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Prevalence of surgery cancelation and challenges in restarting elective surgery in the pandemic: A cross-sectional study

Gezy Giwangkancana [*], Raja Akhmad Anzhari [#], Indriasari [#]

Department of Anesthesia and Intensive Care, Faculty of Medicine, Universitas Padjadjaran/Dr. Hasan Sadikin National Referral and Teaching Hospital Bandung-Indonesia, Bandung Kota, West Java 40161, Indonesia

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ABSTRACT

Objectives: The COVID-19 pandemic caused primary disruption of health services, especially to elective surgery. As the pandemic goes in waves of high and low infection rates in a country, restarting elective surgery must be dynamic while balancing patients' needs, staff safety and the hospital capacity. We aim to report the prevalence of elective surgery and minimally invasive procedures cancelation due to positive Covid-19 screening and describe steps in restarting elective cases after the third wave of Covid-19 infection.

Methods: This study was a descriptive cross-sectional study in Indonesia's tertiary referral and teaching hospital from January to September 2021. Subjects were patients scheduled for elective surgery or minimally invasive procedures from our outpatient clinic. Subjects were screened for SARS-CoV-2 using real-time polymerase chain reaction (rRT-PCR) 24-48 hours before scheduled surgery or intervention. Data was taken from the hospital information system and the central operating theatre online surgical list. Statistical analysis is presented in percentage.

Results: There were 5286 subjects identified for the study, and 3088 were included with an available PCR result from the outpatient department. The average elective cancelation rate was 7.4%, and the highest cancelation was on August 2021, with 14.7%. All subjects with positive results were asymptomatic, with more than 90% cycle time rRT-PCR above 30.

Conclusion: Elective surgery cancelation can reflect a trend in community infection, and monitoring its values is crucial for saving elective surgery plans during a pandemic.

1. Introduction

In 2021, the COVID-19 pandemic entered a new chapter with the third wave due to the emergence of a new infectious and deadly severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) known as the Delta variant. Countries in all five continents, especially India, Indonesia and the United States, suffered high infection rates. The lag in vaccination programs, failure in containment, over-capacity of hospitals and infection of healthcare workers were among the causes of the catastrophic mortality in some countries, never before seen during the COVID-19 pandemic.[1–5] During this period, Indonesia recorded a peak period of infection known as the "third wave." The World Health Organization (WHO) recorded June 7, 2021, as the beginning of the Indonesian third wave with 15.323 confirmed cases per week with a calculated 38.31% weekly increase of positive cases. By July 2021, Indonesia recorded the highest COVID-19 cases ever recorded during the pandemic.[1]

Due to the third wave, the burden of the healthcare system globally was pushed to the maximum capacity. Indonesia's health care system was severely compromised due to the high number of patients requiring medical treatment and the high number of infected healthcare workers. Indonesian Ministry of Health reported that during July-August 2021, more than 50% of all provinces in Indonesia were above the maximum 60% Covid-19 bed occupation rates and above 80% capacity of their Covid-19 ICU beds.[6] To provide medical service for Covid-19 patients, many hospitals had to reroute oxygen supply, bed, staff and other resources. Among these strategic steps was the cessation of elective care such as outpatient care and elective surgery.

By the second week of August 2021, the infection rates hit a low plateau, with 225.635 cases and a reported 48.256 decrease in active

* Corresponding author.
E-mail addresses: Gezy.weita@unpad.ac.id (G. Giwangkancana), sari.anestesi@yahoo.co.id (Indriasari).
co-author.

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cases per week plus a decrease in overall hospital capacity.[1,6] Our hospital, a national referral hospital located on an island with one of the highest COVID-19 prevalence rates during the third wave in Indonesia, decided to restart elective cases on August 5, 2021. Perioperative SARS-CoV-2 testing was still mandated, as studies showed that patients infected with SARS-CoV-2 have higher perioperative morbidity and mortality.[7,8] Testing was also required to protect healthcare workers from getting infected, especially since anesthesia and surgery involve routine aerosol-generating procedures that increase virus transmission.[9,10]

Many studies show that more than 50% of COVID-19 patients were asymptomatic,[7–9] and considering the ongoing national vaccination program during 2021, there is an interest in ascertaining whether COVID-19 patients could still be found using preoperative screening during a low period of community infection or a downslope. This observation may provide another perspective on the possibility of the existence of infected yet undiagnosed individuals during lower number of cases in the community; however, studies regarding this are rare. In this study, we aim to report the prevalence of elective surgery cancelation due to positive results of the SARS-CoV-2 screening tests and describe the steps to be taken in restarting elective cases during the third wave of the pandemic in Indonesia.

