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Results of emergency surgery at the time of epidemic covid-19

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Abstract
Introduction: to investigate emergent surgical procedures in patients with COVID-19 between 19th February and 10th April 2020.
Methods: Retrospectively reviewed the clinical records of all patients who underwent emergent and urgent surgical procedures during the period of COVID-19 at Loghman Medical Center, Tehran, Iran. The suspected patients of COVID-19 were tested using chest CT-scan and reverse transcription-polymerase chain reaction (RT-PCR). Laboratory-Confirmed COVID-19 patients and patients with typical manifestations in CT-scan were thoroughly reviewed. The mortality rate, the need for intensive care unit, and morbidity of the patients were analyzed. Survivors and non-survivors were compared in terms of age, sex, and laboratory data.
Results: Eighty-one patients underwent emergent and urgent surgical procedures within the study periods. Nineteen patients were suspicious of COVID-19 either before or after surgical procedures during the study period. Five out of 11 patients of confirmed COVID-19 died during the study period. Nine of 11 of patients needed ICU care.
Conclusion: The mortality rate of emergency surgical procedures in patients with corona is estimated to be high during the COVID-19 pandemic. Regardless of COVID-19 symptoms, close postoperative monitoring of the operated patients is recommended. Standardized procedure of anesthesia and surgery for patients with or without COVID-19 infection requiring to minimize the risk of virus spread and reduce injury to patients and staff.

Keywords: covid-19, emergency surgical procedures, mortality

Introduction

On February 19th, the first confirmed cases of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have been reported in Iran [1]. Subsequently, an emergency task force was formed by the Iranian government and local health authorities to lead the response to the outbreak of the coronavirus disease 2019 (COVID-19) [2, 3]. One day after the start of the outbreak on February 20th, 2020, a 50-year-old man was admitted to Loghman Medical Center in Tehran, Iran as the first confirmed case of COVID19. Since the first days, Loghman Medical Center has become a central care hospital for COVID-19 patients in Tehran, Iran.

The human to human transmission of COVID-19 [4], and highly contagious nature of the disease [5], made the local health authorities to set the protocols for surgical procedures [3]. Based on these regulations all elective surgical procedures were canceled and postponed which is still an ongoing process like many other countries [6-9]. However, there are many emergency and urgent surgical procedures which cannot be postponed and need special considerations during the new emergent situation [10].

Older age, concomitant comorbidities, surgical time, and complexity of the procedure are associated with poorer prognosis in operative patients [11]. Wen *et al* described the standardized procedure of anesthesia and surgery for patients with or without COVID-19 infection requiring emergency surgery to minimize the risk of virus spread and reduce injury to patients and staff [12]. Similarly, the major Italian surgical and anesthesiologic societies described recommendations for clinical management of COVID-19-positive patients that require acute non-deferrable surgeries [10]. However, these data are based on reports from elective surgeries and also expert opinions [3, 11, 13]. To the best of our knowledge, there is no study reporting the clinical outcomes of surgical procedures in patients with COVID-19 disease.

The present study was established to investigate the clinical characteristics and outcomes of patients undergoing emergency surgeries during two months of COVID-19 infection from a general hospital center specialized for these patients.

Methods

We retrospectively analyzed the clinical data of all patients who underwent emergency surgeries (all invasive procedures local or general anesthesia) during the incubation period of COVID-19 at Loghman Medical Center. COVID-19 diagnosis was defined based on the initiation date of the signs and symptoms reported by the patients. In this approach, symptomatic patients including fever, cough, or respiratory symptoms were tested for RT-PCR of samples from the throat. In patients with respiratory symptoms chest, computed tomography was performed sooner. Either the

reverse transcription-polymerase chain reaction (RT-PCR) was positive or chest CT-scan showed typical involvements [14], the patient was considered COVID-19. Patients' data including surgery indications, outcome, the disease course, presence of COVID-19 signs and symptoms during the admitted period were thoroughly reviewed and recorded. The suspected patients for COVID-19 were extracted and their laboratory, radiologic, and nursing reports were reviewed. Clinical outcomes of operated patients were examined until the patients were discharged or the outcome was death.

