COPD, CHF, Capnography, VADs

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Condell Medical Center EMS System

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Objectives
Upon successful completion of this module, the EMS provider will be able to:

1. Compare the pathophysiology of COPD including acute bronchitis, emphysema and asthma.
2. Compare signs and symptoms of different stages of heart failure.
3. Discuss the assessment process for patients presenting in respiratory distress.
4. Choose the correct intervention plan based on the assessment of the patient’s signs and symptoms.
5. Describe the benefits of CPAP and integration in the treatment plan for patients.
Objectives cont’d

6. Review the benefits of capnography and how it can be used in the field.

7. Analyze waveform capnography reading with the patient’s signs and symptoms to distinguish exacerbation of COPD from CHF.

8. Describe the purpose and function of ventricular assist devices (VADs).

9. Explain appropriate EMS interventions for a patient with a VAD.

10. Actively participate in review of selected Region X SOP’s as related to the topic presented.
Objectives cont’d

11. Actively participate in review and correct identification of a variety of EKG rhythms.
12. Actively participate in case scenario discussion.
13. Actively participate in successful interpretation of a variety of waveforms for capnography.
15. Successfully complete the post quiz with a score of 80% or better
Pathophysiology of Breathing

• Inspiration
  – Bronchioles dilate to allow air to be drawn into alveoli
  – Working phase of ventilations / breathing

• Exhalation
  – Passive phase of ventilations / breathing
  – Bronchioles constrict
  – In COPD, air is trapped due to bronchospasm, mucous production and inflammation present
    • Ability to exhale is a **HUGE** problem for pt with COPD
COPD

• A collection of progressive, debilitating diseases with increasing prevalence
  – Chronic bronchitis
  – Emphysema
  – Asthma

• Common feature is abnormal ventilation

• Characterized by obstruction to airflow with reversible and/or irreversible components
COPD Background

• Physiology may differ but may include
  – Inflammation of air passages with increased mucous production
  – Destruction of alveoli

• Outcome the same
  – Decreased air flow in alveoli
  – Reduction in oxygen exchange

*Note: Less resistance with inhalation; great resistance to exhalation*

  – Tend to see more signs and symptoms during exhalation
Exacerbation of COPD

• Rapid decline of patient related to
  ✓ Hypoxia
  ✓ Hypercapnia – retention of CO$_2$
  ✓ Alteration of acid-base balance
  ✓ Deprivation of oxygen in the tissues

• Goal of intervention / treatment
  – After adequate history and physical exam
    • Reduce dyspnea
      – Improve oxygenation
      – Assist with exhalation of CO$_2$
COPD Presentation

• Bronchospasm
  – Sustained smooth muscle contraction
  – Reversed with agents that affect the beta-"adrenergic$_2$ receptors
    • Stimulate bronchodilation

• Increased mucous production
  – Often poor ability to clear mucous due to long standing destruction of cilia

• Inflammation of bronchial passage
  – Results in accumulation of fluid and inflammatory cells
Chronic Bronchitis

- Has an increased number of mucus secreting cells
- Alveoli not severely affected
- Diffusion remains normal
- Gas exchange reduced in lower alveoli ventilation leading to hypoxia and hypercarbia
- Hypoxia increases production of red blood cells
  - Leads to polycythemia
    - Increased number of RBC’s that causes blood to thicken
Chronic Bronchitis cont’d

• ↑CO₂ causes pulmonary vasoconstriction
  – Can result in pulmonary hypertension
  – Can lead to cor pulmonale
    • Enlargement with decreased function of right ventricle
    • Can lead to heart failure

• Vital capacity decreased
  – Amount of air in lungs at end of inspiration

• Residual volume (amount of air remaining at end of exhalation) normal or decreased
Emphysema

- Destruction of alveolar walls distal to terminal bronchioles
- More common in men
- Major contributing factor cigarette smoking
- Less area is available for gas exchange
- Defect in diffusion of gases
- Decrease in number of pulmonary capillaries
Emphysema cont’d

