Femoral neck stress fracture in a hyperactive child taking methylphenidate
Case report

Rita Grazina, Rafael Portela, Gustavo Martins, Andreia Ferreira, Domingues Rodrigues, Mafalda Santos

Orthopaedics Department, Centro Hospitalar Vila Nova de Gaia/Espinho, Portugal

Received on February 11th, 2017; accepted on October 11th, 2017 • AGUSTÍN DAURIA, MD • rita.grazina@gmail.com

Abstract
Stress fractures affect more frequently physically active people with normal bone, and they are hardly frequent in children with open growth plate. Stress fractures in femoral neck are even more infrequent in the pediatric population. However, they are entities extremely important given the risk of serious complications they are associated with, such as avascular necrosis of the femoral neck.
We describe the case of a 7-year-old girl under methylphenidate treatment who suffered an atypical stress fracture of the femoral neck. The patient consults for right groin pain with no limitations on activities of daily living. X-rays show a stress fracture in the femoral neck that is confirmed by CTscan. The patient is given conservative treatment, and she is free from symptoms four weeks after diagnosis.
This case represents a warning about this infrequent entity diagnostic mistakes might be made in. Recent research also suggests the possible participation of drugs such as methylphenidate in bone demineralization, which may be a possible risk factor for fracture.

Key words: Fracture; femur; paediatrics; methylphenidate.
Level of evidence: IV

Fractura por estrés del cuello del fémur en una niña hiperactiva tratada con metilfenidato. Reporte de caso

Resumen
Las fracturas por estrés afectan, con mayor frecuencia, a personas físicamente activas con hueso normal y son infrecuentes en los niños con placa de crecimiento abierta. Aun más infrecuentes son las fracturas por estrés del cuello femoral en la población pediátrica. Sin embargo, constituyen entidades muy importantes debido al riesgo de complicaciones graves, como la necrosis avascular.
Se describe el caso de una niña de 7 años medicada con metilfenidato que sufrió una fractura por estrés del cuello del fémur atípica. La paciente consulta por dolor inguinal derecho sin limitaciones en las actividades cotidianas. La radiografía muestra una fractura por estrés del cuello del fémur, que se confirma con tomografía. Se instaura un tratamiento conservador, y la paciente está asintomática a las cuatro semanas.
Este caso representa una alerta sobre esta infrecuente entidad en la que podrían presentarse errores diagnósticos. Investigaciones recientes también sugieren la posible participación de fármacos, como el metilfenidato, en la desmineralización ósea, que podría constituir un posible factor de riesgo de fractura.

Palabras clave: Fractura; fémur; pediatría; metilfenidato.
Nivel de Evidencia: IV

Conflict of interests: The authors have reported none.

Introduction

Stress fractures usually occur in people who do intense physical activity, i.e. sport people and recruits, due to repetitive activity. They are infrequent in children with open growth cartilage.[1-4] In children, stress fractures most frequently occur in tibial and metatarsal bones. Stress fractures in femoral neck are exceptional, and there are just few reports in literature. They are very important, however, due to the possible complications they are associated with, such as femoral neck avascular necrosis.[1]

We describe the case of a femoral neck stress fracture in a hyperactive girl under methylphenidate treatment.

Case

A 7-year-old girl with diagnosis of hyperactivity and attention deficit under treatment with methylphenidate-20 mg/day attends our ER accompanied by her parents. The reason for consultation is a one-month history of right groin pain which shows especially at running. The girl's parents deny history of recent traumatism. Along these lines, the girl shows no limitations on activities of daily living. Parents also deny any kind of systemic symptoms, such as fever or weight loss.

At physical examination, we detect discrete functional impairment, normal joint mobility and mild pain at the internal rotation of the right hip. We assess the girl further with a pelvis X-ray, which shows a non-displaced Delbert-type III fracture in her right femur neck (Figure 1). The fracture does not seem to be recent. We confirm fracture with CT scan, which shows signs of sclerosis and calcification, something that is typical of healing fractures (Figure 2).

On the basis of these medical and radiologic features, we start giving conservative treatment to her.

