Journal of Clinical Orthopaedics and Trauma 21 (2021) 101515

Contents lists available at ScienceDirect

Journal of Clinical Orthopaedics and Trauma

journal homepage: www.elsevier.com/locate/jcot

Original article

Impact of Covid-19 pandemic on arthroplasty services and early experience after resuming surgeries at a 'non Covid' center

Varun Khanna*, Piyush Suresh Nashikkar, Ramneek Mahajan, Swayam Tripathi

Max Institute of Musculoskeletal Sciences (Department of Orthopaedic Surgery), Max Super Speciality Hospital, Mandir marg, Press Enclave Road, Saket, New Delhi, 110017, India

ARTICLE INFO

Article history:
Received 27 December 2020
Received in revised form
19 July 2021
Accepted 21 July 2021

Keywords:
Covid-19
Pandemic
Arthroplasty
Disruption
Resumption
Post-lockdown

ABSTRACT

Background: The aim of this study is to assess the impact of Covid-19 crisis on hip and knee joint replacement surgeries at a high volume tertiary care hospital in the Indian National Capital Region and to evaluate the early experience of resumption of arthroplasty services.

Methods: Institutional records of the arthroplasty cases, operated between 1st March to 31 August of 2019 (Group A, pre-Covid) and 2020 (Group B, pandemic year) were compared retrospectively over numerous parameters including the complications within six weeks of surgery.

Results: There was a significant drop (by 82.53 %) in the total number of arthroplasty surgeries in Group B (62) as compared with Group A (355). Average number of arthroplasties per month were 59.17 ± 12.93 and 10.67 ± 13.29 in Group A and Group B respectively ($p < 0.001$). There was a significant increase in postoperative complication rate 7/355 (1.97 %) in Group A vs 7/62 (11.29 %) in Group B during pandemic ($p < 0.002$), along with a higher 30-days mortality rate 2/355 (3.22 %) vs 2/62 (0.56 %). Pandemic year also saw an increased readmission rate (4.83 %) vs (0.56 %) and postoperative ICU transfer rate (1.61 %) vs (0.56 %) in comparison with pre-Covid year.

Conclusion: In the pandemic, arthroplasty services got severely affected at our center. With nearly six fold increase in complication rates, higher 30-days mortality and increased readmission rates, caution is advised in resuming arthroplasty surgeries without robust evaluation of cases. Whether undetected Covid-19 infection or poor pre-existing disease control due to lockdown can be linked to these results is a matter of further research with larger multicenter studies.

1. Introduction

Outbreak of Covid-19 (Coronavirus disease 2019) brought forth one of the most challenging times in modern medical history. By March 11th, 2020, World Health Organisation (WHO) declared Covid-19 infection as a pandemic spreading across the globe.[1] Medical specialities not directly related to clinical effects of Covid-19, such as orthopaedic surgery took a massive hit with disruption of elective surgeries including arthroplasties. In India, to curtail the quick progression of the disease, the government set out guidelines of social distancing, travel restrictions and called for an unprecedented nationwide lockdown from 25th March.[2] Orthopaedic practices then, were restricted only to conservative management of most conditions and surgical management of emergencies. There was complete deferment of elective surgeries and out-patient services at our hospital. Post-lockdown, resumption of arthroplasties posed various challenges such as patient selection, patient and staff safety, regional circumstances of pandemic, health ministry and local governmental guidelines, clarity of surgical recommendations and unpredictability of response. Currently, there is no literature which has published the outcome of arthroplasties done during pandemic and compared them with arthroplasties done in pre-Covid times. This article aims to describe the impact of ongoing Covid-19 crisis on the arthroplasty services at a high volume tertiary care private hospital in Indian National Capital and compare early outcome of

Abbreviations: Covid-19, Coronavirus disease 2019; WHO, World Health Organisation; ICU, Intensive Care Unit; TJRS, Total joint replacement surgeries; RTPCR, Reverse transcription polymerase chain reaction; LDH, Lactate Dehydrogenase; A:G, Albumin:Globulin; IL-6, Interleukin 6; CRP, C-reactive Protein.