• Increased resistance to pulmonary blood flow
  – Can lead to pulmonary hypertension and cor pulmonale (right sided heart failure)

• Lungs lose capacity to recoil
  – Air trapped in lungs – barrel chest
  – Residual volume (air left in lungs after max exhalation) increases
  – Vital capacity remains relatively normal
    • Amount of air exhaled after max inhalation
Emphysema cont’d

• Patients use pursed lip breathing
  – Simulates continuous positive pressure like PEEP
  – Prevents alveolar collapse

• With progression of disease may develop increased red blood cell production
  – Polycythemia – thickened blood

• Develops chronically elevated PaCO$_2$ levels
  – Becomes dependent on hypoxic drive to breath

• Become dependent on bronchodilators, corticosteroids and O$_2$
Asthma

- Chronic inflammatory disorder with reversible air flow obstruction and hyper-responsiveness
- Death rates rising
- Triggers are variable
- Inflammation of airways often start several days or weeks before onset of actual asthma attack
- Bronchoconstriction and mucous plugs add to impairment of ventilation
Asthma cont’d

Two-phase reaction occurs

• First phase
  – Release of chemical mediators (i.e.: histamine)
    • Cause bronchial constriction of smooth muscles
    • Leakage of fluid from capillaries creates bronchial edema
      • Expiratory air flow decreased

• Second phase
  – Inflammation of bronchioles leading to additional edema and swelling with decrease in air flow
Assessment of COPD Patients

• Consider immediate threats to ABC’s

• Evaluate vital signs with pulse oximetry
  – Pulse ox room air as baseline if able to
  – Increased respiratory rate an early indicator of distress

• Auscultate breath sounds
  – FYI – early asthma presents with wheezing first heard end of exhalation
  – Don’t move stethoscope too fast to next location

• Evaluate ability to complete a sentence or not in one breath
Cautious Reliance on Pulse Oximetry

• A quick non-invasive method to obtain oxygen levels on the hemoglobin
• Readings provide delayed picture of what is actually going on
  – Clip a sensor, hold your breath and you will still be saturating at high levels and yet you are apneic
• Evaluates saturation of hemoglobin and not necessarily at the tissue level
• Does not evaluate ventilation
• Can have high pulse ox readings even in low blood flow states and anemia
Signs and Symptoms of Distress

• Tachypnea – rapid breathing
• Use of accessory muscles
• One-to-two word dyspnea
• Tachycardia
• Decreased oxygen saturation
• Hyperinflation of chest wall – air trapping
• Agitation related to hypoxia
General Management Goals

• Relieve hypoxia
• Reverse bronchoconstriction
• Perform detailed respiratory assessment
  – Need to know what is wrong to know what to fix and to monitor for improvement
• Be prepared to assist ventilations
• Assess for need of fluid replacement therapy
Useful Medications

Albuterol

• Bronchodilator
  – Beta$_2$ selective med that relaxes smooth muscles of the bronchioles and, to a smaller degree, peripheral blood vessels
  – As selective drug, minimal influence on heart

• Used to treat and prevent bronchospasm

• Used as a “rescue” drug; quick acting
Meds - Ipratropium (Atrovent)

- Anticholinergic (blocks parasympathetic action)
- Bronchodilator
  - Relaxes smooth muscles in airways
- Dries bronchial secretions
- Used to control and prevent wheezing and shortness of breath
- Not fast acting but lasts long (4-6 hours)
  - Therefore, not considered a ‘rescue’ drug
  - Used as adjunct with Albuterol
Cautions

• Careful monitoring of patient with cardiac history
  – Medications used may cause tachycardia and palpitations
• Avoid getting mist into eyes
  – Could cause narrow angle glaucoma
  – Rinse eyes if accidental exposure
Region X SOP Treatment

• Adult Routine Medical Care
• Albuterol mixed with Atrovent neb treatment
• If no improvement, repeat
• If no improvement, Albuterol alone
• For severe distress, contact Medical Control to consider epinephrine 1:1000 0.3 mg IM
• Duoneb can be administered in-line
• Contact Medical Control to consider use of CPAP for COPD
Medical Control Order For Epi

• Epinephrine usefulness in COPD
  – Bronchodilator
  – Quick acting but short half-life
  – May be necessary to get “over the hump” to get them bronchodilated for rest of treatments to be effective

• Caution in elderly and cardiac patients
  – Potent vasoconstrictor; is a cardiac stimulant
  – May raise heart rates and increase work load on heart
What is a Healthy Heart?