2. Methods

This was a retrospective cross-sectional study performed in a tertiary referral and teaching hospital in Indonesia with a capacity of 23 operating rooms and 1000 in-patient beds. Institutional review board clearance was granted (number LB.02.01/X.6.5/161/2020) as a substudy of the surgical patient cohort with COVID-19. Data was taken from the central operating theatre operating list and hospital information system between 1 January 2021 to 30 September 2021.

The population was patients scheduled for elective surgery and minimally invasive procedures admitted from the outpatient department. Our hospital's elective patients were consequently listed on the operating theatre list based on a waiting-list program from the outpatient department system. The surgical or medical department authorized the cases based on the availability of equipment, surgeons and in-patient beds. The patients came to the outpatient department's designated holding-room at 08.00–10.00, 24 hours before surgery. Their nasal swabs for SARS-CoV-2 were taken in this holding room, and their results were available from 14.00 to 16.00 on the same day. Patients who tested negative would continue to the in-patient care, while the patients who tested positive would be sent home to self-isolate, and their results would be conveyed to their local public health center or *Pusat Kesehatan Masyarakat* (Puskesmas) via the 119 national COVID-19 call centers. Subjects were excluded if they did not have preoperative PCR testing results or if their PCR was not from the outpatient clinic, such as those scheduled from the in-patient care.

Patients' age, sex, type of surgery, COVID-19 related symptoms and cycle time PCR results were collected. The data is presented in percentages, and the prevalence is calculated by dividing the number of positive PCR patients and elective surgery patients within one month. Positive PCR results were defined with a cut-off cycle time (CT) below 40. The writing of this paper follows strengthening the reporting of observational studies in epidemiology (STROBE) checklist.

During the COVID-19 pandemic, our operating room developed a central operating theatre disaster plan (COT-DP) to match our hospital's disaster management program (HD-MP). The Indonesian Ministry of Health required the development of such a disaster plan in every referral hospital to prepare for the pandemic.[11] Some primary considerations were screening protocols, isolation areas, workflows and human resources availability during a particular time/period in the pandemic.[11,12] Our hospital HDMP was developed in early March 2020 as the first cluster of COVID-19 patients were treated in our hospital, but the COT-DP programs were developed much later, in May 2020. Although our center had experience in managing other new emerging diseases such as avian influenza and swine flu, there was no precedence of surgical need during those times, and hence, this was our first experience creating a COT-DP.

The COT-DP was designed around three main goals. One was providing surgical services in the operating room for COVID-19 patients, including preparing a designated infectious disease operating room, workflow adjustments, personal protection equipment and infection control.[12–17] The second goal was planning the elective surgeries during the pandemic, and the third was supporting general hospital requirements in scenarios where the operating room must provide services for non-surgical COVID-19 cases. This disaster plan was laid out in four stages (Fig. 1). The STROBE diagram was used to describe the method of study (Fig. 2).

3. Results

During our study, 5286 elective surgery and minimally invasive procedures cases were scheduled. The eligibility study excluded 2198 patients since no PCR results were not available from the outpatient clinic. Three thousand eighty-eight patients were included in the study from 1 January 2021 to September 31^{st,} 2021.

In general, data collection showed that the prevalence of cancelation was 7.4% from January to September 2021, with the highest prevalence in August 2021(14.7%) and the lowest in March 2021 (2.9%). No elective cases from the outpatient department were conducted during July 2021due to the rise of Covid-19 cases. (Table 1)

The general characteristics of elective case patients with positive COVID-19 screening results after the third wave were collected and presented in Table 2. Positive screening results were found in both months, August (n = 37) and September (n = 47). In both months, positive results were similar between men and women (43% vs 57%; 40% vs 60%). Most patients were in the productive age group, 18–45 years old (48%, 51%), followed by pediatric patients below 18 years old (24%, 19%). PCR results showed that for the majority, the PCR cycle time was above 30 at 30–34.9 (32%, 51%) and 35–40 (62%, 45%) (Table 2).

4. Discussion

Our study is the first to provide information about the impact of the COVID-19 pandemic, especially the third wave, on elective surgery cancelation in a developing country. Our study showed that the prevalence of cancelation of elective surgeries and minimally invasive procedures due to positive preoperative SARS-CoV-2 testing was 7.4%, with the highest cancelation in August 2021 at 14.7%. Interestingly, this high prevalence occurred during the downslope of the third wave in July 2021.

