Comparison of Postoperative Pain and Application Effect of High Tibial Osteotomy and Total Knee Replacement in Patients with Knee Arthritis

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Objective: To investigate the effects of high tibial osteotomy (HTO) and total knee replacement (TKR) on postoperative pain of patients with knee arthritis. Methods: From February 2017 to March 2019, 72 patients with knee arthritis in our unit were collected for the experiment. Patients in the control group (CG, 35 cases) were treated with HTO, and research group (RG, 37 cases) were treated with TKR. Clinical efficacy, Visual Analogue Scale (VAS) score, Knee Society Score (KSS), and Hospital for Special Surgery (HSS) knee rating score of the two groups of patients were observed. Intraoperative blood loss, operative time and hospitalization expenses were observed, as well as the effect of knee joint recovery after operation.Results: In terms of overall effective rate, RG was superior to CG ($p < 0.05$). VAS score of RG was notably lower at 1 week and 2 weeks after operation than that in CG ($p < 0.05$). KSS of RG was evidently higher than that of CG ($p < 0.05$). HSS score of RG was notably higher than that of CG after operation ($p < 0.05$). The intraoperative blood loss and operative time in RG were notably better than those in CG ($p < 0.05$). The effects of knee joint recovery in RG was considerably better than that in CG ($p < 0.05$). Conclusion: TKR has a better clinical effect on elderly patients, which can reduce postoperative pain, intraoperative blood loss and operative time, and improve the recovery effect of knee joint.

Keywords: knee arthritis, high tibial osteotomy, total knee replacement, effect
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INTRODUCTION

Knee arthritis is one of the most common degenerative joint diseases in the world. Knee arthritis, also known as degenerative joint diseases, primary knee arthritis, wear arthritis and age-related arthritis, is the main cause of disability in America [1,2]. It is the most common form of arthritis, which constitutes the main cause of adult disability [3], and knee joint is the most seriously affected joint. Knee arthritis is a heterogeneous pathology with complex and multifactorial characteristics [4]. Therefore, attaching importance to knee arthritis, early diagnosis and active treatment is of great significance.

With the development of society, the increasing obesity level, the aging of the population and the increase of sports-related injuries, some studies have indicated that knee osteoarthritis is expected to cause a greater burden on people in the future[5]. Total knee replacement (TKR) has been gradually applied to clinical practice with the deepening understanding of knee joint diseases and the continuous development of technology [6]. TKR has been proved to improve the knee function and quality of life of patients, and has certain cost-effectiveness [7, 8]. In the past 20 years, the utilization rate of TKR in Australia and other developed countries has increased by 105%, and the number of people who received TKR in treating knee arthritis has increased to 73%,

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showing a gradual increasing trend. Hightibial osteotomy (HTO) is a globally recognized choice for treating knee arthritis, especially for young patients. The main purpose of osteotomy is to improve the function of knee joint by correcting the axis of knee joint and increasing the stability of joint [9-11]. TKR can preserve the bone of knee joint, which provides patients with an operation with less invasive and faster recovery time [12].

Therefore, this experiment compared the clinical efficacy, postoperative pain, intraoperative blood loss, operative time and knee joint recovery effect of HTO and TKR for patients with knee arthritis, aiming to provide reference for future clinical practice.

DATA AND METHODS

Clinical Data

Totally 72 knee arthritis patients admitted to our hospital from February 2017 to March 2019 were collected in this experiment. Patients received treatment of HTO were enrolled in the control group (CG, 35 cases), of which 19 were males and 16 were females, with an age of 50-65 years and an average age of (54.73±7 3.96) years. Patients received treatment of TKR were enrolled in the research group (RG, 37 cases), of which 21 were males and 16 were females, with an age of 51-65 years and an average age of (54.68±3.75) years. This study has been approved by the ethical committee of our hospital.

Inclusion and Exclusion Criteria

Inclusion criteria: Patients met the requirements of the British Orthopaedic Association and were confirmed as knee arthritis by clinical diagnosis [13]. Patients were conscious, able to complete the questionnaire independently. Patients aged 50-70 years old. Patients had complete general clinical data, and patients or their immediate family members signed the informed consent form.