• Heart functions as a forward pump
  – Deoxygenated blood pumped from right heart to the lungs to remove carbon dioxide and become oxygenated
  – Oxygenated blood pumped from left heart to the body organs and cells

• Heart is able to pump enough blood to sufficiently meet the demands of the body and lungs
Heart Failure

• Chronic condition; develops over time; causes difficulty for the heart to function as a forward pump
  – Less blood is pumped = less oxygen distributed
  – Blood may back-up
  – Oxygen supply decreases in muscle and lung tissues

• Ranked in stages based on disease progress

• The left ventricle enlarges/distends due to the excessive/increased workload

• The wall of the left ventricle can thicken
Congestive Heart Failure

• Decreased ability of heart to pump effectively
• Build up of fluid occurs in the body
  – Tissues, organs, extremities, lungs
• Can be chronic or acute
  – Chronic – on-going condition usually managed medically with diet, exercise, medication, rest guidelines
  – Acute – rapid onset of symptoms of shortness of breath, edema, trouble lying flat, feeling tired and weak
Heart Failure

• Most common reason for hospital visits in patient over 65 years of age
• Common causes
  – Heart attacks – acute MI (AMI)
  – High blood pressure – hypertension
  – Viral infections
• Progression of atherosclerosis is base problem for many situations
  – Development of plaque causing narrowing of arteries
  – Results in oxygen starvation at tissue level
Stages of Heart Failure – Stage I/A

• No signs or symptoms but high risk
• Risk factors
  ✓ Hypertension
  ✓ Diabetes
  ✓ Coronary artery disease
  ✓ History of alcohol or drug abuse
  ✓ Family history heart disease
• Essential for health is to improve life style and properly manage existing problems
Stages of Heart Failure – Stage II/B

- None to limited symptoms but evidence of heart damage
- Ejection fraction less than the normal 50-75%
  - Measures amount of blood pumped with each beat
  - Evaluation reflects the pumping strength of the heart
- Patient needs to improve lifestyle as in Stage A
- Be evaluated for surgical interventions as necessary (i.e.: coronary artery repair, heart valve replacement, placement of ICD)
- Take medications as prescribed
Stages of Heart Failure – Stage III/C

- Heart damaged; symptoms present
- Usually feel fine only at rest
- Typical signs or symptoms are fatigue, shortness of breath, inability to perform ordinary tasks
- Interventions include those for Stages I/A and II/B
- Additional medications usually required
- May need more aggressive therapy
Stages of Heart Failure – Stage IV/D

• Signs and symptoms remain present in spite of medical management interventions
  – Signs and symptoms present at rest
• Patient evaluated for aggressive therapies
  – Heart transplant
  – Ventricular assist device (VADS)
  – Additional drug therapy
  – Palliative or hospice care
Typical Signs and Symptoms
Heart Failure

• Shortness of breath
• Edema of feet, ankles, and legs
• Swelling in the abdomen - ascites
• Trouble sleeping when lying flat – orthopnea
• Feeling weak and tired
• Difficulty breathing, even at rest - dyspnea
Chronic vs Acute Heart Failure

- Chronic HF
  - Develops over time
  - Can be managed by patient at home
  - Signs or symptoms may be present but are the patient’s normal status

- Acute HF
  - Sudden onset of signs or symptoms that cause distress
    - Usually from excessive fluid in the airways
  - Patient needs emergent interventions
    - Typically the middle of night call or early morning; patient has been trying to sleep in a chair
Backward vs Forward Heart Failure

