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HIP

Hip and distal femur fracture outcomes over three successive UK lockdown periods during the COVID-19 pandemic: what have we learnt?

A SINGLE-CENTRE RETROSPECTIVE COHORT STUDY

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Aims

This study assessed the impact of COVID-19 on hip and distal femur fracture patient outcomes across three successive UK lockdown periods over one year.

Methods

A single-centre retrospective cohort study was performed at an acute NHS Trust. Hip and distal femur fracture patients admitted within the first month from each of the three starting dates of each national lockdown were included and compared to a control group in March 2019. Data were collected as per the best practice tariff outcomes including additional outcomes as required. Data collection included COVID-19 status, time to theatre, 30 -day mortality, presence of acute kidney injury (AKI) and pneumonia, and do not attempt cardiopulmonary resuscitation (DNACPR) status. Data were analyzed using an independent-samples *t*-test or chi-squared test with Fisher's exact test where applicable. A p-value of < 0.05 was considered statistically significant.

Results

A total of 95 patients during the pandemic were included and 20 were COVID-positive. Patients experienced a statistically significant increase in time to theatre in Lockdown 1 compared to 2019 ($p = 0.039$) with a decrease with successive lockdown periods by Lockdown 3. The 30 -day mortality increased from 8.8% in 2019 to 10.0% to 14.8% in all lockdown periods. COVID-positive patient mortality was 30.0% ($p = 0.063$, odds ratio (OR) = 4.43 vs 2019). The rates of AKI and pneumonia experienced were higher for patients during the pandemic. The highest rates were experienced in COVID-positive patients, with 45.0% of patients with AKI versus 27.0% in 2019 ($p = 0.38$, OR = 1.80), and 50.0% of patients diagnosed with pneumonia versus 16.2% in 2019 ($p = 0.0012$, OR = 5.17). The percentage of patients with a DNACPR increased from 30.0% in 2019 to 60.7% by Lockdown 3 ($p = 0.034$, OR = 3.61).

Conclusion

COVID-positive hip and distal femur fracture patients are at a higher risk of mortality due to AKI and pneumonia. Patient outcomes have improved with successive lockdowns to pre-pandemic levels.

Cite this article: *Bone Jt Open* 2021;2-12:1017–1026.

Keywords: Trauma, Orthopaedics, Hip, Fracture, NOF, Neck of femur, Neck-of-femur, Lockdown, Covid, Covid-19

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doi: 10.1302/2633-1462.212.BJO-2021-0102.R1

Bone Jt Open 2021;2-12:1017–1026.

Introduction

COVID-19 is a highly contagious viral infectious disease that has extended rapidly across the world, and has had a substantial impact on healthcare systems. Information is increasing every day on its understanding, but it is known to cause significant respiratory compromise.[1]

The first national UK lockdown was announced to start on 23 March 2020,[2] to

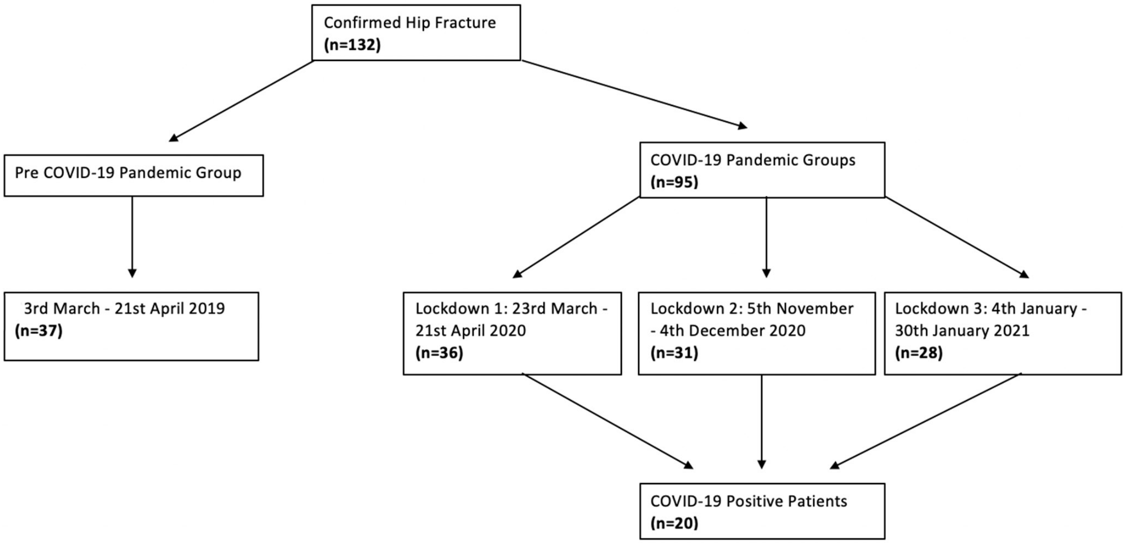

Fig. 1

Flow diagram showing the patient groups assessed, their time periods, and the number of patients in each group.

prevent the spread of COVID-19. At the time of writing, over 150,000 people in the UK have died due to COVID-19,[3] with over 4 million people testing positive over a one-year period.[4] However, national lockdowns have demonstrated a reduction of COVID-19 cases by over two-thirds.[5]

