

CASE REPORT

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Avulsion fracture of the greater trochanter and femoral neck fracture in a young girl: An extremely rare fracture combination

Anderson Freitas, Silvio Leite de Macedo Neto, Bruna Alves de Azevedo, Mário Leite Bringel, Leonardo Santos Diener, Ana Patrícia de Paula

ABSTRACT

Introduction: The femoral neck fractures is a severe pathology, been the fracture site and the deviation two great factors related to osteonecrosis of the femoral head. The avulsion of the apophysis of the greater trochanter is rarely described in literature, even as an example of greater trochanter fracture. The association of femoral neck fracture and apophysis of the greater trochanter in a young patient have not been described in literature yet. **Case Report:** A 10-year-old victim of trampling presented avulsion fracture of the greater trochanter and ipsilateral femoral neck fracture. Here we describe preoperative, intraoperative, and postoperative care, with clinical and radiological results. Injuries were treated with open reduction and internal fixation. After a three-year follow-up, the patient presented no signs of osteonecrosis and no changes in gait, only a slight dysmetria of the lower limbs. **Conclusion:** This rare combination of fractures in a skeletally immature patient caused an unusual behavior in the direction of deviation of the avulsed fragment of the greater trochanter,

which may have been responsible for the good outcome.

Keywords: Femoral, Fracture, Neck, Trochanter

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INTRODUCTION

Femoral neck fracture and avulsion fracture of the greater trochanter in skeletally immature patients, when analyzed individually, present as one of the etiological factors high-energy trauma [1, 2].

Femoral neck fracture in young patients is a severe pathology, which has as complication osteonecrosis of the femoral head, which relates to the fracture site and deviation. According to Delbert classification, type I shows 38% incidence of this complication; type II, 28%; type III, 18% and type IV 5% [3].

However, the fracture of the greater trochanter in young patients is rarely described in the literature as an avulsion of the apophysis of the greater trochanter with a high incidence of osteonecrosis of the femoral head [4–7]. It may occur due to direct trauma, avulsion of the abductor mechanism or infection [4].

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Regardless of etiology, when the detachment of the apophysis of great trochanter takes place, there is a predominance of the abductor mechanism force that deflects the fragment to the anterior portion of the femur, which is one possible cause of osteonecrosis of the femoral head, [7] because this shift would damage the medial circumflex artery. However, other factors are also described as causes of osteonecrosis, such as iatrogenic injury of vascularization during surgery and intracapsular hematoma [5].

The association of a femoral neck fracture and apophysis of the greater trochanter in a young patient, to the best of our knowledge, have not been so far described in literature. Since the prognosis of this type injury would be unusual, we, thus, describe a femoral neck fracture type III and a fracture of the ipsilateral apophysis of the great trochanter in a young patient, including pre, intraoperative and postoperative results with three years follow-up.

CASE REPORT

A 10-year-old girl victim of trampling, presented pain and right lower limb deformity, which slightly mobilized exacerbated the symptom in the hip region.

Hip X-ray showed a trochanteric cervical fracture on the right hip (Delbet type III), which was confirmed by computer tomography (CT) scan. Computed tomography scan showed femoral neck fractures and evidence of associated avulsion fracture of the greater trochanter with posterosuperior deviation (Figure 1).

In the preoperative preparation, patient was kept in skin traction with 5 kilos and medicated with analgesics and non-steroidal anti-inflammatory drugs. Fracture fixation occurred 12h after the accident.

Under general anesthesia and in the supine position, the Harding access was performed. After opening the fascia latae and removal of bulky hematoma, the three fractured fragments were easily observed, the greater trochanter, positioned in the upper posterior region, the metaphysis proximal femur and the femoral neck. The fluoroscopically guided reduction of the femoral neck was performed with a slight traction and internal rotation, provisionally set with guidewire.

Although temporary, the guidewire was positioned to allow proper implantation of a dynamics hip system (DHS) screw. Another guidewire of the same instrument was introduced upward to prevent rotation of the femoral neck during preparation and introduction of the synthesis, by transfixing the epiphysis of the femoral head without invading the joint. After preparation, a sliding bolt was introduced preserving the pin-apex distance (PAD) [8].

A sliding 135° tube plate with three holes was used. When including the plate, steel cerclage wire was positioned below the plate so as to remain trapped

between the plate and the bone. Since one 4.5 mm screw broke, a cotter-pin was used to secure the plate, which improved fracture compression.

