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Case Report

Ilizarov Distraction Before Revision Hip Arthroplasty After Resection Arthroplasty With Profound Limb Shortening

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Abstract: We report the results of Ilizarov gradual distraction to regain 6.7 cm of leg length in a severely contracted hip 11 months after a resection arthroplasty. Restoration of leg length allowed revision hip arthroplasty. At 24 months after the revision arthroplasty, the patient is ambulating independently and pain free. The use of Ilizarov gradual distraction restored leg length and facilitated postoperative function. **Key words:** limb lengthening, contracture, outcomes, Girdlestone procedure, external fixation.

Joint reconstruction after resection arthroplasty is often complicated by soft tissue contractures and massive bone loss [1,2]. In addition, proximal migration of the femur after a resection arthroplasty may preclude implantation of a total hip prosthesis [1].

Immediate intraoperative distraction of the hip using a femoral distractor for an irreducible chronic hip dislocation or long-standing resection arthroplasty has been reported [3]. Little information is available regarding cases where the amount of lengthening required for implantation of a total hip prosthesis cannot be performed acutely.

We report the results of gradual distraction using the Ilizarov method to regain 6.7 cm of length in a severely contracted hip 11 months after a resection arthroplasty procedure. The gradual restoration of leg length allowed revision hip arthroplasty. At 24 months of follow-up, the patient is ambulating independently, is free of pain, and is without signs of implant loosening or infection. The patient was informed that the case would be submitted for publication.

Case Report

In January 2005, a 63-year-old man was referred to our center 6 months after resection arthroplasty to treat a chronically infected and unstable left total hip arthroplasty. The patient had complaints of pain, foreshortening of the left leg, and disability. He was unable to do most of his normal activities of daily living. The patient expressed a desire to undergo repeat revision arthroplasty, with the wish of having equal limb lengths.

The patient's medical history included congestive heart failure, coronary artery disease, arrhythmia, hypertension, cirrhosis secondary to alcohol abuse, and a smoking history of 50 pack-years. Previous medical problems included pneumonia, gout, gastric ulcers, hepatitis, and anemia. Surgical history for the left hip included core decompression, irrigation and

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debridement, resection arthroplasty, total hip arthroplasty, acetabular revision to treat recurrent hip dislocation, and a second resection arthroplasty to treat fractures of the greater and lesser trochanters 7 months before presentation to our center.

Upon presentation at our center, the patient was wheelchair bound and unable to actively move the hip, stand, weight bear, or walk. Radiographic evaluation showed a left hip resection arthroplasty with displaced fractures of the lesser and greater trochanters. Fifty-one–inch leg length radiographs [4,5] revealed 6.7 cm of foreshortening of the left lower extremity (Fig. 1).

The patient underwent joint aspiration, indium bone scanning, and blood work to rule out infection. No organisms were detected in the aspirate or grown in culture. The indium bone scan revealed no areas of increased uptake. Preoperative screening blood work was not indicative of infection.

A 2-stage procedure was planned. The first stage was designed to transfer the femur distally via gradual distraction using the Ilizarov method. The goals in transferring the femur were to restore leg length and lengthen the soft tissues to facilitate prosthetic reimplantation. The second stage was designed to implant a revision total hip prosthesis after restoration of leg length.

Description of the Ilizarov Procedure

A 4-ring Ilizarov frame was preconstructed, with 2 proximal Italian arches for pelvic fixation and 2 distal 205-mm rings for femoral fixation.

The patient was placed in the supine position after induction of general endotracheal anesthesia. Three 6-mm hydroxyapatite half-pins were placed in the left ilium under fluoroscopic guidance by using a 4.8-mm cannulated drill over a 1.8-mm guidewire.

Fig. 1. Anterior 51-in alignment radiograph (A) with close-up of the pelvis and femur (B) of the patient at presentation to our center showing a 6.7-cm leg length discrepancy 6 months after a left hip resection arthroplasty.

Two pins were placed in the iliac crest, and one pin was placed in the supra-acetabular region.

The 2 proximal arches of the Ilizarov external fixator were fixed to the pelvic half-pins using Rancho cubes (Smith and Nephew Orthopedics, Memphis, Tenn). Solid threaded rods connected the Italian arches to a 205-mm two-thirds spatial frame transmission ring (no implants). Six Taylor spatial frame struts were then used to connect the transmission ring to the most distal full ring, which was fixed to the femur using a single 1.8-mm smooth tensioned wire and two 6-mm half-pins.

