Interventions related to cardiovascular complications in people hospitalized by covid-19: a scoping review

Intervenções relacionadas às complicações cardiovasculares em pessoas hospitalizadas pela covid-19: revisão de escopo

Intervenciones relacionadas con complicaciones cardiovasculares en personas hospitalizadas por covid-19: revisión de alcance
INTRODUCTION

Human infection by the new coronavirus, Sars-CoV-2 (Severe Acute Respiratory Syndrome 2), appeared in the city of Wuhan, Hubei province, China, at the end of the year 2019 [1]. In a few months, due to its high transmissibility and dissemination, it became an Public Health Emergency of International Importance and pandemic, with serious repercussions on health systems worldwide [2].

In the World Health Organization (WHO) report, published on April 28th of 2020, there were more than 2,954,222 people infected and 202,597 deaths by Covid-19 in the world, with emphasis on China, Italy, Spain and United States (USA) [3]. A few months later, in the WHO epidemiological report of July 28th of 2020, Brazil ranked second in the ranking of countries with the highest number of reported cases (2,419,091) and confirmed deaths (87,004) [4], testing the Sistema Único de Saúde (SUS) (Unified Health System) [5].

The way Covid-19 behave has mobilized scientists, on different continents, to explain it. The diversity of signs and symptoms of SARS-CoV-2 infection and the worsening and complications of the respiratory, kidney [6], cardiovascular [7] and neurological [8] systems have appeared in studies associated with factors such as advanced age (>65 years old) and comorbidities due to chronic diseases [9-10].

A Chinese study, with hospitalized Covid-19 patients, showed cardiovascular complications in 40.4% of participants (n=99) [11]. Another survey, also carried in China [12], reported 26% (n=138) of patients in need of intensive cardiac interventions, 16.7% of these arrhythmias and 7.2% acute myocardial infarction (AMI), both of which are the most prevalent complications associated with infection or adverse events treatment.

Endothelial and myocardial susceptibility in people with Covid-19 was related to inflammatory and thrombolytic processes [13] with systemic implications, which demand complex interventions and multi-professional operation [14].

Covid-19's potential in the development of cardiovascular complications, disabilities, and deaths requires health professionals and professional associations to monitor the production of scientific evidence to support good care practices [15].

In this context, we emphasize the relevance of the scientific reviews production regarding cardiovascular complication and the respective interventions carried out by the multidisciplinary team, especially nursing, due to its importance in the number of professionals, hours at the bedside and majority management actions, recognized by the World Health Organization [15]. It is noteworthy that this is the right moment for these reflections, considering the year 2020 was elected the year of nursing and midwifery professionals, so reminded in Florence Nightingale’s notes for their performance during the Crimean War [16].

OBJECTIVE

To describe the scientific evidence about complications and the need for cardiovascular interventions in people hospitalized by Covid-19.

METHODS

Ethical aspects

As this is a review study, the Research Ethics Committee was waived. This study strictly followed the Joanna Briggs Institute (JBI) methodological strategy for scoping reviews and authorship quotations.

Study design

Scoping review according to the steps recommended by the Joanna Briggs Institute (JBI), which aims to map the main concepts of a given area and identify gaps in knowledge in the literature [17].

Methodological procedure

The mnemonic population, concept, and context (PCC) were used to ask the guiding question: What studies have been found about cardiovascular complications and respective interventions for people hospitalized by Covid-19? Being P: People infected by Covid-19, C: Interventions related to cardiovascular complications and C: Hospital.

It was included original studies with people infected with Covid 19, systematic reviews, editorial and guidelines published from December of 2019 to April of 2020, in English, Spanish or Portuguese. The time frame comes from the first worldwide registry of the disease [18] and lasts until the day of the search for the articles. Studies with no indication of interventions were excluded.

Data collection and organization

The search was carried out from March to April of 2020 in the databases National Library of Medicine (PubMed), The Cumulative Index to Nursing and Allied Health Literature (CINAHL) through EBSCO, Scopus (Elsevier) and Web of Science.

