## Acute Chest Pain — Suspected Aortic Dissection
## EVIDENCE TABLE

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 1. Nienaber CA, Eagle KA. Aortic dissection: new frontiers in diagnosis and management: Part I: from etiology to diagnostic strategies. *Circulation* 2003; 108(5):628-635. | 12 | N/A | Review etiology, natural history, and classification (with vascular staging) of aortic wall disease and diagnostic strategies. | Modern imaging techniques can reliably identify variants of dissection such as intramural hematoma (IMH), plaque ulceration, or traumatic aortic injury. | 4 |
| 2. Hagan PG, Nienaber CA, Isselbacher EM, et al. The International Registry of AOD(IRAD): new insights into an old disease. *JAMA* 2000; 283(7):897-903. | 13 | 464 | Use case series to assess the presentation, management, and outcomes of acute aortic dissection (AOD). | Wide range of manifestations. Data support the need for continued improvement in prevention, diagnosis, and management of acute AOD. | 2 |
| 3. Erbel R, Alfonso F, Boileau C, et al. Diagnosis and management of aortic dissection. *Eur Heart J* 2001; 22(18):1642-1681. | 15 | N/A | Review diagnosis and treatment of AOD. | CT is often used for patients with suspected aortic dissection. MRI has the highest accuracy and sensitivity as well as specificity (nearly 100%) for detection of all forms of dissection except subtle forms. MRI provides excellent visualization of tear localization, aortic regurgitation, side branch involvement and complications. | 4 |
| 4. Erbel R, Oelert H, Meyer J, et al. Effect of medical and surgical therapy on aortic dissection evaluated by transesophageal echocardiography. Implications for prognosis and therapy. The European Cooperative Study Group on Echocardiography. *Circulation* 1993; 87(5):1604-1615. | 13 | 168 patients in 8 centers | Prospective follow-up study to determine whether status of communications between true and false lumen analyzed by transesophageal echocardiography (TEE) influences risk after initiation of medical or surgical therapy. | Preoperative mortality is reduced by TEE. Intraoperative and postoperative mortality remains high. Fluid extravasation and open false lumen with high communication are risk factors. Important to detect and resect intimal tears as patients with communication have higher reoperation rate and mortality. | 1 |
| 5. Svensson LG, Crawford ES, Hess KR, Coselli JS, Safi HJ. Dissection of the aorta and dissecting aortic aneurysms. Improving early and long-term surgical results. *Circulation* 1990; 82(5 Suppl):IV24-38. | 4 | 690 | Retrospective review of surgical results in patients referred for AOD. | Modern operative techniques have produced 30 operative survivals approaching 95% and improved late results. Patients with lesser repairs of ascending or descending aorta alone at greatest risk for re-operation. | 2 |
| 6. Evangelista A, Mukherjee D, Mehta RH, et al. Acute intramural hematoma of the aorta: a mystery in evolution. *Circulation* 2005; 111(8):1063-1070. | 13 | 1,010 | Study patients with acute aortic syndromes to describe prevalence, presentation, management, and outcomes of acute IMH. | 5.7% patients had IMH. IMH is a highly lethal condition when it involves the ascending aorta and surgical therapy should be considered, but this condition is less critical when limited to the arch or descending aorta. 16% of patients have evidence of evolution to dissection on serial imaging. | 2 |