* Corresponding author. B1/52(Ground floor), Safdarjung enclave, New Delhi, 110029, India.

E-mail addresses: varun0609@yahoo.com (V. Khanna), psnashikkar@gmail.com (P.S. Nashikkar), ramneekmahajan11@gmail.com (R. Mahajan), swayamtripathy@gmail.com (S. Tripathi).

https://doi.org/10.1016/j.jcot.2021.101515
0976-5662/

arthroplasties performed during six months (March to August 2020) of pandemic with corresponding months of previous year (pre-Covid period).

At our center, hospital services were segregated into 'Covid' and 'Non-Covid' zones which were physically apart from each other. All Covid related services were restricted to the Covid facility (with its own emergency, wards and ICU). All other essential medical services were going on in the Non-Covid zone/Covid-free facility, including the Orthopaedics department. Each individual was screened at the entrance of this premises for any Covid-related symptoms.

2. Material methods

We did a retrospective analysis of the records of patient who underwent hip or knee total joint replacement surgeries (TJRS) from 1st March to 31st August in the year 2019 (Group A) and 2020 (Group B), performed by the single senior replacement surgeon (RM) in the arthroplasty unit of our hospital. Approval of the Ethics Committee and Institutional Review board was taken before commencing the study. Fig. 1 illustrates the method of data collection and parameters that were focused upon for comparisons in the two groups and were then subjected to statistical analysis. In Group B, post operative Covid-19 status of the patient was monitored. Any complications arising within six weeks of surgery were noted in both groups. Number of cases per month in both groups and the trajectory shown by the number of new Covid-19 infections per month in the New Delhi Region were depicted using line diagrams (Fig. 2).

2.1. Patient selection criterion

During lockdown, only 'urgent' TJRS, indicated in revision cases, infection, periprosthetic fracture or proximal femur fractures in elderly patients were addressed. After easing of lockdown restrictions, patients with arthritis, in whom activities of daily living were getting restricted and those requiring revision surgeries were selected from the backlog of cases. Only patients testing negative in preoperative Covid-19 RTPCR (Reverse transcription polymerase chain reaction), 24–48 h before surgery were taken up. Computerised tomographic (CT) chest study was warranted in case with clinical suspicion inspite of a negative RTPCR report. Each patient was thoroughly evaluated in the pre-anesthetic check-up and operated only when found to be medically optimized for systemic conditions.

2.2. Statistical analysis

Means of quantitative variables such as number of TJRS, age, and hospital stay in 2019 and 2020 was compared with Student t-test. Gender wise cases and cases with different ASA grades were compared with the Chi-square test. Pearson correlation was computed between month-wise differences (between 2019 and 2020) in the number of TJRS and new COVID-19 cases each month in the New Delhi Region. The statistical significance of these correlations were checked with Student t-test. A P-value less than 0.05 was considered significant. IBM SPSS© V21.0 Software system was used for calculations.

3. Results

During the study period, there was a significant drop in arthroplasty numbers (82.53 % drop) in Group B (62) as compared with Group A (355). 36 out of 62, 58.06% cases operated in Group B were done in the first three weeks of March 2020 before the number of Covid-19 cases began to rise and nationwide lockdown was not implemented in India (Fig. 2). Average number of arthroplasties per month were 59.17 ± 12.93 and 10.67 ± 13.29 in Group A and Group B respectively ($p < 0.001$) with only two hip arthroplasties (for hip fracture as emergency) done in April and none in May 2020. Two patients who were asymptomatic carriers, tested positive for Covid-19 during the preoperative work up and hence had to be quarantined for three weeks. They were operated after two separate negative Covid-19 RTPCR reports. Both patients went on to have uneventful postoperative recovery. There was a significant increase in postoperative complications rate from 1.97% in Group A to 11.29 % in the pandemic period ($p = 0.002$). 5 out of 7 (71.42 %) cases having these complications were of ASA Grade $\geq$ III. Demographic details of Group B (pandemic period) and the comparative analysis of arthroplasties between Group A and Group

