Comparative study of outcomes of surgical patients diagnosed with COVID-19

Estudo comparativo de desfechos de pacientes cirúrgicos diagnosticados com COVID-19

Estudio comparativo de resultados de pacientes quirúrgicos diagnosticados con COVID-19

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ABSTRACT: Objective: To compare the outcomes of patients undergoing conventional gastrointestinal surgeries who developed COVID-19 to those who were not infected. **Method:** Descriptive comparative study. Data were collected from 142 medical records, during the period from March 2020 (beginning of the pandemic in Brazil) to December 2021. Study approved by the Research Ethics Committee (CAAE: 29473520.2.0000.5392). **Results:** The profile of the patients was mostly classified as ASA 2 and 3. There was the presence of at least one chronic disease in all patients with COVID-19 and in most patients without COVID-19. The mean BMI for patients with COVID-19 was type I obesity and overweight for the rest of the sample (p=0.043). There was a predominance of females among patients affected by COVID-19. Complications were longer postoperative hospital stay (p=0.015) and need for surgical approach (p=0.034). **Conclusions:** The profile of surgical patients with COVID-19 was linked to the presence of comorbidities, longer duration of the surgical procedure and high BMI. Complications associated with the presence of COVID-19 were longer postoperative hospital stays and surgical reoperation.

Keywords: Perioperative nursing. Coronavirus infections. Outcome assessment, health care.

RESUMO: Objetivo: Comparar os desfechos de pacientes submetidos a cirurgias gastrointestinais convencionais que desenvolveram *coronavirus disease* (COVID-19) com aqueles que não estavam contaminados. **Método:** Estudo comparativo descritivo. Foram coletados dados de 142 prontuários desde março de 2020 (início da pandemia no Brasil) até dezembro de 2021. Estudo aprovado pelo Comitê de Ética em Pesquisa (CAAE: 29473520.2.0000.5392). **Resultados:** O perfil dos pacientes foi, em sua grande maioria, classificação ASA 2 e 3 e presença de ao menos uma doença crônica em todos os pacientes com COVID-19 e na maioria daqueles sem COVID-19. O índice de massa corpórea (IMC) médio para os pacientes com COVID-19 foi obesidade tipo I e sobrepeso para o restante da amostra (p=0,043). Houve predominância do sexo feminino entre os pacientes acometidos por COVID-19. As complicações foram maior tempo de internação pós-operatória (p=0,015) e necessidade de reabordagem cirúrgica (p=0,034). **Conclusão:** O perfil dos pacientes cirúrgicos com COVID-19 esteve atrelado à presença de comorbidades, maior duração do procedimento cirúrgico e IMC elevado. As complicações associadas à presença de COVID-19 foram maior tempo de internação pós-operatória e necessidade de reabordagem cirúrgica.

Palavras-chave: Enfermagem perioperatória. Infecções por coronavírus. Avaliação de resultados em cuidados de saúde.

RESUMEN: Objetivo: Comparar los resultados de pacientes sometidos a cirugías gastrointestinales convencionales que desarrollaron la enfermedad por coronavirus (COVID-19) con aquellos que no estaban infectados. **Método:** Estudio comparativo descriptivo. Se recopilaron datos de 142 historias clínicas, durante el período entre marzo de 2020 (inicio de la pandemia en Brasil) y diciembre de 2021. Estudio aprobado por el Comité de Ética en Investigación (CAAE: 29473520.2.0000.5392). **Resultados:** El perfil de los pacientes se clasificó en su mayor parte como ASA 2 y 3. Hubo presencia de al menos una enfermedad crónica en todos los pacientes con COVID-19 y en la mayoría de los pacientes sin COVID-19. El índice de masa corporal (IMC) promedio para los pacientes con COVID-19 fue de obesidad tipo I y de sobrepeso para el resto de la muestra (p=0,043). Hubo predominio del sexo femenino entre los pacientes afectados por COVID-19. Las complicaciones incluyeron un mayor tiempo de hospitalización postoperatoria (p=0,015) y la necesidad de

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reabordaje quirúrgico (p=0,034). **Conclusión:** El perfil de los pacientes quirúrgicos con COVID-19 se relacionó con la presencia de comorbilidades, mayor duración del procedimiento quirúrgico e IMC elevado. Las complicaciones asociadas con la presencia de COVID-19 fueron una hospitalización postoperatoria más prolongada y la necesidad de un nuevo abordaje quirúrgico.

