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ORIGINAL RESEARCH

Orthogeriatric Co-Management Improves Early Outcomes in Hip Fractures: A Post-Hoc Analysis of a Prospective Study

Feng Gao[1,*], Zongrui Wang[1,*], Yimin Chen[1–3,*], Mingjian Bei[1–3], Gang Liu[1–3], Minghui Yang[1–3], Xinbao Wu[1–3]

[1]Department of Orthopaedics and Traumatology, Peking University Fourth School of Clinical Medicine, Beijing, People's Republic of China; [2]Department of Orthopaedics and Traumatology, Beijing Jishuitan Hospital, Capital Medical University, Beijing, People's Republic of China; [3]Department of Orthopaedics and Traumatology, National Center for Orthopaedics, Beijing, People's Republic of China

*These authors contributed equally to this work

Correspondence: Minghui Yang; Xinbao Wu, Department of Orthopaedics and Traumatology, Peking University Fourth School of Clinical Medicine, Beijing, People's Republic of China, Email doctyang0125@126.com; wuxinbao_jst@126.com

Purpose: To assess the effect of orthogeriatric co-management care on the geriatric hip fracture patients with high ASA score.
Patients and Methods: A post-hoc analysis of a prospective multicenter study was done. Patients with an ASA score of 3 or 4 were selected from the database for analysis. Patients were divided into the orthogeriatric co-management group (CM group) and traditional consultation mode group (TC group) depending on the management mode. With mortality as the primary outcome, multivariate regression analyses were performed to adjust for confounders. Mobility and quality of life were compared between groups.
Results: A total of 628 patients were included, 593 of whom completed follow-up (388 in CM group, 205 in TC group). The in-hospital mortality, 30-day mortality, 120-day mortality in CM group were significantly lower than those in TC group after adjustment ($P < 0.05$). The difference of 1-year mortality in the two groups was not statistically significant after adjustment ($P > 0.05$). The surgical intervention rate, the early surgery rate, preoperative waiting time, hospital length of stay (LOS), 30-day mobility, 30-day EuroQol-5 Dimensions (EQ-5D) index, 30-day EuroQol-Visual Analog Scale (EQ-VAS), 120-day EQ-5D index, the total incidence of clinical adverse events, as well as deep vein thrombosis (DVT) and cardiac complication between the two groups were statistically significantly different after adjustment ($P < 0.05$). The difference of 120-day mobility was not statistically significant after adjustment ($P < 0.05$). There was no significant difference in the in-hospital total cost, the incidence of other clinical adverse events, 120-day EQ-VAS, 1-year reoperation rate, 1-year mobility, 1-year EQ-5D index, 1-year EQ-VAS between the two groups ($P > 0.05$).
Conclusion: Compared with the traditional consultation mode, orthogeriatric co-management care significantly reduced early mortality and enhanced early mobility and quality of life in geriatric hip fracture patients with high ASA score.
Keywords: geriatric hip fractures, orthogeriatric, ASA, mortality, mobility, quality of life

Introduction

With the increasing aging of the population, the number of geriatric hip fracture patients is increasing globally.[1,2] The treatment of geriatric hip fracture is primarily early surgical intervention, with non-operative treatment being recommended by clinicians only in cases where the patient is unable to tolerate anesthesia and surgery.[3–10] It should be noted that non-operative treatment is associated with a higher mortality rate for geriatric hip fracture patients.[11,12]

Comorbidity indices seek to reduce a person's diseases and their severity to a score that allows comparison with other people. Given the existence of different methods for assessing comorbidity, four indices have been used for assessing comorbidity in elderly patients: the Charlson Comorbidity Index (CCI)[13–15] -the most used, the Cumulative Illness Rating Scale for Geriatrics (CIRS-G),[16] the Index of Co-Existent Disease (ICED)[17] and the American Society of

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Anesthesiologists Physical Status Classification System (ASA)[18] -whose application is practically universal in surgical services around the world.

