

Postoperative complications in adult patients undergoing surgery with confirmed infection by SARS-CoV-2: An integrative review


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Objective: to analyze the evidence available in the literature about postoperative complications in adult patients undergoing surgical procedures with confirmed infection by SARS-CoV-2. **Method:** an integrative literature review conducted in the CINAHL, EMBASE, LILACS, PubMed, Scopus and Web of Science databases, as well as in the gray literature. The references identified were exported to the EndNote manager and, subsequently, to the Rayyan web application for study selection. The stages of sampling, categorization of studies, evaluation of the studies included, interpretation of the results and knowledge synthesis were performed by two reviewers independently and in a masked manner. The data were analyzed descriptively. **Results:** of the 247 articles identified, 15 were selected to comprise this review. The prevalent postoperative complications in patients infected with SARS-CoV-2 were the following: cough, dyspnea and hypoxia, need for invasive mechanical ventilation or not, admission to the intensive care unit and death. **Conclusion:** the most reported postoperative complications in the studies evaluated were respiratory-related, followed by cardiovascular complications. The importance of preoperative screening for COVID-19 is highlighted, as well as of the monitoring and tracking of confirmed cases in the postoperative period, as these actions exert an impact on reducing the occurrence of complications related to SARS-CoV-2.





Descriptors: Postoperative Complications; Coronavirus Infections; SARS-CoV-2; Adult; Perioperative Nursing; Review Literature as Topic.

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Introduction

The Coronavirus 2019 disease (COVID-19) was first identified in Wuhan, province of Hubei, China, in December 2019, and quickly spread around the world. In March 2020, it was declared a pandemic by the World Health Organization (WHO). It is an infectious disease caused by the etiological agent called Coronavirus 2 of Severe Acute Respiratory Syndrome (*Coronavirus 2 - SARS-CoV-2*)⁽¹⁾.

The clinical manifestations caused by COVID-19 are usually related to the upper respiratory tract, with the majority of those infected being asymptomatic or with mild symptoms. The most frequent clinical signs and symptoms are fever, dry cough, myalgia or fatigue and dyspnea and, less frequently, headache, diarrhea, nausea, vomiting, anosmia, dysgeusia and sore throat. Some patients can develop lower respiratory tract infections. However, infections can progress to pneumonia with Severe Acute Respiratory Syndrome (SARS), renal failure, multiple organ dysfunction syndrome and death⁽²⁻⁴⁾.

Given the high rates of infection and transmissibility, there was a significant increase in patients with acute diseases, which overloaded health systems around the world, especially hospitals, which were not prepared to deal with the magnitude of care and resources required by this pandemic. Overcrowding of the Intensive Care Units and overload of health professionals were inevitable, requiring the rapid adaptation of the surgical sectors⁽⁵⁻⁹⁾.

To relieve pressure on the health system and minimize the risk of nosocomial spread of COVID-19 during surgical procedures, specialized societies determined that elective surgical interventions be suspended or postponed. However, urgent and emergency procedures, as well as those with urgent surgical indication, should undergo a careful assessment on a case-by-case basis, to analyze the risk of transmission and postoperative complications⁽⁹⁻¹⁰⁾. In addition to that, measures to prevent and avoid the spread of the virus within the surgical environment highlighted the correct use of personal protective equipment and the reduction in the transit of personnel within operating rooms during invasive procedures^(2,8).

Studies evaluating the impact of postoperative complications in patients infected with SARS-CoV-2 are still scarce in the literature. Despite this, it was evidenced that, due to proinflammatory cytokine and immunosuppressive responses related to surgery and mechanical ventilation, such patients are especially susceptible to subsequent pulmonary complications, changes in laboratory tests, acute kidney injury, arrhythmia, acute cardiac injury, shock and secondary infections⁽¹¹⁻¹⁴⁾.

Identifying postoperative complications early is relevant to reduce morbidity and mortality in this period. A number of studies show that previously undiagnosed

COVID-19 can complicate postoperative recovery^(13,15). In this sense, the importance of the Nursing team in the post-anesthetic recovery room and in the inpatient units is highlighted, as this is the professional category that stays the longest with the patient, being responsible for evaluating complications and implementing interventions aimed at preventing problems and promoting health recovery^(13,15).