We compared our cancelation data with the national COVID-19 data collected by the Indonesian Ministry of Health (**Supplementary 1**). We found two general findings: One, an increase in elective case cancelation might predict an increase in community infection. The operating room manager should notify the hospital management and the general health system when the positivity rates of elective case cancelation are above the recommended WHO threshold of positive results in community testing (5%).[12] The second finding was that although community infections have decreased, prolonged, "persistent positive" SARS-CoV-2 screening results lasted up to 30 days. The persistent positive results are consistent with guidelines and studies that indicate that a persistent positive result is possible in SARS-CoV-2 testing, as rt-PCRs are highly sensitive to traces of viral RNA. [2,5,6,11] Hence, further study is needed on the relationship between infectivity and positive PCR results for elective surgery screening purposes.

Positive results in SARS-CoV-2 screening for elective surgeries presented our hospital with several problems. One was the socioeconomic impact on our canceled patients, who had spent time and money to

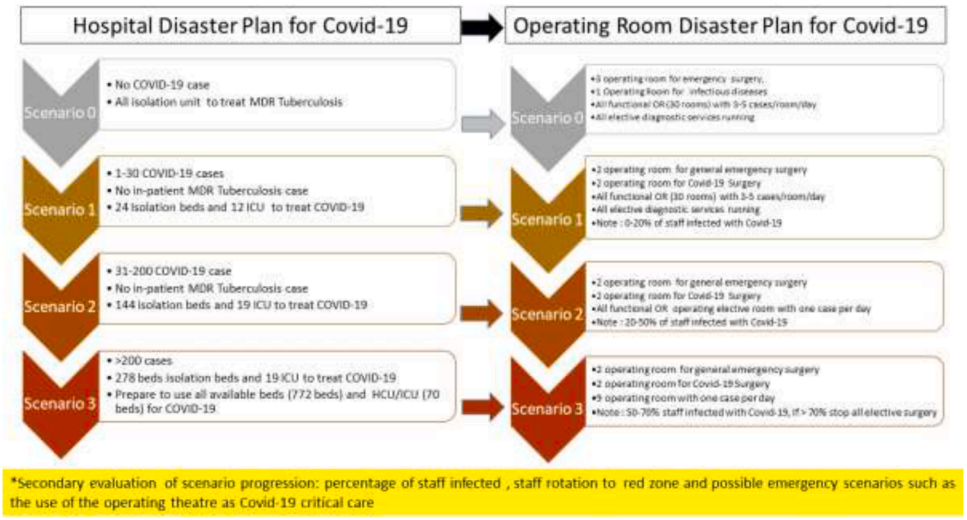

Fig. 1. Central Operating Theatre Disaster Plan for Covid-19.
Legends: MDR: multidrug-resistant; ICU: intensive care unit; HCU: high care unit; OR: operating room.

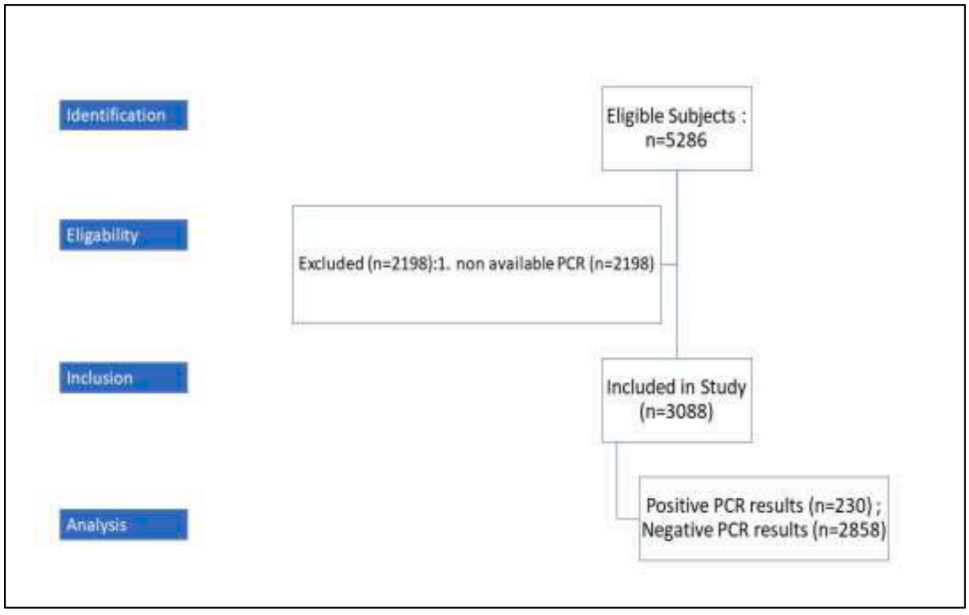

Fig. 2. Strobe Diagram.
Legends:PCR: Polymerase Chain Reaction.

