# "Multidisciplinary fast-track" care can significantly reduce risk of mortality among hip fracture patients at least 80 years old: a single-center retrospective study

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## Abstract

**Background** "Multidisciplinary fast-track" (MFT) care can accelerate recovery and improve prognosis after surgery, but whether it is effective in older people after hip fracture surgery is unclear.

**Methods** We retrospectively compared one-year all-cause mortality between hip fracture patients at least 80 years old at our institution who underwent hip fracture surgery between January 2014 and December 2018 and who then received MFT or conventional care. Multivariable regression was used to assess the association between MFT care and mortality after adjustment for confounders.

**Results** The final analysis included 247 patients who received MFT care and 438 who received conventional orthopedic care. The MFT group showed significantly lower one-year mortality (8.9% vs. 14.4%, $P=0.037$). Log-rank testing of Kaplan-Meier survival curves confirmed the survival advantage. However, the two groups did not differ significantly in rates of mortality during hospitalization or at 30 or 90 days after surgery. Regression analysis confirmed that MFT care was associated with lower risk of one-year mortality (hazard ratio [HR] 0.47, 95% confidence interval [CI] 0.281–0.788, $P=0.04$), and the survival benefit was confirmed in subgroups of patients with anemia (HR 0.453, 95% CI 0.268–0.767, $P=0.003$) and patients with American Society of Anesthesiologists grade III (HR 0.202, 95% CI 0.08–0.51, $P=0.001$).

**Conclusions** MFT care can reduce one-year mortality among hip fracture patients at least 80 years old. This finding should be verified and extended in multi-center randomized controlled trials.

**Keywords** Older people, Hip fracture, Multidisciplinary fast track, Mortality

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## Introduction

By 2050, the global incidence of hip fractures is expected to exceed 6 million per year [1], and such fractures are associated with high mortality and morbidity, especially among the older people [1–7]. Older people are at far greater risk than young people of suffering hip fractures after falls, slips or minor trauma, which reflects loss of bone mass and muscle strength around hip joints during aging [8, 9]. Numerous studies point to the importance of surgical intervention as early as possible after hip fracture in order to optimize prognosis, particularly for patients at least 80 years old [6–9].

Consensus guidelines [7, 10] have begun recommending multidisciplinary collaborative diagnosis and perioperative management of hip fracture patients in order to accelerate surgical intervention and improve prognosis [11–18]. The term "multidisciplinary fast-track" (MFT) is often used to refer to the close cooperation of various clinical departments to diagnose, treat and rehabilitate patients after medical interventions [7, 10, 19]. While MFT care has proven effective at improving prognosis for patients undergoing various types of surgery [12, 13, 15], studies have reported mixed results for its effects on mortality among older people after hip fracture surgery [13, 17, 20, 21]. One reason for the mixed results may be that those studies examined a wide age range of patients, from 60 years and older.

We examined here whether MFT care can improve mortality specifically among patients 80 years and older after hip fracture surgery. We also wished to identify risk factors for worse survival among such patients, regardless of whether they received MFT or conventional orthopedic care.

## Materials and methods

This single-center retrospective cohort study was approved by the Ethics Committee of the Second Affiliated Hospital of Zhejiang University School of Medicine (approval I2019001002), which waived the requirement for informed consent.

### Patients

We retrospective analyzed medical records for patients who underwent hip fracture surgery at our medical center between January 1, 2014 and December 31, 2018 and who were at least 80 years old at the time of surgery. We excluded patients who had pathological or repeat fractures, multiple injuries or fractures, or high-energy trauma such as from an automobile accident.

### Perioperative management

Patients who were enrolled before May 2017 received conventional orthopedic care, i.e. the procedures for diagnosis, treatment and rehabilitation routinely applied to older people with hip fracture at our institution. Patients were examined and admitted to the orthopedic ward after diagnosis of hip fracture, where they underwent additional preoperative testing. If their condition was complex, specialists were consulted. This preoperative examination and assessment might take several days, reflecting the large patient volume at our medical center. As a result, patients typically underwent surgery more than 5 days after admission.

