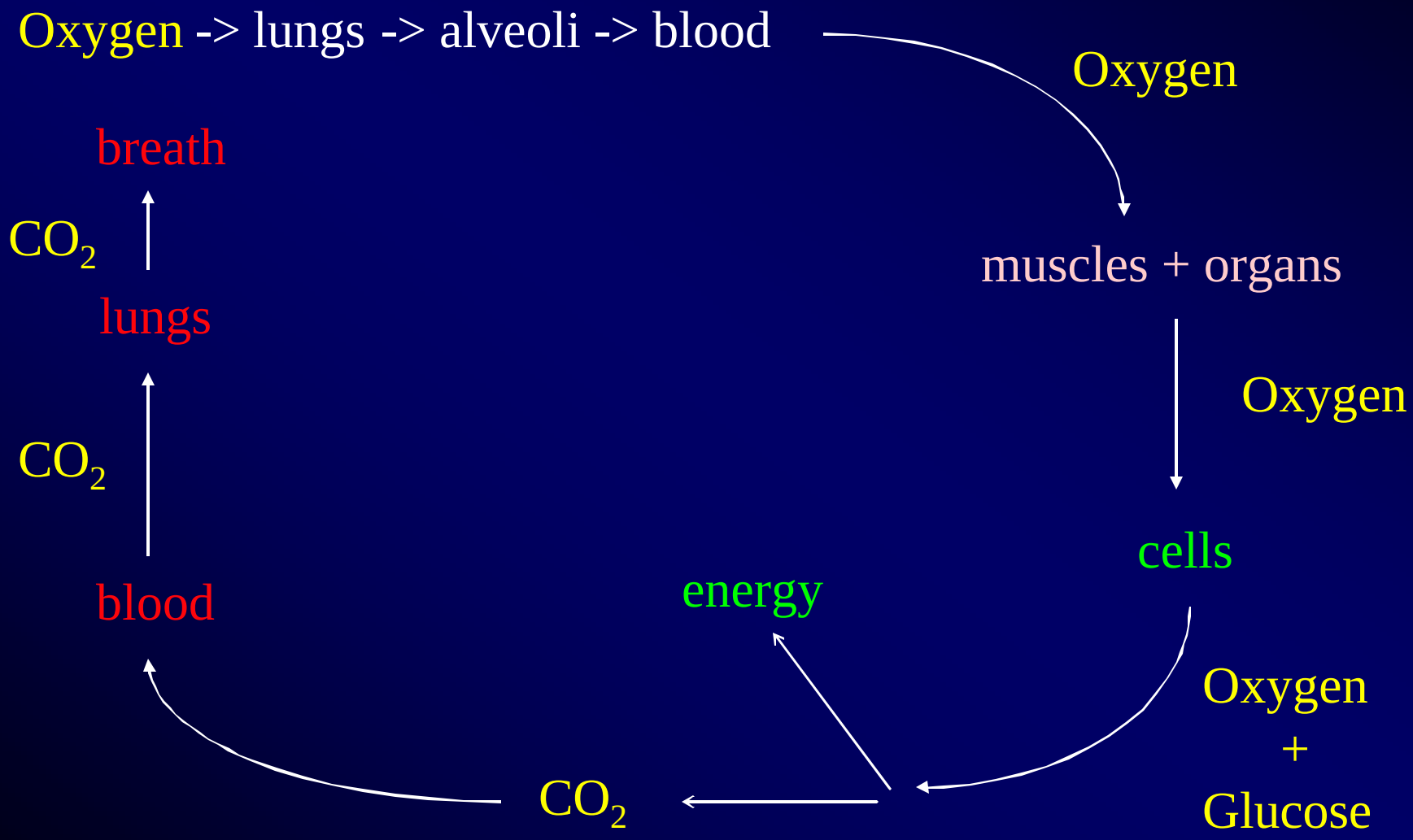
The heart only pumps out what it gets back!

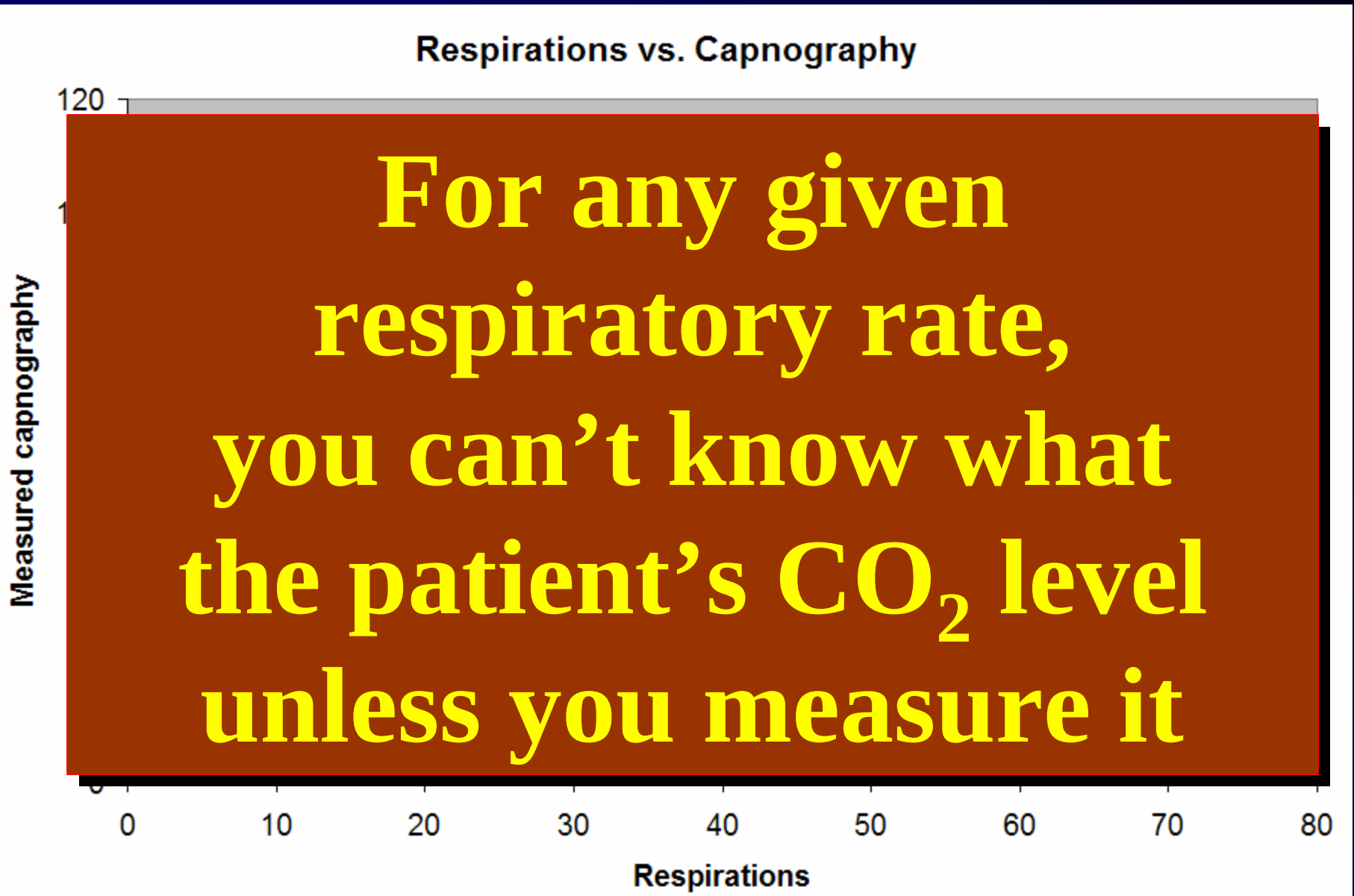
Maintaining the "negativity" of the pressure inside of the thorax is one of the most vital areas of understanding resuscitation

Negative pressure

Positive Pressure in the Thorax decreases Venous Return!!

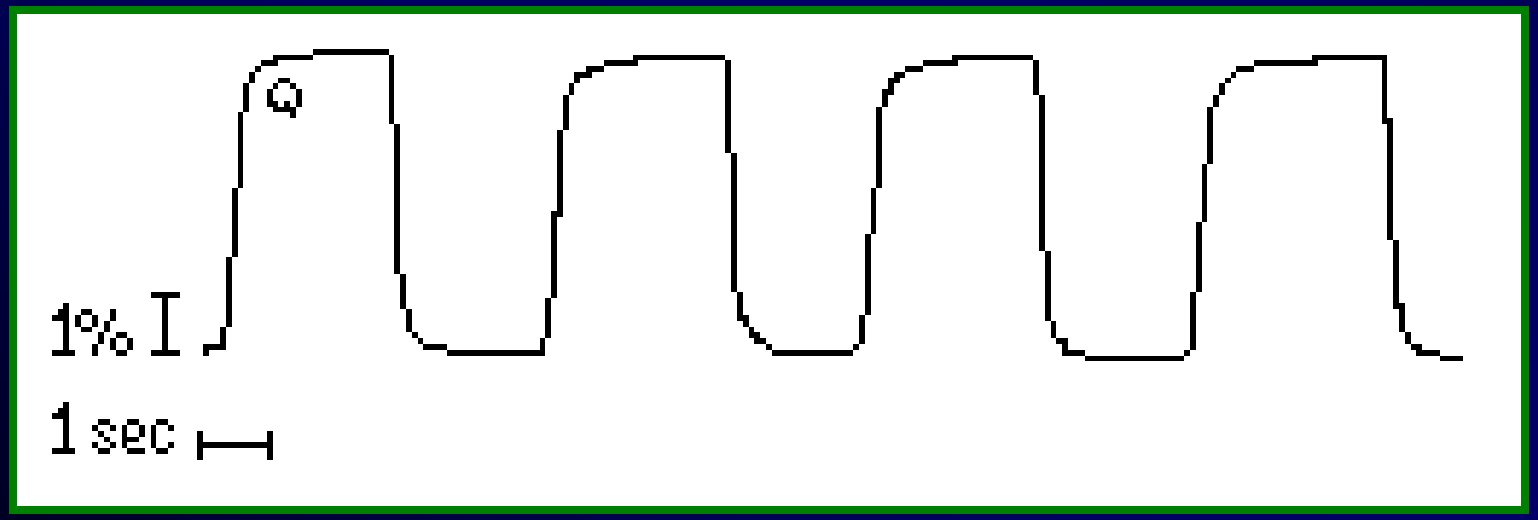
Physiology


Oxygen -> lungs -> alveoli -> blood
Oxygen
muscles + organs
Oxygen
cells
Oxygen
+
Glucose
energy
CO_2
blood
CO_2
lungs
breath
CO_2

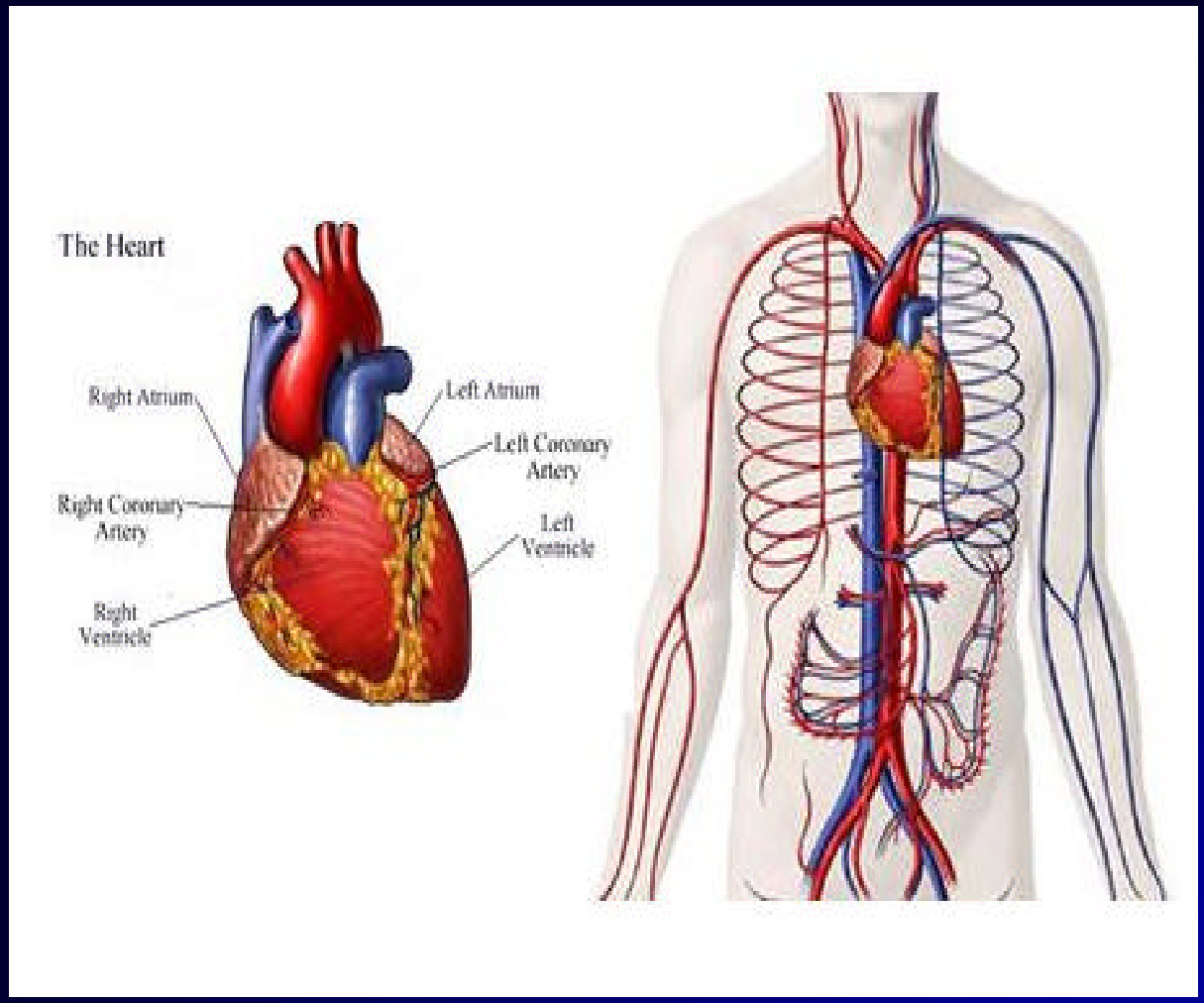


For any given respiratory rate, you can't know what the patient's CO_2 level unless you measure it

Let capnography guide you!



Pathophysiology


The Heart
Right Atrium
Left Atrium
Left Coronary Artery
Right Coronary Artery
Left Ventricle
Right Ventricle

CONGESTIVE HEART FAILURE

THE INABILITY OF THE 'PUMP' TO PROVIDE ADEQUATE BLOOD SUPPLY IN RELATION TO ...

VENOUS RETURN
METABOLIC NEEDS OF BODY TISSUES.

