Effects of fast track co-management care model on perioperative neurocognitive disorders in older patients undergoing hip fracture surgery: a multicenter retrospective cohort study

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Effects of fast track co-management care model on perioperative neurocognitive disorders in older patients undergoing hip fracture surgery: a multicenter retrospective cohort study

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Abstract

Background: This paper attempts to compare the effect of a co-management care model with a traditional orthopedic model on perioperative neurocognitive disorders complications in elderly hip fracture patients.

Methods: In this study, elderly hip fracture patients attending six hospitals in Beijing from November 31, 2018 to November 31, 2020 were divided into co-management care model and traditional orthopedic model according to the intention-to-treat principle. Beijing Jishuitan Hospital implemented a fast track orthogeriatric co-management care model (OGC group), and five Beijing hospitals, including Beijing Anzhen Hospital, implemented a traditional orthopedic model (TOC group). The study used the Confusion Assessment Method (CAM) and a modified telephone interview method targeting patients' cognitive status to assess the incidence of delirium in elderly patients.

Results: A total of 2071 elderly hip surgery patients were included in the study, excluding 128 patients who received conservative treatment and 119 patients who were withdrawn from follow-up. Ultimately, 995 patients in the OGC group and 829 patients in the TOC group were included in the follow-up analysis. The incidence of perioperative neurocognitive disorders was significantly lower in the OGC group than in the TOC group (20.5% vs 69.5%, OR 0.59, 95% CI:0.53~0.65, P=0.000); the incidence of preoperative delirium was significantly lower in the OGC group than in the TOC group (10.5% vs 16.9%, OR 0.64, 95%

CI:0.47-0.70, P=0.000); the incidence of postoperative delirium was also lower in the OGC group than in the TOC group (19.1% vs. 22.6%, OR 0.67, 95% CI:0.58 ~ 0.77, =0.001). Our logistic multivariate analysis also showed that the rapid fast-track co-management care model may be a protective factor against the development of neurocognitive impairment in patients in the perioperative period.

Conclusion: The fast-track co-management care model can reduce the occurrence of perioperative neurocognitive disorders in elderly patients, which is worth being promoted in clinical treatment.

Key words: hip fracture, fast track, co-management care model, delirium, perioperative neurocognitive disorders.

1、Introduction

As the global aging process accelerates, there has been a significant increase in the number of elderly patients suffering from hip fractures[1]. Early surgical treatment is the treatment of choice for elderly hip fracture patients. However, the probability of delirium in the perioperative period remains high in elderly patients. Several studies have confirmed that the incidence of perioperative neurocognitive disorders in elderly patients ranges from 17.4% to 39%[2, 3]. Perioperative neurocognitive impairment in elderly patients undergoing hip fracture surgery is associated with longer hospital stays, increased hospital costs, and 1-year mortality[4]. Risk factors for perioperative neurocognitive disorders in elderly hip fracture patients include advanced age, preexisting dementia or cognitive impairment, functional dependence, depression, and stroke[5, 6]. In addition to these risk factors, perioperative anemia, electrolyte disturbances, severe pain stimulation, hypovolemia, and infection may also precipitate delirium in patients[7, 8].

In 2015, Beijing Jishuitan Hospital piloted and evaluated a joint hip fracture management program for the elderly involving orthopedic and geriatricians. The hospital also established a multidisciplinary collaborative team consisting of orthopedic surgeons, geriatricians, anesthesiologists, nutritionists, emergency physicians, ICU physicians and nurses. The co-management care program aims to reduce preoperative waiting time, postoperative complication rates and postoperative mortality in elderly hip fracture patients[9]. However, the

effectiveness of the co-management care model in reducing the incidence of perioperative neurocognitive disorders in elderly patients remains controversial. Pollmann et al.[10] and Van Heghe et al[11] showed that a co-management care model reduced the incidence of postoperative delirium in elderly hip fracture patients. Compared to the traditional orthopedic model, however, Lee at al[12] and Deschodt at al[13] concluded that the co-management model had no effect on the occurrence of perioperative neurocognitive disorders in elderly hip fracture patients.

We found that most of the comparative studies in the academy addressing the effects of OGC and TOC on postoperative delirium in elderly patients with hip fracture have been done at a single medical research center. To avoid bias in the objectivity of the sample provided by a single medical research center, we conducted a multicenter study to evaluate the effect of a co-management care model in elderly patients undergoing hip fracture surgery and to investigate the role of the co-management care model in reducing the incidence of perioperative neurocognitive disorders in elderly hip fracture patients.

