

**Mending Broken Hearts...Cardiovascular
Emergencies**

Kelley Holdren RN, BSN, CFRN
Administrative Director
Chief Flight Nurse
UCAN

Objectives

- Discuss concepts related to the care of an ED patient experiencing a cardiovascular emergency.
- Describe various patient presentations related to cardiovascular emergencies.
- Evaluate interventions necessary for a patient presenting with a cardiovascular emergency.

Hypertension

- SBP 140-180 mmHg
- DBP 90-120 mmHg
- Headache
- Anxiety
- Asymptomatic

HTN Treatment

- Outpatient follow up w/o ED intervention
- Meds and follow up with PCP
- ED - OBS 3 hrs
- Resume medication / adjust medications

Hypertensive Urgency

- Severely elevated BP
- SBP >180
- DBP >120
- Headache/dizziness
- Anxiety

Urgency Presentation

- BP >140/90 **AND**
- Suspected* acute end organ damage
- Suspicion
 - Headache*
 - Dizziness*
 - SOB
 - Anxiety
 - Noncompliance with known HTN

Urgency Treatment

- ED OBS for 3-6 hrs
- Lower BP with short acting oral agents
- Adjust current therapy
- Labs-Chem panel, CBC

Hypertensive Emergency

- Elevated BP
- SBP >180
- DBP >120
- Concurrent acute end organ damage (EOD)

End Organ Damage (EOD)

- Chest pain / back pain (MI/dissection)
- SOB / increase WOB (CHF/pulm edema)
- Neurological symptoms (stroke/HTN encephalopathy)

EOD Assessment

- Funduscopic exam
- EKG
- Cardiac enzymes/troponin/BNP
- Creatine / UA
- Chem Panel / CBC
- Chest x-ray
- Head CT (neuro deficits)

Emergent Treatment

- Rapid and precise controlled BP decrease
- 20-25% decrease of the presenting MAP within first 60 mins
- Choice of medication relative to EOD
- Ca Channel Blockers
- Beta blockers
- Vasodilators / nitrates

Neurological Manifestations

- HTN Encephalopathy
- Acute ischemic stroke
- Acute intracerebral hemorrhage
- Subarachnoid hemorrhage
- Labetalol / esmolol
- Nicardipine

Cardiovascular Manifestations

- Aortic dissection
 - Labetalol
 - Esmolol
 - Nicardipine
 - Nipride
 - Narcotic
- Myocardial infarction-MONA

End Therapy

- HTN - D/C with F/U
- Urgency - D/C home or floor
- Emergency - transfer to ICU
- Treat the EOD manifestations

Pericarditis

- Swelling & irritation of pericardium
- Sac like covering around heart
- Fluid filled / inflamed / pain
- Acute vs chronic

Pericarditis Causes

- Viral / bacterial /fungal
- MI/surgery/trauma
- Concurrent disease
 - Cancer
 - HIV / AIDS
 - Kidney failure /hypothyroidism
 - TB / rheumatic feve

Emergent Presentation

- Sharp piercing center/left chest pain
- SOB when flat = sit up better
- Low grade temp
- General malaise
- Dry cough
- Abd/leg swelling
- Lungs crackles/decreased BS

Emergent Treatment

- Treat the cause
- Poor heart function (failure)
- Pericardiocentesis – (cath lab/echo guided)
- Chronic – scarring, restrictive pericardium
- EKG/chest x-ray/CT/MRI/ECHO
- Cardiac labs-assess damage

End Therapy

- Treat the cause
- Untreated = tamponade/effusion/failure/death

Endocarditis

- Infection/inflammation inner lining of heart muscle
- Can include the valves
- Bacteria stemming from recent invasive procedure (dentist, IV drug use)
- 3 types
 - NVE –native valve
 - PVE-prosthetic
 - IVDA-intravenous drug abuse

Pathology

- Most commonly on mitral valve (then aortic)
- Bacteremia
- Adherence of organism
- Eventual invasion of the valvular leaflets

