

Total knee arthroplasty treatment of active tuberculosis of the knee: a review of 10 cases

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Abstract. – OBJECTIVE: To discuss the surgical methods of total knee arthroplasty (TKA) in the patients with active tuberculosis of the knee and find out its curative effect after TKA.

PATIENTS AND METHODS: We analyzed 10 patients with active tuberculosis of the knee who received TKA in our department from March 2006 to March 2010, whose ages were from 22 to 64 years old (average age was 40.6 ± 1 years). The following parameters were measured in the pre- and post-operation periods: HSS score, range of motion (ROM). From x-ray to find out post-operate curative effect of TKA.

RESULTS: All cases had pain and elevated ESR. Deep vein thrombosis (DVT) and nerve damage were not found in these cases. There were 4 cases that had sinuses on the skin: the skin healed before the operation took place. Pre-operation HSS average scores were 25.0 ± 2 . All patients received TKA by the para-patellar medial approach. Eight cases were followed-up for 6-28 months; the average follow-up period was 14 ± 0.5 months. Post-operation we took an HSS score and X-rays to find out its curative effect after TKA operation. There were also no patients with dislocation aseptic loosening or fracture of prosthesis, although 1 case had recurrence. Post-operation's HSS average scores were 86.75 ± 5.45 . The average ROM was improved to $95 \pm 5^\circ$.

CONCLUSIONS: Recent clinical results indicate that TKA is effective to treat the patients with active tuberculosis of the knee joint. TKA can significantly improve the function of the joint and relieve pain, improving patients' living conditions.

Key Words:

Total knee arthroplasty, Tuberculosis, Treatment.

Health Organization; DVT = Deep vein thrombosis; HSS = The Hospital For Special Surgery Knee Scoring System; ROM = range of motion.

Introduction

Tuberculosis (TB) has been with human kind for a very long time. It was found that an ancient Egyptian mummy, discovered in an excavated tomb had spinal tuberculosis lesions (2500 BC). Hippocrates (460-377 BC) introduced the ancient Greek term for tuberculosis phthisis, which is similar in meaning to the Latin word "consumere", better known as consumption^{1,2}. *Mycobacterium tuberculosis* is a non-motile, non-spore-forming obligate aerobe responsible for causing the chronic infection know as TB. TB disease is still a major problem in the world, even in well-developed countries. Every year, approximately 8 to 9 million infected people develop active tuberculosis, resulting in almost 3 million deaths annually (WHO, 2005). Tuberculosis remains a major cause of death and is projected to remain among the 10 leading causes of disease burden even in the year 2020³. China is also among the world's 22 high TB burden countries. Xinjiang Uyghur Autonomous Region has the highest rate of tuberculosis incidence in China: 2.8 million new cases of tuberculosis are found each year, and people who die each year from tuberculosis number over 7500^{4,5}. Our hospital has extensive experience in treating tuberculosis cases. From previous reports we knew that TKA can relieve the pain of TB of the knee, and that after operation patients can have good knee function. From previous reports we also learned that total hip arthroplasty (THA) treatment of active tuberculosis of the hip can have good results⁶. As is arthroplasty widely used, more and more papers are reporting on arthroplasty used in tuberculosis

Abbreviations

TKA = total knee arthroplasty; TB = tuberculosis; THA = total hip arthroplasty; ESR = erythrocyte sedimentation rate; CRP = C-reactive protein; WHO = World



Figure 1. T32 years old Uyghur female, suffering from left knee pain for 1year, cannot walk for 2months. The patient's preoperative imaging (32-year old female)

joints. Based on these results we carried out TKA operation on active tuberculosis of knee. The aim of this paper is to discuss the patients with active tuberculosis of the knee and surgical results.

Patients and Methods

Our hospital has 3200 beds for patients, including 150 beds for the orthopedics department. We have 57 departments in hospital, so we have the capacity for comprehensive treatment. Because tuberculosis is an infectious disease, we separated six rooms for these patients only, three of them for pre-operation, and three for post-operation. From this we prevent the spread of tuberculosis to other patients. In our study, all of the cases were unilateral knee tuberculosis, 7 cases were right side TB and 3 were left side TB; six cases were male, and four cases were female. Pa-

tients' age range was from 22 to 64 and the average age was 40.6 ± 1 years old. During the pre-operation examinations we found 4 cases had sinus around the knee joint, which had received debridement and synovectomy in other hospitals before coming to our hospital. Based on the clinical examination we found pain, swelling, deformity, joint dysfunction and clinical weight loss, but no night sweats and fever. On X-ray examination, we found narrowing of the knee joint. Computed tomography (CT) scans showed joint destruction, purulent tissue formation around the joints, a low density area, and synovial hyperplasia. Blood tests showed erythrocyte-sedimentation rate (ESR) 32-85 mm/H (normal 0-20 mm/H). As TB is consumptive and catabolic disease⁶⁻⁸, we gave all patients nutrition consultation from the nutrition department to adjust their hypo-albumin pre-and post-operation, as well as infusion erythrocyte suspension for patients with

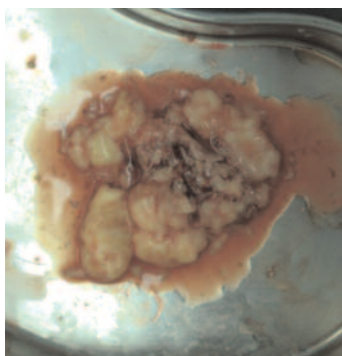


Figure 2. During the operation TB purulent and necrotic tissue were found.

