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Original Article

Efficacy of total knee arthroplasty on patients with severe knee osteoarthritis

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Abstract: Objective: This study aimed to analyze the efficacy of total knee arthroplasty (TKA) on patients with severe knee osteoarthritis (SKOA). Methods: Seventy-two patients with SKOA were enrolled and divided into a control group (treated by debridement of knee joint) and a study group (treated by TKA) (n = 36) based on a random number table. Patients in the two groups were compared in terms of treatment excellent and good rate, incidence rate of complications, KSS, Hss, VAS and NRS scores. Results: Compared with the control group, patients in the study group had significantly higher treatment excellent and good rate and postoperative KSS and Hss scores, but significantly lower incidence rate of complications and postoperative VAS and NRS scores (with statistical differences; $P < 0.05$). Conclusion: TKA significantly relieves pain of patients with SKOA and promotes recovery of knee joint function, with fewer complications and prominent efficacy.

Keywords: Severe knee osteoarthritis, debridement of knee joint, total knee arthroplasty

Introduction

Knee osteoarthritis (KOA) is extremely common in clinical practice, and its global incidence rate has significantly increased in recent years with the changes of the environment, lifestyles, and diets. According to statistical analysis of incomplete data, the incidence rate of severe knee osteoarthritis (SKOA) significantly increases, with nearly 50% of the patients over 60 years old, and nearly 80% over 75 years old. The disease is common in middle-aged and elderly people, mainly characterized by degeneration of the knee articular cartilage, complicated with osteosclerosis and osteophyte formation, and accompanied by walking difficulties, limitation of motion, arthralgia and arthrocele. With the main clinical characteristic of severe pain, the disease causes injury of keen joint and even hyperosteogeny, which has a severe adverse effect on people's work and life [1, 2]. Early KOA is mainly treated by surgery and internal medicine. With drug therapy alone, it is difficult to obtain the effective drug concentration, which greatly reduces the clinical efficacy. Traditional surgery, mainly arthroscopic debridement (AD), is not uniform in the scope of surgery and complications, with a poor therapeutic effect on advanced SKOA. Therefore, both drug therapy alone and traditional surgery cannot meet the current clinical needs [3]. With the development of society, the economy, and medical technology in China, total knee arthroplasty (TKA), compared with traditional debridement of knee joint, is gradually applied to the treatment of SKOA, significantly reducing the pain of the patients and expanding the range of motion (ROM) [4]. Therefore, 72 patients with SKOA were enrolled in this paper for research. The reports are as follows.

Materials and methods

Baseline information

Seventy-two patients with SKOA admitted to Shangrao People's Hospital from August 2015 to August 2018 were enrolled and divided into the control and study groups (n = 36) based on the random number table. The study group consisted of 13 females and 23 males with ages ranging from 59 to 80 years old with an average age of (69.7 ± 5.1) years old. The course of disease was 4-7 years with an average course of disease of (5.1 ± 1.1) years and the body weight was 44-82 kg with an average body weight of

(63.51 ± 5.71) kg. A total of 16 patients had lesions in the left knee and 20 in the right knee. The control group consisted of 15 females and 21 males with the age being 59-79 years old and an average age of (69.9 ± 5.3) years old. The course of disease was 2-8 years with an average course of disease of (5.3 ± 2.1) years and the body weight was 45-81 kg with an average body weight of (63.77 ± 5.55) kg. A total of 15 patients had lesions in the left knee and 21 in the right knee. The data mentioned above were compared, $P > 0.05$. This study was approved by the Ethics Committee of Shangrao People's Hospital.

Diagnostic criteria: (1) All patients met the diagnostic criteria for SKOA in the 2014 edition of *Advanced Course of Osteology*, diagnosed with "SKOA" by CT.

Inclusion criteria: (1) Patients with a HSS score (hospital for special surgery knee score) less than 60 points. (2) Patients with severe limitation of motion.

Exclusion criteria: (1) Those with kidney, heart, brain, liver and other organic diseases. (2) Those with immunological dysfunction and coagulation disorders. (3) Those who had received relevant treatment before. (4) Those with mental illness and depression. (5) Those with poor skin conditions. (6) Those with obesity and severe osteoporosis. (7) Those with latent and active infections.

