

CoVID-19 Pandemic consequences on emergency surgery: an observational case-control study from an Italian tertiary referral hospital

Giovanni Pirozzolo

Dell'Angelo Hospital

Quoc Riccardo Bao

University of Padova

Livio Baiano

Dell'Angelo Hospital

Lucrezia D'Alimonte

Dell'Angelo Hospital

Chiara Vignotto (✉ chiara.vignotto.cv@gmail.com)

University of Padova

Alfredo Piangerelli

University of Padova

Claudia Peluso

University of Padova

Fabrizio Giuseppe Maria Cimino

Dell'Angelo Hospital

Guido Meneghetti

Dell'Angelo Hospital

Alberto Grassetto

Dell'Angelo Hospital

Maurizio Rizzo

Dell'Angelo Hospital

Marco Scarpa

University of Padova

Alfonso Giovanni Recordare

Dell'Angelo Hospital

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Abstract

Background

In 2020, on March the 9th, the Italian Prime Minister announced the lockdown, which was officially closed on May the 4th. This extraordinary measure was necessary to contain the CoVID-19 pandemic spread in Italy. During this phase, a significant decrease of patient's access to Emergency Department (ED) was observed. Delayed access to treatment may have led to a delay in the diagnosis of acute conditions also in the surgical field, as already documented in other areas, with consequences on surgical outcome and survival.

Aim of this study is to provide a detailed description of abdominal urgent-emergent conditions surgically treated and surgical outcomes during the lockdown in a tertiary referral Italian hospital, compared with historical data.

Methods

A retrospective review of urgent-emergent patients surgically treated in our department was conducted in order to compare patients' characteristics and surgical outcomes during the period March 9th - May 4th 2020 with the same period of the previous year.

Results

152 patients were included in our study, 79 patients in 2020 group and 77 patients in 2019. We found no significant differences between the groups about ASA score, age, gender and disease prevalence. Significant differences were found about symptoms duration before ER access and abdominal pain as main symptom in non-traumatic conditions. We also performed a sub-analysis on peritonitis which showed significant differences in: hospital length of stay, presence of colostomy vs ileostomy and fatal events in 2020. No differences were found in the use of laparoscopy.

Conclusions

While the overall number of ER accesses has decreased in 2020 group, the number of patients surgically treated in emergency-urgency conditions has not decreased. However, those patients waited significantly more before the hospital access. This diagnostic delay was associated to a more severe clinical condition and a consequent significantly worse prognosis.

Background

In 2020, on March the 9th, Italian Prime Minister announced the lockdown, which was officially closed on May the 4th. This extraordinary measure was necessary to contain the CoVID-19 pandemic spread in Italy (1, 2). Healthcare systems were deeply reorganized, in order to both hold the burden of the pandemic and

guarantee the essential health services, with direct consequences on the organisation of surgical activity (3, 4).

During this phase, patients access to Emergency Department (ED) dramatically decreased, as already documented during the Taiwan SARS Epidemic in 2003 (5–8). This population's behaviour, strongly motivated by the common perception of Hospitals as hotspots for infection, could have led to severe consequences. For example, the Italian Pediatric Hospital Research Network, reported a small series of 12 cases of delayed access in severe conditions resulting from fear of COVID-19 infection (9), and similarly a dramatic increase of the rate of out-of-hospital cardiac arrest was reported (10). Moreover, data from ISTAT (Statistical Italian Institute) revealed an increased overall mortality in the period between 20 February and 31 March 2020, if compared with the average of the previous years (11).

As well as cardiologic emergencies, emergency surgery outcomes could have been significantly affected by diagnostic delay due to the lockdown (12–14). In fact, a survey from ACOI network showed a significant reduction of urgent interventions, and an unusual delay in the presentation of non-traumatic abdominal emergencies (15). Moreover, a retrospective study about surgical emergencies documented a 32% reduction of the number of people presenting at the ED, compared with the previous year (16). A WSES survey documented the increased incidence of severe septic abdominal abscess during the pandemic, especially for appendicitis and cholecystitis (16). However, clear data about the consequences of population lockdown and, thus, of delayed access in ED and emergency surgery are not available.

The aim of this study is to provide a detailed description of surgical emergencies and outcomes during the lockdown in a tertiary referral Italian hospital, compared with historical data from the same centre.

Materials And Methods

Study design

This is an observational case-control study on the effect of CoVID19 pandemic on emergency surgery delay. This study was carried out in accordance with the principles of Helsinki, and the study was notified to Ethical Committee of the AULSS3 Serenissima. The Case group was composed by a consecutive series of acute patients undergoing surgery for urgent and emergent conditions in the General Surgery Unit of the Dell'Angelo Hospital, Venice, during the lockdown imposed by Italian government due to the CoVID-19 outbreak, from March 9th to May 4th. We retrospectively collected data regarding age, sex, previous comorbidity, ASA score, symptoms at hospital admission and their duration, laboratory findings, diagnosis, type and duration of surgery, Intensive Care Unit (ICU) length of stay, overall length of stay, presence and type of stoma, need of reoperation and survival. The same data were also collected from the same period of the previous year (Control Group), in order to compare the two groups of patients.