Geriatric hip fracture patients often present with multiple comorbidities and inherently have a higher ASA score. Furthermore, acute hip fractures deal a significant blow to the elderly, leaving them bedridden and enduring severe pain, which can precipitously worsen their overall physical condition, and on occasion, it may even elevate their ASA score.[19,20]

Previous studies have emphasized the significance of ASA score in predicting the prognosis of geriatric hip fracture patients. Elevated ASA score is linked to increased postoperative mortality, postoperative complications, extended hospital stays, and overall costs,[21–29] particularly when the ASA score exceeds 3.[22,30–37] For orthopedic surgeons, managing geriatric hip fracture patients with high ASA score has always been a challenge.[24]

Orthogeriatric co-management care refers to the collaborative care of orthopedic and geriatric physicians in the daily diagnosis and treatment of geriatric trauma patients. Previous research has reported that orthogeriatric co-management care could significantly improve the prognosis of geriatric hip fracture patients,[38–43] but there is currently a lack of research focused on the subgroup with high ASA score. The purpose of this study is to assess the effect of orthogeriatric co-management care on the geriatric hip fracture patients with high ASA score.

Patients and Methods

Study Design

This study was a post-hoc analysis of a prospective, multicenter quasi-experimental study, designed to assess the efficacy of co-management care for geriatric hip fracture patients in China.[41] The original study enrolled hip fracture patients aged ≥65 years and were admitted to 6 hospitals in Beijing from November 2018 to November 2019. Among the participating hospitals, one had established a dedicated orthogeriatric unit, implementing an orthogeriatric co-management approach for the perioperative care of geriatric hip fracture patients. This hospital was designated as the orthogeriatric co-management care (CM) group. The remaining 5 hospitals continued with the traditional consultation mode and were designated as the traditional consultation mode(TC) group. For the purpose of this study, we focused on the subgroup of patients with ASA score of 3 or 4 from both groups, and then conducted a retrospective comparison to evaluate the effect of these two distinct care modes on patient outcomes.

The inclusion criteria: 1) Be 65 years or older; 2) Have a confirmed hip fracture (femoral neck, intertrochanteric, or subtrochanteric fracture) diagnosed by X-ray or CT scan; 3) Be admitted within 21 days from injury; 4) Have an ASA score of 3 or 4. The exclusion criteria: 1) Be diagnosed as neoplastic pathological fractures or peri-prosthesis fracture; 2) The ASA score was missing; 3) Have an ASA score of 1 or 2 or 5 or 6.

In this study, we excluded patients with ASA score of 1 and 2, as they were in relatively good overall health condition and did not align with the research objectives. And there were only 3 patients with an ASA score of 5 (moribund patient), which were also excluded to avoid confounder. There were no cases in this study with an ASA score of 6 (brain-dead patient). Therefore, patients with ASA score of 3 and 4 were screened in this study.

Intervention and Control

CM group: This group employed orthogeriatric co-management care. Upon admission, patients were directed to a dedicated orthogeriatric ward, co-managed by orthopedic and geriatric specialists. The mode emphasized early surgery (within 48 hours), comorbidity assessment, secondary fracture prevention, pressure sore avoidance, physical therapy, and expedited discharge. Geriatricians focused on comorbidity assessment and management, and secondary fracture prevention. Orthopedic surgeons handled surgical preparation and execution. Physical therapists and nutrition specialists, along with nurses, were also integral to perioperative care. The rehabilitation plan was collaboratively decided by the orthopedic surgeons and the physical therapists. Throughout the study, all patients at this hospital received co-management care in the orthogeriatric ward.

TC group: This group followed the traditional orthopedic care mode. Patients were admitted to orthopedic wards managed by orthopedic surgeons. The rehabilitation plan was primarily decided by orthopedic surgeon. Geriatricians, physical therapists and nutrition specialists can be consulted when necessary.

Data Collection and Outcome

In the original study, trained nurses were responsible for patients' data collection at the baseline and follow-up. Recruited patients were followed up at three time points via telephone (30 days, 120 days, and 1 year post-admission). All data was established as a database. Patients with ASA score of 3 or 4 were selected from the database for analysis.

The primary outcome was mortality at in-hospital, 30-day, 120-day and 1-year. Secondary outcome variables encompassed surgical intervention rate, early surgery (within 48 hours) rate, preoperative waiting time, hospital length of stay (LOS), 1-year reoperation rate, in-hospital total cost, incidence of clinical adverse events (delirium, stroke, deep vein thrombosis (DVT), pneumonia, urinary tract infection, cardiac complications, and pressure ulcers), the mobility and quality of life at 30-day, 120-day and 1-year post-admission.

