Int J Clin Exp Med 2018;11(4):4188-4192
www.ijcem.com /ISSN:1940-5901/IJCEM0071998

Original Article

Efficacy of proximal femoral nail anti-rotation and dynamic hip screw internal fixation in the treatment of hip fracture in the elderly patients

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Received January 3, 2018; Accepted February 20, 2018; Epub April 15, 2018; Published April 30, 2018

Abstract: Objective: To compare the clinical efficacy of proximal femoral nail anti-rotation (PFNA) and dynamic hip screw (DHS) internal fixation for hip fracture in the elderly patients. Methods: Thirty-six elderly patients with hip fracture were divided into observation group (n=18) and control group (n=18) randomly; the observation group was treated with PFNA, and the control group was treated with DHS for internal fixation. Amount of intraoperative bleeding, incidence of complications, length of stay and Sanders excellent and good rate as well as the differences in time of partial weight bearing, full weight bearing and fracture healing after operation were compared between both groups. Results: In the observation group, amount of intraoperative bleeding was less than that of the control group (P<0.001), and incidence of short-term complications was lower than that of the control group (P=0.733). For postoperative recovery of the patients, Sanders excellent and good rate of the observation group (83.3%) was significantly higher than that of the control group (50.0%, P=0.037). Length of operation presented no significant difference between the two groups (P=0.833). The time of partial weight bearing, full weight bearing and fracture healing in the control group were longer than those of the observation group, all of which presented significant difference (all P<0.01). Conclusion: PFNA can improve Sanders excellent and good rate and reduce the amount of intraoperative bleeding and incidence of complications in the treatment of hip fracture in the elderly patients.

Keywords: Hip fracture, elderly patients, surgical treatment, proximal femoral nail anti-rotation, dynamic hip screw

Introduction

Hip fracture is a type of fracture commonly seen in the elderly population, with a high disability rate and mortality rate [1, 2]. In recent years, the incidence of hip fracture is on the rise, which poses a serious threat to the quality of life and health. The conservative treatment of hip fracture needs to stay in bed for a long time, and it is extremely easy to cause complications in multiple systems, resulting in poor prognosis. In view of this, surgical operations are preferred now. A number of methods can be used to treat the disease, and more and more clinical scholars have studied how to treat hip fracture effectively according to the characteristics of the elderly patients. It is reported that intramedullary fixation is more in line with the biomechanical characteristics of human femur, which can avoid excessive soft tissues being stripped and maximize the reduction of surgical injury [3, 4]. Currently, dynamic hip screw (DHS) and proximal femoral nail anti-rotation (PFNA) internal fixation are popular in the treatment of hip fracture in the elderly patients, while they all hold advantages and disadvantages clinically, and the final conclusion has not been reached yet [5, 6]. In this study, 36 elderly patients with hip fracture were randomly assigned to receive PFNA and DHS internal fixation, so as to study their own clinical efficacy.

Materials and methods

Case selection

A total of 36 elderly patients with hip fracture treated in our hospital between June 2016 and June 2017 were enrolled. All patients met the international definition of the elderly and diagnostic criteria for intertrochanteric fracture of femur [5]. The patients were divided into obser-

Table 1. Comparison of the patients' general information in both groups

Group	Observation group	Control group	P
Gender			1.000
Male	10	9	
Female	8	9	
Age (years old)	63.2±2.3	64.3±1.9	0.127
Fracture pattern (N)			0.980
I	4	5	
II	5	5	
III	7	6	
IV	2	2	
Complications	5 (27.8%)	6 (33.3%)	1.000

Note: Complications included cardio-cerebrovascular diseases, diabetes and respiratory diseases.

vation group (n=18) and control group (n=18) according to random number table. The observation group was treated with PFNA and the control group was treated with DHS internal fixation. The test protocol was approved by the Ethics Committee of Suizhou Hospital, Hubei University of Medicine, and all patients signed the informed consent.