Exclusion criteria: Patients quit the experiment halfway. Patients were complicated with malignant tumor or severe organ dysfunction, infectious disease, suppurative arthritis, or rheumatoid arthritis. Patients had poor treatment compliance. Patients had trauma, fracture or injury of main ligament of knee joint.

Treatment Methods

CG: HTO was performed. A transverse incision with a length of about 6 cm was made at the anterior medial side under the knee tibia. The superficial layer of the medial collateral ligament was peeled off, and a 2.5 mm Kirschner wire was driven in the direction of the fibular head at a parallel angle to open the coronal plane behind the tibial tuberosity to 20°. Tomofix plate was selected as the fixation material, and bone graft was made at the posterior medial side of the ipsilateral iliac bone of the affected limb, and drainage tubes were properly placed, then the surgical incision was closed. Appropriate analgesic drugs were chosen according to the postoperative pain of patients.

RG: the condition of patients were evaluated, and more appropriate prostheses were selected according to specific conditions. Patients should be given general anesthesia before surgery. An incision of about 15 cm was selected in the middle of the patient's knee joint after the anesthetic effect appeared. After the incision, the patient's joint cavity and other tissues were completely exposed to the visual field. The meniscus, fat pad and other tissues of the patient were effectively removed, and the tissues around the knee joint and femur were trimmed according to the patient's condition. The degree of flexion and extension of the patient's knee joint was measured, the gap of the patient's knee joint was understood, the prosthesis was put in and fixed, and the surgical position was disinfected and bandaged after suture. The dressings at the surgical site should be changed to avoid infection at the surgical site. Meanwhile, infection and inflammation should be prevented at the later stage. One day after the operation, the patients were instructed to take low molecular heparin calcium continuously for 7 days, and appropriate analgesic drugs were selected according to their postoperative pain.

Scoring Criteria

Visual analogue scale (VAS) was utilized for assessment of the pain degree of patients after operation, with a full score of 10. The higher the

score was, the more severe the pain degree was, and the worse the pain control effect was. Knee Society Score (KSS), and Hospital for Special Surgery (HSS) knee rating score were applied for assessment of recovery of knee joint, with a total score of 100. Higher score indicated better knee joint recovery.

Outcome Measures

Main outcome measures: clinical efficacy, VAS score, KSS, and HSS score of the two groups of patients were observed.

Secondary outcome measures: intraoperative blood loss, operative time and hospitalization expenses were observed, as well as the effect of knee joint recovery after operation.

Statistical Analysis

SPSS20.0 software package (IBM Corp, Armonk, NY, USA) was utilized for statistical analysis of the collected data, and GraphPad 7 software package was applied for image rendering. K-S test was used to analyze the distribution of counting data, in which the normal distribution data was expressed as mean ± standard deviation (Meas±SD). Independent sample t test was used for comparison between groups. Intra-group comparison was analyzed using the paired t test. Counting data were expressed by rate (%), qualified by chi-square test and represented by χ^2. When P <0.05, there was a statistical difference.

RESULTS

Clinical Data

There was no remarkable difference between RG and CG in clinical data such as age, hypertension history, BMI, smoking history, drinking history, place of residence, food preference, exercise habits, course of disease, suggesting comparability (p > 0.05), as shown in Table 1.

Table 1.
Basic information [n(%)]

	Research group (n=37)	Control group (n=35)	χ^2 or t	p
Age (years)	54.68±3.75	54.73±3.96	0.055	0.956
Hypertension history				
Present	11(29.73)	12(34.29)	0.172	0.679
Absent	26(70.27)	23(65.71)		
BMI	22.05±1.24	22.02±1.17	0.106	0.916
Smoking history				
Present	15(40.56)	14(40.00)	0.002	0.963
Absent	22(59.46)	21(60.00)		
Drinking history				
Present	18(48.65)	17(48.57)	0.007	0.995
Absent	19(51.35)	18(51.43)		
Place of residence				
City	23(62.16)	25(71.43)	0.695	0.405
Countryside	14(37.84)	10(28.57)		
Food preference				
Light	12(32.43)	11(31.43)	0.008	0.927
Spicy	25(67.57)	24(68.57)		
Exercise habits				
Present	23(62.16)	20(57.14)	0.188	0.664
Absent	14(37.84)	15(42.86)		
Course of disease (Week)	4.74±1.04	4.92±0.86	0.798	0.427

