








# COVID-19: analysis of the risks of operating during the pandemic. What are the real perioperative complications in asymptomatic patients and how to optimize early diagnosis?

*COVID-19: análise dos riscos de operar durante a pandemia. Quais as reais complicações perioperatórias em pacientes assintomáticos e como otimizar o diagnóstico precoce?*

THAÍS DE SOUSA GONÇALVES <sup>1\*</sup>   
BRUNA LAGO CHAVES <sup>1</sup>   
LIA PATRUS BANNET <sup>1</sup>   
SERGIO CARREIRÃO <sup>1</sup>   
FARID HAKME <sup>1</sup> 

## ■ ABSTRACT

**Introduction:** Controlling dissemination as well as treating patients infected with the new coronavirus are global challenges. Despite the protocols and guidelines generated by the WHO and the leading medical societies that seek to control the pandemic, there are still few reports in the literature that show complications in the perioperative period of patients, initially asymptomatic, infected by COVID-19. This study aims to offer data to plastic surgeons beyond the scope of aesthetic and reconstructive surgeries. **Methods:** A review article was performed after selecting sixteen articles from PubMed. These were analyzed for their type, statistical relevance, number of participants, complications, and reported outcomes. **Results:** The mortality rate of patients with COVID-19 undergoing surgical procedures was higher than that estimated in infected patients who did not undergo these procedures. There were also increases in the patient's admission rate to intensive care units and the pulmonary complications rate. The main predictors of mortality were defined, besides the role of chest tomography for the diagnosis of COVID-19 in the perioperative period. **Conclusion:** It is essential to understand the risk of operating patients during the pandemic, even if asymptomatic. The increased risk of complications and mortality in elective and emergency surgeries requires disseminating adequate information to both doctors and patients. The objective, therefore, is not to define the medical conduct of surgeons, but to allow analysis in the decision-making process. **Keywords:** Coronavirus; Plastic surgery; Postoperative complications; Mortality; Risk; Risk factors.

Institution: Hospital da Plástica,  
Cirurgia Plástica e Reconstructiva,  
Rio de Janeiro, RJ, Brazil.

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<sup>1</sup> Hospital da Plástica, Cirurgia Plástica e Reconstructiva, Rio de Janeiro, RJ, Brazil.

## ■ RESUMO

**Introdução:** O controle da disseminação e o tratamento de pacientes infectados pelo novo coronavírus é um desafio global. Apesar de protocolos e orientações geradas pela OMS e principais sociedades médicas visando o controle da pandemia, ainda são poucos os relatos na literatura que mostram as complicações no perioperatório de pacientes, inicialmente assintomáticos, que foram infectados pela COVID-19. O presente estudo objetiva oferecer dados aos cirurgiões plásticos que extrapolam o âmbito das cirurgias estéticas e reconstrutoras. **Métodos:** Foi realizado um artigo de revisão após a seleção de dezesseis artigos do PubMed. Estes foram analisados quanto ao seu tipo, relevância estatística, número de participantes, complicações e desfechos relatados. **Resultados:** A taxa de mortalidade de pacientes com COVID-19 submetidos a procedimentos cirúrgicos foi superior do que a estimada em pacientes que não foram submetidos a estes procedimentos. Também foram observados aumento na taxa de admissão de pacientes em unidades de terapia intensiva e na taxa de complicações pulmonares. Os principais fatores preditores de mortalidade foram definidos, assim como o papel da tomografia de tórax para o diagnóstico da COVID-19 no perioperatório. **Conclusão:** É essencial entender o risco de operar pacientes durante a pandemia, ainda que assintomáticos. O maior risco de complicações e mortalidade em cirurgias eletivas e emergenciais demanda a disseminação de informações adequadas tanto aos médicos quanto aos pacientes. O objetivo, portanto, não é definir a conduta médica dos cirurgiões, mas possibilitar a ponderação no processo de tomada de decisões. **Descritores:** Coronavírus; Cirurgia plástica; Complicações pós-operatórias; Mortalidade; Risco; Fatores de risco.

