

CHEST PAIN

Clinical Practice
Guideline for
Primary Health
Care Physicians



Chest Pain: Clinical Practice Guideline for Primary Health Care Physicians



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The guideline is intended for health care professionals, including family physicians, nurses, pediatricians, and others involved in the organization and delivery of health services to provide practical and evidence-based information about management and differential diagnosis of chest pain in adult and pediatric patients. Sections of the guideline were developed for use by patients and their family members.

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In the course of guideline development, consultations of specialists of Emergency Medical Service and out-patient clinics were used, along with pertinent electronic and hard copy publications.

2. List of Acronyms and Abbreviations

AIHA	American International Health Alliance
BP	blood pressure
CNS	central nervous system
CPK	creatine phosphokinase
ECG	electrocardiogram
GIT	gastrointestinal tract
IHD	ischemic heart disease
LDH	lactate dehydrogenase
MI	myocardial infarction
NSAID	non-steroidal anti-inflammatory drugs
SGOT	serum glutamic-oxaloacetic transaminase
YSMU	Yerevan State Medical University

3. Glossary of Terms

- *Echocardiography*: the use of ultrasound in the investigation of the heart.

- *Marfan's syndrome*: a syndrome of congenital changes in the mesodermal and ectodermal tissues, skeletal changes (arachnodactyly, long limbs, laxness of joints), bilateral ectopia lentis, and vascular defects (typically the aneurysm of the aorta).

- *Hyperventilation syndrome*: increased pulmonary ventilation, which is incommensurate to the respiratory metabolism and is manifested by various respiratory, cardiovascular, and autonomic disturbances.

- *Unstable angina*: a syndrome incorporating a number of clinical conditions such as resting angina within one week of occurrence; newly occurred angina of functional category III or IV according to Canadian classification; variant angina; small-size MI; post-infarction angina (Braunwald 1994).

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- *Troponin*: blood protein, concentration of which increases dramatically during acute myocardial infarction.
-
- *Creatine phosphokinase*: an enzyme catalyzing the transfer of phosphate from phosphocreatine to ADP, forming creatine and ATP; CPK M (Muscle) and B (Brain) isozymes are recognized, with MB-type CPK being specific to myocardium.

4. Introduction

4.1. ESSENTIALS

Chest pain complaints are of common occurrence in medical practice. Chest pain frightens the patient and puts the physician on the alert, as it is often a symptom of a serious disease. From the diagnostic standpoint, chest pain may present a real challenge to the physician.

Although chest pain is a subjective symptom, it does have various degrees of intensity. Professor R. Aghababayan suggested the following classification of pain:

0 degree - no pain

1st degree - mild pain; patients are calm; pain may be identified only during physical examination, is short-lasting and transient

2nd degree - moderate pain that is recurrent in nature, with long intervals between episodes; patients appear to be restless

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3rd degree - sharp pain of increasing intensity; frequent recurrences, with short intervals between episodes

4th degree - sharp, extremely severe, intractable pain; patients appear to be very restless, unable to find a comfortable position, and scream

As the pain may be caused by various conditions, careful and detailed medical history is critical, allowing timely and accurate diagnosis to be made.

4.2. GOALS OF DEVELOPMENT OF THIS CLINICAL PRACTICE GUIDELINE

This guideline was developed to:

- emphasize the importance of early diagnosis to prevent undesirable outcome;
- ensure that optimal treatment is provided from the time the diagnosis is made;
- make the patients and their families aware of the need for timely consulting with their family physician;
- discuss the forms of psychological and social support to provide patients and their families with the knowledge for successfully coping with the disease.

4.3. METHOD OF DEVELOPMENT OF THE CLINICAL PRACTICE GUIDELINE

This guideline is the result of joint efforts of primary health care specialists, leading specialists of Emergency Medical Service, and the Chair of family medicine. The aim was to develop a guideline, which might become a reference for family physicians. In addition, this method was rewarding, since it provided a possibility of involving all the parties concerned in the process of guideline creation. The method was designed to emphasize the role of nurses, patients and their families, in addition to that of physicians.

4.4. THE SCOPE OF APPLICATION OF THE CHEST PAIN CLINICAL PRACTICE GUIDELINE INCLUDES THE POPULATION OF THE DISTRICT (ATTACHED FAMILIES, INDIVIDUALS) SERVED BY A FAMILY PHYSICIAN.

4.5. TARGET GROUPS FOR APPLICATION OF THIS GUIDELINE INCLUDE:

- Patients with a chest pain problem

- Risk groups of population (*e.g.*, patients with cardiovascular disease) served by primary health care providers

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4.6. THIS CLINICAL GUIDELINE MAY BE USED BY:

family physicians, district therapists, pediatricians, EMS physicians, and nurses. Some sections of the guideline are reserved for patients and their family members.

4.7. EXPECTED RESULTS

1. Increased identification rate of life-threatening conditions.

2. Reduced complication rate of a number of medical conditions.

3. Elimination of medical errors affecting patients' health.

4. Favorable reports on the part of primary health care physicians regarding clarity, acceptability, and local applicability of the clinical practice guideline developed.

5. Patients' satisfaction by the results of diagnosis and treatment based on the clinical practice guideline developed.

6. Saving financial resources, reducing the number of specialty referrals and hospital admissions.

7. Increased patient referrals to primary health care physicians.

- acute pain,
- gnawing pain,
- pain in the extremities,
- pain radiating along the nerves and worsening during the movements of neck or back

- risk factors for heart
- pain worsened by
- and being relieved
- pain located retrost
- duration of pain
- accompanying sym
- perspiration, weak
- neck, arm, and bac
- presence of the 3rd
- pain relief with nit
- ECG: ST-segment
- ventricular origin
- pain as a sign of p
- when the patient is

mediastinitis, neoplasm

Chest wall disorders:
muscle cramps, muscle spasm, epidemic myalgia

Bone disorders:
costochondral inflammation, including Tietze's syndrome, fractured ribs, tumor metastases, osteochondrosis of cervical and thoracic spine

Neuralgia:
postherpetic, compression of the radicle of a nerve

- Pain of cardiac
- myocardial infar
- angina pectoris,
- valve prolapse

Vascular disorders:

- aneurysm of the aorta and
- pulmonary artery

Di

- History of atherosclerosis, hypertension, Marfan's syndrome (patients are typically tall, have asthenic constitution, conoidal chest with wide intercostal spaces, kyphosis, "spider-like" fingers with long phalanges, hernias, and cardiac defects).
- Ehlers-Danlos syndrome (characterized by overelasticity of the skin, hypermobility of the joints, spontaneous cutaneous hemorrhages, various types of hernia, pneumothorax, and mitral valve prolapse).
- injury caused by stubbed instrument
- difference in blood pressure between arms and legs above 25 mmHg
- presence of acute neurological symptoms: paresthesias, syncope

- Mental disorders:**
- anxiety
 - depression
 - hyperventilation

- indeterminate fe
- days(discomfort
- cardiac area, us
- associated with
- hyperventilation

