
Dr. Szathmári Miklós
Semmelweis University
First Department of Medicine
Ischemic heart disease

- Ischemic heart disease (IHD) is a condition in which there is inadequate supply of blood and oxygen to a portion of myocardium. It typically occurs when there is an imbalance between myocardial oxygen supply and demand.
- The most common, serious, chronic, life-threatening disease in the developed countries.
- The most common cause is atherosclerotic disease of an epicardial coronary artery.
Pathophysiology of myocardial ischemia

• Myocardial oxygen supply is decreased
  – Narrowed coronary arteries (sclerosis, thrombus, spasms, coronary embolism, vasculitis)
  – Hypotension
  – Severe anaemia
  – Methaemoglobinemia, increased carboxyhaemoglobin

• Myocardial oxygen demand is increased
  – Left ventricle hypertrophy
  – Fever
  – Hyperthyroidism
  – Tachycardia
Coronary atherosclerosis

- High LDL-cholesterol, low HDL-cholesterol, cigarette smoking, hypertension, and diabetes mellitus disturb the normal function of vascular endothelium of epicardial coronary arteries.

- Segmental atherosclerotic narrowing of epicardial coronary arteries is caused most commonly by formation of plaque, which is subject to rupture or erosion of the cap separating plaque from the bloodstream.

- When a stenosis reduces the diameter of coronary artery
  - by 50%, there is a limitation on the ability to increase flow, to meet increased myocardial demand
  - by 80%, blood flow at rest may be reduced

- With progressive worsening of epicardial artery stenosis, the distal resistance vessels maximally dilate. Without reserve capacity in cases of increased oxygen demand – exercise, stress, tachycardia – the ischemia manifest clinically by angina.
The clinical manifestations of ischemic heart disease

• Ischemic heart disease **without clinical symptoms. Sudden death** can be the presenting manifestation.

• Cardiomegaly and heart failure that may have caused no symptoms prior the development of heart failure – **ischemic cardiomyopathy**.

• **Angina pectoris.** Stable angina pectoris.

• Unstable angina/Non ST-elevation myocardial infarction (NSTEMI)/STEMI = **acute coronary syndromes**
Angina pectoris

- Angina pectoris (Latin, angere = press or grip, pectus = chest) or stenocardia (Greek, stenos = narrow, cardia = heart) means **chest pain because of episodic myocardial ischemia**
- Angina pectoris is the most common manifestation of the ischemic heart disease.
- The prevalence of angina pectoris is 16% in male and 11% in female population between 65 and 74 year of age*.

Approach to the patient with angina

• **History**
  – Context
  – Location
  – Radiation
  – Quality
  – Timing
  – Factors that aggravate or relieve
  – Associated symptoms
The context of the symptom development can give clues to diagnosis and management

- **Effort angina**
  - Angina, which occurs predictably at a certain level of activity – **stable exertional pectoris**
  - Angina only after minor exertion (a short walk or shaving) in the morning: **first effort or warm-up angina** The patient by midday may capable of much greater effort without symptoms.
  - Emotional stress situation, heavy meal, exposure to cold, or smoking induced angina

- **Gastroesophageal acid reflux induced myocardial ischemia:** **„linked” angina**

- **Angina** (1) that occurs at rest or with minimal exertion, usually lasts more than 10 min, (2) is severe and new of onset, and/or (3) that occurs with a crescendo pattern – more severe, prolonged, or frequent than previously - **unstable angina, acute coronary syndrome**

- **Focal spasm of an epicardial coronary artery** (usually close to a non-critical obstruction of right coronary artery) leading to severe myocardial ischemia. It occurs at rest, and associated with transient ST-segment elevation. **Prinzmetal’s variant angina**
The typical clinical features of angina pectoris

- The typical location of pain is **retrosternal**.
- When the patient is asked to localize the sensation, he or she will typically place their hand over the sternum, sometimes with a clenched fist, to indicate the squeezing. **The pain can not be localized with one finger.**
- Usually described as **heaviness, pressure, squeezing**, or choking.
- Usually associates with **gradual intensification** of symptoms over a period of minutes.
- It **lasts** typically **2-5 min**.
- It can **radiate to** either **shoulder** and to **both arms** (especially the ulnar surfaces of the forearm and hand).
- It can also arise in or radiate to the back, interscapular region, root of neck, jaw, teeth, and epigastrium. Rarely localized below the umbilicus or above the mandible.
- Exertional angina is typically **relieved by rest and nitroglycerin**.
Associated symptoms and physical signs of angina pectoris

• **Associated symptoms**
  – Dyspnoea
  – Fatigue, faintness
  – Nausea, vomiting
  – Sweating
  – Sense of impending doom (mostly in case of myocardial infarction)

• **Physical signs**
  – Third and fourth heart sounds
  – Apical systolic murmur due to mitral regurgitation (impaired papillary muscle function)
  – Pulmonary congestion
Summary of the characteristics of angina pectoris

- **Typical angina pectoris:**
  - Retrosternal chest pain (discomfort)
  - Complaints occur after exertion or emotional stress
  - The pain is relieved by rest and nitroglycerin

- **Atypical angina pectoris:** only two from three characteristics (especially in women and diabetics, angina may be atypical in location and not strictly related to provoking factors)

- **Pseudoangina:** Only one or no one out of three characteristics.
Cardial and extracardial causes of chest discomfort

• CARDIOVASCULAR DISEASES
  – Ischemic heart disease
  – Pericarditis
  – Aortic dissection
  – Congestive heart failure
  – Aortic stenosis and regurgitation
  – Hypertrophic cardiomyopathy
  – Pulmonary hypertension

