

Chronic Chest Pain — Low to Intermediate Probability of Coronary Artery Disease
EVIDENCE TABLE

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|--|------------|---------------------|--|---|-------------------------|
| 1. Kachintorn U. How do we define non-cardiac chest pain? <i>J Gastroenterol Hepatol</i> 2005; 20 Suppl:S2-5. | 12 | N/A | To define non-cardiac chest pain (NCCP) and review causes, diagnosis, and management of this disorder. | <ul style="list-style-type: none"> • In diagnosing NCCP, cardiac ischemic must be excluded and coronary angiography remains the gold standard. • Patients with NCCP usually have gastroesophageal reflux disease (GERD). Initial empiric trial of high-dose acid suppression is the most cost-effective measure in the management of these patients. When a diagnostic workup is chosen, it centers on upper gastrointestinal endoscopy, 24-hour esophageal pH monitoring and esophageal manometry. | 4 |
| 2. O'Gara PT, Bonow RO, Maron BJ, et al. Myocardial perfusion abnormalities in patients with hypertrophic cardiomyopathy: assessment with thallium-201 emission computed tomography. <i>Circulation</i> 1987; 76(6):1214-1223. | 13 | 72 | To assess the relative prevalence and functional significance of myocardial perfusion abnormalities in hypertrophic cardiomyopathy (HCM) patients with thallium-201 emission CT. | <ul style="list-style-type: none"> • Regional perfusion defects were present in 10/18 (56%) completely asymptomatic patients, compared with 31/54 (58%) symptomatic patients. • Perfusion abnormalities are commonly seen in HCM patients. Fixed defects occur in patients with impaired systolic performance. | 3 |
| 3. Prisant LM, von Dohlen TW, Houghton JL, Carr AA, Frank MJ. A negative thallium (+/- dipyridamole) stress test excludes significant obstructive epicardial coronary artery disease in hypertensive patients. <i>Am J Hypertens</i> 1992; 5(2):71-75. | 10 | 92 | To examine the role of thallium stress testing in the detection of significant epicardial coronary artery disease (CAD) in hypertensive patients. | <ul style="list-style-type: none"> • 94.4 ± 5.4% sensitivity (95% CL 71%-100%) • 63.5 ± 5.6% specificity (95% CL 51%-74%), 38.6 ± 7.3% PPV (95% CL 25%-54%) • 97.9 ± 2.1% NPV (95% CL 88%-100%) 69.6 ± 4.8% overall accuracy (95% CL 59%-79%). • For hypertensive patients with chest pain or electrocardiographic (ECG) myocardial ischemia, the high sensitivity and NPV and low false negative rate support the role of thallium stress testing ± dipyridamole as an exclusion test for significant CAD. | 1 |
| 4. Snow V, Barry P, Fihn SD, et al. Evaluation of primary care patients with chronic stable angina: guidelines from the American College of Physicians. <i>Ann Intern Med</i> 2004; 141(1):57-64. | 15 | N/A | Guideline (designed to provide guidance on the management of patients with chronic stable angina). | N/A | N/A |

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| 5. Taki J, Nakajima K, Muramori A, Yoshio H, Shimizu M, Hisada K. Left ventricular dysfunction during exercise in patients with angina pectoris and angiographically normal coronary arteries (syndrome X). <i>Eur J Nucl Med</i> 1994; 21(2):98-102. | 3c | 28 | To investigate left ventricular function during exercise and recovery in patients with angina pectoris ST segment depression during exercise and angiographically normal coronary arteries (syndrome X) using a continuous left ventricular function monitor with cadmium telluride detector (CdTe-VEST). 14 patients with syndrome X and 14 control group. | Left ventricular ejection fraction was impaired in 11 of the 14 patients, but in no control patients. Resting ejection fraction was normal in both groups. Maximum ejection fraction increase in the syndrome X group was less than in the controls. Cardiac stress testing appears useful in this population. | 3 |
| 6. Gibbons RJ, Balady GJ, Bricker JT, et al. ACC/AHA 2002 guideline update for exercise testing: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). <i>Circulation</i> 2002; 106(14):1883-1892. | 15 | N/A | Guideline (update on exercise testing guidelines). | N/A | N/A |
| 7. Williams SV, Fihn SD, Gibbons RJ. Guidelines for the management of patients with chronic stable angina: diagnosis and risk stratification. <i>Ann Intern Med</i> 2001; 135(7):530-547. | 15 | N/A | Guidelines for the management of patients with chronic stable angina. | N/A | N/A |
| 8. Lacima G, Grande L, Pera M, Francino A, Ros E. Utility of ambulatory 24-hour esophageal pH and motility monitoring in noncardiac chest pain: report of 90 patients and review of the literature. <i>Dig Dis Sci</i> 2003; 48(5):952-961. | 9 | 90 | To assess the diagnostic value of ambulatory 24-hr pH and pressure monitoring in patients with noncardiac chest pain. Stationary manometry, edrophonium testing, and ambulatory pH and motility studies were performed. | <ul style="list-style-type: none"> • Diagnoses of specific esophageal motility disorders by stationary and ambulatory manometry were discordant in 48% of the patients. • Edrophonium testing was positive in 9 patients, but correlated poorly with esophageal diagnoses. • During ambulatory studies, 144 chest pain events occurred in 42 patients, and 72 (50%) were related to esophageal dysfunction. • Although the gain is small, ambulatory manometry increases the diagnostic yield of standard esophageal testing in noncardiac chest pain. | 2 |

