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Pulmonary Embolism and COVID-19

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Abstract

Aims
There is increasing concern amongst clinicians of a possible increase in venous thromboembolism (VTE) events in patients with COVID-19. There remains limited data defining the incidence of VTE in this population and thus also a paucity of research examining the impact of targeted treatment in patients with thrombotic complications.

Methods
We examined the number of symptomatic VTE events amongst proven COVID-19 patients admitted to a tertiary level academic hospital, over a one-month period. Patient characteristics, admission and discharge inflammatory and coagulation markers were included in the analysis.

Results
Sixty-one patients were identified. Twelve patients (19.6%) admitted with COVID-19 were treated for a suspected PE. Of these patients, 3 patients were discharged on anticoagulation, 3 died and 6 remain inpatients at the end of the study period.

Discussion
COVID-19 patients are at increased risk of VTE. This risk may extend beyond the period of admission. Further research examining the role of extending the duration of thromboprophylaxis in COVID-19 patients beyond hospital discharge is warranted.

Introduction

There is increasing concern amongst clinicians of an increase in venous thromboembolism (VTE) events in patients with COVID-19, regardless of routine thromboprophylaxis practice.[1,2] COVID-19 promotes a pro-inflammatory and hypercoagulable state. Microvascular pulmonary thrombosis may play a role in the development of acute respiratory failure in this cohort.[3] One recent study has shown a mortality benefit from anticoagulation in patients with severe COVID-19 or a markedly elevated D-Dimer.[4]

However, there remains limited data defining the incidence of VTE in this population and thus also a paucity of research examining the impact of targeted treatment in patients with thrombotic complications.

Methods

We examined the number of symptomatic VTE events amongst proven COVID-19 patients admitted to a tertiary level academic hospital, over a one-month period from 23rd March 2020 to 23rd April 2020. Patient characteristics, admission and discharge inflammatory and coagulation markers were included in the analysis.

Results

Sixty-one patients were identified, with a male predominance at 61%. All were commenced on thromboprophylaxis on admission. The median age (range) was 65 (25-89) years. On admission, D-Dimer and fibrinogen count was carried out in 60 and 47 patients respectively. In these patients, D-Dimer level was elevated in 68% (median 0.68mg/L FEU; Normal hospital range:0-0.5mg/L FEU) and fibrinogen level elevated in 83% (median 5.7; Normal hospital range:1.7-4.1g/L).

Of this cohort, anticoagulation was empirically commenced (weight based therapeutic tinzaparin) in patients with a high clinical suspicion of pulmonary embolus (PE). Acute PE was confirmed by computed tomography pulmonary angiogram (CTPA) in 4 patients (6.6%). A further 8 patients were deemed to have a high probability of PE based on the treating physician's assessment of the patient's acute deterioration in respiratory or hemodynamic status as well as elevated D-Dimer and troponin levels. BNP levels were not routinely measured. Diagnostic imaging was not feasible in these 8 patients due to clinical instability. Of these 8 patients, 38% (3/8) had an elevated troponin level at time of acute deterioration. The median (range) admission D-dimer in this treated cohort of patients was 2.7(0.31-16.7) mg/L FEU.

Hence, within our institution, 19.6% (12/61) of patients admitted with COVID-19 were treated for a suspected PE. Of these 12 patients, at the end of the month study period, 25% (3/12) patients were discharged on anticoagulation, 25% (3/12) died and 50% (6/12) remain inpatients. Post-mortem studies were not carried out on the deceased.

Of our total cohort of 61 patients, 49% (30/61) were discharged and on discharge, 30% (9/30) had a raised D-Dimer level. Excluding the 33% (3/9) of patients who were treated for VTE during their inpatient stay and were discharged on anti-coagulation, there were a further 67% (6/9) patients with elevated D-Dimers on discharge. One patient was on anti-coagulation for a pre-existing cardiac condition pre-admission. The remaining 56% (5/9) patients with elevated D-Dimers on discharge were not commenced on anticoagulation.

Discussion

There is an emerging concept of pulmonary intravascular coagulopathy in patients with COVID-19.[1] In our study, 19.6% of all patients admitted with COVID-19 were treated for an acute PE. This would appear to represent a significantly increased risk, given that in critically ill patients without a diagnosis of COVID-19, the reported rate of PE is 1.3%.[5]

Of the patients diagnosed with co-existing PE and COVID-19, 3 patients died, 2 are currently intubated in intensive care and a further 4 remain inpatients. The median admission D-Dimer in these patients was 2.7mg/L FEU. Elevated D-Dimer levels have been linked with disease progression and an increased mortality rate in hospitalised COVID-19 patients.[6] Our findings would support this data.

Many organisations have advocated for more aggressive thromboprophylaxis regimens.[7] The American College of Chest Physicians guidelines currently recommend against extending the duration of thrombophylaxis beyond the period of acute hospital stay as this did not result in reduced VTE rates.[8] However, further studies have shown that high risk patients such as those with high D Dimers did benefit.[9] A statement endorsed by several international expert bodies, has stated that 'while no data specific to COVID-19 exist, it is reasonable to employ individualized risk stratification for thrombotic and haemorrhagic risk, followed by consideration of extended prophylaxis (for up to 45 days)'.[10] Given the high proportion of our cohort with elevated D-Dimers on discharge, the potential high risk of VTE events and functional limitation, extended thrombophylaxis post hospital stay in this group may be a consideration.

Therefore, we believe that COVID patients are at increased risk of VTE and that this risk may extend beyond the period of admission. Further research, including the enrollment of suitable patients in a clinical trial and, at local level, the engagement of multidisciplinary specialists in decision-making around the use of anticoagulation in this complex and poorly understood area is warranted.

Abbreviations List:

BNP: Brain natriuretic peptide
CTPA: Computed tomography pulmonary angiogram
FEU: Fibrinogen-equivalent-units
PE: Pulmonary Embolus
VTE: Venous Thromboembolism

Keywords:

Venous thromboembolism, COVID-19, Pulmonary Embolus, Anticoagulation

Declarations of Conflicts of Interest:

The authors declare that they have no competing interests.

Ethics Approval and Consent to Participate:

This study was approved by the Clinical Research and Ethics Committee of the University College Cork affiliated hospital group

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