Revista da
SOCESP
Sociedade de Cardiologia do Estado de São Paulo

CHEST PAIN IN THE EMERGENCY ROOM: WHO IS LEFT AND WHO CAN BE RELEASED?

DOR TORÁCICA NA SALA DE EMERGÊNCIA: QUEM FICA E QUEM PODE SER LIBERADO?

Elizabete Silva dos Santos[1]
Ari Timerman[1]

1. Dante Pazzanese Institute of Cardiology, São Paulo, SP, Brazil

Correspondence:
Elizabete Silva dos Santos
Av. Dr. Dante Pazzanese, 500
Vila Mariana. São Paulo, SP, Brasil
elizabsantos43@gmail.co

Received on 07/16/2018,
Accepted on 08/29/2018

ABSTRACT

Acute chest pain is a frequent symptom in emergency units, being a possible warning sign of diseases with an imminent risk of death. Since most of these patients are hospitalized to evaluate possible acute coronary syndrome, this generates a very high hospital cost per patient. Because of this diagnostic possibility, emergency professionals admit most patients. In contrast, the inappropriate release of those with acute myocardial infarction poses a risk to the physician and, especially, the patient. Another important point is the delay in care, where there is an influence of patient-related factors, as well as negative points in the logistics of care in the emergency services in our country. For excellence in care, a detailed anamnesis added to the examination is important, allowing the elaboration of diagnostic hypotheses. Moreover, to assist physicians in selecting the diagnostic hypothesis and making fast decisions, there are risk scores that easily identify the likelihood of adverse events. The immediate management of cases with an imminent risk of death is the main objective to reduce morbidity and mortality and, consequently, increase the safety of emergency professionals. Flowcharts and algorithm suggestions targeting patients in the emergency room objectively define who stays and who can be released.

Keywords: Chest Pain; Diagnosis, Differential; Emergencies; Angina Unstable; Myocardial Infarction.

RESUMO

A dor torácica aguda é um sintoma muito frequente nas unidades de emergência, constituindo-se em um possível sinal de alerta para as doenças com risco iminente de morte. Como a maioria desses pacientes é internada para avaliação de uma possível síndrome coronariana aguda, isso gera um custo hospitalar muito alto por paciente. Por conta dessa possibilidade diagnóstica, muitos emergencistas internam a maioria dos pacientes. Por outro lado, a liberação inapropriada daqueles com infarto agudo do miocárdio representa um risco para o médico e, especialmente, para o paciente. Outro ponto importante é a demora para o atendimento, em que há a influência de fatores relacionados ao paciente, assim como, pontos negativos na logística de atendimento dos serviços de emergência em nosso país. Para excelência no atendimento, é importante uma anamnese detalhada adicionada ao exame físico, a qual permite a elaboração das hipóteses diagnósticas. E para auxiliar os médicos na escolha da hipótese diagnóstica e na tomada rápida de decisão, escores de risco são disponibilizados, os quais, facilmente, identificam a probabilidade de eventos adversos. A conduta imediata de casos com risco de morte imediata tem como principal objetivo reduzir a morbidade e a mortalidade, aumentando, consequentemente, a segurança do profissional da emergência. Sugestões de fluxogramas e algoritmos para o atendimento desses pacientes na sala de emergência definem, de forma objetiva, quem fica e quem pode ser liberado.

Descritores: *Dor Torácica; Diagnóstico Diferencial; Emergências; Angina Instável; Infarto Agudo do Miocárdio.*

INTRODUCTION

Chest pain, a major challenge for emergency physicians owing to the wide list of related differential diagnoses,[1] accounts for around 5–10% of emergency room consultations. Acute coronary syndrome (ACS) is responsible for almost 20% of cases involving chest pain, and 2–10% of patients with this diagnosis are inappropriately discharged and may have unfavorable clinical outcomes. Thus, it is important to provide systematic care using flowcharts and algorithms to achieve high diagnostic accuracy, with the main objective of recognizing and treating the most serious diseases with imminent risk of death, thus avoiding unnecessary hospitalizations and complementary tests in uncomplicated cases.

Several factors contribute to the delay in the care of patients with chest pain in the emergency room and worsen the prognosis. Among them are those attributed to the patient, leading to individual differences in the subjective experience of pain, such as knowing the experience of other patients, genetic contributions to individual differences, interactions between genetic and social factors, psychological factors that influence pain sensitivity, patients not treating symptoms of chest pain seriously, the attribution of symptoms to pre-existing chronic conditions (muscle pain), and a lack of knowledge of the benefits of rapid treatment. It should be noted that only 20% of patients with chest pain and acute myocardial infarction (AMI) seek care in the first 2 hours.

In this context, several factors, such as unavailability of emergency pre-hospital care and delay in care of special groups, like the elderly, females, patients with low socioeconomic class, and black patients, contribute to delays in the care of patients with chest pain and may interfere negatively with the results.

A detailed anamnesis is the basic and most relevant instrument for identifying the cause of chest pain; combined with a physical examination and risk factor analysis, it allows the establishment of diagnostic hypotheses, elucidating the most pertinent complementary tests and avoiding hospital discharge for cases involving an imminent risk of death.