Patients enrolled from May 2017 onwards received MFT care. After admission to the emergency room, patients were examined within 24 h by a multidisciplinary team drawn from at least three departments, which always included the Departments of Emergency Medicine, Orthopedic Trauma, and Anesthesiology. The team focused on stabilizing and optimizing the patient's preoperative condition and, if appropriate, scheduling surgery within 72 h of admission. Surgeries were conducted in the first available operating room, after which patients received early nutritional support and rehabilitation.

### Data collection and outcomes

Clinical data were extracted from the Electronic Medical Record System and "Do care" Anesthesia Information System at our hospital. Preoperative data included demographics, laboratory tests, American Society of Anesthesiologists (ASA) grade, fracture type, comorbidities, and Charlson comorbidity index [22]. Intra-operative data included the type and duration of surgery, type of anesthesia and volume of blood loss. Postoperative data included survival up to 12 months, postoperative complications (new-onset pneumonia, heart failure, deep vein thrombosis, pulmonary embolism), admission to the intensive care unit, length of hospital stay and total treatment costs. Patients were followed up by telephone for at least one year after surgery, and they were considered lost to follow-up if they or their family members could not be reached by telephone.

The primary outcome in this study was all-cause mortality within one year of surgery. Secondary outcomes included all-cause mortality during hospitalization as well as at 30 and 90 days after surgery, postoperative complications, postoperative admission to the intensive care unit, length of hospital stay, and total treatment costs.

### Statistical analysis

We estimated the minimal size of the MFT and conventional groups to be 215 in order to detect a difference of 12% in one-year postoperative mortality with statistical power of 90% at an alpha level of 5%. The difference of 12% was based on a previous study of older hip fracture people who received MFT or usual care [23].

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Continuous data in this study showed a skewed distribution, so they were reported as median (interquartile range), and differences between the two groups were assessed for significance using non-parametric testing. Categorical data were reported as n (%), and intergroup differences were assessed using the chi-squared or Fisher's exact test.

One-year survival curves were generated using the Kaplan-Meier method and compared using the log-rank test. Regression analysis was performed to identify variables associated with one-year mortality: variables that were associated with $P < 0.1$ in univariate regression were then included in multivariate Cox regression to control confounding. Results were reported, where appropriate, as hazard ratios (HRs) or odds ratios (ORs) and associated 95% confidence intervals (CIs). Regression was repeated for subgroups of patients stratified by sex, anemia, and ASA grade.

All statistical analyses were performed using SPSS 25.0 (IBM, Chicago, IL, USA) or R 4.1.0 (https://www.r-project.org). Results associated with $P < 0.05$ were considered significant.

## Results

Of the 891 patients who underwent hip fracture surgery at our medical center during the enrollment period, we included 685, comprising 247 in the MFT group and 438 in the conventional group (Fig. 1). The two groups did not differ significantly in age or sex, with women accounting for more than 74% of patients in each group

(Table 1). The two groups did not differ significantly in most other clinicodemographic variables examined, except that the MFT group showed significantly higher prevalence of pneumonia (39.3% vs. 26.7%, $P = 0.001$) and chronic obstructive pulmonary disease (9.3% vs. 3.9%, $P = 0.004$). A significantly larger proportion of the MFT group received regional anesthesia.

The MFT group showed significantly lower all-cause mortality at one year (8.9% vs. 14.4%, $P = 0.037$; Table 2), which was confirmed by Kaplan-Meier analysis (chi-squared $= 4.12$, $P = 0.042$; Fig. 2). However, the two groups did not differ significantly in rates of mortality during hospitalization or at 30 or 90 days after surgery.

The MFT group showed a significantly lower rate of admission to the intensive care unit after surgery (4.9% vs. 10.7%, $P = 0.009$) and shorter intervals until surgery and discharge, leading to lower total treatment costs (Table 2). The two groups did not differ significantly in incidence of new-onset pneumonia, heart failure, deep vein thrombosis or pulmonary embolism.