Statistical Analysis

To present the data, we used mean, standard deviation, and frequency. To compare the data non-parametric tests were used. To compare continuous variables between two groups (Expired with COVID 19 and survivors) Mann-Witney test was used. To compare the categorical variables chi-square was used. All analyses were performed using SPSS (Version 25, IBM, Chicago) A P-value less than 0.05 was considered statistically significant.

Statement on research ethics

The study protocol adhered to the tenets of the Declaration of Helsinki and was approved by a local research ethics committee, an equivalent to the institutive review board in Shahid Beheshti University of Medical Sciences. The patients' information was kept confidential.

Results

In this case-series, all consecutive patients undergoing an emergency surgical procedure from 20th February to 10th April 2020 were enrolled and reviewed. During the disease progression, approximately an estimated 2000 COVID-19 patients with positive sings and laboratory tests admitted in some special wards and ICUs.

Eighty-one patients including 55 (67.7 %) males underwent emergency surgical procedures summarized in table 1. The leading surgical procedure was simple appendectomy followed by central venous catheter placement, tracheostomy, debridement of wound infection, and other surgery. (Table 1). The mean age of patients was 45.38 ± 22.25. Nineteen patients underwent the procedures under local anesthesia while the other 62 patients were anesthetized generally.

Nineteen patients were suspicious of COVID-19 either before or after surgical procedures during the study period. Among these suspected cases, 10 patients were confirmed to have COVID-19 based on either PCR result or abnormal CT-scan findings. The mean age of confirmed COVID-19 cases who underwent surgical procedures was 48.54 ± 19.38 years. Seven (63.6%) patients were male. Average of C-reactive protein was 43.09 ± 32.01. Two patients had normal CRPs. The average white blood cell counts were 12300 ± 9231 with lymphocyte cells averaging 727 ± 403 numbers. Table 2 summarizes the confirmed COVID-19 patients and their surgical procedures.

Five patients of confirmed COVID-19 died during the study period who are explained in more detail. The mean age of dead patients was 45 ± 22.9 years. The survivors of COVID-19 were comparable to the non-survivors in terms of age (P=0.76), sex (P=0.56), CRP (P=0.09), WBC (P=0.67), and lymphocyte counts (P=0.37). Some dead patients with COVID-19 were described.

Table 1: Surgical indications in all patients underwent surgical procedures between 20th February and 10th April.

Type of surgery	Number of patients	Surgical mortality	Confirmed COVD-19 patients
Simple Appendectomy	16	0	**0**
CV catheter placement	8	0	1
Tracheostomy	8	3	4
Wound infection management	8	0	1
Laparotomy due to peritonitis	6	3	2
Laparotomy due to Caustic injury	6	1	0
Laparotomy due to Bowel obstruction (small bowel or colon)	4	0	0
Thoracotomy	2	0	0
Laparotomy due to GI Bleeding	3	0	0
Cholecystectomy	2	**1**	0
Diabetic foot (amputation or debridement)	6	0	0
Chest tube insertion	4	0	1
Exploration of the chest wall or neck stab wound	2	0	0
Diagnostic Laparoscopy	1	0	0
Whipple procedure	1	0	1
Fasciotomy	1	0	1
Hemorrhoidectomy	1	0	0
Cardiac tamponade pericardial window	1	0	0
Open splenectomy Hypersplenism	1	0	0

Table 2: Characteristics of patients with a definite diagnosis of Covid-19.

Code	Age	Sex	complaint	Procedure	Anesthesiology
1	70	F	Gangrene cholecystitis	cholecystectomy	GA
2	45	F	Peritonitis/ intraabdominal abscess/ cervix cancer/ sigmoid perforation	Laparotomy/ end colostomy and HARTMANN pouch	GA
3	35	M	Upper limb abscess	Incision drainage	GA
4	19	M	Methadone intoxication	Tracheostomy / feeding jejunostomy	GA

5	72	M	Lower G-I bleeding	Laparotomy / colectomy	GA
6	51	F	Long time intubation	Tracheostomy	GA
7	62	F	Central vein catheter insertion	Central vein catheter insertion	LA
8	41	M	Duodenal tumor/ gastric outlet obstruction	Whipple procedure	GA
9	35	M	Pleural effusion	Chest tube insertion	GA
10	67	M	Upper limb compartment syndrome	Fasciotomy	GA
11	23	M	Acute appendicitis	Open appendectomy	GA

