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Original Article

Orthopaedics Section

Combination of Proximal Fibulectomy with Arthroscopic Partial Meniscectomy for Medial Compartment Osteoarthritis Accompanied by Medial Meniscal Tear

ZHI KAI LU[1], CHENG HUANG[2], FEI WANG[3], SHUAI MIAO[4], LEI ZENG[5], SHENGQUAN HE[6], XIAOJING YE[7], WENDI CHEN[8]

ABSTRACT

Introduction: Medial compartment osteoarthritis is usually accompanied by medial meniscal tear. The treatment of symptomatic mild medial compartment osteoarthritis and medial meniscal tears in middle-aged and elderly patients is controversial.

Aim: This study aimed to assess the efficacy of proximal fibulectomy combined with Arthroscopic Partial Meniscectomy (APM) for symptomatic middle-aged and elderly patients with mild medial compartment osteoarthritis and medial meniscal tears.

Materials and Methods: Consecutive hospitalised patients treated with concomitant proximal fibulectomy and APM from April 2013 to June 2014 were included in the study. Proximal fibulectomy and APM were done by the same group of surgeons. APM was performed initially to manage medial meniscal tears. This was followed by the proximal fibulectomy, during which a 20-mm long proximal fibular segment was excised. Preoperative and postoperative Visual Analog Scale (VAS) pain scores, Hospital for Special Surgery (HSS) knee scores, and Ahlbäck grading of knee osteoarthritis were collected. Postoperative complications and subjective patient satisfaction were recorded. For statistical analysis of the VAS and HSS score, Wilcoxon signed-rank test and the paired t-test were used to compare over time, respectively.

Results: A total of 31 out of 38 patients were included. Seven patients were excluded due to follow up loss. The mean follow up duration was 25.3±1.5 months. The postoperative median VAS score and Interquartile Range (IQR) were 0 (0–1), which was significantly lower than the preoperative median VAS score and interquartile range 6 (5–7) ($p< 0.001$). The mean HSS score improved from 78.2±8.2 points preoperatively to 90.1±4.5 points postoperatively ($p< 0.001$). No patients had radiographic evidence of osteoarthritis progression or fibular bony union, or required conversion to other surgeries. Subjective patient satisfaction was rated very satisfied in 7 patients (22.6%), satisfied in 20 patients (64.5%), fairly satisfied in 3 patients (9.7%), and not satisfied in 1 patient (3.2%). Complication in a single patient included a temporary palsy of the superficial peroneal nerve.

Conclusion: Proximal fibulectomy combined with APM produced satisfactory surgical outcomes in our patient cohort at two years after treatment. Concomitant proximal fibulectomy and APM may be considered to be a safe and minimally invasive treatment.

Keywords: Fibula, Knee, Meniscus, Osteotomy

INTRODUCTION

Medial meniscal tear is a prevalent condition in patients with medial compartment osteoarthritis of the knee [1-3]. For symptomatic patients with medial meniscal tears and mild medial compartment osteoarthritis, pharmacologic treatment and exercise therapy could be recommended as the initial treatment [3-5]. When patients are unresponsive to conservative treatment, APM is recommended [3,5]. However, it was reported that APM cannot prevent osteoarthritis progression [4,6].

Recently, a biomechanical study showed that the knee load is transferred from medial compartment to lateral compartment after partial fibulectomy [7]. To date, the performance of partial fibulectomy in patients with medial compartment osteoarthritis has been evaluated by two studies [8,9]. The efficacy is encouraging, and the progression of medial compartment osteoarthritis is halted after partial fibulectomy.

The aim of this study was to assess the efficacy of proximal fibulectomy combined with APM for symptomatic middle-aged and elderly patients with mild medial compartment osteoarthritis and medial meniscal tears after failure of conservative treatment. Our hypothesis was that concomitant proximal fibulectomy and APM could provide satisfactory clinical improvement and halt radiographic progression of medial compartment osteoarthritis.

MATERIALS AND METHODS

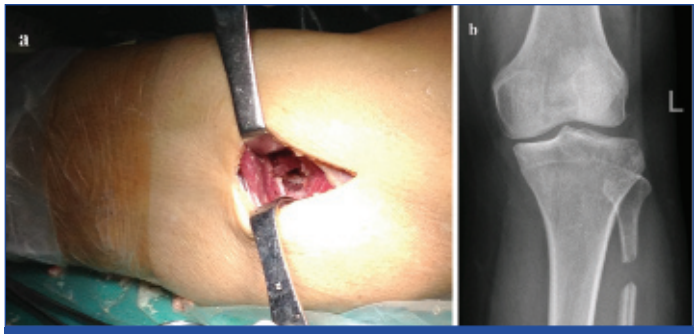
This retrospective study was approved by our Institutional Review Board and conducted in accordance with the Helsinki Declaration. Consecutive hospitalised patients treated with concomitant proximal fibulectomy and APM at our hospital from April 2013 to June 2014 were included in the present study.