NT CARE SYSTEM

rt disease
 physical and emotional stress, cold air,
 at rest
 internally or in the right side or the chest
 mptoms: nausea, vomiting, anxiety,
 ness, and radiation of pain to the jaw,
 ck
 l tone or murmur
 roglycerin
 changes, arrhythmia, particularly of
 ericardial disorders, which is relieved
 sitting or bending forward

origin
 rction
 pericarditis, myocarditis, mitral

Differential diagnosis

n

eeling of anxiety lasting hours or
 t), stinging or squeezing pain in the
 ually radiating to other areas and
 agitation and exertion
 n, weakness, palpitations

- cough
- blood spitting
- shortness of breath
- pulmonary pain influenced by cough and respiratory movements
- tachypnea
- chest injuries due to surgery, history of deep vein thrombosis,
- lung disease detected using X-ray or auscultation: bronchitis, pneumonia, pleurisy (pleural friction rub, signs of obstruction)

Pain of pulmonary origin

- pneumonia
- pulmonary infarction
- pleurisy, including thoracic form of familial Mediterranean fever
- pneumothorax
- bronchitis

Gastrointestinal disorders:

- reflux or spasm
- aerophagia
- gall bladder disease, peptic ulcer disease
- pancreatitis

- tenderness in the right hypochondriac or epigastric area
- burning pain related to eating
- relief after eating

5. Patient Care System

5.1. BASIC NOTIONS

Practical recommendations

- In patients complaining of chest pain, diagnosis of IHD should be considered and ruled out first.
- Medical history plays a major part in diagnosis.
- Mitral valve prolapse is a common and under-recognized cause of chest pain.
- Echocardiography is the most appropriate diagnostic technique.
- Pain related to esophagospasm may be as severe as that in myocardial infarction.
- Like angina, esophagospasm-related pain is relieved by nitrates.
- Intervertebral disc hernia (Th2-Th9) is a very rare cause of chest pain.
- In patients with suddenly occurring severe dyspnea, diagnosis of myocardial infarction or pulmonary embolism should be considered, even when there is no pain.

- Sudden occurrence of pronounced dyspnea during the stable course of myocardial infarction should make you consider the rupture of interventricular septum, acute mitral failure, or pulmonary embolism.

Diagnosis. Essential questions to ask while providing primary health care.

- Show the sore place.

- Where is the pain radiating to?

- Describe the pain. How long does it last? What gives relief?

- Does the pain occur during physical exertion or in cold air? Does it pass when you rest?

- Is the pain accompanied by shortness of breath? Dizziness? Sweating?

- Is the pain worsened by breathing and coughing?

- Have you ever noticed traces of blood in your sputum?

- Is the pain related to eating?
Do you have a bitter taste in your mouth?

- Does the pain occur when you bend or lie on your back? Does it occur at nighttime?

- Does the pain disappear after taking antacids?

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- Have you ever had skin rash on your chest?
- Have you ever had chest or backbone injuries?

Main causes of errors

- Ignorance of IHD epidemiology.
- Inability to diagnose spinal osteochondrosis and osteoarthritis, particularly those of the lower cervical spine.
- Over-diagnosis of neurosis in patients with combination of anxiety, fear and acute chest pain.
- Mistaken opinion that any chest pain radiating along the medial surface of the left arm is caused by angina pectoris.
- Ignorance of the fact that 20% of cases of pulmonary embolism and myocardial infarction are asymptomatic or atypical, especially in elderly patients as well as those with alcoholism and diabetes mellitus.
- Mental disorders and simulation
 - Psychogenic pain is usually stinging and prolonged (several days), has indeterminate location, and may be severe.
 - It is usually accompanied by palpitations, dyspnea, tremor, agitation, or anxiety.
 - Pain occurs during emotional stress, anxiety and depression.

5.2. PROCESS OF PROVIDING PRIMARY HEALTH CARE

Assessment

Medical history taking

The physician should identify location and radiation of the pain, its nature, intensity, duration, time of occurrence, and accompanying symptoms. Factors provoking and relieving the pain must be identified. The patient should be asked about past and current illnesses, giving particular attention to history of diabetes mellitus, Marfan's syndrome, anemia, and systemic lupus erythematosus. If severe pain makes the direct history taking impossible, patient's relatives should be asked.

Accompanying symptoms must be taken into consideration:

- Syncope: myocardial infarction, pulmonary thromboembolism, and aortic dissection must be ruled out.
- Pain worsened on exhalation: pleurisy, pericarditis, pneumothorax, disorders of chest muscles, bones and joints must be ruled out.
- Pain in the back: spinal disorders, myocardial infarction, angina pectoris, aortic dissection, pericarditis, peptic ulcer disease, esophagospasm, and cholecystitis must be ruled out.

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Physical examination

Inspect for visible signs of atherosclerosis: arcus senilis of the cornea, hardening and thickening of the arteries. Inspect skin for rash characteristic of herpes zoster.

Assess the pulse at the radial and femoral arteries.

Measure BP and body temperature.

- Palpate the chest and the spinous processes of vertebrae. Assess for local tenderness, fractures, symptoms of spinal diseases. Percuss the chest (to rule out pneumothorax).

- Inspect the feet. Rule out deep vein thrombosis.

- Perform cardiac and pulmonary auscultation:
 - absence of respiration and vocal fremitus—pneumothorax;
 - pleural (pericardial) friction rub—pleurisy (pericarditis);
 - moist rales in the lower lung fields—heart failure;
 - systolic murmur over the apex—mitral valve prolapse;
 - diastolic murmur over the aorta—dissection of ascending aorta.

- Palpate the abdomen. Epigastric pain may be seen in diseases of gallbladder, stomach, and duodenum.

- In myocardial infarction and aortic dissection, algescic shock often develops. Patients are pale, with cold and clammy skin.
-
- In myocardial infarction, obtuse cardiac sounds, gallop rhythm, and systolic murmur may also be heard; in aortic dissection, absence of pulse at femoral arteries and diastolic murmur over the aorta are observed.

Laboratory and other diagnostic studies
In most cases, ECG at rest, chest X-ray, and blood enzyme activity testing provides sufficient information for making diagnosis.

There are other testing methods. However, they are sophisticated and are reserved for specialized medical centers.

ECG at rest

ECG is the most informative procedure for diagnosing acute ischemia and myocardial infarction. It should be remembered that ECG might show no changes during the first minutes following the onset of MI-related pain attack.

Diagnostic criteria for acute myocardial infarction:

- ST elevation ≥ 1 mm in 2 or more contiguous limb or precordial leads
- Left bundle branch block, not known to be old

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ECG findings useful for establishing the likelihood of coronary artery disease:

- T segment depression ≥ 1 mm
- Inverted T-waves ≥ 1 mm in two or more contiguous leads

ECG is useful for differentiating myocardial infarction from pulmonary thromboembolism and pericarditis. In thromboembolism of large branches of pulmonary artery, electrical axis of the heart deviates to the right. Pericarditis is characterized by depression of waves and elevation of ST-segment in some or all leads.

Radiodiagnostic procedures

- Chest X-ray
- Radiography of cervical and thoracic spine

Total blood count and clinical chemistry panel

At the primary health care level: Total blood count (hemoglobin, leukocyte count, ESR) and determination of C-reactive protein.

