

Delaying and Resuming Hip and Knee Arthroplasty Surgery during Covid-19 Outbreak: A Systematic Review for Solving this Challenge

Abolfazl Bagherifard, Abolfazl Bagherifard, Mehdi Mohammadpour, Mohamadreza Heidari Khoo, Milad Bahari, Sajad Fakoor and Masoud Hasanikhah*

Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Science, Tehran, Iran

***Corresponding Author:** Masoud Hasanikhah, Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of medical science, Tehran, Iran.

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Abstract

Purpose: Given that major orthopedic surgeries can be associated with worsening outcomes, it is not yet clear whether such surgeries should be a priority or postponed as much as possible in Covid-19 outbreak. The present review study tries to provide a reliable and acceptable answer to this question by comprehensively evaluating the available evidence, and finally, to provide a good summary of the results of the studies with the approach to hip and knee arthroplasty surgery.

Methods: Five databases including PubMed, Web of knowledge, Google scholar, EMBASE and SCOPUS were searched using the relevant keywords by two blinded researchers. The risk bias in eligible studies was assessed by two authors based on the nine-star Newcastle-Ottawa Scale scoring system.

Results: Fourteen articles were eligible for the final analysis that published between August and October 2020. With respect to early or delayed hip and knee arthroplasty surgery, we are faced with the triangle of delaying the procedure, the early or delayed patients' discharge after surgery and rescheduling the procedure as soon as possible that patient safety, patient prioritization, patient perspective and financial challenges are in the center of gravity of this triangle.

Conclusion: In fact, the decision to perform surgery or delay it should be made with non- individualized and multidimensional viewpoint.

Level of Evidence: Level III.

Keywords: Hip; Knee; Arthroplasty; Covid-19; Resuming

Introduction

The beginning of the Covid-19 pandemic at the end of 2019 coincided with dramatic yet unfortunate changes in all aspects of human life in almost every world societies. Not only the significant mortality and morbidity caused by this disease, but also the change in all short- and long-term planning of national and international health systems was the result of the pandemic [1,2]. As-

signing the bulk of diagnostic and treatment services to suspected patients with Covid-19, high hospital bed occupancy rates especially in intensive care units, significant government expenditures on patient diagnosis and treatment, significant shortage of human and financial resources in hospitals and, finally, the psychological consequences of prolonging the course of the disease, especially with the arrival of the next waves in both among the community and es-

pecially in the medical staff were all among the problems caused by this epidemic [3,4]. Another dramatic impact that the occurrence of this global disease has had on the body of health care systems is the imbalance of the patient referral chain, the admission of patients and the distribution of financial and human resources in medical centers, and ultimately the decision to perform or delay medical interventions especially surgical approaches [5]. Patients' worry on going to hospitals to follow up on their pain and illness due to fear of getting Covid-19 disease, as well as the doubt and certainty of physicians, especially surgeons, in choosing or delaying the surgery due to the increased risk of spreading the disease are two major treatment problems in this period [6]. Based on this and depending on the type of underlying disorder that requires surgical intervention, guidelines have been developed and presented that suggest the possibility of deciding to perform emergency surgeries or the possibility of delaying them [7]. However, research studies still confirm the fact that the decision to perform or not to perform major surgical interventions in patients with suspected to or with Covid-19 disease is difficult and sometimes, despite predicting the safety of such interventions, high postoperative mortality can be expected [8]. This is especially important in the case of orthopedic surgery, which provide the background for some life-threatening complications such as coagulopathies and infections (which are also problems associated with the severity and adverse outcome of Covid-19 disease) [9]. In other words, given that major orthopedic surgeries, especially after trauma, can be associated with worsening outcomes, it is not yet clear whether such surgeries should be a priority in the affected patients or postponed as much as possible in Covid-19 outbreak [10]. In this regard, what will be important from the point of view of the physician and the patient is the necessity along with optimal time point for delaying along with resuming arthroplasty surgeries considering the highest patient safety, patient prioritization, patient perspective and economic considerations. The present review study tries to provide a reliable and acceptable answer to this question by comprehensively evaluating the available evidence and finally, to provide a good summary of the results of the studies with the approach to hip and knee arthroplasty surgery.

