



## ■ GENERAL ORTHOPAEDICS

# Resuming elective orthopaedic services during the COVID-19 pandemic

OUR EXPERIENCE

**R. Chuntamongkol,  
R. Meen,  
S. Nash,  
N. E. Ohly,  
J. Clarke,  
N. Holloway**

From NHS Golden Jubilee, Clydebank, UK

## Aims

The aim of this study was to surveil whether the standard operating procedure created for the NHS Golden Jubilee sufficiently managed COVID-19 risk to allow safe resumption of elective orthopaedic surgery.

## Methods

This was a prospective study of all elective orthopaedic patients within an elective unit running a green pathway at a COVID-19 light site. Rates of preoperative and 30-day postoperative COVID-19 symptoms or infection were examined for a period of 40 weeks. The unit resumed elective orthopaedic services on 29 June 2020 at a reduced capacity for a limited number of day-case procedures with strict patient selection criteria, increasing to full service on 29 August 2020 with no patient selection criteria.

## Results

A total of 2,373 cases were planned in the 40-week study period. Surgery was cancelled in 59 cases, six (10.2%) of which were due to having a positive preoperative COVID-19 screening test result. Of the remaining 2,314, 996 (43%) were male and 1,318 (57%) were female. The median age was 67 years (interquartile range 59.2 to 74.6). The median American Society of Anesthesiologists grade was 2. Hip and knee arthroplasties accounted for the majority of the operations (76%). Six patients tested positive for COVID-19 preoperatively (0.25%) and 39 patients were tested for COVID-19 within 30 days after discharge, with only five patients testing positive (0.22%).

## Conclusion

Through strict application of a COVID-19 green pathway, elective orthopaedic surgery could be safely delivered to a large number of patients with no selection criteria.

**Cite this article:** *Bone Jt Open* 2021;2-11:951–957.

**Keywords:** COVID-19, Resumption, Arthroplasty, Elective, Orthopaedics

## Introduction

COVID-19, originating in Wuhan, China, quickly spread, being declared a global pandemic on 11 March 2020.<sup>1</sup> In order to redeploy resources to prevent the NHS from being overwhelmed, all nonessential orthopaedic surgery was halted, leading to significant increases to waiting lists.

The cessation of orthopaedic surgery has led to a dramatic increase in waiting times.<sup>2</sup> While these operations are not classed as emergencies, a recent study from Edinburgh showed that patients with severe osteoarthritis view their pain as “worse than death”.<sup>3</sup>

It has been conclusively shown that hip and knee arthroplasty procedures dramatically improve quality of life, and that patients with more advanced arthritis are more willing to accept COVID-19 risks.<sup>4,5</sup> Studies have shown increased mortality rates and postoperative complications in patients with confirmed positive COVID-19 polymerase chain reaction (PCR) test results in the perioperative period.<sup>6,7</sup> There is a lack of large-scale reporting of COVID-19 experience specifically relating to elective orthopaedic surgery.

For this reason, it became imperative that in order to safely resume elective orthopaedic

Correspondence should be sent to Rongkagorn Chuntamongkol; email: rongkagorn.chuntamongkol@gjnh.scot.nhs.uk

doi: 10.1302/2633-1462.211.BJO-2021-0080.R1

*Bone Jt Open* 2021;2-11:951–957.

**Table I.** Risk factors.

Age > 70 yrs
Male sex
BMI > 35 kg/m <sup>2</sup>
Respiratory disease
Heart failure/ischaemic heart disease
Diabetes mellitus
Renal impairment
Autoimmune disease
Immunosuppression

surgery within the NHS, precautions were necessary to decrease the likelihood of this additional risk materializing, and to provide large-scale specific data.

The Golden Jubilee National Hospital (NHS Golden Jubilee) is a special health board located in the Clydebank area of Glasgow. NHS Golden Jubilee provides elective orthopaedic, cardiology, cardiothoracic, and ophthalmic specialist services. The orthopaedic department receives primary and revision elective patients from across Scotland and also deals with acute arthroplasty-associated fractures and infections.