At the specialty level: Myocardial infarction is accompanied by destruction of cardiac myocytes and release of intracellular enzymes into the bloodstream. Valuable diagnostic markers include:

- Troponin T (troponin concentration rapidly increases following myocardial injury [within 4-6 hours] and remains elevated for at least one week). Due to the high sensitivity, this test could also be positive in decompensated heart failure, myocarditis, myocardial hypoperfusion

(syncope, prolonged tachycardia) and other causes of myocardial damage.

- CPK

- SGOT

- LDH

Echocardiography

Echocardiography reveals contractility changes in the ischemic area. Echocardiography may provide useful information early in the course of myocardial infarction when no ECG changes or enzyme activity elevation may be detected.

6. Characteristics of Chest Pain in Various Conditions

A. IHD

In angina pectoris and myocardial infarction, the pain is usually pressing, located retrosternally, and radiating to the lower jaw, neck, back (between blade-bones), epigastrium, and along the medial surfaces of the arms. Radiation to the left arm is observed much more frequently, than to the right one. The pain may be initially located in the arm or epigastrium, rather than retrosternally.

Factors that precipitate, worsen, or relieve the pain should be identified to allow differentiating angina pectoris from cardiodynia caused by spinal disease.

In patients complaining of retrosternal pain that does not correlate to physical exertion and occurs in recumbent position and body bending, esophageal spasm and reflux esophagitis should be ruled out. Most like angina pectoris, pain caused by esophageal disease may radiate to the left arm.

Angina pectoris

Angina pectoris affects 2-3% of people at the age of 25-64. In exertional angina without surgery, ten-year survival is 30%.

Clinical presentation

In angina pectoris, pain is usually pressing, located retrosternally, and radiating to the arms, lower jaw, neck, or back; it is often accompanied by dyspnea.

Pain occurs during physical or emotional stress, in the cold air, or post-prandially, and disappears at rest (within several minutes) or after taking nitroglycerin. Physical examination between episodes reveals few or no abnormalities.

Angina pectoris should be differentiated from the pain caused by mitral valve prolapse and esophageal spasm.

In exertional angina, pain typically lasts 3-5 minutes and passes after taking nitroglycerin. Pain episodes caused by unstable angina are more prolonged and severe. In such cases, relying on clinical manifestations may lead to misdiagnosing myocardial infarction. However, unlike MI, no specific ECG changes or changes in enzymatic activity may be detected.

The onset of angina episodes is associated not only with exertion, but with paroxysmal arrhythmias (arrhythmia paroxysms) as well, with pain occurring and disappearing concurrently with arrhythmia.

Emergency care of angina episode:

- Nitroglycerin, 300-600 (g sublingually).

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Other treatments:

- isosorbide dinitrate, 5 mg sublingually every 5 minutes (up to 3 doses), or
- nitroglycerin dosed spray, 1-2 puffs (up to 3 puffs) within 15 minutes, or
- when nitrate intolerance is present, nifedipine 5 mg sublingually or to be chewed.

Angina of effort (high tolerance to physical exertion):

- Aspirin, 150 mg orally once a day.
- Nitroglycerin to relieve pain (sublingual tablets or dosed spray).
- In some instances, beta-adrenergic blockers, nitrate ointments or patches.

Angina of effort (moderate to low tolerance to physical exertion):

- Aspirin, 150 mg orally once a day.
- Nitroglycerin to relieve pain (sublingual tablets or dosed spray).

Add beta-adrenergic blockers or calcium channel blockers, as well as one of the following drugs:

- isosorbide dinitrate, 10 mg orally 3 times a day, or
- isosorbide mononitrate, 60 mg orally once a day.

Unstable angina

Hospitalization is indicated. Hospitalized patients should be administered intravenous nitroglycerin. Then coronary angiography is performed and decision is made as to whether balloon coronary angioplasty or coronary bypass surgery is indicated.

The above treatment scheme used in exertional angina may be supplemented by calcium antagonists:

- nifedipine, 20 mg orally 2-3 times a day (drug of choice), or
- verapamil, 40-160 mg orally 2-3 times a day, or
- diltiazem, 30-90 mg orally 4 times a day, or
- amlodipine, 2.5-10 mg orally once a day.

Any case of angina requires cardiology referral!

Myocardial infarction

In myocardial infarction, pain lasts 15-20 minutes and does not respond to nitroglycerin. Paleness, clammy sweat, nausea, vomiting, and hypertension may be seen. Painless forms of myocardial infarction are developed mostly in patients with diabetes mellitus, in the elderly, as well as in recurrent myocardial infarction.

In case of suspected myocardial infarction, specialized emergency care should be provided, with subsequent cardiology referral.

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B. Aortic dissection

Aortic dissection is characterized by sudden occurrence of very severe retrosternal pain. Pain radiates to the back, abdomen, and legs.

Diagnostic sign of importance is unequal pulse at carotid, radial, and femoral arteries. Aortic dissection is often complicated by occlusion of coronary and renal arteries, aortic insufficiency, and cardiac tamponade.

In case of suspected aortic dissection, cardiologist should be called for organizing patient management, and emergency care should be provided.

C. Pulmonary thromboembolism

Pulmonary thromboembolism is accompanied by retrosternal pain, dyspnea, and syncope. Physical examination does not usually reveal any changes. In severe cases, hypotension, acute right ventricular failure, and cardiac arrest may develop. Lesions of the trunk and large branches of pulmonary artery often have fatal outcome. In 10% of cases, pulmonary thromboembolism is complicated by pulmonary infarction, which is manifested by pain worsened during respiration, and the spitting up of blood.

Diagnosis of pulmonary thromboembolism presents great difficulties when the only sign is suddenly occurring dyspnea.

In case of suspected pulmonary thromboembolism, specialized emergency care should be provided!

D. Pericarditis

Pericarditis is manifested by:

- pain worsened by cough and deep breathing, and sometimes related to swallowing;

- continuous squeezing retrosternal pain resembling angina;

- throbbing pain in the cardiac area and left shoulder.

In case of suspected pericarditis, cardiology referral is indicated.

E. Pneumothorax

In case of suddenly occurring pain and dyspnea, pneumothorax should be considered, especially in patients with bronchial asthma and emphysema. Pneumothorax may occasionally develop with no underlying lung disease. This is particularly characteristic of young, thin males. Location and intensity of pain vary.

Worsening of dyspnea and pain is indicative of tension pneumothorax; in this case, emergency pleural puncture is indicated.

In case of suspected pneumothorax, pulmonology referral is indicated and emergency medical care should be provided.

F. Pulmonary conditions

Pleurodynia (pleurisy), caused by inflammation of pleura, often accompanies viral or bacterial respiratory infections. It may also occur in collagen

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vascular disorders. History suggesting pleurodynia includes acute onset of sharp pain associated with breathing or movement, sometimes accompanied by systemic symptoms of infection. Physical examination may reveal a pleural friction rub. A chest X-Ray should be obtained to exclude pneumonia, pleural effusion, or other intrathoracic processes.

