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Hospital transmission rates of the SARS-CoV 2 disease amongst orthopaedic in-patients in a secondary care centre: A quantitative review



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ABSTRACT

Introduction: Orthopaedic practice changed during COVID-19 with elective work ceasing, trauma reducing and work forces redistributed to medical areas. During the United Kingdom lockdown, hospitals were stretched thinly with admissions of SARS-CoV-2 positive patients.

Aim: Evaluate orthopaedic admissions to a district general hospital during lockdown and the volume of those who subsequently were found to be COVID-19 positive.

Method: Retrospective study of patients admitted under trauma and orthopaedics between March 23, 2020–June 18, 2020. Data includes; diagnosis, COVID-19 swab dates, results and mortality using orthopaedic admission sheets, patient and pathology electronic recording system.

Results: 3/4 of admitted patients tested negative for SARS-CoV-2 initially. Of these 240 patients, 12.5% subsequently tested positive during their stay, often within one week of their admission. 17.8% of patients were never tested. 7.8% mortality rate of which 48% were neck of femur fracture (NOF#) patients. 28 NOF# were confirmed COVID-19 positive; mortality rate of 21.4%. 87 NOF# were COVID-19 negative; mortality rate 6.9%. Mortality relative risk (RR) for NOF# and COVID-19 positive was 2.6. COVID-19 positive mortality 27% as compared to 4% in COVID-19 negative patients. Patients who acquired COVID-19 whilst in hospital had a mortality relative risk 6.4

Conclusion: 12.5% orthopaedic in-hospital viral transmission rate amongst orthopaedic patients despite the segregation measures taken, possibly due to asymptomatic health care workers or inpatients awaiting swab results. We emphasize the importance of testing all inpatients and regular testing of healthcare workers.

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Introduction

COVID-19; the virus that changed the world. Delivery of care in hospitals changed considerably in all specialities including Orthopaedics which consists heavily of elective work. UK lockdown and social distancing meant that the volume of trauma admissions declined¹⁰ and junior doctors were re-deployed. In a district general hospital which serves a population of 800,000 people our orthopaedic admission rates dropped when compared to previous years.⁹

Despite following the strict Personal Protective Equipment (PPE)

guidelines issued by both Public Health England (PHE) and the Trust, the viral transmission rate remained high. All aerosol generated procedures required strict FFP³ or equivalent masks, visors and gowns when being performed in closed environment. Positive tested patients were placed on separate wards to negative patients where possible. All staff wore gloves and plastic aprons alongside strict hand hygiene for every patient when within 2 m.

The objective of this study was to evaluate the orthopaedic admissions to a district general hospital during lockdown and the proportion of these who acquired COVID-19 whilst in hospital. We consequently assessed the effect of the virus on orthopaedic mortality rates.

Method

Records of all the admissions to a District general orthopaedic

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department between March 23, 2020 to June 18, 2020 were reviewed. Online electronic records were used to collect the data including age, admission reason, SARS-CoV-2 swab results and mortality rates. All the data was tabulated in an excel sheet (Microsoft Corp. Redmond, WA) and a statistical analysis was performed to look for any difference in mortality. No ethical approval or consent was required.

Results

In total there were 320 patients admitted under the orthopaedic

department during the UK lockdown with a 1.16:1.0 female: male ratio. The patient population varied considerable with an age range between 2 months and 101 years old (range 101 years, average age 67.02 years). There were huge variation in admissions including neck of femur fractures (NOF#) n = 115, 35.94%, head injuries (n = 30, 9.38%), back pain (n = 5, 4.69%), peri-prosthetic fractures (n = 12, 3.75%) amongst many others (Fig. 1).

