Annals of Medicine and Surgery 60 (2020) 87–91

Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.elsevier.com/locate/amsu

Does elective orthopaedic surgery in pandemic era increase risk of developing COVID-19? A combined analysis of retrospective and prospective study at Cipto Mangunkusumo Hospital, Jakarta, Indonesia

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ARTICLE INFO

Keywords:
COVID-19
Orthopaedic surgery
Elective surgery

ABSTRACT

Background: To date, no recommendations have been published on when and how to start again carrying out elective, non-urgent surgery on COVID-19-negative patients after the epidemic peak has been reached in a given country or region and the pressure on healthcare facilities, healthcare workers and resources has been released by so far that elective surgery procedures can be safely and ethically programmed again. This study aims to investigate whether elective orthopaedic surgery will increase the risk of developing COVID-19.

Materials and methods: This was a combined retrospective and prospective studies performed at a national tertiary hospital in Jakarta, Indonesia. Subjects were patients who underwent elective orthopaedic surgeries at our institution from April to May 2020. Those who were previously infected with COVID-19 from polymerase chain reaction (PCR) reverse transcriptase (RT) examination obtained via nasopharynx and oropharynx swab, as well as those who were reluctant to participate were excluded from the study.

Results: A total of 35 subjects (mean age 32.89 ± 17.42) were recruited. Fifteen (42.9%) subjects were male, and 20 subjects (57.1%) were female. Mean duration of surgery was 240 min with the longest and shortest duration of 690 and 40 min, respectively. General anaesthesia was performed in the majority of cases in 18 surgeries (51.4%) with local anaesthesia as the least in 2 surgeries (5.7%). Length of stay of our study was 6 days of average. None of the patients developed symptoms suggestive of COVID-19 infection.

Conclusion: We found that elective orthopaedic surgery may not be associated with increased cases of COVID-19 cases. However, our study was limited by short duration of follow-up. Further studies are required in order to investigate the affect of undergoing elective surgery and the number of COVID-19 cases.

1. Introduction

The outbreak of a novel coronavirus disease in Wuhan, China, in December 2019 marked the beginning of unprecedented global spread of the disease, leading to a near-collapse of the healthcare systems in most affected countries [1]. In January 2020, the disease was declared a public health concern of international scale by the World Health Organization (WHO) and has been named COVID-19 in February 2020, with SARS-CoV-2 as the causative virus. As the disease is highly contagious and the presence of asymptomatic carriers make containment a difficult challenge, it has spread around the globe with more than 1.5 million confirmed cases worldwide and nearly 100,000 confirmed deaths as of

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https://doi.org/10.1016/j.amsu.2020.10.015
Received 5 September 2020; Received in revised form 8 October 2020; Accepted 8 October 2020
Available online 15 October 2020

April 10, 2020 [2].

Main transmission vectors were originally thought to be respiratory droplets and direct contact; however, recent publications suggest the possibility of aerosol propagation as well [3–5]. Symptoms may appear 2–14 days after exposure and period incubation ranges from 4 to 7 days, during which any infected patient may be asymptomatic and contagious [2].

Several articles that cover all aspects of contamination prevention, elevated surgical risk and clinical management of COVID-19-positive patients have been published. The question remains if elective surgery is still advisable on infected patients or should be generally postponed [2,6,7].

There seems to be a general consensus in the current published literature on postponing elective, non-urgent surgery on COVID-19-positive patients. However, to our best knowledge, no recommendations have been published regarding when and how to start again carrying out elective, non-urgent surgery on COVID-19-negative patients after the epidemic peak has been reached in a given country or region and the pressure on healthcare facilities, healthcare workers and resources has been released by so far that elective surgery procedures can be safely and ethically programmed again [2]. This study aims to investigate whether elective orthopaedic surgery will increase the risk of developing COVID-19.

2. Methods

This study was a combined retrospective and prospective studies performed at a national tertiary hospital in Jakarta, Indonesia. Subjects were patients who underwent elective orthopaedic surgeries at our institution from April to May 2020. Those who were previously infected with COVID-19 from polymerase chain reaction (PCR) reverse transcriptase (RT) examination obtained via nasopharynx and oropharynx swab, as well as those who were reluctant to participate, were excluded from the study. This manuscript has been written in accordance with the STROCSS 2019 Guideline [8].