Univariate regression identified 17 clinicodemographic variables that showed a $P < 0.1$ association with one-year all-cause mortality, of which 15 also emerged as significant in bivariate analysis (Table 3): age, sex, body mass index, ASA grade, hemoglobin level, albumin level, creatinine level, preoperative comorbidities, Charlson comorbidity index, fracture type, type and duration of surgery, type of anesthesia, intraoperative blood loss and MFT care. Based on the literature [7, 16, 22], we included the following 10 variables in multivariate logistic regression
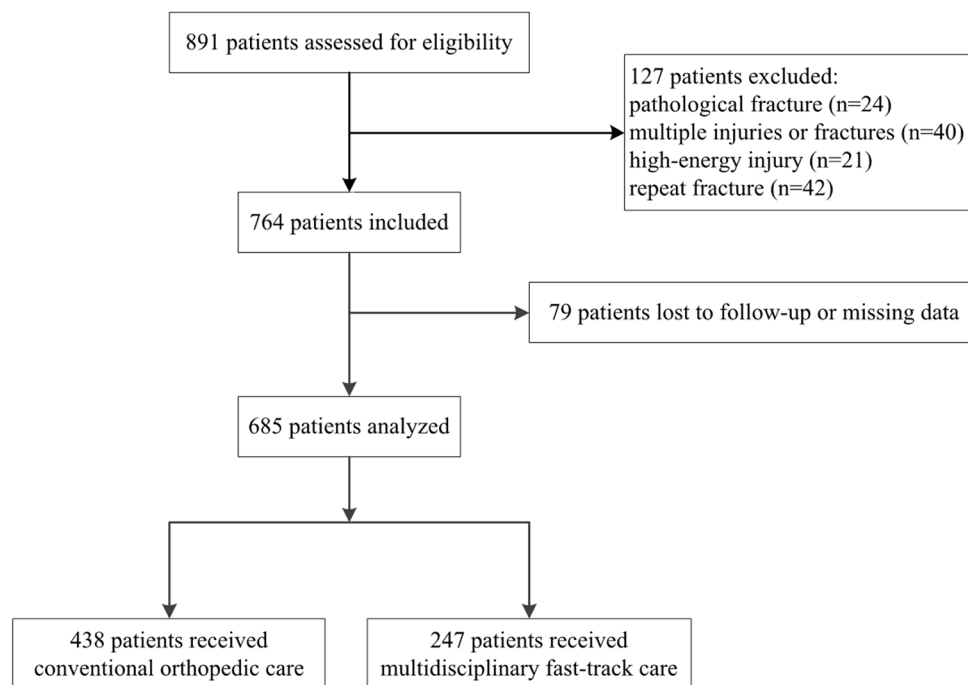


**Fig. 1** Flow diagram of patient selection and group allocation

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**Table 1** Clinicodemographic characteristics of patients