Palabras clave: Enfermería perioperatoria. Infecciones por coronavirus. Evaluación de resultado en la atención de salud.

INTRODUCTION

The coronavirus disease (COVID-19) pandemic, caused by the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2), has been a significant global health crisis for over two years. The severity of the disease and its high transmissibility among humans have been evident since the outset[1]. By May 2020, within the first months of the pandemic, approximately 4 million confirmed cases had been recorded worldwide, alongside over 279 thousand deaths across nearly 190 countries[2]. Presently, Brazil alone has recorded over 679 thousand deaths and 33 million confirmed cases. Globally, the disease has claimed the lives of over 6 million individuals[3].

As per previous information, COVID-19 has significantly impacted public health systems in various countries, leading to the postponement of elective surgeries. This is primarily due to the redirection of resources to prioritize patients requiring treatment for COVID-19. Additionally, the risks associated with post-anesthetic surgical outcomes in individuals infected with SARS-CoV-2 are not fully understood. However, pathological changes such as organ failure, blood clotting, and inflammatory responses observed in patients could pose additional risks related to surgical procedures[4].

Surgical procedures in patients with COVID-19 are generally not recommended and should be avoided whenever possible, except in cases of emergency[4]. The decision to proceed with a surgical procedure in patients diagnosed with COVID-19 is complex due to the potential risk of transmission to healthcare professionals and the heightened risk to the patient's own health. The postoperative period for patients undergoing conventional abdominal surgery can be complicated and may even lead to fatal outcomes[5], in addition to contributing to the development of secondary infections such as surgical site infections (SSI).

Therefore, it is crucial to understand and study the risks associated with SSI in patients diagnosed with COVID-19 to mitigate the occurrence of this complication.

OBJECTIVE

Main objective

- To compare the outcomes of surgical patients undergoing conventional gastrointestinal surgeries who developed COVID-19 to those who were not infected.

Specific objectives

- To characterize surgical patients with COVID-19 and without COVID-19 regarding sociodemographic and health variables;
- To compare surgical patients with COVID-19 and without COVID-19 in terms of outcomes (deaths, surgical readmissions, readmissions, complications and length of stay).

METHOD

Study design

A cross-sectional, comparative, and descriptive study. The outcomes of surgical patients undergoing gastrointestinal surgeries who developed COVID-19 (before or during hospitalization) were compared with those who were not infected.

Study location

The study was conducted at the University Hospital of Universidade de São Paulo (HU-USP), which is a secondary-level teaching hospital that provides services to the USP community (teachers, staff, and students) as well as to users of the Brazilian Unified Health System (*Sistema Único de Saúde* – SUS) through referral services.

Data collection procedures

Data were collected from the medical records of patients undergoing conventional gastrointestinal surgeries between March 2020 (the onset of the pandemic in Brazil) and December 2021. The collected information included the diagnosis of COVID-19, as well as sociodemographic, health, and surgical aspects such as age, gender, presence of comorbidities, anesthetic technique, duration of the procedure, antiseptic agent used in preoperative preparation, use of blood components, need for an intensive care bed in the postoperative period, surgical readmissions, and hospital readmissions.

The outcomes evaluated in this study included various health variables (presence of chronic diseases, previous treatments, ASA classification — American Society of Anesthesiologists, body mass index (BMI), sociodemographic factors (gender and age), length of hospital stay (in days), occurrence of complications (bleeding, infection, and dehiscence), admission to an intensive care unit (ICU), mortality, readmissions, and surgical readmissions.

