ORIGINAL ARTICLE

Correlation of D-Dimer Level with the Presence and Severity of Pulmonary Embolism on Computed Tomography Pulmonary Angiography

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Abstract

Introduction: Early diagnosis of pulmonary embolism can reduce morbidity and motility. D-dimer is well known parameter having high negative prediction value. This study focused on role of D-dimer in early prediction of presence and severity of pulmonary embolism.

Material and Methods: Thirty patients with clinical suspicion of pulmonary embolism along with high D-dimer value were included in this study. All selected patients underwent computed tomography pulmonary angiography assessment. D- dimer value was correlated with presence and proximity of pulmonary embolism.

Results: Out of thirty selected patients 50% had pulmonary embolism on computed tomography pulmonary angiography assessment. D-dimer value correlated well with presence and proximity of pulmonary embolism.

Conclusion: D-dimer value more than 4000 ng/ml had high positive prediction value (79%) in suspected clinical cases. Value more than 8000 ng/ml further improve value to nearly 100% in suspected cases.

Introduction and Background

Acute venous thromboembolism has incidence of 1–2 cases per 1,000 persons per year in the general population.[1-4] Acute pulmonary embolism (APE) is one of its entity with potentially high morbidity and mortality with an incidence of 0.6–0.7 per 1,000 persons per year.[1,3] The mortality rate of APE ranges from 1% to up to 30% . D-dimer is a fibrin degradation fragment that is released endogenously through fibrinolysis. D-dimer is well known parameter for its high negative predictive value in excluding the presence of Pulmonary Embolism (PE). There can be other useful aspects of D-dimer. Our study investigated the correlation between the concentration of D-dimer and the presence and severity of PE.

Table 1: Age, sex, religion wise distribution of study population

Age groups (years)	Male		Female	
	Hindu	Muslim	Hindu	Muslim
30-39	1		1	1
40-49			4	1
50-59	2	1	2	
60-69	3		2	4
70-79	1	1	2	2
>80			2	
Total	7	2	13	8

Material and Methods

Study type- This study was descriptive type of observational study.

Duration- The study was conducted between January to May, 2017 at General Medicine department of Dr. S. N. Medical College, Jodhpur.

- Inclusion criteria: All suspected case of pulmonary embolism based on presenting signs and symptoms like sudden shortness of breath, laboured breathing, coughing, haemoptysis, tachypnoea, tachycardia not explained by other systemic diseases along with raised D-dimer value (>250 ng/ml).
- Exclusion criteria: Patients refused for consent.

Approach: Individuals suspected for pulmonary embolism along with raised D-dimer value as per inclusion criteria included in current study. Written consent was taken from all the individuals. Detailed history was obtained and clinical examination was done. CT pulmonary angiography assessment of all selected individual was done. D-dimer level was determined by rapid automated quantitative latex-based immune agglutination assay. Shortness of breath was graded according to New York Heart Association (NYHA) Functional Classification.[5] D- dimer values were correlated with presence, location of pulmonary embolism and grading of shortness of breath. Statistical analysis was done.

Results

Thirty patients with suspicion of pulmonary embolism had raised D-dimer (>250 ng/ml), participated in this study. Male female ratio was nearly 1:2.3. Age ranges from 34 years to 81 years. Twenty patients were Hindu with male female ratio nearly 1:2. Ten patients were Muslims with male female ratio 1:4 (Table 1).

After CT pulmonary angiography assessment of thirty patients with suspicion of pulmonary embolism along with raised D-dimer, it was found that 15 patients had no pulmonary embolism and 15 patients had pulmonary

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Table 2: Distribution of D-dimer values according to presence and proximity of pulmonary embolism