2 Methods

(1) Study design and object

This is a multicenter, retrospective cohort study in which six medical centers including Beijing Jishuitan Hospital, Beijing Hospital, Beijing Anzhen Hospital, Beijing Changping District Hospital, Beijing Shunyi District Hospital, and Beijing Liangxiang Hospital were invited to participate in the study. The study was approved by the institutional review board of Peking University Health Science Centre(IRB00001052-17021) and the biomedical ethics committee of Beijing Jilin Hospital(201807-11), and was also registered on clinicaltrials.gov(NCT03184896). All study methods involved in the study were conducted in accordance with relevant guidelines and protocols.

The study subject consisted of patients who underwent hip surgery in six hospitals in Beijing from November 2018 to November 2020. The inclusion criteria were (1) age ≥65 years; (2) fracture time ≤21 days; (3) unilateral fracture; and (4) low-energy injury. The exclusion criteria were (1) lack of relevant clinical information; (2) old or pathological fracture; (3) high-energy injury; and (4) multiple trauma

(2) Interventions groups.

Fast track orthogeriatric co-management care model(OGC): First, upon admission, the patient's hip fracture was initially evaluated by an emergency orthopedic surgeon to determine whether the patient should receive surgical or conservative treatment. When the patient required surgery, he or she was immediately transferred to the emergency medical observation ward. Laboratory tests and physical examination of the patient were evaluated and determined by the orthopedic, emergency and geriatricians. Among them, laboratory tests included routine blood, liver function, kidney function, urine routine, cardiac enzyme profile, NT-proBNP, and CRP; physical examination included x-ray, electrocardiogram, echocardiogram, and deep vein ultrasound of lower extremities. All examinations were completed within 24 hours through the emergency green channel. After laboratory examination and physical examination, the elderly hip fracture patient was transferred to the geriatric joint care unit. The anesthesiologist evaluated the patient within 24 hours of admission and proposed a preoperative analgesic plan, vital sign adjustment goals and an anesthetic plan. The geriatrician individualized the treatment according to the anesthesiologist's requirements and the patient's own characteristics, including blood pressure regulation, blood sugar control, blood volume supplementation, and control of pulmonary infection. After the above processes were completed, the orthopedic surgeon, anesthesiologist, geriatrician and ICU physician discussed and studied the patient's postoperative results immediately online or offline. General geriatric hip fracture patients were transferred to the orthopedic co-management care ward after surgery, and critical patients were transferred to the ICU for observation after surgery. The ICU physicians administered blood transfusion, oxygen, anticoagulation, anti-infection and analgesia according to the preoperative, intraoperative and postoperative conditions of critical geriatric hip fracture patients. Patients transferred to the co-management ward were treated and checked by geriatricians according to their condition. Finally, orthopedic and rehabilitation physicians provided post-operative rehabilitation guidance to patients.

Traditional orthopedic care model (TOC): Elderly hip fracture patients were transferred directly from the emergency department or outpatient clinic to the orthopedic ward and were managed primarily by orthopedic surgeons during

their stay, but were also seen by internal medicine, anesthesiologists and ICU physicians.

There were two main differences between the TOC and OGC groups: first, the TOC group lacked a geriatrician involved in the full management; second, the preoperative assessment by the anesthesiologist in the OGC group was delayed until at least 1 day before surgery.

(3) Data collection

a. The study used the Confusion Assessment Method (CAM) and a modified telephone interview method targeting patients' cognitive status to assess the incidence of delirium in elderly patients. b, the incidence of postoperative complications such as pulmonary infection, urinary tract infection, cardiac arrhythmia, and cerebrovascular accident was recorded in both groups; c, the age, preoperative co-morbidities, education history, ASA classification, fracture type, anesthesia type, preoperative Montreal Cognitive Assessment (MoCA) score, preoperative waiting time, and length of hospital stay were recorded for both groups.

(4) Study outcomes

Primary outcome: the incidence of perioperative neurocognitive disorders was compared between the two groups of patients using CAM. The presence of perioperative neurocognitive disorders in elderly patients requires either characteristic 1 (acute change in mental status with a fluctuating course) and characteristic 2 (inattention), or characteristic 3 (confusion in thinking), or characteristic 4.