**Acute Chest Pain — Suspected Aortic Dissection**
**EVIDENCE TABLE**

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 7. Eyler WR, Clark MD. Dissecting aneurysms of the aorta: roentgen manifestations including a comparison with other types of aneurysms. *Radiology* 1965; 85(6):1047-1057. | 13 | 46 cases of dissecting aneurysms and 34 cases of arteriosclerotic , luetic, thoracic aneurysms | Comparison of radiographic findings in patients with aortic dissection and other types of aneurysms. | Radiographic and angiographic manifestations in series of 46 patients with dissecting aneurysm of the aorta reviewed and classified. Classification can be radiographic changes on plain films or on contrast studies. | 3 |
| 8. Moore AG, Eagle KA, Bruckman D, et al. Choice of computed tomography, transesophageal echocardiography, magnetic resonance imaging, and aortography in acute aortic dissection: International Registry of AOD(IRAD). *Am J Cardiol* 2002; 89(10):1235-1238. | 9 | 628 | Comparative study to assess the current status of diagnostic imaging in AOD at several cardiovascular referral centers throughout the world by analyzing data on test preference and performance gathered in the International Registry of AOD (IRAD). | For AOD, CT is selected most frequently worldwide as the initial test, followed by TEE. Aortography and MRI are performed much less often. More than two thirds of the patient's required second imaging tests. | 2 |
| 9. Yoshida S, Akiba H, Tamakawa M, et al. Thoracic involvement of type A aortic dissection and intramural hematoma: diagnostic accuracy--comparison of emergency helical CT and surgical findings. *Radiology* 2003; 228(2):430-435. | 10 | 57 | To assess the accuracy of various findings at emergency helical CT for the evaluation of thoracic involvement of type A aortic dissection and type A IMH and to compare these findings with those at surgical confirmation. | For the detection of aortic dissection or IMH of the thoracic aorta, the accuracy of helical CT was 100%. The sensitivity, specificity, and accuracy, respectively, were 82%, 100%, and 84% for an entry tear; 95%, 100%, and 98% for arch branch vessel involvement; and 83%, 100%, and 91% for pericardial effusion. These values were all 100% for aortic arch anomalies. | 3 |
| 10. Thoongsuwan N, Stern EJ. Chest CT scanning for clinical suspected thoracic aortic dissection: beware the alternate diagnosis. *Emerg Radiol* 2002; 9(5):257-261. | 13 | 130 | Retrospective review to evaluate the spectrum of chest diseases in patients presenting with clinical suspicion of thoracic aortic dissection in the emergency department. | Found aortic dissection in 32 patients (24.6%), 22 of which were Stanford classification type A and 10 Stanford type B. In 28 patients (21.5%), CT revealed an alternate diagnosis that, along with the clinical impression, probably explained the patients presenting symptoms. | 3 |
| 11. Ballal RS, Nanda NC, Gatewood R, et al. Usefulness of transesophageal echocardiography in assessment of aortic dissection. *Circulation* 1991; 84(5):1903-1914. | 9 | 61 | To clarify role of TEE (36% biplane) in evaluation of aortic dissection with attention to type of dissection and associated complications and in assessment of immediate postoperative repair. TEE results compared to CT, angiography, surgery, or autopsy. | TEE made correct diagnosis of dissection in 33/34 patients (sensitivity 97%; specificity 100%). CT made correct diagnosis in only 67% and misclassified the type of dissection in 33%. TEE identified coronary artery involvement by dissection in 6/7 with dissection; detected entry sites, thrombi in false lumen and false aneurysm formation. Sensitivity and specificity calculations suspect as group II patients were not suspected of having dissection and 16 patients had intraoperative TEE. | 3 |

