

GUIDELINES & PROTOCOLS

ADVISORY COMMITTEE

Acute Chest Pain - Evaluation and Triage

Effective Date: November 10, 2008

Scope

The objective of this guideline is to improve the efficiency and effectiveness of diagnosing acute coronary syndrome (ACS) in patients with acute chest pain. Improved diagnostic testing will reduce the number of patients with ACS who go undiagnosed after initial evaluation. ACS includes unstable angina and acute myocardial infarction (ST segment elevation MI [STEMI] and non ST segment elevation MI [NSTEMI]).

This guideline does not address chronic stable angina or the prevention of ACS.

Target Population: Adults presenting with chest pain in physicians' offices, walk-in clinics and emergency departments.

Applicable diagnostic codes: 410 (acute myocardial infarction); 411 (other acute and subacute forms of ischemic heart disease); 413 (angina pectoris).

Evaluation and Diagnosis

A. Selection of patients who may have ACS

Patients presenting with prolonged (> 10 minutes) acute chest pain suggestive of ACS (see Appendix A for suggesting features) require a history and physical examination. If a patient presents in a physician's office or walk-in clinic and no alternative cause can be found with certainty, referral of the patient to the Emergency Department (ED) for further evaluation and observation is essential.¹ If a previous electrocardiogram (ECG) is available, send it with the patient.

Referral of a patient with suspected ACS to a laboratory for ECG and/or cardiac biomarkers*, rather than to the Emergency Department, is not appropriate.

* The term cardiac biomarkers refers to proteins such as troponin I and T, myoglobin and creatinine kinase MB (CK-MB), which are released into the blood after heart muscle necrosis. Because of its greater sensitivity and superior tissue-specificity, cardiac troponin is the preferred biomarker for the detection of myocardial injury.²

B. Initial evaluation in the Emergency Department (ED)

Patients with chest pain suggestive of ACS need further evaluation with a history, physical examination, ECG and cardiac biomarkers, preferably troponin (Appendix B).

Consider other life threatening causes of chest pain, such as aortic aneurysm, pulmonary embolism, perforated viscus and pneumothorax. This guideline does not cover the diagnosis of these conditions.

Criteria for acute myocardial infarction³

Detection of rise and/or fall of cardiac biomarkers (preferably troponin) with at least one value above the 99th percentile (the upper reference limit) together with evidence of myocardial ischemia with at least one of the following:

- symptoms of ischemia
- ECG changes indicative of new ischemia (new ST-T changes or new left-bundle branch block [LBBB])
- development of pathological Q waves in the ECG
- imaging evidence of new loss of viable myocardium or new regional wall motion abnormality

C. Interpretation of troponin values

It is recommended that emergency rooms have urgent troponin testing available.² It is recommended that the laboratory reports the 99th percentile as the decision-limit for myocardial injury. If it is higher than the 99th percentile, use the level at which the coefficient of variation (CV) is 10 per cent for the specific assay in use in that laboratory.⁴

When an elevated troponin is detected, clinical context and serial sampling are needed to evaluate the result. A rising and/or falling level is indicative of a recent myocardial injury. In addition to acute myocardial infarction (AMI), low-level troponin elevations can occur in various other conditions, such as end-stage kidney disease and congestive heart failure.⁵ A stable troponin level in the equivocal range, i.e. less than the 99th percentile, is consistent with an ongoing chronic disorder directly or indirectly affecting the heart. It is not diagnostic of AMI.

Management

A. Management of patients with definite ACS

- Admit and immediately treat patients with new ST segment elevation or new LBBB and a history compatible with ACS, with the intent of re-establishing perfusion.¹
- Admit and immediately treat patients with a history and ECG (without ST segment elevation) compatible with ischemia, plus either elevated cardiac biomarkers (>99th percentile) or hemodynamic compromise (hypotension or electrical instability), for acute myocardial ischemia.

B. Management of patients with possible ACS

- It is recommended that patients with a compatible history and a non-diagnostic initial ECG and cardiac biomarkers, be observed in the ED and be re-assessed at six or more hours after the initial testing with an ECG and cardiac biomarkers.¹ Earlier and more frequent testing (ECGs and cardiac biomarkers) may be necessary in patients with recurrent or ongoing chest pain.
- The status changes from “possible” to “definite” ACS in patients with a compatible history who develop elevated cardiac biomarkers or ischemic ECG changes or hemodynamic compromise at any time (see Management of patients with definite ACS above).
- Patients with a compatible history without elevated cardiac biomarkers at 6 or more hours, and an ECG not diagnostic of ischemia are considered to be at a low or intermediate short-term risk for non fatal MI or death (Appendix B).