Clinical Efficacy of Patients

Compared with CG, RG had notably more patients with markedly effective efficacy (p < 0.05), notably less patients with ineffective efficacy (p < 0.05), and there was no remarkable difference in patients with effective efficacy (p > 0.05). RG was also superior to CG in terms of overall effective rate (p < 0.05), as shown in Table 2.

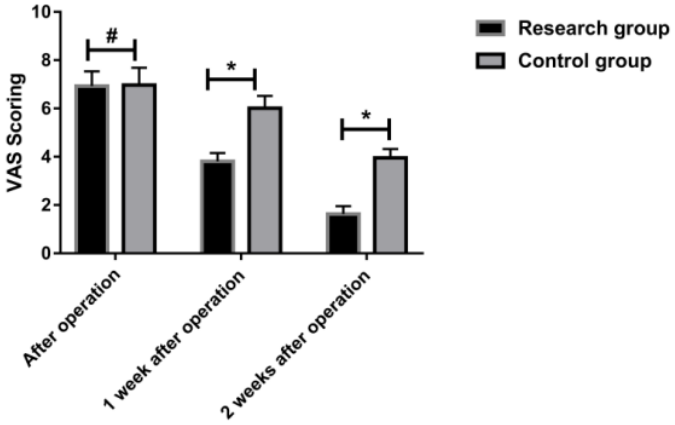
Table 2.
Comparison of clinical efficacy

	Number of people (n)	Therapeutic effect [n(%)]			Effective treatment rate (%)
		Markedly effective	Effective	Ineffective	
Research group	37	24(64.86)	12(32.43)	1(2.71)	97.29
Control group	35	10(28.57)	18(51.43)	7(20.00)	80.00
χ2		15.210	2.670	5.449	5.449
p		0.001	0.102	0.020	0.020

VAS Score

There was no remarkable difference in VAS score between the two groups before operation ($p > 0.05$). The VAS score of RG was notably lower than that of CG at 1 week and 2 weeks after operation ($p < 0.05$), as shown in Figure 1.

Figure 1.
VAS score of patients



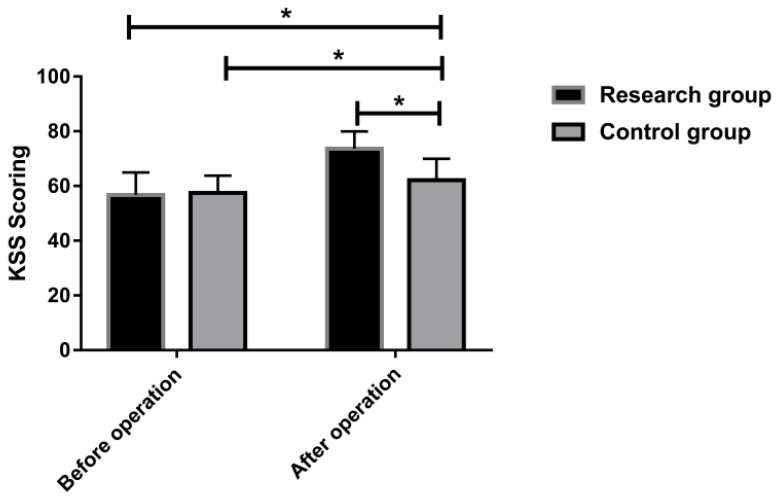
VAS score of the research group was notably lower at 1 week and 2 weeks after operation than that in the control group ($p < 0.05$).