The EuroQol-5 Dimensions (EQ-5D) Questionnaire was employed to evaluate patients' health-related quality of life (HRQoL). This tool systematically assesses HRQoL across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is rated on a five-point scale, ranging from "no problems" to "unable to do/extreme problems". The health status of these dimensions is quantified into an EQ-5D index value using a standardized scoring algorithm. Furthermore, the questionnaire included a 20-cm visual analog scale (VAS), enabling participants to self-assess their health status from 0 to 100 points (the worst to the best).

Statistical Analysis

Means with standard deviation (SD) or median with interquartile range (IQR) or proportion were used to describe patients' data. Student's *t*-test or Mann–Whitney *U*-test were adopted to test for continuous variables, while Chi-square test was adopted to test for categorical variables. Multiple logistic or linear regression was performed to adjust for confounders. Multivariate analysis included clinically meaningful variables (age, whether co-management care, ASA score) and statistically significant variables (living place, pre-fracture mobility, fracture type). Both the binary logistic regression and linear regression analyses were performed using the enter method. The multinomial logistic regression was fitted using a main effects model. Odds Ratios (OR), regression coefficient (b) and 95% confidence interval (95% CI) were calculated. Statistical analysis was performed using the IBM SPSS Statistical Package (version 25) (SPSS Inc., Chicago, IL, USA). All statistical significance was established at $P < 0.05$.

Results

A total of 628 geriatric hip fracture patients with an ASA score of 3 or 4 were recruited in this study, with 414 and 214 patients in the CM and TC groups, respectively. With 35 cases lost to follow-up, the mean follow-up rate was 94.43%, and there was no statistically significant difference between the two groups in follow-up rate ($P = 0.283$). The research flow chart is shown in Figure 1. The data of patients with complete follow-up were analyzed.

The average age is 81.54 ± 7.30 years old. There was statistically significant difference in living place ($P < 0.001$), pre-fracture mobility ($P < 0.001$) and fracture type ($P = 0.046$). The baseline characteristics and the comparison between the two groups are presented in Table 1.

The in-hospital mortality (0.26% vs 4.39%, $P = 0.001$), 30-day mortality (2.06% vs 7.80%, $P = 0.001$), 120-day mortality (5.41% vs 12.20%, $P = 0.003$) in CM group were significantly lower than those in TC group. After adjustment, there was still statistically significant difference between the two groups ($P = 0.015$, 0.008, 0.017). The 1-year mortality (10.05% vs 17.56%) in the two groups were also statistically significantly different ($P = 0.009$), but the difference was not statistically significant after adjustment ($P = 0.065$) (Table 2).

The surgical intervention rate (98.45% vs 82.44%, $P < 0.001$), the early surgery rate (73.82% vs 21.30%, $P < 0.001$), preoperative waiting time (28 (13.75, 49) h vs 110 (59.5, 162.5) h, $P < 0.001$), hospital LOS (6.54 ± 4.08d vs 14.41 ± 8.12d, $P < 0.001$), 30-day mobility (independent: walking aid: non-ambulant 5.53%: 77.37%: 17.11% vs 2.65%: 49.74%: 47.62%, $P < 0.001$), 30-day EQ-5D index (0.57 ± 0.26 vs 0.38 ± 0.29, $P < 0.001$), 30-day EQ-VAS (70.14 ± 14.62 vs

