

Editorial

Stepped Surgical Treatment of Severe Knee Osteoarthritis

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Editorial

Knee Osteoarthritis (KOA) is a common joint disease of middle-aged and old people, which leads to the loss of walking ability. KOA is a chronic degenerative disease, but there is no radical treatment. Total Knee Arthroplasty (TKA) is currently recognized as an effective treatment for end-stage KOA. However, a study in the United States found that at present, about one third of TKA are unreasonable and there are "over medical" problems [1]. TKA is a typical joint replacement reconstruction technology. Although the survival rate of TKA prosthesis is increasing, the patient's satisfaction is not significantly improved. Complications such as discomfort, limited movement, pain and even infection are not uncommon. Therefore, after continuous reflection and summary, at present, four levels of step-by-step treatment are implemented for KOA, namely basic treatment, drug treatment, restorative treatment and reconstruction treatment. In the aspect of KOA surgery, the concept of joint preservation and joint replacement simultaneously has been paid more and more attention by orthopedic surgeons. The restorative and reconstruction surgery mainly includes arthroscopy, osteotomy around the knee joint and knee arthroplasty.

Arthroscopic Surgery

Arthroscopic exploration is usually used to diagnose and grade KOA. Arthroscopic debridement is mainly for patients with mechanical interlocking or meniscus tear. Through arthroscopy, intra-articular free body can be removed and meniscus plasty can be implemented. The short-term analgesic effect of arthroscopic debridement is significant, which has the advantages of less joint wound and early recovery of joint function [2]. However, some studies have shown that, arthroscopic debridement is only to clean the intra-articular irritants, which cannot effectively correct the alignment of lower limb and repair the intra-articular cartilage defects [3]. According to the evidence-based guidelines of AAOS KOA in 2013, arthroscopic debridement is not recommended if there is no meniscus rupture or mechanical obstruction [4]. In recent years, arthroscopic microfracture has been used in the treatment of intra-articular cartilage defects of KOA [5]. When the diameter of articular cartilage defect is more than 4 mm, it is difficult for cartilage to repair itself. Arthroscopic microfracture can remove calcified cartilage tissue, drill

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holes in cartilage, make blood and bone marrow cells ooze out to form blood clots, and start the mechanism of damage repair. In order to increase the effect of microfracture on cartilage repair, in recent years, the operation is often used in combination with joint debridement, autogenous chondrocyte transplantation, adipose mesenchymal stem cell injection, platelet rich plasma injection, etc. and some clinical effects were also obtained [6]. The long-term follow-up clinical results of large sample and multicenter are still lacking, which needs to be further observed.

Osteotomy Around Knee Joint

It is used in patients with unicompartmental osteoarthritis with incorrect alignment of lower limb, including tibial tubercle osteotomy (to correct the poor track of patellofemoral joint), supracondylar osteotomy of the femur (incorrect alignment of the femur, most of which is genu valgus), High Tibial Osteotomy (HTO) (the incorrect alignment of the tibia, most of which is genu varus). According to the characteristics of deformity, the difference of limb length between the two sides, the interference of ligament and tendon, and expected osteotomy line healing, the position of osteotomy and the choice of open or closed osteotomy were determined. HTO is the most common because more than 90% of KOA are varus deformity.

HTO is mainly suitable for relatively young and active patients, whose cartilage wear is limited to the medial compartmental KOA with tibial varus ($>5^\circ$). This operation can delay the process of KOA and relieve the pain by correcting the alignment of knee joint, reducing the load of the involved compartment and the inflammatory factors [7-9]. Since Coventry first reported HTO, it has been used for more than 50 years, and its efficacy has been widely recognized. Short-term and long-term follow-up studies show that HTO is an effective and safe surgical method [10]. A multicenter study showed that the OKS score was significantly improved after HTO, and the pain relief and functional score were better than that of Unicompartmental Knee Arthroplasty (UKA) and Total Knee Arthroplasty (TKA) [11]. According to ekhtiari's research results, 87.2% of sports fans who have undergone HTO can return to the playground, 78.7% can reach the previous or higher level of sports, and 54% of athletes can return to competitive sports. In terms of postoperative function, HTO is superior to TKA [12]. With the improvement of surgical technology, internal fixation strength and rehabilitation level, and more reasonable indications, the 10-year survival rate of HTO implants reached 91.6%. It must be emphasized that the reasonable indications are the key to good curative effect of HTO. The best indications include: the patient's age is less than 65 years old; the range of motion of knee is basically normal, the knee flexion is less than 10° ; the tibial varus is more than 5° , the anatomical medial proximal tibia angle is less than 85° ; the ligament around the knee joint is not loose, and functions of cartilage and meniscus in lateral compartment are normal. Bone quality is a risk factor for high tibial osteotomy. Howells et al. [9] believe that although age has no significant effect on postoperative

efficacy, the older the patient is, the worse the bone quality is, and the lower the internal fixation preservation rate [10]. The early application of opening wedged HTO (OW-HTO) has a high rate of nonunion, which requires a long time of load limitation and leads to correction of angle loss. With the application of the latest tomofix MPT and biplane osteotomy technology, the patients after OW-HTO can also take early weight-bearing rehabilitation exercise. Because of the need to amputate part of fibula, closing wedged HTO (CW-HTO) can affect the stability of the proximal tibiofibular joint, cause great surgical trauma, exist risk of damage to adjacent nerve and blood vessels, cause the shortening of the lower limb and damage the normal anatomy of the tibia, and increase the difficulty for TKA revision in the later period, so there are many scholars in clinical choose OW-HTO. However, we should pay attention to the fact that OW-HTO is a highly targeted operation, which cannot be used as a general method to deal with tibial deformity. OW-HTO has advantages in correcting simple coronary deformity or with slight sagittal deformity. CW-HTO is more effective for severe deformity or complex deformity, such as tibial varus angle is very large or rotating deformity.

