

Case Series

Observational study of the suspected or confirmed cases of sars COV-2 infection needing emergency surgical intervention during the first months of the pandemic in a third level hospital: Case series

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ABSTRACT

Approximately 28, 404, 603 surgical events have been suspended in the 12 peak weeks of the COVID-19 pandemic. The aim of this study was to report all the surgically intervened patients with suspected or confirmed SARS CoV-2 infection from April 1 to July 31, 2020, and to estimate their prognosis in the Surgical Therapy Department of a third level hospital in Mexico.

Method: We conducted an observational study of patients undergoing surgical intervention in the operating room assigned as COVID, where we considered age, sex, treating department, type of intervention, and initial biomarkers (first five days of hospitalization), days of hospital stay, days in the Intensive Care Unit and reason for discharge.

Results: 42 patients have been surgically intervened, with a total of 49 surgeries. For Otolaryngology and General Surgery, there were more deceased cases than alive cases; while for Thoracic Surgery, and Obstetrics and Gynecology, there were more alive cases than deceased ones (36% and 0% deceased, respectively), with statistically significant differences ($p = 0.014$). With regard to mortality for each group of surgical procedure, patients who underwent C-section or pleurostomy had a mortality rate of 0%; the mortality rate for patients who underwent tracheostomy was 52%; patients who underwent laparotomy had a mortality rate of 54%; for those who underwent debridement, the mortality rate was 100%; which show significant differences, with a p value of 0.03.

Discussion: we identified an overall mortality rate of 42.8%, with a significant difference between treating departments and type of surgical procedure. This can be explained because many of the General Surgery patients, in addition to their infectious process by COVID-19, had another complication, like sepsis. In the same way, we can say that pregnant patients are healthy and have a physiological condition. Finally, patients undergoing an open tracheostomy had solely pulmonary complications.

Conclusion: There is no doubt that we face an unknown condition for which we have been learning tests along the way. This sample of cases undergoing surgery at the beginning of the COVID-19 pandemic can provide clues on relevant results that we must consider for future cases.

1. Introduction

The COVID-19 pandemic has taken many lives because of its high

level of contagiousness, with an estimated global mortality rate of approximately 5.8%. About seven months since the beginning of the pandemic, we have reached 10 million of affected people in more than

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200 countries, with more than half a million deaths. Since March 11, 2020, when Dr. Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization, declared it as a pandemic, it adds to the most important epidemics of the century, like the Spanish flu (1918–1919), the Asian flu (1957–1958), Hong-Kong flu (1968–1969), SARS (2002–2003), the avian flu (2009–2010) and MERS (2012) [1].

SARS-CoV-2 infection has proven to be difficult to diagnose and to treat because it can be asymptomatic, can have a florid respiratory presentation, or have gastrointestinal, cutaneous, and ophthalmic manifestations, among others. No laboratory or imaging study has enough precision to make an accurate diagnosis, neither there is a treatment with considerable success, so we have used reverse transcription polymerase chain reaction (RT-PCR) of SARS-CoV-2, going through IgM/IgG serum antibodies, plain X-rays, computed tomography, and dozens of reported medications. Therefore, it is a difficult pandemic to control with so many pathological conditions around the world [2].

In Mexico, the first four cases of COVID-19 infection were reported at the end of February, cases that have been increasing exponentially, with 1211 new cases in March, 18,009 in April, 71,440 in May, and 135,425 in June. There has been a similar curve in hospital admissions with six new cases in March, 219 in April, 413 in May, and 322 in June 2020.

Regarding the impact of the pandemic on elective surgeries, the members of COVIDSurg Collaborative [3] conducted a study that included 71 countries, study that estimated that approximately 28, 404, 603 surgical events have been suspended in the 12 peak weeks of the COVID-19 pandemic. Among these, surgery for benign causes was the most affected, with 90.2%, followed by cancer surgery (8.2%), and obstetric surgery (1.6%). In our hospital, a significant decrease in surgical events has been observed. For example, in the Surgery Building, we rely on 15 operating rooms (ORs) (10 for general surgery, 2 for outpatient surgery, 2 for transplants and one hybrid OR), which have been converted because of the pandemic, leaving one for patients with COVID, and three for patients without COVID in different building levels. We compared the cases through March, April, May, and June 2019 versus the same months of 2020, and found a 19%, 74%, 85%, 79% and 73% decrease, respectively, as well as in emergency surgeries (71%) and laparoscopic surgeries (96%).