Ethical aspects

The present study was conducted as part of the research project titled "Impact of the application of towels impregnated with chlorhexidine on the outcome of surgical site infection in conventional abdominal surgeries." This research was approved by the Research Ethics Committee of the School of Nursing of Universidade de São Paulo (EE-USP) under CAAE number 29473520.2.0000.5392. The study adhered to ethical and legal guidelines outlined in Resolution No. 466/2012 of the National Health Council, which governs research involving human subjects.

Data analysis

The data were entered into a Microsoft Excel® spreadsheet and analyzed using R 4.2.1 software by a statistical professional in accordance with the study's objectives and proposed methodology. The variables were described using position statistics (mean, median, minimum, and maximum) and scale (standard deviation) and the results presented in tables. Dichotomous variables were evaluated using the χ^2 or Fisher's exact test, while continuous variables were evaluated using the Student's *t* test or Wilcoxon-Mann-Whitney test.

RESULTS

During the data collection, the medical records of 142 patients who underwent elective abdominal surgical procedures in 2020 and 2021 were analyzed. Among these patients, three were diagnosed with COVID-19, accounting for 2.11% of the total sample (Table 1).

Table 2 presents the relationships between the variables and their respective categories associated with COVID-19 cases. Among the three positive cases for COVID-19, the majority were female patients (66.67%), and the predominant ASA classification was 2 (66.67%). Additionally, among these patients, 66.67% had an oncological diagnosis, which was also notable among the 139 patients not affected by COVID-19 (70.50%).

Regarding the presence of comorbidities, all patients who tested positive for COVID-19 had some type of chronic disease, which was also present in 139 (74.10%) of the remaining patients. Hypertension was observed in 66.67% of COVID-19 cases and in 43.17% of uninfected patients. Diabetes Mellitus (DM) and heart disease were found in 33.33% of patients infected with COVID-19. However, the incidence of kidney disease among patients in this sample was low, affecting only 2.16% of the 139 patients, with no COVID-19 positive patient presenting it. None of the three COVID-19 cases had respiratory illnesses.

At the time of the surgical procedure, none of the patients who tested positive for COVID-19 were smokers. Among them, 66.67% claimed to have never smoked, while 33.33% declared to be former smokers. In contrast, among the remaining 139 patients, the incidence of non-smokers was 48.92%, former smokers was 35.97%, and active smokers was 15.11%.

Patients who tested positive for COVID-19 underwent either general anesthesia or combined anesthesia (spinal + general).

The highest prevalence of COVID-19 was observed in patients undergoing intestinal surgery (66.67%), while in 33.33% of cases, the disease manifested during liver, pancreatic, or splenic surgery. Regarding mortality, the percentage

Table 1. Cases of COVID-19 among surgical patients undergoing elective conventional abdominal surgeries in 2020 and 2021.

COVID-19	Number	Percentage (%)
No	139	97.89
Yes	03	2.11
Total	142	100.00

Table 2. Variables and respective categories associated with positive and negative COVID-19 cases.

