Int J Clin Exp Med 2020;13(7):4758-4764
www.ijcem.com /ISSN:1940-5901/IJCEM0110077

Review Article

The clinical efficacy of artificial hip replacement and hip brace fixation on elderly hip fracture patients

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Received February 29, 2020; Accepted April 8, 2020; Epub July 15, 2020; Published July 30, 2020

Abstract: Objective: To investigate the clinical efficacy of artificial hip replacement combined with hip brace fixation on elderly hip fracture patients and to compare the prognoses of the patients. Methods: A total of 96 hip fracture patients admitted to our hospital from February 2017 to August 2018 were enrolled as the study cohort, of which 50 patients undergoing artificial hip replacement combined with hip brace fixation were assigned to a research group, and the rest undergoing artificial hip replacement combined with traditional T-shaped anti-rotation shoes were assigned to a control group. The following indexes of the two groups were recorded and compared: Getting out-of-bed time, hospital stay, fracture healing time, postoperative complications, and the expressions of interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) at different time points. The hip joint function the two groups was evaluated using the Harris score after 2 and 6 months of treatment, and the bone mineral density of the two groups was measured at 7 days and 6 months after surgery. In addition, all the patients were followed up for six months after their discharges to determine their quality of life. Results: The research group experienced earlier getting out-of-bed times, earlier fracture healing times, and shorter hospital stays than the control group ((3.42±0.81) d *vs.* (4.57±0.96) d, (112.45±7.61) d *vs.* (134.45±7.89) d, and (12.16±3.02) d *vs.* (14.69±4.19) d, all $P<0.001$) and also showed fewer complications than the control group ($P<0.05$). In addition, before the treatment, the two groups had no significant differences in their expressions of IL-6 and TNF-α, but after 7 days of treatment, the expressions in the research group were significantly lower than they were in the control group ($P<0.001$). After 6 months of treatment, the research group got a greatly higher Harris hip score than the control group ($P=0.001$), and showed better bone mineral density than the control group ($P<0.05$). The follow-up results showed that the research group got higher quality of life scores than the control group ($P<0.05$). Conclusion: Artificial hip replacement combined with hip brace fixation is superior to artificial hip replacement combined with traditional T-shaped anti-rotation shoes, because it can effectively promote the recovery of elderly patients and reduce their complications, it is more efficacious on elderly hip fracture patients, and it can improve their life quality after surgery. Therefore, it is an effective postoperative treatment method.

Keywords: Artificial hip replacement, hip brace fixation, elderly hip fracture, efficacy, prognosis

Introduction

Hip fracture is one of the most common clinical fractures. It is estimated that there will be 21,000,000 new hip fracture cases in 2050 worldwide [1]. Because of increasing age, osteoporosis, and poor physical coordination ability, the elderly are vulnerable to hip fracture [2]. What's more, elderly hip fracture patients are more difficult to treat due to their poor physical state and reserve function of various organs, so their disability rate and mortality are higher, which seriously comprises the physical and mental health of the elderly [3, 4]. Therefore, it is of great importance to find an effective treatment method to improve the treatment efficacy and prognoses of the patients.

Hip fracture is classified into femoral neck fracture and intertrochanteric fracture according to the difference in the fracture position. With the medical development and progression, there has been a gradual increase in treatment methods for hip fracture, including artificial hip

replacement, which is effective for elderly hip fracture patients. Artificial hip replacement can be classified into hemiarthroplasty and total hip arthroplasty according to the surgery mode [5, 6], and it is able to effectively improve hip joint function. At present, in clinical practice, hip fracture is mostly treated with artificial hip replacement combined with T-shaped anti-rotation shoes [7], but with the wide application of the method, it has been found that patients undergoing the treatment usually have complications, including dislocation [8]. Furthermore, T-shaped anti-rotation shoes for fixation of the affected foot hinders effective functional exercise early on, causing swelling, so patients are often reluctant to use T-shaped shoes to fix the affected limb. In recent years, hip brace fixation has been applied as a new immobilization method after hip fracture surgery [9], and it is advantageous for its use of lightweight materials, its stable fixation, and its convenient operation. Furthermore, it only covers the affected part, and it can be worn by patients or their families. However, there are still some controversies on how to choose between the two methods in clinical practice, and there are few studies on the above two methods at home and abroad. Therefore, this study aimed to compare the effects of artificial hip replacement combined with hip brace fixation and artificial hip replacement combined with T-shaped anti-rotation shoes on elderly hip fracture patients and on the laboratory indexes to determine which method is conducive to faster recovery and higher efficacy, so as to improve the quality of life of the elderly and provide relevant reference and guidance for the future treatment of hip fracture in elderly patients.