CAUSES OF CHF

MECHANICAL ABNORMALITIES	MYOCARDIAL FAILURE		ARRHYTHMIAS
	Primary	Secondary	
- Pressure Load - Volume Load	Cardio-myopathy	Inflammat. disease	Heart Block
Vent. Asynergy	Inadequate muscle mass	Metabolic Disorders	Atrial Fibrillation
Vent. Aneurysm	—	—	—
Pericardial Disease	Metabolic Disorders	Dysdynamic	Brady Arrhythmias
		—	—
			Tachy Arrhymias

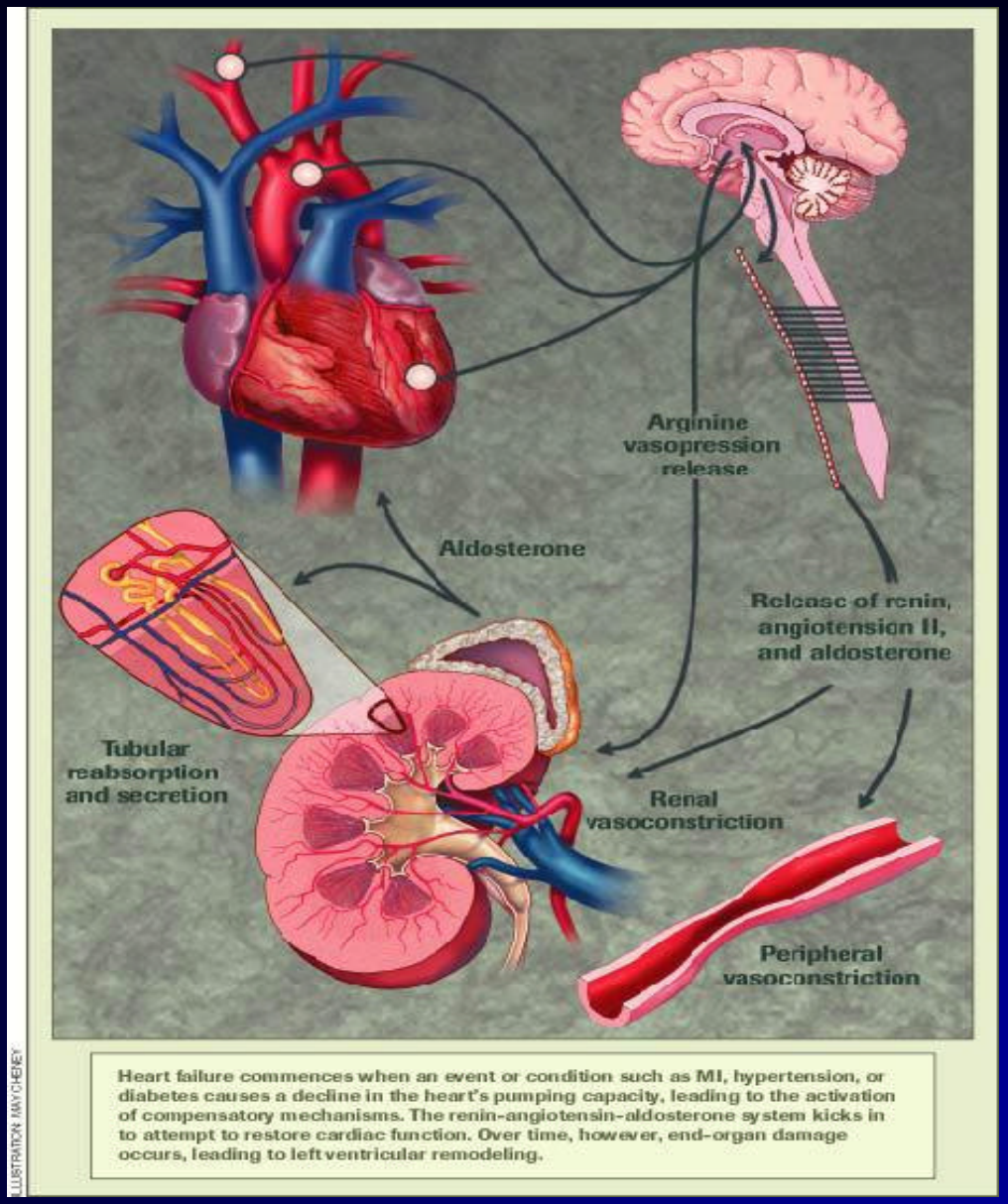
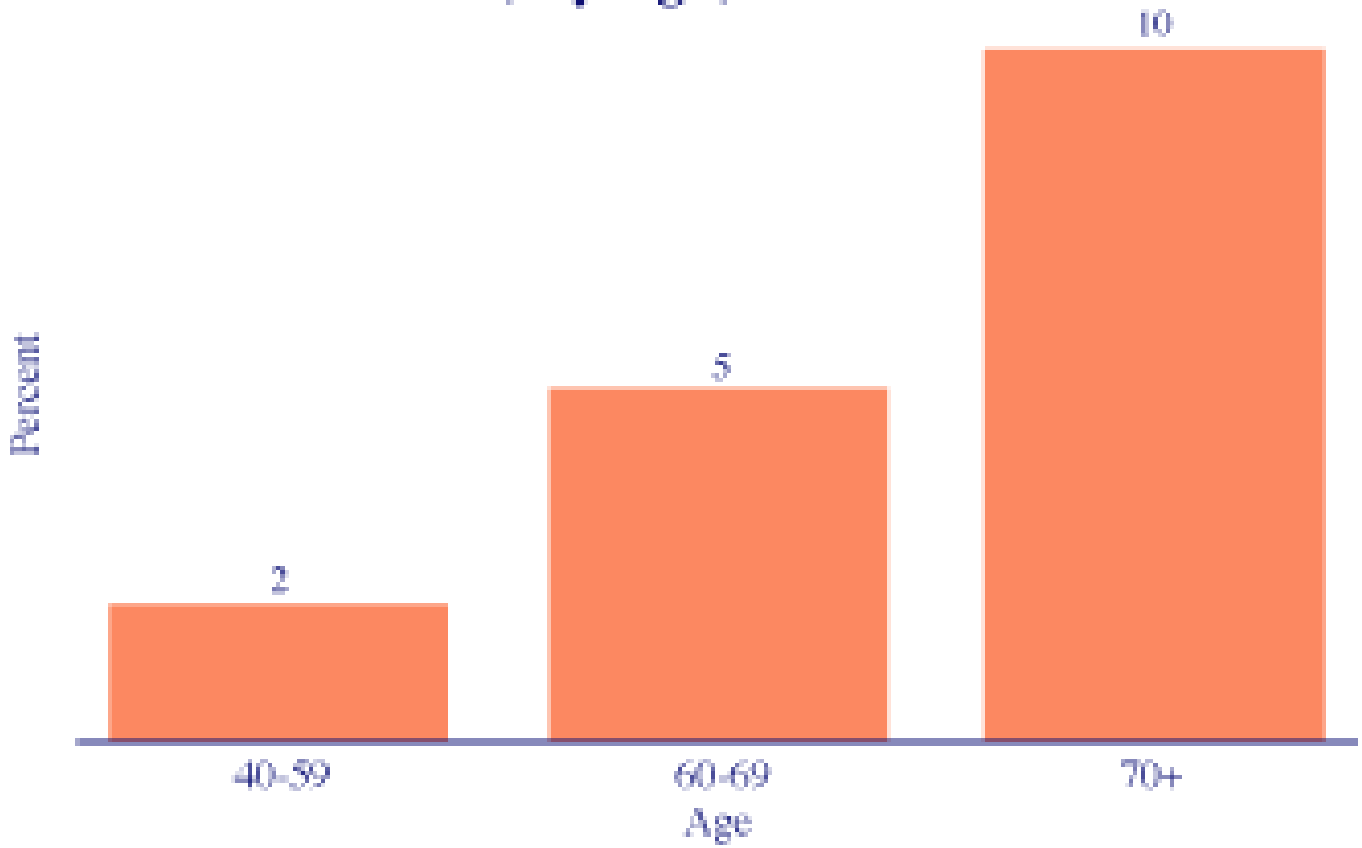


ILLUSTRATION: MAY CHENEY

Heart failure commences when an event or condition such as MI, hypertension, or diabetes causes a decline in the heart's pumping capacity, leading to the activation of compensatory mechanisms. The renin-angiotensin-aldosterone system kicks in to attempt to restore cardiac function. Over time, however, end-organ damage occurs, leading to left ventricular remodeling.

Figure 4

Prevalance of CHF, by Age, 1988-91



Source: National Health and Nutrition Examination Survey (1988-91), National Center for Health Statistics.

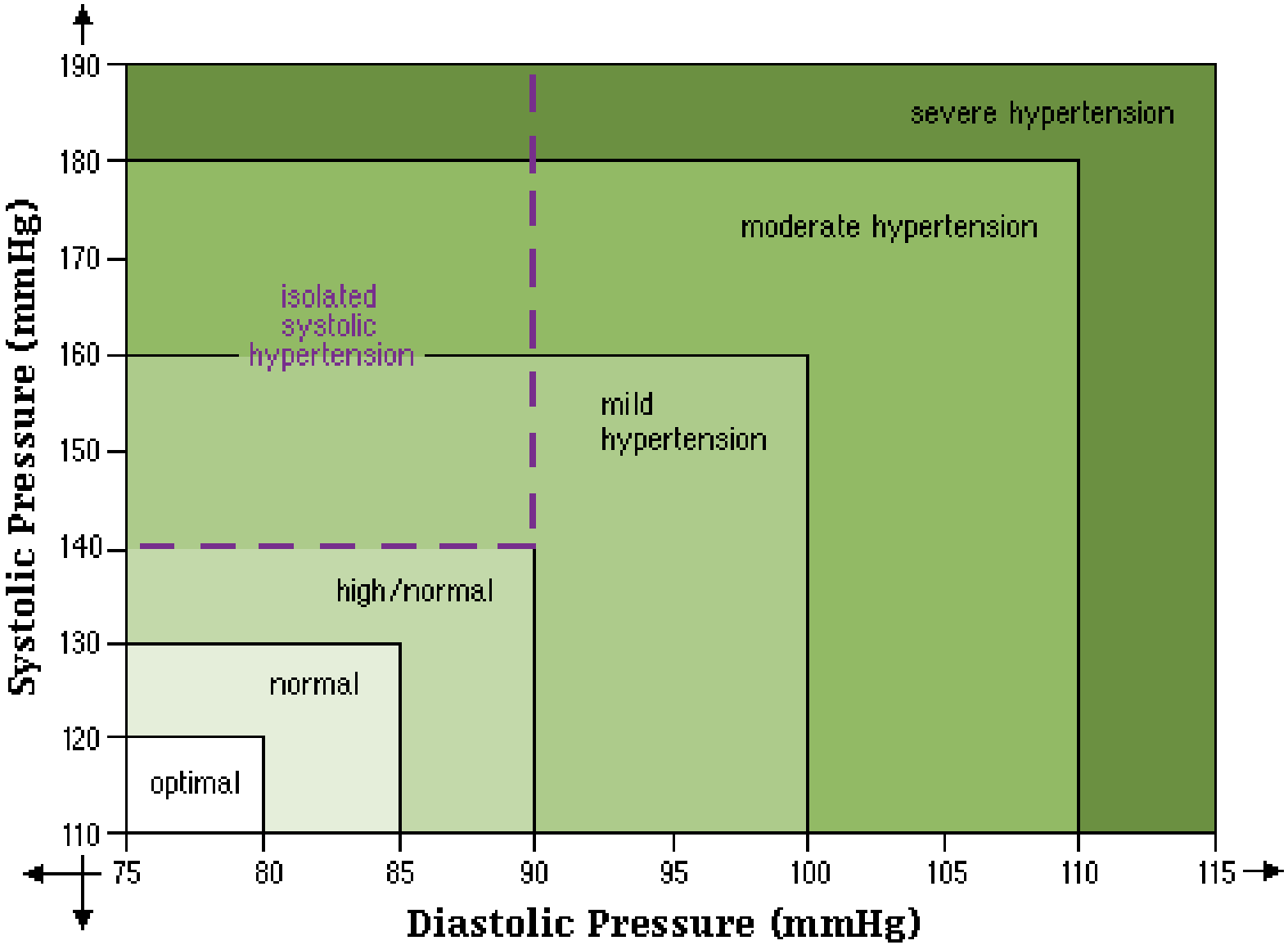
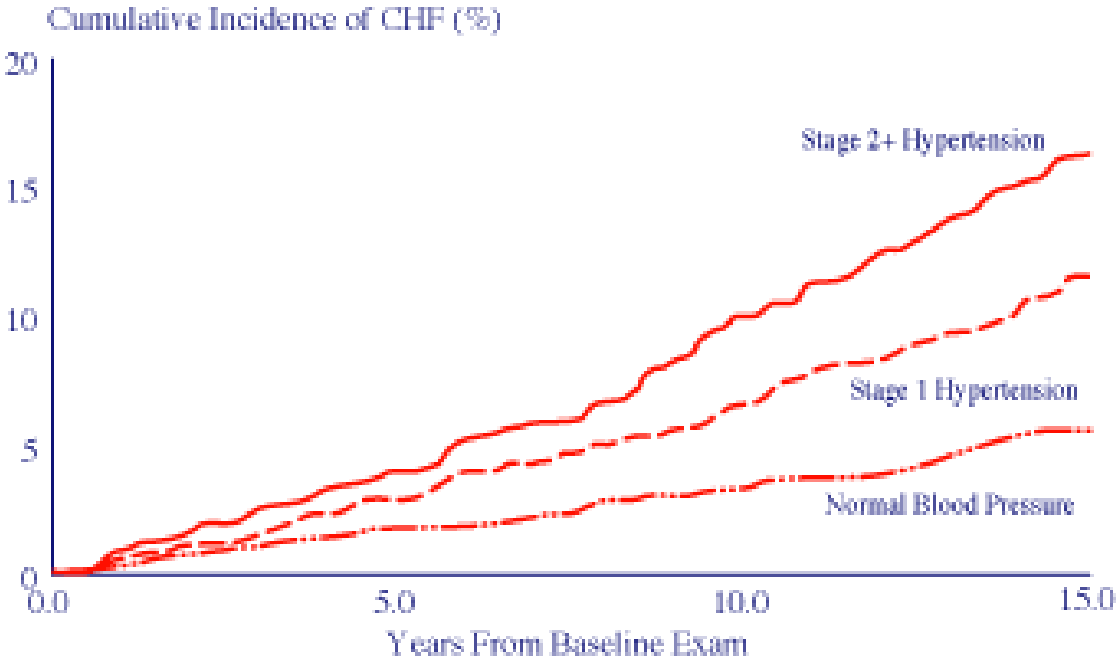

Systolic Pressure (mmHg)
190
180
170
160
150
140
130
120
110
severe hypertension
moderate hypertension
isolated
systolic
hypertension
mild
hypertension
high/normal
normal
optimal
75
80
85
90
95
100
105
110
115
Diastolic Pressure (mmHg)

Figure 2

Incidence of CHF in Men and Women Age 50 to 79, by Hypertension Status

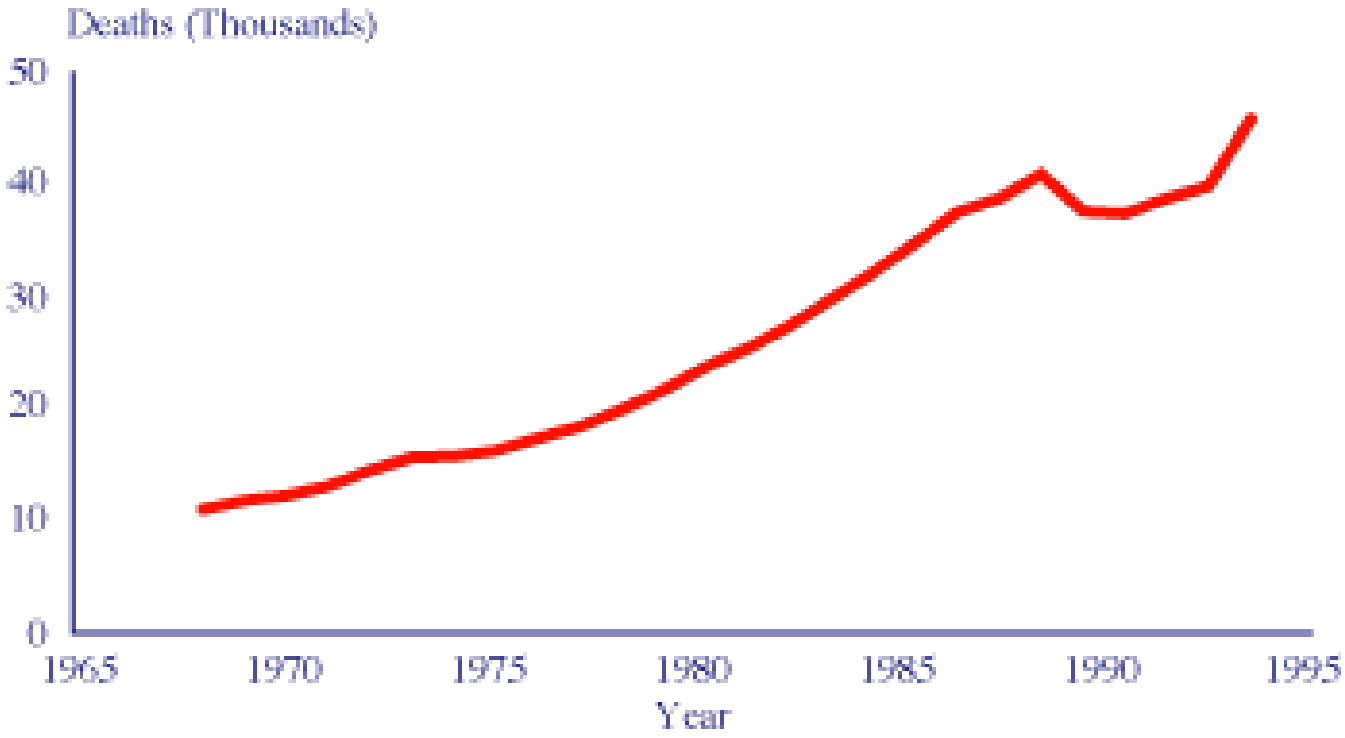


Note: Hypertension is defined as systolic blood pressure (SBP) of 140 mm Hg or greater or diastolic blood pressure (DBP) of 90 mm Hg or greater or taking antihypertensive medication. Stage 1 hypertension is defined as SBP of 140 to 159 mm Hg or DBP of 90 to 99 mm Hg in people not receiving antihypertensive medication; stage 2 or greater hypertension (stage 2+) is defined as SBP of 160 or greater, DBP of 100 or greater, or current use of antihypertensive medication.

