

Effects of COVID-19 pandemic on general surgical emergencies: Are some emergencies really urgent? Level 1 Trauma center experience

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Abstract

Purpose: We aimed to investigate the effect of COVID-19 pandemic on general surgical emergencies. On the other hand, we analyzed the effectiveness of the measures we have taken and the incidence of COVID-19 of patients and healthcare professionals.

Method: In the pandemic period between March 14 and May 15, 2020, and in the same period of the previous year, the files of patients who underwent emergency surgery and followed up nonoperatively were reviewed retrospectively. The incidence of COVID-19 was questioned in patients operated on in the pandemic period and in health professionals working in the general surgery department.

Results: Demographic data were similar between the two groups. The number of patients operated on in the pandemic group (n = 103) was lower than during the control group (n = 252) (p = 0.001). In the pandemic group, there was a significant decrease in the number of surgeries of uncomplicated appendicitis, acute cholecystitis and incarcerated hernia (p=0.001, p=0.005, p=0.001, respectively). Others surgeries were similar in both groups. In the pandemic group, nonoperatively follow-up rates were significantly lower in acute mechanical intestinal obstruction and acute cholecystitis (p=0.001, p=0.011, respectively). The findings of COVID-19 were positive in 6(6/103, %5.82) patients undergoing emergency surgery. None of our doctors had COVID-19 infection (0/20). The findings were positive only in 2 nurses from the general surgery department(2/24, %8,33).

Conclusion: In these and similar pandemics, we think that a new algorithm is needed to approach emergencies and the results of this study can help for that.

Introduction

Coronavirus disease 2019 (COVID-19) is an infectious respiratory disease caused by the new virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Since its inception in December 2019, COVID-19 infection has spread globally and has been declared an epidemic by the World Health Organization on March 11, 2020 [1,2]. SARS-CoV-2 is basically characterized by infected respiratory symptoms such as fever, dry cough, shortness of breath and infiltration in chest x-ray [3]. Despite the mild or moderate prognosis in most of the COVID-19 patients, up to 5-10% can follow a severe, potentially life-threatening course [4]. In addition to the risk of death from infection due to the rapid spread of the epidemic, easy contact from person to person and high mortality rate, it brought unbearable psychological pressures and concerns [5]. People began to fear going out, getting sick and losing their loved ones. One of the most important factors that protect from getting this disease is to apply the social distance rule and to reduce contact from person to person [6]. Physical (social) distance has proven to be one of the most effective ways to reduce the spread of the disease during an epidemic [7]. This is healthy when concerns about

getting coronavirus encourage people to stay physically away from each other. These fears can be dangerous when taking patients away from hospitals.

In this context, there may have been a decrease in patients' application to hospitals even in an emergency. It has been reported that a 38% reduction in US cardiac catheterization laboratory ST-Elevation Myocardial Infarction (STEMI) activations occurred in the early stage of the COVID-19 pandemic, a similar result was reported in Spain with a 40% reduction [8-10]. COVID-19 infection was detected for the first time in Turkey on March 11th and the first death took place on March 18th. The number of non-COVID-19 patients admitted to hospitals decreased after the number of cases started to increase and deaths related to the disease started to appear.

We postponed elective surgeries, but urgent operations had to continue. We had to protect both ourselves and patients who had to undergo this emergency surgery from COVID-19 infection. During this period, European Society of Trauma and Emergency Surgery (ESTES) reported a series of recommendations for hospital perioperative preparation for emergency surgery and trauma patients [11]. These recommendations guided us through the measures we identified.

In this study, we compared the emergency surgeries performed in the COVID-19 pandemic period in our general surgery clinic with the emergency surgeries performed in the same period of last year. We aimed to investigate the effect of COVID-19 outbreak on emergency surgeries. Second progress report for study, we analyzed the effectiveness of the measures we have taken and the incidence of COVID-19 of patients and healthcare professionals.

Materials And Methods

In the pandemic period between March 14 and May 15, 2020, and in the same period of the previous year, the files of patients who underwent emergency surgery and followed up nonoperatively were reviewed retrospectively. Demographic data, types of surgeries, number of surgeries and surgical findings were recorded. Patients who were urgently re-operated due to complications after elective or emergency surgery were excluded from the study. Patients who underwent emergency surgery in the pandemic period in 2020 were named Pandemic Group, and patients who operated emergency on the same period in 2019 were named Control Group. The data obtained were compared between the two groups.