Methods

A systematic review of published articles was performed as per the Preferred Reporting Items for Systematic Reviews and Meta

Analyses (PRISMA) statement for the conduct of a review study [11]. The study team developed a concept table and built a search strategy with a medical librarian to identify articles reporting the following subjects: 1) COVID-19 and changing the volume of hip and knee arthroplasty volume, 2) Disrupting or delaying hip and knee arthroplasty surgery within Covid-19 pandemic, 3) Resuming hip and knee arthroplasty after COVID-19, 4) Triaging hip and knee arthroplasty during the COVID-19 Pandemic, 5) Patient perceptions of hip and knee arthroplasty delaying and resuming. Exploded medical subject heading (MeSH) database was used to set the main keywords related to study context for deeply searching the literature including "Covid-19" OR "orthopedics" OR "hip" OR "knee" OR "arthroplasty". Five databases were searched; using these keywords including PubMed, Web of knowledge, Google scholar, EMBASE and SCOPUS (all inception to 10th October 2020). Reference lists of included articles were also searched and further articles included if appropriate. The full search strategy used is summarized in figure 1. Two blinded researchers independently evaluated the study subjects, abstracts and then full texts of the articles for inclusion. To minimize selection, reporting and publication bias, any case reports were excluded. Those articles with incomplete data, with non-English languages, as well as unavailable full text were inevitably excluded. Any disagreement between the two researchers was judged by the third researcher. In the next stage, full-text versions of eligible studies were retrieved and a consensus was finally reached. After a thorough and in-depth study, the descriptions of the findings of each study were extracted and classified according to the initial topics presented as the objectives of this article. Finally, a summary of the findings was presented and concluded. The risk bias in eligible studies was also assessed by two authors based on the nine-star Newcastle-Ottawa Scale (NOS) scoring system. In this quality assessment technique, each study assessed qualitatively for the three criteria of 1) the selection of the study groups, 2) the comparability of study groups and 3) the ascertainment of the outcome and is finally scored that the studies awarding 7 stars or over were deemed as high quality. The research was performed in Tehran, Iran.

Results

Study selection and quality assessment

The flow diagram of the study selection process is presented in figure 1. Initially, 27 articles were initially collected by database

searching. After removing 1 article due to evidences of duplication, 26 records were primarily under-screened. Based on the titles and abstracts, 11 records were excluded and the remaining 15 citations were assessed for further eligibility. Of those, 1 was also excluded due to incompleteness of the data and contents. In final, 14 articles

were eligible for the final analysis that published between August and October 2020. Table 1 summarizes the characteristics of the studies included. Quality assessment showed a NOS score of 7 or higher for all studies, indicating the presence of high methodological quality (Table 1).

Author, year	Selection				Comparability		Outcome			Total
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	
Wang	★	★	★		★	★	★	★	★	8
Guo	★	★	★	★	★	★	★	★		8
Emanuel	★	★	★	★	★	★	★	★		8
Kurtz	★	★	★	★	★	★	★	★	★	9
Athey	★	★	★		★	★	★	★	★	8
Bedard	★	★	★	★	★	★	★	★		8
D'Apolito	★	★	★	★		★	★	★		7
Thaler	★	★	★	★	★	★	★	★		8
Buller	★	★	★	★	★	★	★	★		8
Brown	★	★	★	★		★	★	★		7
Wilson	★	★	★	★		★	★	★		7
Kort	★	★	★	★	★	★	★		★	8
Zhou	★	★	★	★	★	★		★	★	8
Zagra	★	★	★	★	★		★	★	★	8

Table 1: The quality assessment of the studies according to the nine-star Newcastle-Ottawa Scale (NOS) scoring system.

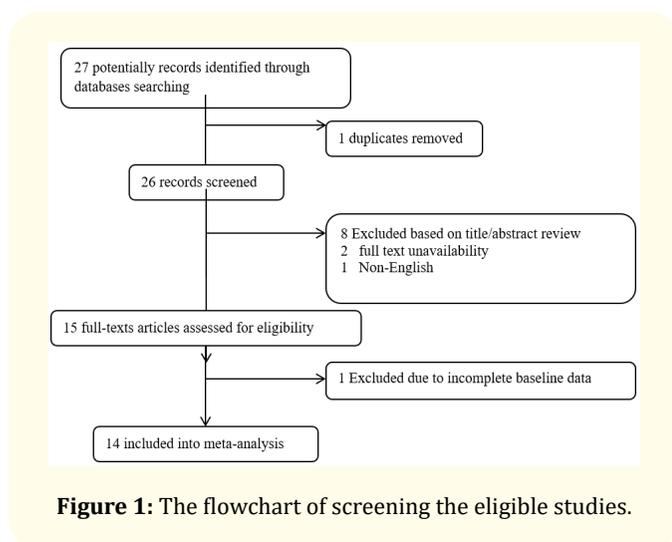


Figure 1: The flowchart of screening the eligible studies.

