Cardiovascular Update: Assessing Chest Pain and Deep Vein Thrombosis (DVT)

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Objectives

• Describe the challenges in assessing chest pain
• Explain typical and atypical chest pain
• Describe chest pain associated with pericarditis, aortic dissection, and gastrointestinal problems
• Describe risk factors, symptoms, diagnosis, and treatment of DVT
• State strategies to prevent venous thromboembolism (VTE)
The Challenge of Chest Pain

• The evaluation of chest pain is complex

• Life threatening conditions
  – Acute myocardial infarction
  – Aortic aneurysm or dissection

• Less severe conditions
  – Pulmonary diseases
  – Gastrointestinal disorders
Differential Diagnosis

- The process of weighing the probability of one disease versus that of other diseases
- Make a list of possible diagnoses
- Remove diagnoses from the list
- Until one diagnosis remains
Differential Diagnosis for Chest Pain

• Must quickly and systematically assess for the most life threatening condition
  – Dissecting aortic aneurysm
  – Acute Coronary Syndrome
    – Stable angina
    – Unstable angina
    – Myocardial infarction

• Then consider conditions with less risk
  – Pulmonary diseases
  – Gastrointestinal disorders
**History**

- A comprehensive history is the foundation of assessment
- A thorough history leads to the correct diagnosis
- Goal: classify the pain as cardiac or non cardiac

**Cardiac**
- Ischemic
- Nonischemic

**Noncardiac**
- Pulmonary
- Gastrointestinal
- Musculoskeletal
- Psychogenic
Chest Pain

Cardiac

Ischemic

Angina

Unstable Angina

Myocardial Infarction

Nonischemic

Gastroesophageal

Gastroesophageal Reflux Disease

Esophageal Spasm

Peptic Ulcer Disease

Nongastroesophageal

Pneumothorax

Pulmonary Embolism

Musculoskeletal

Somatoform Disorder (Panic Attack)

Pericarditis

Valvular

Aortic Dissection

Noncardiac

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Ischemic Chest Pain

• Temporary state in which there is a decreased supply of oxygen to the myocardium due to blockage of coronary arteries

• Always assume chest pain or discomfort is caused by ischemia until proven otherwise

• Unrelieved myocardial ischemia is immediately life threatening
  — Can extend infarct size resulting in serious complication such as lethal arrhythmia and/or cardiogenic shock
Ischemic Chest Pain: Stable Angina

• Episode of substernal chest pain or discomfort; may be accompanied by jaw or arm pain
• Caused by activities that increase myocardial O2 demands
• Predictable and may last from 5-15 minutes
• Relieved with treatment
  – Reduce activity
  – Nitrates
Ischemic Chest Pain: Unstable Angina

• Stage between stable angina and MI
• Associated with onset of prolonged angina or change in pattern of angina
• Results from rupture of atherosclerotic plaque
• Patient must be stabilized and emergency resources must be activated
• Correct precipitating factors
• Nitrates
Non Ischemic Chest Pain: Aortic Dissection

- Tear of the inner layers of the aortic wall
  - Allows blood to flow into the middle layer of the aortic wall

- Pain is usually persistent and severe

- Described as ripping, tearing or a stabbing knife–like sensation

- Treated with antihypertensives

- Surgical repair is required for ascending aorta dissection
Non Ischemic Chest Pain: Pericarditis

- The pericardium is a thin fibrous membrane sac that surrounds the heart.
- Pericarditis is inflammation of the pericardium.
- Chest pain may be sharp at the center of the chest. May be worse when lying down, coughing, or swallowing.
- Often relieved by sitting forward.
Non Ischemic Chest Pain: Valvular Disease

- Valvular stenosis: the valve opening is smaller than normal due to stiff or fused leaflets
- Valvular insufficiency: occurs when a valve does not close tightly
- Patient may feel chest pressure with activity or in cold weather
First Steps in Taking History

• Determine the characteristics of the pain
• Memory aid helps prompt questions during evaluation
• “APQRST”
• Provides a mental checklist
• Helps determine the significance of the chest pain
APQRST

• A = Associated Symptoms
• P = Precipitating Factors and Alleviation
• Q = Quality
• R = Region, Radiation and Risk Factors
• S = Severity
• T = Timing
A = Associated Symptoms

- Dyspnea
- Nausea/vomiting
- Diaphoresis
- Palpitations and/or unexplained fatigue
- “Anginal Equivalents” – in the absence of chest pain, a patient’s angina may be reflected in other symptoms
A = Associated Symptoms: Dyspnea

- Dyspnea is the most common anginal equivalent
- In the elderly, diabetic and female patients, ischemic chest pain may manifest as:
  - Dyspnea
  - Fatigue
  - Epigastric discomfort
Dyspnea: Common Finding in Other Conditions

