

## Case study

### **Proximal Femoral Derotational Osteotomy in a 14-Year-old Patient with Cerebral Palsy: Osteosynthesis Material Failure Three Weeks Postoperative**

#### **Abstract**

Cerebral palsy (CP) is a group of disorders that affect a person's ability to move and maintain balance and posture. Excessive femoral internal rotation is one of the gait problems encountered and can be corrected by femoral derotation osteotomy.

We present here the case of 14 years old boy, known to have cerebral palsy, with increased femoral anteversion treated with proximal subtrochanteric femoral derotation osteotomy fixed with plate and screws.

He experienced a catastrophic failure of the plate. First time revision was done with a dynamic hip screw sliding plate, second time revision was done for pseudarthrosis and consisted of adding a dynamic compression plate (DCP) on the anterior cortex to increase the fixation stability.

As a conclusion, a robust system should be utilized when trying to osteosynthesis fractures near spastic muscles, and tenotomy should be added whenever needed without hesitation.

**Keywords:** cerebral palsy, femoral derotation osteotomy, plate osteosynthesis, failure, children

#### **Introduction**

Cerebral palsy (CP) is defined as damage or abnormal development of the fetal or infant's brain leading to major corporal dysfunctions such as gait abnormalities [1]. One of the causes is the increased hip internal rotation [2] due to the hypertonic internal rotator muscles and the excessive femoral anteversion which are usually associated with weakened hip abductors [3]. Consequently, CP patients having this pathological gait will suffer from walking difficulties and skeletal cosmetic problems due to internal rotation of the foot and hip [2].

Surgical correction (femoral derotation osteotomy: FDO) is an option in CP patients when internal rotation of the anteverted femur interferes and hinders the gait. Moreover, operative management could be indicated based on the patients' symptoms and the anteversion angle (usually an angle greater than 25-30 degrees, with symptomatic patellofemoral malalignment is a surgical indication) [4].

Solid and firm fixation by the locking compression plate system LCP after the osteotomy should be achieved to counteract the deforming force of the spastic muscles [5,6]. Though LCP osteosynthesis is a robust system of fixation, several complications could occur such as metal cut out, loss of correction, metal breakage, femoral neck fracture [2,7].

Reviewing the literature, failure rate of osteosynthesis using either LCP or a blade plate BP was 2.7% of patients post FDO in which all of them had CP as cited by Chung et al in 2018 [8].

However there are no cases describing two consecutive implant failures after femoral osteotomy in patients with CP under non-weight bearing condition.

Therefore, we are reporting a case of LCP system failure that occurred after 3 weeks post operative, complicated by a pseudarthrosis after first time revision and treated by a dual plating system.

## **Case Presentation**

A 14-year-old boy with cerebral palsy (CP), born at 35 weeks of gestation with suboptimal weight and height. Lately, he had a developmental delay and spastic diplegia and he started walking at three years of age.

A pediatric neurologist followed up his seizure episodes of unknown origin, until he stopped the anti-epileptic medications at 12 years old when he was in remission for two consecutive years.

No tenotomy or tendon lengthening was done for the hip but multiple tenotomies were done for the elbow and the knee contractures. He presented to our clinic when he was 14-years-old for repetitive falls due to intoeing gait that causes disequilibrium during ambulation. The parents mentioned that he could walk short distances without assistance at home.

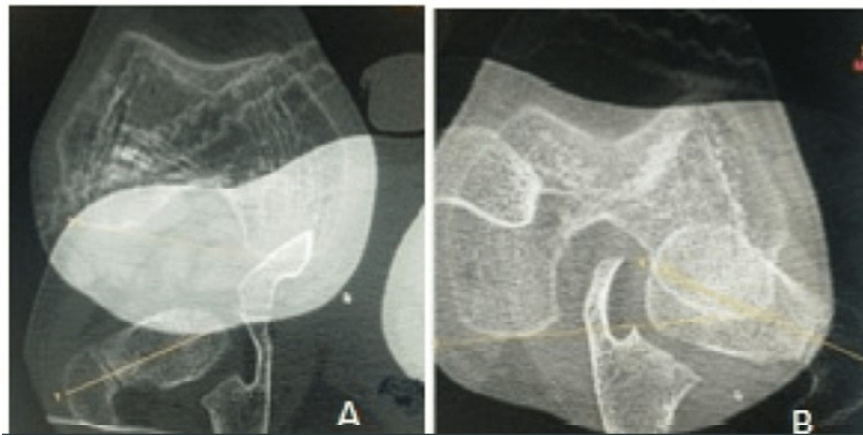
On a physical exam, the patient's leg alignment was neutral in supine position. While on ambulation, internal rotation of the hips and right and left foot were noted.

