

# A monocentric retrospective analysis about the effects of COVID-19 pandemic on emergency general surgery consultations

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**Abstract. – OBJECTIVE:** The pandemic effects due to the coronavirus SARS-CoV-2 caused a health emergency. We decided to carry out a study with the aim to investigate the changes in patients' tendencies for admission to the emergency department for surgical diseases, and the related hospitalizations and urgent surgery rates.

**PATIENTS AND METHODS:** We carried out a retrospective, observational study on patients who received emergency general surgery consultation at our University Hospital during the two COVID-19 pandemic periods and on the same dates one year before. The patients' demographic characteristics, their hospitalization in surgical department and the data about those who underwent urgent surgery were retrospectively recorded.

**RESULTS:** In the period March-April 2020 there were 95 surgical visits recorded; among these patients, 25% required hospitalization and 12.63% underwent urgent surgery. In the period November-December 2020-2021 there were 156 surgical consultations, of which 35.26% required hospitalization and 21.15% underwent urgent surgery. In both considered periods we found that the number of surgical consultations decreased compared to the same periods of the previous year. Moreover, we found a higher rate of hospitalization and need for urgent surgery.

**CONCLUSIONS:** We documented a significant reduction in the overall number of surgical consultations and an increase of hospitalization and urgent surgery rates.

*Key Words:*

COVID-19, Pandemics, General surgery, Emergency department.

## Introduction

The novel coronavirus SARS-CoV-2 was originally identified in the Hubei Province of Wuhan,

China, in December 2019. It has caused a series of atypical and sometimes severe respiratory diseases. In Italy, the first two cases were confirmed on January 30, 2020, when two tourists from China tested positive for the SARS-CoV-2 virus in Rome. An outbreak of infections was subsequently detected on February 21, 2020, starting from 16 confirmed cases in Codogno, in Lombardy<sup>1</sup>.

The disease SARS-CoV-2 was then renamed as COVID-19, and the World Health Organization (WHO) officially declared it a pandemic on March 11, 2020<sup>2</sup>. Several lockdown restrictions were imposed by the Italian Government with the purpose of preventing a healthcare system overload and limiting the viral transmission<sup>3</sup>. At the beginning of March, face-to-face teaching was suspended throughout the country for schools of all grades and universities. Then, the ban on travel, the suspension of sporting activities, demonstrations and events, the closure of museums, cultural sites and sports centres were enacted. Further restrictive measures came into force on March 11, which established the suspension of common retail commercial activities, catering services, religious celebrations, and prohibited gatherings of people in public places or open to the public.

On 17 May 2020, Italy entered the "second phase" of its lockdown, when the Prime Minister and the Minister of Health signed the new ordinance for the reopening of most activities and allowed freedom to travel. In the early October 2020, the epidemiological indicators (new cases, number of critical cases and new deaths) increased again. A new ordinance (18 October 2020) was signed, with the restoration of containment measures; this date marked the official begin of the "second wave" and the second lockdown period.

The pandemic effects due to the new SARS-CoV-2 caused a health emergency, which was re-

sponded with a series of urgent measures. The exponential afflux of patients in need of sub-intensive or intensive care represented a crisis of unprecedented magnitude. While the population continued to be affected by all the others and pre-existing diseases, hospitals were swamped with a massive number of COVID-19 patients. A series of decrees were issued and approved, committing the Regions and the autonomous provinces to draw up operational programs, aimed at strengthening the hospital wards of intensive care and at addressing the epidemiological crisis. The Abruzzo Region, with the Ordinance No. 3 of March 9, 2020, suspended all outpatient and non-emergent surgical activities until further notice, to have all resources readily available for COVID-19 patient care.

Among scheduled activities, only oncological surgery was guaranteed. The lockdown restrictions paired with the widespread hospital fear experienced by most patients, contributed to discourage access to emergency departments all over the country, especially for those conditions perceived as minor. In fact, a decrease in the number of acute non-COVID-19-related emergency hospital presentations was noted in various publications<sup>4,5</sup>.

The purpose of our study was to investigate whether and how access to the emergency department (ED) for hypothetical surgical disease, their related hospitalizations and urgent surgical activities were affected by the COVID-19 outbreak during the two periods of national lockdown.

This study was conducted in a level 2 Accident and Emergency Department of a University Hospital in L'Aquila, Italy, which was purposed as a 'COVID-19 hospital' during the pandemic periods.

## Patients and Methods

We carried out a retrospective, observational study on patients who received emergency general surgery consultation the ED at our University Hospital during the two COVID-19 pandemic periods and on the same dates one year before. Patients were identified by using our Health Information System SISWeb. All patients for whom surgical consultation had been required by ED in the periods March-April 2020, March-April 2019, November-December-January 2020/2021 and November-December-January 2019/2020 were included.

