

Original Research Article

TO ANALYSING PLASMA D-DIMER'S PERFORMANCE AS A FIRST DIAGNOSTIC BIOMARKER FOR CEREBRAL VENOUS THROMBOSIS

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ABSTRACT

Background: Compared to other common causes of stroke, cerebral venous and dural sinus thrombosis is a rare disease that can be hard to spot. General cerebrovascular thrombosis and symptoms that aren't linked to a stroke can both show up.

Materials and Method: This case-control study looked at people from both Department of General Medicine, Government Siddhartha Medical College, Vijayawada, Andhra Pradesh, India. The Patients were registered one at a time from March 2023 to February 2024 of the same year, after signing forms giving their permission. All of the patients had cerebral venous thrombosis, which was clinically suspected.

Results: The current results showed that the levels of D-dimer were very different between the cases and the controls. Using the assay's set criteria, 44 patients were also found to have a positive test result, which is the same as 14% of the control group. This result is the same as the one from the study that looked at 54 straight people who had headaches that might have been caused by CVT. All of the patients in the emergency room had D-dimer level tests done before they got brain CT or MRI scans. Out of the 54 people who took part in the study, 10 of the 12 with CVT had higher amounts of D-dimer.

Conclusion: Finally, these findings show that D-dimer tests can be a useful way to find out if someone has CVT, especially if they have acute or subacute disease.

Keywords: Brain venous thrombosis, diagnostic biomarker, plasma D-Dimer.

INTRODUCTION

Compared to other common causes of stroke, cerebral venous and dural sinus thrombosis is a rare disease that can be hard to spot. Presentations with common CVT symptoms and symptoms that aren't linked to a stroke are also possible. Headaches, seizures, changes in consciousness, and neurological focal symptoms seen during a physical test are the most common signs of the disease. It's possible for CVT to show up as a syndrome with many symptoms or as a single sign. It's hard to diagnose CVT because it has a vague clinical picture.^[1-3]

To measure the amounts of D-dimer, the quick and sensitive D-dimer test was used. We used the independent-samples t-test, Spearman's correlation coefficient test, backward-selection multiple linear regression, and multiple binary logistic regression analysis to look at the data. To find the best D-dimer cut-off for finding CVT, sensitivity and specificity tests were used.^[2-4] Between the case and control groups, there were big differences in the amounts of D-dimer. Magnetic resonance venography is thought to be the best way to diagnose CVT. CT scans have their limits because they only show 70% of the images correctly. But the problems that come with these technologies have made it harder to use them as

general ways to do CVT screening. High and sensitive amounts of D-dimer in the blood can be used to find deep vein thrombosis, such as cerebral venous thrombosis. D-dimer is a biological sign that shows when blood clots are breaking down in the body. Several studies have found a link between D-dimer levels and venous sinus thrombosis.^[3-5] Not enough study has been done to figure out how sensitive and specific D-dimer is for diagnosing CVT. Also, there isn't a clear D-dimer level that tells us for sure how likely it is that someone will get CVT, and this is especially true for people from the East. Due to the need to quickly spot CVT and the lack of clarity surrounding the use of D-dimer in this process.^[5-7] The goal of this study is to find out how well plasma D-dimer levels can be used to diagnose brain venous thrombosis.

MATERIAL AND METHODS

This case-control study looked at people from both Department of General Medicine, Government Siddhartha Medical College, Vijayawada, Andhra Pradesh, India. The Patients were registered one at a time from March 2023 to February 2024 of the same year, after signing forms giving their permission. All of the patients had cerebral venous thrombosis, which was clinically suspected.

Inclusion Criteria

- Symptom onset within 7 days;
- Patients identified as CVT clinically and radiologically.

Exclusion Criteria

- Previous episodes of deep vein thrombosis or other hypercoagulable states
- Conditions linked to elevated serum D-dimer levels, such as pregnancy
- ECG evidence of atrial fibrillation.
- The duration of symptoms beyond 7 days.

Statistical Analysis

The study of the data was done with SPSS 18.0. The statistical information was shown as mean \pm standard deviation. Frequency and percentage were used to show qualitative statistics. The chi-square test was used to see how different non-parametric data sets were. If a p-value was less than 0.05, it was thought to be statistically significant.