| Characteristic | Conventional care (*n* = 438) | MFT care (*n* = 247) | *P* |
|---|---|---|---|
| Age (years) | 85 (82–89) | 86 (83–89) | 0.095 |
| Body mass index (kg/m$^2$) | 20.13 (17.78–21.80) | 19.8 (17.58–22.87) | 0.563 |
| Sex | | | 0.606 |
|   Male | 104 (23.7) | 63 (25.5) | |
|   Female | 334 (76.3) | 184 (74.5) | |
| ASA grade | | | 0.234 |
|   I-II | 106 (24.2) | 70 (28.3) | |
|   III-IV | 332 (75.8) | 177 (71.7) | |
| **Preoperative laboratory tests** | | | |
| Hemoglobin (g/L) | 104 (89–119) | 108 (92–120) | 0.177 |
| White blood cells (10$^9$/L) | 7.4 (5.7–8.9) | 7.4 (6.3–9.1) | 0.18 |
| Platelets (10$^9$/L) | 171 (133–222) | 161 (106.6–161) | 0.294 |
| Albumin (g/L) | 33.9 (31.1–36.1) | 33.6 (31.3–35.9) | 0.692 |
| Creatine (μmol/L) | 60 (49.5–77) | 62 (51–79) | 0.209 |
| C-reactive protein (mg/L) | 52 (27-78.25) | 48.4 (25.4–65.9) | 0.12 |
| **Preoperative comorbidities** | | | |
| Pneumonia | 117 (26.7) | 97 (39.3) | 0.001 |
| Chronic obstructive pulmonary disease | 17 (3.9) | 23 (9.3) | 0.004 |
| Deep vein thrombosis or pulmonary embolism | 9 (2.1) | 5 (2.0) | 0.978 |
| Hypertension | 238 (54.3) | 143 (57.9) | 0.368 |
| Coronary heart disease | 43 (9.8) | 25 (10.1) | 0.898 |
| Heart failure | 8 (1.8) | 1 (0.4) | 0.223 |
| Atrial fibrillation | 19 (4.3) | 18 (7.3) | 0.101 |
| Stroke | 57 [13] | 27 (10.9) | 0.425 |
| Alzheimer's disease | 16 (3.7) | 15 (6.1) | 0.143 |
| Parkinson's disease | 11 (2.5) | 2 (2.4) | 0.947 |
| Diabetes mellitus | 72 (16.4) | 38 (15.4) | 0.718 |
| Malignant tumor | 22 (5.0) | 18 (7.3) | 0.225 |
| Renal insufficiency | 16 (3.7) | 10 (4.0) | 0.795 |
| Charlson comorbidity index | | | 0.869 |
|   0 | 288 (65.8) | 159 (64.9) | |
|   1 | 103 (23.5) | 58 (23.7) | |
|   2 | 37 (8.4) | 21 (8.6) | |
|   3 | 8 (1.8) | 5 (2.0) | |
|   4 | 1 (0.2) | 2 (0.8) | |
|   5 | 1 (1.2) | 0 | |
| **Type of fracture** | | | 0.336 |
| Femoral neck | 256 (58.4) | 135 (54.7) | |
| Trochanteric | 182 (41.6) | 112 (45.3) | |
| **Surgical parameters** | | | |
| Type of anesthesia | | | < 0.001 |
|   General | 311 (71) | 143 (57.9) | |
|   Regional | 59 (13.5) | 61 (24.7) | |
|   Combined | 68 (15.5) | 43 (17.4) | |
| Type of surgery | | | 0.321 |
|   Replacement | 389 (88.8) | 213 (86.2) | |
|   Fixation | 49 (11.2) | 34 (13.8) | |
| Intraoperative blood loss (mL) | 100 (50–200) | 100 (50–200) | 0.053 |
| Duration of surgery (h) | 2 (1.58–2.5) | 2 (1.67–2.42) | 0.764 |

Data are median (interquartile range) or n (%), unless otherwise noted

ASA, American Society of Anesthesiologists; MFT, multidisciplinary fast-track

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**Table 2** Comparison of primary and secondary outcomes between patients who received conventional or MFT care

| Outcome | Conventional care (n = 438) | MFT care (n = 247) | P |
|---|---|---|---|
| All-cause mortality at | | | |
| one year | 63 (14.4) | 22 (8.9) | 0.037 |
| in hospital | 7 (1.6) | 3 (1.2) | 0.944 |
| 30 days | 21 (4.8) | 8 (3.2) | 0.332 |
| 90 days | 33 (7.5) | 14 (5.7) | 0.354 |
| Postoperative admission to intensive care unit | 47 (10.7) | 12 (4.9) | 0.009 |
| Postoperative complications | | | |
| Pneumonia | 32 (7.3%) | 18 (7.3%) | 0.993 |
| Heart failure | 7 (1.6%) | 3 (1.2%) | 0.944 |
| Deep vein thrombosis or pulmonary embolism | 7 (1.6%) | 2 (0.8%) | 0.603 |
| Total treatment costs (USD)* | 6077.6 (5093.6-7374.6) | 5745.5 (4584.9-6673.2) | < 0.001 |
| Length of hospital stay (d) | 10.83 (8.82–13.82) | 8.89 (7.61–11.57) | < 0.001 |

Data are median (interquartile range) or n (%), unless otherwise noted

MFT, multidisciplinary fast-track

*Converted from Chinese RMB using the rate 1 RMB = 0.1437 USD

(Table 4): age, sex, pneumonia, hemoglobin level, albumin level, ASA grade, type of anesthesia, duration of surgery, Charlson comorbidity index and MFT care. Regression analysis linked MFT to significantly lower risk of one-year all-cause death after controlling for the other variables in the model (HR 0.47, 95% CI 0.281–0.788, $P = 0.004$). Across all patients in the study, risk of one-year all-cause mortality was significantly lower among women than men (HR 0.623, 95% CI 0.393–0.987, $P = 0.044$), higher among those with ASA grades III-IV than those with grades I-II (HR 6.238, 95% CI 3.649–10.664, $P < 0.001$), and lower among those with normal hemoglobin levels than among those with anemia (HR 0.985, 95% CI 0.973–0.997, $P = 0.014$), after controlling for the other variables in the model (Table 5).

