

Dramatic decrease of surgical emergencies during coronavirus disease 2019 outbreak

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BACKGROUND:	During the coronavirus disease 2019 (COVID-19) outbreak, a general decrease in surgical activity was observed. There is perception that this phenomenon has involved also surgical emergency, but no extensive data have been presented to date. The aim of this study was to analyze the real number of admissions and procedures for emergency surgical disease during COVID-19 pandemic.
METHODS:	This is a multicenter study including 18 general surgery units performing emergency surgery in hospitals of the “Red Zone” in Lombardy. Data about admissions from emergency department and surgical emergency procedures performed during March 2019 and March 2020 were collected in an online database. Additional data were collected according to the different indications for surgical treatment. The primary outcomes were the overall rate of admissions for emergent surgical disease and the overall rate of emergency surgical procedures in the study periods. The secondary outcome was the overall surgical rates (among all the diagnosed surgical diseases).
RESULTS:	Emergency surgical admissions and surgical operations significantly decreased with a fall in value of 45% ($p < 0.001$) and 41% ($p = 0.001$), respectively. This reduction was confirmed by the analysis according to different surgical indications, with the exceptions of admissions and operations for gastrointestinal bleeding and operations for abdominal trauma. The overall ratio between surgical procedures and diseases was not significantly different (54% vs. 63%; $p = 0.619$). This ratio was significantly different only for bowel obstruction and for gastrointestinal perforation.
CONCLUSIONS:	It seems correct to consider “true” the dramatic decrease of surgical problems during COVID-19 outbreak, despite any therapeutic strategies and logistic difficulties. (<i>J Trauma Acute Care Surg.</i> 2020;00: 00–00. Copyright © 2020 Wolters Kluwer Health, Inc. All rights reserved.)
LEVEL OF EVIDENCE:	Retrospective comparative study without negative criteria, level III.
KEY WORDS:	COVID-19 outbreak; emergency department; surgical emergencies.

Coronavirus disease 2019 (COVID-19) pandemic caused by the severe acute respiratory syndrome coronavirus 2 is currently changing the health, social, and economic world landscape.^{1–3}

Italy was the first European country that suffered a strong impact, in particular in two Northern regions, Lombardy and Veneto. On March 8, 2020, the government decided to extend quarantine measures to all of Lombardy, strict restrictions of people’s movements, and the temporary closure of schools, shops, and industrial activities.⁴

On March 31, 2020, the number of deaths reached 11,591 with 101,739 positive cases in Italy, and 7,199 deaths and 44,585 positive cases in Lombardy, corresponding to 62.1% and 43.8%

of the total number of deaths and positive cases of Italy.^{5,6} Because of a day-by-day increasing number of affected subjects, a reorganization and dynamic distribution of national and regional health care resources were necessary to define algorithms for the management of patients requiring nonelective surgical procedures. In fact, the massive overload of patients with respiratory symptoms needed a reshaping of emergency departments (EDs), intensive care units (ICUs), and medical wards to improve hospital capacity and increase ICUs and COVID-19 dedicated beds.^{7,8}

In every ED, specific pathways for suspected or confirmed COVID-19 patients have been set up. Consequently, personnel health training, application of infection control measures, and mandatory limitations of surgical activities were implemented. In Lombardy, the purpose of redistribution was to create COVID-free hospitals with dedicated pathways to treat tumors and major traumas.⁹ Consistently, several national surgical scientific societies and regional health organizations tried to develop protocols and recommendations based on common sense for surgical practice.^{10–14} Unexpectedly, during the COVID-19 outbreak, also a general decrease in surgical emergency procedures was observed, and some opinions were advanced about this perception.^{15,16} Nevertheless, no extensive data have been presented to date.

