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Clinical application of different operative approach of total knee replacement in knee valgus patients. Retrospective cohort study

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ABSTRACT

Purpose: According to the severity of knee valgus, different operative approaches were applied in total knee replacement. Hence, we assessed the safety and efficacy of different operative approaches in the level IV study.
Methods: From May 2011 to March 2014, a retrospectively analysis was conducted among 31 patients with knee valgus (mild in 10 cases, moderate in 8 cases and severe in 13 cases based on Keblish grade). Medial approach trip knee replacement was performed in mild and moderate patients, which were assigned as medial approach group. Lateral approach was performed in severe patients, which was assigned as lateral approach group. Relevant results were compared between medial approach group and lateral approach group, including valgus corrected angle, postoperative knee joint activity and Kss score. Furthermore, operative time, postoperative blood loss, patellar trajectory and anterior knee pain were also compared between the two groups.
Results: All operations were successful without obvious complications. In medial approach group, postoperative knee valgus angle was (7 ± 1)°. Three months after operation, degree of knee joint activity was (85.2 ± 5.2)°, and KSS score of knee joint was (80.1 ± 5.2). Significant differences were detected in these compared with preoperative data (all $P < .05$). Moreover, similar results were found in lateral approach group with post-operative knee valgus angle as (8.2 ± 2.3)°, degree of knee joint activity three months after operation as (85.2 ± 5.3)°, and KSS score of knee joint as (80.3 ± 3.2). However, no significant differences were found among these three groups in operative time, postoperative blood loss, patellar trajectory or anterior knee pain.
Conclusions: Different operative approaches in total knee replacement according to the severity of knee valgus were proved as effective and safe procedures, which deserved further application.

1. Introduction

As a faulty movement pattern where the knee collapses medially during excessive athletic movements, knee valgus is believed to be a major contributor to the development of noncontact anterior cruciate ligament (ACL) injure and patellofemoral pain (PFP) [1]. ACL injure, one of the most devastating orthopedic diseases, can result in a lot of time lost from sport [2]. Besides, PFP is one of the most common orthopedic conditions, which is usually encountered in sports medicine [3]. Therefore, it is essential for prevention of these sports injuries. However, the pathological mechanism of knee valgus is not completely clear. The mechanisms and risk factors associated with both disorders have been widely investigated, including deficient neuromuscular control, abnormal joint biomechanics and malalignment of the lower extremity [4,5].

Total joint replacement is usually considered as the final route for treatment of severe disease of the knee [6]. Joint replacements have been widely used in recent years, mainly due to the increased functional requirements, the consequent aging of population, and the development and application of new materials and more sophisticated surgical techniques [7]. After the failure of conservative medical therapy, total knee replacement (TKR) has become a significant choice

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in the management of patients with advanced arthritis of the knee. Because of the constant increase annually in the number of TKRs in worldwide, it has been one of the most effective orthopedic procedures resulting in a substantial and sustained improvement in pain and disability of the knee [8]. Annually, it is affirmed that about a million TKRs are performed in the world [8,9]. The increasing demand for TKR is associated with a result of several well-documented reasons, and the procedure is beneficial and can improve the quality of life for patients with severe knee valgus [10,11].

A key to the success of TKR is a safe surgical approach using an exposure which could shorten the operation time and reduces the occurrence of complications [12]. In addition, favorable surgical approach can clear surgical exposure and provide good space for operative procedure [13]. Therefore, the aim of the present level IV study was to verify the safety, clinical efficacy and the possible benefits of knee valgus patients by different operative approach in total knee replacement procedures.

2. Materials and methods

2.1. Clinical data

From May 2011 to March 2014, patients of knee valgus who underwent medial or lateral approach trip knee replacement were considered for this study as research subjects, including 10 mild cases, 8 moderate cases and 13 severe cases based on Keblish grade. Moreover, randomly selected 20 cases without knee valgus were set as medial approach group. Clinical data of individual patients included in the study was listed in Table 1. Preoperatively, all patients were acquired frontal and lateral X-ray films of knee joint and frontal X-ray films of lower limbs. Moreover, before the operation, angle between femoral and tibial anatomical axis (FKA) was tested and KSS score was evaluated to ensure suitable for knee joint replacement.