After adjusting for other factors, MFT care was associated with significantly lower risk of one-year all-cause mortality in subgroups of patients with anemia (HR 0.453, 95% CI 0.268–0.767, $P = 0.003$) or ASA grade III (HR 0.202, 95% CI 0.08–0.51, $P = 0.001$).

## Discussion

Our single-center study suggests that MFT perioperative management of hip fracture patients at least 80 years old can significantly reduce risk of postoperative admission to the intensive care unit, shorten hospital stay, reduce medical costs and reduce risk of one-year all-cause mortality. We observed trends toward lower rates of mortality during hospitalization as well as at 30 and 90 days after surgery with MFT care, but these trends did not achieve statistical significance.

Our results support previous studies that found MFT care to shorten hospitalization and accelerate recovery among geriatric patients covering a wide age range from 60 years and older who underwent.hip fracture surgery [11–18]. At least in the present study, the advantages of MFT care are likely due in part to clinicians' efforts to perform surgery within 72 h after admission. Delaying hip fracture surgery, especially among older people, may increase risk of postoperative mortality [24].

Previous work concurs with our finding of no clear benefit of MFT care on short-term survival [11, 14, 15, 25]. This may reflect that the primary risk factors for mortality soon after hip fracture surgery are age, sex, and preoperative complications [9, 26]. A meta-analysis concluded that treatment pathway was not significantly associated with short-term mortality of older people with hip fracture [27].

We found that our male older people, regardless of whether they received MFT or conventional care, were at higher risk of one-year mortality than female patients, which is consistent with previous studies [28–30]. This may reflect the greater prevalence of pneumonia, chronic obstructive pulmonary disease, smoking, and drinking among men [30].

We found that patients with anemia were at greater risk of one-year mortality than those with normal hemoglobin levels, regardless of whether they received MFT or conventional care. Consistently, previous work showed that normalizing low hemoglobin levels preoperatively can reduce the risk of one-year all-cause mortality in younger and older hip fracture patients [25, 26]. The present study and previous work highlight the need to optimize perioperative management of hemoglobin and nutrition for older people, especially those with known risk factors of anemia, such as metabolic disorders, blood loss, and chronic comorbidities [27].

