International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 274-278 www.ijdmsrjournal.com ISSN: 2582-6018

# Prevalance of Pulmonary Embolism in Covid – 19 Patients Admitted in Icu of Tertiary Care Hospital – Cross Sectional Study

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Submitted: 15-07-2021 Revised: 25-07-2021 Accepted: 28-07-2021

**ABSTRACT**:
The clinical spectrum of the disease caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is wide ranging, from asymptomatic infection to acute respiratory distress syndrome (ARDS) with high mortality. This has been further confirmed in larger studies showing that nearly 50% of patients with laboratory confirmed COVID-19 infection had elevated D-dimer and fibrin degradation products, being the elevation more pronounced among severe cases. Data from the international cohort RIETE showed that patients with respiratory infections had higher risk of PE than patients with other types of infections. Some other studies showed that up to 90% of patients admitted to the hospital for pneumonia had high procoagulant markers, with D-dimer being one of the most common.
This study was conducted with **objectives** to find out the prevalence of pulmonary embolism in covid-19 patients admitted in ICU and to corelate other blood parameters with outcome (pulmonary embolism and non-pulmonary embolism) of patients. **Methodology** It is a cross sectional study 100 covid-19 positive patients getting admitted in ICU of the hospital for the period of 3 month. **Results and discussion**- Mean age in years in PE group was 48.36 years and in Non-PE group it was 50.53 years of age. The performance of the D-dimer assay to determine PE show a receiver operating characteristic (ROC) curve with area under the curve (AUC) was 0.813 (95% confidence interval (CI) 0.656–0.970). Out of 100 patients, 11% were developed pulmonary embolism in ICU during study period. Mortality was higher in Pulmonary embolism patients as compared to non-pulmonary embolism patients.

**Key words-** Covid -19, Pulmonary embolism, d dimer, ICU

## I. INTRODUCTION

Prevalence of pulmonary embolism in covid-19positive patients admitted in ICU of tertiary care hospital- Cross sectional study

**Introduction-**

The clinical spectrum of the disease caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is wide ranging, from asymptomatic infection to acute respiratory distress syndrome (ARDS) with high mortality[(1)]. Coagulation disorders are frequently encountered among COVID-19 patients, especially among those with severe disease .[(2,3)] This has been further confirmed in larger studies showing that nearly 50% of patients with laboratory confirmed COVID-19 infection had elevated D-dimer and fibrin degradation products, being the elevation more pronounced among severe cases.[(1,4)](In addition, in a multicentre retrospective cohort study from China, increased D-dimer levels (>1μg/mL) were significantly associated with in-hospital death in the multivariable analysis (p = 0.003).[(2)]

It is reasonable to conceive that COVID-19 infected patients could be at high risk for venous thromboembolic events. Although the published data are very limited, it seems rational to suggest that D-dimer evaluation could offer useful information for the search of Pulmonary embolism (PE) in severe COVID-19 infected patients. Accordingly, we aimed to evaluate prospectively the prevalence of PE in patients admitted to hospital with COVID-19.

International Journal Dental and Medical Sciences Research
Volume 3, Issue 4, July-Aug 2021 pp 274-278 www.ijdmsrjournal.com ISSN: 2582-6018

**Review of literature**

Data from the international cohort RIETE showed that patients with respiratory infections had higher risk of PE than patients with other types of infections.[5]Some other studies showed that up to 90% of patients admitted to the hospital for pneumonia had high procoagulant markers, with D-dimer being one of the most common.[6]

Klok et al.[7] found, in a retrospective study in 184 intensive care unit (ICU) patients with severe COVID-19 pneumonia, a high prevalence of thrombotic complications and, by far, pulmonary embolism (PE) was the most frequent

A retrospective study evaluated 106 patients who underwent a CTPA during hospitalization and they confirmed PE in 32 subjects. Furthermore, they found higher D-dimer levels in PE
patients compared with those patients without PE.[8]