CAUSES OF CHEST PAIN

The five main groups of causes of chest pain in descending order of prevalence are musculoskeletal, gastrointestinal, cardiac, psychiatric, and pulmonary. In addition to ACS, some causes stand out for their fatal characteristics, such as acute aortic dissection, pulmonary thromboembolism (PTE), hypertensive pneumothorax, cardiac tamponade, and esophageal rupture and perforation. Table 1 describes the main causes of chest pain that should be considered in the differential diagnosis according to the information in the patient's clinical history, physical examination, and laboratory data; this constitutes a difficult task for the emergency physician.[2]

DIFFERENTIAL DIAGNOSIS

The accurate characterization of chest pain is essential for the differential diagnosis. The essential characteristics are as follows: symptom onset and duration, quality, location, irradiation, intensity (Figure 1), triggering factors, relief factors, associated symptoms, and evolution over time (Figure 2). Table 2 presents and outlines the characteristics of chest pain of several causes.

Table 1. Main causes of chest pain in the emergency room.

Ischemic heart diseases	Gastrointestinal diseases
Stable angina Unstable angina* AMI with non-ST-segment elevation* AMI with ST-segment elevation*	Peptic ulcer disease Cholelithiasis, cholecystitis Choledocholithiasis, cholangitis Acute and chronic pancreatitis
Non-ischemic heart diseases	**Chest wall diseases**
Acute aortic dissection* Valvar heart disease Hypertrophic cardiomyopathy Pericarditis Myocarditis Stress-induced cardiomyopathy (Takotsubo)	Myalgia Costochondritis, Tietze's syndrome Bone lesions (fractures, metastases) Cervical disc disease Fibromyalgia Herpes-zoster and postherpetic neuralgia
Pleuropulmonary diseases	**Psychiatric diseases**
Pulmonary thromboembolism* Pulmonary hypertension Hypertensive pneumothorax*	Panic crisis, panic disorder Generalized anxiety disorder Depression
Esophageal diseases	
Gastroesophageal reflux disease Esophageal spasm Esophagitis Esophageal rupture and mediastinitis*	

* Diseases with an imminent risk of death.

CHEST PAIN UNITS

Chest pain units, created in the United States in the 1980s, are a standardized operational strategy for the care of patients with chest pain depending on the structure and care characteristics of each institution.

The goals of the chest pain units are:

1. Prioritize the care of patients with chest pain who present to the emergency room and perform timely electrocardiography (ECG);
2. Allow the early identification of life-threatening conditions followed by specific treatment through protocols;
3. Reduce inadvertent discharges and unnecessary hospitalizations; and
4. Reduce hospital costs.

INITIAL APPROACH

As previously reported, the main objective of caring for patients with chest pain is to immediately rule out the causes that potentially imply an imminent risk of death. This initial assessment includes measurements of vital signs, such as heart rate, blood pressure, respiratory rate, and pulse oximetry to identify the presence or absence of hemodynamic instability and/or respiratory failure. Patients who are not at risk of death, in turn, require a detailed pain characterization (Table 3), evaluation of risk factors for coronary artery disease (CAD) (systemic arterial hypertension, diabetes mellitus, dyslipidemia, smoking, obesity, early family

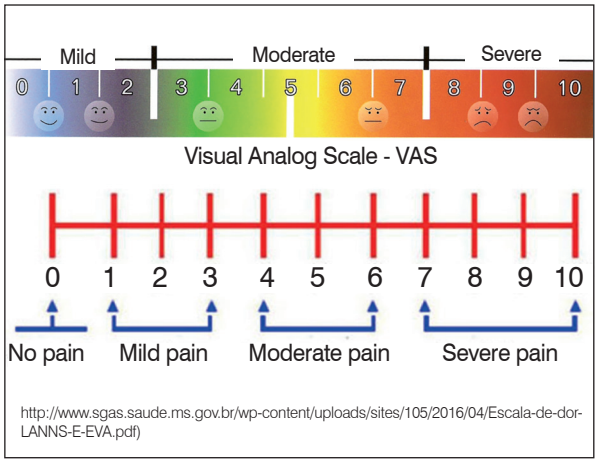

Figure 1. Visual analog scale (VAS).

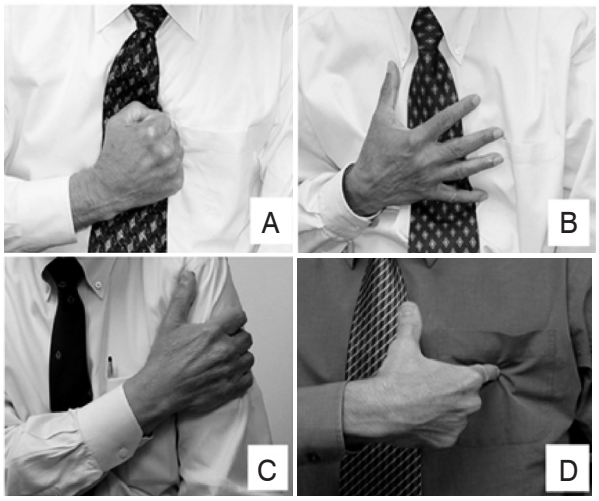

Figure 2. The four most frequent signs experienced by patients with acute chest pain: A, Levine sign; B, palm sign; C, arm sign; D, pointing sign.

history of CAD, history of coronary artery bypass grafting procedure [angioplasty and/or surgery]), and thorough physical examination.

Subsequent complementary exams are suggested. ECG and chest X-rays are fundamental exams, followed by others according to the diagnostic hypotheses.

While still at the start of care, it is very important to identify and classify patients for the probability of chest pain having an ischemic origin:[3]

Type A pain (definitely angina): pain experienced as tightness or burning at rest or triggered by effort or stress, with radiation to the shoulder, jaw, or inner surface of the arm relieved by rest or nitrate. Complementary tests are not necessary for the diagnostic definition.

