Clinical Assessment for Acute Thoracic Aortic Dissection

EBEM Commentator Contact
Jeffrey Bushnell, DO
James Brown, MD

From the Department of Emergency Medicine, Wright State University, Dayton, OH.

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RATIONAL CLINICAL EXAMINATION REVIEW SOURCE

This is a rational clinical examination abstract, a regular feature of *Annals'* Evidence-Based Emergency Medicine (EBEM) series. Each features an abstract of a rational clinical examination review from the *Journal of the American Medical Association* and a commentary by an emergency physician knowledgeable in the subject area.

The source for this rational clinical examination review abstract is: M Klompas. Does this patient have an acute thoracic aortic dissection? *JAMA*. 287:17;2262-2272. The *Annals'* EBEM editors assisted in the preparation of the abstract of this rational clinical examination review, as well as the selection of the Evidence-Based Medicine Teaching Points.

OBJECTIVE

To provide evidence-based support for the use of medical history, physical examination, and plain chest radiographs to assess the patient suspected of having acute thoracic aortic dissection.

DATA SOURCES

The author searched MEDLINE using key words examining the usefulness and accuracy of the medical history, physical examination, and chest radiograph for the detection of acute thoracic aorta dissection.

STUDY SELECTION

Two hundred seventy-four articles were identified. Abstracts were reviewed by the author for inclusion/exclusion criteria. The author included papers that were original studies describing the clinical findings of 18 or more consecutive patients confirmed as having thoracic aortic dissection. Exclusion criteria were any of the following: greater than 15% trauma patients, patients identified as having a history of chronic thoracic aortic dissection (>14 days), abdominal aortic aneurysm, articles containing only patients with proximal or distal dissection. Twenty-one studies met inclusion criteria.

DATA EXTRACTION AND ANALYSIS

Studies selected for inclusion were graded for quality using a modified grading system previously used in the rational clinical examination series. Modifications to the system were made to integrate the large number of studies describing a consecutive case series. Using a scale of 1 to 5, 1 being the highest quality, of the 21 studies reviewed, 20 were classified as level 4 studies (poor quality), and 1 was classified as a level 3 study (moderate quality).

The author calculated sensitivity using data in the 21 studies. Likelihood ratios were calculated on the 4 studies that contained specificity data. The author used a random-effects model to derive summary measures and confidence intervals (CIs) for the sensitivity and likelihood ratios. Interobserver and intraobserver agreement for physician assessment of radiographs was calculated and interpreted using the κ statistic of Landis and Koch.

MAIN RESULTS

The pooled sensitivity of "any pain" for thoracic aortic dissection was 90% (95% CI 85% to 94%). The sensitivity of patients presenting with pain of severe intensity was also 90% (95% CI 88% to 92%), and pain of sudden onset had a sensitivity of 84% (95% CI 80% to 89%). Pain of a tearing or ripping quality had high specificity in 2 studies (94% and 95%) but widely varying sensitivity (62% and 7%, respectively) and likelihood ratios (Table).[1,2]

A pulse deficit in any one of the radial, carotid, or femoral pulses when compared with the contralateral side was supportive of a diagnosis of thoracic aortic dissection (positive likelihood ratio 5.7; (95% CI 1.4 to 23). The 2 studies that examined focal neurologic deficits found positive likelihood ratios ranging from 6.6 to 33 (Table).[1,3]

The radiographic characteristics usually associated with thoracic aorta dissection, such as abnormal aortic contour, pleural effusion, intimal calcification, and wide mediastinum, are not individually sensitive, although some type of abnormality was present in 90% (95% CI 87% to 92%). The likelihood ratio of a negative chest radiograph result (absence of either an abnormal aortic contour or a widened mediastinum) was 0.3 (95% CI 0.2 to 0.4) (Table). However, the 2 studies that assessed interobserver agreement of plain chest radiograph interpretations found only fair agreement (κ 0.23 to 0.33).[2,4]