• Backward failure
  – Heart unable to pump out the amount of blood received in the ventricle

• Forward failure
  – Ventricle is damaged and unable to pump enough blood to meet the metabolic demands of the body

• Right versus left heart failure describes which pump has failed
  – Right ventricle pumps blood to the pulmonary system
  – Left ventricle pumps blood to the body
Right Heart Failure - Chronic

• Blood backing up
  – Distended neck veins – JVD
  – Blood backs up in liver causing engorgement
  – Dependent edema
    • Excess fluid in interstitial space

• Right heart failure also referred to as cor pulmonale

• Can be managed conservatively with life style changes, medications, appropriate activity
Left Heart Failure - Acute

• Commonly referred to as congestive heart failure
• Blood congests in the lungs = pulmonary edema
• Rise in pressure in pulmonary veins makes movement of blood thru lungs difficult
  – As pressure rises, serum moves out of capillaries and into tissue spaces around alveoli
  – Fluid migrates into alveoli
• Findings: crackles, dependent edema, JVD, dysrhythmias, respiratory distress
Acute Heart Failure

• Have high index of suspicion for co-existing acute myocardial infarct
  – Did the heart failure lead to the AMI???
  OR
  – Did the AMI lead to heart damage that caused heart failure???

• If possible, consider obtaining 12 lead EKG on patients with severe heart failure
Commonly Prescribed Home Medications

• ACE inhibitors
  – Relaxes and open blood vessels; blood flows easier
  – Reduces work load on heart
  – Prevents kidneys from retaining sodium and water
  – Typically drug name ends in “pril”

• Beta blockers
  – Slows heart rate and relaxes blood vessels
  – Reduces work load on heart which lowers B/P
  – Typically drug name ends in “olol”
Home Meds cont’d

• Diuretics
  – Helps kidneys excrete urine to get rid of excess fluids; makes it easier for the heart to pump

• Digoxin
  – Inotropic medication that strengthens force of cardiac contraction to propel as much blood forward as possible

• Nitrates
  – Relaxes blood vessels allowing more oxygen to tissues
Need to determine if patient relatively stable or unstable
  – If altered mental status ➔ unstable
  – If systolic B/P < 90 mmHg ➔ unstable

If unstable
  – Consider Cardiogenic Shock Protocol
  – Treat dysrhythmias per protocol
  – Contact Medical control for CPAP order

Note: All meds and treatment used for pulmonary edema can cause drop in B/P
Reg X SOP Pulmonary Edema – Stable Patient

• Nitroglycerin 0.4 mg sl
  – May repeat every 5 minutes to max of 3 doses
    • Potent coronary and peripheral vasodilator
    • Reduces elevated pressures in pulmonary vasculature
    • Causes a decrease in preload, arterial pressures, and afterload
  – Consider need to contact Medical Control for order to continue use of nitroglycerin beyond 3 doses especially during longer transports

• Administer CPAP
  – Works more effectively in combination with nitroglycerin
Pulmonary Edema Meds cont’d

• Lasix 40 mg IVP
  – 80 mg if patient on Lasix
  – Yes, there is some controversy whether diuretic use is appropriate or not

• If systolic B/P remains \( \geq 90 \) mmHg give Morphine 2 mg slow IVP over 2 minutes
  – May repeat 2 mg every 2 minutes to max of 10 mg
CPAP

• **Continuous positive airway pressure**
  – Pressure maintained during inhalation and exhalation keep airways open; alveoli don’t collapse
  – Alveoli expanded and kept open to increase and improve gas exchange surface area
  – Decreases work of breathing
  – Mask must be tight fitting to maintain pressures
  – Buys time for medications to work
  – Medications are to be administered simultaneously during use of CPAP
    • This is *NOT* an either / or treatment process
Benefits of CPAP