Materials and methods

Clinical data

A total of 96 hip fracture patients treated in our hospital between February 2017 and August 2018 were enrolled as the study cohort and assigned into the research group (n=50) and the control group (n=46) according to the treatment method used. This experiment was approved by the Medical Ethics Committee of our hospital, and all the patients or their family members voluntarily cooperated with the treatment and signed informed consent forms after learning about the study.

Inclusion and exclusion criteria

The inclusion criteria were as follows: patients with hip pain, limb pronation, and limited functional activity ability, patients diagnosed with hip fracture according to CT examination in the department of imaging of our hospital, and patients between 60 and 80 years old. The exclusion criteria were as follows: patients with diseases affecting their limb movement such as hemiplegia, patients with other hip diseases or cognitive impairment, patients with severe local skin damage who could not receive brace fixation, patients with end-stage malignant tumors, and patients younger than 60 years old.

Methods

The patients in the research and control groups were treated with total hip replacement or hemiarthroplasty according to their actual situation at the posterior lateral side of the hip joint. During the total hip replacement, the femoral neck of each patient was cut off to take the femoral head out and remove the cartilage, and then the acetabulum was filed, and an acetabular component was placed. After reduction, the wound was sutured. During hemiarthroplasty, the medullary cavity of the patient was reamed after the femoral head was taken out, and the prosthesis was fixed and placed into the acetabulum. Finally the wound was sutured.

The patients in the research group were given hip brace fixation after surgery. An appropriate hip brace with the appropriate belt size was selected for each patient according to his/her body type, and it was used for the affected limb after the buckle was opened. The tightness was adjusted to make the patient comfortable.

The patients in the control group were required to wear T-shaped anti-rotation shoes. The affected limb was made to be in a consistent neutral and abduction position with a soft pillow between the legs for fixation, and the patients were asked to not turn over frequently after surgery to lower the incidence of dislocation.

Venous blood (3 mL) was sampled from each patient in the two groups before the treatment and at 7 days after the treatment, and an enzyme-linked immuno-sorbent assay (ELISA) was applied to determine the expressions of interleukin-6 (IL-6) and tumor necrosis factor-α

(TNF-α) in the peripheral blood of the two groups of patients using a IL-6 kit (Shanghai Yubo Biological Technology Co., Ltd., item number: IC-IL6-P) and a TNF-α kit (Shanghai Joe Feather Biotechnology Co., Ltd., item number: QY-MB10200) in strict accordance with the kits' instructions.

Outcome measures

The two groups were compared in terms of their getting out-of-bed time, their length of hospital stay, their fracture healing time, and their complications, and their expressions of IL-6 and TNF-α in their peripheral blood before the treatment and at 7 days after the treatment, respectively. After 2 months and 6 months of treatment, we used the hip Harris score to evaluate the hip joint function of the two groups, with a score larger than or equal to 90 points indicating excellent hip joint function, a score between 80 and 89 points indicating good hip joint function, a score between 70 and 79 points indicating fair hip joint function, and a score lower than 70 points indicating an adverse outcome [10]. The total effective rate was recorded as the number of patients with excellent, good, or fair hip joint function/the total number of patients. At a half year after the treatment, the patients' quality of life was scored with a hundred-point system, which included the body function score, the cognitive function score, the social activity function score, the negative emotion score, and the pain-free condition score. A higher score for each measure meant a better situation of that aspect, and all the scores were given comprehensively by the patients themselves and their family members based on their understanding of the exact meaning of each item. The bone mineral density of each patient in the two groups was determined using an X-ray absorptiometer at 7 days and 6 months after surgery.

Statistical analysis

In this study, the data were analyzed statistically using SPSS 22.0, and rendered into the required figures using GraphPad 5. The measurement data were expressed as the mean ± standard deviation (mean ± sd) and analyzed using t tests. The enumeration data were expressed as a rate, and the comparisons between groups were carried out using chi-square tests. $P<0.05$ indicated a significant difference.

Results

Clinical data

The two groups were compared in terms of sex, age, white blood cell count, fracture type, etiology, past history, smoking, and drinking, and it was found that none of these characteristics affected the experimental results (all $P>0.05$) **Table 1**.

Comparison of the getting out-of-bed time, hospital stay, and fracture healing time

The research group experienced earlier getting out-of-bed times, earlier fracture healing, and shorter hospital stays than the control group (all $P<0.001$) **Table 2**.

Complications

The two groups were compared in terms of their complications, including pulmonary infections, urethral infections, venous thrombosis, pressure sores, and postoperative joint dislocations, and it turned out that the complication rate in the control group was significantly higher than it was in the research group ($P<0.05$) **Table 3**.

Comparison of the expressions of serum IL-6 and TNF-α in the two groups at different time points

The blood sampled from all research participants before the surgery and after 7 days of treatment was analyzed, and it turned out that before the treatment, the expressions of IL-6 and TNF-α in the research group was not significantly different from the expressions in the control group (both $P>0.05$), but after 7 days of treatment, their expressions in the research group were significantly lower than they were in the control group (both $P<0.001$) **Figure 1**.

