



# Coagulation abnormalities and thrombosis in patients with COVID-19

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Patients with severe COVID-19 infections frequently manifest coagulation abnormalities that are associated with respiratory deterioration and death. In addition, many patients with severe COVID-19 infections develop thromboembolic complications, which seem to be related to the coagulopathy. It has been suggested that undiagnosed pulmonary embolism contribute to a sudden deterioration of pulmonary oxygen exchange that is sometimes seen in patients with COVID-19 infections.

The coagulation changes associated with COVID-19 mimics other systemic coagulopathies that are regularly seen during severe infections, such as disseminated intravascular coagulation (DIC) or thrombotic microangiopathy (TMA). However, at the same time, the clinical and laboratory characteristics of the coagulation changes in COVID are distinctly different from the common presentation of these conditions.

Severe COVID-19 infections seem to cause a profound coagulation abnormality caused by inflammation-induced changes in coagulation in combination with severe endothelial cell injury with consequent massive release of von Willebrand factor and plasminogen activators. This coagulopathy likely contributes to pulmonary microvascular thrombosis, broncho-alveolar fibrin deposition (which is a hallmark of adult respiratory distress syndrome (ARDS)) and thromboembolic complications.

Venous thrombosis is common in patients with severe COVID-19 with incidences up to 30% in some studies. There is ample evidence supporting the use of prophylactic dose low molecular weight (LMW) heparin as prophylaxis for venous thromboembolism in critically ill medical patients. In view of the hypercoagulable state of severe COVID-19 patients and the possibly increased risk of thrombosis, all patients with COVID-19 that are admitted to the hospital should receive this prophylactic treatment. Higher dose thromboprophylaxis have been studied in randomized controlled trials with modest success in non-ICU patients but are currently not advocate in critically ill patients on the ICU.