## INTRODUCTION

In December 2019, in the city of Wuhan, China, we witnessed the beginning of a pandemic with a high mortality rate worldwide, including in more developed countries, such as the United States (USA) and countries of the European Union. Because we are facing a disease in which the clinical spectrum varies from asymptomatic patients to seriously ill patients and its pathogenesis is not yet known, there are technical and economic difficulties related to its treatment and diagnosis. Thus, it is known that the fight against the new coronavirus (COVID-19) has become a global challenge. Notwithstanding the concern of WHO and the leading medical societies regarding the dissemination of COVID-19 in hospital and the surgical environment, few reports in the literature show the complications in the perioperative period of initially asymptomatic patients.

## OBJECTIVE

This study's objective is to review articles in the literature that report the main complications

presented in the perioperative period during the new coronavirus pandemic. This information is essential for surgeons to understand the real risk of operating a patient, in the context of the pandemic, even asymptomatic.

## METHODS

A research was conducted in PubMed on June 22<sup>th</sup> and 23<sup>th</sup> for the following terms: "perioperative," "postoperative," "surgical," "surgery," "aesthetic" and "reconstruction," which should be accompanied by the words "COVID" or "SARS-CoV-2". Therefore, all selected articles had at least one of the terms used in the search in the title. Thus, 16 (sixteen) articles were selected and analyzed regarding the type of article, statistical relevance, number of participants, complications, reported results, and even if they agreed with other clinical studies. It should be mentioned that all the patients who were included in the selected studies, at some point, had a clinical, laboratory, or imaging diagnosis that confirmed the infection by the new coronavirus.

## RESULTS

Of the sixteen articles selected, four articles were “case reports”<sup>1-4</sup>. After analyzing them thoroughly, it was possible to generate a data synthesis, including clinical presentation, diagnosis, and outcomes. In this way, we can concretely assess how patients evolved after COVID-19 infection and the risk factors that each presented individually (Table 1).

Two articles consisted of brief criticisms of other studies<sup>5,6</sup>. The first cohort article, by Zoe et al., in 2020<sup>7</sup>, conducted at an institution in New York with patients over the age of 60 and confirmed diagnosis of COVID-19 through polymerase chain reaction (PCR), which would be submitted to hip surgery, showed a very different mortality rate (10%). However, due to the small number of patients analyzed (10 patients), a large number of comorbidities (mean 3.8, range 1-9), as well as older age groups (mean age 79.7, range 67-90), the current study did not find it valid to make a comparison with the data found.

Postoperative fever was considered a red flag, even in the absence of other symptoms. Lei et al., in 2020<sup>8</sup>, in a cohort article that reports a retrospective study carried out in four Wuhan hospitals, from January 1st to February 5th, 2020, where they analyzed 34 elective surgical patients, fever was evidenced as the main symptom in patients with COVID-19 in the postoperative period, being present in 91.20% of those infected. The other most prevalent symptoms, according to the study, were fatigue (73.5%), dry cough (52.9%), and dyspnea (44.1%).

The average time between the surgery and the first symptoms was two days (range between 1 and 4 days), three

days (range between 2 and 4.5 days) until the diagnosis of pneumonia, and five days (range 2 and 5, 3 days) until the development of dyspnea, this is the only article that describes the postoperative evolution<sup>8</sup>. It is worth questioning, however, the small number of patients evaluated in the article, as well as the absence of diagnostic tests during the preoperative period, reverse transcription followed by polymerase chain reaction (RT-PCR) between them, and the probable marking and performing surgeries during the viral incubation period.

The mortality rate in patients who contracted COVID-19 in the perioperative period was 20.6%, and the presence of at least one comorbidity was still cited as a risk factor for mortality.