A total of 320 admissions, 263 were tested for SARS-CoV-2 within 2.16 days on average. 57 admissions were never tested (C?) presumably due to fast discharge times within 24 h of admission. 240 patients were SARS-CoV-2 negative (C-) and 21

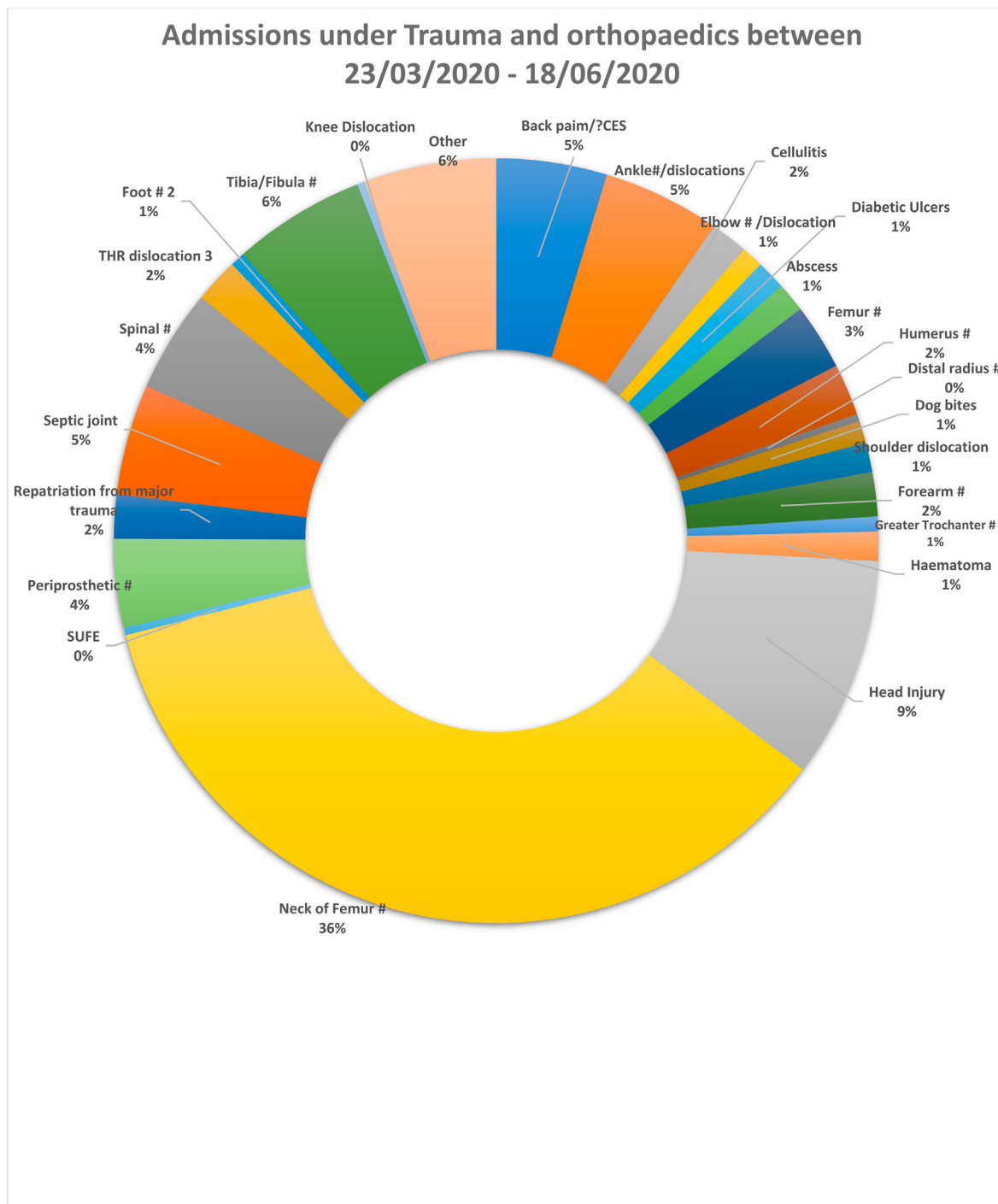


Fig. 1. Graph depicting the different admissions to orthopaedic department in a district general hospital during UK COVID-19 Pandemic lockdown.

Table 1
Figures of COVID-19 positive and negative NOF# and those of the other admissions.