The desire to resume elective arthroplasty during the pandemic led to the development of a standard operating procedure to provide a green pathway for elective orthopaedic surgery at a COVID-19 light site. This was based on emerging clinical evidence as the pandemic progressed as well as analysis of national hospital data for orthopaedic patients treated in the immediate period prior to suspension of elective services.<sup>8</sup>

The aim of this study was to determine whether the standard operating procedure created for the NHS Golden Jubilee sufficiently managed COVID-19 risk to allow safe resumption of elective orthopaedic surgery.

**Methods.** A prospective study was conducted within the Orthopaedic department of NHS Golden Jubilee, carried out between 29 June 2020 and 1 April 2021. The study collected all relevant data regarding surgery conducted and any evidence of COVID-19 symptoms or testing in the preoperative and 30-day post-discharge period. Data were then compiled and analyzed using Microsoft Excel (USA).

Resumption of elective surgery commenced in phases to minimize the risk to patients of contracting COVID-19 from hospital admission. The risk factors considered to be associated with a poorer COVID-19 outcome are shown in Table I.<sup>9</sup> Starting with low-risk day surgery cases (such as knee arthroscopy) in low-risk patients with no risk factors, each phase was reviewed prior to progressively widening the permitted procedures and relaxing the risk factor restrictions for patient selection. This allowed more patients to proceed with their planned operations (Table II).

All patients admitted for surgery were required to undergo COVID-19 PCR testing, either at our hospital

**Table II.** Phases, resumption dates, restrictions, and procedures.

Phase	Resumption date	Restrictions	Procedures
Phase 1	Week 1 to week 3	Restricted to patients with no risk factors	Minor foot and ankle procedures, hand surgery, and simple arthroscopic procedures
Phase 2	Week 4 to week 9	Restricted to patients with no risk factors	All operations (including arthroplasty)
Phase 3	Week 10 to week 40	No restrictions	All operations (including arthroplasty)

or a testing centre local to their home, up to 72 hours prior to surgery (specifically time of surgery rather than day of surgery). For phase 1 and 2, patients were asked to self-isolate, along with their household if necessary, for two weeks prior to and after surgery. For phase 3, patients were told to strictly adhere to social distancing and precautions for two weeks prior to surgery and self-isolate from the time of COVID-19 testing until hospital admission and to follow social precautions until two weeks after surgery (Supplementary Material). The reason for resuming elective surgery in a phased manner was to ensure patient safety, rapidly moving through the phases as the risks failed to materialize.

The only exception to this strict protocol was for patients being transferred from surrounding hospitals for emergency surgery and those who were transferred to other hospitals post-surgery. These patients followed either amber or red pathways on admission to NHS Golden Jubilee. Patients transferred from NHS Golden Jubilee for ongoing care then followed the appropriate measures set out by that local health board when no longer under our care.

During their admission, patients on the green pathway were required to adhere to standard precautions and social distancing measures including wearing a mask when outside of their rooms, and maintaining physical distancing between other patients and staff in common areas. Patients on the amber pathway were taken straight from their room to the operating theatre where anaesthesia would proceed. After surgery these patients were recovered within theatre and transferred to their room on the ward, bypassing the recovery bay. A patient under the red pathway would be transferred to and from theatre in the same manner as amber patients. Staff interacting with amber or red patients were required to wear appropriate personal protective equipment (PPE) at all times.

Following surgery, all patients underwent required rehabilitation with staff members using appropriate levels of PPE according to pathway designation and the activity involved in the interaction.

Data collected included patient demographics, length of stay, surgery type, American Society of Anesthesiologists (ASA) grade,<sup>10</sup> discharge destination, and preoperative

