Excess deaths in the fragility fracture population during the first wave of the COVID-19 pandemic due to altered care pathways

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Abstract

This study of fragility fracture patients demonstrated non-COVID-19 related mortality was significantly higher during the pandemic period (14.7% n=728) than in controls (10.2%; HR=1.86; 95%CI 1.41-2.45; p<0.0001 n=1014). This is associated with a significant decrease in length of stay, both for the whole group and for the hip fracture subgroup. Altered care-pathways and aggressive discharge criteria during the pandemic are likely responsible for the increase in excess deaths.

Introduction

According to the Office of National Statistics in the United Kingdom, between the 1st March and 30th June there were 218,837 deaths in England and Wales, of which 50,335 (23%) were related to coronavirus (COVID-19) [1]. By the end of the first week of April 2020 deaths were more than double the five-year average [1] with studies showing an increase in excess deaths by analysis of all-cause mortality, not just due COVID-19 (COVID) infection [2]. Non-COVID excess deaths are associated with increasing age, with the largest increases in non-COVID deaths being attributed to dementia and frailty. Patients who present with fragility fractures are at risk of poor outcomes[3, 4] and outcomes are care pathway dependent. This study was designed to quantify the excess mortality related to the pandemic in this group related to modifying established care pathways in the light of the first wave. By maintaining long-established evidence-based care pathways for fragility fractures, even in the face of a second wave of the COVID-19 pandemic, excess death in this vulnerable population may be reduced.

Methods

A retrospective cohort study design identified study and control groups from the same institution, a United Kingdom (UK) hospital group with a major trauma centre and 1700 inpatient beds. Inclusion criteria for both groups were all patients, of all ages, admitted with an ICD-10 code [5] of S72 (fracture of femur), M80 (osteoporosis with current pathological fracture), M96 (intraoperative and postprocedural complications and disorders of musculoskeletal system, not elsewhere classified), W06 (fall from bed), W19 (unspecified fall) and Y79 (orthopaedic devices associated with adverse incidents). These ICD-10 codes were selected to capture patients who were likely presenting with fragility fractures. Two time periods were selected to define groups: (i) the study group were admitted during the 1st wave of the UK COVID-19 pandemic, between 1 March 2020 to 1 June 2020, and discharged by 30 June 2020 (ii) the control group were admitted between 1 March 2019 to 1 June 2019, and discharged by 30 June 2019. Excluded were all patients that did not have one of the ICD-10 codes above. Mortality was established using NHS Digital data.

Hip fracture patients from both groups were analysed in greater detail from prospectively collected data was obtained from the institutional local hip fracture database. The study was part of an approved local hospital audit (no. 20-333-C). Funding for this trial was received from UKRI/MRC Rapid Response COVID trial (MR/V027883/1).

Results

Hip fractures were the most common diagnoses making up approximately 20% in each of the two comparative groups. These were selected for subgroup analysis. Table 1 shows group characteristics and outcomes for non-COVID patients. Mortality was significantly higher in the fragility fracture cohort and within and in the hip fracture sub-group during the COVID-19 pandemic period. It was also noted that the length of stay was significantly shorter for the COVID-19 period group and the COVID-19 period hip fracture subgroup.

Table 1. Complications, patient and treatment factors by group.