An antero-posterior pelvic xray was done (Figure 1) and a scannogramme that showed an exaggerated bilateral femoral head anteversion, 36 degrees on the right side (Figure 2A), and 33 degrees on the left side (Figure 2B).



**FIGURE 1: Antero-posterior radiography of the pelvis of the patient.**

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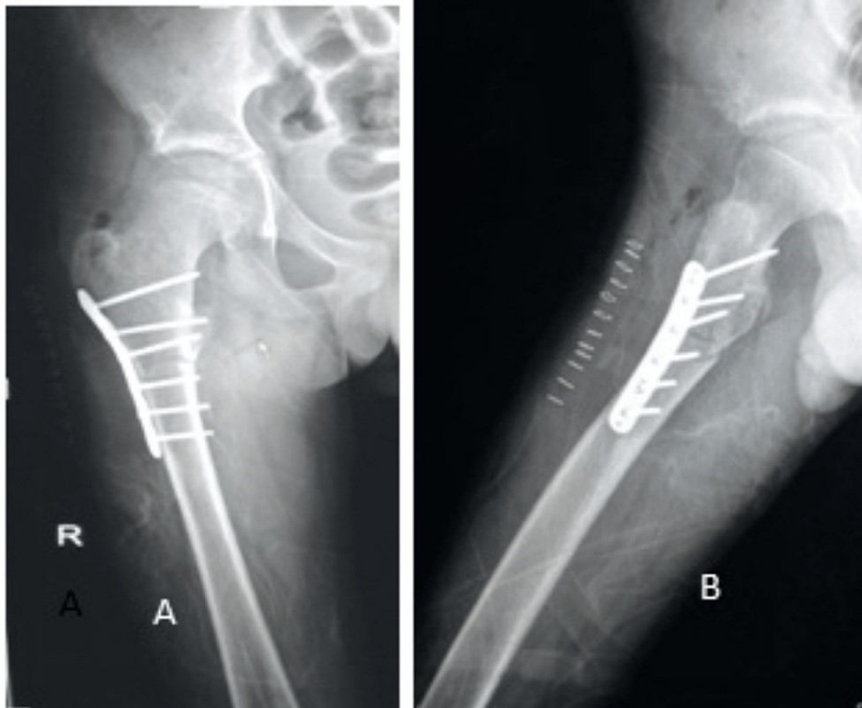


**FIGURE 2: CT scan cuts showing the excessive bilateral anteversion right side 36 degrees (A) left side 33 degrees (B)**

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The patient was referred for surgical intervention.

Using a standard lateral approach, 20 degrees proximal, subtrochanteric, femoral derotation osteotomy was done, and fixed by an LCP plate with six locking screws of 3.5 mm of diameter. Noting that the patient has a good quality of bone. Post operative radiography showed good fixation and alignment (Figure 3A, 3B).



**FIGURE 3: AP (A) and Lateral (B) x ray post-osteotomy and osteosynthesis showing good alignment and solid fixation with the LCP plate.**

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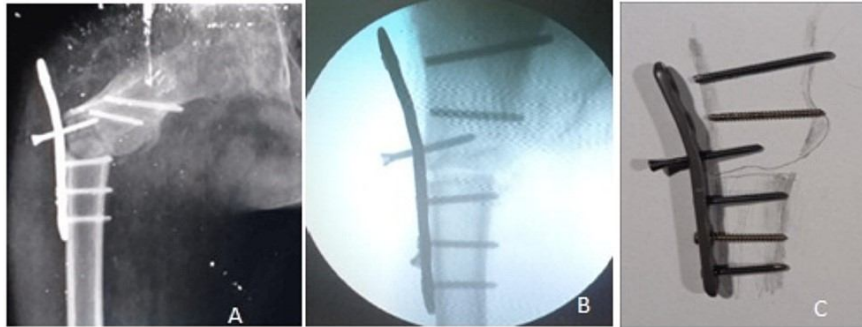
Post-operative pain was managed with intravenous acetaminophen, opioids, and oral ibuprofen. Opioids were discontinued on postoperative day two.

Strict non weight bearing for two months was strictly informed.

After 12 days, the patient was seen with good post operative evaluation, still non weight bearing, good cicatrisation, steady pain, during the day and night, partially relieved by NSAIDs and Paracetamol.

After 21 days, the patient presented to the emergency department complaining of severe pain and obvious angular deformity at the operative site (right hip) with total loss of arc of motion. No infection signs were present. And no history of recent trauma was found.

