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BRIEF REPORT

Physician experiences in management of COVID-19-associated coagulopathy in pregnancy: Communication from the ISTH SSC Subcommittee on Women's Health Issues in Thrombosis and Haemostasis

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Abstract

Background: Coronavirus disease 2019 (COVID-19) occurs following infection with the potentially fatal, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus. Infection can be complicated by coagulopathy, at times featuring thrombocytopenia and thrombosis alongside other coagulation abnormalities, also termed COVID-19-associated coagulopathy (CAC). Data concerning CAC in pregnancy are limited. Better understanding of physician experiences is essential to identify current practice patterns and knowledge gaps.

Objectives: To determine physician experiences and practice patterns regarding CAC in pregnancy.

Methods: Self-administered survey using the RedCap online platform; supported by the ISTH Subcommittee on Women's Health Issues in Thrombosis and Hemostasis.

Results: Seventy-five respondents fully or partially completed the survey. Of 1546 reported cases, disease severity was specified in 1298. Sixty-four percent of COVID-19 infections were mild, whereas 4% were severe. Of all cases, 1% developed CAC, with 65% classified as severe. The most frequent abnormalities included thrombocytopenia, elevated C-reactive protein, D-dimer, and lymphopenia. Low molecular weight heparin was the anticoagulant of choice in CAC and was provided by 77% of respondents, with 60% using standard prophylactic dosing. Thrombosis occurred in seven anticoagulated patients who were receiving standard prophylactic (four) or weight-based (three) dosing. Disease severity and additional thrombosis risk factors dictated anticoagulation duration.

Conclusion: In the select population reported by our survey, CAC appears to be uncommon in pregnancy. Anticoagulation practices vary and may not reflect current guidelines. Venous thromboembolism was observed in some CAC patients despite prophylactic anticoagulation (including standard and weight-adjusted dosing). Urgent

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research is required to determine appropriate anticoagulant dosing and duration in pregnant women with COVID-19 infection.

KEYWORDS
anticoagulant, coagulopathy, COVID-19, pregnancy, thrombosis

1 | INTRODUCTION

Coronavirus disease 2019 (COVID-19) occurs as a result of infection with the highly transmissible severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. COVID-19 can cause substantial pulmonary pathology, systemic inflammation, and COVID-19 associated coagulopathy (CAC).[1,2] CAC is an evolving entity that encompasses laboratory coagulation changes, thrombosis, and bleeding.[3] Pregnancy-related changes in pulmonary, immunologic, and hemostatic systems can influence the development of severe disease, including CAC.[4,5]

It has been proposed that CAC occurs secondary to overstimulation of the inflammatory cascade, leading to endothelial and platelet activation akin to what is observed in disseminated intravascular coagulation.[3,6–8] CAC in the nonpregnant population has been linked to an increased risk of venous thromboembolism in hospitalized patients. Of relevance, pregnant individuals have a four-fold higher venous thromboembolism risk compared with age-matched controls owing to hemostatic alterations in preparation for childbirth.[9] However, information regarding CAC and associated pregnancy complications remains limited. It is likewise unclear whether the physiologic changes of pregnancy compound those observed in CAC.

The beneficial role of anticoagulation in COVID-19 infection, given its thrombogenic nature, is under investigation.[10] Results of international trials (available in preprint) demonstrated increased probability of survival to discharge and reduced vital-organ-support requirements in noncritically ill COVID-19 patients with use of therapeutic-dose low molecular weight heparin (LMWH). Conversely, therapeutic anticoagulation was not associated with improved survival or reduced need for organ support in critically ill COVID-19 patients.[11] Similarly, in the ACTION trial therapeutic anticoagulation in hospitalized COVID-19 patients failed to improve outcomes and resulted in more bleeding events compared with prophylactic anticoagulation.[12] Unfortunately, the role of anticoagulation in pregnant individuals has not yet been addressed, as obstetric patients have been excluded (e.g., ACTIV-4a) or underrepresented in many relevant trials.[13,14] Various organizations, including the International Society on Thrombosis and Haemostasis (ISTH), have published anticoagulation guidelines addressing CAC in pregnancy, but these are based on expert consensus.[5] Given the paucity of pregnancy-related data, we have designed an online survey to understand physician-experience with COVID-19 in pregnancy, focusing on CAC and anticoagulation use.