Despite the publication of guidelines to guide the ways of reorganizing surgical activities during the COVID-19 pandemic, the scientific production related to the management of surgeries is incipient, particularly with regard to the treatment of postoperative complications. Added to this context, the nurse is the protagonist to early identify the clinical manifestations that may be related to such adversities and make evidence-based clinical decisions to solve them. Thus, synthesizing the evidence to increase the safety of surgical patients exposed to SARS-CoV-2 is urgent and necessary, with the potential to directly influence the clinical outcomes of these patients. For this reason, this study aimed at analyzing the evidence available in the literature on postoperative complications in adult patients undergoing surgical procedures with confirmed infection by SARS-CoV-2.

Method

Study type

This study consists of an integrative literature review, filed on the Open Science Framework platform, whose registration is available at <https://osf.io/be97s/>, which enables to gather and synthesize the production of knowledge on a given subject matter, ensuring, through the wide number of studies, theoretical deepening on different perspectives of the same theme⁽¹⁶⁾. The study was conducted in six stages⁽¹⁶⁾, namely: identification of the theme, sampling, categorization of the studies, evaluation of the studies included, interpretation of the results and knowledge synthesis, respectively. The question of this integrative review was guided by the PECO strategy⁽¹⁷⁾ (Figure 1) and consisted of: Which are the postoperative complications in adult patients undergoing surgical procedures with confirmed infection by SARS-CoV-2?

Acronym	Definition	Description
P	Population/ Problem	Adult patients undergoing elective surgeries
E	Exposure	Confirmed infection by SARS-CoV-2
C	Comparison	Does not apply
O	Outcome	Postoperative complications

Figure 1 – PECO strategy to formulate the research question. Ribeirão Preto, SP, Brazil, 2020

Data collection

To identify the studies, the following electronic databases were used: CINAHL, EMBASE, LILACS, PubMed, Scopus and *Web of Science*. The gray literature was consulted using Google Scholar. The search strategy was formulated with the combination of the following

controlled descriptors and/or keywords "Postoperative Complications", "Coronavirus Infections", "COVID-19" and their respective synonyms, combined with Boolean operators (AND and OR), and adapted according to the specifics of each database. The search strategy conducted in each database is described in Figure 2.

Database	Search strategies	Number of studies identified
PubMed	("Postoperative Complications"[Mesh] OR "Postoperative Complications"[All fields] OR "Postoperative Complication") AND ("Coronavirus Infections"[Mesh] OR "Coronavirus Infections"[All Fields] OR "COVID-19" OR "SARS-CoV-2" OR "2019-nCoV infection" OR "2019 novel coronavirus infection" OR "coronavirus disease-19" OR "2019-nCoV disease") Filters: from 2019 - 2020	82 studies
LILACS	("Postoperative Complications" OR "complicaciones posoperatorias" OR "complicações pós-operatórias" OR "Postoperative Complication" OR "complicação pós-operatória" OR "complicación postoperatoria") AND ("coronavirus infections" OR "infecciones por coronavirus" OR "infecções por coronavirus" OR "covid 19") AND (db:(<i>"IBCS"</i>))	1 study
EMBASE	('postoperative complications'/exp OR 'postoperative complications' OR 'postoperative complication'/exp OR 'postoperative complication') AND ('coronavirus infections'/exp OR 'coronavirus infections' OR 'covid-19'/exp OR 'covid-19' OR 'sars-cov-2'/exp OR 'sars-cov-2' OR '2019ncov infection'/exp OR '2019-ncov infection' OR '2019 novel coronavirus infection' OR 'coronavirus disease-19' OR '2019-ncov disease'/exp OR '2019-ncov disease') AND [embase]/lim NOT ([embase]/lim AND [medline]/lim)	55 studies
CINAHL	((<i>"Postoperative Complications"</i> OR <i>"Postoperative Complications"</i> OR <i>"Postoperative Complication"</i>) AND (<i>"Coronavirus Infections"</i> OR <i>"Coronavirus Infections"</i> OR <i>"COVID-19"</i> OR <i>"SARS-CoV-2"</i> OR <i>"2019-nCoV infection"</i> OR <i>"2019 novel coronavirus infection"</i> OR <i>"coronavirus disease-19"</i> OR <i>"2019-nCoV disease"</i>))	10 studies
Scopus	(TITLE-ABS-KEY (<i>"Postoperative Complications"</i> OR <i>"Postoperative Complications"</i> OR <i>"Postoperative Complication"</i>) AND TITLE-ABS-KEY (<i>"Coronavirus Infections"</i> OR <i>"Coronavirus Infections"</i> OR <i>"COVID-19"</i> OR <i>"SARS-CoV-2"</i> OR <i>"2019-nCoV infection"</i> OR <i>"2019 novel coronavirus infection"</i> OR <i>"coronavirus disease-19"</i> OR <i>"2019-nCoV disease"</i>)) AND (LIMIT-TO (PUBYEAR, 2020))	88 studies
Web of Science	((<i>"Postoperative Complications"</i> OR <i>"Postoperative Complications"</i> OR <i>"Postoperative Complication"</i>) AND (<i>"Coronavirus Infections"</i> OR <i>"Coronavirus Infections"</i> OR <i>"COVID-19"</i> OR <i>"SARS-CoV-2"</i> OR <i>"2019-nCoV infection"</i> OR <i>"2019 novel coronavirus infection"</i> OR <i>"coronavirus disease-19"</i> OR <i>"2019-nCoV disease"</i>))	11 studies
Google Scholar	("Postoperative Complications" OR "Postoperative Complication") AND ("Coronavirus Infections" OR "COVID-19" OR "SARS-CoV-2" OR "2019-nCoV infection" OR "2019 novel coronavirus infection" OR "coronavirus disease-19" OR "2019-nCoV disease") Filters: from 2019 – 2020	100 studies