The impact of COVID-19 has also been felt in the field of Trauma and Orthopaedics. Approximately 76,000 hip fractures occur each year within the UK; these patients who have sustained a hip fracture are often elderly with multiple comorbidities,[6] and at a greater risk of adverse outcomes from COVID-19, including hospitalization and death.[7]

At the early stages of the UK COVID-19 pandemic, it was suggested that nonoperative management should be increasingly considered for the management of hip fractures.[8] However, it was quickly anticipated that the incidence of hip fractures would not decrease, and this patient population was still considered to be a priority for early surgery due to a high risk of adverse outcomes,[9] requiring early postoperative mobilization and care. In addition, early discussions about ceilings of care, including do not attempt cardiopulmonary resuscitation (DNACPR), were encouraged.[10]

It has been previous well established that hip and distal femur fractures should be managed with a multidisciplinary team (MDT) approach including geriatric assessment within 72 hours and induction of anaesthesia within 36 hours of admission.[11] On admission, patients should be assessed using an agreed local protocol which can include calculating the Abbreviated Mental Test (AMT) score[12] and preoperative American Society of Anesthesiologists (ASA) grade[13] to help predict patient outcomes. This management approach has been supported by the National Hip Fracture Database (NHFD), demonstrated by the introduction of best practice tariffs to reduce adverse outcomes such as prolonged length of hospital stay and perioperative mortality.[14] The NHFD demonstrated that the most common reason for elderly patients to have emergency surgery during the COVID-19 pandemic was hip fracture, supporting the MDT approach that has been a mainstay for hip and distal femur fracture management.[15]

Literature is increasing every day on the outcomes of hip fracture patients during the COVID-19 pandemic. For example, a multicentre cohort study by Rasidovic et al,[16] with 404 patients, determined that the 30- day mortality rate and length of stay was greater for hip fracture patients during the pandemic compared to a pre-pandemic population. In addition, another study by Hall et al,[17] a nationwide retrospective cohort study in Scotland of 833 patients, demonstrated a three-fold increase in 30 -day mortality for hip fracture patients in the COVID-19 pandemic. A study by Kayani et al[18] also demonstrated a similar increase in 30- day mortality for hip fracture patients who were COVID-positive, with a longer length of hospital stay and postoperative complications as high as 89% compared to just 35% for COVID-negative patients. Additional studies have demonstrated increased rates of mortality for both COVID-positive and non-COVID-positive patients,[19,20] with prolonged hospital admissions.[21] The prevalence of COVID-19 among hip fracture patients was reported to be as high as 13%,[22] with suggestions that the most likely patients to develop COVID-19 were hip fracture patients or patients over 77 years old.[23]

Despite these studies sharing a similar message, most were done at the first UK lockdown, rather than at other

Table I. Table of comparison of patient demographics, fracture types, preoperative scoring grades, and time to orthogeriatric assessment across all four patient groups.

Category	2019	Lockdown 1	Lockdown 2	Lockdown 3
Total number of patients	37	36	31	28
Mean age, yrs (SD)	83.3 (9.1)	80.9 (7.5)	83.5 (10.3)	82.3 (9.5)
Male sex, n	9	15	8	11
Female sex, n	28	21	23	17
Fracture type				
Intracapsular	19	19	17	17
Intertrochanteric	17	13	11	10
Subtrochanteric	1	3	1	0
Distal femur	0	1	2	1
Mean ASA grade (SD)	3.0 (0.6)	2.9 (0.7)	2.9 (0.8)	3.2 (0.6)
Mean AMT score (SD)	7.1 (3.5)	7.9 (3.0)	7.97 (3.5)	6.82 (4.4)
Median time to orthogeriatric assessment in hours (IQR)	19.2 (13.2 to 23.3)	23.5 (18.9 to 49.7)	21.1 (15.5 to 39.6)	19.0 (12.6 to 28.6)

AMT, Abbreviated Mental Test; ASA, American Society of Anesthesiologists; IQR, interquartile range; SD, standard deviation.

stages. Few studies so far have provided an assessment of hip fracture outcomes over the first year of the pandemic, including the effect of subsequent lockdowns and how healthcare systems have responded to COVID-19. In addition, the quoted studies hypothesize the reasons for a higher mortality rate, but fail to establish any definitive conclusions.

This study was a retrospective single-centre cohort study, using the three UK lockdown dates at times of peak COVID cases[2,24,25] with the greatest likely strain on healthcare systems as objective timepoints to assess the outcomes of hip and distal femur fracture patients. This is the first study in the literature using this unique approach to assess hip and distal femur fracture outcomes.

The primary aim of this study was to assess the 30- day mortality of hip and distal femur fracture patients over three successive lockdown periods in COVID-19 compared to a pre-pandemic population. The secondary aims included the assessment of: 1) the time to surgery during the pandemic and the percentages of patients breaching the 36-hour time aim to theatre; if delays were present, the additional aim was to assess their causes; 2) the rate of acute kidney injury (AKI), pneumonia, and length of stay during the COVID-19 pandemic as potential causes of morbidity and mortality; and 3) the percentage of patients with a valid DNACPR in situ during the COVID-19 pandemic.

