

# Surgical impact of the severe acute respiratory syndrome coronavirus 2 pandemic in a third-level hospital in Mexico City

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## Abstract

**Objective:** This article aims to identify the changes that occurred in surgical services due to the coronavirus disease (COVID)-19 pandemic. **Methods:** A comparative observational study of the surgical procedures performed in the first 5 months of 2019 compared to procedures performed in 2020. It addresses the approach, prioritization, and procedures in patients with suspected or confirmed infection with COVID-19. **Results:** A drastic decrease in the number of surgical procedures was observed between March, April, and May 2020 at 19%, 74%, and 85%, respectively. Laparoscopic surgical procedures had a 96% decline rate. The most frequent surgeries in patients with high suspicion or confirmation of severe acute respiratory syndrome coronavirus SARS COV-2 have been tracheostomy due to prolonged intubation, cesarean section, laparotomy, abdominoplasty, appendectomy, and among others. **Discussion:** The SARS COV-2 pandemic has led to a sudden shift in all surgical specialties worldwide. Planning for the return to surgical activities with the “new normal” scenario is of foremost importance, taking into account the protection of health personnel, patients, and families. **Conclusions:** We have a long way to go regarding the actions and reorganization of hospital services in relation to the evolution of the SARS COV-2 pandemic.

**Key words:** Pandemic. Coronavirus. Severe acute respiratory syndrome coronavirus-2. Surgical services. Surgeries. Procedures.

## Introduction

The severe acute respiratory syndrome coronavirus (SARS COV)-2 pandemic has affected more than 6 million people and killed nearly 400,000 worldwide. In Mexico, until May 31, 2020, there have been more than 90,000 cases with nearly 10,000 deaths, which is considered the most relevant and deadly pandemic of our time. Since March, the General Hospital of Mexico “Dr. Eduardo Liceaga” has been considered a coronavirus disease (COVID) hospital by the Ministry of Health, where our team was entrusted with the management of these patients, as well as patients without the infection, but in need of third-level medical treatment (mixed hospital).

From the pandemic's outset in China, a high contagion rate was observed at hospitals among health personnel, patients, and families, so the overall recommendation was for the cancellation of medical consultations and elective surgeries. The members of the COVID Surg Collaborative<sup>1</sup> conducted a study, including 71 countries where they estimated that approx. 28,404,603 surgeries have been suspended worldwide in the 12 peak weeks of the COVID-19 pandemic. Among the most affected procedures, non-cancer surgeries stand out at a 90.2% cancellation rate followed by cancer (8.2%) and obstetrics (1.6%) surgeries.

There are multiple reports where the morbidity and mortality of patients with SARS COV-2 infection

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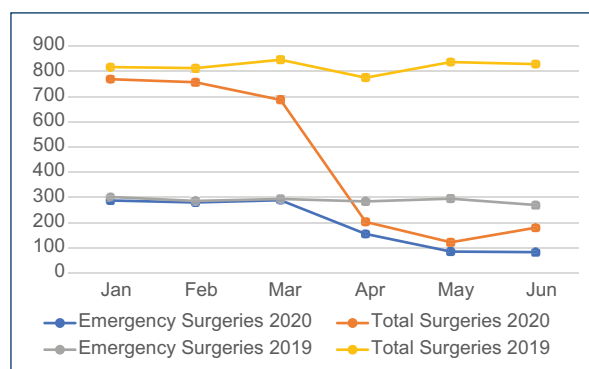
undergoing a surgical procedure are significantly elevated. Among these, the most relevant study with the largest number of patients was the one published by the COVID Surg Collaborative<sup>2</sup>, where they included 1128 patients (835 surgical emergencies, 280 elective surgeries, and 13 unreported cases) in 235 hospitals in 24 countries. The results found that 26% of patients were identified with SARS COV-2 infection preoperatively and 84% postoperatively, with a 23.8% mortality rate at 30 days and pulmonary complications in 51.2% of cases. Factors identified as leading to a poor prognosis as follows: being a male, age over 70 years, American Society of Anaesthesiologists (ASA) score of 3-5, malignant pathology, major surgery, and surgical emergency. Their recommendation was to postpone non-urgent surgeries and promote non-surgical treatment.