- For low-risk patients without an obvious alternative explanation for the chest pain an out-patient stress test within 72 hours and out-patient physician follow-up is recommended.¹
- When possible, discuss intermediate-risk patients with an internist or cardiologist. A stress test prior to discharge is recommended.
- For both low and intermediate risk groups:
 - If the patient's resting ECG is abnormal (see Appendix C), a routine stress test will be non-diagnostic. In this scenario, stress myocardial perfusion imaging or stress echocardiography is required to detect ischemia. Therefore, referral to a facility capable of stress myocardial perfusion imaging or stress echocardiography is recommended for such patients.¹⁴
 - Advise patients to return to the ED immediately if the pain recurs.¹

ST segment changes are often associated with causes other than those of ischemic origin. If there is uncertainty about the underlying cause of an abnormal ECG, consider obtaining an urgent consultation with a cardiologist or internist.

There is currently insufficient evidence to recommend computed tomography (CT) angiography in the acute workup of a patient with possible ACS.

Rationale

Among patients with chest pain, the diagnosis of acute coronary syndromes (ACS) may be missed because no single objective test reliably identifies ACS in these patients.⁷ Inappropriate discharge can lead to preventable acute myocardial infarction (AMI) or sudden death.^{8,9} A Canada-US study showed that 57-99% of patients presenting to an ED with chest pain were admitted for further investigation,¹⁰ and in the participating Canadian hospitals, only 13-51% of admitted patients ultimately proved to have an acute coronary syndrome. In a recent evaluation in two Vancouver hospitals, 4.5% of patients with an AMI and 6.8% of patients with unstable angina were discharged with a non-ACS diagnosis.⁹ The use of guidelines can help to improve these unacceptable high false negative rates. The need for a clinical decision tool is urgent and there is great potential for improvements in detecting ACS.

Some US centres have established chest pain evaluation units (CPEUs) to limit unnecessary coronary care unit (CCU) admissions. These CPEUs apply 9-12 hour step-wise AMI rule-out protocols using observation, serial ECGs and cardiac biomarkers, provocative tests and cardiac imaging. The CPEUs have reported reduced costs and improvements in the identification of ACS compared with facilities that admit all patients to the CCU. Chest pain units are not widely established in British Columbia partly because their true cost-effectiveness is unknown.

Clinical variables associated with ACS include gender, age, family history, previous angina or AMI, pain characteristics, syncope, response to nitro-glycerine, diaphoresis, nausea and vomiting, blood pressure, rales, jugular venous distension, added or unusual heart sounds, descriptive gestures and arrhythmias. Many of the above are strong predictors of ACS but their clinical utility in individual patients is uncertain.⁹

Women and patients with diabetes¹¹ often do not complain of typical chest pain and may present with atypical symptoms.

ECG abnormalities are strong positive predictors, but as many as 82% of patients have normal or near normal ECGs at initial presentation.¹²

Cardiac biomarkers including CK-MB, myoglobin and troponins are released during AMI. The sensitivity of CK-MB assays and troponins may not reach levels high enough at the initial assessment to rely on cardiac biomarkers alone to rule out AMI or unstable angina. Sensitivity improves with serial testing.¹³

Stress tests may be dangerous in high-risk patients, require skilled interpretation and have limited availability in small communities.

Diagnostic uncertainty leaves physicians with the risk of discharging someone who has ACS or admitting someone who does not have ACS. The most difficult cases of ACS to identify are those with chest pain but negative ECGs and cardiac biomarkers. The American Heart Association (AHA) has recently published a revised guideline for the management of patients with unstable angina and non-ST elevation myocardial infarction (NSTEMI).¹ The algorithm from the AHA guideline has been adapted (Appendix C) to help BC physicians diagnose and manage patients who present with chest pain in the ambulatory setting. A table of risk features is also provided (Appendix B) to aid in diagnosis.