Inclusion criteria and outcome measures

All patients underwent urgent/emergency surgical procedure during the study period were included. Intra-peritoneal flogistic diseases (i.e. diverticulitis, appendicitis, cholecystitis) were included in the peritonitis subgroup. All the patients underwent elective surgery, such as the surgical oncology procedure, or patients whose surgical details were not complete available were excluded.

The primary outcome was patient's 30-days survival and mortality. The secondary outcomes were presence of stoma, rate of re-operation, ICU length of stay, overall length of in-hospital stay.

Admission and management protocols during CoVID19 Pandemic

During CoVID19 Pandemic, patients were referred to our surgical Unit after SARS-CoV2 molecular testing, and standard chest x-ray. In the early phase of Pandemic, a Chest CT-scan was routinely performed. The severity of the urgency was evaluated case by case, and patients with severe, not postponable disease, were operated before the molecular testing results. After surgery they were located and monitored in isolated area until the molecular testing results.

Surgical techniques

During CoVID19 pandemic, we followed the recommendation of surgical societies on the management of emergency and urgent patients during CoVID19 pandemic (17). In particular, the special recommendations regarding the use of laparoscopy (18) were followed: use a closed suction system; use of balloon trocars to avoid smoke leakage; avoid the evacuation of fumes; suction of the entire pneumoperitoneum at the end of the procedure before removing the trocars or before conversion to open surgery; in case of a lack of skills and adapted materials, laparoscopy would better be avoided, especially in an emergency setting.

Considering all these recommendations, appendectomy was performed laparoscopically in all cases. Cholecistectomy was performed, if patients presented within the golden 72 hours, mostly with a minimally invasive approach.

Statistical analysis

Continuous data are presented as mean (SD) or median (IQR) and categorical data are presented as n (%). Continuous variables are compared with Student's t test, Mann-Whitney test or Kruskal-Wallis test as appropriate. Categorical variables are compared in 2x2 contingency tables using Chi square test and Fisher exact test. P values less than 0.05 were considered statistically significant. Comparison between the two groups were performed using SPSS Statistics, versions 26.

Results

Patients' characteristics

Overall, 152 patients were included in our study, 79 patients in 2020 case group and 77 patients in the 2019 control group. Median age was 53 years in 2020 and 60 years in control group, male female ratio was 45/34 and 47/30 respectively. Patients' characteristics are summarized in Table 1a.

Table 1

a: patients' characteristics, b: Symptoms, c: laboratory results, d: diagnosis

	2020		2019		p
	median	IQR	median	IQR	
a. Patients Characteristics					
Age	53	50	60	43	
M/F	45/34	M57%	30/47	M61%	
	n (79)	%	n (77)	%	
ASA 1	33	41,8	29	37,7	0,600
ASA 2	22	27,8	29	37,7	0,191
ASA 3	19	24,1	16	20,8	0,624
ASA 4	3	3,8	3	3,9	0,974
ASA 5	2	2,5	0	0	0,164
anticoag.	4	5,1	8	10,4	0,289
antiaggr.	12	15,2	10	13,3	0,558
b. Symptoms					
prehospital delay (days)	1,50	5,00	1,00	0,00	0,056
abdominal pain	79	100,00	70	90,86	0,006
fever	23	29,10	21	27,25	0,860
asthenia	0	0,00	3	3,89	0,118
jaundice	1	1,26	0	0,00	0,322
dysphagia	0	0,00	1	1,29	0,310
nausea/vomiting	37	46,62	26	20,76	0,096
stipsis	17	21,42	11	9,08	0,239
GI bleeding	7	10,08	5	6,49	0,579
diarrhea	1	1,26	1	1,30	0,985
c. laboratory results					
PCR (admission)	5,80	26,93	2,47	19,90	0,648
WBC (admission)	10,85	7,85	10,87	8,18	0,389

	2020		2019		
PCT (admission)	0,21	18,15	0,28	3,83	0,214
d. Diagnosis					
peritonitis	45	57,0	35	45,5	0,151
bowel obstruction	24	30,4	19	24,7	0,425
proctologic emergencies	6	7,6	13	16,9	0,076
GI bleeding	1	1,3	3	3,9	0,299
bowel ischemia	1	1,3	3	3,9	0,299
trauma	0	0,0	4	5,2	0,040
other	2	1,9	0	0,0	0,160

Upon hospital admission, 100% of patients' reported abdominal pain in case group, 90.9% of patients in control group; similarly, nausea, vomiting, constipation and fever were more frequent in case group than control group (symptoms are summarized in Table 1b, Fig. 1). In both groups peritonitis was the most common condition, even if more frequent in 2020 group. The second more frequent condition was bowel obstruction, followed by proctologic emergencies, trauma, gastrointestinal bleeding and bowel ischemia (Fig. 2,3). Contingency tables showed significant differences for abdominal pain (79 vs 70 in 2020 and 2019 respectively, $p = 0.006$) and a statistically significant reduction of trauma patients in 2020 (0 vs 4, $p = 0.04$). Overall results are summarized in Table 1.