• Keeps alveoli distended increasing surface space for gas exchange

Coaching will be key to improving successful outcome
Effects of CPAP

- Without CPAP
- With CPAP
CPAP Precaution

• At any time during administration of CPAP that the patient shows signs and symptoms of deterioration, remove CPAP
  – Consider endotracheal intubation

• Caution:
  – All medications and use of CPAP can potentially lower the patient’s blood pressure
CPAP via FlowSafe II

• Oxygenate patient via 15L non-rebreather mask while setting up CPAP
• Attach proximal end of O₂ tubing with manometer to port in mask
• Attach distal end of tubing to O₂ source
• Secure face mask snugly to patient’s face
• Adjust O₂ flow on O₂ tank to deliver 10 cm H₂O pressure (13-14 lpm)
• Maintain continuous O₂ supply
CPAP — Flow Safe II Device

- See tag on O₂ tubing for guide on O₂ flow rate to achieve prescribed pressures (10 cm H₂O – 13-14 lpm)
- T-piece nebulizer can be added
CPAP Outcome

• To increase the success of using the CPAP mask, patient needs coaching
• Improvement is quick – within minutes
• Coach and provide emotional support
  – Encourage patient to breathe in through nose and out through mouth
• If patient cannot be calmed and coached to tolerate the CPAP mask, contact Medical Control – consider request for Versed to reduce anxiety
Long Term Benefit CPAP

• Avoiding intubation in this patient population is HUGE!!!
  – Avoid intubation on a ventilator
    • Increases risk of infection
    • Increases length of hospital stay
    • Set up for ARDS – adult respiratory distress syndrome which increases complications, mortality and morbidity

• Patient with history of use of CPAP will even request “the mask” as they know the rapid improvement that it delivers
Quantitative Capnography

• Non-invasive, objective, fast, accurate diagnostic tool that can measure ventilation and perfusion
• Provides instantaneous information with each breath
• Expressed as a waveform with a numeric value
• Measure CO$_2$ levels at the end of each breath (ventilation)
• Correlate the reading with the physical exam
Usefulness of ETCO$_2$

• Reflects changes in
  • *Ventilation* - movement of air in and out of the lungs
  • *Diffusion* - exchange of gases between the air-filled alveoli and the pulmonary circulation
  • *Perfusion* - circulation of blood
Capnography to Determine COPD vs CHF

• COPD and asthma
  – Bronchospasm inhibits exhalation / emptying of CO₂
  – Note a slant or slope during the respiratory upstroke
    • Appears as “shark fin”
    • There is loss of the flat plateau

• CHF
  – Relatively normal configuration; no obstruction to exhalation process
Normal Capnography Waveforms

- Normal levels 35-45 mmHg
Waveforms cont’d

CHF with pulmonary edema

• Difficult to diagnose with bedside assessment

• In CHF, may see elevated ETCO$_2$ readings
  – Retained CO$_2$ levels due to increasing ventilation failure
  – Normal respiratory upslope intact
  – Plateau reserved

• Confirm suspicion with clinical assessment
Documentation of Capnography

• Note ETCO$_2$ level printed or noted on graph and record this
  – Results are “mmHg”
• Record in patient’s run report what the ETCO$_2$ readings were including respiratory status obtained during assessment
• Attach copy of printed strip with patient run report given to hospital for patient’s medical record
Differentiating COPD From CHF

• May be very difficult to tell these patients apart
  – Many signs and symptoms cross over

• Better to err toward CHF
  – COPD patients can better tolerate CPAP, and it may do them good, than to treat CHF patient with a diseased heart with bronchodilators that may increase heart rate and challenge the heart
  – Better to dry out the COPD patient than to not dry out the CHF patient
Ventricular Assist Devices - VADs

- Treatment for advanced heart failure
- Surgical process implants device
- VADs assist heart function by pumping blood
  - Does not replace the heart
  - Is a continuous flow blood pump
- Increases energy level of patients
- Patient less symptomatic
  - Patients actually feel great!
  - Quality of life greatly improved
VADs