Type B pain (probably angina): the characteristics of chest pain make coronary insufficiency the main hypothesis; however, complementary tests are necessary for the diagnostic definition.

Type C pain (possibly angina): chest pain whose characteristics do not make coronary insufficiency the main hypothesis (atypical chest pain); however, additional tests are necessary to rule out this hypothesis.

Type D pain (definitely not angina): atypical chest pain, the characteristics of which do not include acute coronary insufficiency in the differential diagnosis.

Similarly, to identify whether patients with acute chest pain in the emergency room have symptoms of ischemic origin, Table 4 shows the probability of signs and symptoms are associated with ACS secondary to obstructive CAD.

Once the initial diagnostic suspicion is established using the clinical history and physical examination, complementary exams are used for diagnostic confirmation and/or risk stratification for short-term adverse events.

RISK STRATIFICATION

The HEART score was developed to assist emergency physicians in choosing the diagnostic hypothesis and deciding the best therapeutic strategy.[4] The HEART score easily identifies the probability of adverse events (death, infarction, urgent myocardial revascularization [angioplasty or surgery]) within 6 months after presentation to help the screening of patients with acute chest pain in the emergency room (Table 5). Patients with scores of 0–3 points have a 1.6% chance of experiencing an adverse event; those with scores of 4–6 have a 13% chance; and those with scores ≥ 7 have a 50% chance. The HEART score allows the immediate identification of patients eligible for discharge without the need for additional testing or invasive procedures.

COMPLEMENTARY EXAMINATIONS

Electrocardiography

ECG should be performed and analyzed within 10 minutes of the first medical contact.[5] Serial ECG trials are needed to increase sensitivity to the presence of ischemic changes as needed.

In the clinical context of ACS, ST-segment elevation, measured from point J, is considered suggestive of acute coronary artery occlusion in the following presentations: presence of ST-segment elevation ≥ 2.5 mm in men under 40 years of age, ≥ 2 mm in men aged ≥ 40 years, or ≥ 1.5 mm in women in V2-V3 derivations and/or ≥ 1 mm in other derivations in the absence of left ventricular hypertrophy or left bundle branch block (Figure 3).[6]

The presence of "new" or "presumed new" left bundle branch block combined with typical symptoms should also be interpreted as AMI due to acute arterial occlusion. The Sgarbossa criteria, which has 90% specificity and 36% sensitivity for the diagnosis of AMI with ST-segment elevation for scores greater than 3 points, are as follows:[7]

ST-segment elevation concordant with QRS ≥ 1 mm = 5 points;

ST-segment depression ≥ 1 mm on V1, V2, or V3 = 3 points; and

ST-segment elevation discordant with QRS ≥ 5 mm = 2 points.

Within the context of ACS, ECG may show ischemic changes such as ST-segment dynamic depression and/or T-wave inversion that would imply an increased risk of cardiovascular complications.[8]

ECG can also be an important tool for the differential diagnosis of the cardiac causes of chest pain and may show findings, such as diffuse ST-segment elevation in pericarditis,

Table 2. Clinical manifestations of the main causes of chest pain.

Disease	Duration	Quality and location	Important aspects
Stable angina	2 to 10 minutes; "crescendo"	Burning or tightening in the retrosternal or precordial region that may radiate to the neck, shoulders or arms	Triggered by physical exercise, emotional stress, exposure to cold and after big meals; may be accompanied by nausea, vomiting, diaphoresis, and dyspnea
Unstable angina	<20 minutes; "crescendo"	Similar to stable angina, but more intense	Onset at rest or with small efforts; worsens with small efforts; may be accompanied by nausea, vomiting, diaphoresis, and dyspnea
Acute myocardial infarction	>30 minutes; "crescendo"; sudden onset	Similar to stable angina but more intense	It often starts at rest without triggering factors; worsens with small efforts; may be accompanied by nausea, vomiting, diaphoresis, dyspnea, and dizziness; signs of heart failure and arrhythmias may be present
Aortic stenosis	2-10 minutes; "crescendo"	Similar to stable angina	Triggered by physical exercise; cardiac auscultation shows systolic murmur over the aortic area with radiation to the carotid arteries
Pericarditis	Hours to days	Acute pleuritic pain in the retrosternal or precordial region which may Radiates to the neck, shoulder, or left arm	Worsens with deep inspiration, cough, and dorsal decubitus; improves in the sitting position with forward inclination; Pericardial friction on physical examination
Myocarditis	Hours to days	Similar to pericarditis but may share common characteristics with acute myocardial infarction	Pericardial friction, heart failure, and ventricular arrhythmias may be present
Acute aortic dissection	Hours; sudden onset	Lacerating pain of strong intensity, usually in the anterior region of the thorax with radiation to the back	Possible migratory pain; may be associated with aortic insufficiency murmur, cardiac tamponade, cerebrovascular accident, and asymmetry of peripheral pulses
Pulmonary embolism	Hours to days; sudden onset	Pleuritic pain in the ipsilateral region of the chest, accompanied by dyspnea	Dyspnea with normal pulmonary auscultation; signs of pulmonary hypertension and right heart failure may be present
Pulmonary hypertension	2-10 minutes	Retrosternal discomfort triggered by effort	May be accompanied by dyspnea, fatigue, and signs of pulmonary hypertension
Pneumonia	Hours to days	Pleuritic pain in the ipsilateral region of the chest	Associated with fever and cough with expectoration; pulmonary auscultation revealing subcrepitant rales and bronchial murmur
Pleuritis	Hours to days	Pleuritic pain in the ipsilateral region of the chest	May be associated with fever; pulmonary auscultation reveals pleural friction
Pneumothorax	Hours; sudden onset	Pleuritic pain in the ipsilateral region of the chest accompanied by dyspnea	Pulmonary auscultation revealing decreased vesicular murmur in the affected hemithorax, associated with tympanic percussion
Gastroesophageal reflux disease	10-60 minutes	Ascending retrosternal burning that may be accompanied by regurgitation	Worsens after big meals and in the dorsal decubitus position; improves with antacids
Esophageal spasm	2-30 minutes	Retrosternal tightness or burning which may radiate to the neck, back or arms; could be similar to angina	Onset usually at rest; can be triggered by swallowing, physical exercise, and emotional stress; improves with nitrates; presence of dysphagia should raise suspicion of esophageal etiology
Esophageal rupture and mediastinitis	Hours; sudden onset	Severe retrosternal pain	It gets worse with swallowing and deep inspiration; associated with symptoms and signs of mediastinitis, such as dyspnea, fever, tachycardia, and hypotension