## II. OBJECTIVES

Primary- To find out the prevalence of pulmonary embolism in covid patient admitted in ICU
Secondary- To corelate other blood parameters with outcome (pulmonary embolism and non-pulmonary embolism) of patients

## III. METHODOLOGY

It is a cross sectional study of covid 19 positive patients getting admitted in the hospital in the study period
Study period- 3 month
Sample size- 100 patients (convenient sample size)
Inclusion criteria

1. Covid-19 positive patients who were admitted into the ICU of hospital during study period
2. Those patient or relative of patients who gave the consent for participation of study

Exclusion criteria

1. Non covid patients were excluded
2. Covid-19 positive patients admitted into the wards were excluded from the study

Collection of data- All required blood parameters and other investigation of covid-19 positive patients were studied after taking the consent

Analysis of data- D-dimer level was measured by a latex photometric immunoassay, with STA-Liatest. Values over 500 ng/mL are considered positive. Detection of COVID-19 was from viral RNA isolated from nasopharyngeal swabs using reverse transcriptase polymerase chain reaction (rtPCR).
Receiver operating characteristics (ROC) curve analysis was performed and area under the curve (AUC) calculated. The results are given as the mean ± standard error of mean (SEM), median (interquartile range), or number (percentage), wherever appropriate. A P value of $< 0.05$ was considered statistically significant. Data analysis was made using SPSS Statistics for Windows, version 26

## IV. RESULTS

During study period, 100 COVID-19 positive patients were included in the study who were admitted in ICU of hospital. The cumulative incidence of PE in patients with COVID-19 in the ICU was estimated to be 11%.

**Table no 1. Age, sex and clinical features of PE and Non-PE patients**

| Parameters | PE patients | Non-PE Patients | P |
|---|---|---|---|
| **Age (mean age in years)** | 48.36 | 50.53 | 0.243 |
| **Sex** | | | |
| **Male** | 7 (63.63%) | 51 (57.3%) | 0.688 |
| **Female** | 4 (36.36%) | 38 (42.69%) | |
| **Clinical presentation** | | | |
| **Dyspnoea/cough** | 11 (100%) | 85 (95.50%) | 0.473 |
| **Chest pain** | 9 (81.8%) | 41 (46%) | 0.025 |
| **Fever/chills** | 11 (100%) | 78 (87.64%) | 0.216 |
| **GI symptoms** | 6 (54.54%) | 36 (40.4%) | 0.372 |

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**Table no 2- Risk factors for comparison between PE and Non-PE patients**

| Parameters | PE patients (n=11) | Non-PE Patients (n=89) |
|---|---|---|
| **PE risk factor** | | |
| **Heart Rate >100** | 7 (63.6%) | 7 (7%) |
| **H/O VTE** | 0 (0%) | 0 (0%) |
| **Haemoptysis** | 3 (27.2%) | 11 (12.3%) |
| **Malignancy** | 4 (36.3%) | 7 (7.8%) |
| DM | 6 (54.5%) | 22 (24.7%) |
| HTN | 6 (54.5%) | 15 (16.8%) |

**Table no 3- Few blood parameters in PE and Non-PE patients**

| Blood parameters | PE | Non-PE | P |
|---|---|---|---|
| | Mean (min- maximum) | Mean (min- maximum) | |
| **Hb (gm%)** | 11.96 (8.6-15.9) | 12.14 (8.3-15.7) | 0.556 |
| **WBC (per $mm^3$)** | 10.20 (3.7-16.1) | 8.88 (3.7-16.1) | 0.298 |
| **Platelet (per l/ $mm^3$)** | 305.27 (230-410) | 265.31 (121-449) | 0.051 |
| **Creatinine (mg/dl)** | 0.93 (0.69-1.32) | 0.83 (0.59-1.21) | 0.067 |
| **CRP** | 139.81 (44-214) | 62.89 (25-150) | 0.0001 |
| **D-dimer** | 4531.73 (1800-8500) | 2424 (576-5640) | 0.001 |