The aim of this study was to report all the surgically intervened patients with suspected or confirmed SARS CoV-2 infection from April 1 to July 31, 2020, and to estimate their prognosis in the Surgical Therapy Department of our hospital.

2. Methods

We conducted an observational study of patients undergoing surgical intervention in the operating room assigned as COVID, where we considered age, sex, treating department, type of intervention, and initial laboratory tests (first five days of hospitalization): ferritin, D-dimer, total leukocyte count, total lymphocyte count, lymphocytes (%), platelets, lactate dehydrogenase, fibrinogen, and procalcitonin; we also considered days of hospital stay (DOHS), days in the Intensive Care Unit (ICU), and reason for discharge. We used the Mann-Whitney *U* test for non-parametric variables as the test for statistical discrimination between groups. The work has been reported in line with the PROCESS criteria [4].

3. Results

During the first trimester of the pandemic, 42 patients have been surgically intervened, with a total of 49 surgeries that correspond to 19 female patients (45.2%) and 23 male patients (54.8%). Mean age of the sample was 49.6 ± 15.1 years, with a minimum value (min. value) of 23 and a maximum value (max. value) of 77 years. Mean hospital stay was 33.5 ± 21.3 days, with a min. value of 3 day and a max. value of 74 days. Thirteen cases (31%) were intervened by the General Surgery

Department, 20 cases (47.6%) by the Thoracic Surgery Division, 6 cases (14.3%) by Obstetrics and Gynecology, and 3 cases (7.1%) by the Otolaryngology Department. Surgical interventions were: tracheostomy in 22 cases (44.8%), exploratory laparotomy in 13 cases (26.5%), C-section in 6 cases (12.2%), wound debridement in 4 cases (8.1%), thoracotomy in 2 cases (4.0%), and endopleural catheter placement in 2 cases (4.0%). Discharge was indicated because of patient improvement in 23 cases (54.8%), death in 18 cases (42.9%), and 1 case is still hospitalized (2.4%) (Table 1).

Thirty-nine cases had clinical signs suggestive of COVID-19 infection (92.9%), while there were no such clinical evidence in three cases (7.1%). Forty-one RT-PCR tests were performed, with positive results in 36 of the cases (85.7%), and negative results in 5 cases (11.9%). RT-PCR test was not performed in 1 case (2.4%). Thoracic axial computed tomography (ACT) was performed in 16 cases (38.1%), with positive findings for COVID-19 in all of them (Fig. 1, 2 and 3).

All six infants were born alive, and all of them were discharged successfully without evidence of COVID-19 infection confirmed by two tests performed in each one of them. Patient 6's infant was the only preterm one, at 30.3 weeks of gestation (WOG) with a good evolution, and was discharged 45 days after he was born (see Fig. 4).

To assess the severity of each case, we considered 2 factor clusters:

- (A) Clinical factors: days of stay in the ICU; days of hospital stay; and discharge status, as improvement or death.
- (B) Para-clinical factors or biomarkers: ferritin, D-dimer, total leukocyte count, total lymphocyte count, lymphocyte percentage, platelets, lactate dehydrogenase, fibrinogen, and procalcitonin.

Thirty-three cases needed treatment in the Intensive Care Unit (ICU) (78.5%), mean ICU length of stay was 20.8 days (min. 0, max. 69). Female patients had a mean length of hospital stay of 23.6 days; and for males, it was 41.7 days, a statistically significant difference ($p = 0.008$). Mean ICU stay was 13.2 days for female patients, and 27.1 days for male patients, a difference deemed statistically significant ($p = 0.007$).

Prognostic markers were determined depending on the sex of the patient. Upon classifying the sample by sex and comparing the differences for the values of the different examined biomarkers, we found a statistically significant difference for ferritin values, with much greater values for men than for women ($p = 0.002$), the other parameters were not significant (Table 2).