- Pulmonary embolism, pulmonary HTN, pneumothorax, pleuritis, pneumonia
- Anemia
- Obesity
- Psychogenic disorder
  - Panic attack
Nausea and Vomiting

- May be cardiac or non cardiac
- An occlusion of the right coronary artery
  - Can cause an inferior or posterior MI
  - Stimulates the vagal receptors and causes nausea
Nausea and Vomiting

• May be an indication of
  – Gastroesophageal reflux disease
  – Pancreatitis
  – Gallbladder disease
  – Peptic ulcer disease

• Burning in the throat or a foul taste
  – More likely gastrointestinal in origin
Palpitations

• May be a result in ischemic or non-ischemic process
• Sinus tachycardia increases myocardial oxygen demand
• Can lead to chest pain in patient’s with underlying coronary disease
• May have symptoms of lightheadedness, dizziness and/or syncope
Palpitations

• May be psychogenetic in origin
• Many patient’s with psychogenic causes of symptoms first seek a cardiac evaluation
• If life threatening causes of symptoms are ruled out and a psychogenetic cause is suspected further evaluation is needed
P = Precipitating Factors and Alleviation

- Chest pain is usually dynamic
- Angina may be associated with physical exertion
  - Walking up an incline
  - Walking in the cold weather
- Angina is usually relieved with rest or with sublingual nitroglycerin
- Not relieved with changing positions
P = Precipitating Factors and Palliation

• Pericarditis
  – Chest pain brought on by deep inspiration or cough; relieved by leaning forward

• Pleuritic pain
  – Pain that varies with the respiratory cycle
  – Usually worsening with deep inspiration
  – Patient may have rib fracture, pneumonia, pleuritis, pneumothorax or pulmonary embolism
Q = Quality

• Ischemic chest pain is often described as
  – Pressure, tightness, crushing, or squeezing sensation
  – Women may also complain of unusual fatigue, aching, and flu like symptoms

• Ask patient about chest discomfort instead of chest pain
  – Many patients do not interpret the sensation as pain
Q = Quality

• For patients with a history of angina
  – Ask if the sensation is similar to earlier episodes

• Pulmonary Hypertension
  – Abnormally high pressures in the arteries of the lungs
  – Right side of the heart works harder than usual
  – Similar in quality to ischemic pain, and often is exertional

• Gastroesophageal disorders
  – May mimic ischemic chest pain
  – May be described as heaviness or a burning sensation
**Q = Quality**

- Acute pericarditis, mitral valve prolapse, and herpes zoster
  - Can cause pain sharper than ischemic heart pain
  - Pain is localized
- Aortic dissection
  - Pain usually persistent, severe
  - Described as ripping, tearing or a stabbing knife–like sensation
  - Up to 15% of aortic dissections are painless
  - Chest pain – ascending dissection
  - Back pain – descending dissection

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R = Region, Radiation and Risk Factors

• Find out the original point of pain or discomfort

• Ischemic pain
  – Usually retrosternal or substernal that may be felt across both the right and left chest
  – Pain radiating down the left arm often accompanies ischemic chest pain

• For a patients who have risk factors associated with CAD
  – Chest pain is highly suspicious of ischemic chest pain

• Take a history of risk factors
  – Can help to make a more informed clinical decision

**R = Region, Radiation and Risk Factors**

- Visceral pain that comes from deeper structures are more diffuse (abdominal)

- Superficial pain (musculoskeletal)
  - Can pinpoint the pain with one or two fingers

- Acute pericarditis
  - Mid-central chest pain that radiates to the left chest and shoulders
  - Can also radiate to the back or abdomen
  - Recent viral upper respiratory infection
  - Tuberculosis
  - Acute MI
  - Previous radiation therapy
R = Region, Radiation and Risk Factors

• Aortic dissection
  – Anterior chest pain is more typical for type A dissection
  – Back and abdominal pain is associated with type B dissection

• Aortic dissection should be considered in
  – Pregnant woman who present with chest pain
  – Patients with a history of:
    – HTN
    – Marfan Syndrome
    – Atherosclerosis
    – Previous aortic or aortic valve replacement
    – A known aortic aneurysm
R = Region, Radiation and Risk Factors: Pulmonary Embolism

• Patients have elevated pulmonary pressures
• May result in right ventricular ischemia and chest pain
• Generalized ischemic discomfort
• Should be considered for patients with dyspnea, chest pain and/or significant risk factors
  – Pelvic or leg trauma
  – Immobility
  – Recent surgery
  – Obesity
R = Region, Radiation and Risk Factors

• Acute Pancreatitis
  – May cause chest pain
  – May cause epigastric pain
  – Pain often radiates to the back
  – History of alcoholism or biliary tract disease is common