In the first stage, the search was broad, using the Medical Subject Heading (MeSH) descriptors COVID-19 [Mesh] AND cardiovascular disease [Mesh] and COVID-19 [Mesh] AND heart disease [Mesh] in the National databases Library of Medicine (PubMed) and The Cumulative Index to Nursing and Allied Health Literature (CINAHL) through EBSCO platform. Initially, titles, keywords, descriptors, and abstracts of studies were explored, and approximation was made with the object of the review. Afterward, the selected studies were fully read.

From the keywords and descriptors, the following search strategies were created for the second stage: COVID-19 [Mesh] AND cardiovascular disease [Mesh]; COVID-19 [Mesh] AND heart disease [Mesh]; COVID-19 [Mesh] AND myocardial infarction [Mesh]; COVID-19 [Mesh] AND cardiac arrhythmia [Mesh]; COVID-19 [Mesh] AND thrombocytopenia [Mesh]; COVID-19 [Mesh] AND myocarditis [Mesh], with sequential searches paired in the Scopus (Elsevier) and Web of Science databases.

In the third stage, the studies selected for full reading had their references investigated, to identify documents to be enclosed in this scoping review. The selection process is presented in the flowchart (Figure 1), based on the Preferred Reporting Items for
Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)\(^{18}\), as recommended by JBI\(^{17}\).

Data analysis

The search and data extraction of the studies were carried out in a paired and independent way, using the standardized JBI data extraction tool\(^{17}\), which allowed data organization based on the literature characterization and the response to the research problem, with a comparative and descriptive analysis. The divergence among reviewers regarding the inclusion of one of the selected articles was handled by a third-party review, elected among the authors, who concluded by excluding this one, as it did not indicate cardiovascular interventions.

The study classification according to the level of evidence was based on the Oxford Center Evidence Based Medicine\(^{19}\) which classifies the studies as to the research design in ten levels: 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 4 e 5, with 1a being the highest level of evidence and 5 the lowest.

RESULTS

Among the 321 documents found, 75 documents were selected for analysis of the abstract, from which 28 documents were excluded due to repetition in the databases and 20 because they did not indicate cardiovascular interventions. Based on the full reading of the texts, 10 documents were selected. The analysis of the references of these articles allowed the inclusion of another one, totaling 11 studies for review.

The 11 selected articles were published in the year 2020 in the English language, with emphasis on their distribution in the Asian (55%), American (18%) and European (27%) continents, with retrospective temporal character and studies with low levels of evidence (54%). Chart 1 shows the other characterization variables.
As for the found evidence, all presented myocardial injury as the most common cardiac complication, present in approximately 8% to 12% of critically ill patients admitted by Covid-19. Also, thrombocytopenia was associated with three times the risk of severe Covid-19. In this setting, the evidence indicated early diagnosis and management as strategies that contribute to the decrease of cardiovascular complications and mortality by Covid-19.

Chart 2 - Cardiovascular complications and interventions indicated in the selected studies, Crato, Ceará, Brazil, 2020

| Code | Cardiovascular complications | Indicated interventions                                                                                                                                 |
|------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | - Acute coronary syndrome     | - Carry out triage and quick management;                                                                                                                |
|      | - Arrhythmias                | - Establish appropriate protocols for diagnosis, triage, isolation and case management;                                                                |
|      | - Acute myocardial infarction | - Carry out diagnostic tests (cardiac enzymes and echocardiography);                                                                                   |
|      |                              | - Carefully give angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, chloroquine/hydroxychloroquine;                             |
| 2    | - Risk of venous and arterial thromboembolism | - Use of low molecular weight heparin;                                                                                                                |
| 3    | - Low oxygen saturation       | - Carry out oxygen support;                                                                                                                             |
|      |                              | - Follow up with arterial blood gases;                                                                                                                   |
|      |                              | - Assess the need for an Intensive Care Unit (ICU) and mechanical ventilation;                                                                       |
| 4    | - Myocardial injury with elevated creatine kinase | - Use mechanical ventilation;                                                                                                                          |
|      |                              | - Proceed with ICU admission;                                                                                                                           |
|      |                              | - Employ oxygen support;                                                                                                                                |
|      |                              | - Carry out cardiac enzyme tests;                                                                                                                        |
| 5    | - Malignant arrhythmias       | - Prescribing medical therapy;                                                                                                                          |
|      |                              | - Manage medical therapy.                                                                                                                              |
| 6    | - Acute myocardial infarction | - Carry out routine electrocardiogram;                                                                                                                  |
|      | - Myocarditis                 | - Carry out cardiac enzyme tests;                                                                                                                        |
| 7    | - Acute myocardial infarction | - Perform intravenous thrombolysis;                                                                                                                      |
|      |                              | - Redo electrocardiogram, bedbound echocardiogram and chest X-ray during thrombolysis;                                                                |
|      |                              | - Check myocardial perfusion;                                                                                                                           |
|      |                              | - Carry out computed tomography scan immediately after thrombolysis;                                                                                    |