Blood loss was approximately 20 mL. Operative time was 47 minutes. Postoperatively, the patient was instructed in ambulation weight bearing as tolerated using 2 crutches for balance and support. He was discharged on the second postoperative day. The patient and his family were instructed in pin site cleaning with a 0.5% chlorhexidine solution twice a day. Sterile dressings were used to cover the pin sites and were changed after pin cleaning or showering.

The patient began gradual distraction on the third postoperative day. Using the Taylor Spatial Frame Fracture Reduction and Deformity Correction Software (Smith and Nephew Orthopedics), a schedule was calculated to allow for 1.75 mm of lengthening per day. The patient was instructed to turn each of the 6 spatial frame struts 2 at a time at 3 equal intervals throughout the day. The distraction phase was 31 days.

On postoperative day 24, the half-pin in the superior aspect of the iliac crest was noted to be loose. This pin was removed atraumatically in a clinic, and the patient was instructed to use both crutches, ambulate non–weight bearing, and continue distraction. The patient returned 1 week later stating that he was satisfied with the amount of length gained and also stating that he was no longer able to tolerate the discomfort associated with the distraction. The 51-in alignment film at that time showed residual shortening of approximately 1.5 cm (Fig. 2). The external fixator was removed 35 days after its application during the same operative session as the revision arthroplasty.

Description of the Revision Arthroplasty Procedure

Implantation of the constrained revision total hip prosthesis (Ranawat 50-mm revision acetabular shell, RingLoc 32-mm 10° constrained liner, Reach size 1 metaphyseal femoral component with an 11 × 165-mm distal stem and a 32-mm femoral head; Biomet, Warsaw, Ind) was performed at the same operative session as removal of the Ilizarov external fixator. The half-pin sites were not in the plane of the surgical dissection. Analysis of multiple frozen section samples from the regions of surgical dissection during the procedure revealed no polymorphonuclear lymphocytes. The trochanters were found to have healed to the femur.

The acetabulum was reamed, and a 50-mm cup was impacted into position, and fixation was supplemented with multiple screws. A constrained liner was used, given the patient's history of multiple dislocations and disrupted proximal femoral bony and muscular anatomy. The intramedullary was reamed and the femoral stem and head were then impacted into place, and the hip was located. The ring that had been placed around the trunnion was assembled onto the constrained liner. The hip was moved through a range of motion and had excellent stability.

During the postoperative hospital stay, the patient received instructions in hip position precautions, toe-touch bearing gait progressing to partial (100 lb) weight bearing at 6 weeks, and hip and knee exercises. Postoperative blood work was not indicative of infection. He was discharged from the hospital on postoperative day 3. The infectious disease service prescribed doxycycline 100 mg twice daily as prophylaxis for the chronic hip infection.

At 3 months after surgery, the patient was allowed to ambulate full weight bearing using a cane for balance. Radiographs revealed a stable ingrown prosthesis (Fig. 3). The patient remains on chronic antibiotic (minocycline) suppression at the recommendation of the infectious disease consultant.

At the most recent clinical visit 24 months after revision arthroplasty, the patient was ambulating full weight bearing without an assistive device. The 51-in alignment radiograph showed residual foreshortening of the left leg of 1.2 cm (Fig. 3). The patient rated his overall quality of life as Good. His Brief Pain Inventory scores had decreased from 6.5 to 3.6 out of 10 for intensity and from 7.4 to 3.0 out of 10 for interference, indicating a substantial decrease in pain and its effects on his life. The patient indicated on the Time Trade Off instrument that he was unwilling to sacrifice any remaining years of life in exchange for perfect health, whereas at presentation, he was willing to sacrifice up to 40% of his remaining years. Based on life expectancy tables [6], he gained 6.1 quality-added life years, or the theoretical equivalent of 6.1 years of perfect health. Outcomes instrument scores indicated that the patient's functional level had improved dramatically. His American Academy of Orthopaedic Surgeons Lower Limb Core score increased from 33 to 76, his SF-12 physical component scale score had increased from 21.0 to 34.0 points, and his SF-12

Fig. 2. Anterior 51-in alignment radiograph (A) with close-up of the pelvis and femur (B) of the patient showing substantial restoration of leg length at the conclusion of 31 days of Ilizarov distraction.

mental component scale score had increased from 37.6 to 50.1 points.