Our overall aim was therefore to compare the outcomes of the COVID-19 hip and distal femur fracture patients to a pre-pandemic population. The study was designed to assess the direct and indirect effects of the pandemic on fracture patients for both COVID-positive and non-COVID-positive patients.

Methods

Study design. This was a single-centre retrospective cohort study aimed at assessing the outcomes of hip and distal femur fracture patients during the COVID-19 pandemic. The study was performed at (removed for purposes of manuscript). The groups for the data collection and the corresponding dates are as follows:

1. 2019 Control: 23 March to 21 April 2019 (30 days)
2. Lockdown 1: 23 March to 21 April 2020 (30 days)
3. Lockdown 2: 5 November to 4 December 2020 (30 days)
4. Lockdown 3: 4 January to 31 January 2021 (28 days)

A subgroup of COVID-positive patients from the three lockdown groups was also established. The dates for the lockdown groups were determined by the first day on which the UK government enforced a national lockdown to prevent the further spread of COVID-19. Each patient was followed from admission up to 30 days after the date of their operation; if a patient was managed nonoperatively, they were followed up to 30 days after their initial admission date.

Eligibility criteria. Consecutive patients were recruited for each group. All hip fractures above the age of 60 years were included. This included intracapsular fractures – either displaced or un-displaced – trochanteric fractures (A1/A2/A3), and subtrochanteric fractures. Distal femur fracture patients over the age of 60 years were also included, as they are managed with the same MDT approach as hip fractures locally and are reported to the NHFD.

Outcomes. A hip or distal femur fracture diagnosis was confirmed on plain radiographs. In the event of unclear image findings, a CT scan was performed. The diagnosis of AKI was determined by the laboratory system calculations and an AKI grade of 1 to 3 was included. The diagnosis of pneumonia was determined radiologically by a reporting radiographer. The diagnosis of COVID-19 was determined by a positive reverse-transcriptase polymerase-chain-reaction (RT-PCR) result.

The data were collected using written notes and local electronic hospital systems. Most of the outcomes measured were those submitted in line with NHFD standards, with extra supplementary information collected

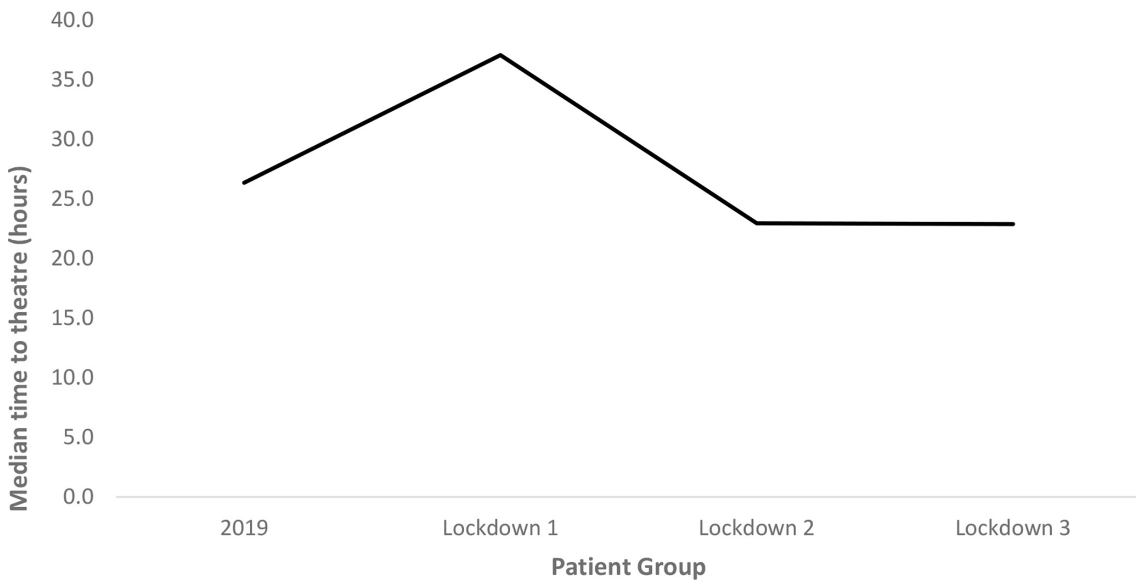

Fig. 2

Graph demonstrating the median time to theatre in hours for all four patient groups.

Table II. Comparison of the number of delays in each patient group and the distribution of the causes of delay.

	Number of patients across each time period			
Delay category	**2019**	**Lockdown 1**	**Lockdown 2**	**Lockdown 3**
Total number of delays	8	18	10	6
Administrative reasons	3	12	2	2
Direct oral anticoagulant	3	2	1	0
Warfarin	1	0	2	0
Awaiting other investigations	1	0	2	0
Medical optimization	0	2	2	3
Other	0	2	1	1

as required for the purposes of the study. The outcomes measured therefore included: age, sex, COVID status, ASA grade, AMT score, type of fracture, operation performed (including nonoperative management), time to theatre (including delays beyond 36 hours), time to geriatric review, 30- day mortality, rates of AKI and pneumonia, length of stay, and number of patients with a valid inpatient DNACPR.

