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The impact of the Covid-19 pandemic on trauma cases in the orthopedics and traumatology services: A systematic review

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ABSTRACT

The COVID-19 pandemic has caused all countries to limit their activities to reduce transmission. In the orthopedic and traumatology services, the COVID-19 pandemic has limited the number of non-emergency surgeries, rescheduling activities, limiting hospitalization, etc. This study aimed to quantify the change in the number of visits, trauma cases, surgeries, and telemedicine in orthopedic and traumatology services. The search was carried out on the PubMed, Research Gate, MedRxiv, Elsevier, Link Springer, and Medline databases. The inclusion criteria of the articles used were observational studies. The assessment of the articles' validity was carried out using a checklist made by the Joanna Briggs Institute. The data being synthesized is limited to quantitative data only. From the 19 articles meeting inclusion criteria, it was found that there was a decrease in the number of visits by 22.4%-86.1%. In additions, there is a decrease in the number of trauma cases by 21.1%-91.2%, lower limb trauma by 20%-77.7 %, upper limb trauma by 6%-78.8%, surgeries by 21.7%-88.8%, elective surgeries by 50%-100%, a change in the number of trauma cases and hip fractures, and an increase in the number of telemedicine application by 9.28%-21.87% in COVID-19 pandemic periode (2020) compared to the pre-COVID-19 pandemic periode (2019 or less). The COVID-19 pandemics affecting the orthopedic and traumatology services decreased the number of visits, especially trauma cases, and surgical intervention

Pandemi COVID-19 membuat seluruh dunia melakukan pembatasan terhadap kegiatan untuk mengurangi transmisi virus corona. Pada sektor kesehatan terutama pada departemen orthopaedi dan traumatologi, pandemi COVID-19 menyebabkan pembatalan operasi non-emergensi, pengaturan ulang jadwal, pembatasan rawat inap, dan sebagainya. Penelitian ini bertujuan untuk mengukur perubahan jumlah kunjungan, kasus trauma, pembedahan, dan telemedicine pada pelayanan ortopedi dan traumatologi. Pencarian artikel dilakukan pada database PubMed, Research Gate, MedRxiv, Elsevier, Link Springer, Medline, dan pencarian web. Artikel penelitian yang digunakan adalah artikel dengan desain penelitian observasional. Penilaian terhadap validitas artikel dilakukan menggunakan checklist yang dibuat oleh Joanna Briggs Institute. Data yang akan disintesis terbatas pada data kuantitatif saja. Dari 19 artikel yang digunakan, didapatkan bahwa terjadi penurunan jumlah kunjungan sebesar 22,4% - 86,1%, penurunan jumlah kasus trauma sebesar 21,1% - 91,2 %, penurunan jumlah trauma ekstremitas bawah sebesar 20%

- 77,7%, penurunan jumlah trauma ekstremitas atas sebesar 6% - 78,8%, perubahan jumlah kasus trauma dan fraktur hip, penurunan jumlah operasi 21,7% - 88,8%, penurunan jumlah operasi elektif sebesar 50% - 100%, dan peningkatan jumlah penggunaan telemedicine 9,28% - 21,87%. Pandemi COVID-19 memengaruhi departemen orthopaedi dan traumatologi yang menyebabkan terjadi penurunan jumlah kunjungan, kasus trauma, operasi, dan peningkatan penggunaan telemedicine dibandingkan dengan sebelum pandemi COVID-19.

