

Therapeutic Effect of Artificial Femoral Head Replacement and Proximal Femoral Nail Antirotation on Elderly Unstable Intertrochanteric Fractures

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Abstract

Objective: To compare the clinical efficacy of artificial femoral head replacement and Proximal femoral nail antirotation (PFNA) in the treatment of unstable femoral intertrochanteric fractures in the elderly. **Methods:** This study retrospectively analyzed 60 elderly patients with unstable intertrochanteric fractures treated with PFNA and artificial femoral head replacement from 2015.06 to 2018.06, of which 34 were in the PFNA group (Group A) and 26 in the artificial femoral head replacement group (Group B). Statistical analysis of relevant surgical indicators such as surgical time, intraoperative blood loss, postoperative blood transfusion, postoperative time to landing, postoperative infection rate, hospital stay, number of secondary operations, postoperative VAS score, and postoperative Hip function score comparison. **Results:** All 60 patients were followed up for 1 - 24 months. Compared with the artificial femoral head replacement group, the operation time of PFNA group was shorter, the blood loss during operation was less, and the difference was statistically significant ($P < 0.05$). The postoperative blood transfusion volume, postoperative time, hospital stay, and postoperative time were higher in PFNA group. In the bone replacement group, the postoperative VAS score and the Harris score were lower than those in the artificial femoral head replacement group, and the differences were statistically significant ($P < 0.05$). There was no significant difference in the incidence of postoperative infection and the number of secondary operations between the two groups ($P > 0.05$). **Conclusion:** The hip joint function and pain scores of the artificial femoral head replacement group in the early and follow-up periods are better than those of the PFNA group. The artificial femoral head replacement is

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more suitable for the treatment of elderly unstable intertrochanteric fractures.

Keywords

Artificial Femoral Head Replacement, PFNA, Elderly, Unstable Femoral Intertrochanteric Fracture, Efficacy Analysis

1. Background

Hip fractures in the elderly are one of the three major types of fractures in the elderly. According to related reports, 90% of patients with intertrochanteric fractures are older than 70 years, accounting for 45% of hip fractures, of which unstable types account for about 35% - 40% [1] [2], the mortality of femoral intertrochanteric fractures in the elderly is high, and the mortality rate of conservative treatment is 34.6% [3]. As China, Japan and other countries enter the aging society, 50% of hip fractures worldwide will occur in Asia in the future, and the incidence rate will be 2 - 3 times that of 2050 by now [4]. At present, the majority of scholars believe that the surgical treatment is better than the conservative treatment of intertrochanteric fractures, and that intramedullary fixation is the most effective treatment. However, for elderly patients with unstable intertrochanteric fractures, due to factors like serious fracture comminution which causes internal fixation instability, osteoporosis which makes it easy to be cut, even after intramedullary fixation, patients could not move in early stages. Besides, there are many complications. Nearly 33.3% of elderly patients with intertrochanteric fracture died within 6 months after fracture. As a result, nearly 33.3% of elderly patients with intertrochanteric fracture died within 6 months after fracture. Studies have shown that the use of artificial joint replacement in the treatment of elderly intertrochanteric fracture has a good effect; patients can be early out of bed activities, thus reducing the occurrence of bed-ridden complications. However, most scholars believe that the artificial femoral head replacement should not be used as one-stage operation for intertrochanteric fracture, but as a remedy or revision operation for failed internal fixation of intertrochanteric fracture. Therefore, what is more controversial for elderly patients with unstable intertrochanteric fractures is the choice of surgical method. In this study, a total of 60 elderly patients with unstable intertrochanteric fractures were treated in our hospital from 2015.06 to 2018.06. They were treated with PFNA and artificial femoral head replacement, respectively, and the effects of the two surgical methods were compared, as reported below.

2. Materials and Methods

2.1. General Information

This study randomly selected 60 elderly patients with unstable femoral intertrochanteric fractures treated with PFNA and artificial femoral head replacement

from 2015.06 to 2018.06. The inclusion criteria were: 1) age ≥ 70 years; 2) fractures according to AO classification unstable femoral intertrochanteric fracture; 3) Purely closed or without other serious injuries; 4) surgery completed within 48 or 72 hours after the injury; 5) the hip joint of the patient can walk with weight-bearing without significant pain before the fracture; 6) all the operation was performed by the same group of doctors .among them:

PFNA treated 34 cases (Group A), 8 males and 26 females, aged 70 - 82 (76 ± 5.9) years; fractures were classified by AO: 16 cases of type A2.2, 10 cases of type A2.3, and A3. There were 6 cases of type 1 and 2 cases of type A3.3; the osteoporosis index was -3.25 ± 0.51 .

