

# Analytical performance of the VIDAS® D-Dimer Exclusion™ II assay and the Beckman Coulter D-dimer assay

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## Introduction

D-dimer is a unique protein fiber degradation product of cross-linked fibrin that is generated by the hydrolysis of the fibrinolytic enzyme [1,2]. D-dimer can be released into the circulatory system when a thrombus degrades [3]. Generally, the amount of D-dimer is low in normal blood; however, the D-dimer level is increased when thrombosis occurs [4]. D-dimer levels increase in patients with cardiovascular and cerebrovascular diseases; the increased D-dimer level is associated with prognosis [1]. Also, the measurement of D-dimer has aided in the diagnosis of disseminated intravascular coagulation [5]. As we know, low levels of D-dimer can be detected in the whole blood and plasma of healthy subjects. However, in patients with thrombosis, it is a helpful indicator for venous thromboembolism (VTE). In the emergency department, D-dimer is utilized as an initial screening test to detect patients who have symptoms suggestive of VTE. D-dimer is also a marker of endogenous fibrinolysis, because it can be detected in patients with deep venous thrombosis (DVT). A D-dimer test is also essential to exclude pulmonary embolism (PE) in low-risk patients. At present, D-dimer is used routinely as part of a diagnostic algorithm in order to exclude the diagnosis of DVT or PE by physicians. D-dimer assays have also been applied to predict the incidence of recurrent thrombosis when anticoagulants are cancelled. Overall, D-dimer is an ideal diagnostic method that helps in detecting intravascular coagulation and fibrinolysis, thereby providing fast, feasible, and reliable results to physicians.

The various types of common D-dimer assay include latex-enhanced turbidimetric immunoassay, chemiluminescent immunoassay, enzyme-linked fluorescent assay, solid-phase immunochromatography, and fluorescent immunoassay. Each methodology has its advantages and disadvantages. Ellis et al. reported that the point-of-care (POC) LumiraDx D-dimer test showed good agreement with the VIDAS® D-dimer Exclusion™ II assay. They concluded that the quantitative POC LumiraDx D-dimer test is easy to use and improves the assessment of VTE cases. Similarly, Heerink et al. demonstrated that POC D-dimer assays can be applied to the exclusion of VTE in clinical settings. The reference method for D-dimer measurement is the enzyme-linked immunosorbent assay. In fact, VIDAS® D-dimer Exclusion™ II assay is an enzyme-linked immunofluorescence assay that brings rapid results and is presently the most clinically validated assay for D-dimer measurements. However, our previous study showed that the main disadvantage of VIDAS® is that the platform is manually operated and requires hands-on technical expertise as well as time. Recently, Talon et al. demonstrated that a fully automated Yumizen G DDi2 immunoturbidimetric assay carried out by the Yumizen G800 analyzer is appropriate for fast measurement of D-dimer in a clinical setting. The Beckman Coulter D-dimer assay is a fully quantitative and automated immunoturbidimetric assay which decreases the hands-on time requirements in a clinical laboratory setting. Until recently, the analytical performance of the Beckman Coulter D-dimer assay had not been reported. Therefore, in the present study, we aimed to evaluate the validity of two different D-dimer assays.

## Materials and Methods

The levels of plasma D-dimer were tested using the VIDAS® D-dimer Exclusion™ II assay and the Beckman Coulter D-dimer assay, which have reported ranges of 45 – 10,000 ng/mL (FEU) and 0.25 - 8.00 µg FEU/mL, respectively. The limit of detection using the VIDAS® D-dimer Exclusion™ II assay and the Beckman Coulter D-dimer assay is < 45 ng/mL (FEU) and ≤ 0.08 µg FEU/mL, respectively. The open reagent pack and the calibration curve of the VIDAS® D-dimer Exclusion™ II assay and the Beckman Coulter D-dimer assay are stable for 28 days and 30 days, respectively.