Essentials

- COVID-19 infection is highly prothrombotic and associated with a unique form of coagulopathy.
- Information regarding COVID-19 in pregnancy is lacking, particularly regarding anticoagulation.
- There is significant variability in physician prescribing of anticoagulation in COVID-19 pregnancy.
- COVID-19 associated coagulopathy in pregnancy can result in thrombosis, despite prophylactic anticoagulation.

2 | METHODS

This was a cross-sectional study to assess physician knowledge and practices pertaining to pregnancy-related CAC and anticoagulation, completed under the auspices of the ISTH Subcommittee on Women's Health Issues in Thrombosis and Haemostasis. The online questionnaire was divided into four sections: (1) physician and hospital demographics; (2) experience with COVID-19 infection in pregnancy; (3) experience with CAC in pregnancy; and (4) personal COVID-19-related anticoagulation practices and guideline adherence. Based on known differences in evidence-based management for these populations, COVID-19 severity was defined as mild (outpatient management), moderate (hospitalization not requiring critical care), or severe (intensive care unit admission).[15] Respondents were asked to provide the number of COVID-19 and CAC cases. A partially closed-ended question listing various biochemical parameters was used to determine common biomarkers used in practice. These were chosen based on their previously reported prognostic value in COVID-19.[16] Because CAC is an emerging concept, the survey definition encompassed "any coagulation profile abnormality, bleeding event, or thrombotic event." Questions regarding anticoagulation focused on LMWH, given its role as a preferred antithrombotic agent in pregnancy. Survey answers were based on aggregate level data provided by the respondent and did not involve a formal chart review. The study received ethics approval (REB# 20-0287-E).

The 122-element survey (Appendix S1) was distributed through email via specialist societies, including the ISTH, Canadian Society of Maternal-Fetal Medicine, and British Maternal-Fetal Medicine Society. Social media platforms were also used for dissemination.

Study data were collected and managed using the RedCap platform, hosted by the ISTH.[17,18] Strategies to maximize completion

rate included reminder emails and user-friendly options to save and resume later. The survey was open from October 16, 2020, to March 1, 2021.

Descriptive statistics included frequencies, medians, and interquartile ranges or means and standard deviations (SDs), depending on normality of data distribution. Where data were missing or inconsistent, they were excluded from analysis of the relevant question.

3 | RESULTS

One-hundred and eighteen participants responded to the survey invitation with a completion rate of 75 (64%), of whom 40 (53%) answered every question (Table S1). Respondents represented the specialties of maternal-fetal medicine (29, 39%); hematology or thrombosis (23, 31%); obstetrics and gynecology (19, 25%); obstetric medicine (13, 17%); and internal medicine (2, 3%). The majority were consultants/attendings (66, 88%), with a minority constituting residents/trainees (6, 8%) and subspecialty trainees/fellows (3, 4%). The mean number of years in practice was 11.3 (SD 7.7), and most practiced in academic centers (49, 67%).

3.1 | Physician experience with COVID-19 in pregnancy

Fifteen-hundred and forty-six COVID-19 obstetric cases were managed by the respondents, of which 1298 had disease severity specified. The majority were mild ($n = 837$, 64.4%), followed by moderate cases requiring admission ($n = 411$, 31.7%) and severe cases requiring critical-level care ($n = 50$, 3.9%). This severity is higher than that seen in certain registries, such as the Canadian Surveillance of COVID-19 in Pregnancy (8.1% hospitalizations and 1.6% critical care; CANCOVID-Preg). However, our findings are in keeping with Centers for Disease Control and Prevention data reporting 21% hospitalized and 3.3% requiring critical-level care.[19–21] Despite these variations, there is a consistent observation of a higher risk of hospitalization and critical care in comparison with nonpregnant individuals.