INTRODUCTION

In December 2019, a respiratory disease caused by the novel coronavirus or well-known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was reported in Hubei province, China.[1,2] The disease is being called coronavirus disease 2019 (COVID-19), which has the same symptoms as pneumonia in the forms of fever, cough, and dyspnea.3-4 On March 11, 2020, the World Health Organization (WHO) declared the outbreak as a pandemic since the virus has spread to almost all countries in the world, with 100,000 cases in more than 200 countries with a case fatality rate of 5.2%.[5]

COVID-19 pandemic has forced many countries to place community restrictions to avoid a wider transmission of the virus. The restrictions have impacted many sectors, including tourism, economy, culture, and health. In the health sector, the pandemic has resulted in the cancellations of non-emergency surgeries, the rearrangements of outpatient care, inpatient care restrictions, and medical staff's deployments to medical and intensive care for COVID-19 patients.[6] Besides, the COVID-19 pandemic has caused a major impact on Orthopedics and Traumatology services. However, the World Health Organization (WHO), the National Health Service (NHS), and the British Orthopedic Association (BOA) have published the guidelines for Orthopedic patients' treatment during the COVID-19 pandemic.[7,9]

Based on the problem explained previously, the authors are interested in conducting a systematic review to discover the rate of COVID-19 pandemic impacts on the Orthopedic and Traumatology Services. This research is important to prepare the department for the upcoming pandemic or endemic. Through this study, the authors would like to know the impacts of the COVID-19 pandemic on the number of visits, the number of surgeries, the number of traumatic cases, and the application of telemedicine by the orthopedic and traumatology services.

Protocol and registration

This systematic review was performed using Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines.[10] The protocol of this review has been registered in International Prospective Register of Systematic Reviews (PROSPERO, ID: CRD42021231880).

Search strategy

The searching strategy is designed to access the published material. The searching strategy consist of three stages. The stages are as follows.

a. Restricted searching in PubMed, Research Gate, MedRxiv, Elsevier, Link Springer, Medline, and web search to identify relevant keywords in the title, abstract, and subject description of the study.
b. The keywords used in the literature exploration and the synonyms will be used in each database.
c. The references list and the bibliography of identified articles collected in the two stages above will be explored.

The terms of the initial search are (Impact) AND ((COVID-19) OR (Sars-Cov-2)) AND (Orthopedics) AND (Traumatology) AND (Services). The articles have been published in English from December 2019 until December 2020 and have been indexed in the database as above.

Inclusion and exclusion criteria

The systematic review consider all research studies which involve subjects of all ages who come to Orthopedics and Traumatology services for treatment. The outcomes that will

be explored in this systematic study include the proportion of the changes in the number of visits, the changes in the number of surgeries, the changes in the number of trauma cases, and the application of telemedicine in the COVID-19 pandemic period (2020) compared to the pre-COVID-19 pandemic period (2019 or less). This study considers all research studies which evaluate the impacts of COVID-19 related to the services for inpatients and outpatients in the Orthopedics and Traumatology Department. Only the observational research design will be used and included in the inclusion criteria. The study that does not meet the inclusion criteria will be excluded. Inclusion and exclusion criteria can be seen in Table 1.

Table 1. Inclusion and exclusions criteria

Study component	Inclusions	Exclusions
Participant	Subjects of all ages who come to Orthopedics and Traumatology services for treatment	Non-traumatic cases who come to Orthopedics and Traumatology services.
Intervention and Comparison	Study comparing conditions during the COVID-19 pandemic and pre-COVID-19 pandemic	None
Outcome	Study showing data on the proportion of changes in the number of visits, trauma cases, surgery, and telemedicine application.	Research data in the form of survey results or interviews of experts or hospital officials.
Study design	An observational study (cross-sectional, case-control, and cohort study)	Article review

Study selection and data collection

The authors conduct research articles through observational study design as the inclusion criteria. The complete copies of the identified articles, which are supposed to meet the inclusion and exclusion criteria based on the title, abstract, and subject description, will be obtained for data synthesis. The articles identified through the references list and bibliography searching will also be considered for the data collection based on the title.

After collecting a number of articles, the authors then filtered the duplicate articles. The articles that have been screened are then selected based on the predetermined methodology (namely observational studies). All articles included are then reviewed independently by the author to carry out critical appraisal or validity assessment. The validity assessment utilizes a sequence of questions based on the checklist in accordance with the types of studies that Joanna Briggs Institute develops. Every disagreement regarding the result of the validity assessment among the reviewers will be resolved through discussion. The data obtained is then entered into Microsoft Excel to recapitulate the data. The data to be retrieved are the changes in the number of visits, the changes in the number of surgeries, the changes in the number of trauma cases, and the application of telemedicine.