The aim of the present multicenter study, based on the experience of 18 centers of the “Red Zone” in Lombardy, was to analyze

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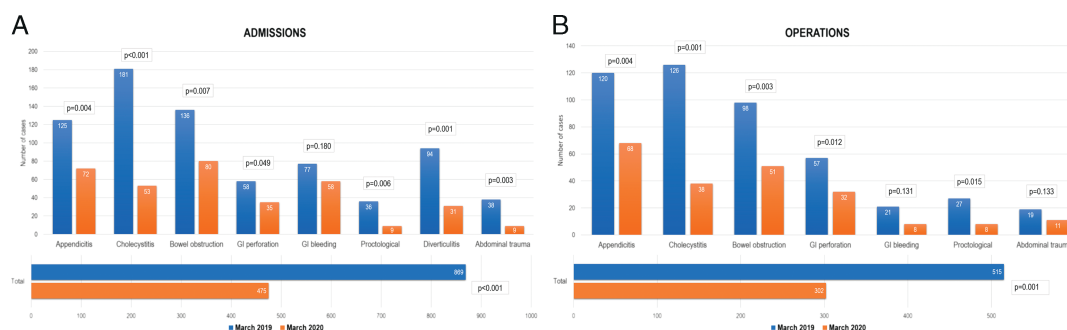


Figure 2. Bar graphs for emergency surgery volume of the 18 study centers in March 2020 (compared with March 2019) according to the different surgical diagnoses. A, Admissions. B, Operations.

The overall ratio between surgical procedures and diseases was not significantly different in the two observation months (54% in March 2020 vs. 63% in March 2019; $p = 0.619$). This ratio was significantly different only for bowel obstruction (with a median increase of 30%) and for GI perforation (with a median decrease of 46%) (Table 3).

DISCUSSION

Since the first Italian case of a patient tested positive for severe acute respiratory syndrome coronavirus 2 has been reported (February 21, 2020), the Lombardy region had the highest burdens in Italy.¹⁸ Last March, the public health care system and governmental offices deployed containment measures to all Italian regions to limit COVID-19 spread with a progressive and dramatic impact on hospitals and health care resources.¹⁹

This challenging necessity to redesign hospital services and to shift medical personnel in the ED and medical wards dedicated to COVID-19 patients implied a stringent reduction of elective surgical activities and an organization of hub centers for tumors and major trauma.^{20,21} Nonetheless, since the beginning of the outbreak, an unexpected decrease in surgical emergencies and admissions for surgical disease to ED was commonly perceived among surgeons working in the Red Zones.

This multicenter study, collecting data related to March 2019 and March 2020 from 18 Lombardy centers, confirms the efficacy of solutions in reducing elective surgical activity (up to 95% for nononcologic and 46% for oncologic diseases; Table 1) and demonstrates the overall decreasing in the demand for surgical care in ED during the COVID-19 outbreak: a fall in the value of more than 40% for ED admissions and emergency surgical procedures (45% and 41%, respectively; Table 2) was calculated

TABLE 3. Surgical Rates Among All the Emergency Surgical Diseases Diagnosed in March 2020 (Compared With March 2019)