Because of the pulmonary complications found in most of the analyzed articles, we should highlight the contribution of the article by Lei et al. (2020)<sup>8</sup>, in which 100% of patients, initially asymptomatic, evolved with pneumonia in the postoperative period, among them, 32.4% progressing to acute respiratory distress syndrome (ARDS).

The extensive cohort articles, prospective or retrospective, thanks to a higher number of participants and their respective statistical significance, showed us that pulmonary complications could be present in up to 50% (fifty percent) of patients, with considerable variation in the clinical presentation and, therefore, with different outcomes<sup>8,9</sup>.

Along with the increase in postoperative complications, an increase in the admission of patients to intensive care units was also observed, varying between 31.83% and 44.11% in the two main cohort

**Table 1.** Data compiled from “case report”<sup>1-4</sup> articles.

Study place	Age and sex	Type of surgery	Date of surgery	Date of symptoms	Clinical presentation	Chest CT	Result RT-PCR	Evolution and outcome
Iran	75, F	Incisional herniorrhaphy	09/02/2020	27/02/2020	Fever, cough, dyspnea	Typical 19° POD	+	Death
Iran	81, M	Cholecystectomy	08/02/2020	22/02/2020	Abdominal pain, anorexia, fever, dyspnea, diarrhea	Typical 16° POD	-	Death
Iran	54, F	Cholecystectomy and hysterectomy	24/02/2020	26/02/2020	Fever in the 2nd POD and dyspnea in the 3rd POD	Typical 3° POD	+	Symptoms improvement
Italy	64, F	Ileum volvolus enterectomy	04/03/2020	04/03/2020	Fever in the 3rd POD and diarrhea in the 5th POD	Typical 14° POD	+	-
USA	51, M	Left mastectomy	-	Intraoperatório	Desaturation, dyspnea, ventilatory asynchrony	-	+	-
China	63, M	Right lobectomy	-	1°DPO	1st POD Fever, cough, sputum in the 1st POD and dyspnea in the 4th POD	Typical 4° POD	+	Death

F: Female; M: Male; POD: Postoperative days.

articles, especially in those with supplemental need oxygenation due to pulmonary complications<sup>8,9</sup>.

Among the analyzed articles, it was possible to perform an adequate comparison between two of them, both cohort, one observational prospective, and one retrospective<sup>8,9</sup>. The third cohort article, by Archer et al., in 2020<sup>9</sup>, in a publication made in "The Lancet," evaluated data collected in 235 hospitals in 24 countries between January 1st and March 31st, 2020. The perioperative period was defined as 7 days before to 30 days after surgery, and 1,128 patients were analyzed. It is worth mentioning that this was the article that contributed to the most significant number of cases. Among the relevant data, we can mention the predominance of patients older than 70 years (49.59% of patients) and at least one comorbidity, in 87.69% of cases. These variables must be taken into account since they may increase the risk of unfavorable outcomes and complications.

Hypertension (50.49%) and diabetes mellitus (25.15%) were cited as highly prevalent comorbidities. Neoplasms, present in 16.98% of patients, could also be considered an independent risk for the unfavorable outcome. It is noteworthy that the clinical changes described were collected on patients' admission and that other data are not offered regarding their evolution in the postoperative period. Fever (20.75%), cough (13.29%), dyspnea (12.03%), and fatigue (5.39%) have, in this context, a low incidence when compared to other studies that describe the same symptoms during the postoperative. However, abdominal pain was described as a symptom on admission in 22.37% of patients, questioning whether such a disparate number is genuinely related to the underlying surgical pathology and not to the isolated manifestation of COVID-19.

The increase in the mortality rate of surgical patients who contracted the infection in the perioperative period is a common denominator in the reported cohort articles. The 30-day mortality rate was 23.8%, according to Archer et al. (2020)<sup>9</sup>. The predictive factors for mortality were: male gender, age greater than or equal to 70 years, ASA grades III-V, cancer surgery, and emergency surgery<sup>9</sup> (Figure 1). It is important to emphasize that although the highest number of deaths is related to more severe patients and emergency surgeries, the increase in this rate was also seen in procedures known as low and medium risk and in elective surgeries<sup>9</sup> (Figure 2).

