# Post-operative management of local infection after unicompartmental knee arthroplasty with antibiotic bone cement implanting: Nursing.

**Li Jihua, Zheng Meizhen, Li Shuhua*, Xie Denghui***

Department of Orthopaedics, The Third Affiliated Hospital of Southern Medical University, China

## Abstract

**Unicompartmental knee arthroplasty (UKA) is an effective means of treating severe knee mono-mesooeciumarthritis. By preserving normal cruciate ligaments and patella of the knee, UKA limits the volume of bone cutting, retaining normal kinematics and mobility of knee joint at a relatively high level. Compared to total knee arthroplasty (TKA), UKA has its advantages of low expense, less trauma, rapid recovery and good function. Infection after joint replacement is a disastrous complication with an incidence rate of 0. 5%～3%, often resulting in failure of operation and great physical, psychological and financial burden to the patient. Revision operation (thorough debridement + removal of the prosthesis + antibiotic bone-cement implanting + local or systematical application of antibiotics + joint replacement) is the golden rule of treating joint infection. The orthopaedics department of the third affiliated hospital of Southern Medical University performed 75 UKA from January 2014 to January 2016, with only one infection case. Through symptomatic treatment and nursing care, the infection is under control and the patient is discharged from the hospital, with no recurrent infection found in follow-up visits so far. Following is the clinical case report.**

**Keywords**: Arthroplasty, Periprosthetic bone, *Staphylococcus aureus*, Epidermidis, Bacteriostasis.

*Accepted on February 16, 2017*

## Introduction

Patient A, male, 63 years old, was hospitalized due to pain one day after he sprained his right knee, diagnosed as right knee medial compartment osteoarthritis. Arthroscopy and UKA on the right knee were performed under epidural space block anesthesia on December 12, 2014. One month after the operation, patient developed the following symptoms: swelling right knee, impaired mobility (range of knee flexion was 15), increase of local skin temperature, sinus formation at the incision, mild pitting edema on front skin of the upper right shank, no show of fever or chill, and decrease of the periprosthetic bone mineral density at the tibial plateau indicated by the X-ray. After hospitalized, patient's erythrocyte sedimentation was 125 mm/h and C reactive protein 171.49 mg/L. Joint puncture, bacterial culture and drug-sensitivity test were performed before the surgery, and on Mach 29, 2015, focal debridement of the infected joint + removal of the prosthesis + antibiotic bone cement implanting + focal tube insertion occludes perfusion washing. The result of the bacterial examination and culture on joint fluid and peripheral tissues during the operation indicated *Staphylococcus aureus*, same as the result of the culture of the joint punctured fluid done before the operation. After the operation, sensitive antibiotics for the whole body was given for 8 weeks (4 weeks of intravenous administration and 4 weeks of oral administration), and continuous joint cavity irrigation was given for 6 weeks, during which bacterial smear examination and culture on drainage fluid extracted from the joint discontinuously were carried out, and the antibiotics treatment was adjusted accordingly. After negative result of the culture occurred three times on a row, drainage tube was removed. The local swelling of the knee was subsided, skin temperature was back to normal, and the incision was healing well. The range of joint flexion reached 90. Erythrocyte sedimentation was 13mm/h and c reactive protein was 3.2 mg/L. After the patient was discharged, telephone follow-up was done every two weeks, and no recurrent or new infection has occurred so far. TKA will be performed three months later [1,2].

## Nursing Care

### *Pre-operative care*

**Mental nursing**: Undergoing several surgeries in the hospital without seeing good healing in a long period, the patient was pessimistic and had concerns on the therapeutic effect. The primary nurse communicated with the patient every day, trying to understand the patient's mental status, so as to take proper measures accordingly and provide counseling, consolation and encouragement to him. At the meantime, the primary nurse introduced to the patient knowledge and treatment of his disease, and examples of the healed patients, in order to dispel his pessimism and help him rebuild faith in the treatment. Besides, the primary nurse provided comfortable environment to the patient by keeping the ward clean, tidy, and ventilating, which also helped the patient to relax his mind.

**Diet nursing:** Patient is inclined to malnutrition and decrease in immune function owing to his long-term infection, so the patient is advised to have a diet with high calorie, protein and vitamin to enhance the immunity of the body.

**Preoperative preparation**: Preoperative preparation included informing the patient the operative procedure and notes before the operation, keeping the skin in the operation area dry and clean, and assisting the surgeon to do the preoperative examinations such as monitoring indexes of c reactive protein, ESR, and routine blood test, and assisting the surgeon to do the joint puncture fluid drawing and to do the bacterial culture and drug sensitivity test [3].

### *Post-operative care*

**Post-operative position:** A supine position without pillow was given to the patient 6 hours after the surgery, with the right limb being 20 cm lifted by putting a soft pillow under the popliteal fossa to maintain the buckling functional position.

