Cost Associated with D-Dimer Screening for Acute Aortic Dissection

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ABSTRACT

Introduction: D-Dimer (DD) has been described as a useful predictor of both morphologic changes in acute thoracic aortic dissection (TAD) and of TAD-associated mortality. This study analyzed the use of DD screening to screen patients with chest pain for acute (TAD) to determine if it improves diagnosis and cost effectiveness. This study also looked at the association of DD levels with diagnoses frequently seen in patients with dyspnea or chest pain. Methods: At the Helios Hospital, Krefeld, the authors analyzed the data of all patients (n=1053, age (mean, SD) 62±19 years, 49% males) admitted for chest pain to the nonsurgical emergency department (ED) in February 2010. Chest pain was the second most frequent symptom causing 138 (13.1%) admissions, 102 of which had DD testing (Innovance® D-Dimer Assay, Dade Behring/Siemens, Germany). To assess the diagnostic reliability of DD testing, the sensitivity, specificity, and odds ratio, including 95% confidence interval, were estimated. Results: None of the patients admitted were found to have acute TAD. Had the authors used a computerized tomography (CT) scan to rule out TAD in every patient with chest pain, actual costs would have been €12,328. A restriction of CT scans to patients with elevated DD levels would have lowered costs to €5360. The actual costs were €670.30 for CT scans and €540.60 for DD tests. On analyzing the association with other diagnoses, both sensitivity and specificity were low, with the exception of pneumonia. Conclusion: Owing to the low incidence of TAD, DD screening increases diagnostic efforts and costs but it remains unclear whether it would actually speed up TAD diagnosis. In a clinical setting DD did not help
to discriminate other relevant diagnoses. Despite the high sensitivity of DD for aortic dissection published in the literature, the physician’s clinical judgment remains paramount.

Keywords: aortic dissection; chest pain; CT scan; D-Dimer; thoracic aortic dissection

INTRODUCTION

D-Dimer (DD) is the primary degradation product of cross-linked fibrin. As DD testing is easily and quickly performed, it has been proposed as a measure to improve diagnosis of diseases, such as deep vein thrombosis (DVT) and pulmonary embolism (PE). Although DD sensitivity for venous thromboembolism (VTE) is high, its specificity is not.1-4 DD levels can be elevated in active malignancy, rheumatoid arthritis, inflammation, or a postsurgical state, but also in very specific acute diseases, such as myocardial infarction and acute aortic dissection. Thoracic aortic dissection (TAD) is a rare finding, estimated to occur at a rate of three to four cases per 100,000 persons per year and is associated with a high mortality rate.5

A recent meta-analysis reported a sensitivity of DD of 0.97 (95% confidence interval [CI]: 0.94, 0.99) and a specificity of 0.56 (95% CI: 0.51, 0.60) for the detection of acute aortic dissection.6 The study concluded that plasma DD <500 ng/mL is a useful screening tool to identify patients who do not have TAD, but that elevated DD cannot add to the certainty of TAD diagnosis as such.

This study analyzed collected data to measure the cost associated with routine DD testing for acute TAD in patients with chest pain. In addition, we estimated sensitivity and specificity of DD screening in other diseases frequently diagnosed in patients admitted to a nonsurgical emergency department (ED).

METHODS

Krefeld is a city of 240,000 inhabitants in the west of Germany. The Helios Hospital in Krefeld has 1000 beds and treats approximately 46,000 patients a year. In addition to a surgical ED there is a large nonsurgical ED, which is visited by approximately 1000 patients/month. The mandatory use of DD in patients admitted for chest pain was initiated in January 2010, and the authors analyzed data of all patients visiting the nonsurgical ED in February 2010. As the authors just analyzed routine data documented in the medical curves and did not influence patients’ treatment in any way, written consent or ethical approval was not requested.

A total of 1053 patients were included. For each patient admitted to the ED, the major clinical symptom for admission was documented. Blood samples were drawn for a small routine laboratory, including C-reactive protein and DD. If indicated, compression sonography of the vein of the lower limb, a computerized tomography (CT) or magnetic resonance imaging (MRI) scan of the thorax or abdomen, X-rays, echocardiography, or coronary artery angiography were performed (see Table 1). After the diagnosis had been made, the patient was either admitted for inpatient treatment or discharged. In the latter case, the family doctor was contacted to ensure continuing prescription of drugs.

The study used the Inniovance® D-Dimer Assay (Dade Behring/Siemens, Marburg, Germany), which is a quantitative assay based on human DD antibodies. The results of this test are expressed as mg/L FEU (fibrinogen equivalent unit), where 1 mg/L FEU is the concentration of fibrin degradation products representing 1 mg/L fibrinogen. The cut-off value representing normal fibrinogen degradation was set at <0.55 mg/L FEU. The costs for DD testing was