We chose the start of the vaccination campaign as the end of the second period, because the immunization of the healthcare personnel could be considered a bias in the analysis of our work.

Patients were divided into four groups. Group 1A included patients who had been seen one year before the first pandemic happened, in the period March-April 2019; Group 1B included patients who had been seen in the period March-April 2020 (first pandemic period); Group 2A included patients who had been seen in the period November-December-January 2019/2020. Group 2B included patients who had been seen in the period November-December-January 2020/2021 (second pandemic period).

All patients were firstly evaluated by Emergency Clinicians in the ED, then routine blood exams and imaging exams were required. We included in our study all the patients who received emergency general surgery consultation after that preliminary screening. Surgeons, on the basis of the exams and clinical examination, then evaluated whether require more diagnostic investigations, indicate the hospitalization or indicate the emergency surgery.

The patients' demographic characteristics, their hospitalization in surgical department and the data about those who underwent urgent surgery were retrospectively recorded for each group. The surgical diagnoses were grouped into classes. Differences between the groups were investigated.

## Statistical Analysis

The characteristics of the sample were summarized using descriptive statistics. Frequencies and percentages were used to describe categorical variables and mean values with standard deviations ( $\pm$ SDs) for continuous variables. Data for the periods March-April 2020 (Group 1B) and November-January 2020/2021 (Group 2B) were compared to the same period in 2019 (Group 1A) and 2019/2020 (Group 2A), respectively. Another comparison was made between the first (March-April 2020) and second wave (November-January 2020/2021) of COVID-19 epidemics. Chi-squared or Fisher's exact test, as appropriate, were used to compare categorical variables and the Student's *t*-test was used to analyze differences between continuous variables.  $p < 0.05$  was the criterion for statistical significance. Data analysis was performed using STATA/IC 15.1 (StataCorp., LLC, College Station, TX, USA).

## Results

A total of 729 patients were identified for this study. The mean age was 56.5 years, and 43.9% were female patients.

There were 171 patients included in the Group 1A (mean age 54.50 years, 45.18% female) and 95 patients in the Group 1B (mean age 56.02 years, 32.63% female).

There were 307 patients included in the Group 2A (mean age 53.44 years, 47.84% female) and 156 patients in the Group 2B (mean age 61.13 years, 45.16% female). Overall findings are summarized in Tables I and II. Statistically significant differences in the recorded patient demographics (age and sex) were found in gender between Groups 1A and 1B ( $p$ -value=0.047), and in mean ages between Groups 2A and 2B ( $p$ -value<0.001).

In terms of total surgical emergency room consultations, in the first period (March-April 2020) there had been 95 recorded visits, while during the same period of the previous year there had been 171 recorded visits. Among patients within the Group 1B, 25.26% required hospitalization and 12.63% underwent urgent surgery, but these data were not statistically different compared to that of the Group 1A the previous year (18.71% and 9.94% respectively) (Table I). The diagnoses of patients who underwent surgery are also shown in Table I. When all types of diagnosis were considered, there was no significant difference between the two groups ( $p$ =0.231) in terms of frequency distribution among classes.

In the second period (November-December-January 2020/2021) there were 156 surgical emergency room consultations, while during the same period of the previous year there had been 307 visits recorded. Among patients of the Group 2B, 35.26% required

hospitalization and 21.15% underwent urgent surgery, and the differences were both statistically significant compared to data from the Group 2A the previous year (16.94% and 9.77%, respectively) (Table II). The diagnoses of patients who underwent urgent surgery are also shown in Table II. When all types of diagnoses were considered, the difference was significant between the two groups ( $p$ =0.030) in terms of frequency distribution among classes.

Moreover, we compared the first (March-April 2020) and second wave (November-December-January 2020/2021) of COVID-19 pandemic. There were no significant differences in terms of hospitalization nor urgent surgery rates, while among diagnoses a significant difference was reported. The comparison between the periods is reported in Table III.

## Discussion

The COVID-19 pandemic had a great economic, social and health impact worldwide<sup>6-8</sup>. In the field of surgery, it forced substantial changes: specific guidelines have been published by the major national companies to manage surgical activities, either under elective or under emergency conditions, and to define the precautions that should have been taken<sup>9-13</sup>.

The rescheduling of hospital activities was primarily due to the need to allocate staff, beds, and spaces to the management of COVID-19 areas.

