

Analysis of Risk Factors for Postoperative Complications in Elderly Patients with Femoral Neck Fracture

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Abstract: The objective is to screen and analyze independent risk factors related to postoperative complications in elderly patients with femoral neck fracture, so as to provide a theoretical basis for formulating targeted prevention strategies and improving clinical prognosis. A total of 124 elderly patients (aged ≥ 65 years) with femoral neck fracture who underwent surgical treatment in our hospital from January 2022 to December 2023 were enrolled in this retrospective study. According to whether postoperative complications occurred within 3 months after surgery, they were divided into a complication group (39 cases) and a non-complication group (85 cases). General data, preoperative comorbidities, laboratory indicators, fracture-related parameters, surgical and anesthesia-related indicators, and postoperative management data of the two groups were collected. Univariate chi-square test and multivariate logistic regression analysis were used to identify independent risk factors for postoperative complications. The overall incidence of postoperative complications was 31.45% (39/124), mainly including lower extremity deep vein thrombosis, pulmonary infection, urinary tract infection, postoperative delirium, anemia, hypoproteinemia, and acute kidney injury. Multivariate logistic regression analysis showed that age ≥ 80 years (OR=3.216, 95%CI: 1.524–6.782, $P=0.002$), at least two preoperative comorbidities (OR=4.153, 95%CI: 1.897–9.086, $P<0.001$), ASA grade III–IV (OR=3.684, 95%CI: 1.655–8.197, $P=0.001$), preoperative hypoalbuminemia (albumin <35 g/L, OR=2.947, 95%CI: 1.326–6.541, $P=0.008$), preoperative anemia (hemoglobin <110 g/L, OR=2.753, 95%CI: 1.241–6.102, $P=0.013$), time from injury to surgery >48 hours (OR=2.869, 95%CI: 1.307–6.295, $P=0.009$), and operation time >90 minutes (OR=2.615, 95%CI: 1.184–5.773, $P=0.018$) were independent risk factors for postoperative complications in elderly patients with femoral neck fracture. The incidence of postoperative complications in elderly patients with femoral neck fracture is relatively high, and it is affected by a variety of factors. Clinicians should conduct comprehensive preoperative evaluation, optimize perioperative management, shorten the time to surgery, and strengthen postoperative monitoring for high-risk patients, so as to reduce the occurrence of complications and improve the quality of rehabilitation.

Keywords: femoral neck fracture; elderly patients; postoperative complications; risk factors; logistic regression; perioperative management; clinical prognosis

1. Introduction

The elderly population is especially susceptible to femoral neck fractures that represent one of the most common hip fracture with high incidence rate, disability and death[1]. Year to year, due to aging process among elderlies, there are alarming increase in incidence rate for femoral neck fractures and hence it becomes one of the leading public health problem which adversely affects the quality of life of them[2]. Femoral neck fracture in elderly people usually choose surgery as a first-line treatment and can help restore their hip function; reduce problems associated with long term immobility, improve its survival. Despite the frailty of elders with insufficient compensation ability and complicated chronic diseases in most cases, post-operative complications are very common, detrimentally influencing the outcomes of surgery as well as long term prognosis including mortality in some cases[3].

Deep vein thrombosis of the lower extremities, lung infection, urinary tract infection, postoperative delirium, anemia, hypoproteinemia, and achilles are common postoperative problems. They not only extend duration of hospitalization but also increase the medical burden and considerably elevate the risk for dying after an operative incident[4]. Identifying high-risk factors for postoperative complications early, and taking targeted preventive and control measures, is a key factor for decreasing the incidence of complications, improving surgical cure rate as well as the patient's prognosis [5].

Studies on the potential risk factors of postoperative complications in elderly patients with femoral neck fracture, both domestically and internationally, are under way but results have been inconsistent given variations in sample sizes, study designs and population groups across regions. However most researches are limited to one complications and no comprehensive evaluation has been done for all post-operative problems. This study was a retrospective analysis of 124 cases of elderly patients with femoral neck fracture and underwent surgical treatment in our hospital, in order to identify

independent risk factors which might cause postoperative complications, so as to provide reference for the clinical perioperative optimized management.

2. Materials and Methods

2.1 General Information

A retrospective examination of 124 elderly individuals with femoral neck fracture who had been treated in our hospital's Department of Orthopedics from January 2022 to December 2023 was conducted.

(1) Inclusion criteria.

Age ≥ 65 years old;

Femoral neck fracture was detected by X-ray, CT or other image examination.

Procedure was open reduction and internal fixation, hemiarthroplasty, or total hip arthroplasty.

Full clinical information with a 3-months' follow-up period.

Signed the informed consent: Patient/family.

(2) Exclusion criteria.

A pathologic fracture is caused by a tumour, osteoporosis or other causes.