(5) Statistical analysis.

The sample frame for this study was 995 for the OCG group and 829 for the TOC group, with a detection rate of 95.490% and a difference ratio between groups of -0.075. The proportion for the OCG group (treatment group) was assumed to be 0.2930 under the null hypothesis and 0.2180 under the alternative hypothesis. The TOC group (control group) was 0.2930. The test statistic used was a two-sided Z-Test with unpooled variance.

SPSS 24.0 software was used for statistical analysis in this study. For continuous variables, the relevant data were expressed as mean ± standard deviation or median (interquartile variance). For categorical variables, the relevant data were expressed as numbers (percentages). We used

independent samples t-test or Mann-Whitney u-test for all sample data between groups; chi-square test was used for categorical variables. Univariate and multivariate analyses were applied respectively in the analysis of independent risk factors for perioperative neurocognitive disorders. Of these, all variables with $p < 0.05$ in the univariate model were included in the multivariate model. Logistics regression models were used for all patient survival analyses to compare outcomes between study groups and to identify predictors of perioperative neurocognitive disorders. All tests in this study were two-sided tests, and $P < 0.05$ was considered a statistically significant difference.

3 Results.

From November 2018 to November 2020, we screened 2071 patients, of which 128 patients were excluded due to conservative treatment and another 119 patients were lost to follow-up. Ultimately, 1824 patients were selected for the sample frame, of which 995 patients received fast-track orthopedic co-management care (OGC group) and the other 829 patients received traditional orthopedic care (TOC group) (Figure 1).

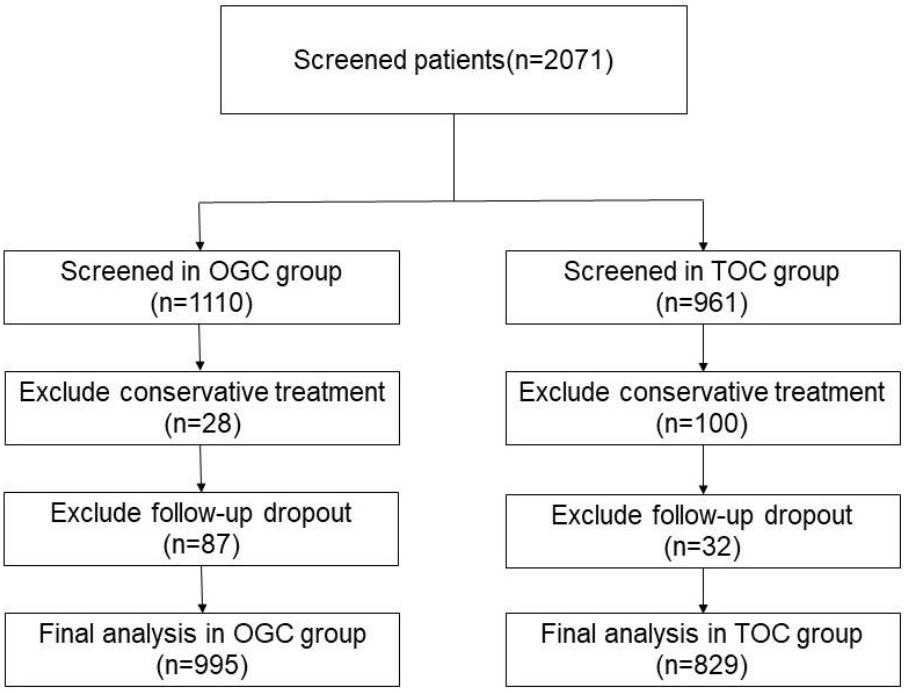

Figure 1, CONSORT diagram

A comparison of age, MoCA score, hypertension, coronary heart disease, diabetes mellitus, and depression in the two groups showed no statistically significant differences ($P>0.05$). In contrast, data analysis showed that the

differences were statistically significant (P<0.05) when comparing gender, ASA classification, education, stroke, anemia, dementia, and preoperative waiting time in both groups. As shown in Table 1.