**Acute Chest Pain — Suspected Aortic Dissection**
**EVIDENCE TABLE**

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 12. Laissy JP, Blanc F, Soyer P, et al. Thoracic aortic dissection: diagnosis with transesophageal echocardiography versus MR imaging. *Radiology* 1995; 194(2):331-336. | 9 | 41 | Retrospective study to compare TEE and MRI in diagnosis of dissection of thoracic aorta. Imaging results compared at independent double-blind readings. | MRI depicted intimal flap in 95% aortic dissections; TEE in 86% ($p$=<0.05). Sensitivity for MRI for detection of residual dissection 100% vs 86% with TEE. Inferior extent dissection seen only with MRI. MRI superior to TEE in follow-up thoracic aortic dissection. However, because of limited MRI availability, TEE should remain standard modality for diagnosis. | 2 |
| 13. Nienaber CA, von Kodolitsch Y, Nicolas V, et al. The diagnosis of thoracic aortic dissection by noninvasive imaging procedures. *N Engl J Med* 1993; 328(1):1-9. | 9 | 110 | Comparative study to assess reliability and safety of TTE, single plane TEE, contrast enhanced CT and MRI as compared to contrast angiography in patients with clinically suspected aortic dissection. Results were compared in a blinded fashion and validated independently against intraoperative findings in 62 patients, autopsy findings in 7, and the results of contrast angiography in 64. | MRI, TEE and x-ray CT have similar sensitivities for detecting dissection; 98.3%, 97.7% and 93.8% respectively. Specificities of both TTE (83%) and TEE (76.9%) were lower than those of CT (87.1%) and MRI (97.8%) mainly as a result of false positive findings in the ascending aorta. A noninvasive diagnostic strategy using MRI and TEE in unstable patients should be considered optimal approach to dissection of thoracic aorta. | 2 |
| 14. Sommer T, Fehske W, Holzknecht N, et al. Aortic dissection: a comparative study of diagnosis with spiral CT, multiplanar transesophageal echocardiography, and MR imaging. *Radiology* 1996; 199(2):347-352. | 9 | 49 | Prospective study to compare usefulness of spiral CT, multiplanar TEE and MRI in the diagnosis of thoracic aortic dissection and arch vessel involvement. | Sensitivity in detection thoracic aortic dissection was 100% for all techniques, specificity 100%, 94% and 94% for spiral CT, multiplanar TEE and MRI, respectively. For assessment of aortic arch vessel involvement, sensitivity 93%, 60% and 67% respectively and specificity was 97%, 85%, and 88% respectively. In the assessment of the supra aortic branches, spiral CT is superior ($p$<.05). | 2 |
| 15. Rubin GD. MDCT imaging of the aorta and peripheral vessels. *Eur J Radiol* 2003; 45 Suppl 1:S42-49. | 12 | N/A | To describe how MDCT technology has substantially improved imaging of the aorta and peripheral vessels. | Discusses advantages of MDCT for evaluating a variety of aortic pathologies including aortic dissection. Discusses strengths and limitations of TEE, CT and MRI in aortic dissection and makes recommendations on efficient use of MDCT. | 4 |
| 16. Shiga T, Wajima Z, Apfel CC, Inoue T, Ohe Y. Diagnostic accuracy of transesophageal echocardiography, helical computed tomography, and magnetic resonance imaging for suspected thoracic aortic dissection: systematic review and meta-analysis. *Arch Intern Med* 2006; 166(13):1350-1356. | 11 | 1,139 | Systematic review of the diagnostic accuracy of imaging techniques: TEE, CT, MRI in patients with suspected thoracic aortic dissection. | TEE, helical CT, and MRI, yield clinically equally reliable diagnostic values for confirming or ruling out thoracic aortic dissection. | 1 |