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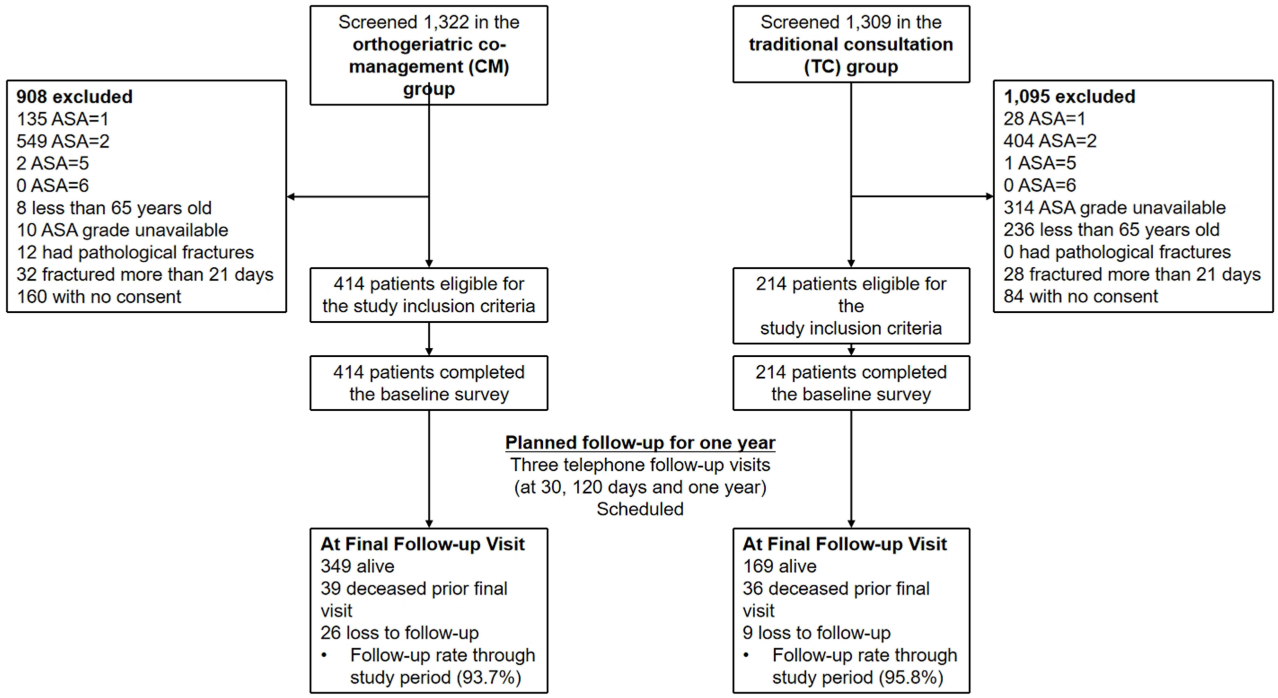

Figure 1 Research flow chart.

62.20 ± 17.26), $P < 0.001$, 120-day EQ-5D index (0.74 ± 0.27 vs 0.64 ± 0.27, $P < 0.001$), the total incidence of clinical adverse events (12.40% vs 20.41%, $P = 0.011$), as well as DVT (2.06% vs 6.12%, $P = 0.011$) and cardiac complication (3.09% vs 10.10%, $P < 0.001$) between the two groups were statistically significantly different. And the difference was still statistically significant after adjustment ($P < 0.05$). The 120-day mobility (independent: walking aid: non-ambulant

Table 1 Comparison of Baseline Characteristics

	Total (N = 593)	CM Group (N = 388)	TC Group (N = 205)	Statistics	*P* Value
Age/years, mean ± SD	81.54 ± 7.30	81.16 ± 7.50	82.25 ± 6.86	−1.743	0.082#
Gender, n (%)				0.235	0.615Δ
Male	166(27.99)	106(27.32)	60(29.27)		
Female	427(72.01)	282(72.68)	145(70.73)		
Smoking history, n (%)	119(20.07)	76(19.59)	43(20.98)	0.161	0.688Δ
Alcohol drinking, n (%)	38(6.41)	24(6.19)	14(6.83)	0.093	0.761Δ
Living place, n (%)				42.505	<0.001Δ
Urban area	497(83.81)	353(90.98)	144(70.24)		
Rural area	96(16.19)	35(9.02)	61(29.76)		
Pre-fracture mobility, n (%)				23.577	<0.001□
Independent	330(55.65)	243(62.63)	87(42.44)		
Walking aid	244(41.15)	132(34.02)	112(54.63)		
Non-ambulant	19(3.20)	13(3.35)	6(2.93)		
Fracture type, n (%)				6.053	0.046□
FNF	282(47.55)	197(50.77)	85(41.46)		
ITF	301(50.76)	183(47.16)	118(57.56)		
STF	10(1.69)	8(2.06)	2(0.98)		
ASA score, n (%)				1.622	0.203Δ
3	562(94.77)	371(95.62)	191(93.17)		
4	31(5.23)	17(4.38)	14(6.83)		

(*Continued*)

Table 1 (Continued).