The objectives of this article are to identify the changes that occurred in surgical services due to the COVID-19 pandemic, as well as establishing a panorama for the future of surgical therapeutic services of the General Hospital of Mexico "Dr. Eduardo Liceaga."

## Method

The proposal for the management of patients with suspected or confirmed SARS COV-2 infection was applied after the literature review<sup>3-8</sup> with 100% effectiveness as, until June 2, 2020, we had not had any contagion reports regarding health professionals arising from such procedures. The personal protective equipment (PPE) assigned to the health professionals involved in surgical procedures during the COVID-19 pandemic is that recommended by the World Health Organization<sup>9</sup> which includes: two disposable surgical caps, goggles, face shield, N95 face mask, triple-layer face mask, specific scrubs, two disposable gowns (with or without polypropylene reinforcement), two pairs of disposable boots, and 2-3 pairs of gloves.

A comparative observational study was conducted regarding surgical procedures performed in the first 5 months of 2019 with surgical procedures of 2020. The analysis was carried out pursuant to the surgical services that make use of the operating rooms of the surgical therapeutic service, the changes in the approach, and prioritization according to the basic pathology. In addition, the changes related to the most relevant inputs used, such as laparoscopic surgery, were taken into account. Subsequently, the most common procedures in patients with suspected or confirmed COVID-19 infection were identified.



**Figure 1.** Comparison of surgical procedures in the surgical therapeutic service from January to May 2019 and 2020.

## Results

Figure 1 shows the comparison of surgical procedures in the surgical therapeutic service from January to May 2019 and 2020, where we can observe a dramatic decline between March, April, and May 2020 of 19%, 74%, and 85%, respectively. It is also worth noting that there is a decrease in the number of surgical emergencies at 45% for April and 71% for May. As for procedures per surgical department, it was observed that all departments had considerably reduced the number of scheduled elective surgeries, with only cancer surgeries or surgical emergencies as priorities in the social distancing period.

As main procedures during the period from March to May 2020 in the operating rooms assigned as non-COVID rooms, we had pancreatoduodenectomy, nephrectomy, various fractures, osteomyelitis, surgical washing and debridement of necrotizing fasciitis, exploratory laparotomy due to abdominal infection, surgical lavage with change of negative pressure wound therapy, skin flap, hemicolectomy, low anterior resection, and among others. As for laparoscopic surgery, the numbers were similar to the previous year during January and February. However, since March 2020, there has been a decrease of 25% compared to 2019, with a drastic decline during April and May (approximately 96%).

The number of surgeries in the COVID operating room for patients with high suspicion or confirmation of SARS COV-2 at the surgical hall from April 1 to June 3 was as follows: three surgeries in April, followed by 15 surgeries in May and three procedures in June. The most frequent surgical procedure was tracheostomy due to prolonged

tracheal intubation<sup>6</sup>, followed by cesarean section<sup>5</sup>, laparotomy for abdominal sepsis<sup>5</sup>, abdominoplasty for incarcerated hernia<sup>2</sup>, open appendectomy<sup>1</sup>, perforated peptic ulcer<sup>1</sup>, splenectomy for splenic abscess,<sup>1</sup> and ventriculostomy due to a previous condition<sup>1</sup>.

It is worth mentioning that although it is difficult to determine when a person can get infected, none of the health professionals who performed the surgical procedures in the COVID-19 operating room have tested positive or presented symptoms. However, in relation to the procedures in the non-COVID operating rooms, two patients tested positive subsequently, with co-infection to two members of the surgical team who were asymptomatic.