• Gastroesophageal pain
  – Including esophageal reflux and/or spasm
  – Pain is substernal and mimics ischemic pain
  – Can radiate to the back, arms, neck or jaw
S = Severity

• Pain rating scales are used to determine the severity of pain

• The 10 point numeric scale is most commonly used
  – For adult patients who are cognitively intact
  – 0: no pain to 10: worst pain

• Perception of pain varies with individuals
  – There is no correlation between a specific number and specific disease entity

• Pain usually reported as most severe includes:
  – Aortic dissection
  – Acute MI
  – Pericarditis
  – Esophageal perforation
T = Timing

• The onset and duration of chest pain can give clues to the origin
  
  • Anginal pain is usually brief
    – Lasting between 5 and 15 minutes
    – Relived with rest or nitroglycerin

  • Chest pain associated with an acute MI
    – Pain is more intense
    – Can last longer than 15 minutes
T = Timing

• Pain that begins suddenly suggests
  – Pulmonary embolism
  – Pneumothorax
  – Esophageal perforation
  – Aortic dissection

• Esophageal reflux
  – Pain may occur 20-30 minutes after meals
  – May last several hours
  – May be aggravated by recumbent position
  – Often occurs at night
Medical Treatment for Ischemic Chest Pain

• Sublingual nitroglycerin

• Indications
  – Treat or prevent chest pain

• Trade Names
  – Nitrostat
  – Nitro-Bid
    – Tablets, sublingual 0.3 mg
    – Tablets, sublingual 0.4 mg
    – Tablets, sublingual 0.6 mg

Sublingual Nitroglycerin - Therapeutic Uses

- Nitrates relax vascular smooth muscle
- Reduces the left ventricular workload
- Decreases myocardial oxygen consumption
- Specifically relieves the pain of angina

Sublingual Nitroglycerin - Onset and Caution

• Onset of action: 1 to 3 min

• Caution patient not to crush, chew, or swallow sublingual tablets

• During administration of sublingual tablets, patient should rest, preferably in the sitting position

• Caution patients not use nitroglycerin if they are taking sildenafil (Viagra) as serious, life-threatening side effects can occur (hypotension)

Sublingual Nitroglycerin - Instruction to Patients

- Recommendations from the American College of Cardiology and the American Heart Association (2013)
- Healthcare professionals should instruct patients who are prescribed nitroglycerin to use one dose immediately for chest discomfort or pain
- The patient should activate emergency resources if symptoms have not improved or worsen after five minutes
- Emphasizes earlier activation of the emergency resources after five minutes, not 15 minutes

Case Study

• M.E is a 57 yr old woman who lives with her husband, age 64. She works in the State Department and comes to your clinic stating that her husband made her come for an evaluation

• Two nights before her visit she awoke with heavy substernal chest pressure accompanied by epigastric distress. The pain was reduced when changed position but did not completely subside for about 4 hours.

• The following night she experienced the same discomfort
Case Study

• What other information do you want from Mrs. M. E.?
• What may be responsible for her chest and epigastric discomfort?
• How does a differential diagnosis relate to Mrs. M.E.’s case?
Case Study

• What other information do you want from Mrs. M. E.?
  — Risk factors for cardiac disease: activity, weight, smoking, family history, menopause, alcohol intake, blood pressure, blood lipid levels, diabetes
  — What medications are you taking?
  — Did the pain increase with respirations?
  — Did you take any medication to relieve the pain / Did it work?
Case Study

• What may be responsible for her chest and epigastric discomfort?
  – Cardiac disease
  – Gastrointestinal disease

• How does a differential diagnosis relate to Mrs. M.E.’s case?
  – Rule out the most severe diagnosis (MI and aortic dissection)
Case Study

• What is the diagnosis that is left?
  – Gastrointestinal disease as the pain lasted over 4 hours, occurred at night repeatedly, and was relieved with position change

• Esophageal reflux
  – Pain may occur after meals
  – May last several hours
  – May be aggravated by recumbent position
  – Often occurs at night
Deep Vein Thrombosis (DVT)

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Types of Venous Thromboembolism (VTE)

• Deep vein thrombosis (DVT)
  – Blood clot that forms in deep vein
  – May limit or completely block blood flow through the vein
  – Most form in lower leg, thigh or pelvis
  – Not life threatening, but if the blood clot breaks free and travels to the lungs → pulmonary embolism

• Pulmonary embolism

• Superficial vein thrombosis
  – Blood clot develops in superficial vein
  – Less severe than DVT, but can progress to DVT if it moves into the deep vein
Pathogenesis of VTE

Virchow’s Triad:

• Alterations in blood flow (stasis)
• Vascular injury
• Alterations in the components of blood (inherited or acquired hypercoagulable state)
Risk Factors

• 80% of patients with thrombotic event have one risk factor; often there is more than one risk factor present