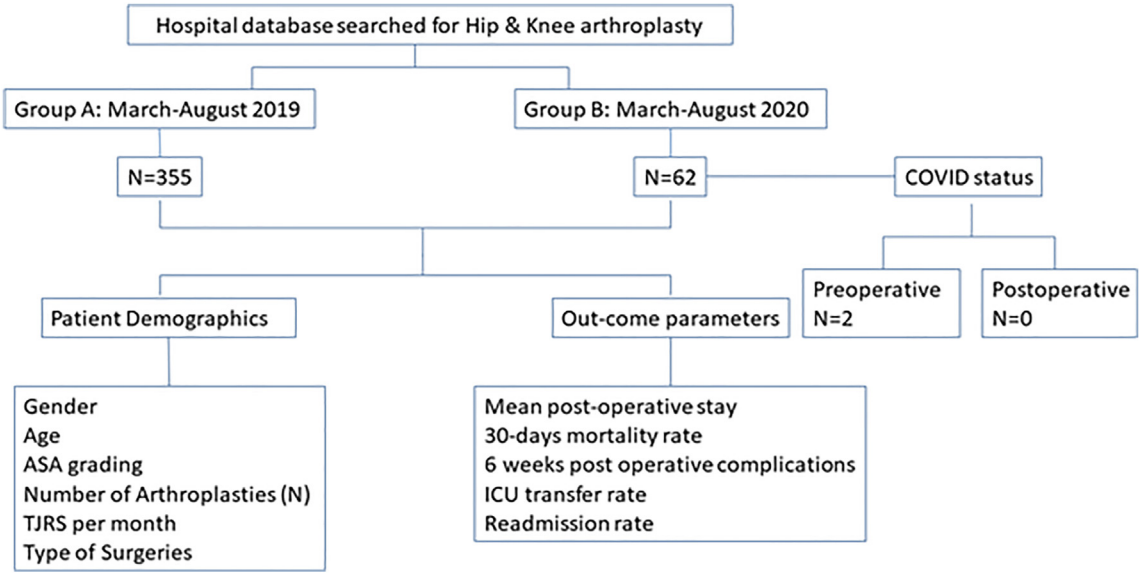

Fig. 1. Scheme of study
TJRS- total joint replacement surgeries; ASA- American Society of Anesthesiologists; ICU- Intensive Care Unit.

