



Case report

Reactive scoliosis: a challenging phenomenon in adolescent patients with hip arthritis

Madhav Chowdhry ^{a, b}, Laura Matsen Ko, MD ^a, Corinna Franklin, MD ^c,
Javad Parvizi, MD, FRCS ^{a, *}

^a Department of Orthopaedic Surgery, The Rothman Institute at Thomas Jefferson University, Philadelphia, PA, USA

^b Department of Orthopaedic Surgery, Jawaharlal Nehru Medical College, AMU, Aligarh, India

^c Department of Orthopaedic Surgery, The Shriners Hospital for Children, Philadelphia, PA, USA

ARTICLE INFO

Article history:

Received 16 January 2017

Received in revised form

27 February 2017

Accepted 28 February 2017

Available online 22 April 2017

Keywords:

Reactive scoliosis

Slipped capital femoral epiphyses

Limb length discrepancy

Total hip arthroplasty

Adolescent

ABSTRACT

Functional limb length discrepancy (LLD) in adolescents can result from soft tissue contracture following long-standing hip disease. We present a case of a 13-year-old girl with difficulty in ambulation due to right hip pain and LLD. Radiographs revealed severe arthritis of right hip with signs of avascular necrosis of the femoral head. The patient had developed reactive scoliosis of lumbar spine along with pelvic obliquity. After failing conservative management, total hip arthroplasty (THA) without attempting to equalize LLD was performed. At 6-month follow-up, patient was pain free with full range of motion and her functional LLD was completely resolved. In such adolescent patients, reactive scoliosis of spine is reversible, and with no evidence of true LLD, THA without correcting LLD should be the right choice.

© 2017 The Authors. Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Adolescent patients may develop end-stage arthritis of the hip and may require total hip arthroplasty (THA). End-stage arthritis of the hip could present with a limb length discrepancy (LLD) which in adolescents could be true or functional. True LLD may arise in some patients following conditions like developmental dysplasia of the hip. On the other hand, functional LLD may be result of various conditions such as abnormal foot mechanics, adaptive shortening of the soft tissues, joint contractures, ligament laxity, and axial malalignments [1]. However, functional LLD especially in an adolescent patient may also arise due to what we term as reactive scoliosis. Adolescent patients have a very flexible spine and can develop extreme LLD due to reactive scoliosis. Both true LLD and

reactive scoliosis pose unique challenges in performing THA in adolescent age-group.

We believe this case of a 13-year-old female patient with severe functional LLD will highlight some of the important issues in this age-group and should be of benefit to the surgeons who encounter such patients with functional LLD.

Case history

A 13-year-old girl presented to our clinic with a history of severe right hip pain for 2 years. The patient had difficulty in ambulation due to LLD and severe right hip pain. She was prescribed a 5-cm shoe lift on the affected right lower extremity, which according to the patient was not adequate in addressing her complaint. Around 2 years before her initial visit, the patient had developed bilateral slipped capital femoral epiphyses (SCFE) that required percutaneous fixation with a single screw on both sides at a different hospital (Fig. 1). The screws were removed 1 year later. However, the patient continued to have severe pain in the right hip along with radiological evidence of avascular necrosis in the right femoral head (Fig. 2). At presentation, the patient was 5'3" tall and weighed 172 lbs. Her physical examination revealed a severe antalgic gait. The right lower extremity was apparently shorter than the left by

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <http://dx.doi.org/10.1016/j.artd.2017.02.009>.

* Corresponding author. 125 S 9th St. Ste 1000, Philadelphia, PA 19107, USA. Tel.: +1 267 339 7813.

E-mail address: research@rothmaninstitute.com

<http://dx.doi.org/10.1016/j.artd.2017.02.009>

2352-3441/© 2017 The Authors. Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

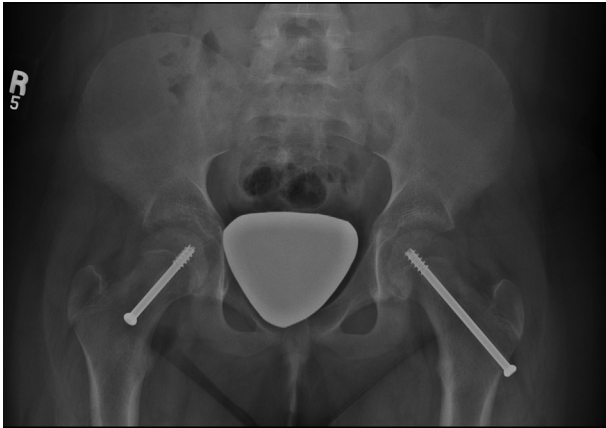


Figure 1. Anteroposterior (AP) pelvis radiograph showing bilateral percutaneous screw fixation for slipped capital femoral epiphysis (SCFE).