In the present study, we collected 89 plasma samples from the clinical laboratory of Asia University Hospital and measured the plasma values of D-dimer, which ranged from 89.2 to 7,452.9 ng/mL (FEU) when tested on the VIDAS® platform and from 20 to 7,770 ng/mL (FEU) when tested on the Beckman Coulter platform. All plasma samples were anticoagulated with 3.2% sodium citrate. The patients included 45 females ranging from 20 to 95 years of age (69.8 ± 15 years) and 44 males ranging from 26 to 86 years of age (63.6 ± 15.6 years). The plasma samples were stored at -80°C after D-dimer measurement using the VIDAS® D-Dimer Exclusion™ II assay. The ethics approval was obtained from the Institution Review Board of the China Medical University Hospital (CMU111-REC3-183). The two methods were compared using Pearson's correlation analysis.

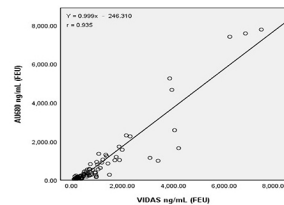
## Results

Figure 1 demonstrates Pearson's correlation coefficient between the D-dimer levels from the two assays. The D-dimer levels determined with the VIDAS® D-Dimer Exclusion™ II assay were correlated with the D-dimer levels obtained with the Beckman Coulter D-dimer assay, resulting in a Pearson's correlation coefficient of 0.935 (p < 0.001).

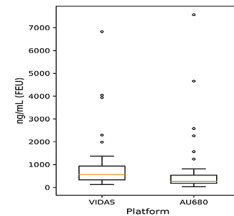
The sequential flow of the VIDAS® D-Dimer Exclusion™ II Assay and the Beckman Coulter D-Dimer Assay is shown in Tables 1 and 2, respectively. The Beckman Coulter D-Dimer Assay requires fewer steps than the VIDAS® D-Dimer Exclusion™ II Assay. Additionally, the turnaround time for D-Dimer detection using the Beckman Coulter D-Dimer Assay is only 10 minutes.

## Conclusions

In summary, a high correlation exists between quantitative D-dimer measurements conducted with the VIDAS® D-dimer Exclusion™ II and the Beckman Coulter D-dimer assays. The VIDAS® D-dimer Exclusion™ II is a feasible and accurate method for determining the levels of D-dimer in plasma, but requires manual operation and longer turnaround times. On the contrary, the Beckman Coulter platform is fully automated and may increase laboratory performance, decrease manual work, and decrease the turnaround time for emergency samples.



**Figure 1.** Comparisons of the two methods of D-dimer measurement using Pearson correlation coefficient.



**Figure 2.** D-dimer values obtained from VIDAS® D-Dimer Exclusion™ II assay and Beckman Coulter D-dimer assay when evaluating the clinical specimens. The box plots describe the median value and the interquartile range, and the whiskers represent the nearest value to 1.5 times the interquartile range (IQR). Outliers are plotted separately.

**Table 1.** Sequential flow on VIDAS® D-Dimer Exclusion™ II Assay and the time required for each step in the detection of D-Dimer

Step	Activity	Type	Complexity	Duration
1	Remove one "DEX2" strip and one "DEX2" SPR; blow the lid for each sample to be tested.	Manual	Low	1 min
2	Place the "DEX2" strip and "DEX2" SPR on the VIDAS® SPR on the bench top.	Manual	Low	5 min
3	Insert the "DEX2" SPRs and "DEX2" strips into their appropriate position on the instrument.	Manual	Low	1 min
4	The assay results are available.	Manual	Low	20 min

**Table 2.** Sequential flow on Beckman Coulter D-Dimer Assay and the time required for each step in the detection of D-Dimer

Step	Activity	Type	Complexity	Duration
1	Place the sample in the AU680 system	Manual	Low	1 min
2	The assay results are available.	Manual	Low	8.5 min

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