



Operating Room Utilization During The COVID-19 Pandemic In K.R.M.T Wongsonegoro Regional Public Hospital Semarang Indonesia

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Abstract

Background: Coronavirus Disease 2019 (COVID-19) is a highly contagious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Along with progressive spread of COVID-19 cases, health care facilities are one of the places with a high possibility for COVID -19 transmission and health care providers are at high risk. **Methods:** This study is a retrospective study on utilization operating room during COVID-19

pandemic in March 2020 until July 2021 at K.R.M.T. Wongsonegoro Regional Public Hospital, Semarang, Central Java. **Results:** There was an increase of COVID-19 surgical procedures since March 2020, with decrease in Non-COVID-19 surgical procedures, followed by gradual increase in the following month. Most of the COVID-19 patients who underwent surgery were female (62,25%). A total of 334 (41,59%) patients were aged 19-40 years. The most surgical procedures performed on COVID-19/non-COVID-19 are Caesarean Section (SC), Double lumen, Curettage, Tracheostomy and Debridement. **Conclusion:** It is necessary to emphasize proper operating room arrangement and the use of required PPE in order to prevent the spread of COVID-19

Keywords : COVID-19, Operating Room, PPE

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Introduction

Coronavirus Disease 2019 (COVID-19) is a highly contagious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Currently, COVID-19 pandemic has become a fairly serious health problem around the world.¹ Since August 5, 2021, the number of confirmed cases of COVID-19 worldwide reached 198,964,259 cases, including 4,232,713 deaths.² Indonesia has the second highest number of COVID-19 cases with more than 3 million cases, with 95,723 death.² In Central Java, the number of confirmed cases of Covid-19 are 423,916 cases with 26,926 deaths.³ More specifically, in Semarang City, the number of confirmed cases of Covid-19 are 84,181 cases with 4,264 deaths.⁴

Based on Indonesian Minister of Health Decree Number HK.01.07/MENKES/169/2020 concerning the Designation of Referral Hospital for the Management of Certain Emerging Infectious Diseases, K.R.M.T Wongsonegoro Regional Public Hospital is one of the COVID-19 referral hospital in Central Java. Along with the progressive spread of this virus, health facilities are one of the places with high possibility for transmission of this virus, putting health care providers at high risk.

Proper operating room management is needed in order to control the risk of virus transmission in the operating room. The increase in covid-19 cases requires some modifications in operating room such as negative pressure room equipped with a HEPA (High Efficiency Particulate Air) filter, as well as separate operating room aimed at preventing the spread of the virus in the operating room environment. The effort to reduce the risk of infection are carried out by wearing complete PPE (gloves, disposable gowns, masks, eye protection, etc.) for health workers, division of operating zones, as well as establishing a flow for operating room workers and patient transfer in the operating room.

Then, how to use the operating room properly during the COVID-19 pandemic, wear PPE, and arrange operating room to prevent the spread of COVID-19 virus?



Methods

This study is a retrospective descriptive study on the use of operating room during the COVID-19 pandemic in K.R.M.T. Wongsonegoro Regional Public Hospital, Semarang. The data used in this study were in the form of surgery data, gender, age range, and the type of procedures, as well as surgeons and non-surgical doctors who were affected by COVID-19 in K.R.M.T. Wongsonegoro Regional Public Hospital from March 2020 to July 2021.

Results and Discussion

The comparison of the total COVID-19 and Non-COVID-19 surgeries is shown in Graph 1. It is found that the number of COVID-19 surgeries has increased since March 2020 (2 surgeries) and peaked in January 2021 (88 surgeries), followed by declining number of COVID-19 surgery in February 2021 until May 2021 then peaked and touched the highest number in July 2021 (148 surgeries).

In addition, the number of non- COVID-19 surgeries decreased in April 2020 (220 surgeries), then gradually increased in the following months and reached 397 surgeries in April 2021 followed by gradual decline in May to the lowest number of surgeries in July 2021 with 176 surgeries.



