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Effect of Artificial Hip Replacement Surgery on the Treatment of Intertrochanteric Femur Fractures in Elderly Patients and Its Impact on Hip Joint Function and Quality of Life

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Abstract: *Objective:* To evaluate the treatment effect of total hip arthroplasty (THA) for intertrochanteric femur fractures (IFF) in elderly patients. *Methods:* Thirty-two elderly patients with IFF admitted to the hospital from August 2021 to August 2024 were selected and randomly divided into two groups using a random number table. The experimental group (16 patients) underwent THA surgery, while the control group (16 patients) underwent proximal femoral nail antirotation (PFNA) surgery. Hip joint function and quality of life indicators were compared between the two groups. *Results:* Before surgery, there was no significant difference in hip joint function and quality of life scores between the two groups ($P > 0.05$). However, at six months postoperatively, the experimental group had higher hip joint function and quality of life scores compared to the control group ($P < 0.05$). The total effective rate was higher in the experimental group than in the control group ($P < 0.05$). The complication rate in the experimental group was similar to that in the control group ($P > 0.05$). *Conclusion:* THA can improve the clinical efficacy of elderly patients with IFF, minimize postoperative complications, effectively restore hip joint function, and optimize postoperative quality of life.

Keywords: Artificial hip replacement surgery; Intertrochanteric femur fractures; Elderly patients; Hip joint function; Quality of life

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1. Introduction

The causes of intertrochanteric femur fractures (IFF) include bone fragility, osteoporosis, and physical function decline. Patients often experience symptoms such as loss of lower limb function and lower limb pain, with a high disability rate [1]. Proximal femoral nail antirotation (PFNA) is a commonly used surgical procedure for this condition, capable of stabilizing the fracture site and maintaining joint stability. However, due to osteoporosis,

patients are unable to bear weight early postoperatively, resulting in prolonged bed rest and an increased risk of complications such as pressure ulcers, leading to generally poor surgical outcomes. Additionally, elderly patients often have reduced physiological function and numerous comorbidities, making them less tolerant of surgical treatment. Therefore, alternative surgical approaches are needed [2]. Total hip arthroplasty (THA) has demonstrated significant advantages in treating this condition, as it can quickly improve hip joint function and achieve better long-term outcomes. This study evaluated the therapeutic effects of THA in 32 elderly IFF patients.

2. Materials and methods

2.1. General information

A total of 32 elderly patients with IFF admitted between August 2021 and August 2024 were enrolled in the study. Patients were randomly divided into two groups using a random number table. The experimental group consisted of 16 patients, including 11 males and 5 females, aged between 62 and 87 years, with an average age of 72.68 ± 2.94 years. The duration of illness ranged from 3 to 31 hours, with an average of 19.86 ± 2.76 hours. All cases involved fragility fractures. The control group consisted of 16 patients, including 10 males and 6 females, aged between 61 and 88 years, with an average age of 72.91 ± 2.83 years. The duration of illness ranged from 4 to 30 hours, with an average of 19.93 ± 2.57 hours. All cases involved fragility fractures. A comparison of general data between the two groups showed no statistically significant differences ($P > 0.05$).

Inclusion criteria: Diagnosis of IFF confirmed by multiple imaging examinations such as X-ray or CT; age > 60 years; normal skin condition in the surgical area; complete clinical data; meeting surgical indications; informed consent for the surgical plan. Exclusion criteria: Accompanied by open injuries; accompanied by heart, liver, kidney, or other lesions; combined with old fractures; suffering from other types of orthopedic diseases; accompanied by joint diseases.

2.2. Methods

The experimental group underwent THA surgery. Spinal-epidural combined anesthesia or general anesthesia was administered. Patients were positioned on the healthy side. A curved incision, centered on the greater trochanter, measuring 12–15 cm, was made on the lateral side of the hip joint. The skin, subcutaneous tissue, and deep fascia were incised. The fascia lata was separated along with the tensor fasciae latae, and the anterior one-third of the gluteus medius was dissected. The anterior joint capsule was incised to fully expose the fractured joint. Following osteotomy, the femoral neck was severed, exposing the femoral head, which was removed. The acetabulum was then prepared by thoroughly removing the cartilage, down to the subchondral bone, and washed extensively. A suitable prosthesis was placed. The femoral canal was reamed until the cortical bone was reached. An appropriately sized prosthetic stem was selected and inserted into the femoral canal. A femoral head of suitable length was installed, and the stability and tension of the prosthetic joint were assessed, along with the range of motion. Once the results were satisfactory, the canal was rinsed with saline, a drainage tube was placed, and the incision was closed.