Data synthesis

The data to be synthesized and used in this systematic study is limited to quantitative data. The quantitative data obtained by the three reviewers will then calculate the proportion of each type of data to be taken. The minimum data obtained is proportion, but the odds ratio, risk ratio, prevalence risk, standard mean difference, and 95% confidence interval will be included in the data synthesis if possible. The data that has been obtained is then recapitulated into Microsoft Excel. The three reviewers will then describe the results of the recapitulation.

RESULTS

Search is carried out systematically using a predetermined protocol. Articles obtained using keywords in a predetermined database are 126 articles. A total of 126 articles obtained by the three authors were then screened to exclude duplications, resulting in 95 articles. The articles were then screened by title and abstract so that a total of 34 articles obtained and could be accessed as a full-text article. A total of 8 articles were excluded because 1 article was a systematic review, 7 articles were not the result of research, and 6 articles with unsupportive data. Thus, in this systematic review, 19 articles met the criteria (Figure 1).

Changes in visits

From all articles obtained in this systematic review, it was found that a total of 15 articles included data on changes in visits in the orthopedics and traumatology services. The change in visits was compared between visits during the COVID-19 pandemic and those before the COVID-19 pandemic. From 15 data, it is known that the proportion of the largest decrease in visits during the COVID-19 pandemic was 86.1%, while the smallest proportion was 22.4%.[11,12] From the overall visit data, there was no increase in the number of visits found during the COVID-19 pandemic than the period before the COVID-19 pandemic (Table 2).

Changes in trauma cases

Based on the changes in the number of trauma cases in the orthopedics and traumatology services that have been reported in 10 articles, during the COVID-19 pandemic, more surgical procedures were performed in trauma cases (62.8%). Based on Table 2 shows data regarding changes in trauma cases based on conditions before and during the COVID-19 pandemic. The largest decrease in the number of trauma cases during the COVID-19 pandemic was 91.2%, while the lowest decrease in the number of cases was 21.1%.[11, 14] After a systematic review of articles discussing changes in the number of trauma cases, it was found that a decrease in the number of trauma cases during the COVID-19 pandemic compared to before the pandemic.

Based on the upper limbs' regions, lower limbs, and pelvis, the change in the number of trauma cases during the COVID-19 pandemic was reported in 10 articles. In 10 articles, there was a decrease in cases of lower limb trauma handled in the orthopedics and traumatology services compared to before the COVID-19 pandemic. The highest reduction in lower limb trauma cases in the study of Esteban et al., that is, 77.1% and the lowest was in the Pintado study at 7.1%.[11, 15] In cases of upper limb trauma, 8 studies reported a decrease in cases and 1 study reported an increase in cases between before the COVID-19 pandemic and during the COVID-19 pandemic. The highest decrease in the upper limb cases was found in Esteban et al. amounted to 78.8%, while Elbardesy's study found an increase in trauma cases by 0.14%.[11, 16] In the pelvic region, 5 studies stated a decrease in cases, and 3 studies stated an increase in cases. The highest reduction in pelvic trauma cases was in Alonso's study of 54.4% and the highest increase in cases was in Arafah's study of 61.7%.[17,18] Similarly, tumor procedures were reduced 33,3% and infection-related procedures were reduced almost 50% from the pre-COVID era.[13]

Changes in the number of surgeries

The number of surgeries in the orthopedics and traumatology services during the COVID-19 pandemic was decreased compared to pre-COVID-19 pandemic era. The largest proportion of the decline was 88.8%, while the smallest decline was 21.7%.[17, 19] In addition, there was a decrease in emergency surgeries by 15.6%, minor surgeries by 43.2%, and major surgeries by 82.97%.[20,21] The COVID-19 pandemic also decreased the number of elective surgeries during the pandemic compared to the pre-pandemic period. Patients with non-traumatic cases getting elective surgery (21.71%) which included tumors and removal of any implants.[13]