Graph 1. Comparison of Total COVID-19 and Non-COVID-19 Surgeries March 2020-June 2021

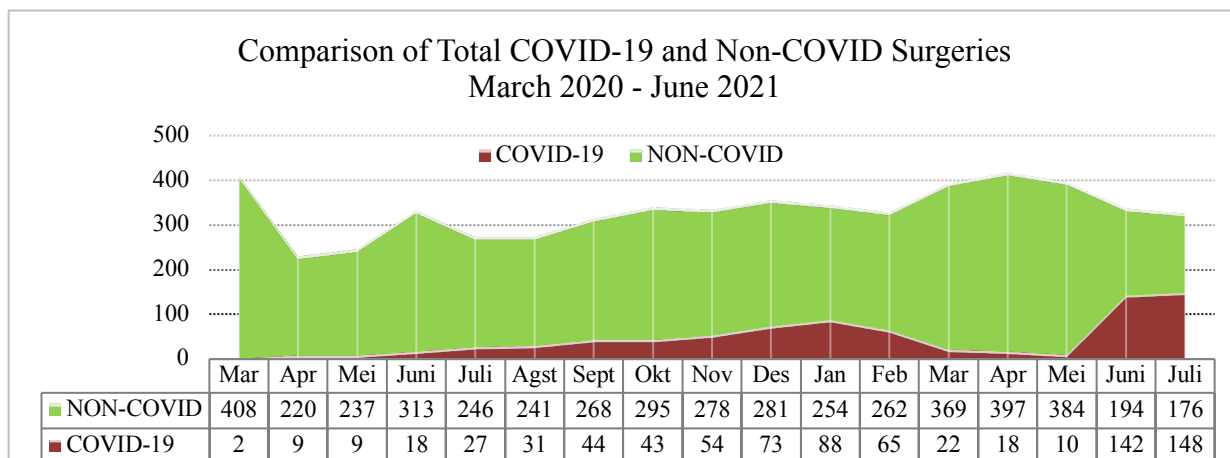


Table 1. Characteristics of COVID-19 and non-COVID-19 Patients

Variables	non-COVID-19(%) N=4823	COVID-19(%) N=803	Mean	Min;Max
Gender				
• Male	1930(40,02%)	304(37,85%)		
• Female	2893(59,98%)	499(62,25%)		
Age (years old)				
• 0 - 18	121(2,47%)	18(2,24%)	38	2 ; 87
• 19 – 40	2157(44,72%)	334(41,59%)		
• 41 – 60	1868(38,73%)	309(38,48%)		
• >60	677(14,03%)	142(17,69%)		



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Table 2. Characteristics of Surgical Procedures and Diseases

Non-COVID-19	Proportion (%) N=4823	COVID-19	Proportion(%) N=803
Surgical Procedures		Surgical Procedures	
• <i>Caesarean Section</i>	758(28,94%)	• <i>Caesarean Section</i>	182(48,27%)
• ORIF	576(21,99%)	• <i>Double Lumen</i>	111(29,44%)
• <i>Debridement</i>	493(18,82%)	• <i>Curettage</i>	37(9,81%)
• Laparotomy	407(15,54%)	• Tracheostomy	26(6,89%)
• <i>Curettage</i>	385(14,71%)	• <i>Debridement</i>	21(5,57%)
Diseases		Diseases	
• Complicated Pregnancy	758(15,71%)	• Complicated Pregnancy	182(22,66%)
• Fracture	576(11,94%)	• Kidney failure	111(13,82%)
• DM ulcer	493(10,22%)	• Incomplete Abortion	37(4,61%)
• Peritonitis	407(8,43%)	• <i>Prolonged Ventilator</i>	26(3,23%)
• Incomplete Abortion	385(7,98%)	• DM ulcer	21(2,61%)

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Table 3. Characteristics of Surgeons and Non-Surgical Doctors