Two weeks later we get follow-up MRI (Figure 3), which reveals the favourable progression of the bone healing process as compared to previous studies.

Four weeks after diagnosis, the patient shows symptoms no longer and, three months later, she has retaken daily activities, including sports practice (Figure 4).

Discussion

Stress fractures can be divided into fatigue and deficiency fractures.[2,5]

Fatigue fractures occur mainly in young patients as a consequence of repetitive loads on bones which are normal from the elasticity point of view; therefore, they are more frequently diagnosed in recruits and sport people, such as ballet dancers and marathon runners. On the other hand, insufficiency fractures result from physiological loads on poor-quality bone with decrease in elastic resistance, and tend to occur in elderly patients or those with metabolic conditions.[1,2,5]

Stress fractures in children are mainly fatigue fractures and, in general, there are no reports on traumatism history.[2-4, 6-8] The bones most frequently affected in children are tibial and metatarsal bones.[1]

▲ **Figure 1.** First X-ray showing a Delbert-type III femoral neck fracture.

ISSN 1852-7434 (online) • ISSN 1515-1786 (printed)

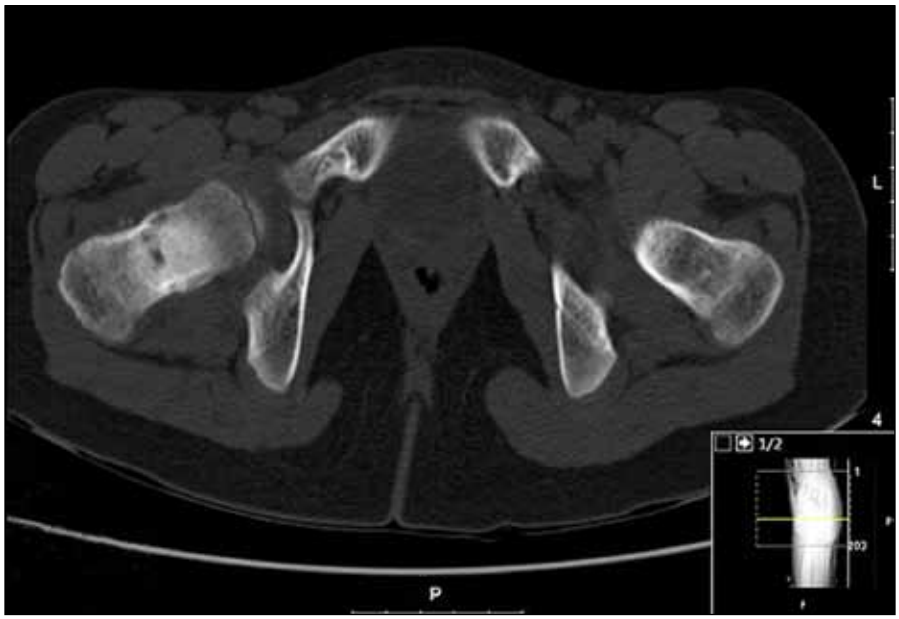

Figure 2. Axial CT scan confirming healing fracture in femoral neck.

