Lesser Trochanter Avulsion Fracture in a Young Soccer Player: An Uncommon Cause of Hip Pain in Adolescents

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Resumo

As fraturas por avulsão do trocânter menor em adolescentes são raras e geralmente devido a traumas relacionados à prática desportiva. O mecanismo de lesão mais comum consiste numa forte contração muscular no contexto de um esqueleto estruturalmente imaturo. Neste artigo, relatamos o caso de um homem (jovem) de 14 anos de idade, sem queixas prévias, que se apresentou com dor anterior na anca de início súbito durante a corrida e claudicação dolorosa após o exercício (um treino/jogo). A ressonância magnética nuclear revelou uma fratura por avulsão do trocânter menor com deslocamento mínimo. O tratamento conservador demonstrou bom resultado com retorno à atividade desportiva 4 meses após a lesão. A abordagem cirúrgica está geralmente recomendada nas situações de não consolidação sintomática ou exostose dolorosa O prognóstico é geralmente excelente, independentemente da abordagem, com retorno ao nível anterior de atividade.

Palavras-chave: Adolescente; Dor Articular; Fracturas do Femur; Futebol; Traumatismos em Atletas.

Abstract

Avulsion fractures of the lesser trochanter in adolescents are rare and usually due to sports-related trauma. Forceful muscle contraction in the setting of an immature skeleton represents the most common injury mechanism. We report the case of a 14 year-old male with no previous complaints that presented with sudden anterior hip pain while sprinting and painful limp after sport. Magnetic resonance imaging revealed a lesser trochanter avulsion fracture with minimal displacement. Conservative treatment demonstrated good result with return to play 4 months after injury. Surgical approach is usually recommended for symptomatic nonunion or painful exostosis. Prognosis is usually excellent regardless approach with return to previous level of activity.

Keywords: *Adolescent; Arthralgia; Athletic Injuries; Femoral Fractures; Soccer.*

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Introduction

Apophyseal injuries around the hip are commonly found in the young athlete.[1] The ischial tuberosity, the anterior inferior iliac spine and the anterior superior iliac spine are mostly involved.[2] Avulsion fracture of the lesser trochanter of the femur is rare, representing only 3% of hip avulsion injuries.[1] The mechanism of lesion is caused by vigorous or uncoordinated contraction of the iliopsoas muscle usually in the setting of hyperextension and abduction of the hip.[3-5] The suddenly stopping to avoid a fall or a collision has also been postulated as a causative mechanism for lesser trochanter injury.[5] The apophysis is a secondary center of ossification and serves as an attachment for tendons and ligaments.[6] In order to establish a parallel to epiphyseal lesions, Milch has suggested the term apophysiolysis to refer to this lesion.[3,7] As tendon bone insertions and Sharpey's fibers are stronger than the growth plate a sudden and violent contraction can cause its disruption.[2,6] Avulsion fracture of the lesser trochanter is most likely to happen as a sports-related trauma[2] although other mechanisms have been described.[6,8,9] Isolated fractures of the lesser trochanter in adults are even less common and some authors report it as pathognomonic of metastatic cancer disease.[4] In this case report we describe an avulsion fracture of the lesser trochanter in a teenager during a soccer practice.

Case Report

The authors report the case of a 14-year-old male with no past medical illness who came to a Physiatrist appointment due to anterior hip pain in the last 3 weeks, aggravated by activity and improved by rest, along with weakness and functional disability. The reported injury mechanism was a forceful hip extension while sprinting in a soccer practice. Physical examination revealed tenderness located in the upper thigh, just below the anterior inferior iliac spine to the midguinal point. No obvious deformities, edema or bruising were observed. Active hip flexion and passive stretching of this muscle-tendon group were painful and decreased hip flexor strength was attributed to pain. No limitation on passive movement was appreciated and neurological examination was normal. A magnetic resonance imaging (MRI) was ordered and revealed a small avulsion of the lesser right femoral trochanter and an effusion band between the iliopsoas tendon and rectus femoris-separating fascia (Fig. 1). Due to minimal displacement of the avulsed fragment, the authors decided for nonoperative treatment. Because patient was very symptomatic, he was advised for nonweight bearing during one month followed by gradual weight bearing. Follow-up MRI performed 6 weeks after injury revealed great improvement of bone and peritendinous edema and integrity of the femoral lesser trochanter (Fig. 2). The patient started a comprehensive