Exclusion criteria: HIV-positive patients; patients with coagulation disorders; patients with hepatic and renal insufficiency; patients who suffer from severe circulatory system diseases such as acute myocardial infarction and could not tolerate operation; patients who are definitely diagnosed with mental disorder and could not cooperate with the treatment.

Procedure

The observation group was treated with PFNA internal fixation as follows specifically: the patients received combined spinal-epidural anesthesia and then laid in the supine position, with an angle of about 10° between the affected limb and trunk; traction reduction was performed at the fracture site; the incision began at the fixed point of the lateral thigh trochanter and traveled along the fracture to make the fracture site exposed; the vertex of the trochanter was drilled to enlarge the proximal medullary cavity; an opening was made to introduce the guiding needle; PFNA was placed through the guiding needle to fix the aiming mechanism, and its depth was adjusted under X-ray fluoroscopy, with an angle of about 13° with the femur; the guiding needle was introduced into the proximal medullary cavity at femoral head and neck through the sleeve; an opening was made along the guiding needle, and then the screw blade was placed and positioned into the femoral head and neck; the distal locking nail and end cap were installed after aiming; the wound was washed and the drainage tube was placed under negative pressure, and then the incision was sutured.

The control group was treated with DHS internal fixation as follows: anesthesia and position were the same as group A; longitudinal incision was made at lateral hip after anesthesia and traction reduction; blunt dissection of the lateral muscle was performed and then the lateral muscle was raised to the exposed fracture site; the guiding needle was introduced with an anteversion of 15° below the lesser trochanter tip of femur under X-ray fluoroscopy; the guiding needle was located slightly lower midline of the femoral head and neck normally, and in the central part of the femoral head and neck laterally; tapping was performed and the screw was screwed, and then the dynamic hip plate was placed for pressurization fixation; the wound was washed with normal saline and the drainage tube was placed under negative pressure, and finally the incision was sutured.

Both groups received conventional anti-inflammatory treatment after operation, and antithrombotic drugs were given on day 1 after operation.

Outcome measures

Amount of intraoperative bleeding, length of operation, length of stay, incidence of short-term complications and time of partial weight bearing, full weight bearing and fracture healing after operation were compared between both groups. The patients were followed up for 6 months after operation. According to Sanders post-trauma hip function assessing system, recovery of patients was evaluated (55-60, excellent; 45-54, good; 35-44, poor; <34, fail) [7, 8]. The indicators representing the long-term recovery of patients after operation such as Sanders score and fracture healing time were the main outcome measures.

Statistical analysis

Statistical analysis was conducted using SPSS-17.0. The quantitative data were expressed in mean ± standard deviation ($\bar{x} \pm sd$). Comparison

Table 2. Comparison of intraoperative and postoperative outcomes between the two groups ($\bar{x}$ ± sd)

Group	Case	Amount of intraoperative bleeding (mL)	Length of operation (min)	Length of stay (d)
Observation group	18	323.1±9.4	110.2±20.1	13±4
Control group	18	433.5±8.9	111.6±19.5	16±4
P		<0.001	0.833	0.031

Table 3. Comparison of postoperative complications between the two groups ($\bar{x}$ ± sd)

Group	Case	Postoperative short-term complications	Sanders excellent and good rate
Observation group	18	2 (11.1%)	15 (83.3%)
Control group	18	9 (50.0%)	9 (50.0%)
P		0.028	0.037

Table 4. Comparison of the time of partial weight bearing, full weight bearing and fracture healing after operation between the two groups ($\bar{x}$ ± sd)

Group	Case	Partial weight bearing time	Full weight bearing time	Fracture healing time (weeks)
Observation group	18	8.6±1.7	12.3±4.4	16.8±3.2
Control group	18	11.2±3.2	17.1±3.7	22.5±7.5
P		0.004	0.001	0.006

was conducted using independent-sample t test. The qualitative data were expressed in proportion and percentage (n, %), and compared using Fisher exact test. P<0.05 represents a statistically significant difference.

