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## The impact of covid-19 on orthopaedic surgery in regional covid-19 referral hospital: a cross-sectional study

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### Abstract

**Introduction:** The Covid-19 pandemic has been a profound phenomenon affecting the entire world, primarily healthcare systems. Since the first Covid-19 case in Indonesia around March 2020, the healthcare systems and public regulations have been constantly readjusted. In our centre, the pandemic has also had major effects on the orthopaedic and trauma services. This study aims to evaluate the impact of Covid-19 on orthopaedic surgery in Wangaya General Hospital.

**Method:** A cross-sectional study is done retrospectively through medical records among patients underwent orthopaedic surgery from March 2019 to 2021. Pre-Covid control group (March 2019-2020) is compared to Covid case group (March 2020-2021). The parameter of study includes: patient's demographics, orthopaedic diagnosis, anatomical location, orthopaedic surgery, and type of surgery. T test and chi square test is used for data analysis.

**Result:** Out of the total 916 cases, the number of orthopaedic surgeries is decreased by 42,61% (582 vs. 334 cases;  $48,5 \pm 10,11$  vs.  $27,83 \pm 4,89$  cases/month) on the first year of pandemic. The number of emergency surgeries has escalated significantly with inverted proportion to elective surgeries, such as arthroplasties, implant and benign tumor removal. Polytrauma, lacerations and tendon rupture case has been increased considerably requiring immediate surgical treatment.

**Conclusion:** In response to the pandemic, the objective is to restore high quality healthcare systems by reconstructing newly updated strategies for patient management plan and public regulations during the ongoing Covid-19 pandemic.

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### Introduction

The Covid-19 outbreak has been a catastrophic experience in the late 2019 until 2020. It immediately became an international concern of emergency public health matters. The Covid-19 numbers are increasing day by day. It reaches a staggering 3 million global Covid-19 deaths within a year period. In South-East Asia, Covid-19 case arrived quite early on January 2020 in Thailand. Every other country in South-East Asia thus came to an alerting governmental discussion for immediate actions and regulations. Unfortunately, each healthcare departments in South-East Asia exhibits varying degrees of preparedness for Covid-19. It is reflected by the high fatality rate, mainly in Indonesia and Philippines [1-2].

The first Covid-19 case in Indonesia is encountered in March 2020. Early on, Indonesia faces many challenges in preparing this Covid-19 outbreak with limited diagnostic facilities, limited treatment regimens & facilities, and ongoing developing guidelines for patient management and public regulations. The

whole healthcare systems and public regulations have been constantly readjusted accordingly. Nevertheless, within a year period, more than 1.5 million people is confirmed with Covid-19, and 40.754 deaths recorded. It makes Indonesia as the leading country in South-East Asia for confirmed Covid-19 case, with the highest number of case fatality rate (2,7%) [3]. Despite all the struggles and inconvenient, Indonesia still manages to be resilient and willing to learn from other international countries. An enormous transformation is carried in order to manage the Covid-19 pandemic in Indonesia. All personnel are challenged to work at the higher stake physically, mentally, and financially to provide the best quality possible in such limitations. Regional Covid-19 referral hospital is fully supported by the government to manage Covid-19 patients nationwide [4].

As the top ten province with highest confirmed Covid-19 case in Indonesia and a very popular tourism island, Bali undoubtedly has taken this Covid-19 pandemic seriously.

Located in the center of Bali, Wangaya General Hospital in Denpasar become one of the largest referring Covid-19 hospital in the province. All facilities and resources are directed to support the management of Covid-19 patients in Bali. In the meanwhile, the pandemic has also had major effects on other non-Covid healthcare services, and one of them is the orthopaedic and trauma services. A substantial drop in orthopaedic and trauma patients during the pandemic have been reported in many studies nationwide and internationally, for example: Utomo et al. (2022), Barohana et al. (2021), Wong et al. (2020), and many more. The aim of this study is to evaluate the impact of Covid-19 on orthopaedic surgery in Wangaya General Hospital, Bali, Indonesia [5-7].