Acute Infective Presentation

- High fever/chills/night sweats (90%)
- Exhaustion /muscle & joint pain
- SOB with light activity
- Murmur (85%)
- 50%-Janeway lesions /osler nodes/ petechiae/subungual hemorrhages
- 40%-neuro changes (embolic stroke)

Complications

- MI, pericarditis, cardiac arrhythmias
- Valvular insufficiency
- CHF
- Stroke
- Arthritis
- Aneurysm / abscesses

Emergent Treatment

- IV Antibiotics
- Support the complications
- Surgical repair/valve replacement

Pericardial Tamponade

- Accumulation of fluid in the pericardial space
- Reduced ventricular filling
- Hemodynamic compromise

Pathophysiology

- Pericardium-2 layers
- Space contains 20-50ml of fluid
- Hemodynamic changes
 - Accumulation = stiff ventricles = higher filling pressures = reduced C.O.

Complications

- Pulmonary edema
- Shock
- RAPIDLY fatal

Emergent Presentation

- Dyspnea/tachypnea
- Tachycardia
- Poor perfusion –cold clammy extremities
- Becks’s Triad -↑ JVD/↓ BP/↓ heart sounds
- Hepatomegaly
- Decreased heart sounds / friction rub

Precipitating factors

- Dissecting aortic aneurysm
- End stage lung CA
- MI or cardiac surgery
- Pericarditis
- Trauma

Emergent Treatment

- CT/ECHO/EKG
- Labs-CK-MB, Chem, CBC w/ diff, PT/PTT, ANA, ESR, RhF
- Pericardiocentesis
- Pericardial window
- Oxygen-avoid intubation
- BP support – volume, inotropics (dobutamine)

End Therapy

- Emergent pericardiocentesis
- Surgery for pericardial window
- Treat the cause

Heart Failure

- Often chronic but can be acute
- Heart's pumping less effective - works harder (systolic heart failure)
- Heart muscles stiff and fill improperly (diastolic heart failure)

Precipitating Factors

- Coronary artery disease
- Hypertension
- CHD/MI/Valve regurgitation/infection/arrhythmias

Emergent Presentation

- Cough / crackles
- SOB (active or paroxysmal nocturnal dyspnea)
- Fatigue/weakness/faintness
- Palpitations
- Nocturia
- Weight gain (ascites)
- Peripheral edema
- Exacerbation-MI, end stage failure

LVEF

- Normal EF is 55% to 70%
- Example;
 - EF of 60% = 60% of the total amount of blood in the LV is ejected with each HB

Systolic Failure

- Heart cannot effectively eject blood out from the LV to body. (Not at all or working harder)
- Low EF can help confirm Sys heart failure
- Typically EF 20-40%
- < 35% increases risk of life threatening irregular HB, sudden cardiac arrest (AICD)

Diastolic Failure

- Heart muscle is stiff, can't fill properly
- EF is normal (filling is problem not ejecting)

Emergent Presentation

- Fast/difficult breathing
- Peripheral edema
- JVD
- Lungs – crackles
- Swelling of liver / ABD – ascites
- Irregular and/or fast HB
- S3-Gallop

Emergent Treatment

- O2-NC/FM/BiPap/CPAP
- Diuresis (furosemide)
- Preload/afterload reduction (vasodilators & nitrates)
- Support HR and BP

Medications

- ECHO
- Ace Inhibitors (dilate vessels)
- Angiotensin receptor blockers (dilate vessels)
- Beta-blockers (decrease HR & BP)
- Diuretics –(thiazide, loop, K+ sparing)
- Digoxin – (strengthen force of contraction)

End Therapy

- AICD/pacemakers
- Percutaneous coronary intervention (Cath)
- CABG
- End stage = IABP / LVAD / RVAD
- Transplant - progressive

Acute Coronary Syndrome

- 3 Types CAD
- Unstable Angina
- NSTEMI
- STEMI
- Ruptured athrosclerotic plaque in artery
- Partial vs complete thrombosis of artery

Unstable Angina

- New symptom/change from STABLE angina
- Increase frequency/severity
- Longer lasting/occurs resting
- Untreated may progress to MI
- More intense treatment then before

