Advanced Hip Arthrosis, Massive Perceived LLD, and Pelvic Obliquity due to Adduction Contracture Treated with THR

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Abstract

These two cases represent patients with advanced hip arthrosis and massive perceived limb length discrepancies (LLD) due to concomitant ipsilateral adduction and flexion contractures of the involved hip. Despite having moderate true LLD, the perceived LLD by both patients was massive. Alleviation of end-stage arthritis symptoms was achieved by performing a total hip replacement (THR). Correction of the flexion and adduction hip deformities by soft-tissue releases around the hip resulted in almost complete and complete resolution of the perceived LLD in the first and second cases, respectively. The joint replacement and soft-tissue releases unlocked the adduction deformity of the hip and the Pelvic obliquity due to adduction contracture of the hip (POACH), leading to correction of the apparent LLD, which was the main contributing factor to the massive perceived LLD.

1 Brief Clinical History

Case 1: A 54-year-old man presented with a history of a pathological fracture of the right femoral neck due to a simple bone cyst that was surgically managed by curettage, screw fixation, and hip spica casting at the age of 12 years and was subsequently complicated by avascular necrosis (AVN) of the femoral head and end-stage arthrosis. He had been using a 10-cm shoe lift and had early complaints of low back pain from the LLD and associated imbalance. Examination of the patient revealed an antalgic as well as a Trendelenburg gait on the right hip. In the standing position, the right side of the pelvis was elevated compared to the left. This was corrected in the sitting position where the pelvis was leveled, denoting a flexible pelvic obliquity without any fixed sacroiliac or lumbosacral spine deformity. The right hip exhibited a fixed flexion deformity (FFD) of 25° and an adduction contracture of 25° as well as painful, extremely limited, or no internal/external rotation. Hip radiographs revealed a deformed right hip with end-stage arthrosis and a retained screw in the femoral neck.

Case 2: A 26-year-old female with a history of untreated Perthes disease of the right hip presented with right hip pain and a perceived LLD of 9 cm with the right lower extremity being shorter than the left. The patient had a similar presentation as that of case 1 and similar right hip and low back pain. Clinical examination findings were similar with a right hip FFD of 30° and an adduction contracture of the same magnitude. Radiographs also revealed similar findings, yet with no retained hardware.

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2 Preoperative Clinical Photos and Radiographs

Case 1:
See Figs. 1 and 2.
Case 2:
See Fig. 3.

3 Preoperative Problem List

1. Right hip dysplasia with end-stage arthrosis
2. Adduction + flexion contracture of the R hip
3. Massive perceived LLD and short right lower extremity
4. Pelvic obliquity due to adduction contracture of the hip (POACH)

4 Treatment Strategy

1. Performing a THR for advanced end-stage hip arthrosis. The THR along with soft-tissue releases enables correction of the adduction contracture.

Fig. 1 Preoperative clinical photographs of the (a) front, (b) side, and (c) back views of the patient showing a massive perceived LLD, with the patient feeling comfortable with a 10-cm block under the right lower extremity
2. Correction of true LLD due to bony deficiency by increasing the femoral neck length to match the contralateral hip, based on preoperative templating and planning.

3. Increasing the femoral neck offset of the femoral stem to increase stability postoperatively and restore the abductor moment arm and strength is mandatory, especially in the presence of a coxa vara and breva as in these two cases. This should be, again, guided by preoperative templating and planning.

4. Correction of the apparent LLD by releasing the tight soft tissues around the hip, contributing to the flexion and adduction contractures. For the flexion contracture, release of the iliopsoas tendon, rectus femoris, and anterior hip capsule is performed. A percutaneous adductor tenotomy at the end of the THR is carried out for the adduction contracture.

5 Basic Principles

1. Clinical examination is of utmost importance to detect fixed versus flexible pelvic obliquity as well as hip flexion and adduction contractures. This helps in formulating the surgical plan and the
need for additional muscle releases during the anticipated THR to resolve apparent LLD resulting from such contractures.

