

Evaluation of anesthetic approaches to surgical patients during early COVID-19 pandemic

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ABSTRACT

Objectives: We aimed to evaluate the anesthetic approaches of patients who underwent surgery in our hospital during the early COVID-19 pandemic period.

Methods: All patients admitted to general surgery (GS), orthopedics, neurosurgery (NS), urology, cardiovascular surgery (CVS), thoracic surgery, ear nose throat, and plastic and reconstructive surgery at the operating rooms in our hospital in early pandemic periods were scanned retrospectively. Demographical data, surgical indications, urgency, anesthetic methods, and complications are evaluated. Anesthetic methods used in the operations were examined as general anesthesia, regional anesthesia, and sedoanalgesia. In addition, patients' hospital stay period, intensive care unit admission rate, 30 days mortality, and COVID-19 positivity after surgery were examined.

Results: Two hundred and ninety patients were admitted for operation in our hospital during a pandemic. CVS, Orthopedics, and GS were departments that admitted the most number of patients with ratios of 27.2%, 26.2%, and 25.2% respectively. The patients who underwent emergency surgery were seen in the CVS with 79 patients and the orthopedics with 73 patients. In anesthesia management, the application rate of general anesthesia was 44.1%, regional anesthesia 33.1%, and sedoanalgesia 22.8%. Totally 61 patients were admitted to ICU. According to surgical branches, 30-day mortality rates were determined as 8.3% in NS, 6.6% in GS, 3.8% in CVS, and 2.7% in orthopedics respectively. 4 patients were postoperative COVID-19 positive in total.

Conclusions: Anesthetic approaches in surgical patients may affect the length of hospital stay, referral to the intensive care unit, and mortality in the early period of the COVID-19 pandemic.

Keywords: COVID-19, pandemics, anesthesia, emergency surgery, mortality, regional anesthesia.

Airway As coronavirus disease (COVID-19), spread rapidly throughout the world on 11th of March 2020, it was announced to be a pandemic by World Health Organization [1]. SARS COV-2 is widely transmitted by droplets from person to person, by contact with infected objects, and by aerosol at a high viral concentration at a close distance. Since its high rate of transmission, the exposure to the disease and the risk

of infection has increased for healthcare workers in centers where surgeries will be performed. In order to manage the pandemic period, in addition to the organization of hospital areas, personnel, and equipment, there was also a need to make a plan relating to patients to be taken into surgery. For this reason, a guideline in which suggests postponing elective surgeries during pandemic had been published by the American

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College of Surgeons and United States Department of Health and Human Services [2, 3]. In our country, the Ministry of Health has been declared several precautions in a statement to reduce the overload on health services with a directive dated 17/03/2020 with no 14500235-403.99, where authorities pointed out that elective surgeries should be postponed to a suitable time and be cautious about the availability of the beds in intensive care units [4]. Recommendations regarding anesthetic approaches applied to patients undergoing surgery during the pandemic process have been published. Therefore, the urgency of the operations and the anesthesia management of the patients have been changed.

The aim of our study is to examine our anesthetic approaches to surgical cases taken in our hospital in the early period of the COVID-19 pandemic.

METHODS

After obtaining approval of the local Ethics Committee (Approval number: 2011-KAEK-25 2020/05-06), the data of all surgical patients including general surgery (GS), orthopedics, neurosurgery (NS), urology, cardiovascular surgery (CVS), thoracic surgery, ear-nose-throat surgery (ENT) and plastic surgery (PRS) between 1 April 2020 and 20 May 2020 were retrospectively taken to the study. Patients with an ASA score I-IV diagnosed whether COVID-19, suspicious or not, underwent urgent and/or malignancy surgery were included. Polymerase Chain Reaction (PCR) tests were requested before all surgeries. However, emergency cases had to be taken without waiting for the results of PCR tests. All patients were taken to