G. Gastrointestinal conditions

Reflux esophagitis is characterized by burning retrosternal or epigastric pain radiating to the lower jaw. Pain occurs or worsens in recumbent position and front bend, especially after a meal; sleep is often disturbed. Pain may be worsened by concomitant esophageal spasm. Esophageal spasm often develops without underlying reflux esophagitis. In this case, pain occurs when eating, especially very hot or very cold food. Pain radiates to the back and passes after taking nitrates. Pain from gallstones can be referred to the lower chest as well as the shoulder. Post-prandial chest discomfort, especially if associated with radiation to the back or abdomen and accompanied by nausea, is suggestive of gallbladder disease.

In case of suspected esophageal disease, gastroenterology referral is indicated.

H. Spinal diseases

Chest pain is frequently caused by osteochondrosis (including hernias of intervertebral discs, especially those of cervical spine) and osteoarthritis of cervical and thoracic spine. Pain in spinal disease

is described as dull and gnawing, may be located in any area of the chest, including sternal area, and worsens during strain, movements and deep breathing.

In case of suspected spinal disease, patient should be referred to neurologist and other specialists, as necessary.

I. Psychogenic pain

Psychogenic pain is typically located in the cardiac area and usually does not radiate. The pain is prolonged, jabbing or pressing. Although resembling angina, it lasts significantly longer—several hours or even days. Pain occurs during exhaustion and agitation. Concomitant symptoms include dyspnea, weakness, and palpitations. Chest pain caused by anxiety or emotional stress most commonly occurs in healthy young men or women, but it can occur at any age.

In case of suspected psychogenic pain, patient should be referred to neurologist or psychiatrist, as necessary.

J. Chest pain in the elderly

In elderly people, chest pain is primarily caused by cardiovascular disease. Approximately 20% of males and 12% of females over 65 suffer from IHD. There is a dramatic increase in MI morbidity with age.

In elderly patients complaining of chest pain, angina pectoris and myocardial infarction should be considered first. Pain may be also caused by

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herpes zoster, fractured ribs, pleurisy, malignant neoplasm, pulmonary thromboembolism, reflux esophagitis, etc.

Drug treatment recommendations:

- in IHD, nifedipine is usually combined with a beta-adrenergic blocker

- in vasomotor angina, nitrates and calcium antagonists should be administered (beta-adrenergic blockers are not indicated)

- combined treatment with beta-adrenergic blockers and verapamil should be administered with caution

- administration of long-acting nitrates with doses separated by equal time intervals (to maintain constant blood concentration throughout the day) should be avoided, because it leads to nitrate addiction

- patients should be warned of nitroglycerin side effects, particularly headache and blood pressure decrease.

Before administering nitroglycerin, patients should be told the following:

- first nitroglycerin dose is recommended to be taken when sitting
-

- nitroglycerin tablets contain 0.15 to 0.6 mg of the drug; for initial use, low dose tablets are preferable

- if pain does not respond to the first tablet, then one tablet every 5 minutes (but no more than 3 tablets at a time) may be taken

- in case the pain does not respond to 3 nitroglycerin tablets, the physician should be called immediately

- tablets should be stored in a cool, dry place; once opened, the bottle should be replaced every 3 months when stored at home, or every 3 days when kept in the pocket

K. Chest pain in disorders of muscles, bones and joints

Patient history and physical examination usually provide sufficient information for identifying disorders of muscles, bones, and joints. For instance, pain may be often caused by fractured ribs. Chest pain may also be seen in spondylarthropathies. Muscular chest pain is the most frequent diagnosis in active young men and women (25-65 years old). The pain is the result of overuse of chest wall muscles and a resulting strain within a muscle body or at its insertion site. The characteristic physical examination finding is tenderness to palpation of the chest wall muscles. In many cases, palpation of the affected muscle reproduces the chest pain experienced by the patient. When this occurs, the diag-

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nosis is clear and no additional testing is necessary.

Pain may be either sharp and sudden or prolonged and gnawing; it may be worsened by deep breathing, coughing, or sneezing.

Conservative treatment with analgesics and both oral and topical NSAIDs must be administered. In very severe pain, injections of local anesthetics and corticosteroids into the affected area are indicated. Injections into the chest wall should be done with extreme caution to avoid injuring parietal pleura. Special elastic bandage proved to be effective (it relieves pain significantly without hampering respiration).

Costochondral inflammation

Costochondral inflammation is characterized by jabbing, unilateral, mild to moderate pain radiating to the back and abdomen and worsened by deep breathing and physical exertion; pain is influenced by change of posture. Costochondral inflammation occurs as a result of acute viral respiratory infection or physical overexertion and lasts up to several months. Tenderness of the area of sternocostal joints is typically seen.

Differential diagnosis includes Tietze's syndrome, which is characterized by the thickening of costal cartilages. Costochondral inflammation is most often diagnosed in women (25-44 years old) The pain is thought to be due to inflammation of the 3rd or 4th left costochondral junction. Suggestive

history includes pain with use of chest wall muscles. In addition, the pain may occur at rest or with deep inspiration, and there is usually no history of recent trauma or muscular exertion. The characteristic physical finding is tenderness to palpation over a costochondral junction. If the patient has tried them, anti-inflammatory agents have often provided relief.

Costochondral inflammation may also be seen in spondylarthropathies.

Back pain

Back pain is usually caused by spinal disease; osteoarthritis affecting costovertebral articulations is among the most common causes. These joints may be affected, particularly during sternotomy with wound edges spread wide apart. Pain caused by spinal disease may migrate frontward and downward.

Acute back pain is a rare occurrence and may be caused by spinal fracture or severe vascular or visceral disease. Other causes include intervertebral disc hernias and penetrating gastric or duodenal ulcer.

Treatment: if no osteoporosis and acute inflammation are present and if the patient is not receiving anticoagulants, chiropractic may be administered.

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L. Chest Pain in Children

Although chest pain is a common occurrence in teenagers, it rarely indicates severe disease. Mean age of children complaining of chest pain is 12.

In a number of cases, pain cause remains unknown, because it is mostly psychogenic in nature.

Other causes of pain include: disorders of chest wall muscles, bones and joints; hyperventilation syndrome, bronchial asthma; pain caused by bad cough; chest, back and upper arm traumatism occurring during games or sports.