In the second progress report for study, patients were investigated for COVID-19 infection. Those who had pre-operative COVID-19 infection and those who had postoperative hospital-induced COVID-19 infection were investigated. Preoperative chest tomography was performed in patients who underwent surgery in the Pandemic Group. The patients with findings consistent with COVID-19 pneumonia were PCR tested and these patients were hospitalized in isolated rooms. In addition, chest tomography and PCR tests were performed on patients with postoperative clinical findings. Also, doctors and nurses working in the general surgery department and healthcare professionals attending in the operations of these patients were questioned for the COVID-19 infection.

SPSS (Statistical Package for the Social Sciences) 24.0 program was used for statistical analysis. While evaluating the study data, Mann Whitney U was used for descriptive statistical methods (Mean, Standard Deviation, Median, Frequency, Rate, Minimum, Maximum) as well as two group comparisons of normally distributed parameters. Person Chi-Square test was used in the analysis of qualitative data. P value below 0.05 was considered statistically significant.

Results

A total of 355 patients were included in this study. The number of patients operated on the Control Group (n = 252) was higher than the Pandemic Group (n = 103) (p = 0.001), and the demographic data of the patients in the two groups were similar (Table 1).

The number of total trauma patients operated due to gunshot wounds, stab wounds and blunt trauma were 12 and 11, respectively, in the Pandemic and Control Group (p = 0.817) (Table 1).

While in the Pandemic Group, 2 patients were operated due to gastrointestinal system (GIS) bleeding, 2 patients due to mesenteric ischemia and in the Control Group, 3 patients were operated due to GIS bleeding and 2 patients due to mesenteric ischemia. The two groups were similar (Table 1).

Nine patients were operated due to the small bowel and colon perforation in the pandemic group and 8 patients in the Control Group, there were similar in the two groups. Due to peptic ulcer perforation, 9 patients in the Pandemic Group and 6 patients in the Control Group were operated on. There was no difference between the two groups (p = 0.41). The total number of perforations was higher in the Pandemic Group (n = 18 vs. 14), but statistically insignificant (p = 0.411) (Table 1).

Although the number of patients operated on the Control Group (n = 25) due to mechanical intestinal obstruction was higher than the Pandemic Group (n = 20), there was no statistical difference between the two groups (p = 0.348). Non-operatively followed Acute Mechanical Intestinal Obstruction (AMIO) patients were more in the Control Group (21 vs. 5, p = 0.001). When the etiological causes were investigated, the decrease of adhesive intestinal obstruction applications was statistically significant (15 vs. 2; p = 0.001) (Table 1).

The patients who operated due to incarcerated abdominal anterior wall hernia were higher in the Control Group (n = 25 vs. 2; p = 0.001). However, the number of patients who underwent intestinal resection due to strangulated hernia was similar between the two groups (n = 3vs1; p = 0.311) (Table 1).

The number of operations for acute cholecystitis was higher in the Control Group (n = 17 vs. 5; p = 0.005). Similarly, the non-operatively followed patients was also higher in the Control Group (38 vs. 24, p = 0.011). However, percutaneous cholecystostomy was performed in 14 (36.8%) of the non-operative patients in the Control Group and 8 (33.3%) in the Pandemic Group, the two groups were similar (Table 1).

The number of appendectomies was higher in the Control Group (n = 155 vs. 42; p = 0.001). When we investigated the appendicitis subgroups, the number of complicated appendicitis was similar in both

groups (n = 26 vs. 18; p = 0.1131). However, uncomplicated appendicitis was higher in the Control Group (n = 129 vs. 26; p = 0.001) (Table 1).

Table 1: Demographic data and The Numbers of Emergency Surgery

	Control group	Pandemic group	p value
Mean Age	46.12	46.66	1
Gender			0.98
Male	160 (%63,5)	67(%65)	
Female	92 (%36,5)	36(%35)	
Trauma	11	12	0.817
Blunt trauma	3	3	1
Gunshot wound	3	2	0.649
Stab wound	5	7	0.544
GIS bleeding	3	2	0.649
Acute mesenteric ischemia	2	2	1
Perforations	14	18	0.411
Peptic ulcer	6	9	0.41
Small intestines	2	3	0.649
Colon	6	6	1
AMIO	46	24	0.001
Surgery performed	25	20	0.348
Nonoperatively followed	21	4	0.001
Incarcerated hernia	25	2	0.001
Without resection	22	1	0.001
With resection	3	1	0.311
Acute cholecystitis	55	29	0.001
Surgery performed	17	5	0.005
Nonoperatively followed	38	24	0.011
Acute appendicitis	155	42	0.001
uncomplicated	129	24	0.001
complicated	26	18	0.131
Total	252	103	0.001