Center ID	% Surgical Procedures/Diagnoses															
	Appendicitis		Cholecystitis		Bowel Obstruction		Bowel Perforation		GI Bleeding		Proctologic Disease		Abdominal Trauma		Total	
	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020	March 2019	March 2020
1	0.88	0.80	0.23	0.50	0.89	0.80	1.00	0.80	0.00	0.00	—	—	0.60	0.00	0.36	0.37
2	0.91	1.00	0.71	1.00	1.00	1.00	1.00	0.67	0.00	0.25	1.00	—	0.50	1.00	0.40	0.54
3	0.90	1.00	0.64	0.00	0.78	1.00	0.88	0.25	0.89	0.50	1.00	0.00	0.57	0.50	1.33	0.58
4	1.00	—	0.33	0.00	0.50	—	0.67	—	0.00	0.00	0.50	—	—	—	0.37	1.67
5	0.90	0.50	0.89	0.40	0.50	0.50	1.00	0.57	0.00	0.50	—	—	1.00	2.67	0.90	0.96
6	1.00	1.00	0.13	0.86	0.67	1.00	1.00	0.70	1.00	0.00	0.00	—	0.25	—	0.71	0.90
7	1.00	1.00	1.00	1.40	1.00	1.00	1.00	1.33	0.00	0.00	1.00	1.00	0.75	—	0.58	0.80
8	1.00	1.00	0.80	0.60	0.33	1.00	1.00	0.00	0.14	0.00	1.00	—	0.50	—	0.31	0.47
9	1.00	1.00	0.90	1.00	0.00	1.00	—	0.50	—	0.20	—	0.00	—	—	0.56	0.31
10	1.00	1.00	0.80	0.83	0.80	0.50	1.00	—	0.00	0.00	1.00	1.00	0.00	—	1.50	—
11	0.75	0.67	0.86	—	0.67	0.67	—	0.50	1.00	—	—	—	0.50	—	0.69	0.55
12	1.22	1.00	1.14	0.33	1.00	1.00	1.00	0.50	0.10	0.00	0.00	—	0.50	—	0.67	0.48
13	1.00	1.00	0.40	0.20	0.69	1.00	1.00	1.00	0.67	1.00	1.00	—	0.67	—	0.61	0.42
14	1.00	1.00	1.00	—	0.71	1.00	1.00	1.00	0.33	0.00	1.00	0.50	—	1.00	0.93	0.94
15	1.00	1.00	0.25	1.00	1.00	1.00	1.50	0.43	1.00	—	0.20	—	—	—	0.25	0.50
16	1.00	1.00	1.50	2.00	0.67	1.00	—	0.60	—	0.00	2.00	1.00	0.00	—	0.78	1.05
17	0.67	1.00	1.00	1.00	0.33	1.00	1.00	0.50	0.13	0.33	0.00	—	—	—	0.38	0.50
18	1.00	1.00	0.42	1.00	1.00	1.00	1.00	0.50	0.25	0.00	0.60	—	0.00	—	0.72	0.35
Median	1.00	1.00	0.80	0.86	0.70	1.00	1.00	0.54	0.13	0.00	1.00	0.50	0.50	1.00	0.63	0.54
	$p = 0.866$		$p = 0.594$		$p = 0.011$		$p = 0.009$		$p = 0.646$		$p = 0.102$		$p = 0.715$		$p = 0.619$	

for March 2020, compared with March 2019. Particularly, a statistically significant reduction involved all the surgical diseases counting a drop at least 40% (Fig. 2; Supplemental Digital Content, Supplementary Table, <http://links.lww.com/TA/B797>), with the exceptions of admissions and operations for GI bleeding and operations for abdominal trauma. Even the cases of GI perforation decreased, but not in a statistically relevant way (58 admissions in March 2019 vs. 35 in March 2020; $p = 0.049$). However, unlike the hospital reorganization imposed by the region, in some centers, there was no expected reduction in oncologic surgical operations (Table 1); just as in others, emergency surgical admissions and procedures could appear slightly different (i.e., abdominal trauma in the center 5; Supplemental Digital Content, Supplementary Table, <http://links.lww.com/TA/B797>).

Nevertheless, this evident lowering of impact on emergency services by surgical diseases needs to be explained. The lockdown measures adopted in Italy and in particular in Lombardy, to flatten the contagion curve of the COVID-19, have undoubtedly forced people to stay at home and to use emergency services only if strictly indispensable for serious reasons. On the other hand, most likely, patients were reluctant to reach the ED to avoid being infected. Similarly, common sense and literature suggestions induced surgeons to modulate surgical timing in case of non-life-threatening conditions and to stress for at-home management of mild-moderate patterns of disease.^{22–25} Hence, the results of this study confirm that regional rules and people and surgeons' attitudes negatively affected the number of hospital admissions. What is more, it is not possible to exclude (and to measure) the intriguing phenomenon for which changes in lifestyle during confinement, with particular regard to diet (i.e., low-fat, less convenience food), hygiene (i.e., handwashing and personal hygiene, environmental sanitation), and habits (i.e., less stressing activities), may have contributed to lower the incidence of some surgical diseases. Finally, it cannot be excluded that COVID-19 itself with specific effects on GI tract may have affected incidence of surgical diseases and/or altered their clinical presentation.

In this context, as expected, two results did not seem so consistent and have to be clarified: the statistical decrease of cases of GI perforation and bleeding was only slightly or not significant.