Cardiovascular complications in hospitalized people diagnosed with Covid-19 and the cardiovascular interventions indicated in the results of the 11 studies are described in Chart 2.

As for cardiovascular complications, the results highlighted Acute Myocardial Infarction (AMI) (36.4%), arrhythmias (36.4%), myocarditis (27.3%) and thrombotic disorders (9.1%).

Regarding interventions, there was a predominance of: providing/maintaining oxygen support, performing a routine electrocardiogram, hemodynamic monitoring, evaluating biochemical markers of myocardial injury and performing echocardiogram.

The professional class elected in all studies like the one responsible for carrying out interventions was the physician, not always specified by specialty. Psychology was mentioned in only one study.

**DISCUSSION**

The production of evidence for the dissemination of good health practices in the Covid-19 pandemic scenario converges with findings that pointed out as the main cardiovascular complications: AMI, myocarditis, heart failure, malignant arrhythmias and thrombotic disorders, especially in individuals with chronic comorbidities, exposed to cardiovascular risk factors or with cardiac dysfunction.

According to the evidence of the investigated studies, cardiovascular complications in people with Covid-19 are triggered by an imbalance between high metabolic demand and low oxygen supply to tissues, resulting from the infectious and inflammatory systemic response to the virus. These conditions trigger hypoxemia, arrhythmias, AMI and myocarditis, requiring...
health professionals to update and prepare for cardiovascular interventions (32).

Concerning the cardiovascular assessment of infected people, the studies showed as evidence the triage for the symptoms’ magnitude to determine the need for hospitalization. Anamnesis and cardiovascular physical examination were recommended, with a request for electrocardiogram (ECG), transthoracic echocardiogram, complete blood count, coagulation factors, electrolytes (sodium, magnesium, potassium, and calcium), arterial blood gases and test for biochemical markers of myocardial necrosis (20-22,25-29) among those with severe symptoms.

There is no consensus among experts about the treatment provided in the studies analyzed, especially in critically ill patients, indicating medical therapy that is still controversial. The lack of protocols and the search for effective treatment with clinical studies contribute to the production of evidence about medical treatment and clinical guidelines, such as the lopinavir/ritonavir combination considered ineffective (33) and chloroquine/hydroxychloroquine more recently (34), although still recommended in Brazilian clinical protocols.

It is important to consider that the multi-professional health team is prepared and attentive to side effects and medical interactions. The evidence in this review described that the use of hydroxychloroquine (HCQ) in combination with azithromycin can prolong the QT interval of the electrocardiographic tracing and cause malignant arrhythmia (torsades de points), progressing to ventricular fibrillation and cardiac arrest (22-26). This association has a direct influence on mortality, even beyond hospital environments, with a record of fatal adverse events in those under home treatment (34).

The need for cardiovascular interventions in critical Covid-19 patients in Intensive Care Units (ICU) (22-23) was related to the recommendation of oxygen therapy, hemodynamic monitoring with echocardiography, ECG and analysis of biochemical markers of myocardial necrosis and arterial lactate (31). Based on this setting, the evidence indicated the echocardiogram as the method of choice in the analysis of the daily cardiac function of critically ill patients to assess their hemodynamic status, helping with therapeutic management (20,26-27,30).

Routine ECG can identify suggestive changes of myocardial ischemia and QT segment prolongation due to medication therapy, preventing cardiac arrest (31). The analysis of biochemical markers of myocardial necrosis complements this assessment, especially in those with troponin above the 99th percentile of the reference value (21,22).