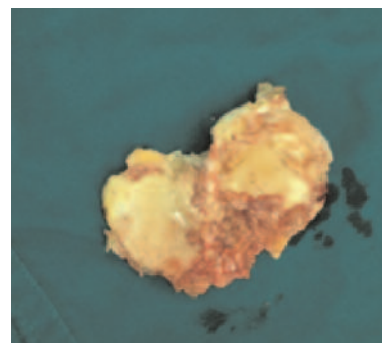


Figure 3. Tibia osteotomy articular surface damage

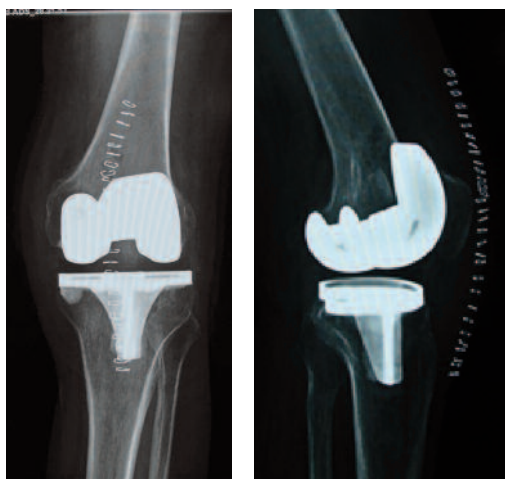


Figure 4. Post-operation imaging of this patient.

low hemoglobin. All these we call pre-operation nutritional support therapy considering it as an important part of treatment. When we completed the physical examination of patients, then saw the imaging (X-ray CT MRI), if we considered a patient to have tuberculosis of the knee joint, formal anti-TB drug therapy (preoperative general quadruple anti-TB) treatment would begin^{9,10}. Patients received 2 to 4 weeks of anti-tuberculosis drugs, and to make the ESR below 40mm / H pre-operation. Preoperative knee HSS scores were 20 to 38 points (average 25.0 ± 2 points). Eight cases were followed up for 6-28 months; the average follow-up period was 14 ± 0.5 months. In our study we used a *t*-test to find significant differences of knee function (SPSS12.0, SPSS Inc., Chicago, IL, USA).

All patients had general anesthesia or continuous epidural anesthesia. When the anesthesia was ready, we prepared patients in the dorsal decubitus position sterilized of the operation area prepared the drapes. All surgical procedures were performed by a single surgeon (one of the authors) using a standard medial patellar arthrotomy technique with a tourniquet^{11,12}. In the joints we could see purulent or necrotic tissue. The liquor puris was a turbid, pale yellow color with caseous necrosis (cheesy necrosis), and synovial hyperplasia edema, synovial hyperemia or synovial partial necrosis. We did the debridement first, making sure purulence and necrosis synovial tissue were cleaned out. After performing tibial and femoral osteotomy, but before installing the prosthesis, we cleaned the tuberculin bacillus from bone. If there was dam-

age in the bone, pulse pressure washing could help to clean out the tuberculin bacillus. We carefully looked for potential sinuses and cleaned them. After cleaning and then installing the prosthesis, we used liquor natrii chloridi isotonicus for pulse pressure washing after bone cement was dry, and used streptomycin powder directly around the prosthesis. There was no special requirement in prosthesis placed and soft tissue balance. We made sure there were no knee joint instabilities.

Results

We choose a standard medial patellar arthrotomy technique with a tourniquet for all patients^{11,12}, 8 cases were followed-up for 6-28 months, average follow-up period was 14 ± 0.5 months. DVT and injury of nerve and blood vessels were not found in all patients. There were also no occurrences of dislocation, aseptic loosening or fracture of the prosthesis. Post-operation HSS¹³ average scores were 86.75 ± 5.45 . The average ROM was improved to $95 \pm 5^\circ$. We used a *t*-test and found a significant difference between pre- and post-operation HSS scores and ROM ($p < 0.05$). We did the pathological examination of synovial and necrosis tissue of every patient; only two cases tested positive for acid-fast staining, and we found eosinophilic granuloma (we could see Langerhans' cells) in 8 cases. One case was recurrent.

