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Effects of Total Hip Replacement and Femoral Head Replacement in the Treatment of Femoral Neck Fractures in Elderly Patients and Their Impacts on Hip Joint Function

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Abstract: *Objective:* To explore the therapeutic value of total hip replacement and femoral head replacement in elderly patients with femoral neck fractures. *Methods:* 30 elderly patients with femoral neck fractures were sampled from January 2019 to August 2023 and randomly divided into two groups. Total hip replacement was adopted in the research group, and femoral head replacement was performed in the control group. The surgical indicators, quality of life, hip replacement, Harris hip score, and surgical complications were compared between the groups. *Results:* The operation time of the research group was longer than that of the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those of the control group, $P < 0.05$; the SF-36 (36-Item Short Form Health Survey) score of the research group was higher than that of the control group, $P < 0.05$; the Harris scores of various hip joints of the research group were higher than those in the control group, $P < 0.05$; the femoral neck fracture complication rate in the research group was lower than that in the control group, $P < 0.05$. *Conclusion:* Both total hip replacement and femoral head replacement can improve hip joint function in treating femoral neck fractures in elderly people. However, total hip replacement has better long-term efficacy and can enhance patients' quality of life and reduce postoperative complications.

Keywords: Femoral neck fracture in the elderly; Femoral head replacement; Total hip replacement; Efficacy

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1. Introduction

Femoral neck fractures are more common in older people and are related to osteoporosis and abnormal hip muscle function. Older people are prone to falls, increasing femoral neck fracture incidence. In addition, femoral neck fracture can cause damage to the blood vessels and affect the blood supply of the affected limb, thereby increasing the risk of femoral head necrosis, nonunion of the fracture, and even secondary traumatic infection, which can reduce the patient's quality of life, so surgical treatment should be performed as soon as possible. Currently, the main clinical treatments for femoral neck fractures are total hip replacement and

femoral head replacement, which can improve patients' hip joint function. However, the long-term effects of the two surgeries are different [1]. This article selects 30 elderly patients with femoral neck fractures treated from January 2019 to August 2023 as samples to explore the value of total hip replacement and femoral head replacement.

2. Materials and methods

2.1. Materials

A sample of 30 elderly patients with femoral neck fractures treated from January 2019 to August 2023 were randomly divided into two groups. There was no difference in the data of the patients in the research group and the control group, $P > 0.05$, as shown in **Table 1**.

Table 1. Analysis of femoral neck fracture data in the elderly patients

Group	n	Gender [n (%)]		Age (years)		Garden classification of fracture type [n (%)]		Cause of fracture	
		Male	Female	Range	Mean	Type III	Type IV	Car accident	Injured by fall
Research group	15	9 (60.00)	6 (40.00)	62–82	70.36 ± 3.25	9 (60.00)	6 (40.00)	10 (66.67)	5 (33.33)
Control group	15	10 (66.67)	5 (33.33)	63–84	70.39 ± 3.27	8 (53.33)	7 (46.67)	11 (73.33)	4 (26.67)
χ^2/t	-	0.1435		0.0252		0.1357		0.1587	
P	-	0.7048		0.9801		0.7125		0.6903	

2.2. Inclusion and exclusion criteria

Inclusion criteria included patients with normal walking function of the affected limb before fracture; hip X-ray showing femoral neck fracture; patients aged over 60 years old; patients with informed consent; and patients with no history of diseases affecting bone metabolism.

Exclusion criteria were patients with abnormal coagulation; patients with abnormal organ function; and patients with femoral neck fracture caused by metabolic diseases.

2.3. Treatment methods

Preoperative hip X-ray and CT diagnosis were performed. Active treatment of the original disease, apparent fracture displacement, and acetabular lesions were carried out. A surgical plan based on the examination results was formulated.