Variable	Proportion Surgeons N=21	of (%) Inpatient N=30	Proportion of Doctor for Isolation(%)	Mean	Min;Max
Exposed to COVID-19	7(33,33%)	7(23,33%)			
Not Exposed to COVID-19	14(66,67%)	23(76,67%)			
Age (years old)				55	36;58
• 30 – 40	2(28,57%)	1(14,28%)			
• 40 – 50	2(28,57%)	3(42,85%)			
• 50 – 60	3(42,85%)	3(42,85%)			
COVID-19 Severity					
• Mild	3(42,85%)	4(57,14%)			
• Moderate	3(42,85%)	3(42,85%)			
• Severe	1(14,28%)	0(0%)			

In Table 1, the number of surgeries of COVID-19 and non-COVID-19 were 4832 and 803 with the majority of the patients were female (n=2893; 59.98%, n=499; 62.25%). In this study (Table 1), the age range of the patients were divided into children, young adults, older adults and the elderly. In non-COVID-19 surgery, the majority of the patients were young adults (19-40 years) (n= 2157; 44.72%) while in the COVID-19 surgery, the majority of the patients were young adults (19-40 years) (n=334; 41, 59%).

Table 2 shows that the most surgical procedures for non-COVID-19 patients from March 2020 to July 2021 were caesarean section (SC) with 758 procedures (28.94%), open reduction internal fixation (ORIF) (n= 576; 21.99%), debridement (n= 493; 18.82%), laparotomy (n= 407; 15.54%), and curettage (n= 385; 14.71%). On the other hand, the most conducted surgical procedures in COVID-19 patients were Caesarean Section (SC) (n=182;



48.27%), double lumen (n= 111; 29.44%), curettage (n= 37; 9.81%), tracheostomy (n= 26; 6.89%) and debridement (n= 21; 5.57%).

From the results described above, we analyzed how the patient was diagnosed when undergoing surgery for non-COVID- 19 patients (Table 2). During March 2020 to July 2021, it was found that the most common diseases were pregnancies with complications, fractures, diabetic ulcers, peritonitis and incomplete abortions. The majority of patients experienced complicated pregnancy with total of 758 cases. Meanwhile, for the COVID-19 patients who underwent surgery, it was found that the most common diseases encountered were, respectively, pregnancy with complications, kidney failure, incomplete abortions, prolonged use of ventilators, and diabetic ulcers. The majority of the patients experienced complicated pregnancy with a total of 182 cases.

Based on Table 3, data obtained from frontline health workers, out of 21 surgeons, 7 were diagnosed with COVID- 19 and 14 were negative for COVID-19. Meanwhile, from a total of 30 non-surgical doctors who took care of COVID-19 patients, 7 were diagnosed with COVID-19 and 23 doctors were not exposed to COVID-19 during the COVID-19 pandemic.

From this study, it was found that there was a significant decrease in the number of non- COVID-19 surgeries at the beginning of the pandemic, there were 53% of decrease in April compared to March 2020. The same result was found in a study conducted by Martin et al, in health referral center in Switzerland, where in their study it was stated that in the early period of the pandemic, the decline in the number of elective surgeries decreased by 43% compared to prior COVID-19 pandemic.⁶

Based on the results of this study, an increase of surgery for COVID-19 patients was seen in January 2021 and June 2021. Along with the increase in COVID-19 cases due to New Year's event in January 2021 and the celebration of Eid al-Fitr in June 2021, the number of COVID-19 surgery also increased. This is similar to the conditions that



occurred in India when Hindus people gathering was held by bathing together in the Gangga river during the COVID-19 pandemic. The crowd that occurred without implementing Covid-19 protocol became "super spreader" of COVID-19 virus, causing a spike in cases in India and the emergence of a new variant of the COVID-19 virus, namely the Delta virus.⁷ This Delta virus spread to Indonesia, causing an increase in COVID- 19 cases in Indonesia, as well as the surgery for COVID-19 patients in June 2021, especially in K.R.M.T Wongsonegoro Regional Public Hospital.