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| 9. Mousavi S, Tosi J, Eskandarian R, Zahmatkesh M. Role of clinical presentation in diagnosing reflux-related non-cardiac chest pain. <i>J Gastroenterol Hepatol</i> 2007; 22(2):218-221. | 10 | 78 | To evaluate the role of clinical presentation when diagnosing GERD among patients with NCCP. Clinical presentation was compared between 2 groups: GERD and non GERD patients. | The chest pain severity, site, radiation and relation to food, exercise, and sleep were equal in the 2 groups, except for two symptoms: pain that was relieved by antacid (P<0.031) and presence of classical reflux symptoms (P<0.009), seen in the GERD patients. With regard to recent patient history, heartburn and regurgitation symptoms were seen more frequently in GERD patients (P<0.036 and P<0.002, respectively). Clinical history is important in diagnosing NCCP in GERD. | 2 |
| 10. Abbott BG, Abdel-Aziz I, Nagula S, Monico EP, Schriver JA, Wackers FJ. Selective use of single-photon emission computed tomography myocardial perfusion imaging in a chest pain center. <i>Am J Cardiol</i> 2001; 87(12):1351-1355. | 10 | 2,601 | Prospective evaluation of the use of SPECT imaging in patients with chest pain and nonischemic ECG in an emergency department chest pain center. | 906 patients required SPECT imaging to complete the evaluation. Had SPECT not been performed and all 906 patients been admitted, 29% (762) would have been admitted to the hospital unnecessarily. Sending all 906 patients home would have meant that, 6% (144) of patients would have been discharged inappropriately as they had CAD. | 2 |
| 11. Kaul S, Senior R, Firschke C, et al. Incremental value of cardiac imaging in patients presenting to the emergency department with chest pain and without ST-segment elevation: a multicenter study. <i>Am Heart J</i> 2004; 148(1):129-136. | 9 | 203 | To compare contrast echocardiography (CE) with SPECT to determine incremental value of cardiac imaging in patients presenting to the emergency department with chest pain and without ST-segment elevation on the electrocardiogram. Both CE and SPECT readings included separate and composite assessments of both regional myocardial function and perfusion. | Concordance between contrast-enhanced and SPECT was 77% (73%-82%) for all territories, with a higher concordance for the anterior wall of 84% (78%-89%). Regional myocardial function and composite evaluation was better on SPECT compared with CE, while perfusion alone was not. | 2 |
| 12. Metz LD, Beattie M, Hom R, Redberg RF, Grady D, Fleischmann KE. The prognostic value of normal exercise myocardial perfusion imaging and exercise echocardiography: a meta-analysis. <i>J Am Coll Cardiol</i> 2007; 49(2):227-237. | 11 | N/A | To determine the prognostic value of normal exercise myocardial perfusion imaging (MPI) tests and echocardiography tests. | NPV was 98.8% for MPI, and 98.4% for echocardiography. Prognostic utility of both modalities is similar for both men and women. | 1 |