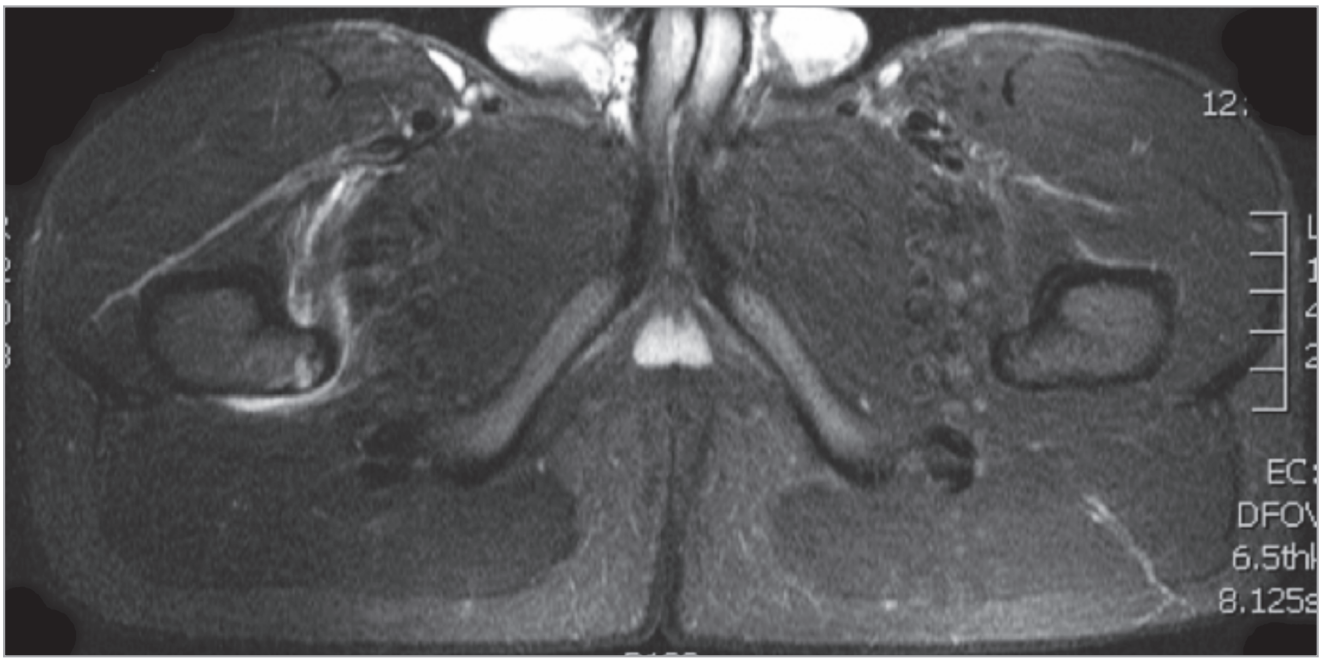

Figure 1 - MRI showing a small fracture trace (arrow) of the lesser right femoral trochanter. Minimal displacement can be observed. Peritrocantheric edema can be observed in the surrounding soft tissues (arrowhead).