the operating room by measuring their fever and questioning the infection findings and coronavirus contact. The demographic data (age, gender, comorbidities, diagnosis), surgical indications, urgency, anesthesia management, and complications were evaluated. The anesthetic method used in the operation is examined as general anesthesia (GA), regional anesthesia (RA), regional anesthesia + sedoanalgesia (RSA), and sedoanalgesia (SA). The use of an endotracheal tube (ET) and laryngeal mask airway (LMA) during general anesthesia were recorded. Regional anesthesia included central neuraxial blocks (spinal, combined spinal-epidural, and epidural) and peripheral nerve blocks (interscalene, suprascapular, supraclavicular, infraclavicular, axillary, sciatic, femoral, and popliteal nerve blocks). Besides, patients' hospital stay period, intensive care unit (ICU) admission rate, 30 days mortality, and COVID-19 positivity after surgery were examined.

Statistical Analysis

Statistical evaluation is made by using SPSS 23.0 program. For numeric variables, descriptive statistics is defined as average ± standard deviation, and for data having a categorical structure they are defined in numbers and percentages. Results are evaluated in a confidence interval of 95%.

RESULTS

In our study, 290 patients in total are operated in a period of nearly two months in the surgery room of our hospital. In demographic data, there were observed that the number of female patients was less in all sur-

Table. 1. Demographic data

	General Surgery	Orthopedics	Neurosurgery	Urology	Cardiovascular Surgery
Age (year) (mean ± SD)	38.69 ± 15.85	44.42 ± 19.43	56.90 ± 13.39	55.17 ± 11.60	51.12 ± 17.36
F/M (n)	30/46	28/ 45	12/24	4/16	18/ 61
ASA I/II/III/IV (n)	8/12/4/2	0/0/0/0	0/10/6/0	0/ 3/7/ 0	0/0/0/0
ASAE I/II/III/IV (n)	15/20/9/6	14/39/14/6	0/10/7/3	0/ 4/ 6/ 0	3/10/46/20

F = Female. M = Male, ASA = American Society of Anesthesiologists

Table 2. Surgical indications of patients admitted for surgery

General surgery	Orthopedics	Neurosurgery	Urology	Cardiovascular Surgery
Appendectomy	Femur Fracture	Intracranial Tm	Bladder Ca	Coronary Bypass
Breast Ca	Subraconpylar Fracture	Aneurysm	DJ Stent	Dissection
GIS Perforation	Humerus Fracture	LDH	Nefrectomy	Embolectomy
Ileus	Amputation	CDH	Nephrolithiasis	EVAR
Stomach Ca		Shunt		Arterial injuries
Colon Ca		Subdural hematom		Pediatric CVS
Rectum Ca		Stabilization		
Mesenteric Ischemia		Decompression		
Thyroid Ca				
Perianal Abscess				

Ca = Cancer, LDH = Lumbar disc herniation, CDH = Cervical disc herniation, EVAR = Endovascular Aneurysma Repair, Tm =Tumor, DJ = Double J, CVF = Cardiovascular Surgery

gical branches (Table 1). The surgical indications of patients admitted during a pandemic period are shown in Table 2. CVS, Orthopedics, and GS were departments that admitted a most number of patients with ratios of 27.2%, 26.2%, and 25.2%, respectively. Patients undergoing emergency surgery were seen 79 patients in CVS, 73 patients in orthopedics, and 76

patients in GS. In anesthesia management, the application rates were GA 47.9%, RA 24.1%, RSA 9.0%, and SA 19.0%, respectively. The numbers of central nerve blocks were 11 combined spinal-epidural, 14 epidural, and 27 spinal blocks. All peripheral nerve blocks were performed with ultrasound guidance. If there was a motor branch of the nerve to be blocked,

Table 3. Type of surgeries and anesthetic approaches (n, %)

