OPEN Case Report

# Neglected Developmental Hip Dysplasia Treated With External Iliofemoral Distraction, Open Reduction, and Pelvic Osteotomy: Eleven-Year Follow-Up

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## ABSTRACT

Neglected untreated developmental hip dysplasia can result in severe deformities and functional disabilities. This report describes the treatment and 11-year follow-up of a patient who underwent the procedure in two stages. At the time of treatment, the patient was 7 years of age and was diagnosed with acetabular dysplasia and neglected right hip dysplasia. A stepwise treatment approach, including gradual distraction of the iliofemoral joint, open reduction, and pelvic osteotomy, was performed. Subsequent postoperative rehabilitation and regular follow-up assessments were performed over 11 years. The long-term results indicated notable improvements in hip joint congruency, functional range of motion, and overall quality of life. Early diagnosis and appropriate intervention are crucial for patients with developmental hip dysplasia, and the treatment methods described here are effective.

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There are various predisposing factors, including first birth, female sex, breech delivery, family history, oligohydramnios, and associated malformations/syndromes such as clubfoot, as well as other congenital deformities.[1]

Dysplasia of the hip (DDH), which is often neglected, occurs in patients unable or unwilling to seek appropriate medical care. Thus, chronic dislocations are commonly observed in those who are highly sensitive to pain, have a poor ability to recognize or communicate pain, or have additional injuries that are more obvious or potentially life-threatening.[2] Furthermore, parents often lack sufficient knowledge to detect problems in their children.

A salvage pelvic osteotomy is a treatment option for older children with DDH. Open reduction, pelvic osteotomy, and femoral shortening are recommended to treat high DDH. However, in older children, the femur is shortened; therefore, this approach is not effective.[3] Moreover, postsurgical complications are common.[4] Regardless of the child's age, surgical treatment for neglected DDH can be technically challenging and can result in

## FIGURE 1




Radiograph demonstrating the pelvis in the anterior-posterior view (**A**) and anterior-posterior frog lateral view (**B**).

osteonecrosis of the femoral head and hip.[3] Some authors argue against these treatment options in older children because poor results may result in greater disability than a dislocated hip, particularly in cases of bilateral DDH.[5]

This report describes the surgical technique and discusses the treatment outcomes in children with high DDH.

## Case Presentation

The patient described in this report provided consent for the publication of the anonymized case details. In 2013, a 7-year-old girl presented with unsteady gait and limb shortening. Physical examination and hip assessment, including range-of-motion tests, revealed reduced right hip abduction and shortening of the right lower limb by approximately 4 cm. Pelvic radiography confirmed the diagnosis of right DDH (Figure 1). The patient was admitted for surgical management and correction of right DDH.

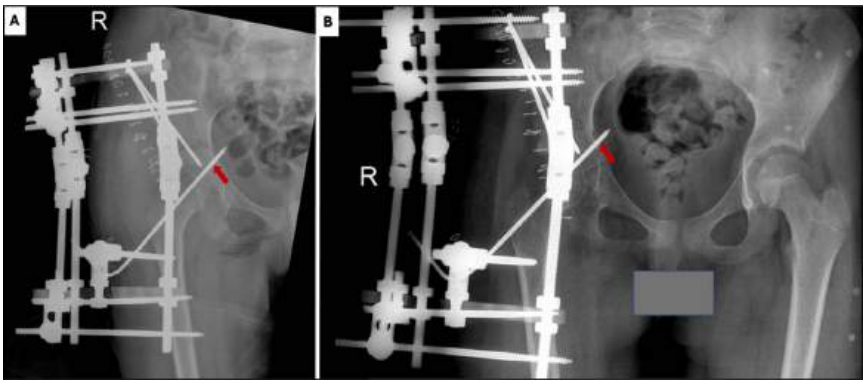
The management process was divided into two stages. First, the femoral head was lowered back to the level of the acetabulum using the anterior Smith-Peterson approach with soft-tissue release and installation of an Ilizarov frame. The soft tissue was released as follows: split the iliac apophysis and dissect the subperiosteal to partially detach the gluteus medius and minimus from the iliac crest; release the sartorius tendon and biceps femoris long-head tendons; perform iliopsoas tenotomy, followed by femoral capsulotomy; and clean the acetabular socket. The sartorius and biceps femoris long-head tendons were marked with proline sutures and approximated after distraction. An Ilizarov frame was installed for gradual distraction. The device was fixed proximal to the right iliac bone using three pins introduced superiorly to the acetabular roof and one ring. The frame was fixed distal to the femoral shaft using three pins and one ring. Distraction was 1.5 mm

## FIGURE 2




**A,** Radiograph demonstrating the pelvis in the AP view at 1 d postoperatively, showing that the proximal pin is fixed to the iliac bone (red arrow). **B,** Radiograph demonstrating the pelvis in the AP view at 15 d postoperatively after the gradual distraction of the right femur, showing the proximal pin dislodgement from the iliac bone (red arrow). **C,** Radiograph demonstrating the pelvis in the AP view at 30 d postoperatively, showing that the right femur head is leveled with the acetabulum and the proximal pin in the soft tissue without complications (red arrow).