Methods

Control group: With routine monitoring of vital signs, patients in a supine position were administrated with intra-articular injection of 100 mL of 0.5% procaine (Beijing Yimin Pharmaceutical Co., Ltd.; specifications: 2 mL: 40 mg) and 30 mg of ephedrine (Dikang Changjiang Pharmaceutical Co., Ltd., Chongqing; specifications: 1 mL: 30 mg) for epidural anesthesia. Patients were assisted to bend the knee joint by 90 degrees while keeping the shank naturally perpendicular to the distal part of the operating bed. Then, 60 mL of normal saline was injected into the articular cavity, from which the scope lemma was inserted in an appropriate way after the joint capsule was moderately expanded. After that, appropriate amount of 0.9% sodium chloride solution was used to repeatedly wash the articular cavity.

Study groups: With routine monitoring of vital signs, patients in a horizontal position were subjected to general or epidural anesthesia. An incision and operative approach (the medial side of the patella) were made in the middle of the knee joint, which was washed with normal saline after synovium of suprapatellar bursa and medial and lateral meniscal tissues were completely removed. Then, the cruciate ligament was excised, the contracture tissue was released, and osteophyte at proximal and distal tibia were completely excised to completely expose the tubercle of tibia. The osteotomy was intramedullary positioned to ensure the valgus angle close to 6 degrees and the external rotation angle close to 3 degrees. The osteotomy was rotated along the ankle joint line. The articular surface of the tibia was removed through intramedullary positioning, and the bone with a thickness of 9-10 mm was cut off to ensure the surface of the osteotomy tilted back by 5 degrees. After that, the lateral side was released and the deformity was corrected in time, with a rectangular gap of the femorotibial joint. According to the anterior and posterior diameter of the distal femur, the optimal femoral prosthesis was determined through debugging, and patella tracking was measured. The knee joint was repeatedly flexed and extended, and the rotational alignment of the tibial prosthesis was marked, with the test mold removed and the tibial medullary cavity treated. The limb alignment was defined, and the stability of the joint was observed in detail at the time of varus and valgus, extension and flexion. The prosthesis was inserted into the medullary cavity after which was repeatedly washed, and bone cement was injected at the same time to fix the prosthesis. Finally, the incision was sutured and bandaged.

Observational indexes

Hss score: Three months after treatment, the knee joint function was assessed with the Hss scores, with a total score of 100 points, 10 points for joint instability, 10 points for flexion deformity, 10 points for muscle strength, 18 points for ROM, 22 points for function, 30 points for pain. Higher scores indicate stronger knee joint function [5].

Excellent and good rate: The excellent and good rate was assessed with the Hss scores. (1) Hss score ≥ 85 points was excellent. (2) Hss

Table 1. Comparison of baseline information

Group	Study group (n = 36)	Control group (n = 36)	t	P
Gender			0.2338	0.6287
Male	23	21		
Female	13	15		
Average age (year)	69.7 ± 5.1	69.9 ± 5.3	0.1631	0.8709
Average course of disease (year)	5.1 ± 1.1	5.3 ± 2.1	0.5062	0.6143
Average body weight (kg)	63.51 ± 5.71	63.77 ± 5.55	0.1959	0.8452
Lesion location				
Left knee	16	15	0.0566	0.8119
Right knee	20	21		

Table 2. Comparison of treatment excellent and good rate

Group	Study group (n = 36)	Control group (n = 36)	χ^2	P
Excellent	15 (41.67)	10 (27.78)		
Good	19 (52.78)	14 (38.89)		
Acceptable	2 (5.56)	8 (22.22)		
Poor	0 (0.00)	4 (11.11)		
Excellent and good rate	34 (94.44)	24 (66.67)	8.8670	0.0029

score ≥ 70 points but less than 84 points was good. (3) Hss score ≥ 60 points and less than 69 points was acceptable. (4) Hss score less than or equal to 59 points was poor. The total excellent and good rate was the sum of (1) and (2) divided by the total number of cases [6, 7].

KSS score: Three months after treatment, the knee joint function was assessed with the KSS (knee society score) with a total score of 100 points, 50 points for pain, 25 points for stability, 25 points for ROM. A high defect (deduction) score indicates a strong knee joint function [8].

VAS score: Three months after treatment, patient pain was assessed with VAS (Visual Analogue Scale) with a total score of 10 points. Lower scores indicate milder pain [9, 10].

NRS score: Three months after treatment, patient pain was assessed with NRS (Numerical Rating Scale), 0 for painless, 1-3 points for mild pain, 4-6 points for moderate pain, 7-10 points for severe pain. A lower score indicates milder pain.