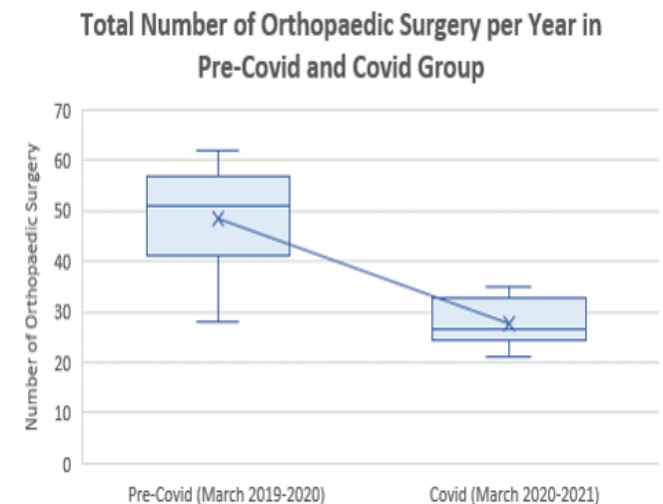
## Method

A retrospective cross-sectional study is done in this study. We examined all patients admitted to our orthopaedic department in Wangaya General Hospital who underwent orthopaedic surgery between March 2019 to March 2021. All patients with any orthopaedic diagnosis who are treated by our team of dedicated orthopaedic surgeons in our operating theatre is included in this study. The participants are divided into pre-Covid control group (March 2019-2020), and will be compared to the Covid case group (March 2020-2021). Data collection is further assembled from patient's medical record. The parameter of study includes: patient's demographics, orthopaedic diagnosis, anatomical location, orthopaedic surgery, and type of surgery. Our patient's diagnosis ranges from: open fracture, closed fracture, dislocation, lacerations, crush injury, amputation, tendon rupture, fingertip injury, osteoarthritis, union fracture, hemarthrosis, osteomyelitis, tendinitis, necrotic finger, infected wound, avascular necrosis, implant failure, tumor, malunion, non-union, and compartment syndrome. The anatomical location of the injury is classified into polytrauma, head-neck, clavicle, shoulder, humerus, elbow, forearm, hand, pelvis, hip, femur, patella, knee, leg, ankle, foot, and vertebra. The orthopaedic surgical treatment done ranges from open reduction with internal fixation (ORIF), open reduction with external fixation (OREF), hemiarthroplasty bipolar, total knee replacement, closed reduction with casting immobilization, tendon repair, debridement, reposition, implant removal, implant revision, excision, debridement of osteomyelitis, total hip replacement, skeletal traction, amputation, open reduction with casting immobilization, stumpplasty and fasciotomy. Data analysis is performed using Microsoft Excel and IBM SPSS, with independent T test and chi square test for statistical analysis.