	Total (N = 593)	CM Group (N = 388)	TC Group (N = 205)	Statistics	*P* Value
Hypertension, n (%)	371(62.56)	247(63.66)	124(60.49)	0.576	0.448$^{\Delta}$
Diabetes mellitus, n (%)	209(35.24)	135(34.79)	74(36.10)	0.100	0.752$^{\Delta}$
Coronary heart disease, n (%)	171(28.84)	115(29.64)	56(27.32)	0.352	0.553$^{\Delta}$
Dementia, n (%)	44(7.42)	33(8.51)	11(5.37)	1.924	0.165$^{\Delta}$
Surgery type, n (%)*				6.892	0.057$^{\square}$
Dynamic hip screw fixation	2(0.4)	1(0.3)	1(0.6)		
Cannulated screw fixation	49(8.9)	40(10.5)	9(5.3)		
Intramedullary nail fixation	293(53.2)	192(50.3)	101(59.8)		
Hip arthroplasty	207(37.6)	149(39.0)	58(34.3)		
Anesthesia type, n (%)*				1.960	0.162$^{\Delta}$
General anesthesia	31(5.6)	18(4.7)	13(7.7)		
Neuraxial anesthesia	520(94.4)	364(95.3)	156(92.3)		

Note: * Only includes patients who have undergone surgical treatment; # Student's *t*-test; $^{\Delta}$ Chi-square test; $^{\square}$ Fisher's exact test.
Abbreviations: TC, traditional consultation mode; CM, orthogeriatric co-management; FNF, femoral neck fracture; ITF, intertrochanteric fracture; STF, subtrochanteric fracture; ASA, American Society of Anesthesiologists; SD, standard deviation.

Table 2 Comparison of Major Outcome Variables

	Total (N = 593)	CM Group (N = 388)	TC Group (N = 205)	Statistics	*P* Value	OR/b	95% CI/T	Adjusted *P* value*
In-hospital mortality, n (%)	10(1.69)	1(0.26)	9(4.39)	11.436	0.001 □	0.070	0.008~0.597	0.015 ◊
30-day mortality, n (%)	24(4.05)	8(2.06)	16(7.80)	11.392	0.001 Δ	0.282	0.111~0.718	0.008 ◊
120-day mortality, n (%)	46(7.76)	21(5.41)	25(12.20)	8.624	0.003 Δ	0.444	0.227~0.867	0.017 ◊
1-year mortality, n (%)	75(12.65)	39(10.05)	36(17. 56)	6.846	0.009 Δ	0.604	0.354~1.031	0.065 ◊
Surgical intervention, n (%)	551(92.92)	382(98.45)	169(82.44)	52.272	<0.001 Δ	18.918	7.055~50.728	<0.001◊
Early surgery, n (%)	318(57.71)	282(73.82)	36(21.30)	132.425	<0.001 Δ	11.027	6.901~17.620	<0.001 ◊
Preoperative waiting time/ hours, median (IQR)	45(23, 74)	28(13.75, 49)	110(59.5, 162.5)	−13.867	<0.001	−84.757	−15.398	<0.001‡
Hospital LOS/ days, mean ± SD	9.26 ± 6.90	6.54 ± 4.08	14.41 ± 8.12	−13.037	<0.001#	−8.108	−15.439	<0.001‡
1-year reoperation, n (%)	11(1.85)	7(1.80)	4(1.95)	0.000	1.000 □	0.645	0.177~2.359	0.508 ◊
Total clinical adverse events, n (%)	88(15.09)	48(12.40)	40(20.41)	6.505	0.011 Δ	0.588	0.359~0.964	0.035 ◊
Stroke, n (%)	2(0.34)	1(0.26)	1(0.51)	Fisher	1.000 □	0.747	0.034~16.360	0.853 ◊
DVT, n (%)	20(3.43)	8(2.06)	12(6.12)	6.459	0.011 Δ	0.238	0.088~0.642	0.005 ◊
Pneumonia, n (%)	28(4.77)	18(4.64)	10(5.03)	0.043	0.835 Δ	1.074	0.460~2.510	0.869 ◊
Urinary tract infection, n (%)	3(0.51)	1(0.26)	2(1.02)	0.363	0.547 Δ	0.356	0.028~4.511	0.426 ◊
Cardiac complication, n (%)	32(5.46)	12(3.09)	20(10.10)	12.472	<0.001 Δ	0.303	0.139~0.662	0.003 ◊
Pressure sores, n (%)	19(3.20)	14(3.61)	5(2.44)	0.591	0.442 Δ	1.769	0.578~5.415	0.318 ◊
In-hospital total cost/thousand yuan, mean ± SD	57.04 ± 23.21	56.54 ± 20.63	57.99 ± 27.46	−0.666	0.506 #	−1.195	−0.577	0.564 ◊