Complications: The incidence rates of prosthetic loosening, infection of incisional wound and prosthetic dislocation during treatment were counted. (1) Criteria for prosthetic loosening: Sinking and displacement of the prosthesis, and fracture of bone cement and lucent areas around the prosthesis examined by X-ray. (2) Criteria for infection of incisional wound: Pain, heat, swelling and redness on the incision with exudation of purulent fluid, or exudation of the fluid after suture removal, regardless of whether there was bacteriological evidence. (3) Criteria for prosthetic dislocation: Shortening of lower limb accompanied by deformity of external and internal rotation, diagnosed by X-ray.

Statistical methods

SPSS 24.0 software was used to process the data. Measurement data are expressed by mean ± standard deviation ($\bar{x}$ ± sd), and an independent t test was used for comparison between the groups. Count data are expressed by the number of ceases/percentage (n/%) and tested by χ^2. $P < 0.05$ indicates a statistical difference.

Results

Comparison of baseline information

There were no statistical differences in gender, age, course of disease, lesion location, body weight and other baseline information between the two groups, $P > 0.05$. More details are shown in **Table 1**.

Comparison of treatment excellent and good rate

The clinical total excellent and good rate in the study group was higher than that in the control group, $P < 0.05$. More details are shown in **Table 2** and **Figure 1**.

Comparison of Hss score

Before treatment, there was no statistical difference in the Hss score between the two groups, $P > 0.05$. After treatment, the Hss score in the study group was significantly high-

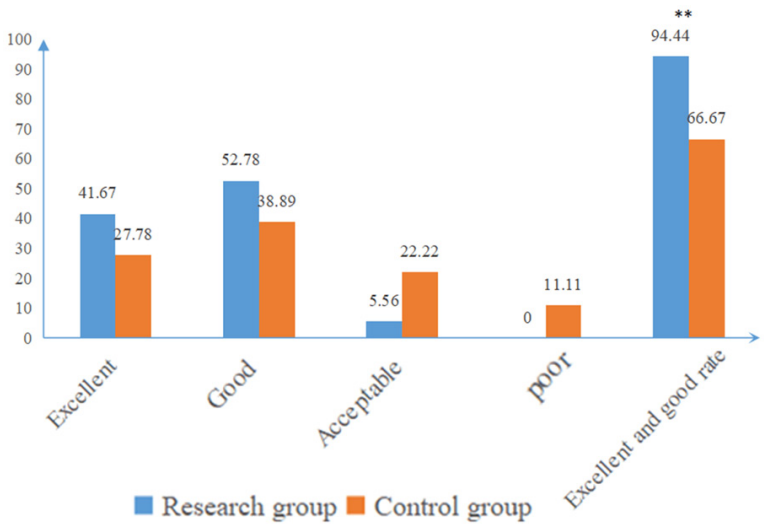

Figure 1. Comparison of excellent and good rate. Compared with control group, **P<0.01.

Table 3. Comparison of Hss score

Group	Study group (n = 36)	Control group (n = 36)	t	P
Before treatment	55.62 ± 3.17	55.79 ± 3.25	0.2247	0.8229
After treatment	90.25 ± 7.18	72.56 ± 5.66	11.6093	< 0.001
t	26.4733	15.4166		
P	< 0.001	< 0.001		

Note: Hss score, hospital for special surgery knee score.

Table 4. Comparison of KSS score

Group	Study group (n = 36)	Control group (n = 36)	t	P
Before treatment	53.62 ± 5.17	53.71 ± 5.21	0.0736	0.9416
After treatment	86.28 ± 8.66	70.25 ± 7.11	8.5838	< 0.001
t	19.4292	11.2587		
P	< 0.001	< 0.001		

Note: KSS score, knee society score.

er than that in the control group (P < 0.05). More details are shown in **Table 3**.

Comparison of KSS score

Before treatment, there was no statistical difference in the KSS score between the two groups, P > 0.05. After treatment, the KSS score in the study group was significantly higher than that in the control group (P < 0.05). More details are shown in **Table 4**.

Comparison of VAS and NRS scores

Before treatment, there were no statistical differences in the VAS and NRS scores between the two groups, P > 0.05; after treatment, the VAS and NRS scores in the study group were significantly lower than those in the control group (P < 0.05). More details are shown in **Table 5**.

Comparison of incidence rate of complications

The incidence rate of complications in the study group was lower than that in the control group (P < 0.0). More details are shown in **Table 6**.