In the second progress report for study, in preoperative evaluation, findings compatible with COVID-19 infection were observed in thorax tomography of 6(%5.8) patients. PCR test of 2(%1.94) of these patients

was determined positive. All of these patients were consulted to infectious diseases clinic and received COVID-19 treatment. None of the patients developed mortality. In a patient without initial COVID-19 findings, findings consistent with COVID-19 infection were observed in thorax tomography taken during postoperative intensive care follow-up. PCR test of this patient was negative. This patient was ASA 4 and was admitted to the postoperative intensive care unit. Mortality developed in this patient on the 5th postoperative day. In our clinic, no COVID-19 infection was observed in any assistant doctors and specialist doctors. COVID-19 infection was no determined in the surgical team that participated in the surgery of these patients, too. However, COVID-19 infection was detected in 2(2/24, %8.3) nurses working in our clinic (Table 2).

Table 2: COVID-19 incidence of patients and healthcare professionals

Groups	Covid 19 – findings(n)	Covid 19 + findings(n)	Total
Total emergency surgery patients	97(%94.2)	6(%5.8)	103(%100)
Patients initially having COVID-19 negative	96(%98.97)	1(%1.03)	97(%100)
Specialist doctors	20(%100)	0(%0)	20(%100)
Assistant doctors	20(%100)	0(%0)	20(%100)
Surgical team	36(%100)	0(%0)	36(%100)
Clinical nurses	22(%91.67)	2(%8.33)	24(%100)

Discussion

Studies reveal that the hospital-acquired virus was 41% among patients during the SARS-COV-2 pandemic. Therefore, outpatient clinic of intensive hospitals are important places to communicate the disease [12]. In the Covid-19 pandemic, people's fear of getting sick reduced the number of hospital admissions. Most countries affected by pandemic have delayed elective procedures to prevent these infections. ESTES(European Society for Trauma & Emergency Surgery) suggested to postpone elective cases to a later date and cancer operations, patients with highly symptomatic benign disease, significant infections, and those whose delay would precipitate life threatening outcomes or patient harm should be considered for operative intervention on a case-by-case basis by a multidisciplinary team [11]. Our Ministry of Health issued an announcement suggesting postponement of elective procedures within the scope of the recommendations of scientific committee members and measures taken by the government [13]. We have postponed elective cases to a later date except for cancer patients within the scope of these measures. In this period, articles reporting that some emergency cases had a decrease in hospital admission rates were also published [9,10,14-16]. In this article, we aimed to evaluate whether there is a decrease in the number of applications requiring urgent surgery and operations performed in terms of

general surgery in the pandemic period. Also we investigated the incidence of COVID-19 in our patients and healthcare professionals.

Our general surgery department performs approximately 250 elective and 150 emergency cases per month and has the higher number of emergency surgery in Turkey [1]. When the patients who were re-operated due to complications of elective and emergency operations were excluded, a total of 103 patients were operated urgently during the 2-month period in Pandemic Group. In the 2-month period in the same period of 2019, we determined that this number was 252. The number of emergency surgeries performed in the Pandemic Group was less than the Control Group. We determined that emergency surgeries decreased by 59.1% compared to the same period of the previous year (figure 1). Gallego et al. reported that the number of general surgical emergency interventions decreased from an average of 3.6 to 1.6 per day in the pandemic period [18].

When we analyzed the operation subgroups, there was no statistical difference between patients who were operated on due to trauma patients, blunt traumas, gunshot wounds and stab wounds in two group. We think the reason for this is that these patients were brought to our hospital by ambulance without their own will. There was no statistical difference in the rate of patients' undergone surgery due to gastrointestinal system bleeding, mesenteric ischemia and gastrointestinal system perforation between groups. One of similar the features of blunt trauma, gunshot wounds, stab wounds, GIS bleeding, mesenteric ischemia, GIS perforations, is that they are in the emergency surgery class that requires intervention for immediate or several hours. Mortality is high if early intervention is not performed in these emergencies [19]. In our study, we concluded that these surgeries, which are in the Immediate and emergency class requiring intervention within several hours, are not affected by the COVID 19 pandemic. In a study investigating the effect of COVID-19 infection on emergency upper GIS endoscopy numbers performed due to GIS bleeding in Australia, reported that the number of emergency endoscopy decreased by 40% during the pandemic period. However, it has been reported that there was no decrease in variceal bleeding rates with higher mortality and requiring early intervention [20]. In a similar study by Madelona M. et al. [21], although there was a decrease in total urology emergency application, it has been reported that emergency applications requiring immediate intervention such as testicular torsion, acute obstructive pyelonephritis and acute obstructive renal injury did not decrease. These studies support our results and it has been shown that there was no difference in the number of emergencies that should be intervened very early in the period before and after the pandemic.