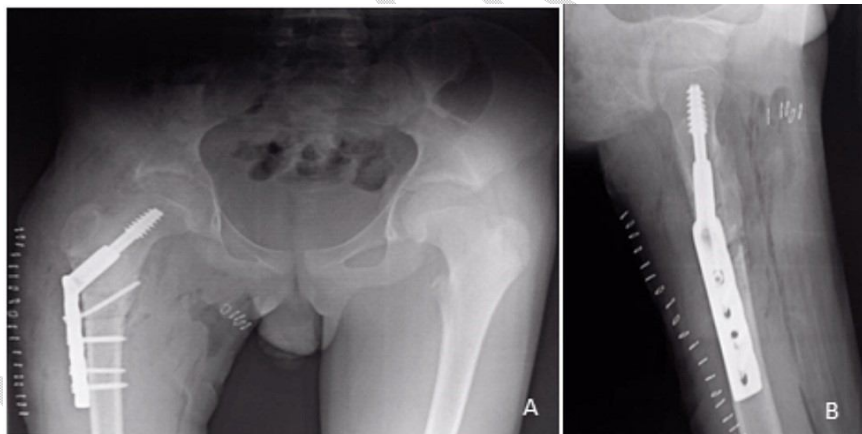
X-rays of the right hip presented osteosynthesis failure (dismantling of the plate), with breaking of the proximal two screws, and the third screw was migrated distally in the vastus lateralis muscle with severe varus angulation (Figure 4A, 4B, 4C).



**FIGURE 4: (A) radiography of the hip in the emergency room showing the failure and the dismantling of the plate and screws. (B) intraoperative xray after reduction on an orthopedic table (C) schematic view of the dismantled plate**

A revision surgery was done, first removal of the old plate through the old lateral scar, and fixation with a dynamic plate screw type DHS with four cortical screws. Post operative radiography showed satisfactory results (Figure 5A, 5B).

Since the excessive femoral anteversion in CP patients is associated with muscle spasticity mainly the adductors, an adductor tenotomy was also done at the end of the operation to decrease muscle deforming forces over the fracture site.



**FIGURE 5: AP (A) and Lateral (B) x-rays after fixation with a DHS with satisfactory alignment, good bone quality.**

At follow up, the patient demonstrated significant improvement in the range of motion of the hip with no evidence of tenderness or swelling, the wound edges were healed. But the patient complains of persistent pain that increased when he started weight bearing.

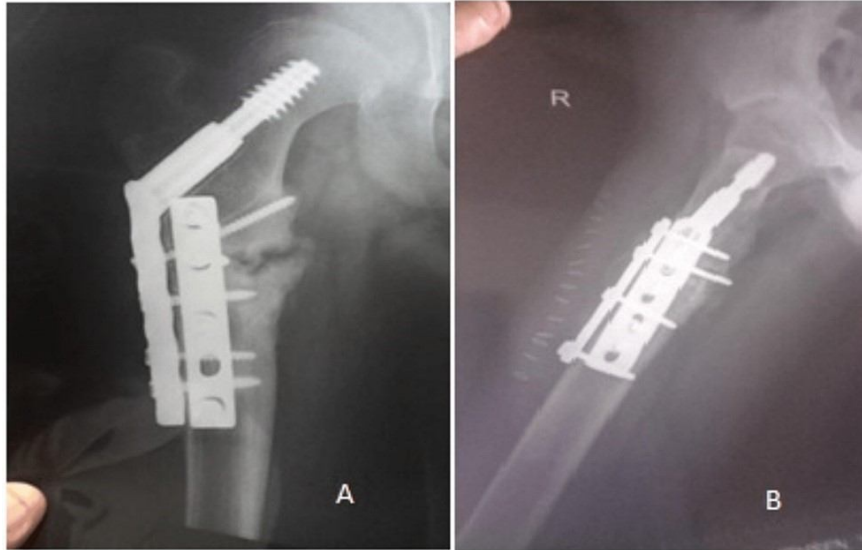
X-rays after three months showed a hypertrophic nonunion, due to hypermobility at the osteotomy site (Figure 6).



