Application of D-dimer to Aid in Diagnosis of Acute Aortic Dissection

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INTRODUCTION

• Acute aortic dissection (AAD), although rare, is a tear in the wall of the aorta which classically presents with severe chest pain. However symptoms may be vague, and if misdiagnosed AAD can be lethal.
• Currently the gold standard for diagnosis is imaging, mainly computed tomography (CT).
• CT can be an expensive first line test that will increase patients’ exposure to radiation.
• D-dimer is a degradation product of fibrin that is elevated in many diseases (including AAD) that can be measured in the blood.

Figure 1: See Reference

D8dimer is a degradation product of fibrin that is elevated in many diseases Acute aortic dissection (AAD), although research has shown the use of D-dimer assays, which have high sensitivity and specificity, may contribute to the clinician’s resources to exclude AAD.

CT can be an expensive first line test that will increase patients’ exposure to radiation.

Results of D-dimer can be used to help determine the need for imaging.

CLINICAL QUESTION

Population

Patients with Acute Aortic Dissection

In patients presenting with symptoms of an acute aortic dissection, can a D-dimer assay be used to help determine the need for imaging?

Methods

Table 1. Comparison of Three Studies

<table>
<thead>
<tr>
<th>Study type</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-dimer Cut Off Value (ng/ml)</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Sample Size</td>
<td>887</td>
<td>220</td>
<td>2827</td>
</tr>
<tr>
<td>Pretest odds AAD</td>
<td>123</td>
<td>87</td>
<td>833</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.97</td>
<td>0.966</td>
<td>0.952</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.84</td>
<td>0.466</td>
<td>0.604</td>
</tr>
<tr>
<td>Diagnostic Odds Ratio</td>
<td>0.87</td>
<td>0.84</td>
<td>0.954</td>
</tr>
<tr>
<td>Positive Likelihood Ratio</td>
<td>1.73</td>
<td>1.81</td>
<td>2.4</td>
</tr>
<tr>
<td>Negative Likelihood Ratio</td>
<td>0.07</td>
<td>0.07</td>
<td>0.079</td>
</tr>
</tbody>
</table>

Outcome

D-dimer was significantly increased in AAD compared with pulmonary embolism, acute myocardial infarction, and other diagnoses that present with chest pain.

D-dimer can distinguish AAD with acute chest pain with high sensitivity and modest specificity, age-adjusted formula reduced number of false negatives.

Outcome

D-dimer >500 largely decreases the possibility of AAD high quality studies replicated high sensitivity and modest specificity

The D8dimer assay was able to diagnose AAD with a high posttest probability of 0.97, and negative posttest probability of 0.1%.

Figure 2. PRISMA: Flow Diagram

ELIMINATE IRRELEVANT RESULTS

Records identified through PubMed: "acute aortic dissection" and "D-dimer" (n = 153)

Exclusion criteria: Language, Non-human subjects, Published >5 years ago (n = 96)

Records screened (n = 59)

Exclusion criteria: Duplicates, Small sample sizes (n = 32)

Eligible full-text articles (n = 7)

Exclusion criteria: No sensitivity or specificity information (n = 4)

Studies included in qualitative synthesis (n = 3)

Figure 3. Image above shows the classifications of aortic dissections. All three studies suggested there may be differences in the accuracy of a D-dimer assay depending on the subtype of the aortic dissection.

Figure 4: Nomograms below show the probability of having an acute aortic dissection when having a positive and negative D-dimer assay at a cutoff at 500ng/ml.

Discussion

The nomograms below show the probability of having an acute aortic dissection when having a positive and negative D-dimer assay at a cutoff at 500ng/ml.

Figure 2: See Reference

Figure 3: See Reference

Figure 4: See Reference

CONCLUSION

In a patient presenting to the Emergency Department with symptoms suspicious of an acute aortic dissection, a D-dimer level less than 500ng/ml may be a useful tool to decrease the likelihood of the disease and reduce the need for advanced imaging. The D-dimer is not shown to be specific for acute aortic dissection. We believe more research is needed on the D-dimer assay’s diagnostic accuracy for different types of AAD. The addition of a D-dimer as a first line test may be a quick tool to help a clinician adjust their differential diagnoses to determine the need for imaging.

Acknowledgements

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References

3. Diagnosis of acute aortic dissection by D-dimer. The international Registry of acute aortic dissection sub study on biomarkers.

Figure 1: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31349-1/fulltext
Figure 2: https://www.ncbi.nlm.nih.gov/pubmed/25281170

APPENDIX


Subtypes of AAD include: intramural hematoma (ITH), penetrations ulceration of aorta (POA), aortic aneurysm leak (AIL), aortic aneurysm rupture (AAR), and traumatic aortic transection (TAT).