

## DIAGNOSIS AND TREATMENT OF ACUTE SURGICAL DISEASES IN PATIENTS WITH COVID-19

Vechyorko VI, Anosov VD, Silaev BV ✉

Municipal Clinical Hospital № 15 named after O. M. Filatov, Moscow, Russia

Emergency surgery in the infectious diseases hospital is an urgent problem during the COVID-19 pandemic. Municipal Clinical Hospital No.15 named after O. M. Filatov has been providing emergency surgical care after conversion, from March 27, 2020 until now. The hospital's medical staff has built up extensive experience: 194 surgical procedures were carried out in April, and 289 surgical procedures were carried out in May 2020. The paper reports the experience of emergency surgery at the stage of conversion to an infectious diseases hospital. Among all hospitalized patients, 482 (5.29%) people had acute surgical pathology requiring emergency surgery. Among patients who underwent urgent surgery, 472 (98%) people had the caused by COVID-19 community-acquired pneumonia of various degrees of severity. The paper discusses some features of acute surgical pathology and complications identified in patients with COVID-19. The surgical care features in the hospital after conversion are proper epidemiological regime implementation, minimization of the number of staff in the operating room, possible minimization of the number and reduction of the duration of surgical procedures. The most important challenge during the COVID-19 pandemic is medical staff safety.

**Keywords:** acute surgical pathology, peritonitis, acute intestinal obstruction, bleeding, acute appendicitis, acute cholecystitis, hernias, acute pancreatitis, COVID-19, mesenteric thrombosis

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**Compliance with ethical standards:** all patients submitted the informed consent to personal data processing and surgical treatment. When it was not possible to obtain the patient's informed consent due to the severity of the disease, a consultation was issued in accordance with the Ethics Committee requirements and local regulations.

✉ **Correspondence should be addressed:** Borislav V. Silaev  
Veshnyakovskaya, 23, Moscow, 111539; drsilaev@yandex.ru

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## ДИАГНОСТИКА И ЛЕЧЕНИЕ ОСТРЫХ ХИРУРГИЧЕСКИХ ЗАБОЛЕВАНИЙ У ПАЦИЕНТОВ С COVID-19

В. И. Вечорко, В. Д. Аносов, Б. В. Силаев ✉

Городская клиническая больница № 15 имени О. М. Филатова, Москва, Россия

Экстренная хирургическая помощь в условиях инфекционного стационара — актуальная проблема во время пандемии новой коронавирусной инфекции COVID-19. Городская клиническая больница № 15 имени О. М. Филатова оказывает экстренную хирургическую помощь в условиях реперофилирования с 27 марта 2020 г. по настоящее время. Специалистами больницы накоплен большой практический опыт: в апреле 2020 г. выполнено 194, а в мае — 289 оперативных пособий. В статье представлен опыт работы экстренной хирургической службы на этапе реперофилирования в инфекционный стационар. Среди всех госпитализированных пациентов 482 (5,29%) имели острую хирургическую патологию, потребовавшую экстренного оперативного вмешательства. У 472 (98%) экстренно прооперированных пациентов присутствовала вызванная COVID-19 внебольничная пневмония разной степени тяжести. В статье рассмотрены некоторые особенности острой хирургической патологии и осложнения, встречающиеся у пациентов с COVID-19. Особенности хирургической помощи в реперофилированном стационаре — это строгое соблюдение эпидемиологического режима, минимизация численности персонала в операционной, возможная минимизация числа оперативных пособий и сокращение их длительности. Наиболее важной задачей в условиях пандемии COVID-19 является безопасность персонала.

**Ключевые слова:** острая хирургическая патология, перитонит, острая кишечная непроходимость, кровотечение, острый аппендицит, острый холецистит, грыжи, острый панкреатит, COVID-19, мезентериальный тромбоз

**Вклад авторов:** все авторы внесли равный вклад в планирование исследования, организацию работы стационара, сбор и обобщение материала, а также написание статьи.