Combined positive findings increased the likelihood of dissection. The only large, prospective investigation[1] examined the effects of combining "aortic pain" (severe, sudden-onset, tearing pain), blood pressure, or pulse difference between

Table. Likelihood ratios of major presenting signs and symptoms.*

Finding	+LR (95% CI)	−LR (95% CI)
Sudden-onset pain	1.6 (1.0–2.4)	0.3 (0.2–0.5)
Tearing or ripping pain	1.2 (0.2–8.1)	0.99 (0.9–1.1)
	10.8 (5.2–22.0)	0.4 (0.3–0.5)
Migrating pain	(0.5–2.4)	0.97 (0.6–1.6)
	7.6 (3.6–16.0)	0.6 (0.5–0.7)
Pulse deficits	5.7 (1.4–23)	0.7 (0.6–0.9)
Focal neurologic deficits	6.6 (1.6–28.0)	0.71 (0.6–0.9)
	33.0 (2.0–549.0)	0.87 (0.8–0.9)
Enlarged aorta or wide mediastinum	2.0 (1.4–3.1)	0.3 (0.2–0.4)

LR, Likelihood ratios.
*Single rows indicate summary statistics; double rows indicate results from 2 studies.

upper extremities and wide mediastinum on chest radiograph. The likelihood ratio of a negative finding for any of these was 0.1 (95% CI 0 to 0.2). If only 1 factor was present, the likelihood ratio increased to 0.5 (95% CI 0.3 to 0.8). However, if 2 were present, the likelihood ratio of this as a positive test was 5.3 (95% CI 3 to 9.4), and if all 3 were present, the likelihood ratio was 66 (95% CI 4.1 to 1,062).

CONCLUSIONS

Pain of abrupt onset, pulse deficits, and neurologic deficits all increase the likelihood of aortic dissection, whereas a normal chest radiograph result and the absence of acute-onset pain appear to decrease this likelihood. However, estimation of the sensitivity in the included studies probably overestimates the accuracy of some of these findings because of inclusion bias (see teaching point). Combinations of findings in the clinical history, physical examination, and chest radiograph can help rule in thoracic aortic dissection but lack the accuracy to rule out the disease. More prospective, independent, blinded studies are needed to help clinicians refine their clinical examination process to help identify these patients as rapidly and efficiently as possible.

Rational Clinical Examination Author Contact
Michael Klompas, MD
Department of Medicine
Brigham and Women's Hospital
75 Francis Street
Boston, MA 02115
Email: mklompas@partners.org

COMMENTARY: CLINICAL IMPLICATION

Thoracic aortic dissection continues to be a commonly missed and catastrophic condition that demands early recognition and aggressive treatment.[5] This review presents the available clinical data about the test performances of common clinical signs and symptoms, as well as chest radiologic findings to diagnose aortic dissection. However, because of the relatively low frequency of the condition, large, high quality, prospective observational cohort studies of diagnostic test performance are uncommon. Accordingly, 20 of the 21 articles reviewed were retrospective, unblinded evaluations of the impact of clinical history, physical examination, and chest radiographs on the diagnosis, and almost all scored low on methodologic quality.

Several of the pooled statistical results demonstrate useful likelihood ratios. The presence of a unilateral deficit in one of the radial, carotid, or femoral pulses has an important likelihood ratio (5.7), as does the presence of a focal neurologic deficit (6.6 and 33.0 in 2 studies). Negative findings associated with potentially helpful likelihood ratios ($\leq$0.5) in combined study data included absence of sudden onset of pain (0.3), absence of a history of hypertension (0.5), and absence of an abnormal aortic contour or widened mediastinum on chest radiograph (0.3). Combinations of findings improved the diagnostic test performance. Von Kodolitsch et al[1] showed a positive likelihood ratio of 66.0 with the 3 findings of typical pain, pulse discrepancy, and an abnormal aortic contour or widened mediastinum on radiograph, although the 95% CI for this was wide (4.1 to 1062.0). This triad was seen in 27% of dissection patients overall. Blood pressure abnormalities, the presence of murmurs, and ECG findings appear unlikely to significantly affect the detection of thoracic aortic dissection, although they may indicate additional complications or an alternate diagnosis or help guide treatment strategies.