2. It is necessary to perform such soft-tissue release when the flexion or adduction contractures are equal to or greater than 15–20°.

3. Residual perceived LLD can be corrected over time as the released structures stretch over time postoperatively with rehabilitation. However, some residual perceived LLD can persist due to partially fixed pelvic obliquity at the spinal-pelvic junction that would not be resolved by the soft-tissue releases.
4. Assessment of hip version clinically is challenging in the face of advanced arthrosis and limited rotation of the hip. If severe version abnormality is noted on plain radiography from the profile of the trochanters compared to the contralateral normal side, then a CT version study of the hip is useful and a modular stem THR allowing for anteversion adjustment should be considered.

6 Images During Treatment

The following definitions are important for the readers to understand:

1. **True LLD** arises from actual shortening of the affected lower extremity bones (including femoral neck shortening) as well as deformed and proximally migrated femoral head as in developmental dysplasia of the hip (DDH). Measurement of true LLD in such cases is best measured from a line crossing the highest point of the pelvis at the level of the posterior superior iliac spines (PSIS), passing through the center of the hip to the ankle. Alternatively, it can be measured from a transpelvic line connecting the lowest part of both inferior pubic rami to the ankle (Fig. 1).

   See Fig. 4.

2. **Apparent LLD** may be the result of other abnormalities, including (a) fixed pelvic obliquity at the spine-pelvic junction, (b) causes at the level of the pelvis as pelvic obliquity due to adduction contracture of the hip (POACH) (Fig. 2), and (c) infra-pelvic causes as contractures of the knee, ankle, or foot.

   See Fig. 5.

3. **Perceived LLD** is the discrepancy in limb length difference that the patient perceives and is usually reflected on the shoe lift the patient wears or the block height placed under the short extremity on clinical examination required to make the patient comfortable with the short extremity reaching the ground. **Perceived LLD** is due to the summation of true LLD and apparent LLD.

4. \( \text{Perceived LLD} = \text{True} + \text{Apparent LLD} \).

7 Technical Pearls

1. A thorough clinical examination in cases of hip arthrosis with massive perceived LLD is of utmost importance to detect soft-tissue contractures around the hip joint. The LLD from flexion contracture is seen as true LLD. The apparent LLD from the adduction contracture is seen as elevation of the pelvis and POACH.

2. Assessment of combined hip version (acetabular and femoral version) with CT should be always considered if the rotational profile appears grossly abnormal on clinical exam and plain radiographs. Extremely abnormal version should be ideally managed by a modular femoral stem allowing anteversion adjustment, which must be anticipated, and the implant made available at the time of surgery after adequate preoperative templating. If such implants are not readily available, then a proximal femoral derotational osteotomy fixed by a long stem femoral prosthesis is an alternate option.

3. Restoration of femoral neck length should be aimed for by adjusting the level of the femoral neck cut and the prosthetic femoral neck length to equalize true LLD resulting from head and neck shortening/deformity.
4. Likewise, restoration of femoral neck offset with a high offset stem is necessary to increase hip abductor moment and increase hip stability postoperatively. This, again, should be accounted for during preoperative templating.

5. After placement of the THR prosthetic components, assessment of the range of motion of the hip dictates the sequential release of periarticular soft tissues. If hip extension is impeded, flexion contractures are managed by releasing the anterior hip capsule, followed by recessing the iliopsoas tendon insertion onto the lesser trochanter and then the rectus femoris if necessary. Likewise, if hip abduction is restricted, adduction contracture is managed by percutaneous adductor tenotomy at the end of the THR procedure.