Discussion

The current case demonstrates the use of the Ilizarov method to treat soft tissue contractures and restore leg length before revision total hip arthroplasty after resection arthroplasty. Gradual distraction permits adaptation of the tissues, avoids the problems associated with immediate distraction, and facilitates implantation of a revision prosthesis and eliminates the need for osteotomy of the proximal femur for access or shortening. Gradual distraction also restores leg length to allow for normalization of gait.

The restoration of leg length is one of the primary goals of revision reconstruction after resection arthroplasty [2,7]. Our general guideline is that 4 cm of foreshortening or more at the hip requires slow gradual distraction to restore length before hip arthroplasty. Proximal femoral migration after a resection arthroplasty can result in a leg that is several centimeters shorter than the uninvolved

Fig. 3. Anterior 51-in alignment radiograph (A) with close-up of the pelvis and femur (B) of the patient showing a stable prosthesis and only 1.2 cm of foreshortening at the most recent follow-up 24 months after reimplantation of a total hip arthroplasty. Anterior (C) and lateral (D) clinical photographs of the patient at the most recent follow-up. The patient rated his overall quality of life as Good compared with his rating of Poor before our treatment.

side, as occurred in our patient. Intraoperative use of a femoral distractor has been recommended when soft tissue deficiencies interfere with reduction of a revision total hip prosthesis [3]. Immediate intraoperative lengthening of the leg, however, may lead to nerve traction injury and partial or complete nerve palsy [2,7]. Several authors have reported using a monolateral external fixation device to apply gradual distraction to restore limb length before late primary total hip arthroplasty in patients with high congenital hip dislocation [8,9] and before primary total hip arthroplasty after chronic (13-year history) femoral osteomyelitis [10]. To our knowledge, the use of gradual distraction in preparation for revision hip arthroplasty after resection arthroplasty has not been reported.

The use of the Ilizarov method to gradually distract the leg allows the soft tissues and nerves to adapt to a new length [4,11]. If signs of nerve traction or injury appear during gradual distraction, the distraction can be stopped or reversed. No such signs appeared in our patient during or after lengthening. Antibiotics are not routinely prescribed in our center for our patients undergoing Ilizarov treatment; this patient was prescribed doxycycline to address the quiescent infection of his proximal femur. The primary contraindication to Ilizarov limb lengthening is a patient who has severe psychologic or social issues that will not permit appropriate care and monitoring during the lengthening phase.

Treatment options for symptomatic resection arthroplasty with proximal femoral contracture are limited. Revision arthroplasty may be performed with proximal placement of the acetabular component, producing a "high hip center" [12-14]. Surgical release of contractures may be performed either alone or in concert with revision arthroplasty. Surgical release of contractures in our patient would likely have led to extensive scarring or weakness because of the extent and duration of his soft tissue problems after multiple dislocations and surgeries. The release also would not have addressed shortening of the neurovascular structures.

Joint reconstruction after resection arthroplasty may be complicated by soft tissue contractures and bone loss [1,2]. These problems are associated with postoperative complications such as dislocation, prosthetic loosening [1,15], peroneal and sciatic nerve palsies [2,7], and the need for additional revision surgery [2]. Other typical problems include leg length discrepancy due to soft tissue contractures; deformities of length, angulation, or rotation; and increased risk of prosthetic loosening and failure [1,2,7]. These problems can be addressed by using the Ilizarov method before reimplantation.

Because of our strong concerns for the possibility of reshortening after frame removal, hip arthroplasty was performed at the same operative setting. This approach perhaps increased the risk of infection slightly, but the hip arthroplasty incision was not in proximity to the Ilizarov implant sites because these had been placed well away from this zone. In addition, our patient was on long-term antibiotic suppression as prophylaxis for the chronic infection that had led to his multiple resection and revision arthroplasties, so risk of infection related to the pin sites was felt to be minimal.

Our ability to distract the patient's femur with the Ilizarov method greatly facilitated the reimplantation exposure. Stability of the prosthesis and achievement of wound closure at surgery are key to success. Both of these issues can be adversely affected by contracted soft tissues. Immediate distraction is unlikely to result in normal soft tissue length or tension [2,7]. Soft tissue imbalances may remain despite successful implantation of the revision hip prosthesis. Soft tissue imbalances have been implicated in delayed wound healing, prosthetic loosening, and dislocation after reimplantation [1,15]. Our use of Ilizarov gradual distraction allowed the soft tissues to adapt to an appropriate length [16-18], which in turn decreased the risk of postoperative instability or surgical wound problems.

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