In the control group, femoral head replacement was adopted. Combined spinal and epidural anesthesia was performed, ensuring that the limb on the side of the femoral neck fracture was on top. The pelvis was fixed, and a posterolateral approach was used to incise the skin, subcutaneous tissue, superficial and deep fascia, and gluteus maximus fascia lata in sequence. At the muscle attachment point, the gluteus maximus was bluntly separated, exposing and cutting off the attachment points of the piriformis muscle, superior and inferior medullary muscles, and other external rotator muscles at the insertion point of the greater trochanter. Part of the quadratus femoris muscle was cut off, making a T-shaped incision for the joint capsule. The femoral torque was kept at about 1 cm, and the neck-shaft angle at 135°, an oscillating saw was used to flatten the end of the femoral neck, and the femoral head and residual bone fragments were removed. This was followed by internal rotation, hip flexion, and knee flexion of the left lower limb to expose the femoral neck section. A box-type opener was used to open the medullary cavity of the proximal femur. The medullary cavity expander gradually expanded the medullary cavity. Then, a femoral stem was used to maintain the anteversion angle of about 15°

to expand the medullary cavity. Bone debris was flushed and absorbed, the trial prosthesis was driven in and installed, externally rotating and abducting, flexing and resetting the knees and hips, checking that there was no dislocation during movement in all directions and that the length was appropriate. The trial prosthesis was taken out, the corresponding artificial femoral stem was inserted, and the anteversion angle was kept at 15° for hammering. It was fastened tightly, the artificial femoral head was installed and hammered tightly, and the joint was reset, checking that the joint movement was normal and the stability was good. It was also checked that the head socket was well contained, the tightness was appropriate, with 90° flexion and 30° adduction, and it was stable without dislocation, and that both lower limbs were the same length. The surgical field was flushed, and the bleeding area around the femoral stem was covered with bone wax to stop the bleeding. The instruments and gauze were checked to see if they were correct in number. Part of the joint capsule was repaired and the external rotator muscles were repaired and reconstructed. The incision was sutured layer by layer, negative pressure drainage was placed, and moderate pressure was applied to the dressing.

Total hip replacement was performed in the research group. Combined spinal and epidural anesthesia was performed, ensuring that the limb on the side of the femoral neck fracture was on top. The pelvis was fixed, and a posterolateral approach was used to sequentially incise the skin, subcutaneous tissue, superficial and deep fascia, and gluteus maximus fascia lata. At the attachment point of the tensor muscle, the gluteus maximus was bluntly separated, exposing and cutting off the attachment points of the piriformis muscle, superior and inferior medullary muscles, and other external rotator muscles at the insertion point of the greater trochanter. Part of the quadratus femoris muscle was cut off, making a T-shaped incision for the posterior joint capsule. The femoral torque was kept at about 1 cm, and the neck-shaft angle at 135°, an oscillating saw was used to flatten the end of the femoral neck, the femoral head and residual bone fragments were removed, and the diameter of the femoral head was measured. The hyperplastic joint capsule and synovial tissue along the edge of the acetabulum were removed. An acetabular file with a suitable diameter was used to maintain an angle of about 45° and tilted forward at an angle of 15°. The acetabulum was gradually expanded and deepened until blood oozed evenly. After the acetabular mold was tested suitable, the bone chips were vacuumed and dried, a press-fit artificial acetabular cup of appropriate size was inserted. An orientater was used to keep it outward at about 45°, it was tilted forward at an angle of about 15° and hammered. The corresponding lining was installed and hammered tightly. This was followed by internal rotation, hip flexion, and knee flexion of the left lower limb to expose the femoral neck section. A box-type opener was used to open the medullary cavity of the proximal femur. The medullary cavity expander was used to gradually expand the medullary cavity, and then the femoral stem was used to expand the medullary cavity with an inclination angle of about 15°. Bone debris was flushed and absorbed, the trial prosthesis was inserted and the trial cast was installed, externally rotating and abducting, flexing and resetting the knees and hips, checking that there was no dislocation during movement in all directions and that the length was appropriate, and the trial cast was taken out. The prosthesis was inserted into the corresponding artificial femoral stem, and the anteversion angle was kept at 15°, hammering to tighten it. The artificial femoral head was installed and hammered tightly, and the joint was reset, checking that the joint movement was normal and the stability was good. It was also checked that the head socket was well contained, the tightness was appropriate, with 90° flexion and 30° adduction, and it was stable without dislocation, and that both lower limbs were the same length. The surgical field was flushed, and the bleeding area around the femoral stem was covered with bone wax to stop the bleeding. The instruments and gauze were checked to see if they were correct in number. Part of the joint capsule was repaired and the external rotator muscles were repaired and reconstructed. The incision was sutured layer by layer, negative pressure drainage was placed, and moderate pressure was applied to the dressing.

2.4. Statistical methods

The data of patients with femoral neck fractures were processed with SPSS21.0. % recorded (χ^2 test) the count data of patients with femoral neck fractures, and mean ± standard deviation (SD) recorded (*t* test) the measurement data of patients with femoral neck fractures. There was a statistically significant difference if $P < 0.05$.