**Table I.** Comparison between the period March/April 2020 (Group 1A) and the same period in 2019 (Group 1B).

	Total n=266	Group 1A n (%) 171 (64.29)	Group 1B n (%) 95 (35.71)	$p$ -value
<b>Sex, n (%)</b>				<b>0.047*</b>
Male	155 (59.39)	91 (54.82)	64 (67.37)	
Female	106 (40.61)	75 (45.18)	31 (32.63)	
Age (years), mean±SD	55.05 ± 22.83	54.50 ± 23.29	56.02 ± 22.08	0.604**
<b>Hospitalization, n (%)</b>				0.209*
No	210 (78.95)	139 (81.29)	71 (74.74)	
Yes	56 (21.05)	32 (18.71)	24 (25.26)	
<b>Surgery, n (%)</b>				0.500*
No	237 (89.10)	154 (90.06)	83 (87.37)	
Yes	29 (10.90)	17 (9.94)	12 (12.63)	
<b>Diagnoses, n (%)</b>				0.231***
Appendicitis	11 (37.93)	6 (35.29)	5 (41.67)	
Bowel obstruction	4 (13.79)	4 (23.53)	0 (0.00)	
Others	14 (48.28)	7 (41.18)	7 (58.33)	

\* $\chi^2$  test; \*\*Student's  $t$ -test; \*\*\*Fisher's exact test.

**Table II.** Comparison between the period November-January 2020/2021 (Group 2A) and the same period in 2019/2020 (Group 2B).

	<b>Total n=463</b>	<b>Group 1A 307 (66.31)</b>	<b>Group 1B n (%) 156 (33.69)</b>	<b>p-value</b>
<b>Sex, n (%)</b>				0.587*
Male	242 (53.07)	157 (52.16)	85 (54.84)	
Female	214 (46.93)	144 (47.84)	70 (45.16)	
<b>Age (years), mean±SD</b>	56.03 ± 22.31	53.44 ± 22.67	61.13 ± 20.74	<b>&lt;0.001**</b>
<b>Hospitalization, n (%)</b>				<b>&lt;0.001*</b>
No	356 (76.89)	255 (83.06)	101 (64.74)	
Yes	107 (23.11)	52 (16.94)	55 (35.26)	
<b>Surgery, n (%)</b>				<b>0.001*</b>
No	400 (86.39)	277 (90.23)	123 (78.85)	
Yes	63 (13.61)	30 (9.77)	33 (21.15)	
<b>Diagnoses, n (%)</b>				<b>0.030***</b>
Appendicitis	12 (19.05)	9 (30.00)	3 (9.09)	
Bowel obstruction	9 (14.29)	6 (20.00)	3 (9.09)	
Others	42 (66.67)	15 (50.00)	27 (81.82)	

\* $\chi^2$  test; \*\*Student's *t*-test; \*\*\*Fisher's exact test

**Table III.** Comparison between the first (March-April 2020, Group 1B) and second wave (November-January 2020/2021, Group 2B) of COVID-19 epidemic.

	<b>Total n=463</b>	<b>Group 1A 307 (66.31)</b>	<b>Group 1B n (%) 156 (33.69)</b>	<b>p-value</b>
<b>Sex, n (%)</b>				0.050*
Male	149 (59.60)	64 (67.37)	85 (54.84)	
Female	101 (59.60)	31 (32.63)	70 (45.16)	
<b>Age (years), mean±SD</b>	59.20 ± 21.36	56.02 ± 22.08	61.13 ± 20.74	0.066**
<b>Hospitalization, n (%)</b>				0.098*
No	172 (68.53)	71 (74.74)	101 (64.74)	
Yes	79 (31.47)	24 (25.26)	55 (35.26)	
<b>Surgery, n (%)</b>				0.088*
No	206 (82.07)	83 (87.37)	123 (78.85)	
Yes	45 (17.93)	12 (12.63)	33 (21.15)	
<b>Diagnoses, n (%)</b>				<b>0.048***</b>
Appendicitis	8 (17.78)	5 (41.67)	3 (9.09)	
Bowel obstruction	3 (6.67)	0 (0.00)	3 (9.09)	
Others	34 (75.56)	7 (58.33)	27 (81.82)	

\* $\chi^2$  test; \*\*Student's *t*-test; \*\*\*Fisher's exact test

Moreover, the reduction of the surgical activities was also linked to the low propensity of the population to frequent places at risk, especially hospitals.

Based on these findings, we decided to carry out a study with the aim to investigate the changes in patients' tendencies for admission to the emergency department for surgical diseases, and the

related hospitalizations and urgent surgery rates.

In both considered periods (corresponding to the first and second lockdown), we found that in our hospital the number of consultations for general surgery for patients who had been admitted to the ED decreased compared to the same periods of the previous year, as expected.