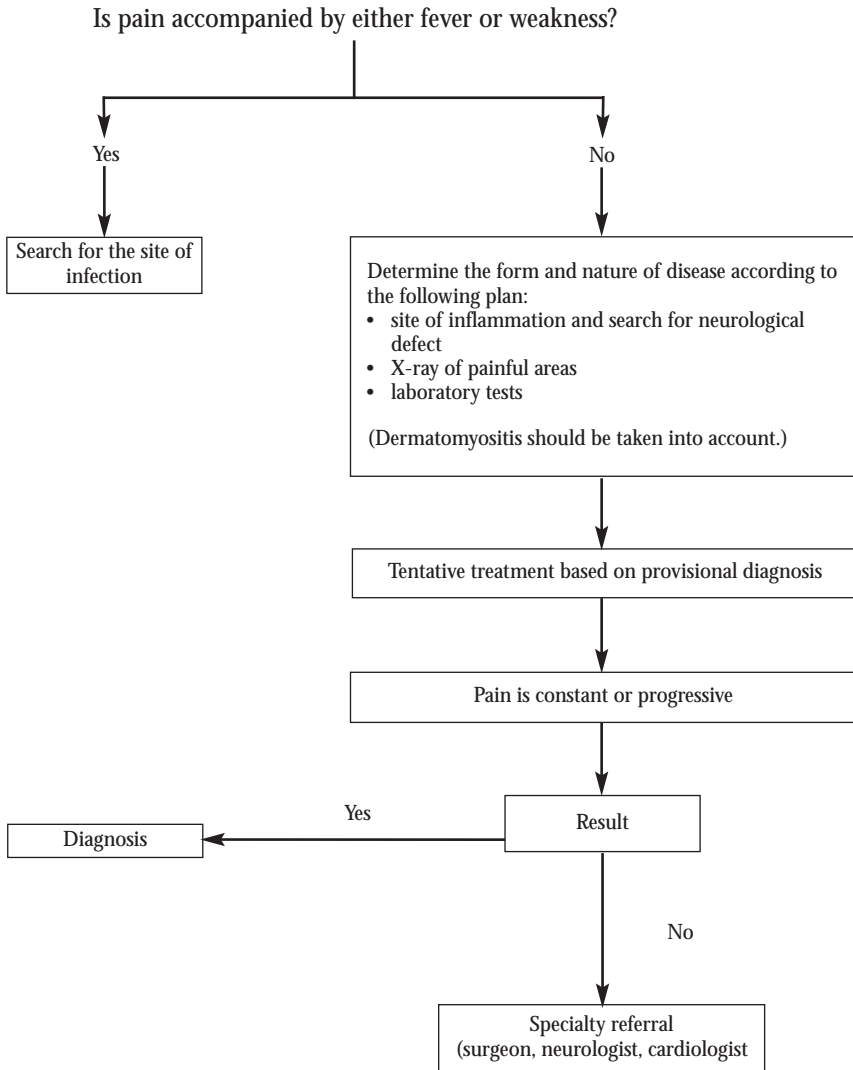
In teenage girls, breast disorders should be ruled out.

In children, lung disease (pneumonia, bronchial asthma, recurrent bronchitis) and heart disease should be ruled out. In teenagers, chest pain is often psychogenic.

Causes of chest pain in children:

Unknown	21%
Disorders of muscles, bones and joints	16%
Cough	10%
Costochondral inflammation	9%
Psychogenic pain	9%
Bronchial asthma	7%
Traumatism	5%
Pneumonia	4%

ALGORITHM OF DIAGNOSIS AND TREATMENT OF PAIN SYNDROME
(CHEST PAIN)



Chest Pain

Gastrointestinal disease	4%
Cardiovascular disease	4%

Myocardial ischemia

Myocardial ischemia is an extremely rare occurrence in children. It may be caused by coronary dystopia or microcirculation disorders, *e.g.*, in diabetes mellitus and sickle cell anemia.

Pain caused by myocardial ischemia should be differentiated from squeezing pain in the chest and left hypochondrium caused by contraction of splenic capsule (it is a common occurrence, especially in unexercised children after a long-distance race).

7. Protocol for providing qualified primary health care (examples)

A) Patient G.B., 56 years old, male
Patient presents with severe left-sided chest pain. Pain occurred 2 hours ago, during hard physical work. Pain is influenced by breathing (worsened by deep inspiration). Pain does not radiate to other areas and is not influenced by movements.

Patient has history of hypertension over the last 10 years (varying within a range of 140/80 to 150/90 mmHg).

Physical examination reveals the following:

No breathing movement on the left side of the chest. Palpation is painless. Respiration rate - 22/min. *Auscultation:* absence of breath sounds in the upper left third of the chest; accentuated respiration on the left side. *Percussion:* bandbox resonance over the upper left third of the chest; vesicular resonance over the left side.

Heart: sounds are somewhat faint, heart rate—86 beats/min, BP - 145/85.

Abdomen is painless and soft on palpation. CNS examination reveals no abnormalities.

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ECG: sinus rhythm, 86/min, signs of left ventricular hypertrophy.

Based on the above findings, provisional diagnosis of spontaneous pneumothorax was made. *Patient was injected an analgesic and hospitalized in the department of thoracic surgery, where the provisional diagnosis was confirmed.*

B) Patient V.A., 71 years old, female
Patient presents with severe left-sided chest pain. Pain occurred 3 days ago and worsened gradually. She ascribes her illness to common cold.

Aside from increase in severity, the pain became constant with time and was influenced by breathing, movements and change of body position in bed.

She had myocardial infarction 7 years ago, followed by 2-3 transient angina episodes. She also had surgery for cholelithiasis (6 years ago).

Physical examination reveals the following:

Breathing movements appear to be symmetrical. Palpation reveals tenderness in 4th-5th intercostal spaces and along the scapular line.

Lungs: vesicular respiration on auscultation, vesicular resonance on percussion.

Heart: sounds are slightly faint, regular; heart rate—82/min; BP - 140/80.

Abdomen is soft and painless on palpation. CNS examination reveals no abnormalities.

ECG: sinus rhythm, 82/min. Signs of posterior wall cicatrisation without evidence of ongoing changes.

Diagnosis of intercostal neuralgia was made as evidenced by gradual development and worsening of pain, correlation to movements, as well as the absence of ECG changes. *Patient was injected an analgesic. Neurologist's examination was provided and resulted in confirmation of diagnosis; appropriate treatment was administered.*

C) Patient S.G., 67 years old, male
Patient presents with severe left-sided chest pain. He notes that similar pain associated with physical exertion and emotional stress has occurred periodically (but not frequently) over the last 8 years. He visited his physician, who referred him to a cardiologist; the resulting diagnosis was "IHD, angina of effort, functional category I-II".

Current episode of pain was related to the fact that this day the elevator was out of order and the patient had to climb the stairs to the 8th floor. When he reached the 5th floor, he suddenly felt acute pain in sternal area, which was stinging and squeezing in nature and radiated to the left forearm.

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Pain did not pass even after he had stopped to rest and used two nitroglycerin tablets with a short interval. Nitroglycerin relieved the pain to some extent so he was able to get home. However, the pain worsened again and did not respond to repeated nitroglycerin doses. Relatives called emergency medical service.

Physical examination reveals the following:

Breathing movements appear to be symmetrical (respiration rate - 18 breaths per minute). Lung auscultation reveals vesicular respiration.

Heart: sounds are somewhat faint, heart rate—90/min, BP—130/80.

Abdomen is soft and painless on palpation. CNS examination reveals no abnormality.

ECG: sinus rhythm, 90/min. Marked anterior and cupular hypoxia (prominent coronary T-waves).

Patient was injected analgesics, promedol I.M.

2% —1.0, as well as heparin I.V. 10,000 U.