**Vital signs observation:** Vital signs observation included continuous telemetry of electrocardiograph (ECG), monitoring and recording the oxygen saturation for 6 hours.

**Post-operation observation of the right limb:** Closely monitoring the blood supply, skin temperature, feeling, mobility and swelling of the right limb was done to determine whether there was injury in blood vessels or nerves.

### *Continuous joint cavity irrigation*

**Drainage tube position**: Washing pipes were indwelled inside and outside of the upper joint cavity during the operation, and a catheter was indwelled at the lower joint cavity to connect with a negative pressure drainage bottle. The infusion bag of the infusion vessels was placed 60 cm to 70 cm high than the right limb, while the negative pressure drainage bottle was placed 50 cm lower than the limb [4].

**Keeping the drainage tube fixed and clear**: Negative pressure drainage was maintained because negative pressure drainage can suction out the errhysis and transvasations in the wound, ensuring the effectiveness of the drainage. The tubes were avoided from pressure, fold or bending, and the patient was told to avoid pulling the tubes when he moved. *Staphylococcus aureus* infection was detected from the bacterial culture, and the plasma-coagulase *staphylococcus aureus* secret can lead to the formation of fibrin clot in the lesion area which can result in blocking or partly-blocking in the drainage tube. Therefore, squeezing the tube from top to bottom for 2 hours each time every day was necessary for the prevention of tube blocking. If there should be blocking, after eliminating causes of pressure, bending, folding, displacement and coming off, separate the joint of the discharging tube and the drainage tube, then sterilize the junction of the tube with iodine cotton balls. And then start the suction with a 50 ml injector until the tube is clear. Injecting fluid into the cavity is forbidden or retrograde infection could happen. There was tube blocking on the first after operation. The above method was adopted and the place of the tube was adjusted to make the tube clear again.

**Washing speed**: Variable speed irrigation can effectively clear the purulent exudate, inflammatory mediator, injured tissue debris, cartilaginous loose bodies and metabolites, and prevent blockage in the tube caused by fibrous protein and pus accumulation [5]. The variable speed irrigation is to make liquid go straight into the focus by accelerating the instillation speed for 1 minute every 2 to 3 hours for three days after operation. In the first three days, the washing speed was kept at a 120 d/m speed. Three days later, the instillation speed was kept at a constant speed at 60 d/m to 80 d/m, with one quick wash at every shift. If washing too quickly, the incision is more inclined to ooze and the fluid can be wasted. If washing too slowly, the tube is more likely to block and cannot have the washing effect. Hence, a close observation and a prompt adjustment of the speed are of necessity.

**Washing volume**: Normal saline 3000 ml and gentamicin 480,000 units. Total volume is 9 liters per day. The washing volume in the first three days after operation can be adjusted according to the color of the drainage fluid.

**Observation and record of the drainage fluid**: Through close observation of the quantity, quality and color of the drainage fluid and recording washing and drainage volume every 24 hours, it can find that the drainage volume is more than the instillation at the early stage. The drainage fluid was mainly in congestive color and gradually turned clear. Meanwhile, the volume of drainage and instillation gradually balanced. Attention should be paid to floccule and blood clot.

**Observation of travasations and joint swelling**: Quick wash could lead to travasations in the incision at the early stage. To prevent infection, a prompt report to the doctor and a change of dressing was done. During the wash, travasations can lead to swelling of the joint and the shank, so attention needed to be paid to the swelling, and the washing speed and method should be adjusted accordingly in order to prevent swelling.

**Extubation care**: After 6 weeks of washing, the washing fluid was clear. Tube was drawn after three times of negative results of bacterial culture. The drainage tube can be removed when it had no liquid drainage three days after the washing tube was drawn. Healing of the incision needed to be monitored after extubation for travasations.

**Drug therapeutic effect and adverse reaction:** Close observation was needed for drug resistance and toxic and side effect due to wide application of antibiotics after UKA.

**Therapeutic effect observation**: Dynamic observation was needed for sensitive indexes of infection, such as ESR and C-reactive protein in the blood test. Bacterial culture and drug sensitivity tests were done discontinuous l with drainage fluid from the joint. The subsiding process of swelling was recorded for a prompt understanding of the drug's therapeutic effect.

**Adverse reaction observation**: Patient was observed and inquired of tinnitus, epicophosis, and dizziness. A routine urine test was done to determine renal toxicity. The patient did not develop any side effect.

**Functional training**: Functional training, therapeutic exercise which can maintain and recover joint function and prevent muscle atrophy, is an important measure to avoid and reduce sequelae. Functional training should be personalized and should be carried out step by step. Untimely load-bearing could lead to pain and wear of the antibiotic bone cement.