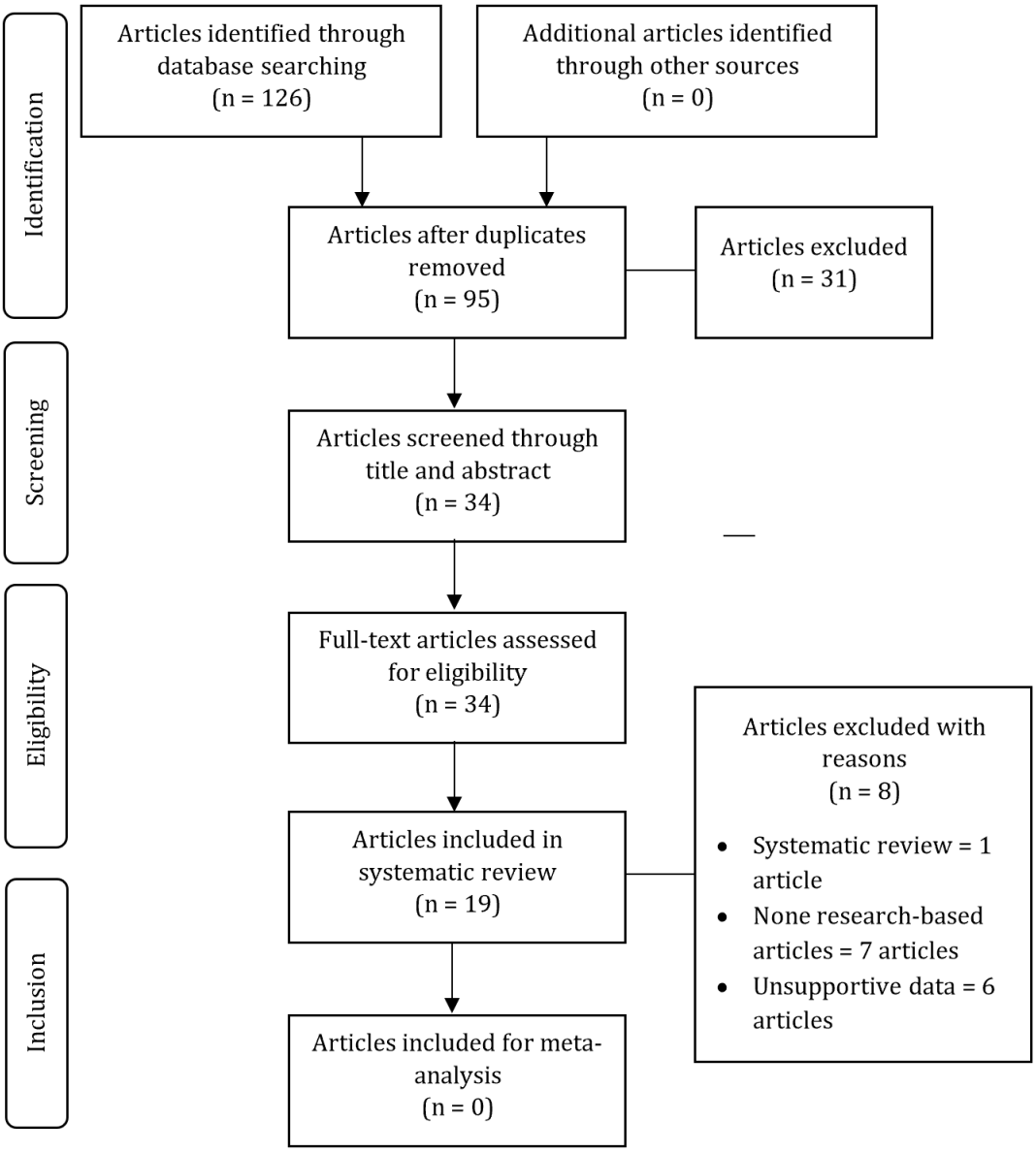

Figure 1. PRISMA flowchart

COVID-19 disrupted daily practice, the number of elective procedures was reduced significantly in the COVID-19 pandemic period and was 50% less compared with the pre-COVID-19 group.[13] The largest reduction in elective surgery reached 100%, while the lowest reduction was 50% (Table 3).[17, 19]

The proportion of Covid-19 positive patients

Patients receiving treatment at the Orthopedics and Traumatology services are separated between COVID-19 positive patients and COVID-19 negative patients. Patients diagnosed positive for COVID-19 accompanied by hip fracture reached 36.1%.[12] Of all articles that were reviewed systematically, the lowest positive cases of COVID-19 were 2.06% of all orthopedic and traumatology patients (Table 3).[22]

Table 2. Summary of the decrease in the number of visits and trauma

Author	Year	Country	Number of changes				
			Visit	Trauma cases	Lower extremity trauma cases	Upper extremity trauma cases	Hip fracture and trauma
Hashmi, et al.[13]	2020	Pakistan	50% (D)	40% (D)	49.10% (D)	53.40% (D)	-
Zagra, et al.[23]	2020	Italy	65.52% (D)	-	-	-	-
Arafa, et al.[18]	2020	UK	-	-	-	-	61.7% (I)