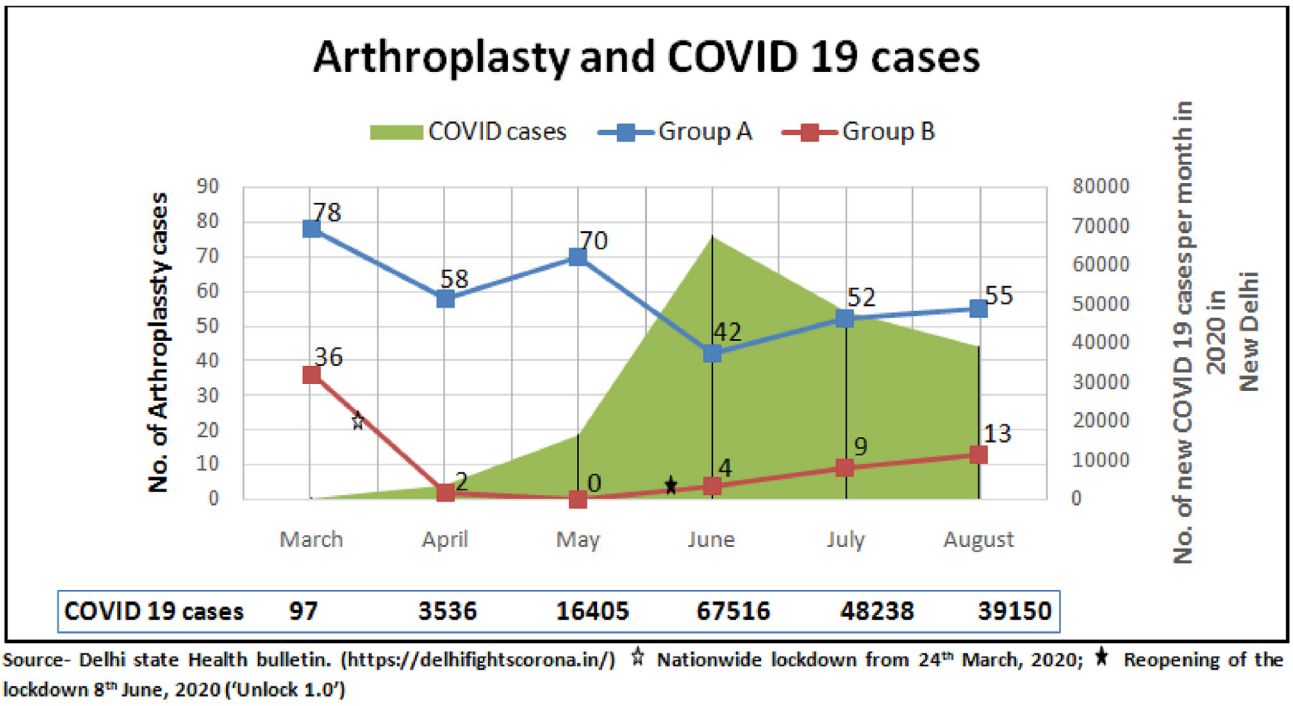

Fig. 2. Line diagram depicting month-wise comparison of number TJRS in Group A, 2019 (Blue) and Group B, 2020 (Red). Number of new cases of Covid-19 per month in New Delhi Region (Green).

B including postoperative complications is illustrated in Table 1 and Table 2 respectively. The month-wise differences (between 2019 and 2020) in the number of TJRS and new COVID-19 infection each month in the New Delhi Region showed no statistically significant correlation ($p > 0.05$).(Fig. 2).

4. Discussion

There is an estimate that more than two million non-emergent surgeries were being cancelled every week during the pandemic.[3] During the study period, there was 82.53 % drop in TJRS performed at our center as compared to previous year. Such drastic drop can be attributed to nationwide lockdown, governmental guidelines, apprehension of the patients to visit hospital, local authorities and hospital policies to conserve and direct resources for management of Covid-related patients. There are reports of similar disruption of arthroplasty services around the globe. A study performed in a high volume Orthopaedic Center, in Northern Italy (which was the first and the most severely hit regions of Italy) showed a decrease in cases by 76.5 % when compared with corresponding seven weeks duration in 2019.[4] A survey conducted in Europe, in March and April 2020, comprising of 272 Orthopedicians from 40 countries, reported cancellation of 92.6 % primary and 94.7 % aseptic revisions TJRS.[5]

In India, after 75 days of stringent lockdown, gradual reopening was ensued from 8th June 2020.[6] At the same time, guidelines to start elective arthroplasty surgeries were emerging from various centers around the world. It was vital to restart elective surgeries when new Covid infections in our region showed a decreasing trend (Fig. 2). Various other factors were considered before starting these surgeries such as risk of exposure to staff and patients, clearance from the authorities, availability of resources, and clinical urgency of the patient. The recent recommendations were incorporated during the surgeries and the postoperative period.[7–9] Even though no patient became Covid positive, post-surgery, we saw significant increase in complication rate (11.29 vs 1.97 %) when compared with previous year ($p < 0.002$). Higher complication rates were observed inspite of the presence of the same surgical team and staff as last year (Table 2).

Higher 30-days mortality rate was also seen despite the limited number of cases done this year (3.22 vs 0.56 %). The two patients who expired in Group B included a 58 years old female, a known diabetic who developed fever and unexplained gastrointestinal symptoms (abdominal pain and diarrhea) on 10th day post surgery. While the other patient was a 60 years old female, with no known comorbidities, who developed accelerated hypertension post-operatively and a hemorrhagic stroke (basal ganglia bleed) on 3rd postoperative day. Patient was shifted to ICU where she succumbed after 23 days of ICU stay. Patient had tested negative for Covid-19 RTPCR on two separate occasions while in ICU.