**Соблюдение этических стандартов:** все пациенты подписали согласие на обработку персональных данных, а также согласие на оперативное лечение. В случае невозможности получения информированного согласия пациента ввиду тяжести его состояния, в соответствии с требованиями этического комитета и действующих нормативных актов был оформлен консилиум.

✉ **Для корреспонденции:** Борислав Владимирович Силаев  
ул. Вешняковская, д. 23, г. Москва, 111539; drsilaev@yandex.ru

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The coronavirus infection outbreak in 2019 (COVID-19) posed a serious challenge to the global community [1]. Introduction of the self-isolation and social distance regime all over the world led to the incidence rate decrease. However, it is too early to talk about full control over the situation.

During the pandemic, the burden on surgical services has increased significantly [2–5]. The world surgical communities (Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) [6, 7], American College of Surgeons [8], Royal College of Surgeons of England [9]), together with Russian communities of surgeons [10], urologists and obstetrician-gynecologists have published the joint guidelines

on the surgical service management under the new conditions [10, 11]. The framework of the “Temporary Guidelines” aimed, firstly, at preventing the medical staff infection, and, secondly, at developing principles for the provision of medical care to the infected patients, which cannot be postponed until the pandemic ends up. The “Temporary Guidelines” are as follows:

- all planned surgical procedures, manipulations and studies should be postponed;
- when conducting emergency medical procedures, the possibility of medical staff infection should be considered, therefore, the amount of intervention should be minimized;
- minimum number of personnel should be involved in the

treatment process; the full advantage should be made of remote communication between the medical staff and the patient, as well as of the remote medical specialists' consultations;

- surgical service is quite likely to experience the shortage of personnel, as surgeons may be called upon to provide medical care to patients in the infectious diseases hospitals.

The study was aimed to report the results of diagnosis and treatment of acute surgical diseases during the COVID-19 pandemic.

## METHODS

Since March 27, 2020, after conversion to the infectious diseases hospital which took about five days, the Municipal Clinical Hospital № 15 named after O. M. Filatov started to provide medical care to patients with COVID-19.

In a short time, a gateway was built with channels for entry, staff changing in protective clothing, and leaving the “red zone”.

The surgical service staff number was reduced to the minimum, since most doctors of all specialties, including surgeons, were called upon to provide medical care to patients with COVID-19. The planned surgical procedures were cancelled. Along with patients with an infection, hospitalization of patients with acute surgical diseases, injuries, acute urological and gynecological pathology against the background of COVID-19 began.

Despite the problems, the high quality emergency surgical care had to be provided to all patients in a timely manner. For that purpose, compliance to the following was fundamental:

- proper patient routing;
- selection of the sufficient (usually minimum) volume of surgical procedure;
- creation of the safe working environment for the operating room team.

To date, the experience gained by countries which have already faced a new infection has made it possible to develop principles for carrying out surgical procedures during COVID-19 pandemic. These principles have been implemented in the Municipal Clinical Hospital № 15:

- the operating suite ventilation mode should be changed: air extraction should take precedence over the air inflow, and the negative pressure should be created in the operating room;
- all operating room team members enter the operating suite wearing the personal protective equipment (PPE): protection suit, bouffant cap, safety glasses or plastic face shield, shoe covers, latex gloves and respirator;
- in addition to PPE, surgeons and operating room nurses wear disposable sterile operating clothing and sterile gloves;
- the patient is provided with disposable bouffant cap and disposable surgical mask;
- optimal temperature and humidity should be maintained in

the operating room (given that operating room team members are wearing a double outfit);

- maximum use of disposable surgical instruments;
- only the operating room team members stay in the operating room; during the surgical procedure, the doors of the supportive units and operating rooms are closed tightly;
- the nurse on duty responsible for the delivery of the instruments stays in supportive unit;
- intercom is used for communication between operating room and supportive units.