References

1. Anderson JL, Adams CD, Antman EM, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non-ST segment elevation myocardial infarction: Executive summary and recommendations. *Circulation* 2007;116(7):803-77.
2. Morrow DA, Cannon CP, Jesse RL, et al. National Academy of Clinical Biochemistry laboratory medicine practice guidelines: Clinical characteristics and utilization of biochemical markers in acute coronary syndromes. *Clinic Chem* 2007;53(4):552-574.
3. Thygesen K, Alpert JS, White HD: On behalf of the joint ESC/ACCF/AHA/WHF Task Force for the redefinition of myocardial infarction. Universal definition of myocardial infarction. *Circulation* 2007;116(22):2634-53.
4. Apple FS, Jesse RL, Newby K, et al. National Academy of Clinical Biochemistry and IFCC committee for standardization of markers of cardiac damage laboratory medicine practice guidelines: Analytical issues for biochemical markers of acute coronary syndromes. *Clinic Chem* 2007;53(4):547-51.
5. Roongsritong C, Warraich I, Bradley C. Common causes of troponin elevations in the absence of acute myocardial infarction: Incidence and clinical significance. *Chest* 2004;125(5):1877-1884.
6. Fitchett D, Goodman S, Langer A. New advances in the management of acute coronary syndromes: 1. Matching treatment to risk. *CMAJ* 2001;164(9):1309-16.
7. Dagnone E, Collier C, Pickett W, et al. Chest pain with nondiagnostic electrocardiogram in the emergency department: a randomized controlled trial of two cardiac marker regimens. *CMAJ* 2000;162(11):1561-6.
8. Limkakeng A Jr, Gibler WB, Pollack C, et al. Combination of Goldman risk and initial cardiac troponin I for emergency department chest pain patient risk stratification. *Acad Emerg Med* 2001;8(7):696-702
9. Christenson J, Innes G, McKnight D, et al. A clinical prediction rule for early discharge of patients with chest pain. *Ann Emerg Med* 2005;47(1):1-10.
10. Gibler WB, Hoekstra JW, Weaver WD, et al. A randomized trial of the effects of early cardiac marker availability on reperfusion therapy in patients with acute myocardial infarction: The serial markers in AMI and rapid treatment trial. *J Am Coll Cardiol* 2000;36(5):1500-6.
11. Chiariello M, Indolfi C. Silent myocardial ischemia in patients with diabetes mellitus. *Circulation*. 1996;93:2089-91.
12. Fesmire FM, Percy RF, Bardoner JB, et al. Usefulness of automated serial 12-lead ECG monitoring during the initial emergency department evaluation of patients with chest pain. *Ann Emerg Med* 1998;31(1):3-11.
13. Kontos MC, Shah R, Fritz LM, et al. Implications of different cardiac troponin I levels for clinical outcomes and prognosis of acute chest pain patients. *J Am Coll Cardiol* 2004;43:958-965.
14. Braunwald E, Antman EM, Beasley JW, et al. A report of the American College of Cardiology/American Heart Association Task Force on practice guidelines (Committee on the Management of Patients with Unstable Angina). *J Am Coll Cardiol* 2000;36:970.

Resources (for health care providers and patients)

- Heart and Stroke Foundation of BC & Yukon
Web site: www.heartandstroke.bc.ca
Tel: 1 888 473-4636
- St. Paul's Hospital Healthy Heart Program
Web site: www.heartcentre.ca
- BCHealthGuide Online
Web site: www.bchealthguide.org (search word: heart attack and unstable angina)

- BCNurseLine
Toll-free in BC 1 866 215-4700
In Greater Vancouver: 604 215-4700
Deaf and hearing impaired: 1 866 889-4700
- American Heart Association
Web site: www.americanheart.org
Tel: 1 800 242-8721
- American Academy of Family Physicians
Web site: www.familydoctor.org (search words: angina; heart disease; heart attack)
- The Journal of the American Medical Association
Web site: www.jama.com; click on “patient page” for free patient information on myocardial infarction
- National Heart, Lung and Blood Institute
Web site: www.nhlbi.nih.gov
Tel: 301 496-4236
- National Institute for Health and Clinical Excellence (NICE)
Web site: www.nice.org.uk

This guideline is based on scientific evidence current as of the Effective Date.

Contact Information

Guidelines and Protocols Advisory Committee
PO Box 9642 STN PROV GOVT
Victoria BC V8W 9P1

Phone: 250 952-1347

Email: hlth.guidelines@gov.bc.ca

Fax: 250 952-1417

Web Site: www.BCGuidelines.ca

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances.