Characteristic	Category	COVID-19				p value*
		No		Yes		
		N	%	N	%	
Gender	Female	65	46.76	2	66.67	0.496
	Male	74	53.24	1	33.33	
ASA (American Society of Anesthesiologists) classification	1	10	7.19	0	0.00	1.000
	2	85	61.15	2	66.67	
	3	41	29.50	1	33.33	
	4	3	2.16	0	0.00	
Oncological diagnosis	No	41	29.50	1	33.33	1.000
	Yes	98	70.50	2	66.67	
Chronic diseases	No	36	25.90	0	0.00	0.571
	Yes	103	74.10	3	100.00	
Diabetes Mellitus	No	106	76.26	2	66.67	0.563
	Yes	33	23.74	1	33.33	
Hypertension	No	79	56.83	1	33.33	0.418
	Yes	60	43.17	2	66.67	
Kidney disease	No	136	97.84	3	100.00	1.000
	Yes	3	2.16	0	0.00	
Cardiopathies	No	122	87.77	2	66.67	0.336
	Yes	17	12.23	1	33.33	
Respiratory diseases	No	118	84.89	3	100.00	1.000
	Yes	21	15.11	0	0.00	
Smoking	No	68	48.92	2	66.67	1.000
	Former smoker	50	35.97	1	33.33	
	Yes	21	15.11	0	0.00	
Anesthetic technique	General	81	58.27	1	33.33	0.246
	Epidural + general	23	16.55	0	0.00	
	Spinal anesthesia + general	34	24.46	2	66.67	
	Other	1	0.72	0	0.00	
Surgery	Gastric	24	17.27	0	0.00	0.504
	Hepatic, pancreatic, or splenic	9	6.48	1	33.33	
	Intestinal	68	48.92	2	66.67	
	Cholecystectomy	22	15.83	0	0.00	
	Exploratory laparotomy	12	8.63	0	0.00	
	Other	14	2.88	0	0.00	
Death	No	132	94.96	2	66.67	0.161
	Yes	7	5.04	1	33.33	
Surgical readmission	No	125	89.93	1	33.33	0.034
	Yes	14	10.07	2	66.67	
Readmission	No	128	92.09	2	66.67	0.234
	Yes	11	7.91	1	33.33	
Readmission to intensive care	No	136	97.84	3	100.00	1.000
	Yes	3	2.16	0	0.00	
Surgical site infection	No	116	83.45	1	33.33	0.080
	Yes	23	16.55	2	66.67	

*Pearson's χ^2 test or Fisher's Exact Test.

was 33.33% among patients with COVID-19 and 5.04% in the rest of the sample.

Regarding complications, surgical re-approach occurred in 66.67% of patients who tested positive for COVID-19 and in 10.07% of the 139 patients who did not have COVID-19. This complication showed a statistically significant association with positive cases of COVID-19 (p=0.034). Among patients with COVID-19, only one was readmitted (33.33%). However, none of the three cases of readmission to the ICU (2.16%) were diagnosed with COVID-19.

The SSI rate was 16.55% among patients who did not test positive for COVID-19 and 66.67% for those with a positive result.

For patients who tested positive for COVID-19, the mean BMI was 32.87 kg/m², categorizing them as type I obese (p=0.043). The mean preoperative hospital stay was four days, while surgery duration was 4.72 hours, classified as size 3. Postoperative hospitalization averaged 30.67 days (Table 3).

For patients who did not test positive for COVID-19, the average BMI was 26.47 kg/m², categorizing them as overweight. The average preoperative hospitalization time was 2.76 days, with surgery lasting 2.88 hours, classified as size 2. Postoperative hospitalization averaged 8.12 days.

In comparison, the average number of days of preoperative hospital stay was longer in patients with COVID-19 than in non-infected patients, and the same was true for the average postoperative hospital stay. Regarding surgical duration, it was longer for patients with COVID-19, classified as size 3, compared to non-infected patients, classified as size 2.

Regarding the symptoms presented by patients with COVID-19, fever, cough, tiredness, sore throat, diarrhea, anosmia (loss of smell), ageusia (loss of taste), conjunctivitis, and rash were not present in any of the three patients in this sample. However, 33.33% of them experienced headache, dyspnea, and/or chest pain (Table 4).

Table 4. Symptoms presented by patients who tested positive for COVID-19.