Artificial femoral head replacement was performed in 26 cases (group B), 7 males and 19 females, aged 71 - 82 (76.8 ± 5.9) years; fractures were classified by AO type: 17 cases of type A2.2, 4 of type A2.3 There were 3 cases of type A3.1 and 2 cases of type A3.3. The osteoporosis index was -3.25 ± 0.51 .

The basic diseases include medical diseases such as coronary heart disease, hypertension, diabetes, and chronic heart failure. In order to compare the differences between the medical diseases of group A and group B, those with only one medical disease are classified as one category, and those with two medical diseases are classified as one category, the combination of 3 and more medical diseases as a category. There were no significant differences in gender, age, fracture classification, medical complications, and osteoporosis between the two groups ($P > 0.05$).

2.2. Preoperative Preparation

Before surgery, the patients in both groups had perfect head, heart, lower limb blood vessels and other examinations to clarify the basic conditions of the patients; please refer to relevant specialists for diagnosis and treatment of related medical diseases; if oral anticoagulants are used, the drug should be discontinued according to the instructions; antibiotics should be given intravenously 30 minutes before surgery; to prevent excessive bleeding during surgery, routine blood preparation before surgery.

2.3. Surgical Methods

PFNA treatment group (Group A): the patient was in a supine position, the affected foot was placed on a traction foot frame, the limbs flexed and abducted on the healthy side, and the perineum was placed against the traction column to protect the perineum. The pelvis is placed in a horizontal position. The traction bed is closed after the traction is closed and the affected limb is satisfied. The traction bed is fixed. A 6 cm incision is made proximally at a height of 1 - 2 cm above the apex of the greater trochanter. Muscle tissue is bluntly isolated in the direction of the muscle fibers of the middle muscle. After exposing the apex of the greater trochanter, insert the guide needle into the medullary cavity with the help of an opener and “golden fingers”. C-arm fluoroscopy confirms the posi-

tion of the guide needle. See depth for perspective. Under the guidance of the sight, adjust the forward inclination angle, screw in the guide pin, and confirm that the guide pin is inserted into the femoral neck and femoral head. After the position and depth are satisfied, insert a suitable spiral blade and pressurize the broken end. Partial free bone mass was left open. The distal femoral shaft lock is inserted through the distal aiming system and sutured layer by layer after irrigating.

Artificial femoral head replacement treatment group (Group B): the patient adopted the surgical approach of the lateral position and exposed the femoral neck and the trochanter according to the approach. After the conventional osteotomy of the femoral neck, the osteotomy surface and the intertrochanteric fracture line were removed. The femoral head was taken out after the bone was removed, and a part of the small trochanter was left open. After the medulla reamed, the appropriate type of long-stem biological prosthesis was placed. After the long-stem prosthesis was successfully inserted, some patients used steel cables to fix the fracture block between the rotors through the reserved holes in the prosthesis stem. After installing an appropriately sized artificial femoral head, the hip joint function meets the basic requirements, and the incision can be sterilized, a negative pressure drainage device is placed, and an analgesic “cocktail” is injected around the incision, and the incision is closed layer by layer.

2.4. Postoperative Management

Antibiotics were routinely applied to prevent infection in the two groups for 48 to 72 hours after operation. Low molecular weight heparin and plantar pumps were used to prevent lower extremity venous thrombosis, oral analgesics, and routine fluid replacement. The blood analysis, CRP and other indicators were reviewed on the first and third days after operation, and if there was any abnormal symptomatic treatment. On the first day, functional exercises on the bed began. Group A performed weight-bearing exercise 2 or 3 weeks after surgery. In Group B, standing weight-bearing exercises can be performed with the aid of a walker for 3 days after surgery.