When we investigated the patients who had surgery due to peptic ulcer perforation, we determined that 9 patients were operated due to peptic ulcer perforation during the pandemic period and 6 patients during the control period. Although more peptic ulcer perforation was operated during the pandemic period, it was statistically insignificant. The higher rate of peptic ulcer perforation during the pandemic period may be due to the reduced in the demand for health care at outpatient clinic of gastroenterology due to COVID 19. This reason may have increased the perforation rate.

When the number of patients operated due to acute mechanical intestinal obstruction (AMIO) was examined, there was no statistical difference between the 2 groups. However non-operative follow-up was lower in the pandemic group (figure 2) when we investigated the indications for surgery, it was determined that 11 patients were operated due to obstructive colon cancer, 3 patients for volvulus and 6 patients for adhesive intestinal obstruction in the Pandemic Group. In the Control Group, 13 patients were operated for obstructive colon cancer, 3 patients for volvulus and 9 patients for adhesive intestinal obstruction. However, when we investigated the number of nonoperatively followed patients, it was determined that 5 patients were followed up non-operatively during the pandemic period and 21 patients during the control period. In the Pandemic Group, 2 of the non-operative patients were adhesive intestinal obstruction, one was volvulus that was performed colonoscopic detorsion, and 2 were obstructive colon cancer that was inserted stent. In the Control Group, 15 of the non-operative patients were adhesive intestinal obstruction, 2 were volvulus that was performed colonoscopic detorsion and 4 were obstructive colon cancer that was inserted stent. Among these patients, an etiologically significant decrease was observed in adhesive intestinal obstruction patients. In the literature, it is known that the highest rate of non-operative follow-up success among the intestinal obstruction etiology is adhesive intestinal obstructions. Level 2 data reported that non-operative follow-up was successful between 65-80% in these patients [22]. The reason for the decrease in the admission of adhesive intestinal obstructions in our data was that they had recovered in quarantine without any treatment and any hospitalization, perhaps because of the high success rate of non-operative follow-up. Were we hospitalizing and treating these patients more than necessary? Although the number of emergency applications was higher in the control group due to AMIO, the fact that there was no difference in the number of operations in the two groups indicates that patients who really need urgent surgery apply to the emergency room during the pandemic period.

The low number of patients in the pandemic group who underwent surgery due to incarcerated anterior abdominal wall hernia was found statistically significant. 25 patients in the control group and 2 patients in the pandemic group were operated for incarcerated hernia. When the files of these patients were investigated, only 3 patients were observed to have bowel resection due to strangulation in Control Group. In the Pandemic Group, 1 patient underwent bowel resection due to strangulation (figure 3). There was no statistically significant difference between the two groups in the number of patients who developed strangulation. Perhaps the reduced number of emergency applications of incarcerated hernias due to COVID-19 infection may enable us to prioritize the future nonoperatively approach in these patients. Especially in patients with high risk of emergency surgery, it may encourage to direct to elective surgery. Because morbidity in emergency cases have been reported as high as 19% to 30%, and mortality at 1.4% to 13.4% [23]. In the literature, there are articles stating that the taxis procedure in order to direct patients to elective surgery has achieved 60% success in incarcerated hernias, that mortality and morbidity have not occurred in these patients and that they can be performed safely [24]. The most important issue here is to exclude strangulation and in the slightest doubt, the patient should be directed to surgery.

It was statistically significant that the patients who underwent surgery for acute cholecystitis were less in the pandemic group. While 5 patients were operated in the pandemic group, 17 patients were operated in

the control group. While the number of patients who were followed up nonoperatively during the pandemic period was 24, this number was 38 during the control period (figure 4). There was no difference in our percutaneous cholecystostomy rates. While 29 patients were treated for acute cholecystitis in the pandemic group, 55 patients were treated in the control group. These data reveal that both the number of non-operative patients and the number of operated patients were lower during the pandemic period. The gold standard treatment in acute cholecystitis is laparoscopic cholecystectomy. Antibiotic therapy is also effective at the beginning of the acute cholecystitis, but the rate of recurrence is higher. Another option is percutaneous cholecystostomy [25]. In this period, the decreased in acute cholecystitis surgeries and applications may be due to these patients being treated with more antibiotics or perhaps anxiety of getting COVID 19 infection may be more dominant than their pain.