The most frequently assessed laboratory parameters were platelet count ($n = 43$, 81%) and C-reactive protein (CRP) ($n = 40$, 76%), with other commonly used markers including lymphocyte count, D-dimer, coagulation tests (PT, APTT), and fibrinogen (Figure 1). These choices are likely driven by test-related ease of access and evidence supporting their prognostic value related to mortality.[16,22] IL-6 and von Willebrand factor (VWF) were rarely evaluated by clinicians ($n = 2$, 4%; $n = 1$, 2%, respectively). Although VWF has similar prognostic implications as D-dimer, the specialized testing likely prohibits its regular use in the clinical setting.[6] Furthermore, VWF is known to increase throughout pregnancy and thus may be difficult to interpret in COVID-19.[23] For those who selected "other," two participants specified liver enzymes ($n = 1$, 2%) and thrombin-antithrombin complex ($n = 1$, 2%) monitoring.

3.2 | COVID-19 coagulopathy in pregnancy

A total of 14 participants (24%) diagnosed CAC in their patient population, with an estimated prevalence of 1% among all COVID-19 pregnancies (20/1546). Most CAC patients required intensive-level

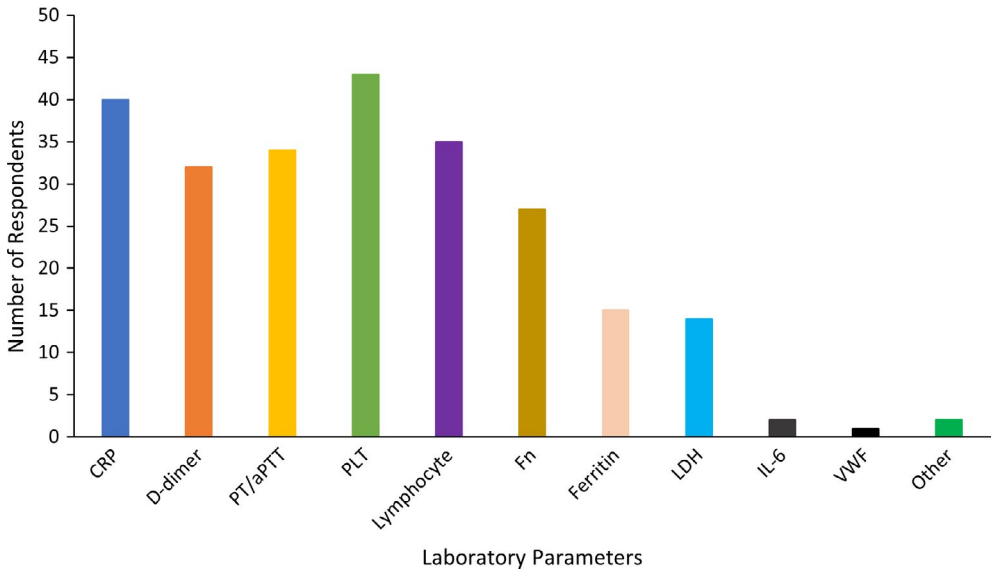

FIGURE 1 Commonly monitored biochemical parameters in COVID-19-affected pregnancies. Data are representative of 52 respondents. The most frequently monitored values were related to hemostatic parameters and inflammatory markers, most notably platelet count and CRP. COVID-19, coronavirus disease 2019; CRP, C-reactive protein; Fn, fibrinogen; LDH, lactate dehydrogenase; IL-6, interleukin-6; VWF, von Willebrand factor; other, thrombin-antithrombin complex ($n = 1$) and liver enzymes ($n = 1$) [Color figure can be viewed at wileyonlinelibrary.com]

care (n = 13, 65%) or hospitalization (n = 4, 20%), whereas the remainder had mild (n = 1, 5%) or unspecified (n = 2, 10%) illness. These results suggest an association between critical COVID-19 course and CAC in pregnancy, indicating the need for increased vigilance in this group of women.