low voltage, and/or electrical alternation in pericardial effusion, and sinus tachycardia and signs of right ventricular overload of PTE.

Chest Radiography

It is important to note that normal ECG findings significantly reduce the probability of AMI but do not rule out it completely. About 6% of patients who present to an emergency department and have normal ECG findings have AMI,[9] which does not rule out the possibility of the chest pain having a cardiogenic etiology; in such cases, the clinical picture should always prevail. The initial ECG sensitivity for AMI is 45–60% when ST-segment elevation is used as a diagnostic criterion. Thus, 50% of patients with AMI are not diagnosed with a single ECG, requiring the performance of serial ECG trials.

Markers of Myocardial Necrosis

Cardiac muscle necrosis promotes the release of enzymes and structural proteins from myocytes that can be quantified by analyzing the blood of patients with AMI using specific techniques.[10] The main serum markers of myocardial necrosis are myoglobin, creatine kinase isoenzyme MB (CK-MB), CK-MB mass, and troponins I and T.[11] The Brazilian and American guidelines recommend the use of troponins I and T and, if not available, CK-MB mass for the diagnosis of AMI or reinfarction due to its earlier normalization. Therefore, troponins T and I are the most sensitive and specific laboratory markers of myocardial injury. Troponin T has a sensitivity

Table 3. Characteristics of chest pain.

	Typical	Atypical
Characteristics of pain	Constraint Compression Burning Weight Slightly intense and deep	Stabbing, sticking, and pricking sensations Acute worsening when breathing
Pain location	Retrosternal Left shoulder Neck Face, teeth Epigastric interscapular region	Right shoulder Right hemithorax
Triggering factors	Exercise Sexual excitation Stress Cold Big meals	At rest

Table 5. HEART score for patients with chest pain in the emergency room.

History	Strong suspicion	2
	Moderate suspicion	1
	Slight or no suspicion	0
Electrocardiogram findings	Significant ST-segment deviation	2
	Nonspecific changes of ventricular repolarization	1
	Normal	0
Age (years)	>64	2
	46-64	1
	<46	0
Number of risk factors	>2; history of coronary artery disease	2
	1 or 2	1
	None	0
Troponin level	>2 times the limit of normal	2
	Up to 2 times the limit of normal	1
	At or below the limit of normal	0

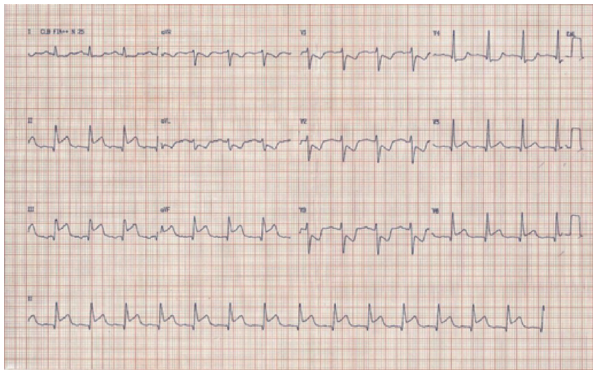

Figure 3. Electrocardiogram of a patient who presented to the emergency room with type A chest pain revealing ST-segment elevation in the inferolateral wall, leading to the diagnosis of acute myocardial infarction with ST-segment elevation and indication of coronary reperfusion therapy.

Table 4. Probability that signs and symptoms are associated with acute coronary syndrome and secondary coronary artery disease.

Characteristic	High	Intermediate	Low
Clinical history	Chest pain/MSE/discomfort similar to previous angina; known history of CAD, including AMI	Chest pain/MSE/discomfort as main symptom; age >70 years; male sex; diabetes mellitus	Ischemic symptoms without any intermediate characteristic
Physical examination	CABG, hypotension, sweating, pulmonary edema, or rales	Extracardiac vascular disease	Chest pain on palpation
Electrocardiogram	Transient ST-segment deviation (≥1 mm) or T-wave inversion in multiple derivations	Q waves; ST-segment depression of 0.5-1 mm or T-wave inversion > 1 mm	T-wave inversion < 1 mm in derivations with R dominant; normal
Myocardial necrosis markers	cTnI, cTnT, or CK-MB elevation	Normal	Normal

of 96.9% and specificity of 94.5% for the diagnosis of AMI. CK-MB mass, in turn, may be an alternative marker when troponins are not available.