## Acute Chest Pain — Suspected Aortic Dissection
## EVIDENCE TABLE

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 17. Barron DJ, Livesey SA, Brown IW, Delaney DJ, Lamb RK, Monro JL. Twenty-year follow-up of acute type a dissection: the incidence and extent of distal aortic disease using magnetic resonance imaging. *J Card Surg* 1997; 12(3):147-159. | 13 | 87 | To report findings of 20-year follow-up in patients who have undergone surgical repair of type A dissection with all survivors undergoing MRA. | For dissection extending beyond arch, the choice of surgical technique does not prevent persistence of a distal false lumen. MRI gives ideal assessment of distal aortic disease and provides surgeon with all necessary information to plan timing and indications for further surgery. | 2 |
| 18. Prince MR, Narasimham DL, Jacoby WT, et al. Three-dimensional gadolinium-enhanced MR angiography of the thoracic aorta. *AJR* 1996; 166(6):1387-1397. | 10 | 90 patients 97 MR exams 4 observers | To evaluate image quality and preliminary experience with 3D gadolinium enhanced MRA of thoracic aorta. All MR exams were evaluated retrospectively for intravascular signal-to-noise ratio. | Signal-to-noise ratio highest in aortic arch, upper descending aorta, upper abdominal aorta. Stenoses of major branch vessel origins detected with sensitivity 90%, specificity 96%. Type of dissection correctly determined in all 8 dissection patients. 3D gadolinium-enhanced MRA has the potential to accurately diagnose aortic dissection, coarctation, and aneurysm. | 2 |
| 19. Cigarroa JE, Isselbacher EM, DeSanctis RW, Eagle KA. Diagnostic imaging in the evaluation of suspected aortic dissection. Old standards and new directions. *N Engl J Med* 1993; 328(1):35-43. | 12 | N/A | To discuss the strengths, weaknesses and relative merits of the four imaging techniques: CT, echocardiography, (especially TEE), MRI, and angiography available for evaluating patients with suspected aortic dissection. | MRI and TEE are the most sensitive studies. Specificity of aortography CT and MRI quite high, but TEE specificity high only when strict definition is positive study applied. Selection of imaging technique depends on hospital resources. | 4 |
| 20. Nienaber CA, Spielmann RP, von Kodolitsch Y, et al. Diagnosis of thoracic aortic dissection. Magnetic resonance imaging versus transesophageal echocardiography. *Circulation* 1992; 85(2):434-447. | 8 | 53 | To prospectively assess reliability of ECG triggered MRI and monoplanar TEE for diagnosis of aortic dissection. Patients were subjected to a protocol in random order; imaging results were compared and validated against "gold standard" of intraoperative findings (n=27), necropsy (n=7), and/or contrast angiography (n=53). | Both MRI and monoplanar TEE had sensitivity of 100%. TEE had lower specificity of 68% vs 100% for MRI resulting mainly from false positive findings confined to ascending segment of aorta. | 1 |
| 21. Pereles FS, McCarthy RM, Baskaran V, et al. Thoracic aortic dissection and aneurysm: evaluation with nonenhanced true FISP MR angiography in less than 4 minutes. *Radiology* 2002; 223(1):270-274. | 13 | 29 | Retrospective review. Authors hypothesized that nonenhanced true fast imaging with steady-state precession (FISP) portion alone of their comprehensive imaging protocol would be adequate to confidently confirm or exclude dissection or aneurysm of the aorta. | Nonenhanced true FISP MRI alone was 100% accurate for determining the presence or absence of dissection or aneurysm. | 3 |