Differential diagnosis was performed considering exertional angina, progressive unstable angina, and acute myocardial infarction. Provisional diagnosis was made to be “progressive unstable angina”.

Based on the above findings, patient was hospitalized in the intensive care unit, where, after additional studies, diagnosis was made to be “IHD, progressive unstable angina”. The patient was suggested

to have his district therapist attend him after discharge.

Had the district therapist administered early maintenance treatment and educated the patient on specific topics of his disease, this episode would have been avoided.

D) Patient S.M., 39 years old, male
Patient presents with anterior chest wall pain, which occurred 10 hours ago. Pain is constant, limited to the above-mentioned area, and not influenced by breathing (deep inspiration is troublesome). In addition, patient complains of fever (38-39°C). He has history of periodic episodes of pain (every 2-3 months) with fever over the last 7-8 years. However, this particular type of pain occurs for the first time.

Physical examination reveals the following:
Breathing movements appear to be symmetrical, but shallow; abdominal participation is seen. Lung auscultation reveals faint vesicular respiration; respiration rate—25/min.

Heart: sounds are clear and regular; heart rate - 110/min; BP—120/80.

Abdomen is soft and painless on palpation. CNS examination reveals no abnormalities.

ECG: sinus tachycardia (110/min), no specific ECG changes.

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Differential diagnosis was performed between pneumonia/IHD (angina? infarction?) and familial Mediterranean fever (thoracic form); symptomatic treatment was administered, and diagnosis was made to be “familial Mediterranean fever, thoracic form”.

A day later, after having temperature decreased and pain relieved, physician referred the patient to appropriate specialists and arranged for necessary laboratory testing, which confirmed the presence of collagenosis; patient was administered appropriate treatment under his physician's supervision.

E) Patient S.L., 58 years old, male
Patient presents with severe retrosternal-epigastric chest pain.

Pain had a sudden onset, which occurred 3 hours ago. Pain was initially intermittent, but over the last 1.5 hours it became constant, without radiating to other areas. Pain was accompanied by anxiety, nausea, vomiting, and diaphoresis (clammy sweat). Patient has history of chronic gastritis (over last 6-7 years); however, because the disease caused little or no discomfort, he has never been tested and treated.

Before calling his physician, the patient took an analgesic (sedalgine) and nitroglycerin, which gave no relief.

Physical examination reveals the following:

Patient is restless; skin and visible mucosa are pale; clammy sweat is observed.

Tongue is clear, somewhat dry. Abdomen is soft; abdominal palpation is slightly tender in the epigastric area. Blumberg's sign is negative. CNS examination reveals no abnormality.

Breathing movements appear to be symmetrical; respiration rate - 22/min.

Heart: sounds are somewhat faint; heart rate—92 beats/min; BP—125/80.

ECG: sinus rhythm, 92 beats/min. Acute inferoposterior myocardial infarction, injury phase.

Diagnosis: "Acute myocardial infarction".

Patient was injected an analgesic (promedol I.M. 2%—1.0).

Emergency medical service was called and the patient was hospitalized in CPR unit.

F) Patient M.Z., 38 years old, female
Previously healthy, presents with sudden chest pain, fever and dyspnea at rest.

She notes that during the last 3 days her right calf muscles grew swollen and became painful. She believes herself to have no illness except mild smoker's bronchitis (she smokes one pack of ciga-

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rettes a day). She does not take any medication apart from oral contraceptives.

Physical examination reveals the following:

Breathing movements appear to be symmetrical (respiration rates—18 breaths per minute). Lung auscultation reveals vesicular respiration.

Heart: sounds are obtuse, heart rate—86 beats/ min, BP—130/80.

Abdomen is soft and painless on palpation. CNS examination reveals no abnormality.

ECG: sinus rhythm, 86/min, no specific ECG changes.

Provisional diagnosis: “Deep vein thrombosis, pulmonary thromboembolism”.

Patient was referred to pulmonologist and then hospitalized. Additional testing in the hospital confirmed the diagnosis.

G) Patient A.A., 50 years old, male
Patient presents with squeezing chest pain and nausea. Pain occurred approximately an hour ago. He has no history of such a pain, and before this episode had believed himself to be in good health.

Physical examination reveals the following:

Patient is anxious, with pale skin and clammy sweat. Tongue is clear and somewhat dry.

Abdomen is soft and painless on palpation. Blumberg's sign is negative. CNS examination reveals no abnormalities.

Breathing movements appear to be symmetrical; respiration rate—22/min. Auscultation reveals moist rales in the lower fields of both lungs.

Heart: sounds are obtuse, pulse—72/min, BP—110/70.

ECG: sinus rhythm—72/min. Report: Acute anterior myocardial infarction, injury phase.

Diagnosis: “Acute anterior myocardial infarction.

Patient was injected an analgesic (promedol I.M. 2%—1.0).

EMS was called, and patient was hospitalized in CPR unit.

H) Patient B.K., 40 years old, male Patient presents with retrosternal pain, dyspnea during physical exertion, orthopnea. He had two short-lasting syncopes over the last year. Five years ago “cardiac murmur” was occasionally identified during a routine examination; however, further testing was not performed. Patient appears to be restless.

Physical examination reveals the following:
Tongue is clear and somewhat dry. Abdomen is

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soft and painless on palpation; hepatomegaly is identified. Blumberg's sign is negative. CNS examination reveals no abnormalities.

Breathing movements appear to be symmetrical; vesicular respiration is heard on auscultation. Percussion reveals vesicular resonance. Shins are edematous.

Cardiovascular system: Heart is not enlarged on percussion; apex beat is hyperdynamic. In the left intercostal space near the sternal edge, a scratching systolic murmur is heard, being accompanied by thrill. Aortic component of sound is decreased. Pulse—90 beats/min, regular; blood pressure—130/90 mmHg.

The most likely diagnosis: “Aortic stenosis”.

Care (symptomatic treatment) is provided; patient is hospitalized in cardiology department. Clearly, negligence of primary health care physician resulted in late diagnosis and complications.

8. Education of patients and their families

Education of patients and their families is aimed to provide them with easy-to-understand information to ensure that they have adequate knowledge to be able to prevent diseases that may cause chest pain.

Prevention topics should be discussed with patients and their family members.

Prevention is particularly important in case of genetic predisposition to IHD.

Preventive measures are aimed to eliminate risk factors for IHD:

- smoking cessation,

- weight reduction,

- diet low in animal fats,

- treatment of hypertension and diabetes mellitus.

General recommendations:

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- Patients should be informed about the effectiveness of early IHD treatment and the need to adhere to physician's recommendations.
- Risk factors for atherosclerosis should be identified.
- Physical exercises program should be recommended, with intensity depending on angina severity.
- In patients subject to significant emotional exertion and prone to social conflicts, psychotherapy should be administered.
- Patients should be educated on how to prevent angina episodes in daily life.
- Very strict limitations are to be avoided, because they may deteriorate patient's quality of life.