Along with the increase in surgery for COVID-19 patients in January and June 2021, there was a decrease in surgery for non-COVID-19 patients in K.R.M.T Wongsonegoro Regional Public Hospital. This decreased number of surgeries is due to the limitation of elective surgeries during the pandemic. This could be due to the scarcity of oxygen in K.R.M.T. Wongsonegoro Regional Public Hospital and the Indonesian Medical Association (IDI) recommendation which stated that there were restrictions on elective surgery during COVID-19. This restriction is carried out with considerations to prevent transmission and anticipate an increase in the need for health services. During the beginning of the pandemic, this measure is expected to reduce hospitalization rates (to flatten the curve), and avoid an imbalance between patient needs and available resources and at the same time allowing more time to provide bigger resources and capacity against surges that occur.⁸

Based on Indonesian Minister of Health Decree, K.R.M.T. Wongsonegoro Regional Public Hospital is one of the COVID-19 referral hospitals. This causes reduced patient visits, therefore impacting the utilization of the operating room. The public's stigma about the COVID-19 disease causing people reluctant or refrain from seeking treatment. This corresponds to a study in the United States, which stated that during January 2020 to March 2020, outpatient visits at Veteran Affairs clinics decreased about 55.5%, but the number of telemedicine increased about 139%.⁹



During this pandemic, surgery are done based on the level of urgency, therefore some cases that do not require immediate (non-urgent) treatment will be postponed. This limitation of surgery may result in a worse prognosis. Thus, the operating room utilization decreases over time. Restrictions that were too strict at the beginning of the pandemic resulted in long queues that could lead to worsening of the disease due to delays in diagnosis and treatment.¹⁰

In this study, the majority of COVID- 19 patients who underwent surgery during the pandemic in K.R.M.T. Wongsonegoro Regional Public Hospital were female (62.25%) with the most common age range were 19-40 years old (41.59%). Different results were found in a study conducted by Grassner et al where female COVID-19 patients who underwent surgery during the pandemic were 41% and 44%, with a mean age of 61 and 65 years old, with the majority of non-COVID-19 patients were female (59.98%) with age range of 19 to 40 years old (44.72%). This is different from the research conducted by Nepogodiev et al. It was found that the majority of non-COVID-19 patients were male (54%) with an average age of over 70 years old (49.5%).¹²

In this study, the most frequently surgical procedure conducted was Caesarean Section (n=182; 48.27%). COVID-19 infection with severe symptoms in pregnancy can have a poor prognosis.

This is consistent with a study in Beijing, China which has shown that SARS during pregnancy is associated with a high incidence of maternal and neonatal complications, such as spontaneous miscarriage, premature birth, IUGR, ICU admission, kidney failure, and disseminated intravascular coagulopathy.¹³ Tarar et al. stated that out of 32 pregnant patients with COVID-19, about 47% of patients gave birth prematurely and 6.25% (2 patients) needed intensive care.¹⁴ Early identification of COVID-19 in pregnant women can prevent disease progression.¹³ The decision to do caesarean



section surgery can be done on the consideration that this action can reduce the risk of transmitting COVID-19 virus from patients to other patients and to medical workers.¹⁵

Caesarean Section procedure is related to COVID-19 infection in pregnant women, in a study conducted by Yang et al stated that there was an increased risk of undergoing Caesarean Section procedure in pregnant women with COVID-19.¹⁶ One of the indications that Caesarean Section procedure should be done is the worsening of symptoms that occur such as respiratory problems in pregnant women such as pneumonia.¹⁷ In addition, an increase of Caesarean Section rate may be associated with an increase in gestational weight due to physical activity decreased during the pandemic, this is explained in a study conducted in China by Zhang et al.¹⁸ There were 758 actions (28,94%) of non-COVID- 19 SC surgery in K.R.M.T. Wongsonegoro Regional Public Hospital. Based on the research of Verma et al, Caesarean Section is considered to be a relatively safer and preferred method of gave birth, since the last decade, the prevalence of Caesarean Section has increased in both developed and developing countries. Based on 9 South Asian and Southeast Asian countries, the prevalence of SC was 19%.¹⁹