Inclusion criteria: (1) patients with knee varus; (2) with Grade I medial compartment osteoarthritis according to the Ahlbäck classification [10] with Magnetic Resonance Imaging (MRI)-verified medial meniscal tears; (3) age ≥ 45 years; (4) underwent concomitant proximal fibulectomy and APM after conservative treatment failures; (5) a follow up of at least 24 months.

Exclusion criteria: (1) any other surgery or severe trauma in the affected limb; (2) rheumatoid arthritis and tumours; (3) follow up loss.

Proximal fibulectomy and APM were done by the same group of surgeons. Spinal or general anaesthesia was administered in all cases. During the surgery, all the patients were in a supine position, and a pneumatic tourniquet was used.

APM was performed through two standard portals using a 4.5 mm, 30° arthroscope. The torn medial meniscus was trimmed back to a stable rim and loose bodies were also removed.



[Table/Fig-1]: a,b) A longitudinal skin incision was made over the posterolateral surface of the fibula, and a fibular segment of about 20 mm was resected.

Proximal fibulectomy was carried out after APM. A longitudinal skin incision was made over the posterolateral surface of the fibula with a length of approximately 40 mm. The center of the incision was 50 mm from the fibular tubercle. The fibula was exposed via the intermuscular septum of peroneal muscle and soleus muscle. Then, a fibular segment of 20 mm, which was 40 mm to 60 mm distal to the fibular tubercle, was resected using an oscillating saw [Table/Fig-1]. The periosteum of the fibular segment was also excised. The fibular ends were sealed with bone wax. No drain tube was placed. Full weight-bearing was allowed on the day of surgery.

Patients' data were retrospectively collected after July 2015. Clinical information and follow up data were obtained from preoperative records, by telephone calls and at subsequent outpatient clinic visits. The severity of pain was measured using a VAS pain scores and knee function was evaluated with the HSS knee scale at baseline and the follow up of at least 24 months. The Ahlbäck scores of knee osteoarthritis were accessed in standing anteroposterior knee radiographs. Subjective patient satisfaction was rated on ordinal scale as very satisfied, satisfied, fairly satisfied, or not satisfied at the latest follow up. Any postoperative complications were noted.

STATISTICAL ANALYSIS

Categorical variables were presented as absolute numbers, the VAS scores were presented as median and IQR (q_{25}–q_{75}), and the HSS scores were presented as mean±standard deviations. For statistical analysis of the VAS score, Wilcoxon signed-rank test was used to compare over time. In terms of HSS score, the paired t-test was used for comparison over time. A p-value of <0.05 was considered statistically significant. Analysis was performed with SPSS version 13.0 for windows (SPSS, Chicago, Illinois).

RESULTS

We identified 38 patients who had undergone concomitant proximal fibulectomy and APM from April 2013 to June 2014. About, seven patients were excluded due to follow up loss. A total of 31 patients {31 knees (17 right knees and 14 left knees); 12 men and 19 women; with mean age of 58.8±6.0 years (range, 45–68 years)} were included in the present study. The mean body mass index of the patients was 24.2±2.7 kg/m^2.

The mean follow up was 25.3±1.5 months (range, 24–30 months). Patients exhibited significant improvements from baseline to more than 24 months after treatment according to the VAS and HSS scores [Table/Fig-2]. During follow up, no patient had radiographic evidence of osteoarthritis progression according to the Ahlbäck classification or fibular bony union, and no patients required conversion to other surgeries. Subjective patient satisfaction was rated very satisfied in 7 patients (22.6%), satisfied in 20 patients (64.5%), fairly satisfied in 3 patients (9.7%), and not satisfied in 1 patient (3.2%).

There were no haematomas or infections after concomitant proximal fibulectomy and APM. One patient had a postoperative symptom of superficial peroneal nerve injury, which manifested as hypesthesia at the anterior and lateral aspects of the leg and the dorsum of the foot, but it was resolved within thee months.

Score	Baseline	Postoperative	Test statistic	p-value*
VAS score	6 (5-7)	0 (0-1)	-4.883†	<0.001
HSS score	78.2±8.2	90.1±4.5	-8.662‡	<0.001

[Table/Fig-2]: Mean VAS scores and HSS scores at baseline and 24 months after treatment.
VAS score = Visual Analog Scale pain score; HSS score = Hospital for Special Surgery knee score; The VAS scores are given as median (interquartile range, q_{25}–q_{75}); The HSS scores are given as mean±standard deviation; †Z value; ‡t value; *A p-value of <0.05 was considered statistically significant.