Table 3

Code	CRP	WBC	Lymph	CTscan Features	Hospitalization(day)	COVID Duration(Day)	PCR	Outcome
1	74	8400	59	Y	36	14	+	Death
2	12	39000	468	Y	2	10	+	Death
3	37	12600	982	Y	6	13	+	Death
4	115	10100	1030	N	24	18	+	Death
5	20	11800	802	N	5	14	+	Death
6	36	11400	866	Y	20	20	+	Recovered
7	38	4800	926	N	4	8	+	Recovered
8	55	10600	1076	Y	9	9	+	Recovered
9	70	4900	289	Y	13	17	+	Recovered
10	15	10700	214	N	30	15	+	Recovered
11	2	11000	1287	N	4	10	+	Recovered

1. Patient

A 70-year-old woman admitted with acute cholecystitis that did not medically improve. The patient had diabetes and cardiac and COPD history. The patient underwent cholecystectomy. Three days after the procedure, the patient's O2 saturation dropped critically and respiratory distress was developed. The patient's PCR test and chest CT-scan was positive and was transferred to the Corona facility care. The patient died after 21 days

2. Patient

A forty-five-year-old woman referred to our hospital with fever, decreased level of consciousness, leukocytosis, and evidence of typical lung involvements in CT-scan. The patient was admitted to the Corona special facility care and was consulted for abdominal distention. Abdominal CT-scan revealed multiple abdominal abscesses. The patient underwent laparotomy which revealed a sigmoidal perforation secondary to cancer of the cervix invading the sigmoid. The patient underwent a Hartmann procedure. She was not extubated after surgery and died after 36 hours.

3. Patient

A 72-year-old man complaining of hematochezia from 17 days before surgery were admitted and underwent a thorough investigation. The patient was asymptomatic of COVID-19 before the procedure. He underwent laparotomy and total colectomy was done. The patient wan not extubated and was transferred to ICU. The patient developed pneumonia in a pattern suggestive of COVID-19. His PCR result was positive. During admission, he had multiple drops of o2 saturation and underwent tracheostomy. He died 18 days after the first surgical procedure.

4. Patient

A 35-year-old man with a decreased level of consciousness, dyspnea, and fever was admitted to the Corona care facility. His PCR result for COVID-19 was positive. The consultation was requested with the surgery department secondary to hand abscess. The patient underwent debridement of necrotic tissue and drainage. Extubation was not possible after the surgery the patient was transferred to the ICU. The procedure was repeated several times during the admission. The patient died 7 days after the first procedure.

5. Patient

A 19-year-old man admitted with methadone intoxication and was intubated. The patient underwent tracheostomy because of lengthening of intubation. Three days after the procedure, the patient's O2 saturation dropped critically and respiratory distress was developed. The patient's PCR test was positive and was transferred to the Corona facility care. The patient died after 4 days.

The mortality during the study period inpatient with positive laboratory test was 45%. The mortality rate among the patients without confirmed corona (71 patients) was 4.3 % that was significantly lower than the patients with confirmed COVID-19. ($P< 0.001$). Nine out of 11 confirmed COVID-19 patients needed ICU care post-operatively. The corresponding value for the patients without confirmed COVID-19 was 23.1 % which was significantly lower than the COVID-19 patients. ($P= 0.03$) All survivors were followed after the discharge and were doing well within the study period.

During this time, insignificant numbers of staff developed QOVID-19, but the method of infection and the source of their infection were not determined.

Discussion

Our study shows the outcome of emergency surgical procedures performed in a center specialized for COVID-19 during the breakout. Our results estimate the mortality rate of not-elective procedures to be 45 %. It is hard to estimate the mortality rate purely attributable to patients with COVID-19. However, to our knowledge, this is the first study investigating the emergency surgical procedures in these patients.

Considering surgery and the epidemics, Lei *et al* (11) investigated 34 operative patients in a multicenter study from the epicenter of the outbreak. They mainly investigated no symptomatic patients who underwent elective procedures. Among these populations, 34 patients developed symptoms of coronavirus involvement

after the surgery. Therefore, most of the included patients possibly were in the incubation period of the disease at the time of surgery. Their results showed that 44.1 % of the patients needed ICU care and the mortality rate was 20.5 %.