Table 1, Comparison of basic characteristics between the two groups

	ALL （n=1824）	OGC （n=995）	TOC （n=829）	P Value
Age(year)	79.7±7.6	79.6±7.8	79.8±7.4	0.739
Sex(M/F)	1249/575	710/285	539/290	0.004
ASA(II/III/IV)	949/581/294	483/325/187	466/256/107	0.001
Education				0.000
＜Elementary school	392(21.5%)	178(17.9%)	214(25.8%)	
Elementary school	547(30.0%)	249(25.0%)	298(35.9%)	
Secondary school	707(38.8%)	431(43.3%)	276(33.3%)	
≥University	178(9.8%)	137(13.8%)	41(4.9%)	
MoCA(score)				0.439
27～30	997(54.7%)	560(56.3%)	437(52.7%)	
21～26	516(28.3%)	275(27.6%)	271(29.1%)	
10～20	174(9.5%)	91(9.1%)	83(10.0%)	
≤9	137(7.5%)	69(6.9%)	68(8.2%)	
Comorbidity				
Hypertension	1051(57.6%)	567(57.0%)	484(58.4%)	0.547
Coronary heart disease	404(22.1%)	224(22.5%)	180(21.7%)	0.682
Diabetes	493(27.0)%	277(27.8%)	216(26.1%)	0.393
Alzheimer's	78(4.3%)	54(5.4%)	24(2.9%)	0.008

Apoplexy	279(15.3%)	183(18.4%)	96(11.6%)	0.000
Anemia	44(2.4%)	16(1.6%)	28(3.4%)	0.014
Depression	33(1.8%)	21(2.1%)	12(1.4%)	0.290
Type of fracture				
Intertrochanteric	994(54.5%)	463(46.5%)	531(64.1%)	
Femoral neck	790(43.3%)	509(51.2%)	281(33.9%)	0.000
Subtrochanteric	40(2.2%)	23(2.3%)	17(2.1%)	
Time to surgery(＜48h)[a]	981(53.8%)	756(76.0)%)	225(27.1%)	0.000

a, Time to surgery was calculated from hospital admission to skin incision.

The incidence of perioperative neurocognitive disorders was significantly lower in the OGC group than in the TOC group (P < 0.05); the frequency of spinal anesthesia use was significantly higher in the OGC group than in the TOC group (P < 0.05); the length of hospital stay was shorter in the OGC group than in the TOC group (P < 0.05); the differences were not statistically significant when comparing the incidence of postoperative pneumonia, urinary tract infection, arrhythmia, and cerebrovascular accidents in the two groups The differences were not statistically significant (P > 0.05). As shown in Table 2.

Table 2, Comparison of perioperative conditions between the two groups

	ALL （n=1824）	OGC （n=995）	TOC （n=829）	P Value
Type of anesthesia				
General anesthesia	137(7.5%)	36(3.6%)	101(12.2%)	0.000
Spinal anesthesia	1687(92.5%)	959(96.4%)	728(87.8%)	0.000
Complications				
PND	460(25.2%)	217(21.8%)	243(29.3%)	0.000
Pneumonia	25(1.4%)	14(1.4%)	11(1.3%)	0.898
UTI	8(0.4%)	3(0.3%)	5(0.6%)	0.480

Arrythmia	31(1.7%)	15(1.5%)	16(1.9%)	0.487
CVA	6(0.3%)	2(0.2%)	4(0.5%)	0.420
LOS(d)	6.6(4.8,11.0)	5.0(4.0,6.6)	10.8(7.0,14.8)	0.000

PND, perioperative neurocognitive disorders; UTI，urinary tract infection; CVA, cerebrovascular accident; LOS, length of stay.

The incidence of perioperative neurocognitive disorders was significantly lower in the OGC group than in the TOC group (20.5% vs 69.5%, OR 0.59, 95% CI:0.53~0.65, P=0.000); the incidence of preoperative delirium was significantly lower in the OGC group than in the TOC group (10.5% vs 16.9%, OR 0.64, 95% CI:0.47-0.70, P=0.000); the incidence of postoperative delirium was also lower in the OGC group than in the TOC group (19.1% vs. 22.6%, OR 0.67, 95% CI:0.58 ~ 0.77, =0.001), s shown in Table 3.