DISCUSSION

In middle-aged and elderly patients, degenerative medial meniscal tears are considered part of the spectrum of the pathology seen in medial compartment osteoarthritis and a risk factor for further articular cartilage degeneration [11,12]. The efficacy of APM for symptomatic patients with medial compartment osteoarthritis and medial meniscal tears after conservative treatment failure has been confirmed [4,13,14]. However, APM alone was not effective at halting the progression of osteoarthritis [4,6]. In the present study, proximal fibulectomy combined with APM offered satisfactory clinical improvement for mild medial compartment osteoarthritis and medial meniscal tears, and no patients had radiographic osteoarthritis progression. We believe that the pressure reduction of the medial compartment, which was achieved by proximal fibulectomy, may halt the osteoarthritis progression. The fibula has an additional important supporting role for lateral tibial plateau [15]. When osteoporosis is present in middle-aged and elderly persons, the supporting role may lead to the non-uniform settlement of the plateau, followed by knee varus and pressure overload of the medial compartment [9]. The pressure overload could be responsible for the progression of medial compartment osteoarthritis and a factor for medial meniscal tears. After proximal fibulectomy, the support from the fibula was weakened, and knee force center was transmitted laterally. A cadaveric study showed that the pressure of medial compartment decreased by 21.57% at most and the pressure of lateral compartment increased by 12.92% at most after partial fibulectomy [9]. The weakened support and the redistribution of knee load halted the non-uniform settlement of the plateau and progression of medial compartment osteoarthritis, and led to a correction of the varus deformity [9]. Meanwhile, the pressure reduction of the medial compartment was also conducive to lessen the medial compartment inflammation. And, the lessening of the medial compartment inflammation, together with the trim of torn medial meniscus was conducive to relieve the knee pain and improve the knee function. Hence, concomitant proximal fibulectomy and APM might offer further improvement of the knee pain and function as compared with APM alone.

The site of partial fibulectomy for medial compartment osteoarthritis in a previous report was at the junction of the middle and distal thirds of the fibula [8]. Swelling, weakness, and instability of the ankle were present at follow up [8]. The stability of the ankle joint complex depends on the integrity of the fibula. Although it has been suggested that 6 cm of the distal fibula is essential for ankle stability [16], there would be fewer ankle complications if partial fibulectomy is performed more proximally. In addition, the fibers of interosseous membrane are oblique from tibia down to fibula [17]. During weight-bearing, the interosseous membrane pulls the fibula towards the tibia that results in load sharing between the two bones [15]. When partial fibulectomy was performed more proximally, fewer loads could be shared with the proximal fibular segment, and the support from the proximal fibular segment to the lateral tibial plateau would be weaker.

At the proximal fibula, the region from 40 mm to 60 mm distal to the fibular tubercle is safe for motor branches of the deep peroneal nerve during proximal fibulectomy [18]. However, the superficial peroneal nerve travels along the lateral border of the fibula, and the deep peroneal nerve is on the anterior border for almost the whole

proximal one-third fibula [19,20]. Therefore, the incision of proximal fibulectomy should be made over the posterolateral surface of the fibula, and the soft tissue on the fibular surface should be detached immediately on the fibular cortex with caution.

Our initial experience with concomitant proximal fibulectomy and APM has been favourable. As, a therapeutic technology, proximal fibulectomy combined with APM has the advantages of simple operation, minimal surgical trauma, little postoperative pain, fast rehabilitation, and low rate of complications. It can be safely performed in an outpatient setting. Proximal fibulectomy combined with APM offers a good option for mild medial compartment osteoarthritis accompanied by medial meniscal tears.

LIMITATION

This study has several limitations. First, it was a retrospective study, and a prospective randomized controlled trial comparing concomitant proximal fibulectomy and APM with APM alone is required. Second, the number of cases in this series was small. Larger numbers of cases was necessary to determine the validity and reproducibility of our results. Third, the follow up period was short. Long-term follow up is necessary to determine if concomitant proximal fibulectomy and APM remains effective. Fourth, the mechanisms of proximal fibulectomy for treating medial compartment osteoarthritis were not further confirmed by biomechanical studies, including gait analysis.

CONCLUSION

At two years after treatment, proximal fibulectomy combined with APM produced satisfactory surgical outcomes for symptomatic middle-aged and elderly patients with grade I medial compartment osteoarthritis, as per the Ahlbäck classification, and medial meniscal tears after failure of conservative treatment. Concomitant proximal fibulectomy and APM may be considered to be a safe and minimally invasive treatment in this group of patients.

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PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
2. Associate Professor, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
3. Attending Surgeon, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
4. Attending Surgeon, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
5. Resident, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
6. Resident, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
7. Resident, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.
8. Professor, Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army, Ningbo, Zhejiang, China.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Cheng Huang,
Department of Joint Surgery and Sports Medicine, No. 113 Hospital of People's Liberation Army,
No. 377, Zhongshan Road, Jiangdong District, Ningbo, Zhejiang, China.
E-mail: jfj113hc@163.com

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