Non-significant differences were showed for diagnostic delay (Fig. 4), surgery duration (Fig. 5), ICU length of stay (Fig. 6), overall length of stay (Fig. 7). Overall results are summarized in Table 2.

Table 2
overall outcomes

	2020		2019		
	median	IQR	median	IQR	p
prehospital delay (days)	1,5	5	1	0	0,056
Surgery duration (minutes)	71	61	49	60	0,119
ICU length of stay (days)	3,5	15	6	8	0,314
Overall length of stay (days)	15,5	36	15,5	25	0,231

Peritonitis patients'

We conducted a sub-analysis on peritonitis patients, which showed a significant delay before hospital access (median 2 vs 1 days in 2020 and 2019 respectively, $p = 0.013$) (Table 3), a significantly increased mortality (5 vs 0 in 2020 and 2019 respectively, $p = 0.045$), but a less frequent ileostomy in 2020, (0 vs 3 in 2020 and 2019 respectively, $p = 0.207$) with more frequent colostomy (2 vs 0 $p = 0.045$) (Table 4).

Table 3
peritonitis subgroup

	2020		2019		p
	median	IQR	median	IQR	
prehospital delay (days)	2	4	1	0	0,013
PCR (admission)	14,7	23,3	0,5	14,9	0,686
WBC (admission)	14	8,3	13,3	11,1	0,902
PCT (admission)	0,25	0,98	0,56	5,32	0,164

Table 4
peritonitis subgroup, surgical outcome

	2020		2019		p
	n	%	n	%	
re-operation	3	6,7	2	5,7	0,449
ileostomy	0	0	3	8,6	0,207
colostomy	2	4,4	0	0	0,045

No significant differences in laboratory findings, use of minimally invasive surgical techniques, duration of surgery, ICU length of stay, overall length of stay and re-operation rate between the two groups were found.

CoVID19 detection

We found only one patient, treated for emergency surgery in that period, positive to the CoVID-19 RNA test, completely asymptomatic for SARS-CoV. The patient, treated for appendicitis, was recovered in the CoVID ward after the surgical treatment, and he didn't report neither surgical postoperative complications nor CoVID-related consequences.

Discussion

During 2020 lockdown, even if the overall number of ED accesses decreased, the number of patients surgically treated in emergency-urgency conditions did not decreased in an Italian tertiary referral center for emergency and trauma surgery. The overall analysis showed a statistically significant difference on

abdominal pain prevalence as main symptom, and about the complete absence of trauma patients in 2020 group. This last result is easily understandable, since this was a direct consequence of travel limitation imposed by Italian government. On the other hand, the data on pain as main symptom, finds a more complex explanation, which could be clarified by the sub-analysis results.

Peritonitis' patients sub-analysis showed that, in our series, in 2020 patients waited significantly more before the hospital access, as already hypothesized in other studies (7, 16) compared to 2019. A similar situation had already been described during SARS Epidemic in Taiwan in 2003 (6). Thus, this behaviour is, very likely, a direct consequence of the fact that hospitals were perceived, especially during the early phase of pandemic, as unsafe places, despite emergency cares never stopped on the national territory. Indeed, health facilities and, consequently, health workers were the most affected by the CoVID-19 infection, as reported by Italian Istituto Superiore di Sanità (ISS) and by the Chinese experience (19).

The effects of delayed diagnosis in emergency conditions, especially in abdominal sepsis, are well known, as well as morbidity and mortality are time-dependant factors in those patients (20, 21). This diagnostic delay was, consequently, associated to a more severe clinical condition and a significantly worse prognosis. The most evident consequence was the dramatic increase in of post-operative mortality in peritonitis patients in 2020 group. Moreover, the lower incidence of ileostomy and the increased frequency of Hartmann's procedures performed in 2020 could be a direct consequence of more severe peritonitis found in this group of patients. On the other hand, secondary to a safer approach favoured by surgeons to avoid unnecessary complications and re-interventions in a phase of great stress for the hospital, especially the intensive care units. Therefore, the cost of the pandemic was not only paid in term of direct deaths from SARS-CoV2 infection, but also paid in term of deaths due to delayed emergency condition treatments.