With the cerclage wire fixed to the DHS, reduction of the greater trochanter was carried out manually and directly after the femur has been positioned in external rotation and slight abduction. We used two 2.5 mm Kirschner wires from top to bottom, fixating the inferior and medial portion of the femur, tangential to DHS, and performing the tension band with the cerclage wire previously positioned. (Figure 2).

The immediate postoperative period occurred in the infirmary with permanent suction drain for 48 h and third generation venous cephalosporin for 72 h. Active and passive physical therapy was started 24 h after surgery. Ambulation with crutches without support from the operated leg was allowed after 48h, and the patient was discharged on the third day after surgery, with no significant complaints in the operated limb.

Active physical therapy was kept for eight weeks, gait with partial load bearing of the operated limb using crutches was allowed after five weeks. Release of one crutch occurred after eight weeks. Ambulation without crutches after 12 weeks was allowed when X-ray image showed bone consolidation.

At one year after surgery, X-rays showed good consolidation and signs of bone remodeling, as the patient had not had menarche and showed pelvic radiological signs of skeletal immaturity. We chose to remove all synthesis material, having left over the bolt broken in the first surgery, which was not removed to avoid greater bone damage in the proximal femur. Upon removal of the synthesis material, ambulation with partial load using two crutches was allowed for three weeks, and partial load with one crutch for another two weeks. After three years follow-up, X-ray images showed total bone remodeling and closing of the femoral head physis and of apophysis of the greater trochanter, with no signs of necrosis on the femoral head (Figures 3–5). There still was a 0.8 cm dissymmetry of the lower limbs, but no clinical significance in gait. A Harris hip score of 98 was obtained for the right hip.

DISCUSSION

Delbet type III femoral neck fracture shows 18% incidence of osteonecrosis of the femoral head. Various surgical treatment methods have been described, e.g. using DHS, which protects the femoral head physis [3, 9]. The authors chose to use DHS without sparing the physis of the femoral head, because of the degree of fracture instability by its association with the fracture of the greater trochanter. For the sake of greater stability, it was a surgical priority to obtain a perfect PAD, leading to the sacrifice of the proximal physis.

The avulsion fracture of the greater trochanter in skeletally immature patients, however, is very often

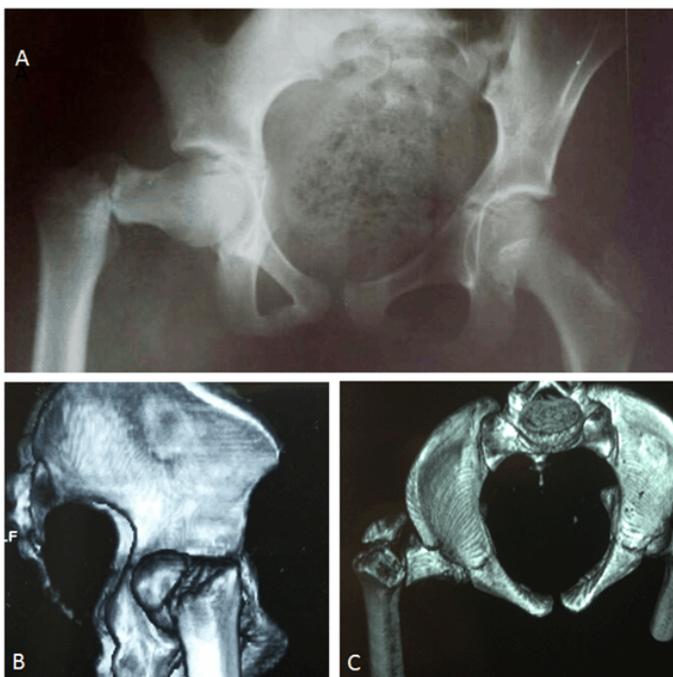


Figure 1: (A) X-ray image showing fracture of the right femoral neck. (B, C) Computed tomography image of the pelvis confirming the fracture of the femoral neck and making evident the fracture of the great trochanter with posteriorsuperior deviation.



Figure 2: (A) Frontal view X-ray showing fractures fixed with DHS and tension band, presenting a slight medial superposition of fractures. (B) Lateral view X-ray showing fixation of fractures.



Figure 3: (A) Frontal view X-ray. (B) Axial view of the right hip after two years follow-up, showing total bone consolidation and remodeling, with closure of the femoral head epiphysis and apophysis of the great trochanter, without radiological signs of necrosis of the femoral head.