7.5 cm. She wore a 5-cm shoe raise on the right side, prescribed to alleviate pain and facilitate walking. Range of motion of the right hip was reduced to 90° of flexion and 10° of internal rotation with no external rotation. Abduction of right hip was markedly reduced. The left hip was pain free with full range of motion. Radiographic examination revealed severe arthritis of the right hip and evidence of prior surgical intervention (Fig. 2). The radiographs of the spine showed severe pelvic obliquity measuring approximately 60° arising out of lumbar spine scoliosis (Fig. 3).

The initial management of the patient included nonoperative measures such as pain management and hydrotherapy. However, the scoliosis of spine was not deemed to be due to an underlying spine pathology as the patient had developed reactive scoliosis following severe right hip pain after fixation for SCFE. Patient continued to be severely symptomatic and had refrained from attending school due to pain and also peer banter. After discussion with the parents, decision was made to proceed with a THA.

The surgery was performed via Smith-Peterson approach under spinal anesthesia. The patient had an anterior incision from prior surgery which was used. Use of anterior approach to the hip allowed us to position the patient supine and assess the limb length in a better way. Under anesthesia, the LLD improved from 7.5 cm to



Figure 2. AP pelvis radiograph (12 months before THA) demonstrating prior surgical fixation with removal of hardware and collapse of the right femoral head. There was no radiographic sign of avascular necrosis in left hip.



Figure 3. Full-length spine film radiograph (11 months before THA) demonstrating severe pelvic obliquity of approximately 60° and associated lumbar spine scoliosis.

4 cm. However, the pelvic obliquity had not resolved completely. As the patient did not have any alteration in the normal anatomy of the acetabulum, we decided to perform routine THA restoring the appropriate anatomic landmarks such as center of rotation of the femoral head and did not attempt to equalize the limb lengths by unduly lengthening the right lower extremity. We had assumed that resolution of the hip pain after THA would also allow for the pelvic obliquity to dissipate.

At 4 weeks postoperatively, patient had painless full range of motion in the right hip. Radiographs showed the components to be in excellent position and pelvic obliquity was almost completely resolved (Fig. 4).

At 6-month follow-up, the patient was pain free and able to ambulate without an assistive device or a shoe lift. Her lower extremities were neutral in alignment and equal in length with full range of motion. Her previous functional LLD of 7.5 cm had completely resolved. The radiograph showed the pelvis in straight position and reactive scoliosis had corrected completely (Fig. 5). At 1-year follow-up, the patient was very happy with the progress and had even started participating actively in various sports.

Discussion

THA is a very successful surgical procedure and restores functionality in patients with end-stage arthritis of the hip. Although infrequent, some recipients of THA may be extremely young patients in their adolescence. Although THA in the very young is likely to be just as successful as the older adults, some unique challenges to this patient population exists. The appropriate choice of prosthesis and the bearing surfaces to maximize the longevity of the prosthetic hip is one such issue. In addition, some of these patients

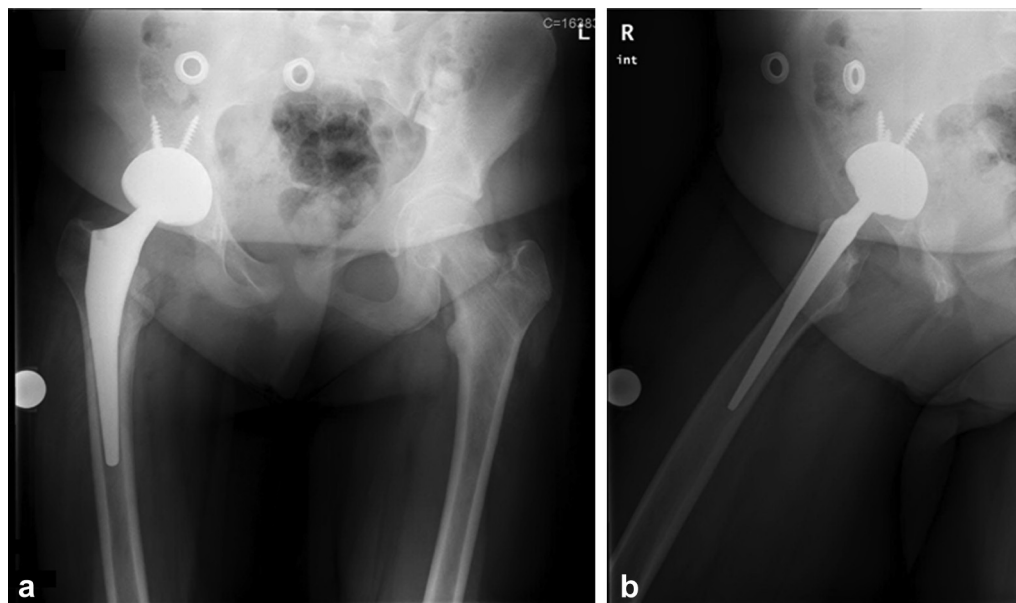


Figure 4. AP pelvis (a) and frog lateral (b) radiographs showing the components to be in appropriate position.