Discussion

Tuberculosis has been plaguing us from the ancient to the modern times. For knee tuberculosis we choose debridement and joint fusion as the best treatment before, but we found post-operation joint function became poor, and had a serious impact on patients' normal work and life¹⁴. And from the previous reports we also found there was a 1%-9% recurrence rate¹⁵. With arthroplasty technology widely used, we found more and more reports about arthroplasty for patients with stationary tuberculosis of the knee joint. But for the active tuberculosis of the knee joint, it is still in the dispute phase in China. In this study, we selected 10 patients for whom anti-tuberculosis treatment was previously effective.

We relied be on the performance of X -ray, CT or MRI imaging as the conventional method



Figure 5. After 2 years of follow-up, general imaging, patients' knee showed no visible signs of infection such as redness, the joint functioned well.

of active tuberculosis determination. Bone destruction, knee effusion, soft tissue swelling around the joint capsule, and ESR level are also important. In this study ESR was 32-85 mm/H pre-operation and, imaging confirmed tuberculosis of the knee joint. It was very important to know whether anti-tuberculosis treatment was effective or not for anti-tuberculosis treatment. If 2 to 4 weeks of anti-tuberculosis drugs were used, but ESR and CRP did not show a downward trend, but had increased, it means there was a mycobacterium tuberculosis drug resistance or the patient was not sensitive to anti-TB treatment. If we performed the operation at this time, risk of recurrence was being too high. From the recurrent case we found that after 2 weeks of using anti-tuberculosis drugs, ESR and CRP were increased. We carried out the operation, but the tuberculosis was recurrent. So our suggestion is continuation of anti-tuberculosis treatment until there is a downward trend in ESR levels, then we can carry out the operation. In our study, operations were carrying out while the ESR levels were below 40 mm/H, and nutritional status had improved. There was one case of recurrence 3 months post-operation in which, we performed the two stage revision operation, and after operation the patient was cured. In our study, we could see purulent or necrotic tissue in knee joint consistent with the imaging. If tuberculosis is recurrent it means a failure of the operation. So we should make sure purulence and necrosis synovial tissue was cleaned out

clearly that the surgeon have more experiences and in highly technical surgery, in order to clean out the articular capsule, labrum articular and necrosis synovial tissue, as well as check for sinuses. The surgeon also needed to be able to perform osteotomy of the tibia and femur and install the prosthesis, then use streptomycin powder directly around the prosthesis.

Several studies¹⁶⁻¹⁸ on the adhesion and the formation of small membrane-like material, including mycobacterium tuberculosis, on the fixture or artificial prosthesis provide a reliable theoretical basis for prosthesis implantation. Prosthesis selection is also important. Some authors believe that TKA used in active tuberculosis of the knee joint should use a cemented prosthesis, as production of bone cement polymerization heat can kill mycobacterium tuberculosis and lower the rate of recurrence. For patients with bone defects, cemented prosthesis is the best choice. In this study, a compressive dressing was applied with an immobilizer during the first 24 hours after surgery. Patients were encouraged to perform quadriceps strengthening exercise after they had returned to the ward. All patients were allowed to walk as tolerated using a walker on the 3rd or 4th day post-operation.

In our study we found significant difference between pre- and post-operation of HSS scores and ROM ($p < 0.05$). This means the TKA operation can help patient receive relief from pains and have good function of the knee, which is our aim.

The reports said that they have good results in using THA in treating active hip tuberculosis^{14,15}.

In our study, pathology findings show that only two cases tested positive for acid-fast staining, and we found eosinophilic granuloma (we could see Langerhans cells) in 8 cases. From performing an endoscopy, we could see inflammatory cells, fibroblasts, epithelioid cells and Langerhans' cells all of these constitute typical tuberculosis nodules. In two cases we found inflammatory cells, epithelioid cells, mixed bone erosion, damage to the subperiosteal bone layer and small beams in the medullary cavity, a small number of lymphocytes, a large amount of necrotic tissue around the joint, and synovial hyperplasia. Irregular use of TB drugs, drug resistance and longer course of patient history can explain why not every patient showed typical tuberculosis nodules when examined by endoscopically. We can found granulation hyperplasia, synovial tissue congestion and scarring in most patients. The rate of positive results from acid-fast staining was not so high. Our patients with active tuberculosis of the knee joint were from suburban's areas, did not have high education, and lived in poor economic conditions. Thus, educating them with knowledge of tuberculosis and, the importance of anti-tuberculosis treatment, have dragged on for 1-1.5 years.

Conclusions

Total knee replacement for the treatment of active knee tuberculosis is controversial in China and abroad, and there is a need for further in-depth research and long-term follow-up reports. Research in this group of patients still needs to be followed-up with further observation. But we found that treatment of patients with active tuberculosis should be separated into two kinds (patients for whom anti-tuberculosis treatment was effective and patients for whom there was no effect), and that all the patients should use anti-tuberculosis drugs for 1-1.5 years.

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Conflict of Interest

The Authors declare that they have no conflict of interests.

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