Nevertheless, the surgical approach did not change about the use of minimally invasive techniques, despite the recommendations of some surgical societies (18), without consequences on intra-hospital spread of CoVID-19. Indeed, none of the staff of our Department, neither the patients, tested positive to the CoVID-19 swab test during the lockdown. Actually, only one patient treated for emergency surgery, was resulted positive at the admission swab test, but it was completely asymptomatic. He was isolated in a CoVID area before and immediately after surgery, and he has never passed through the General Surgery ward that was kept safe.

The retrospective design, the heterogeneity and complexity of conditions and treatments and the relatively small sample are the main limits of the study. However, this sample size permitted to evidence the difference in term of diagnostic delay and mortality.

In conclusion, our results seem to confirm some previous observations about the severe consequences of diagnostic delay during the early phase of pandemic outbreak. Those findings could help health authorities to consider adequate countermeasures in order to guarantee the hospital access of urgent-emergent non-pandemic conditions, in critical situation such as the pandemic.

Declarations

Ethical Approval and Consent to participate

All procedures performed in this study were in accordance with the ethical standards of the institutional and national committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

For this type of study formal consent is not required.

Availability of data and materials

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have no relevant financial or non-financial interests to disclose.

The authors have no conflicts of interest to declare that are relevant to the content of this article.

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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Consent for publication

All named authors have read the manuscript and have agreed to submit the paper to Your journal in its present form.

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Authors' contributions

All those named as authors have made a sufficient contribution to the work:

(I) Conception and design: Pirozzolo G, Scarpa M, Recordare A

(II) Administrative support: Pirozzolo G, Bao Q R, Recordare A

(III) Provision of study materials or patients: Rizzo M, Cimino F, Meneghetti G, Grassetto A

(IV) Collection and assembly of data: Baiano L, D'Alimonte L, Vignotto C, Piangerelli A, Peluso C