The higher mortality rate and need for ICU in our study are attributable to many factors. First, all of our patients were a candidate for emergency procedures which normally have higher mortality rates. Second, four of our patients have been first admitted to the Corona facility care and were consulted for surgical procedures. These are the patients with more severe involvement of the disease who needed admissions. We believe their lung involvement and also possible systemic coagulate and electrolyte disturbances will increase the need for ICU care and subsequently the risk of mortality.

Similarly, Aminian *et al* [13]. investigated four patients who underwent elective surgeries within the first weeks of the outbreak. Three out of five patients died with ARDS pictures developed in the postoperative period.

Another result of the present study is the fact that age, gender, CRP level, WBC, and lymphocyte counts were comparable between the COVID-19 survivors and no survivors. This result could be the result of a few numbers of patients that make it difficult to conclude. Zhou *et al* [15]. Investigating 191 inpatients with laboratory-confirmed COVID-19 reported older age and d-dimer greater than 1 microgram / mL could predict the poorer prognosis. However, the clinical application of laboratory tests is yet to be determined yet [16, 17].

Various studies reported the morbidity and mortality rates after emergent and urgent surgical procedures. In a nationwide cohort study of 173643 patients undergoing general surgeries, urgent procedures were defined as a separate surgical category which had a 12.3% rate of morbidity and a 2.3% rate of mortality [18]. In another study investigating 294602 emergency admissions to 156 national health system Trusts, the 30-day mortality rate was reported to be 4.2 % ranging from 1.6 to 8 %. Considering these reports, our mortality rate is strikingly higher which cannot easily be attributed to the differences in the hospital setting [19].

However, it should be noted that the patient population referring to our center is different than the other general hospitals. This center has long been a referral toxicology department in the country. (20) Therefore, a long intubation period secondary to drug intoxication or a higher prevalence of caustic injuries could change the demographic characteristics of the patients. As both of these deadly diseases are more prevalent in younger patients.

Another limitation of the present study could be diagnostic approaches to COVID-19 patients. We used both CT-scans and RT-PCR for confirmation of the COVID-19. Various reports showed a higher sensitivity for chest CT-scan in the diagnosis of COVID-19 compared with RT-PCR (21, 22). We considered the patient to be COVID-19 when either of these tests was positive. However, either the chest CT-scan or RT-PCR was not routinely performed for all patients undergoing surgical procedures. Therefore, we may be overestimating the mortality rate through underestimating positive COVID-19 patients.

Surgical departments deserve special considerations through the outbreak from several points of view. [6, 8, 10, 23]. First, multiple emergency procedures should be done and cannot be postponed. Second, patients with diagnosed COVID-19 might have or develop comorbidities that necessitates a surgical procedure like a central venous catheter or hemodialysis catheter placement. Third, the surgeries performed in the operating rooms raise the exposure of all anesthesiology staff and the operating team with patients in the incubation period or established disease. The result of our study with the high striking mortality rate in these patients adds another alarm for the surgeons. Therefore, we recommend close monitoring of all operated patients in terms of vital signs, hemodynamic status, laboratory data, and electrolyte disturbances even the specific tests for COVID-19 are not performed or are negative. Moreover, the patients should be isolated based on an existing protocol to avoid exposure to COVID-19 patients. Considering COVID-19 as possible major comorbidity in all patients undergoing surgeries, the surgical team should minimize any excessive stress in all periods including before, during, and after surgery. These considerations include good pain management, preoperative medications, minimizing procedure time, performing less invasive techniques to control the damages and avoidance of any additional steps that could be escaped. All the operations should be arranged in a negative pressure operating room (12). The anesthesiologist should be cautious during the induction of the sedations. Avoidance of cough should be considered in all steps through adequate use of muscle relaxants and intravenous opioids. The operating room must be disinfected after the operations. Every patient with suspected exposure with SARS-CoV-2 infectious pneumonia should be isolated and observed for 14 days.

In conclusion, we reported the mortality rate after emergent and urgent surgical procedures to be as high as 45 %. This result necessitates the close monitoring of all patients undergoing surgical procedures during the outbreak.

Disclosure statement

None of the authors have any conflict of interest. No funding was received for this study. The study is not an official representative or on behalf of the government

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