Assessment of effectiveness of patient education:

- evidence of appropriate behavior
- evaluation of quality of life, emotional adjustment, identification of barriers to active lifestyle
- awareness
- evaluation of health profile

9. Conditions Necessary for Provision of Preventive Services

9.1. PERSONNEL

Personnel for diagnosis and management of chest pain: primary health care physicians (family physicians, district therapists and district pediatricians), as well as nurses (family nurses, district therapists and pediatric nurses) are needed.

9.1.1. Specialty referral:

Primary health care physicians should refer their patients to cardiologists, neurologists, surgeons, and endocrinologists, as outlined in this clinical practice guideline.

9.2. PHARMACEUTICALS

For detailed treatment of chest pain in various pathologies, refer to the chapter describing the process of care.

9.3. EQUIPMENT

Equipment employed in management of patients with chest pain is not sophisticated and may be routinely used by primary health care providers. It is described in this clinical practice guideline.

10. Assessment of the Impact of the Application of Clinical Practice Guideline (pre- and post-testing examples)

10.1. PRE-TESTING

1. All of the following are incorporated into the concept of unstable angina except:
 - a) exertional angina of recent occurrence (usually within last 4-8 weeks)
 - b) progressive angina
 - c) resting angina
 - d) chronic stable angina

2. All of the pharmaceuticals listed below are effective in treating unstable angina and MI except:
 - a) aspirin
 - b) nitroglycerin
 - c) heparin
 - d) calcium channel blockers
 - e) β -blockers

3. All of the following statements regarding use of the most frequently tested cardiac markers for differential diagnosis of chest pain in the intensive care unit are correct except:
 - a) myoglobin is a serum marker, which demonstrates earliest elevation accompany-

- ing onset of acute MI
- b) troponin is a serum marker demonstrating high sensitivity in identifying patients with unstable angina and providing a possibility of detecting myocardial injury within one week of developing acute MI
 - c) “cardiospecific” CPK isoenzyme contains both M and B subunits
 - d) serum CPK activity may be determined both by electrophoretic and immunological methods; the latter are less sensitive
4. Of which of the following conditions pulmonary embolism is least characteristic?
- a) heart disease
 - b) malignant neoplasms
 - c) age over 70
 - d) estrogen treatment
 - e) immobilization
5. The most frequent radiographic finding in patients with pulmonary embolism is:
- a) elevation of diaphragmatic cupola
 - b) local infiltrates
 - c) cuneate pulmonary infarction
 - d) pleural effusion
 - e) normal roentgenogram
6. All of the statements below are pertinent to chest pain, which may be caused both by esophageal and heart disease, except:
- a) nitroglycerin and calcium channel blockers may relieve chest pain

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- b) chest pain may be provoked by physical exertion
 - c) chest pain may be relieved by discontinuing exertion
 - d) ECG may reveal ST-segment changes
 - e) change of posture may provoke pain
7. Which of the factors below is NOT a risk factor for coronary artery disease?
- a) Cholesterol-LDL of 140 mg/dL
 - b) Two cans of beer a day
 - c) One pack of cigarettes a day
 - d) Cholesterol-HDL of 20 mg/dL
 - e) Blood pressure of 140/90 mmHg
8. Pain in dry pleurisy:
- a) is sharpened by ill-side bend
 - b) is sharpened by healthy-side bend
 - c) is sharpened equally by ill- and healthy-side bend
 - d) does not influenced by side bends

10.2. POST-TESTING

Case report #1

A 48-year-old woman comes to her family physician's office complaining of chest pain. Pain is pressing in nature, is located retrosternally, and radiates to left blade bone and left shoulder. Pain occurs without any visible cause, lasts 5-10 minutes, is accompanied by anxiety and fear of death, and passes spontaneously without any treatment. Patient notes that pain episodes occur primarily in the nighttime, disturbing her sleep.

The patient has history of 2nd degree chronic obstructive pulmonary disease. The only harmful habit is smoking.

Patient is of normosthenic constitution, body mass index - 24. Blood pressure - 145/95 mmHg, P3/4 - 70. Cardiac boundaries within the normal range, heart sounds are clear. Lung auscultation reveals dry whistling and humming rales. Ophthalmoscopy does not reveal any abnormality. ECG taken during the pain episode reveals ST-segment elevation.

1. Select the most likely diagnosis:
 - a) angina of effort
 - b) mitral valve prolapse
 - c) Prinzmetal's angina
 - d) herpes zoster

2. Identify the incorrect statement:
 - a) Episodes of Prinzmetal's angina are caused by epicardial vascular spasm;
 - b) Provoking factors for Prinzmetal's angina include physical exertion;
 - c) Attacks of Prinzmetal's angina occur at the same time of the day;
 - d) Attacks of Prinzmetal's angina are accompanied by ventricular arrhythmia.

3. What is the appropriate drug combination to be administered to such patient?
 - a) nitroglycerin + captopril + propranolol

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- b) nitroglycerin + enalapril + atenolol
 - c) nitroglycerin + nifedipine
 - d) nitroglycerin + verapamil + atenolol
4. Which factor does NOT cause Prinzmetal's angina?
- a) Alcohol use
 - b) Smoking
 - c) Pulmonary hyperventilation
 - d) Abdominal palpation
5. Which lipoprotein fraction is believed to be anti-atherogenic?
- a) Low density
 - b) Very low density
 - c) High density

Answers

1. (c) In this case, the most likely diagnosis is Prinzmetal's angina as evidenced by sudden onset of episodes, especially in the nighttime and without any visible cause. Occurrence of the angina of effort is associated with physical exertion, which is not the case for this patient. Pain caused by mitral valve prolapse is pricking, without specific radiation, long-lasting, and resistant to sublingual nitroglycerin administration; it occurs both with and without physical exertion. Early herpes zoster infection may mimic angina episode, especially when accompanied by the left-sided chest pain. Occurrence of herpetic rash allows diagnosis of angina to be ruled out.

2. **(b)** Prinzmetal's angina is a variety of rest angina characterized by the absence of specific association with physical exertion. Night episodes are the most typical sign of Prinzmetal's angina; in fact, patients often note that they are started from sleep by the pain. Patients suffering from this type of angina may tolerate hard and long physical exertion without developing episode of angina. All other statements are correct.

3. **(c)** In this case, combined administration of nitroglycerin and nifedipine is most effective, because strong vasodilative action of nifedipine makes it effective in Prinzmetal's angina. Administration of ACE inhibitors (captopril, enalapril) is inappropriate, because the patient has chronic obstructive pulmonary disease (COPD) that may be complicated by bronchospasm caused by bradykinin accumulation resulting from administration of ACE inhibitors. As propranolol is a beta-adrenergic blocker, selectively blocking beta₂-adrenoceptors, propranolol administration may also lead to bronchospasm in a patient with COPD. Although atenolol is cardioselective beta-blocker, its administration is also to be avoided.

4. **(d)** Among the factors listed, only abdominal palpation cannot cause an episode of Prinzmetal's angina.

5. **(d)** High density lipoproteins are referred to as anti-atherogenic, because they bind cholesterol and transport it to the liver, where it is metabo-

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lized and eliminated with the bile through gastrointestinal tract.