We found that patients with ASA grades III-IV were at greater risk of one-year mortality than those with milder ASA grades, regardless of whether they received MFT or conventional care. This finding concurs with previous work identifying ASA grade as a predictor of postoperative mortality in older people with hip fractures [23, 31–33]. Our observation of ASA grade III as a "threshold" in risk of one-year mortality should be interpreted with caution, given that 70% of our study participants belonged to that grade. If this threshold can be verified in further studies, it may mean that patients with severe systemic comorbidities (ASA > III) are less likely than
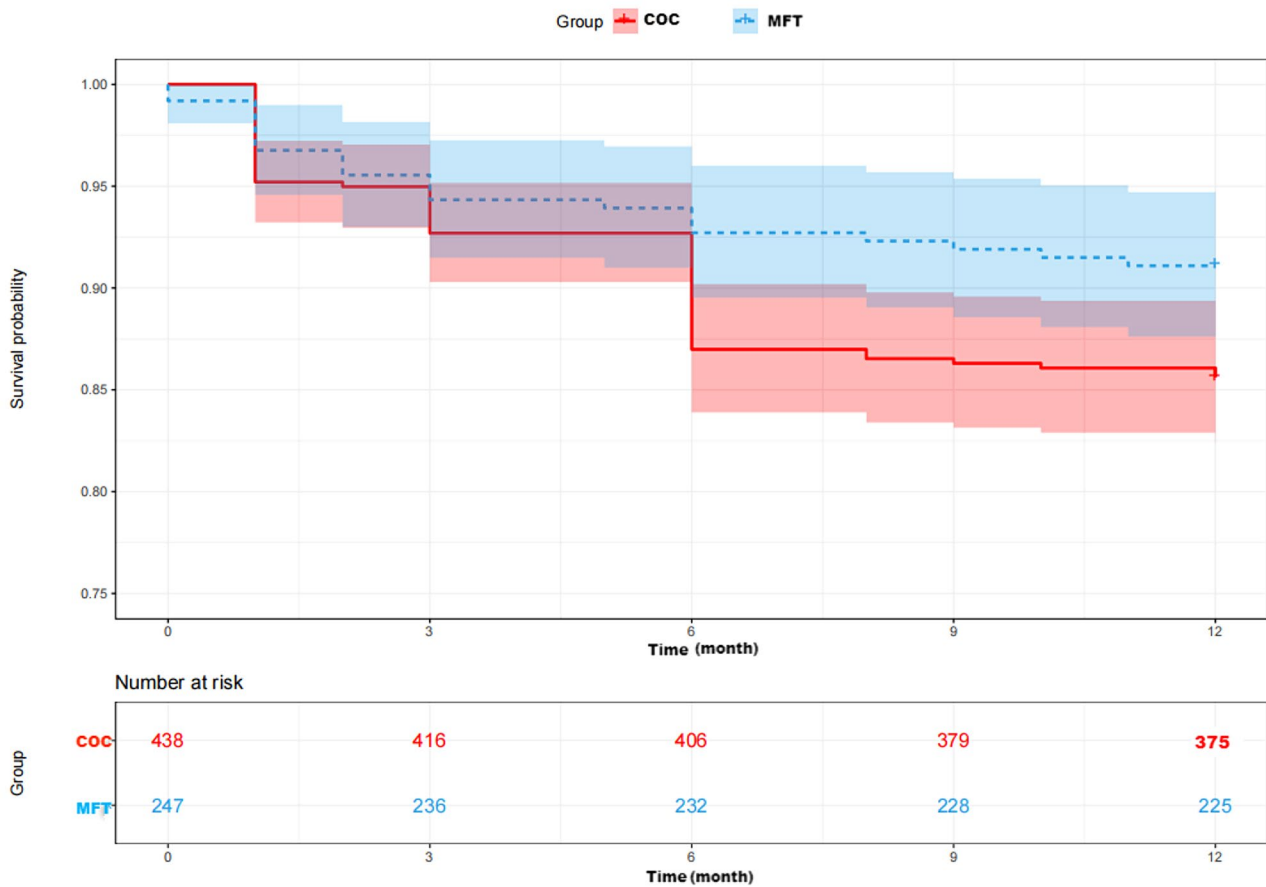
**Fig. 2** Kaplan-Meier curves of one-year survival among patients who received conventional orthopedic care or multidisciplinary fast-track (MFT) care. The shaded area indicates the 95% confidence interval around the corresponding curve

other patients to benefit from MFT care. This possibility should be explored in future work.

The present study focused on patients at least 80 years old, and its findings echo previous work on the benefits of MFT care for hip fracture patients at least 65 years old. In contrast to younger patients, our patients at least 80 years old were more likely to have life-threatening comorbidities or to suffer postoperative complications. One study has suggested that the risk of postoperative death among older people with hip fracture increases by 6% with every year of aging [23]. The similarities between patients below and above 80 years is interesting given that susceptibility to traumatic stress, time needed to recover from surgery, and overall risk of mortality increase strongly with age [34], while organ function and resilience decline [18, 35–37].

Our findings should be interpreted with caution given several limitations. First, the retrospective nature of the study prevented us from assessing the potential influence of events before admission or after discharge on postoperative mortality. In addition, nearly 90% of study participants had a Charlson cormobidity index of 0 or 1,

so our results may not be generalizable to frailer patient populations. These low indices may underestimate actual comorbidity in our sample because certain conditions may not have been recorded appropriately. Third, we considered MFT care as a "whole" in our study without attempting to identify the influence of specific measures or practices on mortality. Given the lack of standardization about MFT care around the world, future work should examine particular MFT components that may be more effective at improving prognosis. Our results should be verified in larger, multi-center studies.

## Conclusions
MFT perioperative care can improve survival among hip fracture patients at least 80 years old. If these findings can be verified in larger studies, they argue for continuing research into MFT protocols for older people undergoing hip fracture surgery and for expanding such research to other types of orthopedic surgery.