Variables analysed in this study includes age, gender, types of anaesthesia, duration of surgery, length of stay, clinical symptoms, smoking status, comorbidities, any history of visitation to pandemic countries, and any frequent contact with COVID-19-positive patients. These variables are considered risk factors that may contribute to the development of COVID-19.

Patients who were eligible for elective surgery underwent laboratory examination (routine blood test and differential blood count) and plain chest radiograph. They also underwent COVID-19 screening by SARS CoV-2 Immunoglobulin G & IgM antibody test using 2019-nCoV IgG/IgM Detection Kit® (Vazyme Biotech, China). Those with positive antibody test results were excluded from the study. Moreover, the surgery was postponed until they had negative results. The patients were also encouraged to undergo self-isolation, and if they had suggestive signs and symptoms, they would be advised to go to the hospital. After the examinations, the patients would underwent surgical procedure in our institution. During surgery, preventive measures were applied according to the level of infection spread risk.

One week after discharge, laboratory testing (routine blood test and differential blood count) and plain chest radiograph was conducted. Multiple screening levels, social distancing, hand hygiene, utilization of protective equipment including surgical masks by both health practitioners and the patients were all done in our polyclinic setting. Patients indicative of having COVID-19 were then consulted to the Internal Medicine Department for further workup including nasopharyngeal/oropharyngeal swab test.

All statistical analyses were performed using SPSS 23 for Mac. Descriptive data were presented in frequency for categoric data and mean/median for numerical data. This study has received ethical clearance from the Research Ethical Committee of the Faculty of Medicine, *Universitas Indonesia*, no: KET-809/UN2.F1/ETIK/PPM.00.02/2020, protocol no. 20-05-0558. This study is registered at UMIN Clinical Trials Registry (https://www.umin.ac.jp/ctr/index.htm) with UIN of UMIN000042052. This study followed the STROCSS guideline [9].

3. Results

A total of 35 subjects (mean age 32.89 ± 17.42) were recruited for this study. Total sampling was performed to recruit the study participants from April 1st to May 26th 2020. Fifteen (42.9%) subjects were male, and 20 subjects (57.1%) were female. Mean duration of surgery was 240 min with the longest and shortest duration of 690 and 40 min, respectively. General anaesthesia was performed in the majority of cases in 18 surgeries (51.4%) with local anaesthesia as the least in 2 surgeries (5.7%). Length of stay of our study was 6 days of average. Characteristics of the subjects are presented in Table 1.

None of the patients developed symptoms suggestive of COVID-19 infection. Ten patients had comorbidity and the most common comorbidity was malignancy (n = 6 [17.1%]). Two (5.7%) of the patients were smokers (Table 1).

Investigations were also carried out on those 35 subjects after discharge to see if there were any suggestive signs indicative to COVID-19 infection. Blood tests include routine blood and differential count. Plain chest radiograph was also performed on all patients.

Only one patient was detected suggestive of COVID-19 infection which was found to have infiltrates on the plain chest radiograph. The appearance of ground glass opacity (GGO) was found in this patient after confirmation using chest Computed tomography (Chest CT Scan). In other patients, chest CT Scan was not performed because there were no indications based on clinical symptoms (Fig. 1). The patient then underwent further examination of PCR-RT swab from nasopharyngeal and oropharyngeal samples with negative results. From this study, no one showed any symptoms that were confirmed as cases of COVID-19 (See Fig. 2).

4. Discussion

COVID-19 cases in Indonesia were first announced on March 2, 2020. As of August 17, 2020, confirmed cases in Indonesia have reached 141,370 cases with 94,458 recovered patients and 6297 deaths. Indonesia has had ranked 23rd in the world and ranked 9 in Asia [10]. This infectious disease has a high probability of transmission through the air due to aerosol viruses that are thought to last longer in the air [11]. Elective surgery should not be performed immediately because it has no indication of a threat to life or disability, it is different from

Table 1
Characteristics of the patients.