(V) Data analysis and interpretation: Pirozzolo G, Scarpa M, Bao Q R

(VI) Manuscript writing: Pirozzolo G

(VII) Final approval of manuscript: All authors

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Figures

Symptoms

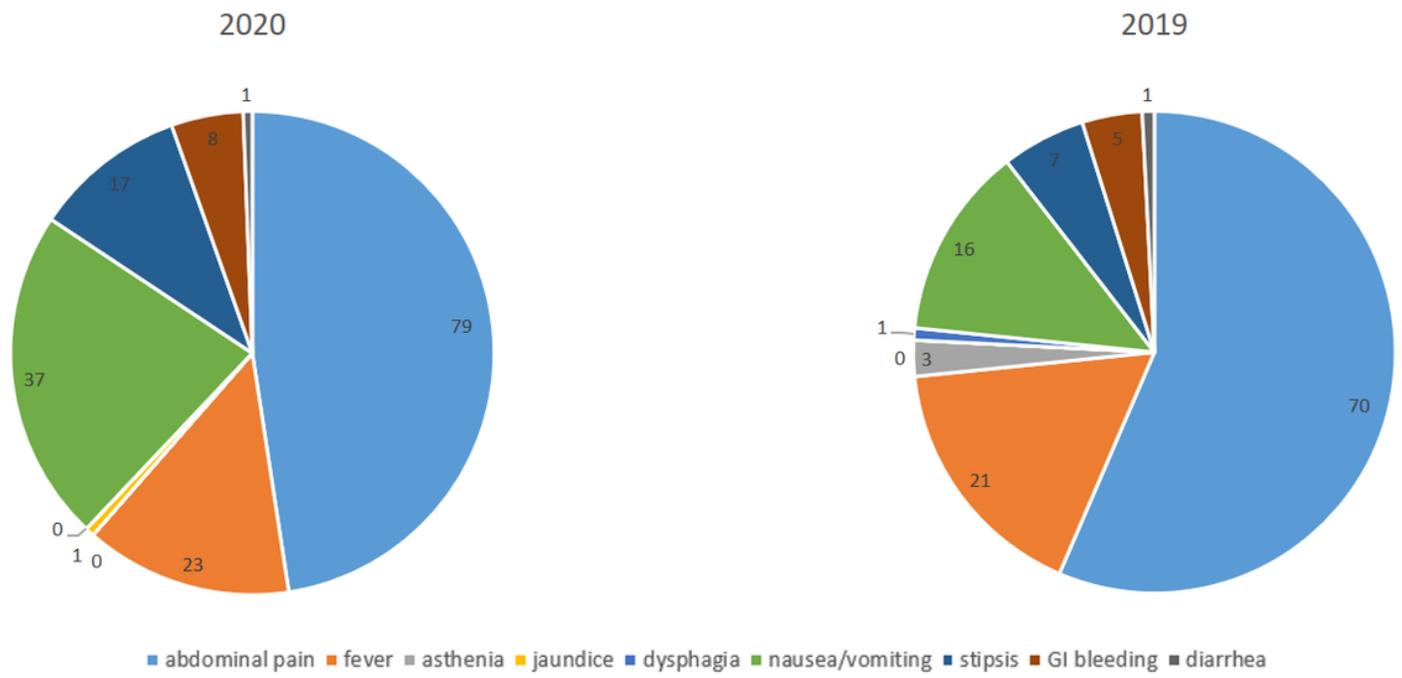


Figure 1
symptoms

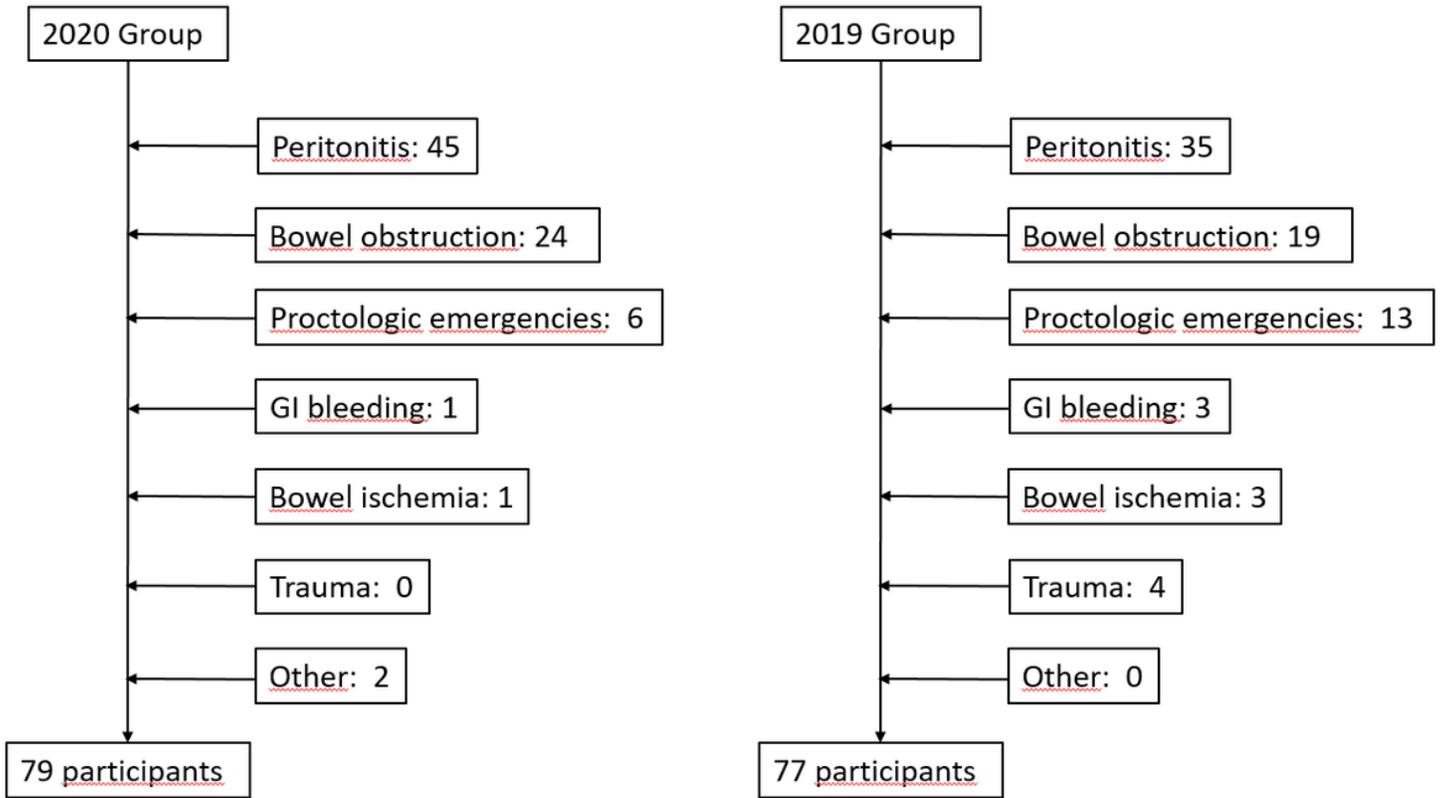


Figure 2

flow chart

