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Elective foot and ankle surgery following the peak of the COVID-19 pandemic is safe: A report of 30-day morbidity and mortality☆

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ABSTRACT

Introduction: The safety of resuming elective surgical services remains unclear following several surges of the COVID-19 pandemic worldwide. Multiple studies have reported high rates of post-operative mortality and pulmonary complications. 30-day outcomes on an initial cohort of patients undergoing elective foot and ankle surgery at 3 central London hospitals are presented.

Materials and methods: This study is a retrospective review of the first 63 patients undergoing surgery following the first UK surge via a modified treatment pathway, based on published national guidelines, designed to minimise the risks to patients and staff associated with COVID-19.

Results: 90% of patients were ASA 1 or 2, with an average age of 46. All tested negative for COVID-19 pre-operatively and all but one underwent a general anaesthetic. 10 patients required one night hospital stays and 1 was admitted for four nights. 52 were day case procedures. 2 complications were identified, not relating to COVID-19 infection. No 30-day mortalities or pulmonary complications were recorded.

Conclusions: With a community prevalence of COVID-19 of between 1 in 1500 and 1 in 1700, elective foot and ankle surgery was safe following the first surge of the pandemic in the UK. This data can guide elective service planning in countries with pandemic curves behind the UK’s or in the event of further surges in national cases.

1. Introduction

In response to the worldwide COVID-19 (SARS-CoV-2) pandemic, elective surgery in the UK was suspended on 15th April 2020 [1]. By the beginning of June 2020, the incidence of COVID-19 infections in the UK had significantly decreased [2] and elective surgical units cautiously began restarting routine activity.

Initial outcomes regarding elective surgery in Wuhan were highly concerning- a 20.6% mortality rate was reported in 34 patients undergoing elective surgery by a variety of specialties [3]. A further worldwide study by the COVIDSurg collaborative of 1128 COVID-19 positive patients undergoing a range of surgical procedures demonstrated a 30-day mortality rate of 18.9% for elective surgery and pulmonary complications in 51.2% of the total population [4].

However, further evidence from the UK regarding emergency trauma surgery was more encouraging, with one study involving 484 patients reporting a 30-day mortality risk of 1.9%, with a 15% 30-day mortality for those who contracted COVID-19 [5].

To combat the potential increased risk posed by COVID-19 to both patients and health care workers, guidelines for the reopening of elective services in England continue to evolve [6]. By necessity, these are based on expert opinion and pre-existing guidelines as well as evidence published globally since the start of the pandemic. Specific to the UK, NICE guidelines recommend a range of measures including a period of self-isolation for patients pre- and post-operatively, pre-admission PCR testing and personal protective equipment (PPE) use by patients and staff [6].

The sensitivity of RNA PCR swab testing is between 71% to 98% [7], therefore, there remains a risk of asymptomatic COVID-19 positive patients receiving elective surgery, despite a negative test result. The risk

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of mortality to an asymptomatic patient with a negative test has been calculated as 1 in 7000 [8].

Therefore, despite the measures set out in national guidelines, the safety of treating patients requiring non-urgent surgery, to the authors’ knowledge, is not yet confirmed. Data is vital for demonstrating that such a service is safe and viable given the uncertainty that the COVID-19 pandemic has caused.

A 30-day mortality and morbidity outcomes are presented for an initial cohort of patients treated following the reintroduction of elective foot and ankle surgery in three hospitals in central London following the first surge of COVID-19 cases in the UK.

2. Material and methods

A retrospective review, in the form of an audit of practice, was performed of all patients undergoing elective foot and ankle surgery at three central London hospitals (Guys’ Hospital, The London Bridge Hospital and Schoen Clinic Orthopaedic and Spinal Hospital) from 4th June 2020. This period coincided with the easing of the UK national “lockdown” and captured both NHS and private cases performed by four different consultant foot and ankle specialist orthopaedic surgeons.