	NOF#	Other admissions
COVID Positive	28	23
COVID Negative	73	139
Not tested	14	43
Total	115	205

Table 2
Deaths recorded in District general hospital under the trauma and orthopaedic department and the reason for admission.

Admission reason of recorded orthopaedic deaths	Total number recorded
Neck of Femur fracture	12
Head Injury	3
Diabetic infected ulcer	2
Greater tuberosity fracture	2
Tibial fracture	1
Back pain/Cauda equina syndrome	1
Abscess/local infection	1
Septic arthritis	2
Ankle fracture	1

were SARA-CoV-2 positive (C+) a rate of 6.56%. (Table 1). Average length of stay of orthopaedic patients during this time was 11.7 days with a range of 1–86 days.

Twenty-five deaths were recorded during the lockdown (7.8%) and a variety of reasons for admission (Table 2) (Fig. 1). Comparing COVID-19 positive and negative patients, there was a mortality relative risk of 6.466 with a p value < 0.0001 using Chi Squared test and assuming 95% confidence intervals (Table 4) 56% of orthopaedic deaths during lockdown were SARS-CoV-2 positive whilst 36% of the deaths were SARS-CoV-2 negative (Fig. 4).

12 NOF# patients died (3.8% of all admissions, 10.4% of NOF# admissions) of which 6 were confirmed SARS-CoV-2 positive and 6 were negative. Of the 115 total NOF# admissions, 103 survived and of these 22 were positive (21.4% survival rate) whilst 67 were negative (65.1%) and 14 were never tested (13.6%) (Table 3). The relative risk of NOF# and COVID-19 positive mortality was 2.6071 with a p-value of 0.0721 (assuming 95% confidence intervals) (Fig. 3).

176 of the tested admitted patients were retested for SARS-CoV-2 on average within 5.55 days after their initial test. 150 of these continued to be C- whilst 21 were then found to be C+. 2 patients had indeterminate results. 102 were not retested.

98 patients were subjected to 3rd SARS-CoV-2 swabs, 81 patients continued to be found C- whilst 16 patients were found to be C+ and 1 continued to be indeterminate.

49 patients underwent a 4th SARS-CoV-2 screening swab with 8 patients testing C+. 2 patients were found to be C+ on day 14 and day 19 of their admission.

Overall, 30 orthopaedic admitted patients, during the UK lockdown, tested positive for SARS-CoV-2 virus after they were admitted to our district general hospital with an initial negative result. This suggests some in-hospital transmission with a rate of 12.5%. (Table 4) (Fig. 2).

Table 3
Figures showing the distribution of COVID-19 positive and negative patients amongst those admitted with NOF # patients and the distribution of dead and alive amongst these.

	NOF# and COVID-19 Positive	NOF# and COVID-19 Negative	NOF# and Not tested for COVID-19
Alive	22	67	14
Dead	6	6	0

NOF# with COVID-19 positive mortality Relative Risk = 2.6071.
P value = 0.0721 (95% confidence intervals).

Discussion

Evidence from around the world has shown an increase in mortality rate in hip fracture patients who were found to be SARS-CoV-2 positive (C+) (1,2). This mortality rate varies between studies. Neck of Femur patients have the highest morbidity and mortality of orthopaedic admissions due to their comorbidities and this seemed to be increased further with a C+ test result. Early results from a trauma centre in New York regarding hip fracture patients during the pandemic showed 15% of patients were COVID -19 positive and 68% negative. Those with positive results also appeared to have a higher American Society of Anaesthesiologists (ASA) and inpatient mortality was significantly increased (56% v 4%).³

Evidence from China suggests that the early prognosis of COVID-19 positive patients with a fracture is more severe when compared to COVID-19 positive patient without a fracture.⁴ The stress known to be associated with a fracture and subsequent surgical intervention could trigger an excessive inflammatory response decreasing the immunity of patients thus increasing the likelihood of COVID infection.⁴

All patients admitted were treated equally and as they would have done prior to the COVID-19 pandemic, whether they were positive or negative for the virus. Those patients that required operative management still underwent surgical procedures as required in a timely manner with no change in their treatment if they were found to be positive for COVID-19. This suggested that any increase in death rate during this time was potentially because of the disease. At our district general hospital, the wards changed to accommodate the intake of COVID-19 positive patients by being split into Red and Blue wards to denote Non-COVID and COVID respectively. Patients were admitted to a COVID ward if they were proven positive for the virus or suspected positive (temperature >38 or a persistent cough). The neck of femur specific ward became a Blue ward and as such NOF patients were split amongst the remaining orthopaedic red wards where possible. The emergency department was adapted and became more streamlined towards admitting and directing COVID-19 positive patients towards appropriate areas of the hospital (ITU or a blue ward).