Pulmonary complications also increased, according to the authors. Among them, we can see that 40.4% of the patients developed pneumonia and 14.4% ARDS (Figures 3 and 4). In approximately 20% of chest CT scans, the pattern in ground-glass was evidenced; however, other parenchymal changes could also be seen as consolidations (14.94%), and pulmonary infiltrates (10.30%). However, most patients were

not submitted to chest tomography, which makes us question whether the diagnostic method was not underused, thus interfering in statistics.

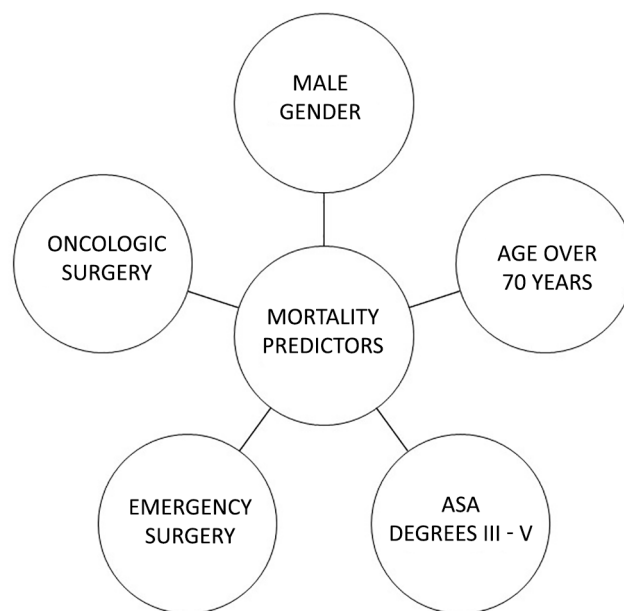


Figure 1. Predictive factors for mortality.

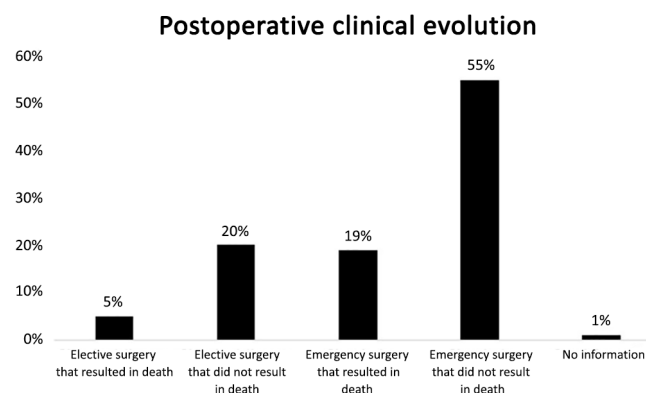
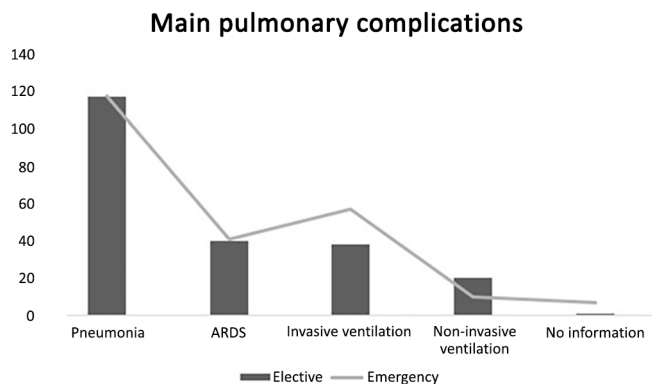
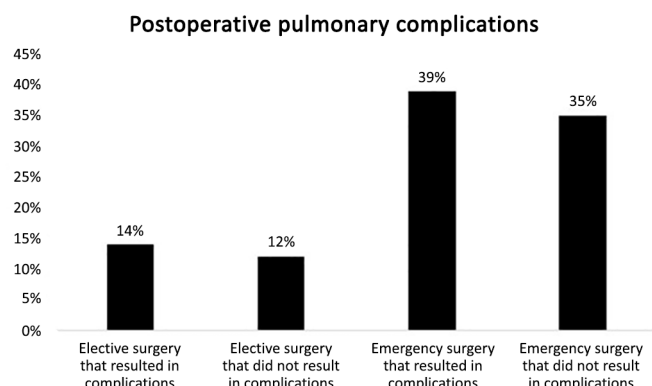