Symptom	Categories	Number	Percentage (%)
Fever	No	3	100.00
	Yes	0	0.00
Cough	No	3	100.00
	Yes	0	0.00
Fatigue	No	3	100.00
	Yes	0	0.00
Sore throat	No	3	100.00
	Yes	0	0.00
Diarrhea	No	3	100.00
	Yes	0	0.00
Headache	No	2	66.67
	Yes	1	33.33
Loss of smell	No	3	100.00
	Yes	0	0.00
Loss of taste	No	3	100.00
	Yes	0	0.00
Conjunctivitis	No	3	100.00
	Yes	0	0.00
Skin rash	No	3	100.00
	Yes	0	0.00
Dyspnea	No	2	66.67
	Yes	1	33.33
Chest pain	No	2	66.67
	Yes	1	33.33
Oxygen saturation drop	No	1	33.33
	Yes	2	66.67
Loss of speech or movement	No	3	100.00
	Yes	0	0.00

Table 3. Measures of position and scale for variables in patients with COVID-19 and without COVID-19.

Characteristic	COVID-19	N	Lost data	Mean	Median	Minimum	Maximum	Standard deviation	p value*
Body mass index	No	129	10	26.47	26.89	13.98	42.39	5.38	0.043
	Yes	3	0	32.87	33.06	28.08	37.46	4.70	
Preoperative length of stay	No	139	0	2.76	1	0	35	5.23	0.172
	Yes	3	0	4.00	0	1	9	4.36	
Surgery time	No	139	0	2.88	2.75	0.5833	7.667	1.40	0.133
	Yes	3	0	4.72	5.083	2.25	6.833	2.31	
Postoperative length of stay	No	139	0	8.12	6	0	124	12.25	0.015
	Yes	3	0	30.67	33	9	50	20.60	

*Student's *t*-test or Wilcoxon-Mann-Whitney test.

DISCUSSION

The present study, conducted on a sample of 142 patients undergoing gastrointestinal surgeries, revealed that individuals diagnosed with COVID-19 (2.11%) were predominantly classified as ASA 2 (66.67%) and ASA 3 (33.33%), with all patients having at least one chronic disease. Among these patients, hypertension was the most prevalent, followed by DM and heart diseases, while none of the patients had respiratory diseases.

Regarding patient characterization, associations were observed between the presence of comorbidities and a longer duration of the anesthetic-surgical procedure, as well as a higher incidence of complications, consistent with findings in the literature[6]. This is evidenced by comparing the mean surgery time for patients with COVID-19 (4.72 hours), classified as size 3, with that of patients without COVID-19 (2.88 hours), classified as size 2.

The incidence of comorbidities was also 100% in a study with a sample of five patients diagnosed with COVID-19 in the pre- or post-operative period of elective or emergency surgeries. This highlights a direct relationship between the presence of chronic diseases and potential perioperative complications[7]. Smoking was present in patients in the same study[7]; in the present research, only one of the three patients affected by COVID-19 was a smoker.

BMI emerged as a significant factor in surgical patients with COVID-19, with an average value falling into the type I obese category (32.87 kg/m^2). This finding aligns with a case where a severely obese patient experienced cardiorespiratory complications and severe acute respiratory distress prior to gastric surgery at the onset of the COVID-19 outbreak[5]. Additionally, obesity and hypertension were identified as the most common comorbidities among all groups of surgical patients with active or resolved COVID-19 in a survey conducted in the United States[8].

The diagnosis of SSI emerged as a notable complication in both the pre- and postoperative periods of patients with COVID-19, with two out of three infected individuals affected by SARS-CoV-2, indicating a high incidence within this sample. Additionally, the need for surgical re-approach was significantly associated with the infected group when compared to the non-infected cohort, suggesting that the presence of the coronavirus may indeed pose a risk factor for postoperative complications[9]. This likely contributed to prolonged hospital stays, as evidenced by the significantly longer duration of pre- and postoperative hospitalization in COVID-19 patients (30.67 days) compared to those without the disease — almost four times the average number of days for patients without the disease; this time was statistically significant.

The absence of ICU readmissions among the three patients infected with SARS-CoV-2 is notable, although it is important to consider the small sample size, likely influenced by the testing protocol before surgery. A study conducted in Wuhan, China, involving 34 COVID-19 patients who underwent surgery, reported a 44.1% ICU admission rate postoperatively, with 58.8% of those patients presenting at least one comorbidity, primarily hypertension and DM[10]. Such data are similar to those found in the present study.