a.	COVID period group COVID-19 negative (total: n=728)	Control period group (total: n= 1014)	p value
Age on admission; mean years (±SD); n	73.9 (±20.7)	72.8 (± 21.4)	0.301[1]
Male sex; n (%)	292/728 (40.1%)	385/1014 (38.0%)	0.370[2]
Length of stay; mean days (± SD); n	8.0 (±8.3)	12.1 (±14.3)	<0.00001[1]
ARDS or sepsis, n (%)	26/728 (3.6%)	26/1014 (2.6%)	0.254[2]
b.	**COVID period hip fracture subgroup COVID-19 negative (total: n= 168)**	**Control hip fracture subgroup (total: n= 190)**	**p value**
Age on admission; mean years (±SD); n	83.1 (±9.0)	81.9 (± 9.2)	0.181[2]
Male sex; n (%)	44/168 (26.1%)	51/190 (26.8)	0.905[2]
Length of stay; mean days (± SD); n	10.7 (±5.15)	15.3 (± 7.4)	<0.00001[2]
Hip fracture treatment			
• Arthroplasty	68/165* (41.2%)	81/190 (42.6%)	0.227[3]
• Fixation	90/165* (54.6%)	103/190 (54.2%)	0.355[3]
• Non-operative	7/165* (4.2%)	6/190 (3.2%)	0.587[3]
Pneumonia	14/168 (8.3%)	13/190 (6.8%)	0.081[3]
UTI	7/168 (4.2%)	10/190 (5.3%)	0.804[2]
Blood transfusion	32/168 (19.1%)	40/190 (21.1%)	0.856[3]
Renal failure	18/168 (10.7%)	22/190 (11.6%)	0.813[3]
BMI	24.27 (±5.1);150	23.2 (± 4.4); 169	0.072[2]

[1]2-tailed distribution with homoscedastic variance Student's t-test. [2]Fisher exact test. [3]Chi-squared statistic calculated on a 2x3 contingency table.* Data was only available for 165 patients.

Mortality of fragility fracture patients without COVID-19 was significantly higher among pandemic period admissions (14.7%) than in the pre-pandemic cohort (10.2%) after adjusting for age and sex (hazards ratio (HR)=1.86; 95%CI 1.41-2.45; p<0.0001) (Figure 1). Length of stay was shorter during the pandemic period (effect size adjusting for age and sex =-4.2 days 95%CI -5.8,-3.1, p<0.0001). A subanalysis of hip fracture patients revealed a mortality of 8.4% among 190 admissions in the prepandemic set, and of 15.48% among 168 pandemic admissions with no COVID diagnosis, resulting in a HR=2.08 95%CI 1.11-3.90 p=0.021. After further adjustment for clinical frailty scores this became HR=2.15 95%CI 1.15-4.04 p=0.0162.

Discussion

In this study we report significantly higher mortality among fragility fracture patients with no COVID-19 related diagnosis admitted during the COVID-19 pandemic period compared to patients admitted with the same ICD-10 codes to the same hospital in the same time period of the year 2019. We also report significantly shorter hospital length of stay during the months of the pandemic compared to the same period a year earlier. These results hold true after adjustment for potential confounders such as age and sex. A sub-analysis on femoral neck fractures where frailty indices and other clinical assessments were readily available showed a similar pattern whilst there was no difference in frailty between the pandemic and pre-pandemic cohorts.

A recent report from the Office for National Statistics found that England had the highest overall relative excess mortality out of all the European countries compared during the first 6 months of 2020 [6]. While none of the four UK nations had a peak mortality level as high as Spain or the worst-hit local areas of Spain and Italy, excess mortality was geographically widespread throughout the UK during the pandemic, whereas it was more geographically localised in most countries of Western Europe. Our data add to this picture by showing that excess mortality involves patients without COVID-19 and areas of England with rates of infection below the national average. Achievement of best practice hip fracture tariff [7] at our institution during the pandemic fell from an average of 42% (Mar-Jun 2019) to 38% (Mar-Jun 2020) with a particular failure to achieve the delirium assessment, which fell from an average of 96% to 62% for the respective periods. In addition, there was a significant decrease in the number of hip fracture patients who were not delirious after surgery, from 81% to 63% respectively. These indicates breakdown of standard care pathways due to extrinsic pressures and provides a likely explanation for the excess mortality. As there are no agreed pathways or metrics for other fractures it is impossible to prove, although probable that the same factors apply.

Hip fractures occurred at the same frequency during the COVID-19 period and the national lockdown, as before it, with no differences identified for age, sex, BMI, AMTS, mobility, NHFS, anaemia, fracture type or frailty between groups. Similar incidence pre- and post- COVID with similar demographics allows a valid comparison to examine excess deaths.