Of note, although pain is a hallmark of most thoracic aortic dissections, one retrospective study suggested that only 42% of conscious patients were asked all relevant questions about their pain.[6] A comprehensive evaluation of a patient's pain may be beneficial, particularly in light of the potentially useful likelihood ratios reported in some studies with the absence of acute-onset, migratory, and tearing or ripping pain.

TAKE HOME MESSAGE

The presentation of thoracic aortic dissection is highly variable, and the diagnosis cannot be ruled out based on medical history, examination, or plain radiography findings. Combinations of signs and symptoms and findings such as neurologic abnormalities and pulse deficits may heighten clinical suspicion, and the absence of chest radiograph abnormalities, sudden-onset pain, and a history of hypertension all decrease the likelihood of the diagnosis. However, transesophageal echocardiography, magnetic resonance imaging, or computed tomography will still be required to confirm or rule out the diagnosis.[7-9]

EBEM Commentator Contact
Jeffrey Bushnell, DO
Department of Emergency Medicine
Wright State University
3525 Southern Boulevard
Dayton, OH 45429
E-mail: jeffrey.bushnell@wright.edu

EBEM TEACHING POINT

Inclusion/incorporation bias. A criterion (previously referred to as a "gold") standard test must be performed in any high-quality study evaluating the performance of diagnostic tests or maneuvers. Inclusion bias occurs when the criterion standard test is interpreted with knowledge of the results of the diagnostic test(s) being studied. The criterion standard test and the test or maneuver being studied should be evaluated independently by individuals blinded to the results of the other. Because of the low incidence of the disease in all of the aortic dissection studies reviewed in the abstract above, data were collected only when the diagnosis had already been confirmed. Therefore, each diagnosis was made by radiologists, surgeons, or pathologists aware of the positive physical findings or historical features that led to the criterion standard test being ordered. The knowledge of this information may theoretically have affected the interpretation of the test as positive or negative for the disease. When the final diagnosis incorporates the result of the diagnostic test being studied as a contributing determinant of whether or not the disease was present, this is referred to as incorporation bias.

REFERENCES

1. von Kodolitsch Y, Schwartz AG, Nienaber CA. Clinical prediction of acute aortic dissection. *Arch Intern Med*. 2000;160: 2977-2982.
2. Luker GD, Glazer HS, Eagar G, et al. Aortic dissection: effect of prospective chest radiographic diagnosis on delay to definitive diagnosis. *Radiology*. 1994;193:813-819.
3. Armstrong WF, Bach DS, Carey LM, et al. Clinical and echocardiographic findings in patients with suspected acute aortic dissection. *Am Heart J*. 1998;136:1051-1060.
4. Jagannath AS, Sos TA, Lockhart SH, et al. Aortic dissection: a statistical analysis of the usefulness of plain chest radiographic findings. *Am J Roentgenol*. 1986;147:1123-1126.
5. Spittell PC, Spittell JA Jr, Joyce JW, et al. Clinical features and differential diagnosis of aortic dissection: experience with 236 cases (1980 through 1990). *Mayo Clin Proc*. 1993;68:642-651.
6. Rosman HS, Patel S, Borzak S, et al. Quality of history taking in patients with aortic dissection. *Chest*. 1998;114:793-795.
7. Knaut AL, Cleveland JC Jr. Aortic emergencies. *Emerg Med Clin North Am*. 2003;21:817-845.
8. Khan IA, Nair CK. Clinical, diagnostic, and management perspectives of aortic dissection. *Chest*. 2002;122:311-328.
9. Woo Y, Bavaria J, Mohler M. Clinical features and diagnosis of thoracic aortic aneurysm. In: Rose BD, ed. *UpToDate*. Wellesley, MA: UpToDate; 2004.