Source: Framingham Heart Study, National Heart, Lung, and Blood Institute.

Figure 1

Deaths From Congestive Heart Failure, 1968 to 1993

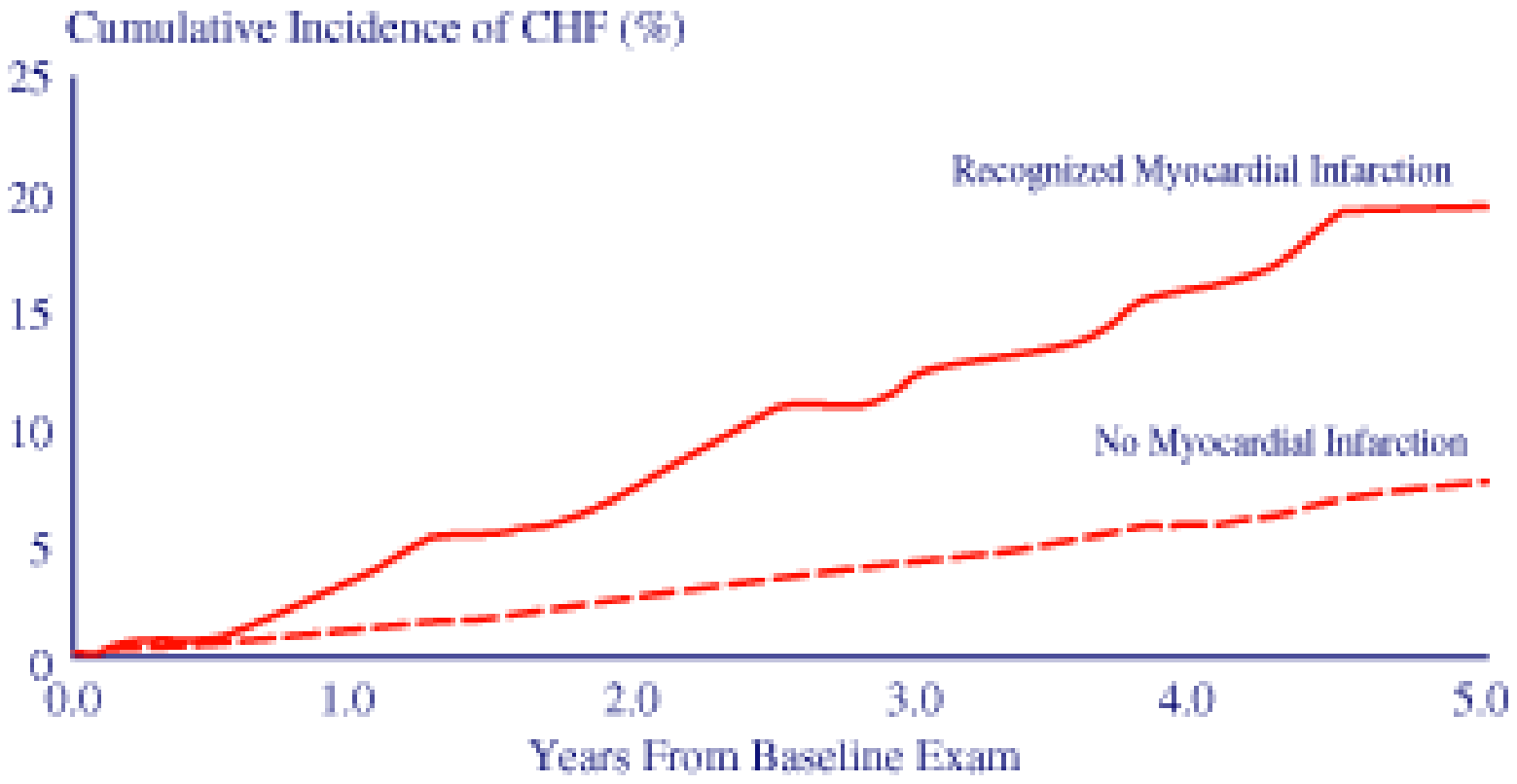


ICD Code 428.0.
The sharp drop occurring in 1989 is attributed to revision of the death certificate.

Source: Vital Statistics of the United States, National Center for Health Statistics.

Figure 3

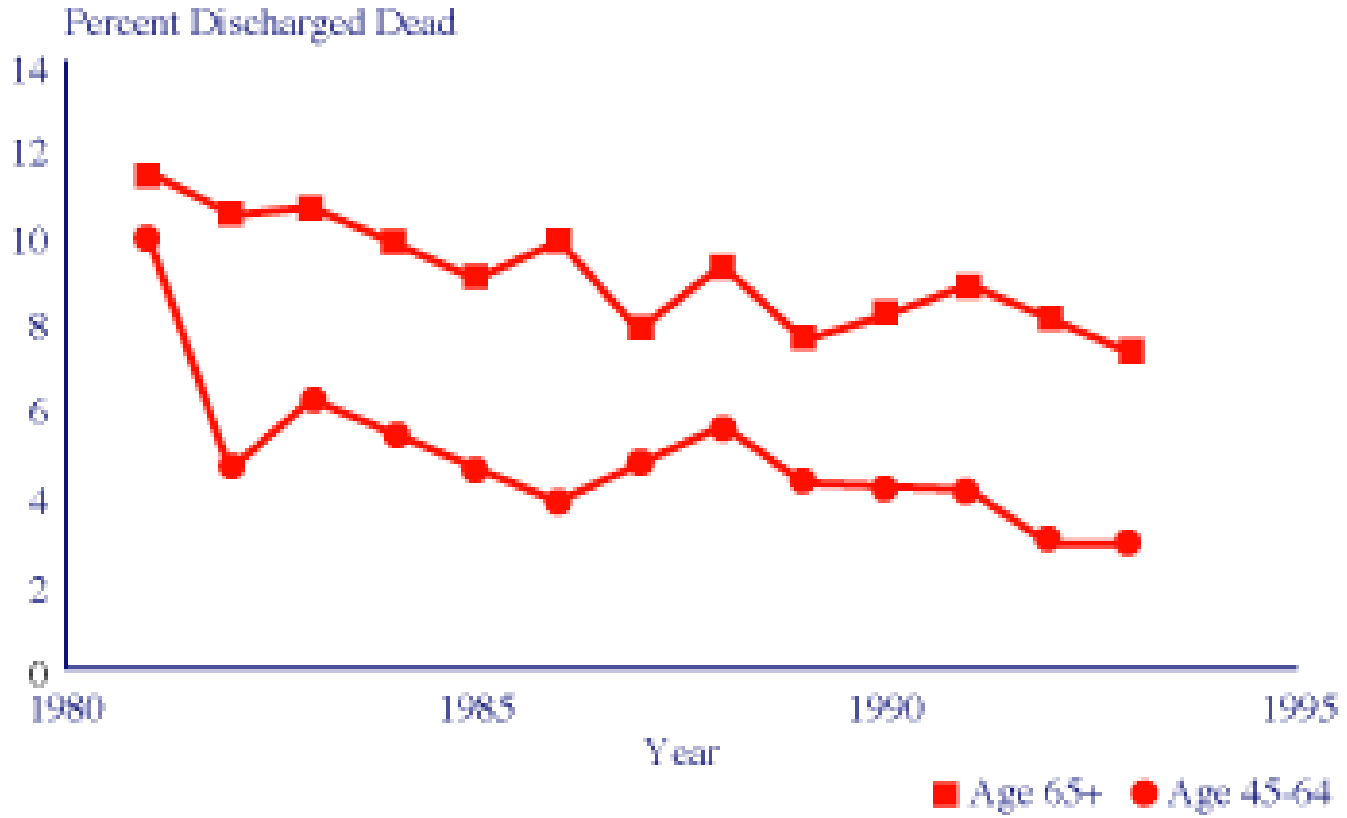
Incidence of CHF, by Myocardial Infarction Status



Source: Cardiovascular Heart Study, National Heart, Lung, and Blood Institute.

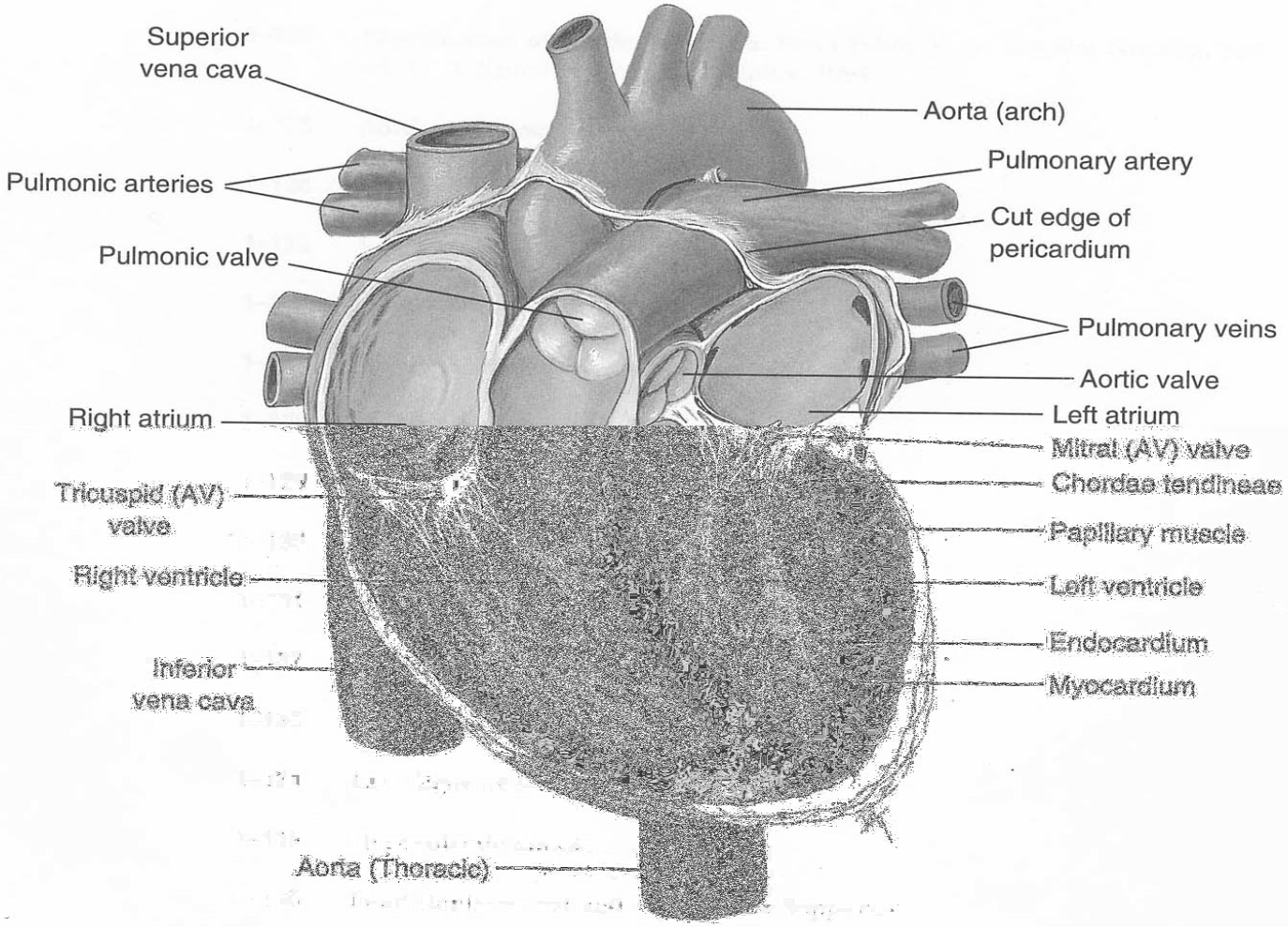
Figure 7

Percent of Hospitalized CHF Patients Discharged Dead, by Age, 1981 to 1993



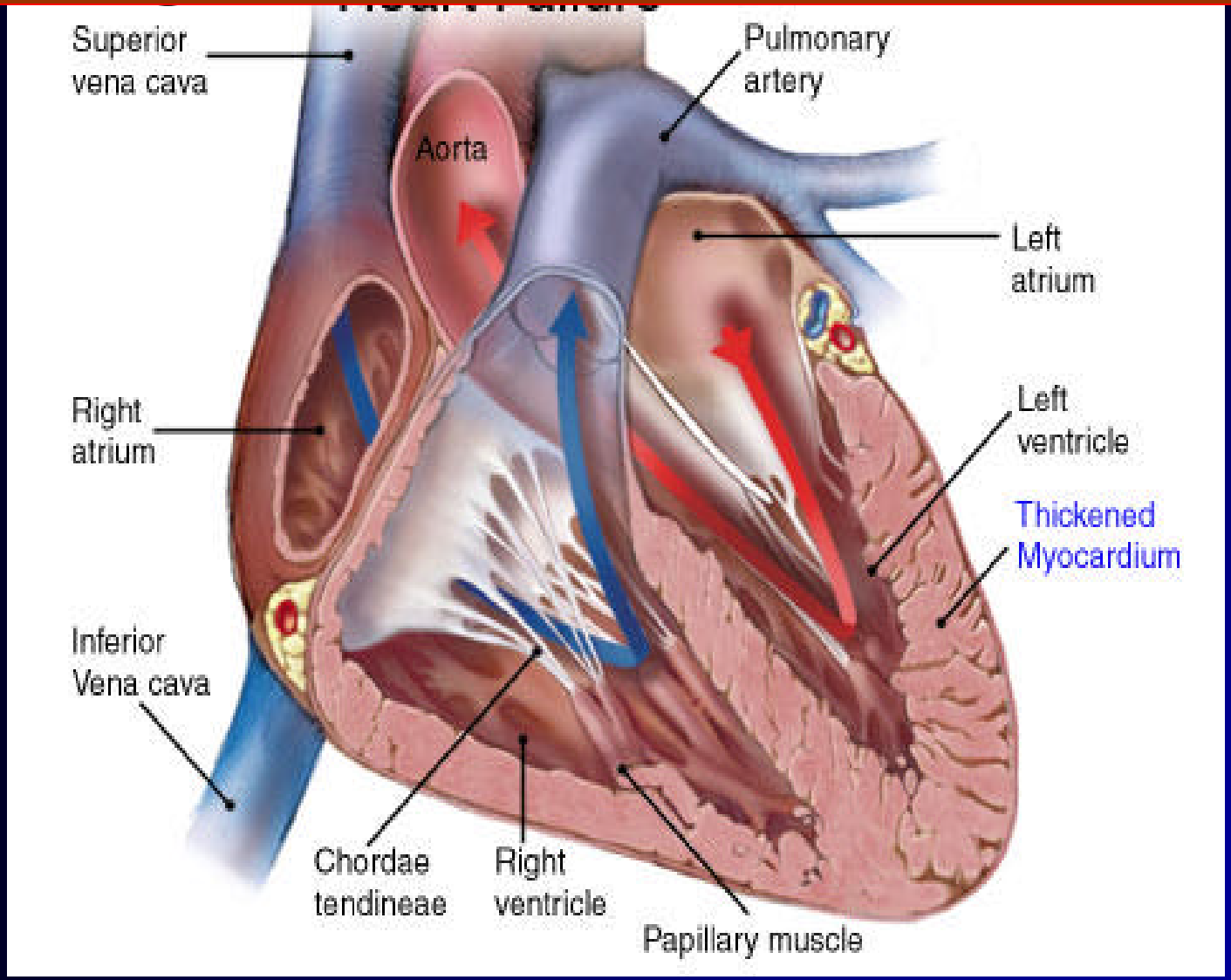
Source: National Hospital Discharge Survey, National Center for Health Statistics.

