Case study

Proximal Femoral Osteosynthesis Material Failure Three Weeks Postoperative in a 14 Years old Patient Suffering From Cerebral Palsy

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 de-rotation 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 osteosynthesise fractures near spastic muscles, and tenotomy should be added whenever needed without hesitation.

Categories: Pediatrics, Orthopedics
Keywords: cerebral palsy, femur, derotation osteotomy, plate osteosynthesis, failure

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 gate 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 gate. 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 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 atero-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.

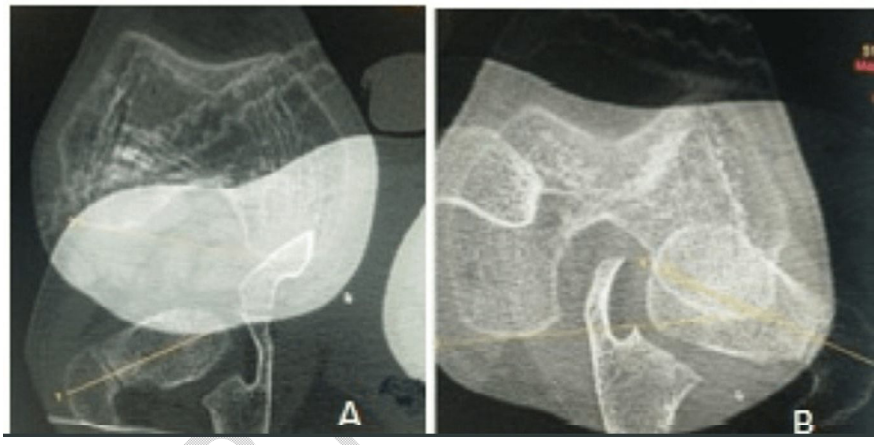

FIGURE 2: CT scan cuts showing the excessive bilateral anteversion right side 36 degrees (A) left side 33 degrees (B)

Surgical decision was taken to correct the deformity of the right hip. 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*).

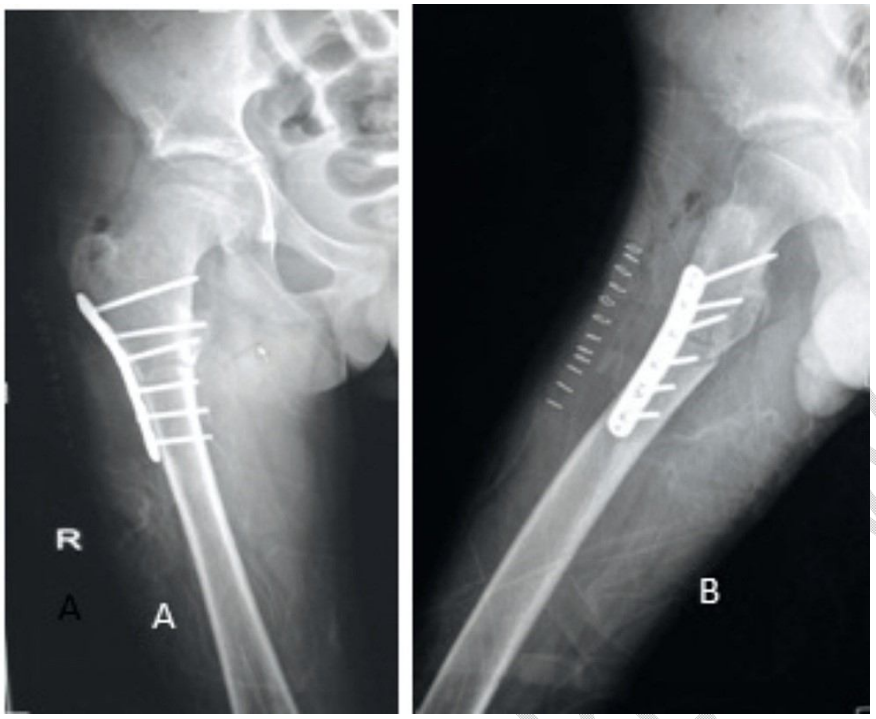

FIGURE 3: AP (A) and Lateral (B) x ray post-osteotomy and osteosynthesis showing good alignment and solid fixation with the LCP plate.

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*).