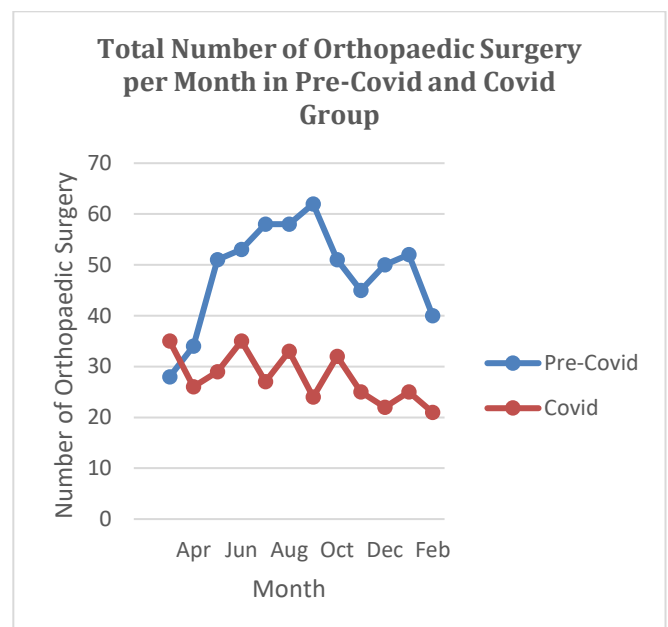
## Result

There are a total of 916 patients underwent orthopaedic surgeries in Wangaya General Hospital between March 2019 to March 2021, that are included in this study. A significant 42,61% decrease in total number of orthopaedic patients over the first year of Covid-19 pandemic is found in this study ( $p$ -value < 0.05). In pre-Covid group, there are 582 cases and  $48,5 \pm 10,11$  cases/month. While in the Covid group, there are 334 cases and  $27,83 \pm 4,89$  cases/month (Figure 1). In monthly view, the number of cases also shown significant reduction with exception in March 2019, when our department is short

on orthopaedic surgeon and underwent some renovation in the operating theatre (Figure 2).



**Figure 1: Total Number of Orthopaedic Surgery per Year in Pre-Covid and Covid Group**



**Figure 2: Total Number of Orthopaedic Surgery per Month in Pre-Covid and Covid Group**

In terms of patient's demographic, there is similar proportion of gender and age in both groups. Male to female patient ratio is 1,4:1 to 1,5:1. In pre-Covid group, there are 341 male (58,59%) and 241 females (41,41%). While in Covid group, there are 204 male (61,08%) and 130 females (38,92%). The age distribution in both groups is also similar. In the pre-Covid group, the mean age is  $41,45 \pm 22,59$  years old with elderly age group dominance (21,99%), while 0-10 years (7,56%), 11-20 years (14,95%), 21-30 years (13,4%), 31-40 years (12,89%), 41-50 years (13,57%), and 51-60 years (15,64%) groups remain constant. In Covid group, the mean age is  $42,22 \pm 21,69$  years old with elderly age group dominance (23,05%), while 0-10 years (9,58%), 11-20 years (9,88%), 21-30 years (14,67%), 31-40 years (12,57%), 41-50 years (11,68%), and 51-60 years (18,56%) groups remain constant. This profile suits the

patient's age and gender distribution mentioned by other studies, that is not affected during the pandemic (Table 1) [8].

The number of emergency surgeries has escalated significantly with inverted proportion to elective surgeries (p-value 0.0002). In pre-Covid group, there are 494 elective surgeries (84,88%) and 88 emergency surgeries (15,12 %) performed by our team of surgeons. While in Covid group, there are 250 elective surgeries (74,85%) and 84 emergency surgeries (25,15%) performed. The number of elective surgeries is decreased by 10,03% which includes arthroplasties, implant and benign tumor removal. On the other hand, the number of emergency surgeries is increased by 10,03% which includes debridement, tendon repair, and implant revision [9].

Trauma is the leading cause of death worldwide and it remains an important aspect in orthopaedic healthcare services, nonetheless, in this Covid-19 pandemic. Changes in social habits and practices supervised by the public regulations to minimize the Covid-19 spread has placed many patients to be less likely involved in high energy trauma due to, for example: road traffic accident and extreme outdoor activities. The leading orthopaedic case treated in our hospital is bone fractures, mainly closed fractures. In pre-Covid group, there are 383 cases (65,81%) of closed fracture and 79 cases (13,57%) of open fracture. While in Covid group, there are 187 cases (55,99%) of closed fracture and 55 cases (16,47%) of open fracture. Both numbers of fracture cases are decreasing, but statistically, only closed fracture case is decreased significantly (p-value 0.0032). It correlates with the number of Open Reduction with Internal Fixation (ORIF) surgery for fracture treatment that is reduced significantly (p-value 0,0016). There are 333 ORIF surgery (57,22%) in pre-Covid group and 155 ORIF surgery (46,41%) in Covid group, with no Open Reduction with External Fixation (OREF) performed in both years. In addition, femoral injury that is usually caused by high energy trauma is also decreased significantly (p-value 0.04) during the Covid-19 pandemic [10].