	(n = 35)
Age (years)	32,89 ± 17,42
Sex	
Male	15(42,9%)
Female	20(57,1%)
Type of anaesthesia	
Local	2(5.7%)
Spinal	10(28.6%)
General	18(51.4%)
Combined spinal and epidural anaesthesia (CSE)	5(14.3%)
Duration of surgery	240 (40, 690)
Length of Stay (LOS)	6 (1, 27) [median, (min and max)]
Comorbidities	6 (17,1%)
Malignancy	1 (2,86%)
Smoking	2 (5,7%)
Lung Tuberculosis (TB) infection	1 (2,86%)
Systemic lupus erythematosus (SLE)	

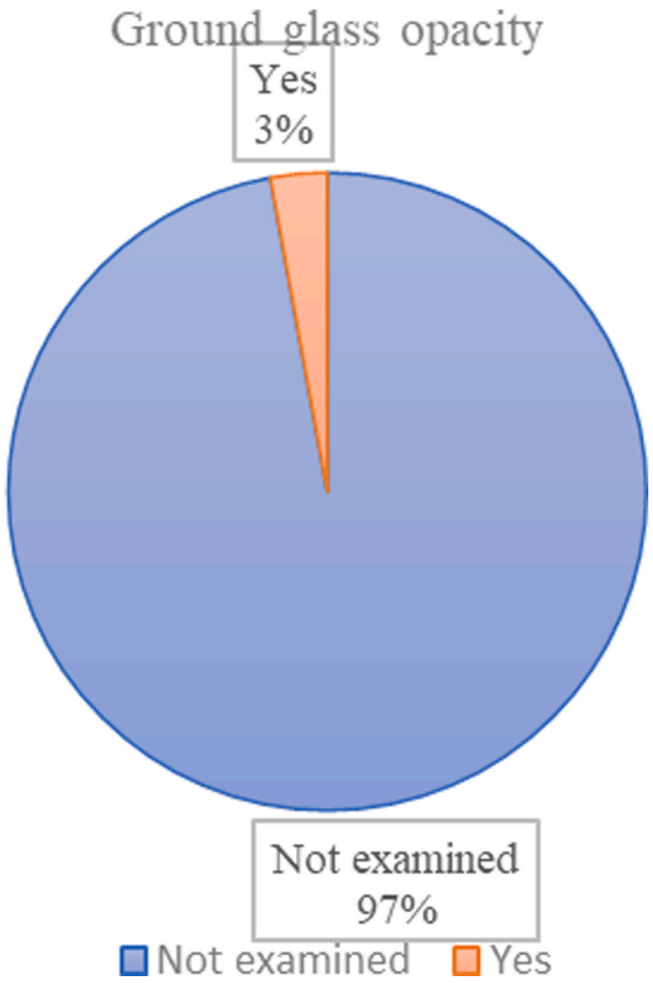

Fig. 1. Ground glass opacity appearance from the subjects.

Fig. 2. Operating room condition and anaesthetic procedure.

emergency surgery. There are many considerations for delaying planned operations during the COVID-19 pandemic. One of them is the concern that planned surgical procedures could contribute to health workers as well as by increasing exposure time to the virus in hospitals, especially in the operating room. Data from the Centers for Disease Control and Prevention (CDC) is also a consideration for delaying planned operations. According to CDC data, around 25% of people who catch COVID-19 do not show any symptoms [12].

In this study, we recorded patients who underwent elective orthopaedic surgery at the Central Surgical Installation of our institution. Strategies to prevent the spread of the virus have become clear, namely through proper hygiene, quarantine, social distancing, self-isolation and community restrictions. This main strategy is effective in flattening the curve of infection and can delay the peak point. However, this strategy does not reduce the absolute number of infections occurring [13].

The working environment of anaesthesia and its surface are at high risk of harbouring droplets which can serve as virus reservoirs if proper decontamination processes are not carried out. Thus, it would be preferable to use disposable equipment whenever possible. Patients who are suspected or confirmed to be infected should be taken to the operating room after a prescribed route, designed to minimize contact with other people. All patients must wear a surgical mask [14].

The main transmission risks are exposure to droplets and contact transfer of the virus. Droplets are severe and usually spread within a maximum distance of 2 m after coughing and sneezing from an infected patient. The exception is when a procedure is performed on a patient that generates artificially generated aerosols (small particle nuclei, which can penetrate a standard surgical mask and contaminate a wider range of dispersions). Aerosol-generating procedures include tracheal intubation, noninvasive ventilation, administration of high-flow nasal oxygen, bronchial oxygenation. suctioning, bronchoscopy, and sputum induction. These procedures place health care workers in close proximity to the upper respiratory tract source containing viral load, which has been associated with an increased risk of transmission of coronavirus [14]. In this study, there was no association between the type of anaesthesia used in elective orthopaedic procedures because there were no patients who showed symptoms or were confirmed as COVID-19 cases.

