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TREATMENT OF CHRONIC PROSTHETIC JOINT INFECTION AFTER TOTAL KNEE ARTHROPLASTY WITH TWO-STAGE REVISION - A CASE SERIES

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ABSTRACT

Periprosthetic Joint Infection (PJI) is a common complication of knee arthroplasty. Treatment is based on many factors in each patient individually, especially the time onset of infection whether it is acute or chronic. Two stage revision is the best method in chronic PJI case under certain circumstances. There are few patients in three years period diagnosed with chronic PJI after Total Knee Arthroplasty (TKA). All patients diagnosed more than three months post-operation, confirmed clinically by presence of sinuses on the knee, and laboratory and radiological sign of infection. All cases were treated with two-stage revision which comprises of debridement, removal of all implants & placement of articulating knee spacer during the first operation, followed by arthroplasty using constrained implant in the second operation after infection has been confirmed to be eradicated. These steps were done by one consultant surgeon in the same hospital. All patients showed good results with no pain, stable knee and satisfying knee Range Of Motion (ROM) following different recovery time. Two-stage revision have a good success rate in chronic PJI treatment as long as the patient fulfill the treatment criteria.

Keywords: TKA (total knee arthroplasty), PJI (prosthetic joint infection), two stage revision procedure.

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INTRODUCTION

Joint replacement for a long time has been regarded as a successful procedure providing pain relief, restore function, & improve quality of life (1). While majority of patients have good results, minority of them experience failure requiring additional surgery. Periprosthetic Joint Infection (PJI) which also referred as periprosthetic infection is defined as infection involving joint prosthesis & surrounding tissue (1,2). It is one of the most common major and devastating complication causing high morbidity and substantial cost following Total Knee Arthroplasty (TKA). PJI is also regarded as the most common cause for failed knee replacement requiring revision (2,3). PJI contributes approximately 20%-25% of all TKA revision cases (4). Management of PJI after TKA is challenging for surgeons, and various classification system have been introduced which consider variables such as onset of symptoms, pathogenesis and clinical manifestation (4), with different substantial between institutions and countries, diagnosis & treatment of PJI based on tradition, personal experience, and liability aspects (5).

Two-stage revision technique for PJI was first described by Insall et al in 1983. This method is divided into two surgery time. The first surgery is to remove all in-situ prosthesis through debridement of bone and soft tissue, followed by insertion of joint spacer into the join along with antibiotics. The second surgery is to be performed after time interval of 2-8 weeks as the infection has been eradicated (6,7). The two-stage procedure has a highest success rate exceeding 90%, though the cost for patient and surgery are higher than other option (3). Generally, there are two types of joint spacer, static and mobile/articulating spacer. Articulating spacer preserve the limb function as they maintain joint space, leg length, extensor elasticity, and allow joint motion between revision surgery, preventing quadriceps shortening and contracture (8,9).

MATERIAL AND METHODS

We include six patients diagnosed with chronic PJI. All patients underwent TKA within a three year period and presented to our outpatient clinic with history of primary knee replacement between six months to one year before having any complaint (Figure 1.). Due to duration of symptoms, all cases were considered as chronic joint infection. All of them came with inflammation clinical signs such as knee pain, swelling, and have a drainage sinus around the knee. All patients have an elevated Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP). In plain radiograph, there is an osteolytic sign at the cement-implant interface as seen below.

Figure.1 X-ray showing radiolucency on cement-implant interface

RESULTS

We decided to perform two-stage revision for all six cases, which the procedure will generally be described at below 4,6,10, the first stage procedure are:

1. Approach from incising the old scar skin along with sinus excision
2. After full exposure, take the surrounding infected soft tissue deep to posterior capsule, and made a swab onto implant surface. All samples are kept in a sterile tube to be sent to lab.
3. Removal of all implanted components including all bone cement remnant, and we also did bacterial swab onto to the femur and tibial bone below implant, followed by aggressive bone dan soft tissue debridement to remove all infected tissue especially in the difficult to access area such as posterior capsule.
4. Low pressure lavage used with saline 10 liters interspersed with povidone iodine and hydrogen peroxide is spread along the joint. The surgical debridement is then continued until satisfactory clean surgical field is achieved.
5. The surgical team changed into a new gown and gloves. The surgical area was then re-draped and a new surgical set tray is used.
6. Mobile or articulating spacer made of antibiotic loaded acrylic bone cement to cement were implanted into the distal femur dan proximal tibia. The antibiotic mixture was vancomycin and gentamycin with a total of 1 g on each side of femur and tibia (Figure 3.).

Three of our patients have a positive bacterial culture obtained during first stage surgery whereas the others have a negative result (no growth) for bacteria, fungi and mycobacterium.

Figure 2. X-ray of the knee with articulating spacer.

Table 1. bacteria culture results obtained from first stage procedure.