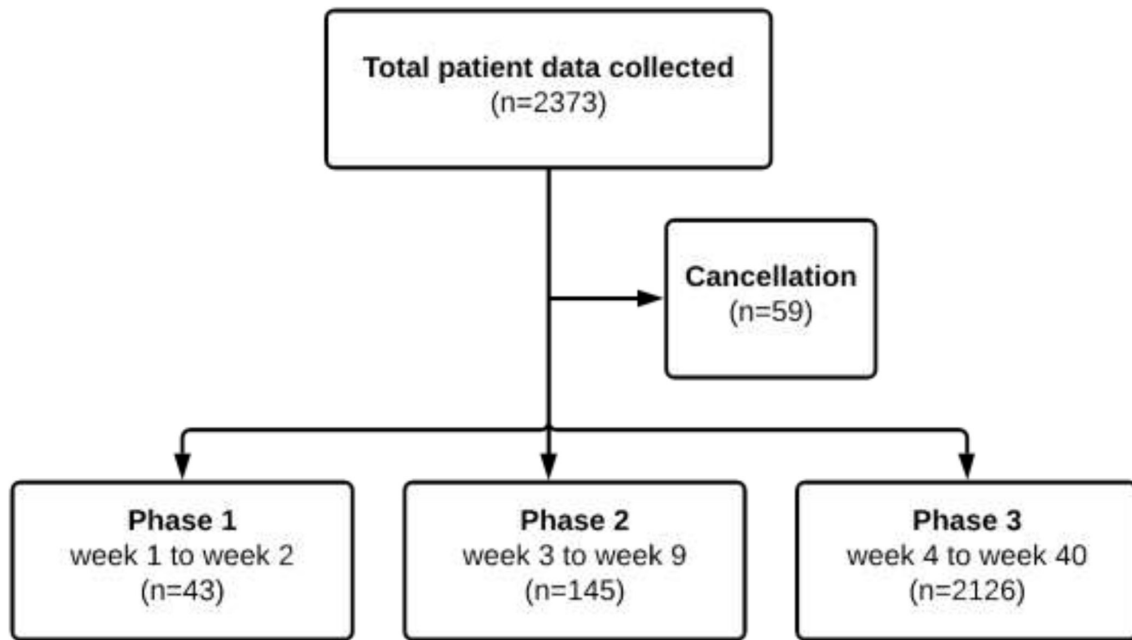


Fig. 1

Numbers of cancellations and patients in each phase.

Table III. Patient details.

Variable	Total (n = 2,314)
Mean age, yrs (SD)	67 (17 to 94)
<b>Sex, n (%)</b>	
Male	996 (43)
Female	1,318 (57)
<b>ASA grade, n (%)</b>	
ASA 1	526 (22.7)
ASA 2	1,609 (69.5)
ASA 3	179 (7.7)

ASA, American Society of Anesthesiologists; SD, standard deviation.

COVID-19 test results. Patients were contacted by telephone at 15 days post-discharge and every patient was asked if they had developed any COVID-19 symptoms or received any additional COVID-19 testing during this time. This was incorporated within the standard postoperative follow-up call for arthroplasty patients conducted by our arthroplasty practitioner team (consisting of physiotherapy and nursing staff), and for minor surgery, a call conducted by a member of the middle grade orthopaedic team. For arthroplasty patients, further routine contact at six weeks for knee arthroplasty and three months for hip arthroplasty reinforced the questions regarding symptoms or testing. This meant that we could respond rapidly if symptoms or cases were occurring early post-discharge but that we could also monitor the longer-term 30-day period. Beyond 15 days, and in cases where patients were not contactable by phone, national clinical systems were reviewed for any COVID-19-positive results up to 30 days postoperatively. These data were under

Table IV. Reasons for cancellations

Reason for cancellation	n (%)
Acute clinical problems	11 (18.6)
Untreated comorbidity	9 (15.3)
Operative leg compromised	6 (10.2)
COVID-positive	6 (10.2)
Logistics (staffing or equipment)	4 (6.8)
Anaesthetic complications	4 (6.8)
Dental issues	3 (5.1)
Medication-related	1 (1.7)
Patient self-cancelled	3 (5.1)
Unknown reasons (missing documentation)	12 (20.3)
<b>Total</b>	<b>59</b>

constant surveillance by the study team. This allowed near to real-time analysis as to whether or not patients were contracting COVID-19 during their admission.

A total of 2,373 cases were analyzed in the 40-week study period commencing 29 June 2020. Procedures were cancelled on 59 occasions (2.49%) and therefore excluded from further analysis (Figure 1). The demographic data for the remaining 2,314 cases is shown in Table III.