Myocardial necrosis markers should be requested in all patients with suspected ACS and repeated at 6–12 hours. The elevation of such markers is not exclusive to cases of AMI; it may also be present in situations that lead to myocardial injury of another nature, such as tachyarrhythmias, myocarditis, heart failure, post-cardiopulmonary resuscitation, chest trauma, pulmonary embolism, and pulmonary hypertension. Table 6 shows the kinetics of myocardial necrosis markers.

Chest radiography is important for the differential diagnosis of chest pain (aortic dissection, PTE, pneumothorax, and pneumomediastinum) and identification of AMI complications (Figure 4).[10] Therefore, it is mainly used in the differential diagnosis of non-ischemic chest pain and may suggest the presence of pneumonia, pneumothorax, pleural effusion, pericardial effusion, pulmonary embolism, and pulmonary hypertension.

Chest CT and coronary CT angiography

Chest CT is a more sensitive and specific test than chest X-ray for the diagnosis of pleural, parenchymal, and pulmonary vasculature diseases and assists in the differential diagnosis of acute aortic dissection, PTE, and pulmonary diseases (pneumothorax, pneumonia) (Figure 5).

Coronary CT angiography can be used to noninvasively evaluate the coronary anatomy through its lumen and parietal analysis, identifying the presence of atherosclerotic plaques and classifying its degree of stenosis.[10] This test has high accuracy in the identification of significant coronary stenosis (≥50%), showing high negative and positive predictive values, and its use is now widespread in Brazil, comprising the screening of patients with acute chest pain in emergency units of reference hospitals in cardiology.[12] Therefore, its use is indicated in emergency units as a diagnostic method in low-risk patients with suspected ACS, as its boasts the advantages of rapid image acquisition and not requiring additional time after risk stratification (Figure 6).

Table 6. Kinetics of myocardial necrosis markers after acute myocardial infarction.

Marker	Start	Peak	Duration
Myoglobin	1-4 hours	6-7 hours	24 hours
CK-MB	3-12 hours	18-24 hours	36-48 hours
Troponin I	3-12 hours	24 hours	5-10 days
Troponin T	3-12 hours	12-48 hours	5-14 days

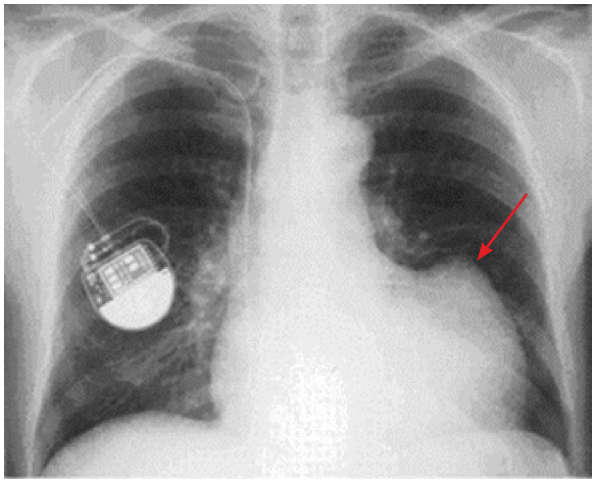

Figure 4. Patient with true left ventricular aneurysm (arrow) secondary to acute myocardial infarction. The patient used a pacemaker.

Echocardiography

Echocardiography is indicated for patients with suspected pericardial effusion, valve diseases, hypertrophic cardiomyopathy, acute aortic dissection (Figure 7), pulmonary embolism, and pulmonary hypertension but is of little value in the emergency room for patients with ACS except in situations in which ischemic changes on ECG are masked, such as in the presence of left bundle branch block or pacemaker rhythm. In these cases, the change in "new" myocardial segment mobility may suggest current AMI.

However, echocardiography can be used in ACS to evaluate the ischemic etiology of chest pain, investigate stress-induced ischemia in patients in whom AMI and ischemia at rest were ruled out, complete prognostic evaluations, and screen for complications of ACS.[13,14]

Exercise Stress Test

Exercise stress tests are recommended in chest pain units as a safe complementary examination in low-risk patients with the aim of investigating stress-induced ischemia. It has important diagnostic and prognostic value.[10] It is a simple, widely available, low cost test with a high negative predictive value (>95%) for adverse cardiac events.[11,13] Therefore, it can be performed in patients with chest pain suggestive of angina or even in patients with ACS stratified initially as low risk whose normal result corresponds to a risk of less than 2% of cardiovascular events in 1 year. Before an exercise stress test is performed, moderate to high risk status, acute aortic diseases, PTE, myocarditis, and pericarditis should be ruled out. Among the necessary conditions for this test are: absence of symptoms and ECG changes suggestive of myocardial ischemia in the last 24 hours; and presence of at least two serial samples of negative markers of myocardial necrosis.

Figure 5. Patient with thoracic aortic aneurysm associated with ascending aortic dissection extending to the descending aorta. The arrows point to the dissection lines.

