

Two-Stage Total Knee Arthroplasty in Juvenile Rheumatoid Arthritis with Severe Flexion Deformity

A Case Report

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Abstract

Case: Juvenile rheumatoid arthritis (JRA) is associated with severe flexion contracture of the knees disabling a patient's ability to walk. Although various treatment modalities are available in the literature, we report a 2-stage procedure in a case of a 22-year-old female JRA patient with bilateral severe flexion deformity of the knee: stage 1—correction of the flexion contracture deformity by ring fixators and stage 2—total knee arthroplasty (TKA) for arthritis. To the best of our knowledge, no such approach has been reported previously.

Conclusions: An Ilizarov ring fixator is a safe technique for gradual correction of a severe flexion deformity. Subsequent TKA can be performed as a standard procedure.

Osteoarthritis of the knee is often associated with flexion contracture in approximately 60% of the patients¹. It is usually less than 30°. Severe flexion contracture of the knee is often seen in rheumatoid arthritis. Flexion contracture of more than 30° leads to difficulty in daily activities, such as climbing stairs, walking, or even standing. Although total knee arthroplasty (TKA) is the treatment of choice for these severe arthritic knees to relieve pain, correction of a severe fixed flexion deformity (FFD) is a problem. Various methods are available for the treatment of FFD. An FFD of less than 30° can be corrected during TKA by capsular release, posterior cruciate ligament resection, or additional distal femoral resection². For a flexion deformity of more than 30°, release of collateral ligaments, additional distal femoral resection up to +6 mm, and constrained or hinged prostheses are used. Preoperative manipulation and serial casting are described for severe flexion contracture of 45° to 60°. Serial correction by plasters for 2 to 4 weeks before TKA was reported by Firestone et al.³. Successful correction of severe FFD by TKA followed by serial casting and physical therapy was reported by Hwang et al.⁴. The acute operative or nonoperative treatment of FFD is associated with large complications including neurovascular problems, skin

necrosis, insufficient correction, and recurrence of deformity. Gradual correction of these FFDs with a ring fixator is an effective method^{5,6}. In this study, we report a case of juvenile rheumatoid arthritis (JRA) with bilateral severe FFD treated in a 2-stage procedure, initial correction of FFD with an Ilizarov ring fixator and subsequently addressed end-stage arthritis with TKA.

The patient was informed that data concerning the case would be submitted for publication, and she provided consent.

Case Report

A 22-year-old woman presented to our hospital with multiple deformities and inability to walk for 2 years. She was diagnosed with Still's disease (JRA) at the age of 15 years and was on conservative treatment with a rheumatologist with disease-modifying antirheumatic drugs, steroids, medications for osteoporosis, and physiotherapy. She has a sedentary job as a bank officer. Her main disability was severe pain from both knee joints with FFD making her unable to walk even with a walker. The FFD was 50° in the left and 45° in the right knee with further free flexion on both sides up to 70° (Fig. 1). She also had a bilateral wrist/hand Z deformity (Fig. 2), flexion contracture of

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Keywords JRA; flexion contracture knee; Ilizarov ring fixator; arthritis; TKA



Fig. 1



Fig. 2

Fig. 1 Clinical image of a flexion deformity of the knees. **Fig. 2** Clinical image of a Z deformity of the wrist/hand.

the bilateral elbow, and correctable eversion deformity of the bilateral ankle. Plain radiographs of the bilateral knee showed severe destruction and Kellgren and Lawrence grade IV arthritis with osteopenia (Fig. 3).

Because of the severe flexion deformity, we planned her treatment in 2 stages:

Stage 1—correction of the FFD in both knees with circular ring fixators.

Stage 2—simultaneous bilateral TKA after correction of the FFD.