**Exercise:** 6 hours after the operation: Centripetal massage of the limb, ankle dorsal stretch and plantar flexion. First day after operation: encouraged patient to exercise his limb and to do the quadriceps femoris contraction. Second day after operation: straight leg raising for 30 minutes, 4-6 times a day. Third day after operation: stretch and bend the knee actively and passively after the drainage tube was drawn, such as CPM, to gradually enhance the range and times of exercise. When discharged, the buckling of the patient's knee was 90°. 6 weeks later, patient can do half-weight bearing walking with the walking aid, and then can do full-weight bearing. But he would need to watch out for falling.

**Effectiveness evaluation:** Primary nurse recorded patient's functional training daily. In order to let the patients have the best training effect, effectiveness evaluation was done by evaluating skin elasticity, myodynamia and mobility of the knee, and adjusted the exercise schedule accordingly.

### *Life care*

After the operation, the patient was bedridden, and temporarily lost some limb function. The loss of activity of daily living brought great impact to the patient both physically and mentally. The primary nurse should do more ward rounding and satisfy the patient's living needs, to minimize his bad mood and help him to cooperate with the treatment and recovery [5].

### *Discharging*

Guidance given to the patient when he discharged: keep exercising until the knee joint retain its normal function; exercise should be done in a bearable pain range; avoid long time standing or intense activities; enhance immunity of the body by intaking more nutrition; pay attention to the recovery of the knee; visit the clinic if there should be any swelling or pain or change of skin temperature.

## Discussion

The most common bacteria of post-operative infection of UKA are *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus*, while the most common post-operative infection of UKA are gram negative bacteria such as *Colibacillus* and *Pseudomonas aeruginosa*. Bacteria attach to the surface of the bone cement by glycoproteins, cilia and adhesion. They form a layer of extracellular glycosaminoglycan on the surface of the prosthesis, enabling the bacteria to adhere to the surface of the prosthesis and reproduce. At the meanwhile, as a barrier against the body's immune system, it handicaps the antibiotics' ability to do the sterilization and bacteriostasis. Application of antibiotic acrylic cement is an important step to treat treating the knee joint peri-prosthetic infection at knee joint. Antibiotics can be eluted from the bone cement, which helps to suffice the concentration of the antibiotics in the knee cavity, so as to enhance the cure rate of the infection and prevent formation of cicatrices inside the knee cavity, giving good tension to the soft tissue around the knee joint. What's more, it can reduce the bacterial adherence [6]. Bone No antibiotic bone cement divider without antibiotic can lead to contracture of the peri-articular soft tissues, instability of the joint, fibrillation around the joint and the loss of the balance of the soft tissues, which would cause great difficulty for the second implanting of the prosthesis.

Only a little volume of antibiotics can reach the lesion through intravenous administration. Continuous close irrigation is an extension of the comprehensive application of drainage and systematical antibiotic application. Continuous drainage of remaining inflammatory substances, necrotic tissue and hematoma can gradually reduce the number of pathogenic bacteria and dilute the toxin generated by the infection. Local lesion should maintain high concentration of effective antibiotics to kill the residual bacteria directly so as to control the infection.

In addition, the inside of the joint cavity should be kept with plentiful liquid which can prevent synarthrophysis. Negative pressure makes the surrounding tissue sunken, and it is good for reducing dead space and helping the fresh granulation grow. Therefore, performing the double tube close washing negative pressure drainage properly has direct influence on the clinical treatment. Nursing staff should watch closely at the volume of the washing fluid, speed, and washing method to guarantee the effectiveness. Comfortable daily care is vital for the recovery of the patient. Nursing staff should provide health education to the patient and make a detailed and personalized exercise plan for the patient, to help maximize the knee function and prepare for TKA [6].

## References

1. Jun W. 9 Examples of unicompartmental knee arthroplasty treating knee uni-mesooecium lesion. Journal of Shanxi Medical College for Continuing Education. 2009;19(4):52-3.
2. Zhongli L, Yujie L, Yan W. Unicompartmental knee arthroplasty treating knee ni-mesooecium osteoarthritis [J]. J Clin Orthop. 2008;11(2):107-9.
3. Joseph TN, Chen AL, di Cesare PE. Use of antibiotic-impregnated cement in total joint arthroplasty. J Am Acad Orthop Surg.2003;11(1):38-47.
4. Durbhakula SM, Czajka J, Fuchs MD, et al. Spacer endoprosthesis for the treatment of infected total hip arthroplasty. J Arthroplasty. 2004;19(6):760-7.
5. Min Y, Xiaoqin Y. Observation of variable speed joint cavity washing treating knee joint suppurative arthritis. J Nursing Sci. 2007;11(22):33-4.
6. Oga M, Arizono T, Sugioka Y. Inhibition of bacterial adhesion by to bra2-mycin-2imp reignited PMMA bone cement [J]. Acta Orthop Scand. 1992;63:301.

***Correspondence to:**

Shuhua Li and Denghui Xie
Department of Orthopaedics
The Third Affiliated Hospital of Southern Medical University
No 183, Zhongshan Dadao West
Tianhe District, Guangzhou
China
Tel: +8613802408767
E-mail: 13802408767@163.com