Table 1
Elective Case and Positive Covid-19 Screening.

Month of Evaluation	Total Subjects (n)	Positive PCR Screening Test (n)	Negative PCR Screening Test (n)	Prevalence
January	298	22	276	7,4%
February	344	31	313	9,0%
March	481	14	467	2,9%
April	499	20	479	4,0%
May	371	18	353	4,9%
June	358	41	317	11,5%
July	Not available	Not available	Not available	Not Available
August	252	37	215	14,7%
September	485	47	438	9,7%
Total	3088	230	2858	7,4%

travel to the hospital, as most of our surgical cases were referral cases. The second was the added burden to our elective surgery waiting list, as canceled cases needed to be rescheduled, and there was no possibility of switching cases to other potential patients, as screening required a minimum of 12 hours period for next day surgery. Before the pandemic, our elective surgery waiting list was already long, with a 3–9 month-long wait, and the pandemic increased the strain on the system. There is a general opinion among our surgeons that elective patients came for elective surgery in a more advanced stage of their disease and a lower overall health status, although a study on this is needed.

Several methods were applied in other studies to reduce elective surgery cancelations. A study in Japan for elective orthopedic surgery resulted in zero PCR cases in the preoperative period. A zero prevalence was achieved, as the patients were required to undertake mandatory isolation for 14 days and were admitted to the hospital on the fifth day before taking the PCR test for the surgery(which would take place 24 hours before the surgery).[16] Another study in a United States pediatric

Table 2
Characteristics of Elective Case Patients with Positive Covid-19.

Variable	August 2021 (n=37)	September 2021 (n=47)
Sex		
Male	16(43%)	19 (40%)
Female	21(57%)	28(60%)
Age (years old)		
< 18	9(24%)	9(19%)
18-45	18(48%)	24(51%)
46-60	9(24%)	12(25%)
>60	1(4%)	2(5%)
PCR cycle threshold value		
<25	1(3%)	0(0%)
25-29.9	1(3%)	2(4%)
30-34.9	12(32%)	24(51%)
35-40	23(62%)	21(45%)
Division		
Maxillofacial surgery	8	7
Digestive Surgery	6	5
Urology Surgery	5	3
Obstetrics and gynecology	3	4
Orthopedic Surgery	3	4
Oncologic Surgery	3	4
Ear Nose and Throat	2	3
Neurosurgery	2	6
Pediatric Surgery	3	3
Plastic Surgery	1	3
Cardiology	1	5

orthopedic surgery center found a low rate (0.58%) of positive cases during preoperative screening utilizing a similar isolation period.[17] This particular isolation and admission protocol could not be applied in our center, as, logistically and financially, we were not able to provide isolation facilities within our hospital, and many of our patients' socioeconomic backgrounds do not permit them to have reasonable space or finances to be able to self-isolate for an extended period. Studies have shown that people from a higher socioeconomic status can have an isolated place and place social distancing measurements during the pandemic.[18,19] Although our strategy was ineffective in reducing the cancelation number, it was the most efficient approach considering our circumstances.

Providing emergency surgery for non-COVID-19 and COVID-19 patients was the hospital's main concern with the added possibility of the greater need for COVID-19 surgery during peaks of infection; elective surgery flow was the variable that changed dynamically throughout the pandemic.[12,13,17] Three primary considerations were accounted for to reduce or increase the number of elective surgeries: the number of surgical and anesthesia staff actively in service, the availability of equipment and drugs for surgery and anesthesia, the availability of postoperative surgical beds, as in some conditions, wards could be switched to COVID-19 wards. One unprecedented factor evident during the peak infection season (July–August 2020) was the limited oxygen supply to our hospital; hence, elective anesthesia and surgical services were reduced, and oxygen supply was primarily used in COVID-19 intensive and high care wards. Through a weekly meeting and on a day-to-day basis via an online chat room, the COT executive manager was notified of the hospital's general COVID-19 scenario (1–4), which depends mainly on the number of COVID-19 patients being treated in the hospital. Our hospital has 990 beds, and critical occupancy was considered to be when more than 200 beds (20%) were assigned to COVID-19 (Fig. 1).

During the Indonesian third wave in June–July 2021, the COT progressed from COT-DP scenario 1 to scenario three. Elective surgery ceased in July 2021 mainly due to the number of surgical and anesthesia staff infected with COVID-19, including surgeons, anesthesiologists, operating theatre nurses and anesthesia nurses. As most of our anesthesia nurses had emergency and critical training, some were redirected to COVID-19 care, which further reduced staff availability in the COT. Elective cases were resumed on August 5, 2021, after a general meeting between the hospital management and COT managers, who concluded that enough staff was available to provide elective surgery, and most surgical wards were not treating COVID-19 patients anymore (Fig. 1).