Emergent Presentation

- CP /discomfort in center chest
- Heaviness/tight/pressure/ache/burning
- Numbness/fullness/squeezing/"heartburn"
- Arms/neck/shoulder blades
- Lasts for a few mins
- Comes and goes away repeatedly

Emergent Presentation

- Cold Sweat
- Fullness / indigestion / N/V
- Dizziness/anxiety/extreme weakness
- Rapid and/or irregular heart beats

NSTEMI

- Minimal/No changes on EKG-typically
- Chemical markers-detect damaged heart muscle (CK-MB, troponin, myoglobin, CBC, BMP)
- Blockage partial or temporary
- Minimal damage

STEMI

- Prolonged period of blocked blood supply
- Effects large area of heart muscle
- EKG changes-ST segment elevation/T wave changes
- Chemical blood markers

EKG Changes

- Transient ST-segment elevations
- Dynamic T-wave changes
- ST depressions-junctional, downsloping, horizontal

Emergent Presentation

- Palpitations
- Pain
- Exertional dyspnea
- Diaphoresis
- N/V
- Decreased exercise tolerance

Emergent Presentation

- Hypotension
- Hypertension
- Diaphoresis/cool/clammy
- Pulmonary edema (Left heart failure)/rales
- Extracardiac vascular disease
- JVD/S3 (3rd heart sound)/systolic murmur

Emergent Treatment

- ABCs
- Anti-ischemic
 - Nitrates
 - Beta blockers
- Anti-thrombic
 - ASA
 - Clopidogrel

Emergent Treatment

- Anticoagulants
 - Unfractional heparin
 - LMWH
 - Factor Xa inhibitors
- Thrombolysis
- Percutaneous coronary intervention

End Therapy

- Medication
- Cardiac Cath-plasty vs stent
- IABP/VAD/ECMO
- CABG

Dysrhythmias

- Abnormal heart beats
- 5 Main types
 - Tachycardia
 - Bradycardia
 - Supraventricular arrhythmias
 - Ventricular arrhythmias
 - Bradarrhythmias
- Stable vs unstable

Causes

- CAD / HTN
- Cardiomyopathy
- Valve disorders
- Electrolytes (Na, K)
- Injury of cardiac muscle (MI, BFT)
- S/P cardiac surgery

Tachycardia

- Normal 50-100 bpm
- > 100 bpm
- Normotensive / hypotensive / hypertensive
- Treat the cause - pain meds, fluids, antipyretics

Bradycardia

- < 60 bpm
- Hypotensive/altered/shock/chest pain/acute heart failure
- Symptomatic?
 - Atropine (0.5mg IV)
 - Transcutaneous pacing
 - Dopa/Epi gtts

Supraventricular Arrhythmias

- Originates in atria
 - PACs
 - PSVT
 - WPW
 - AVNRT
 - Atrial fibrillation
 - Atrial flutter

Ventricular Arrhythmias

- PVCs
- V-tach
- V-Fib
- Long QT

Assessment and Treatment

- > 100 bpm
- Normotensive / hypotensive / hypertensive
- MS changes
- Pulse vs no pulse (cardiovert vs shock)
- Stable vs unstable (meds vs cardiovert/shock)
- HR (>150 bpm)
 - Cardiovert (sync) (50-200J biphasic)
 - Adenosine (150 mg over 10 mins)

Bradyarrhythmias

- Caused by diseased conduction system
- Heart block (delay or complete)
 - SA node
 - AV node
 - HIS-Purkinje network
- Pacing

Unstable Tachycardia

- Pulse (>150 bpm)
 - Unstable-Cardiovert (sync) (50-200J biphasic)
 - Stable-Adenosine (150mg over 10 mins)
- No Pulse –VT/VF-shock –CPR-Epi (1 mg)-shock-CPR-amiodarone (300mg)

Emergent Presentation

- Anxiety/diaphoresis/palpitations
- Dizziness/SOB/Chest discomfort
- Loss of vitals hypotensive/ poor perfusion
- Neuro changes

Emergent Treatment

- Stable-meds / support
- Unstable-electricity and meds

End Therapy

- Correct underlying problem
- Cardiac work up/ EP
- Cath/surgery/AICD/pacemaker

Sudden Cardiac Arrest

- Not a MI
- Electrical system of heart fails malfunctions and suddenly irregular (V-fib)
- No symptoms –too fast
- Early intervention-defibrillation / CPR