Table 3, Comparison of pre- and postoperative incidence of delirium between the two groups

	ALL（n=1824）	OGC（n=995）	TOC（n=829）	OR	95%CI	P Value
No delirium	1367(74.9%)	791(79.5%)	576(69.5%)	0.59	0.53～0.65	0.000
Delirium preoperatively	244(13.4%)	104(10.5%)	140(16.9%)	0.64	0.47～0.70	0.000
Delirium postoperatively	349(19.1%)	162(16.3%)	187(22.6%)	0.67	0.58～0.77	0.001

Logistic multivariate analysis showed that alzheimer's, apoplexy, anemia were associated with perioperative neurocognitive disorders in patients undergoing hip fracture surgery. Higher education and co-management care model could reduce the incidence of perioperative neurocognitive disorders among patients undergoing hip fracture surgery, as shown in Table 4.

Table 4 Factors related to perioperative neurocognitive disorders at multivariate analysis

	Unadjusted		Fully Adjusted	
	OR(95%CI)	P value	OR(95%CI)	P value
Sex	1.11(0.89～1.39)	0.356	1.22(0.96～1.56)	0.097
Education	0.60(0.53～0.68)	0.000	0.61(0.54～0.69)	0.000

ASA	1.02(0.86～1.21)	0.805	1.02(0.86～1.21)	0.793
Type of fracture	1.31(1.08～1.60)	0.007	1.12(0.90～1.39)	0.326
Type of anesthesia	0.95(0.63～1.42)	0.786	0.77(0.50～1.18)	0.234
Alzheimer's	2.93(1.86～4.62)	0.000	3.68(2.24～6.02)	0.000
Apoplexy	1.49(1.13～1.97)	0.005	1.57(1.13～2.19)	0.007
Anemia	1.92(1.04～3.55)	0.038	1.58(0.83～3.04)	0.167
Time to surgery	0.86(0.70～1.06)	0.166	1.12(0.85～1.46)	0.418
Length of stay	1.01(0.99～1.02)	0.236	0.99(0.97～1.01)	0.482
OGC vs TOC	0.59(0.47～0.73)	0.000	0.57(0.43～0.76)	0.000

3 Discussion

The results of our multicenter study found that the fast track geriatric co-management care model (OGC group) not only significantly reduced the incidence of perioperative neurocognitive disorders in elderly patients undergoing hip fracture surgery, but also reduced postoperative mortality in patients.

We found that the OGC model played a positive role in reducing the incidence of both preoperative and postoperative delirium in patients. We believe this may be related to the following reasons.

First, in the OGC group, geriatricians were able to manage elderly patients with hip fracture perioperatively. When patients were found to have comorbidities upon admission, geriatricians were able to perform a comprehensive medical examination of the patient's condition in a timely manner. Afterwards, the geriatricians provided specialized treatment for the patient's comorbidities. We must acknowledge that geriatricians have a better understanding and management of the patient's condition than orthopedic surgeons, and therefore they are better able to avoid common risk factors that lead to delirium, such as anemia, electrolyte disturbances, dysglycemia and hemodynamic instability. Shields et al[15] found that geriatricians reduced the incidence of delirium in patients after hip fracture by performing a comprehensive preoperative assessment of elderly patients (RR = 0.81, 95% CI = 0.69-0.94). Deschodt et al[13] included 173 hip fracture patients aged 65 years and older in the geriatric multidisciplinary intervention group (n = 94) and the usual care group (n = 77) and showed that the incidence of perioperative

neurocognitive disorders was higher in the usual care group than in the geriatric multidisciplinary intervention group (53.2% vs. 37.2%, or = 1.92, 95% CI = 1.04-3.54, p = 0.04). Similarly, in our OGC group, the geriatricians were completely involved in the patient's hospitalization, including daily visits on weekdays and on-call visits on weekends. In summary, it is easy to see that a co-management model involving geriatricians helps to reduce the incidence of perioperative neurocognitive disorders in patients.

