

# 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*

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## ABSTRACT

**Objective:** To describe the scientific evidence of complications and the need for cardiovascular interventions in people hospitalized by Covid-19. **Method:** a scoping review carried out according to The Joanna Briggs Institute recommendations, in the MEDLINE, CINAHL, SCOPUS and Web of Science databases. **Results:** A total of 11 published studies from December of 2019 to April of 2020, presenting low levels of evidence were selected. The evidence described the myocardial injury as the most common cardiac complication reported in Covid-19, reported in approximately 8% to 12% of all severe individuals, with indications for oxygen therapy interventions, thrombotic disorders prevention and treatment, hemodynamic monitoring and assessment tests of cardiac function's performance, along with biochemical markers of myocardial injury, yet not addressing nursing interventions. **Conclusion:** Cardiovascular complications and interventions have not shown consensus on the found evidence, requiring causal analysis by explanatory studies that support multi-professional clinical protocols in health. **Descriptors:** Coronavirus Infections; Cardiovascular Diseases; Hospital Care Services; Cardiovascular Nursing; Review.

## RESUMO

**Objetivo:** Descrever as evidências científicas de complicações e a necessidade de intervenções cardiovasculares em pessoas hospitalizadas pela Covid-19. **Método:** Scoping review realizada conforme as recomendações do The Joanna Briggs Institute, nas bases de dados MEDLINE, CINAHL, SCOPUS e Web of Science. **Resultados:** Foram selecionados 11 estudos publicados de dezembro de 2019 a abril de 2020, apresentando baixos níveis de evidência. As evidências descreveram a lesão miocárdica como a complicação cardíaca mais comumente relatada na Covid-19, presente em aproximadamente 8% a 12% de todos os indivíduos graves, com indicações de intervenções em oxigenoterapia, prevenção e tratamento dos distúrbios tromboticos, monitorização hemodinâmica e realização de exames de avaliação da função cardíaca, além de marcadores bioquímicos de lesão miocárdica, até então sem alusão a intervenções de enfermagem. **Conclusão:** As complicações cardiovasculares e intervenções não demonstraram consenso nas evidências mapeadas, demandando esclarecimento causal por estudos explicativos que subsidiem protocolos clínicos multiprofissionais em saúde. **Descritores:** Infecções por Coronavírus; Doenças Cardiovasculares; Assistência Hospitalar; Enfermagem Cardiovascular; Revisão.

## RESUMEN

**Objetivo:** Describir las evidencias científicas sobre complicaciones de personas hospitalizadas por Covid-19 y la necesidad de intervenciones cardiovasculares. **Método:** Se trata de una revisión de alcance realizada en las bases de datos MEDLINE, CINAHL, SCOPUS y Web of Science, según las recomendaciones del Instituto Joanna Briggs. **Resultados:** Se seleccionaron 11 estudios publicados entre diciembre de 2019 y abril de 2020, los cuales presentaban niveles de evidencia bajos. Las pruebas describían la lesión miocárdica como la complicación cardíaca más frecuente de la Covid-19 en aproximadamente el 8 y el 12% de todos los individuos graves, con indicación de intervenciones en la oxigenoterapia, la prevención y el tratamiento de trastornos tromboticos, la vigilancia hemodinámica y la realización de pruebas para evaluar la función cardíaca, además de los marcadores bioquímicos de las lesiones miocárdicas, hasta entonces sin alusión a las intervenciones de enfermería. **Conclusión:** No existe un consenso sobre la evidencia mapeada de las complicaciones e intervenciones cardiovasculares, lo que requiere una aclaración causal mediante estudios explicativos que subvencionen protocolos clínicos sanitarios multiprofesionales. **Descriptor:** Infección por Coronavirus; Enfermedades Cardiovasculares; Atención Hospitalaria; Enfermería Cardiovascular; Revisión.

## 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<sup>(1)</sup>. In a few months, due to its high transmissibility and dissemination, it became a Public Health Emergency of International Importance and pandemic, with serious repercussions on health systems worldwide<sup>(2)</sup>.

In the World Health Organization (WHO) report, published on April 28<sup>th</sup> 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)<sup>(3)</sup>. A few months later, in the WHO epidemiological report of July 28<sup>th</sup> 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)<sup>(4)</sup>, testing the *Sistema Único de Saúde* (SUS) (Unified Health System)<sup>(5)</sup>.