RESULTS

There were 30 women and 10 men in the group, with a mean age of 27.4 ± 9.9 years. In 24 cases, headaches with blurred vision were the first sign. This was followed by focal seizures in 8, hemiparesis in 5, and generalized tonic-clonic seizures in 3. It was found in 27 different people who had papilledema. 27 people had problems with the deep vein system, 8 people had problems with the superior sagittal sinus, and 25 people had problems with the transverse sinus. The amounts of creatine, AST, and ALT in each patient's blood were all normal. There were no statistically

significant changes found between the groups in terms of age, sex, liver enzymes, kidney functions, or the time between when the samples were taken and when the symptoms started.

It was found that the four demographic factors looked at were good for both the control group and the CVT patients. Table 1 and Figure 1 show that the differences between the groups were not statistically significant, even though the controls had slightly higher percentages of men and users.

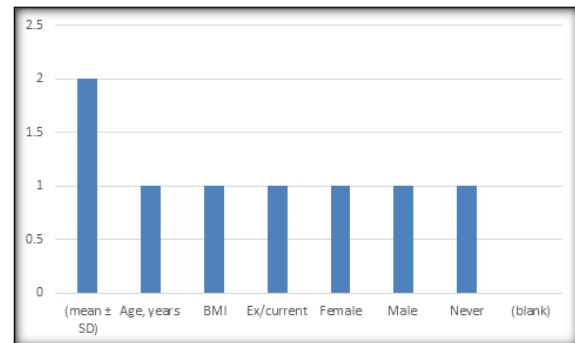


Figure 1: The study population's baseline demographics

Clinical Features of Patients with CVT

With 84% of the cases, headaches were the main symptom. In 42% of patients, there were seizures, 40% had papilledema, and 38% had localized neurological complaints. It took an average of 6.9 ± 3.2 days for the signs to show up. It was most common for thrombosis to happen in the transverse sinus (52% of cases). Next came the superior sagittal sinus, which was involved in 26% of cases. Finally, the left and right lateral sinuses each played a role in 26% of cases. Thirteen of the patients had a brain infarction during the imaging process, and seven had lesions that were bleeding. One sixteenth of the time, infection was the main risk factor. If you look at Table 2 and Picture 2, oral contraceptives and cancer were the least common risk factors. Each was found in only 6% of cases.

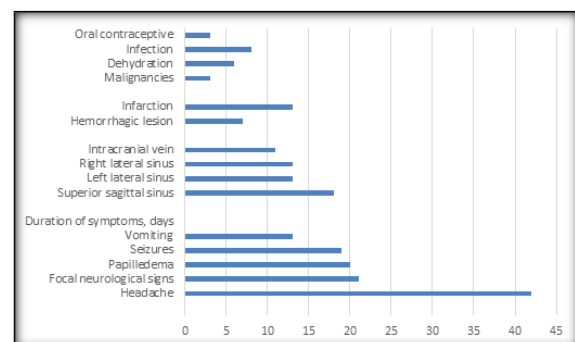


Figure 2: Clinical features of CVT patients

Plasma concentrations of D-dimer

In the CVT group, the average plasma amount of D-dimer was 536.7 ± 102.34 ng/mL, while in the control group, it was 318.4 ± 88.71 ng/mL. A t-test done on its own showed a significant difference. Using the test's

cut-off value, 44 people with CVT tested positive for the assay, but only 7 people who were not sick tested positive. The study population was clearly divided by gender, with a big difference seen between the male normal and sick groups. The gap was not as big in women, but it was still noticeable. In the group of 29

men, only 3 had a normal D-dimer test. On the other hand, 27 of the 31 guys in the control group had an average D-dimer level. In the test group of 31 people, only 3 had normal D-dimer levels, but none of the 29 women in the control group did.

Table 1: No. of maternal deaths based on age distribution

Sr. No.	Variables	Patients	Controls
1.	Age, years (mean ± SD)	41.7 ± 12.9	42.2 ± 17.4
Gender			
2.	Male	29 (58%)	31(62%)
3.	Female	21 (42%)	19 (38%)
4	BMI (mean ± SD)	26.19 ± 6.1	27.34 ± 6.6
Smoking			
5	Ex/current	13 (26%)	15 (30%)
6	Never	37 (74%)	35 (70%)

Table 2: Clinical features of the patients with CVT

Sr. No.	Variables	Mean
Clinical presentation		
1	Headache	42
2	Focal neurological signs	21
3	Papilledema	20
4	Seizures	19
5	Vomiting	13
6	Duration of symptoms, days	6.9 ±3.2 (range 4-10)
Site of thrombosis		
7	Superior sagittal sinus	18
8	Left lateral sinus	13
9	Right lateral sinus	13
10	Intracranial vein	11
Imaging findings		
11	Hemorrhagic lesion	7
12	Infarction	13
Risk factors		
13	Malignancies	3
14	Dehydration	6
15	Infection	8
16	Oral contraceptive	3