Initially patients were only tested if they were symptomatic. This policy quickly evolved, and all patients being admitted to the hospital were tested on day 1 of admission then day 3 and then day 7 (if they remained in hospital) to try and identify positive patients quickly as per PHE guidelines. Our testing policy remained uniform for all trauma patients whether they had an operation or not. Patients who underwent surgery did not routinely have extra testing unless they became symptomatic.

All patients were treated the same intra-operatively whether they were positive or negative for COVID-19. The guidelines produced by our trust were based on PHE and royal college guidelines and advice the use of full PPE, avoidance of aerosol generating procedures including performing spinal anaesthetic where possible and limiting the number of staff in theatre for every operation. Furthermore, theatres would undergo a deep thorough clean between every operation.^{8,9,12}

We noted a 12.5% in hospital viral transmission rate amongst orthopaedic inpatients tested (Fig. 2). This was despite segregation

Table 4
Table showing the distribution of COVID-19 positive and negative patients amongst the patients were died.

	COVID-19 Positive during admission	COVID-19 Negative during admission	Not tested for COVID -19 during admission
Alive	37	203	55
Dead	14	9	2
Total	51	212	57

COVID-19 positive mortality relative risk = 6.466.
P value < 0.0001 (95% confidence intervals).

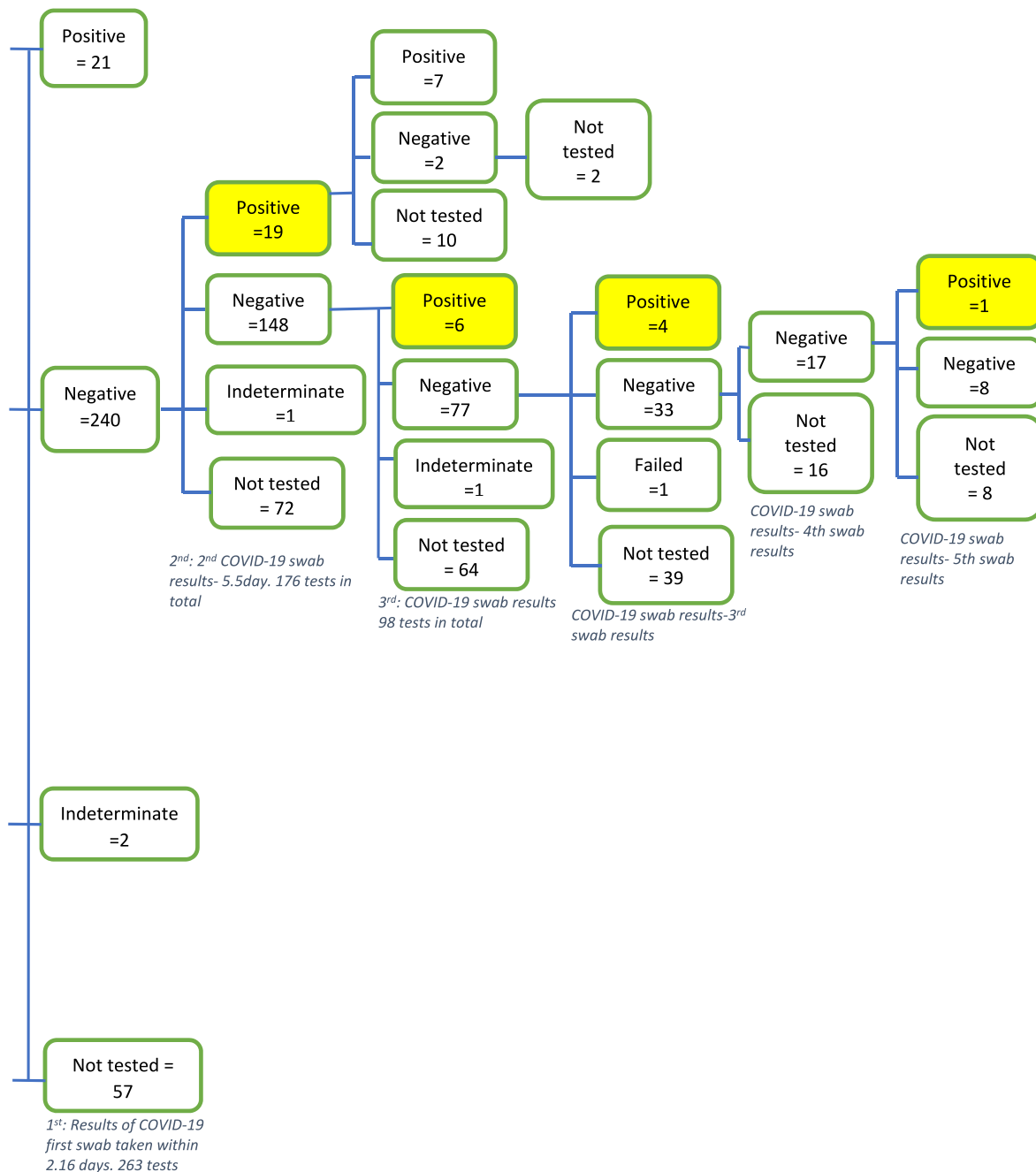


Fig. 2. Diagrammatic representation of the SARS-CoV-2 swab results to orthopaedic patients during UK COVID-19 pandemic lockdown highlighting (yellow) the 'in-hospital' contracted virus.

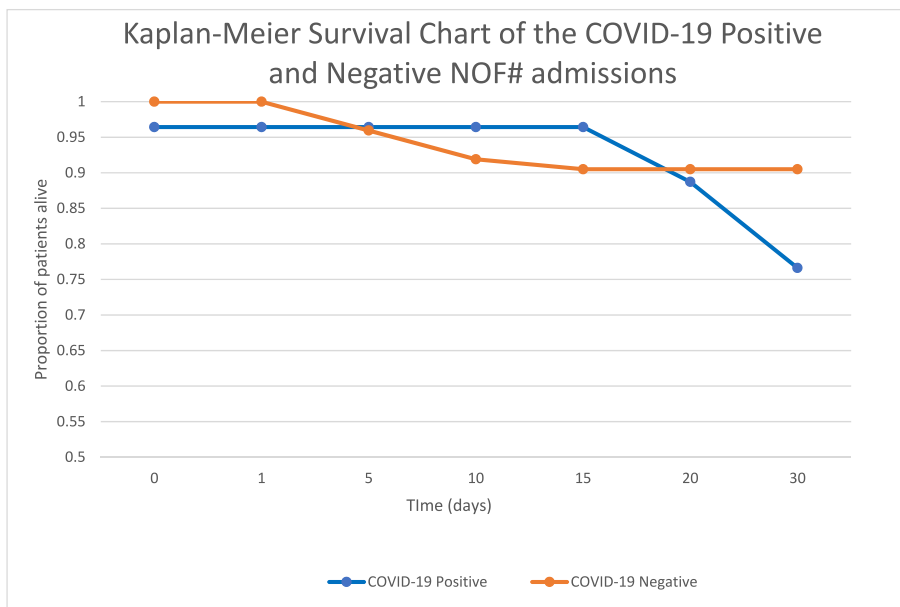


Fig. 3. Kaplan Meier survival curve showing the difference between COVID-19 positive and negative Neck of femur fractures.