There were no differences in biomarker values between patients younger than 59 years old compared with patients 60 years and older. Regarding biomarker values found on patients with a positive or negative result for SARS-CoV-2 (PCR), we found a higher number of leukocytes for cases with a positive result compared to those with a negative test ($p = 0.03$), and a higher mean value for fibrinogen for cases with a positive test than for those with a negative one ($p = 0.04$). There were no differences in the comparison of other biomarker values. In relation to biomarker mean values for deceased or alive patients, there were no differences between groups.

When comparing mortality per treating department, we observed that, for Otolaryngology and General Surgery, there were more deceased cases than alive cases (100% and 61% deceased, respectively); while for Thoracic Surgery, and Obstetrics and Gynecology, there were more alive cases than deceased ones (36% and 0% deceased, respectively), with statistically significant differences ($p = 0.014$) (Table 3).

With regard to mortality for each group of surgical procedure, patients who underwent C-section or pleurostomy had a mortality rate of 0%; the mortality rate for patients who underwent tracheostomy was 52%; patients who underwent laparotomy had a mortality rate of 54%; for those who underwent debridement, the mortality rate was 100%; which show significant differences, with a p value of 0.03 (Table 4).

Table 1

Data from 42 surgically intervened patients with suspicion or confirmation of SARS-CoV-2 infection.

Patient	Sex	Age, years	Diagnosis	Surgical procedure	Days in ICU	DOHS	Reason for discharge
1	F	24	Pregnancy of 34.4 WOG + PROM	C-section	0	8	Improvement
2	F	28	Pregnancy of 37 WOG + DM + GH	C-section	0	6	Improvement
3	F	36	Pregnancy of 40 WOG + DM + hypothyroidism	C-section	0	4	Improvement
4	F	27	Pregnancy of 40.1 WOG + latent labour	C-section	17	35	Improvement
5	F	39	Pregnancy of 39 WOG	C-section	0	3	Improvement
6	F	37	Pregnancy of 30.3 WOG + preeclampsia + postpartum state	C-section	18	33	Improvement
7	M	69	Sacral ulcer	Lavage and debridement of the wound	69	74	Death
8	F	46	Acute complicated appendicitis	Exploratory laparotomy + Open appendectomy	7	13	Improvement
9	F	54	Incarcerated eventration	Exploratory laparotomy + Abdominal plasty	5	5	Death
10	F	64	Abdominal sepsis	Exploratory laparotomy + abdominal cavity irrigation	11	34	Death
			Abdominal sepsis				
11	M	30	Complicated epigastric hernia	Exploratory laparotomy + Abdominal plasty	0	4	Improvement
12	F	59	Perforated gastric ulcer	Exploratory laparotomy + primary closure + patch of epiploon	7	18	Death
13	M	38	Splenic abscess	Exploratory laparotomy + abdominal cavity irrigation	2	64	Improvement
				Exploratory laparotomy + Splenectomy			
14	M	48	Abdominal sepsis	Exploratory laparotomy + abdominal cavity irrigation	5	21	Death
15	F	59	Soft-tissue abscess	Drainage + Soft-tissue debridement	21	26	Death
16	F	23	Entero-atmospheric fistula	Lavage and output control of the fistula	0	20	Death
17	M	68	Incarcerated inguinal hernia	Exploratory laparotomy + left inguinoplasty	34	37	Death
			Prolonged intubation	Open tracheostomy			
18	M	45	Mesenteric thrombosis	Exploratory laparotomy + jejunal resection + anastomosis	0	8	Improvement
19	F	42	Hepatic hematoma + HELLP syndrome + surgical puerperium	Exploratory laparotomy	16	22	Improvement
			Hemothorax (SVC lesion) + abdominal oozing hemorrhage	Right thoracotomy + SVC repair + exploratory laparotomy + packing			
			Hemoperitoneum + packing state	Exploratory laparotomy + packing withdrawal			
20	F	59	Prolonged intubation	Open tracheostomy	24	44	Improvement
21	M	59	Prolonged intubation	Open tracheostomy	39	62	Improvement
22	M	47	Prolonged intubation	Open tracheostomy	52	67	Improvement
23	M	49	Prolonged intubation	Open tracheostomy	30	63	Improvement
24	M	66	Prolonged intubation	Open tracheostomy	32	57	Improvement
25	M	59	Prolonged intubation	Open tracheostomy	29	29	Death
26	M	58	Prolonged intubation	Open tracheostomy	42	48	Death
27	F	62	Prolonged intubation	Open tracheostomy	26	26	Death
28	M	52	Prolonged intubation	Open tracheostomy	34	41	Death
29	M	39	Prolonged intubation	Open tracheostomy	30	34	Death
30	M	23	Prolonged intubation	Open tracheostomy	35	45	Improvement
31	F	65	Prolonged intubation	Open tracheostomy	24	27	Death
32	M	39	Prolonged intubation	Open tracheostomy	33	61	Improvement
33	M	50	Prolonged intubation	Open tracheostomy	22	26	Death
34	F	67	Pulmonary nodule + probable malignant pleural effusion	Endopleural catheter placement	0	23	Improvement
35	M	64	Pleural effusion	Endopleural catheter placement	0	12	Improvement
36	F	42	Prolonged intubation	Open tracheostomy	30	51	Improvement
37	F	77	Prolonged intubation	Open tracheostomy	45	64	Improvement
38	M	24	Hemothorax	Thoracotomy	34	46	Improvement
39	M	61	Prolonged intubation	Open tracheostomy	36	58	Hospitalization
40	M	76	Prolonged intubation	Open tracheostomy	33	36	Death
41	M	59	Prolonged intubation	Open tracheostomy	18	25	Death
42	M	52	Mucormycosis	Wound debridement	2	4	Death