CARDIAC STRUCTURES

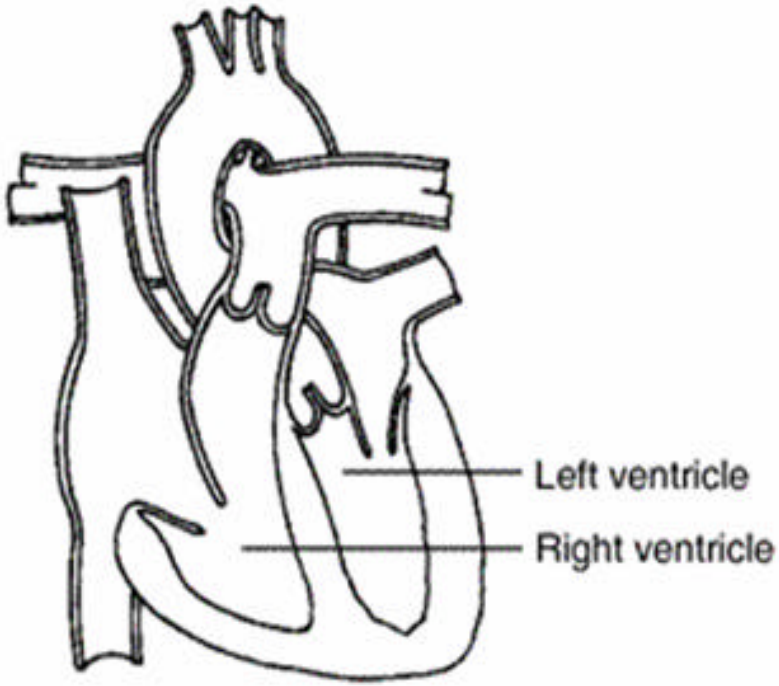


From Jarvis, C.: Physical Examination and Health Assessment, 3rd ed. W. B. Saunders Co., Philadelphia, 2000.

Congestive Heart Failure



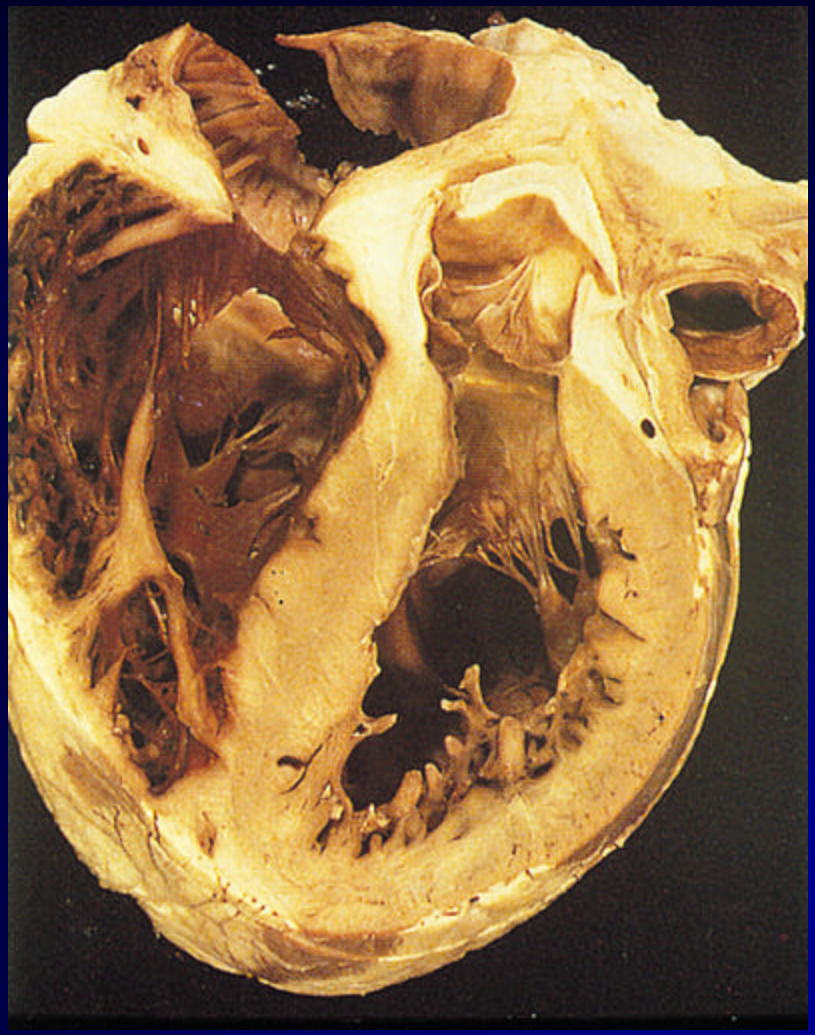
Normal Heart

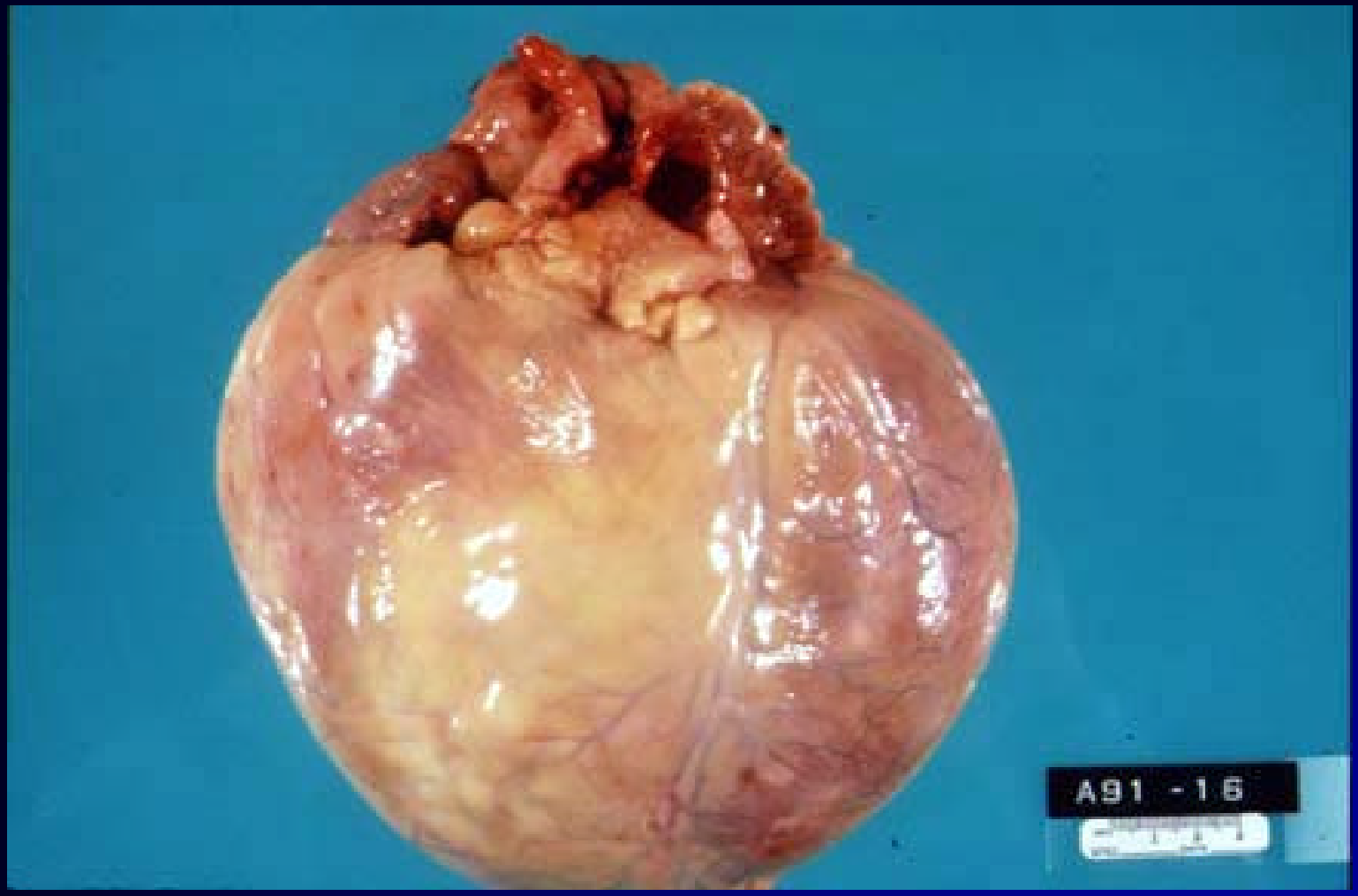


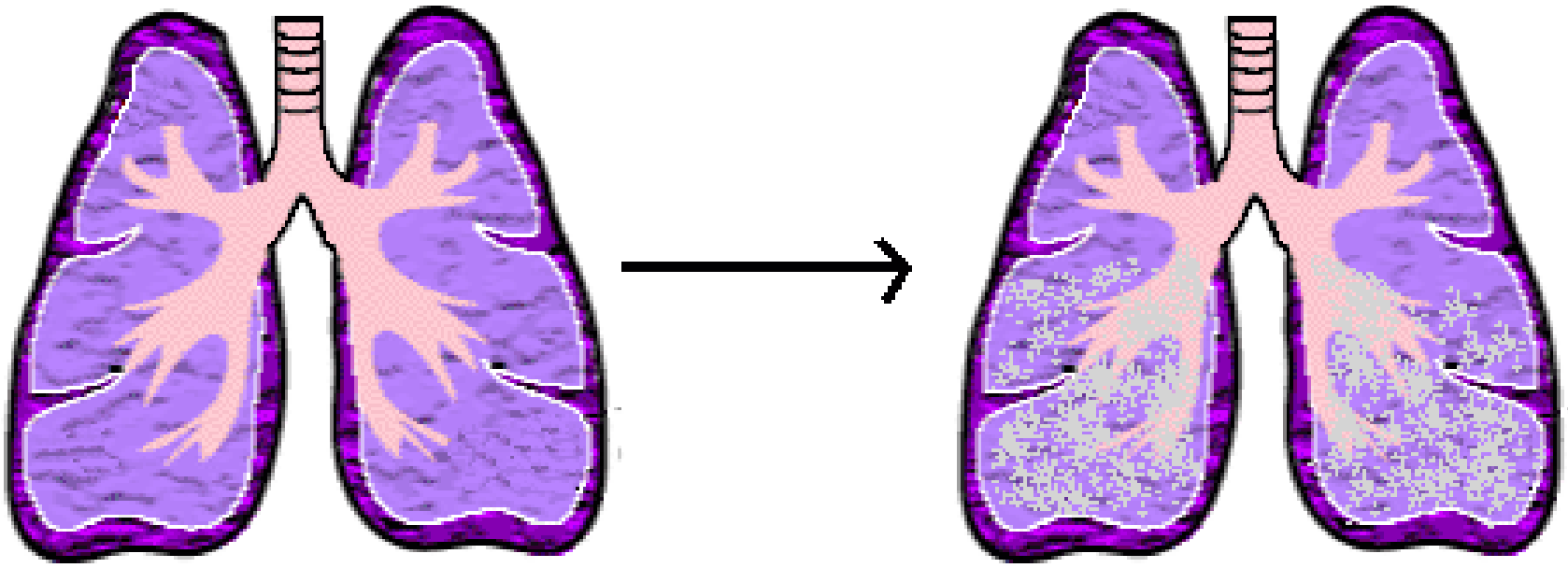
Heart chambers relax and fill,
then contract and pump.

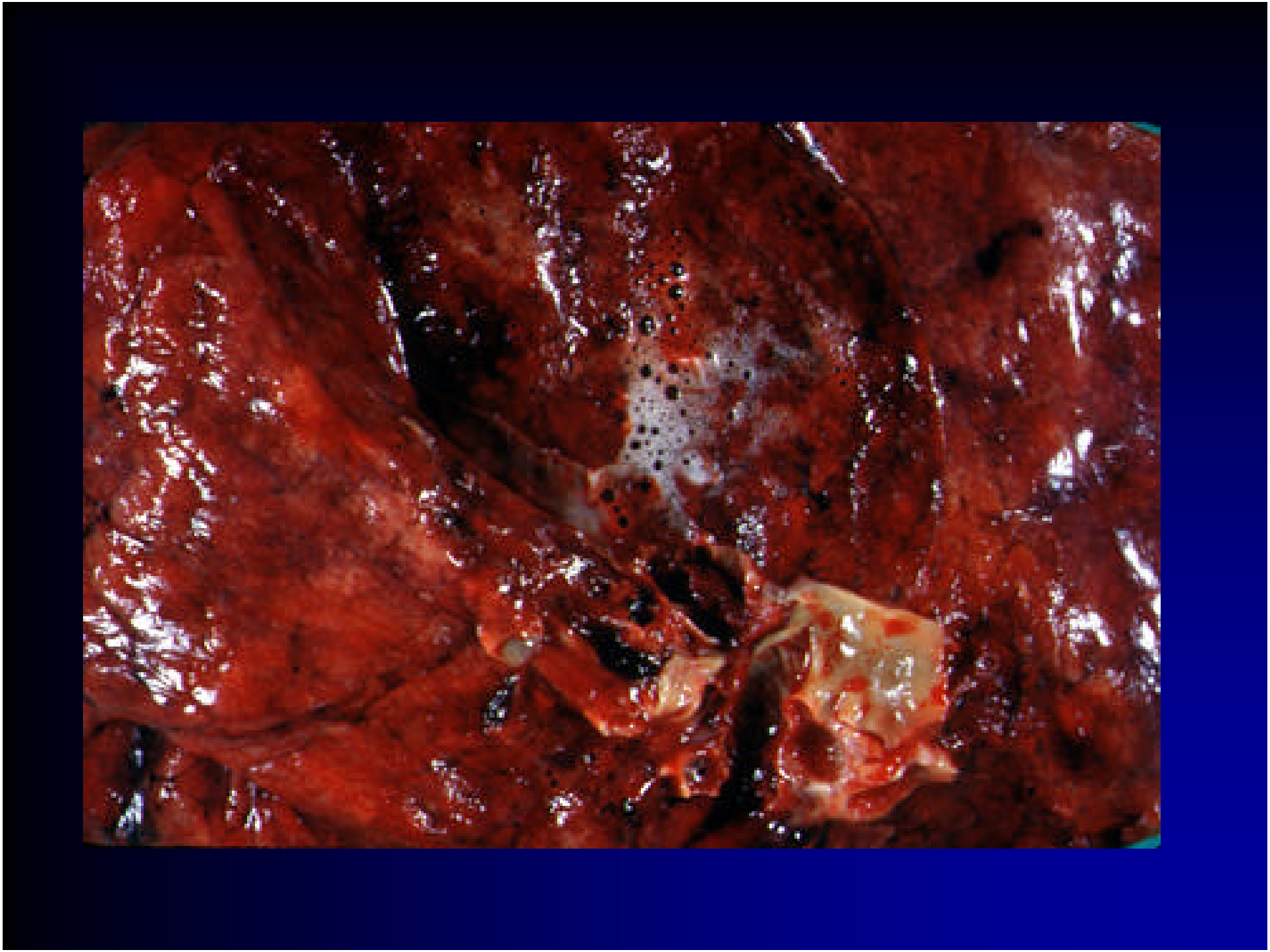
Heart with Dilated Cardiomyopathy

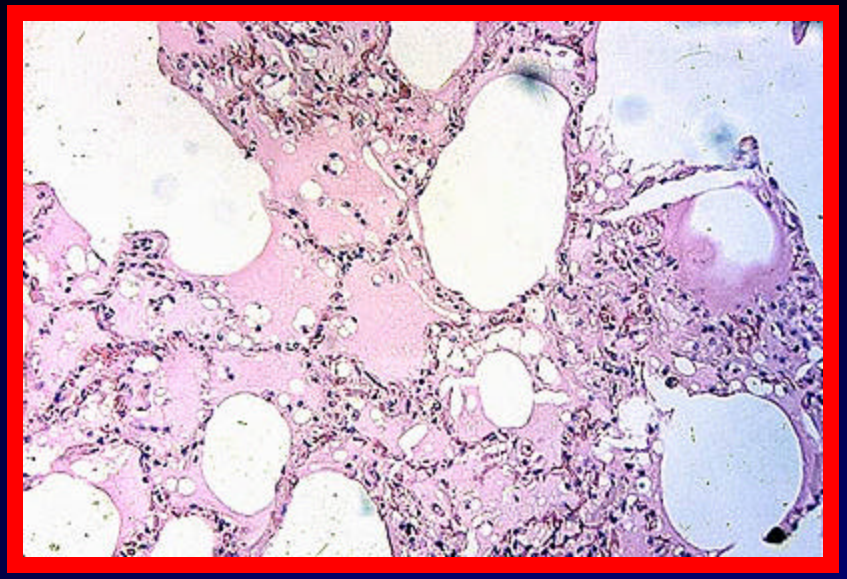
Muscle fibers have stretched.
Heart chamber enlarges