Unicompartmental Knee Arthroplasty (UKA)

The design concept of unicompartmental prosthesis is used for the unicompartmental KOA, but in the early stage of UKA application, because of the immaturity of prosthesis design and operation method and the narrow range of indications, the clinical effect of UKA was not ideal. In the past decade, with the specification of UKA technology and the renewal of prosthesis, UKA has been revived and its advantages have been highlighted. Compared with TKA, UKA only displaces 1/3 of the joint surface and retains the original normal structure of the joint, including all ligaments of the knee joint. After the operation, the proprioception and range of motion of the knee are not lost, which can restore the strong load-carrying capacity. A randomized controlled study with a follow-up of up to 15 years showed that the survival rate of UKA prosthesis (80%) was not significantly different from that of TKA prosthesis (79%), even higher [13]. In terms of postoperative range of motion of the knee, patient's ability of daily activity, functional score and patients' satisfaction, UKA has more advantages. Moreover, the surgical wound of UKA is significantly less than TKA, and the perioperative infection rate and mortality rate are significantly lower than TKA.

Both UKA and HTO can correct the deformity of knee joint, the main difference is that UKA corrects the abnormal alignment by correcting the intra-articular deformity caused by cartilage wear, while HTO corrects the abnormal alignment of the knee joint by correcting the extra-articular deformity. Compared with HTO, UKA needs to implant prosthesis on the worn articular surface, so UKA is suitable for the elderly patients with relatively less activity; on the contrary, HTO is more suitable for the young patients with better bone mass and relatively active function. The Indications for UKA proposed by Scott in 1989 include: patients over 60 years old, with low mobility requirements, non obese (body weight <82 kg is the best); knee joint range of motion >90°, flexion contracture <6° and varus deformity <10° and can be manually corrected; no subchondral exposure of patellofemoral joint; intact cruciate ligament and no abnormality of the contralateral compartment. However, when Scott proposed the classic indications, UKA used fixed-bearing prosthesis. Today, mobile-bearing unicompartmental prosthesis (Oxford) is widely used. But mobile-bearing unicompartmental prosthesis is mainly used in the medial compartment. Recently, many studies have

shown that weight, age, patient activity, patellofemoral OA (except for bone defects and groove like lesions) are not contraindications of mobile-bearing unicompartmental prosthesis [14-16].

The natural progression of KOA is unsynchronism (medial wear, lateral natural aging) in medial and lateral compartment. Anteromedial OA (AMOA) is a common in human KOA. The pressure is mainly on the anteromedial compartment of the knee joint, which is also the cost of human upright walking. Therefore, AMOA is the main form of human OA, accounting for more than 85% of KOA. At present, the indications of mobile-bearing UKA of include: full-thickness cartilage loss with eburnated bone to bone contact in medial compartment; normal ligament function of knee joint, presence of intact ACL and PCL; full-thickness cartilage preserved in the lateral compartment, demonstrated on a valgus stress radiograph; intra-articular varus deformity manually correctable (in 20° flexion), best seen on a valgus stress radiograph; the fixed flexion deformity is less than 15°; varus deformity is less than 15°. The mobile-bearing UKA has achieved very good results in clinical practice [17-19].

Total Knee Arthroplasty (TKA)

TKA, as the final treatment of the end-stage KOA, has been widely accepted because of its stable effect, which can effectively reduce pain, relieve symptoms, correct deformities, and improve the quality of life for patients. TKA is superior to other methods in the treatment bicompartamental or multicompartmental KOA. The amount of TKA around the world is increasing day by day. In 2012, only in the United States, the amount of TKA has exceeded 700000, and it is estimated conservatively that it will reach 1001000 in 2050 [20]. However, some patients fail to achieve satisfactory function after TKA, so that their ability of daily activities and social participation is still limited [21]. In a follow-up study of 15321 patients, 56% of them had complications within 4 weeks after TKA. A study in the United States found that about 1/3 of TKA indications are not reasonable and there are "over medical" problems [1]. Compared with UKA revision, TKA revision has more wound higher surgical risk and higher cost, which should be considered.

The development process of KOA is stepped, so the treatment process should also be stepped. When KOA is more serious, surgical treatment is needed, and the operation should also be stepped. Joint preservation and joint replacement should be used reasonably, so as to avoid the expansion of joint replacement. For each patient who needs surgery, it is necessary to comprehensively evaluate the personal situation and propose individualized treatment plan.

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