F: Female; M: male; ICU: Intensive Care Unit; DOHS: days of hospital stay; WOG: weeks of gestation; PROM: premature rupture of membranes; DM: diabetes mellitus; GH: gestational hypertension; SVC: superior vena cava.

4. Discussion

Multiple reports have demonstrated a significant increase in morbidity and mortality in patients infected by SARS-CoV-2 undergoing any surgical procedure. Among these, the most relevant study with the highest amount of patients is the one published by COVIDSurg Collaborative [5], that included 1128 patients (835 urgent procedures, 280 elective procedures, and 13 not reported) in 235 hospitals from 24 countries. During the preoperative period infection by SARS-CoV-2 was

found in 26.1% of the patients, with a 30-day mortality rate of 23.8% and pulmonary complications in 51.2% of the patients. They identified several factors for bad prognosis: male gender, age >70 years, an American Society of Anesthesiologists (ASA) score of 3–5, malignant pathology, major surgery, and emergency surgery. Their recommendation was to postpone non-emergency surgery and to promote non-surgical treatments.

Before the publication of this article, Vivek N. Prachand et al. [6] established a scoring system to define the need for surgery of patients



Fig. 1. Computed tomography of Patient No. 22.

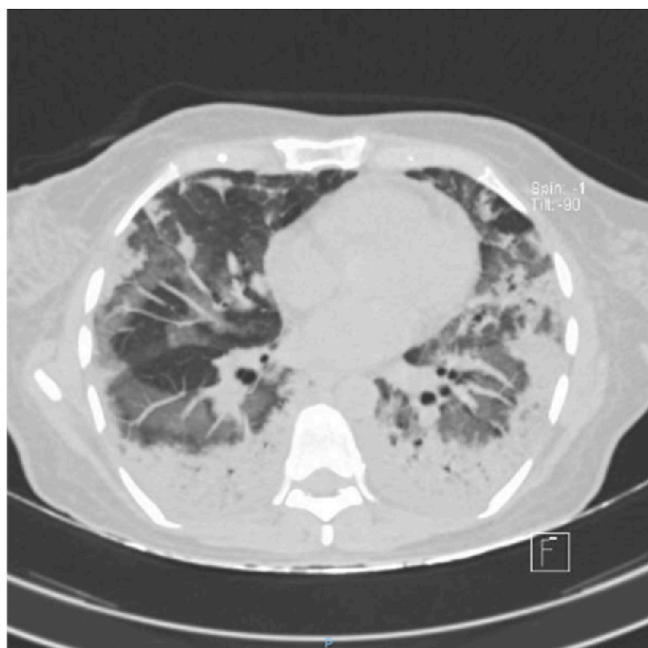


Fig. 2. Computed tomography of Patient No. 22.