Note: * Multivariate analysis included age, living place, pre-fracture mobility, fracture type, ASA score, and whether co-management care; # Student's *t*-test; Mann–Whitney *U*-test; Δ Chi-square test; □ Fisher's exact test; ◊ binary logistic regression; ‡ linear regression analyses.
Abbreviations: TC, traditional consultation mode; CM, orthogeriatric co-management; LOS, length of stay; DVT, deep vein thrombosis; OR, odds ratio; 95% CI, 95% confidence interval; IQR, interquartile range; SD, standard deviation.

20.71%: 69.48%: 9.81% vs 10.56%: 75.56%: 13.89%, *P* = 0.008) between the two groups was also statistically significantly different, but the difference was not statistically significant after adjustment (*P* = 0.138 and 0.538). There was no significant difference in the in-hospital total cost (*P* = 0.564), the incidence of other clinical adverse events (*P* > 0.05), 120-day EQ-VAS (*P* = 0.767), 1-year reoperation rate (*P* = 0.508), 1-year mobility (*P* = 0.178 and 0.292), 1-year EQ-5D index (*P* = 0.354), 1-year EQ-VAS (*P* = 0.063) between the two groups. Detailed data are shown in Table 2 and 3.

Discussion

Previous studies have explored the effect of orthogeriatric co-management on the general geriatric hip fracture population,[41] and therefore, this study aims to delve deeper into the effect of orthogeriatric co-management on these

Table 3 Comparison of Mobility and QoL of Survived Patients at Follow-Up

	Total	CM Group	TC Group	Statistics	*P* Value	OR/b	95% CI	Adjusted *P* value*
30-day mobility, n (%)				59.569	<0.001 □			
Independent	26(4.57)	21(5.53)	5(2.65)			0.196	0.066~0.584	0.003 †
Walking aid	388(68.19)	294(77.37)	94(49.74)			0.249	0.161~0.383	<0.001 †
Non-ambulant	155(27.24)	65(17.11)	90(47.62)			Ref	Ref	Ref †
120-day mobility, n (%)				9.594	0.008 □			
Independent	95(17.37)	76(20.71)	19(10.56)			0.552	0.252~1.210	0.138 †
Walking aid	391(71.48)	255(69.48)	136(75.56)			0.827	0.452~1.514	0.538 †
Non-ambulant	61(11.15)	36(9.81)	25(13.89)			Ref	Ref	Ref †
1-year mobility, n (%)				1.427	0.490 □			
Independent	184(35.52)	129(36.96)	55(32.54)			1.692	0.787~3.641	0.178 †
Walking aid	284(54.83)	185(53.01)	99(58.58)			1.468	0.719~2.993	0.292 †
Non-ambulant	50(9.65)	35(10.03)	15(8.88)			Ref	Ref	Ref †
EQ-5D index, mean ± SD								
30-day	0.51 ± 0.29	0.57 ± 0.26	0.38 ± 0.29	7.240	<0.001 #	0.166	6.686	<0.001 ‡
120-day	0.71 ± 0.27	0.74 ± 0.27	0.64 ± 0.27	3.979	<0.001 #	0.076	3.028	0.003 ‡
1-year	0.75 ± 0.28	0.75 ± 0.28	0.75 ± 0.29	0.027	0.978 #	−0.025	−0.928	0.354 ‡
EQ-VAS, mean ± SD								
30-day	67.46 ± 15.99	70.14 ± 14.62	62.20 ± 17.26	5.387	<0.001 #	6.782	4.679	<0.001 ‡
120-day	73.61 ± 13.97	73.90 ± 12.89	73.04 ± 15.92	0.621	0.535 #	−0.391	−0.297	0.767 ‡
1-year	74.01 ± 17.83	73.20 ± 17.51	75.69 ± 18.41	−1.492	0.136 #	−3.221	−1.860	0.063 ‡