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| 13. Herzog C, Britten M, Balzer JO, et al. Multidetector-row cardiac CT: diagnostic value of calcium scoring and CT coronary angiography in patients with symptomatic, but atypical, chest pain. <i>Eur Radiol</i> 2004; 14(2):169-177. | 9 | 38 | To examine the accuracy of multidetector-row cardiac CT (MDCT), calcium scoring (Ca-Sc), and MDCT coronary angiography (MD-CTA) in the assessment of coronary atherosclerosis. Findings were compared to invasive coronary angiography. | <ul style="list-style-type: none"> • Patients with hemodynamically relevant (>75%) stenoses were detected by MD-CTA with 72.2% sensitivity and 100% specificity (20/20). • For Ca-Sc sensitivity ranged between 94.7% and 66.7%, specificity between 20% and 80% respectively, depending on the prevailing cutoff value. • Combination of both methods led to 83.3% sensitivity and 100% specificity, reaching no level of significance as compared with Ca-Sc (p=0.73) or MD-CTA (p=0.23) alone. | 2 |
| 14. Hoffmann U, Nagurney JT, Moselewski F, et al. Coronary multidetector computed tomography in the assessment of patients with acute chest pain. <i>Circulation</i> 2006; 114(21):2251-2260. | 10 | 103 | Prospective blinded study of patients presenting with acute chest pain admitted to the hospital to rule out acute coronary syndrome (ACS) with no ischemic ECG changes and negative initial biomarkers. MD-CTA was performed immediately before admission, and data sets were evaluated for the presence of coronary atherosclerotic plaque and significant coronary artery stenosis. | 14/103 patients had evidence of ACS. Both the absence of significant coronary artery stenosis (73 of 103 patients) and nonsignificant coronary atherosclerotic plaque (41/103 patients) accurately predicted the absence of ACS (NPV 100%). MDCT is good for ruling out ACS in subjects presenting with possible myocardial ischemia. | 1 |
| 15. Johnson TR, Nikolaou K, Wintersperger BJ, et al. ECG-gated 64-MDCT angiography in the differential diagnosis of acute chest pain. <i>AJR</i> 2007; 188(1):76-82. | 9 | 55 | To assess the diagnostic value of an ECG-gated 64-MDCT angiography protocol for simultaneous assessment of the pulmonary arteries, coronary arteries, and aorta within a single breath-hold. Findings on CTA were compared with those on X-ray coronary angiography in 20 patients. | Cause of chest pain correctly diagnosed in 37/55 patients. The protocol proved helpful in the differential diagnosis of acute chest pain. | 2 |
| 16. White CS, Kuo D, Kelemen M, et al. Chest pain evaluation in the emergency department: can MDCT provide a comprehensive evaluation? <i>AJR</i> 2005; 185(2):533-540. | 10 | 69 | To determine if MDCT could provide a comprehensive assessment of cardiac and noncardiac causes of chest pain in stable emergency department subjects. | Sensitivity and specificity for all other cardiac and noncardiac causes were 87% and 96%, respectively. | 2 |
| 17. Schmid M, Achenbach S, Ludwig J, et al. Visualization of coronary artery anomalies by contrast-enhanced multi-detector row spiral computed tomography. <i>Int J Cardiol</i> 2006; 111(3):430-435. | 10 | 35 | To examine the potential of 16-slice MDCT with retrospective ECG-gating for evaluation of coronary artery anomalies. | MDCT is a reliable noninvasive technique to identify and define anomalous coronary arteries and their course. | 3 |

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| 18. Hundley WG, Morgan TM, Neagle CM, Hamilton CA, Rerkpattanapipat P, Link KM. Magnetic resonance imaging determination of cardiac prognosis. <i>Circulation</i> 2002; 106(18):2328-2333. | 10 | 279 | To test the utility of MRI stress tests for the assessment of cardiac prognosis. | The results of cardiac MRI stress tests can be used to forecast myocardial infarction or cardiac death in patients with poor echocardiograms. | 2 |
| 19. Paetsch I, Jahnke C, Wahl A, et al. Comparison of dobutamine stress magnetic resonance, adenosine stress magnetic resonance, and adenosine stress magnetic resonance perfusion. <i>Circulation</i> 2004; 110(7):835-842. | 9 | 79 | To evaluate the diagnostic value of inducible wall motion abnormalities (IWMA) during dobutamine and adenosine stress MR and compare adenosine MR perfusion with invasive coronary angiography. | 53 patients (67%) had coronary artery stenoses >50%. Sensitivity and specificity for detection by dobutamine; 89% and 80%, respectively, adenosine stress; 40% and 96%, respectively, adenosine perfusion; 91% and 62%, respectively. Dobutamine stress MR is the method of choice for current state-of-the-art treatment regimens to detect ischemia in patients with suspected or known CAD but no history of prior myocardial infarction. | 2 |
| 20. Ingkanisorn WP, Kwong RY, Bohme NS, et al. Prognosis of negative adenosine stress magnetic resonance in patients presenting to an emergency department with chest pain. <i>J Am Coll Cardiol</i> 2006; 47(7):1427-1432. | 10 | 135 | To determine the diagnostic value of adenosine cardiac MR in troponin-negative patients with chest pain. Hypothesis that adenosine cardiac MR could determine which troponin-negative patients with chest pain in an emergency department have CAD or future adverse cardiac. | Adenosine perfusion abnormalities had 100% sensitivity, 93% specificity for detection of CAD and were the single most accurate component of the cardiac MRI. | 2 |
| 21. Panting JR, Gatehouse PD, Yang GZ, et al. Abnormal subendocardial perfusion in cardiac syndrome X detected by cardiovascular magnetic resonance imaging. <i>N Engl J Med</i> 2002; 346(25):1948-1953. | 10 | 30 | To analyze myocardial-perfusion cardiovascular MRI performed in 20 patients with syndrome X and 10 matched controls. Hypothesis that perfusion cardiovascular MRI would identify nontransmural ischemia in patients with syndrome X. | Subendocardial perfusion abnormalities occur in patients with syndrome X, with a reduction in subendocardial perfusion normalized to heart rate and a reduction in the ratio of subendocardial to subepicardial perfusion reserve. Results support the concept that chest pain may be related to myocardial ischemia. | 3 |
| 22. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/contrast_manual.aspx . | 15 | N/A | Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media. | N/A | 3 |

Evidence Table Key

Study Type Key

Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
 - a. Cohort
 - b. Cross-sectional
 - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews

8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.