Alonso, et al.[17]	2020	Spain	34.40% (D)	54% (D)	44.40% (D)	54.50% (D)	54.4% (D)
D'Apolito, et al.[29]	2020	Italy	-	-	-	-	-
Esteban, et al.[11]	2020	Spain	86.10% (D)	91.20% (D)	77.70% (D)	78.80% (D)	-
Wong, et al.[19]	2020	Australia	28% (D)	-	18.75% (D)	-	-
Wong & Cheung[14]	2020	Hong Kong	-	21.10% (D)	20% (D)	23% (D)	21.2% (D)
Sugand, et al.[22]	2020	UK	67.88% (D)	67.88% (D)	74.10% (D)	66.67% (D)	-
Pintado, et. al.[15]	2020	American	79.10% (D)	30% (D)	7.10% (D)	6% (D)	11.3% (I)
Probert, et. al.[20]	2020	Australia	30.80% (D)	-	-	-	-
Murphy, et al.[30]	2020	UK	33% (D)	26% (D)	-	-	-
Nunez, et al.[12]	2020	Spain	22.40% (D)	-	-	-	27.9% (I)
Elbardesy, et al.[16]	2020	Ireland	-	-	20.44% (D)	0.14% (I)	-
Giuntoli, et al.[21]	2020	Italy	70.95% (D)	30.85% (D)	45.51% (D)	51.42% (D)	-
Hampton et al.[25]	2020	UK	55.70% (D)	46.87% (D)	48.93% (D)	55% (D)	3.13% (D)
Gumina et al.[28]	2020	Italy	64.80% (D)	64.66% (D)	-	-	-
Elhalawany et al.[31]	2020	UK	58.60% (D)	-	-	-	23.26% (D)
Greenhalgh & Dupley[33]	2020	UK	50.70% (D)	-	-	-	5.77% (D)

D : Decrease, I : Increase

Table 3. Summary of the decrease in the number of surgeries, Covid-19 proportion, and telemedicine application