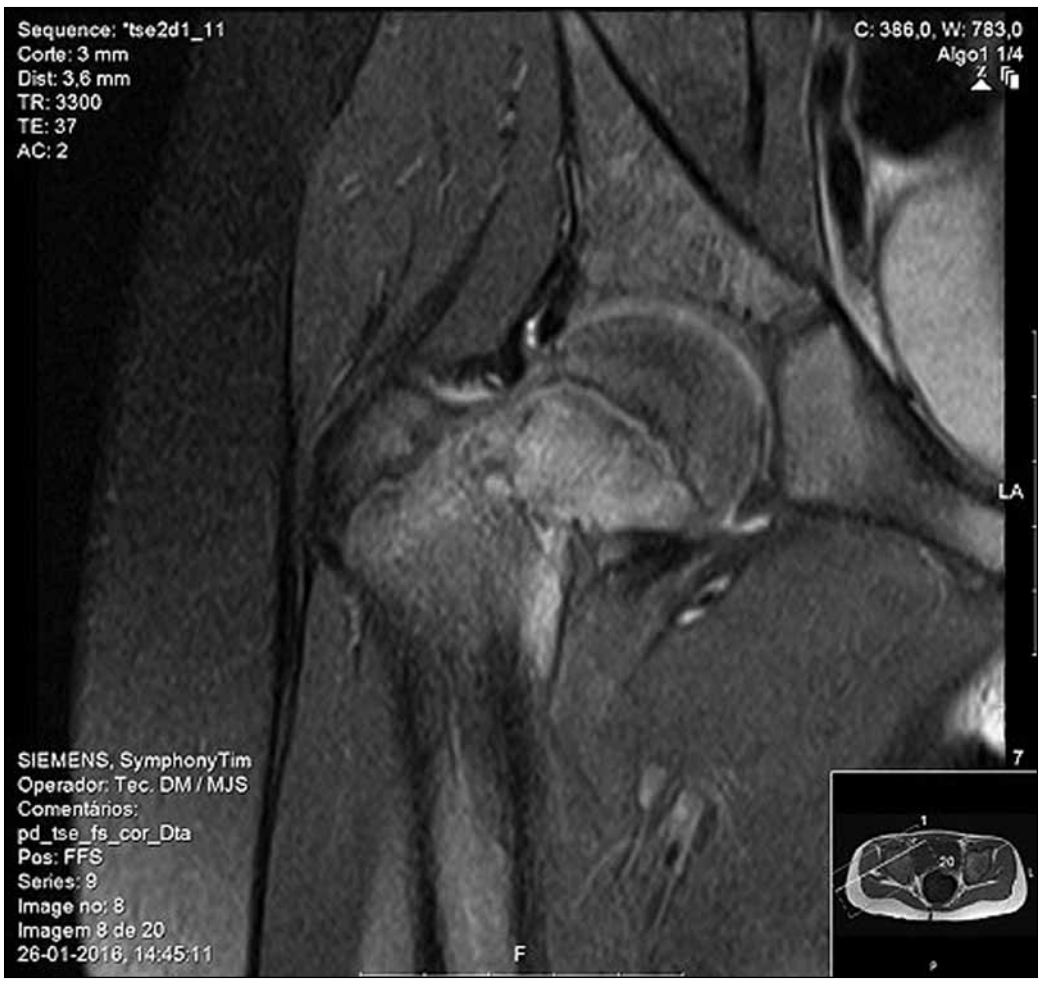

Figura 3. Coronal MRI showing favourable progression in fracture healing.

Figure 4. Follow-up X-ray (9 months after the fracture).

Stress fractures in femoral neck are not only infrequent in children, but they are also extremely important, since they can be associated with future consequences, especially diagnostic mistakes and fracture displacement.[5,8]

In 1963, Devas reported this type of fracture in children for the first time. He describes two types of fracture on the grounds of their radiologic aspect: transverse fractures or fractures by tension, and fractures by compression.[1,8]

Fractures by tension occur on the upper cortex of the femoral neck, and tend to get displaced, since the fracture line is perpendicular to the force transmission axis. Therefore, they are surgical fractures.[1,6,8] According to Blickenstaff and Morris,[9] these fractures do not occur in children. However, there are already several reports.[6,10]

On the other hand, fractures by compression seem to be more stable since they occur on the lower cortex of the femoral neck; therefore, they can be treated conservatively.[1]

In this particular case, the patient consulted with an approximately one-month-history healing fracture, what conditioned our choice of conservative treatment.

According to the specialized bibliography, patients with femoral stress fractures in general suffer functional impairment and hip pain. These symptoms are common to diverse differential diagnoses during the pediatric age, such as synovitis, osteomyelitis, osteoid osteoma, epiphysiolysis of the femoral head, Legg-Calvé-Perthes disease and malignant conditions. Imaging studies play a key role to get accurate diagnosis; sometimes, the patient even needs to undergo MRI and bone scintigraphy.[8]

This patient had no restrictions in activities of daily living; she reported hip pain, but limitations neither on mobility nor on hip rotations, what helps at the time of differential diagnosis with infection or Legg-Calvé-Perthes disease.