Figure 2 – Search strategies used in the databases used. Ribeirão Preto, SP, Brazil, 2020

After the search, the results were exported to the EndNote Basic⁽¹⁸⁾ reference manager, online version, to remove duplicate references. Subsequently, they were imported into the Rayyan web application, which can be accessed through <https://rayyan.qcri.org>, for the selection of studies.

In the Rayyan web application, the studies were evaluated and selected by two reviewers independently

and blindly, first by reading the titles and abstracts, in order to verify if they met the eligibility criteria of this review. The studies considered eligible were then analyzed by reading the text in its entirety, according to the eligibility criteria. In case of disagreement between the reviewers, a third reviewer with expertise in the subject matter was consulted.

Period

The search in the electronic databases was carried out on August 19th, 2020.

Selection criteria

Primary studies addressing postoperative complications occurring in adult patients undergoing surgery and infected with COVID-19, published in Portuguese, English or Spanish, were included. Studies conducted with pediatric patients, conference proceedings and abstracts, and studies that did not meet the scope of this review were excluded.

A total of 247 studies were identified in the databases, of which 87 were excluded for being duplicates in at least two databases, totaling 160 studies. Among the 160 studies identified and evaluated by reading titles and abstracts, 96 were excluded for not meeting the eligibility criteria of this review. Of the 64 studies eligible for analysis by reading the text in its entirety, 15 were included in this review. At the end of the selection process, a manual search was carried out in the list of references of the included studies. However, it did not identify publications that could be included in the final review sample. Thus, the final sample consisted of 15 primary studies.

Instrument used to collect the information

The data from the studies were collected using an adapted form⁽¹⁹⁾, which includes the following: reference and year of publication, country where the study was conducted, methodological characteristics [study design according to the nomenclature used by the author(s) and sample] and main outcomes (postoperative complications).

Data treatment and analysis

The data were analyzed qualitatively, synthesizing the evidence from the primary studies in a descriptive way.