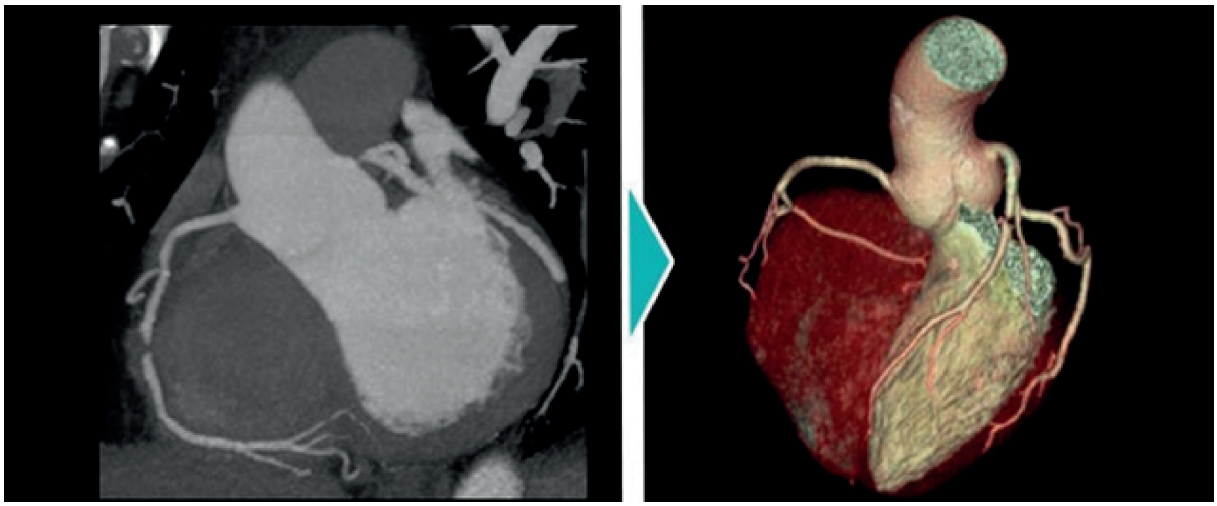

Figure 6. Patient with acute chest pain. Coronary computed tomography angiography showing severe obstruction in the middle third of the right coronary artery (arrows).

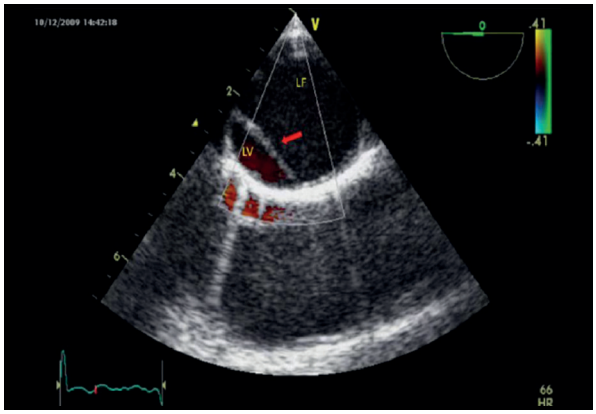

Figure 7. Doppler echocardiography image of a patient with acute aortic dissection. The arrow points to the dissection line. FL, aortic false lumen; TL, aortic true lumen.

Myocardial Perfusion Scintigraphy

To evaluate chest pain in the emergency room, we can use myocardial perfusion scintigraphy (MPS) at rest and under stress. MPS at rest is indicated in patients with suspected ACS and undiagnosed ECG to confirm or rule out this diagnosis early.[10] Patients with normal examinations are at low risk for adverse cardiac events in the coming months and may be discharged immediately from emergency units, which reduces hospital costs.[11,15]

Coronary cineangiography

Coronary cineangiography is considered the gold standard in the evaluation of coronary anatomy and obstructive/stenotic lesions and essential for deciding whether myocardial revascularization should be performed in patients with ACS.[16]

Coronary cineangiography associated with primary percutaneous coronary intervention is indicated in the context of AMI with ST-segment elevation or new or presumed new left bundle branch block for patients up to 12 hours from the onset of chest pain, aiming for a 90-minute door-to-balloon time.[17] The invasive strategy of using coronary cineangiography is preferred for patients with intermediate- or high-risk ACS and non-ST-segment elevation.[10]

Perspectives

The appropriate care of patients with acute chest pain in the emergency room requires a structured risk classification objectively conducted by an experienced multidisciplinary team. For this purpose and to provide a rapid diagnosis, especially of conditions with an imminent risk of death, it is important to systematize care using flowcharts and algorithms. The immediate management of these cases reduces morbidity and mortality, consequently increasing the safety of the emergency professional. On the other hand, the early discharge of patients who are not at risk of death reduces operating costs, which is fundamental in the current context of emergency services in Brazil.

Figures 8 and 9 respectively present suggestions of a flowchart and an algorithm for the care of patients with acute chest pain in the emergency room, objectively defining who should stay and who can be discharged.

CONFLICTS OF INTEREST

The author declares that he has no conflicts of interest in this work.

REFERENCES

1. Minuzzo L. Estratégia Diagnóstica no Paciente com Dor Torácica: Como Conciliar Rapidez e Eficiência no Diagnóstico Diferencial? Rev Soc Cardiol. 2009;19(2):94-107.
2. Meisel JL. Differential Diagnosis of Chest Pain in Adults. [Internet] [acesso em 2018 may 14]. Disponível em: http://www.uptodate.com
3. Weiner DA, Ryan TJ, McCabe CH, Kennedy JW, Schloss M, Tristani F, et al. Exercise Stress Testing — Correlations among History of