Alongside the implementation of large-scale social restriction in Indonesia, many patients requiring medical orthopaedic assistances have to postpone their doctor visit, unless it became an emergency case that require immediate medical assistances. Thus, it reduces the overall number of orthopaedic patients and surgeries in hospitals. Patients with chronic orthopaedic cases are decreased, including: osteoarthritis, tumor, union fracture, tendinitis, avascular necrosis of hip, and malunion. The number of corresponding elective surgery for these cases are also decreasing, including: hemiarthroplasty hip bipolar, total hip replacement, total knee replacement, benign tumor excision, and implant removal [11].

On the contrary, remaining inside the house turns to have an unexpected effect on trauma by increasing domestic injuries found at home. Many people occupy themselves with some at home activities and learning new skills at home, such as: cooking, gardening, and home renovation. In our study, we found a significant increased number of polytrauma patients

(p-value < 0.05) undergoing orthopaedic surgeries. There was only 2 polytrauma patients (0,34%) in pre-Covid group that increases to 19 polytrauma patients (5,68%) in Covid group. Socea et al. (2020) reported the pandemic increases the proportion of domestic aggression induced by higher stress from quarantining, isolation, and loss of income. Some orthopaedic trauma injuries have been increased during the pandemic, including: lacerations (p-value < 0.05), tendon rupture (p-value 0.02), crush injury, fingertip injury, and implant failure. Thus, the number of corresponding emergency surgery for these cases are also increasing, for example: debridement and tendon repair [12].

**Table 1: The Differences in Orthopaedic Surgery Patients During Covid-19 Pandemic**

|                 | PRE-COVID   |                | COVID       |                | p-value |
|-----------------|-------------|----------------|-------------|----------------|---------|
|                 | Number (n)  | Percentage (%) | Number (n)  | Percentage (%) |         |
| Total patient   | 582         |                | 334         |                |         |
| Mean Case       | 48,5±10,11  |                | 27,83±4,89  |                | <0.05*  |
| Sex             |             |                |             |                |         |
| Male            | 341         | 58,59          | 204         | 61,08          | 0.4605  |
| Female          | 241         | 41,41          | 130         | 38,92          |         |
| Mean Age        | 41,45±22,59 |                | 42,22±21,69 |                | 0.5734  |
| 0-10            | 44          | 7,56           | 32          | 9,581          | 0.2859  |
| 11-20           | 87          | 14,95          | 33          | 9,88           | 0.0287  |
| 21-30           | 78          | 13,4           | 49          | 14,67          | 0.5928  |
| 31-40           | 75          | 12,89          | 42          | 12,57          | 0.8918  |
| 41-50           | 79          | 13,57          | 39          | 11,68          | 0.4094  |
| 51-60           | 91          | 15,64          | 62          | 18,56          | 0.1463  |
| >60             | 128         | 21,99          | 77          | 23,05          | 0.7108  |
| Type of Surgery |             |                |             |                |         |
| Elective        | 494         | 84,88          | 250         | 74,85          | 0.0002* |
| Emergency       | 88          | 15,12          | 84          | 25,15          |         |
| Type of Injury  |             |                |             |                |         |
| Open Fracture   | 79          | 13,57          | 55          | 16,47          | 0.233   |
| Closed Fracture | 383         | 65,81          | 187         | 55,99          | 0.0032* |
| Dislocation     | 20          | 3,436          | 12          | 3,593          | 0.9013  |
| Lacerations     | 3           | 0,515          | 16          | 4,79           | <0.05*  |
| Crush injury    | 0           | 0              | 2           | 0,599          | 0.0616  |

