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Title:
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Date:
2018-10-01

Citation:
Rotella, J. A., Goel, V., Chan, T., Yeoh, M. & Taylor, D. M. D. (2018). Aortic dissection detection risk score has high sensitivity with moderate inter-rater reliability. EMA Emergency Medicine Australasia, 30 (5), pp.720-721. https://doi.org/10.1111/1742-6723.13152.

Persistent Link:
https://hdl.handle.net/11343/284362

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Original Article Submission to Emergency Medicine Australasia

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The Aortic Dissection Detection Risk Score (ADD-RS) has high sensitivity with moderate inter-rater reliability

Running title: Aortic Dissection Detection Risk Score

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/1742-6723.13152

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Abstract

Objective: To retrospectively assess the accuracy and inter-rater reliability of the Aortic Dissection Detection Risk Score (ADD-RS).

Methods: Single-centre, observational, diagnostic accuracy study undertaken in a university-affiliated, tertiary hospital emergency department.

Results: 200 patients were enrolled. Five patients were diagnosed with AAD and had an elevated ADD-RS >0. The ADD-RS was 100% sensitive with a negative and positive predictive values of 100% (if ADDRS ≥1). Inter-rater reliability was moderate (Kappa 0.55).

Conclusion: The ADD-RS was highly sensitive in our cohort. Further work to evaluate the score prospectively and in combination with a D-Dimer is required.

Report

Introduction:

Acute aortic dissection (AAD) is a lethal cardiovascular emergency and whilst rare, continues to present a diagnostic challenge. There is an imperative to improve diagnostic accuracy and ensure patients are appropriately investigated. At present, imaging is required to exclude the diagnosis regardless of the level of risk. The ability to risk stratify patients is highly desirable.

The Aortic Dissection Detection Risk Score (ADD-RS) is a consensus score that offers clinicians a means to risk stratify patients in whom a diagnosis of ADD has been considered[1]. It determines

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level of risk using presence or absence of features on past history (e.g. Marfan's syndrome, personal or family history of aortic valve disease or aneurysm), pain characteristics (chest, abdominal or back pain described as severe, sudden onset, ripping or tearing) and/or examination (evidence of perfusion deficit, new aortic regurgitation murmur or hypotension) with a maximum achievable score of 3.

A previous study found that an ADD-RS of 0 was more than 90% sensitive and proposed that it may assist in reducing the need for CT imaging in patients deemed to be 'low risk' by the clinician[2]. In preparation for a larger, multi-centre prospective study, we undertook an audit of ED patients investigated for AAD with CT imaging and applied the ADD-RS retrospectively. We assessed the accuracy of the score and inter-rater reliability. We aimed to determine whether an ADD-RS score of 0 would have safely reduced the need for unnecessary CT imaging.

Methods:

This was a single-centre, observational, diagnostic accuracy study undertaken in the ED of a university-affiliated, tertiary hospital between October 1, 2015 and May 1, 2017. The hospital has a cardiothoracic surgery service and the ED has an annual patient census greater than 75,000. The study was approved by the hospital's human research ethics committee.

Patients were identified retrospectively from the ED database of patients undergoing CT imaging. Patients were enrolled if they were aged 18 years or more, had a differential diagnosis of AAD and underwent CT imaging. For each patient, the ADD-RS was calculated by two independent Emergency Medicine physicians, each more than 10 years post-fellowship. Both physicians were blinded to the final diagnosis and utilised a study-specific data collection document to extract relevant clinical data (symptoms, medical history and physical examination) from the electronic medical record. The elements of the score that were not documented were defaulted to negative as previously performed[2]. The derived ADD-RS was then compared with

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the final diagnosis as per CT. Any of the following diagnoses were considered aortic dissection: Stanford Type A or B, intramural haematoma and penetrating aortic ulcer.

The ability of an ADD-RS score of 0 to safely 'rule out' patients and reduce unnecessary CT imaging was determined. For each physician, the diagnostic accuracy of the ADD-RS (specificity, sensitivity, positive and negative predictive values) were calculated. Inter-rater reliability was also assessed.

Results:

Two hundred patients were enrolled. Of those, 106 (53%) were male and 16 (8%) had a known aneurysm. Five (2.5%) patients were diagnosed with an AAD.

The ADD-RS and risk category determined by each physician are shown in Table 1.

All AAD cases had an elevated ADD-RS >0. Three and two cases had scores of 1 and 2, respectively. Where there was a difference in risk category between the two physicians, it varied only by one category (e.g. low vs intermediate or intermediate vs high). The inter-rate reliability was moderate (Kappa 0.55).

Conclusion:

Our proportion of AAD cases is consistent with previous studies[2,3,4]. The ADD-RS was sensitive with a negative predictive value of 100%. The ADD-RS did not miss any AAD in the cases reviewed when applied by two blinded physicians. However, their scores sometimes differed and the inter-rater reliability was moderate. This suggests that variance exists between clinicians in calculating the ADD-RS retrospectively. This may have been, in part, due to the accuracy of their data extraction and it is not known if the inter-rater reliability would be better if undertaken prospectively, at the bedside.

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This was a small study undertaken in a single institution and by only two clinicians. Our analyses were limited by the quality of the treating clinician's documentation. The default to a negative status if an ADD-RS variable was not documented may have under-estimated some scores.

The ADD-RS was greater than 1 in patients eventually diagnosed with an AAD and may be a useful tool if used prospectively. Further work will evaluate the score prospectively and in combination with a D-Dimer.

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Table 1: Analysis of retrospective application of the ADD-RS

Risk Category	**Physician 1** (n=200)	**Physician 2** (n=200)
Low (ADDRS 0)	65 (32.5%)	62 (31.0 %)
Intermediate (ADDRS 1)	97 (48.5%)	100 (50%)
High (ADDRS >1)	38 (19.0 %)	38 (19.0 %)
Sensitivity (if ADDRS ≥1)	100%	100%
Specificity (if ADDRS ≥1)	40%	40%
Negative Predictive Value (if ADDRS ≥1)	100%	100%
Positive Predictive Value (if ADDRS ≥1)	100%	100%

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