Second, in the OGC group, anesthesiologists were required to perform preoperative assessments within 24 hours of patient admission. On the one hand, it facilitated anesthesiologists to provide early guidance for preoperative analgesic management of patients to relieve perioperative pain and reduce the incidence of delirium.[16]. Morrisonet al[17] used a multifactorial logistic regression analysis to examine the risk factors leading to the development of delirium in 541 elderly patients after hip fracture surgery. The results found that patients with perioperative neurocognitive disorders often did not receive adequate pain control. Also, they found that adequate analgesia reduced the incidence of delirium in patients. Therefore, early analgesic management by an anesthesiologist in the OGC group could help reduce the incidence of perioperative neurocognitive disorders in elderly patients with hip fractures. On the other hand, timely preoperative evaluation facilitates the anesthesiologist to set the patient's perioperative management goals in advance with the geriatrician and orthopedic surgeon to guide the perioperative treatment in order to reduce the incidence of postoperative complications and mortality in patients. Oberai at al[18] reviewed the management patterns of elderly hip fracture patients in recent years. Their conclusions showed that early involvement of anesthesiologists and geriatricians in the perioperative management of patients is essential to prevent and reduce the occurrence of delirium in patients. In addition, after reviewing 64,418 surgical patients, Blitz at al[19] found that early preoperative evaluation by anesthesiologists helped to reduce postoperative mortality in patients (OR, 0.48; 95% ci, 0.22 - 0.96, p = 0.04).

Last but not the least, the OGC model can significantly reduce the preoperative waiting time for patients. Several studies have found that the longer the preoperative wait time for elderly hip fracture patients, the higher the

risk of perioperative neurocognitive disorders. In an analysis of data from 364 elderly hip fracture patients aged 65 years or older, Juliebo [20] found that the risk of delirium increased by approximately 5% when patients had a 1-hour delay in preoperative wait time (OR 1.05, 95% CI 1.0–1.1 per hour). HIP ATTACK Investigators[21] surveyed 2970 hip fracture patients aged 45 years or older worldwide and found that the shorter the patient's surgical wait time, the lower their risk of perioperative neurocognitive disorders (OR 0.72, 95% CI 0.58-0.92). In this study, the hospital opened a 24-hour preoperative examination green channel for elderly hip fracture patients treated with the OGC model, allowing x-ray, electrocardiograms, echocardiography, and laboratory tests to be performed in the emergency department. In addition, compared with the TOC model, anesthesiologists in the OGC model can perform preoperative assessments 1-2 days earlier, and based on the anesthesiologist's assessment and examination results, the geriatrician performs preoperative management and adjustment of patients including blood pressure, blood glucose, oral medications, and anti-infection to meet anesthesia requirements more quickly and shorten preoperative waiting time. Our study showed that the OGC model can significantly reduce the preoperative waiting time of patients compared with the TOC model, and to some extent can reduce the incidence of delirium in patients.

Wu at al[5] found that male gender, ASA ≥III, stroke, and Alzheimer's disease were risk factors for triggering delirium in elderly patients with hip fracture. In our study, the proportion of patients with male gender, ASA ≥ III, suffering from stroke and Alzheimer's disease was much higher in the OGC group than in the TOC group, but their incidence of perioperative neurocognitive disorders was significantly lower than that in the TOC group. Therefore, it can be concluded that the OGC model has a preventive effect on patients at high risk of delirium. Although the mean literacy level of patients in the OGC group was higher than that in the TOC group, the difference in preoperative MoCA scores between the two groups was not statistically significant. Therefore, we concluded that there was no significant difference in the cognitive level between the two groups of patients at the time of admission.

This study found no significant difference in the incidence of delirium in patients with different hip fracture types, despite differences in fracture types

between the OGC and TOC groups [5, 22]. Neuman at al[23] showed that when spinal anesthesia was used for hip fracture surgery in older patients, the incidence of delirium was not significantly better than general anesthesia. Brown at al[24] found that spinal anesthesia based on BIS values did not reduce the incidence of delirium in elderly patients compared with general anesthesia based on occult BIS values (interquartile range, 69 to 77). Li at al[25] also found that in patients aged 65 years and older undergoing hip fracture surgery, regional anesthesia without sedation did not significantly reduce the incidence of postoperative delirium in patients compared with general anesthesia (20.5% vs 19.7%, RR 1.04; 95% CI, 0.84 - 1.30). Although our study found differences in the type of anesthesia between the OGC and TOC groups, based on the current state of research both nationally and internationally, we concluded that the different types of anesthesia had little effect on the incidence of postoperative delirium in patients.

Reviewing the whole study, we still have many limitations. One is the lack of analysis of perioperative patient data, such as preoperative laboratory findings, duration of surgery, bleeding volume, and whether or not they were admitted to the ICU for monitoring treatment. This part of the data may also have an impact on the occurrence of delirium. Second, because we used CAM, we were unable to grade the degree of delirium in patients and therefore could not compare the effect of the OGC model and the TOC model on the degree of delirium in patients. To address these limitations, we will improve and add to them in our future work.