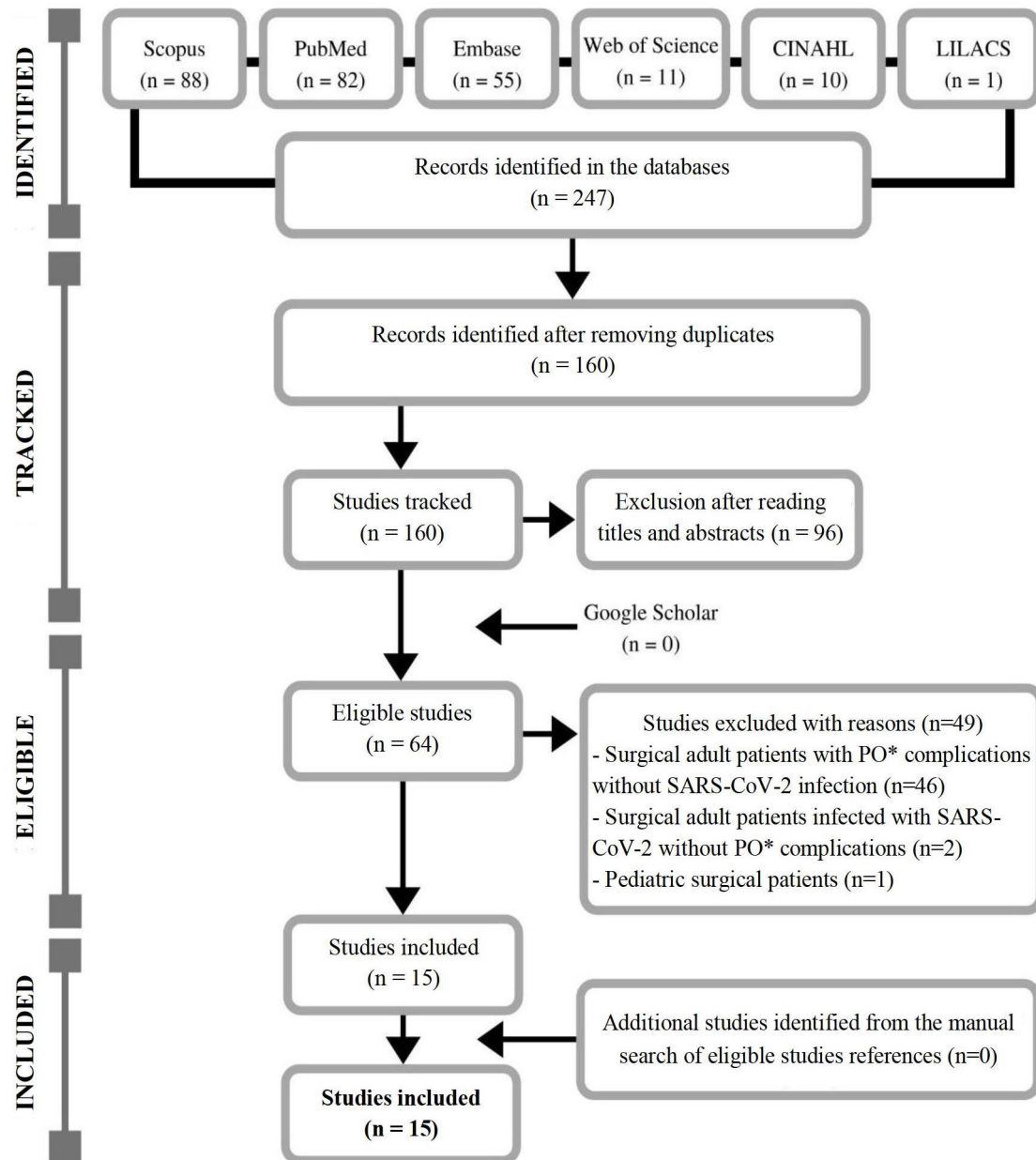
For the critical evaluation stage, it was decided to assess the methodological quality of the primary studies included in the sample, using the tools provided by the Joanna Briggs Institute (JBI)⁽²⁰⁾, also independently, by two reviewers. This evaluation was carried out considering the appropriate tools for each type of design included, which can present "yes", "not clear", "no" or "not applicable" answers. Before initiation of the critical evaluation of the studies, decisions about the scores were agreed upon between the reviewers. The studies included were categorized for risk of bias as follows: high risk of bias (when it reached a "yes" score below 49%), moderate risk of bias (when the "yes" score reached 50% to 69%), and low risk of bias (when the study reached a "yes" score above 70%)⁽²¹⁾. The third reviewer was consulted in case of conflicts in the assessment between the first two reviewers.

Considering that it is fundamental to unite methodological quality and the strength of the evidence for decision-making in the clinical practice, the evaluated studies were classified according to the level of evidence, according to the hierarchy for clinical issues of prognosis/prediction or etiology, which varies from level I (evidence from synthesis of cohort studies or case-control studies) to level V (evidence from experts' opinion)⁽²²⁻²³⁾.

Results

This integrative review analyzed 15 primary studies that identified postoperative complications in adult patients undergoing surgeries with confirmed SARS-CoV-2 infection, which were published in 2020, in English (n=14) and Spanish (n =1), in international journals. The flowchart corresponding to the selection of studies can be seen in Figure 3.

The analysis allowed identifying four articles characterized as cohort studies^(9,24-26), three cross-sectional studies⁽²⁷⁻²⁹⁾, three case reports⁽³⁰⁻³²⁾, two retrospective studies^(15,33), two case series⁽³⁴⁻³⁵⁾ and a letter to the editor⁽³⁶⁾.