Results

Comparison of the patients' general information

The patients were aged from 62 to 70. The observation group were treated with PFNA, including 10 males and 8 females, with an average age of 63.2±2.3 years old; 8 cases were treated in the left, and 10 cases were treated in the right; according to Evan-Jensen typing, there were 4 cases of type I, 5 cases of type II, 7 cases of type III and 2 cases of type IV. The control group was treated with DHS internal fixation; there were 18 patients in total, including 9 males and 9 females, with an average age of 64.3±1.9 years old; 10 cases were treated in the left, and 8 cases were treated in the right; according to Evan-Jensen typing, there were 5 cases of type I, 5 cases of type II, 6 cases of type III and 2 cases of type IV.

Both groups presented no significant difference in age, gender, cause of fracture, fracture pattern and complications (all P>0.05), all of which were comparable. See **Table 1**.

Intraoperative and postoperative outcomes

The postoperative short-term complications including coxa vara and internal fixation rupture, amount of intraoperative bleeding and length of stay in the observation group were significantly lower than those in the control group (P=0.028, P<0.001, P=0.031). For the postoperative recovery of patients, Sanders excellent and good rate was 83.3% in the observation group, which was significantly higher than that in the control group (50.0%, P=0.037). Patients in both groups presented no significant difference in length of operation (P=0.833). See **Tables 2** and **3**.

Comparison of the time of partial weight bearing, full weight bearing and fracture healing after operation between the two groups

The time of partial weight bearing (P=0.004), full weight bearing (P=0.001) and fracture healing (P=0.006) in the control group were longer than those in the observation group, all of which presented statistically significant difference. See **Table 4**.

Discussion

For the surgical treatment of hip fracture in the elderly patients, internal fixation characterized by favorable wrapping effect is a commonly used treatment method, which can avoid bone waste and enhance the holding force [9, 10]. Internal fixation includes intramedullary fixation and extramedullary fixation generally. In this study, PFNA used in the observation group was intramedullary fixation, while DHS used in the control group was extramedullary fixation.

Singisetti et al. treated 68 patients with an average age of 80 years old using PFNA, and the results showed that PFNA achieved favorable efficacy on unstable femoral intertrochanteric fractures [11, 12]. DHS is a kind of traditional material for internal fixation of femoral intertrochanteric fractures. It has been widely applied clinically due to easy to operate and low cost. However, it was found that DHS has high failure rate to treat unstable femoral intertrochanteric fractures [13-15]. Compared with DHS, PFNA not only can avoid reaming of patients and loss of bone mass, but shorten length of operation and reduce amount of intraoperative bleeding and incidence of complications [16, 17]. Especially, others reports have already proved that PFNA had firm fixation and better anti-rotation ability compared with DHS or other internal fixation method [18, 19].

The study showed that postoperative short-term complications and amount of intraoperative bleeding in the observation group were significantly lower than those in the control group. For the postoperative recovery of patients, Sanders excellent and good rate was 83.3% in the observation group, which was significantly higher than that in the control group (50.0%). Shan et al. and Ping et al. found that compared with DHS, PFNA internal fixation can recover hip fracture faster, achieve better efficacy and reduce incidence of complications and amount of intraoperative bleeding in the treatment of the elderly patients with hip fracture [20, 21]. In addition, Zhao et al. compared the efficacy of 40 patients with hip fracture who received PFNA with that of 30 patients with hip fracture who received DHS, and found that compared with DHS, PFNA hold more advantages in the treatment of hip fracture, such as easier to operate, less trauma, less postoperative complications and better recovery of hip function, especially PFNA could overcome DHS's poor anti-rotation ability and stress concentration in femoral calcar [22]. These results are consistent with this study's results.

However, this study had some shortcomings, such as no long-term observation indicators, small sample size and few observation indicators. In the future, we will expand the sample size, extend the follow-up period and increase the observation indicators, so as to verify the conclusions and conduct further research.

To sum up, PFNA, characterized by less trauma, quick recovery, easy to operate, can improve the efficacy and reduce the incidence of complications in the treatment of the elderly patients with hip fracture, especially for the frail elderly.

Disclosure of conflict of interest

None.

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