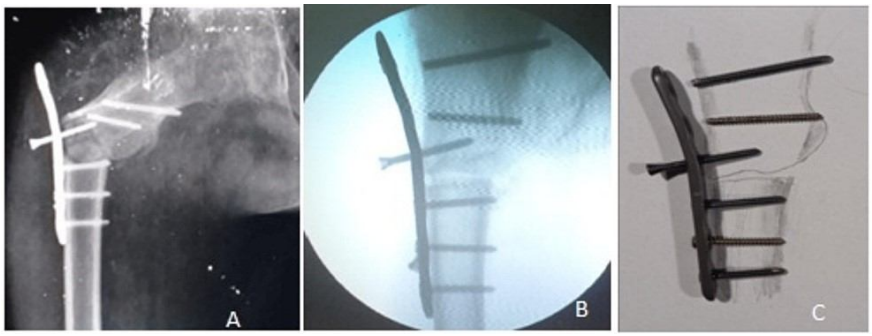

FIGURE 4: (A) radiography of the hip in the emergency room showing the failure and the dismantling of the plate and screws. (B) intraoperative xray after reduction on an orthopedic table (C) schematic view of the dismantled plate

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.

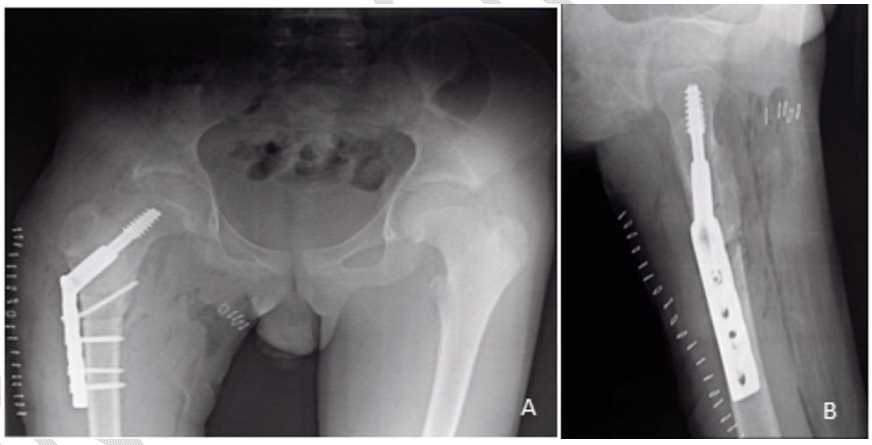

FIGURE 5: AP (A) and Lateral (B) x-rays after fixation with a DHS with satisfactory alignment, good bone quality.

At follow up, the patient was doing well, improvement of the pain, good surgical site cicatrisation. 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.

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

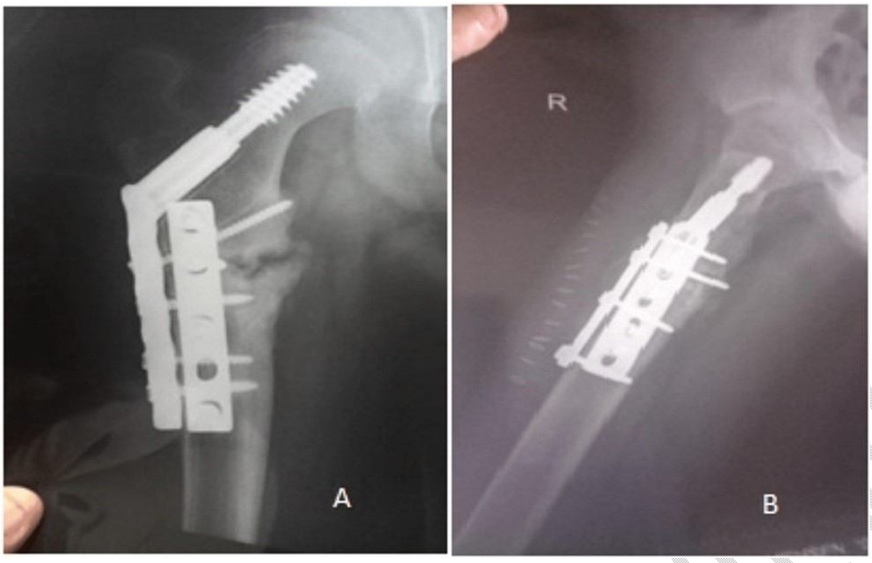

FIGURE 7: (A) And (B) show the AP and Lateral x-ray views after addition of the DCP plate

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

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

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 [11].

Many signs and symptoms can result due to excessive femoral anteversion including anterior thigh pain due to laxity, in-toing of the foot, increased tibio-femoral torsion that leads to anterior knee pain, patellofemoral instability and degenerative knee changes [12-13].

In our case, the patient was complaining of painful in-toing 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 convexe

site of the osteotomy) higher than the pullout strength of the screws and its maximal plastic limit.

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

We represent a case of two times failure of osteosynthesis material after FDO in a CP patient that was due to spasticity in the muscles. This highlights the importance of using a solid system from the beginning and treating the spasticity medically and/or surgically to protect the osteosynthesis material.

Additional Information

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