## Acute Chest Pain — Suspected Aortic Dissection
## EVIDENCE TABLE

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 22. Erbel R, Engberding R, Daniel W, Roelandt J, Visser C, Rennollet H. Echocardiography in diagnosis of aortic dissection. *Lancet* 1989; 1(8636):457-461. | 9 | 164 | Multicenter study to measure sensitivity, specificity and predictive value of echocardiography including TEE in diagnosis aortic dissection. | • Echocardiography had sensitivity of 99% and specificity of 98% with PPV of 98% and NPV of 99%.<br>• CT had sensitivity of 83% and specificity of 100%, with PPV of 100% and NPV of 86%.<br>• Aortography had sensitivity of 88% and specificity of 94% with PPV of 96% and NPV of 84%. | 1 |
| 23. Keren A, Kim CB, Hu BS, et al. Accuracy of biplane and multiplane transesophageal echocardiography in diagnosis of typical AODand intramural hematoma. *J Am Coll Cardiol* 1996; 28(3):627-636. | 10 | 112 | To evaluate diagnostic accuracy of biplane and multiplane TEE in patients with suspected aortic dissection including IMH. | Overall sensitivity and specificity of TEE for presence dissection 98% and 95% respectively. Specificity for type A and B dissection 97% and 99% respectively. Accuracy of TEE for diagnosis of acute aortic regurgitation and pericardial tamponade was 100%. | 2 |
| 24. Adachi H, Omoto R, Kyo S, et al. Emergency surgical intervention of AODwith the rapid diagnosis by transesophageal echocardiography. *Circulation* 1991; 84(5 Suppl):III14-19. | 10 | 45 | Evaluate rapid diagnosis and emergency surgical intervention of AOD by biplanar TEE. | Sufficient information for surgery obtained with bedside TEE (uniplane and biplane) with 98% of patients diagnosed accurately without aortography. | 3 |
| 25. Omoto R, Kyo S, Matsumura M, et al. Evaluation of biplane color Doppler transesophageal echocardiography in 200 consecutive patients. *Circulation* 1992; 85(4):1237-1247. | 9 | 200 | To evaluate the clinical applicability and advantages of biplane images of the heart using a biplane TEE probe. | Both transverse and longitudinal scans allowed correct identification of true and false lumina in all 30 aortic dissection examinations but longitudinal scans were superior in detecting types I and III entry sites. Longitudinal images increased acoustic window of the heart. | 2 |
| 26. Willens HJ, Kessler KM. Transesophageal echocardiography in the diagnosis of diseases of the thoracic aorta: part 1. Aortic dissection, aortic intramural hematoma, and penetrating atherosclerotic ulcer of the aorta. *Chest* 1999; 116(6):1772-1779. | 12/14 | 1 | Cased-based review to focus on the use of TEE in the acute aortic syndrome (aortic dissection, aortic IMH and penetrating atherosclerotic ulcer) of the aorta. Discusses the strengths and weaknesses of monoplane and biplane TEE in particular the problems with both in the assessment of the ascending aorta. | Suggests use of TEE-derived M-mode echocardiography may help to distinguish reverberation artifacts originating from posterior wall of the aorta or right pulmonary artery and to differentiate these artifacts from dissection. | 4 |
| 27. Chan KL. Impact of transesophageal echocardiography on the treatment of patients with aortic dissection. *Chest* 1992; 101(2):406-410. | 9 | 18 | Prospectively assess impact of TEE on clinical treatment of patients of the aortic dissection by monitoring clinical outcome including end points such as survival, surgery and need for ancillary tests. Angiography was also performed. | In most cases of ascending aortic dissection, TEE provides all the necessary information to surgeons, thus obviating the need for angiography. Angiography has larger role in descending aortic dissection for evaluating branch vessel involvement and distal extension. | 3 |

## Acute Chest Pain — Suspected Aortic Dissection
## EVIDENCE TABLE

| Reference | Study Type | Patients/ Events | Study Objective (Purpose of Study) | Study Results | Strength of Evidence |
|---|---|---|---|---|---|
| 28. Chirillo F, Cavallini C, Longhini C, et al. Comparative diagnostic value of transesophageal echocardiography and retrograde aortography in the evaluation of thoracic aortic dissection. *Am J Cardiol* 1994; 74(6):590-595. | 9 | 64 | Prospective study to assess the comparative diagnostic value of TEE and retrograde aortography for morphologic evaluation and anatomic mapping of aortic dissection. | For detection of aortic dissection, aortography showed lower sensitivity (87.5% vs 97.5%) and NPV (85.3% vs 96.7%; For the epiphenomena of aortic dissection, aortography was significantly more accurate (97.2% vs 78%; $p<0.05$) in assessing the site of entry, and TEE was more accurate in identifying thrombus formation (90% vs 65%; $p<0.05$). In elective patients, combining both techniques seems the best approach; in unstable patients, TEE may be preferential because it is less invasive, requires no contrast injection, and provides accurate diagnosis in a short time at the bedside. | 3 |
| 29. Andresen J, Baekgaard N, Allermand H. Evaluation of patients with thoracic aortic dissection by intraarterial digital subtraction angiography. *Vasa* 1992; 21(2):167-170. | 10 | 17 patients 11 patients | Determine quantity of information obtainable with arterial subtraction angiography in planning treatment of thoracic aortic dissection. | In 17 patients, a thoracic aortic dissection could be revealed by intraarterial DSA with exact delineatin of the proximal and distal extent. In 11 patients the entry was seen over a longer area. Arterial DSA provided accurate diagnosis with visualization of all pathophysiological aspect including flow into supra aortic and infradiaphragmatic arteries. | 3 |
| 30. American College of Radiology. *Manual on Contrast Media*. 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.