Open fracture or combined with other parts of the fracture;

Other systemic disease of severe degree (e.g., liver and kidney disease, heart and lungs disease, malignancies or other severe illnesses).

Individuals with mental illness or cognitive impairment that cannot be cooperative in the study.

Patients transferred to another institution for treatment, and/or patients lost to follow-up.

The 39 cases with complication and the 85 cases without complication were divided into two groups. According to whether there are postoperative complications in 3 months after operation, this study is approved by the Ethics Committee of our hospital (Approval No.: 2021-056).

2.2 Treatment Methods

All the patients were given standardised surgical treatment; 42 cases received closed reduction and cannulated screw internal fixation, 58 receiving hemiarthroplasty and 24 total hip arthroplasty. The decision for the correct method was made according to age, fracture type, bone quality; and physical status. The patients underwent preoperative preparation including blood test, liver, kidney examination and coagulation tests, ECGs, etc. , as well as active treatment of the pre-existing comorbidities). Most patients received either spinal anesthesia or combined spinal-epidural anesthesia, while those of poor toleration were given general anaesthesia. Postoperatively, antibiotic prophylaxis, pain relief, antithrombotic therapy, nutrition support and exercise intervention were provided, with the complication if it is treated, or not.

2.3 Observation Indicators

Comparing between two group's data, we get below as follows:

General data: age, gender, body mass index (BMI);

Preoperative comorbid diseases including hypertension, diabetes mellitus, coronary heart disease, chronic obstructive pulmonary disease and cerebrovascular disease, may be complicated.;

Preoperative surgical laboratory indexes including hemoglobin (Hb), albumin (ALB), fasting blood sugar, and CRP can be obtained.;

Fracture indicators: Garden classification, Side injured, Cause of Injury; all are related with the fracture.

Indications of surgery and anaesthesia: time between injury and operation, length of the operation, method of anaesthesia, and intra-operative blood loss.

Post-operative complications may include deep venous thrombosis of the legs, pneumonia, uropathy, delirium postoperatively; anemia; hypoalbuminemia; AKI.

2.4 Statistical Methods

Data analysis was conducted with SPSS 26.0 statistical software, and the measurement data were expressed as ($\bar{x} \pm s$). To compare between groups, a t-test was used; for counting data it is expressed as (%), χ^2 test was adopted. Multivariate Logistic Regression Analysis: The indexes which have statistical difference in univariate analysis are added into multivariate logistic regression analysis to find out the independent risk factors; Statistically significant results were defined as $P < 0.05$.

3. Results

3.1 Univariate Analysis of Postoperative Complications

A multivariate analysis on the univariate variables showed that age, pre-operative comorbidities, ASA grade, hypoalbuminemia before surgery, anemia before surgery, time of injury to surgery and operation time are all with statistical significance between the two group ($P < 0.05$). Sex, BMI, fracture type, anesthesia method and intraoperative blood loss showed no significant differences between the two groups ($P > 0.05$). (Table 1)

Table 1. Univariate analysis of postoperative complications in elderly patients with femoral neck fracture

Index	Complication group (n=39)	Non-complication group (n=85)	χ^2/t value	P value
Age (years, ≥ 80)	22 (56.41)	20 (23.53)	12.897	< 0.001
Gender (male)	17 (43.59)	41 (48.24)	0.235	0.628
BMI ≥ 28 kg/m ²	10 (25.64)	16 (18.82)	0.742	0.389
Preoperative comorbidities ≥ 2 kinds	25 (64.10)	21 (24.71)	17.654	< 0.001
ASA grade III–IV	20 (51.28)	18 (21.18)	11.562	0.001
Preoperative hypoalbuminemia	18 (46.15)	19 (22.35)	7.581	0.006
Preoperative anemia	16 (41.03)	18 (21.18)	5.247	0.022
Time from injury to surgery > 48 h	17 (43.59)	19 (22.35)	5.784	0.016
Operation time > 90 min	15 (38.46)	17 (20.00)	4.682	0.03

3.2 Multivariate Logistic Regression Analysis of Postoperative Complications

The indicators that had statistically significant differences in univariate analysis were selected as the independent variable, and the postoperative complication was used as the dependent variable for multivariate logistic regression. Results showed that elder patient of femoral neck fracture (aged ≥ 80 years old) has two or more preoperative diseases (ASA grade III–IV), preoperative hypoalbuminemia, preoperative anemia, interval between trauma and surgery > 48 h and operative duration longer than 90 min, were independent risk factors for postoperative complications ($P < 0.05$). (Table 2)

Table 2. Multivariate logistic regression analysis of postoperative complications