	290 n (%)	Ca/ Emergency n (%)	ETT/LMA (n)	GA/RA/RSA/SA n (%)
		50/240 (17.2/82.8)	134/3	139/70/26/55 (47.9/24.1/9.0/19.0)
General Surgery	76 (26.2)	22 /54	55/0	55/6/15/0 (72.4/7.8/19.8/0)
Orthopedics	73 (25.2)	0/73	9/3	12/50/11/0 (16.4/68.5/15.1/0)
Neurosurgery	36 (12.4)	16/20	32/0	32/2/0/2 (88.8/5.6/0/5.6)
Urology	20 (6.9)	10/10	6/0	6/12/0/2 (30/60/0/10)
Cardiovascular Surgery	79 (27.2)	0/79	28/0	28/0/0/51 (35.4/0/0/64.6)
Ear Nose Throat	6 (2.1)	2/4	6/0	6/0/0/0 (100/0/0/0)
Thoracic Surgery				
Plastic Surgery				

ETT = Endotracheal tube, LMA = Laringeal mask airway, GA = General anesthesia, RA = Regional anesthesia, RSA = Regional anesthesia + Sedoanalgesia, SA = Sedoanalgesia

stimulation with a neurostimulator (Stimuplex Ultra, B Braun, Melsungen AG, Germany) was added to the ultrasound (Esaote, MyLab30Gold Cardiovascular, Florence, Italy) imaging. The numbers of upper extremity peripheral nerve blocks were 2 interscalene, 2 suprascapular, 4 supraclavicular, 11 infraclavicular, and 8 axillary blocks. The numbers of lower extremity nerve blocks were 15 sciatic, 9 popliteal, and 16 femoral blocks. In some situations, one of the peripheral nerve blocks or central neuraxial blocks could be combined with another nerve block or GA in the same patient. The application rates of regional anesthesia (with/without sedation) were 86.3% in orthopedics, 60.0% in urology, 27.6% in general surgery, and 0% in other surgeries (Table 3). Endotracheal intubation was performed in all patients except 3 child cases under general anesthesia. Laryngeal mask airway was used only in these cases in the orthopedics room. The average period of staying at the hospital was given in Table 4. 21% of total patients were admitted to ICU. The most number of ICU admissions were made in the CVS department. 30 days mortality rates as per surgical branches were determined as, 8.3% in NS, 6.6% in GS, 3.8% in CVS, and 2.7% in orthopedics. (Table 4). If the preoperative PCR test was negative, anesthesia was given. However, especially in emergency cases, some cases underwent surgery before the PCR test wasn't concluded. PCR tests were positive in the postoperative period in only 4 patients whose preoperative COVID-19 status was unknown. In 7 patients with a fever higher than 37.3°C at the preoperative period, then 2 patients of them had positive PCR test re-

sults postoperatively.

Hypotension was observed in 18 patients and bradycardia was seen in 13 patients perioperatively. Nausea and vomiting were observed in 14 patients postoperatively. Perioral cyanosis and metallic taste were seen in a patient who was administered sciatic and femoral nerve block. Methemoglobinemia (MetHb: 5.9%) was observed and treated with 6 l/min oxygen inhalation therapy and ascorbic acid 2g iv.

DISCUSSION

We evaluated our anesthesia approaches to 290 patients who were operated during the COVID-19 pandemic period, a total of 17.2 % malignancy and 82.8 % emergency patients were included. Our anesthesia approach was primarily planned according to the type of surgery and to prevent the transmission of COVID-19. In cases where GA was required to ensure airway safety, ETT was preferred instead of LMA to prevent particle contamination. RA was preferred whenever possible especially in orthopedic (83.6%) and urology (60.0%) patients.

Correctly defining surgical indications of patients during the pandemic period include importance both to avoid mortality relating to emergency cases and for correct organization of cancer patients during the process [4-6]. COVID-19 pandemic is an important public health disease with mortality and it requires a multidisciplinary approach relating to it. During treatment of patients for whom operation planning is made

Table 4. Durations of hospital stay, referral to intensive care unit and mortality rates