## Discussion

Regarding the surgical area and mainly the surgical therapeutic service, the latter is in charge of the administration, organization, and distribution of resources of the 15 operating rooms within the surgical hall: ten central operating rooms (first floor), two rooms for outpatient procedures, two transplant operating rooms, and a hybrid operating room (second floor). This last operating room is where surgical procedures such as general, urology, orthopedic, colorectal, and plastic surgeries are mainly performed. Since mid-March, a hospital reconversion has been carried out, which included the operating rooms, where it was decided to suspend elective and short-stay surgeries. Moreover, the number of “clean” operating rooms for patients without suspected infection or negative results for SARS COV-2 was reduced, and an operating room was exclusively assigned for patients with suspicion or confirmation of SARS COV-2 infection (second floor). It is worth highlighting that this is not the only area assigned to attend to COVID-19 patients in need of surgical treatment. The cardiothoracic and vascular surgery unit also has an operating room for these patients.

The SARS COV-2 pandemic led to a 180-degree turn to the functioning and operation of probably every hospital in the world. At the General Hospital of Mexico “Dr. Eduardo Liceaga,” a drastic change in the therapeutic surgery services can be observed due to the way of working, the distribution of material and human resources, spaces and surgery times, and among others. The use of some resources that were deemed indispensable (laparoscopic surgeries) had a decrease rate over 96% and resources that had never been required, such as polypropylene-reinforced surgical

gowns, N95 masks, and face shields, became of foremost necessity.

The reduction in surgical emergency procedures could be explained by the fact that patients preferred to go to another hospital deemed non-COVID or by referral/cross-referral to other hospitals because of their increased hospital capacity to receive patients. In addition to laparoscopic surgery, because of the little evidence reported from the onset, in multiple articles around the world that insufflation gas and the use of electrocautery or harmonic scalpel could produce aerosols. At present, in the few laparoscopic surgeries performed, filters are placed so that pneumoperitoneum is evacuated and health professionals are protected with high-risk PPE (category III). Transmission through smoke by the use of mono and bipolar energy has also been described, as well as by the use of the harmonic scalpel, which makes surgical procedures difficult to perform and forces the total protection of health professionals<sup>10-12</sup>.

At present, we are still under the red color code, regarding the number of cases and bed occupancy rates established by the government of our country. However, it is of foremost importance to initiate a plan for the return to surgical activities within the new “normal” reality, taking into account the protection of health professionals, patients, and families. There are reports showing an increase in comorbidities and mortality during the perioperative period in patients infected with SARS COV-2, which is not detected at the time of surgery because they are either asymptomatic or have contracted the infection during hospitalization. Therefore, we must have a prioritized and gradual return of scheduled surgeries.

According to the recommendations of the Spanish Association of Surgeons, to resume “normal” elective surgical activity, the bed occupancy rate by COVID-19 patients should be a maximum of 5%<sup>13</sup>. The proposed scale is determined by phases according to the percentage of COVID-19 inpatients, resources, and proposed surgical procedures. With a bed occupancy rate > 75%, only surgical emergencies related to life-threatening conditions are recommended. Thus, bed occupancy rates should be as follows: 50-75% for surgical emergencies, 25-50% for emergencies and cancer surgeries that compromise life, if waiting period exceeds 3 months, with no alternative treatment option and without the need for a prolonged stay in intensive care, and 5-25% for a short-stay emergency, cancer, and non-cancer surgeries.

**Table 1.** Prioritization of surgical procedures in cancer patients

Level of priority	Features	Color code
< than 1 week	Emergency due to oncological complications (risk of death or tumor-related complications)	Red
2-4 weeks	Almost urgent due to biological factors (aggressive resectable tumors, which surgery prevents progression)	Orange
4-8 weeks	Non-urgent with the absence of therapeutic alternatives (aggressive tumors where neoadjuvant or interventional radiation therapy may defer surgery)	Yellow
> 8 weeks	Differentiable (non-aggressive with therapeutic alternatives)	Green

The recommendation to prioritize cancer patients in need of surgical treatment was recently published.<sup>14</sup> Table 1 explains it according to the priority in time and its characteristics. Initially, the safety of patients, families, and health professionals will be prioritized. Thus, an early detection system of SARS COV-2 infection should be implemented to patients who are scheduled for elective surgery. Triage is recommended in the literature for patients requiring elective surgery and includes<sup>15,16</sup>:

1. Epidemiological evaluation: contact with persons with confirmed or suspected COVID-19 infection in the past 14 days.
2. Clinical assessment: presence or history of fever, cough, dry throat, asthenia, dyspnea, myalgia, arthralgia, chills, diarrhea, nausea, vomiting, nasal congestion, and anosmia/hyposmia.
3. Laboratory tests: blood biometry, C-reactive protein, SARS COV-2 reverse transcription-polymerase chain reaction (PCR), specific Immunoglobulin M (IgM), and immunoglobulin G (IgG) antibodies.
4. Clinical studies: chest telemetry and in specific cases, chest computed tomography scan.

Risk factors for a negative outcome in patients with COVID-19 infection in the post-anesthesia phase are as follows: age over 65 years, ASA score of 3 or higher, New York Heart Association class III-IV, emergency surgery, high blood pressure, cerebrovascular disease, heart ischemia or valve disease, heart arrhythmia, diabetes

**Table 2.** Surgical complexity classification

Level	Surgical complexity
1	Minimal risk regardless of anesthesia Minimal bleeding Breast biopsy, excisional biopsy, hysteroscopy, cystoscopy, or bronchoscopy.
2	Minimally or moderately invasive procedure Bleeding < 500 cc Diagnostic laparoscopy, dilation and curettage, bilateral tubal obstruction (BTO), arthroscopy, inguinal hernia surgery, laparoscopic lysis of adhesion, tonsillectomy, umbilicoplasty, septoplasty/rhinoplasty, percutaneous lung biopsy, local anesthesia procedures
3	Moderate to a significant invasive procedure Bleeding 500-1500 cc Hysterectomy, myomectomy, cholecystectomy, laminectomy, knee/hip replacement, major laparoscopic procedure, abdominal resection/reconstruction surgery
4	Highly invasive procedure Bleeding > 1500 cc Spinal reconstruction, major gastrointestinal reconstruction, major vascular repair without the need for subsequent intensive care
5	Highly invasive procedure Bleeding > 1500 cc Cardiac, intracranial, vascular, or major neurological surgery requiring a shift to subsequent intensive care

mellitus, end-stage kidney disease, chronic obstructive pulmonary disease, asthma, and obesity. Hence, Pa-protka et al.<sup>16</sup> performed levels to classify surgical complexity taking into account anesthetic risk, transoperative bleeding, and surgical pathology (Table 2).

Another way to classify the complexity and favorable outcome for elective surgery is proposed by Prachand et al.<sup>17</sup>, where they published a scoring system to determine the surgical need of patients by time called "medically necessary score (MENTS)," where patient, procedure and disease factors are taken into account (Table 3). If a score of 27-55 is achieved, surgery can be performed with precautions. However, with a score above 65, the procedure is not justified.

