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Original Article

Pathology Section

Efficacy of D-Dimer Assay in Pulmonary Venous Thromboembolism: Study of 76 Cases

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ABSTRACT

Introduction: Venous Thromboembolism (VTE) encompasses a wide spectrum consisting predominantly of deep venous thrombosis and pulmonary embolism. The value of Fibrin Degradation Product (FDP) of which, most common is D-dimer which is most commonly deployed to pre-diagnose venous thrombosis. Diagnosing it has always been a hard effort. It is produced when cross-linked fibrin is broken down; among patient who is suspected of having pulmonary embolism, blood D-dimer levels correlate with the probability of having pulmonary embolism.

Aim: This study was done to analyse the sensitivity of plasma D-dimer for VTE.

Materials and Methods: Retrospective case study of 76 patients with VTE in form of pulmonary embolism done at the Dhiraj Hospital, Sumandeep Vidyapeeth Deemed University, Vadodara from January 2019 to January 2020 for a period of one year. Prethrombolytic plasma was withdrawn and D-dimer quantification were measured using fully automatic stago coagulometer instruement (STA Compact Max). Sensitivity, Specificity, Negative Predictive Value (NPV) and Positive Predictive Value (PPV) was calculated and formulated in tables and graphs.

Results: The sensitivity, NPV, specificity and PPV of the D-dimer was 95.65%, 76.92%, 66.66% and 92.95%, respectively. CT pulmonary angiography had a specificity of 80%, sensitivity of 92.75%, a NPV of 70.58% and a PPV of 95.52%.

Conclusion: D-dimer is mostly the go to test for ruling out VTE especially pulmonary embolism, if the pre-test probability is intermediate. Rationale use of this test does help in prognostification and helps to achieve therapeutics faster and more effectively.

Keywords: Deep venous thrombosis, Pulmonary angiography, Pulmonary embolism

INTRODUCTION

Pulmonary thromboembolism is defined as clinico-pathological syndrome resulting due to sudden or chronic occlusion of main pulmonary artery, right pulmonary artery, left pulmonary artery by either a thrombus or embolus via venous system, leading to cor pulmonale [1]. It is a life threatening condition with incidence of 65 persons per 1,00,000 individuals per year [2]. Pulmonary embolism is a dangerous condition which causes significant Right Ventricular (RV) Disease [3]. As the progress in diagnostic modalities has occurred, the diagnosis of PE is enhanced leading to timely intervention [4].

Pulmonary Computed Tomography (CT) angiography has been the gold standard for diagnosing pulmonary thromboembolism but is costly and has the risk of radiation [5]. D-dimer molecules are cross-linked degradation products of fibrin suggestive of active fibrinolysis [6], due to thromboembolic complications [7]. D-dimer assays are reliable, cost effective [8]. The aims and purpose of this study is to study the sensitivity of D-dimer for Venous thromboembolism.

MATERIALS AND METHODS

A hospital based retrospective study of 76 patients with VTE diagnosed by ultrasound in form of pulmonary embolism at the Dhiraj Hospital, Sumandeep Vidyapeeth Deemed University, Vadodara was done for a time period of one year from 13th January 2019 to 13th January 2020. Prethrombolytic blood was withdrawn and plasma D-dimer levels were obtained using fully automatic Stago coagulometer instruement (STA Compact Max). The standard concentration of D-dimer is <2500 ng/dL or <4 µg/dL [9].

Inclusion criteria

1. Acute shortness of breath with stabbing chest pain.
2. Either known case of deep vein thrombosis or suspect of pulmonary embolism.

Exclusion criteria

1. On blood thinners, anti platelets or anticoagulation before plasma assay.
2. Recurrent pulmonary embolism.
3. Hepatic or renal dysfunction.

STATISTICAL ANALYSIS

Sensitivity, Specificity, NPV and PPV was calculated and formulated in tables through their formula in MS Word.

RESULTS

The present study included 76 cases in which 49 (64%) were males and 27 (36%) were females. The main symptoms were acute onset breathlessness, chest pain and coughing. Among the 76 cases, there were 32 patients with deep vein thrombosis, 6 patients with a recent operation, 2 postpartum, 26 patients with CAD and 10 smokers. Pulmonary CT angiography is the confirmatory test for PE. Of 76 cases, 64 patients had pulmonary thromboembolism and 12 patients without any abnormality on CTPA, while D-dimer shows 66 patients with pulmonary thromboembolism and 10 patients with other abnormalities [Table/Fig-1].

	CT pulmonary angiography		
D-dimer +/-	Positive	Negative	Total
Positive	61	5	66
Negative	3	7	10
Total	64	12	76

[Table/Fig-1]: Comparison of CT pulmonary angiography with D-dimer levels.

Diagnosing pulmonary embolism by either D-dimer or CT pulmonary angiography does not yield any statistically significant differences. D-dimer had a specificity of 66.66%, sensitivity of 95.65%, NPV of 76.92% and PPV of 92.95% [Table/Fig-2].

Parameters	D-dimer	CT pulmonary angiography
Sensitivity	95.65%	92.75%
Specificity	66.66%	80%
PPV	92.95%	95.52
NPV	76.92%	70.58%

[Table/Fig-2]: Sensitivity, specificity, PPV and NPV of D-dimer assay and CT pulmonary angiography.
NPV: Negative predictive value; PPV: Positive predictive value

DISCUSSION

Pulmonary thromboembolism is the fourth most common cardio vascular disease. Many patients die of pulmonary embolism especially postsurgery or with the history of deep vein thrombosis because they are not diagnosed early. The fatality of pulmonary thromboembolism can be reduced by diagnosing and treating the patients on time [10]. CTPA is the most sensitive diagnostic test for PTE, but it is costly affair and not readily available everywhere and prone to artefacts. The presence of lymph nodes, tissue oedema, peri pulmonary capillaries does change the results of CT pulmonary angiogram [11]. CT Pulmonary angiography is still not perfect so D-dimer assays which can be routinely used are needed [5,11-15].

D-dimer is a FDP (fibrin degradation product) and its increased values suggests that there is presence of thrombus and its degradation by plasmin is going on [16], for example in pulmonary thromboembolism [17-19]. Perrier A et al., explained that D-dimer had a sensitivity of 99.5% and specificity of 41.0% for diagnosing pulmonary embolism which is quite similar with present study in which sensitivity is 95.65% and specificity is 66.66% [17]. Schutgens RE et al., essayed that D-dimer should be used as first line investigation for pulmonary VTE, because it is highly sensitive and can easily rule out pulmonary thromboembolism [20]. Gao H et al., conducted a study on 32 patients and concluded that D-dimer levels were elevated in patients with pulmonary embolism by pulmonary CT Angiography [21]. In present study, D-dimer had a specificity of 66.66%, sensitivity of 95.65%, a NPV of 76.92% and a PPV of 92.95% [22,23]. Furthermore, elevated D-dimer are seen in PE [25]. Another study diagnosed Venous Thromboembolism in 35 of 74 ICU patients whose D-dimer values were directly proportional to increased morbidity and mortality [25].

Limitation(s)

Certainly, there were some limitations for this study like the sample size used was small. Also, the Electrocardiogram (ECG)-gated Pulmonary CT Angiography was not performed due to dyspnea.

CONCLUSION(S)

D-dimer should be used as a primary screening modality for the low to intermediate pre-test probability of PE. Rationale usage of this D-dimer test does produce a massive impact on early diagnosis and cost effective treatment which can help to save a person's life.

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