Study size. The three lockdown periods were selected as an opportunity to assess outcomes over a one-year timeframe. As the hospital admits approximately 400 to 500 patients every year with hip and distal femur fractures,[26] the sample size from the three lockdown periods over three months would equate to approximately 90 patients with a further 30 patients from the control group in 2019. This sample size was felt to be large enough to extract meaningful results and draw valid conclusions.

Ethical considerations. Ethical approval was sought and approved by the local audit department at (removed for purposes of manuscript). The publication was written following the STROBE cohort reporting guidelines.[27]

Statistical analysis. Quantitative variables were described with counts and percentages, means with standard deviations (SDs), medians with interquartile ranges (IQRs) where appropriate. For continuous variables, an independent-samples *t*-test was used to assess for statistical significance between groups. For categorical variables, a chi-squared test was used or Fisher's exact test for any subgroup had fewer than ten data points. Analysis of variance (ANOVA) was used to assess statistical significance across multiple means. Statistical significance was deemed when $p < 0.05$. Statistical analysis was performed using Microsoft Excel 16.48 (Microsoft, USA). Missing data was addressed by expressing any figures as means or percentages where appropriate.

Results

Patients. A total of 132 patients were included in the study, 95 of whom were included during the COVID-19 lockdown periods, with 20 of these patients testing positive for COVID-19. The number of patients was similar in all time periods assessed (Figure 1).

Table I summarizes the patient demographics in further detail, as well as the fracture subtypes and preoperative scores. The average age of all groups was similar and there was a female preponderance. The distribution of fracture subtype was similar across all groups. A statistically significant difference was not observed across all groups with regards to AMT score ($p = 0.51$) and ASA grade ($p = 0.31$). As demonstrated in Figure 2, the time to orthogeriatric assessment increased from 2019 with a median time of 19.2 hours (IQR 13.2 to 23.3) to 23.5 hours (IQR 18.9 to 47.9) in Lockdown 1. However, this decreased in Lockdown 2 to 21.1 hours (IQR 15.5 to 39.6) and Lockdown 3 19.0 hours (IQR 12.6 to 28.6) . The

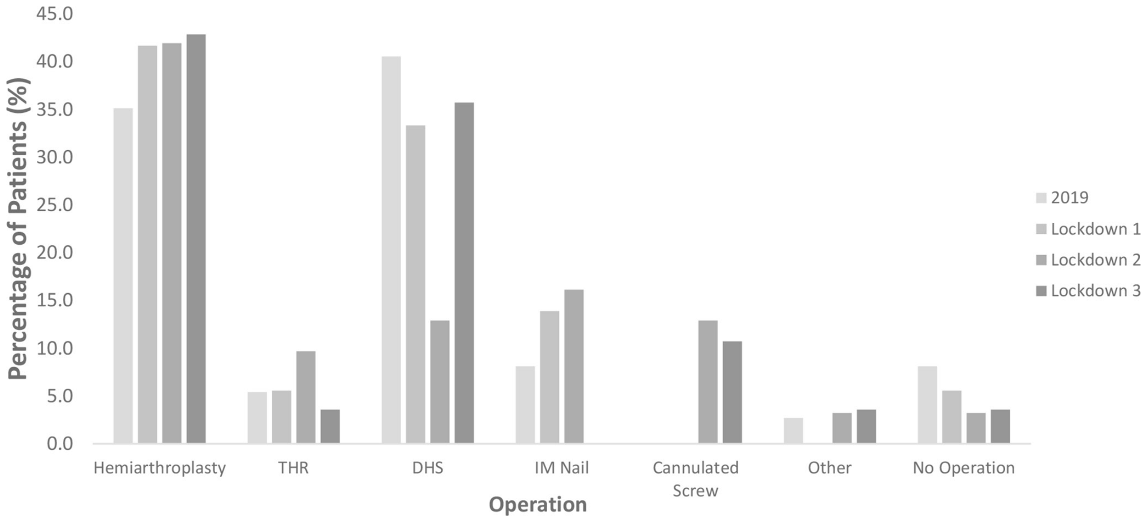

Fig. 3

Graph demonstrating the percentage of operations performed for each patient group. DHS, dynamic hip screw; IM, intramedullary; THA, total hip arthroplasty.

difference in time to orthogeriatric assessment was statistically significant when comparing 2019 to Lockdown 1 (p = 0.005) and Lockdown 2 (p = 0.048); however, by Lockdown 3 the difference was not statistically significant (p = 0.46).

Time to theatre. In 2019, the median time to theatre was 26.3 hours (IQR 20.9 to 35.8) (Figure 2). However, this increased to 37.1 hours (24.3 to 44.9) in Lockdown 1 and this difference was statistically significant (p = 0.039). The time to theatre gradually decreased with Lockdown 2 to 23.0 hours (IQR 17.8 to 38.4) and in Lockdown 3 to 22.9 hours (18.3 to 31.1) . The difference was therefore not statistically significant when comparing 2019 to Lockdown 2 (p = 0.706, independent-samples *t*-test) and Lockdown 3 (p = 0.912, independent-samples *t*-test).

The number of patients breaching more than 36 hours until theatre followed a similar pattern: 23.5% of patients (8/34) breached in 2019; this rose to 52.9% (18/34) in Lockdown 1 and this difference was statistically significant (p = 0.024, Fisher's exact test). The percentage of patients breaching decreased with Lockdown 2 to 33.3% (10/30) and to 22.2% (6/27) with Lockdown 3 to pre-pandemic levels. The difference was therefore not statistically significant when comparing 2019 to Lockdown 2 (p = 0.417, Fisher's exact test) and Lockdown 3 (p = 1.000, Fisher's exact test).