Stage 1: Correction of FFD

Simultaneous correction of both knee flexion deformities was performed using an Ilizarov external fixator. On both sides, Ilizarov ring fixators were applied with 2 rings each on the femur and the tibia (Figs. 4 and 5). Care was taken to keep the rings as far away from the knee as possible to leave a virgin area for future TKA. Gradual distraction was performed at 1 to 2 mm/day, and correction of flexion contracture was achieved in 10 weeks (Fig. 6). Mobilization was difficult, especially for going to toilet, with the presence of bilateral ring fixators. The patient being lean and short, parents managed her by lifting her up whenever required. Joint distraction was noticed for both knees in the last week of distraction. After complete correction, fixators were retained for 4 weeks. At 14 weeks, fixators were removed and we noticed mild joint laxity. The patient was mobilized with a walker, and knee braces were given to prevent recurrence of deformity and address the joint laxity. The range



Fig. 3

Preoperative bilateral x-ray of the knee in anteroposterior and lateral views showing the deformity.



Fig. 4

Fig. 4 Immediate postoperative clinical image depicting application of the ring fixator. **Fig. 5** Immediate postoperative x-ray after TKA. TKA = total knee arthroplasty.



Fig. 5

of movement on both sides was from 5° FFD to 50° of free flexion (Fig. 7). There was no pain or infection at wire/pin sites, and all of them healed well. No antibiotics were prescribed after removal of the fixator. We did not notice any skin traction issues. The joint laxity settled in 2 weeks of duration. The medication for JRA and osteoporosis was continued.

Pin tract care: Pin tract sites were cleaned twice a week with chlorhexidine, and Betadine-soaked dressings were applied. The ring fixators were cleaned with chlorhexidine once in 10 days.

Stage 2: Simultaneous Bilateral TKA 6 Weeks After Removal of Fixators

Bilateral TKA was planned at 6 weeks after removal of fixators. The anticipated intraoperative challenges were exposure of the joint, sizing of components in view of small bones, osteoporosis, optimizing patellar tracking, and wound closure. We chose standard midline incision with medial parapatellar arthrotomy. The patella was adherent to the femur with abundant fibrous tissues. Near total excision of hyperplastic synovium was performed. The parapatellar gutters were cleared of fibrous tissues,



Fig. 6

Fig. 6 X-ray at the 10-week follow-up. **Fig. 7** Clinical image showing a 5° residual flexion deformity before TKA. TKA = total knee arthroplasty.



Fig. 7

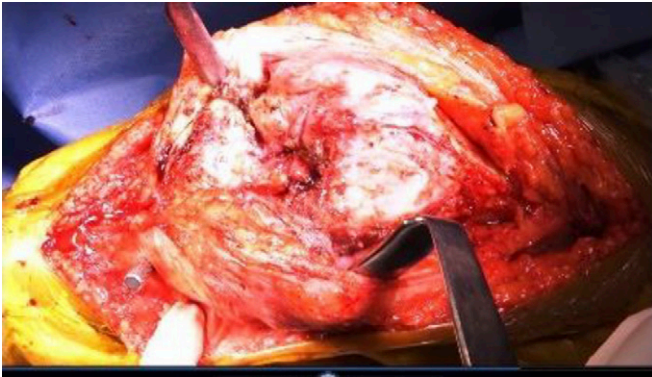


Fig. 8

Fig. 8 Intraoperative image showing complete erosion of articular cartilage.

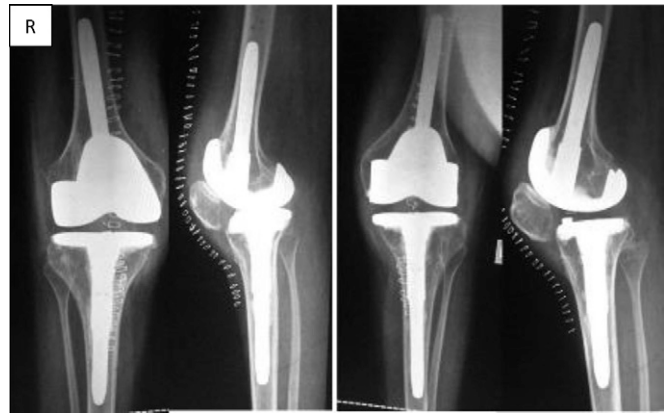


Fig. 9

Fig. 9 Immediate postoperative x-ray after TKA. TKA = total knee arthroplasty.