Literature on resuming elective surgeries during pandemic is still evolving. A prospective study of 309 cases who underwent non-emergent/elective surgeries during April 8th to May 29th, 2020 in a 'Covid-free' hospital, showed complications in 27 cases

Table 1
Patient demographics during Pandemic period.

N	62
Gender	
Male	42
Female	20
Age (years)	65.77 ± 12.26
Mean Hospital stay (days)	2.87 ± 1.05
Surgeries performed	
• Total hip arthroplasty	16
• Hemi-arthroplasty for femoral neck fractures	14
• Megaprosthesis (Tumor resection)	1
• Hinged prosthesis knee (Aseptic loosening)	1
• Stage I Revision for Chronic Periprosthetic Joint Infection	3
• Bilateral Total Knee Arthroplasty	18
• Unilateral Total Knee Arthroplasty	9

Table 2
Comparative analysis of Arthroplasties done in 2019 and 2020.

Parameters	Group A 2019 (March to August)	Group B 2020 (March to August)	P value
Total number of Arthroplasties (**n**)	355	62	
Mean cases per month	59.17 ± 12.93	10.67 ± 13.29	**<0.001**
Mean age (years)	64.23 ± 10.98	65.77 ± 12.26	**0.388**
Mean post-op hospital stay (days)	2.94 ± 0.497	2.87 ± 1.055	**0.690**
30-days mortality	2 (0.56 %)	2 (3.22 %)	
ASA Grade			
I/II	103	30	**0.035**
≥ III	252	32	
Readmissions after discharge	2 (0.56 %)	3 (4.83 %)	
ICU transfer	2 (0.56 %)	1 (1.61 %)	
Overall Complications (within 6 weeks)	1.97 %	11.29 %	
DVT/PE	0	2	**0.002**
Infection	0	0	
Pulmonary Complications	2 (2 cases Pneumonia)	0	
Cardiological	2 (Myocardial Infarction, Accelerated hypertension)	2 (Accelerated hypertension, Post operative arrythmia)	
Neurological	1 (Delirium)	1 (Stroke)	
Others	2 (2 cases of UTI)	2 (UTI,Dyselectrolytemia)	

(8.7 %).[10] The early concerning reports of evaluating outcome of elective surgeries, at the beginning of the pandemic, had reported mortality rate up to 21%.[11,12] These reports had led to cessation of non-emergent surgeries and more stringent measures while performing such surgeries in the Covid times. Strikingly, these studies lacked proper preoperative Covid -19 RTPCR testing or screening of the patients. Though none of our cases developed any pulmonary complications, we did observe two cases (3.2 %) of deep vein thrombosis in Group B while none in Group A. Even though data on thrombotic risk is limited, but increased risk of thromboembolic disease due to Covid-19 has been widely observed and reported in literature.[13]

Mean postoperative hospital stay during the pandemic was slightly lower as comparable to previous year 2.87 ± 1.05 Vs 2.94 ± 0.49 days ($p = 0.690$). The effort to minimize stay in the hospital in order to reduce risk of exposure may have proved counterproductive as we saw increased readmission rates (4.83 vs 0.56 %) in comparison with the previous year. Also, postoperative ICU transfer rate was also increased in the pandemic year (1.61 vs 0.56 %). Noticeably, 5 out 7 (71.42 %) cases that complicated in Group B were of ASA grade ≥ III. Some authors have suggested enrolling only ASA grade I or II for arthroplasty surgeries in the early phase of resuming elective surgeries.[14,15] One may attribute increased complications to the fact that during the lockdown, patients could poorly control their comorbidities due to inactivity, relying mainly on telecommunication with physicians and inadequate check-ups, though more data is needed to establish this. As no patient tested positive for Covid-19 postoperatively and all cases operated were RTPCR negative for Covid-19, pre-surgery, undetected or asymptomatic Covid infections, predisposing the cases to increased susceptibility to thromboembolic or vascular complications cannot be entirely ruled out. Further studies are warranted to attribute these increased complications to the Covid-19 infection.