2.1. Modified patient pathway

A modified patient pathway was created, based on current Public Health England Guidelines [9], agreed at executive level in the treating hospitals. All patients undergoing surgery were asked, via telephone consultation, to self-isolate alongside all household members for 14 days prior to their surgery. 24–48 h prior to their admission, all patients were tested with a SARS-CoV2-2 viral RNA PCR test (Aptima assay) via nose and throat swabs. This was either couriered to their home or patients attended the treating hospital, avoiding public transport and contact with others. Results were obtained prior to admission. As part of the consent process, all patients were counselled specifically on the known increased risks associated with contracting COVID-19 and surgery at a later date was offered. Written consent specific to COVID-19 risks was obtained in all cases.

Patients were admitted to a dedicated elective orthopaedic ward with staggered timings to minimise potential contact between individuals and side rooms were utilised where possible. PPE in the form of FFP2 face masks were used by all staff and patients whilst in the hospital and rigorous hand hygiene was encouraged as per government guidelines [10].

Post-operatively, patients were transferred to a recovery ward and were nursed by staff in PPE. After returning to the level 1 ward, patients continued to be observed until safe for discharge and were advised to continue to self-isolate alongside household members for another 2 weeks.

2.2. Data collection

Patients were identified from theatre lists using the NHS Trust’s electronic theatre management system (Galaxy) and equivalent electronic databases in the private hospitals. Patient data was collected retrospectively from hospital records and individual operation notes and anaesthetic charts were reviewed and patients’ demographics and co-morbidities, alongside their American Society of Anaesthesiologists (ASA) score, method of anaesthesia, and length of stay were recorded. To identify peri-operative mortality or morbidity, both the electronic patient records system and the summary care record (SCR) were used to review laboratory and radiological results, discharge summaries, unplanned primary or secondary care visits and death certification.

3. Results

From 4th June 2020, 63 patients (19 male, 44 female) underwent elective foot and ankle operations, totalling 69 separate procedures (Table 1). All of these but 1 were performed under a general anaesthetic. 40 patients were classified as ASA 1 (63%), 17 as ASA 2 (27%) and 6 patients were ASA 3 (10%). The mean age was 46 years (18–68). All patients had a recorded negative SARS-CoV2-2 PCR test <48 h prior to their operation. 42 patients were treated on the NHS, 21 privately.

Peri-operatively, 2 morbidities were identified. The first occurred in a 50 year old female patient (ASA 1) who was under general anaesthetic for 40 min with no concurrent tourniquet use or local nerve block. She developed ventricular bigeminy requiring a one night admission to the critical care unit for cardiac monitoring. She was subsequently discharged the day following surgery with outpatient cardiology follow-up. The second occurred in a 67 year old female patient (ASA 1) who underwent removal of metalwork from her midfoot. At her initial follow-up a superficial wound infection was noted and successfully treated with oral antibiotics.

52 patients were discharged on the day of surgery and 10 were discharged the day following surgery. All 10 were planned as day cases but turned around times initially increased as staff adjusted to the new protocols. In the private hospitals, the timings of the planned lists were delayed to the evenings. This meant that these patients had not recovered in time to be assessed as safe for home by the physiotherapy teams and required overnight admission.

One patient was discharged 4 days following surgery. They had undergone a removal of a suspected infected hindfoot nail and were monitored in hospital until microbiology results were available and an antibiotic plan was in place.

There were no mortalities in the 30-day post-operative period. No pulmonary complications and no patient subsequently tested positive for COVID-19 or presented with symptoms of the disease.

4. Discussion

At a time of ongoing uncertainty regarding new COVID-19 variants and elective orthopaedic operating in the UK, evidence of safety for resumption of non-urgent foot and ankle surgery following the first surge of the COVID-19 pandemic is provided.

At the beginning of June 2020, when the elective procedures reported here commenced, there remained significant uncertainty over the safety of performing elective surgery in the UK despite the significant decrease in prevalence of COVID-19 from the peak of the pandemic. From 31st May to 13th June, the Office of National Statistics reported an estimated average COVID-19 community infection prevalence of 1 in 1700 [11]. This remained stable throughout the period of the operations reported here — between 20th-26th July there remained an estimated prevalence of 1 in 1500 in England [12] Due to new variants frequently