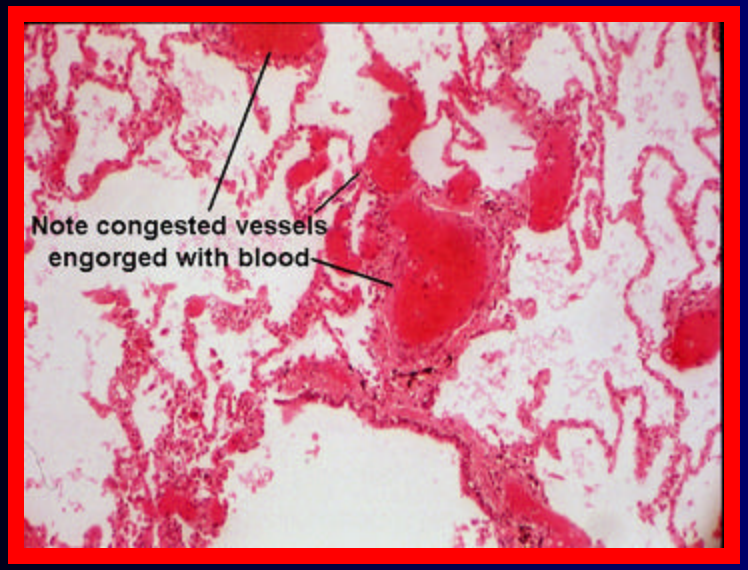


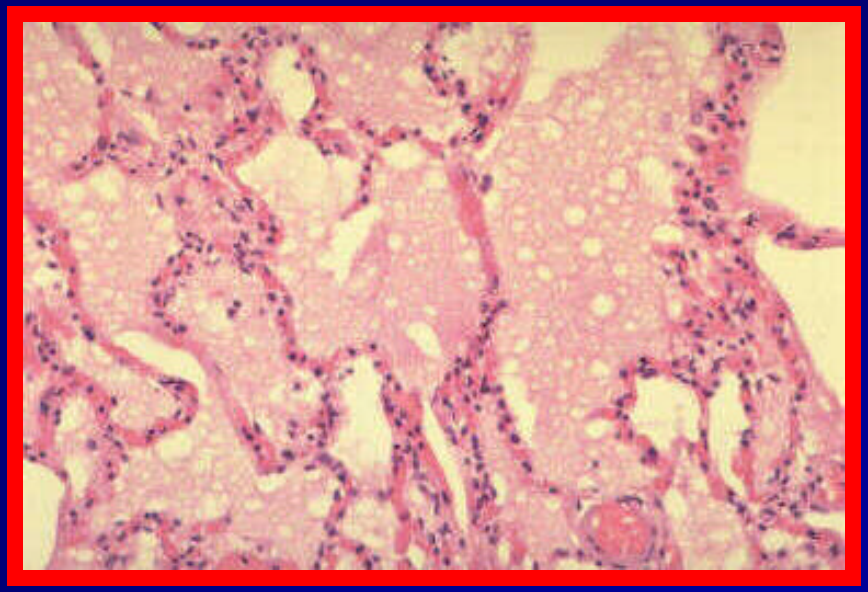

A91 -16

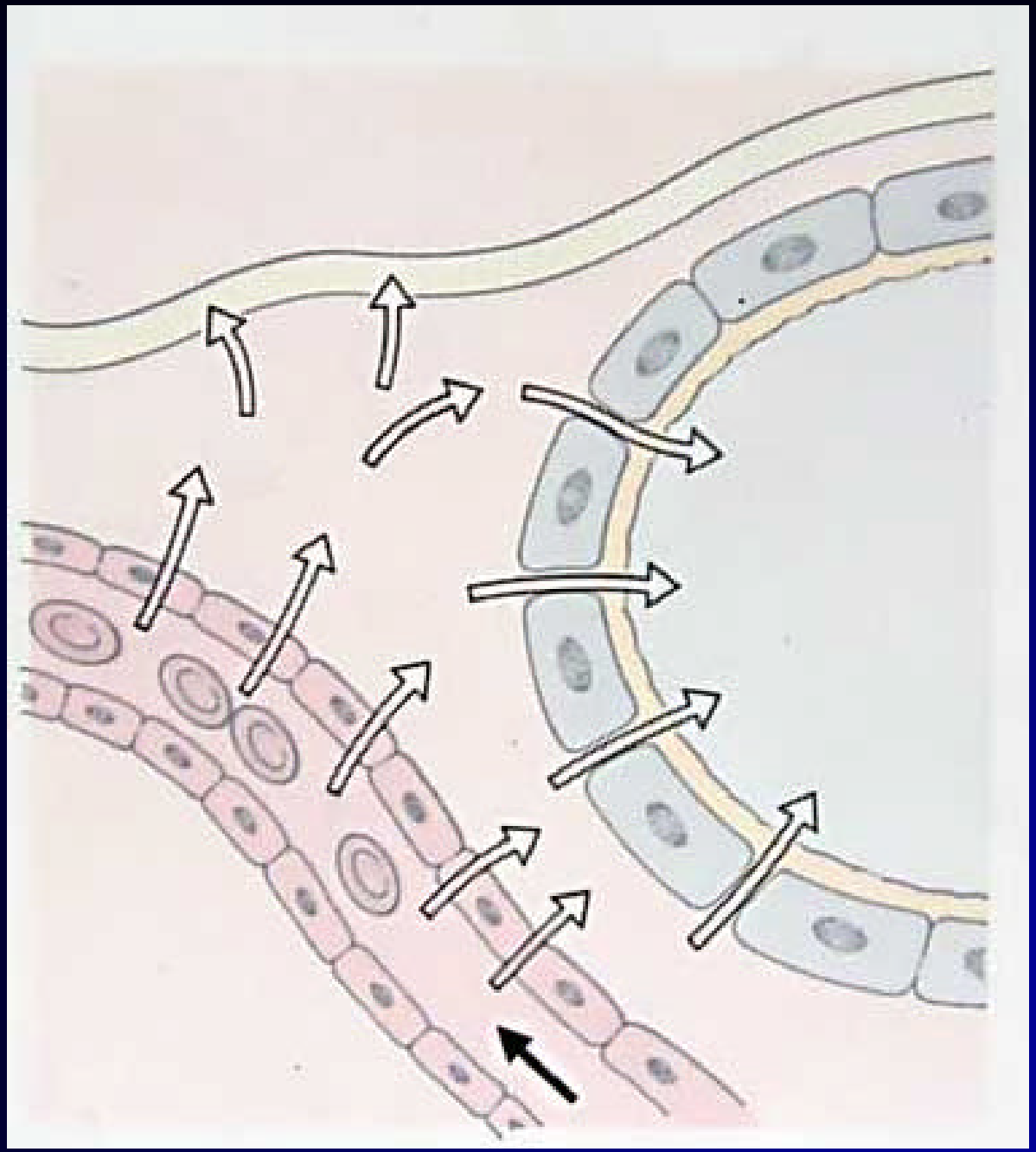

Normal
Pulmonary Edema

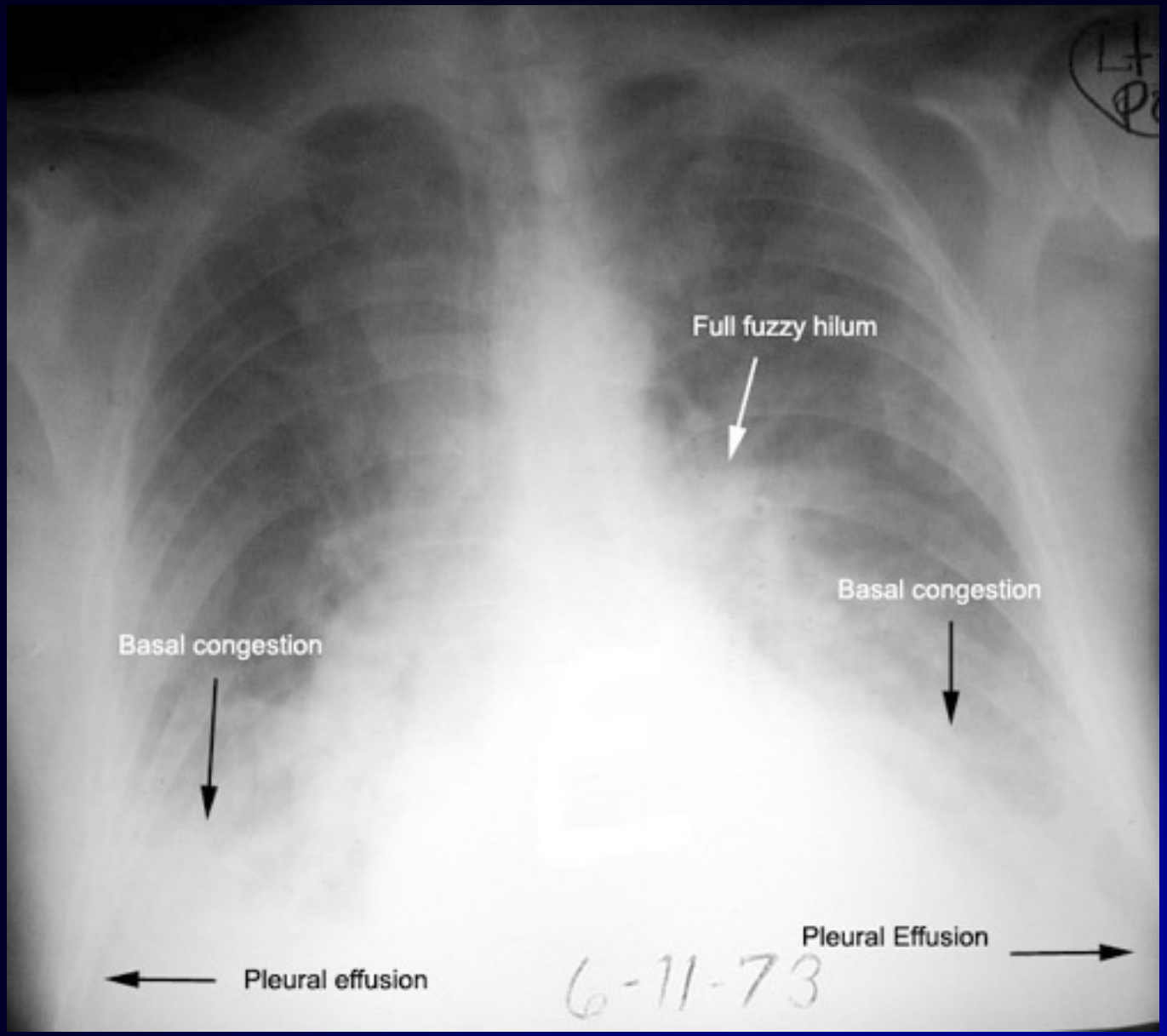




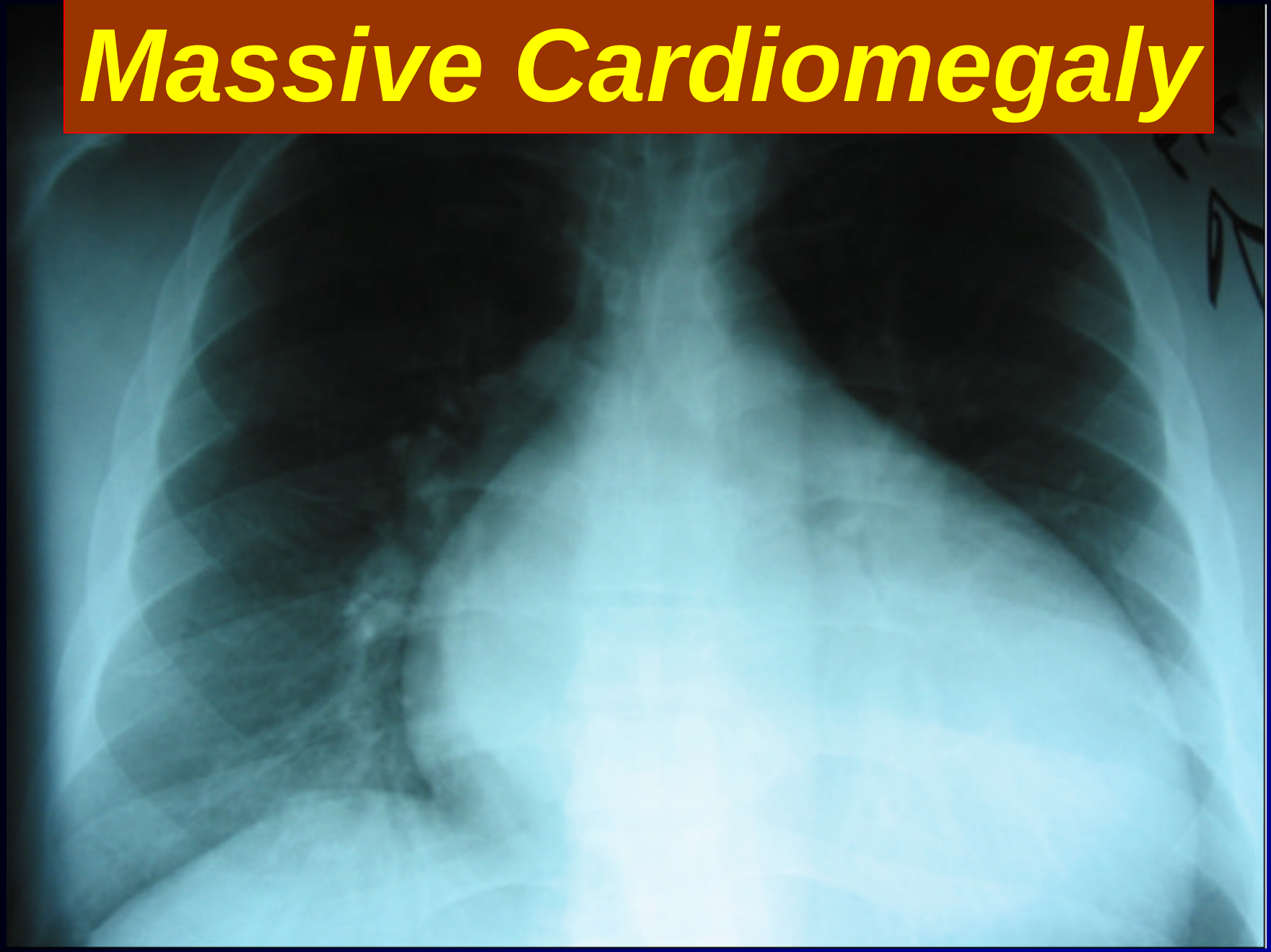

Note congested vessels
engorged with blood

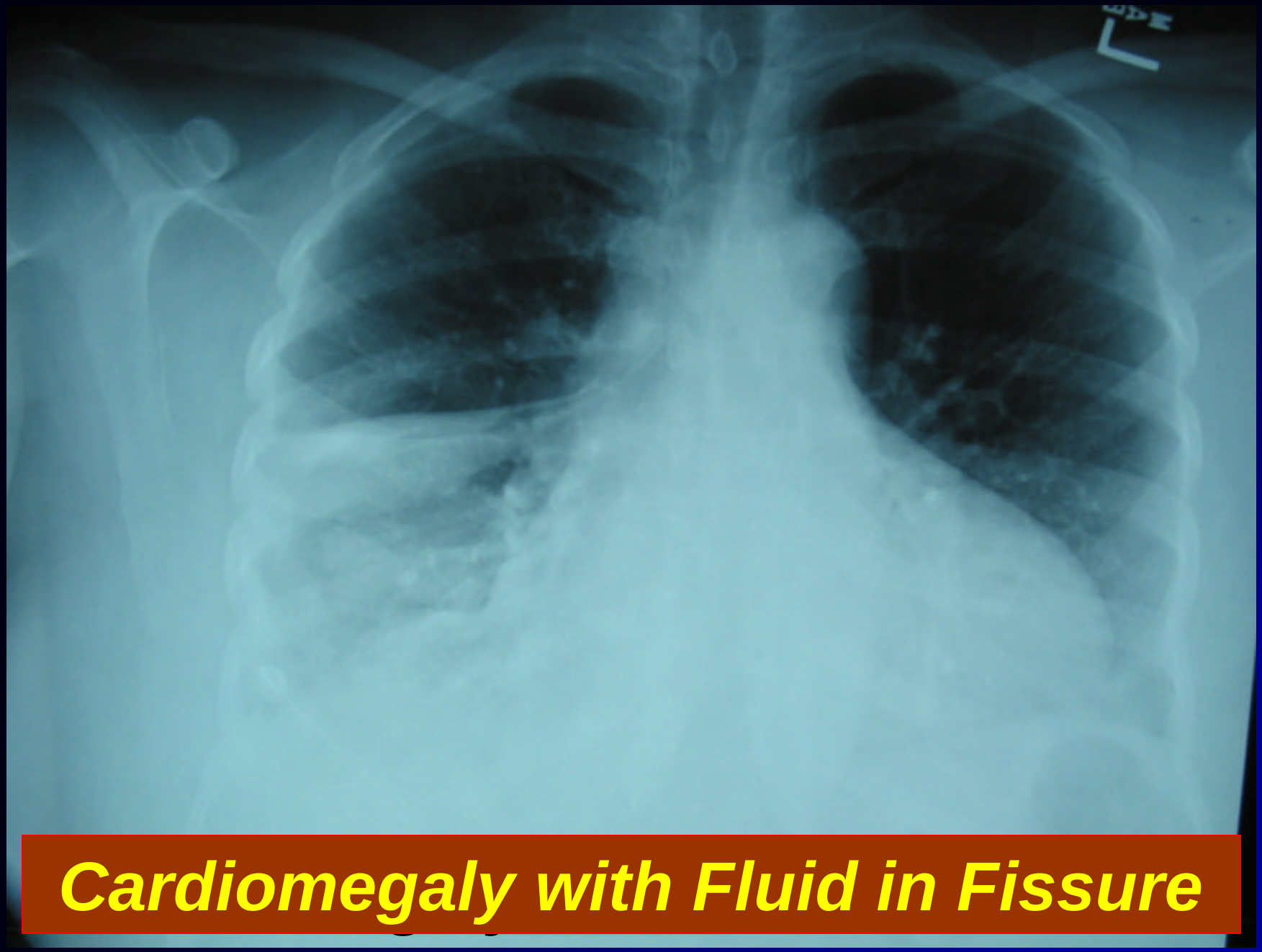





Full fuzzy hilum
Basal congestion
Basal congestion
Pleural Effusion
Pleural effusion
6-11-73

