Manuscript Accepted **Early View Article**

Early View Article: Online published version of an accepted article before publication in the final form.

Journal Name: Journal of Case Reports and Images in Orthopedics and Rheumatology

Type of Article: Case Report

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

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

doi: To be assigned

Early view version published: September 22, 2016

How to cite the article: Freitas A, Neto SLDM, Azevedo BAD, Bringel ML, Diener LS, Paula APD. Avulsion fracture of the greater trochanter and femoral neck fracture in a young girl: An extremely rare fracture combination. Journal of Case Reports and Images in Orthopedics and Rheumatology. Forthcoming 2016.

TYPE OF ARTICLE: Case Report

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

AUTHORS:

Anderson Freitas[1],

Silvio Leite de Macedo Neto[2],

Bruna Alves de Azevedo[3],

Mário Leite Bringel[4],

Leonardo Santos Diener[5],

Ana Patrícia de Paula[6]

AFFILIATIONS:

[1]Hospital Ortopédico e Medicina Especializada (HOME), SGAS Quadra 613 Conjunto C, 70200-730 Brasília, DF, Brazil

CORRESPONDING AUTHOR DETAILS

Anderson Freitas,

Hospital Ortopédico e Medicina Especializada (HOME), SGAS Quadra 613 Conjunto C, 70200-730 Brasília, DF, Brazil

Email: silviomneto@hotmail.com

Short Running Title: Avulsion fracture of the greater trochanter

Guarantor of Submission: The corresponding author is the guarantor of submission.

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

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 3-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: Trochanter, femoral, neck, fracture

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

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].

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 causes 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 our knowledge, have not been so far described in the 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, intra and postoperative results with 3 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). CT showed femoral neck fractures and evidence of associated avulsion fracture of the greater trochanter with posterosuperior deviation. (Figure 1A, B)

In the preoperative preparation patient was kept in skin traction with 5 kilos and medicated with analgesics and nonsteroidal 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 guide wire 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 4.5mm 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 2A, B)

The immediate postoperative period occurred in the infirmary with permanent suction drain for 48h and third generation venous cephalosporin for 72h. Active and passive physical therapy was started 24h 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 8 weeks, gait with partial load bearing of the operated limb using crutches was allowed after 5 weeks. Release of one crutch occurred after 8 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 2 weeks. After 3 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 (Figure 3 A-D). 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's 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 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, intra-operative 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]. The treatments described for this fracture are: conservative treatment, [4] open reduction and internal fixation, 5 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 the 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.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL STANDARDS

The patient gave the informed consent to the publication of the case study.

AUTHOR'S CONTRIBUTIONS

Anderson Freitas

Group 1- Acquisition, analysis an interpretation of data, design,

Group 2- Final approval of version to be published

Silvio Leite de Macedo Neto

Group 1- Acquisition, analysis an interpretation of data

Bruna Alves de Azevedo

Group 1- Acquisition, analysis an interpretation of data

Mário Leite Bringel

Group 1- Acquisition, analysis an interpretation of data

Leonardo Santos Diener

Group 1- Acquisition, analysis an interpretation of data

Ana Patrícia de Paula

Group 1- Acquisition, analysis an interpretation of data

REFERENCES

1. Canale ST, Bourland WL. Fracture of the neck and intertrochanteric region of the femur in children. J Bone Joint Surg Am. 1977; 59:431–3
2. Milch, H. Avulsion fracture of the great trochanter. Arch Surg. 1939; 38(2):334-50.
3. Moon ES, Mehlman CT. Risk factors for avascular necrosis after femoral neck fractures in children: 25 Cincinnati cases and meta-analysis of 360 cases. J Orthop Trauma. 2006; 20:323-9.
4. Thienhaus CO. Epiphyseal separation of the great trochanter with report of a case. Ann Surg. 1906; 43(5):753-7
5. Kaweblum M, Lehman WB, Grant AD, Strongwater A. Avascular necrosis of the femoral head as sequelae of fracture of the greater trochanter: a case report and review of the literature. Clin Orthop Relat Res. 1993; 294:193-5.
6. Linhart W, Stampfel O, Ritter G. Post-traumatic femur head necrosis following trochanter fracture. Z Orthop Ihre Grenzgeb. 1984; 122(6):766-9.
7. O'Rourke MR, Weinstein SL. Osteonecrosis following isolated avulsion fracture of the greater trochanter in children. A report of two cases. J Bone Joint Surg Am. 2003; 10:2000-5.
8. Baumgaertner MR, Solberg BD. Awareness of tip-apex distance reduces failure of fixation of trochanteric fractures of the hip. J Bone Joint Surg Br. 1997; 79(6):969-71.
9. Lam SF. Fractures of the neck of the femur in children. J Bone Joint Surg Am 1971; 53:1165-79.
10. Merlino AF, Nixon JE. Isolated fractures of the greater trochanter. Report of twelve cases. Int Surg. 1969; 52(2):117-24.
11. Kim SJ, Park BM, Yang KH, Kim DY. Isolated Fractures of the Greater Trochanter Report of 6 Cases. Yonsei Med J. 1988; 29(4):379-83.
12. Armstrong GE. XV. Isolated fracture of the great trochanter. Ann Surg. 1907; 46(2):292-7.