	Hospital stay (d) mean± SD	Referral to ICU n (%) 61 (21)	Mortality n (%) 13 (4.5)
General surgery	4.82 ± 4.12	15 (19.7)	5 (6.6)
Orthopedics	4.16 ± 2.06	6 (8.2)	2 (2.7)
Neurosurgery	4.6 ± 2.06	12 (33.3)	3 (8.3)
Urology	3.4 ± 2.12	0	0
Cardiovascular Surgery	7.24 ± 2.44	28 (35.4)	3 (3.8)
Ear Nose Throat	3.15 ± 1.18	0	0
Thoracic Surgery			
Plastic Surgery			

ICU = Intensive Care Unit

due to emergency or diagnosis of cancer, protection of health personnel and other patients, isolation of patient rooms, perioperative treatments and most importantly taking precautions for medical personnel, operating rooms, and surgical tools have significant importance [7, 8]. Chen *et al.* [9] recommended that surgical operations should be reduced to prevent cross-infection, non-surgical anti-tumor therapies should be chosen with higher priority if it is possible to recommend multidisciplinary therapies for malignant tumors, and neoadjuvant therapies for advanced gastrointestinal system malignancies. However, delaying of surgery for progressing disease would cause another public health crisis. For this reason, health service providers must consider the risks and benefits of malignancy surgery under these conditions [10]. With the announcement of pandemic, elective cases were delayed by complying with the directive of the Ministry of Health in the operating room of our hospital. By reducing a number of operating rooms, recommended arrangements were made. Emergency (82.8 %) and cancer patients (17.2 %) were taken into operations.

The first step of anesthesia planning for a patient during COVID-19 pandemic period is to determine whether COVID-19 test of a patient comes out to be negative, positive, or suspicious positive. When the spreading of disease is considered, until it is proven otherwise, all patients should be deemed to be positive [11]. A preoperative coronavirus PCR test was performed on cancer patients and emergency patients scheduled for surgery in our hospital. Emergency patients underwent surgery without waiting for the PCR test results and were taken into operation pretending to be positive. Emergency patients whose PCR test was not completed were taken to surgery in the negative pressure operating room. All patients were taken to the operating room by measuring their fever and questioning the infection findings and coronavirus contact in our hospital. In all patients, 7 patients had a fever higher than 37.3°C, and only 2 of them had positive PCR test results postoperatively. Since every patient was considered to be positive for COVID-19 and all precautions were taken against COVID-19 preoperatively and intraoperatively, health workers were not infected.

Planned anesthesia method should be the most appropriate technique for patient and surgery type carrying a minimum risk of viral transmission for the periop-

erative intervention team. The American Society of Regional Anesthesia and Pain Medicine and the European Society of Regional Anesthesia and Pain Therapy have recommended neuraxial anesthesia and peripheral nerve blocks for patients with COVID-19. If it is possible to use RA, it should be the primary anesthesia method that is preferred. In addition to post-operative pain control, RA can prevent pulmonary complications and viral transmission. Usage of RA is not contraindicated for COVID-19 positive and suspicious patients [12, 13]. A good planning should be made for the operation to be performed with RA. In the intraoperative period having a requirement to turn back to GA in an unexpected way would be the least desired situation [14]. In the study of Price *et al.* [15], which included 100 emergency orthopedic patients during the COVID-19 period, 70% (n = 70) general anesthesia and 30% (n = 30) regional anesthesia were applied. Although our RA rate was 33.1% totally, our RA according to surgical branches was applied to 83.6% of orthopedic patients and 60.0% of urology patients. Axillary or infraclavicular brachial plexus block instead of superior truncus block (supraclavicular and interscalene) should be preferred. Potential complications specific to brachial plexus blocks include pneumothorax and phrenic nerve injury, which can cause further respiratory failure in the COVID-19 patient [16]. For these reasons, we preferred infraclavicular and axillary blocks in 76.0% of the upper extremity blocks in orthopedic cases.