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<sup>(6)</sup>, cardiovascular<sup>(7)</sup> and neurological<sup>(8)</sup> systems have appeared in studies associated with factors such as advanced age (>65 years old) and comorbidities due to chronic diseases<sup>(9-10)</sup>.

A Chinese study, with hospitalized Covid-19 patients, showed cardiovascular complications in 40.4% of participants (n=99)<sup>(11)</sup>. Another survey, also carried in China<sup>(12)</sup>, 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<sup>(13)</sup> with systemic implications, which demand complex interventions and multi-professional operation<sup>(14)</sup>.

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<sup>(15)</sup>.

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<sup>(15)</sup>. 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<sup>(16)</sup>.

## 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<sup>(17)</sup>.

### 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<sup>(1)</sup> and lasts until the day of the search for the articles. Studies with no indication of interventions were excluded.

### Data collection and organization

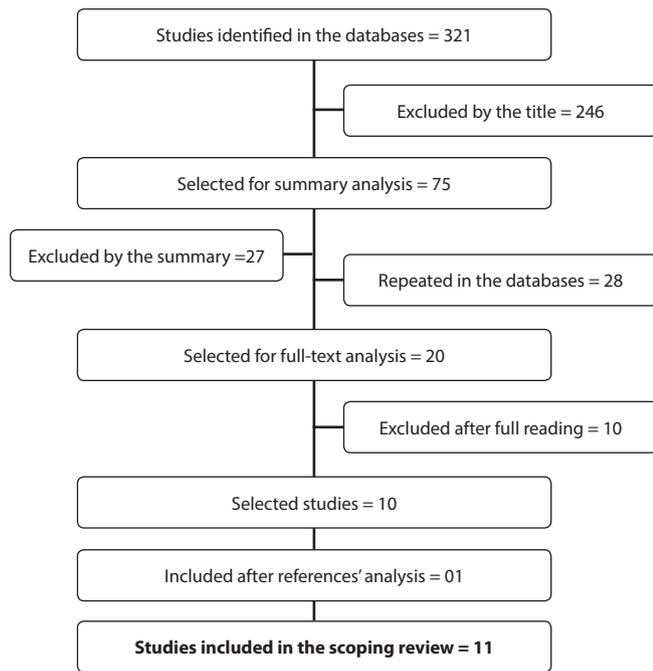
The search was carried out from March to April of 2020 in the databases National Library of Medicine (PubMed), The Cumulative Index to Nursing and Allied Health Literature (CINAHL) through EBSCO, Scopus (Elsevier) and Web of Science.

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)<sup>(18)</sup>, as recommended by JBI<sup>(17)</sup>.



**Figure 1** - Flowchart of study selection according to PRISMA-ScR<sup>(18)</sup> and recommendations Joanna Briggs Institute <sup>(17)</sup>, Crato, Ceará, Brazil, 2020

**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<sup>(17)</sup>, 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<sup>(19)</sup> 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.

**Chart 1** - Characterization of the selected studies, Crato, Ceará, Brazil, 2020

Code	Study reference	Origin	Study design	LE*	Evidence of studies found
1	Bansal. (2020) <sup>(20)</sup>	India	Narrative review	5	-Myocardial injury is the most common cardiac complication reported in Covid-19. Occurs in approximately 8% to 12% of all patients.
2	Klok et al. (2020) <sup>(21)</sup>	Netherlands	Cohort	2B	- Thrombocytopenia is associated with three times higher the risk of severe Covid-19.
3	Wang et al. (2020) <sup>(22)</sup>	China	Cohort	2B	-The person with Covid-19 has an increase in inflammatory cytokines, which causes an imbalance between high metabolic demand and low oxygen supply to the tissues, causing hypoxemia, arrhythmias, and acute myocardial infarction.
4	Guan et al. (2020) <sup>(23)</sup>	China	Cohort	2B	-Early diagnosis and management contribute to the decrease of cardiovascular complications and mortality by Covid-19.
5	Guo et al. (2020) <sup>(24)</sup>	China	Cohort	2B	-Myocardial injury is significantly associated with fatal Covid-19 results.
6	Driggin et al. (2020) <sup>(25)</sup>	United States	Review with meta-analysis	1A	- The infection has been associated with multiple cardiovascular complications, including acute myocardial injury, myocarditis, arrhythmias, and thromboembolism.
7	Jing et al. (2020) <sup>(26)</sup>	France	Guideline	5	-Covid-19 infection causes several cardiovascular complications, including acute myocardial infarction, myocarditis and malignant arrhythmias.
8	Lakkireddy et al. (2020) <sup>(27)</sup>	United States	Guideline	5	-The importance of electrophysiology as an investigative aspect especially suitable in the provision of virtual and remote care, along with the support and readiness of the health team capable of providing the necessary care.
9	Ammirati et al. (2020) <sup>(28)</sup>	China	Editorial	5	-The elevation of troponin during hospitalization is an important prognostic marker and should appear as a warning sign for cardiovascular complications. -The use of hydroxychloroquine in combination with azithromycin can prolong the QT** interval of the electrocardiographic tracing and cause malignant arrhythmia.