Some guidelines have come up in guiding the surgical timing for doing arthroplasty in cases who are post Covid infection, with authors recommending a wait of at least two months to be appropriate.[14] In our study, we followed our institutional guidelines of two negative RTPCR tests three weeks apart before considering the case for elective surgeries and we observed no postoperative complications those cases. It also seems worth noticing that we resumed surgeries roughly three weeks from the peak of the infection curve in our region, gradually enrolling only the prioritized cases, but ended up facing increased complication rates. Authors are of an opinion that a wait of at least 8–10 weeks from the peak to be a safer wait period. Though larger evidence and the need for further research on it cannot be overstressed. It goes without saying that the availability of the resources required for management of the Covid-19 cases can never be compromised in the process of resuming elective surgeries. So we suggest scope of further probing some important unanswered questions such as - "what is the appropriate time to resume surgeries from the peak of the infection wave in the region ?" also "what role can the vaccines play in ensuring safety of patients undergoing elective surgeries?" Answer to these questions would be vital in ensuring safety of both patients and the healthcare workers.

Our study has several limitations, firstly a small number of arthroplasty cases (62) were evaluated in the Group B. Studies with a larger number of cases is required to better characterize the outcomes, including complications of resuming arthroplasties during pandemic. Being a single center study, it will be premature to generalize these results in all working capacities. Number of Covid-19 cases in the region/locality and the patient selection criterion varying from center to center can also influence the result. We believe data derived from multiple centers with heterogeneous healthcare systems in regions affected by Covid-19 pandemic at different times would be a better study design and bring more credibility to these results. Nonetheless, it is the first study that describes the early experience after resuming the arthroplasty services in a 'Non-Covid' hospital after resumption of nationwide lockdown. Our study has relevant implications in resuming arthroplasty surgeries, keeping in mind the chances of new waves of Covid-19 infection in the future and need of further lockdown, if required.

The negative effect of Covid-19 pandemic on strained hospitals, implant vendors and replacement surgeons is palpable. The lingering apprehension in the minds of the patients re-engaging with the healthcare system when it comes to arthroplasties will take time to resolve. We observed a slow return of patients, post-lockdown at our hospital, with a low percentage of cancelled patients accepting to reschedule surgery (Fig. 2). Several surveys and online trend analysis reported decreased interest of patients in hip and knee replacement surgeries.[16,17] While at one end, patients may opt to precautionarily delay elective surgeries as much as they can and on the other, ones with end stage hip or knee arthritis who continue to suffer with pain and disabilities needing arthroplasty want to get operated as early as possible. Ensuring safety of both patients and staff is paramount and delivering optimal results with minimum complications is a challenging task.

5. Conclusion

Our comparative analysis of the arthroplasty cases done in pre-Covid and during Covid pandemic emphasizes the adverse impact on the arthroplasty services. We report 85.2 % drop in the number of arthroplasty cases during Covid times. With nearly six fold increase in complication rates, higher 30-days mortality and increased readmission rate, it is imperative that all patients who undergo TJRS, go through a more stringent selection process, especially ones with pre-existing comorbidities during this pandemic. Caution in advised while using fast-track protocols in which patients are admitted, operated and discharged early, post-surgery. We propose a more robust evaluation of cases chosen for TJRS. This may include baseline estimation of inflammatory markers like D-Dimer, ferritin, LDH, A:G ratio, IL-6, CRP as Covid-19 predictors. Patients should be made aware of the increased risk of postoperative complications at the time of informed consent. Studies with a larger number of subjects and longer follow-up is warranted to streamline the resumption of arthroplasty surgeries in these unprecedented times.