In this study, the median surgical duration was 240 (40–690) minutes. We hypothesised that the longer the surgical duration, the higher the risk of COVID-19 infection, but there is no previous evidence regarding this. Further studies investigating operative duration and risk of COVID-19 infection are required in the future.

Singapore decided to limit the number of elective operations as a measure to prevent the spread of COVID-19. Stratification of elective surgery requirements for patients with orthopaedic spine into emergencies, tier 2 and tier 3. It is a priority to manage resources during the pandemic so that Orthopaedic and Traumatology services can continue [15].

Al-Jabir et al. [16] highlighted several points on surgical services that must be changed: 1) using part of the operating room as an emergency treatment room for COVID-19, 2) redistributing staff and operating room personnel, and 3) stratifying patients based on their operational needs whether emergency or non-emergency.

It is crucial to pay attention on preventing the transmission of COVID-19 among operating room personnel. Two independent teams should be formed, namely a team that specifically handles routine patients in hospitals and a special team to manage COVID-19 isolation patients. After 2 weeks interval, the two teams were swapped to see if any personnel developed symptoms of COVID-19 [16].The condition of our operating room and anaesthetic procedure is depicted in (Figure 2)

According to the clinical practice guidelines of our institution, regarding COVID-19, our institution has principles in considering patients being operated on [17].

a) Reducing the number of elective surgeries during the COVID-19 pandemic
b) All suspected or confirmed COVID-19 positive patients should receive optimal therapy by prioritizing the safety of medical personnel and patients
c) For emergency patients requiring surgery, COVID-19 screening should be performed
d) Consider nonsurgical therapy whenever clinically possible
e) Consider waiting for the results of the COVID-19 screening if possible

f) Use of a negative pressure operating room in surgery for ODP, PDP, or COVID-19 positive patients

Our institution also created intraoperative guidance: surgery should be carried out quickly and efficiently as possible. The number of personnel in the operating room should be kept to a minimum. The need for surgery was assessed using the Elective Surgery Acuity Scale (ESAS).

Another policy from the hospital to reduce the risk of transmitting COVID-19 is to create a special protocol to be implemented in the operating room during this time of the COVID-19 pandemic, particularly protocols regarding the flow of patients and staff in and out of the operating room. Ideally, there should be surgical staff and operating room personnel dedicated only to COVID-19 patients, but given the limited number of human resources in the hospital, this will be difficult to do. It is also advisable to create a special operating room to manage COVID-19 patients and transportation to the patient room must be monitored strictly and adjusted to the protocol for COVID-19 [18].

In this study, we found that malignancy is the most common co-morbidity. Although malignancy is included in elective surgery, in cases of malignancy in this pandemic era, it cannot be postponed because the late treatment is carried out, the worse the prognosis. This is in accordance with the SMO Surgery Acuity Scale (ESAS). On this scale, the need for elective surgery can be assessed. In ESAS, the level of need for urgency or need for surgery is divided into six categories, ranging from 1A, 1B, 2A, 2B, 3A, and 3B according to the level of need for elective surgery. Those who are categorized as 1A and 1B do not required immediate surgery; thus, the surgical procedures can be postponed. In patients 2A and 2B, these patients were categorized as postponed or attempted to do one day care (ODC). As for patients 3A and 3B, it is recommended not to delay surgery because they are afraid that their condition will worsen. The malignancy is included in the 3A category so that it cannot be delayed for surgery [17].

There was no association between length of stay and the occurrence of COVID-19 infection in this study. This could be due to the relatively short length of stay in this study [4]. However, Marago et al. [19] found that patients who acquired nosocomial COVID-19 infection had a higher length of stay (38.29 days vs 9.41 days, $p < 0.001$). However, the length of stay in the study was much longer than in this study.

Those who were planned to undergo elective surgery were screened for COVID-19 at the polyclinic. Patients were tested for body temperature, laboratories, plain chest radiographs, and a rapid test for COVID-19. The results of the examination were subsequently reviewed by the Internal Medicine Physician to determine the patient's status. If the patient' had positive rapid test results, the patients' surgery was postponed until the results were negative. This protocol is certainly not completely perfect, but it is felt to be the most effective compared to requiring a Swab as a preoperative filter.