Of the 20 CAC cases, complications included thrombotic events (n = 7, 35%), bleeding (n = 4, 20%), or both (n = 2, 10%). Although the incidence of thrombosis is high among the women who developed CAC, the rate of thrombosis across all hospitalized women is 2% (7/461). This is in line with a rate of 2% reported in two systematic reviews among women with severe or critical disease,[24,25] but much lower than that seen in a meta-analysis of nonpregnant COVID-19 patients (21% overall, 31% intensive care).[26] Four patients required blood products, including red blood cell transfusion (n = 2), platelets (n =1), or fresh frozen plasma (n = 1).

Laboratory investigations were similar in those with and without CAC. Most respondents identified thrombocytopenia (n = 13, 65%), elevated CRP (n = 17, 85%), and elevated D-dimer (n = 16, 80%) in the CAC population. Both hyperfibrinogenemia (n = 6, 30%) and hypofibrinogenemia (n = 3, 15%) were encountered. Given the physiologic pregnancy-associated increase in fibrinogen, and the correlation of hypofibrinogenemia (<2 g/L) with severe postpartum hemorrhage, fibrinogen replacement may be worth considering in this setting.[5,27,28]

Additional coagulation abnormalities are highlighted in Figure 2. The high prevalence of elevated CRP and D-dimer in these patients suggests that the inflammatory environment observed in the nonpregnant COVID-19 population likely extends to pregnant individuals.[4,29] These findings raise the possibility that anti-inflammatory therapeutics, such as dexamethasone and tocilizumab, which have shown benefit in nonpregnant hospitalized COVID-19 patients.[30,31] may extend to those with CAC in pregnancy. This provides further support for the ongoing calls to include pregnant women in trials to afford them the opportunity for appropriate evidence-based interventions.[14,32]

Responses from 12 respondents recorded no maternal mortality. Most individuals with CAC during pregnancy went on to have live births beyond 37 weeks' gestation (n = 9, 75%). Premature birth (n = 4, 33%) and stillbirth (n = 3, 25%) occurred at somewhat higher rates than the 12% and 1.2% rate of preterm birth and stillbirth reported by CANCOVID-Preg, respectively.[20] However, this can likely be accounted for by the fact that our survey focused on CAC patients who have higher disease severity, whereas this was not the case for CANCOVID-Preg.

3.3 | Anticoagulation use in COVID-19 coagulopathy

The question regarding anticoagulation use pertained to the subgroup that experienced CAC. LMWH was the sole anticoagulation agent used and was prescribed in 90% of CAC patients (n = 18). Two patients (10%) did not receive any anticoagulation. Ten participants provided further detail regarding timing of LMWH administration and dosing preferences: two prescribed LMWH on patient admission (20%); five during the course of admission (50%); two either on admission or during admission (20%); and one upon diagnosis of CAC (10%). There was a preference for standard-prophylactic (n = 6, 60%) and weight-adjusted prophylactic (n = 3, 30%) dosing, as compared with intermediate or therapeutic dosing (n = 1, 10% for both). Current guidelines recommend at minimum of weight-based prophylactic dosing, with multidisciplinary discussion of dosing in severe disease.[5,33]