References

1. Vannabouathong C, Devji T, Ekhtiari S, et al. Novel coronavirus COVID-19: current evidence and evolving strategies. *J Bone Joint Surg Am*. 2020 May;102(9):734–744, 6.
2. https://www.thehindu.com/opinion/lead/differential-impact-of-covid-19-and-the-lockdown/article32416854.ece.
3. CovidSurg Collaborative, et al. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *Br J Surg*. 2020. https://doi.org/10.1002/bjs.11746 [PMC free article] [PubMed] [CrossRef].
4. D'Apolito R, Faraldi M, Ottaiano I, Zagra L. Disruption of Arthroplasty practice in an orthopaedic center in northern Italy during COVID-19 pandemic. *J Arthoplasty*. 2020. https://doi.org/10.1016/j.arth.2020.04.057.
5. Thaler M, Khosravi I, Hirschmann MT, et al. Disruption of joint arthroplasty services in Europe during the COVID-19 pandemic: an online survey within the European Hip Society (EHS) and the European Knee Associates (EKA). *Knee Surg Sports Traumatol Arthrosc*. 2020 Jun;28(6):1712–1719. https://doi.org/10.1007/s00167-020-06033-1. Epub 2020 May 2. PMID: 32361927; PMCID: PMC7195619.
6. https://en.wikipedia.org/wiki/COVID-19_pandemic_lockdown_in_India.
7. Chang Liang Z, Wang W, Murphy D, Po Hui JH. Novel coronavirus and orthopaedic surgery: early experiences from Singapore. *J Bone Jt Surg Am*. 2020. https://doi.org/10.2106/JBJS.20.00236 guidelines.
8. Parvizi J, Gehrke T, Krueger CA, et al. Resuming elective orthopaedic surgery during the COVID-19 pandemic. *J Bone Joint Surg Am*. 2020;102(14):1205–1212. https://doi.org/10.2106/JBJS.20.00844 [PMC free article] [PubMed] [CrossRef] [Google Scholar].
9. Guy DK, Bosco JA, Savoie FH. *AAOS Guidelines for Elective Surgery. American Academy of Orthopaedic Surgeons*; 2020. May 14 https://www.aaos.org/about/covid-19-information-for-our-members/aaos-guidelines-for-elective-surgery/.
10. Gammeri E, Cillo GM, Sunthareswaran R, Magro T. Is a "COVID-19-free" hospital the answer to resuming elective surgery during the current pandemic? Results from the first available prospective study. *Surgery*. 2020;168(4):572–577. https://doi.org/10.1016/j.surg.2020.07.003.
11. Lei S, Jiang F, Su W, Chen C, Chen J, Mei W. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine*. 2020. https://doi.org/10.1016/j.eclinm.2020.100331 [PMC free article] [PubMed] [CrossRef] [Google Scholar].
12. COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study [published correction appears in Lancet. 2020 Jun 9;:]. *Lancet*. 2020;396(10243):27–38. https://doi.org/10.1016/S0140-6736(20)31182-X.
13. Terpos E, Ntanasis-Stathopoulos I, Elalamy I, et al. Hematological findings and complications of COVID-19. *Am J Hematol*. 2020 Jul;95(7):834–847. https://doi.org/10.1002/ajh.25829. Epub 2020 May 23. PMID: 32282949; PMCID: PMC7262337.
14. Mouton C, Hirschmann MT, Ollivier M, Seil R, Menetrey J. COVID-19 - ESSKA guidelines and recommendations for resuming elective surgery. *J Exp Orthop*. 2020;7(1):28. https://doi.org/10.1186/s40634-020-00248-4. Published 2020 May 13.
15. Sadigale O, Bagaria V, Vaishya R. Resuming arthroplasty: a well aligned and a balanced approach in the COVID-19 era. *J Clin Orthop Trauma*. 2020;11(Suppl 4):S423–S425. https://doi.org/10.1016/j.jcot.2020.06.024.
16. Jella TK, Samuel LT, Acuña AJ, Emara AK, Kamath AF. Rapid decline in online search queries for hip and knee arthroplasties concurrent with the COVID-19 pandemic. *J Arthroplasty*. 2020 Oct;35(10):2813–2819. https://doi.org/10.1016/j.arth.2020.05.051. Epub 2020 May 26. PMID: 32534864; PMCID: PMC7248628.
17. Landy DC, Chalmers BP, Utset-Ward TJ, Ast MP. Public interest in knee replacement fell during the onset of the COVID-19 pandemic: a google trends analysis [published online ahead of print, 2020 sep 15]. *HSS J*. 2020:1–5. https://doi.org/10.1007/s11420-020-09794-0.