| Table 1 | List of procedures performed. |
|---------|-----------------------------|
| Procedures performed                      | Number |
| Removal of metalwork                      | 4      |
| Forefoot reconstruction                    | 5      |
| Manipulation under anaesthesia            | 1      |
| Joint Injection                           | 2      |
| 1st metatarsal-phalangeal joint fusion    | 1      |
| 1st metatarsal-phalangeal joint arthroplasty | 1    |
| Ankle arthroscopy                         | 7      |
| Hallux valgus correction                  | 21     |
| Excision of lesion (bone/neuroma)         | 6      |
| Lesser toe correction                     | 7      |
| Removal of foreign body                   | 1      |
| Calcaneal osteotomy                       | 3      |
| Tibialis posterior reconstruction         | 2      |
| Haglund’s excision                        | 3      |
| Lateral ligament reconstruction           | 2      |
| Tendo achilles reconstruction             | 2      |
| Stress fracture fixation                  | 1      |
emerging [13], it is uncertain in which direction infection rates will move in the UK in the future, but these figures are a valuable reference if the halting of elective services continues to be a possibility.

Kader et al. had calculated a theoretical risk of death and for testing positive for the SARS-CoV-2 PCR test at the post pandemic levels of infection within the community. Predicting a worse case mortality rate of 1 in 7000 [8]. They had, however, assumed a community infection rate of 1 in 400. The infection rate during our study period was lower at an average of 1 in 1500. Thus, lowering the theoretical risks even further. Furthermore, Kader et al. had not included the further risk reduction gained by 14 days of self-isolation. Studies of the incubation period of COVID-19 have suggested that 99% of patients will show symptoms within a 14 day period [14] and, as such, the chance of symptomatic infection is lowered to 1% after 14 days in our cohort.

The theoretical risk of contracting the virus was calculated, assuming a 30% false negative rate for the PCR test; following a 14 day self-isolation period; and at the time when the community prevalence was 1 in 1500. The probability of SARS-CoV-2 infection in our cohort would therefore have been 0.0002% or 1 in 500,000. The probability of death from the infection after application of a worst-case fatality rate of 20.5%, was calculated as 0.00004% or 1 in 2,500,000. Despite our relatively small sample size, this figure is very reassuring.

Of note, a very high proportion of patients in this series underwent general anaesthetic. The decision for this over regional block in the majority of cases was to allow for thigh tourniquet use. The increased risk of respiratory complication was considered negligible, as every patient had a negative COVID-19 test pre-operatively. Our data helps confirm this assertion and provides further support for the safe use of general anaesthesia in similar circumstances.

Since this review was completed, the National Institute of Clinical Excellence (NICE) have updated their guidelines with regards to planned procedures requiring anaesthesia or sedation [6]. These guidelines remove the requirements for 14 days of isolation prior to surgery, and instead recommend patients follow UK government social distancing regulations up until they have a SARS-CoV-2 PCR test 24–48 h prior to their procedure, after which they need to self-isolate until admission. This is less disruptive to patients and their households but, if the community prevalence increases above the levels reported in June and July 2020 in England, will result in increased risk to the patients.

Although the safety of patients and staff remains the top priority when running an elective service, efficiency must also be considered. Several features of the initial pathway did cause delays, resulting in the increased length of hospital stay for 10 of the patients in this series. The staggered admissions of the patients, designed to minimise contact between patients and keep numbers low in each hospital area, added to the turnaround times between procedures. Often each patient arrived during a preceding case and surgical and anaesthetic staff would have to pause the list between cases to assess and consent the following patient. 20 min pauses following extubation adds further delays and even the process of ‘donning and doffing’ PPE can be reasonably time-consuming.

More recently, guidelines in the treating hospitals now mirror national guidance and elective patients are treated on a ‘Green’ pathway. They are required to isolate for 72 h and have a negative PCR result prior to admission. Throughout their inpatient stay, they are kept separate from non-elective ‘Amber’ pathway patients, who have not isolated or been tested for COVID-19 prior to admission. ‘Green’ pathway patients are treated as COVID-19 negative which has reduced some of the described delays, such as need for pauses post-extubation and the need for full PPE during procedures.

Other potential barriers to full restoration of elective services include critical care and high dependency bed capacities. This series represents predominantly day surgery cases in patients with ASA 1 and 2 scores. Despite this, one patient required admission to a critical unit for one night post-operatively. Patients with more significant pre-existing medical issues or undergoing more major surgery may require higher level care peri-operatively and availability of these beds may become scarce with a future increase in COVID-19 prevalence.