Analysis and comparison of the hip joint function in the two groups (Harris score)

The Harris score of the research group was much higher than it was in the control group after 2 and 6 months of treatment, respectively ($P<0.01$) **Table 4**.

Table 1. Comparison of the clinical data [n (%)]

	The research group (n=50)	The control group (n=46)	t or χ^2	*P*-value
Sex			0.082	0.775
Male	21 (42.00)	18 (39.13)		
Female	29 (58.00)	28 (60.87)		
Age	68.47±9.15	69.68±9.21	0.645	0.520
White blood cell count (10*9/L)	7.65±2.19	7.34±2.16	0.697	0.487
Fracture type			0.298	0.585
Femoral neck fracture	31 (62.00)	26 (56.52)		
Intertrochanteric fracture	19 (38.00)	20 (43.48)		
Etiology			0.560	0.756
Injury from fall	21 (42.00)	19 (41.30)		
Traffic accident	12 (24.00)	8 (17.39)		
Sprain	17 (34.00)	11 (23.91)		
Past history			0.280	0.597
Yes	44 (88.00)	42 (91.30)		
No	6 (12.00)	4 (8.70)		
Smoking			1.096	0.295
Yes	18 (36.00)	12 (26.09)		
No	32 (64.00)	34 (73.91)		
Drinking			0.608	0.436
Yes	19 (38.00)	14 (30.43)		
No	31 (62.00)	32 (69.57)		

Table 2. Comparison of the getting out-of-bed times, hospital stay, and fracture healing times

	The research group (n=50)	The control group (n=46)	t	*P*-value
Getting out-of-bed times	3.42±0.81	4.57±0.96	6.360	<0.001
Hospital stay	12.16±3.02	14.69±4.19	3.414	<0.001
Fracture healing times	112.45±7.61	134.45±7.89	13.900	<0.001

Quality of life scores

The quality of life of the patients in the two groups was scored at one-half year after the treatment, and the average score of the research group was higher than the average score of the control group ((75.21±4.55) points vs. (73.36±4.35) points, P<0.05). The quality of life scores of the research group were better than those of the control group (all *P*<0.05), except that there was no significant difference in the cognitive function between the two groups (*P*>0.05) **Table 5**.

Comparison of the bone mineral density

At 7 days after the surgery, the two groups showed no significant difference in their bone mineral density (*P*>0.05), but at 6 months after the surgery, both groups showed increased bone mineral density, and the bone mineral density of the research group was significantly higher than it was in the control group (both *P*<0.05) **Table 6**.

Discussion

The Hip is the only joint connecting the lower limbs and the trunk of the human body [11]. With the acceleration of the aging population, the incidence of hip fractures in the elderly is also gradually increasing year by year [12, 13]. Hip fractures in the elderly are mostly caused by direct or indirect strong forces [14], among which femoral neck fracture is prone to complications of the respiratory and urinary systems due to the special anatomical results and functions, resulting in an increase in mortality [15, 16]. Fractures easily bring about severe pain and deformations in the patients' affected limbs, so they are mostly treated with surgery in clinical practice. At present, artificial hip replacement is more effective than other meth-

Table 3. Comparison of the complications between the two groups

Group	Pulmonary infection	Urethral infection	Venous thrombosis	Pressure sores	Postoperative joint dislocation	Complication rate
The research group (n=50)	0	0	1	2	1	4 (8.00)
The control group (n=46)	2	1	2	3	3	11 (23.91)
χ^2						4.602
P-value						0.032

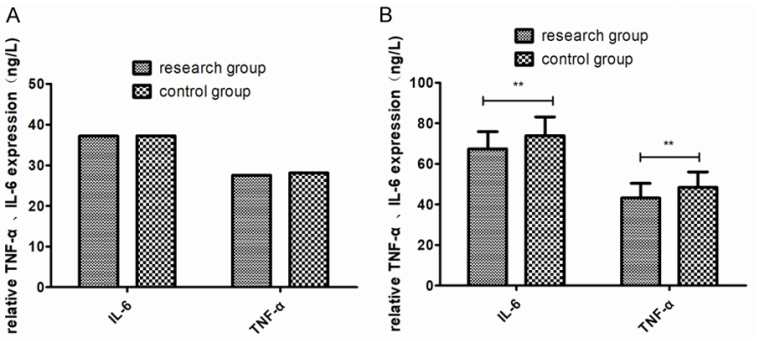

Figure 1. Separate comparisons of the expressions of serum IL-6 and TNF-α in the two groups before the surgery and after 7 days of treatment. A. A comparison of the expressions of IL-6 and TNF-α between the two groups before the surgery; B. A comparison of the expressions of IL-6 and TNF-α between the two groups after 7 days of treatment. ** indicates *P*<0.001.