and finally, we could sublaxate the joint and noticed complete erosion of articular cartilage (Fig. 8). Bones were extremely porotic with multiple metaphyseal cysts. Bone cuts and soft-tissue balancing were performed by a flexion first gap-balancing technique. Collaterals were not released, and no additional bone cuts were required. Bone chips were packed into metaphyseal cysts. A cruciate-substituting mobile bearing joint was implanted with extension rods on both ends. Care was taken throughout the procedure to prevent avulsion of the patellar tendon from tibial tuberosity by prophylactic pinning. Intraoperatively, the range of movement was from 0° to 90° of flexion. The left knee was performed first. Wounds were closed in layers and compression dressings applied and postoperatively immobilized with long knee braces. Immediate postoperative x-rays show good alignment and balancing with complete correction of the deformity (Fig. 9).

Immediate Postoperative Protocol

Mobilization with a walker started on day 1 after surgery. Knee bending exercises both active and passive with a continuous passive

motion machine started. The range of movement achieved in the first week postoperatively was from 0° to 90° for both knees. Immobilization with long knee braces continued for 1 month during rest and sleep. Deep vein thrombosis prophylaxis was given.

Follow-up at 3 Months

All wounds healed well. The patient was ambulant without any support. The range of movement in both knees was from 0° to 90° flexion.

Follow-up at 1 Year

The patient was able to mobilize without any support. She was attending to her job at bank daily. The range of movement in both knees retained from 0° to 90° flexion (Fig. 10).

Discussion

JRA (Still's disease) is an autoimmune inflammatory condition characterized by synovitis and destruction of articular cartilage ultimately leading to deformity and restricted range of movements and mobility of individuals. It commonly affects the knee



Fig. 10

Clinical image at the 18-month follow-up.

joint. In JRA or early-onset Rheumatoid Arthritis of the knees, the knee joint goes into flexion for relief of pain. This leads to soft-tissue contracture and secondary FFD. Flexion contracture of more than 30° results in loss of ambulation, leading to restriction of activities of daily living. These patients can be benefitted by TKA, which not only relieves pain but also improves mobility and function⁷. TKAs in these patients are complicated because of small bones, longer duration of survival age necessitating revision surgeries, increased risk of infection due to long-term administration of immune suppressive drugs, and poor quality of bone due to these drugs⁸⁻¹⁰. The main difficulty is correcting the FFD.

For FFD less than 30°, correction can be performed during TKA by soft-tissue release and increased bone resection¹¹. For fixed flexion deformities more than 30°, correction of the deformity is complex and challenging. Many methods are reported for correcting flexion deformity, including serial casting, soft-tissue release, and mechanical distraction with external fixators^{5,6,12}. Scott reported that manipulation and serial casting give good correction of fixed flexion deformities of the knee¹³. However, these nonoperative methods are associated with complications such as skin necrosis, neurovascular complications, posterior subluxation of the tibia, and incomplete correction.

Gradual correction of the deformity by distraction using Ilizarov ring fixators is a safe procedure. In the Ilizarov technique, the fixator continuously and slowly distracts the joint and corrects the deformity, thereby reducing the complications of skin necrosis and neurovascular injury^{14,15}.

In our case of JRA with bilateral FFD and arthritis, we managed in 2 stages. The FFD of 50° is corrected simultaneously

on both sides with an Ilizarov ring fixator. After correction of the deformity, bilateral simultaneous TKA was performed. Postoperative rehabilitation and physiotherapy was as per standard TKA protocol. At the 1-year follow-up, the patient is pain-free and ambulant and no recurrence of deformity was observed. The advantage of a 2-stage procedure is complete correction of deformity before TKA, thereby minimizing bone resections, soft-tissue release, and no need for constrained and hinged prosthesis. The disadvantages are the 2-stage procedure, extra cost and possibility of pin tract infection.

Conclusion

In young and active JRA patients with severe FFD and arthritis of the knee, a 2-stage procedure where FFD is corrected as stage 1 and a standard TKA as stage 2 can be considered as one of the options based on the results of this case report. ■

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