## Results

Analysis of the reasons for cancellation of planned surgery showed a wide range of causes (Table IV). Six patients were cancelled due to having a positive preoperative COVID-19 test and were not admitted to the ward, accounting for 10.2% of cancellations. This equates to a

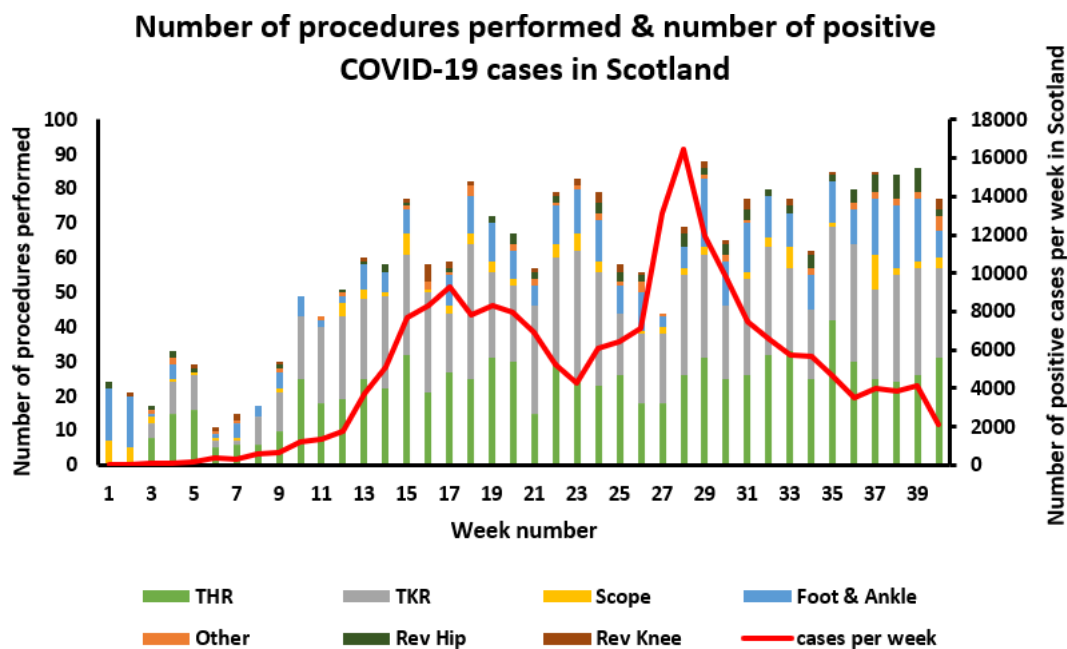


Fig. 2

Number of operations performed and number of Scottish COVID-19 community cases by week. THR, total hip replacement; TKR, total knee replacement.

preoperative positive COVID-19 rate of 0.25% (six out of 2,373).

**Operations performed.** The total number of operations performed within the data collection period was 2,314, with the majority being hip and knee arthroplasty. The number of operations performed is compared to community prevalence of COVID-19 infection and is displayed in Figure 2. There were 871 (37.6%) hip and 868 (37.5%) knee (total and unicompartmental) arthroplasties performed in the study period. During phase 1, 43 procedures were performed. Foot and ankle operations accounted for the majority of these (27/43;63%). No major arthroplasty procedures were performed during phase 1. There were 145 procedures performed during phase 2, comprising 66 hip and 45 knee arthroplasties (44% and 30%, respectively). Foot and ankle operations accounted for 12% (255 cases) in this phase. A total of 2,126 operations were performed in phase 3. The mean number of orthopaedic procedures performed in phase 3 was 62.4 per week (43 to 88 procedures) compared to 21.5 in phase 2 (11 to 33 procedures).

**Follow-up.** From the 30-day follow-up data, 39 patients were tested for COVID-19, of whom five were positive, giving a postoperative COVID-19 rate of 0.22%. Patients were tested for COVID-19 for a variety of reasons (Figure 3). Nine patients required COVID-19 testing as screening at other hospitals upon transfer for ongoing care according to their local protocol, while 14 patients were tested due to an acute medical problem at local hospital presentation.

Two patients died during the study period, one patient suffering a stroke four days after discharge and another dying from acute coronary syndrome. Both deaths were unrelated to COVID-19 and this did not feature on their death certification. None of the positive cases required high level care or died, the majority having mild symptoms only.

**Not able to contact.** There were 49 (2.1%) patients uncontactable at 15-day follow-up. A total of 11 patients during the study period were treated by visiting surgeons from another health board and while their routine follow-up was not conducted by our team (this was performed by the local team at their base hospital), there were no tests or admissions for this group. The remaining patients did not answer repeated attempts, but again there were no records of positive tests or hospital admissions on national systems for up to 30 days post-surgery.