Figure 2. Evolutionary analysis regarding mortality in the first 30 days after surgery.

Moliere and Veillon, in 2020<sup>10</sup>, the fourth cohort article, emphasized the use of chest computed tomography for early diagnosis of COVID-19 infection. The article showed that in 17% of patients diagnosed with COVID-19 through computed tomography, 100% had their diagnosis confirmed by RT-PCR (Figure 5). Among the chest tomographies analyzed, the most common findings in patients with a confirmed diagnosis of COVID-19 were ground-glass opacities and linear subpleural opacities<sup>10</sup>. The imaging diagnosis was made an average of up to 1.2 days (range between 0 and 4 days) before the result of the PCR<sup>10</sup>, which would allow early treatment measures in the context of potentially severe disease.



Figures 3. Comparative analysis of pulmonary complications presented by patients with confirmed diagnoses of COVID-19



Figures 4. Comparative analysis of pulmonary complications between elective and emergency surgeries.

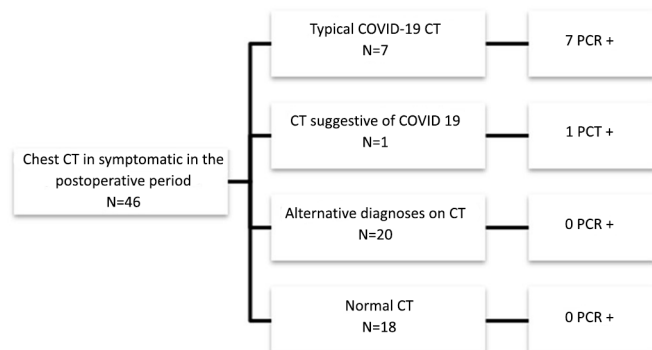


Figure 5. Relationship between laboratory and imaging diagnostic methods for the detection of COVID-19.

Ye et al., in 2020<sup>11</sup>, corroborate the data found when defining that the tomographic findings characteristic of the new coronavirus are ground-glass opacity, consolidations, reticular pattern, and mosaic paving pattern (Figure 6).

Ai et al. confirm the importance of chest tomography. In 2020<sup>12</sup>, it showed 97% sensitivity in suggesting infection by the new coronavirus. Thus, tomography is an essential ally in the early diagnosis of these patients in the perioperative period, even without the positive result of RT-PCR.

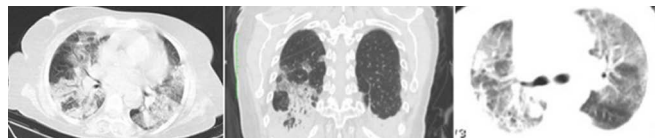


Figure 6. Tomographic findings in patients with a confirmed diagnosis of COVID.

Nahshon et al., in 2020<sup>13</sup>, the only review article analyzed, defined the postoperative mortality rate at 27.5%. It is worth mentioning that all the mortality rates described showed values much higher than those found in patients infected with COVID-19 not undergoing a surgical procedure (2 to 3%)<sup>14</sup> and in patients undergoing non-cardiac surgery, without infection by the coronavirus, admitted to the ICU<sup>15</sup> (7-9%).

