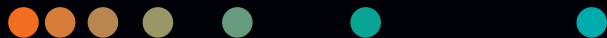




Coagulation abnormalities in COVID-19 patients

Current testing and treatment protocols

siemens-healthineers.com/covid-19-hemostasis





Siemens Healthineers is supporting labs in the diagnosis, treatment, and management of coagulation abnormalities in COVID-19 patients

For more than 40 years, Siemens Healthineers has been recognized as the global leader in hemostasis testing. We offer the broadest range of scalable hemostasis systems for low-, mid-, and high-volume laboratories. Our comprehensive portfolio of coagulation assays supports physicians in making sound diagnostic and therapeutic decisions.

COVID-19 patients are experiencing serious—and sometimes fatal—clotting abnormalities

While it's not unusual for infections to raise the risk of clotting, the COVID-19 virus is associated with an unprecedented range of clotting-related disorders in affected patients. From benign skin lesions on the feet to life-threatening thrombotic events, the COVID-19 virus has demonstrated a strikingly high prevalence of deadly blood clots. Studies show that about 20–45%¹⁻³—and possibly up to 70%⁴—of critically ill patients have confirmed venous thromboembolism (VTE) or pulmonary embolism (PE), and approximately 70% of COVID-19 patients who died had met the criteria for disseminated intravascular coagulation (DIC).⁵

We've increased production of vital coagulation assays for quick, accurate identification and treatment of clotting abnormalities

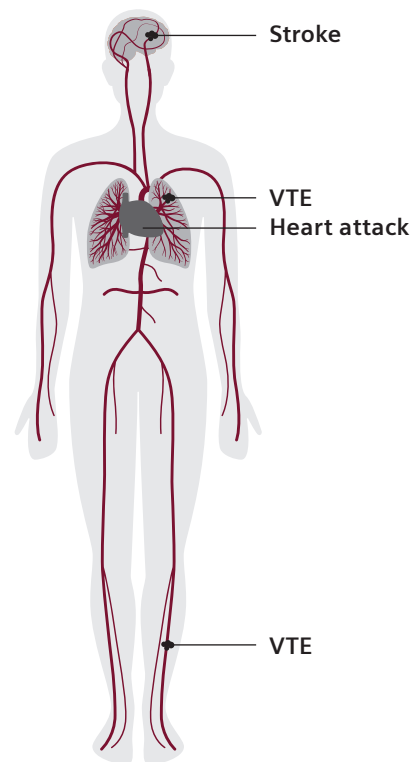
Our coagulation tests are playing an important role in the diagnosis, treatment, and management of coagulation abnormalities in COVID-19 patients. We've been working diligently to produce these assays at a higher volume than ever before. We've changed our production model to ensure an increased output of reagents while also putting appropriate safety measures in place that are intended to help protect our workers from exposure to COVID-19. We will continue these efforts so that we remain positioned to provide high-quality assays to meet the increased testing demand.

The information in this document is accurate as of posting time. However, as the situation surrounding COVID-19 continues to evolve, it's possible that some data will have changed since publication. While Siemens Healthineers is trying to keep COVID-19 content as up to date as possible, we also encourage readers to stay informed on news and recommendations by referencing guidelines published by the ISTH, AACC, CDC, and WHO and consulting with local healthcare authorities.