### Discussion

The experience at NHS Golden Jubilee, where elective orthopaedic surgery resumed during the pandemic, has been highly positive in terms of success. This was achieved through the adoption and strict application of the locally formulated protocol approved by the Scottish government. We were able to operate on elective patients safely, minimizing risk, and without transmitting COVID-19 to our patients, despite the several peaks of high level of community transmission of COVID-19.

COVID-19 infection during the postoperative period has been associated with a poorer outcome for patients,

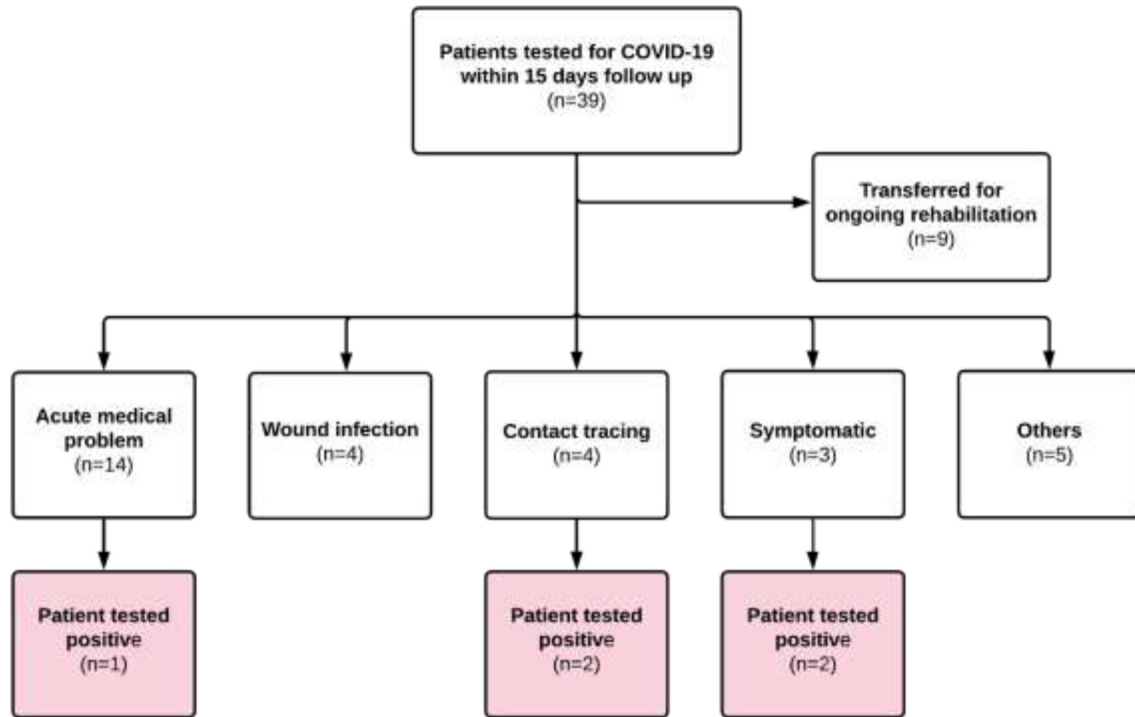


Fig. 3

Reasons for COVID-19 testing within 30 -day follow-up.

mainly due to pulmonary complications and a reduced immune capacity.<sup>11,12</sup> A positive COVID-19 status postoperatively was linked to higher mortality compared to positive COVID-19 status preoperatively.<sup>12</sup> The preoperative and 30 -day postoperative incidence of COVID-19 in this cohort was 0.25% and 0.22%, respectively, but did not represent hospital transmission at our institution.

Comparing our results with others with an established COVID-19 pathway, there is little difference in infection and mortality rates associated with COVID-19.<sup>13–15</sup> One study reported 0% postoperative COVID-19 rates two weeks postoperatively and another reported one out of 92 patients testing positive for COVID.<sup>13,15</sup> Another study showed patients on a COVID-19 pathway had lower rates of COVID-19 infection, lower pulmonary complications, and lower mortality compared to patients who are not on a COVID-19 pathway.<sup>14</sup> However, these studies involved low study numbers and a mix of acute and elective cases, whereas our cohort was significantly larger and specific to elective orthopaedic surgery.