When assessing the cause of delays to theatre (Table II), the most remarkable result is the cause of delays in Lockdown 1, with 12 out of 18 delays due to administrative reasons, compared to just three in 2019. As expected during the lockdown periods, more patients were delayed due to medical optimization (i.e. treating underlying chest infections and improving oxygen saturations prior to theatre). A similar number of patients across all time periods experienced delays due to anticoagulation optimization, such as correcting the warfarin INR level or suspending direct oral anticoagulants prior to theatre.

Operation performed. When assessing the operation performed (Figure 3), a similar percentage of patients underwent each procedure, with more patients requiring cannulated screws in Lockdowns 2 and 3. The percentage of patients managed nonoperatively actually decreased; for example, 8.1% of patients (3/37) were managed nonoperatively in 2019 as compared to 5.6% (2/36) in Lockdown 1.

Mortality. The overall percentage of operated hip and distal femur fracture mortality increased from 2019 in comparison to all three lockdown periods (Figure 4). The 30- day mortality for the patients in 2019 was 8.8% (3/34); this increased to 14.7% (5/34) in Lockdown 1, with a slight decrease to 10.0% (3/30) in Lockdown 2 followed by an increase to 14.8% (4/27) in Lockdown 3. The difference in mortality rate was not statistically significant when comparing 2019 to Lockdown groups 1, 2, and 3.

Few patients were managed nonoperatively. In 2019, one of three patients who were managed nonoperatively died within 30 days of admission. In Lockdown 1, two patients who were managed nonoperatively survived at 30 days, as was the case for one patient managed nonoperatively in Lockdown 3. In comparison, one patient who was managed nonoperatively in 2019 died.

AKI, pneumonia, and length of hospital stay. Figure 5 demonstrates the percentages of patients who suffered with AKI and pneumonia in each group. The percentage of patients suffering with AKI increased from 2019 from 27.0% (10/37) to 30.6% (11/36) in Lockdown 1. The highest rate of AKI was observed in Lockdown 2 with 38.7% (12/31) and a decrease to pre-pandemic levels of 28.6% (8/28) in Lockdown 3. The differences in number

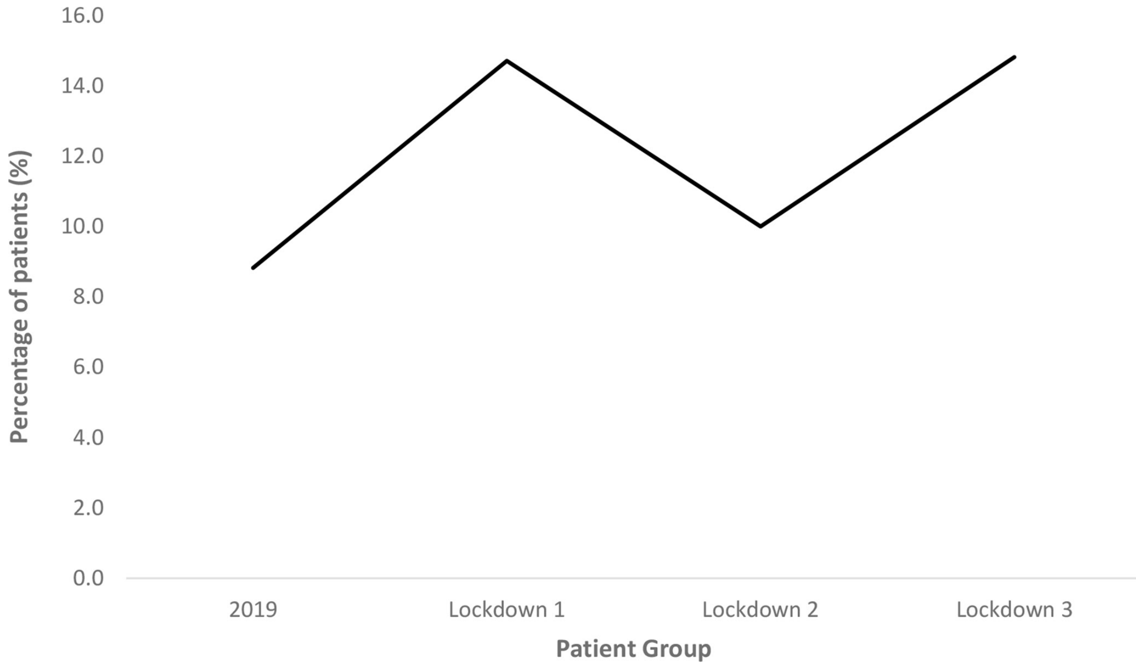

Fig. 4

Graph demonstrating percentage of patients who died within 30 days of their operation date across all four patient groups.