It is important to emphasize that, in the ICU, prolonged immobilization associated with the active inflammatory process makes the patient susceptible to vascular damage, because of the onset of microthrombi (35), which justifies the prevalence of venous thrombosis of 27% in Covid-19 patients admitted to the ICU, described in one of the found evidence. Also, the long period of immobilization restates the indication for prophylactic anticoagulant therapy with low molecular weight heparin (36).

All evidence about cardiovascular interventions was related to the medical team. In the studies, the nursing interventions take place only indirectly, when the authors suggest, for example, the prevention of venous thrombosis and pressure wounds resulting from immobility in the bed; management and assessment of the effect of potentially dangerous medications (anticoagulants), used in the prevention/treatment of thrombotic events, also in those with the potential to widen the QT interval (hydroxychloroquine and azithromycin), when, in their analysis, it is possible to assess the risk of complications (arrhythmias and cardiorespiratory arrest).

It is worth noting that some of the interventions found in the selected studies were about the implementation of strict measures to control the spread of infections in hospitals, including among health professionals and patients, actions strictly followed during the patient’s stay in hospital treatment. General and essential clinical care management interventions were not described in the articles, understood as intrinsic to the professions and the health environments, but described in the specialized literature as good nursing practices (37).

**Study limitations**

The non-systematization of care by professional competences, due to the lack of specification in the studies, and the information changing, since the pandemic is still ongoing and new evidence related to the area is constantly disseminated.

**Contributions to the Nursing, Health or Public Policy area**

Through this study, it was possible to understand the scientific evidence on the main cardiovascular complications related to the person with Covid-19, along with the indicated interventions. The results presented can assist in the process of generating and acquiring knowledge of health professionals and workers, in the development of interdisciplinary care instruments, in the contribution to teamwork and the promotion of knowledge production in nursing care for people with Covid-19.

**CONCLUSION**

The found evidence showed a predominance of the following cardiovascular complications in patients infected with Covid-19: AMI, myocarditis, heart failure, malignant arrhythmias and thrombotic disorders; with an indication for interventions in oxygen therapy, medical prophylaxis of thrombotic disorders, hemodynamic monitoring, routine echocardiography, ECG and analysis of biochemical markers of myocardial damage, associated with the need for ICU admission.

As it is a new global public health problem, the cardiovascular interventions indicated in the evidence did not show consensus among specialists and were centered on the physician, despite the relevance given to the multi-professional team. Besides, nursing was absent in the production of evidence, making it clear the gap in specific knowledge in this area in assisting cardiovascular complications resulting from Covid-19 and consensus on multi-professional care that can subsidize the creation of care protocols that promote quality and safety in clinical practice.
REFERENCES

1. Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. J Am Med Assoc. 2020;323(13):1239-42. doi:10.1001/jama.2020.2648

2. Organização Pan-Americana da Saúde (OPAS). Folha informativa – COVID-19 (doença causada pelo novo Coronavírus) [Internet]. Brasília. Brasil 2020[cited 2020 Mar 30]. Available from: https://www.paho.org/bra/index.php?option=com_content&view=article&id=6101: covid19 &Itemid=875

3. Organização Mundial da Saúde (OMS). Coronavirus disease 2019 (COVID-19) Situation Report – 99 [Internet]. Genebra: OMS; 2020 [cited 2020 Apr 28]. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200421-1904-99-covid-19.pdf?sfvrsn=119fc381_2

4. Organização Mundial da Saúde (OMS). Coronavirus disease 2019 (COVID-19) Situation Report – 190 [Internet]. Genebra: OMS; 2020 [cited 2020 Jul 28]. Available from: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200728-covid-19-sitrep-190.pdf?sfvrsn=1e17314_2

5. Ministério da Saúde (BR). Secretaria de Atenção Primária à Saúde. Protocolo de manejo clínico do coronavírus (COVID-19) na atenção primária à saúde [Internet]. Brasília: Ministério da Saúde Março; 2020 [cited 2020 Mar 13]. 35p. Available from: http://189.28.128.100/dab/docs/portalab/documentos/20200330_ProtocoloManejo_ver06_Final.pdf