The control group underwent PFNA surgery using the same anesthesia method. Fracture conditions were evaluated, and a urinary catheter could be placed. Patients were positioned supine, ensuring comfort, with the healthy lower limb moderately flexed. A soft cushion was used to slightly elevate the pelvis. The surgical area was disinfected, and a film was applied over the perineum. During fracture reduction, detailed observation was

performed using a C-arm X-ray machine. Once reduction was successful, an incision measuring 3–5 cm was made above the greater trochanter. The skin was separated, and hemostasis was achieved using an electrocautery device. The position of the gluteus medius was identified, followed by blunt dissection to fully expose the apex of the greater trochanter. A guide pin was inserted approximately one-third anterior to this point, and a reaming tool was used to prepare the canal. The femoral canal near the proximal femur was reamed using the guide pin, and the main nail was gradually screwed in. A spiral blade guide was used for positioning, and a longitudinal incision measuring 2 cm was made. The targeting device was used to align the guide pin, which was inserted to reach approximately 1 cm below the cartilage of the femoral head. The position of the guide pin was observed and reduction was evaluated. The channel was reamed along the guide pin, and a spiral blade of appropriate specifications was inserted, followed by the distal locking screw. Once all procedures were completed, the targeting device was removed, and the proximal tail cap was tightened. After confirming satisfactory results, instruments were counted, a drainage tube was placed, and the incision was sutured.

Both groups remained bedridden for more than 6 hours postoperatively and received anti-infection, pain management, and thrombosis prevention treatments. Drainage tubes were removed 1–2 days after surgery, and patients were mobilized 3–7 days postoperatively.

2.3. Observation indices

(1) Hip joint function score: The Harris Hip Score was used to evaluate hip joint function. It included dimensions for pain (44 points), range of motion (5 points), deformity (4 points), and function (47 points), totaling 100 points. A higher score indicated better hip joint function.

(2) Quality of life score: The General Quality of Life Inventory-74 (GQOL-74) was used, consisting of four dimensions, each scored out of 100. Higher scores indicated better quality of life.

(3) Total effective rate: This was evaluated using the Harris Hip Score. Significant efficacy was defined as a score >90, moderate efficacy as a score of 70–90, and no efficacy as a score <70.

(4) Complication rate: Complications such as included pressure ulcers and deep vein thrombosis (DVT) in the lower limbs were observed.

2.4. Statistical analysis

The data were processed using SPSS28.0 software. Measurement data were expressed as mean ± standard deviation (SD) and compared using the *t*-test. Count data were expressed as numbers and percentages [*n* (%)] and compared using the chi-square test. Statistical significance was set at $P < 0.05$.

3. Results

3.1. Comparison of hip function scores between the two groups

Before surgery, there was no difference in hip function scores between the two groups ($P > 0.05$). At six months postoperatively, the hip function scores of the experimental group were higher than those of the control group ($P < 0.05$), as presented in **Table 1**.

Table 1. Comparison of hip function scores between the two groups (mean ± SD, points)

Group	*n*	Pain		Range of motion		Deformity		Function	
		Pre-operation	Post-operation	Pre-operation	Post-operation	Pre-operation	Post-operation	Pre-operation	Post-operation
Experimental group	16	23.62 ± 2.91	35.19 ± 3.10	2.05 ± 0.43	4.03 ± 0.26	1.55 ± 0.32	3.02 ± 0.31	27.75 ± 2.86	39.35 ± 3.29
Control group	16	23.41 ± 2.88	31.53 ± 3.08	2.07 ± 0.41	3.57 ± 0.31	1.57 ± 0.43	2.59 ± 0.27	27.71 ± 2.91	34.15 ± 3.24
t	-	0.205	3.350	0.135	4.548	0.149	4.184	0.039	4.505
P	-	0.839	0.002	0.894	0.000	0.882	0.000	0.969	0.000

3.2. Comparison of quality of life scores between the two groups

Before surgery, there was no difference in the quality of life scores between the two groups ($P > 0.05$). However, six months after surgery, the quality of life scores of the experimental group were higher than those of the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of quality of life scores between the two groups (mean ± SD, score)

Group	n	Material life		Physical function		Psychological function		Social function	
		Pre-operation	Post-operation	Pre-operation	Post-operation	Pre-operation	Post-operation	Pre-operation	Post-operation
Experimental group	16	78.95 ± 6.23	91.20 ± 5.33	79.32 ± 6.10	92.35 ± 4.18	74.18 ± 4.92	92.83 ± 4.45	76.33 ± 4.15	91.29 ± 4.07
Control group	16	79.08 ± 6.21	86.15 ± 5.27	79.26 ± 6.08	88.03 ± 4.11	75.02 ± 4.33	87.03 ± 4.01	76.29 ± 4.20	87.12 ± 4.03
t	-	0.059	2.695	0.028	2.948	0.513	3.873	0.027	2.912
P	-	0.953	0.011	0.978	0.006	0.612	0.001	0.979	0.007

3.3. Comparison of the total effective rate between the two groups

Based on **Table 3**, the total effective rate of the experimental group was higher than that of the control group ($P < 0.05$).