*PO = Postoperative

Figure 3 – Adaptation of the study selection flowchart of this integrative review (n=15), according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model⁽³⁷⁾. Ribeirão Preto, SP, Brazil, 2020

Figure 4 presents the general synthesis of the studies included in this review by author, year of publication, country, method, objective, main results (herein represented by the postoperative complications in adult patients infected with SARS-CoV-2), methodological quality and level of evidence.

The main postoperative complications identified in the primary studies were related to the respiratory system, the most prevalent being cough^(15,25-26,34-35), dyspnea^(26,31,34), hypoxia^(25,31,34-35), severe respiratory failure^(24,28,33), pulmonary embolism^(9,28-29) and severe

respiratory infection requiring invasive or non-invasive mechanical ventilation^(9,25-26,34).

Patients with confirmed infection by SARS-CoV-2 presented changes in their imaging exams, compatible with pneumonia caused by COVID-19, such as ground-glass opacity, nodular consolidations in lobules and pleural effusion^(25-26,30,32,35-36). Changes in laboratory tests evidenced metabolic acidosis⁽²⁴⁾, coagulation disorders^(24,29-30) and acute kidney injury⁽²⁴⁾.

A number of studies emphasize the importance of preoperative screening for COVID-19 for all patients, in

order to exclude the possibility of infection, considering the incubation period of the virus for patients with negative results^(32,35). Some authors report difficulty in diagnosing postoperative SARS-CoV-2 infection^(30,36), as the symptoms are similar to those of common postoperative complications, such as increased body temperature^(15,25-26,30-32,35).

Other complications observed were related to the cardiovascular system, including acute myocardial infarction⁽²⁴⁾, hypotension⁽²⁵⁾, acute cardiac injury⁽¹⁵⁾ and cardiac arrhythmia^(15,28). In addition to that, cases of septic shock⁽²⁴⁾, urinary tract infection^(28,34) and multiple organ dysfunction were observed^(15,24).

The studies also evidenced cases of need for second surgeries⁽⁹⁾, unplanned admission to the ICU^(9,15,34) and death^(15,25-26,29,33-34,36), resulting from worsening of the postoperative complications among patients with confirmed SARS-CoV-2 infection.

Regarding the methodological quality of the primary studies included, eight were classified as with low risk of bias and, therefore, they present good methodological quality. Six studies were classified as with moderate risk of bias and moderate methodological quality, and only one as with high risk of bias and low methodological quality. Regarding the level of evidence, four studies presented level II, seven were level IV and four, level V.