Discussion

Delaying and resuming hip and knee arthroplasty in Covid-19 period

Obviously, the treatment and care staff are at a much higher risk than the general population for Covid-19 disease [12]. According to a survey on orthopedic surgeons in Wuhan, China, the overall incidence of Covid-19 infection in orthopedic surgeons was up to 20.7% in the early stages of the outbreak with the main suspected site of infection occurring on the general wards [13]. Frequent exposure to patients and in the hospital environment, frequent use of supportive systems for patients with Covid-19 such as mechanical ventilation and even fatigue and burnout due to patient care, are all factors associated with increasing the likelihood of COVID-19 among medical staff [14]. Also, invasive and even semi-invasive

treatment interventions effectively increase the risk of spreading the infection. Therefore, according to the recommendations of the American College of Surgeons, non-emergency surgeries should be delayed as much as possible during the Covid-19 period. As a result, many US hospitals have delayed elective surgeries, and the clinics and doctors' practices have either closed or received very limited and selective admissions. Orthopedic surgeons, meanwhile, were no exception, and many invasive surgical interventions (except in cases of trauma requiring emergency intervention) were delayed. In this regard, the admission volume load of hip and knee arthroplasty surgeries dropped a lot during Covid-19 period [15]. According to a great survey by the American Association of Hip and Knee Surgeons (AAHKS) and using an online survey with the participation of orthopedic surgeons in more than 32 countries, the arthroplasty practice of almost all surgeons (except for Japanese) was impacted by the effects of COVID-19 leading stop of elective in-patient hip and knee arthroplasty surgeries in about 70% of referral hospitals. Although in some hospitals, semi-urgent arthroplasty surgeries such as periprosthetic fracture or first-stage resection for prosthetic joint infection had been still scheduled of course following preoperative patients and physicians testing for COVID-19 infection [16]. According to another large survey in US, the potential effect of Covid-19 pandemic on volume of hip and knee arthroplasty was demonstrated, in the pointed survey, about 30,000 primary and 3000 revision hip and knee arthroplasty procedures were canceled each week in Covid-19 outbreak that seems to be considerably high. In that survey, 100% cancellation of nonessential primary and revision total knee arthroplasty was reported in 20738 and 1893 cases and total hip arthroplasty in 9265 and 977 cases respectively [17]. D'Apollito, *et al.* [18] in Italy also showed 76.5% reduction in hip and knee arthroplasty surgeries in Covid-19 outbreak as compared to the same period of 2019. In fact, the outbreak of COVID-19 had a considerable effect on the load of hip and knee arthroplasties that rapidly decreased to 0 in parallel to the worsening of the situation in the country. Similarly, Thaler, *et al.* [19] showed a massive reduction in primary and revision hip and knee arthroplasty surgery across Europe in response to the pandemic. Of the participating surgeons, more than 90% stated that their institutions no longer provided primary total joint arthroplasty.

In addition to the two issues of delayed surgery and rescheduling to perform surgery as soon as possible, another indicator has been considered and that is early or delayed discharge of patients after surgery. Many people are of the opinion that both early dis-

charge of patients and prolonged hospitalization of patients can be associated with potentially dangerous complications. However, in a survey by Buller, *et al.* [20] by comparing the outcome of early and delayed patients' discharging, it was shown that early discharge following aseptic revision hip and knee arthroplasty could not increase 90-day readmissions or emergency department visits. In other words, despite the small number of hospital beds allocated to Covid 19 patients and the unsafe nature of hospital settings, early discharge of these patients after orthopedic procedures has no significant effect on postoperative outcomes and therefore the possibility of further patient care at home.

Patients' perception toward delaying or resuming the procedure

Brown, *et al.* [21] in a same survey in US assessed a new but interesting issue on the patients' viewpoint toward delaying the procedure. However, patients will be hesitant and even anxious about the delay in orthopedic procedures, especially emergency or major procedures, because they will be worried about its unpredictable complications and consequences. Therefore, it seems that before delaying the mentioned surgeries, the evaluation of patients' opinions should be considered with emphasis. As pointed in a population-based survey by Brown, although 14% of patients especially the elderly initiated the cancellation the procedure, about 90% of patients planned to reschedule the procedures as soon as possible due to raising their anxiety and fear of future arthritis [21]. In a similar comprehensive survey by Wilson and colleagues [22] on patient perceptions of COVID-19-related surgical delay, the patients who were planned for COVID-19-driven delaying to scheduled total hip or knee arthroplasty were asked about the procedural delay by telephone survey and ultimately indicated that 90% of patients believed that the surgical delay was in their best interest; 68% reported their emotional distress from the delay of procedure, and 45% reported a desire to wait longer for the pandemic to subside. According to their results, the main predictors for patients' desire for early surgery were pain intensity, higher functional disability, and longer latency from personally deciding to pursue surgery. Considering the patients' views on the need for the procedure, Kort, *et al.* [23] presented a new classification of postponed patients waiting for hip and knee arthroplasty during the pandemic. The first group with severe hip and knee defects but without risk factors for complications or death from COVID-19 those were very concerned about disease transmission or delaying the procedure independent to the Covid-19 situation. The second group with the