|                                      |     |       |    |       |         |
|--------------------------------------|-----|-------|----|-------|---------|
| Amputation                           | 2   | 0,344 | 1  | 0,299 | 0.9102  |
| Tendon Rupture                       | 5   | 0,859 | 9  | 2,695 | 0.0293* |
| Fingertip injury                     | 4   | 0,687 | 5  | 1,497 | 0.2317  |
| Osteoarthritis (OA)                  | 8   | 1,375 | 1  | 0,299 | 0.1123  |
| Union Fracture                       | 37  | 6,357 | 25 | 7,485 | 0.5132  |
| Hemarthrosis                         | 1   | 0,172 | 0  | 0     | 0.4485  |
| Osteomyelitis                        | 8   | 1,375 | 2  | 0,599 | 0.2768  |
| Tendinitis                           | 5   | 0,859 | 2  | 0,599 | 0.6632  |
| Necrotic finger                      | 1   | 0,172 | 1  | 0,299 | 0.6905  |
| Infected wound                       | 8   | 1,375 | 5  | 1,497 | 0.8801  |
| Avascular Necrosis                   | 4   | 0,687 | 0  | 0     | 0.1289  |
| Implant Failure                      | 8   | 1,375 | 9  | 2,695 | 0.1542  |
| Tumor                                | 2   | 0,344 | 0  | 0     | 0.2835  |
| Malunion                             | 4   | 0,687 | 0  | 0     | 0.1289  |
| Non-union                            | 0   | 0     | 1  | 0,299 | 0.1866  |
| Compartment Syndrome                 | 0   | 0     | 1  | 0,299 | 0.1866  |
| <b>Anatomical Location of Injury</b> |     |       |    |       |         |
| Polytrauma                           | 2   | 0,344 | 19 | 5,689 | <0.05*  |
| Head-neck                            | 0   | 0     | 0  | 0     | 0       |
| Clavicle                             | 33  | 5,67  | 17 | 5,09  | 0.7098  |
| Shoulder                             | 23  | 3,952 | 11 | 3,293 | 0.6119  |
| Humerus                              | 25  | 4,296 | 17 | 5,09  | 0.5801  |
| Elbow                                | 30  | 5,155 | 13 | 3,892 | 0.3846  |
| Forearm                              | 127 | 21,82 | 64 | 19,16 | 0.3402  |
| Hand                                 | 65  | 11,17 | 50 | 14,97 | 0.0946  |
| Pelvis                               | 0   | 0     | 0  | 0     | 0       |
| Hip                                  | 63  | 10,82 | 25 | 7,485 | 0,0987  |
| Femur                                | 32  | 5,498 | 9  | 2,695 | 0.0482* |
| Patella                              | 11  | 1,89  | 10 | 2,994 | 0.2826  |
| Knee                                 | 21  | 3,608 | 15 | 4,491 | 0.5081  |
| Leg                                  | 68  | 11,68 | 27 | 8,084 | 0.08    |

|                                           |     |       |     |       |         |
|-------------------------------------------|-----|-------|-----|-------|---------|
| Ankle                                     | 23  | 3,952 | 11  | 3,293 | 0.6119  |
| Foot                                      | 58  | 9,966 | 46  | 13,77 | 0.0805  |
| Vertebra                                  | 1   | 0,172 | 0   | 0     | 0.4485  |
| <b>Surgical Treatment</b>                 |     |       |     |       |         |
| ORIF                                      | 333 | 57,22 | 155 | 46,41 | 0.0016* |
| OREF                                      | 0   | 0     | 0   | 0     | 0       |
| Hemiarthroplasty Bipolar                  | 40  | 6,873 | 20  | 5,988 | 0.6024  |
| Total Knee Replacement                    | 7   | 1,203 | 1   | 0,299 | 0.1573  |
| Closed Reduction + Casting Immobilization | 82  | 14,09 | 59  | 17,66 | 0.149   |
| Tendon Repair                             | 10  | 1,718 | 12  | 3,593 | 0.0745  |
| Debridement                               | 25  | 4,296 | 28  | 8,383 | 0.0108* |
| Reposition                                | 17  | 2,921 | 9   | 2,695 | 0.8426  |
| Remove of Implant                         | 37  | 6,357 | 26  | 7,784 | 0.4114  |
| Revision of Implant                       | 8   | 1,375 | 7   | 2,096 | 0.4078  |
| Excision                                  | 4   | 0,687 | 0   | 0     | 0.1289  |
| Debridement of Osteomyelitis              | 8   | 1,375 | 2   | 0,599 | 0.2768  |
| Total Hip Replacement                     | 2   | 0,344 | 1   | 0,299 | 0.9102  |
| Skeletal Traction                         | 1   | 0,172 | 0   | 0     | 0.4485  |
| Amputation                                | 1   | 0,172 | 1   | 0,299 | 0.6905  |
| Open Reduction + Casting Immobilization   | 2   | 0,344 | 6   | 1,796 | 0.0229* |
| Stumplasty                                | 5   | 0,859 | 6   | 1,796 | 0.21    |
| Fasciotomy                                | 0   | 0     | 1   | 0,299 | 0.1866  |