The decrease in the number of patients who underwent surgery for acute appendicitis revealed that it was the group most affected by COVID-19 infection. A total of 44 patients were operated for acute appendicitis in the pandemic group. It was determined that 155 patients were operated in the control group. The low number of surgeries in the pandemic group was statistically significant. The number of appendectomies in our hospital decreased by 65% in the pandemic period compared to last year. When we investigated the findings of the surgery, it was observed that 129 patients were uncomplicated and 26 patients had complicated appendicitis in the control group. In the pandemic group, 24 cases were uncomplicated and 18 cases were complicated (figure 5). The number of patients operated on due to complicated appendicitis was statistically insignificant between the two periods. It was observed that the statistical difference was in uncomplicated appendicitis. This reduction in uncomplicated appendicitis is 81.3%. So where did these patients go? We think that these patients were less likely to apply to other hospitals. Because in Istanbul on March 17, those with internal medicine specialists, infection specialists and intensive care units, including public and private hospitals, were declared as pandemic hospitals by the Ministry of Health, General Directorate of Health Services [26]. The vast majority of hospitals in Istanbul met these criteria. Gallego et al. reported that they performed only 4 appendectomy surgeries in the 20-day period during the pandemic period and all were perforated [18]. Similarly, in our study, there was no significant decrease in the number of perforated appendicitis compared to last year. The treatment of these patients during the pandemic should be discussed. We performed surgery on all patients diagnosed with appendicitis. The gold standard in the treatment of acute appendicitis is laparoscopic appendectomy. However, systematic reviews and meta-analysis of RCT studies have recently reported that uncomplicated appendicitis can be successfully treated initially with antibiotics [27-28]. In a review by De Simone et al. [29], it has been stated that in the pandemic period, non-operative approach can be applied unless acute appendicitis, acute cholecystitis, and adhesive small bowel obstructions develop peritonitis and no strangulation is suspected in incarcerated hernias. In another review by Gok et al. [30], stated that nonoperatively follow-up should be considered when clinically appropriate for the patient. They reported that nonoperatively follow-up can be performed especially in uncomplicated appendicitis, acute cholecystitis, Hinchey 2-3 diverticulitis, and hemodynamically stable trauma patients. The patients whose operation and admission rate decreased significantly in the pandemic group with uncomplicated appendicitis, acute cholecystitis, incarcerated hernias and adhesive

intestinal obstruction who were recommended to be followed up nonoperatively during the pandemic period may have healed themselves without any treatment?

On the other hand, we took some prevention to protect ourselves and our patients from the COVID-19 pandemic. We performed chest tomography to investigate COVID-19 infection in patients. In a study by Fang et al. [31], the sensitivity of thorax tomography to COVID-19 pneumonia was observed higher than the PCR test and they stated that low patient viral load and improper clinical sampling caused this. In the study by Tao Ai et al. [32], the sensitivity of chest tomography was observed as 97% in patients with positive PCR test and it was stated to be highly sensitive for the diagnosis of COVID-19. For this reason, we performed chest tomography in all patients who underwent emergency surgery during this period. Six of 103 patients operated during the pandemic period had findings consistent with COVID-19 pneumonia in thorax tomography in preoperative evaluation. PCR test was positive in only 2 (1.94%) of these patients. We isolated patients with findings consistent with COVID-19 on chest tomography from others. An operating room was designated for patients with signs of COVID-19 infection, and no other operations were performed in these rooms except for these patients. A special elevator was designed for these patients. Surgical masks were worn by these patients during transportation to operating room. In only one of the patients without initial signs of infection, findings consistent with COVID-19 pneumonia were observed on chest tomography taken postoperatively. However, PCR test was observed negatively. This patient, who was taken from the emergency room to the operating room and from the operating room to the intensive care unit, was never hospitalized in our general surgery service.

In the operations of the patients with suspected COVID-19, the surgical team absolutely used N95 / FF3 masks, protective overalls and eye visors. The COVID -19 infection was not observed in the doctors and surgical team with the measures we took in line with the recommendations of ESTES and the Turkish Surgical Association [11,30]. Only, COVID-19 infection was detected in 2 of the nurses working in the general surgery department. We think that the measures we take are very successful. In the study by Gallego et al., 12 (24%) general surgical doctors were reported to be infected with COVID-19 [18].

It was found that the number of surgeries that were in the immediate and emergency surgery class requiring intervention within several hours did not decrease, even if it was not reflected in the statistics, it increased in numbers. The number of emergencies with nonoperatively follow-up option in their treatment decreased in the pandemic period. Especially in unusual situations like this pandemic, I wonder if outpatient follow-up is possible in these patient groups where nonoperatively follow-up is successful. Because more beds may be needed in hospitals. The first conclusion of this study reveals that this is possible. Although the study is single centered, we believe that this result may represent national reality. Our hospital is a level 3 reference center and a level 1 trauma center that covers a large audience.