## FIGURE 3




**A,** Radiograph demonstrating the right hip at 1 month postoperatively, with the wire protruding medially through the acetabulum (red arrow). **B,** Radiograph demonstrating the right hip at 3 months postoperatively, showing no complications from the wire protruding through the acetabulum (red arrow).

per day divided into six increments (0.25 mm every 4 h) for 30 d until the proximal femoral head was level with the acetabulum. During the distraction program, the proximal pin was dislodged without complications from the iliac bone by gradual distraction. It was removed once the distraction program was completed (Figure 2).

In the second stage, the hip joint was reduced after pelvic osteotomy and fixed using Kirschner wires. Owing to the poor quality of the intraoperative images, the transcervical wire protruded medially to identify the issue postoperatively. Upon examination of the patient, no harm to the patient was noted during the healing process. The sartorius and biceps femoris long-head tendons were approximated. Reinstalling the Ilizarov frame as a static frame rather than a hip spica enabled the patient to move freely and care for themselves (Figure 3). Physiotherapy was prescribed to prevent knee contracture. During treatment, the patient was recommended to assume full weight-bearing as tolerated. Notable improvement in the patient's movement was observed over the course of 3 months and during periodic follow-ups. Once signs of bone healing were confirmed, the Ilizarov frame was removed, and physiotherapy with full hip motion was permitted immediately to ensure a satisfactory outcome (Figure 4).

The patient was extremely satisfied with the treatment and services provided after multiple clinic visits. However, after years of normal gait, the patient reported of right hip pain and limping in 2021. Although the peripheral nervous system and blood perfusion were normal in both lower limbs, the right lower limb had weaker muscle strength than the left one. Plain radiographs revealed that the femoral acetabular joint was congruent. In addition, a long radiograph was obtained with no discrepancies in limb length (Figures 5 and 6). CT revealed flat surfaces on the right femoral head,

## FIGURE 4




Radiograph demonstrating the pelvis in the AP view. Following removal of the Ilizarov device, the right DDH was reduced with a satisfactory outcome. DDH = dysplasia of the hip.

## FIGURE 5



Radiograph demonstrating the pelvis in the AP view at 9 years postoperatively.

## FIGURE 6




Scanogram demonstrating the lower limb in the AP view, showing equal bilateral limb length.

osteoarthritic changes with sclerosis, and cystic changes (Figures 7–9).

Muscle strengthening and pain control involved 20 intensive physiotherapy sessions. At the beginning of each session, the quadriceps, hamstrings, gluteus, and calf muscles were electrically stimulated for 20 min, followed by applying a warm pack to the hip joint for 10 min. Stretching and strengthening exercises were initiated by lifting weights increased by 1 kg every five sessions.[6,7] To date, the patient has continued to follow her physiotherapy program and feels better as long as she is compliant.

## Discussion

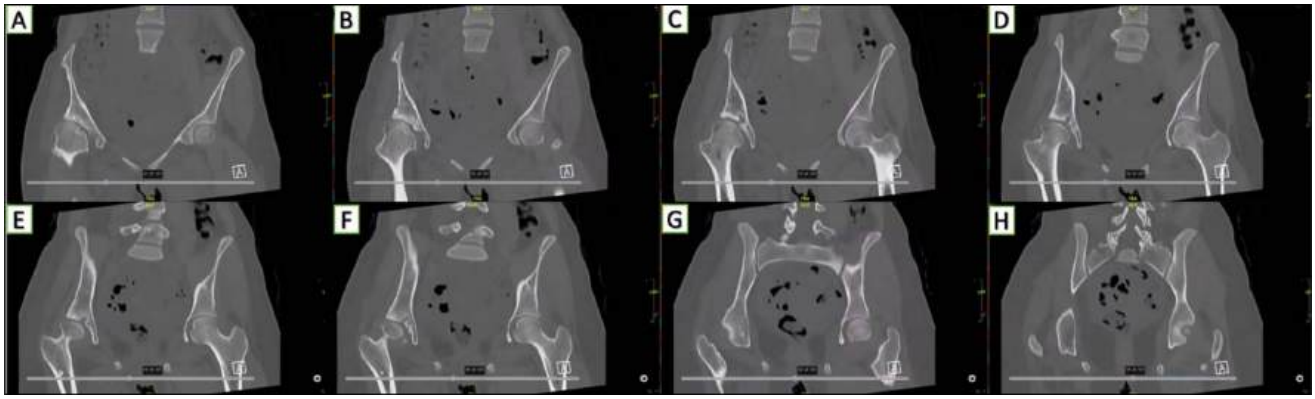
The goals of treatment for children with neglected DDH are equalization of lower extremity lengths and maintenance of concentric reduction with satisfactory hip function.[3,5] However, successful results usually depend on the patient's age at the initial hip reduction.[5] A major advantage of external iliofemoral distraction for slowly lowering a high DDH is its ability to reduce the hip joint slowly.[3]