On the other hand, publications presenting COVID-19 infection rates and/or pulmonary complications without a COVID-19 pathway reported higher mortality. Perioperative COVID-19 infection was associated with increased mortality rate. A multicentre study quoted mortality as high as 23.8%.<sup>12</sup> A meta-analysis found 20% mortality among perioperative surgical patients.<sup>7</sup> Both these studies examine COVID-19 infections across multiple specialties.

Comparing our results with those without a COVID-19-specific pathway (and reasonable study numbers > 200), and assuming a worst-case scenario, one would have expected between 178 and 705 perioperative COVID-19 cases and mortality rates as high as 462 deaths directly related to COVID-19 if applied to our cohort.<sup>7,16,17</sup>

There are a number of potential reasons why there is such disparity between our own experience (and other sites with a COVID-19 pathway) and cases where a COVID-19 pathway was not present,<sup>6,12,16–18</sup> one of which is patient factors. The majority undergoing arthroplasty were aged 60 and above and may have had multiple comorbidities, which required them to be shielding during the lockdown period.<sup>19</sup> By shielding they would have minimized exposure and chance of infection. Patients with osteoarthritis, which is the number one indication for joint arthroplasty, experience significant pain and reduced mobility.<sup>20</sup> As a consequence, they may not have been able to leave their homes as much as their healthier, more mobile, counterparts. Through this, they had self-selected to a potentially low-exposure, and therefore low-risk, group.

Prior to their admission, patients who adhered to strict social distancing guidelines were far less likely to contract COVID-19 from the community. As per our protocol, all patients coming to NHS Golden Jubilee for elective operations were required to have a negative COVID-19 screening test within 72 hours of proposed surgery and

therefore follow the green pathway. Patients with positive or unknown COVID-19 status were not admitted to our inpatient wards with the exception of emergency admissions for periprosthetic fractures or joint infections. These patients followed either amber or red pathways.

During their hospital stay, patients were required to follow strict guidance according to their pathways (i.e. green, amber, or red). Additionally, all patients in the orthopaedic department occupy single rooms. The NHS Golden Jubilee is a national centre for orthopaedics and it receives patients from all over Scotland. Through strict protocol adherence, we were able to perform over 2,000 operations in the space of 40 weeks, through multiple peaks of the pandemic. The orthopaedic department does not receive acute trauma patients directly. This, combined with absence of acute receiving units (medical and surgical), meant we were able to limit our patients' exposure to COVID-19 from the general public.

Prolonged length of stay has been shown to be linked to increased incidence of postoperative COVID-19 infection.<sup>21</sup> To minimize duration of inpatient stay, NHS Golden Jubilee uses the Clinical Attitude Leading to Early Discharge (CALEDonian) technique, an enhanced recovery pathway, as part of our standard rapid discharge policy.<sup>22</sup> The IMPACT study showed a longer length of stay of greater than three days was a predictor of increased mortality.<sup>21</sup> As our mean length of stay was 2.6 days (median 2 days), the impact of this factor was minimal.

Visitors were not permitted to enter the hospital during the perioperative period. This was done in accordance with infection control guidance, in order to limit patient and staff exposure to COVID-19 and facilitate maintenance of social distancing. However, a lack of visitors has been linked to poorer patient satisfaction and psychological wellbeing.<sup>23</sup> Having said this, with a short duration of admission, the effect of this was also minimal.

After hospital discharge, patients were asked to strictly adhere to social distancing measures in accordance with national guidelines. This would also potentially limit their exposure to COVID-19.

As previously stated, the mean number of orthopaedic procedures performed in phase 3 was much higher compared to phase 2. Several factors contributed to this. Patients aged above 70 years fell in the high-risk category and were not offered operations during phase 2. There was also reduced theatre capacity during phase 2, restricted to three theatres per day and three arthroplasty-equivalent procedures per list. This compared to a pre-COVID-19 workload of four arthroplasty-equivalent procedures per list in five theatres. The reason for this reduced capacity was multifactorial, one of which was to maintain staged progression in activity while under surveillance, as well as additional factors related to staff

shortage due to redeployment and shielding at both the ward and theatre level.

