

The Prognostic Value of D-dimer Testing and Its Role in the Prompt Diagnosis of Atypical Acute Aortic Dissection

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ABSTRACT

Background: Acute aortic syndrome is a life-threatening condition, and its timely diagnosis poses a significant clinical challenge. Observations during the COVID-19 pandemic suggest that the routine measurement of D-dimer levels contributed to a substantial improvement in the timely diagnosis of acute aortic dissection, particularly in atypical presentations.

Objectives: To evaluate the role of D-dimer as a diagnostic biomarker for facilitating the timely diagnosis of type A acute aortic dissection.

Methods: We retrospectively analyzed two cohorts of patients: one from the pre-COVID pandemic period (2018) and the other from the COVID pandemic period (2020). We compared referral times and the relationship between these groups' D-dimer levels and diagnostic efficiency.

Results: The findings demonstrate that D-dimer testing significantly expedited surgical intervention in patients with suspected type A acute aortic dissection, which remains the definitive treatment for this condition.

Conclusions: The COVID-19 pandemic highlighted the utility of D-dimer measurement in patients with acute symptoms suggestive of aortic dissection. This readily accessible laboratory test can be implemented across various levels of healthcare facilities and plays a pivotal role in the timely diagnosis and prognosis of critical conditions.

Keywords: Acute aortic dissection; computed tomography (CT); COVID-19 pandemic; D-dimer; DeBakey classification; mortality rate; Stanford classification; surgical intervention; transesophageal echocardiography (TEE).

BACKGROUND

Acute aortic dissection is a relatively rare yet potentially fatal condition, with an estimated incidence of approximately 3.5 cases per 100,000 individuals annually.^{1,2} Two primary classification systems are utilized for aortic dissection: the Stanford and DeBakey systems. The DeBakey classification is based on the intimal tear's location and the dissection's extent. In contrast, the Stanford system categorizes dissections based on the involvement of the ascending aorta. Stanford type A dissections (DeBakey I and II) involve the ascending aorta and necessitate surgical intervention. In contrast, Stanford type B dissections (DeBakey III) do not include the ascending aorta and are typically managed medically.

The mortality rate for untreated acute aortic dissection increases by approximately 1–2% per hour after symptom onset. Advances in surgical techniques and medical management have decreased the mortality rate for type A dissection from 31% to 22%, whereas the rate for type B dissection has remained around 13%.^{3,4} Timely diagnosis is critical for reducing mortality; however, it is often hindered by the condition's variable presentations, which can mimic more common diseases such as acute coronary syndrome, pulmonary embolism, renal colic, or stroke. The most

prevalent symptom is acute, severe pain in the chest or back, reported in 85% of patients.⁵

A subset of patients (6%) presents with atypical manifestations, such as syncope, neurological deficits, or new-onset congestive heart failure, in the absence of pain. These atypical cases are associated with higher mortality rates due to delayed diagnosis. Additionally, classic physical examination findings, such as hypertension, diastolic murmurs, or high pulse pressure, may be absent, further complicating the diagnostic process.^{5,7}

The diagnosis of aortic dissection primarily relies on imaging techniques such as transthoracic or transesophageal echocardiography, computed tomography (CT), and magnetic resonance imaging (MRI). However, D-dimer, a biomarker produced during fibrin degradation, has emerged as a promising diagnostic tool. Elevated D-dimer levels are observed in various conditions, including infection, trauma, pregnancy, myocardial infarction, pulmonary embolism, and acute aortic dissection. Significantly, D-dimer levels directly correlate with outcomes in acute aortic dissection: higher levels are associated with increased mortality risk.

Spiral CT or CT angiography is the gold standard for imaging in hemodynamically stable patients, offering 100% sensitivity.



Transesophageal echocardiography (TEE), although highly operator-dependent and subject to false positives and negatives, is often preferred for hemodynamically unstable patients.^{5,8,9}

Addressing the overuse of CT imaging in emergency medicine is important, as it increases healthcare costs and extended waiting times. Incorporating D-dimer testing as a highly sensitive biomarker in patients with suspected type A aortic dissection could optimize resource use by reducing unnecessary CT scans, thereby supporting timely and accurate diagnosis.

METHODS

This retrospective study analyzed 25 patients who underwent surgical intervention for type A acute aortic dissection at the Western Georgia Medical Center in 2018 and 2020. Four were women, and 21 were men. The cohort was divided into two groups based on the year of surgery: 2018 (9 patients) and 2020 (16 patients). The study evaluated changes in referral patterns for patients with type A aortic dissection to a tertiary care facility during the COVID-19 pandemic.

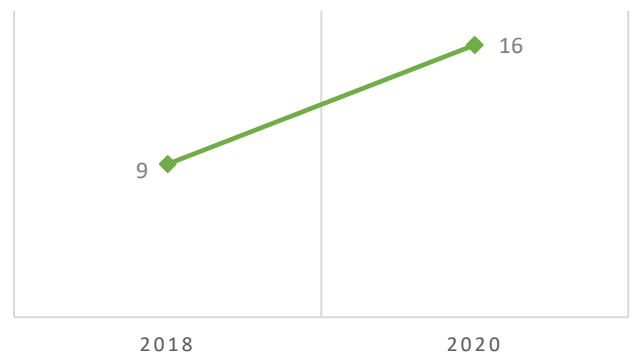
The study's inclusion criterion was radiologically confirmed type A aortic dissection before surgery. For the 2020 cohort, an additional inclusion criterion was the preoperative measurement of D-dimer levels, which could not be applied to the 2018 cohort due to less frequent D-dimer testing before the COVID-19 pandemic.