Nevertheless, few studies have optimized gradual distraction of the iliofemoral region using internal or external devices, particularly in patients with neglected DDH. An external device was used in the case described, with a prolonged follow-up period and satisfactory results.[3,8]

In addition to gentle relaxation of the contracted muscles, external iliofemoral distraction enables blood vessels and nerves to adapt, thereby reducing the risk of sciatica and osteonecrosis of the femoral head.[9,10] Furthermore, it reduces the risk of postoperative joint stiffness.[9] By using iliofemoral distraction before surgery, surgeons can prevent intraoperative shortening of the femur.[9]

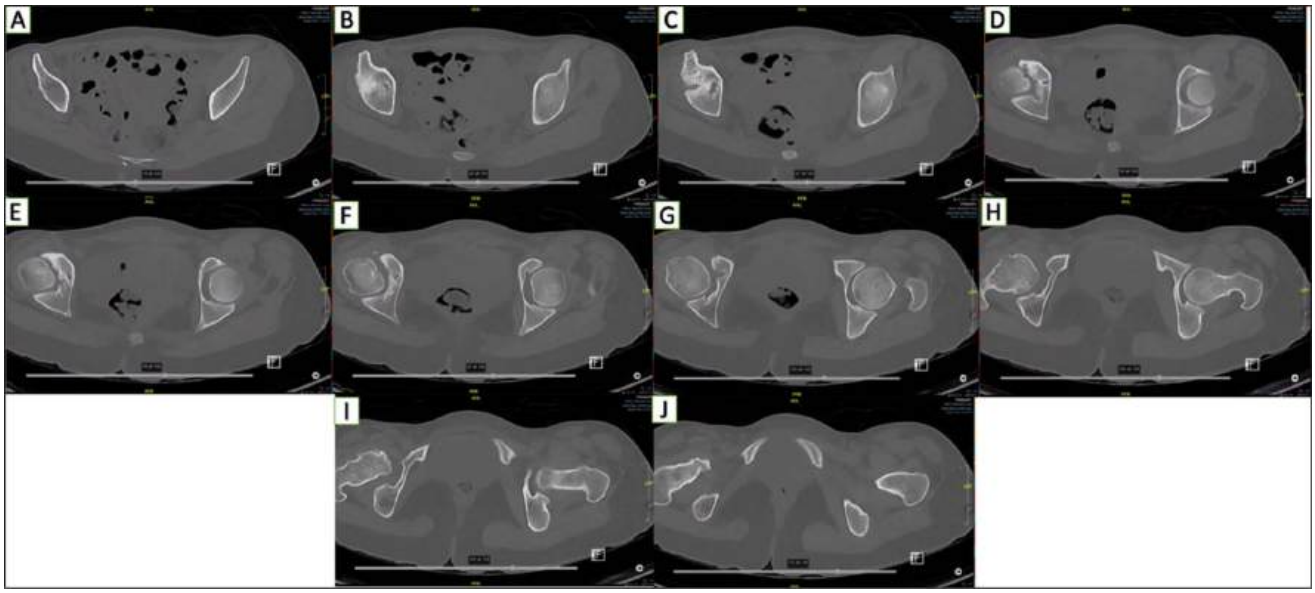
A dislocated femoral head can be returned to its correct position using an external iliofemoral distraction device or by applying skeletal traction until the Shenton-Menard line is restored. Skeletal traction for

## FIGURE 7




CT scan demonstrating the pelvis in coronal views at 9 years of follow-up (**A**–**H**).