6. While it is generally safe in the adult reconstruction to lengthen the lower extremity with a THA up to 2–4 cm without any complications, the most concerning complication is sciatic nerve palsy. This is of no concern in massive perceived LLD due to POACH. We have not encountered any cases of postoperative sciatic nerve palsy. This is due to the fact the sciatic nerve lies posterior to the plane of correction of the adduction hip deformity (the coronal plane) and is therefore not subjected to any stretch upon correction from hip adduction to an abducted position. Moreover, correction of the FFD of the hip does not pose any jeopardy to the sciatic nerve. The sciatic nerve lies in the convexity of the deformity of the flexed hip in the sagittal plane. Therefore, correction of the FFD of the hip actually relieves the stretch on the sciatic nerve as the hip is brought into extension.

7. Gait training and stretching exercises can reduce residual early postoperative perceived LLD by gradual stretch of the released muscles. Abductor strengthening and increased range of motion

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Fig. 4  Preoperative 51-inch-long erect radiographs of the hip to the ankle of a 54-year-old male patient (Case 1) who presented with a massive perceived LLD of 10 cm. True LLD was measured as 43 mm via lines crossing the highest point of each hemipelvis at the level the posterior superior iliac spines (PSIS), passing through the center of the hip to the ankle. The patient felt comfortable with a 10-cm shoe lift (perceived LLD = 10 cm). The difference between the true LLD and the perceived LLD is attributed to the POACH which accounts for the remaining apparent LLD of 57 mm.
postoperatively also enhances adductor stretching. Long leg standing radiographs are recommended for follow-up as they aid in identifying residual fixed bony changes, residual apparent LLD, and its response to rehabilitation protocols.

8 Outcome Clinical Photos and Radiographs

Case 1:
See Figs. 6 and 7.

Case 2:
See Fig. 8.

9 Avoiding and Managing Problems

1. If femoral version is found to be severely abnormal intraoperatively, resorting to a modular femoral stem allowing version adjustment is the optimal solution and should be anticipated for. If not available, then a subtrochanteric derotational femoral osteotomy and a long stem traversing the osteotomy are alternative options.
2. “Balancing” the THR once both femoral and acetabular components are placed and range of motion (extension and abduction) is tested intraoperatively is crucial for resolving apparent LLD due to soft-tissue flexion and adduction contractures. Soft tissue releases should be carried out sequentially as outlined above.

3. Restoring femoral neck length increasing the femoral neck length is required to resolve true LLD from femoral head/neck bony deformity and will also increase implant stability. Safe lengthening up to 2–4 cm can be carried out without significant risks to neurovascular structures.

4. If, after an appropriate femoral component with the desired femoral neck length is placed, the hip is still “unstable” or “loose” with a visible “chuck” on “push-pull” testing, then stability can be enhanced by a high offset stem that will increase stability without affecting the femoral neck length.

Fig. 6 Postoperative clinical photographs of the (a) front and (b) back views of the patient showing an almost complete correction of the perceived LLD. The patient was able to reduce the height of his shoe lift from 35 mm at 2 weeks postoperatively to 17 mm at 1 year postoperatively due to gradual stretching and rehabilitation of the released flexors and adductors of the right hip. He had excellent functional outcome and was extremely satisfied with his surgery.
Fig. 7 (a, b) Postoperative 51-inch-long erect radiographs of the hip to the ankle demonstrate a perceived LLD of 17 mm at 1 year after THR. The patient felt comfortable with a 3/4-in. (17 mm) shoe lift under the right lower extremity which leveled his pelvis on the long-standing radiograph. Residual LLD seemed to be from spinal-pelvic deformity.

Fig. 8 (a–b) Postoperative 51-inch-long erect radiographs of the hip to the ankle demonstrate complete restoration of limb length equality and complete resolution of perceived LLD 1 year after THR. The patient had no apparent LLD and did not need any shoe lifts postoperatively. This is likely due to the patient’s young age and the complete reducibility of the POACH without any structural bony changes that allowed full correction with the soft-tissue releases and THR.
10 Cross-References

- Ilizarov Hip Reconstruction for Post Infective Femoral Head Destruction
- Septic Destruction of the Hip and Significant LLD Treated By Pelvic Support Osteotomy and Femoral Lengthening

References and Suggested Reading