COVID-19 and thrombosis: an overview

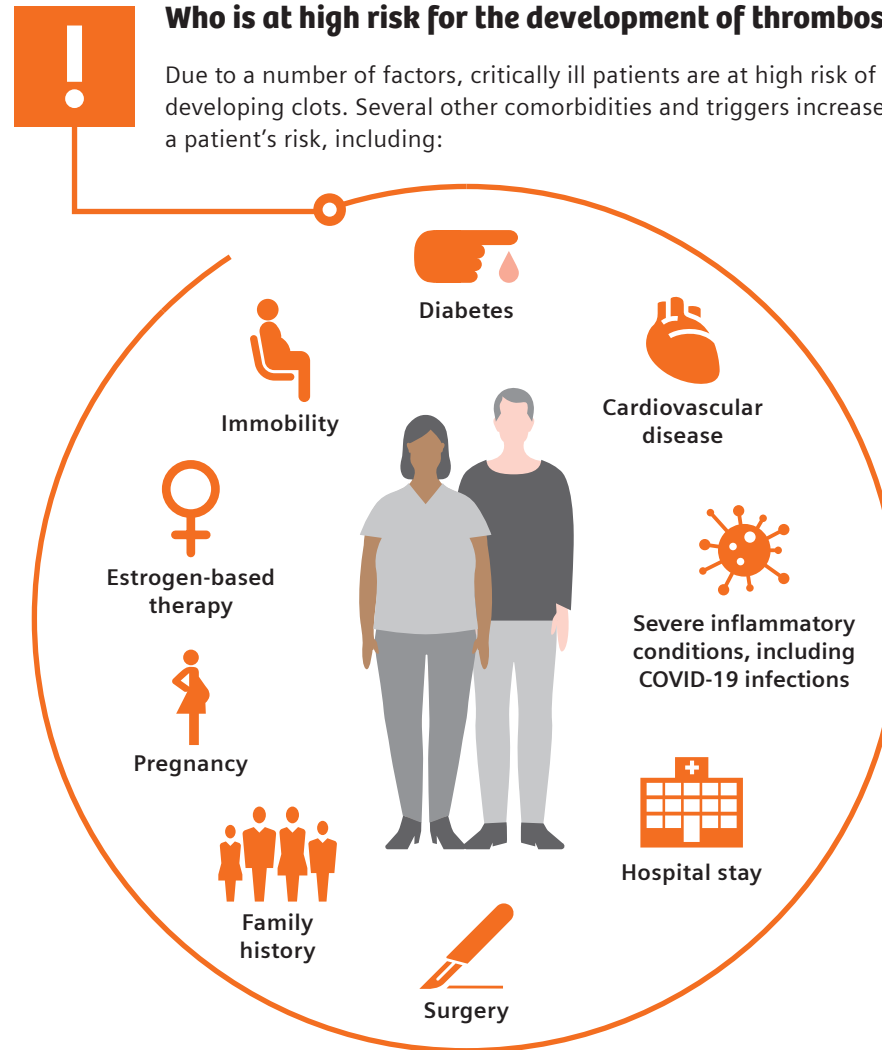
What is thrombosis?

Thrombosis is a blood clot that forms in an artery or vein. It is the one disorder that causes the world's top three cardiovascular killers: **heart attack, stroke, and venous thromboembolism (VTE)**, a blood clot found mostly in the leg and lungs.



Who is at high risk for the development of thrombosis?

Due to a number of factors, critically ill patients are at high risk of developing clots. Several other comorbidities and triggers increase a patient's risk, including:

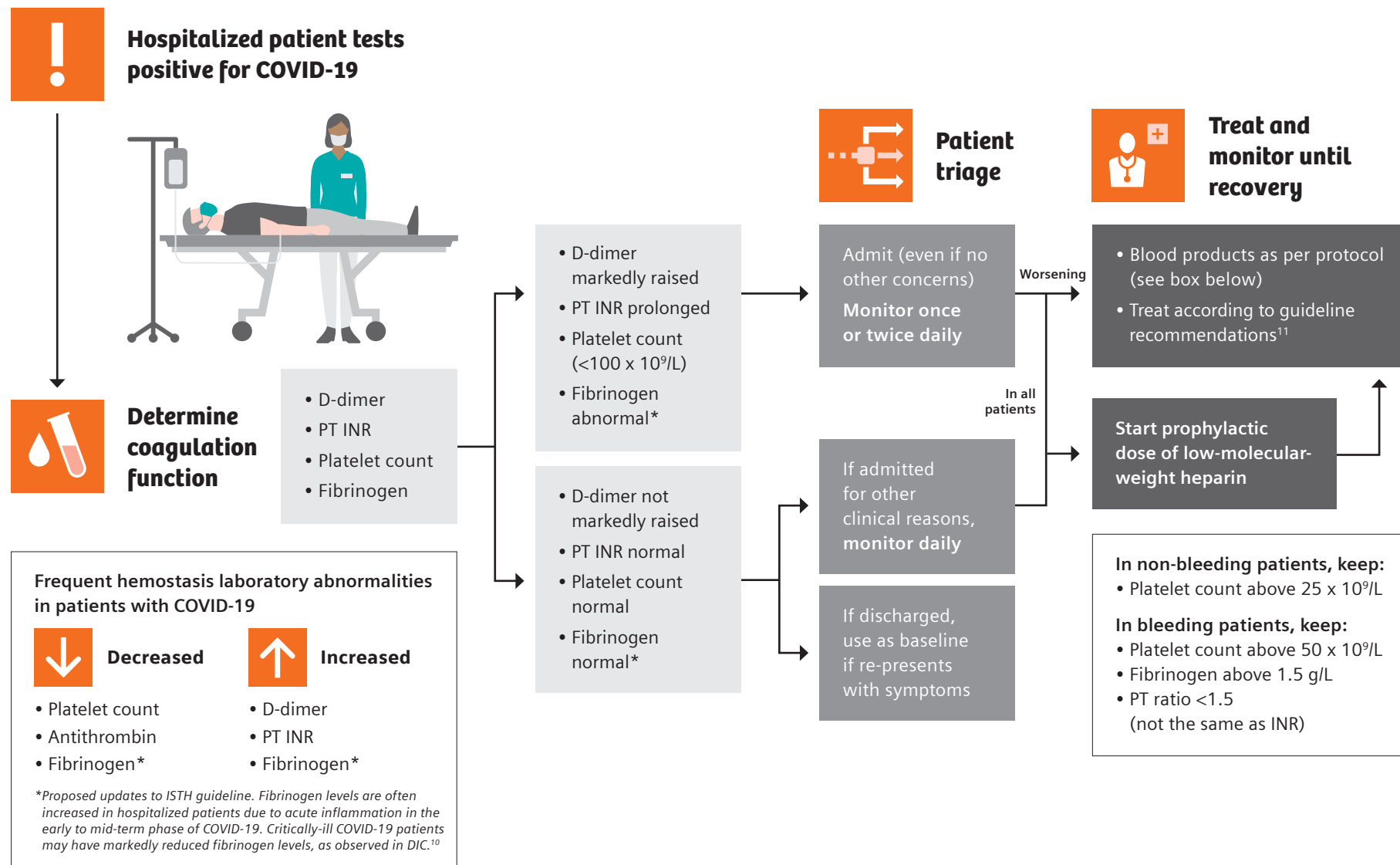


What is the relationship between COVID-19 and thrombosis?



While the connection between COVID-19 and thrombosis is not yet fully understood, many studies and publications have reported thrombosis and thromboembolism as a leading cause of death in COVID-19 patients.²⁻⁶ Elevated D-dimer levels were found to be a crucial laboratory marker indicating thrombotic risk in COVID-19 patients.^{5,7,8} Following a COVID-19 diagnosis, hemostasis testing, therapy, and monitoring have been shown to play a decisive role in COVID-19 patient management.

Laboratory testing in the identification of coagulation abnormalities in COVID-19 patients



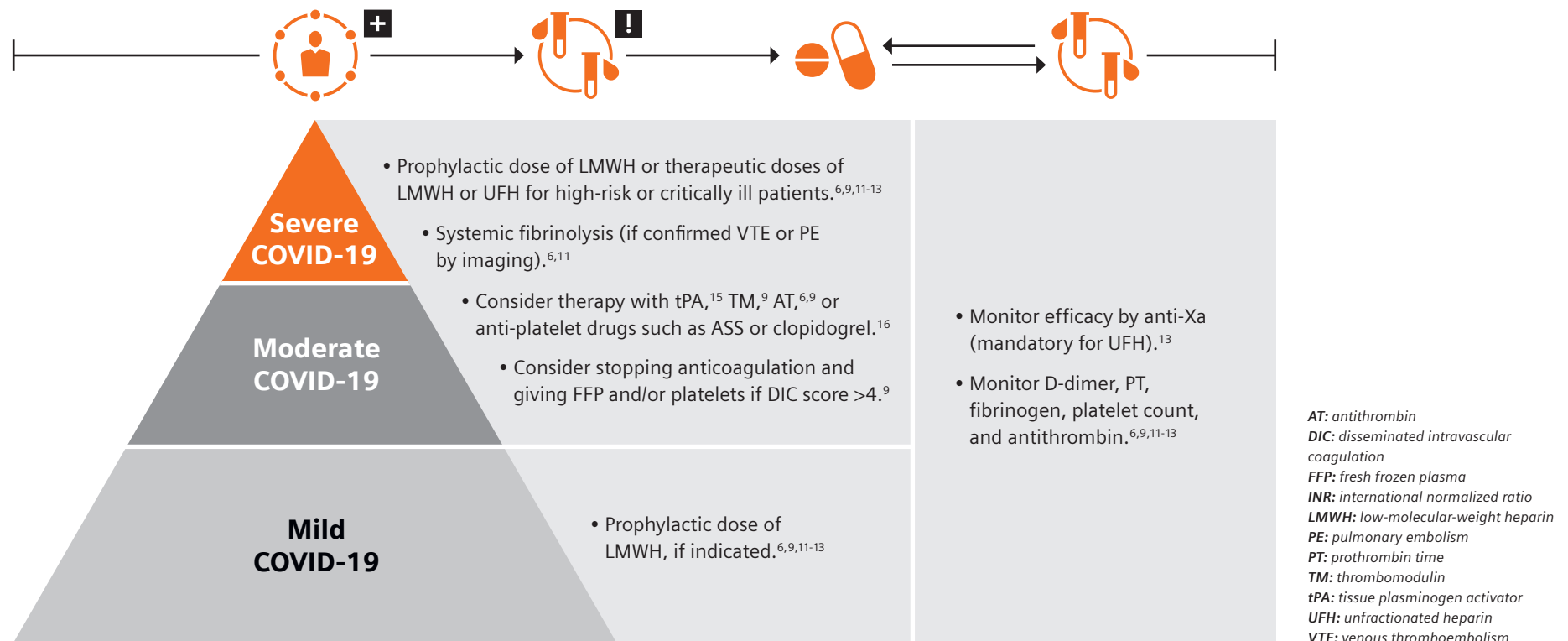
Treatment of coagulation abnormalities in COVID-19 patients