## FIGURE 8



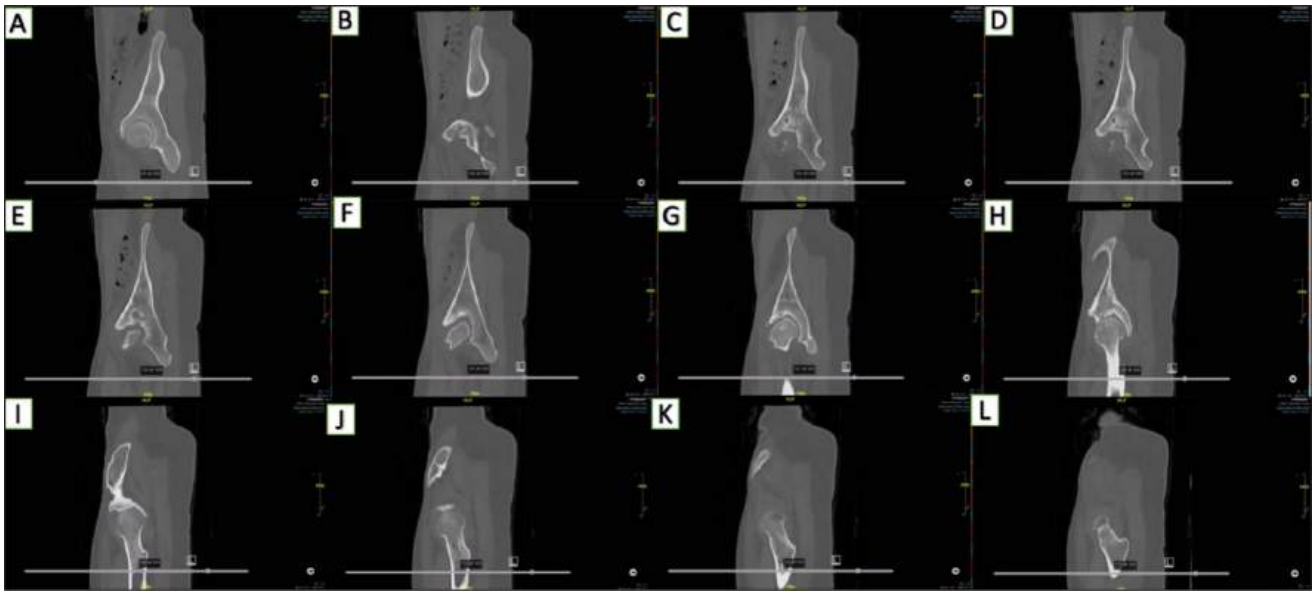

CT scan demonstrating the pelvis in axial views at 9 years of follow-up (**A–J**).

preoperative treatment has several disadvantages.[9] For example, the acetabulum and femoral head cannot be lowered because of pelvic instability, prolonged hospitalization, and nursing difficulties.[3]

The Ilizarov frame was used as a distraction device until the head of the femur was aligned with the true acetabulum. It was then maintained as a static frame after pelvic Salter osteotomy to enable the patient to serve herself.

Shortening the femoral shaft can also reduce the risk of postoperative osteonecrosis of the femoral head. This is based on the assumption that the length of the excised bone fragment is equal to the distance between the ends of the disrupted Shenton-Menard line.[11] The risk of osteonecrosis is reduced; however, limb shortening persists.[3] Iliofemoral distraction is a good option for preventing limb length discrepancies; however, leaving

## FIGURE 9




CT scan demonstrating the pelvis in sagittal views at 9 years of follow-up (**A– L**).

the Ilizarov frame for prolonged periods may result in pin-tract infections.[3]

Untreated developmental hip subluxation or dysplasticity almost always results in early degenerative changes within the joint and subsequent osteoarthrosis,[12] regardless of the type of dislocation, presence or absence of the false acetabulum, or position of the false acetabulum.[3]

Treatment of osteoarthrosis with a total hip replacement may be successful in older patients.[13] Changes in osteoarthritis secondary to residual subluxation are difficult to treat and prevent in younger patients.[3,10] Osteotomy of a dysplastic hip is technically difficult, and the joint may not always be congruent after the procedure,[3] although some improvements have been achieved using rotational acetabular osteotomy.[14]

To treat high DDH with total hip replacement, restoring normal joint anatomy, including the Shenton-Menard line, is necessary.[3] In this case, a Salter pelvic osteotomy was performed to provide adequate coverage of the femoral acetabulum and facilitate future total hip replacement.

## Conclusion

If left untreated, hip dysplasia can result in severe deformities and functional limitations. Approaches to treating neglected DDH include gradual distraction of the iliofemoral joint, open reduction, pelvic osteotomy, postoperative rehabilitation, and regular follow-up assessments. In this case, these treatments markedly improved hip joint congruency, functional range of motion, and quality of life. Early diagnosis and appropriate intervention are essential in patients with DDH.

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