In conclusion, the SARS-CoV-2 epidemic has a major impact on health systems worldwide, and challenges the reorganization of available resources. To cope with the rapid spread of the coronavirus and the severity of the clinical picture it produces, general surgery emergency services may need to change surgical and healthcare activities. Many of us have faced such an epidemic for the first time and

have been in dilemma in the management of some emergency surgeries. In these and similar pandemics, perhaps a new approach algorithm will be required for emergencies. In such pandemics, there may be an increase in the number of nonoperatively approaches in some emergency cases in order to protect healthcare professionals and patient health. In such cases that paralyze the health system, some emergencies may need to be followed up without hospitalization. This pandemic may shed light on determining real emergencies. We think that the results of this study may be useful in determining patients who can be followed up nonoperatively or outpatient for general surgery emergencies in these and similar pandemic periods and/or in normal times.

Declarations

Declarations

All procedures performed in this study involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants of the study.

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The authors also declare that they have no competing financial interests

Conflicts of interest/Competing interests

The authors declare that they do not have any conflict of interest.

Ethics approval

There is ethical approval from the local ethics committee (Bakirkoy Dr. Sadi Konuk Ethics Committe) and Ministry of Health approval (2020-05-20T19_56_28)

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Figures

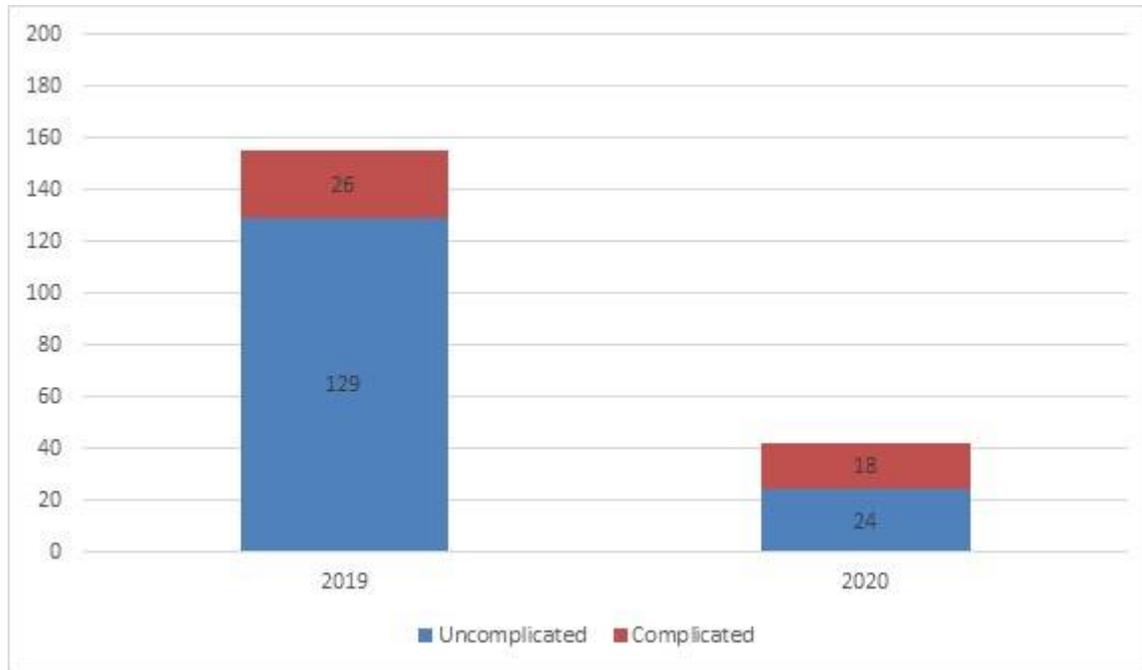


Figure 1

The number of Complicated and uncomplicated appendicitis between both groups

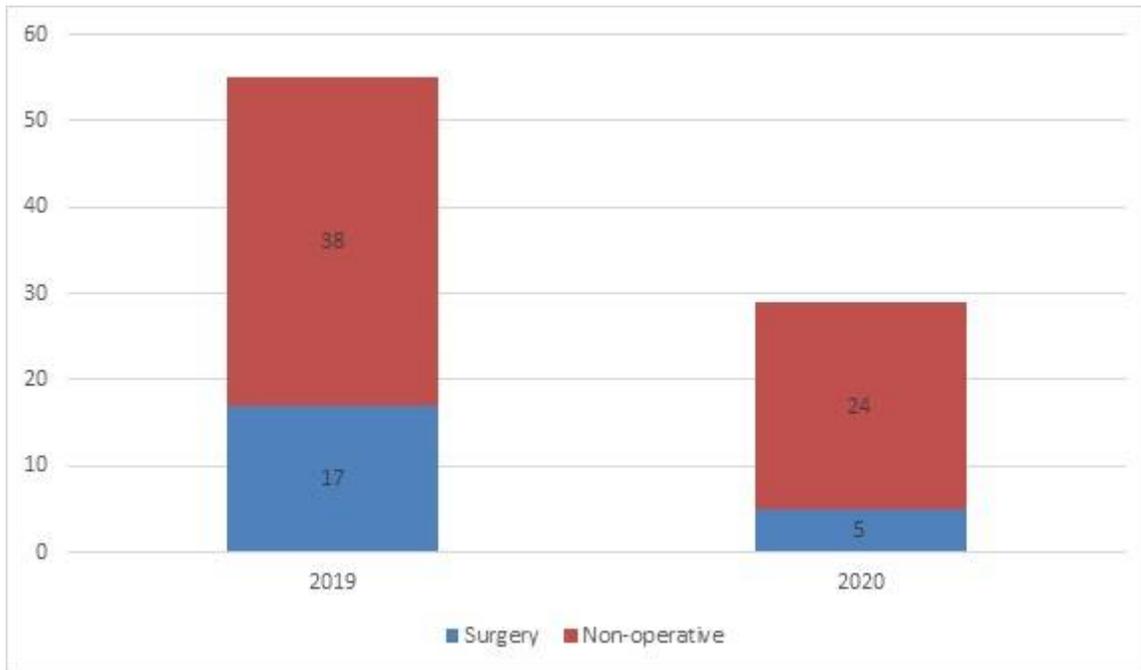


Figure 2

The number of Acute cholecystitis surgery performed and non operative followed-up between both groups

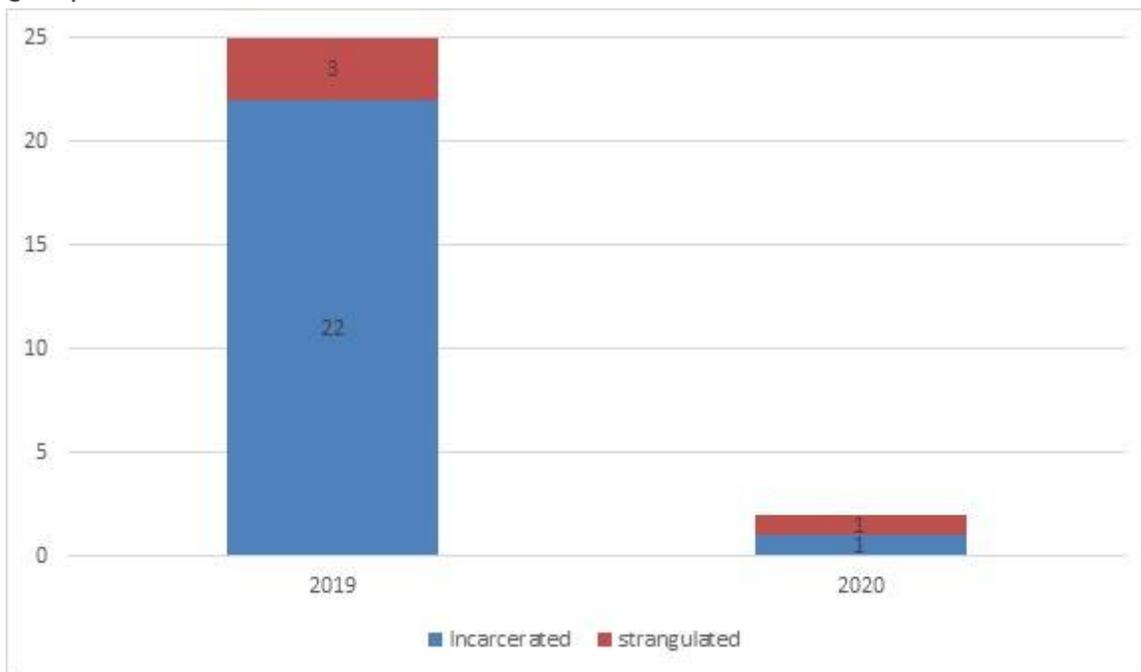


Figure 3

The number of incarcerated hernia surgeries with resection and without resection between both groups