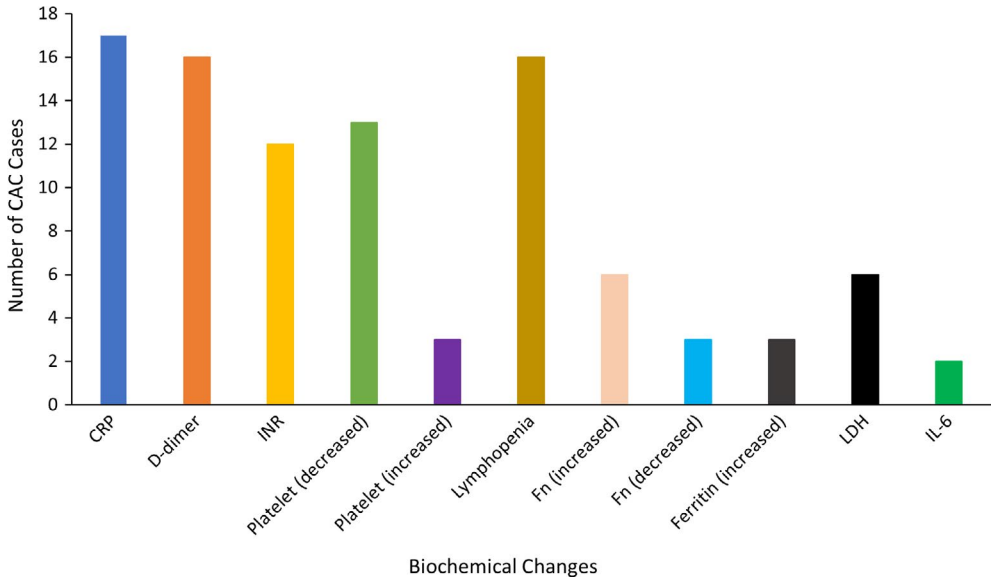

FIGURE 2 Biochemical changes identified in COVID-19 coagulopathy in pregnancy. Data are representative of 19 obstetric COVID-19 coagulopathy cases. COVID-19, coronavirus disease 2019; CRP, C-reactive protein; Fn, fibrinogen; IL-6, interleukin-6; INR, international normalized ratio; LDH, lactate dehydrogenase [Color figure can be viewed at wileyonlinelibrary.com]

Thrombosis was reported in 7/18 (39%) patients receiving LMWH. Thrombosis occurred in a total of four patients under standard-prophylactic dosing and in three using weight-based prophylactic dosing. Major postpartum hemorrhage and need for blood product administration were also reported in the setting of LMWH administration (11% and 6%, respectively), though further peripartum details are unavailable. Antepartum hemorrhage was not reported, and one patient (6%) had no complications from LMWH.

3.4 | COVID-19-related anticoagulation practices and guideline adherence

Of 40 respondents, most clinicians reported prescribing LMWH in pregnancy with COVID-19 infection (n = 27, 68%), primarily for those with moderate (n = 23, 85%) or severe disease (n = 21, 78%), and in one case (4%) in the context of mild disease (Table S1). Four (15%) prescribed LMWH when additional thrombotic risk factors were present or with hospital admission for obstetric complications in the setting of COVID-19.