- Pump attached to the heart circulates blood when heart too weak to pump on own
- Consists of internal and external equipment
- Power line exits skin
  - Connects pump to power source
    - Pair of batteries or AC electrical outlet
    - Wearable batteries can last more than 10 hours
  - Connects to wearable computer/system controller
    - Monitors the pump activity
Patient Profile

• Typical range 35 – 65 years of age
• Patient usually has multiple medical problems
  – So not the healthiest population to begin with
• Death usually from non-VAD related causes
• If not transplant eligible, average survival on VAD of 4-5 years
  – “VAD” used as a generic term
    • Not all devices assist the left ventricle

Note: with a VAD, patient looks healthy and feels great, warm & pink, can carry on most normal activities
Indications for VADs

• Patient in Class 3 or 4 heart failure
  – Symptoms of heart failure at rest
  – May be waiting for transplant or for long term use

• Short term - patient on heart transplant list

• Long term use - not a candidate for transplant

• Bridge to recovery; short term use
  – Treating cardiogenic shock
  – Waiting to get patient off heart-lung machine after open heart surgery
Risks To Patient

• Bleeding
  – All patients on prophylactic anticoagulants due to increased risk of clot formation

• Infection
  – Direct access portal of entry to the heart

• Stroke

• Device malfunction

• Death
VAD Function

• Inflow to device surgically connected to the apex of left ventricle
• Outflow from heart surgically connected to ascending aorta
• Right heart still can function normally
Components of VADs

- Surgical implantation of device with communication outside the body
- Pump – inside body
  - Delivers blood to aorta
- Driveline – outside body
  - “Communicates” with pump
- System controller – outside body
  - The “brain” – controls all functions
- Batteries/AC power – outside body
  - External power pack
VAD Batteries

• Charged batteries provide 6-10 hours of function
  – Used when patient is mobile
• Patient uses AC power when stationary
• Batteries can be recharged within 4 hours
  – Battery fuel gauge listed on each battery
    • Green light indicates 20% of charge capacity
Living with VADs

- Patient may return to daily life with few limitations
- Patients look healthy, normal level of consciousness, warm and pink
- Patients have more energy to do things they enjoy; no restrictions for traveling
- Various types of exercise are appropriate
  - General exercise, dance, golf, biking
- Need to avoid contact sports
- Needs to avoid water activities
Care of Driveline

• This is “wire” that exits body and connects to the battery pack
  – Site ALWAYS covered with sterile dressing
    • Risk of infection high
    • This is direct portal of entry to the heart
  – Do NOT remove dressing
  – Do NOT tug or pull on driveline
  – Do not use scissors around driveline or disconnect driveline from battery pack
Patient Assessment with VAD

Very patient dependent

• Heart may/may not contract
• If pump inadvertently stops, depends on native heart as to how the patient responds
  – If totally dependent on pump, will arrest with no blood flow
  – May be able to support own circulation *IF* heart can function on own
• May or may not palpate pulses
Patient Assessment cont’d

• May or may not obtain B/P
  – If palpable pulse, attempt manual B/P
    • Often need to obtain via Doppler
      – B/P may be 60-80 mmHg as obtained by Doppler
      – If pulseless, may need invasive monitoring for B/P
  • Will NOT hear “lub dub”; will hear “hmmmm”
    – Auscultate in the left upper abdominal quadrant
• Pulse oximetry may be unreliable
Patient Assessment

• Assessment only differs when it comes to circulation – assessing pulses and B/P
• Neurological assessment the same
  – What is the level of consciousness?
  – Is the patient talking?
• Blood glucose levels unchanged
Patient Assessment cont’d

• Assess the patient’s skin condition
  ✓ Color
  ✓ Warmth
  ✓ Sensation

• VAD does NOT affect EKG
  – Obtain EKG rhythms and 12 lead EKG’s in usual manner
    • Electrical activity of heart unaffected
VAD and Anticoagulation