The study evaluated how D-dimer measurement influenced the time from symptom onset to surgical intervention by comparing data between the 2018 and 2020 cohorts. Additionally, it aimed to assess the prognostic value of D-dimer by analyzing its correlation with the elapsed time since symptom onset. Mortality rates between the two groups were also compared, with three deaths recorded in each cohort (3/9 in 2018 and 3/16 in 2020).

RESULTS

This study highlights the significant impact of increased D-dimer testing during the COVID-19 pandemic on the management and outcomes of acute type A aortic dissection at the West Georgia Medical Center. The number of patients presenting with this condition rose by 1.8 times (78%) in 2020 compared to 2018, as illustrated in Figure 1. The active use of D-dimer testing in 2020, implemented initially to rule out pulmonary embolism, played a pivotal role in the timely diagnosis of acute aortic dissections.

FIGURE 1. Number of patients before and during COVID-19



The mortality rate in patients with type A aortic dissection decreased by 1.8 times (44%) in 2020 compared to 2018, as shown in Figure 2. This improvement is attributed to earlier diagnoses and expedited surgical interventions, with the average time from the onset of symptoms to surgical treatment reduced from 10.7 hours in 2018 to 3.5 hours in 2020, as depicted in Table 1.

FIGURE 2. Mortality rate

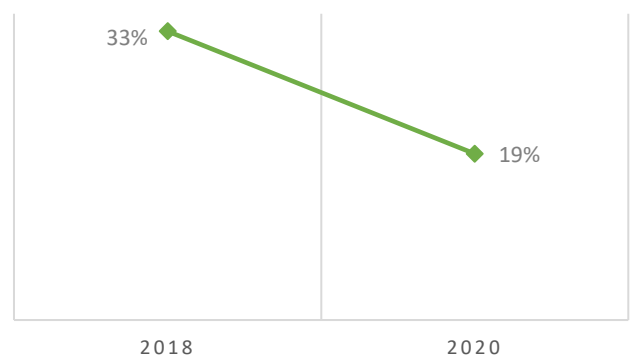


TABLE 1. Average referral time

Years	Number of patients	Mean referral time (h) M±SD	p-value
2018	9	10.7±13.1	0.013
2020	16	3.5±1.02	

D-dimer levels were directly proportional to the time elapsed since the onset of symptoms, as demonstrated in 16 patients of Group 2 (Tab.2). The highest D-dimer levels (3000 ng/ml, 2900 ng/ml, and 2550 ng/ml) were observed in patients who succumbed to the condition despite surgical intervention, as shown in Table 2. These patients presented for testing later, with the highest levels recorded in a patient 5.5 hours after symptom onset. Conversely, lower D-dimer levels (e.g., 1200

ng/ml) were seen in patients who underwent testing within 2 hours of symptom onset.

TABLE 2. Correlation between referral time, D-dimer level and outcome in 16 patients of Group 2 (2020 year)

Referral time (Hours)	D-dimer (ng/mL)	Mortality
4.50	2365.00	-
5.00	2900.00	+
3.00	1588.00	-
2.50	1322.00	-
4.50	2550.00	+
3.00	1300.00	-
3.50	1784.00	-
3.00	1483.00	-
5.50	3000.00	+
4.00	2005.00	-
3.50	1685.00	-
2.00	1200.00	-
3.00	1496.00	-
3.00	1500.00	-
2.00	1345.00	-

Explanations: -, negative for death; +, positive for death.

The findings emphasize the critical role of D-dimer testing in the early identification of acute type A aortic dissection, enabling timely surgical intervention. This approach not only reduced diagnostic delays but also contributed to improved patient survival rates during the COVID-19 pandemic.

DISCUSSION

Acute type A aortic dissection is a rare but highly lethal condition. Our observations indicate that the frequency of D-dimer testing increased during the COVID-19 pandemic. In cases of positive results, computed tomography (CT) was performed to rule out pulmonary embolism, which in some instances revealed type A aortic dissection. Consequently, in 2020, patient referrals increased by 1.8 times, and the time interval from symptom onset to surgical intervention decreased significantly, leading to markedly improved outcomes. Mortality decreased by 1.8 times (44%). Additionally, the study demonstrated that D-dimer levels are directly proportional to adverse outcomes of the disease.^{3,4}

A technically straightforward and cost-effective method, such as a blood test, can help rule out a life-threatening diagnosis, which benefits both patients and healthcare providers. However, this study has limitations. First, determining D-dimer levels in the subacute and chronic phases of type A aortic dissection loses significance due to its short half-life of less than 8 hours. Furthermore, the study does not account for other physiological processes and conditions that can elevate D-dimer levels, which may influence the outcomes.

CONCLUSIONS

This study underscores the potential utility of D-dimer as a valuable diagnostic tool for early detection of acute type A aortic dissection. Increased D-dimer testing during the COVID-19 pandemic was associated with a significant rise in patient referrals and reduced time to surgical intervention, ultimately lowering mortality rates. While additional research is warranted, our findings suggest that incorporating D-dimer testing into the diagnostic algorithm for acute chest pain may improve outcomes in patients with this critical condition.

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