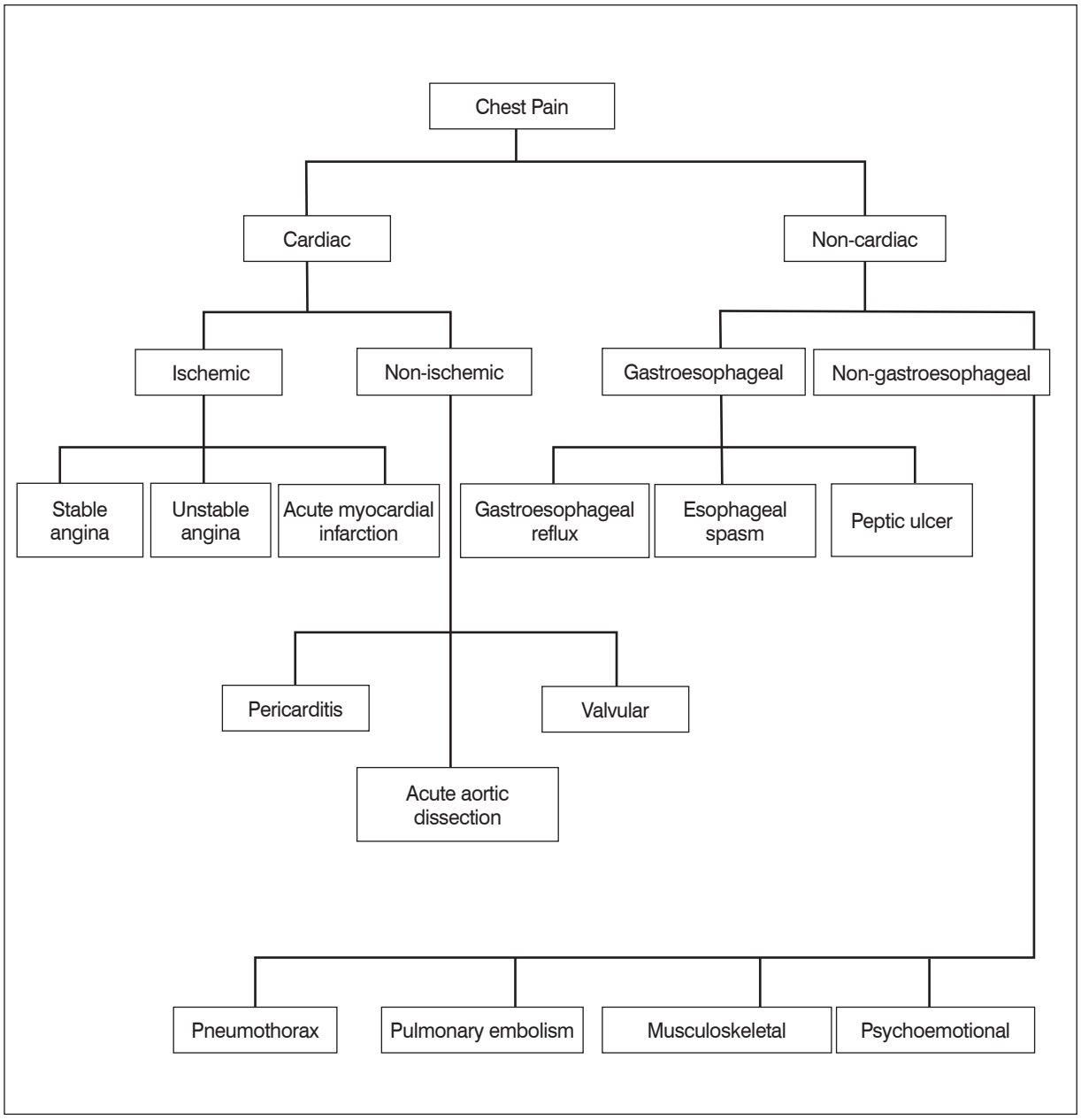

Figure 8. Flowchart of care of patients with chest pain in the emergency room[11]

Angina, ST-Segment Response and Prevalence of Coronary-Artery Disease in the Coronary Artery Surgery Study (CASS). N Engl J Med. 1979;301(15):230-5.

4. Six AJ, Backus BE, Kelder JC. Chest pain in the emergency room: value of the HEART score. Neth Heart J. 2008;16(6):191-6.
5. Anderson JL, Adams CD, Antman EM, Bridges CR, Califf RM, Casey DE Jr, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non–ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines for the Management of Patients With Unstable Angina/Non–ST-Elevation Myocardial Infarction). Circulation. 2007; 116(7): e148-e304.
6. Ilbanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). Eur Heart J. 2018; 39(2):119–177.
7. Sgarbossa EB, Pinski SL, Barbagelata A, Underwood DA, Gates KB, Topol EJ, et al. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle-branch block. N Engl J Med. 1996; 334(8):481-7.
8. Savonitto S, Ardissino D, Granger CB, Morando G, Prando MD, Mafrici A, et al. Prognostic value of the admission electrocardiogram in acute coronary syndromes. JAMA. 1999;281(8): 707-13.
9. Panju AA, Hemmelgarn BR, Guyatt GH, Simel DL, et al. The Rational Clinical Examination. Is This Patient Having a Myocardial Infarction? JAMA. 1998;280(14): 1256-63.
10. Santos ES, Trindade PHDM, Moreira HG. Tratado Dante Pazzanese de Emergências Cardiovasculares. São Paulo: Editora Atheneu. 2016.