Discussion

With an aging population in China, the incidence rate of KOA has increased significantly [11, 12]. Currently, the disease is generally believed to be caused by the coaction of local and systematic factors, risk factors for the disease are considered as injury, occupation, obesity, and advanced age [13, 14]. The long-term varus and valgus of the knee joint in patients with SKOA leads to severe internal and external friction until gradual thinning and disappearance of the joint, which results in joint acceleration dysfunction, instability, knee joint pain and degeneration, significantly reducing patients' quality of life [15, 16]. With celecoxib and meloxicam as commonly used drugs, conventional conservative treatment focuses on maintaining bone strength and delaying cartilage degeneration, which only temporarily relieves pain but cannot effectively improve knee joint function. Therefore, conservative treatment has limitations, with a worse therapeutic effect on patients with SKOA [17]. Patients treated by debridement of knee joint, with a general therapeutic effect, have obvious postoperative pain, and the disease is easy to relapse, so many patients after operation have a secondary visit with poor tolerance and acceptance. Moreover, varus and deformity in young patients after debridement of knee joint

Table 5. Comparison of VAS and NRS scores

Group	Before treatment	After treatment	t	P
VAS score				
Study group (n = 36)	5.62 ± 1.06	1.08 ± 0.21	25.2082	< 0.001
Control group (n = 36)	5.59 ± 1.04	2.28 ± 0.34	7.7557	< 0.001
t	0.1212	18.0169		
P	0.9039	< 0.001		
NRS score				
Study group (n = 36)	5.56 ± 1.08	1.03 ± 0.26	24.4676	< 0.001
Control group (n = 36)	5.59 ± 1.02	2.64 ± 0.44	15.9337	< 0.001
t	0.1212	18.9013		
P	0.9039	< 0.001		

Note: VAS score, visual analogue scale; NRS score, numerical rating scale.

Table 6. Comparison of incidence rate of complications

Group	Study group (n = 36)	Control group (n = 36)	χ^2	P
Prosthetic loosening	1 (2.78)	4 (11.11)	1.9343	0.1643
Infection	1 (2.78)	3 (8.33)	1.0588	0.3035
Prosthetic dislocation	0 (0.00)	3 (8.33)	3.1304	0.0768
Incidence rate of complications	2 (5.56)	10 (27.78)	6.4	0.0141

aggravate the condition. Due to poor therapeutic effect, osteotomy is often necessary.

In this study, compared with the control group, patients in the study group had significantly higher treatment rated excellent and good rates, higher postoperative KSS and Hss scores, but significantly lower incidence rates of complications, postoperative VAS and NRS scores. According to Chen et al. compared with before treatment, the VAS score was significantly lower but the Hss score was significantly higher with treatment after 3 months, which is consistent with the results of this study, indicating the effectiveness and safety of TKA in the treatment of SKOA [18]. Reasons are as follows: (1) TKA could improve joint stability and ligament balance and effectively relieve the pain in a short time by releasing the lateral soft tissue. Furthermore, TKA effectively corrects flexion joint deformity, easily removes residual degenerative synovium, bone cement, osteophyte, and promotes recovery of the knee joint function, as well as improves patients' quality of life [19, 20]. (2) Patients treated by TKA have low hospital expenses, fast recovery of knee joint function, early ambulation, few traumas, short hospital stay, significant efficacy, mild pain, short operation time and few intraoperative bleeding [21, 22].

Combined with practical experience, the following points in TKA should be valued: (1) Precise placement of prosthesis: the placement of prosthesis varies due to different surfaces of osteotomy; patellar prosthesis is inward whereas femoral prosthesis is outward. (2) Accurate osteotomy: Inaccurate osteotomy causes irreparable consequences, so osteotomy must be cautious to ensure the accuracy and precision. (3) Reduction of postoperative bleeding: Bleeding between 600 and 800 mL is generally considered as massive hemorrhage, so the drainage tube should be reasonably clamped and reopened after the operation to reduce bleeding. (4) Complete release of the soft tissue: Soft tissue injury affects the recovery of muscle strength exercise, so full and accurate intraoperative separation of the soft tissue should be valued.

In this study, the small sample size and short duration affect the universality and generality of the results. Clinically, the sample size should be expanded and the duration should be extended to provide more scientific and accurate literature for the evaluation of clinical efficacy of TKA in the treatment of SKOA.

In summary, TKA can effectively reduce the pain of patients with SKOA, improve knee joint function and reduce the incidence rate of complications, and may thus bring relief to patients with the disease.

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Disclosure of conflict of interest

None.

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