However, in a meta-analysis conducted by Deeks et al. [20], it was found that rapid test which is the anti-SARS Cov-2 IgG/IgM serology test, regardless of the type of brand, does not have a high sensitivity as a screening J. They stated that the sensitivity of serological tests was influenced by the time since the patient had symptoms, where the best sensitivity was on the 21st day after the onset of symptoms. The review suggests that antibody tests can have a useful role in detecting whether a person has contracted COVID-19, but the timing at which the test is used is important. An antibody test can help confirm COVID-19 infection in people who have symptoms for more than two weeks and do not have an PCR-RT test, or a negative PCR-RT test result. Camarena et al. [21] suggested creating a preparation flow chart for surgery to ensure that the patient is not infected with Covid. In the diagram, the serology test is used twice and the PCR-RT test. Even with a layered test according to the diagram, Camarena stated that there is still a 10% chance of patients with COVID-19 infection who will escape [21].

The fields of orthopaedics and traumatology play an important role in which operations performed on patients will have a lasting impact regardless of the status of COVID-19. Therefore, careful planning is required and ensure that the surgical management received is optimal. On the other hand, orthopaedic surgeons should predicted that there will be a large increase in patient volume during this time of the pandemic. To facilitate this, patients can be stratified based on their needs whether they require immediate action or can be taken.

COVID-19 has an enormous impact on hospital services. The postponement of elective and non-urgent surgical procedures can make orthopaedic surgeons an important human resource in dealing with the COVID-19 pandemic. In pandemic condition, all available health workers are expected to be able to contribute in handling COVID-19, both surgeons and non-surgical doctors.

5. Conclusions

We found that elective orthopaedic surgery was not associated with increased rate of COVID-19 cases. Factors including duration of surgery, length of stay, types of anaesthesia and comorbidities were also not associated with COVID-19 cases in this study. However, we did not perform nasopharyngeal/oropharyngeal swab to confirm the diagnosis, thus the results may not be valid. We suggest performing PCR-RT swab examination for etiological diagnosis in pre-operative settings in further studies.

Funding sources

The authors report no external source of funding during the writing of this article.

Ethical Approval

This study has received ethical clearance from the Research Ethical Committee of the Faculty of Medicine, Universitas Indonesia, no: KET-809/UN2.F1/ETIK/PPM.00.02/2020, protocol no. 20-05-0558.

Consent

Written informed consent was obtained from the patient for publication of this article and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Kamal AF contributed to conceptualization, methodology, validation, investigation, resources, writing - review & editing, supervision.

Widodo W contributed to conceptualization, methodology, resources, supervision.

Kuncoro MW* contributed to investigation, writing - original draft, project administration.

Karda IWAM contributed to investigation, writing - original draft, project administration.

Prabowo Y contributed to conceptualization, methodology, resources, supervision.

Sigh G contributed to resources, supervision.

Liastuti LD contributed to resources, supervision.

Trimartani contributed to resources, supervision.

Hutagalung EU contributed to conceptualization, resources, supervision.

Saleh I contributed to conceptualization, resources, supervision.

Tobing SDAL contributed to conceptualization, resources, supervision.

Gunawan B contributed to conceptualization, resources, supervision.

Dilogo IH contributed to conceptualization, resources, supervision.

Lubis AMT contributed to conceptualization, resources, supervision.

Kurniawan A contributed to conceptualization, resources, supervision.

Rahyussalim contributed to conceptualization, resources, supervision.

Oesman I contributed to conceptualization, resources, supervision.

PPSI NN contributed to conceptualization, resources, supervision.

Latief W contributed to conceptualization, resources, supervision.

Wijaya MT contributed to validation, investigation, project administration.

Ivansyah MD contributed to validation, investigation, project administration.

Primaputra MRA contributed to validation, investigation, project administration.

Reksoprodjo AY contributed to validation, investigation, project administration.

Hendriarto A contributed to validation, investigation, project administration.

Novriandi KMA contributed to validation, investigation, formal analysis.

Alaztha Z contributed to validation, investigation, formal analysis.

Canintika AF contributed to validation, investigation, formal analysis.

Sitanggang AHR contributed to project administration.

Registration of Research Studies

This study is registered at UMIN Clinical Trials Registry (https://www.umin.ac.jp/ctr/index.htm) with UIN of UMIN000042052.

Guarantor

Achmad Fauzi Kamal is the sole guarantor of this submitted article.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

None.

Acknowledgment

We would like to thank the Department of Orthopaedic and Traumatology, Faculty of Medicine, *Universitas Indonesia*, Cipto Mangunkusumo Hospital, Jakarta, Indonesia.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2020.10.015.

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