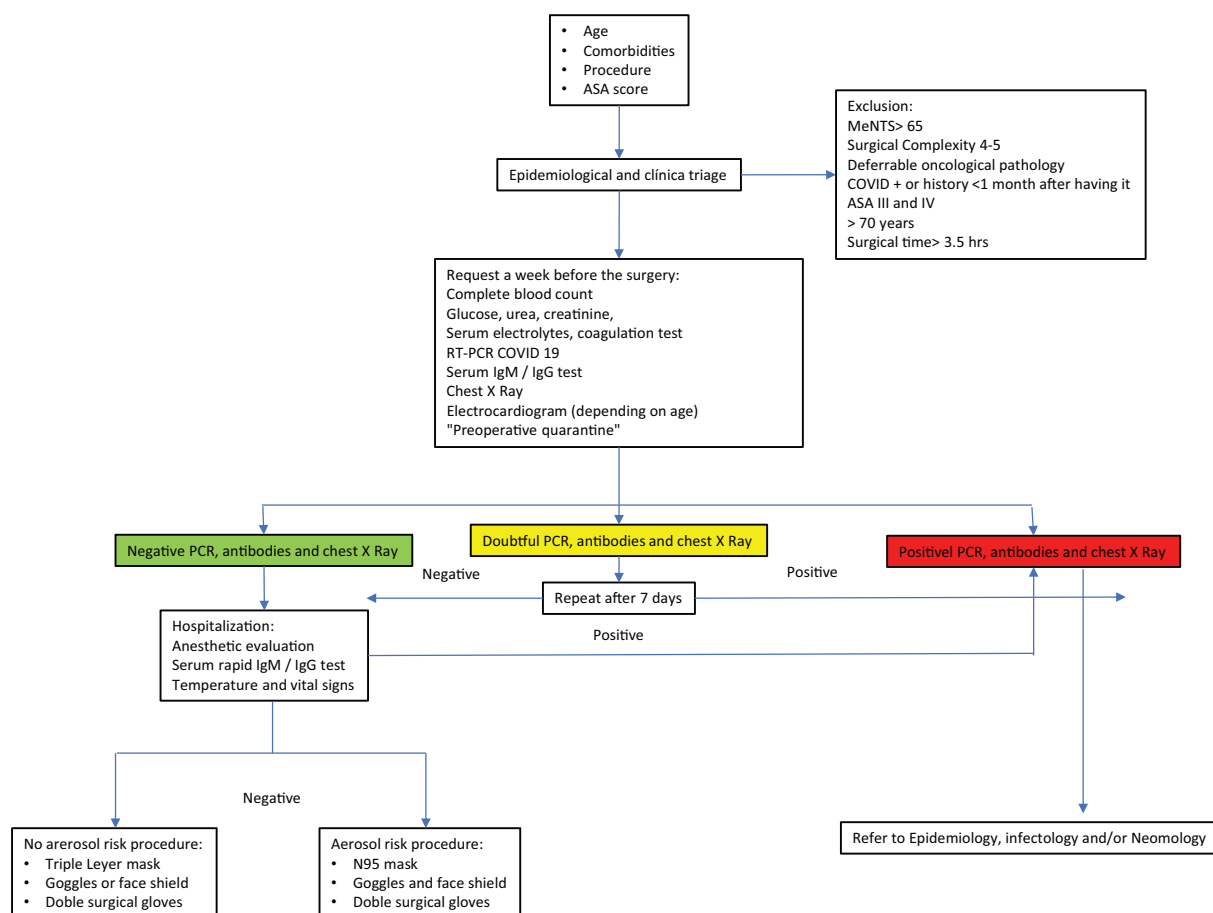
The American College of Surgeons, ASA, Association of Perioperative Registered Nurses, and the American Hospital Association joined efforts to publish a consensus for the re-establishment of elective surgery after the pandemic. It discloses multiple recommendations that consider the appropriate opening times related to the pandemic phase in which each country, pre-operative COVID-19 tests, PPE, prioritization according to the disease, and the patient's state (MENTS

