Research Article

Pulmonary Thromboembolism Complicated COVID-19

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Abstract

Recent studies demonstrated that most severe COVID-19 patients with intensive-care-unit (ICU) admission for respiratory failure presented possible arterial and thromboembolisms. Infection and hypoxia in severe pneumonia can cause increased thrombin generation and reduced fibrinolysis confirmed by the presence of occlusive microthrombi in pulmonary blood vessels in lung dissection of critical COVID-19 patients. In conclusion, COVID-19-related hypercoagulopathy can be evaluated by another interesting test, called " thromboelastometry ". This test is also used for screening COVID-19-related hypercoagulopathy to allow identifying patients at greatest risk of thrombosis, including thromboprophylaxis.

***Keywords**: COVID-19, embolism, hypercoagulopathy, pulmonary, thromboembolism, thrombosis*

Abbreviations:

COVID-19: Coronavirus Disease 2019,

ICU: Intensive Care Unit,

LMWH: Low Molecular Weight Heparin,

SARS: Severe Acute Respiratory Syndrome,

SOFA: Sequential Organ Failure Assessment,

UFH: Ultra-Fine heparin,

vs: versus,

p: probability

Introduction

Recent studies demonstrated that most severe COVID-19 patients with intensive-care-unit (ICU) admission for respiratory failure presented possible arterial and thromboembolisms **(**1**)**. Infection **(**2**)** and hypoxia in severe pneumonia **(**3**)** can cause increased thrombin generation and reduced fibrinolys is confirmed by presence of occlusive microthrombi in pulmonary blood vessels in lung dissection of critical COVID-19 patients **(**4**)**. The final step of the coagulative cascade in COVID-19 nary alveolar and interstitial spaces may lead to acute respiratory failure **(**5**)**, supported by a Chinese expert consensus of the implementation of thromboprophylaxis in severe COVID-19 patients **(**5**)**. Other known risk factors for thromboembolism in COVID-19 patients are corticosteroid treatment, hospitalization, bed rest, etc. It is reasonable to hypothesize that thromboembolism in COVID-19 patients could mirror previously reported data in SARS patients, such as 11.4 % of pulmonary embolism and 20.5 % of deep vein thrombosis, whereas there is currently limited data on venous thromboembolism in COVID-19 patients **(**6, 7, 8**)**. Nevertheless,this complication may be associated with host-pathogen interaction immune mechanisms **(**7, 8**)**. A previous study demonstrated that D-dimer levels > 1 µg/ml, higher SOFA score, and older age on hospital admission were associated with higher hospital death **(**9**)**.

Tacking COVID-19 Coagulopathy

Several reports from Wuhan, China demonstrated that low-molecular weight heparin (LMWH) or ultra-fine heparin (UFH) uses at prophylactic doses decreased 28-day mortality in COVID-19 patients with severe pneumonia and either D-dimer levels > 6 folds the upper limit of normal (mortality rate 32.8 % vs 52.4 %, p = 0.017), or an SIC score at least 4 (mortality rate

40.0 % vs 64.2 %, p = 0.029) (10). In vitro and in vivo studies have demonstrated that human coronavirus utilize heparin sulfate proteoglycans for target cell attachment (11), indicating a potential role of heparin against COVID-19. Fondapariux, an attractive drug has been proposed as a COVID-19 treatment (12) due to its anti-viral and anti-inflammatory properties (13, 14) and as it is not associated with heparin-induced thrombocytopenia (15).

Discussion

COVID-19 patients presenting with rapidly worsening respiratory symptoms or sudden hypoxic respiratory failure could be from worsening pneumonia, but could be due to an undiagnosed pulmonary embolism. Evaluation of the pre-test probability of pulmonary embolism via scores, such as Wells score is difficult in these COVID-19 patients, as the score may already be high at the time of hospital admission. COVID-19 patients frequently demonstrate right ventricular dysfunction on the echocardiography that whether they may be pulmonary embolism or not. This observation raise the importantly initiating an adequate and timely anticoagulant prophylaxis or therapy in COVID-19 patients, either with LMWH or fondaparinux or mechanical methods in high bleeding risk patients (16).

Conclusion

COVID-19-related hypercoagulopathy can be evaluated by another interesting test, called "thromboelastometry". This test is also used for screening COVID-19-related hypercoagulopathy to allow identifying patients at greatest risk of thrombosis, including thromboprophylaxis.

Authors Contributions

Dr. Attapon Cheepsattayakorn conducted the study framework and wrote the manuscript. Associate Professor Dr. Ruangrong Cheepsattayakorn contributed to scientific content and assistance in manuscript writing. Both authors read and approved the final version of the manuscript.

Competing Interests

The authors declare that they have no actual or potential competing financial interests.

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