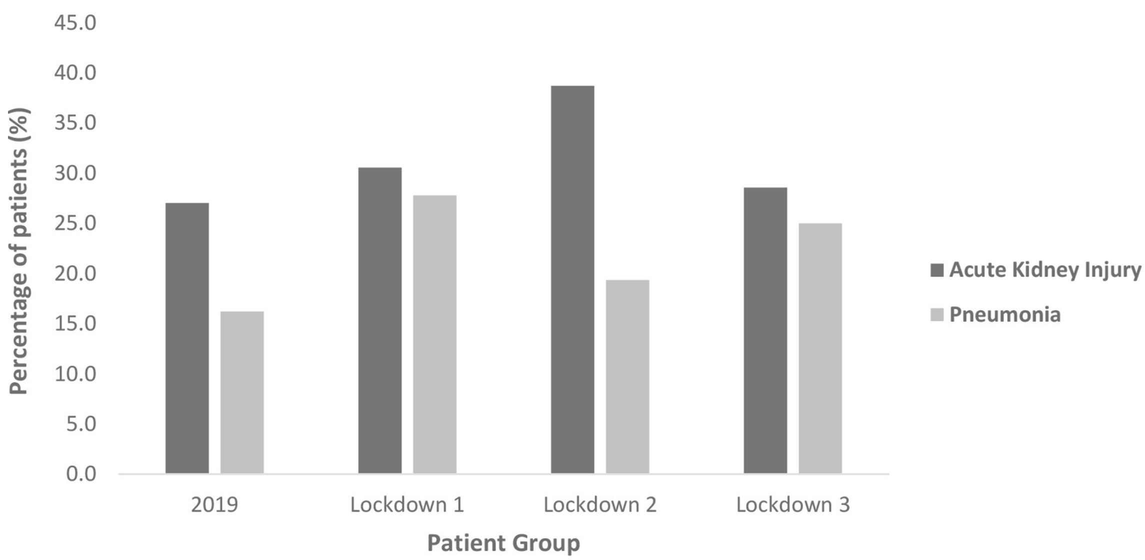

Fig. 5

Graph demonstrating percentages of patients suffering with acute kidney injury and pneumonia in each patient group.

of patients suffering with AKI were not statistically significant when comparing 2019 to each lockdown group.

The overall percentage of patients suffering with pneumonia increased in all lockdown groups when compared to 2019. In 2019, 16.2% of patients (6/37) were radiologically diagnosed with pneumonia; this increased to 27.8% (10/36) in Lockdown 1 but gradually decreased to 19.4% (6/31) in Lockdown 2 followed by an increase in lockdown 3% to 25.0% (7/28). Again, the difference when comparing lockdown groups to 2019 was not statistically significant.

The mean length of hospital stay was similar across all groups and lower in Lockdown 3 as compared to 2019 (Figure 6). The difference in length of stay between all groups was not statistically significant ($p = 0.326$, ANOVA).

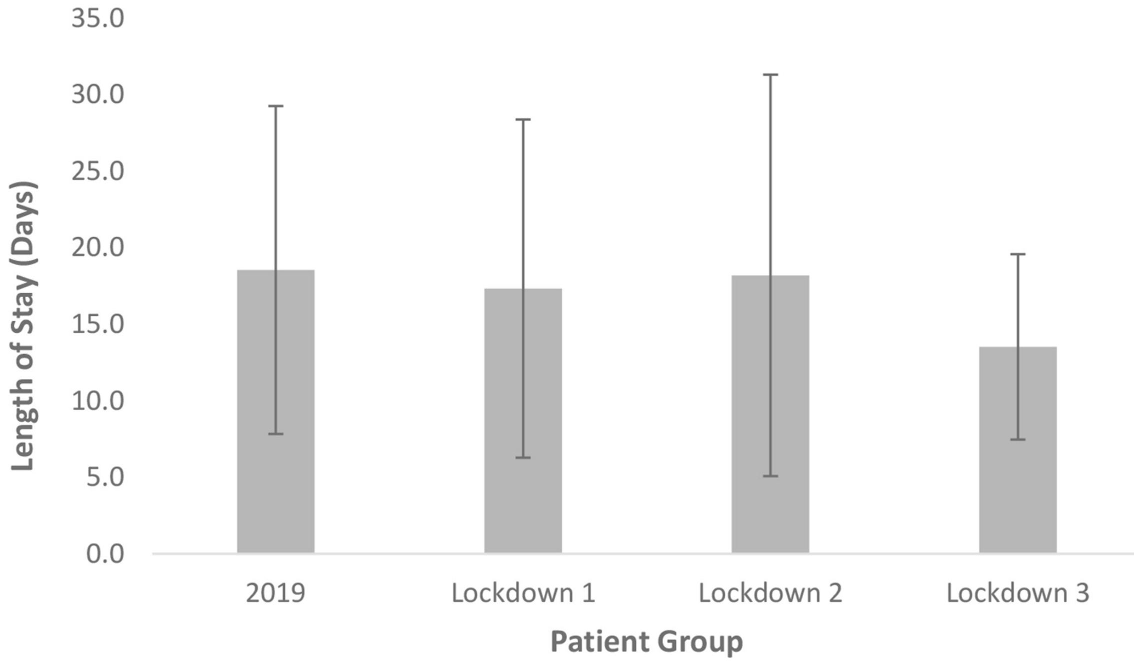

Fig. 6

Graph demonstrating mean length of hospital stay in each patient group (error bars show standard deviation).