NHS Golden Jubilee is a high turnover elective orthopaedic unit that was able to maintain a safe environment to enable the resumption of this service. Orthopaedic departments at other hospitals should strive to achieve similarly low rates of perioperative COVID-19 infections by using the guidelines and protocols developed and adhered to at NHS Golden Jubilee. Barriers to this may include co-location of trauma and acute surgical and medical services with elective orthopaedics at other sites. Patients from other departments such as general medical wards, COVID-19 intensive care units, and the emergency department may be a source for COVID-19 exposure for staff, and risk exposure to elective orthopaedic patients. Bed availability may also be scarce given the COVID-19 burden of those requiring hospital treatment. Redeployment of staff and physical resources, such as wards and recovery areas at other sites, as experienced at NHS Golden Jubilee, may also significantly impact a hospital's ability to resume a full elective service.

In summary, through strict COVID-19 testing and self-isolation protocols, our unit has been able to safely deliver elective orthopaedic services during the COVID-19 pandemic and avoid postoperative COVID-19-related complications in a large cohort of patients. Despite potential obstacles when attempting to apply this to other sites, the protocol here may be used as a blueprint for other hospitals when progressively reinstating their own elective services.



#### Take home message

- Through strict application of a COVID-19 green pathway, elective orthopaedic surgery could be safely delivered to a large number of patients with no selection criteria.

#### Supplementary material



COVID-19 Remobilisation Guidance, which outlines different levels of restrictions and protocols for patients in each pathways to follow (green, amber, red).

#### References

1. **Zhu H, Wei L, Niu P.** The novel coronavirus outbreak in Wuhan, China. *Glob Health Res Policy.* 2020;5(1):6.
2. **Iacobucci G.** Covid-19: All non-urgent elective surgery is suspended for at least three months in England. *BMJ.* 2020;368:m1106.
3. **Clement ND, Scott CEH, Murray JRD, Howie CR, Deehan DJ, IMPACT-Restart Collaboration.** The number of patients "worse than death" while waiting for a hip or knee arthroplasty has nearly doubled during the COVID-19 pandemic. *Bone Joint J.* 2021;103-B(4):672–680.
4. **da Silva RR, Santos AAM, de Sampaio Carvalho Júnior J, Matos MA.** Quality of life after total knee arthroplasty: systematic review. *Rev Bras Ortop.* 2014;49(5):520–527.
5. **Hotchen AJ, Khan SA, Khan MA, et al.** Insights into patient preferences for elective surgery during the COVID-19 pandemic. *Bone Jt Open.* 2021;2(4):261–270.
6. **Wang K, Wu C, Xia Z, et al.** Author's reply - factors affecting the mortality of patients with COVID-19 undergoing surgery and the safety of medical staff: A systematic review and meta-analysis. *EClinicalMedicine.* 2021;31:100704.