Massive Cardiomegaly




Cardiomegaly with Fluid in Fissure

Critical Features of Severe CHF at the Bedside

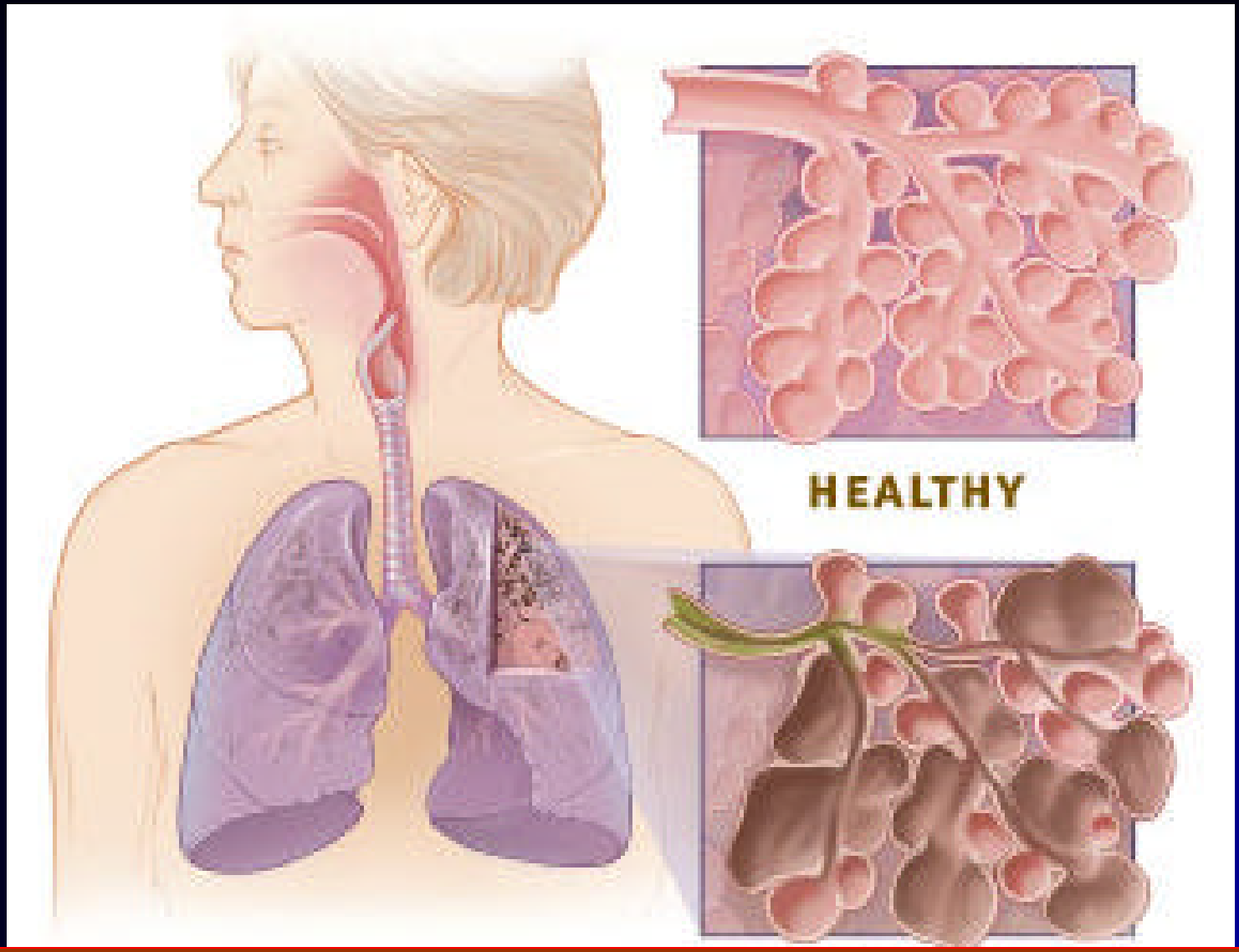
- Patient very short of breath
- Elevated respiratory rate
- Labored respirations
- May be tachycardic, not always
- Usually hypertensive
- Jugular venous distension
- Edema
- Rales (crackles)
- +/- Wheezes
- Cyanosis

Key point!!!

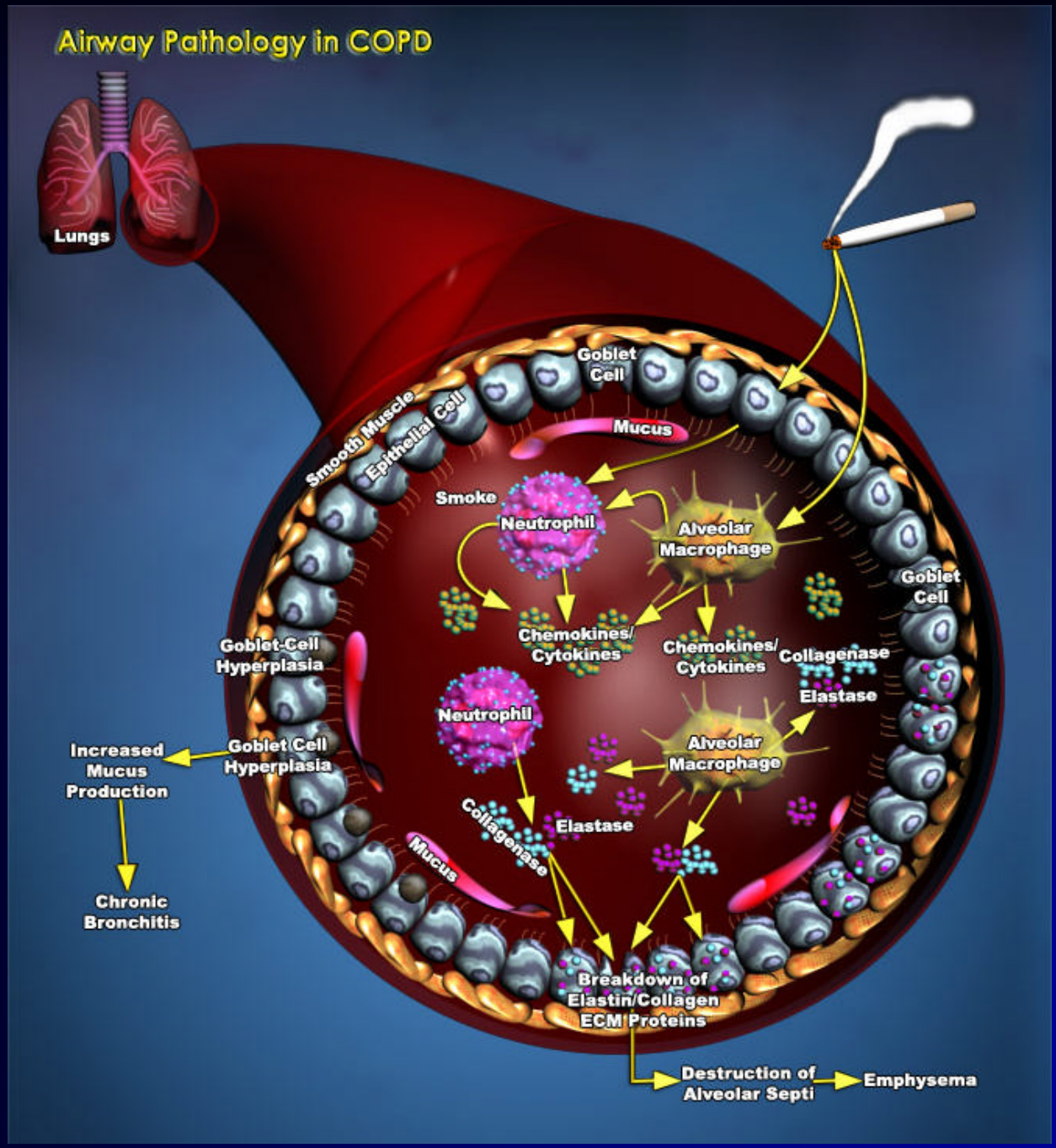
Severe CHF has similar features to tension pneumothorax, cardiac tamponade, and massive pulmonary embolism

- ***SOB***
- ***JVD***
- ***Tachycardia***
- ***Cyanosis***

Chronic Obstructive Pulmonary Disease

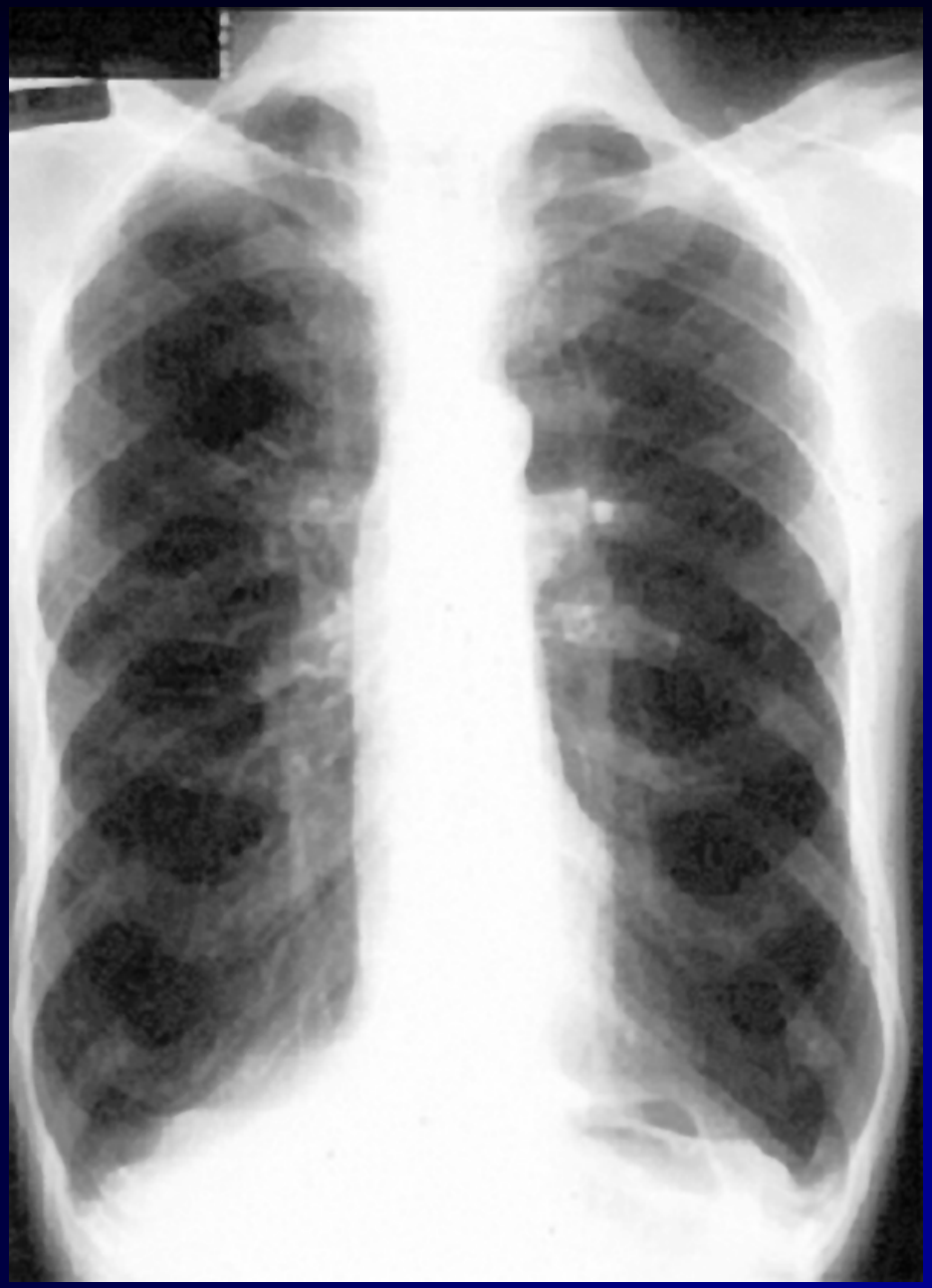


COPD = Alveolar Destruction with Air Trapping

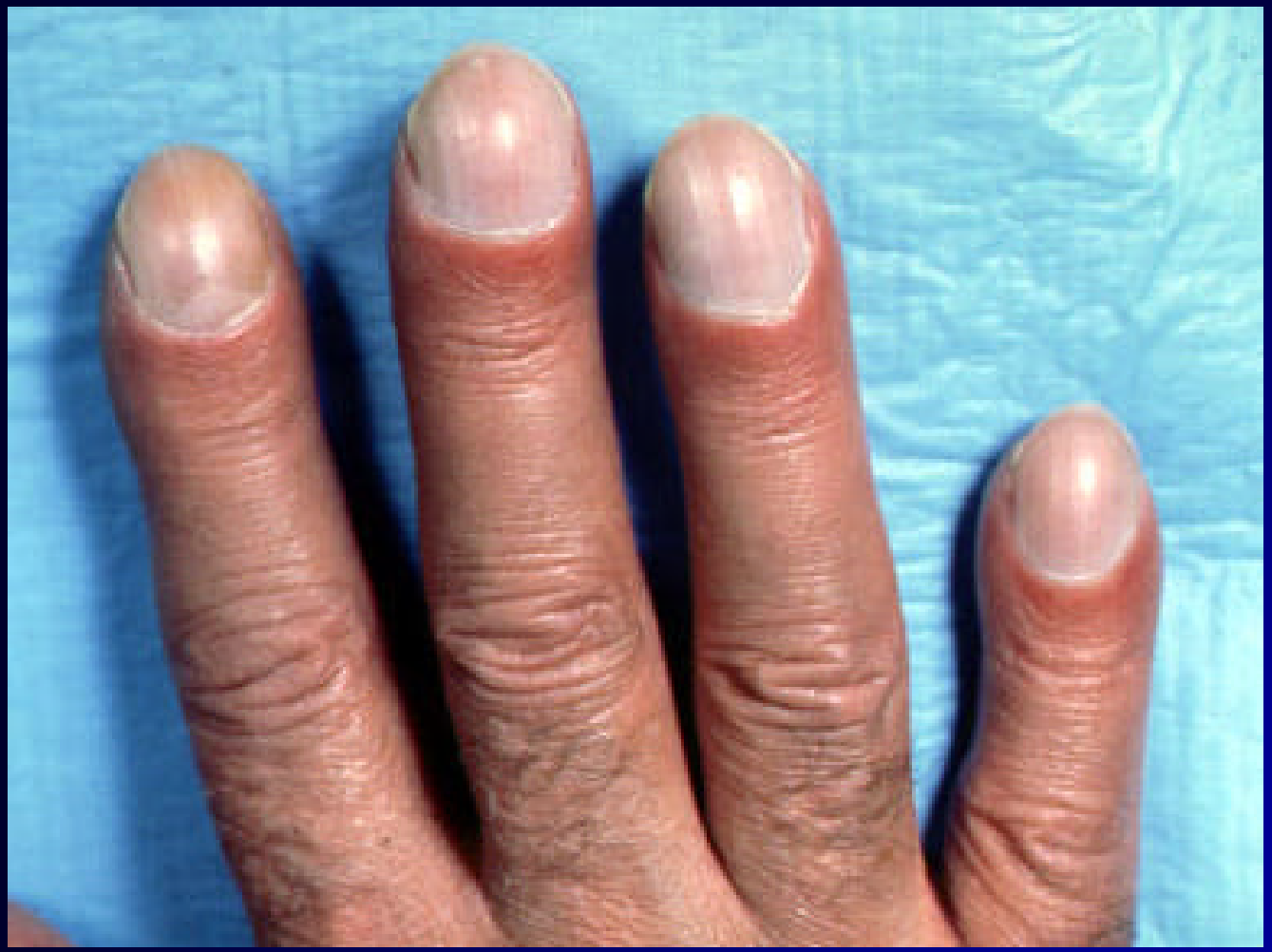

Airway Pathology in COPD
Lungs
Goblet Cell
Mucus
Smooth Muscle
Epithelial Cell
Smoke
Neutrophil
Alveolar Macrophage
Goblet Cell
Chemokines/ Cytokines
Chemokines/ Cytokines
Collagenase
Elastase
Goblet-Cell Hyperplasia
Neutrophil
Alveolar Macrophage
Increased Mucus Production
Goblet Cell Hyperplasia
Collagenase
Elastase
Mucus
Chronic Bronchitis
Breakdown of Elastin/Collagen ECM Proteins
Destruction of Alveolar Septi
Emphysema