No.	Patient	Bacteria	Antibiotic
1	F/48yo	Staphylococcus coagulase negative	Vancomyci, Levofloxacin
2	M/59yo	Staphylococcus aureus	Vancomyci, Amoxiclav
3	F/59yo	-	-
4	F/46yo	Enterobacter cloacae	Meropenem, Chloramphenicol
5	F/70yo	-	-
6	F/63yo	-	-

During recovery time after first stage operation, each patient with negative culture results was given broad spectrum antibiotic such as ceftriaxone intra venously for at least seven days. Patients with positive culture were given antibiotic sensitive to the bacteria for a period of 7 to 14 days. All patients were given oral antibiotic for one month after being discharged from the hospital.

The second stage procedure was performed between 1 to 3 months after the

first stage having ensured the infection has been eradicated with parameter of healed wound, painless knee, normal body temperature, good radiology result, ESR and CRP value at baseline (Table 1.). These are the following steps of procedure (4,6,10):

1. Approach from incising the old scar. As we deepened the incision, we found no sign of infection from the soft tissue down to the bone and spacer.
2. In three patients suffering from knee stiffness (0-10 degrees fixed flexion), a tibial tubercle osteotomy was performed to flex the knee and achieve adequate exposure. We are also release the fibrous and contracted soft tissue, especially on anterior structure (quadriceps muscle) (Figure 3.).

Figure 3. During second stage there was no sign of infection, and some patients needs tibial tubercle osteotomy due to joint stiffness.

3. Several soft tissue samples were taken, and the spacer was swabbed for bacteria culture.
4. Spacer was then removed followed by cleaning of the bone and soft tissue from fragmented bone cement.
5. New prosthesis was then implanted while addressing the bone and soft tissue defect. Bone reconstruction was aided by using various methods such as metal sleeve, porous metal cone, allograft with the addition of antibiotic beaded bone cement (antibiotic content does not exceed 10% of cement).
6. Fix the tibial tuberosity tibia with two cortical screw pug divergently.
7. Clean the knee with 10 L saline lavage followed by layer-by-layer tight wound closure and the application of drainage.

Figure 4. X-ray showing knee with the new implants.

All patients were given broad spectrum antibiotic for second-stage perioperative prophylaxis, preoperative and post operative with intravenous ceftriaxone for one week (Figure 4.). Patients were then obliged to consume oral antibiotics two weeks after being discharged. The bacteria culture results were completed few days after the surgery with negative culture result in all cases.

We evaluated patients in outpatient clinic, with one patient evaluated through the phone as she was living in a remote area. All of them have good clinical condition with no pain and satisfying knee function score (Oxford knee score ± 32), and normal ESR and CRP blood level. Patients were capable of walking painlessly daily without the need of walking aid.

DISCUSSION

Two-stage revision surgery is regarded as the current standard of treatment for chronic PJI as it allows the delivery of a high local concentration of antibiotics. It is considered as the most definitive method in terms of infection eradication and joint function preservation (11). In 2004 Springer et al showed that high dose antibiotic cement was clinically safe with two-stage arthroplasty technique showing both improvement of functional outcomes and eradication of infection in more than 90% of cases. However, the re-infection rate was estimated to be as high as 37% (12). Other numerous studies have reported that two-stage surgery with articulating spacer can result in infection control up to 95% (13). This is the most common technique for PJI performed in North America, although some research demonstrated that either one-stage or two stage has similar outcomes (4,8). In chronic PJI, whenever the patients do not have any contraindication, two-stage procedure has become the preferred method of option. These following are few indications for two-stage procedure (13,14):

1. chronic late PJI with loose implants and unknown causing organism

2. PJI with difficult to treat organism

3. Extensive bone or soft tissue defect

4. Remote source of infection other location

One of the most common bacteria causing PJI detected in patients is coagulase negative Staphylococcus (1,5). Ideally at the second stage procedure, biopsy specimens are obtained for histopathologic exam and bacteria culture. Histopathologic examination using frozen section analysis allows the surgeon to assess ongoing inflammation prior to reimplantation of new prosthesis.

If ongoing inflammation process is detected, reimplantation should be postponed (1,6). Since we do not have frozen section facility, we only assess the infection or inflammation by clinical & blood investigation before the second stage. As for the bacteria culture in the second stage, we performed the procedure and found negative results in all six patients. Physiotherapy after the first stage is needed to achieve and maintain good knee range of motion. In three of our cases, patients suffered from knee joint stiffness requiring tibial tuberosity osteotomy to provide adequate exposure during the second stage surgery (5,6).

CONCLUSIONS

The infected TKA is a significant challenge for surgeon, and it is a catastrophic, life or limb threatening complication for patient. In the presence of draining sinus, the THA is always considered as infected, and a staged procedure should be scheduled. According to 2018 ICM Philadelphia major

criteria, a sinus tract connected to the knee joint in this case were enough to determine the prosthetic infection, with elevated LED and CRP make the infection diagnosis solid. In certain cases, two-stage revision are deemed necessary and regarded as the best method to treat PJI. Even, some previous literature regarded it as a better choice for chronic case compared to one-stage procedure.

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