Table 3. Comparison of the total effective rate between the two groups [*n* (%)]

Group	n	Significant effect	Preliminary effect	No effect	Total effective rate
Experimental group	16	10	5	1	93.75 (15/16)
Control group	16	5	5	6	62.50 (10/16)
χ^2	-	-	-	-	4.571
P	-	-	-	-	0.033

3.4. Comparison of complication rates between the two groups

The complication rate of the experimental group was similar to that of the control group ($P > 0.05$), as presented in **Table 4**.

Table 4. Comparison of complication rates between the two groups [*n* (%)]

Group	*n*	Pressure ulcers	DVT	Pulmonary infection	Urinary tract infection	Incidence rate
Experimental group	16	1	0	1	0	12.50 (2/16)
Control group	16	1	1	1	1	25.00 (4/16)
χ^2	-	-	-	-	-	0.821
P	-	-	-	-	-	0.365

4. Discussion

Intertrochanteric femoral fractures are a common type of fracture in the elderly, primarily caused by aging, osteoporosis, and external factors such as falls or traffic accidents [3]. This condition is often accompanied by displaced fractures and poor femoral stability, which impact lower limb mobility and cause severe pain. Various treatment methods are available, including conservative and surgical approaches. However, conservative treatment has limitations, such as a prolonged recovery period, resulting in suboptimal clinical outcomes. Additionally, elderly patients often suffer from osteoporosis and require prolonged bed rest post-fracture, increasing the risk of adverse events like bone loss. Therefore, surgical intervention is generally necessary for these patients [4]. At present, common surgical options include intramedullary fixation, extramedullary fixation, and artificial joint replacement, often supplemented by progressive functional training of the knee and ankle joints to restore joint function [5].

Proximal femoral nail antirotation surgery is a widely used procedure for IFF. It is designed to align with the biological structure of the human body, featuring straightforward surgical steps. The insertion of screws during the procedure creates adequate pressure on the lateral femoral wall, thereby stabilizing joint function [6]. The use of helical blades simplifies the surgical process, reduces abnormal bone loss, and increases cancellous bone density, providing strong anti-rotational effects. However, this technique requires preoperative traction and reduction and demands a high level of surgical expertise, posing challenges to surgical safety [7]. THA, on the other hand, involves a comprehensive preoperative assessment of the elderly patient's bone health to determine the most suitable surgical plan. THA effectively utilizes prosthetics to prevent complications associated with internal fixation, such as screw cutting or varus deformities, thus reducing fracture healing time.

The results showed that at six months post-surgery, the hip joint function scores in the experimental group were significantly higher than those in the control group ($P < 0.05$). These findings align with the study conducted by Liu [8]. Additionally, six months post-surgery, the quality of life scores and overall effectiveness rates in the experimental group were higher than those in the control group ($P < 0.05$), while the complication rates in the experimental group were comparable to those in the control group ($P > 0.05$). Analysis suggests that THA allows for effective management of soft tissues around the femoral head and femoral neck during surgery and facilitates hip joint replacement with prosthetics that provide strong stability, enabling early joint function recovery. The prosthetics used in THA are designed to match the biomechanical and anatomical features of the trochanteric region, offering excellent fixation [9]. Moreover, the prosthetic's extended length increases the interface between the medullary cavity and the prosthetic stem, enhancing the contact area and distributing stress more evenly, thereby improving joint stability. Crucially, the artificial prosthetic tightly integrates with the femoral bone, evenly distributing forces generated by the prosthetic to the distal femur, preventing long-term prosthetic failure. This design also allows for earlier postoperative functional training, significantly improving the patient's quality of life [10].

5. Conclusion

In conclusion, THA enhances hip joint function and quality of life in IFF patients, improves surgical efficacy, and minimizes the incidence of postoperative complications. It is a highly feasible surgical option and can be considered the preferred treatment method for IFF patients.

Disclosure statement

The authors declare no conflict of interest.

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