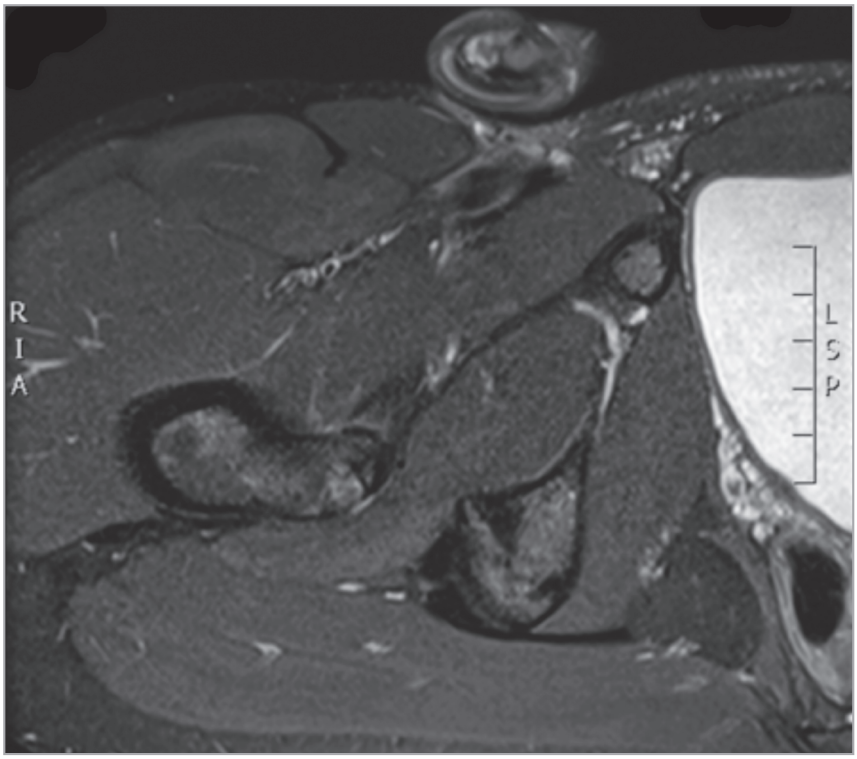

Figure 2 - MRI performed 6 weeks after injury showed normalization of lesser trochanter morphology, along with mild signs of bone and peritendinous edema. The integrity of the iliopsoas tendon can be observed in its insertion in lesser trochanter.

rehabilitation program focused on range of motion exercises and strength reconditioning. The physiatrist designed a rehabilitation program comprising gradual weight-bearing activities and progressive resistance exercises were introduced according pain and patient tolerance. Impact activities were avoided for 4 weeks to allow further healing. Balance and proprioceptive training were addressed. Later the patient progressed his recuperation on the field and return to play was achieved three months after injury.

Discussion

Lesser trochanter avulsion fracture is a rare entity in young population (Table 1)[5,8] accounting for only 3% of all pelvis and femur avulsion injuries.[1]

The primary age for these injuries to occur is between 11 and 17 years[5] with predominance for male gender.[1] The appearance of a secondary ossification center in the lesser trochanter at eighth to twelfth year with closure by the eighteenth year explains the greater incidence during this period,[5] even though some have reported cases in the third decade in individuals with delayed skeletal maturation.[3] Additionally, an impairment of the growth cartilage under anabolic hormonal influence of testosterone and somatotropin has been postulated has a contributor to male predominance.[10] The iliopsoas muscle complex arises from transverse apophysis of lumbar vertebrae and iliac fossa and inserts on the lesser trochanter of the femur[5,6] acting primarily as a hip flexor.[9] Muscle strains of the iliopsoas usually occur near its insertion in the cortical bone[8] and it is well recognized that lesser trochanter avulsion fractures represent a continuum of this disease.[8] Similar to other avulsion fractures, vigorous and repetitive physical activity in the setting of an immature skeleton, cause a continuous stretching of the iliopsoas muscle leading to disruption of the apophysis[1] and the same mechanism may be involved in lumbar transverse process fracture.[5] A study of the forces

Table 1 - Literature review of published lesser trochanter avulsion fractures (RTA: road traffic accident, ORIF: open reduction internal fixation, NA: Non-available)

Study	Year	Number of cases	Sex distribution	Average age (years)	Cause of injury	Treatment	Results
Dimon	1972	30	Males=23 Females=7	NA	Sports: 22 Fall: 2 RTA: 1 Unreported: 4	28 conservative 2 ORIF	Satisfactory
Fasting *et al*	1978	1	Male=1	13	Jumping	Surgery	Good result
Hösli	1995	3	NA	NA	NA	Conservative	Good result
Theologis *et al*	1997	3	NA	5,1	Fall: 1 Skating: 2	Conservative	Good result
Ruffing	2012	1	Male: 1	13	Running	Conservative	Good result
Papacostas	2013	1	Male: 1	15	Basketball	Conservative	Good result
Vazquez	2013	1	Male: 1	15	Sprinting	Conservative	Good result
Khemka	2014	3 1	Male: 3	15,3	Soccer: 2 Rugby: 1	Surgery	Good results
Obi	2014	1	Male: 1	15	Football	Conservative	Good result
Homma	2015	1	Male	14	Freestyle football	Conservative	Good result
McMillian	2016	5	Male: 1	16	Seizure	Conservative	NA
Ruffing	2018	35	Male: 4 Female: 1	13,8	Sprinting: 5	Conservative	Good results
Goodbody	2014	3	Males: 33 Females: 2	13,7	Sprinting: 26 Fall: 9	Conservative	Good result
Metzmaker	1985	1	Males: 2 Females: 1	15,3	Basketball: 2 Running: 1	Conservative	Good results
Current study	2019		Male: 1	14	Sprinting	Conservative	Good result