with developmental dysplasia of the hip may have poor bone stock in the acetabulum that makes fixation of acetabular components challenging. Another issue that may be present in patients with hip arthritis in general, and the younger patient population in particular, is LLD.

LLD is a common condition and can be broadly classified into 2 etiological types: anatomic and functional [2–4]. Anatomic LLD, also referred to as true or structural LLD, is defined as physical shortening or lengthening of the lower limb due to actual skeletal differences in shape and length of the lower limb bones [1]. Functional or apparent LLD is determined not only by true limb length but also by the position of the hip joint on the pelvic wall [5]. Functional LLD can occur when the legs are technically the same length but other conditions such as soft tissue contractures, spinal scoliosis, or pelvic asymmetries create the appearance of one leg being longer than the other.

Our objective of presenting the case here is to make the orthopaedic community aware that functional LLD, and an extreme

one, may be present in adolescent patients with underlying hip pathology. Although evaluation of the spine to rule out serious anatomic pathology such as hemivertebra may be beneficial in these patients, the ensuing pelvic obliquity due to severe hip pain could result in what we term as “reactive scoliosis”. The term “reactive scoliosis” implies that there is a condition other than the spinal pathology that results in scoliosis of spine. In this situation, severe hip pain due to avascular necrosis and collapse of the femoral head led to reactive scoliosis of the spine. The scoliosis was likely to be correctable as there was no underlying pathology of the spine that would prevent it from resolving once the underlying hip condition had been addressed. The anatomy of the hip, other than avascular necrosis and collapse of the femoral head, was for most part normal. The challenge faced in these patients is what to do with the extreme LLD at the time of THA. In the absence of any severe anatomic abnormality affecting the spine as well of the remaining hip joint, one is inclined to believe that this LLD is correctable. In this particular patient, addressing the hip pathology and restoration of hip function alone led to complete resolution of the scoliosis and the pelvic obliquity. In other words, it appears that reactive scoliosis in such patient population is flexible and fully reversible.

It is critical that preoperative templating is performed in such patients to identify the appropriate level for femoral neck osteotomy and acetabular component positioning to ensure that anatomy of the hip is restored to normal. Our patient did indeed have a superior migration of the femoral head that had to be addressed at the time of THA, which led to some lengthening of the limb in order to make it anatomically equal to the opposite side.

The message we wish to convey through this case report is that functional LLD in adolescents with an underlying painful hip pathology can be a result of severe muscle contracture and appears to resolve after THA. In these patients without true LLD, the limb length shortening produced by functional LLD should not be addressed at the time of performing THA. This finding may be of benefit to the orthopaedic surgeons who deal with very young patients requiring THA and can be shared with the patient and family.



Figure 5. Postoperatively, at 6 months, radiograph shows pelvic obliquity nearly resolved.

Summary

We present the case of an adolescent patient with functional LLD due to reactive scoliosis of the lumbar spine arising out of painful end-stage arthritis of the hip joint. This case illustrates that reactive scoliosis in adolescent patients is flexible and reversible. Therefore, in such patients having no true LLD, THA without addressing the limb length shortening should be the right approach. The reactive scoliosis, and in turn the functional LLD, gets completely resolved on addressing the hip pathology.

References

- [1] Brady RJ, Dean JB, Skinner TM, Gross MT. Limb length inequality: clinical implications for assessment and intervention. *J Orthop Sports Phys Ther* 2003;33(5):221.
- [2] Blake RL, Ferguson H. Limb length discrepancies. *J Am Podiatr Med Assoc* 1992;82(1):33.
- [3] Mannello DM. Leg length inequality. *J Manipulative Physiol Ther* 1992;15(9):576.
- [4] Smith CF. Instantaneous leg length discrepancy determination by "thigh-leg" technique. *Orthopedics* 1996;19(11):955.
- [5] Hoikka V, Vankka E, Tallroth K, Paavilainen T, Lindholm TS. Leg length inequality in total hip replacement. *Ann Chir Gynaecol* 1991;80(4):396.