Graph no 1- ROC for D-dimer, Creatinine and CRP

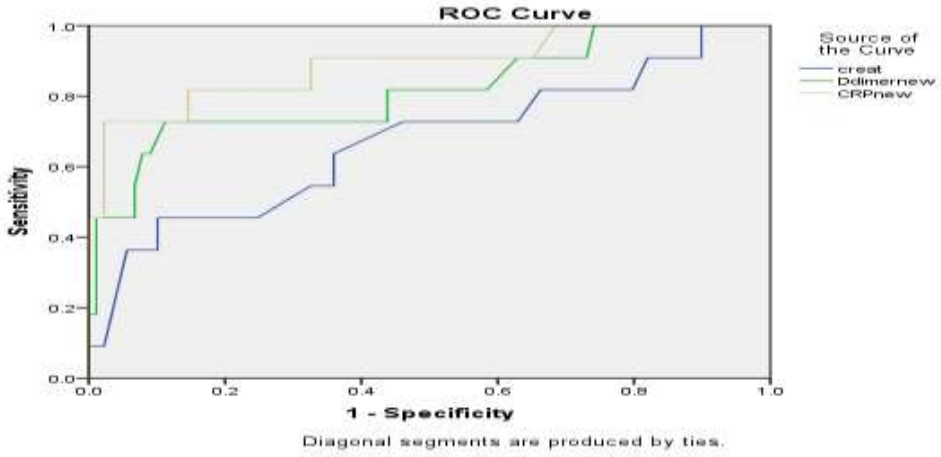


**Table no 4- AUC for D dimer, CRP and Creatinine levels**

| Blood parameters | AUC | Standard error | Asymptotic significance | 95%CI |
|---|---|---|---|---|
| **D dimer** | 0.813 | 0.080 | 0.001 | 0.656-0.970 |
| **CRP** | 0.890 | 0.062 | 0.000 | 0.769-1 |
| **Creatinine** | 0.670 | 0.098 | 0.067 | 0.479-0.861 |

**Table no 5- Clinical outcome (Death and Discharge) in PE and Non-PE patients**

| Clinical outcome | PE patients | Non- PE patients | Total | P |
|---|---|---|---|---|
| Discharge | 4 (36.36%) | 74 (83.14%) | 78 (78%) | 0.0001 |
| Death | 7 (63.63%) | 15 (16.85%) | 22 (22%) | |
| Total | 11 (11%) | 89 (89%) | 100 (100%) | |

## V. DISCUSSION-

Mean age in years in PE group was 48.36 years and in Non-PE group it was 50.53 years. Out of 11 PE patients, 7 (63.63%) were male and 4 (36.36%) were female and in Non-PE group, 51 (57.3%) were male and 38 (42,69%) were female patients.

Study conducted by Bompard F, Monnier H, Saab I, et al. [9] reports an overall 24% (95% CI 17–32%) cumulative incidence of pulmonary embolism in patients with COVID-19 pneumonia, 50% (30–70%) in ICU and 18% (12–27%) in other patients

All patients from PE group and 85 (95.5%) patients from Non-PE group had history of cough, chest pain was more commonly associated with PE group than in Non-PE group. In 9 (81.8%) patients from PE group and 41 (46%) from Non-PE group had chest pain. ($p<0.025$). All patients from PE group and 78 (87.64%) from non-PE group had history of fever whereas 6 (54.54%) from PE group and 36 (40.4%) from Non-PE group had gastrointestinal complaints. (Table no 1)

The patients who were diagnosed as pulmonary embolism, 7 had heart rate more than 100 beats per minute, 3 had haemoptysis, 4 had malignancy, 6 had DM and 6 had history of Hypertension. In Non-PE patient, no patients of immobilization 11 had H/O haemoptysis and 7 had H/O malignancy, 22 had history of DM and 15 had Hypertension. (Table no 2)