during the pandemic, known as Medically Necessary, Time-Sensitive Procedures (MeNTS), in which they considered patient factors, as well as procedure and illness factors. They agree with the COVIDSurg Collaborative [5] recommendation to avoid non-urgent major surgery, prolonged surgical procedures, surgery that requires postsurgical intensive care or multiple days of hospital stay, patients with multiple comorbidities and who can be managed by conservative treatment.

In our sample of suspicious or confirmed cases of COVID-19 undergoing surgery, we identified an overall mortality rate of 42.8%, with a significant difference between treating departments and type of surgical procedure. This can be explained because many of the General Surgery

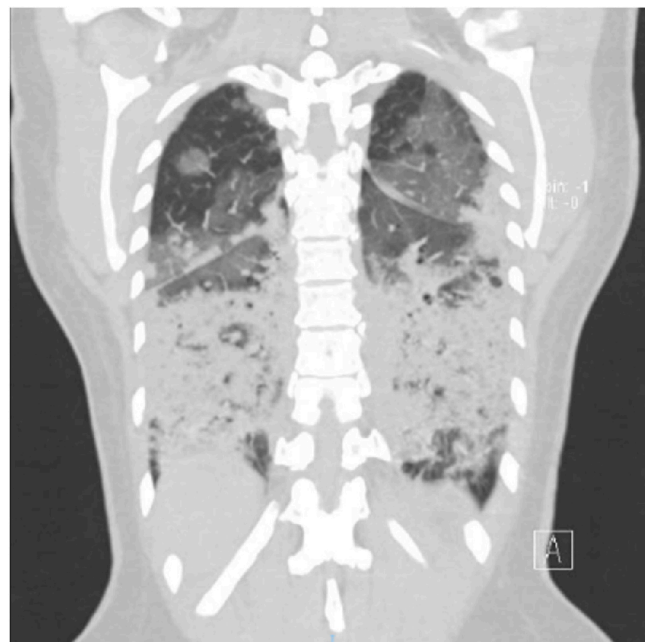


Fig. 3. Plain radiography of preterm neonate of Patient No. 6.



Fig. 4. Plain X-ray of the neonate of patient 6, premature with very ill mother.

patients, in addition to their infectious process by COVID-19, had another complication, like sepsis, which could have complicated their general state and lung function. In the same way, we can say that pregnant patients are healthy and have a physiological condition (pregnancy), besides being female and younger than 40 years, conditions to consider as good prognosis indicators. Finally, patients undergoing an open tracheostomy had solely pulmonary complications, compared to abdominal pathologies related to exploratory laparotomies.

It's already known that early tracheostomy in intubated patients with mechanical ventilatory support is associated with a lower incidence of ventilator-related pneumonia, time on mechanical ventilatory support, sedation time and ICU length of stay [7]. There are multiple clinical guides and published papers about the technique, personal protection equipment and general recommendations for tracheostomy, as it is considered a high risk procedure for infection because of the aerosols it

Table 2

Biomarkers of patients with suspicious or confirmed COVID-19.

Biomarker	Number of cases	Mean value	Standard Deviation	Min. value	Max. value
Ferritin (ng/ml)	40	903	1039	29	4917
D-dimer (ug/L)	40	3911	4049	310	16,548
Total leukocyte count (uL)	42	11,566	6978	200	40,700
Total lymphocyte count (uL)	42	1033	635	90	2800
Lymphocytes (%)	42	11.5	9.04	1.5	38.9
Platelets (uL)	42	314,714	227,309	9000	1,376,000
Lactate dehydrogenase (U/L)	41	405	200	98	912
Fibrinogen (mg/dL)	40	615	209	187	1156
Procalcitonin (ng/ml)	41	1.19	2.04	0.2	9.08

Table 3

Comparison of mortality between treating departments.