Diagnosis

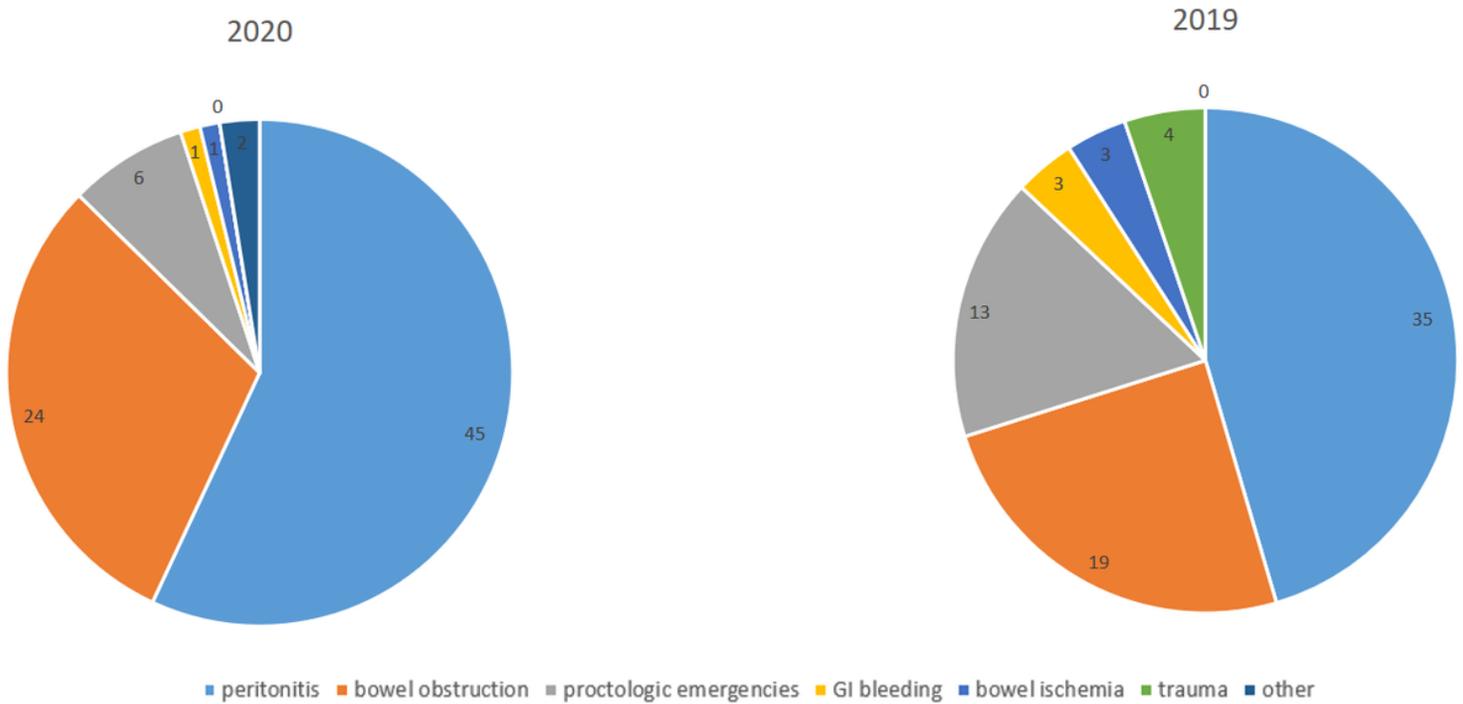


Figure 3

Diagnosis

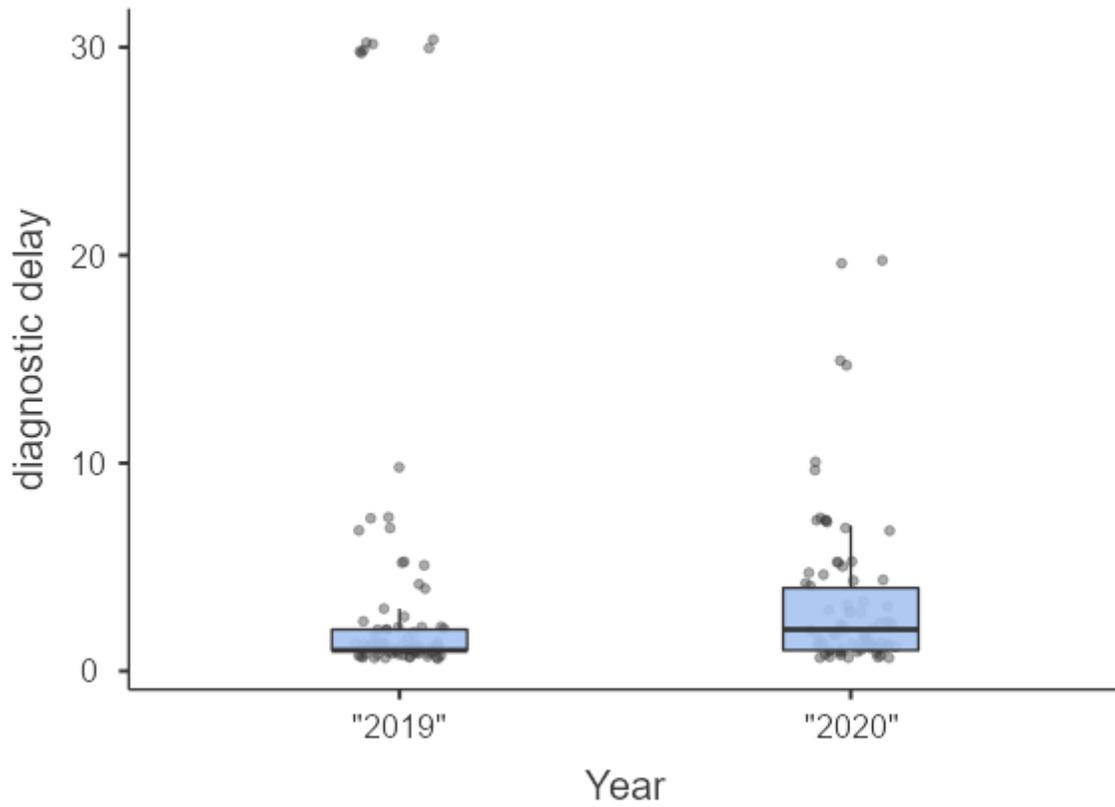


Figure 4

diagnostic delay

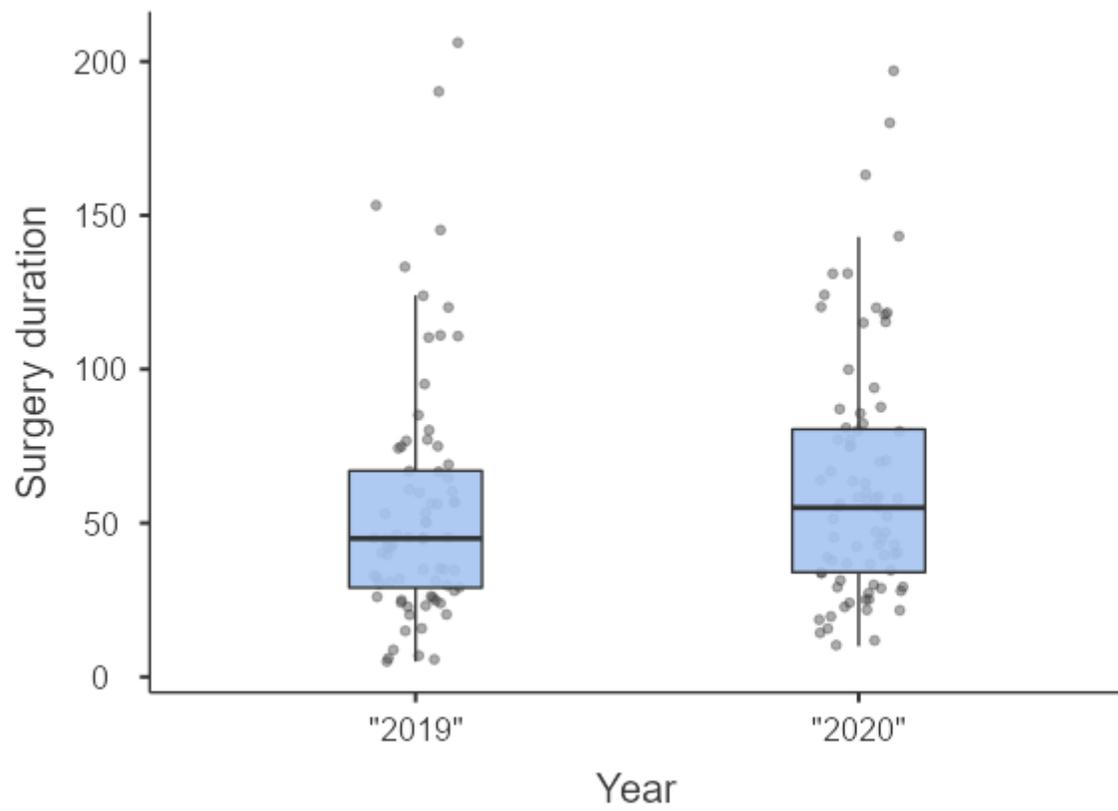