2.5. Comparative Evaluation Index

Related surgical indexes including surgical time, intraoperative blood loss, postoperative blood transfusion, postoperative landing time, postoperative infection rate, hospital stay, number of secondary operations, postoperative VAS score, and postoperative Harris score were compared between the two groups.

2.6. Statistical Methods

SPSS 24.0 statistical software was used for analysis. Measurement data were expressed as mean \pm standard deviation ($x \pm s$) and independent sample t test was used. Count data were expressed as percentage and χ^2 test was used. Differences

were statistically significant at $P < 0.05$.

3. Results

All 60 patients were followed up for 1 - 24 months, with an average of 15 months. Specific comparison indicators are shown in **Tables 1-4** below.

Table 1. Comparison of preoperative clinical data between PFNA group (Group A) and artificial femoral head replacement group (Group B).

Group	Number of cases (example)	Male/female (example)	Age	AO typing		Osteoporosis index
				A2	A3	
Group A	34	14/20	76 ± 5.9	26	8	2.64 ± 0.12
Group B	26	11/15	76.8 ± 5.9	21	5	2.64 ± 0.12

Table 2. Surgical indicators of PFNA group (Group A) and artificial femoral head replacement group (Group B).

Group	Operation time (min)	Intraoperative blood loss (ml)	Postoperative blood transfusion (ml)
Group A	46.3 ± 11.4	90.0 ± 20.0	200 ± 200
Group B	62.2 ± 10.5	150.0 ± 35.0	200 ± 200
t value	-10.14	-13.37	2.33
p-value	<0.05	<0.05	<0.05

Table 3. Related indexes after operation in PFNA group (Group A) and artificial femoral head replacement group (Group B).

	Landing time after operation (days)	Postoperative infection rate (%)	Length of hospital stay (days)	Second operation (example)
Group A	21.0 ± 7.0	2.94	14.0 ± 6.0	1
Group B	7.0 ± 2.0	0	12.0 ± 5.0	0
T value	7.24	0.873	2.41	0.873
p-value	<0.05	>0.05	<0.05	>0.05

Table 4. Postoperative pain and function indexes of PFNA group (Group A) and artificial femoral head replacement group (Group A).

Group	Postoperative VAS score (points)				Harris score after operation (points)			
	1 month	3 months	6 months	12 months Rear	1 month	3 months	6 months	12 months Rear
Group A	8.2 ± 1.8	5.2 ± 1.7	3.2 ± 1.2	2.2 ± 1.1	61.0 ± 7.0	71 ± 7	84 ± 7	88 ± 6
Group B	7.1 ± 1.6	4.3 ± 1.8	2.1 ± 1.3	1.1 ± 0.5	81 ± 6	86 ± 7	90 ± 7	91 ± 6
t value	7.07	3.96	6.27	9.55	-22.23	-15.07	-4.95	-4.09
p-value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Compared with the artificial femoral head replacement group, the operation time of PFNA group was shorter, and the blood loss during operation was less, and the difference was statistically significant ($P < 0.05$). The postoperative blood transfusion volume, postoperative time, hospitalization time, and duration of PFNA group were higher than those of artificial femoral head. In the bone replacement group, the postoperative VAS score and the Harris score were lower than those in the artificial femoral head replacement group, and the differences were statistically significant ($P < 0.05$). There was no significant difference in the incidence of postoperative infection and the number of secondary operations between the two groups ($P > 0.05$).

4. Discussion

With people's emphasis on quality of life and new surgical methods and clinical application of internal fixation devices, most elderly patients and their families tend to choose surgical treatment. The purpose of surgical treatment is: strong fixation, early movement. The shortcomings of the external fixator are more prominent, it cannot bear the weight early, it is inconvenient to carry, the nail channel is loose and infected, and the bone fracture deformity heals and delays healing in the later stage [5]. Therefore, with the exception of patients with extremely poor systemic conditions that cannot tolerate anesthesia, external fixators should be used with caution. Extramedullary fixation belongs to eccentric fixation and has poor anti-rotation ability. For unstable intertrochanteric fractures, internal fixation can easily lead to fatigue fracture due to internal wall defects. Postoperative rehabilitation cannot be carried out with early weight bearing [6] [7]. Intramedullary fixation conforms to the characteristics of human biomechanics, has the advantages of standardized operations, less trauma during surgery, and better stability [8], and has unparalleled advantages of extramedullary fixation.