Airway management during general anesthesia causes aerosol emission, exposing the healthcare team to the increased risk of COVID-19 transmission during both intubation and extubation. It is known that the probability of acute respiratory tract infection transmission to a healthcare professional during tracheal intubation is 6.6 times higher than those who do not have tracheal intubation [17]. The Anesthesia Patient Safety Foundation (APSF) and the American Society of Anesthesiologists (ASA) recommend rapid sequence induction and intubation because of the risk of supraglottic airways (e.g. laryngeal mask) generating more aerosols compared to tracheal intubation [18, 19]. Preoxygenation was achieved by applying 100% O₂ for 3-5 minutes with a face mask before anesthesia to our patients who are given general anesthesia. In these patients, it was avoided ventilation with a mask. An endotracheal tube was applied with rapid serial in-

duction using analgesia and muscle relaxants. The laryngeal mask was used in 3 children patients who required mask ventilation in which sedoanalgesia was insufficient.

Operating rooms are high-risk areas concerning transmission by airway or contact. For this reason, it is recommended that all surgical procedures be performed in a negative pressure room, if available [20]. Although operating room systems in our country are generally well designed to deal with such high-risk situations, the high risk of transmission and prevalence of the disease, limited resources, heavy workload, greatly increase the risk of COVID-19 transmission to the operating room team. In the management of surgical patients worldwide, anesthesiologists encounter more cases of COVID-19 cases. To minimize all these risks, all the necessary equipment for anesthesia and surgery was prepared in our hospital. Doctors, nurses and staff were trained. Materials such as monitors and ultrasound devices were protected with a transparent cover, protective personal equipment (PPE) for the team was worn in accordance with the instructions.

Concerning postoperative complications and mortality, it is important whether surgical intervention is urgent or malignancy. In a study, conducted it was emphasized that emergency surgical application is an important indicator in predicting mortality risk [21]. Emergency abdominal surgery has worst results and high death rates when compared with elective surgery. In the studies conducted at normal times 30 days mortality was determined as 3.8-5% in general surgical GS cases, it was determined as 0.92% in orthopedics, as 1.9-5.3% in CVS and as 2.6% in NS [22-25]. Changes in mortality rates have been investigated in some studies during the COVID-19 pandemic period. In a study in orthopedic patients in the early period of the COVID-19 pandemic, they reported the overall 30-day mortality rate was 3% [15]. In another study involving 153 emergency general surgery patients during the surge of COVID-19 pandemic, they found a 30-day mortality rate of 7% [26]. Grassner *et al.* [27] examined emergency neurosurgical procedures during the first wave of the pandemic, they found that the 30-day mortality did not increase compared to the previous 4 years (between 4,5%-8,9%). They stated that decreased incidence of neurosurgical emergency and this was related to the restrictions placed on mobility within countries [27]. In our study, the mortality rates

were seen as 8.3% in NS, 6.6% in GS, 3.8% in CVS and 2.7% in orthopedics. We consider that operations admitted in NS due to tumor surgery and emergency intervention to hemorrhagic cerebrovascular events. GS department during COVID-19 pandemic period generally included malignancies that might cause metabolic dysfunction and therefore they had higher mortality rate. In the postoperative period, PCR tests were positive in 4 patients. Two of them were hospitalized in ICU and were died during their follow-up. We think that the type of surgery performed and the presence of comorbid diseases in these patients are effective in their mortality. The other covid positive patients were treated in their clinics.

CONCLUSION

We think that the correct and timely selection of surgical indications and the planning of the process with protective anesthesia approaches for the patient and healthcare personnel may affect morbidity and mortality in the early covid 19 pandemic period. As a result surgical operations and anesthetic approaches were performed in accordance with the guidelines, and the correct usage of beds and ICU capacity of our hospital was ensured and the mortality rates were kept at normal levels. In cases where anesthesia can be managed with RA during the Covid-19 pandemic period, we recommend that RA be applied firstly if there are no contraindications.

Authors' Contribution

Study Conception: ÜK; Study Design: ÜK; Supervision: ÜK, FA; Funding: ÜK, CY; Materials: FA, CY; Data Collection and/or Processing: ANB; Statistical Analysis and/or Data Interpretation: ÜK; Literature Review: TO; Manuscript Preparation: ÜK, FA and Critical Review: CY.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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