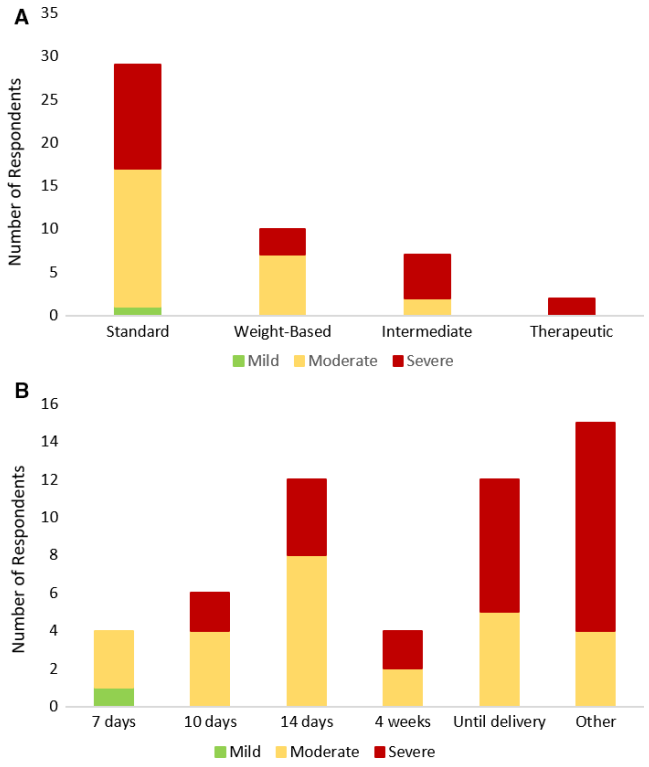

FIGURE 3 COVID-19-related anticoagulation practices regarding anticoagulant dosing (A) and postdischarge duration (B) in pregnant patients with COVID-19, with disease severity stratification. With increasing severity, there is a shift toward higher anticoagulant dosing and longer postdischarge duration. Duration of "other" for moderate disease was specified as "until discharge" (n = 2) or based on VWF and TAT stratification (n = 1). Duration of "other" for severe disease included individualized approach (n = 4); 6–12 weeks (n = 3); until hemostatic parameters normalized and lung/maternal status was reassessed (n = 1); and not prescribed postpartum (n = 1). Standard and weight-based refer to prophylactic anticoagulation dosing. COVID-19, coronavirus disease 2019; TAT, thrombin-antithrombin; VWF, von Willebrand factor [Color figure can be viewed at wileyonlinelibrary.com]

The preferred dose of LMWH varied according to disease severity (Figure 3A). Standard-prophylactic dosing was favored for mild disease (n = 1, 100%); with increased use of weight-based prophylactic, intermediate, and weight-based therapeutic dosing with worsening disease severity. The duration of postdischarge LMWH therapy also varied by severity (Figure 3B); 7 days was used for mild disease (n = 1 respondent), whereas longer durations were preferred with moderate and severe disease. For severe disease, respondents (total = 21) preferred an individualized approach to anticoagulation (n = 11, 52%). This involved anticoagulation use for 6 to 12 weeks postpartum, until hemostatic parameters had normalized, or based on maternal status.

Local guidance and hospital policy was used by approximately one-half the respondents to guide management of COVID-19 in pregnancy (n = 20/38, 53%). A similar number referred to international or national society guidelines for management (n = 9/17, 53%); these included MFM Quebec, Royal College of Obstetricians and Gynaecologists, ISTH, Society of Obstetrician and Gynaecologists of Canada, and American College of Obstetricians and Gynecologists. Almost all respondents reported that these guidelines offered recommendations for thromboprophylaxis or anticoagulation use (n = 25/28, 89%). The significant variation in guideline use highlights the need for future prospective investigations.

International registries related to CAC in pregnancy, including those by the Women's SCC of the ISTH, play a substantial role in gathering data on disease course and outcomes. These data will help generate guidance on management, including anticoagulation.

4 | CONCLUSION

Our data show physicians have encountered a low rate of severe COVID-19 infection among pregnant individuals. Furthermore, within the limitations of survey reporting, CAC is uncommon in pregnancy and appears to accompany more severe disease. Our findings further highlight significant practice variability in biomarker measurement and anticoagulation use, both during hospitalization and following discharge, with a signal toward preference for higher anticoagulant dosing with worsening disease severity. Our observation of thrombosis in some individuals with CAC, despite standard prophylactic anticoagulation, is concerning and requires vigilance and corroboration in prospective investigations. Our findings are limited by potential for recall bias and variable completeness of responses for some questions. Notwithstanding these limitations, our survey highlights the critical need for prospective investigations addressing coagulopathy and anticoagulation in COVID-19-affected pregnancies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Stefan D. Jevtic, Ann Kinga Malinowski, Maha Othman, and Rezan A. Abdul Kadir all contributed equally to study design, methodology, survey distribution, data analysis, and manuscript production.