All surgical procedures were carried out by the pre-trained and instructed personnel in accordance with the epidemiological regime and the rules of aseptics and antiseptics.

The total of 482 patients underwent surgery in the Municipal Clinical Hospital № 15 from April 1 to May 23, 2020, which made up 5.29% of the total number of all hospitalized patients. Among patients with surgical diseases, there were 226 men (46.8%) and 256 women (53.2%), the average age was  $57.2 \pm 6.9$  (Table 1).

In 436 patients (90.4%), the coronavirus infection was confirmed by the laboratory test results (nasopharyngeal swab, PCR). In other 46 patients (9.6%), the coronavirus infection had no laboratory confirmation, however, all the patients demonstrated clinical manifestations of highly probable viral pneumonia.

Highly probable viral pneumonia of varying severity was identified in 472 patients (97.9%). The patient distribution according to pneumonia severity is presented in Table 2.

Inclusion criteria: patients of both genders, of any age, with new coronavirus infection COVID-19 confirmed by PCR, and acute surgical disease, requiring emergency surgery. Exclusion criteria: no COVID-19 confirmation in patients of both genders.

Statistical processing was performed by standard methods using the Microsoft Excel application (Microsoft; USA).

## RESULTS

The categories and number of surgical procedures performed in the hospital from April 1 to May 23, 2020 are listed in Table 3.

Of all operated patients, only 32 (6.6%) were placed in the intensive care units. The others were transferred to the ward from the operating room immediately after waking up.

## DISCUSSION

Based on the data obtained, it is necessary to discuss the diagnosis and treatment of some acute surgical diseases in the context of conversion to the infectious diseases hospital for patients with COVID-19.

Prior to conversion to the infectious diseases hospital, the diagnostically “obscure” patients with suspected *acute appendicitis* were prescribed multislice spiral computed tomography (MSCT), but in the context of overburdened

**Table 1.** Patient age distribution

Age	Number of patients	% of patients' total number
18–44 years	107	22.3
44–60 years	192	39.9
60–75 years	104	21.5
75–90 years	73	15.1
> 90 years	6	1.2
Total:	482	100

CT-rooms the exploratory laparoscopy started to be used more often. Thus, of 36 patients with suspected acute appendicitis, the diagnosis was confirmed by exploratory laparoscopy in 28 people.

Some papers suggest upfront surgery instead of laparoscopy since it is believed that laparoscopic procedures increase the risk of medical staff infection [7, 8]. Other specialists perform laparoscopic appendectomy even in patients with viral pneumonia [12]. We decided not to change the usual surgical tactics. The total of 27 laparoscopic appendectomies was performed after the conversion to the infectious diseases hospital. The average duration of the procedure was 44.7 min (for reference, the average duration of 25 laparoscopic appendectomies performed in January–February 2020 was 42.4 min). In one patient, we used laparotomy, and performed the open appendectomy. No complications were observed during the postoperative period.

In the literature, different approaches to the treatment of *acute cholecystitis* in patients with somatic comorbidities are discussed [6, 7, 13]. During the described period, 16 patients with acute calculous cholecystitis were treated in the hospital. Nine of them received the effective non-surgical treatment, in 6 patients laparoscopic cholecystectomy was performed. Six patients had acute cholecystitis contributed to by viral pneumonia with CT-3–4 score of lung parenchymal lesion. These patients underwent the US-guided biliary drainage. The postoperative period was uneventful, the cholecystostomy tube was removed in 9–18 days after surgery.

Twelve patients with *acute destructive pancreatitis* were treated. The diagnosis was confirmed by MSCT, the US-guided percutaneous drainage of fluid was carried out. One patient diagnosed with destructive pancreatitis and severe (CT-4) viral pneumonia died.

