



The effect of becoming a major trauma centre on outcomes for elderly hip fracture patients



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ABSTRACT

Twenty-two major trauma centres (MTCs) became operational across England on 1st April 2012. The aim of this study was to ascertain whether becoming an MTC has affected outcomes for elderly hip fracture patients at our institution.

Eight hundred and twenty-four patients aged ≥ 60 years who sustained 841 consecutive hip fractures over a two-year period were included. There were 381 fractures during the year prior to (pre-MTC group), and 460 fractures during the year after (post-MTC group) becoming an MTC. Outcomes analysed were time to theatre, length of acute hospital stay, post-operative complications, and mortality at 30, 120 and 365 days.

No statistically significant difference was found in median length of stay between the two groups (13 days vs 14 days, $p = 0.2888$). In the post-MTC group there was a significant increase in median delay to theatre for medically fit patients (25.5 h vs 31.5 h, $p < 0.0001$), and there was a significant increase in post-operative medical complications (29.7% vs 37.6%, $p = 0.0160$). There was no statistically significant difference in overall mortality rates, however 30-day mortality rose from 4.7% to 8.0% ($p = 0.0678$). These results suggest that becoming an MTC has led to a significant increase in the delay to surgical management of our hip fracture patients with consequent increases in morbidity and mortality.

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Introduction

Osteoporotic hip fractures are an increasing challenge to healthcare systems and society as a whole, due to the ageing of our population. There are around 70,000 hip fractures annually in England, and this is predicted to increase to 100,000 by 2033 [1]. Initiatives such as the National Hip Fracture Database (NHFD) [2], the British Orthopaedic Association/British Geriatrics Society 'Blue Book' [3], and the Best Practice Tariff (BPT) in England and Wales aim to standardise, optimise and improve hip fracture management and outcomes. Elderly hip fracture patients often have multiple medical co-morbidities and are therefore at high risk of developing complications post-operatively [4]. The mortality rate according to the most recent NHFD report is 8.2% at 30 days [5], further highlighting the frailty of this patient population and the need for medical optimisation peri-operatively. Delays to surgery have been shown to increase post-operative complications [6], and several studies have also shown a consequent increase in mortality

rates [7–9]. A systematic review studying the timing of hip fracture surgery in over 250,000 patients concluded that early surgery reduces hospital stay, and is likely to reduce complications and mortality [10].

Following a government review of trauma provision in the United Kingdom, regional trauma networks and major trauma centres (MTCs) were inaugurated [11]. The role of MTCs is to allow early total care for multiply and severely injured trauma patients in dedicated centres where key specialties such as orthopaedics, neurosurgery, plastic surgery and general surgery are based together. It is estimated that 80% of polytrauma patients will have orthopaedic injuries. With the advent of MTCs, the orthopaedic surgical workload in such hospitals is anticipated to increase. Our hospital was designated as a regional MTC and became operational on 1st April 2012. This study came about because of concerns that the increased workload in our department was putting pressure on our ability to optimally treat patients who had sustained a fractured neck of femur. The primary aim of the study was to determine whether outcomes for elderly hip fracture patients had been affected by becoming an MTC. The outcome measures studied included: time to surgery, acute length of stay, post-operative complication rate and mortality at 30, 120 and 365 days. The null hypothesis was that there is no

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significant difference in outcomes between the pre- and post-MTC groups.

Patients and methods

All patients aged 60 years and over, who were admitted to our institution with a primary diagnosis of hip fracture during the two year study period were included. Patients for whom insufficient data was available, and those who were treated non-operatively, or who had already had their fracture treated elsewhere were excluded. Those admitted 1st April 2011–31st March 2012 were placed in the pre-MTC group, and those admitted 1st April 2012–31st March 2013 in the post-MTC group. Data was collected from the prospectively recorded hospital NHFD entries, PACS system, and the electronic medical records regarding age, gender, ASA, type of fracture, time to theatre, reason for any delay to theatre, length of acute hospital stay, post-operative complications, and mortality at 30, 120 and 365 days. Medical and surgical post-operative complications were defined according to the consensus opinion identifying standard outcome parameters for orthogeriatric co-management of hip fractures [12].

Statistical analysis was carried out using Graphpad Prism (GraphPad Software, Inc., La Jolla, CA). Fisher's exact test was used for categorical data. A Mann–Whitney *U*-test was used for non-parametric continuous data, and an unpaired Student's *t*-test for the normally distributed continuous data. Kaplan–Meier survival analysis was used to analyse mortality data and comparison between the two groups carried out using the log rank test. A *p*-value of <0.05 was accepted as being statistically significant.