To be continued

Chart 1 (concluded)

Code	Study reference	Origin	Study design	LE*	Evidence of studies found
10	Han et al. (2020) <sup>(29)</sup>	China	Guideline	5	-Myocardial hypoxia contributes to the exacerbation of cardiovascular diseases.
11	Incurrdi et al. (2020) <sup>(30)</sup>	Italy	Editorial	5	-The recognition by the scientific community of acute myocarditis as a possible complication associated with Covid-19 can be useful for the rigorous monitoring of affected patients and to intensify the knowledge of these complications for public health authorities.

Note: \*LE- level of evidence. \*\*QT- measures the duration of electrical activation and recovery of the ventricular myocardium.

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 - Arrhythmias - Acute myocardial infarction	- Carry out triage and quick management; - Establish appropriate protocols for diagnosis, triage, isolation and case management; - 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 - Myocarditis	- Carry out routine electrocardiogram; - 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;

To be continued

Chart 2 (concluded)

Code	Cardiovascular complications	Indicated interventions
8	- Arrhythmias	- Carry out routine electrocardiogram; - Carry out transeophageal echocardiogram; - Carry out cardioversion;
9	- Myocarditis - Arrhythmias	- Carry out electrocardiographic monitoring; - Monitor the QT* interval when using chloroquine or combining antiviral medication; - Provide high potassium infusion to patients with long QT syndrome or on medication that prolong the QT interval to avoid hypokalemia; - Monitor the QT* interval 24 hours after starting therapy; - Assess electrolyte conditions during the use of hydroxychloroquine or chloroquine and/ or antiviral;
10	- Atherosclerosis - Acute coronary syndrome	- Consider a differential diagnosis; - Carry out cardiac catheterization; - Carry out negative pressure ventilation when emergency intervention or surgical procedure is required; - Transfer to ICU with negative pressure ventilation for continuous treatment; - Carry out electrocardiogram if cardiac complications are suspected; - Proceed with early rehabilitation;
11	- Acute myocarditis - Pericardial effusion	- Carry out echocardiography; - Manage medication: aspirin, hydroxychloroquine, lopinavir/ritonavir, methylprednisolone.

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<sup>(20-21,24-30)</sup>, especially in individuals with chronic comorbidities, exposed to cardiovascular risk factors or with cardiac dysfunction<sup>(31)</sup>.

According to the evidence of the investigated studies<sup>(20-30)</sup>, 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<sup>(32)</sup>.

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<sup>(20-22,25-29)</sup> 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<sup>(33)</sup> and chloroquine/hydroxychloroquine more recently<sup>(34)</sup>, 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<sup>(22-26)</sup>. This association has a direct influence on mortality, even beyond hospital environments, with a record of fatal adverse events in those under home treatment<sup>(34)</sup>.

The need for cardiovascular interventions in critical Covid-19 patients in Intensive Care Units (ICU)<sup>(22-23)</sup> was related to the recommendation of oxygen therapy, hemodynamic monitoring with echocardiography, ECG and analysis of biochemical markers of myocardial necrosis and arterial lactate<sup>(31)</sup>. 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<sup>(20,26-27,30)</sup>.

Routine ECG can identify suggestive changes of myocardial ischemia and QT segment prolongation due to medication therapy, preventing cardiac arrest<sup>(35)</sup>. The analysis of biochemical markers of myocardial necrosis complements this assessment, especially in those with troponin above the 99<sup>th</sup> percentile of the reference value<sup>(21,22)</sup>.

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<sup>(36)</sup>, 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<sup>(36)</sup>.

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<sup>(37)</sup>.

### 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.

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