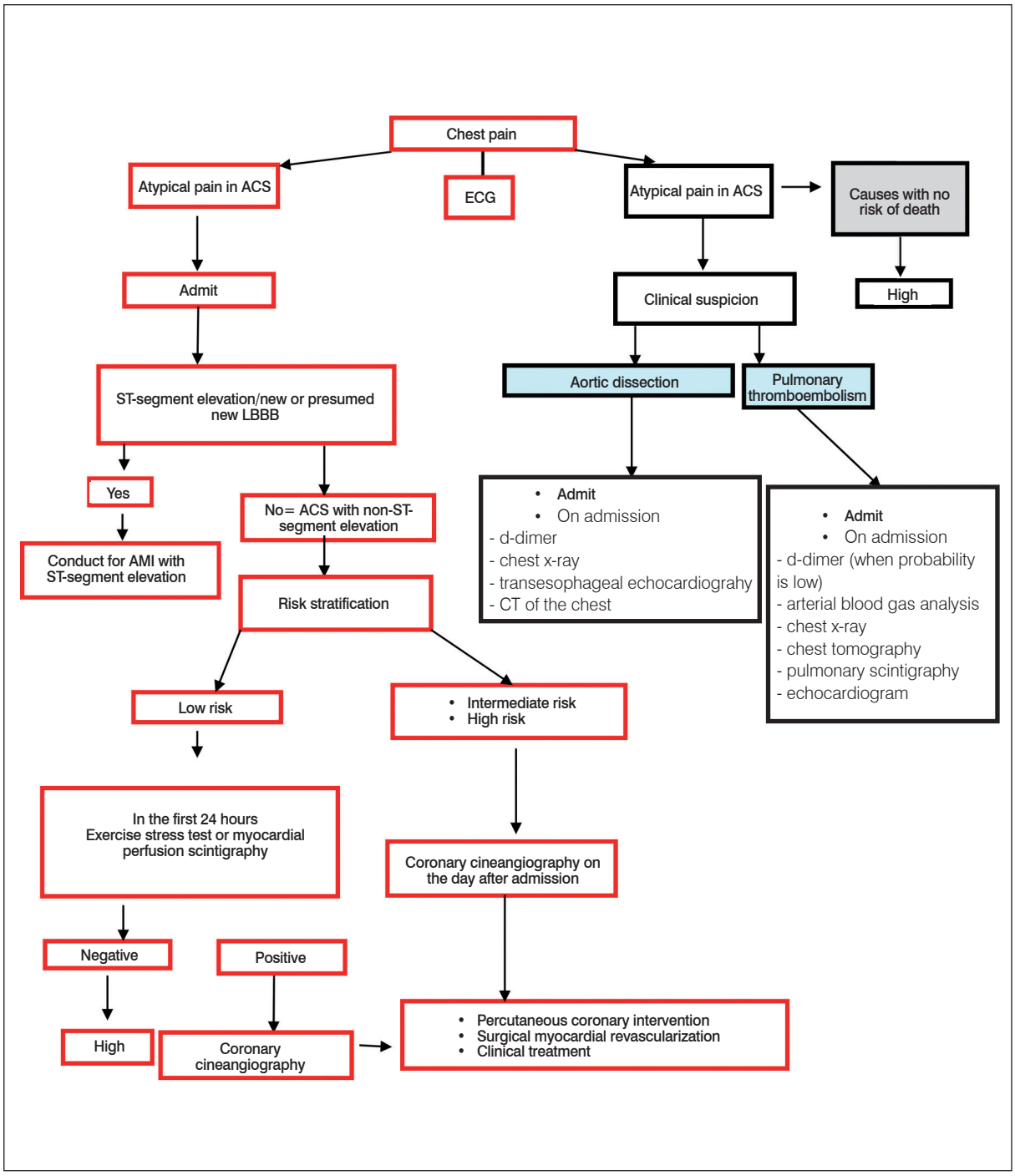

Figure 9. Algorithm of care of patients with chest pain in the emergency room.

11. Bassan R, Pimenta L, Leões PE, Timerman A. Sociedade Brasileira de Cardiologia – I Diretriz de Dor Torácica na Sala de Emergência. Arq Bras Cardiol. 2002;79 (supl II): 1-22.
12. Min JK, Shaw LJ, Berman DS. The Present State of Coronary Computed Tomography Angiography – A Process in Evolution. J Am Coll Cardiol. 2010; 55(10): 957-65.
13. Nicolau JC, Timerman A, Marin – Neto JA, Piegas LS, Barbosa CJ, Franci A, et al. Guidelines for Unstable Angina and Non-ST-Segment Elevation Myocardial Infarction of the Brazilian Society of Cardiology (II Edition , 2007). Arq Bras Cardiol. 2014; 102 (3 Suppl 1)1-61.
14. Barbosa MM, Nunes MCP, Campos Filho O, Camarozano A, Rabischoffsky A, Maciel BC, et al. Sociedade Brasileira de Cardiologia. Diretrizes das Indicações de Ecocardiografia. Arq Bras Cardiol. 2009: 93 (6 supl. 3): e265-e302.
15. Meneghetti JC, Smanio P, Ramos CD. Medicina Nuclear na Doença Arterial Coronária. Rev SOC Cardiol. 2009;19 (3): 284-302.
16. Popma JJ. Coronary Arteriography and Intravascular Imaging. In. Libby P, Bonow RO, Mann DL, Zipes DP 8. ed. Amsterdã: Braunwald's Heart Disease. 2008. p. 465-508.
17. Piegas LS, Feitosa G, Mattos LA, Nicolau JC, Rossi Neto JM, Timerman A, et al. Sociedade Brasileira de Cardiologia. Diretriz da Sociedade Brasileira de Cardiologia sobre Tratamento do Infarto Agudo do Miocárdio com Supradesnível do Segmento ST. Arq Bras Cardiol. 2009; 93 (6 supl. 2) e179-e264.