Preoperatively, according to X-ray, patients of knee valgus were classified based on Keblish score (mild $< 15^{\circ}$, 10 cases; moderate $15–30^{\circ}$, 8 cases; severe $> 30^{\circ}$, 13 cases) [14]. Mild and moderate patients were assigned as medial approach group, and severe patients were assigned as lateral approach group. Medial approach trip knee replacement was performed in medial approach group, while lateral approach was performed in lateral approach group. Relevant results were compared between different medial approach groups, including valgus corrected angle, postoperative knee joint activity and Kss score. Furthermore, operative time, postoperative blood loss, patellar trajectory and anterior knee pain were compared among three groups.

All operations were performed by the same surgeon, and prosthesis was supplied by Depury Company (CR). The Institutional Review Board of XXX Hospital approved the level IV study, and all patients provided written consent. The study was performed in accordance with the provisions of the Declaration of Helsinki 1995 (as revised in Brazil 2003).

Table 1
Clinical data of individual patients included in the study.

Variables	MA group	LA group	P value
Age	65	68	< .01
Gender (male/female)	1/17	1/12	< .01
Family history	5	7	< .01
VAS	8.5	8.6	< .01
Valgus angle	18.2 ± 3.1	25.2 ± 6.1	> .01
Preoperative activity	50.2 ± 5.2	60.2 ± 8.2	> .01
KSS score	45.2 ± 5.3	42.3 ± 5.1	> .01

MA group: Medial approach group; LA group: Lateral approach group.

2.2. Inclusion and exclusion criteria

Patients were included if they met the inclusion criteria as follows [1]: preoperative measurement of FKA angle more than 10° [2]; preoperative American knee society knee score (KSS score) lower than 50 points [3]; there are obvious symptoms of osteoarthritis, and conservative treatment is invalid [4]; patient has a good cardiopulmonary function to tolerate the operation [5]; patient older than 55 years. In addition, the major excluding criterion was as follows [1]: valgus knee less than 10° [2]; preoperative KSS score more than 50 points [3]; patient has no obvious symptoms of osteoarthritis [4]; patients cannot tolerate the surgery [5]; patient younger than 55 years.

2.3. Procedures of medial and lateral approach trip knee replacement

The patient was placed in supine position and performed combined spinal-epidural anesthesia. The pressure of tourniquet in lower limbs was increased to 260–300 mmHg. Median incision of knee joint was utilized. Routine procedures of medial or lateral approach trip knee replacement were adopted afterwards. In the procedure of medial approach, patella eversion was performed, while patella varus was adopted in lateral approach. The key points of soft tissue release included release of lateral collateral ligament, handling lateral osteophytes of tibial plateau, and cleaning of osteophyma in posterior knee joint.

Tranexamic acid 50 ml was injected after suture joint capsule, and wound compression bandage was performed after skin suture. Internal drainage tube was adopted, and was released after clamping for three hours postoperatively. The tube would be removed 24–72 h after the operation according to extraction content. Additionally, low molecular heparin 0.4 IU was subcutaneously injected 24 h postoperatively. After removal of drainage tube, exercise of knee joint function could be performed under the guidance of rehabilitation teacher.

2.4. Statistical analysis

All data are reported as mean and range. Student's t-test was applied for analyzing continuous variables and the χ^2 test for categorical variables. Statistical analysis was performed using SPSS 19.0 software (IBM, USA). $P < .05$ was considered statistically significant.

3. Results

All operations were successful with satisfactory prognosis in two groups. After the operation, knee valgus was obviously corrected and walking pain was significantly reduced. During a mean postoperative follow-up of 10 months of all patients (6–12 months), no serious complications were found, including severe pain or dysfunction. Superficial venous thrombosis occured postoperatively in one case of medial approach group, which was cured with low molecular heparin. The patient was given oral medication of rivaroxaban for one month after discharge, and no deep vein thrombosis was found during the following one year follow-up. One case in lateral approach group was found with larger lateral defect preoperatively, so screw and bone cement were utilized to fix the prosthesis in operation. No prosthesis loosening was observed during postoperative follow-up. Additionally, wound swelling happened in another case of lateral approach group during hospital stay. However, primary healing was acquired after wet compress of alcohol and frequent dressing change. Knee flexion of 80° was detected three months postoperatively without wound infection.

Fig. 1 indicated the surgical procedure and relevant X-ray films of total knee replacement. Lateral approach was adopted in Fig. 1A. Fig. 1B indicated preoperative severe left knee valgus ($> 30^{\circ}$) with dislocation of patella, and Fig. 1C showed suitable position of prosthesis and recovery of lower limb vertical line.

As shown in Table 2, in medial approach group, compared with