CASE REPORT

Hip Arthroplasty and its Revision in a Child: Case Report and Literature Review

Mohammad Gharehdaghi, MD; Hasan Rahimi, MD; Reza Eshraghi,MD; Alireza Mousavian, MD; Maryam Assadian, MD

Research performed at Orthopedic Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

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Abstract

Juvenile idiopathic arthritis is the leading cause of hip replacement in young children. However, arthroplasty in this population is challenging with several concerns about quality of the growing bone, young age for revision surgery, and difficulties in potential several revisions. In this study we introduce a case of a 12-year old who is one of the youngest patients to undergo revision hip arthroplasty. The index operation was done as a hybrid replacement, cemented for stem and press fit for acetabular component. Two years later revision was done with severe femoral deficiency. This second procedure was challenging but with short-term promising results. So we reviewed the literature for arthroplasty in this young population regarding recent findings and trends. According to the literature survival of the prosthesis is longer with a cemented acetabular component and press fit stem; however, there are evidences that show poor outcome of joint replacement after the first revision in juvenile idiopathic arthritis patients.

Key words: Arthritis, Idiopathic, Juvenile, Revision, Total hip replacement

Introduction

Juvenile idiopathic arthritis (JIA) consists of a spectrum of diseases characterized by persistent inflammation of the joints for more than 6 weeks with age of onset less than 16 years old. The hip can be involved in 20-40% of patients that represents the eighth involved joint (with knee, ankle and elbow as the three most common sites of involvement respectively) (1-3). However hip joint involvement affects mobility more than other joints (4). Hip disease in these patients cause impairment in function and produces hip pain and implicates a decreased quality of life that indicates failure of medications(5).However, prosthesis implantation is challenging in these patients as they have poor bone quality in both the femur and acetabulum and increased femoral ante version (5). Recently, in spite of increased tendency toward hip joint arthroplasty in hip disorders prevalence of hip replacement in juvenile arthritis has been steady or even decreased, showing poorer outcomes of joint replacement in this population (6). Owing to unique difficulties of the procedure in these patients there are several controversies for total hip arthroplasty in adolescents regarding kind of implant, the best fixation method, and suitable joint bearings (4).

In this case report we want to introduce one of the youngest revision cases of a cemented hip replacement in a patient with juvenile rheumatoid arthritis and its difficulties and outcome.

Case presentation

The patient was a12-year-old boy with a known case of juvenile idiopathic arthritis, whose both hips had been already replaced by cemented total hip prosthesis three years ago. He was referred to our department in 2013 because of severe pain and limping related to a loose left total hip prosthesis. Three years ago in a two-month interval he underwent bilateral hybrid total hip replacement, cemented for the femoral component and

Corresponding Author: Alireza Mousavian, Orthopedic Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
E-mail: mousaviana@mums.ac.ir

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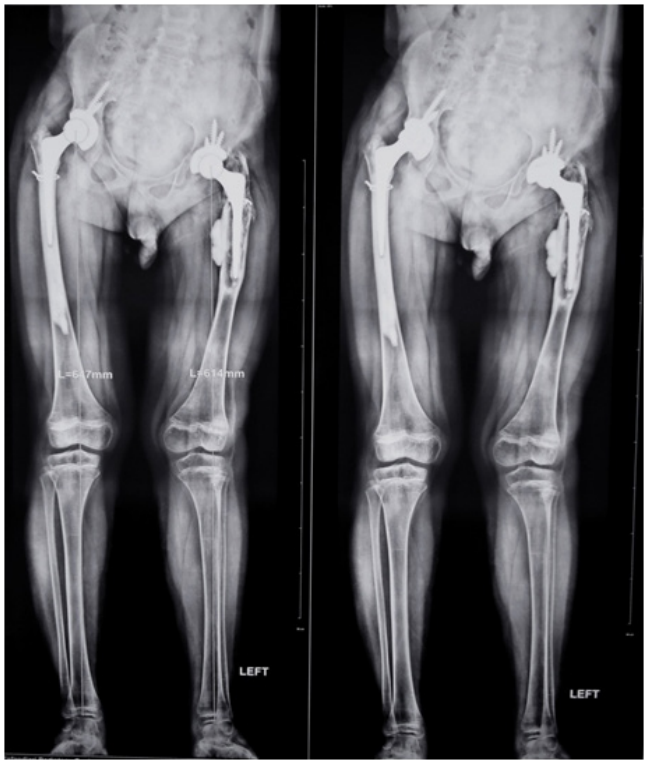