Double lumen procedure ranks second with the number of actions, which are 111 actions (29.44%) in COVID-19 patients. A study conducted by Sherif Aly et al in Boston Medical Center, out of 1,196 hospitalized cases, 107 required double lumen procedures.²⁰ Renal impairment in hospitalized patients with COVID-19 infection was associated with increased mortality and worse clinical development. Viewed from the pathophysiology, COVID-19 infection will produce excessive pro-inflammatory cytokines (IL- 6, TNF-alpha), causing systemic inflammation and hypercoagulability, as well as multiple organ dysfunction syndrome.²¹

In this study, ORIF (open reduction internal fixation) was the second most frequent procedure for non-COVID-19 surgery in K.R.M.T. Wongsonegoro Regional Public Hospital. This is in accordance with the research of Lili Schindelar et al, who



explained that there were 2728 out of 62,000 patients with ORIF procedure, which was the second most frequent procedure.²²

Curettage procedure is the third most frequent procedure for COVID-19 surgery with a total of 32 actions. These results are consistent with study conducted by Esra Keles et al in Zeynep Kamil Women's and Children's Disease Training and Research Hospital, Istanbul, Turkey, where curettage was the second highest surgery in gynecological cases. Emergency gynecological and oncological surgeries should be continued even though the SARS-CoV-2 (COVID-19) pandemic has impacted patient management through delaying elective surgery.²³ From the results of the study, curettage is the fifth most frequent surgery for non-COVID-19 surgery. Curettage performed on average is due to the occurrence of abortion in pregnant women so that action needs to be taken. This is in accordance with research conducted in America which stated that pregnant women who have a miscarriage (abortion) have 2 options, letting the fetus in the womb come out naturally or going to the hospital for dilation and curettage. However, the majority of doctors recommend that pregnant women should limit visits to the hospital due to the COVID-19 pandemic.²³

In early March 2020, Italian Society of Otorhinolaryngology, British Association of Otorhinolaryngology, and American Academy of Otolaryngology-Head and Neck Surgery warned otolaryngologists about the possible increase in tracheostomy related to COVID-19 infection.²⁴ In this study, tracheostomy (n= 25; 4%) is one of the most frequent procedure performed in K.R.M.T. Wongsonegoro Regional Public Hospital, Semarang. Volo et al reported that during the COVID-19 emergency, 23 of the 50 patients (46%) admitted to the intensive care unit for COVID-19 underwent a temporary tracheostomy.²⁵

Debridement (n=20) was the fifth most frequent procedure for COVID-19 surgery and the third most frequent procedure for non-COVID-19 surgery during this pandemic, especially in Diabetes Mellitus (DM) patients. This is in accordance with a study conducted by Casciato et al in Riverside Methodist Hospital, Columbus, Ohio,



that debridement procedure was the second most frequent surgery done on DM patients during the COVID-19 pandemic.²⁶

In patients with diabetic foot ulcer (DFU), the infection can lead to septic shock and becoming a life-threatening condition. Therefore, surgical debridement is required for severely infected ulcers and is considered as a surgical emergency.²⁷

Laparotomy is the fourth most frequent surgical procedure for non-COVID-19 patients from March 2020 - July 2021. The laparotomy procedure in K.R.M.T. Wongsonegoro Regional Public Hospital was mostly performed on indications of peritonitis. This is in accordance with the research conducted by Alvarez et al, who conducted research during March 2020 in the Hospital Universitario La Paz, Spain. From 14 patients who will undergo laparotomy, as many as 42% of patients diagnosed with peritonitis.²⁸

The survey data of IDI Mitigation Team showed that the deaths of health workers (doctors) reached 640 doctors, including 347 general practitioners (54.21%), 284 specialist doctors (44.37%), and 9 resident doctors (1.42%). Central Java province ranks second after East Java. With the highest number of 347 general practitioners (54.21%), followed by 46 obstetrician and gynecologists (7.18%), 34 pediatricians (5.31%), 32 internists (5%), 19 surgeons (2.96%), and 17 anesthesiologists (2.65%).