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**Table 3** Comparison of clinicodemographic factors between study participants who died or not within one year after surgery, and bivariate regression to identify factors associated with mortality

| Factor | Patient outcome | | P | Bivariate regression | |
|---|---|---|---|---|---|
| | Survival (n=600) | Death (n=85) | | HR | 95% CI |
| Age (years) | 85 (83–89) | 85 (83–91) | 0.02 | 1.055 | 1.008–1.103 |
| Sex | | | 0.01 | 0.557 | 0.357–0.869 |
|   Female | 463 (77.2) | 30 (35.3) | | | |
|   Male | 137 (22.8) | 55 (64.7) | | | |
| Body mass index (kg/m$^2$) | 20.13 (17.8–22.2) | 19.79 (13.5–29.6) | 0.201 | 0.961 | 0.903–1.022 |
| ASA grade | | | < 0.001 | 6.558 | 4.412–10.384 |
|   II | 167 (27.8) | 9 (10.6) | | | |
|   III | 426 (71.0) | 54 (63.5) | | | |
|   IV | 7 (1.2) | 4 (25.9) | | | |
| Hemoglobin (g/L) | 107 (92–120) | 96 (80–111) | < 0.001 | 0.975 | 0.964–0.987 |
| Albumin (g/L) | 33.9 (31.4–36.2) | 31.8 (29.1–34.7) | < 0.001 | 0.886 | 0.840–0.935 |
| Creatine (μmol/L) | 61 (50–78) | 64 (53-90.5) | 0.008 | 1.006 | 1.002–1.010 |
| Pneumonia | | | 0.028 | 1.621 | 1.053–2.498 |
|   No | 421 (70.2) | 50 (58.8) | | | |
|   Yes | 179 (29.8) | 35 (41.2) | | | |
| Heart failure | | | 0.043 | 3.288 | 1.038–10.409 |
|   No | 594 (99) | 82 (96.5) | | | |
|   Yes | 6 [1] | 3 (3.5) | | | |
| Deep vein thrombosis or pulmonary embolism | | | 0.26 | 1.939 | 0.613–6.137 |
|   No | 589 (98.2) | 82 (96.5) | | | |
|   Yes | 11 (1.8) | 3 (3.5) | | | |
| Malignant tumor | | | 0.28 | 1.532 | 0.707–3.319 |
|   No | 567 (94.5) | 78 (91.8) | | | |
|   Yes | 33 (5.5) | 7 (8.2) | | | |
| Charlson comorbidity index | | | 0.133 | 1.209 | 0.944–1.549 |
|   0 | 395 (65.8) | 52 (61.2) | | | |
|   1 | 139 (23.2) | 22 (25.9) | | | |
|   2 | 51 (8.5) | 7 (8.2) | | | |
|   3 | 11 (1.8) | 2 (2.4) | | | |
|   4 | 2 (0.3) | 1 (1.2) | | | |
|   5 | 0 (0) | 1 (1.2) | | | |
| Type of fracture | | | 0.259 | 0.783 | 0.511-0.1.198 |
|   Femoral neck | 347 (57.8) | 44 (51.8) | | | |
| Trochanteric | 253 (42.2) | 41 (48.2) | | | |
| Type of surgery | | | 0.078 | 0.444 | 0.180–1.096 |
|   Replacement | 522 (87) | 80 (94.1) | | | |
|   Fixation | 78 [12] | 5 (5.9) | | | |
| Type of anesthesia | | | 0.56 | 1.084 | 0.826–1.423 |
|   General | 401 (66.8) | 53 (62.4) | | | |
|   Regional | 102 [16] | 18 (21.2) | | | |
|   Combined | 97 (16.2) | 14 (16.5) | | | |
| Duration of surgery (h) | 1.9 (1.6–2.4) | 2.3 (1.8–2.7) | 0.005 | 1.553 | 1.145–2.104 |
| Intraoperative blood loss (mL) | 100 (50–200) | 100(50–200) | 0.814 | 1 | 0.998–1.002 |
| Perioperative care | | | 0.048 | 0.612 | 0.377–0.995 |
|   Conventional | 375 (62.5) | 63 (74.2) | | | |
|   MFT | 225 (37.5) | 22 (25.9) | | | |