The Covid-19 pandemic definitely has had major effects on every healthcare services immensely. Being a regional Covid-19 referral hospital, our centre, Wangaya General Hospital portrays a representation perspective of the Indonesian healthcare systems in managing this Covid-19 pandemic. Every patient admitted to hospital should underwent serial diagnostic testing, and chest radiology for Covid-19 status confirmation and to decide the appropriate bed and ward. At this step, many patients received delayed treatment due to long waiting period to get PCR Covid testing that is only available in

certain laboratories with some limited testing capacity per day. Thus, it resulted in long queue at the Emergency Department (ED) or transit room, that happened to have limited availability as well. Unspecific antibodies IgM and IgG rapid testing with antigen rapid testing are more widely available, but it gives many false positive or false negative result. Inappropriately assigned bed and ward leads to improper patient's treatment and it could interrupt other non-Covid patient management. Limited availability of treatment regimens and facilities are also crucial. We experience many times with shortage of antiviral, immunoglobulin, symptomatic medicine, hospital beds, ICU, ventilators, and many more. Shortage of healthcare personnel are an added problems along with the limited PPE for their safety [13].

The same problem applies to every orthopaedic patient admitted to the hospital, who are usually non-Covid related but should go through all the diagnostic testing and protocols during this Covid-19 pandemic. Long diagnostic workup and limited ED or transit room available leads to delayed orthopaedic treatment or procedure performed. Elective surgical treatment is postponed until all tests are considered normal, with exception during a certain period when Oxygen stock is preserved and allocated for Covid patients only, all elective surgeries are omitted. In the meantime, conservative treatment is performed, for example: skin traction for hip fractures, immobilization for closed fracture, and pain management. Emergency surgical treatment is still performed following the Covid-19 protocols in the operating theatre, with adaptation from international guideline for surgeons performing surgery during Covid. Orthopaedic treatment procedure using casting immobilization is very suitable during the pandemic since the application is quick and uncomplicated, in order to minimize contamination and spreading to healthcare personnel. Closed reduction with casting immobilization is increased from 14,09% in pre-Covid group to 17,66% in Covid group (p-value 0.14). While open reduction with casting immobilization is increased significantly from 0,34% in pre-Covid group to 1,79% in Covid group (p-value 0.02). Other emergency surgery with short surgical duration is encouraged during this Covid pandemic, for example: debridement with primary suturing for lacerations (p-value 0.01), and simple tendon repair for tendon ruptures (p-value 0.07) [14].

Despite all the struggles and inconvenient, all healthcare personnel still manage to keep working, learning and improving the Covid-19 healthcare system and protocols to provide the best qualities possible. Compared to other international countries, Indonesia is lacking on preparing for all the necessary facilities and had to be slightly behind. All equipments are limited during the first year of Covid-19 pandemic. Assigned wards and operating theatre for Covid-19 confirmed case was ready around the next 6 months after the outbreak. It also applies to distribution of Covid vaccines that was started after about 1 year of Covid-19 pandemic in February and March 2020, while in the United States, they have already passed more than 100 million vaccinations administered. This resulted in a huge substantial drop in the

number of patients admitted to the hospital, mainly the non-Covid patients, including our orthopaedic patients. Generally, getting prepared for the pandemic is extremely complicated, yet there are rooms for improvements and expansion along the way. To date, with more than 2 years of the on-going Covid-19 pandemic, we believe all the previous problems should be well-handled with proper facilities, Covid-19 guideline, public protocols, and achieving nation-wide complete vaccine administration [15].

## Conclusion

In response to the pandemic, the objective is to restore high quality healthcare systems by reconstructing newly updated strategies for patient management plan and public regulations during the ongoing Covid-19 pandemic.

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