**FIGURE 6: AP x-ray view showing a hypertrophic nonunion at the osteotomy site.**

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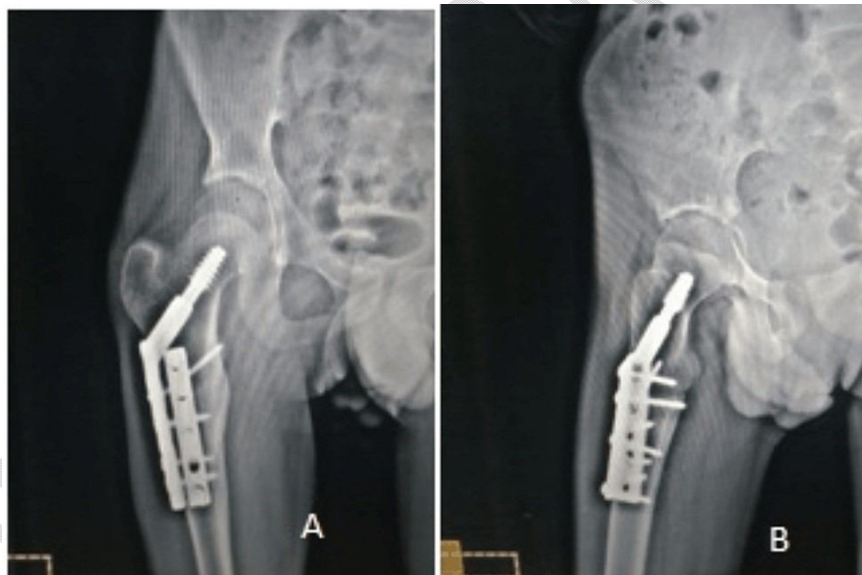
A revision was done with the addition of a dynamic compression plate anteriorly to increase the stability (Figure 7A, 7B).



**FIGURE 7: (A) And (B) show the AP and Lateral x-ray views after addition of the DCP plate**

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Full consolidation was attained after four months (Figure 8A, 8B).



**FIGURE 8: Full consolidation after 4 months , AP (A) and Lateral (B) xray**

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### **Discussion**

Femoral version is defined as the angular difference between the axis of the femoral neck and the transcondylar axis of the knee. Femoral anteversion ranges between 0° in early gestation to 30° at birth, decreasing to 10-15° in adulthood [9-10]. Rotational deformities are usually self-corrected [04].

Many signs and symptoms can result due to excessive femoral anteversion including anterior thigh pain due to laxity, in-toeing of the foot, increased tibio-femoral torsion that leads to anterior knee pain, patellofemoral instability and degenerative knee changes [11-12].

In our case, the patient was complaining of painful in-toeing of the right foot and the femoral anteversion angle was 36 degrees, so we did the osteotomy that was fixed with an LCP plate that was known to be a rigid system.

The failure in our patient was due to the excessive pulling force caused by the spastic internal rotators (mainly the adductors) leading to high deforming forces over the new osteotomy site, (having the plate on the distraction convex site of the osteotomy) higher than the pullout strength of the screws and its maximal plastic limit.

The initial surgical procedure overlooked the impact of certain forces, underscoring the crucial need for a thorough and meticulous assessment of muscular tone before undertaking any surgical intervention. Moreover, it is plausible that the patients' discomfort and anxiety following the operation could have resulted in an elevated tone in an already spastic muscles. Therefore, it is imperative to consider such variables to prevent any unforeseen complications and ensure a successful surgical outcome.

we should keep in our minds that the mechanical load caused by the spasticity may equal the weight-bearing load causing implant failure, adding on the lack of casting in our case.

The second operation was done with a cephalic screw with four locking screws in a DHS, and at the end we did an adductor tenotomy to reduce the muscular deforming force. Thus trying to create a stable and rigid environment for the union to occur.

After three months, this osteotomy was also complicated by a hypertrophic non union, due to excessive micromotion at the osteotomy site despite the DHS plate and the tenotomy that was treated by a second anterior DCP plate to increase the stability.

Full consolidation was attained after 3 months.

All other reported cases of implant failure were only screw failure, and were under weight-bearing condition. only one was under non weight bearing conditions but in a spica cast.

None of them had a second complication as pseudarthrosis.

Failure of our synthesis might be due to its decreased rigidity especially that the cephalic screw was not inserted from the beginning as in the LCP pediatric system, and the lack of a proper treatment for the spasticity.

The second failure, pseudarthrosis, was due to the micromotion that were higher than the accepted.

## Conclusions

In conclusion, our case report highlights the challenges encountered in managing a CP patient who underwent FDO and experienced two instances of osteosynthesis material due to muscle spasticity. This underscores the significance of utilizing a robust and reliable osteosynthesis system and adopting an integrated approach to managing spasticity, including medical and surgical interventions, to safeguard the integrity and longevity of the implants. Such an approach mitigate the risk of complications, enhance the effectiveness of the procedure, and optimize patient outcomes.

## Consent

As per international standard or university standard, parental(s) written consent has been collected and preserved by the author(s).

## Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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