Note:* Multivariate analysis included age, living place, pre-fracture mobility, fracture type, ASA score, and whether co-management care; # Student's *t*-test; □ Fisher's exact test; ‡ linear regression analyses; † multinomial logistic regression.

Abbreviations: TC, traditional consultation mode; CM, orthogeriatric co-management; QoL, quality of life; EQ-5D, EuroQol- 5 Dimensions; EQ-VAS, EuroQol-Visual Analog Scale; OR, odds ratio; 95% CI, 95% confidence interval; SD, standard deviation.

patients with bad overall health condition. Given the constraints imposed by the available dataset, we were unable to secure a more objective metric, such as CCI,[14,15] to assess the overall health status of the patients. Based on extensive international studies on ASA and geriatric hip fractures,[26,29,44] which has showed that an ASA score ≥3 is a significant predictor of poor prognosis in geriatric hip fractures, we opted to employ the ASA score as a proxy, while acknowledging its inherent subjectivity in clinical practice.

In terms of the primary outcome, the results of this study suggest the orthogeriatric co-management care significantly reduces in-hospital, 30-day, and 120-day mortality rates among geriatric hip fracture patients with high ASA score, compared with the traditional consultation mode. This is consistent with the findings of other geriatric hip fracture patient groups in other studies.[45,46] The reason is closely associated with geriatricians' more meticulous and timely comorbidity management for elderly hip fracture patients with high ASA score. Geriatricians played an integral role in the management of elderly hip fracture patients, achieving a significant reduction in preoperative waiting time, and an increase in both the early surgery rate and the total surgical intervention rate, which are significantly associated with the prognosis of the elderly hip fracture patients.[5–10] This also suggests that for geriatric hip fracture patients with high ASA, early surgery after detailed preoperative assessment and management does not increase the risk of death, thereby confirming the significance of early surgical intervention for this patient cohort. Furthermore, the management of geriatrics is also effectively realized a marked reduction in perioperative overall adverse events incidence including DVT and cardiac complications, which may also be associated with reduced early mortality under orthogeriatric co-management care. The study by G Kastanis et al [24] noted that the treatment of geriatric hip fracture patients with high ASA score requires a multidisciplinary approach and special evaluation to reduce mortality and provide optimal function, and this study confirms this conclusion. This study showed no significant difference in 1-year mortality between the two groups, which is not consistent with some previous studies in other populations of elderly hip fracture patients.[37,47,48] The reason for the difference may be that our study only included patients with higher ASA score, which have higher natural mortality and shorter natural life span, and these studies included a general population of geriatric hip fracture patients.[37,47,48]

This study demonstrated significant improvements in 30-day mobility among geriatric hip fracture patients under orthogeriatric co-management care, which is also better than the results of previous study,[49] likely due to higher rates of early and overall surgery, more meticulous comorbidity management, better prevention of perioperative adverse events, and more timely rehabilitation guidance. While patients under this care mode also showed higher mobility at 120 days, the difference was not statistically significant after adjustment, and there was no significant difference in mobility between the two groups at 1 year, which is consistent with the expected natural recovery trajectory following geriatric hip fractures. Both the fracture and mobility typically recover by 1 year. In this study, 9.3% of elderly hip fracture patients were non-ambulant at the one-year mark, which is essentially consistent with the 13.3% reported in previous study.[50] Due to the lack of data on pre-injury mobility, it is difficult to determine whether the patients' mobility has returned to pre-injury levels, which depends on future research.

