What Is the Accuracy of the Aortic Dissection Detection Risk Score?

TAKE-HOME MESSAGE

An aortic dissection detection risk score (ADD-RS) greater than or equal to 1 is sensitive but not specific. The addition of a D-dimer test further increases the sensitivity while decreasing the specificity.

METHODS

DATA SOURCES

The authors searched MEDLINE, EMBASE, and the Cochrane Controlled Register of Trials to identify studies examining the diagnostic accuracy of the ADD-RS compared with aortic imaging from inception to December 12, 2018. Searches were constructed by the combination of Medical Subject Headings and free keywords such as "aortic dissection" and "acute aortic syndrome." Additional reference searches were also performed. There were no language or age restrictions.

STUDY SELECTION

Two reviewers independently screened the titles and abstracts, using the following criteria. Studies needed to report the diagnostic accuracy of ADD-RS alone or with D-dimer testing. Both case-control and cohort reports were included. However, cases that did not provide sufficient information to calculate the diagnostic accuracy were excluded if the authors could not provide the missing information when contacted. Studies were also excluded if their reference standard test was not definitive aortic imaging, operation, or autopsy. If there were multiple studies with an

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Results

Diagnostic accuracy of ADD-RS and D-dimer test.

Outcome	No. of Studies (No. of Participants)	Sensitivity (95% CI)	Specificity (95% CI)	Negative Likelihood Ratio (95% CI)
ADD-RS ≥1	8 (26,598)	0.94 (0.90–0.96)	0.40 (0.26–0.57)	0.16 (0.09–0.29)
ADD-RS ≥2	8 (26,598)	0.46 (0.34–0.59)	0.91 (0.79–0.96)	0.59 (0.46–0.76)
ADD-RS ≥1 or a positive D-dimer test	4 (3,421)	1.00 (0.99–1.00)	0.15 (0.13–0.18)	0.01 (0.00–0.07)
ADD-RS ≥2 or a positive D-dimer test	4 (3,421)	0.99 (0.97–1.00)	0.35 (0.14–0.64)	0.02 (0.01–0.06)

CI, Confidence interval.

The literature search identified 739 publications, of which 9 studies (n=26,598 for ADD-RS alone and n=3,421 for ADD-RS with D-dimer test) were included in the final analyses. There were 8 retrospective studies and 1 prospective cohort study. One study was conducted in the out-of-hospital setting, whereas the rest were performed in the emergency department (ED). Sample sizes varied from 162 to 22,075

overlapped cohort, only the study with the largest population of each index test was included. Differences between the authors were resolved by consensus.

DATA EXTRACTION AND SYNTHESIS

Two review authors independently extracted data to construct a 2×2 contingency table, with disagreements resolved by consensus and consultation with a third author if necessary. Because diagnostic accuracy was examined according to different threshold values of ADD-RS (scores ≥1 and ≥2) with or without a D-dimer test, the contingency table was based on each threshold separately. For studies including both ADD-RS and a D-dimer test, a finding was considered positive when either one was positive. A D-dimer–level threshold of 500 ng/dL was used for determining elevation. Pooled estimates of sensitivity, specificity, and negative likelihood ratio with 95% confidence intervals were calculated with a bivariate model. Methodological quality was assessed with the Quality Assessment of Diagnostic Accuracy Studies version 2.[1] Heterogeneity and publication bias were not assessed.

participants. Eight of the studies reported ADD-RS without a D-dimer test. Four of the studies were from a cohort with overlap and reported both ADD-RS with and without a D-dimer test. Studies were deemed to have low or unclear risk of bias, except for 4 studies that had high risk of bias for patient selection. Overall, an ADD-RS greater than or equal to 1 was highly sensitive and improved with the addition of a D-dimer test, whereas an ADD-RS greater than or equal to 2 was poorly sensitive but highly specific for aortic dissection (Table).

Commentary

Acute aortic dissection is a disorder associated with significant morbidity and mortality. It is typically confirmed with advanced imaging (eg, computed tomography, transesophageal echocardiography, magnetic resonance imaging, aortic angiography). Clinicians may suspect this disorder in patients presenting with chest, back, or abdominal pain. However, although these symptoms are common, aortic dissection is a rare condition, occurring in only 2.9 to 3.5 cases per 100,000 person-years.[2,3] Therefore, having an effective screening test would be beneficial in reducing unnecessary testing, thereby decreasing radiation exposure and health care costs. The ADD-RS was developed as a tool in 2010 to risk stratify patients with concern for aortic dissection, using a combination of 12 clinical factors, including medical history, symptoms, and physical examination findings.[4]

This systematic review and meta-analysis found that an ADD-RS greater than or equal to 1 was sensitive and that the sensitivity increased with the addition of a D-dimer test. For a setting with a low prevalence of aortic dissection (5% pretest probability), an ADD-RS greater than or equal to 1 alone would have a failure rate of 0.8% and an ADD-RS greater than or equal to 2 would have a failure rate of 3%. If a D-dimer test were added, an ADD-RS greater than or equal to 1 would have a failure rate of 0.05%; and of greater than or equal to 2, 0.1%. For a setting with a high prevalence of aortic dissection (20% pretest probability), ADD-RS alone would have a failure rate of 3.8% at an ADD-RS greater than or equal to 1 and 12.9% at an ADD-RS greater than or equal to 2, whereas ADD-RS with a D-dimer test would have a failure rate of 0.2% at an ADD-RS greater than or equal to 1 and 0.5% at an ADD-RS greater than or equal to 2. These data indicate that an ADD-RS greater than or equal to 1 alone could be useful in screening for aortic dissection in a low-prevalence setting, whereas an ADD-RS with a D-dimer test can be used in a high-prevalence setting. Clinicians should consider the baseline prevalence in their ED when using these tools.

This review had several limitations. First, some of the studies had a very high prevalence of aortic dissection. This may have been due to spectrum bias, which can artificially increase the diagnostic accuracy of these tests. Second, most of the studies were performed in Europe or Asia and they may not reflect populations in other locations. Additionally, the majority of the data was from a single out-of-hospital study that was designed to determine optimal field triage protocols, which may not apply to the ED environment.[5] Moreover, the majority of the data was retrospective and excluded patients without an index test or reference standard, which may

have led to selection bias. Many of these studies also relied on retrospective calculations of the ADD-RS, which can also be subject to bias and missing data. For studies using a D-dimer test, there were only sufficient data to assess this at a threshold of 500 ng/dL, so the diagnostic accuracy at other thresholds (including age-adjusted D-dimer levels) remains unclear. Additionally, some of these studies obtained D-dimer levels in all patients who were enrolled, whereas others included D-dimer levels only if they were already obtained, which may have biased the results in the D-dimer groups. Finally, it is important to consider the poor specificity for ADD-RS greater than or equal to 1 with or without a D-dimer test. Clinicians should consider the potential increase in testing if this were indiscriminately used and ensure this is applied appropriately to patients with a realistic possibility of aortic dissection.

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