In particular, the surgical consultations requested during the lockdown periods were about half of those requested in the same periods of the previous year (251 vs. 478). It is conceivable that patients may have been afraid of getting COVID-19 and the number of admissions to the ED decreased. In association with this reduction in surgical consultations, we found, however, a higher rate of hospitalization and need for urgent surgery. This data was evident in both periods, although it was statistically significant only in the months of November-December-January. In fact, in the first examined period (March-April), although fewer patients were admitted to the surgical ED, the difference in hospitalization and surgery rates was not significant compared to the previous year (non-COVID-19 period). These results confirmed the findings of the study of Tarim et al<sup>14</sup>, in which they analyzed emergency general surgery consultations in tertiary hospital in Samsun, Turkey, during the first COVID-19 pandemic period (between March 15, 2020, and May 15, 2020).

In the second examined period, the hospitalization and surgery rates were significantly higher than those of the previous year. In these months, in fact, we recorded a hospitalization rate of 35% (almost 4 patients out of 10) and an urgent surgery rate of over 20%. These values are approximately doubled compared to those of the previous year (17% of hospitalizations and 10% of interventions). We could, therefore, assume that the pathologies were more serious or that the symptoms were more relevant, so as to justify hospitalization in a surgical setting.

These data could have a series of possible interpretations. It is clear that when people had real intractable pain, they went to the emergency department irrespective of the pandemic, as expected, and it is also clear that some of the patients admitted to the emergency department before the pandemic showed not real emergencies<sup>14</sup>.

Moreover, to explain the difference between the first and the second considered period, it is hypothesized that the data collected during the second lockdown were the result of months that cannot be considered “normal”, in which the behaviour of people was prudent, anyway. They tried to avoid hospitals and possible COVID-19 exposure, leading to an aggravation of some pathologies and to a delay in presenting to the ED. Consequently, when they were forced to have a medical examination, the disease had worsened in terms of symptoms intensity or in terms of episodes of relapse, requiring hospitalization or urgent surgery. During the first

lockdown, the pathologies had not enough worsened, because in the previous months the health situation was completely normal and functional. In addition, the city of L’Aquila suffered more during the second pandemic wave (less than 300 cases until April 2020 and more than 8,000 cases between November 2020 and January 2021), and this could have affected people’s behaviour regarding going to the hospital<sup>15</sup>.

Our results highlighted the need to educate patients to present to ED also during periods of crisis, avoiding postponing or neglecting the problem, as this leads to a worsening of the symptoms. In this perspective, the improvement of differentiated pathways within the ED, in which patients of surgical interest are early identified and directed towards “protected” paths, could also be possible. This could in part reduce patients’ fear about getting to hospital in a pandemic period.

The diagnoses among the patients who had had consultations for general surgery were similar in the first period, while in the second period the difference was significative. In particular, in November-December-January, 30% of appendectomies in 2019 vs. 9% during the lockdown months and 20% of bowel obstructions in 2019 vs. 9% during the lockdown months were recorded. We have to consider that reference is made only to operative diagnosis. Moreover, groups of the most frequent pathologies (appendicitis, intestinal obstruction, etc.) have been highlighted, while other conditions are included in the “other” group.

Both appendicitis and bowel occlusion are conditions that in some cases can be treated conservatively and may not require urgent surgery<sup>16-18</sup>. In these borderline cases, the approach of the medical staff may have preferably been conservative whenever the clinical conditions made it possible, to reduce COVID-19 exposure and to reduce the commitment of operating theatres in the critical period. From this point of view, it could be assumed that during the second COVID-19 lockdown the surgically treated pathologies were those included in the “other” group (82%), i.e., perforations, abscesses or other conditions for which the conservative approach is neither justified nor contemplated by the guidelines<sup>19</sup>.

Our study has some limitations, mainly because it is a retrospective single-centre analysis. Although we reported a reduction in surgical consultations and increased rates of hospitalization and urgent surgery, we can only hypothesize factors determining these data, but other variables may have played a role during pandemic periods.

## Conclusions

We documented a significant reduction in the overall number of surgical ED consultations and an increase in hospitalizations and urgent surgery rates, in particular in the second pandemic period.

We could hypothesize that the pathologies were more serious or the symptoms more relevant, so as to justify hospitalization in a surgical setting. This could be explained by people's tendency to avoid hospitals and possible COVID-19 exposure, leading to an aggravation of some pathologies and to a delay in presenting to the ED. However, many other variables may have played a role during pandemic period to justify the reported data.

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### Authors' Contributions

Lucia Romano and Antonio Giuliani drafted manuscript. Fabiana Fiasca and Antonella Mattei analyzed and interpreted data. Andrea Nervini and Vincenzo Vicentini acquired the data. Mario Schietroma and Francesco Carlei provided study conception and design. All authors read and approved the final version of the manuscript.

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### Conflicts of Interest

The authors declare no conflicts of interest.

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### Ethics Statement

The study has been performed in accordance with the ethical standards of the Declaration of Helsinki.

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### Informed Consent

Informed consent was obtained from all individual participants included in the study.

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