- This patient population are anti-coagulated
  - This adds high risk for bleeding to this population
- Warfarin / Coumadin only medication approved for all devices
- Patient at high risk for hemorrhagic stroke and GI bleeds
- Take usual bleeding precautions while caring for this population
Anticoagulant vs Antiplatelet

• Referred to as “blood thinners” but don’t thin blood
  – Prevent or break up clots
  – Work on different parts of clotting mechanism

• Anticoagulant
  – Reduces ability of body to form clots
  – Most effective against venous clots

• Antiplatelet
  – Reduces ability of platelets to stick together
  – Most effective against arterial clots
Anticoagulants and Antiplatelets

- Coumadin / Warfarin
- Xarelto / Rivaroxaban
- Pradaxa – Dabigatran
- Eliquis – Apixaban
- Lovenox – Enoxaparin

Antiplatelets
- Aspirin
- Plavix – Clopidogrel
- Ticlid - Ticlopidine
Patient Care with VAD

• Patient and their caregivers (i.e.: family) best source of information!
• Transplant Centers available 24/7 and are great resource (see handout for resources)
• Make sure all connections are connected and tight
• Check that power source is charged/plugged in
Caring for Patient with VAD

• If readable screen, record information noted
  ✓ Speed
  ✓ Flow
  ✓ PI
  ✓ Power

• Transport patient with equipment
  – Travel bag
    • Battery charger with 2-4 extra batteries and battery clips
    • Wall module with AC adapter
    • Back-up pocket system controller
EMS Interventions with VADs

• If cardiac meds need to be given, are they effective?
  – All ACLS medications can be given
  – Variable response by individual patient
    • Ex - Epinephrine, Vasopressor, Dopamine
    • Best to discuss with facility coordinator before use of Dopamine

• Is defibrillation effective?
  – FYI - 90-95% of VAD patients have ICD implanted
  – Most arrests not cardiac related but some other system
  – If defibrillation required, okay to perform in normal fashion
EMS Interventions cont’d

• Do these patients have DNR’s?
  – Not necessarily
  – Death usually from other non-cardiac causes
    • With VAD, these patients are fairly stable related to blood flow/circulation

• Can CPR be performed?
  – Yes, BUT….
    • May dislodge surgically implanted equipment
    • But, if patient arrested, you do nothing, they will die
    • There is NO manual pump for the VADs
Emergency Action

• If VADs stop functioning, must restore pump function or patient will die
  ✓ Check driveline connection to pocket system controller
  ✓ Check power lead connections to pocket system controller
  ✓ Change power sources
  ✓ Replace System controller (all patients have back-up)

(Note – see handout for detailed information)
Case Scenario #1

• You are on the scene for a patient who feels “under the weather”
• They are responsive, GCS 15, warm and dry, with capillary refill under 2 seconds
• They have a VAD device
• How will the VAD influence your ability to complete assessment of vital signs and EKG?
Case Scenario #1

• Vital signs
  – May or may not palpate a pulse
  – May or may not obtain a B/P
    • If you have a Doppler, use this device with a cuff
    • Readings will be low numbers (i.e.: 60-80 mmHg)
      – Represents MAP – mean arterial pressure
        » Perfusion pressure in organs
        » Normal MAP >60 mmHg
        » Calculated by mathematical formula

• EKG tracing
  – Electrical system of the heart is unaffected
  – Will get rhythms and 12 lead views as usual
Case Scenario #2

• You are on the scene for a patient in relatively stable pulmonary edema

1. What treatment should be started?

2. What steps should be taken to improve outcome of using CPAP?

3. What co-existing problem often is associated with acute pulmonary edema that you should be considering?
Case Scenario #2

- #1 – Region X SOP treatment – Pt stable?
  - Routine Medical Care
  - Supportive oxygen via non-rebreather
  - Nitroglycerin sl – may repeat every 5 minutes x 3
  - Begin CPAP
  - Lasix 40 mg IVP (80mg if on at home)
  - Morphine 2 mg IVP if B/P ≥90; repeat every 2 minutes to max of 10 mg as needed
Case Scenario #2

• #2 – Best outcome with CPAP?
  – Coach and support patient during use
    • This is key!
  – Encourage breathing in through nose and exhaling through mouth
  – Quietly talk patient through first few minutes

• #3 – co-existing problem with pulm edema?
  – Consider acute MI pushing patient into heart failure or heart failure causing the acute MI
Case Scenario #3

• How can you tell the difference between acute CHF and exacerbation of COPD in the field???