Author	Year	Country	Number of decrease			
			Surgery	Elective Surgery	Positive COVID-19 Proportion	Telemedicine Application Proportion
Hashmi, et al. 13	2020	Pakistan	50%	67.00%	-	-
Zagra, et al. 23	2020	Italy	-	69.42%	31.64%	-
Arafa, et al. 18	2020	UK	-	-	-	-
Alonso, et al. 17	2020	Spain	88.80%	100%	-	21.87%
D'Apolito, et. al.29	2020	Italy	-	-	6%	-
Esteban, et al. 11	2020	Spain	-	-	-	-
Wong, et al. 19	2020	Australia	21.70%	50%	-	44.20%
Wong & Cheung 14	2020	Hong Kong	44.20%	73.50%	-	-
Sugand, et al. 22	2020	UK	66.67%	-	2.06%	9.28%

Author	Year	Country	Number of decrease			
			Surgery	Elective Surgery	Positive COVID-19 Proportion	Telemedicine Application Proportion
Pintado, et. al.15	2020	America	-	-	13%	-
Probert, et al. 20	2020	Australia	15.6% (Emergency)	-	-	-
Murphy, et al. 30	2020	UK	-	-	-	-
Nunez, et al. 12	2020	Spain	-	-	36.10%	-
Elbardesy, et. al.16	2020	Ireland	-	-	-	-
Giuntoli, et. al.21	2020	Italy	43.2% (Minor), 82.97% (Major)	64.28%	-	-
Hampton et al.25	2020	UK	-	-	-	-
Gumina et al.28	2020	Italy	-	-	-	-
Elhalawany et al. 31	2020	UK	47.62%	-	-	-
Greenhalgh & Dupley 32	2020	UK	43.20%	-	-	-

Implementation of telemedicine

During the COVID-19 pandemic, effective communication media by minimizing contact between doctors and patients has been implemented in various health centers. Three articles discuss the use of telemedicine in Orthopedics and Traumatology services from all articles. The largest proportion of telemedicine use was 44.2% in the study by Wong et al., while the lowest proportion of telemedicine use was 9.28% in Sugand et al. (Table 3).[14,22]

DISCUSSION

The COVID-19 pandemic has changed most of the orders in life, one of which is in the health sector. Lockdowns, restrictions, and public reactions to the COVID-19 pandemic have led to decreased visits, surgeries, and general trauma cases occurring in the orthopedics and traumatology services. Of the 19 articles used in this systematic review, a total of 15 articles shows the highest reduction in visits to the orthopedics and traumatology services by 86.1% during the COVID-19 pandemic compared to the year before the pandemic.[11] The decrease in visits did not occur during emergency visits, where there was an increase of 69.6% in 2020 compared to 2019.[23] From the author's thought, a decrease of visits in general, is likely due to public concern about coronavirus transmission and people tend to postpone visits to the hospital instead.

Most of the cases found in hospitals during the COVID-19 pandemic were caused by trauma by 63%, there was a decrease in trauma cases compared to pre-COVID-19 pandemic reaching 40%, possibly due to lockdowns and reduced activities outside the home.[13] Orthopedic diagnosis that is classified into trauma cases, namely contusions, fractures, dislocations, and multiple injuries, while those classified as non-traumatic are bone infections, pain disorders, and others.[11] The most cases of trauma are hip fractures due to osteoporosis, fractures of this type tend not to experience a decrease in cases because they are low-energy injuries.[24] Hip fractures due to osteoporosis require operative intervention and treatment to improve the patient's quality of life. Due to an increase in low-energy trauma cases such as hip fracture induced by osteoporosis, it is important to

prepare an intervention plan such as surgery and treatment according to the implementation of the COVID-19 pandemic protocol. Preparation of an intervention plan needs to be done in order to decide whether to be elective surgery or to do an immediate intervention.[15]

Trauma cases to the upper and lower extremities tend to decrease in the COVID-19 pandemic. The decrease in upper and lower extremities cases tends to be due to restrictions on activities such as sports, traffic, and work.[11,13,17,19,25] This limitation reduces the incidence of major traumas. In the COVID-19 pandemic, the reduction in minor trauma was higher than in major trauma cases.[11, 19] The opposite happened, namely the number of major trauma cases that came to the hospital more than minor trauma cases. However, it still cannot be explained with certainty about reducing patients with minor trauma who go to the hospital or the orthopedics and traumatology services.[19] This is likely based on public anxiety about the spread of COVID-19 in the hospital so that when there is minor trauma, the community prefers not to go to the hospital for treatment.[11, 26]