Risk factor	β	SE	Wald χ^2	OR (95%CI)	P value
Age ≥ 80 years	1.168	0.375	9.712	3.216 (1.524–6.782)	0.002
Preoperative comorbidities ≥ 2 kinds	1.424	0.392	13.185	4.153 (1.897–9.086)	< 0.001
ASA grade III–IV	1.305	0.396	10.864	3.684 (1.655–8.197)	0.001
Preoperative hypoalbuminemia	1.081	0.408	7.014	2.947 (1.326–6.541)	0.008
Preoperative anemia	1.013	0.412	6.047	2.753 (1.241–6.102)	0.013
Time from injury to surgery > 48 h	1.053	0.403	6.825	2.869 (1.307–6.295)	0.009
Operation time > 90 min	0.961	0.405	5.638	2.615 (1.184–5.773)	0.018

3.3 Postoperative Complication Types

Complication Group: Lower extremity deep venous thrombosis occurred 11 cases (28.21%), Pulmonary infection 9 cases (23.08%), Urinary tract infection 6 cases (15.38%), 5 cases of postoperative delirium (12.82%), 4 cases of anemia (10.26%), 3 cases of hypoproteinemia (7.69%), and 1 case of acute kidney injury (2.56%).

4. Discussion

The occurrence rate of postoperation complication in elder people who suffer from femoral neck fracture because of their poor physical function, due to the absence of resistance and the complexity of chronic disease, it plays an important role in the determination of surgical effect and prognosis [6]. The results of this study showed that the total incidence was 31.45%. Previous studies have shown that post-operative complication is a problem that can not be ignored for geriatric patients who had undergone femoral neck fracture surgery [7].

Multivariate logistic regression results of this study showed that patients with age > 80 years were the independent risk factors in terms of postoperative complications. Functions of the old people's organs are getting worse with increasing age, they can not compensate so well, their ability to tolerate anaesthesia and surgery is insufficient, and their resistance

to infection and healing after trauma is reduced — thereby greatly increasing susceptibility to many problems. Thus, strict perioperative care must be provided in patients over the age of 80 and enhanced postoperative monitoring is warranted with a view to detecting problems at an early stage [8].

Preoperative comorbidities of ≥ 2 and ASA grade III–IV were also the important risk factors especially for elderly patients with usually suffering from hypertension, diabetes mellitus, ischaemic heart disease, chronic obstructive lung disease, and any other underlying conditions. These diseases could have adverse effects on patients' physical status and surgical tolerance and increase their risks for postoperative CVAs and CVAEs: pulmonary infection, and other complications[9]. ASA grade reflects patients' physical states as well as the probability for them to undergo operation, with high grades indicating worse physical conditions and higher risk of complications. Preoperative intervention should actively treat the underlying disease of the patients, optimize their physical conditions and reduce surgical risks[10].

Preoperative hypoalbuminemia is closely related with anemia as they are both vital nutrients that should be maintained for keeping the body's nutritional condition and the immune system. Hypoalbuminemia may cause low immunity, impaired wound healing ability, increased susceptibility to infection and poor surgical wound healing. Anemia could decrease the ability of blood to carry oxygen, which would lead to local tissue ischemia/hypoxia, thereby affecting organ functions and postoperative recoveries. Therefore, preoperative nutritional support is recommended, albumin and blood transfusion are appropriately given in order to correct hypoalbuminemia and anaemia, thereby increasing surgical tolerability for the patient.

The period between injury and surgery (which ranges between 48h-90min) is an independent risk factor; if it remains prolonged, then there would be more pain for the patient, bleeding, an increased risk of thrombus and infection, or adversely impact on their physical and psychological health. The longer an operation lasts, the more trauma it causes, bleeds under the knife, and the longer the anaesthesia lasts, so the greater is its stimulation to the body and the greater becomes the risk of complication. In terms of security, we need to shorten the interval between injury occurrence and surgery treatment as far as possible, and carry out professional surgical operation to accelerate the progress and reduce the damage of surgery.

The limitations of this single center, small-sample-size, and potentially selection-biased retrospective study are obvious. Besides, the complications have been found only in 3-months after surgery therefore more follow up is needed for finding out long term prognosis and complication. In conclusion a prospective multicenter and large sample study is required for validation of results of current study in future.

A relatively high incidence of post-operative complications among the elderly with femoral neck fractures are observed, and age more than 80 years, two or more preoperative comorbidities, ASA grade III–IV, hypoalbuminemia before operation, anemia before operation, time between injury and operation >48 h, and operation time more than 90 min, were all independent risks. We need to pay attention to these high-risk factors and make good preoperative evaluation, correct the abnormal signs, shorten preoperative waiting period for surgery; normalize surgical procedures; strengthen follow-up after surgery and integrated treatment, all for reducing postoperative complications and increasing surgical success rate and the quality of life of elderly patients.

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