Table 4. Comparison of the hip joint function (Harris Score)

Group	After 2 months of treatment	After 6 months of treatment
The research group (n=50)	71.25±5.42	85.64±6.59
The control group (n=46)	68.33±5.15	81.21±6.37
t	2.701	3.343
P-value	0.008	0.001

ods, including internal fixation [17]. Therefore, it has been widely applied in the treatment of hip fracture in the elderly in recent years. However, with the increasing use of artificial hip replacement, it has been found that artificial hip replacement often brings about complications such as prosthetic dislocation [18], and it is worse than fixation at accelerating the getting out-of-bed time and reliving pain [19]. Therefore, currently, artificial hip replacement is usually adopted together with T-shaped anti-rotation shoes to achieve immobilization, thus relieving pain and accelerating wound healing. However, it is hard to effectively limit hip joint motion with T-shaped anti-rotation shoes, and long-term bed rest may bring about pressure sores and pulmonary infections. Hip brace fixation is a new immobilization method, which can limit hip joint activity with a structure composing of a waistband, an adjustable bracket, and a fixing hasp, and it can stabilize the hip joint.

Inappropriate treatment methods for hip fracture affect patient prognosis, so it is necessary to select a method that can minimize adverse reactions and provide the best efficacy as much as possible in the clinical selection of treatment methods. In this study, we analyzed and compared the effects of artificial hip replacement combined with T-shaped anti-rotation shoes and artificial hip replacement combined with hip brace fixation to provide a reference and guidance for the selection of hip fracture treatment strategies.

The results of this study showed that the research group experienced earlier getting out-of-bed times, earlier fracture healing times, and shorter hospital stays than the control group, and it showed a lower complication rate than the control group. In addition, the expressions of IL-6 and TNF-α in the blood at different time points in the two groups showed that before the treatment, the two groups showed no significant difference in their expressions, but after 7 days of treatment, the research group showed significantly lower expressions of the two indexes than the control group. IL-6 and TNF-α are the main pro-inflammatory factors. Some studies have revealed that the expressions of IL-6 and TNF-α in the blood of patients who died after artificial hip replacement were significantly higher than they were in the blood of the sur-

Table 5. Life quality scores (point)

	The research group (n=50)	The control group (n=46)	t	P
Body function	75.72±4.26	73.65±4.14	2.411	0.018
Cognitive function	81.97±5.34	80.63±5.22	1.242	0.218
Social activity function	68.93±4.12	66.89±3.94	2.475	0.015
No negative emotion	78.16±4.72	76.21±4.34	2.101	0.038
No pain	71.27±4.33	69.43±4.13	2.126	0.036
Average score	75.21±4.55	73.36±4.35	2.032	0.045

Table 6. Comparison of the bone mineral density (g/cm^2)

	The number of patients	At 7 days after surgery	At 6 months after surgery
The research group	50	0.69±0.10	0.88±0.13**
The control group	46	0.67±0.09	0.83±0.11**
t		1.027	2.025
P-value		0.307	0.046

**indicates compared with the situation at 7 days after surgery, $P<0.001$.

viving patients after the surgery, so IL-6 and TNF-α are important indexes for determining prognoses [20, 21]. Therefore, lowering the expressions of IL-6 and TNF-α after surgery is crucial to patient prognosis. Moreover, the Harris scores of hip joint function in the research group were significantly higher than they were in the research group, and the average quality of life quality in the research group was higher than it was in the control group, which implied that total hip replacement combined with hip brace fixation was more beneficial for the recovery of hip joint function and quality of life improvement. The results of the bone mineral density tests in the patients from the two groups showed that after 6 months of treatment, the bone mineral density of the patients in the research group was much higher than it was in the patients in the control group ($P<0.05$), which may be due to the following fact: Hip brace fixation can better fix the hip joint and reduce compression on the skin, thus benefiting the peripheral vessels and promoting the formation of bone resorption and osteogenesis. The results are consistent with the results of the study by Kazemian et al. [22].

For a subsequent analysis, we will conduct a long-term follow-up investigation to judge the long-term efficacy for this experiment, so as to obtain the best experimental results. Because of the limited experimental conditions, we were unable to determine whether the efficacy of the surgery in this study is the same in young and middle-aged people. We will continuously supplement the data to improve our experiment in the future.

To sum up, artificial hip replacement combined with hip brace fixation is superior to artificial hip replacement combined with traditional T-shaped anti-rotation shoes because it can effectively promote the recovery of elderly patients and reduce their complications, it is more efficacious on elderly hip fracture patients, and it can improve their quality of life after surgery. Therefore, it is an effective treatment method.

Disclosure of conflict of interest

None.

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