Out of 30 doctors in K.R.M.T. Wongsonegoro Regional Public Hospital who treated COVID-19 patients, 7 doctors were diagnosed with COVID-19, consisted of 3 internist, 1 cardiologist, 1 pediatrician, 1 radiologist and 1 neurologist with varying age range. There are 1 doctor aged 30-40 years old, 3 doctors aged 40-50 years old and 3 doctors aged 50-60 years old who treat COVID-19 patients and are exposed to COVID-19. From this data, all doctors who were exposed to COVID-19 had mild to moderate symptoms. This is in accordance with research conducted by Xihong Lin which stated that from December 2019 to February 2020 there was an increase in confirmed cases of COVID-19 by health workers (221 people) in Wuhan, China.²⁹



Based on data from health workers in Regional Public Hospital of Wongsonegoro Hospital, 7 out of 21 surgical doctors were diagnosed with COVID-19 (33.33%), consisting of 2 surgeons, 2 ENT specialists, 2 anesthesiologists and 1 obstetrician and gynecologist. The majority of surgeons who were exposed to COVID-19 were aged 50-60 years old, consisted of 3 people, followed by doctors with an age range of 30-40 years old and 40-50 years old, with 2 people in each of age range. The severity of COVID-19 experienced by the majority was mild and moderate, 3 doctors experienced mild symptoms, 3 doctors experienced moderate symptoms and 1 doctor experienced severe symptoms.

The comparison of surgeons who were exposed to COVID-19 was higher than the doctors who were in isolation room from COVID-19, which was 7 out of 30 doctors (23.33%). This might be due to many surgeons underestimate the COVID-19 disease, including the use of adequate PPE. After the surgery was done, the surgeons will give education to the patient's family, however, K.R.M.T. Wongsonegoro Regional Public Hospital has not set rules for doing COVID-19 examination such as PCR test or antigen test on patient's guardian who are in the hospital.

This might cause the surgeons to be carelessly maintaining the health protocol and without realizing it, a silent transmission occurs.³⁰

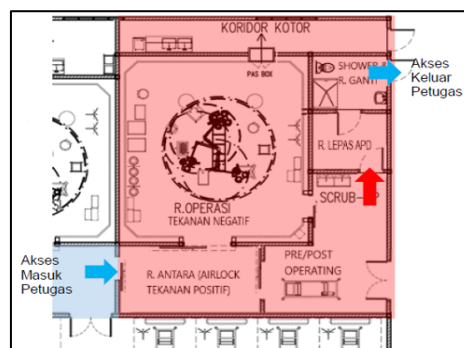


Figure 1. Isolation Operation Room Plan based on the Ministry of Health

Indonesian Ministry of Health recommends several requirements in rearranging isolation room, such as separate entry and exit access for covid-19 patients, different entry and exit for health workers. As well as adjustments to air conditioning system.