D- dimer value (ng/ml)	Pulmonary embolism (No. of cases)		
	Absent	Sub segmental	Segmental
250-1999	8	0	0
2000-3999	3	0	0
4000-5999	2	2	0
6000-7999	2	4	3
8000-9999	0	0	3
≥10000	0	0	3
Total	15	6	9

embolism with male female ratio of 1:2. Among 15 patients of confirmed pulmonary embolism 6 patients had sub segmental pulmonary embolism (distal) and 9 patients had segmental pulmonary embolism (proximal). Mean D-dimer value of study population was 5163 ng/ml. After CT pulmonary angiography assessments mean D-dimer value of patients with absent pulmonary embolism, sub segmental pulmonary embolism, segmental pulmonary embolism was 2500, 5913, 9100 ng/ml respectively. No patient had pulmonary embolism on CT pulmonary angiography assessment with D-dimer value less than 4000 ng/ml. Among patients (n=13) with D-dimer value 4000 to 7999 ng/ml, 31% (n=4) patients had absent pulmonary embolism, 46% (n=6) patients had sub segmental embolism and 23% (n=3) patients had segmental embolism. Among patients (n=6) with D-dimer value equal or more than 8000 ng/ml all patients (100%) had segmental embolism.

These results showed that D- dimer value equal and more than 4000 had high positive prediction value (79%) of presence of pulmonary embolism. D-dimer value also correlated well with proximity and size of pulmonary embolism. (Table 2)

Among patients (n=15) with confirmed pulmonary embolism on CT pulmonary angiography 3 patients were having NYHA class III symptoms and 12 had NYHA class IV symptoms. Among 3 patients with NYHA class III symptoms all (100%) had segmental (proximal) embolism with mean D-dimer value 8067 ng/ml. Among 12 patients with NYHA class IV symptoms 7 (58.3%) had sub segmental (distal) embolism with mean D-dimer value of 5069 ng/ml and 5 (41.7%) had segmental (proximal) embolism with mean D-dimer value of 10260 ng/ml.

Table 3: Correlation of NYHA class with presence and proximity of pulmonary embolism along with mean D-dimer values

NYHA class	N	Pulmonary embolism		
		Without	Sub-segmental	Segmental
I	0	0	0	0
II	0	0	0	0
III	9	6	0	3 (8067)
IV	21	9	7 (5069)	5 (10260)

Mean D-dimer value ng/ml in parenthesis

Thus all (n=7) sub segmental (distal) embolism cases had NYHA class IV symptoms on the contrary all (n=3) NYHA class III patients had segmental (proximal) embolism with tendency of raised D- dimer value with proximity of embolism. These results showed that proximity of embolism as well as D-dimer values did not correlate with severity of symptoms (Table 3).

Discussion

In current study among 15 confirmed cases of pulmonary embolism on CT pulmonary angiography assessment male female ratio was 1:2. In study by Quinn DA et al[6] male female ratio in confirmed cases of pulmonary embolism was 3:2. According to Yousuf et al[7] male female ratio was 6:5. Further studies are needed in same region to establish higher incidences in females.

In current study among patients with suspected pulmonary embolism along with raised D-dimer 50% had confirmed pulmonary embolism on CT pulmonary assessment showing positive predictive value of D-dimer for pulmonary embolism. Raised D-dimer value found common in unexplained dyspnoea. When D- dimer values was more than 4000 ng/ml positive prediction value improved to 79%. D-dimer value more than 8000 ng/ml had 100% prediction value for pulmonary embolism in current study. According to Yousuf et al[7] positive prediction value of D-dimer was 67.7% and in patients with high clinical suspicion positive prediction value was 100% for pulmonary embolism. Few studies had reverse results like according to Chopra et al[8] positive prediction value of D- dimer was only 4.2 %. According to Vicente Gomez V et al[9] only 40% patients had pulmonary embolism among patients with D-dimer value more than 8000 ng/ml.

In current study D-dimer value also correlate well with proximity and size of pulmonary embolism but not correlate well with symptoms (NYHA class). According to Coskun et al[10] D-dimer value correlate well with massive pulmonary embolism. Blamoun J et al[11] also supported this results and showed D – dimer concentration value correlate well with severity of pulmonary embolism.

Conclusion

Although D-dimer value is not gold standard diagnostic test for pulmonary embolism but cut off value of more than 4000 ng/ml can give good positive prediction of pulmonary embolism in suspected cases. D- dimer value also correlate well with size and proximity of pulmonary embolism that can help to assess outcome.

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