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REFERENCES

1. Godoy LC, Goligher EC, Lawler PR, Slutsky AS, Zarychanski R. Anticipating and managing coagulopathy and thrombotic manifestations of severe COVID-19. *CMAJ*. 2020;192(40):E1156-E1161.
2. Guan W, Ni Z, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382(18):1708-1720.
3. Iba T, Warkentin TE, Thachil J, Levi M, Levy JH. Proposal of the definition for COVID-19-associated coagulopathy. *J Clin Med*. 2021;10(2):191.
4. Malinowski AK, Noureldin A, Othman M. COVID-19 susceptibility in pregnancy: immune/inflammatory considerations, the role of placental ACE-2 and research considerations. *Reprod Biol*. 2020;20(4):568-572.
5. Kadir RA, Kobayashi T, Iba T, et al. COVID-19 coagulopathy in pregnancy: critical review, preliminary recommendations, and ISTH registry—communication from the ISTH SSC for Women's Health. *J Thromb Haemost*. 2020;18(11):3086-3098.
6. Goshua G, Pine AB, Meizlish ML, et al. Endotheliopathy in COVID-19-associated coagulopathy: evidence from a single-centre, cross-sectional study. *Lancet Haematol*. 2020;7(8):e575-e582.
7. Nazy I, Jevtic SD, Moore JC, et al. Platelet activating immune complexes identified in COVID-19 associated coagulopathy. *medRxiv*. 2020. https://www.medrxiv.org/content/10.1101/2020.11.04.20226076v1. Accessed July 26, 2021.
8. Althaus K, Marini I, Zlamal J et al. Severe COVID-19 infection is associated with increased antibody-mediated platelet apoptosis [Internet]. *medRxiv*. http://medrxiv.org/lookup/doi/10.1101/2020.09.03.20187286. Accessed July 26, 2021.
9. Marik PE, Plante LA. Venous thromboembolic disease and pregnancy. *N Engl J Med*. 2008;359(19):2025-2033.
10. Connors JM, Levy JH. COVID-19 and its implications for thrombosis and anticoagulation. *Blood*. 2020;135(23):2033-2040.
11. The REMAP-CAP, ACTIV-4a, ATTACC Investigators, Zarychanski R. Therapeutic anticoagulation in critically Ill patients with Covid-19 – preliminary report. *medRxiv*. https://www.medrxiv.org/content/10.1101/2021.03.10.21252749v1. Accessed July 26, 2021.
12. Lopes RD, Silva PGM de BE, Furtado RHM, et al. Therapeutic versus prophylactic anticoagulation for patients admitted to hospital with COVID-19 and elevated D-dimer concentration (ACTION): an open-label, multicentre, randomised, controlled trial. *Lancet*. 2021;397(10291):2253-2263.
13. LaCourse S, John-Stewart G, Adams Waldorf KM. Importance of inclusion of pregnant and breastfeeding women in COVID-19 therapeutic trials. *Clin Infect Dis*. 2020;71(15):879-881.
14. Malinowski AK, Snelgrove J, Okun N. Excluding pregnancy from COVID-19 trials: protection from harm or the harm of protection? *CMAJ*. 2020;192(23):E634.
15. Kim MS, An MH, Kim WJ, Hwang TH. Comparative efficacy and safety of pharmacological interventions for the treatment of COVID-19: A systematic review and network meta-analysis. *PLoS Med*. 2020;17(12):e1003501.
16. Zhang L, Yan X, Fan Q, et al. D-dimer levels on admission to predict in-hospital mortality in patients with Covid-19. *J Thromb Haemost JTH*. 2020;18(6):1324-1329.
17. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381.
18. The REDCap consortium: Building an international community of software platform partners - PubMed [Internet]. https://pubmed.ncbi.nlm.nih.gov/31078660/. Accessed February 15, 2021.