About the first category, it is really surprising even to detect any lowering trend (confirmed by its operations rates), but it could be interesting to discuss it along with the very significant reduction of admissions for diverticulitis (>65%; Fig. 2; Supplemental Digital Content, Supplementary Table, <http://links.lww.com/TA/B797>). The decrease of complicated diverticular diseases can recognize all the aforementioned causes, but an additional factor, strongly related to GI perforation, might have influenced this figure. The initial warnings about the possible role of non-steroidal anti-inflammatory drugs and corticosteroids in worsening the severity of COVID-19^{26,27} and, consequently, their minor use may partially explain the decreased incidence of diverticulitis and GI perforation (for demonstrated cause-effect relationships).²⁸

Similarly, the decreasing rates of diverticulitis may have implied a reduction of the cases of closed perforation of the colon, included in the multifaceted definition of GI perforation.

With specific regard to GI bleeding (and its nonsignificant fall in value), its clinical presentation generally induces patients to ED, independently from any restriction. Moreover, despite the reduced probability of drug-induced gastric injuries, the diffusion of low molecular weight heparin used at an anticoagulant dose in the treatment of COVID-19 may have affected this result.^{29,30}

Once adjusted for the number of emergency admissions, this analysis confirmed the more immediate perception about the dramatic decrease of emergency surgical procedures. In particular, it tried to measure the conservative approach of surgeons by calculating the ratio between surgical procedures and diseases in March 2020 compared with March 2019 (Table 3). The overall ratio was not significantly different in the two observation months (54% vs. 63%; $p = 0.619$): this general result was not consistent with more conservative management of surgical diseases. However, the disease-specific analysis provided conflicting data: this ratio was significantly increased for bowel obstruction (about 30%) and decreased for GI perforation (about 45%) (Table 3).

Literature specifically addressed to the COVID-19 pandemic underlined that indications for emergency surgery must be considered to be the same as before, although a more conservative approach for some diseases could be reasonable to avoid hospital resources overload.^{22,31} Furthermore, in the case of deferrable treatment, delays due to the achievement of swab test finding and to patients' hospitalization may contribute to exceeding the optimal timing for surgery. Again, in this situation, the concerns about the use of laparoscopy related to the potential risk of viral dissemination with the pneumoperitoneum more often induce a conservative approach without the drawbacks of an open surgery.^{24,32–34}

With these assumptions, the more aggressive attitude of surgeons toward bowel obstruction observed in this study could be justified from more severe clinical presentations (likely related to a late referral to ED). Contrarily, it seems paradoxical to attribute the reduction of procedures for GI perforation to conservative management by surgeons. More probably, this is a result even due to the aforementioned multifaceted definition of GI perforation.

To provide an accurate interpretation of the results of this study, it seems correct to consider "true" the dramatic decrease of surgical problems during COVID-19 outbreak, despite any therapeutic strategies and logistic difficulties. Other reports have supposed a general decrease in non-COVID emergency activities,^{15,16,35–37} but this is the first multicenter study conducted in a high-incidence country evaluating this suggestive aspect of COVID-19 pandemic.

However, this study has several limitations. First of all, data about COVID-19 status of patients have not been reported, and its consequences in terms of incidence, clinical presentation, and management of surgical diseases have not been evaluated. Second, there were no data about the outcome of operated patients. Similarly, it remains unknown what happened next, if untreated or undertreated, diseases may break out or a higher number of complications may be registered during the subsequent months. This can be an interesting starting point for further studies analyzing follow-up. Third, it was not always easy to discriminate the patients admitted to ED vs. those transferred from another hospital and then underwent surgery: therefore, in some calculations,

the operated patients resulted to be more than the admitted ones. Finally, no comparison was made with other areas affected by the COVID-19 outbreak.

In conclusion, the study aimed to confirm the dramatic decrease in surgical emergencies during this unusual period and looking for its reason. Now, it offers some simple tools to understand this particular, nonsecondary, epidemiologic aspect of this pandemic. After follow-up data collection, it will probably help to think over nonsurgical alternative treatment of certain emergencies and face the near future.

AUTHORSHIP

S.R. contributed in the study design, data analysis, data interpretation, and writing. F. Ferrara contributed in the study design, data collection, literature search, and writing. T.Z. contributed in the data collection, literature search, data interpretation, and writing. F. Frattini contributed in the data interpretation and writing. O.C. contributed in the study design and critical revision. A.P. contributed in the study design, data interpretation, and critical revision. G.S. contributed in the study design and critical revision.

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DISCLOSURE

The authors declare no conflicts of interest.

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