Conclusion: The fast track orthogeriatric co-management care model is conducive to reducing the incidence of perioperative neurocognitive disorders in patients and reducing early, intermediate and long-term postoperative mortality in patients, and can be applied in clinical practice.

Abbreviations：orthogeriatric co-management care model, OGC; traditional orthopedic model, TOC; Confusion Assessment Method, CAM; Montreal Cognitive Assessment, MoCA; PND, perioperative neurocognitive disorders; UTI，urinary tract infection; CVA, cerebrovascular accident; LOS, length of stay.

Declarations

Ethics approval and consent to participate: he studies involving human participants were reviewed and approved by the Institutional Review Board at Peking University Health Science Centre(IRB00001052-17021) and Biomedical Ethics Committee at Beijing Jishuitan Hospital (201807-11). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from each participant before participation in the study and reserved the right to withdraw from the study at any time without consequences.

Consent for publication: The manuscript does not contain any individual person's data.

Availability of data and materials: The datasets generated for this study are available on request to the corresponding author.

Competing interests: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author's Contributions: Study planning, conception and design: ZWC, WG, YMH, WXB. Acquisition of data: XR, XT. Analysis and interpretation of data: LTJ, ZWC, DFF. Drafting the manuscript: LTJ, ZWC. Revised and approved the manuscript: LTJ, ZWC, DFF, XR, XT, WG, YMH, WXB. The authors read and approved the final manuscript.

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1. Zhang C, Feng J, Wang S, Gao P, Xu L, Zhu J, et al: Incidence of and trends in hip fracture among adults in urban China: A nationwide retrospective cohort study. PLoS Med 2020;17:e1003180. doi: 10.1371/journal.pmed.1003180.
2. Oberai T, Oosterhoff JHF, Woodman R, Doornberg JN, Kerkhoffs G, Jaarsma R: Development of a postoperative delirium risk scoring tool using data from the Australian and New Zealand Hip Fracture Registry: an analysis of 6672 patients 2017-2018. Arch Gerontol Geriatr 2021;94:104368. doi: 10.1016/j.archger.2021.104368.
3. Song Y, Liu Y, Yuan Y, Jia X, Zhang W, Wang G, et al: Effects of general versus subarachnoid anaesthesia on circadian melatonin rhythm and postoperative delirium in elderly patients undergoing hip fracture surgery: A prospective cohort clinical trial. EBioMedicine 2021;70:103490. doi: 10.1016/j.ebiom.2021.103490.
4. Mosk CA, Mus M, Vroemen JP, van der Ploeg T, Vos DI, Elmans LH, et al: Dementia and delirium, the outcomes in elderly hip fracture patients. Clin Interv Aging 2017;12:421-430. doi: 10.2147/CIA.S115945.
5. Wu J, Yin Y, Jin M, Li B: The risk factors for postoperative delirium in adult patients after hip fracture surgery: a systematic review and meta-analysis. Int J Geriatr Psychiatry 2021;36:3-14. doi: 10.1002/gps.5408.
6. Yang Y, Zhao X, Dong T, Yang Z, Zhang Q, Zhang Y: Risk factors for postoperative delirium following hip fracture repair in elderly patients: a systematic review and meta-analysis. Aging Clin Exp Res 2017;29:115-126. doi: 10.1007/s40520-016-0541-6.
7. Bramley P, McArthur K, Blayney A, McCullagh I: Risk factors for postoperative delirium: An umbrella review of systematic reviews. Int J Surg 2021;93:106063. doi: 10.1016/j.ijsu.2021.106063.
8. Inouye SK, Westendorp RG, Saczynski JS: Delirium in elderly people. Lancet 2014;383:911-922. doi: 10.1016/S0140-6736(13)60688-1.
9. Swift C, Ftouh S, Langford P, Chesser TS, Johanssen A: Interdisciplinary management of hip fracture. Clin Med (Lond) 2016;16:541-544. doi: 10.7861/clinmedicine.16-6-541.
10. Pollmann CT, Mellingsaeter MR, Neerland BE, Straume-Naesheim T, Aroen