Key Features in COPD

- ***Severe SOB***
- ***Cyanosis* (Late)**
- ***?Pulse Ox***
- ***?CO_2* (Late)**
- **JVD (Late)**
- **Usually wheezing**
- **"Air trapping"**

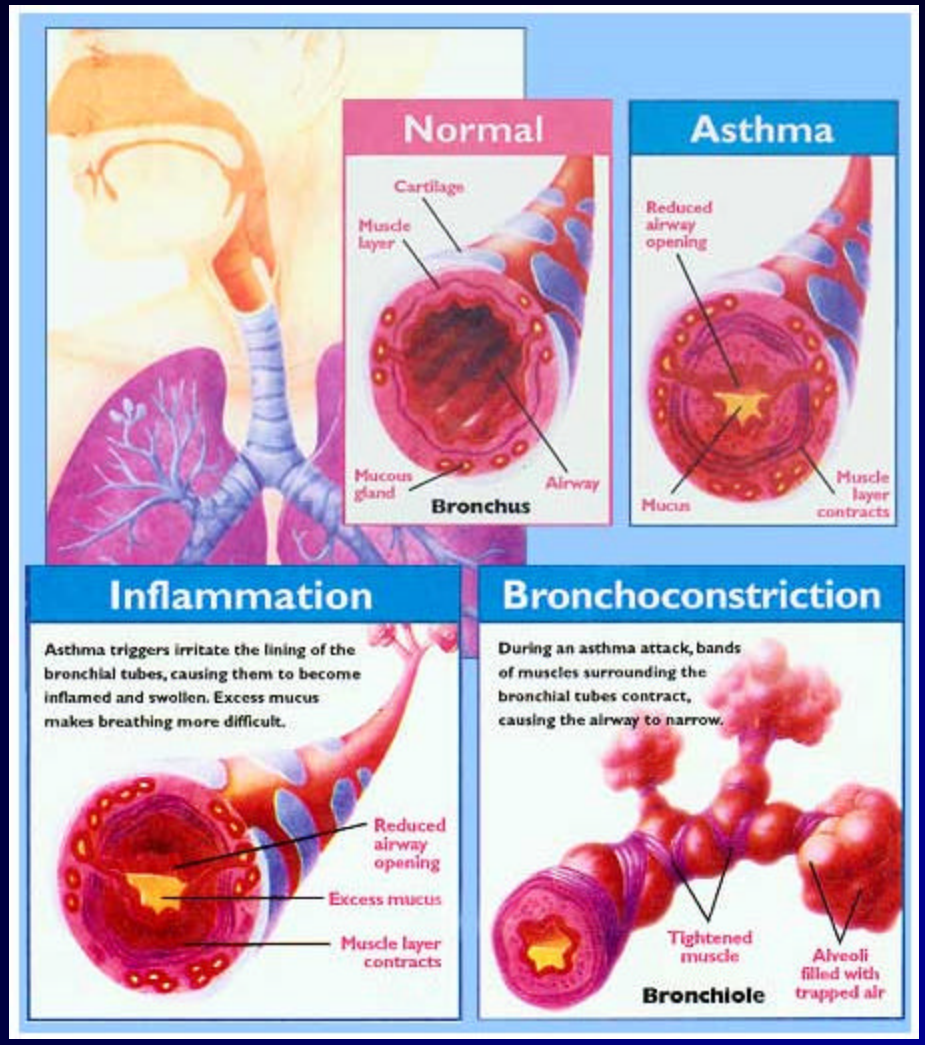


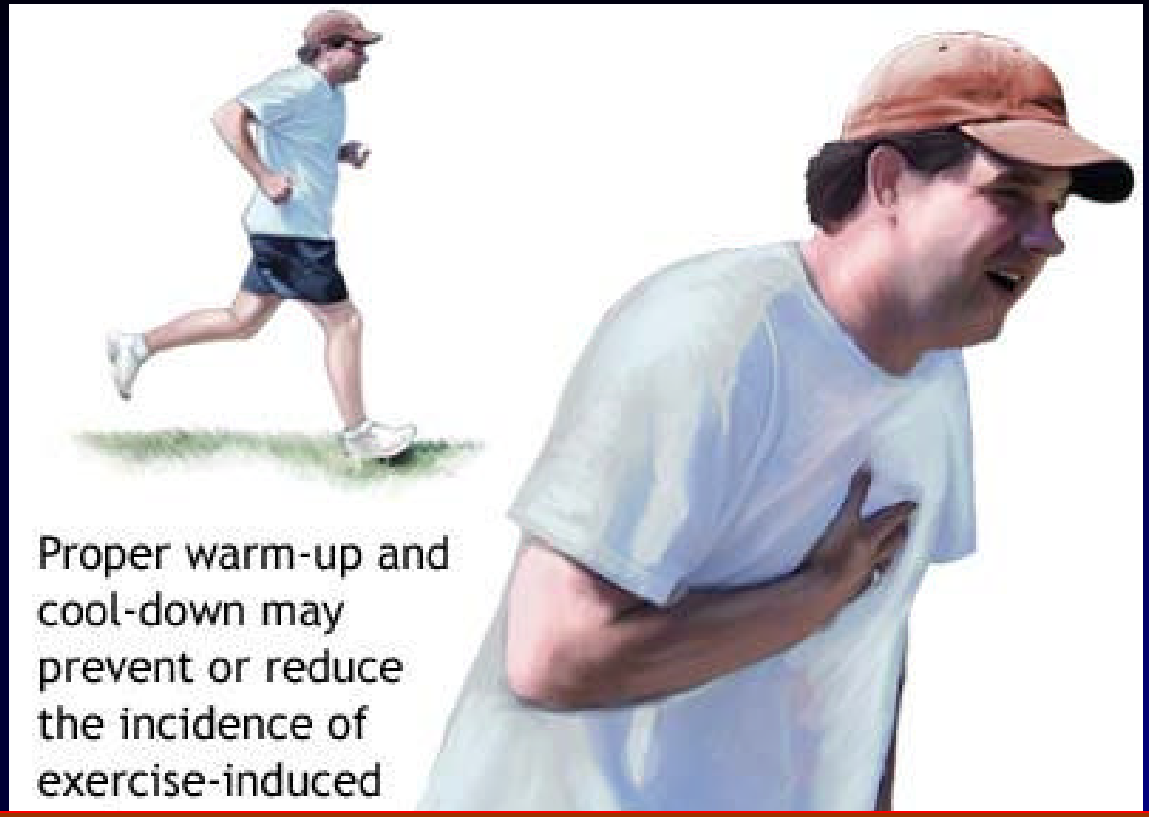
Nail Clubbing in Late COPD



Asthma ("Status Asthmaticus")

An acute attack of severe shortness of breath in a (usually) previously diagnosed patient with asthma


Normal
Cartilage
Muscle layer
Mucous gland
Airway
Bronchus
Asthma
Reduced airway opening
Mucus
Muscle layer contracts
Inflammation
Asthma triggers irritate the lining of the bronchial tubes, causing them to become inflamed and swollen. Excess mucus makes breathing more difficult.
Reduced airway opening
Excess mucus
Muscle layer contracts
Bronchoconstriction
During an asthma attack, bands of muscles surrounding the bronchial tubes contract, causing the airway to narrow.
Tightened muscle
Alveoli filled with trapped air
Bronchiole



As many as 1 in 8 people have exercise induced asthma

Key Features in Status Asthmaticus

- ***Severe SOB***
- ***Cyanosis* (Late)**
- ***?Pulse Ox***
- ***?CO_2* (Late)**
- **Usually wheezing**
- **"Air trapping"**

Let's Discuss!

The clinical presentation of these respiratory problems can be so similar that making a clear determination is difficult, even for the most experienced physician

Differentiating The Desaturating

Focus Your History

- **Sub-acute symptoms**
  - **PND**
  - **Orthopnea**
  - **Worsening SOB with normal activities**
  - **Fever**
  - **Cough (productive or non-productive)**

Differentiating The Desaturating

- **Fluid retention: Patients often know if they're retaining more water than usual, just ask**
- **Renal roundup: Have they made their dialysis appts?**

Differentiating The Desaturating

- **Medications**
  - **Anti-hypertensives**
  - **Diuretics**
  - **Antibiotics**
  - **Steroids**
  - **Nebulized medications**

Differentiating The Desaturating

- **Signs around the scene**
  - **Never-ending lengths of oxygen tubing**
  - **Ashtrays with cigarette butts**
  - **Nebulizer machines**

Management of the Patient with Shortness of Breath

Considerations 1

The patient with CHF, COPD, and asthma attacks have common features

Considerations 1

They're short of breath, usually tachypneic, tachycardic, cyanotic (late)

Considerations 1

They all may be wheezing, and have some features of JVD

Considerations 1

Telling them apart may be difficult:

- **?Hx of CHF**
- **?Hx of COPD**
- **?Hx of Asthma**

Considerations 2

End stage COPD may have right heart failure

- **JVD**
- **Cyanosis**

Considerations 3

CHF may present with wheezing also

- **"Cardiac Asthma"**

Considerations 4

These people are SICK, and you must act quickly

Risks

- They may stop breathing
- They may develop cardiac arrest

Common Treatment Goals 1

- ***These patients are hypoxic and need oxygen***

Common Treatment Goals 2

- ***Be prepared to assist ventilation***

Common Treatment Goals 3

- ***Wheezing is treated with albuterol in all of these patients***

Treatment Goals 4

The patient with CHF is volume overloaded in the chest and must have this volume displaced elsewhere

Treatment Goals 4

The chief difference in treating severe CHF vs. COPD/asthma is in the use of nitroglycerin

Treatment Goals 4

NTG provides rapid displacement of the thoracic volume load into the vascular tree, principally in the veins

Treatment Goals 4

NTG reduces afterload, meaning lowering blood pressure, which takes pumping strain off of the heart

Treatment Goals 4

NTG also improves forward flow from the heart, allowing perfusion of the kidneys so that diuresis can occur

Treatment Goals 5

Be very careful with morphine in severe CHF: Data suggests that outcome is worsened in the EMS environment

1: Prehosp Emerg Care. 2003 Jan-Mar;7(1):13-23.

Griswell et al 2003:

"Diuretics and morphine should be used with caution, as they carry higher risks, especially in misdiagnosed patients"

personnel in the future. But for now, EMS personnel must rely on their fundamental skills of history taking and physical examination for accurate diagnosis of CHF.

The chief risk of morphine use in severe CHF is that the patient may become over-sedated, appear to be clinically better, but is in fact worsening

A useful thing to remember about morphine use in CHF is that you use it as you are preparing to intubate the patient

Continuous Positive Airway Pressure

A relatively new treatment in patients with shortness of breath

CPAP produces a continuous positive pressure in the airway of the treated patient

CPAP Physiological Effects

- Airways less likely to collapse, as happens in CHF
- Pulmonary edema is pushed out of the alveoli and back into circulation
- Edema AROUND the alveoli is pushed back into the circulation
- Higher levels of delivered oxygen
- Nebulized treatments better delivered

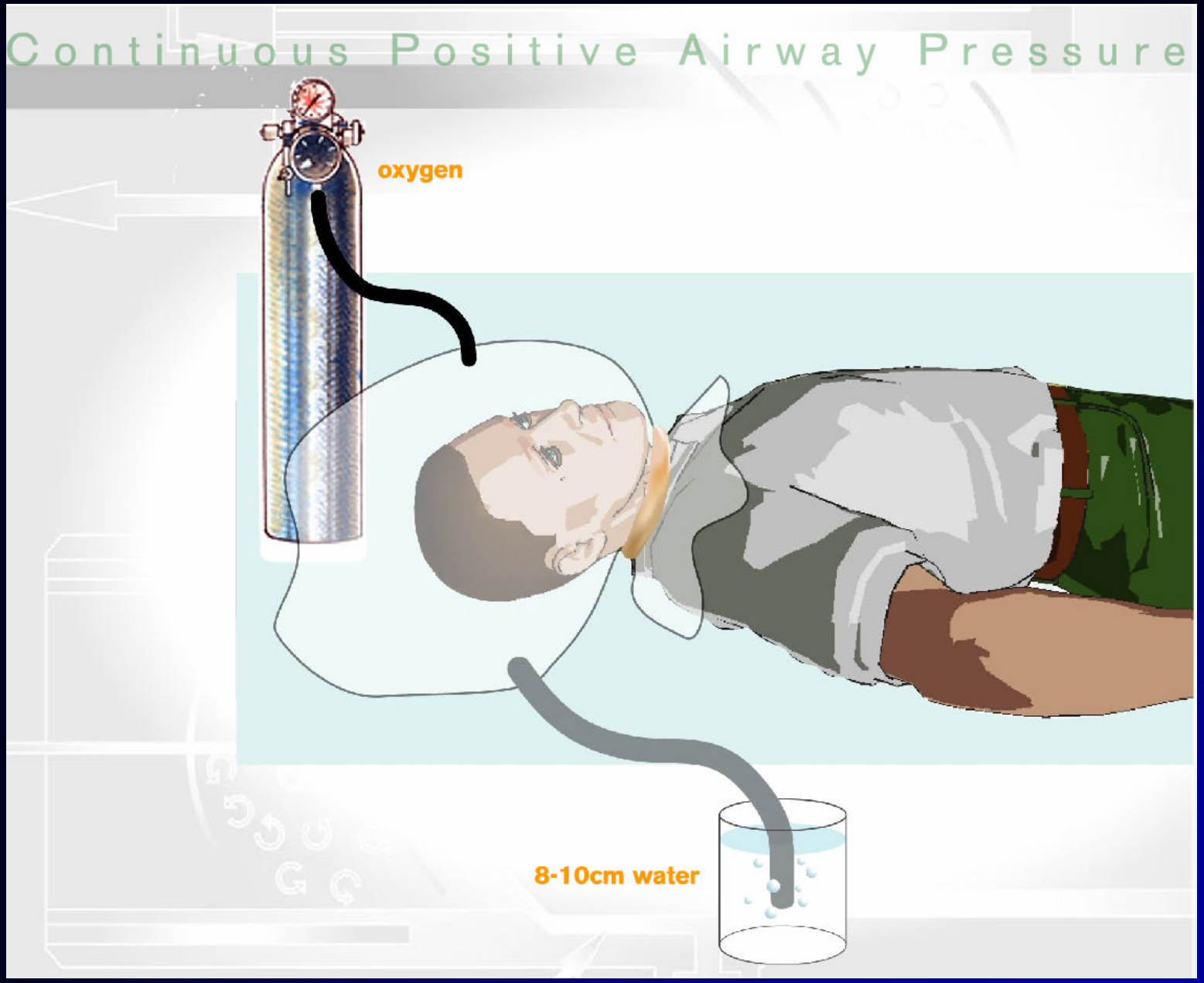
CPAP Clinical Effects

- The work of breathing is reduced
- Patients usually feel less short of breath
- Delivered oxygen improves, decreasing the sense of smothering
- Improved nebulization delivery allows more rapid improvement in wheezing