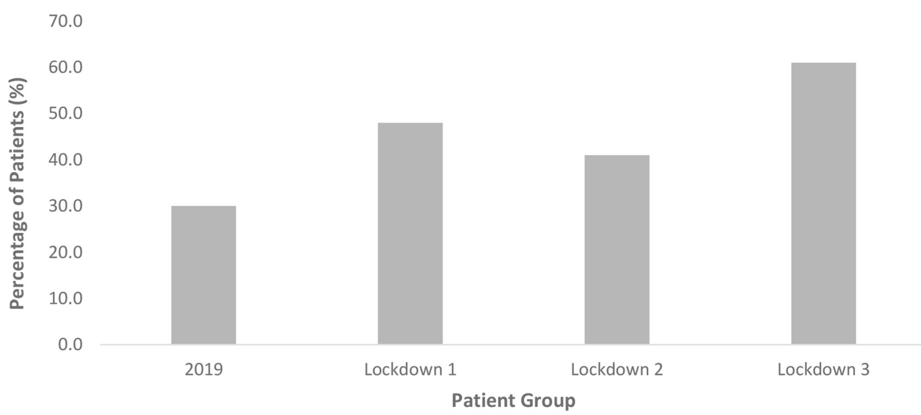

Fig. 7

Graph demonstrating percentage of patients with a valid inpatient DNACPR across all four patient groups.

DNACPR

The percentage of patients with a valid inpatient DNACPR increased from 30.0% (9/30) in 2019 to 48.5% (16/33) in Lockdown 1. A slight decrease was seen in Lockdown 2% to 41.4% (12/29) followed by an increase to 60.7% (17/28) in Lockdown 3 (Figure 7). The difference in the number of patients with a DNACPR was not statistically significant when comparing 2019 to Lockdown 1 ($p = 0.198$, Fisher's exact test) and Lockdown 2 ($p = 0.422$, Fisher's exact test); however, by Lockdown 3, this comparison was statistically significant ($p = 0.034$, Fisher's exact test, odds ratio (OR) = 3.61).

DNACPR status was missing for 12 patients in total: seven patients in 2019, three in Lockdown 1 and two in Lockdown 2. Therefore, the figures were reported as percentages.

COVID-positive group. A comparison with the COVID-positive patients across all three lockdown periods in comparison to the 2019 control group is summarized in Table III. A total of 20 hip or distal femur fracture patients tested positive for COVID-19, with 16 patients (80%) testing positive postoperatively. One patient tested positive in Lockdown 1, 11 patients in Lockdown 2, and a further eight patients in Lockdown 3. Eight patients out of 37 (21.6%) were not tested for COVID-19 in the Lockdown 1 group due to lack of test availability.

When comparing both groups, most outcomes were similar. There was no statistically significant difference

Table III. Comparison of patient demographic data, preoperative scoring, and patient outcomes between 2019 control group and COVID-positive group across all three lockdown periods.

Variable	2019 group	COVID-positive group
Number of patients	37	20
Mean age, yrs (SD)	83.3 (9.1)	83.4 (10.8)
Sex (Male), n	9	5
Sex (Female), n	28	15
Median time to theatre, hrs (IQR)	26.3 (20.9 to 35.8)	21.4 (17.3 to 38.9)
> 36 hrs to theatre, n (%)	8 (23.5)	7 (35.0)
Mean AMT score (SD)	7.1 (3.5)	6.1 (4.6)
Mean ASA grade (SD)	3.0 (0.6)	3.1 (0.7)
Mean length of hospital stay, days (SD)	18.5 (9.9)	22.9 (11.0)
30- day mortality, n (%)	8.8 (3/34)	6/20 (30.0)
AKI, n (%)	10/37 (27.0)	9/20 (45.0)
Pneumonia, n (%)	6/37 (16.2)	10/20 (50.0)

AKI, acute kidney injury; AMT, Abbreviated Mental Test; ASA, American Society of Anesthesiologists; IQR, interquartile range; SD, standard deviation.

with regard to age (p = 0.978, independent-samples t-test), AMT score (p = 0.390, independent-samples t-test), ASA grade (p = 0.595, independent-samples t-test), and median time to surgery (p = 0.849, independent-samples t-test). The mean length of stay was longer for COVID-positive patients, but the difference was not statistically significant (p = 0.162, independent-samples t-test). In addition, the percentage of COVID-positive patients breaching beyond 36 hours to theatre was higher (35.0% vs 23.5% in 2019); however, the difference was not statistically significant (p = 0.353, chi-squared test, OR = 1.75).

The percentage of COVID-positive patients who died within 30 days of their operation was 30.0% (6/20) and all COVID-positive patients were managed operatively. In comparison, just 8.8% of patients (3/34) died within 30 days of their operation in 2019; however, the difference between these groups was not statistically significant (p = 0.063, OR = 4.43). The percentage of patients with AKI was higher in the COVID-positive group with 45.0% (9/20) compared to 27.0% (10/37) in 2019; this difference was also not statistically significant (p = 0.38, OR = 1.80). However, the greatest difference was seen with regards to pneumonia percentages with 50.0% (10/20) of COVID-positive patients diagnosed with pneumonia compared to just 16.2% (6/37) in 2019. This difference was statistically significant (p = 0.001, OR = 5.17).