Notes: symbol # indicates that there is no difference between the two groups ($p > 0.05$), and symbol * indicates that there is a difference between the two groups ($p < 0.05$).

KSS

There was no remarkable difference in postoperative KSS scorebetween the two groups ($p > 0.05$). The score of RG was notably higher than that of CG after operation ($p < 0.05$), as shown in Figure 2.

Figure 2.
KSSof patients

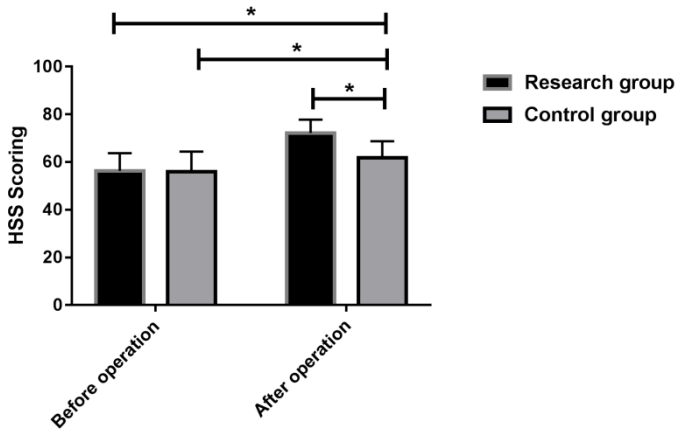


KSS score of the research group was notably higher than that in the control group after operation ($p < 0.05$).
Note: the symbol * indicates a difference between the two groups ($p < 0.05$).

HSS Score

There was no remarkable difference in postoperative HSS scores between the two groups ($p > 0.05$). The score of RG was notably higher than that of CG after operation ($p < 0.05$), as shown in Figure 3.

Figure 3.
HSS score of patients

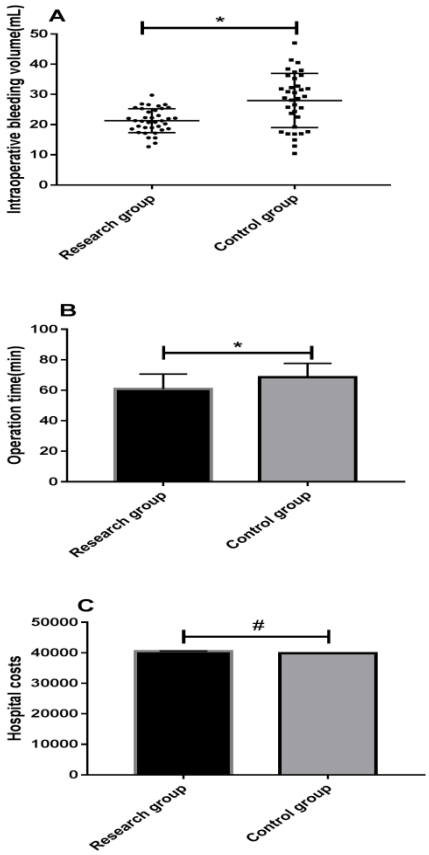


HSS score of the research group was notably higher than that in the control group after surgery ($p < 0.05$).
Note: the symbol * indicates a difference between the two groups ($p < 0.05$).

Intraoperative Blood Loss, Operative Time and Hospitalization Expenses of Patients

Comparison of intraoperative blood loss, operative time and hospitalization expenses between the two groups showed thatintraoperative blood loss and operative time of RG were evidently better than those of CG ($p < 0.05$), and there was no remarkable difference in hospitalization expenses between the two groups ($p > 0.05$), as shown in Figure 4.

Figure 4.
Intraoperative blood loss, operative time and hospitalization expenses of patients

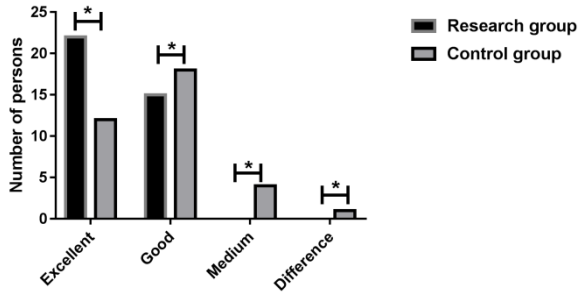


A, Comparison of intraoperative blood loss of patients.
B, Comparison of operative time of patients.
C, Comparison of hospitalization expenses of patients.
Notes: # indicates that there is no difference between the two groups ($P > 0.05$), and * indicates that there is a difference between the two groups ($P < 0.05$).