• How would waveform capnography be helpful?
Case Scenario #3

• Field assessment CHF vs COPD
  – Difficult many times to tell the difference
  – Want to “nail it” as treatments differ
  – Both patients present in respiratory distress
  – Both patients can have wheezing and crackles

• Waveform capnography
  – “Shark fin” sloping with loss of plateau in asthma and COPD
    • Bronchospasm makes it difficult to exhale measurable CO₂
  – Normal waveform in CHF
Case Scenario #3

- Waveform on capnography of CHF vs COPD and asthma

- CHF

- COPD with bronchospasm
Case Scenario #3

• Identify this rhythm for the patient in CHF

• What is the rhythm?
  – Atrial fibrillation
Case Scenario #4

- Your patient is in acute pulmonary edema
- Why do we use the meds and interventions that we do?
  - Nitroglycerin?
  - CPAP?
  - Lasix?
  - Morphine?
Case Scenario #4

• Nitroglycerin
  – Peripheral vasodilator
  – Reduces work load of heart
  – Reduces preload – amount of blood returning to the right heart
  – May want to contact Medical Control to obtain orders to continue administration of nitroglycerin during transport

• CPAP
  – Expands surface space of alveoli that expands surface available for gas exchange
Case Scenario #4

- **Lasix**
  - Diuretic – effect takes approximately 20 minutes
  - Venodilator – effect almost immediately

- **Morphine**
  - Venodilator – pool blood away from the heart which reduces the preload which reduces the work load of the heart
  - Anxiolytic – reduce anxiety
Case Scenario #5

- You are on the scene for a patient with an acute asthma attack
- What are the typical signs and symptoms you would observe?
  - Respiratory distress with shortness of breath
  - Use of accessory muscles
  - Increased respiratory rate
  - Inability to lie down
  - Wheezing that starts first at end of exhalation
    - Silence indicates extreme bronchospasm
  - Unproductive cough
Case Scenario #5

• Why are the medications used in asthma helpful?
• Albuterol
  – Rescue bronchodilator – relatively fast acting
• Ipratropium (atrovent)
  – Bronchodilator – exerts long term effect
  – Dries secretions (anticholinergic)
  • This could be counterproductive to help loosen and move mucous plugs
Case Scenario #5

- Identify this rhythm of your 35 year-old patient with an acute asthma attack
  
- SVT – rate of 180
  - No discernable P waves
Case Scenario #6

• You have been called to the scene for a 50 year-old patient who has collapsed
• You obtain history that this patient has a VAD
• Upon arrival, the patient is pulseless and apneic
• You listen with a stethoscope over the left abdominal wall and hear a hum
• What actions are appropriate by EMS?
Case Scenario #6

• Circulation status should be assessed by evaluating level of consciousness and skin parameters
  – Patients won’t always have a pulse

• Patient is pulseless and apneic, begin CPR
  – Most of these patients have an ICD implanted
  – CPR compressions may dislodge surgically implanted equipment
  – Usual drug therapy and defibrillation is okay
Case Scenario #6

• What equipment should be transported to the hospital with a patient on a VAD?
  – Leave all equipment attached to the patient
    • Be careful if using scissors not to cut any lines
  – Bring the extra batteries, extra controller, battery charger base unit in the travel bag
    • Charged batteries last approximately 10 hours
    • Don’t know if hospital will have batteries to loan
  – Remember to consult VAD coordinator at the facility implanting the device for guidance and direction
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