Regarding the data found, we can question the presence of abdominal pain as a symptom of high incidence in COVID-19 infection, since in a meta-analysis with more than 10,000 patients, abdominal pain was present in only 3.8% of cases<sup>16</sup>. It is still possible to emphasize the values related to pulmonary complications since they were much higher than those found in patients in the postoperative period, even though major surgery. Chen et al., in 2014<sup>17</sup>, described an incidence of 1.58% of pneumonia after abdominal surgery, while other reports show a variation of 0.5% to 28% after general surgery<sup>18</sup>.

Five articles were excluded for addressing the topic from the perspective of training in the surgical environment or information analysis in medical societies<sup>19-23</sup>.

Among the 16 articles initially selected, only two covered subjects related to plastic surgery<sup>19,20</sup>. In 2020<sup>19</sup>, in the first article, Al-Benna assessed the availability of information regarding the new coronavirus pandemic on national and international plastic surgery websites. Study, in the opinion of the present article, extremely important for us to increase the knowledge and the dissemination of information within the plastic surgery societies. In the second article, Specht et al., in 2020<sup>20</sup>, described a surgical protocol for breast reconstruction in a single day to minimize the risks of contamination during the pandemic. Despite critical topics, there is still a shortage of “case reports” and “review articles” in patients undergoing aesthetic and reconstructive plastic surgery.

## DISCUSSION

Despite the data collected, it is unknown whether the effects of surgical and anesthetic stress, the use of perioperative medications, blood loss, and the systemic inflammatory response syndrome are related to a higher predisposition to COVID-19 and worsening of a pre-existing infection. However, we can assume that the immunocompromised state, mainly due to the decrease

in the postoperative cellular immune response and the inflammatory response itself, is related to a worse prognosis of surgical patients facing infection with the new coronavirus.

We conclude that there is a higher risk of complications and mortality in elective and emergency surgeries due to individual risk factors such as age, sex, and comorbidities.

Chest computed tomography was defined as a means of early diagnosis, considering its higher sensitivity and availability of execution than RT-PCR, ideally performed on any suspected COVID-19. It should be noted that in the face of potentially severe disease, with pathophysiology not yet fully defined, a day of early treatment can represent not only a change in the clinical outcome of the patient but changes regarding the team's conduct, aiming at protection and less risk of contamination.

The data presentation referring to elective and emergency surgeries, as well as patients with several comorbidities, oncology, and a wide age range, legitimizes the use of the data found for plastic surgery. Thus, the objective of the current study is to offer plastic surgeon data beyond the scope of aesthetic and reconstructive surgeries. However, the objective is not to define the medical conduct of surgeons but to allow for consideration in the decision-making process, to preserve the patient's life.

## CONCLUSION

This review article proposes to analyze the main complications presented in the perioperative period during the new coronavirus pandemic and, therefore, to provide the necessary data, so that plastic surgeons understand the risk of operating patients in this context, even if initially asymptomatic, since the chances of complications and unfavorable outcomes are considerably higher.

## COLLABORATIONS

**TSG** Analysis and/or data interpretation, Conception and design study, Conceptualization, Data Curation, Final manuscript approval, Formal Analysis, Methodology, Project Administration, Supervision, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing

**BLC** Analysis and/or data interpretation, Conception and design study, Data Curation, Formal Analysis, Methodology, Supervision, Writing - Review & Editing

**LPB** Analysis and/or data interpretation, Conception and design study, Conceptualization, Data Curation, Methodology, Supervision, Writing - Review & Editing

**SC** Project Administration, Resources, Supervision

**FH** Project Administration, Resources, Supervision

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**\*Corresponding author:****Thaís de Sousa Gonçalves**

Rua, nº - Bairro, Cidade, estado, Brazil

Zip Code ??????

E-mail: [thais\\_sg92@yahoo.com.br](mailto:thais_sg92@yahoo.com.br)