Treating Department					<i>P</i> < 0.05
	Death		Improvement		
	Number of cases	%	Number of cases	%	
General Surgery	8	61.5	5	38.5	0.014
Otolaryngology	3	100	0	0	
Obstetrics and Gynecology	0	0	6	100	
Thoracic Surgery	7	36.8	12	63.2	

Table 4

Comparison between surgical procedure and mortality.

Surgical procedure					<i>P</i> < 0.05
	Death		Improvement		
	Number of cases	%	Number of cases	%	
C-section	0	0	6	100	0.03
Debridement	2	100	0	0	
Exploratory Laparotomy	6	54.5	5	45.5	
Pleurostomy	0	0	3	100	
Tracheostomy	10	52.7	9	47.3	

produces [8]. The general recommendation is that surgeons and intensive care personnel must perform it with the technique they are most familiar with; to delay it for at least 10 days on mechanical ventilation; and to evaluate according to clinical evolution and clinical improvement evidence [9,10].

There are multiple systematic reviews and meta-analyses regarding pregnant patients infected with SARS-CoV-2; the largest of them included 324 women, which reported four spontaneous abortions, most resolved by C-section, seven maternal deaths, four intrauterine fetal deaths, and two neonatal deaths. Currently, there is no direct evidence to support vertical transmission of SARS-CoV-2, so the recommendation is to perform additional RT-PCR tests in amniotic fluid, placenta and umbilical cord blood. All three papers concluded that we need more high-quality information to determine the severity and impact of SARS-CoV-2 infection on pregnant patients, as well as to determine vertical transmission, and perinatal and neonatal complications [11–13]. In our case series, 100% of the newborns are alive and were negative for vertical transmission, confirmed by PCR tests and clinical and radiographic findings.

Since the beginning of COVID-19 epidemic in China, investigators have been trying to identify prognostic markers to define the severity of the disease from the beginning of the clinical picture. Many studies, systematic reviews and meta-analyses about laboratory tests have been published for this purpose [14–18]. Practically all of them agree that lymphopenia is one of the cardinal laboratory results at presentation and for prognosis in presence of SARS-CoV-2 infection. Furthermore, they explain the importance of thrombocytopenia, hypoalbuminemia, of the increase in ferritin, D-dimer, procalcitonin, C-reactive protein, troponin I, interleukin 6, and lactate dehydrogenase, among others. Our results show that male gender carries worse prognosis than female gender, and we did not find significant differences in specific biomarkers, age, or even hospital and intensive care lengths of stay.

5. Conclusions

There is no doubt that we face an unknown condition for which we have been learning about its clinical manifestations, laboratory and radiologic tests along the way. Indeed, it has been decided to reduce elective surgical treatment, we have also observed that patients undergoing emergency surgery with suspicion or confirmation of SARS-Cov-2 infection have significant mortality depending on the performed surgical procedure, without relevant findings regarding biomarkers. This sample of cases undergoing surgery at the beginning of the COVID-19 pandemic can provide clues on relevant results that we must consider for future cases.

Ethical approval

No need for ethical approval due to the observational study.

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There were no funding for this research.

Author contribution

Study conception and design: Mariel Gonzalez-Calatayud M.D. Acquisition of data: Benito Vargas-Abrego M.D, Gabriela Gutiérrez. Uvalle M.D, Luis Gabriel González-Pérez M.D, José Alberto Carranco Martínez M.D. Analysis and interpretation of data: Noe. I Grcida-Mancilla M.D, Mariel Gonzalez-Calatayud M.D. Drafting of manuscript: Mariel Gonzalez-Calatayud M.D, Sandra C. López-Romero M.D. Critical revision: Sandra C. López-Romero M.D, Jed Raful-Zacarías-Ezzat M.D

Registration of research studies

- 1 Name of the Registry: Research Registry
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Declaration of competing interest

There is no Conflict of Interest by any of the authors

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2020.10.038>.

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