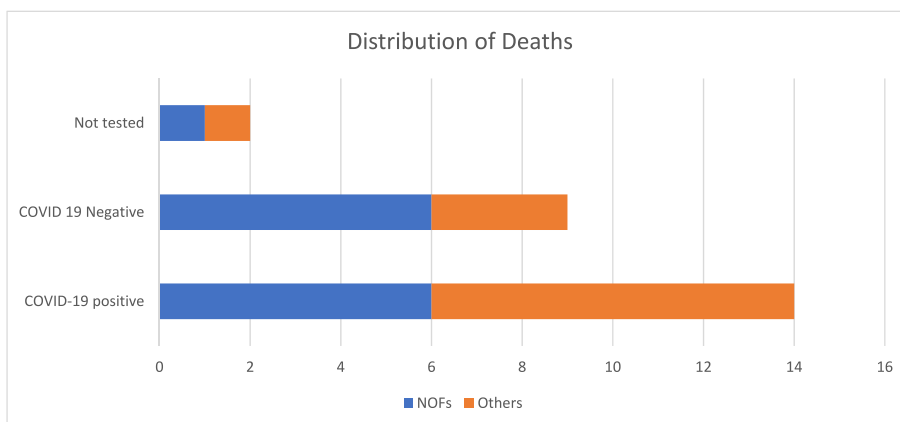


Fig. 4. Graph depicting the distribution of deaths amongst the orthopaedic admissions during lockdown.

of patients and having a dedicated nursing staff for their care. Although, it cannot be assumed that this was hospital acquired, it is highly suspicious as these patients were asymptomatic, had a negative swab on admission but subsequently developed symptoms and tested positive. The source of infection could be asymptomatic health care workers or other patients. Considering the higher relative risk for mortality in COVID positive orthopaedic patients, these findings assume significance. Most commonly, areas of transmission within a hospital appear to be on the general wards followed by public places, operating rooms and outpatient clinics.⁵ All appropriate measures should be taken to reduce the risk of transmission in hospital from COVID positive patients. On general wards, healthcare professionals wore a normal surgical mask, a plastic apron, and gloves when within 2 m from a patient as per national guidance⁽¹²⁾.

More than 10% of deaths due to COVID-19 in the United Kingdom in the month of July 2020 (1st July to 21st July) have been from our trust.⁽¹¹⁾ In hospital viral transmission has been a significant factor responsible for this. On the orthopaedic red wards (Non-COVID) 23 members of staff testing positive over three

months (April 2020–June 2020). This study reiterates, asymptomatic transmission as a contributing cause to the wide spread of COVID-19^{6,7} and therefore regular healthcare worker testing could prove vital in preventing further transmission and thereby ensuring the safety of both patients and staff.

Our trust responded by recommending all patients were treated as suspected COVID-19 when coming to hospital and all new admissions underwent nasopharyngeal swab for RT-PCR to detect the virus whether they presented with symptoms or not. Healthcare workers across the trust were only initially tested if they were symptomatic (new persistent cough or high temperature) during the initial first wave but by May 2020 each department had all their staff tested with a one-off RT-PCR test to detect the asymptomatic positive people and thus ensure that these people could isolate appropriately. This change in protocol to test asymptomatic staff came at a time when COVID-19 positive cases in hospital were extremely high and was implemented as a way of trying to control the outbreak. No staff member who tested positive could return to work until they had a negative test result. There was no systematic contact tracing for those patients who tested positive and were

admitted to hospital or for asymptomatic positive staff during the first wave of the pandemic.

Conclusion

From the results of this study there was a 12.5% 'in-hospital' viral transmission rate of SARS-CoV-2 virus during the UK lockdown, amongst orthopaedic admitted patients. An increased mortality rate was also observed in the neck of femur patients which is comparative to other studies seen around the world. It is possible that the source of infection could be asymptomatic health care workers or inpatients who have not yet tested positive although this has not been tested. We underscore the importance of testing all inpatients and regular testing of healthcare workers. This study also reiterates that the mortality in orthopaedic in-patients with COVID-19 is high but there is no study that has analysed the in-hospital transmission rate amongst orthopaedic patients in the literature.

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Declaration of competing interest

The authors do not have any conflicts of interest to disclose.

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