The observed mortality rate of 33.33% among COVID-19 patients in this study is higher than that reported in another study, where the mortality rate reached 20.5%[10]. Additionally, a meta-analysis confirmed a high postoperative mortality rate in COVID-19 patients (20%), with a postoperative ICU admission rate of 15%[9], indicating a significant incidence of postoperative complications and corroborating the findings of this study, even though few positive cases of COVID-19 were found in the sampling.

In existing literature, numerous patients necessitated a post-surgery ICU bed due to mechanical ventilation requirements, exhibiting respiratory complications like acute respiratory distress syndrome (ARDS), pneumonia, and atelectasis. Additionally, some patients had prior respiratory conditions such as asthma and COPD[9,10], a contrast not observed in our study. The absence of mechanical ventilation necessity postoperatively might be linked to the absence of pre-existing respiratory ailments among the three COVID-19 patients. Such conditions could exacerbate health status and elevate the risk of pre- and post-operative complications.

In SARS-CoV-2 infection, predominant symptoms included headache, dyspnea, and chest pain, occurring in 33.33% of cases. Dyspnea and headache demonstrated significant incidence rates in another study, with 44.1% and 23.5% of patients respectively, presenting fever (91.2%), fatigue (73.5%), and dry cough (52.9%) as the most common symptoms[9]. Moreover, fever emerged as the most prevalent symptom in a separate sample of surgical patients with COVID-19, followed by dry cough (80%)[7].

Overall, the profile of surgical patients with COVID-19 in this study was associated with the presence of comorbidities, elevated BMI, and extended duration of the surgical procedure, in contrast to patients without COVID-19. Complications were characterized by prolonged postoperative hospital stays (p=0.015) and the requirement for surgical re-approach (p=0.034).

Regarding the study's limitations, out of the 142 patients sampled, only three were diagnosed with COVID-19 at the time of surgery. This low number can be attributed to the pre-operative screening protocol for elective surgeries, which involved RT-PCR testing (nasal swab and/or oral). This precautionary measure was vital in averting potential complications arising from surgical procedures conducted while infected with SARS-CoV-2 and mitigating risks of exposure for the anesthetic-surgical team.

It is worth noting that the RT-PCR screening of patients adhered to national recommendations from the National Health Surveillance Agency[11] and international guidelines[12]. Additionally, the decision to proceed with essential or non-essential elective anesthetic-surgical procedures in patients with COVID-19 or those in recovery was left to medical discretion, considering the risks and benefits on a case-by-case basis[11].

Lastly, it is important to highlight the absence of studies indicating a higher risk of SSI in patients with COVID-19 undergoing surgical procedures, suggesting an area that warrants further investigation. Nevertheless, it is advisable, when clinically feasible, to postpone elective surgeries in infected patients due to the heightened risk of postoperative complications, as recommended by existing literature[9,11,12].

CONCLUSION

In this study, the patient profile concerning health variables predominantly comprised individuals categorized as ASA 2 and 3, with all COVID-19 diagnosed patients and a majority of those uninfected exhibiting at least one chronic disease. The average BMI for COVID-19 patients fell within the classification of type I obesity, while uninfected patients were categorized as overweight. Furthermore, there was a higher proportion of females among COVID-19-affected patients, whereas an equitable distribution of biological sex was observed among those uninfected.

In terms of outcomes, patients with COVID-19 exhibited a higher percentage of mortality, surgical readmissions, overall readmissions, and diagnoses of SSI, along with longer durations of surgery and pre- and postoperative hospitalization, compared to patients without COVID-19. Notably, the sole readmissions to the ICU occurred in patients not infected with SARS-CoV-2.

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None.

CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

AUTHORS' CONTRIBUTIONS

LES: Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. JRG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. CL: Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. VBP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing

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