What is the Distribution of Aortic Dissection Detection Risk Score in an Undifferentiated Emergency Department Chest Pain Population?

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ABSTRACT

Objective: To determine the distribution of Aortic Dissection Detection Risk Score (ADDRS) in undifferentiated chest pain patients.

Methods: Prospective observational study of adult patients presenting to the ED with non-traumatic chest pain.

Results: Of 139 patients studied, more than 75% of patients has an ADDRS ≥ 1 , mainly due to report of severe pain. There were no aortic dissections. In patients with non-specific chest pain, testing driven by the ADD-RS protocol would have seen a 280% increase in D-dimer testing and 2200% increase in CTA rates.

Conclusion: Widespread use of the ADDRS and its investigation protocol cannot be supported.

Key words: aortic dissection, risk score, clinical decision rule, chest pain

INTRODUCTION:

Aortic dissection is a cardiovascular emergency with high mortality. Its presentation is variable, and misdiagnosis is common.[1] Chest pain is a common symptom. Using a consensus methodology, the American Heart Association, in collaboration with other stakeholders but not emergency physicians, developed the Aortic Dissection Detection Risk Score (ADDRS) in an attempt to reduce the rate of misdiagnosis.[2] (See box 1). The score, which ranges from 0-3, is designed to apply to all chest pain patients. It recommends d-dimer testing for scores ≤ 1 (including 0) and CT aortogram (CTA) for scores >1 , with positive d-dimer results also proceeding to CTA. In effect, it is designed as a clinical decision rule (CDR), but was not developed using methodology that would be widely accepted for a CDR.[3] In particular, the variables in the score have not been adequately tested for their discriminative performance and robust validation on the population of interest – the undifferentiated emergency department (ED) chest pain population - has not been undertaken.

Previous research has focussed on establishing the sensitivity of the score, with little attention to specificity. Broad application of the score could result in increased rates of testing, especially CTA, with its inherent risks. Even if the score and investigation strategy are highly sensitive, if the proportion of cases of aortic dissection is very low, it could result in more harm than good.

We aimed to determine the distribution of ADDRS in undifferentiated chest pain patients and to estimate the impact on testing if the recommended investigation strategy was applied to patients with a final ED diagnosis of non-specific chest pain.

METHODS

We undertook a prospective observational study in two metropolitan ED in Melbourne with a combined annual adult census of approximately 90,000. We included a convenience sample of patients presenting to the ED with undifferentiated chest pain. ADDRS was calculated at the bedside, with additional data collected retrospectively from medical records. The primary outcome of interest was distribution of the ADDRS. A secondary outcome was the impact of the score distribution on recommended testing. To estimate the impact on testing we assumed a positive d-dimer rate of 20%, which is modest when compared to rates reported for thromboembolic disease.[4] Descriptive analysis was performed. The project was approved by Western Health Low Risk Ethics Committee (QA 2019.44).

RESULTS

One hundred and thirty-nine patients were studied; median age 57, 47.5% male. The score distribution was 0 – 23.7% (33 patients), 1 – 72.7% (101 patients), 2 – 3.6% (5 patients) and 3 – 0%. No patients reported high-risk conditions associated with AD. High-risk pain features were present in 105 patients (75.5%). Six patients (4.3%) exhibited high-risk examination features. A score of ≥ 1 was almost entirely driven by

patient report of pain features. Of patients with an ADDRS score of 1, 99% (100/101) were due to patient-reported pain features alone.

Final ED diagnosis was acute coronary syndrome in 12 patients (8.6%), pulmonary infection in one patient (0.7%), other in 20 (14.4%) and non-specific chest pain in 104 (74.8%). No patient was diagnosed with aortic dissection.

The estimated impact of the implementation of the ADDRS score investigation strategy in patients with a final ED diagnosis of non-specific chest pain is shown in Table 1. It would result in 23% of ED patients with non-specific chest pain requiring a CTA.

DISCUSSION

This study showed that most ED patients with atraumatic chest pain will have an ADDRS score ≥ 1 , driven mainly by report of their description of pain. If the ADDRS score investigation strategy was implemented in patients with a final ED diagnosis of non-specific chest pain, it would result in 23% of ED patients with non-specific chest pain requiring a CTA, compared to the estimated prevalence of aortic dissection in ED chest pain patients of 0.1%.[5] Given the risks of CTA including contrast nephropathy, radiation-induced cancer and allergic reaction, this rate of testing could potentially cause more harm than good. This is even without considering the associated cost and impact on ED and radiology department flow.

Extrapolating the reported prevalence of aortic dissection in ED chest pain patients and our findings, if all were correctly identified by CTA, the rate of positive CTA would be 0.5%.

Limitations of this study include that it was conducted at a single health service and has a small sample size, with data collection stopped due to COVID-19.

CONCLUSION

On this basis on our results, the ADDRS score and its associated investigation strategy are not fit for purpose and its application to ED patients with non-traumatic chest pain cannot be justified.

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Box 1: ADDRS calculation

Category	Description	Score allocated
Presence of a high-risk condition	Marfan's syndrome Family history of aortic disease Known aortic valve disease Recent aortic valve manipulation Known thoracic aortic aneurysm	1
Presence of a high-risk pain feature	Chest, back, abdominal pain, described as Abrupt onset Severe intensity Ripping/tearing	1
Presence of a high-risk examination feature	Evidence of perfusion deficit (pulse deficit, systolic blood pressure differential) Focal neurological deficit (with pain), new aortic insufficiency murmur (with pain) Hypotension or shock	1

Table 1: Impact of ADD-RS investigation strategy on testing

ADDRS distribution (N, %)	N=104	D-dimer tested ordered in practice	D -dimer positive#	CTA ordered	Additional D-dimer tests	Additional CTA^
0	27, 26%	4, 14.8%	1, 25%	0	23	5
1	73, 70.2%	16, 21.9%	3, 18.8%	0	57	15
2	4, 3.8%	1, 25%	0	1, 25%	0	3
		21, 20.2%	4, 3.8%	1, 1%	83 (280% increase)	23 (2200%

						increase)
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-age adjusted d-dimer cut-off

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