Discussion

Overall, the number of hip and distal femur fractures was similar across all groups, which is in keeping with predictions prior to the pandemic.[10] As demonstrated by the similar age, sex distribution, AMT score, and ASA grades across all groups, the patient population during the COVID-19 pandemic represented that of a pre-pandemic population.

The trends across most outcomes measured followed a similar trend: outcomes were worse in Lockdown 1 as compared to 2019, with a gradual improvement towards pre-pandemic outcomes by the time of Lockdown 3. This was the case for median time to geriatric assessment, median time to surgery, and percentage of patients breaching. This observation is supported by the literature, with suggestions that early in the UK pandemic in March 2020, outcomes were worse, using theatre efficiency as an example.[28] However, with the progression of the pandemic, theatre efficiency improved.[29] This can be explained locally due to administrative disruptions, such as re-deployment of staff to intensive care, a lack of understanding on the management of COVID-19, and the lack of personal protective equipment. However, with an improvement in these areas over time, outcomes therefore steadily improved compared to pre-pandemic levels in 2019.

When comparing the operation choice, the percentage of patients undergoing each operation was broadly similar across all time periods. This was surprising given the suggestion early during the pandemic to perform a hip hemiarthroplasty rather than total hip arthroplasty when possible;[9] however, the choice of operation was supported due to the lack of significant difference with regard to 30- day mortality and length of stay across all lockdown groups in comparison to 2019. The same justification can be used to explain the number of patients undergoing nonoperative management, which was similar in all lockdown groups or even fewer when compared to 2019. Local management therefore did not change significantly and suggests that the early guidelines were simply to assist with decision-making rather than dictate the final decision; the decision to operate was performed on a case-by-case basis and requires a MDT approach, understanding the implications of nonoperative management that other centres may have favoured.

The mortality within all lockdown groups was higher compared to 2019, which was likely due to higher rates of AKI and pneumonia. The difference in mortality was not statistically significant; however, for the COVID-positive subgroup, the difference would have likely been statistically significant if more patients had been included. This is supported by the literature,[16-20] with COVID-positive patients experiencing higher rates of mortality compared to non-COVID-positive patients. The rates of AKI and pneumonia were also highest for the COVID-positive group. COVID-positive patients are at a higher risk of AKI due to the risk of volume depletion and viral infection causing tubular injury.[30] Given the pathophysiology of COVID-19 as a viral respiratory illness, the percentage of patients experiencing pneumonia during the pandemic was higher as compared to pre-pandemic years.[31] The higher rates of AKI and pneumonia for COVID-positive hip and distal femur fracture patients, resulting in higher rates of mortality, is also supported by a study by Ward et al[32] who demonstrated similar findings. Our results therefore demonstrate the importance of early recognition and management for AKI and pneumonia, especially for COVID-positive patients. However, other causes of mortality were not assessed, and it is well recognized that in addition to kidney and respiratory failure, hip and distal femur fracture patients are at risk of cardiac failure and pulmonary embolism,[33] resulting in death. It has even been hypothesized that vitamin D deficiency for COVID-positive hip fracture patients may contribute to increased mortality.[34]

This study highlighted the improvement from the pandemic with regard to DNACPR decision-making as a good practice, suggesting the overall evolution of hip and distal femur fracture management. The importance of establishing ceilings of care is not new, but the pandemic highlighted the importance of having these discussions early.[35]

The main limitations of this study include missing data and the sample size. Missing data was present for DNACPR results, with 12 patients missing and two days of data missing in Lockdown 3, with 28 days analyzed instead of 30 in the other groups. However, most patient data were still collected, and values were expressed as percentages where possible. With regard to the relatively small sample size, with just 20 COVID-positive patients in total, the validity of these conclusions could be questioned. However, the trends observed were comparable to those in the literature and so the authors were confident with the results and explanation of trends.

The external validity of the study was impacted by the limitations. Despite this, as the results were similar to those found in the literature, the results and conclusions drawn add to the limited body of research currently available, while also applying a different approach to studying hip and distal femur fracture outcomes using the three lockdown dates over a one-year period.

In conclusion, services in Trauma and Orthopaedics are gradually returning to pre-pandemic levels, as demonstrated by hip and distal femur fracture outcomes in three successive UK lockdown periods. COVID-positive patients are at a greater risk of developing AKI and pneumonia, resulting in higher mortality rates. The percentage of patients with a DNACPR has increased, suggesting an improvement in healthcare practice.

Take home message

- Services in trauma and orthopaedics are gradually returning to pre-pandemic levels.
- COVID-19-positive patients are at a greater risk of developing acute kidney injury and pneumonia, resulting in higher mortality rates.
- The percentage of patients with a do not attempt cardiopulmonary resuscitation order has increased, suggesting an improvement in healthcare practice.

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Funding statement:
- No funding was obtained to perform the study. 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.

Acknowledgements:
- The authors would like to thank the trauma and orthopaedics team at Russells Hall Hospital, Dudley Group NHS Foundation Trust, and the audit management team for giving their permission to perform the study. Only listed authors were involved in conceptualization, methodology, data collection, data interpretation, and decision to submit for publication.

Open access funding
- The authors confirm that the open access fee for this study was self-funded.