6. Valizadeh R, Baradaran A, Mirazadeh A, Bhaskar VKSL. Coronavirus-nephropathy; renal involvement in COVID-19. J Renal Inj Prev. 2020; 9 (2). doi: 10.34172/jrip.2020.18

7. Long B, Brady WJ, Koyfman A, Gottlieb M. Cardiovascular complications in COVID-19. Am J Emerg Med. 2020;38(7):1504–7. doi: 10.1016/j.ajem.2020.04.048

8. Bridwell R, Long B, Gottlieb M. Neurologic complications of COVID-19. Am J Emerg Med. 2020; 38(7):1549.e3-1549.e7. doi: 10.1016/j.ajem.2020.05.024

9. European Centre for Disease Prevention and Control (ECDC). Coronavirus disease 2019 (COVID-19) in the EU/EEA and the UK – eighth update [Internet]. 2020 [cited 2020 Apr 30]. 39 p. Available from:https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-risk-assessment-coronavirus-disease-2019-eighth-update-8-april-2020.pdf

10. Chen N, Zhou M, Dong X, QU J, Gong F, Han Y et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395:507-13. doi: 10.1016/S0140-6736(20)30211-7

11. Chen L, Li X, Chen M, Feng Y, Xiong C. The ACE2 expression in human heart indicates new potential mechanism of heart injury among patients infected with SARS-CoV-2. Cardiovasc Res. 2020;116(6):1097-1100. doi: 10.1093/cvr/cvaa078

12. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020;382:727-733. doi: 10.1056/NEJMoa2001017

13. Tang N, Bai H, Chen X, Gong J, Li D, Sun Z. Anticoagulant treatment is associated with decreased mortality in severe coronavirus disease 2019 patients with coagulopathy. J Thromb Haemost. 2020; 18(5):1094-1099. doi: 10.1111/jth.14817.

14. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395:507-13. doi: 10.1016/S0140-6736(20)30211-7

15. World Health Organization (WHO). 2020: International Year of the Nurse and the Midwife [Internet] Genebra: World Health Organization, 2020 [cited 2020 Apr 15]. Available from:https://apps.who.int/ebwha/pdf_files/WHAT2/A72_54Rev1-en.pdf

16. Nightingale F. Notes on nursing: what is and what is not. New York (US): Dover publications; 1969.

17. Peters MDJ, Godfrey C, McInerney P, Soares CB, Khalil H, Parker D. Chapter 11: Scoping Reviews. In: Aromataris E, Munn Z (Editors). Joanna Briggs Institute Manual [Internet]. The Joanna Briggs Institute; 2017 [cited 2020 Mar 20]. Available from: https://reviewersmanual.joannabriggs.org/

18. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. PLoS Med. 2009(6):e1000097. doi: 10.1371/journal.pmed.1000097

19. OCEBM Levels of Evidence Working Group. The Oxford levels of evidence. Grades of recommendation. [Internet]. Oxford Centre for Evidence-Based Medicine. 2009 [cited 2020 Jul 21]. Available from: http://www.cebm.net/index.aspx?o=1025

20. Balsal M. Cardiovascular disease and COVID-19. Diabetes Metabol Syndrome: Clin Res Rev. 2020;14(3):247-50. doi: 10.1016/j.dsx.2020.03.013

21. Klok FA, Kruip MJHA, van der Meer NJM, Arbous MS, Gommers DAMPJ, Kant KM, Kaptein FHJ, Van Paassen J, Stals MAM, Huisman, MV. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. Thromb Res. 2020; 191:145-147. doi: 10.1016/j.thromres.2020.04.013

22. Wang Z, Yang B, Li Q, Wen L, Zhang R. Clinical Features of 69 Cases With Coronavirus Disease 2019 in Wuhan, China. Clin Infect Dis. 2020;71(15):769-777. doi: 10.1093/cid/ciaa272

23. Guan W, Ni Z, Hu Yu, Liang W, Ou C, He J et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020; 382:1708-20. doi: 10.1056/NEJMoa2002032
24. Guo T, Fan Y, Chen M, Wu X, Zhang L, He T et al. Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19) 2020. JAMA Cardiology. 2020;5(7):811-8. doi: 10.1001/jamacardio.2020.1017