Nine patients underwent surgery due to *acute bowel obstruction* contributed to by viral pneumonia (lung parenchymal lesion score CT-3–4). In 5 patients, the obstruction was associated with adhesions, therefore, the dissection of adhesions was carried out (in 2 patients it was performed by laparoscopy). In 4 patients, the obstruction was associated with the sigmoid and rectum tumor. Two of these patients underwent the sigmoid resection with colostomy due to the signs of tumor perforation, the other 2 patients underwent the double-barrel colostomy. Two patients with severe viral pneumonia (CT-3–4) and comorbidities died during the early postoperative period.

Three patients underwent surgery due to *strangulated hernias*. The 1<sup>st</sup> patient had strangulated inguinal hernia (herniorrhaphy was performed successfully followed by recovery), the 2<sup>nd</sup> female patient had giant ventral hernia with multiple comorbidities (herniorrhaphy was performed followed by the patient's death due to the comorbidities' severity), the 3<sup>rd</sup> female patient had diaphragmatic hernia on the 3<sup>rd</sup> day after the cesarean section. The patient underwent laparotomy, reduction of the stomach into the abdominal cavity and diaphragm defect closure. Postoperative course was uneventful, the patient was discharged from the hospital.

After conversion to an infectious diseases hospital, 3 patients underwent surgery due to *perforated ulcer of stomach or duodenum*. In all patients, the open suture of ulcers was carried out. One 92-year old female patient had diffuse peritonitis, the ulcer suture failure occurred during the postoperative period. Two relaparotomies were performed, the patient died on the 8<sup>th</sup> day after hospitalization.

The total of 34 patients had ulcers of stomach or duodenum complicated with bleeding. Emergency fibrogastroduodenoscopy (FEGDS) in patients with COVID-19 has an inherent risk of the endoscopy team infection, therefore, some experts recommend performing it only on special indications within 24 hours from the patient's hospitalization [7, 14]. Our patients underwent emergency FEGDS during the first 3 hours after hospitalization. Primary hemostasis was achieved during the endoscopic examination, however, the recurrent bleeding occurred in 12 patients. The repeated endoscopic hemostasis was effective in 11 of them. One patient underwent emergency surgery due to relapse: laparotomy, duodenotomy, suture repair of bleeding ulcer making full recovery.

Almost simultaneous hospitalization of 2 patients with *spontaneous spleen rupture* of the may be considered the feature of the described period. Of the disease symptoms, the patients complained of pain in the left half of the chest when coughing. In both patients the diagnosis was verified by ultrasonography. The patients' subcapsular hematomas volume was 55 and 120 ml. We selected the conservative "wait-and-see" approach. On the 1<sup>st</sup> day, no negative dynamics were detected, and on the 2<sup>nd</sup> day the hematoma volume increase to 150 and 220 ml respectively was observed with a strip of free fluid in the abdominal cavity. Both patients underwent splenectomy followed by full recovery.

Two patients hospitalized with severe pneumonia (CT-3–4) were supported by mechanical ventilation. They had *pneumoperitoneum and pneumomediastinum*. The surgeon on duty suspected perforation of the hollow organ, but no abdominal lesions were found during surgery. Both patients died due to increasing acute respiratory distress and multiple organ failure. The described cases require further analysis and evaluation.

Patients with *mesenteric thrombosis* should be discussed specifically. Even in normal conditions, the mortality in this group exceeds 75% [15]. The discussed group included 8 patients with mesenteric thrombosis. Four patients were hospitalized with symptoms of peritonitis. The total necrosis of small bowel and right side of the colon was detected during the emergency surgical procedure. Four patients underwent superior mesenteric artery thrombectomy with resection of small bowel. One patient underwent endovascular thrombectomy. However, despite anticoagulation with therapeutic dose, all patients had retrombosis, necrosis of the remaining part of the small bowel during the early postoperative period, and died.