3. Results

3.1. Surgical indicators

The operation time, time to get out of bed for the first time after surgery, and hospitalization time in the research group were all longer than those in the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those in the control group, $P < 0.05$. The results are shown in **Table 2**.

Table 2. Comparison of surgical indicators in patients with femoral neck fractures (mean ± SD)

Group	Operation time (minutes)	Intraoperative blood loss (ml)	Postoperative drainage volume (ml)	Time to get out of bed for the first time after surgery (days)	Hospitalization time (days)
Research group (n = 15)	99.14 ± 2.63	369.48 ± 6.36	206.11 ± 4.36	15.01 ± 2.43	25.64 ± 1.89
Control group (n = 15)	78.31 ± 1.89	318.44 ± 4.18	184.36 ± 2.45	11.43 ± 1.86	20.47 ± 1.63
t	24.9097	25.9737	16.8434	4.5309	8.0228
P	0.0000	0.0000	0.0000	0.0001	0.0000

3.2. Quality of life

After nursing, the SF-36 (36-Item Short Form Health Survey) score of the research group was higher than that of the control group, $P < 0.05$, as shown in **Table 3**.

Table 3. Comparison of quality of life in patients with femoral neck fractures (mean ± SD)

Group	Good health (points)		Mental health (points)		Physiological functions (points)		Social functions (points)	
	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing
Research group (n = 15)	62.25 ± 2.43	87.36 ± 3.21	63.42 ± 2.38	88.41 ± 3.18	62.41 ± 2.36	88.41 ± 3.52	63.25 ± 2.39	88.43 ± 3.48
Control group (n = 15)	62.31 ± 2.41	74.21 ± 3.15	63.39 ± 2.39	75.25 ± 3.06	62.39 ± 2.39	73.09 ± 3.13	63.27 ± 2.41	72.43 ± 3.25
t	0.0679	11.3243	0.0344	11.5492	0.0231	12.5966	0.0228	13.0140
P	0.9463	0.0000	0.9728	0.0000	0.9818	0.0000	0.9820	0.0000

3.3. Harris hip scores

The Harris scores of all hip joints in the research group were higher than those in the control group, $P < 0.05$, as shown in **Table 4**.

Table 4. Harris hip scores analysis (mean ± SD)

Group	Joint movement	Joint deformity	Joint function	Pain level
Research group (n = 15)	3.78 ± 0.25	4.39 ± 0.21	29.21 ± 1.36	42.81 ± 3.25
Control group (n = 15)	3.21 ± 0.21	4.04 ± 0.18	20.18 ± 1.21	36.82 ± 2.87
t	6.7615	4.9010	19.2122	5.3506
P	0.0000	0.0000	0.0000	0.0000

3.4. Comparison of fracture complications

Based on **Table 5**, the fracture complication rate of the research group was lower than that of the control group, $P < 0.05$.

Table 5. Analysis of fracture complications [n, (%)]

Group	Periprosthetic fracture	Heterotopic ossification	Deep vein thrombosis of lower limbs	Incidence
Research group (n = 15)	0 (0.00)	0 (0.00)	0 (0.00)	0.00
Control group (n = 15)	1 (6.67)	2 (13.33)	1 (6.67)	26.67
χ^2	-	-	-	4.6154
P	-	-	-	0.0317

4. Discussion

Femoral neck fractures are common in older people. This disease is mainly treated with surgery. However, postoperative complications such as avascular necrosis of the femoral head and nonunion of the fracture are prone to occur. Femoral neck fractures in older people are mainly related to the following factors:

(1) Reduced bone strength, occurrence of osteoporosis, changes in the biomechanical structure of the femoral neck region, and increased fragility of the femoral neck all increase the risk of fractures.

(2) The hip muscles of older people have degenerated, and the hip joints are unresponsive, thus unable to weaken the harmful stress on the hip. Local fractures may occur under the action of external forces such as falls and car accidents.

Elderly patients with femoral neck fracture may develop the following symptoms:

(1) Deformity: External rotation deformity of the affected limb or hip flexion deformity.

(2) Pain: The pain is more severe, especially when moving the affected limb. Tapping the affected limb's greater trochanter area and heel area can aggravate the hip pain. Pressing the inguinal ligament will cause tenderness.