The operating room with negative pressure is an ideal way to reduce the spread of the virus outside the operating room.³¹

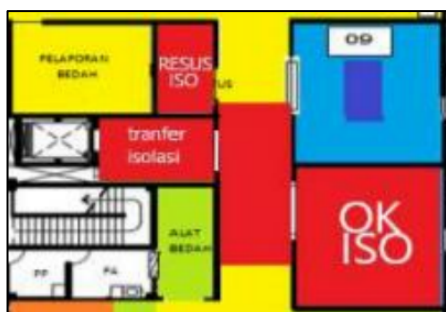


Figure 2. Isolation Operating Room Sketch in K.R.M.T. Wongsonegoro Regional Public Hospital

Although the management that has been carried out in dealing with COVID-19 cases in the operating room is good, it is still possible for the transmission of the COVID-19 virus. This might be caused by the flow of health care workers for COVID-19 patients has not been done in accordance with the regulation made by Ministry of Health. The patient handover flow shown in Figure 2 and Figure 3 shows that the handover should be in operating room number 10 with health care workers wearing level 3 PPE. After the procedure is done, the surgeon and anesthesiologist will escort the postoperative patient to the treatment room using complete PPE. After the escorting, the health workers will immediately clean themselves and remove the PPE, followed by spraying disinfectant on their work clothes in all parts to avoid the spread of COVID-19 and dispose the used PPE into a specific container. The final step is taking a shower in a provided bathroom and changing room that is located differently (Figure 3). Contrary to reality, following the surgery, the health workers returned to the general changing rooms where the workers entered before surgery. This leads to an increased risk of transmission of COVID-19 in public changing rooms. This is in accordance with the study of Dexter et al which stated that the transmission of the virus (SARS CoV-2) could be caused by contact with contaminated environmental surfaces.³²



Figure 3. Flow of Operating Room Workers for COVID-19 Patients in K.R.M.T. Wongsonegoro Regional Public Hospital

Data from UK and US, among 2,035,395 people and 99,795 primary health workers, 5,545 of them were diagnosed as positive for COVID-19. Compared to the civil society, frontline health workers have an 11.6 times higher risk of being diagnosed positive COVID-19 and those who do not have access to adequate PPE have a 23% higher risk. In addition, health workers with adequate PPE who do not take care COVID-19 patients have 5 times higher risk of being diagnosed with covid-19 compared to health workers who treat COVID-19 patients and almost 6 times the risk if they do not have adequate PPE.³³

In this study, the majority of surgeons who were confirmed positive for COVID-19 were 50-60 years old and the majority of non-surgical doctors who were confirmed positive for COVID-19 who took care of COVID-19 patients were 40-60 years old. This study is not in accordance with the Semarang City Corona Alert data, which said that the majority were aged 20-50 years. Because the number of surgeons in K.R.M.T. Wongsonegoro Regional Public Hospital who are over than 50 years old is more than those less than 50 years old. The severity of COVID-19 in some surgeons who were diagnosed with COVID-19 were mostly mild to moderate. This might be because those surgeons have received vaccinations therefore the symptoms do not become severe.³⁴



Health workers have much higher risk of being infected with COVID-19. An adequate supply of PPE is not sufficient to fully protect health workers who took care of COVID-19 patients. We also need to focus on ensuring that health workers are trained in how to properly equip their PPE. Health workers should be vigilant in implementing other infection control to minimize infection, including quickly and effectively diagnose and isolate COVID-19 patients and ensuring that the environment around covid-19 patient is adequately disinfected.³⁵

According to the CDC, health workers need to pay attention to several things before taking an act on confirmed and suspected Covid-19 patients, including comprehensive training on the use of PPE, donning and doffing their PPE, care, maintenance, and proper disposal of PPE. Health workers must pay attention to the following points such as, PPE must be worn properly prior entering the COVID-19 patient area (isolation room), and must be worn correctly while working in potentially contaminated areas. PPE should not be touched (e.g., re-tying gowns, adjusting respirators/face masks) while treating the patient and must be removed slowly and carefully in correct order to prevent contamination.³⁵

Conclusion and Recommendation

This study shows an increasing number of surgeries on COVID-19 patients. Proper use of operating rooms during the pandemic needs to be considered, and correct use of PPE and appropriate operating room arrangements have a role in preventing the spread of this virus, especially to health workers and patients, given the increasing number of COVID-19 cases in Indonesia.



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