Case report #2

A 35-year-old woman comes to her family physician's office complaining of chest pain. Pain is constant, dull, pressing in nature, located in the left side of the chest, spreading over the anterior surface of the chest, and radiating to the left breast. Pain is worsened by deep breathing and coughing.

Medical history reveals that 2 months ago the patient came through an acute laryngotracheobronchitis, which was manifested by high fever, myalgia, and consumptive cough. The latter was initially dry, and then became productive with mucopurulent sputum. Patient reports that all these manifestations passed, but the cough has remained.

The woman has asthenic constitution; height—165 cm; weight—67 kg. Skin and visible mucosa are pale.

Chest palpation over 2nd and 3rd sternocostal articulations reveals tender nodes. Breast palpation reveals no abnormality. Lung auscultation, palpation and percussion reveal no abnormality. Cardiac boundaries are within the normal ranges. Abdomen is soft and painless. Blood pressure - 125/85 mmHg; pulse—75.

1. Select the best diagnostic option:
 - a) intercostal neuralgia
 - b) Tietze's syndrome
 - c) angina pectoris
 - d) infective pericarditis

2. Select the most appropriate examination procedure:
 - a) Chest X-ray
 - b) ECG
 - c) Echocardiography
 - d) Mammography

3. In case of this patient, chest X-ray is likely to reveal:
 - a) foci of calcification in sternocostal articulations
 - b) rib injuries with high-density destruction foci
 - c) increased size of cardiac shadow

4. In case of this patient, ECG is likely to reveal:
 - a) decreased amplitude of waves
 - b) flat ST-segment depression below the isoelectric line or elevation above the isoelectric line
 - c) no changes

5. Select the most effective treatment:
 - a) antibiotic therapy
 - b) nonsteroidal anti-inflammatory drugs
 - c) corticosteroids

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Answers

1. **(b)** In this case, the most likely diagnosis is Tietze's syndrome. Tietze's syndrome is a fairly common pathology, with chest pain as the main or only symptom. Pain is often unilateral, and rarely, bilateral, spreading over the anterior chest wall and radiating to the breasts. Pain may be constant, dull, and pressing; or it may be sharp and intermittent. Development of Tietze's syndrome may be precipitated by pathologies accompanied by violent cough. Probably, it may be associated with continuous traumatization of sternocostal articulations, which is the most common occurrence in the area of 2nd and 3rd sterno-costal joints.

2. **(a)** The correct answer is chest X-ray, which may reveal possible calcification of sternocostal articulations. If no calcification occurs, X-ray will not reveal any changes because of roentgen-negativity of cartilaginous tissue.

3. **(a)** Chest X-ray would reveal calcification of sternocostal articulations.

4. **(c)** ECG would not reveal any specific change.

5. **(c)** This patient would benefit most from the administration of topical corticosteroids.

Case report #3

A 42-year-old man comes to his family physician's office complaining of burning retrosternal pain, shortness of breath related to physical exertion, and 2 episodes of syncope over the last week.

Patient has suffered from type II diabetes for 10 years and has received insulin therapy for the last 2 years. He has history of rheumatism. He has normosthenic constitution; body mass index—29.

Examination reveals paleness of skin and visible mucosa and no edema. Cardiac boundaries are within the normal range. Apex beat is hyperdynamic, but not ectopic. Cardiac auscultation reveals decreased 2nd tone over the aortic valve auscultation point and the sternal angle; over the carotid artery, rough systolic murmur is heard. BP—90/65 mmHg; pulse-70 beats/min, weak.

Abdomen is soft and painless on palpation; liver is not palpable.

1. Select the most likely diagnosis:
 - a) aortic stenosis
 - b) defect of interventricular septum
 - c) mitral valve disease
 - d) aortic atherosclerosis

2. Aortic stenosis is characterized by:
 - a) systolic thrill
 - b) Morgani-Adams-Stokes syndrome
 - c) Pancoast syndrome

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3. ECG is likely to reveal:
 - a) S1 R111 , RV1 V2, SV5 V6
 - b) R1 S111 , RV5 V6, SV1 V2
 - c) “P— mitrale”

4. The most likely cause of angina is:
 - a) coronary spasm
 - b) decreased stroke volume
 - c) coronary atherosclerosis

5. What is the best therapeutic option?
 - a) Conservative treatment with beta-adrenergic blockers and cardiac glycosides
 - b) Balloon valvuloplasty
 - c) Either mechanical prosthetic valve replacement or homograft implantation

Answers

1. **(a)** In this case, the most likely diagnosis is aortic stenosis as evidenced by the following:
 - presence of classic triad of aortic stenosis: angina, syncope and dyspnea during physical exertion;

 - rough systolic murmur radiating to carotid arteries;

 - low systolic and diastolic blood pressure readings;

 - pulsus parvus.

2. **(a)** Aortic stenosis is characterized by pronounced systolic thrill, which may be felt by placing the palm over the area of projection of manubrium sterni.

3. **(b)** R1 S111, RV5 V6, SV1 V2 are signs of left ventricular hypertrophy. In aortic stenosis, left ventricular hypertrophy rapidly develops, but ventricular function remains intact for a long period of time; in pronounced stenosis, however, the ailment is rapidly complicated by heart failure. S1 R111, RV1 V2, SV5 V6 are signs of right ventricular hypertrophy. “P-mitrale” is an ECG sign characteristic of mitral stenosis and seen as a broad double-humped P-wave in standard limb leads I and II.

4. **(b)** In this case, angina is most likely to be caused by decreased stroke volume leading to disturbed blood supply to myocardium and development of ischemia.

5. **(c)** The most effective surgical method to treat aortic stenosis is mechanical prosthetic valve replacement or homograft implantation. The latter does not require anticoagulant therapy; however, homograft is destroyed after a maximum of ten years.

11. Role of Physician/ Nurse and Other Health Professionals

This guideline was created for primary health care providers with the aim of increasing their understanding of various diseases, and is intended to build up their knowledge of early identification, management, and prevention of those diseases causing chest pain symptoms.

Primary health care physician and nurse should remember that:

- Chest pain is often a warning sign of life-threatening conditions, thus family physician's alert is indispensable.

- Patient assessment should be done according to accepted algorithm as describe in this guideline. Family nurse's actions should be focused on three principal issues:
 - Patient education
 - Family members education
 - Education on self-control

11.1. COOPERATION BETWEEN FAMILY PHYSICIANS AND OTHER SPECIALTIES (CARDIOLOGISTS, NEUROLOGISTS, SURGEONS, ENDOCRINOLOGISTS, ETC.)

Cases requiring specialty referral:

- Suspected myocardial infarction.

- Complications of myocardial infarction requiring emergency transfer to cardiology department:

 - left ventricular aneurysm,
 - life-threatening arrhythmias resistant to treatment,
 - cardiogenic shock.

- Angina pectoris:

 - post-infarction,
 - unstable,
 - resistant to drug treatment,
 - prolonged attack (more than 15 min), not responding to nitroglycerine - emergency hospitalization is indicated.

- Pulmonary thromboembolism, aortic dissection, pneumothorax, or other life-threatening condition (after having provided emergency care, e.g. pleural puncture).

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