Cardiac Arrest

- CPR / oxygen
- Shockable rhythm?
- V-fib or pulseless V-tach
- Shock 100J-200J (biphasic)
- CPR 2 mins (access)
- Shock
- CPR 2 mins and Epi
- Shock
- CPR & amiodarone

Cardiac Arrest

- CPR /oxygen
- Asystole / PEA
- CPR 2mins & Epi (access & airway)
- Treat reversible causes
- CPR & Epi
- ROSC/pronounce/another algorithm

Reversible Causes-5H & 5T

- | | |
|-------------------------|---------------------|
| • Hypovolemia | • Tension pneumo |
| • Hypoxia | • Tamponade |
| • Hydrogen ion-acidosis | • Toxins |
| • Hypo/hyperkalemia | • Thrombosis, pulm |
| • Hypothermia | • Thrombosis, cards |

Peripheral Vascular Diseases

- Affects arteries, veins, lymphatic system
- Slow and progressive circulation disorder
- Directly affects each system
- Secondary affects to organs
- Caused by atherosclerosis

Atherosclerosis

- Causes PVD
- Slow & progressive
- Fatty build up of plaque on arterial wall
- Arterial wall narrow and stiff
- Leg muscles work harder to get more oxygenated blood

Peripheral Artery Disease

- Condition that leads to narrowing/hardening of arteries outside of heart
- Affects blood flow by blocking or weakening vessels
- Secondary damage to organs from decreased blood flow/oxygen/nutrients

Peripheral Venous Disease

- Chronic venous insufficiency
- Deep vein thrombosis (DVT)
- Thrombophlebitis

Peripheral Lymphatic Disease

- Lymphadema-edema caused by blockage to the normal drainage pattern in the lymph nodes.

PVD Symptoms

- Pain /burning
- Achiness/discomfort to the muscles in your feet/calves/thighs
- Poor peripheral perfusion
- Appear most during movement/exercise
- Disappear with rest
- At rest- numb/pale/cool

Complications

- Emboli
- Thrombi
- CAD
- Impotence
- Ischemic ulcers
- Gangrene (tissue death)
- Critical limb ischemi

Emergent Presentation

- Pulmonary embolism
- MI
- Stroke
- Infection (ulcers/gangrene)
- Critical Limb ischemia

Emergent Therapy

- Control ABCs
- Obtain IV access
- Oxygen
- Neuro exam
- Assess perfusion – limb ischemia (surgery)
- Emboli/thrombi-heparin

Thromboembolic Disease

- Blood clots/cellular debris form clots
- Lodge in vessels
- Travel to end organs where they wreak havoc
- DVT

Deep Vein Thrombosis

- Blood clot develops in deep vein in muscles
- Pieces of clot break off (emboli) and travel through bloodstream – path of damage
- Emboli (clot or debris) can become lodged in brain, lungs, heart, any other area
- Sever damage

DVT Presentation

- Edema to affected leg
- Pain in leg (calf w/ radiation)
- Warm affected area
- Color changes (red, blue, pale)

DVT Treatment

- Anticoagulants (prevents new/progression)
- Thromolytics (fibrinolytics/TPA)
- Vena Cava Filter
- Compression socks

Emboli Emergent Presentation

- Pulmonary Embolism
- Stroke

Pulmonary Embolism

- Sudden/unexplained SOB
- Chest pain/discomfort
- Worse w/ deep breath/cough
- Light headed/dizzy/fainting
- Rapid pulse / diaphoresis
- Hemoptysis
- Anxiety/nervousness

PE Treatment

- ABCs
- Oxygen / IV access
- Interventional radiology
- Anticoagulation therapy
- Thrombolytic therapy

Ischemic Stroke

- Emboli lodged in brain/carotid artery
- Stroke symptoms
- Manage the emergency
 - ABCs
 - Oxygen / IV access
 - TPA
 - BP control
 - ASA