**Measures of blood parameters.**

Mean Haemoglobin level in study sample was 12.11 mg/dl, out of which in pulmonary embolism patients mean Hb level was 11.96 mg/dl and in non -PE patients it was 12.14mg/dl. Mean WBC count was 9.02 per $mm^3$ in total sample and in PE patients it was 10.20 per $mm^3$slightly higher than in non-PE patients which was 8.88 per $mm^3$. Mean Platelets count was 269.71 lac/$mm^3$in total patients and in PE patients it was 305.27 lac/$mm^3$higher than in non-PE patients where it was 265.31 lac/$mm^3$. Mean creatinine level in total patients was 0.84 mg/dl and in PE patients it was 0.93mg/dl, in non -PE patients it was 0.83 mg/dl.

The range of blood D-dimer levels were between 1050ng/mL and 8500 ng/mL in total patients. D-dimer values were significantly higher in those with confirmed PE. (Table no 3)

The performance of the D-dimer assay to determine PE is shown as a receiver operating characteristic (ROC) curve. The area under the curve (AUC) was 0.813 (95% confidence interval (CI) 0.656–0.970).

ROC curve for C-reactive protein show 0.890 AUC with 95% CI of 0.769-1 whereas for creatinine level AUC was 0.670 with 95 CI of 0.479-0.861 (Table no 4, Graph no 1)

D-dimer tended to rise during hospitalization in the PE group, which is consistent with studies correlating high D-dimer levels in patients at high-risk for PE. [10]

However, the results were not consistent, so we could not conclude that initial or serial D-dimer assays could reliably predict who would subsequently develop PE and who would not.

Out of 100 patients, 11% developed pulmonary embolism in ICU during study period. Mortality was higher in Pulmonary embolism patients as compared to non-pulmonary embolism patients. Out of 11 PE patients, 7 (63.63%) died and 4 (36.36%) got discharged after treatment for pulmonary embolism. In 89 patients who were non-PE patients, 15 (16.85%) died and 74 (83.14%) got discharged. (Table no 5)

Study conducted Tang N et al[11] shows that in COVID-19 patients' coagulation disorders showed thrombocytopenia, elevated D-dimer, prolonged prothrombin time, and disseminated intravascular coagulation. These coagulation alterations have been associated with poor prognosis.

Shah et al. [12]observed an awfully high prevalence (53.5%) of pulmonary embolism (PE) among 30 intensive care unit (ICU) patients with coronavirus disease 2019 (COVID-19) in Oxford, UK. Although several studies have focused on this cardiovascular complication of PE in COVID-19 patients, the prevalence of PE varies from study to study.[13–15].

## VI. CONCLUSION

Our study adds to the growing recognition that patients with COVID-19 appear to be at high risk ofdeveloping PE. Since a search for PE was not conducted in all our patients admitted to the ICU, the 11% incidence of PE identified in this study may be an underestimate.

A high index of clinical suspicion for PE in patients with COVID-19 is warranted. D dimer, C-reactive protein was found to be significantly associated with pulmonary embolism patients. Mortality is higher in PE patients as compared to Non-PE patients. Association of comorbidities such as DM and HTN was found to be associated with mortality of patients.

**Limitation of study-**

We were not able to evaluate the presence of DVT in our study population as none of the patients underwent compression ultrasound.

Very few individuals had fibrinogen measured (outside of ICU) and we are therefore unable to determine the presence of DIC for most of the cohort.

We did not collect data on whether segmental/subsegmental PE were co-localised to areas with

lung parenchymal disease.All patients diagnosed with PE during hospitalisation had received at least weight-based thromboprophylaxis beforehand.

**Funding**

This research did not receive any specific grand from funding agencies in the public, commercial, or not-for-profit sectors.

**Declaration of competing interest**

The authors declare no relevant conflicts of interest for the submitted work.

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