pointed major risk factors for adverse consequences of surgery those were adversely eager to be scheduled for arthroplasty. The third group that in spite of benefit from arthroplasty, they are unsure about proceeding in current circumstances and request guidance from the surgeon. But what remains a fundamental question is the optimal time for delaying these surgeries has not yet been determined and these is no so far a reliable qualitative and quantitative system based on its determinants to decide the rate of delay in surgery. However, in this regard, there are some hypotheses and indicators have been discussed.

Selective criteria for resuming the hip and knee arthroplasty

Reviewing the literature suggested four criteria to resume the hip and knee arthroplasty in Covid-19 outbreak. As the first criteria, patient safety seems to be the most critical index. In fact, patient safety should be considered as an ethical issue to reopen joint arthroplasty services. In this regard, with considering the potential postoperative complications of arthroplasty especially in pandemic outbreak with raised likelihood of Covid-19 disease, the assessment of the level of the safety of surgical intervention is essential. This patients' safety should be assessed considering some items such as the risk for the nature of the surgery itself independent to pandemic situation, the underlying risk profiles of the patients, and the risk for transmitting the virus in healthcare centers and from healthcare workers. It should be noted that to maximize safety, comprehensive assessment of the patients' underlying risk profile (particularly those with immunocompromised, thromboembolism, and cardiovascular states), staff and patients testing for Covid-19 before procedure and creating especial hospital pathways for non-Covid-19 patients to protect them against infectious ones are very helpful [24,25]. The second criterion is patient prioritization. In the case of orthopedic injuries, there is an obvious imbalance between the need for hospitalization and emergency interventions with the lack of hospital resources and facilities during the pandemic. In this regard, prioritization of patients in need of hospitalization services, especially admission to intensive care units is essential. This prioritization is usually based on the demographic characteristics of patients (advanced age), the severity of traumatic injuries, and the presence of underlying comorbidities [26]. In non-pandemic condition, the American College of Surgeons has described the following criteria for prioritization of patients for hip and knee arthroplasty: hip or knee dislocation, acute pain exacerbation, periprosthetic fracture, inability to bear weight on the ex-

tremity, high fever, wound drainage, and fever [27]. Obviously, the added index of suspected Covid-19 disease and its severity should be considered as a major indicator in deciding to prioritize patients for surgery. As the third criterion, patient perspective is proposed. The high volume of cases requiring admission for surgery raises the need to delay surgery and, accordingly, raises the need to use patient waiting checklists. On the other hand, the high occupancy of physicians during the pandemic greatly limits the possibility of face-to-face contact between physician and patient. These conditions can lead to a significant reduction in communication between physician and patient and ultimately weaken the patient's view of his or her physician and medical staff. Therefore, the patient's confidence in the doctor's decision and the reason for the delay of the procedure is greatly reduced. As a result, the patient's explanation of the advantages and disadvantages of delay in treatment, his/her rational justification of the need for patience to perform surgery and strengthen the doctor-patient communication will eventually lead to the correction of the patient's perspective. In order to achieve such a communication between physician and patient, pay special attention to the patient's expectations from the protocol and his/her treatment process, use absentee methods such as telemedicine and telenursing for continuous communication with the patient and collaborating with the patient to choose the time of surgery can strengthen such companionship [28,29]. Finally, the economic consequences of the Covid-19 pandemic and their persistence due to the emergence of continuous waves of disease has put great economic pressure on the body of societies and governments. Obviously, in the absence of financial support from governments or support agencies, especially insurance companies, major surgeries and related care will be associated with a heavy financial burden on patients, especially in developing societies that seems to have an increasing trend [29]. This issue will be very effective in deciding whether to perform major surgical interventions or postpone it in pandemic period.

Conclusion

In general, with respect to early or delayed hip and knee arthroplasty surgery, we are faced with the triangle of 1) delaying the procedure, 2) the early or delayed patients' discharge after surgery and 3) rescheduling the procedure as soon as possible that patient safety, patient prioritization, patient perspective, and financial challenges are in the center of gravity of this triangle. In fact, the decision to perform surgery or delay it should be made

with a comprehensive view of the above set, because decisions are not individualized and not single-dimensional. Although this process is important for all periods and types of surgeries, it will have a special place in the pandemic period and especially in orthopedic surgeries.

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