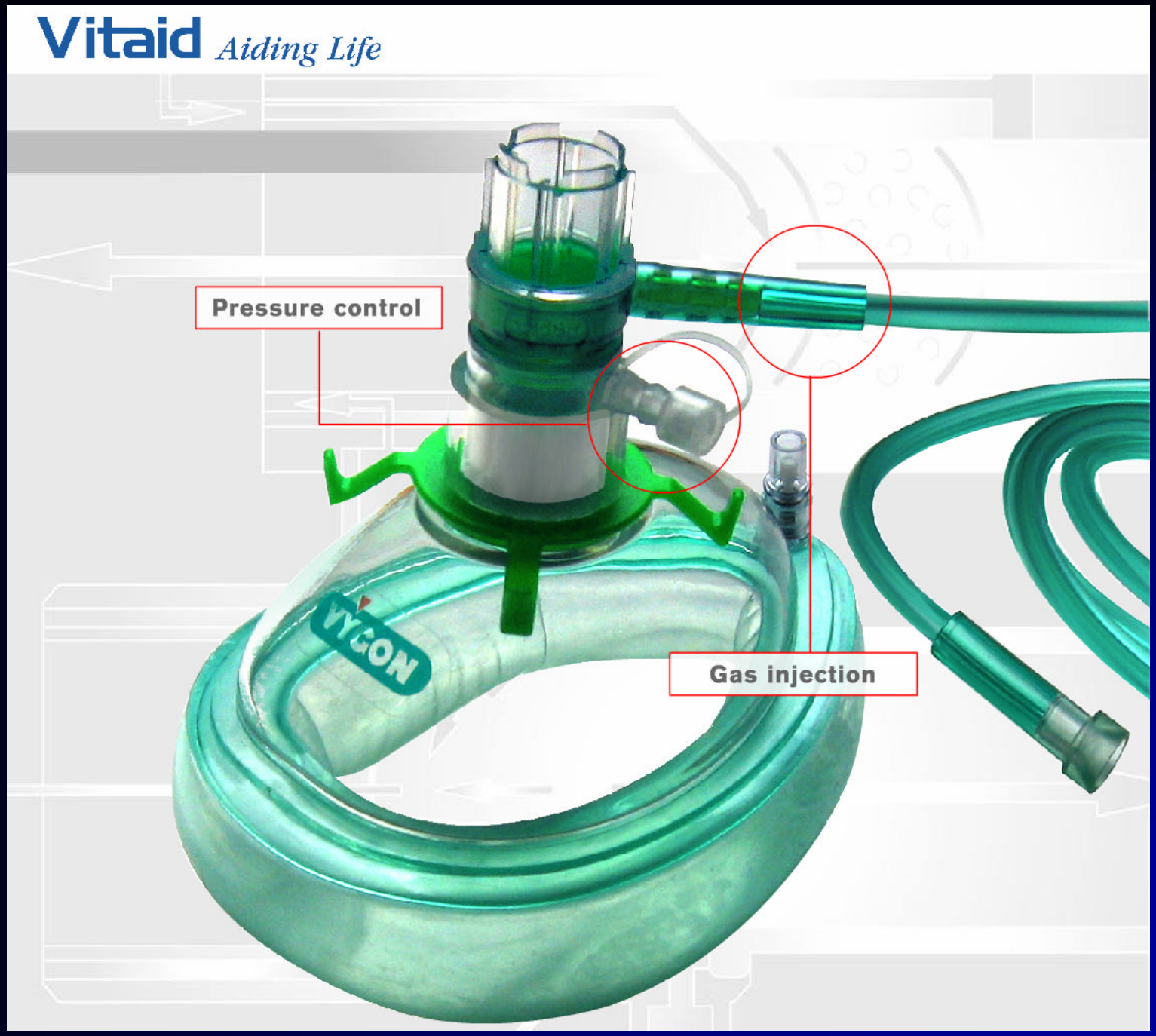
1973

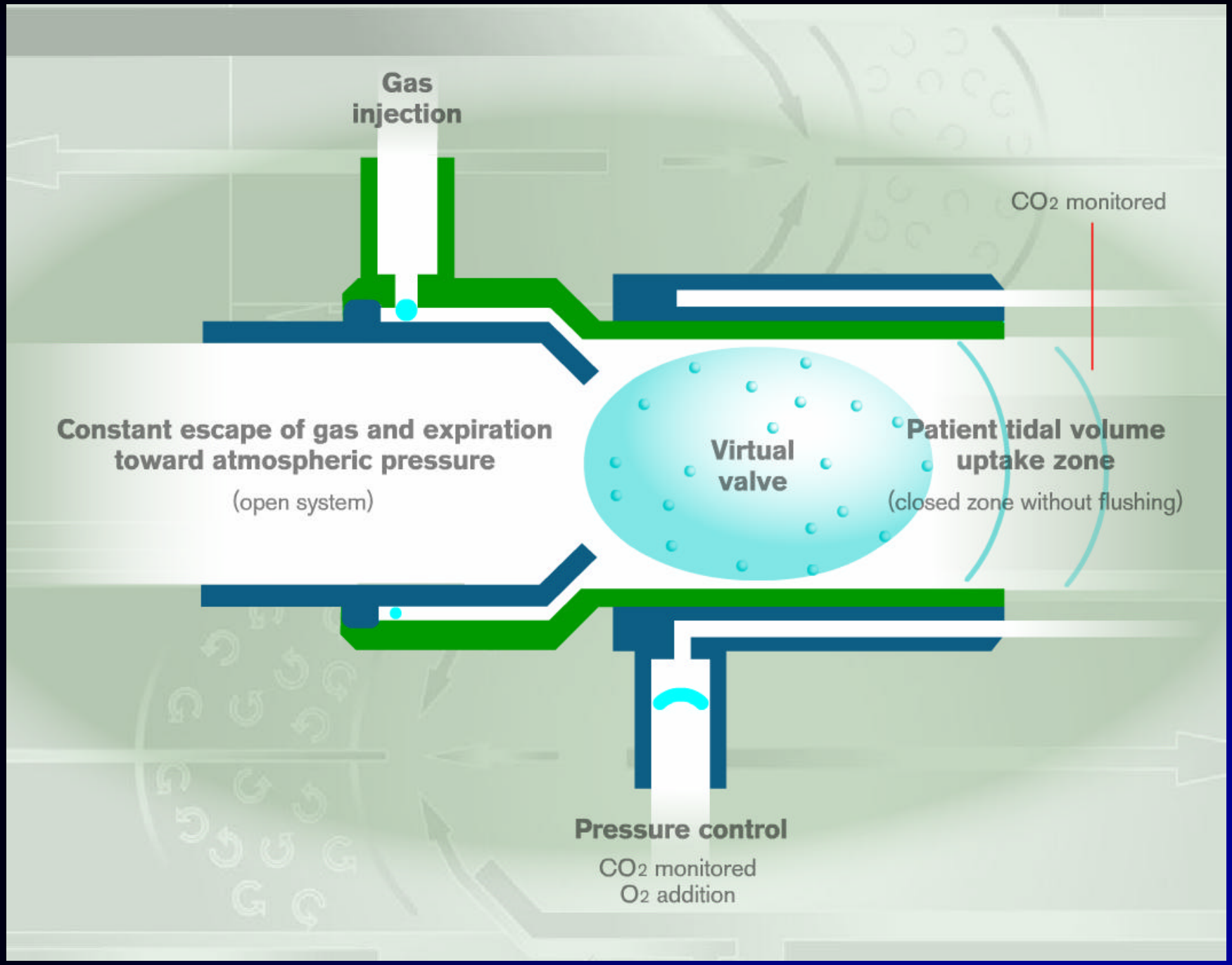
125 fatalities

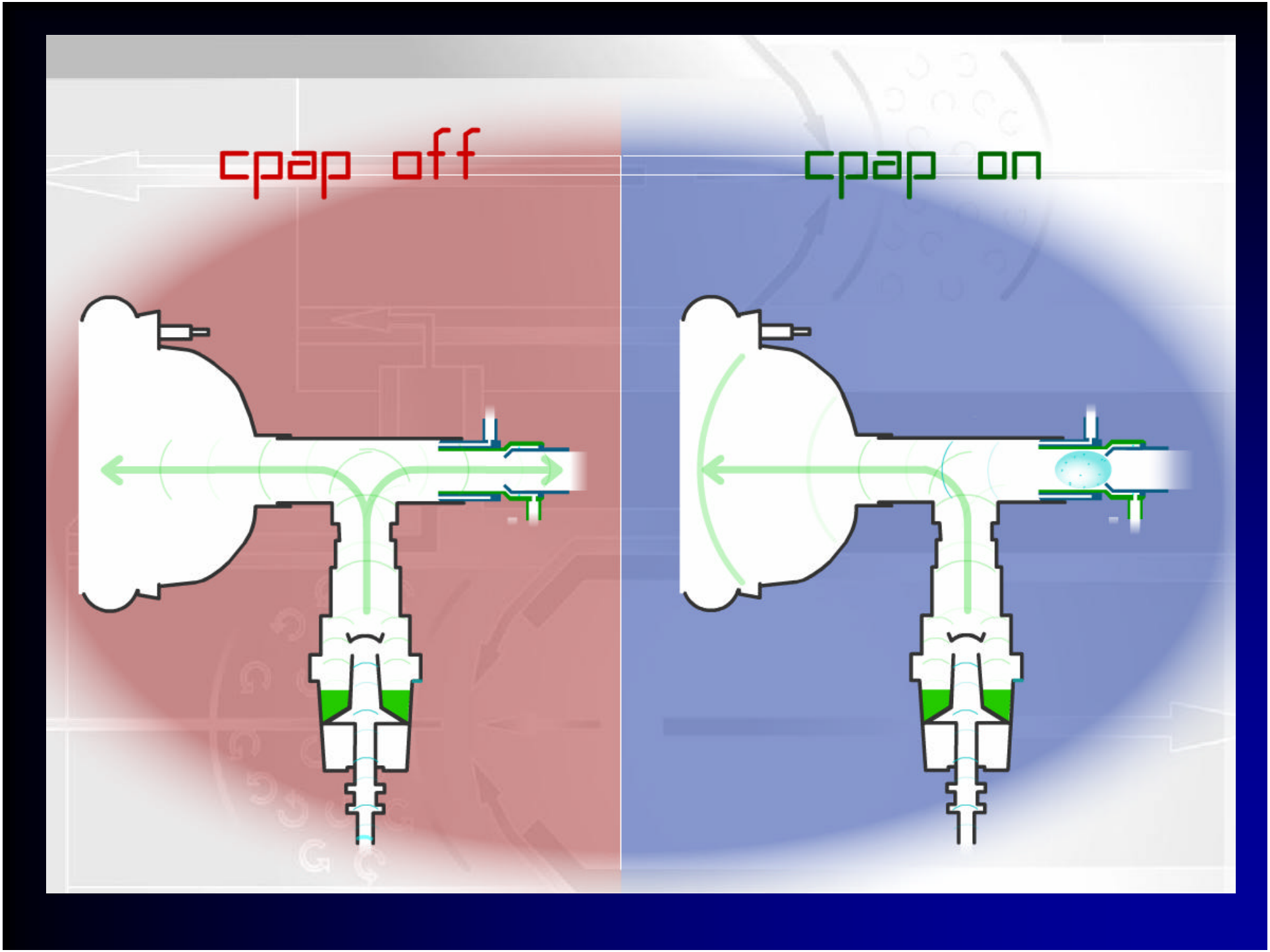
Continuous Positive Airway Pressure



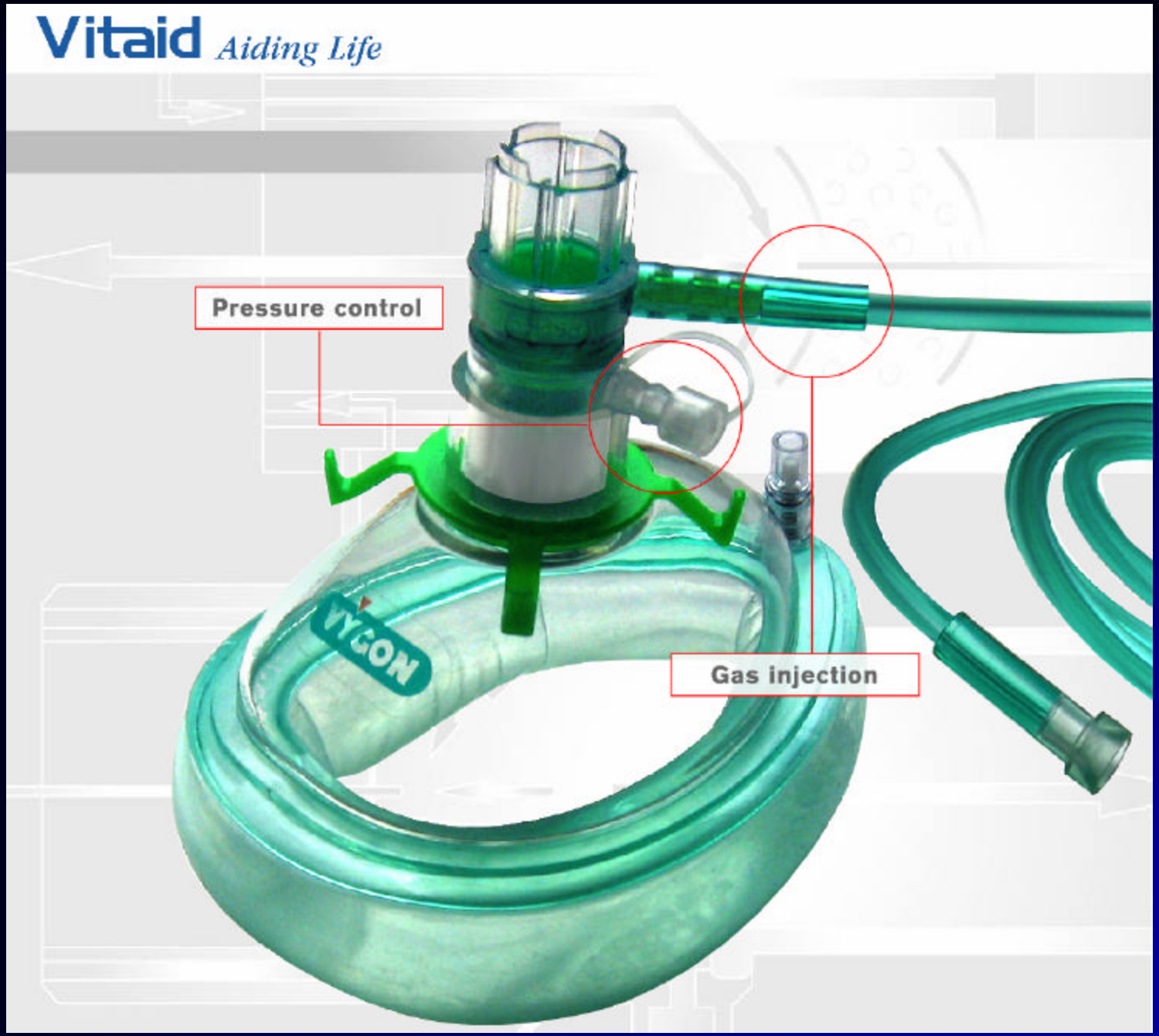
Vitaid *Aiding Life*




Gas injection
CO_2 monitored
Constant escape of gas and expiration toward atmospheric pressure
(open system)
Virtual valve
Patient tidal volume uptake zone
(closed zone without flushing)
Pressure control
CO_2 monitored
O_2 addition


cpap off
cpap on

Vitaid *Aiding Life*



The Boussignac

- Cheap
- Portable
- Disposable
- Can put it in your respiratory kit
- Can take it to the patient's bedside
- Can leave it at the hospital

CPAP Essential 1

- *If you apply CPAP, do NOT leave your patient unattended at any moment!*
- *These patients may worsen quickly*
- *Beware of increasing CO_2 in the setting of the patient who appears to be more relaxed*
- *This may indicate impending respiratory distress*

Fowler's Law of Decreased Work of Breathing

The work of breathing in patients who are severely short of breath will appear to improve for one of two reasons

They're getting better…

…or they're getting worse

Don't get fooled

AND

Don't let a patient get hurt!

CPAP Essential 2

- Continuous respiratory monitoring
- Continuous pulse ox monitoring
- Continuous capnography monitoring
- Simultaneous Neb administration
- Suction through the mask if needed

CPAP Essential 3

- Do NOT use high CPAP on the patient with COPD or status asthmaticus
- 5 cm of water CPAP is the most you want to give to these patients
- While studies are not conclusive on this point, air trapping could theoretically worsen with CPAP in these patients

CPAP Essential 3

- Start out at 15 lpm in CHF
- Start out at 10 lpm in asthma an COPD

Summary

CPAP in the field is evidence of this new era in EMS professionalism…
…heightening our ability to treat less invasively, while emphasizing the requirement for excellent assessment and monitoring

Questions and Comments?