**Table 3.** Medically necessary scoring system, time-sensitive procedures (MENTS)

Procedural factors					
Variable	1	2	3	4	5
Surgical time (min)	< 30	31-60	61-120	121-180	> 180
LOS estimation	Outpatient unit	< 23 h	24-48 h	2-3 days	> 3 days
ICU need (%)	Minimal	< 5	5-10	11-25	> 25
Bleeding estimate (cc)	< 100	100-250	250-500	500-750	> 750
Surgical team size	1	2	3	4	> 4
Probability of intubation (%)	< 1	1-5	6-10	11-25	> 25
Surgical site	None of the following	Abdominal-Pelvic MI	Open abdominal-pelvic infra-umbilical	Open abdominal-pelvic supra-umbilical	ENT, Upper Gastrointestinal or Thoracic
Disease factors					
Variable	1	2	3	4	5
Effectiveness of conservative treatment	Not available	< 40% effectiveness	40-60% effectiveness	61-95% effectiveness	Same effectiveness
Conservative treatment effectiveness/exposure and risk	Significantly worse/not applicable	Somehow worse	Equivalent	Somehow better	Significantly better
Impact of a 2-week delay on outcome	Very severe deterioration	Significant deterioration	Moderate deterioration	Minor deterioration	No deterioration
Impact of a 2-week delay on surgical complexity and risk	Very severe deterioration	Significant deterioration	Moderate deterioration	Minor deterioration	No deterioration
Impact of a 6-week delay on outcome	Very severe deterioration	Significant deterioration	Moderate deterioration	Minor deterioration	No deterioration
Impact of a 6-week delay on surgical complexity and risk	Very severe deterioration	Significant deterioration	Moderate deterioration	Minor deterioration	No deterioration
Patient factors					
Variable	1	2	3	4	5
Age	< 20	20-40	40-50	50-65	> 65
Chronic neuropathy (COPD, asthma)	No			Treatment on demand	Regular treatment
Obstructive sleep apnea syndrome (OSAS)	No			No treatment	CPAP
Cardiovascular disease	No	No medication	1 medication	2 medications	3 medications
Body mass index	<25			25-30	>30
Diabetes mellitus 2	No		No medication	Anti-diabetic medication	Insulin
Immunosuppression	No			Moderate	Severe
Influenza-like illness (ILI)	No				Yes
Contact with people with COVID-19 (+) in the last 14 days	No	Probably not	Possible	Likely	Yes

CPAP: continuous positive airway pressure; COPD: chronic obstructive pulmonary disease; ICU: intensive care unit; LOS: length of hospital stay; MI: minimally invasive; OSAS: obstructive sleep apnea syndrome.





**Figure 2.** Flow chart for the resumption of elective surgeries at the General Hospital of Mexico “Dr. Eduardo Liceaga.” Pre-operative quarantine: isolation of people or animals for an unspecified period as a method of preventing or limiting the risk of spreading disease. Procedures with aerosol exposure risk: balanced general anesthesia, airway management, use of electrocautery or bi-mono polar energy, harmonic scalpel, laparoscopic surgery. ASA; American Society of Anaesthesiologists; COVID-19 RT-PCR: COVID-19 reverse transcription-polymerase chain reaction; MENTS: medically necessary score.

score and outpatient/short-stay surgery, emergency surgery)<sup>18</sup>. For each procedure, according to the specialty, the American College of Surgeons determined the clinical guide to prioritize specific pathologies<sup>19</sup>, as well as other authors<sup>20</sup>.

Hence, we propose the following flowchart for the gradual resumption of elective surgery, bearing in mind that we must be in the yellow color code group, established by the government of Mexico (bed occupancy rate < 50% with 2 weeks on a downward trend) and with 100% of working personnel<sup>21-26</sup> (Fig. 2). The advantages of this system include the selection of patients from the follow-up consultation to avoid intensive care saturation, the need for blood products or prolonged hospital stays, and the safety of other patients, families, and health professionals using two diagnostic methods: COVID-19

RT-PCR and the rapid test for IgM and IgG antibodies. As drawbacks, the 7-day period ranging from the COVID-19 RT-PCR test to admission, the patient may not follow pre-operative quarantine measures properly and become infected in the days leading to the surgery. Furthermore, the sensitivity of the tests is not ideal and there may be false negatives. To compensate for these drawbacks, we suggest PPE to all health professionals according to the risks involved and the type of surgery (with or without aerosol exposure risk).

## Conclusions

There is a long way to go regarding the actions and organization of hospital services in view of the evolution of the SARS COV-2 pandemic for multiple reasons:

each country, state, and even city has different needs, organizations, hospital capacities, etc. Thus, although a single set of guidelines or procedures cannot be generalized, it can be adapted for each health institution. This article shows the changes brought about by this pandemic at a third-level referral hospital in the surgical services and the proposed preparation for return to activity, without absolute evidence as to how it would be in any other context. Therefore, we must be cautious and learn as we go.

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## Conflicts of interest

The authors declare that they have no conflicts of interest.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

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