• LUNG DISEASES
  – Pulmonary embolism
  – Pneumothorax
  – Pleuro-pneumonia
  – Pleuritis

• GASTROESOPHAGEAL DISEASES
  – Gastroesophageal reflux
  – Oesophageal motility disorders
  – Peptic ulcer
  – Gallstones

• NEUROMUSCULOSKELETAL DISEASES
  – Fracture of sternum or rib
  – Spondylarthrosis
  – Periarthritis humeroscapularis
  – Intercostal muscle cramp
  – Tietze’s syndrome

• MISCELLANEOUS
  – Subphrenic abscess
  – Herpes zoster
  – Splenic infraction
  – Psychiatric disease
The epidemiology of chest discomfort in primary care and in patient who present to emergency department

<table>
<thead>
<tr>
<th>Condition</th>
<th>In primary care (%)</th>
<th>In emergency department (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuromusculoskeletal conditions</td>
<td>29</td>
<td>7</td>
</tr>
<tr>
<td>Gastrointestinal conditions</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Serious cardiovascular conditions (stable and unstable angina, acute myocardial infarction, pulmonary embolism, heart failure)</td>
<td>13 (more common is the stable angina)</td>
<td>54 (more common is the unstable angina)</td>
</tr>
<tr>
<td>Emotional and psychiatric conditions</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Pulmonary disorders (PTX, lung cancer, pneumonia)</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Non-specific chest discomfort</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
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Differential diagnosis of chest discomfort

- **Acute myocardial infarction**
  - The duration of the pain often more than 30 min
  - Often more severe than angina
  - Unrelieved by nitroglycerin
  - May be associated with evidence of heart failure or arrhythmia

- **Aortic dissection**
  - Tearing, ripping pain with abrupt onset
  - Associated with hypertension, and/or connective tissue disorder
  - Depending on the location of dissection:
    - Loss of peripheral pulse
    - Pericardial tamponad
    - Murmur of aortic insufficiency
Differential diagnosis of chest discomfort

• **Pericarditis**
  – The duration of the pain is hours to days
  – Sharp, retrosternal pain that is aggravated by coughing, deep breath, or changes in body position (relieved by sitting and leaning forward)

• **Pulmonary embolism**
  – Abrupt onset of the pain. Location is often lateral
  – Associated symptoms are dyspnoea, tachycardia and occasionally haemoptysis

• **Pneumothorax**
  – Sudden onset of pleuritic chest pain. Location: lateral to side of pneumothorax
  – Dyspnoea, decreased breath sounds, tympanic percussion sound.

• **Pneumonia or pleuritis**
  – Localized sharp, knifelike pain
  – Pain is aggravated by inspiration and coughing
  – Dyspnoea, fever, rales, occasionally pleural rub
Differential diagnosis of chest discomfort

- **Oesophageal reflux**
  - Deep, burning discomfort that may be exacerbated by alcohol, aspirin, or some foods
  - Worsened by postprandial recumbence, relieved by antacids

- **Ulcer disease**
  - Symptoms do not associated with exertion
  - Prolonged burning pain
  - Typically occurs 60 to 90 min after meals, when postprandial acid production is no longer neutralized by food in the stomach

- **Gallbladder disease**
  - Prolonged colic pain
  - Occurs an hour or more after meals
Differential diagnosis of chest discomfort

- **Neuromusculoskeletal diseases**
  - Cervical disk disease: compression of nerve roots – dermatomal distribution (pain in dermatomal distribution can also be caused by intercostal muscle cramp and herpes zoster)
  - The pain is aggravated by movement
  - Costochondral and chondrosternal syndromes (Tietze’s syndrome)
    - direct pressure on the costochondral-costosternal junctions may reproduce the pain.

- **Psychiatric conditions**
  - The symptoms are frequently described as visceral tightness or aching that last more than 30 min.
Pathophysiology of acute coronary syndrome

• UA/NSTEMI: Caused by a reduction in oxygen supply and/or by an increase in myocardial oxygen demand superimposed on an atherosclerotic coronary plaque.

• STEMI: coronary blood flow decreases abruptly after a thrombotic occlusion of a coronary artery previously affected by atherosclerosis.
Acute coronary syndromes

Presentation

Ischemic discomfort

Hypothesis

Acute coronary syndrome

Subtotally occlusive thrombus

Completely occlusive thrombus

ECG

No ST elevation

ST elevation

Biochemical markers

NSTEMI

NonQ MI

Diagn.

Unstable angina

NSTEMI

STEMI

Qwave MI
Diagnostic tests in patients with chest discomfort 1.

- ECG and X-ray are essential tests for adults with chest discomfort

First the physician should be focused on life-threatening problems:

- Presence of electrocardiographic changes consistent with ischemia or infarction:
  - Serum cardiac biomarkers of myocardial injury (Troponin I or T)
  - Coronarography, Primary percutaneous coronary intervention
Diagnostic tests in patients with chest discomfort 2.

- If the patient’s history or examination is consistent
  • with pulmonary embolism
    – D-dimer, CT-angiography or a lung scan, echocardiography combined with lower extremity venous ultrasound
  • With aortic dissection
    – Chest CT scan with contrast, MRI, or transoesophageal echocardiography

No evidence of life-threatening conditions, the clinician should then focus on serious chronic conditions with the potential to cause major complications, the most common of which is stable angina
- exercise electrocardiography, stress echocardiography or stress perfusion imaging
- Pericarditis (, blood pressure pattern, echocardiography)

If not, could the discomfort be due to an acute condition that warrants specific therapy?
- Pneumonia – Chest X-ray
- Herpes zoster – physical examination

If not, another treatable chronic condition