A, Watne LO: Orthogeriatric co-management reduces incidence of delirium in hip fracture patients. Osteoporos Int 2021;32:2225-2233. doi: 10.1007/s00198-021-05974-8.
11. Van Heghe A, Mordant G, Dupont J, Dejaeger M, Laurent MR, Gielen E: Effects of Orthogeriatric Care Models on Outcomes of Hip Fracture Patients: A Systematic Review and Meta-Analysis. Calcif Tissue Int 2022;110:162-184. doi: 10.1007/s00223-021-00913-5.
12. Lee JC, Koo K, Wong EKC, Naqvi R, Wong CL: Impact of an orthogeriatric collaborative care model for older adults with hip fracture in a community hospital setting. Can J Surg 2021;64:E211-E217. doi: 10.1503/cjs.001720.
13. Deschodt M, Braes T, Flamaing J, Detroyer E, Broos P, Haentjens P, , et al: Preventing delirium in older adults with recent hip fracture through multidisciplinary geriatric consultation. J Am Geriatr Soc 2012; 60:733-739. doi: 10.1111/j.1532-5415.2012.03899.x.
14. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI: Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med 1990;113:941-948. doi: 10.7326/0003-4819-113-12-941.
15. Shields L, Henderson V, Caslake R: Comprehensive Geriatric Assessment for Prevention of Delirium After Hip Fracture: A Systematic Review of Randomized Controlled Trials. J Am Geriatr Soc 2017;65:1559-1565. doi: 10.1111/jgs.14846.
16. Scurrah A, Shiner CT, Stevens JA, Faux SG: Regional nerve blockade for early analgesic management of elderly patients with hip fracture - a narrative review. Anaesthesia 2018;73:769-783. doi: 10.1111/anae.14178.
17. Morrison RS, Magaziner J, Gilbert M, Koval KJ, McLaughlin MA, Orosz G, ,et al: Relationship between pain and opioid analgesics on the development of delirium following hip fracture. J Gerontol A Biol Sci Med Sci 2003; 58:76-81. doi: 10.1093/gerona/58.1.m76.
18. Oberai T, Laver K, Crotty M, Killington M, Jaarsma R: Effectiveness of multicomponent interventions on incidence of delirium in hospitalized older patients with hip fracture: a systematic review. Int Psychogeriatr 2018; 30:481-492. doi: 10.1017/S1041610217002782.
19. Blitz JD, Kendale SM, Jain SK, Cuff GE, Kim JT, Rosenberg AD:

Preoperative Evaluation Clinic Visit Is Associated with Decreased Risk of In-hospital Postoperative Mortality. Anesthesiology 2016;125:280-294. doi: 10.1097/ALN.0000000000001193.
20. Juliebo V, Bjoro K, Krogseth M, Skovlund E, Ranhoff AH, Wyller TB: Risk factors for preoperative and postoperative delirium in elderly patients with hip fracture. J Am Geriatr Soc 2009; 57:1354-1361. doi: 10.1111/j.1532-5415.2009.02377.x.
21. Investigators HA: Accelerated surgery versus standard care in hip fracture (HIP ATTACK): an international, randomised, controlled trial. Lancet 2020;395:698-708. doi: 10.1016/S0140-6736(20)30058-1.
22. Oh ES, Li M, Fafowora TM, Inouye SK, Chen CH, Rosman LM, et al: Preoperative risk factors for postoperative delirium following hip fracture repair: a systematic review. Int J Geriatr Psychiatry 2015;30:900-910. doi: 10.1002/gps.4233.
23. Neuman MD, Feng R, Carson JL, Gaskins LJ, Dillane D, Sessler DI, et al: Spinal Anesthesia or General Anesthesia for Hip Surgery in Older Adults. N Engl J Med 2021;385:2025-2035. doi: 10.1056/NEJMoa2113514.
24. Brown CH, Edwards C, Lin C, Jones EL, Yanek LR, Esmaili M, et al: Spinal Anesthesia with Targeted Sedation based on Bispectral Index Values Compared with General Anesthesia with Masked Bispectral Index Values to Reduce Delirium: The SHARP Randomized Controlled Trial. Anesthesiology. 2021;135:992-1003. doi: 10.1097/ALN.0000000000004015.
25. Li T, Li J, Yuan L, Wu J, Jiang C, Daniels J, et al: Effect of Regional vs General Anesthesia on Incidence of Postoperative Delirium in Older Patients Undergoing Hip Fracture Surgery: The RAGA Randomized Trial. JAMA 2022;327:50-58. doi: 10.1001/jama.2021.22647.