Data are n (%) or median (interquartile range), unless otherwise noted

ASA, American Society of Anesthesiologists; CI, confidence interval; HR, hazard ratio; MFT, multidisciplinary fast-track

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**Table 4** Multivariate Cox regression to identify factors independently associated with one-year all-cause mortality

| Factor | β value | Standard error | Wald chi-squared | P | HR | 95% CI |
|---|---|---|---|---|---|---|
| Perioperative care | | | | | | |
| Conventional | Reference | | | | | |
| MFT | -0.754 | 0.263 | 8.216 | 0.004 | 0.47 | 0.281–0.788 |
| Age | 0.034 | 0.024 | 2.034 | 0.154 | 1.035 | 0.987–1.085 |
| Sex | | | | | | |
| Male | Reference | | | | | |
| Female | -0.474 | 0.235 | 4.059 | 0.044 | 0.623 | 0.393–0.987 |
| ASA grade | 1.831 | 0.274 | 44.788 | <0.001 | 6.238 | 3.649–10.664 |
| Hemoglobin | -0.015 | 0.006 | 6.044 | 0.014 | 0.985 | 0.973–0.997 |
| Albumin | -0.041 | 0.03 | 1.841 | 0.175 | 0.96 | 0.905–1.018 |
| Pneumonia | 0.135 | 0.231 | 0.34 | 0.56 | 1.144 | 0.728–1.798 |
| Charlson comorbidity index | 0.116 | 0.134 | 0.753 | 0.385 | 1.123 | 0.864–1.461 |
| Type of anesthesia | 0.08 | 0.142 | 0.313 | 0.576 | 1.083 | 0.819–1.431 |
| Duration of surgery | 0.195 | 0.165 | 1.404 | 0.236 | 1.216 | 0.880–1.679 |

ASA, American Society of Anesthesiologists; CI, confidence interval; HR, hazard ratio; MFT, multidisciplinary fast-track

**Table 5** Bivariate and multivariate analysis to verify associations of MFT care with one-year all-cause mortality in different patient subgroups

| Stratifying variable | Bivariate analysis | | | Multivariate analysis | | |
|---|---|---|---|---|---|---|
| | Unadjusted HR | 95% CI | P | Adjusted HR | 95% CI | P |
| Sex | | | | | | |
| Male | 0.612 | 0.377–0.995 | 0.048 | 0.483 | 0.291–0.801 | 0.005 |
| Female | 0.44 | 0.227–0.852 | 0.015 | 0.409 | 0.208–0.803 | 0.009 |
| Anemia | | | | | | |
| Yes | 0.651 | 0.394–1.073 | 0.092 | 0.453 | 0.268–0.767 | 0.003 |
| No | 0.284 | 0.034–3.361 | 0.244 | 0.371 | 0.040–3.430 | 0.382 |
| American Society of Anesthesiologists grade | | | | | | |
| II | 0.021 | 0–5.199 | 0.17 | 0 | - | 0.961 |
| III | 0.204 | 0.081–0.512 | 0.001 | 0.202 | 0.080–0.510 | 0.001 |
| IV | 1.407 | 0.519–3.819 | 0.502 | 1.545 | 0.433–5.504 | 0.503 |

CI, confidence interval; HR, hazard ratio

**Abbreviations**
ASA　　American Society of Anesthesiologists
CCI　　Charlson comorbidity index
CI　　Confidence interval
COC　　Conventional orthopedic care
HR　　Hazard ratio
MFT　　Multidisciplinary fast-track

**Declarations**

**Ethics approval and consent to participate**
All analyses of human data conducted in this study were approved by the Ethics Committee of the Second Affiliated Hospital of Zhejiang University School of Medicine. We use the medical record data of our medical unit to conduct retrospective research that does not involve personal privacy and commercial interests.The basic information and data used in the study come from previous hospitalized patients in our hospital, and the informed consent of the subjects could not be obtained objectively. The Ethics Committee of the Second Affiliated Hospital of Zhejiang University School of Medicine agreed to exempt informed consent (Approval number: I2019001002).

**Competing interests**
The authors declare no competing interests.

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