

# Post-COVID Hypercoagulability: Implications for Perioperative Anticoagulation and Thromboembolism Prevention in Surgical Patients

Brendan Jones\*

Kansas City University, Kansas City, MO, USA

\*Corresponding Author

Brendan Jones, Kansas City University, Kansas City, MO, USA.

Submitted: 2025, June 13; Accepted: 2025, July 08; Published: 2025, July 18

**Citation:** Jones, B. (2025). Post-COVID Hypercoagulability: Implications for Perioperative Anticoagulation and Thromboembolism Prevention in Surgical Patients. *Biomed Sci Clin Res*, 4(3), 01-03.

## Abstract

**Background:** SARS-CoV-2 infection induces a persistent prothrombotic state involving endothelial dysfunction, elevated coagulation markers, and systemic inflammation. This hypercoagulable state can persist for weeks to months post-infection, posing unique challenges for perioperative thromboembolism risk assessment and anticoagulation management.

## Objective

This review synthesizes emerging evidence on post-COVID hypercoagulability and its implications for perioperative anticoagulation and thromboprophylaxis in surgical patients.

## Methods

A narrative review of clinical trials, observational studies, guidelines, and meta-analyses retrieved from PubMed was conducted, focusing on perioperative thrombotic risk in post-COVID patients.

## Results

Persistent endothelial dysfunction, platelet activation, and elevated D-dimer levels contribute to sustained thrombotic risk post-COVID. Incidence of venous thromboembolism (VTE) post-discharge ranges from 0.6% to 2.5%. Extended thromboprophylaxis may reduce VTE in high-risk surgical patients, but bleeding risks remain significant.

## Conclusion

Individualized perioperative risk assessment, consideration of biomarker-guided prophylaxis, and selective use of extended anticoagulation are essential until more robust surgical data emerge.

**Keywords:** COVID-19, Hypercoagulability, Perioperative Management, Anticoagulation, Venous Thromboembolism (VTE)

## 1. Introduction

Coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2, is associated with a profound and unique coagulopathy distinct from classical disseminated intravascular coagulation. This prothrombotic state, characterized by elevated D-dimer, fibrinogen, and endothelial injury, may persist for months after clinical recovery, complicating perioperative management decisions for surgical patients.

As the pandemic evolves into its endemic phase, increasing numbers of recovered COVID-19 patients are presenting for elective and urgent surgeries. Understanding the long-term thrombotic risk and optimizing perioperative anticoagulation strategies is critical for

improving surgical outcomes in this population.

## 2. Pathophysiology of Post-COVID Hypercoagulability

Post-COVID hypercoagulability arises from several overlapping mechanisms:

- **Endothelial Dysfunction:** SARS-CoV-2 directly infects endothelial cells, causing endotheliitis and persistent microvascular injury.
- **Platelet Activation and Thrombin Generation:** Sustained platelet hyperreactivity and activation of the coagulation cascade led to elevated thrombin generation even months after recovery.
- **Elevated Biomarkers:** D-dimer, fibrinogen, and von Willebrand

factor remain elevated in convalescent patients, reflecting ongoing vascular inflammation.

These factors collectively result in a state of increased thrombotic potential that may not be captured by conventional perioperative risk scores.

### 3. Clinical Evidence of Thrombotic Risk in Post-COVID Patients

Several large-scale studies and meta-analyses have confirmed an elevated risk of VTE in patients recently recovered from COVID-19:

- Patell et al. reported a post-discharge VTE incidence of 0.6% and bleeding rate of 3.7% in 163 hospitalized COVID-19 patients.
- Giannis et al. (CORE-19 registry) demonstrated a 90-day cumulative thromboembolic rate of 2.5%, comparable to medically ill patients with non-COVID illnesses.
- A systematic review by Zuin et al. estimated the post-acute VTE incidence at approximately 2%, with higher risks observed in ICU survivors.

While most data are from non-surgical cohorts, the extrapolation of this risk to perioperative settings suggests the need for heightened vigilance in surgical patients.

## 4. Perioperative Anticoagulation Considerations

Evidence to guide perioperative anticoagulation in post-COVID patients remains limited. However, the following principles can be drawn:

### 1. Preoperative Risk Stratification:

- Recent COVID-19 illness (within 3 months), persistent symptoms, elevated D-dimer (>500 ng/mL), and ICU stay are potential risk enhancers.

### 2. Biomarker-Guided Prophylaxis:

- Persistent elevation in D-dimer may indicate ongoing risk; however, no prospective trials validate routine preoperative D-dimer testing.

### 3. Thromboprophylaxis Strategy:

- Standard LMWH or DOAC dosing is recommended perioperatively, with consideration of intensified prophylaxis in patients with additional risk factors (e.g., cancer, immobility, prior VTE).

### 4. Extended Prophylaxis:

- The MICHELLE trial demonstrated that 35-day rivaroxaban reduced VTE risk in high-risk post-discharge COVID-19 patients without significantly increasing bleeding.