Cases of the upper and lower extremities that occur are mostly low-energy injuries such as low-energy distal radius fracture. Low energy radius fracture based on one study is the fracture with the highest cases in the COVID-19 pandemic.[13] In addition, mid-shaft and distal humerus fractures are more common at a younger age. The number of low-energy injuries also occurred due to activity restrictions and their impact on the road's lack of vehicles. Traffic accidents, which are the most common cause of high energy injuries, decrease during the COVID-19 pandemic. The mechanism of trauma such as falling remains the same before the pandemic and even increases during the pandemic.[13, 25]

The COVID-19 pandemic is also impacting surgeries performed in the orthopedic and traumatology services. In general, there was a decrease in the number of surgeries during the pandemic period compared to the pre- COVID-19 pandemic period, with the highest proportion of decline reaching 88.8% and including a decrease in emergency surgeries of 15.6%.[17] The decrease in the number of surgeries was related to restrictions on community activities, thus reducing the number of trauma cases. A decrease in the number of trauma cases such as road accidents will reduce general surgeries and emergency surgeries. In addition, non-emergency orthopedic cases such as neoplasms, metabolic disorders, congenital disorders, and degenerative diseases may also affect the number of surgeries due to the postponement non-emergency surgery schedules. Elective surgeries in the COVID-19 pandemic were also affected, as a result of which there was a decrease in the number of elective surgeries, even reaching 100%. The decrease in elective surgery, including joint and ligament repair procedures, decreased by 70%-90%. This decrease in elective surgery was caused by elective surgeries that were not scheduled during the pandemic.[14, 17] In addition, the decline could result from concerns about the transmission of COVID-19 to patients. COVID-19 infection will certainly make the patient's condition worse, especially in patients with comorbid diseases and the elderly.

Significant reduction in case visits to emergency trauma and patient care in the hospital is found in almost all countries in the world. Recent studies on elderly patients with comorbidities have a higher risk of being infected with COVID-19 due to a weak immune system.[27] In a study by Nunez et al., the most common orthopedic case was a pelvic fracture. It was more common among the elderly with a mean age of 86.9 years. Of the 36 patients with pelvic fractures, 13 patients were diagnosed positive COVID-19, and 4 patients died after surgeries.12 Positive cases of COVID-19 in other health centers found that out of 79 positive patients with COVID-19, 25 patients (31.64%) showed COVID-19 symptoms. After being treated at the orthopedics and traumatology services, 11 patients died with 6 of all patients who died diagnosed positive for COVID-19.[23]

The development of technology allows patients to get care without having to contact health workers. Reducing direct contact in an

effort to prevent the spread of COVID-19 can be done through telemedicine. Based on research in 2020 regarding the use of telemedicine in orthopedic services, it was found that the effectiveness of using telemedicine during the COVID-19 pandemic was estimated to be around 25%, this could increase the number of services for limited patients during the pandemic.[17]

This study's limitation is that it does not specifically determine the number of samples used and does not collect qualitative data such as surveys and questionnaires. The author takes available data from each article, but not all articles have data in accordance with the variables required in making a systematic review.

CONCLUSIONS

The COVID-19 pandemic has an impact on orthopedics and traumatology services based on the number of visits, especially trauma cases and surgical intervention. In the process of patient care, the application of telemedicine has started in several hospitals. However, in cases of hip fracture and trauma, several studies have shown an increase compared to the pre- COVID-19 pandemic period. We hope that in the future that elective surgery postponed during the COVID-19 pandemic can be scheduled appropriately to obtain optimal outcomes for patients in the orthopedics and traumatology services.

CONFLICT OF INTEREST

No conflict of interest

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None declare

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