25. Driggin E, Madhavan MV, Bikdeli B, Chuich T, Laracy J, Bondi-Zoccai G, et al. Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the Coronavirus Disease 2019 (COVID-19) Pandemic. J Am Coll Cardiol. 2020;75(18):2352-2371. doi: 10.1016/j.jacc.2020.03.031

26. Jing ZC, Zhu HD, Yan XW, Chai WZ, Zhanget S. Recommendations from the Peking Union Medical College Hospital for the management of acute myocardial infarction during the COVID-19 outbreak. Eur Heart J. 2020;41(19):1791-4. doi: 10.1093/eurheartj/ehaa258

27. Lakkireddy DR, Chung MK, Gopinathannair R, Patton KK, Gluckman TJ, Turagam M. Guidance for Cardiac Electrophysiology During the Coronavirus (COVID-19) Pandemic from the Heart Rhythm Society COVID-19 Task Force; Electrophysiology Section of the American College of Cardiology; and the Electrophysiologist and Arrhythmia Committee of the Council on Clinical Cardiology, American Heart Association. Heart Rhythm. 2020. doi: 10.1016/j.hrthm.2020.03.028

28. Ammirati E, Wang DW. SARS-CoV-2 inflames the heart. The importance of awareness of myocardial injury in COVID-19 patients. Int J Cardiol. 2020;311:122-123. doi:10.1016/j.ijcard.2020.03.086

29. Han Y, Zeng H, Jiang H, Yang Y, Yuan Z, Cheng X, et al. CSC Expert Consensus on Principles of Clinical Management of Patients with Severe Emergent Cardiovascular Diseases during the COVID-19 Epidemic. Circulation AHA. 2020; 48(3):189-194. doi: 10.3760/cma.j.cn112148-20200210-00066

30. Inciardi RM, Lupi L, Zaccone G, Italia L, Raffo M, Tomasoni D, et al. Cardiac involvement in a patient with coronavirus disease 2019 (COVID-19). JAMA Cardiol. 2020;5(7):819-24. doi: 10.1001/jamacardio.2020.1096

31. Xiong TY, Redwood S, Prendergast B, Chen M. Coronavirus and the cardiovascular system: acute and long-term implications. Eur Heart J. 2020;41(19):1798-1800. doi: 10.1093/eurheartj/ehaa231

32. Costa IBSS, Bittar CS, Rizk SI, Araújo-Filho AE, Santos KAQ, Machado TIV, et al. The Heart and COVID-19: What Cardiologists Need to Know. Arq Bras Cardiol. 2020; 114(5):805-816. doi: 10.36660/abc.20200279

33. Mehra MR, Sapan SD, Ruschitzka F, Patel NA. Hydroxychloroquine or chloroquine with or without a macrolide for treatment of COVID-19: a multinational registry analysis. Lancet. 2020;395(10240). doi: 1.0.1016/S0140-6736(20)31180-6

34. Fei Zhou, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395(10229):1054-62. doi: 10.1016/S0140-6736(20)30566-3

35. Kang Y, Chen T, Mui D, Ferrari V, Jagasia D, Scherrer-Crosbie M. Cardiovascular Manifestations and Treatment Considerations in covid-19. Heart. 2020;106(15):1-10. doi: 10.1136/heartjnl-2020-317056

36. Helms J, Tacquard C, Severac F, Leonard-Lorant I, Ohana M, Delabranche X, et al. High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study. Intensive Care Med. 2020;1-10. doi: 10.1007/s00134-020-06062-x

37. Agência Nacional de Vigilância Sanitária – ANVISA. Orientações para serviços de saúde: medidas de prevenção e controle que devem ser adotadas durante a assistência aos casos suspeitos ou confirmados de infecção pelo novo coronavírus (SARS-CoV-2) [Internet]. Brasília: ANVISA; 2020 [cited 2020 May 16] Available from: http://portal.anvisa.gov.br/documents/33852/271858/Nota+T%C3%A3nia+cnica+n+04-2020+GVIMS-GGTES-ANVISA-ATUALIZADA/ab598660-3de4-4f14-8e6f-b9341c196b28