The pathophysiology of the fatigue fracture of the femoral neck in children is unknown, since there is no acknowledged association with any type of underlying disorder. In Paediatrics, deficiency fractures are associated with diseases which weaken the bones, such as terminal renal failure, fibrous dysplasia, thyrotoxicosis, and drugs such as anticonvulsants.[5]

In this report, we describe the case of a girl with hyperactivity disorder and attention deficit under methylphenidate treatment. As far as we know, there is only one report on stress fracture of the femoral neck in patients with this diagnosis,[11] and this is the first one describing one such patient under psychiatric treatment.

Published articles suggest that methylphenidate could have adverse effects on bones. Komatsu et al.[12] carried out a study to determine methylphenidate-skeletal effects on

ISSN 1852-7434 (online) • ISSN 1515-1786 (printed)

adolescent male rats, and concluded that bones in these animals' limbs were smaller and weaker after drug administration, and they were less mineralized. Femoral bones were associated with less intense maximal strength and energy to get fractured.[12]

Moreover, according to the Howard et al.'s study,[13] there are real differences in bone mineral density between children who take medication for hyperactivity disorder and attention deficit, and similar children who do not. These data support the hypothesis that methylphenidate could increase the risk of limb fracture; therefore, it is a possible risk factor in the case that this report describes.

Conclusions

In Paediatrics, stress fractures are infrequent and, among them, fractures in femoral neck are even more infrequent, although they are very important due to the possible complications they are associated with.

Diagnosing and treating these patients properly takes a high suspicion rate.

It is necessary to take risk factors into account so as to identify susceptible children, what allows doctors to make diagnosis and give treatment faster, something that improves patients' prognosis.

Bibliography

1. Fiévez EFPA, Hanssen NMAI, Schotanus MGM, van Haaren EH, Kort NP. Stress fracture of the femoral neck in a child: a case report. *J Pediatr Orthop Br* 2013;22:45-8.
2. Roman M, Recio R, Moreno JC, Fuentes S, Collantes F. Stress fracture of the femoral neck in a child: case report and review of the literature. *Acta Orthop Belg* 2001;67:286-9.
3. Coldwell D, Gross GW, Boal DK. Stress fracture of the femoral neck in a child (stress fracture). *Pediatr Radiol* 1984;14:174-6.
4. Devas M. Stress fractures in children. *J Bone Joint Surg Br* 1963;45:528-41.
5. El-Sayed MAEK, El-Adl WAMM. Insufficiency stress fractures of the femoral neck in children. *Eur J Orthop Surg Traumatol* 2011;21:579-85.
6. Bouchoucha S, Barsaoui M, Saied W, Trifa M, Khalifa SB, Benghachem M. Bilateral stress fractures of the femoral neck with no risk factor: A case report. *Journal de la Société Tunisienne de Sciences Médicales* 2011;89:295-7.
7. Leum P, Lam S. Long-term follow-up of children with femoral neck fractures. *J Bone Joint Surg Br* 1986;68:537-40.
8. Mehmet SE, Mehmet E, Altinel L. Femoral neck stress fracture in children: a case report, up-to-date review, and diagnostic algorithm. *J Pediatr Orthop Br* 2014; 23:117-21.
9. Blickenstaff LD, Morris JM. Fatigue fracture of the femoral neck. *J Bone Joint Surg Am* 1966;48:1031-47.
10. Lehman R, Shah S. Tension-side femoral neck fracture in a skeletally immature patient: a case report. *J Bone Joint Surg Am* 2004;86:1292-5.
11. Miller F, Wenger D. Femoral neck stress fracture ina hyperactive child. *J Bone Joint Surg Am* 1979;61:435-7.
12. Komatsu DE, Thanos PK, Mary MN, Janda HA, John CM, Robison L, et al. Chronic exposure to methylphenidate impairs appendicular bone quality in young rats. *Bone* 2012;50:1214-22.
13. Howard J, Walick K, Rivera J. Preliminary evidence of an association between ADHD medications and diminished bone health in children and adolescents. *J Pediatr Orthop* 2017;37(5):348-54.