5. Conclusions

The results from this series of operations demonstrate that, with a community prevalence of COVID-19 of between 1 in 1500 and 1 in 1700, elective foot and ankle surgery was safe during the period following the first surge of the pandemic. The majority of patients included in this cohort had ASA scores of 1 or 2 and the mean age was 46, so care needs to be taken when expanding such services to include more elderly and medically complex patients. However, this data can help other countries who are behind the UK in their pandemic curves or help direct planning elective surgery following future surges of COVID-19 infections.

6. Brief summary

What is already known

• Covid-19 continues to be responsible for thousands of deaths daily worldwide with the regular emergence of new variants
• The safety of elective surgery is not clear- 18.9% mortality rates previously reported
• Pulmonary complications of 51% in elective surgery with COVID-19 infections

What this study adds

• Elective foot and ankle surgery is safe with a community COVID prevalence of 1 in 1500 to 1 in 1700
• Pre-admission testing and PPE use is strongly recommended
• Pre-admission self-isolation of patients dramatically reduces the risks of COVID-related mortality

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Declarations of interest

None.

References

1 Iacobucci G. Covid-19: all non-urgent elective surgery is suspended for at least three months in England. BMJ 2020;368(March):m1106. https://doi.org/10.1136/bmj.m1106.
2 Coronavirus (COVID-19) in the UK: UK Summary. [Online]. Available: https://covid-19.data.gov.uk.
3 Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. ClinicalMedicine 2020;20. https://doi.org/10.1016/j.clinmed.2020.100302.
4 Nepogodiiev D, Omar O, Glassby J, Li E, Simoes J, Abbott T, et al. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. Lancet 2020;9–11. https://doi.org/10.1016/S0140-6736(20)31102-X [Online]. Available.
5 Karayanannis PN, Roberts V, Cassidy R, Mayne A, McAuley D, Milligan D, et al. 30-day mortality following trauma and orthopaedic surgery during the peak of the COVID-19 pandemic. Bone Jt Open 2020;1(7):392–7. https://doi.org/10.1302/2046-3758.17.bjo-200975.1.
6 NICE. COVID-19 rapid guideline: arranging planned care in hospitals and diagnostic services. Nice Guidel 2020;179(July) [Online]. Available: www.nice.org.uk/guidance/ng179.
7 Arevalo-Rodriguez I, Buitrago-Garcia D, Simancas-Racines D, Zambrano-Achig P, Del Campo R, Ciapponi Agustin, et al. False-negative results of initial RT-PCR assays for covid-19: a systematic review. MedRxiv 2020:1–26. https://doi.org/10.1101/2020.04.16.20066787.
8 Kader N, Clement N, Patel V, Cavagnolo R, Banaszekiewicz P, Kader D. The theoretical mortality risk of an asymptomatic patient with a negative SARS-CoV-2 test developing COVID-19 following elective orthopaedic surgery. Bone Jt J 2020;1. https://doi.org/10.1302/0301-620X.102B11.2020-1147.R1.
Public Health England. https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control#history; 2020.

Public Health England. Reducing the risk of transmission of COVID-19 in the hospital setting, Wuhan Novel Coronavirus - Infection Prevention & Control [Online]. Available from: 2020. p. 1–14. https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/reducing-the-risk-of-transmission-of-covid-19-in-the-hospital-setting#transmission-based-precautions.

ONS. Coronavirus (COVID-19) infection survey pilot: England, 18 June 2020. Off Natl Stat Bull 2020;(June):1–14.

ONS. Coronavirus (COVID-19) infection survey pilot: England, 31 July 2020. Off Natl Stat Bull 2020;(July):1–14.

Lauer SA, Grantz K, Bi Q, Jones F, Zheng Q, Meredith H, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Ann Intern Med 2020;172(9):577–82. https://doi.org/10.7326/M20-0504.

Torjesen Ingrid. Covid-19: Delta variant is now UK’s most dominant strain and spreading through schools. BMJ 2021. https://doi.org/10.1136/bmj.n1445.