DISCUSSION

The current results showed that the levels of D-dimer were very different between the cases and the controls. In addition, 44 patients had a positive test result, which is the same as 14% of the control group based on the assay's set level. The outcome of this study matches the results of the study that looked at 54 straight people who had headaches that might have been caused by CVT. The emergency room staff checked the D-dimer levels of all patients before doing any brain CT or MRI tests. Out of the 54 people who took part in the study, 10 of the 12 with CVT had higher amounts of D-dimer. The other two patients had a history of headaches that wouldn't go away for more than thirty days, cerebral venous thrombosis, and normal amounts of D-dimer.^[8-10]

This study looked back at 71 people from Helsinki University Central Hospital who had been diagnosed with cerebral vein thrombosis. The D-dimer was checked out before the surgery. The study found that 62 of the 71 patients who were looked at had high

amounts of D-dimer. But the control subjects were left out of the study by the writers. A meta-analysis of 1134 people with suspected or proven CVT found that only 10 people, or 6.5% of the total, had normal D-dimer levels. A systematic review and meta-analysis study looked at 636 people with confirmed CVT. Of those, 591 had high D-dimer levels.^[11-13] Other studies have also found that none of the patients who had a recent CVT had normal D-dimer levels, which is similar to what this study found. Still, the current results were different from those of an earlier study that looked back at the medical records of 65 patients with CVT and was done in Kuwait. Twenty-three of the 42 cases had D-dimer levels that were too high, while the levels in the other 42 cases were normal. There are other things that have led to these different effects. The most important factor is the amount of time that has passed since the clotting event.^[14-16]

From what studies have shown, the D-dimer number goes back to normal three months after a blood clot. As this study shows, it is very important to get the

samples within three weeks of the start of the thrombosis. The second part is made up of how different the patients' baseline traits were and how often thrombotic risk factors showed up. Oral contraceptives, getting older, and having a high body mass index are all known to raise the risk of thrombosis and have a big impact on D-dimer readings. So, both the previous study and this one agree that measuring plasma D-dimer is a very good way to find out if someone has CVT.^[17-19] According to the current study, affected males had slightly higher levels of D-dimer than affected females. On the other hand, healthy females had slightly higher levels of D-dimer than healthy males. The results are in line with what the scientists found when they looked at a group of 16 male and 13 female Iranian patients. The researchers found that the females had lower amounts of D-dimer than the men.^[18-20] Several factors can affect clotting, including pregnancy and the use of oral contraceptives in women, smoking habits in men, age and body mass index in both men and women, and other important factors. Another interesting thing that this study found was that the D-dimer test was very good at determining CVT. Researchers from around the world have found that this test has different amounts of sensitivity, specificity, and predictive value when it comes to diagnosing CVT.^[19-21] New information that is related to the current investigation. It was found that 34 of the 35 people with CVST in the study had higher amounts of D-dimer. This turned out to have a precision of 91.2%, a negative predictive value of 99.6%, and a positive predictive value of 55.7%. It was found that the D-dimer test was 85.7% sensitive and 85.5% specific. Higher amounts were found in later tests. The sensitivity, specificity, positive predictive value, and negative predictive value of the d-dimer. This test has a sensitivity of 97.8% and a negative prediction value of 99.8%.^[20-22]

The main thing that usually changes the test's sensitivity and specificity is the time when the blood sample is taken. As time goes on between collecting the sample and the thrombotic event, the test becomes less sensitive and specific.^[21-23] The method of discovery is one of the things that can affect how well the test works. For this work, the cassette technique was used. This method is known to be less sensitive and specific than the enzyme linked immunological sorbent test. This is why the sensitivity and specificity aren't as high as they are in many other world studies. On the other hand, the tape method is easier to use and costs less.^[24-26]

CONCLUSION

The test's usefulness can also be affected by factors like age, body mass index, patient sex, and smoking status. Because of this, these traits should be similar between cases and controls; this idea was used in this study. Another interesting thing about this study is

that it used controls and a prospective design, which makes the data more reliable. Finally, these findings show that D-dimer tests can be a useful way to find out if someone has CVT, especially if they have acute or subacute disease. Quantitatively measuring D-dimer in plasma is easy, accurate, and doesn't cost a lot of money with the screening cassette test.

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