ID [†]	Method	Objective	Main Results (postoperative complications)	JBI [†]	Level of evidence
COVIDSurg Collaborative ⁽⁹⁾ 2020 United Kingdom	Observational cohort study	To report 30-day mortality and pulmonary complication rates in patients with perioperative SARS-CoV-2 infection.	Pulmonary complications occurred in 52% of the patients, with cases of pneumonia, acute respiratory failure syndrome, need for invasive and non-invasive ventilation, and pulmonary embolism being observed. There was unplanned admission to the ICU [‡] for 102 patients, and 154 required second surgeries.	Moderate	II
Di Martino, et al. ⁽³³⁾ 2020 Spain	Retrospective study	To analyze the impact of the COVID-19 pandemic on patients undergoing surgeries at a tertiary-level hospital in Spain.	Fifteen (7%) cases of SARS-CoV-2 infection were observed among the 213 surgical patients. Of these, 17% were in the elective cancer group, 1% in the benign disease elective group, and 7% in the urgent surgery group (p<0.001). Five patients presented severe respiratory infection, of which 4 had cancer. There were 3 deaths (1.4%), all due to respiratory infection complications.	Low	IV
Evans, et al. ⁽²⁷⁾ 2020 England	Cross-sectional study	To summarize the initial experience of implementing elective colorectal cancer surgery during the COVID-19 pandemic.	Of the 23 patients undergoing surgeries, 10 presented postoperative complications, but none was serious or related to COVID-19. There were no cases of unplanned second surgeries or readmissions.	Low	IV
Gruskay, et al. ⁽³⁴⁾ 2020 USA [§]	Retrospective case series	To report the results of a universal test protocol for COVID-19 in patients undergoing orthopedic surgeries during the coronavirus pandemic and to describe the postoperative evolution of asymptomatic patients positive for COVID-19.	12% of the surgical patients tested positive for COVID-19, 58% of them asymptomatic. Postoperative complications such as pneumonia, urinary tract infection, need for transfusion, admission to the ICU, need for intubation, cough, dyspnea, hypoxia and death were observed. In addition to that, four patients presented alterations in the postoperative pulmonary x-rays, and all had abnormal values in the laboratory tests.	High	IV
Kayani, et al. ⁽²⁴⁾ 2020 England	Multicenter cohort study	To establish the effects of COVID-19 on perioperative morbidity and mortality and to determine any risk factors for increased mortality in patients with COVID-19 undergoing hip fracture surgery.	COVID-19-positive patients had increased postoperative mortality rates when compared to COVID-19 negative patients (30.5% [25/82] vs 10.3% [35/340], p<0.001). The following postoperative complications were observed: respiratory infection, acute kidney injury, septic shock, myocardial infarction, thromboembolic disease, ARDS , multiple organ dysfunction, severe metabolic acidosis, and coagulation dysfunction.	Low	II
LeBrun, et al. ⁽²⁵⁾ 2020 USA [§]	Multicenter retrospective cohort study	To evaluate the outcomes of hospitalized hip fracture patients treated during the COVID-19 pandemic in New York City.	Among the 59 patients undergoing hip fracture surgery, 15% tested positive for COVID-19, 7 in the preoperative period and 2 in the postoperative period, and one was presumed positive due to death related to COVID-19. The postoperative complications described were the following: cough, fever, hypoxia, hypotension, need for complementary oxygen through nasal cannula or intubation, radiological alterations and death.	Low	II
Lei, et al. ⁽¹⁵⁾ 2020 China	Multicenter retrospective study	To describe the clinical characteristics and outcomes of patients undergoing surgeries during the COVID-19 infection incubation period.	34 patients were operated on, and all developed COVID-19 pneumonia soon after surgery. The common symptoms included fever, fatigue and dry cough. The complications presented included the following: ARDS , shock, secondary infection, arrhythmia, acute cardiac injury, acute kidney injury. 15 patients needed admission to the ICU [‡] and 7 died, all after admission to the ICU [‡] .	Moderate	IV