7. **Abate SM, Mantefardo B, Basu B.** Postoperative mortality among surgical patients with COVID-19: A systematic review and meta-analysis. *Patient Saf Surg.* 2020;14(1):37.
8. **Clement ND, Hall AJ, Kader N, et al.** The rate of covid-19 and associated mortality after elective hip and knee arthroplasty prior to cessation of elective services in UK. *Bone Joint J.* 2021;103-B(4):681–688.
9. **Wolff D, Nee S, Hickey NS, Marschollek M.** Risk factors for Covid-19 severity and fatality: a structured literature review. *Infection.* 2021;49(1):15–28.
10. **American Society of Anesthesiologists (ASA).** ASA Physical Status Classification System. 2020. <https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system>
11. **Dąbrowska AM, Słotwiński R.** The immune response to surgery and infection. *Cent Eur J Immunol.* 2014;39(4):532–537.
12. **Almaadany FS, Samadov E, Namazov I, Jafarova S, Ramshorst GHV, Pattyn P, et al.** Mortality and pulmonary complications in patients undergoing surgery with perioperative sars-cov-2 infection: An international cohort study. *Lancet.* 2020;396(10243):27–38.
13. **Zahra W, Dixon JW, Mitorabi N, et al.** Safety evaluation of a strategy to restart elective orthopaedic surgery during the de-escalation phase of the COVID-19 pandemic. *Bone Jt Open.* 2020;1(8):450–456.
14. **Glasbey JC, Nepogodiev D, Simoes JFF, et al.** Elective cancer surgery in covid-19-free surgical pathways during the SARS-COV-2 pandemic: An international, multicenter, comparative cohort study. *J Clin Oncol.* 2021;39(1):66–78.
15. **Boffa DJ, Judson BL, Billingsley KG, et al.** Results of covid-minimal surgical pathway during surge-phase of COVID-19 pandemic. *Ann Surg.* 2020;272(6):e316–e320.
16. **Knisely A, Zhou ZN, Wu J, et al.** Perioperative morbidity and mortality of patients with COVID-19 who undergo urgent and emergent surgical procedures. *Ann Surg.* 2021;273(1):34–40.
17. **Kayani B, Onochie E, Patil V, et al.** The effects of COVID-19 on perioperative morbidity and mortality in patients with hip fractures. *Bone Joint J.* 2020;102-B(9):1136–1145.
18. **Clement ND, Hall AJ, Makaram NS, et al.** IMPACT-RESTART: The influence of COVID-19 on postoperative mortality and risk factors associated with sars-cov-2 infection after orthopaedic and trauma surgery. *Bone Joint J.* 2020;102-B(12):1774–1781.
19. **No authors listed.** Shielding guidance for high risk vulnerable patients. NHS. 2020. <https://111.nhs.uk/isolation-note> (date last accessed 22 September 2021).
20. **McDonough CM, Jette AM.** The contribution of osteoarthritis to functional limitations and disability. *Clin Geriatr Med.* 2010;26(3):387–399.
21. **Hall AJ, Clement ND, IMPACT-Restart Group, Patton R, Jenkins P, Ohly N, et al.** IMPACT-Restart report on elective orthopaedic services: risk of postoperative COVID-19 following hip & knee arthroplasty. <https://www.boa.ac.uk/uploads/assets/1b6791d2-2128-4168-a17c0d2fc3cdd2/1838-IMPACT-Restart-report-for-orthopaedic-elective-arthroplasty-the-risk-of-postoperative-COVID-19-following-total-hip-and-knee-arthroplasty.pdf> (date last accessed 22 September 2021).
22. **Place K, Scott N.** Enhanced recovery for lower limb arthroplasty. *Continuing Education in Anaesthesia Critical Care & Pain.* 2014;14(3):95–99.
23. **Zeh RD, Santry HP, Monsour C, et al.** Impact of visitor restriction rules on the postoperative experience of COVID-19 negative patients undergoing surgery. *Surgery.* 2020;168(5):770–776.

**Author information:**

- R. Chuntamongkol, MBChB, BSc, Orthopaedic Research Fellow
- R. Meen, BSc, MSc, PA-R, Orthopaedic Physician Associate
- S. Nash, BSc, MSc, PA-R, Orthopaedic Physician Associate
- N. E. Ohly, MBBS, MSc, FRCSEd (Tr&Orth), Orthopaedic Consultant
- J. Clarke, MBChB, PhD, FRCS (Tr&Orth), Orthopaedic Consultant
- N. Holloway, MBChB, BMedSci (Hons), FRCSEd (Tr&Orth), Orthopaedic Consultant Orthopaedics, NHS Golden Jubilee, Glasgow, UK.

**Author contributions:**

- R. Chuntamongkol: Investigation, Formal analysis, Writing – original draft, Writing – review & editing.
- R. Meen: Data curation, Writing – original draft
- S. Nash: Data curation.
- N. E. Ohly: Data curation.
- J. Clarke: Writing – review & editing.
- N. Holloway: Conceptualization, Supervision, Data curation, Writing – review & editing.

**Funding statement:**

- This publication was funded by the Orthopaedic Department of NHS Golden Jubilee. No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

**Ethical review statement:**

- Audit approved by local committee. Due to the nature of the project, no extra approval was required.

**Open access funding**

- The authors confirm that the open access funding for this article was provided by the Orthopaedic Department of NHS Golden Jubilee.

© 2021 Author(s) et al. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (CC BY-NC-ND 4.0) licence, which permits the copying and redistribution of the work only, and provided the original author and source are credited. See <https://creativecommons.org/licenses/by-nc-nd/4.0/>