Appendices

Appendix A - Features of acute chest pain

Appendix B - Risk of death or non-fatal MI in patients with Unstable Angina (UA)/NSTEMI

Appendix C - Evaluation and management of patients suspected of having ACS

Disclaimer

The Clinical Practice Guidelines (the “Guidelines”) have been developed by the Guidelines and Protocols Advisory Committee on behalf of the Medical Services Commission. The Guidelines are intended to give an understanding of a clinical problem, and outline one or more preferred approaches to the investigation and management of the problem. The Guidelines are not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of clinical problems.

Appendix A

Features of Acute Chest Pain

Features of Persistent Chest Pain that Suggest ACS

- Cardiac chest “pain” is usually described by the patient as an unpleasant sensation in the chest: “pressing”, “squeezing”, “constricting”, “bursting”, “burning”, “a band around the chest”, “a weight in the centre of the chest” or a “vise tightening around the chest”. Clenching the fist in front of the sternum (Levine’s sign) is a strong indication of an ischemic origin of the pain.
 - It is important to note that the sensation is often not described as being severe. The discomfort may radiate or be completely isolated to the neck, jaw, teeth, epigastrium, shoulder or arms (most commonly the left). It is frequently associated with shortness of breath, diaphoresis, weakness, nausea and vomiting, and occasionally associated with gas, belching or “indigestion”.
 - The discomfort may be partially or fully relieved by nitro-glycerine, but may not respond to nitro-glycerine at all. There may or may not be a prodrome of the discomfort precipitated by exercise, cold weather or emotional stress relieved by rest or nitro-glycerine.
 - Chest discomfort that lasts for more than 10 minutes or occurs at rest suggests unstable angina; chest discomfort that lasts for more than 20 minutes suggests acute myocardial infarction. An acute coronary syndrome may present with acute shortness of breath with or without evidence of chest pain.
-

Features of Chest Pain that do not Suggest ACS

- Pain or discomfort that is localised to the skin or chest wall and can be reproduced by localised pressure.
 - Pain that is localised to a small area of the chest (< 3 cm in diameter), or pain that radiates to the right lower chest.
 - Pain that is sharp, stabbing or knifelike and aggravated by deep breathing or rotating the chest.
 - Pain that is worse in the supine position and relieved by sitting up or leaning forward is suggestive of pericarditis.
 - Pain that lasts for less than 15 seconds is rarely ischemic in origin.
 - Dissection of the aorta often causes pain in the back in addition to the front of the chest.
-

Appendix B

Risk of death or non-fatal MI in patients with Unstable Angina (UA)/NSTEMI

High-Risk ACS

Prolonged chest pain either > 20 minutes or ongoing, with one or more of the following high-risk features:

- Acute myocardial infarction within the past 4 weeks
- Pain with ST abnormalities on the ECG
- ECG:
 - transient ST-segment elevation or depression > 0.5 mm
 - sustained ST-segment depression > 0.5 mm
 - T-wave inversion > 1 mm in > 5 leads
 - deep (e.g. > 5 mm) T-wave inversion
 - recurrent myocardial ischemia with ECG ST-segment shift with or without pain
- Positive cardiac biomarkers:
 - troponin level or CK-MB index is clearly positive with compatible history
- Hemodynamic compromise with ongoing chest pain: heart failure/hypotension

30-Day Rate of Death or Myocardial Infarction: 12-30 %

Intermediate-Risk of ACS (recommendations are for functional assessment within 48hrs)

No high-risk features, but one or more of:

- Ongoing chest pain
- Crescendo angina preceding rest pain
- Previous intervention: percutaneous transluminal coronary angioplasty/coronary artery bypass surgery
- Known coronary disease, two or more risk factors for coronary heart disease (CHD)
- Increased baseline risk: e.g. diabetes, elderly

30-Day Rate of Death or Myocardial Infarction: 4-8 %

Low-risk of ACS (can be discharged with a recommendation for a functional assessment as soon as possible (within 1 month), with subsequent office follow-up)

No high- or intermediate-risk features:

- Chest pain: single episode at rest (resolved), crescendo exertional angina
- ECG: normal or non-specific abnormalities, or unchanged from previous
- Normal cardiac biomarkers

30-Day Rate of Death or Myocardial Infarction: <2 %

Reference:

Fitchett D, Goodman S, Langer A. New advances in the management of acute coronary syndromes: Matching treatment to risk. CMAJ 2001;164(9):1309-16.

Appendix C

Evaluation and management of patients suspected of having ACS