Parameter	Standard Patients	Post-COVID Patients	Management Implications
VTE Risk Score (Caprini, Padua)	Validated for general use	May underestimate COVID-related risk	Consider "COVID-19 history" as risk modifier
D-dimer Levels	Typically normal or mildly raised	Frequently elevated up to 3 months post-infection	Pre-op D-dimer testing may guide prophylaxis intensity
Endothelial Function	Intact	Persistent dysfunction documented	Justifies careful perioperative thromboprophylaxis
Extended Prophylaxis Need	Limited to high-risk subgroups	Potential benefit in COVID-recovered high-risk cases	Consider extended prophylaxis (>28 days) selectively

**Table 1: Perioperative Anticoagulation Considerations in Post-COVID Patients**

### 5. Risks of Bleeding Versus Thrombosis

Balancing VTE prevention with bleeding risk is critical:

- Post-discharge bleeding rates (~3.7%) are comparable to thrombosis rates (~2.5%).
- The MICHELLE trial showed no significant rise in major bleeding with extended rivaroxaban prophylaxis, but this finding may not generalize to surgical patients.

Individualized assessment remains paramount, pending surgery-specific outcome data.

### 6. Current Guideline Recommendations

The ISTH and CHEST guidelines recommend prophylactic-dose anticoagulation for hospitalized COVID-19 patients but acknowledge insufficient data for post-discharge or surgical populations. Similarly, the American College of Chest Physicians suggests cautious extended prophylaxis in high-risk individuals.

### 7. Future Directions

Emerging research areas include:

- Biomarker-driven risk models: Validating perioperative D-dimer thresholds.
- Perioperative VTE trials: Evaluating the safety and efficacy of extended DOAC prophylaxis in post-COVID surgical patients.
- Enhanced ERAS protocols: Integrating COVID history into enhanced recovery after surgery guidelines.

### 8. Conclusion

Post-COVID hypercoagulability presents new challenges for perioperative management. While evidence is still evolving, clinicians should adopt individualized thromboprophylaxis strategies incorporating COVID history, biomarker trends, and patient-specific risk factors. Prospective trials are urgently needed to optimize care pathways in this growing patient population [1-10].

---

## Author Disclosures

## Author Contributions

I, Brendan Jones, conceptualized the review, conducted the literature search, synthesized the findings, and wrote the manuscript.

## Conflict of Interest

The author declares no conflicts of interest. Funding: No external funding was received for this work.

## Use of AI Tools

This manuscript was prepared with the assistance of AI language models to enhance clarity, grammar, and structure. All intellectual content, critical analysis, and interpretation of data remain the sole responsibility of the author.

## References

1. Connors, J. M., & Levy, J. H. (2020). COVID-19 and its implications for thrombosis and anticoagulation. *Blood, The Journal of the American Society of Hematology*, 135(23), 2033-2040.
2. Patell, R., Bogue, T., Koshy, A., Bindal, P., Merrill, M., Aird, W. C., ... & Zwicker, J. I. (2020). Postdischarge thrombosis and hemorrhage in patients with COVID-19. *Blood, The Journal of the American Society of Hematology*, 136(11), 1342-1346.
3. Giannis, D., Allen, S. L., Tsang, J., Flint, S., Pinhasov, T., Williams, S., ... & Spyropoulos, A. C. (2021). Postdischarge thromboembolic outcomes and mortality of hospitalized patients with COVID-19: the CORE-19 registry. *Blood, The Journal of the American Society of Hematology*, 137(20), 2838-2847.
4. Zuin, M., Barco, S., Giannakoulas, G., Engelen, M. M., Hobohm, L., Valerio, L., ... & Konstantinides, S. V. (2023). Risk of venous thromboembolic events after COVID-19 infection: a systematic review and meta-analysis. *Journal of Thrombosis and Thrombolysis*, 55(3), 490-498.
5. Ramacciotti, E., Agati, L. B., Calderaro, D., Aguiar, V. C. R., Spyropoulos, A. C., de Oliveira, C. C. C., ... & Santos, M. V. B. (2022). Rivaroxaban versus no anticoagulation for post-discharge thromboprophylaxis after hospitalisation for COVID-19 (MICHELLE): an open-label, multicentre, randomised, controlled trial. *The Lancet*, 399(10319), 50-59.
6. Moores, L. K., Tritschler, T., Brosnahan, S., Carrier, M., Collen, J. F., Doerschug, K., ... & Wells, P. (2020). Prevention, diagnosis, and treatment of VTE in patients with coronavirus disease 2019: CHEST guideline and expert panel report. *Chest*, 158(3), 1143-1163.
7. Tremblay, D., Van Gerwen, M., Alsen, M., Thibaud, S., Kessler, A., Venugopal, S., ... & Naymagon, L. (2020). Impact of anticoagulation prior to COVID-19 infection: a propensity score-matched cohort study. *Blood, The Journal of the American Society of Hematology*, 136(1), 144-147.
8. Spyropoulos, A. C., Connors, J. M., Douketis, J. D., Goldin, M., Hunt, B. J., Kotila, T. R., ... & Schulman, S. (2022). Good practice statements for antithrombotic therapy in the management of COVID-19: guidance from the SSC of the ISTH. *Journal of Thrombosis and Haemostasis*, 20(10), 2226-2236.
9. Zhang, H., Liu, Z., Mu, G., Wang, Z., Zhou, S., Xie, Q., ... & Cui, Y. (2020). Diagnostic performance of coagulation indices for direct oral anticoagulant concentration. *Thrombosis research*, 195, 171-179.
10. Al-Ani, F., Chehade, S., & Lazo-Langner, A. (2020). Thrombosis risk associated with COVID-19 infection. A scoping review. *Thrombosis research*, 192, 152-160.

*Copyright:* ©2025 Brendan Jones. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.