The data obtained indicated a significant increase in the number of emergency and urgent surgical interventions in May

**Table 2.** Patient distribution according to pneumonia severity

Pneumonia severity	Number of patients	% of patients' total number
COVID-19 with no pneumonia	10	2
Pneumonia CT-1	118	24.5
Pneumonia CT-2	228	47.4
Pneumonia CT-3	85	17.6
Pneumonia CT-4	41	8.5
Total:	482	100

Table 3. Surgical procedures carried out in the Municipal Clinical Hospital № 15 after conversion to infectious diseases hospital for patients with COVID-19

Surgical procedures	April 2020	May 2020	Procedures number increase, %
General surgery			
Appendectomy	9	19	
Amputation (toes, lower leg, thigh)	14	25	
Sigmoid colectomy in patients with peritonitis	3	1	
Laparotomy, superior mesenteric artery thromboembolectomy in patients with mesenteric arterial thrombosis	2	2	
Adhesiolysis in patients with acute bowel obstruction	3	2	
Splenectomy	2	1	
Laparoscopic cholecystectomy	0	6	
Microcholecystostomy	2	4	
Strangulated hernia surgery	0	2	
Perforated ulcer suturing	0	2	
Percutaneous transhepatic biliary drainage (PTCD)	1	0	
Endoscopic retrograde papillotomy	5	5	
Phlegmon lancing	14	24	
TOTAL:	55	93	69.09
Cardiovascular surgery			
Coronary angioplasty	13	21	
Lower extremity arterial thrombectomy	12	21	
Inferior Vena Cava (IVC) filter placement	1	3	
Arteriovenous fistula formation	1	5	
Aortic prosthetic reconstruction	1	0	
Pacemaker insertion	0	4	
Coronary artery bypass grafting (CABG)	0	1	
Valve replacement surgery	0	2	
Stenting in the leg arteries	0	2	
Vascular catheter insertion	6	4	
TOTAL:	34	63	85.29
Trauma surgery			
Osteosynthesis	8	15	
Transpedicular fixation of the spine	0	1	
Hip replacement in patients with fractures	0	3	
TOTAL:	8	19	137.5
Neurosurgery			
Cranial trepanation in patients with intracranial hematomas	0	6	
TOTAL:	0	6	
Urologic surgery			
Nephrostomy	5	10	
TOTAL:	5	10	100
Other procedures (exploratory laparoscopy, primary surgical treatment of wounds, tracheostomy, thoracostomy, etc.)	92	98	
TOTAL:	194	289	48.96

2020 compared to April 2020. In April 2020, mainly patients with viral pneumonia caused by COVID-19 were hospitalized to the clinic, and only a few of them had emergency surgical diseases. The situation changed in May 2020. Due to opening of a number of other large clinics in Moscow for treatment of patients with COVID-19, the Municipal Clinical Hospital № 15 named after O. M. Filatov started to admit patients with acute surgical diseases contributed to by COVID-19.

The built up experience allows us to state that there are no fundamental changes in the management of patients with acute surgical diseases. However, in patients diagnosed with

acute surgical disease contributed to by COVID-19 and viral pneumonia of varying severity, it is necessary to consider the increased risk of both bacterial and thromboembolic complications.

Based on the incomplete two months of work, it is difficult to draw conclusions about the features of the acute surgical disease course contributed to by viral pneumonia. However, it is obvious that at the peak of the COVID-19 incidence the correct management of surgical care in the infectious diseases hospital for patients with the new coronavirus infection makes it possible to establish balance between reducing the volume

of surgical care to the emergency level on the one hand and reducing the risk of infection of medical staff on the other hand.

## CONCLUSION

In patient with acute surgical disease contributed to by COVID-19 and viral pneumonia of varying severity, the increased risk of

both bacterial and thromboembolic complications should be considered. The surgical care features in the infectious diseases hospital for patients with COVID-19 are proper epidemiological regime implementation, minimization of the number of staff in the operating room, possible minimization of the number and reduction of the duration of surgical procedures. The most important challenge is medical staff safety.

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