Results

Records were obtained for a total of 850 consecutive hip fracture admissions. Four patients were treated non-operatively in the pre-MTC group. In the post-MTC group there was insufficient information available for two patients, two were treated non-operatively, and one had had a hemiarthroplasty abroad prior to admission. Following application of the exclusion criteria, data was analysed for a total of 824 patients who sustained 841 fractures (381 pre-MTC and 460 post-MTC). There was no significant difference between the two groups with respect to age, gender, ASA or type of fracture (Table 1).

Table 1

Patient case-mix variables for each group. * Represents Mann–Whitney *U*-test. All other *p*-values represent Fisher's exact test.

Variable	Pre-MTC (n = 381)	Post-MTC (n = 460)	<i>p</i> -value
Mean age (y) (SD; range)	82.62 (8.10; 60–100)	83.63 (8.16; 60–102)	0.0726*
Gender (n, %)			
Male	105 (27.6)	133 (28.9)	0.7008
Female	276 (72.4)	327 (71.1)	
ASA (n, %)			
1	4 (1.0)	4 (0.9)	1.0000
2	138 (36.2)	160 (34.8)	0.6648
3	187 (49.1)	249 (54.1)	0.1463
4	52 (13.7)	47 (10.2)	0.1331
Side (n, %)			
Left	195 (51.2)	220 (47.8)	
Right	186 (48.8)	240 (52.2)	0.3678
Fracture type (n, %)			
Intracapsular undisplaced	41 (10.76)	43 (9.35)	0.5638
Intracapsular displaced	193 (50.66)	228 (49.57)	0.7818
Intertrochanteric	122 (32.02)	170 (36.96)	0.1458
Subtrochanteric	25 (6.56)	19 (4.13)	0.1222

Length of stay

There was no statistically significant difference in the median acute hospital length of stay between the two groups: pre-MTC 13 days (IQR 9–19.5) vs post-MTC 14 days (IQR 9–21) *p* = 0.2888.

Time to surgery

In patients who were medically fit for surgery there was a statistically significant increase of 6 h in the median time from admission to theatre in the post-MTC group (25.5 h vs 31.5 h, *p* < 0.0001). In the pre-MTC group 114 patients had surgery more than 36 h after admission. In 41 (36.0%) of these cases the reason for delay was because the patient was not medically fit for surgery, in 69 (60.5%) cases there were no available theatre slots, and in four cases the reason for delay was not recorded. In the post-MTC group 172 patients had surgery more than 36 h after admission. About 35 (20.3%) of these patients were not medically fit, in 129 (75%) cases the reason for delay was due to no available theatre time, 2 cases were delayed due to insufficient staffing in theatres, and 6 cases were delayed for unknown reasons. The overall percentage of patients achieving the BPT target of surgery within 36 h of admission significantly decreased post-MTC (70% vs 62.6% *p* = 0.0236) (Table 2).

Post-operative complications

Medical and surgical post-operative complications are detailed in Table 3. There was a significant increase in the proportion of patients who developed a chest infection in the post-MTC group (*p* = 0.0264), and also in those who developed a pressure ulcer (*p* = 0.0057). Over the entire study period, patients who went to surgery more than 36 h after admission had a relative risk of developing post-operative medical complications of 1.3828 (95% CI 1.1471–1.6670 *p* = 0.0007).

Overall, the percentage of post-operative surgical complications remained largely unchanged at 5.5% pre-MTC and 4.6% post-MTC, however there was a statistically significant increase in medical complications in the post-MTC group (29.7% vs 37.6% *p* = 0.0160) (Fig. 1).

Mortality

There was a notable rise in 30-day mortality rates from 4.72% pre-MTC to 8.04% post-MTC, however this did not quite reach statistical significance (*p* = 0.0678). One-year mortality was similar, at 23.36% (95% CI 19.11–27.61) for the pre-MTC group and 23.26% (95% CI 19.40–27.12) for the post-MTC group (Table 4).

There was no significant difference in overall mortality between the two groups (logrank test *p* = 0.8809) (Fig. 2).

Of the 18 pre-MTC patients who died by 30 days, six (33%) had surgery at more than 36 h after admission, five of these were deemed medically unfit to undergo surgery any sooner, and only one of the patients had been delayed due to lack of theatre

Table 2

Patients who had surgery within, or beyond 36 h of admission, and median time to surgery for medically fit patients in each group. * Denotes Fisher's exact test and ⁵ denotes Mann–Whitney *U* test.

	Pre-MTC	Post-MTC	<i>p</i> -value
Patients who had surgery <36 h from admission (n, %)	267 (70.0)	288 (62.6)	0.0236*
Patients who had surgery >36 h from admission (n, %)	114 (30.0)	172 (37.4)	
Median time to surgery for medically fit patients (h)	25.5 (n = 340)	31.5 (n = 425)	<0.0001 ⁵

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