19. Zambrano LD, Ellington S, Strid P, et al. Update: characteristics of symptomatic women of reproductive age with laboratory-confirmed SARS-CoV-2 infection by pregnancy status — United States, January 22–October 3, 2020. *MMWR Morb Mortal Wkly Rep [Internet]*. 2020;69(44):1641-1647. https://www.cdc.gov/mmwr/volumes/69/wr/mm6944e3.htm. Accessed August 3, 2021
20. McClymont E, Abenhaim H, Albert A, et al. Canadian surveillance of COVID-19 in pregnancy (CANCOVID-Preg): a rapidly coordinated national response using established regional infrastructures. *J Obstet Gynaecol Can*. 2021;43(2):165-166.
21. CDC. COVID data tracker [Internet]. Centers for disease control and prevention. https://covid.cdc.gov/covid-data-tracker. Accessed April 6, 2021.
22. Yang X, Yang Q, Wang Y, et al. Thrombocytopenia and its association with mortality in patients with COVID-19. *J Thromb Haemost JTH*. 2020;18(6):1469-1472.
23. Castaman G. Changes of von Willebrand factor during pregnancy in Women with and without von Willebrand disease. *Mediterr J Hematol Infect Dis [Internet]*. 2013;5(1):e2013052. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3736880/. Accessed August 3, 2021.
24. Malas MB, Naazie IN, Elsayed N, Mathlouthi A, Marmor R, Clary B. Thromboembolism risk of COVID-19 is high and associated with a higher risk of mortality: a systematic review and meta-analysis. *EClinicalMedicine [Internet]*. 2020;29:100639. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7679115/pdf/main.pdf. Accessed August 3, 2021.
25. Turan O, Hakim A, Dashraath P, Jeslyn WJL, Wright A, Abdul-Kadir R. Clinical characteristics, prognostic factors, and maternal and neonatal outcomes of SARS-CoV-2 infection among hospitalized pregnant women: a systematic review. *Int J Gynecol Obstet*. 2020;151(1):7-16.
26. Servante J, Swallow G, Thornton JG, et al. Haemostatic and thrombo-embolic complications in pregnant women with COVID-19: a systematic review and critical analysis. *BMC Pregnancy Childbirth*. 2021;21(1):108.
27. Vlachodimitropoulou Koumoutsea E, Vivanti AJ, Shehata N, et al. COVID-19 and acute coagulopathy in pregnancy. *J Thromb Haemost*. 2020;18(7):1648-1652.
28. Charbit B, Mandelbrot L, Samain E, et al. The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. *J Thromb Haemost*. 2007;5(2):266-273.
29. Zhang J, Tecson KM, McCullough PA. Endothelial dysfunction contributes to COVID-19-associated vascular inflammation and coagulopathy. *Rev Cardiovasc Med*. 2020;21(3):315-319.
30. The RECOVERY Collaborative Group. Dexamethasone in hospitalized patients with Covid-19. *N Engl J Med*. 2021;384:693-704.
31. RECOVERY Collaborative Group. Tocilizumab in patients admitted to hospital with COVID-19 (RECOVERY): a randomised, controlled, open-label, platform trial. *The Lancet*. 2021;397(10285):1637-1645.
32. Taylor MM, Kobeissi L, Kim C, et al. Inclusion of pregnant women in COVID-19 treatment trials: a review and global call to action. *Lancet Glob Health*. 2021;9(3):e366-e371.

33. ASH Guidelines on Use of Anticoagulation in Patients with COVID-19 - Hematology.org [Internet]. https://www.hematology.org:443/education/clinicians/guidelines-and-quality-care/clinical-practice-guidelines/venous-thromboembolism-guidelines/ash-guidelines-on-use-of-anticoagulation-in-patients-with-covid-19. Accessed April 6, 2021.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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