The orthogeriatric co-management care in this study led to significant improvements in the 30-day and 120-day quality of life for surviving patients. Research by Amarilla-Donoso FJ et al demonstrated that the geriatric hip fracture patients of traditional orthopedic ward could achieve an EQ-5D index of 0.16 ± 0.20, and an EQ-VAS of 48.3 ± 17.2 at 1 month after surgery,[49] worse than the results in this study. This enhancement is likely attributed to the meticulous management of comorbidities and the effective prevention of perioperative adverse events in orthogeriatric co-management care. Similar to mobility, the quality of life at the 1-year mark showed a tendency towards consistency between the two groups, which may be also associated with the complete healing of the hip fracture.

In this study, the 1-year reoperation rate of 1.85% was notably lower than the rates reported in previous research, which ranged from 7% to 13%.[51–55] This reduction may be attributed to the lower need in the elderly with multiple comorbidities, coupled with their increased vulnerability to surgical risks, thus making them more inclined to evade a second surgery. The LOS in this study was shorter under orthogeriatric co-management care, which was in line with previous studies.[39,42] This suggests that the orthogeriatric co-management care, which advocates for early discharge, can effectively enhance the utilization of medical resources. It is important to note that the orthogeriatric co-management care does not impose an additional financial burden on the patients in this study, which is consistent with the results of previous studies.[56]

This study represents a pioneering effort as the first multicenter, prospective, and controlled study to meticulously assess the efficacy of orthogeriatric co-management care specifically for elderly hip fracture patients who have an ASA score of 3 or 4. The findings are poised to furnish guidance for the management of these geriatric hip fracture, while also providing pivotal evidence for the advancement of orthogeriatric co-management care in China. Despite the methodological rigor employed in this study, including the use of multivariate analysis to mitigate confounding biases, several limitations warrant acknowledgment: (1) The ASA score, being somewhat subjective, may introduce biases in patient assessment; (2) The study design is prospective but not randomized; (3) The composition of the study groups, with the CM group encompassing a single hospital and TC group comprising five hospitals of different calibers, introduces potential center-effect biases; (4) Fewer patients were included in the post hoc analysis, which may reduce statistical power, especially for outcomes with low incidence; (5) The outcome assessment was conducted by telephone, which may not be reliable and may introduce bias; (6) There may be some factors in the overall management of patients that cannot be quantified, such as surgical and anesthesia techniques, surgeon's surgical details, surgical instruments, anesthesia drugs, development and implementation of the rehabilitation protocols, etc., which may lead to bias. It is imperative that the conclusions drawn from this study need to be corroborated through additional large-scale, multicenter, controlled trials with more objective metric to assess the overall health status and more detailed follow-up. It should be emphasized the quest for the optimal management paradigm is still ongoing, necessitating further exploration and improvement.

Conclusion

Compared with the traditional consultation mode, orthogeriatric co-management care significantly reduced early mortality and enhanced early mobility and quality of life in geriatric hip fracture patients with high ASA score.

Abbreviations

TC, traditional consultation mode; CM, orthogeriatric co-management; FNF, femoral neck fracture; ITF, intertrochanteric fracture; STF, subtrochanteric fracture; ASA, American Society of Anesthesiologists; LOS, length of stay; DVT, deep vein thrombosis; QoL, quality of life; EQ-5D, EuroQol-5 Dimensions; EQ-VAS, EuroQol-Visual Analog Scale; OR, odds ratio; 95% CI, 95% confidence interval; SD, standard deviation; IQR, interquartile range.

Data Sharing Statement

The datasets used in this study are not publicly available because of patient confidentiality but are available from the corresponding author on reasonable request.

Ethics Approval and Informed Consent

Approval was obtained from the Institutional Review Board at Peking University Health Science Centre (IRBo0001052-17021) and Biomedical Ethics Committee at 6 center Hospital: Beijing Jishuitan Hospital, Capital Medical University (201807-11); Beijing Hospital (2018BJYYEC-130-01); Beijing Anzhen Hospital, Capital Medical University (Relied on the approval from the lead center, thus no separate number was issued); Beijing Changping District Hospital (2018-GK-001-A); Beijing Fangshan District Liangxiang Hospital (201690); Beijing Changping District Hospital (Relied on the approval from the lead center, thus no separate number was issued). All procedures used adhere to the tenets of the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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