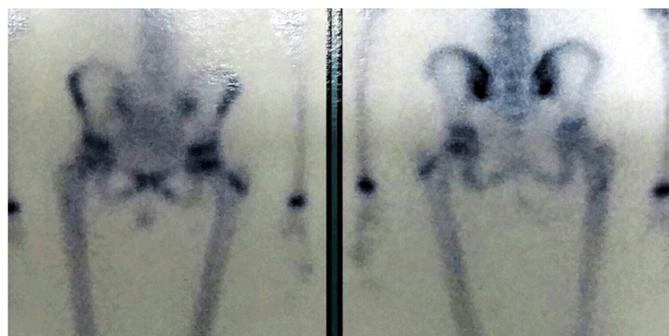


Figure 4: Both views of technetium scintigraphy, confirming the absence of osteonecrosis of the femoral head.

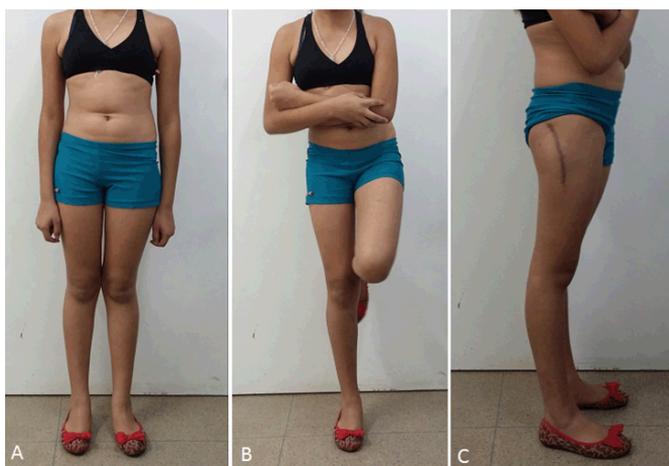


Figure 5: (A) Frontal view, (B) Monopodal support, (C) Lateral view photo of the patient.

associated with osteonecrosis of the femoral head [4–7]. Studies propose several theories regarding osteonecrosis in fractures of the proximal end of the femur in young patients, such as the presence of intracapsular hematoma, intraoperative vascular injury, and vascular injury inherent to trauma [5, 6].

Our case report strengthens the vascular injury theory inherent to trauma combined to deviation of the fractured greater trochanter, because X-rays of previous articles show anterior deviation of the fragment. Besides, all reported cases evolved with necrosis of the femoral head [5–7]. Treatments described for this fracture are: conservative treatment, [4] open reduction and internal fixation, five closed reduction, and percutaneous fixation [6].

We have chosen open reduction and internal fixation because we believed that this would be the only way to obtain a good reduction of the fracture fragments involved. We also noticed that this case is different from similar ones reported in literature, by the direction of deviation of the greater trochanter fragment (posterosuperior). Such a deviation occurs due to the integrity of the external hip rotators, as seen in isolated

fractures of the great trochanter in adults [10–12].

Since this is very rare in immature skeletons, the integrity of the rotators in this case may have been possible by the association of femoral neck fracture that shortened the lever arm, making it possible to protect the external rotators and, with them, the medial circumflex artery close to the greater trochanter, allowing vascular integrity of the femoral head.

The isolated fracture of the greater trochanter was classified by Merlino and Nixon, as follows: type I, affecting adult patients; and type II, the apophyseal detachment of the greater trochanter, frequent in skeletally immature patients [10].

We are aware that a single case does not allow us to state how important this observation is. However, we analyzed articles describing isolated fractures of the greater trochanter in adults regarding the direction of deviation of the fracture and lack of correlation with osteonecrosis of the femoral head [10–12]. When comparing the latter with those describing the apophysis fracture of the greater trochanter in young patients, we observed a relationship with osteonecrosis of the femoral head [5–7].

We believe that the observation of the anteriorly or posteriorly deviation of fracture may be of great importance for the isolated fracture of the greater trochanter in young patients. Although rare and appearing simple to solve, it can surprise unsuspecting professionals with unfamiliar information on prognosis and to become an issue with dreadful outcome.

CONCLUSION

The outcome of this case of avulsion fracture of the greater trochanter and femoral neck fracture is of great importance. Although rare and appearing simple to solve, it can surprise unsuspecting professionals with unfamiliar information on prognosis and to become an issue with dreadful outcome.

Author Contributions

Anderson Freitas – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Silvio Leite de Macedo Neto – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Bruna Alves de Azevedo – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Mário Leite Bringel – Analysis and interpretation of data, Revising it critically for important intellectual content,

Final approval of the version to be published
Leonardo Santos Diener – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Ana Patrícia de Paula – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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