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ID*	Method	Objective	Main Results (postoperative complications)	JBI†	Level of evidence
Lepre, et al. ⁽³⁰⁾ 2020 Italy	Case report	To highlight the possibility of infection by COVID-19 during the postoperative period of patients admitted for emergency surgical procedures.	Female patient, undergoing a laparotomy for ileocolic resection, diagnosed with COVID-19 infection on the 3 rd PO [‡] . The patient presented AT** over 38°C, with persistence of fever until the 14 th PO [‡] . Laboratory and imaging alterations were seen from the 1 st PO [‡] and 7 th PO [‡] , respectively. She presented diarrhea from the 6 th PO [‡] . Postoperative fever must be valued, even in the absence of other symptoms. It can be related to surgical complications or respiratory complications secondary or not to COVID-19.	Low	V
McDermott, et al. ⁽³⁶⁾ 2020 Ireland	Letter to the editor	To present the perioperative outcomes of patients undergoing urological surgeries during the onset of the SARS-CoV-2 pandemic.	Seven surgical patients (7/101, 7%) developed symptoms of SARS-CoV-2 infection during the postoperative period, three (3/101, 3%) diagnosed with symptomatic SARS-CoV-2 infection. These three patients developed postoperative pulmonary complications and one of them died. The complications were evidenced by imaging findings consistent with SARS-CoV-2 infection, including pleural effusion, ground-glass opacity, and nodular consolidations in lobules.	Moderate	V
Molier e Veillon ⁽²⁶⁾ 2020 France	Retrospective cohort study	To evaluate the frequency of COVID-19 in a cohort of newly operated on patients, performing imaging exams due to acute symptoms, and to evaluate the role of chest computed tomography in this setting.	Of 46 patients operated on with acute postoperative symptoms, 17% were diagnosed with COVID-19. Of these, 62% required mechanical ventilation and 25% died. All had abnormal chest CT, 87% with typical findings of COVID-19. The most frequent complications were hyperthermia, cough, dyspnea, need for intubation, and death.	Moderate	II
Rescigno, et al. ⁽³¹⁾ 2020 United Kingdom	Case report	To describe a cardiac surgery with a poor outcome due to postoperative COVID-19 infection, in addition to changes in the practice during the pandemic.	Male patient undergoing coronary artery bypass surgery. In the postoperative period, the patient evolved with respiratory complications attributed to COVID-19, such as hypoxia, dyspnea and fever in the 1 st PO [‡] , with evolution to death in the 9 th PO [‡] . The patient was not tested during the preoperative period, and the waiting time in the hospital was clearly too long.	Moderate	V
Seretis, et al. ⁽²⁸⁾ 2020 United Kingdom	Cross-sectional study	To present the experience related to postoperative morbidity and mortality associated with COVID-19 after emergency gastrointestinal surgery.	A total of 100 patients were analyzed. The overall postoperative respiratory complication rate was 5%, with an infection rate of 3% for COVID-19. Eleven patients had non-respiratory postoperative complications, including urinary tract infection, surgical wound infection and central catheter-related infection, acute coronary syndrome and cardiac arrhythmia. Five patients developed postoperative respiratory complications, including changes in the respiratory tract, pulmonary embolism and respiratory failure.	Low	IV
Yu, et al. ⁽³²⁾ 2020 China	Case report	To present the experiences obtained with a patient who presented a severe burst-type lumbar fracture complicated by an occult SARS-CoV-2 infection.	Male patient, evaluated during the COVID-19 incubation period. On the 3 rd PO [‡] , the patient developed chills and high fever. A chest computed tomography scan showed ground-glass opacity in the lower part of the right lung and the test for SARS-CoV-2 was positive.	Low	V
Yang, et al. ⁽³⁵⁾ 2020 China	Case series	To report the characteristics and prognosis of three women diagnosed with COVID-19 after oncological gynecological surgeries.	SARS-CoV-2 infection was observed in three patients during the postoperative period. The main complications reported were fever (within 2 days after the surgery), cough and hypoxemia. In addition to that, changes were observed in the imaging exams, compatible with viral pneumonia ten days after the surgery.	Low	IV
Zhao, et al. ⁽²⁹⁾ 2020 China	Cross-sectional study	To retrospectively review 34 patients with acute abdomen who underwent emergency surgeries during the COVID-19 outbreak.	Six cases of pneumonia due to COVID-19 were identified. The patients with COVID-19 presented worse liver function and coagulation indicators and longer hospital stays. Postoperative complications occurred in two patients: one had aspiration pneumonia and the other presented multiple organ dysfunction. Both required mechanical ventilation, and one of them evolved to death.	Moderate	IV

*ID = Identification; †JBI = Methodological quality assessment using the Joanna Briggs Institute tool, being considered as with high risk of bias when the study reached a "yes" score below 49%, moderate when the "yes" score reached 50% to 69%, and low when the study reached a "yes" score above 70%; ‡ICU = Intensive Care Unit; §USA = United States of America; ¶ARDS = Acute Respiratory Disease Syndrome; †PO = Postoperative; **AT = Axillary Temperature

Figure 4 – Synthesis chart of the studies included to compose the final sample of this integrative review (n=15).
Ribeirão Preto, SP, Brazil, 2020

Discussion

This study synthesized the evidence related to the postoperative complications in adult patients undergoing surgical procedures with SARS-CoV-2 infection and verified that the most reported complications in the primary studies included in this review were related to the respiratory system and associated with high mortality rates among the patients undergoing surgeries. Cough, dyspnea and hypoxia, image changes compatible with the COVID-19 disease, and the need for invasive mechanical ventilation were among the most frequently found in the studies analyzed.

Respiratory complications are common in the postoperative period in general, mainly due to the anesthetic procedure. In general anesthesia, given the need for orotracheal intubation, changes occur in the pulmonary system due to changes in respiratory impulse and muscle function in the anesthetized patient, reducing lung volumes and, in many cases, leading to complications such as atelectasis. The respiratory system can take up to six weeks to return to its baseline condition after general anesthesia for major surgeries⁽³⁸⁾.

However, the incidence of postoperative respiratory complications during the pandemic is even higher. A multicenter international cohort study, carried out between January and March 2020 in 235 hospitals from 24 countries, with 1,128 patients undergoing surgeries with confirmed infection by SARS-CoV-2, found a 51.2% incidence of pulmonary complications⁽⁹⁾. This rate is higher than that identified in a multicenter cohort study, carried out pre-pandemic from 2014 to 2015, in 211 hospitals from 28 European countries with 21,694 adult patients undergoing general anesthesia, in which the incidence of postoperative pulmonary complications was 7.6%⁽³⁹⁾.