Figure 1. Anteroposterior radiograph of the pelvis and scan grams just before revision surgery.

uncemented for the acetabular side. He was 9-years-old at the time of the index operation. The skeletal age of the patient at the time of revision was 10, which was two years younger than his chronological age.

When he was referred to our department he was almost wheelchair bound and could just walk with two crutchesrestrictedly and there was 33 mm shortening of the femur on the scan gram. His JIA subsided and he was using just 5 mg prednisolone per day. He was using methotrexate but it was discontinued. Both components were loose and there was extensive osteolysis on the femoral side [Figure1]. Laboratory tests were done. ESR (erythrocyte sedimentation rate) was 15 in the first hour and C-reactive protein level was 16mg/L (normal under 10 mg/L) and hip joint aspiration showed 7 PMN in each HPF. We could not definitely rule out infection, so we decided on revision in two stages. At the first stage both components, which were grossly loose, were removed. On the acetabular side a type II defect - according to the classification of the American Academy of Orthopedic Surgeons - was found, just around screws (7). The stem was completely loose and removed easily, but residual cement was spread to the distal femoral canal and extruded from the perforation of the cortex to the medial side [Figure1].

All the cement was removed and the whole the canal curetted and six specimen for culture were taken. There was substantial loss of the proximal part of the femur

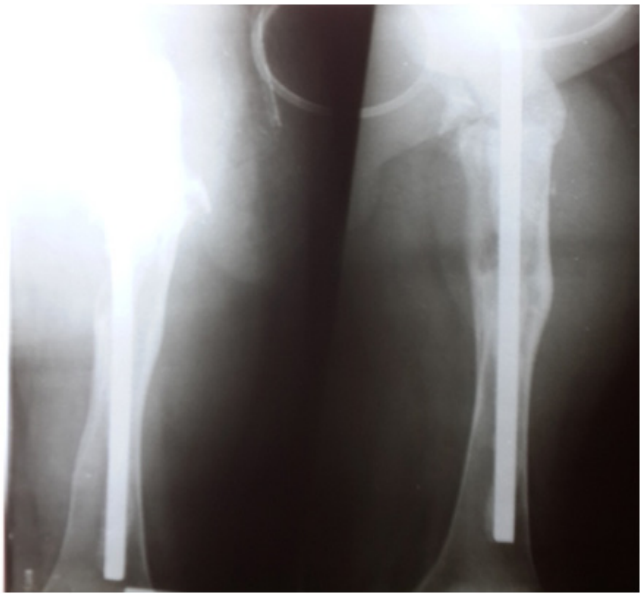

Figure 2. Anteroposterior and lateral view after the first stage of revision.

and just a thin shell of cortex only on lateral side was left. So on the femoral side, a type 3B defect according to the classification of Paprosky was found (8). Complete irrigation was done and a cemented spacer with Vancomycin was made by hand and placed in the femur and acetabulum [Figure 2].

All the cultures were negative and biopsy was reported as nonspecific synovitis. After three months