Analysis of the COVID-19 negative subset of those presenting during the COVID-19 period compared to the control period does identify associations that may be relevant. Whilst there were no differences identified between these groups for age, the development of ARDS or sepsis of the requirement for ventilatory support post procedure, significant difference were noted in the COVID-19 period group (COVID-19 negative subset) for a shorter length of stay and reduced number of procedures. Both differences suggest that the standard care pathways were altered for fragility fractures, which is further supported by the observed fall in BPT achievement. A reduced length of stay is often considered a positive outcome. However, if the threshold for a safe discharge is altered, for instance in the face of a great need for more inpatient beds to manage a pandemic, there may be unintended consequences affecting mortality.

For those presenting with hip fractures during the COVID-19 period, who did not test positive for COVID-19, that no differences were seen for age, sex, BMI, treatment type (including non-operative treatment) and complications including: venous thromboembolism, urinary tract infection, stroke, myocardial infarction, failure of fixation or dislocation, transfusion, acute renal failure, pulmonary embolus or clostridium difficile when compared to the control group suggests that understanding the reasons for the excess mortality is complex. Despite this, reduction in length of stay seems to be a significant factor in the hip fracture subgroup analysis, where changes to operative treatment frequency (as for the fragility fracture group as a whole) is not.

During the COVID-19 period, only 12 patients tested positive for COVID-19. When compared to those presenting during the same time period, they were older and had a longer length of stay. Age, as a risk factor for developing COVID-19, is well established [8].

Conclusions

These data suggest that excess deaths are likely due to changing established, evidence-based care-pathways, particularly regarding thresholds for safe discharge and length of stay. Excess mortality seen in this vulnerable fragility fracture population is likely to be minimised by maintaining standards of care during the second wave of the COVID-19 pandemic.

Declarations

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Conflict of Interest: None to declare

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Figures

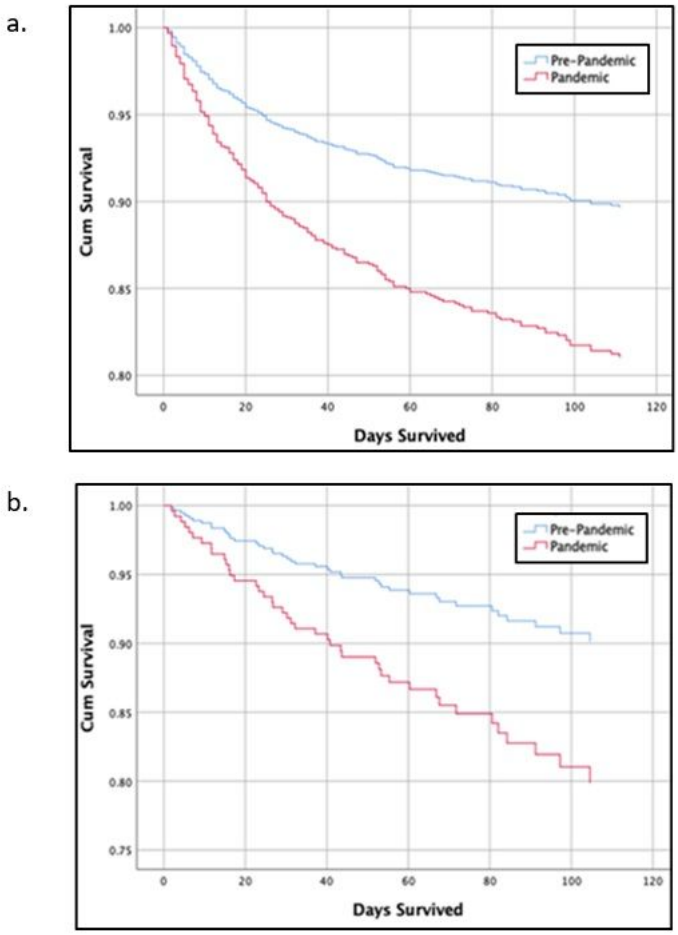

Figure 1

Reduced survival in (a) non-COVID-19 fragility fractures and (b) non-COVID-19 hip fractures.