Protecting staff from COVID-19 infection is vital in managing the pandemic, specifically in elective surgery, as surgery and anesthesia are healthcare services requiring specialized skills, and not all health case workers (HCW) can provide these surgical and anesthesia services. Studies show that HCW contract COVID-19 at a higher rate than non-medical personnel and reported infection transmission from surgical patients to medical staff; hence, COVID-19 testing remains a cornerstone in surgical and anesthesia service during the COVID-19 pandemic. Another finding in the study was that, alarmingly, the positive cases found in our study were primarily asymptomatic patients, and the possibility of hidden transmission is high.[9,16,20–24] Our hospital policy required patients to answer a preoperative screening questionnaire. The questionnaire is used to rule out symptomatic patients, and failure in the screening result would prompt the elective case to be rescheduled for 14 days, and a resolution of symptoms is noted by a screener.

Systematic reviews and meta-analyses have shown that asymptomatic patients in COVID-19 are typical and that the relative risk (RR) of asymptomatic transmission was 42% lower than that of symptomatic transmission (combined RR 0.58; 95% CI 0.34 to 0.99, $p = 0.047$) but still sufficient to warrant policy attention.[22–24] Another possible explanation was that the positive patients in August 2021 and September 2021 had contracted COVID-19 infection four–six weeks prior to their preoperative schedule, which was not covered in our preoperative screening questionnaire, as it covers only 14 days. Studies have shown that a persistent positive PCR test with a high CT value (above 30) may be seen up to four weeks after infection in COVID-19 patients, especially among those who are asymptomatic. The second possibility was that the positive patients were in their pre-symptomatic COVID-19 infection period, and their CT value could decrease after examination; moreover, the last was that there were underestimations of unreported cases in our country.[25–27] Due to changes in self-isolation protocols released by the WHO and Indonesian Ministry of Health in 2022, especially regarding shorter isolation periods and PCR no longer being used as a requirement for isolation, it would be interesting to study the role of routine PCR testing in the preoperative period as the pandemic evolves and vaccination coverage expands.[1,2,28,29]

The success of the Indonesian vaccination campaign, which reached one hundred million recipients at the end of 2021, may also explain our study's high number of asymptomatic infections.[1,6] Some studies have shown that vaccination increases the number of asymptomatic cases, but a larger cohort in England shows that the vaccine decreases both symptomatic and asymptomatic infection.[30,31] Nevertheless, some studies still argue that vaccination may not prevent SARS-CoV-2 transmission; hence, preoperative testing becomes an important topic to discuss in the future, especially for protecting operating room personels.[32]

Some weaknesses of our study were that we did not evaluate whether our patients were COVID-19 survivors and whether they were vaccinated. Another weakness was that this was a cross-sectional study; hence, we did not follow up on the clinical condition of our positive cases and did not check whether their infection became symptomatic. Thus, our study cannot analyze the actual pattern of disease and risk factors. Another weakness was the substantial number of excluded patients from our preoperative screening database. Patients could have their PCR done from another laboratory outside of the hospital facility, suggesting a bias that the actual positivity rate of our elective cases was higher than our record.

Finally, the scenarios presented in Fig. 1 may not be applied fully by a hospital if considering only the total bed occupation rate of the hospital; rather, they must consider the number of staff infected at a time. Surgery and anesthesia require highly trained and specialized medical providers, and other healthcare personnel may not be easily replaced in a short period. During this pandemic, anesthesiologists and anesthesia

nurses are also essential staff because they provide critical and high care healthcare services for severe COVID-19 patients. Thus, safety in the operating room is paramount for the prospective continuation of surgery and COVID-19 health care in general.

Conclusion

Monitoring preoperative PCR testing results in elective surgery for SARS-Cov-2 provided predictions for community infection trends, and the operating room management should develop a disaster plan to actively respond to changes in infection trends to provide safe and effective surgery service.

CRediT authorship contribution statement

Gezy Giwangkancana: Conceptualization, Methodology, Investigation, Writing – original draft. **Raja Akhmad Anzhari:** Investigation, Data curation, Writing – original draft. **:** Resources, Data curation, Writing – review & editing.

Declaration of Competing Interest

The authors received no financial support for this article's research and authorship. The authors declare that they have no conflict of interest in the publication of this article.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.pcorm.2022.100271.

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