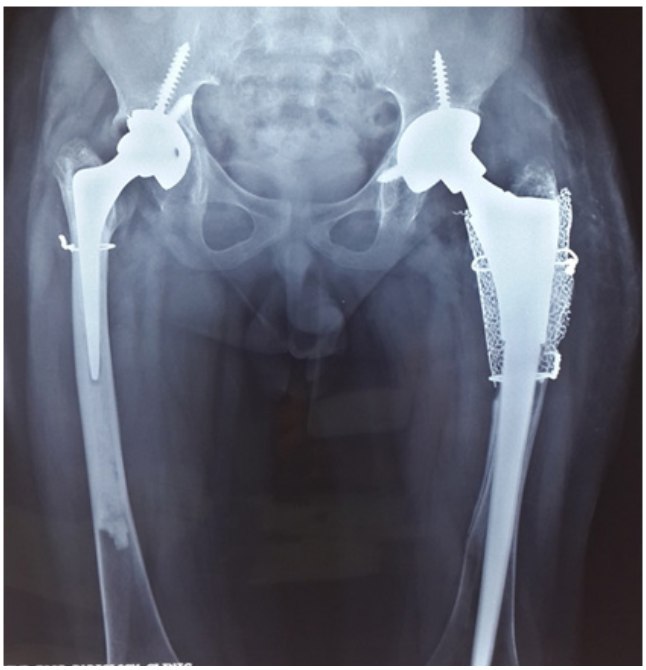

Figure 3. One day after revision arthroplasty for the left hip.

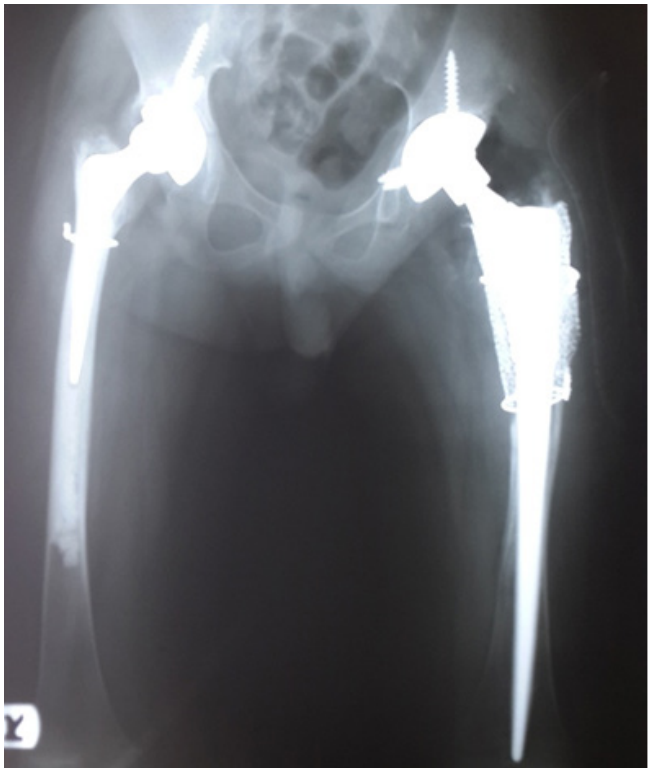

Figure 4. One-year after revision with evidences of callus formation over mesh-auto graft construct.

there was no irritation of the wound. Lab results showed that C-reactive protein was 6 mg/L (normal under 10 mg/L) so revision was planned. The proximal femur was reconstructed by metal mesh and fixed in the canal distally and allograft chips were impacted on the mesh. We broached the canal with long reamers and a long femoral stem press was fitted on the allograft bone chips and the distal femur and lateral and greater trochanteric cortex was fixed to the mesh. On the acetabular side, a cement-less cup was press fitted over the cancellous bone graft [Figure 3]. Pre-operatively in both surgeries 100mg hydrocortisone was used. Postoperative treatment included systemic antibiotics, anticoagulative therapy, non-steroidal anti-inflammatory drugs to prevent heterotopic ossification and three days of 100mg hydrocortisone [Figure 3].

Immediately postoperatively, passive-motion exercises for the left leg were undertaken. The patient was free to walk with two supports and to bear partial weight after three days. Full weight bearing was delayed until the third month. At one year the reconstructed proximal femur was incorporated by the host bone as suggested by the presence of callus around the mesh [Figure 4]. The hip was graded as very good (pain free, 90 degree of flexion and a mild limp that did not require the patient to use a cane) according to the functional score of Merle d'Aubigné. There was not any resorption of the impaction graft; however, it was too soon to judge after one year.