Thoracic Aortic Aneurysm (TAA) Abdominal Aortic Aneurysm (AAA)

- Weakened/bulging area of aorta
- Abnormal widening/ballooning >50% of norm
- Type = Location, shape, size
- Thoracic = ascending, arch, descending
- Abdominal = abdominal, infrarenal (common)

Causes

- HTN
- Atherosclerosis
- DM
- Smoking/ETOH
- Genetics
- Hyperlipidemia

True aneurysm

- Shape is fusiform (around) or saccular (side)
- Involves all 3 layers of arterial vessel wall
- Under constant pressure
- Gradually increase in size
- Progressive weakening of wall
- Causing rupture or dissection

Ascending TAA

- Chest, neck, &/or back pain
- Edema to head, neck, arms
- Heart failure

Arch or Descending TAA

- Wheezing, coughing, SOB
- Hemoptysis
- Hoarseness
- Dysphagia
- Chest/back pain

Abdominal Aortic Aneurysm

- 3 out of 4 asymptomatic
- Pain –abdomen, chest, lower back, groin
- Pain can be severe or dull
- Pain associated with imminent rupture
- Pulsing mass in abdomen

Treatment

- Modify risk behaviors
- BP/HR control (Beta-blockers)
- Medication for some
- Surgical for others

Aortic Dissection

- Tearing of inner layer of aortic wall
- Allows blood to enter the wall of aorta
- Separates the layers of tissues
- Greater risk of rupture
- Type A (ascending aorta) surgical
- Type B (arch and descending aorta) surgical vs med

Emergent Presentation

- Sudden onset of "Ripping" or "tearing" pain
- Pain can be migratory
- Neuro changes (syncope, numbness, tingling, weakness)
- Severe aortic regurgitation (systolic murmur)
- SOB, hemoptysis
- Anxiety
- HTN, tachy

Emergent Treatment

- Treat the HTN/tachycardia-beta-block
- Pain control (fentanyl)
- Type and cross
- UOP

- Hypotensive = ticking bomb
- OR

Cardiac Trauma

- Blunt cardiac injury (BCI)
- Penetrating cardiac injury

Blunt Cardiac Injury (BCI)

- MVC (70-80%)
- Ped vs car
- Falls
- Acts of violence
- Blast
- Significant force

Forces

- Shearing from rapid decelerations
- Direct blow to precordium
- Compression of heart (spine & sternum)
- Abrupt pressure changes (abd & chest)
- Blast injury
- Bone fragments (ribs)

BCI Manifestations

- Myocardial contusions (cardiac contusion)
- Transient arrhythmias
- Cardiac wall rupture
- Valvular/coronary injury/pericardial rupture

Myocardial Contusions

- Decreased contractility
- Decreased stroke volume and CO

Arrhythmias

- Tachycardia due to hemorrhage
- Persistent tachycardia
- New BBB / 1st degree HB
- PVCs
- SVT
- Evolving MI

Cardiac Rupture

- Hypotension
- JVD
- Muffled heart sounds (tamponade)
- Most expire on scene

Valvular Injury

- Rare
- Valve insufficiency
- Widening pulse pressure
- New murmur
- Acute heart failure
- Aorta-most injured

Emergency Treatment

- ABCs
- Treat the presenting injury
 - ACLS
 - HTN/tachycardia (Beta-blockers)
 - Hypotension (IVF & blood)
 - Pericardiocentesis/thoracentesis
- Unstable to OR or morgue

Penetrating Chest Trauma

- Piercing of the chest wall
- R ventricle most injured
- Below nipples & inferior scapular angles
- Low, med, high velocity

Velocity

- Low
 - Knife /wooden stake
- Medium
 - GSW
 - Air powered guns
- High
 - Mines /grenades
 - Rifle

Emergent Presentation

- Open wound vs object in chest
- Hypotensive/HTN?
- Tachycardic/bradycardic?
- Tamponade?
- Rapid assessment

Emergent Treatment

- ABCs
- Fluid / blood
- Cardiac penetration is 70-80% fatal
- Pericardiocentesis/thoracentesis
- Thoracotomy
- Damage control surgery or morgue

Conclusion

Questions???

The End