needed to cause an apophyseal avulsion injury has concluded that a quickly applied force more easily injures the physis than one of the same amount but applied gradually.[11] The proposed mechanism for lesser trochanter fracture involves hyperextension and abduction of the hip.[5] For this reason, hurdling, running, sprinting and jumping are the most commonly documented sports-related mechanisms of lesion[1,2] although some authors have reported lesser trochanter fracture in relation with freestyle football,[2] gymnastics[6] and classical ballet.[9] A case of sequential bilateral fracture in the setting of epileptic seizures[8,12] has been reported and some authors described a predisposition for avulsion fractures in patients with transient synovitis or Perthes disease.[13]

Clinically, lesser trochanter fractures are characterized by painful limp, inability to actively raise the thigh and tenderness around groin and upper medial thigh.[6] Pain is the most common symptom and prodromal pain has been described.[1,14,15] Sometimes, patients are unable to stand erect.[5] Our patient reported a sudden snap and pain in the groin while sprinting that forced him to stop. Physical examination may reveal localized tenderness, crepitation or hematoma and inability to actively flex the thigh in the sitting position (positive Ludloff sign), which suggests a lesion of the iliopsoas complex.[5] Some authors argue for partial hip flexion preservation because iliacus portion inserts broader with fibers extending to the linea pectinea and those remain intact.[5] The range of motion of the hip may be diminished due to muscle spasm or pain.[5]

Plain radiographs together with typical clinical features in the absence of warning signs are diagnostic.[1,8] In order to avoid missing the lesion, an external rotation radiogram should be obtained.[5] Routine further investigation with computed tomography (CT) and MRI is controversial[1,2] although they may be helpful for the detection of avulsions of non-ossified bone.[1] The authors have opted for an MRI because of the patient's age and parents' opposition to the use of radiogram. Non-traumatic lesser trochanter avulsions in adults are highly suspicious of malignancy and impose further investigation.[8]

McKinney *et al* have developed a classification and treatment recommendations for lesser trochanter avulsion fractures (Table 2).

Current literature supports a conservative approach in type 1-3 fractures with union occurring in 6 weeks[5] and full return to preinjury levels of activity.[1,8] Sport activity should be avoided until complete bony healing, which can take up to 12 weeks.[6] In accordance with literature, we managed our patient conservatively and obtained excellent functional and symptomatic results documented by a return to competition 4 months after injury. Initial treatment with analgesics and crutches followed by an individualized rehabilitation program with range of motion and supervised strengthening exercises as prescribed by a physiatrist are the cornerstone of treatment.[8] About half of the patients maintain a normal level of activity and do not require non-weight bearing ambulation.[3] Surgical management has been traditionally recommended for symptomatic nonunion and exostosis.[6] Although avulsion fractures of the lesser trochanter with displacement greater than 20 mm should be managed conservatively, there is a greater risk to develop nonunion and further ischiofemoral impingement especially when heterotopic ossification occurs.[16] Some authors defend surgical management to avoid complications.[6] A case of chronic pain after lesser trochanter avulsion fracture in a ballet dancer achieved complete symptomatic resolution after excision of a loose fragment.[6] A description of arthroscopically assisted fixation by Khemka *et al* showed excellent results in all three patients.[16] Even though surgery may warrant a faster recovery and return to sports, the risk of neurovascular structures damage, including femoral vessels and anterior branch of the obturator nerve is not negligible.[6] Lesser trochanter avulsion fracture has an excellent prognosis and the patients become asymptomatic despite the presence of radiographic deformity or treatment approach.[3]

Table 2 - Classification of lesser trochanter avulsion fractures in young adults[17]

Type 1	Non-displaced	Non-operative
Type 2	Displacement <20 mm	Non-operative
Type 3	Displacement >20 mm	Non-operative
Type 4	Symptomatic nonunion or painful exostosis	Surgical

Take home messages

Lesser trochanter avulsion fracture is associated with trauma in young adolescents and is characterized by painful limp. An external rotation radiogram and clinical history is diagnostic, although sometimes, hip MRI is necessary. Nontraumatic lesser trochanter fracture in adults should be thoroughly investigated for further metastatic disease. Conservative management is the mainstay of treatment with good functional outcomes and rapid return to sport activity. Nonunion symptomatic fractures and exostosis should be managed surgically.

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