Figure 5

Surgery duration

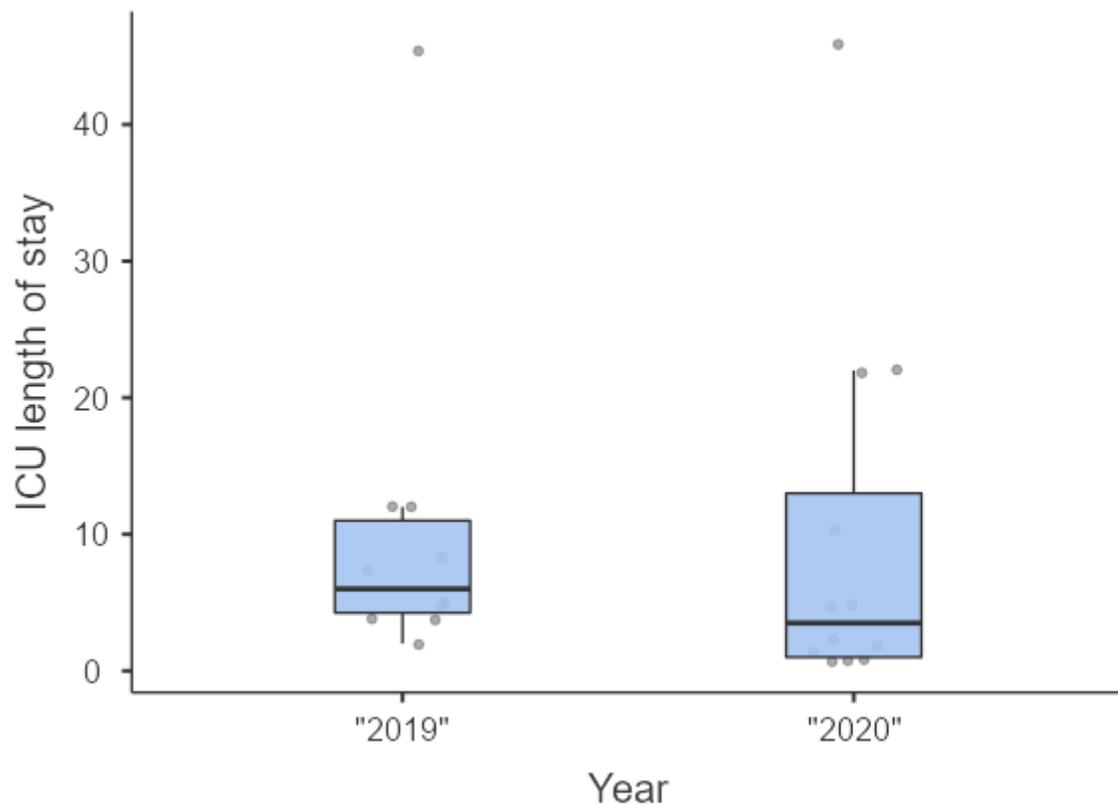


Figure 6

ICU length of stay

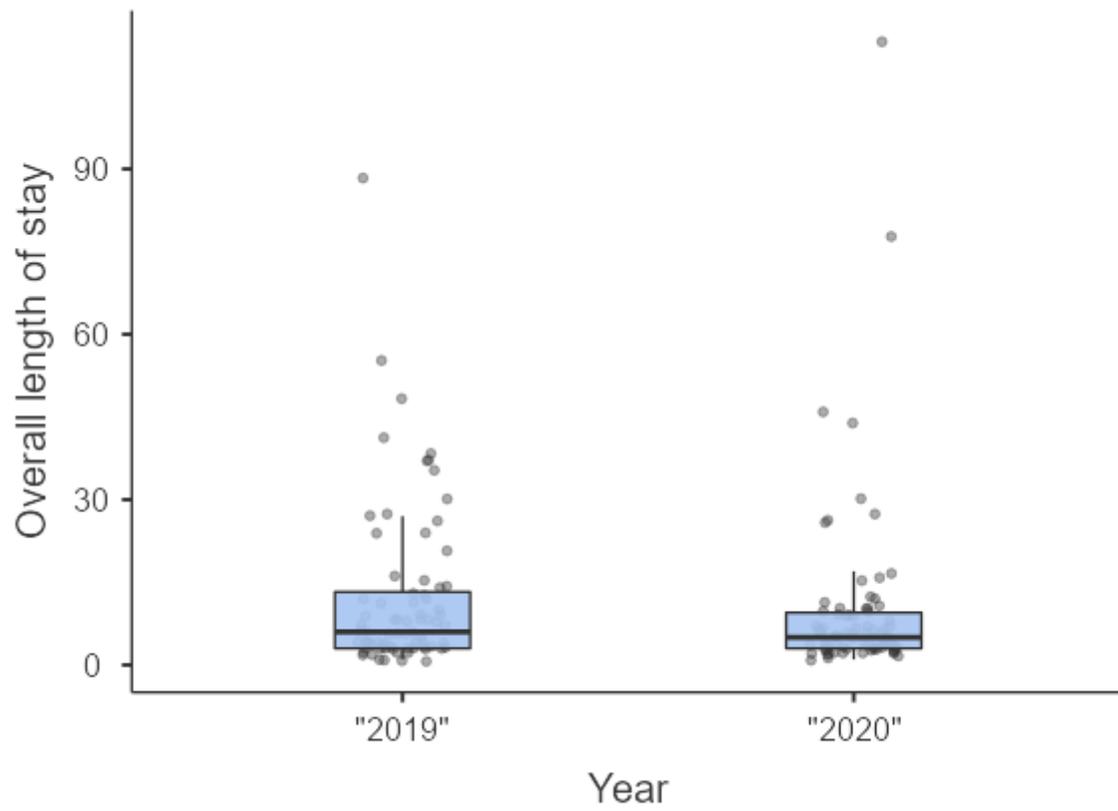


Figure 7

Overall length of stay