PFNA is an intramedullary fixation device designed for femoral intertrochanteric fractures. Due to the closed reduction of the small incision, the intraoperative trauma is small [9], and the short and central fixation of the arm [10] does not require anatomical reduction, which fully protects the bone. Periosteal blood transport has unparalleled advantages of ordinary internal fixation, but due to severe osteoporosis in elderly patients, the initial stability of PFNA is not enough to carry weight early [11].

Early femoral head replacement was an internal fixation device specifically designed for elderly femoral neck fractures [12]. In 1974, Tronzo's first attempt to use artificial joint replacement to treat femoral intertrochanteric fractures received widespread attention [13]. According to Sing *et al.* [14] doctors realized the advantages of artificial femoral head replacement and used it in the treatment of elderly femoral intertrochanteric fractures, which achieved good clinical results. Zhang Hua *et al.* [15] thought that after the artificial femoral head replacement surgery, a better hip joint stability was obtained immediately, the hip

joint could be partly moved immediately, and the rehabilitation exercise was carried out under the weight to reduce postoperative complications.

With the development of artificial femoral head replacement and ERAS in the lateral lying DAA, the surgical injury is getting smaller and smaller, and the weight bearing time of patients is getting earlier and earlier [16]. The lateral lying DAA is directly separated from the muscle space to reveal the fractured end. There is no need to cut muscles during the operation. The soft tissue damage is small, which reduces the postoperative pain of the patient [17] [18].

PFNA surgery requires reduction with the aid of a traction table and a C-arm machine. Due to the complexity of the fracture, it is often accompanied by the separation of the large and small trochanters and the separation of the femoral neck shaft. Reduction is relatively difficult. The artificial femoral head replacement is a fixed operation, which does not require reduction during the operation, without the need for a traction bed and a C-arm machine. The surgeon has a short learning curve, is easy to grasp, and has no radiation exposure, which is beneficial to the relatively basic hospital.

Long-stem PFNA can be replaced in patients with secondary fractures after PFNA. At the same time, artificial femoral head replacement is also an effective method to save secondary fractures [19]. With the emergence of long-stem and full-stem joint prostheses, the treatment of fractures around the prosthesis after artificial femoral head replacement has become easier and more convenient [20], and the second fracture rate is only 0.1% - 2.1% [21].

Immediately after the artificial femoral head replacement, the hip joint has better stability. The hip joint can be partly moved immediately. With the application of local analgesics, the hip pain is significantly reduced, so the hip joint function and pain scores early after surgery. All were better than PFNA group. The artificial femoral head replacement group can use a walker to stand weight-bearing exercises early, reduce complications caused by long-term bed rest, and help improve the overall situation. During follow-up, patients' hip joint function and pain scores were better than PFNA group. Due to the limitation of follow-up time, the long-term effect needs to be further verified.

Unstable intertrochanteric fractures in the elderly are often accompanied by severe osteoporosis and a series of medical diseases. The treatment is difficult, and conservative treatment requires long-term bed rest, which greatly increases the incidence of lower limb venous thrombosis and pulmonary infection, the incidence of Bedsore and other complications. The principle of surgical treatment is strong internal fixation and early functional exercise. Because of the complexity of unstable intertrochanteric fractures in the elderly, it is very important to choose the operative method. The type of fracture, the age of the patient, the basic condition of the patient and the economic condition of the Family should be considered before the operation. The aim of this study was to analyze and compare the clinical efficacy of artificial femoral head replacement and PFNA in the treatment of unstable intertrochanteric fractures in the elderly. All cases were

followed up and analyzed statistically. There were significant differences in operative time, intraoperative blood loss, postoperative blood transfusion, postoperative time, postoperative infection rate, hospital stay, number of secondary operations, VAS score and Harris Score. In general, artificial femoral head replacement is relatively simple and stable in the treatment of unstable intertrochanteric fractures in the elderly compared with PFNA, and can be performed early after operation, it is more suitable for the treatment of unstable intertrochanteric fractures in the elderly. Because of the small sample size, the short observation time and the fluctuation of the late patient data collection, the comparison of the two methods needs to be further studied in the future.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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