(3) Swelling: Most femoral neck fractures are intracapsular fractures. The amount of bleeding after the onset is small, and the extra-articular muscles are affected, thus local swelling symptoms are more likely to occur.

(4) Functional impairment: The patient's activities can be restricted, causing the patient to be unable to stand or sit up independently. However, some patients with impacted fractures and linear fractures can still walk after the injury.

Relevant literature reports that the efficacy of surgical treatment for patients with femoral neck fractures is slightly worse than that of fractures in other locations, and there is a higher nonunion rate after surgery. In addition, the elderly population has a low overall physical fitness and underlying severe diseases, which may aggravate bedsores, urinary tract infections, and other risks [2]. Therefore, choosing which surgical methods to treat femoral neck fractures in older people, improving the prognosis of patients, and reducing surgical complications are still popular topics in clinical research.

When clinically treating elderly patients with femoral neck fractures, internal fixation, artificial hip replacement, and other options are often chosen, which have the advantages of high solidity, easy operation, and fast recovery. However, various surgical methods have different indications. Some orthopedic surgeons recommend artificial joint replacement to treat patients with Garden III to IV types to restore hip joint function and improve the quality of life [3]. Relevant literature reports that compared with conventional internal fixation

treatment, choosing an artificial joint replacement to treat femoral neck fractures in older people can reduce postoperative nonunion, bone necrosis, and other symptoms. It can also reduce the fracture nonunion rate and shorten the time for patients to get out of bed after surgery [4]. Summary analysis shows that artificial hip replacement has the following advantages in treating patients with femoral neck fractures:

(1) Safe and efficient: After hip replacement, it can reduce joint pain caused by femoral head necrosis, restore joint movement function, and correct limping, enabling the patient to stand and walk normally.
(2) Mature technology: Hip replacement has been developed for decades, and the current technology in replacement operation is relatively mature.
(3) Short cycle: Conventional femoral neck fracture patients can complete the hip replacement operation in about 1 hour, and the affected limb can be moved typically about one month after surgery [5].

When total hip replacement is used to treat elderly patients with femoral neck fractures, it can quickly reduce postoperative complications, restore the patient's essential joint functions, and significantly reduce or eliminate the patient's pain symptoms. It is suitable for patients with good physical fitness; elderly patients with high hip joint activity after surgery are being treated with this approach [6]. However, before total hip replacement surgery, it is necessary to strictly control the indications for prosthetic replacement, make preoperative preparations, and regulate the range of intraoperative operations. In addition, although total hip replacement has excellent long-term effects, as the patient ages, complications such as aseptic loosening may occur, and remediation is complex. A femoral head replacement has the characteristics of minor trauma and low blood loss and is suitable for treating comminuted fractures in patients with poor physical fitness [7]. However, it should be noted that the artificial femoral head prosthesis cannot fully match the bony acetabulum, and concentrated stress is prone to occur in the bony acetabulum load-bearing area, which may lead to thigh pain and acetabular wear during postoperative activities [8]. Total hip replacement and femoral head replacement have both advantages and disadvantages, and the surgical plan must be scientifically selected based on the specific conditions of patients with femoral neck fractures.

Based on the data analysis in this article, the operation time, time to get out of bed for the first time after surgery, and hospitalization time in the research group were all longer than those in the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those in the control group, $P < 0.05$. It shows that total hip replacement operation is relatively complicated and slightly more invasive. Another set of data showed that the SF-36 score of the research group was higher than that of the control group, $P < 0.05$; the Harris hip score of each hip joint in the research group was higher than that of the control group, $P < 0.05$. It indicates that total hip replacement has significant long-term effects, and the physiological function of the hip joint recovers well after surgery. This may be due to that the trauma of hemiarthroplasty is relatively mild, but the acetabulum continues to wear after surgery, and there is a risk of hip pain and limited joint movement, hence the quality of life after surgery is relatively low [9]. The results also showed that the fracture complication rate in the research group was lower than in the control group, $P < 0.05$. Analyzing intraocular pressure, total hip replacement treatment can avoid acetabular cartilage wear and facilitate postoperative functional exercise, reducing the risk of complications. However, this article reported no postoperative complications, which may be related to the small number of patients with femoral neck fractures included in this study [10].

5. Conclusion

In summary, total hip replacement and femoral head replacement can improve hip joint function in elderly patients with femoral neck fractures. However, total hip replacement has better long-term effects.

Disclosure statement

The author declares no conflict of interest.

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