Among the risk factors for the development of respiratory complications in the postoperative period, comorbidities (systemic arterial hypertension, chronic obstructive pulmonary disease and cancer) stand out, as well as extrinsic factors such as smoking and the surgical procedure itself, which can lead to impairment of the immune system cells⁽⁴⁰⁻⁴¹⁾. Added to these factors, the infection by the new coronavirus presents itself as an additional risk factor for worsening of the postoperative complications, since SARS-CoV-2 presents tropism for the cells of the respiratory system^(9,42-45) and increases the pro-inflammatory cytokines and chemokines levels, correlated with disease severity⁽⁴⁶⁻⁴⁷⁾.

The signs of SARS-CoV-2 infection in the postoperative period can manifest themselves very similarly to common infections, such as surgical site infections, hindering COVID-19 diagnosis. Therefore,

fever episodes in the postoperative period, even if incidental and without the presence of other signs and symptoms, must be carefully investigated, as they can be related to surgical or respiratory complications arising from SARS-CoV-2 or from another microorganism infection^(30,36).

When perioperative SARS-CoV-2 infection is identified, the prognosis tends to be worse, with a significant increase in the mortality rates, length of stay and need for mechanical ventilation, either invasive or not. Therefore, preoperative screening is recommended to detect SARS-CoV-2 infection in all patients undergoing elective surgical procedures. However, it is known that this practice is not possible in all surgical services. In addition to that, the virus incubation time and the possibility of perioperative infection must be taken into account during screening, and postoperative testing is also recommended^(24,29,32,35-36). For this reason, a number of studies suggest that each case be evaluated individually, in relation to the risks associated with perioperative SARS-CoV-2 infection, when compared to the risks of delaying the performance of surgical procedures. Male patients aged 70 years old or more, with comorbidities, and patients classified as ASA (American Society of Anesthesiologists) from 3 to 5, undergoing oncologic surgeries, major surgeries or emergency surgeries, are the most vulnerable to adverse outcomes^(9,45).

This synthesis also evidenced other complications among the surgical patients infected with SARS-CoV-2, mainly cardiovascular complications such as arrhythmia, acute cardiac injury and acute myocardial infarction. Corroborating these results, a recent study showed that SARS-CoV-2 has a pathogenicity that can increase myocardial damage⁽⁴⁸⁾. The results of this research showed cases of acute cardiac injury, shock and arrhythmia in 7.2%, 8.7% and 16.7% of the infected patients, respectively, being more prevalent among those who needed intensive care. Based on these data, careful attention must be given to cardiovascular protection during treatment for COVID-19⁽⁴⁹⁾, especially in the postoperative period.

The Nursing team plays a leading role in the care provided to surgical patients. Perioperative Nursing care based on scientific evidence is essential to prevent postoperative complications⁽⁵⁰⁻⁵¹⁾ and also to prevent and reduce the transmission of SARS-CoV-2 in surgical environments.

The need of new research studies on the subject matter is highlighted, pointing out the effects of the SARS-CoV-2 infection on the prognosis of surgical patients, so that the health team can intervene early and ensure patient safety in the postoperative period.

Among the weaknesses of this study, it is highlighted that most of the articles analyzed addressed problems of a respiratory nature, which can hinder the analysis of other complications experienced by surgical patients with SARS-CoV-2. It is also noteworthy that, of the 15 studies, 11 presented a classification of evidence level between IV and V, and that seven had a vulnerable methodological quality, which can compromise generalization of the results to other contexts. Among the knowledge gaps identified, there was lack of studies that addressed complications of other natures, in addition to the respiratory system. New studies with robust methodological approaches and that comprehensively identify systemic complications are recommended.

Conclusion

Considering the diverse evidence synthesized on the postoperative complications that affected adult patients infected with SARS-CoV-2 and undergoing surgeries, it is concluded that the main complications are related to the respiratory system, with increased mortality rates, need for hospitalization in intensive care unit and prolonged hospital stay. This occurrence can be explained by the fact that SARS-CoV-2 has greater affinity with respiratory epithelial cells. In addition to that, complications related to the cardiovascular system and other systemic complications were observed in this population.

The importance of rigorous preoperative screening that meets at least the majority, but preferably all patients undergoing surgical procedures, is highlighted, taking into account the incubation period of the virus, monitoring and tracking of confirmed cases in the post-operative period, in order to reduce the occurrence of complications related to the SARS-CoV-2 infection.

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