Approximately 5–10% of COVID-19 patients develop a severe condition requiring hospitalization. Depending on the patient's condition and disease severity, anticoagulation treatment and monitoring recommendations can vary.¹¹

Most leading coagulation experts suggest therapeutic anticoagulation with LMWH or UFH in severe COVID-19 patients, and recommend prophylactic anticoagulation with heparins for all hospitalized patients.^{6,9,11-13} The measurement of antithrombin levels might be helpful,¹⁴ because antithrombin affects heparin treatment efficacy and might be decreased in COVID-19 patients.⁵

COVID-19 patients with D-dimer levels >2 mg/L are 50 times more likely to die than patients with D-dimer levels <2 mg/L.¹⁵

For an overview of the latest research and publications on hemostasis testing in COVID-19, please visit [siemens-healthineers.com/covid-19-hemostasis](https://www.siemens-healthineers.com/covid-19-hemostasis).



At Siemens Healthineers, our purpose is to enable healthcare providers to increase value by empowering them on their journey toward expanding precision medicine, transforming care delivery, and improving patient experience, all made possible by digitalizing healthcare.

An estimated 5 million patients globally benefit every day from our innovative technologies and services in the areas of diagnostic and therapeutic imaging, laboratory diagnostics, and molecular medicine, as well as digital health and enterprise services.

We are a leading medical technology company with over 120 years of experience and 18,000 patents globally. Through the dedication of more than 50,000 colleagues in 75 countries, we will continue to innovate and shape the future of healthcare.

References:

1. Cui, et al. Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia. *J Thromb Haemost.* 2020;18:1421-4.
2. Klok FA, et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. *Thromb Res.* 2020;191:145-7.
3. Minno A, et al. COVID-19 and venous thromboembolism: a meta-analysis of literature studies. *Semin Thromb Hemost.* 2020;46:763-71.
4. Llitjos, et al. High incidence of venous thromboembolic events in anticoagulated severe COVID-19. *J Thromb Haemost.* 2020;18:1743-6.
5. Tang N, et al. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *J Thromb Haemost.* 2020;18:844-7.
6. Bikdeli B, et al. COVID-19 and thrombotic or thromboembolic disease: implications for prevention, antithrombotic therapy, and follow-up. *J Am Coll Cardiol.* 2020;75:2950-73.
7. Lippi G, Favaloro EJ. D-dimer is associated with severity of coronavirus disease 2019: a pooled analysis. *Thromb Haemost.* 2020;120:876-8.
8. Al-Samkari, et al. COVID-19 and coagulation: bleeding and thrombotic manifestations of SARS-CoV-2 infection. *Blood* 2020;136:489-500.
9. Tachil, et al. ISTH interim guidance on recognition and management of coagulopathy in COVID-19. *J Thromb Haemost.* 2020;18:1023-6.
10. Thompson et al. IFCC Interim Guidelines on Biochemical/Hematological Monitoring of COVID-19 Patients. *Clin Chem Lab Med.* 2020; 58(12): 2009–201
11. Spyropoulos et al. Scientific and Standardization Committee communication: Clinical guidance on the diagnosis, prevention, and treatment of venous thromboembolism in hospitalized patients with COVID-19. *J Thromb Haemost.* 2020;18:1859-65.
12. Barnes, et al. Thromboembolism and anticoagulant therapy during the COVID-19 pandemic: interim clinical guidance from the anticoagulation forum. *J Thromb Thrombolysis.* 2020;50:72.
13. Zhai Z, et al. Prevention and treatment of venous thromboembolism associated with coronavirus disease 2019 infection: a consensus statement before guidelines. *Thromb Haemost.* 2020;120:937-48
14. GTH Geschäftsstelle: Empfehlungen zur Thromboseprophylaxe bei SARS-CoV-2 (COVID-19).
15. Zhang L, et al. D-dimer levels on admission to predict in-hospital mortality in patients with Covid-19. *J Thromb Haemost.* 2020.
16. Vieca, et al. Enhanced platelet inhibition treatment improves hypoxemia in patients with severe Covid-19 and hypercoagulability. A case control, proof of concept study. *Pharmacol Res.* 2020;158:104950.

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