Discussion

Primary total hip replacements in JIA cases were cemented. Because of high failure rate and complexity in revision of cemented arthroplasties in the juvenile population, uncemented press fit fixation gradually became a choice. However, recent findings show that there is not any difference in short term outcomes of the cemented and uncemented group (9). Hybrid replacements have promising results as well (10). De Ranieri et al. reported outcomes and complications of 37 uncemented total hip replacements in patients with JIA. In this series function in noncemented cups with a screw was well, however polyethylene wear was an important cause of failure in midterm results. They concluded that even though noncemented cups have an advantage of osseous integration and modularity that facilitates revision surgery, thin polyethylene is a concern. Polyethylene dislodgment is another specific problem in this group. Results of press fit stems were acceptable; however, the importance of accurate intraoperative stem sizing should not be ignored (5).

There is some evidence that survival of the prosthesis is longer with cemented acetabular components and press fit stem (11). Eskelinen et al. in a large series of hip replacements in young patients with rheumatoid arthritis had the best outcome when stems were uncemented proximal porous-coated with cemented all polyethylene cups(12). However, with the coming of new ceramic and metal on metal bearings, survival of uncemented cups has been improved (10). In our case the primary procedure does not appear to be a standard one and the surgeon experienced intraoperative issues such as cement extrusion and possibly an intraoperative fracture. Cementing in primary stem implantation is a sign of inadequate press fitting. All of these problems resulted in a short-term survival for their replacement; however, we believe the root of these problems is related to the young age and poor bone quality specifically in a JIA patient.

An important debate has always been on the matter of appropriate age of this group of patients. Mertelsmann-Voss in a research on discharge database compared recent rates and trends of arthroplasty. They discovered that despite the total increase rate of arthroplasty (doubled), amount of replacements in JIA has been significantly decreased (by 50%). Another noticeable finding was increased age of these patients at the time of arthroplasty (11). There are three explanations for this finding. First of all, it shows that JIA patients are young enough to postpone their replacement to older ages. On the other hand, it can be interpreted that joint replacement in premature individuals with JIA that have altered anatomy, poor bone quality, and remaining growth has high failure rate. However, it could be due to promising therapeutic effects of new disease modifying medications.

Prosthesis design and wearing surfaces are known important factors in the survival of prosthesis. The best results have been reported with ceramic on ceramic or metal on metal implants (5, 10, 13, 14).

There are several other factors that predict survival in

the literature than age, systemic inflammatory disease, prosthesis design, and fixation method. Malviya et al. showed outcome is significantly poorer in patients receiving corticosteroid than methotrexate (11). Our patient had been using both of these medications that can be a risk in its short-term failure.

Another concern in these patients is necessity of revision in a young age on a severely compromised bone. There are evidences that show poor outcomes of joint replacement after the first revision. Goodman et al. worked on revision JIA hip replacement. Revision in these patients was more challenging than usual because of poorer bone quality, peri-prosthetic osteolysis that caused proximal femoral fracture and sciatic nerve injury. Rate of infection in reoperation is high as well. Whenever loosening occurscement-less components should be used for revision as complications of cementing in revision surgery is not tolerable(because of very poor bone quality and difficulty in making centralized stem) (2). We used cement-less long stem with impaction grafting in a two-stage operation because of relief from subsequent infection. We believe we should always consider feasibility of other revisions in the years ahead at the time of the first revision.

Della Valle et al. in a review of their results of revisions could achieve good results in femoral deficiency type 1, 2, and 3A, but results of type 3B and 4 was not very good. It means that a cemented stem in very young patients is not logical as they produce type 3 and 4 femoral deficiencies. They stated that cylindrical extensive porous coated long stems have good results just for type 3A and not more. They recommended modular, cement less, tapered stem with flutes in these cases (15). We used this type of stem as well for our type 3B case, but we could get enough proximal fitting by proximal femoral reconstruction using metal mesh and wire with dedicatedly impaction grafting.

There are specific concerns in JIA patients regarding primary and revision arthroplasties, such as poor bone quality and difficulty in achieving a durable fixation of components as well as high risk for infection. The other side is a person with a long-life expectancy and potentially several revisions that we can burden our patient with. Hence, we could recommend hip replacement in older ages for this population (16, 17).

Mohammad Gharehdaghi MD
Hasan Rahimi MD
Reza EshraghiMD
Alireza Mousavian MD
Maryam Assadian MD
Orthopedic Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

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