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: Paramedicine
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!”

“A. Fowler, Jr.

“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
Scene Survey/Mechanism/# pts.
LOC/Airway/Cspine
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Neck appearance, JVD, Trachea
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Quick survey of abdomen, pelvis, and extremities

Reveals threats to Basic Physiology

. . .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.
Positive Pressure in the Thorax decreases Venous Return!!
Oxygen -> lungs -> alveoli -> blood

breath

CO₂

lungs

CO₂

blood

energy

Oxygen

muscles + organs

Oxygen

cells

Oxygen + Glucose
For any given respiratory rate, you can’t know what the patient’s CO$_2$ level is unless you measure it.
Let capnography guide you!
Pathophysiology
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

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<th>MYOCARDIAL FAILURE</th>
<th>ARRHYTHMIAS</th>
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<td>- Pressure Load</td>
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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

**Figure 2**

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

Cumulative Incidence of CHF (%)

- Stage 2+ Hypertension
- Stage 1 Hypertension
- Normal Blood Pressure

**Years From Baseline Exam**

**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

Deaths (Thousands)

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

Figure 3

Incidence of CHF, by Myocardial Infarction Status

Cumulative Incidence of CHF (%)

Years From Baseline Exam

Source: Cardiovascular Heart Study, National Heart, Lung, and Blood Institute.
Figure 7
Percent of Hospitalized CHF Patients Discharged Dead, by Age, 1981 to 1993

Percent Discharged Dead

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

- Superior vena cava
- Pulmonary artery
- Aorta
- Left atrium
- Right atrium
- Left ventricle
- Inferior Vena cava
- Chordae tendineae
- Right ventricle
- Papillary muscle
- Thickened Myocardium
Normal Heart

Heart with Dilated Cardiomyopathy

Left ventricle
Right ventricle

Heart chambers relax and fill, then contract and pump.

Muscle fibers have stretched. Heart chamber enlarges.
Note congested vessels engorged with blood.
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
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
Key Features in COPD

- Severe SOB
- Cyanosis (Late)
  - ?Pulse Ox
  - ?CO₂ (Late)
- JVD (Late)
- Usually wheezing
- “Air trapping”
Asthma
(“Status Asthmaticus”)

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

Asthma triggers irritate the lining of the bronchial tubes, causing them to become inflamed and swollen. Excess mucus makes breathing more difficult.

Bronchoconstriction

During an asthma attack, bands of muscles surrounding the bronchial tubes contract, causing the airway to narrow.
As many as 1 in 8 people have exercise-induced asthma.

Proper warm-up and cool-down may prevent or reduce the incidence of exercise-induced asthma.
Key Features in Status Asthmaticus

- Severe SOB
- Cyanosis (Late)
- Pulse Ox
- CO₂ (Late)
- Usually wheezing
- “Air trapping”
The clinical presentation of these respiratory problems can be so similar that making a clear determination is difficult, even for the most experienced physician.
Focus Your History

- Sub-acute symptoms
  - PND
  - Orthopnea
  - Worsening SOB with normal activities
  - Fever
  - Cough (productive or non-productive)
• Fluid retention: Patients often know if they’re retaining more water than usual, just ask.
• Renal roundup: Have they made their dialysis appts?
**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)
They all may be wheezing, and have some features of JVD
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
The patient with CHF is volume overloaded in the chest and must have this volume displaced elsewhere.
The chief difference in treating severe CHF vs. COPD/asthma is in the use of nitroglycerin.
NTG provides rapid displacement of the thoracic volume load into the vascular tree, principally in the veins.
NTG reduces afterload, meaning lowering blood pressure, which takes pumping strain off of the heart.
NTG also improves forward flow from the heart, allowing perfusion of the kidneys so that diuresis can occur.
Be very careful with morphine in severe CHF: Data suggests that outcome is worsened in the EMS environment.
Griswell et al 2003:
“Diuretics and morphine should be used with caution, as they carry higher risks, especially in misdiagnosed patients”
The chief risk of morphine use in severe CHF is that the patient may become oversedated, 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.
Continuous Positive Airway Pressure

- Oxygen
- 8-10cm water
Constant escape of gas and expiration toward atmospheric pressure
(open system)

Virtual valve

Patient tidal volume uptake zone
(closed zone without flushing)

Gas injection

Pressure control
CO₂ monitored
O₂ addition

CO₂ monitored
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
• If you apply CPAP, do NOT leave your patient unattended at any moment!

• These patients may worsen quickly

• Beware of increasing CO2 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
• Start out at 15 lpm in CHF
• Start out at 10 lpm in asthma and 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?