Recovery Effect of Knee Joint after Operation

In RG, there were 22 cases with excellent knee joint recovery, 15 cases with good recovery, and 0 case with medium and poor recovery. In CG, there were 12 cases with excellent knee joint recovery, 18 cases with good recovery, 4 cases with medium recovery and 1 case with poor recovery. The effect of knee joint recovery in RG was evidently better than that in CG ($p < 0.05$), as shown in Figure 5.

Figure 5.
Knee joint recovery effect



Comparison of knee joint recovery effect between two groups after operation.

Note: the symbol * indicates a difference between the two groups ($p < 0.05$).

DISCUSSION

Knee arthritis is a chronic degenerative joint disease, which is the main cause of pain and disability, and has caused a huge and growing burden on individuals and society [14,15]. It is characterized by slow progress, and may only be detected and clinically diagnosed in the late stage [16]. Thus, early detection and diagnosis of the disease can lead to better recovery, during which period mitigation actions can be taken before irreversible changes and aggravating disabilities occur [17]. Although extensive research has been carried out and billions of dollars have been spent, no drug can change the biological process of knee arthritis [18,19]. Except for pain relief or TKR, the treatment options for knee arthritis are very limited, and there are only a few treatments that alleviate symptoms but do not cure the disease. Therefore, this time, by comparing the effects of TKR and HTO on patients with knee arthritis, we aimed to provide reference and guidance for clinical practice.

In this study, we first compared the clinical efficacy of the two groups of patients after treatment, and found that the clinical efficacy and overall effective rate of the patients in RG were evidently better than those in CG, and the ineffectiveness was lower than that in CG, which indicated that TKR could improve the effective treatment rate of patients. By observing patients' VAS score, we found that there was no considerable difference in VAS score between the two groups before treatment, but the score of RG was notably lower than CG after treatment. We hypothesized that TKR could preserve part of knee bone and the wound area was small, so that the postoperative pain of patients in RG was lower than that in CG. In the study of Ivarsson et al. [20], it is also indicated that the TKR is less traumatic, so patients feel less pain and recover more quickly. There was no remarkable difference in KSS and HSS scores between the two groups before treatment, but RG had notably better scores than CG after treatment, suggesting that patients treated with TKR had better postoperative recovery effect. By observing the blood loss, operative time and hospitalization expenses, it was found that TKR could better control the blood loss, operative time and hospitalization expenses. Postoperative knee joint recovery was observed, andknee recovery in RG was found to be evidently better than that in CG. Santoso et al. [21], Higgins et al. [22], and Takeuchi et al. [23] pointed out in their studies that HTO is a globally recognized treatment method with little impact on body load, so it is more suitable for young people. TKR is suitable for the elderly because of its smaller trauma area and faster recovery time. And it is indicated that the two treatment schemes have achieved satisfactory results. Therefore, we cannot conclude which scheme is better. The subjects included in this study were all the elderly, so we believed that TKR was more suitable for the elderly than THO, and that TKR had more advantages in the clinical treatment of senile knee arthritis.

Through the above research, we have preliminarily proved that TKR can improve the clinical efficacy, postoperative pain and knee joint recovery of patients with knee arthritis. However, there are still some limitations in this study. First of all, there are many clinical treatment schemes, but in this study, only HTO scheme is used as the control, which is relatively simple. Therefore, we hope to include more treatment schemes in future research to expand our comprehensiveness and supplement our research results.

To sum up, TKR has a better clinical effect on elderly patients, which can reduce postoperative pain, blood loss and operative time, and improve the recovery effect of knee joint.

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