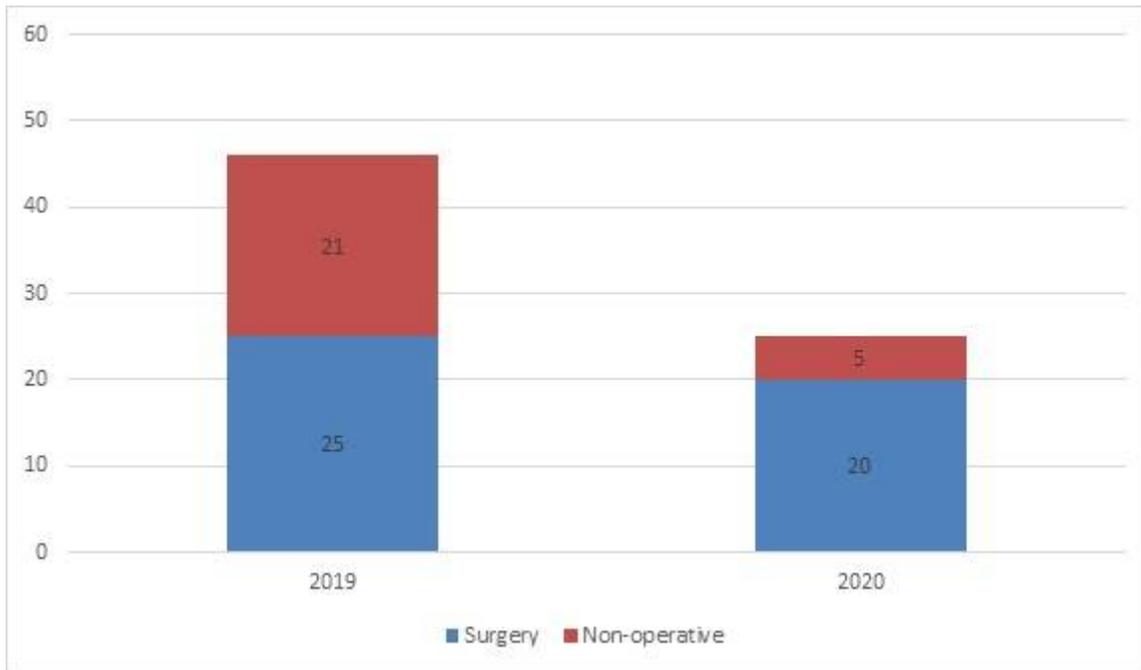


Figure 4

The number of AMIO surgery performed and non operative followed-up between both groups

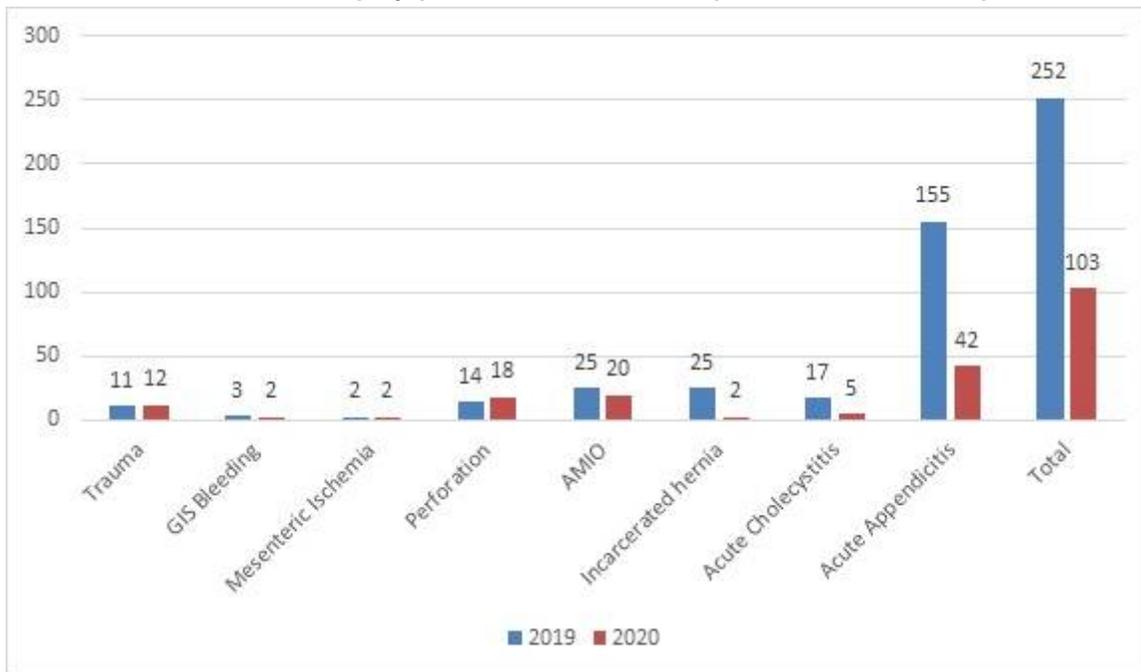


Figure 5

The number of operations between both groups