• Hereditary
  – Antithrombin deficiency
  – Protein C deficiency
  – Protein S deficiency
  – Prothrombin mutation
  – Factor V Leiden mutation
Risk Factors

• Acquired disorders
  – Malignancy (hypercoagulable state)
  – Reduced mobility (venous stasis)
  – Pregnancy and first 6 weeks after birth (obstruction of venous return by large uterus; hypercoagulable state)
  – Advanced age
  – Smoking
  – Prolonged leg dependence (travel)
  – Heart failure (hypercoagulable state with ↓LV function and atrial fibrillation)
  – Orthopedic surgery
  – Trauma
  – Spinal cord injury
  – Oral contraceptives
  – Hormone replacement therapy
  – Obesity
  – Previous DVT
Symptoms

- Swelling in leg or arm (can happen suddenly)
- Pain or tenderness in leg or arm (may occur when standing or walking)
- Warmth
- Redness
- Veins near the skin surface may be larger than normal
- Palpable cord reflecting a thrombosed vein
- There is not always a correlation between location of symptoms and the site of thrombosis
Diagnosis

• Complete history focusing on risk factors for DVT
• Family history
• Physical exam
• Laboratory testing
  – Complete blood count (CBC)
  – Platelet count, PT, aPTT
  – Renal and liver function tests
  – Urinalysis
• Screen for hypercoagulable state
  – Inherited (Factor V Leiden, protein C deficiency)
  – Acquired (antiphospholipid antibody, after orthopedic surgery)
Disorders that Mimic DVT

- Cellulitis
- Lymph obstruction
- Venous insufficiency
- Chronic venous insufficiency with chronic unilateral edema (seen with past history of DVT)
- Knee joint abnormality with pain, inflammation, and swelling
- Calf muscle or tear with bleeding within muscle compartment
Diagnostic Testing

- Compression ultrasonography (non-invasive test of choice if first episode of suspected DVT)
- D-dimer assay
- Pretest probability probability score: Wells score
- Ultrasonography
- CT scan
Wells Score

- Active cancer (1)
- Paralysis, paresis, or recent plaster immobilization of LE (1)
- Recently bedridden for more than 3 days or major surgery within 4 weeks (1)
- Localized tenderness along the deep venous system (1)
- Entire leg swollen (1)
- Calf swelling > 3 cm when compared to asymptomatic leg (1)
- Pitting edema (greater in the symptomatic leg) (1)
- Collateral superficial veins (1)
- Alternative diagnosis as likely or more likely than DVT (-2)

Wells Score

• High probability   3 or greater
• Moderate probability  1 or 2
• Low probability     0 or less

• Modification:

• Previous DVT given score of 1

DVT likely          2 or greater
DVT unlikely        1 or less
Treatment Goals

• Prevent pulmonary embolism
• Prevent clot from becoming larger
• Prevent new clots from forming
• Prevent long-term complications

• The primary treatment for DVT is anticoagulation
  – Does not dissolve the clot, but help prevent new blood clots from forming
  – Choice of anticoagulant depends on multiple factors (patient’s medical history, physician preference, bleeding risk, cost)
Anticoagulation

• Low molecular weight heparin (subcutaneously)
  – Enoxaparin (Lovenox)
  – Dalteparin (Fragmin)
  – Tinzaparin (Innohep)

• Fondaparinux (Arixtra) (injection)

• Unfractionated heparin (intravenously)

• Wafarin (Coumadin) (oral)
  – INR must be measured regularly

• Direct oral anticoagulants
  – Rivaroxaban (Xarelto)
  – Pixaban (Elquis)
  – Dibigatran (Pradaxa)
Anticoagulation

• Recommended for a minimum of 3 months in patient with DVT

• Treatment may continue indefinitely (two or more episodes of VTE or if permanent risk factor is present)

• Ambulation encouraged

• Increased risk of bleeding

• Reduce risk of bleeding
  – Soft bristle toothbrush
  – Shave with electric razor
  – Use safety equipment (helmets, padding) during physical activity
  – Do not take ASA or NSAIDS

Prevention

• Risk for DVT increases if travel time is > 4 hours
  – Walk up and up and down the aisles of the bus, train or airplane
  – If traveling by car, stop about every hour and walk around
  – Move your legs and flex and stretch your feet to improve blood flow in your calves
  – Wear loose comfortable clothing
  – Drink plenty of fluids and avoid alcohol

• If you are at risk for DVT
  – Regular visits to your healthcare provider
  – Take all medications prescribed
  – Get out of bed and move around as soon as possible after surgery or illness per your healthcare provider recommendation
  – Exercise your lower leg muscles during long trips

• If you have had a DVT before use compression stockings per healthcare provider recommendation to prevent leg swelling

Every life deserves world class care.