FIGURE LEGENDS

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 posterior-superior deviation

Figure 2: (A) Frontal view X-ray showing fractures fixed with DHS and tension band, presenting a slight medial superposition of the femoral neck. (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 followup, 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.

FIGURES

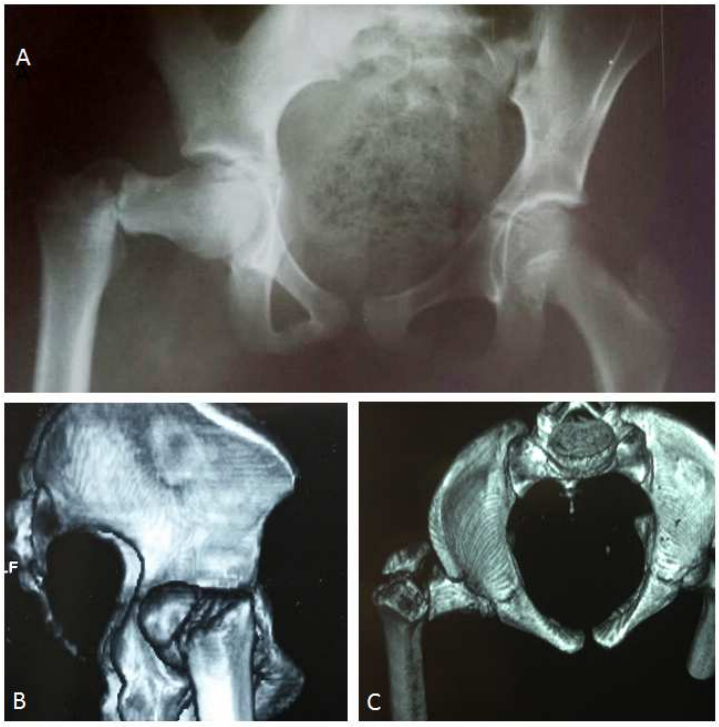

Figure 1: (A) X-ray image showing fracture of the right femoral neck. (B,C) Computed tomography image of the pelvis confirming the fracture of the femoral neck and making evident the fracture of the great trochanter with posterior-superior deviation

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

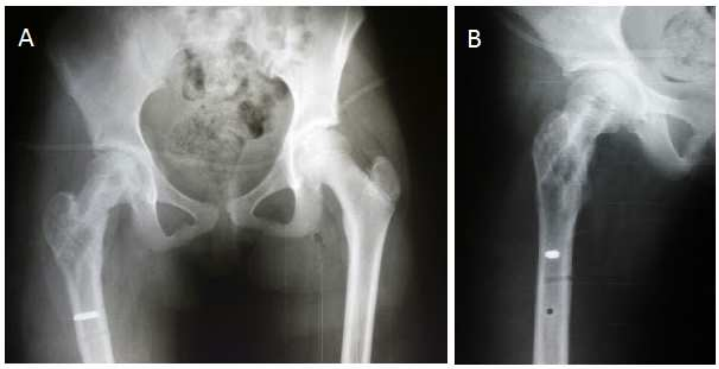

Figure 3: (A) Frontal view X-ray. (B) Axial view of the right hip after two years followup, showing total bone consolidation and remodeling, with closure of the femoral head epiphysis and apophysis of the great trochanter, without radiological signs of necrosis of the femoral head.

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

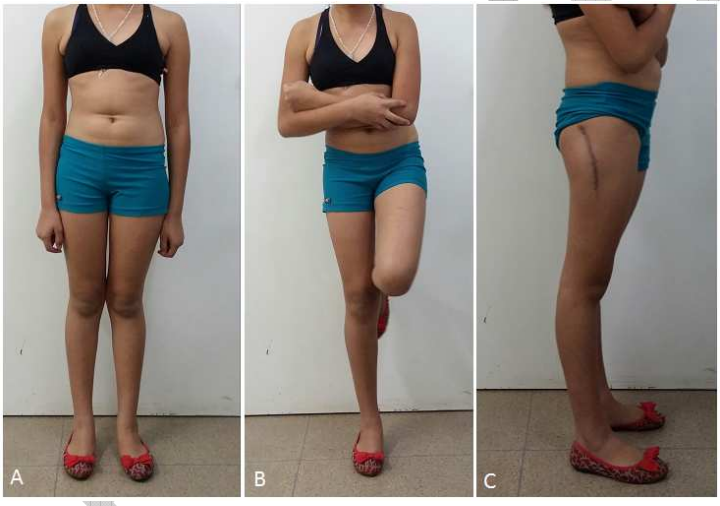

Figure 5: (A) Frontal view, (B) Monopodal support, (C) Lateral view photo of the patient.