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Avulsion fracture of legamentum teres without dislocation: A case report and literature analysis

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Abstract
Background: Femoral head avulsion fracture is a rare diagnosis in general and even rarer when it is identified without a dislocation.
Case presentation: This is a case of 16 year old Female, not known to have any past medical nor surgical history, presented to our hospital as a case of motor vehicle accident, frontal collision at a speed of around 90km/h, she was a back seat passenger and she denied any history of head trauma, loss of consciousness nor amnesia, upon arrival in hospital assessment revealed an isolated lower back pain with bilateral hips pain, upon further examination the range of motion was restricted bilaterally in both hips due to pain, pan CT scan showed an avulsion fracture of the left femoral head.
Conclusion: We usually relate femoral head fracture with hip dislocation, nevertheless a finding of legamentum teres avulsion fracture of the femoral head is by far extremely rare without a dislocation. The outcome of conservative management was successful with weight bearing precautions and early physiotherapy (PT) and range of motion (ROM).

Keywords: Legamentum teres, Avulsion fracture, hip dislocation, without hip dislocation, Ligament avulsion, femoral head

Introduction
Femoral head (FH) fractures constitute a rare injury which gravely compromises the optimal functional outcome of the hip [1]. The first description of such an injury was found in a post-mortem dissection by Birkett [2]. FH fractures are almost exclusively associated with dislocation of the hip. It is extraordinary to occur without any dislocation [3-5]. FH avulsion fractures in its type without any trace of hip dislocation are extremely rare. Pipkin classification has explained the FH fracture in relation to the weight bearing areas and the association with acetabular or femoral neck injuries [6]. Extensive review of the literature has not demonstrated any case report of FH ligamentum teres avulsion fracture without dislocation of the hip. Only one case reported a rupture of the ligamentum teres which caused hip pain but no avulsion fracture identified [7]. Therefore, we would like to present a case of an 18-year old female with a left FH avulsion fracture without a dislocation.

The case
This is a case of 16 year old Female, not known to have any past medical nor surgical history, presented to our hospital as a case of motor vehicle accident (MVA), frontal collision at a speed around 90km/h, she was a back seat passenger and she denied any history of head trauma, loss of consciousness nor amnesia, upon arrival assessment revealed an isolated lower back pain with bilateral hips pain, upon further examination the range of motion was restricted bilaterally in both hips due to pain.
On further imaging X-Rays and Computer Tomography Scan she was found to have right L4 and L5 transverse process fractures, right inferior pubic rami fracture, right sacral wing nondisplaced fracture and left FH minor avulsion fracture with no signs of hip dislocation. (See Figures 1-4)
Upon further assessment the next few days after pain was controlled, she was able to do full range of motion in both hips' flexion, extension, internal and external rotation with minimal pain but no mechanical block. She was treated conservatively with initial bed rest for 2 weeks,

non-weight bearing on the affected side, early ROM then to start mobilization with weight bearing as tolerated after 2 weeks with physiotherapy and close clinical follow up.
She was seen in one week after discharge in the physiotherapy department, sitting on a chair and showed improvement in the active range of motion in the hips, as she was committed with the physiotherapy plan.

Discussion

Functional outcome after FH fracture can be debilitating. It was first described in an autopsy by Birkett [2]. FH fractures has a very high correlation with hip dislocation. In very rare entities, it may occur with no evidence of previous dislocation.
It is extremely rare to observe an isolated avulsion fracture of the ligamentum teres with no associated injuries. A couple of cases were published on avulsion fractures of the ligamentum teres after minor injury [5, 14]. Hyperabduction was reported in two cases as a cause of avulsion injury [5].
A thorough analysis of the literature, it has revealed a very limited number of publications illustrating FH with no dislocation published to this date [6, 12] [table 1]. All of the reported literature had patients with either fracture of fracture of the acetabulum or the NOF. Kim *et al*. [4] reported two cases of FH fractures, the first was associated neck of femur (NOF) fractures. While in the other case there was associated with NOF and intertrochantric femur fractures. Mody and Wainwright [3] reported two cases of FH fracture without associated hip dislocation. Both patients had fracture following low energy trauma. Fabre *et al*. [5] reported a case of comminuted fracture of the FH and neck without a hip dislocation and acetabulum fracture following a high energy trauma.
Pattern and severity of the fracture is determined by the direction and amount of the forces sustained combined with the hip position, in terms of flexion, abduction or adduction and rotation at the time of the accident [14].
It is advised in patients with a history of dislocation or subluxation to proceed with either Computer Tomography (CT) scan or Magnetic Resonance Imagining (MRI) to rule out a fracture of the FH after carefully reviewing the trauma history [10].
In our case, there was no clear history of any dislocation or subluxation. Nevertheless, as per hospital protocol any trauma case with high energy mechanism such as an MVA a pan CT scan is mandatory to rule out any hidden or un identified injuries. If we had relied only on the plain x ray it would have misguided us in treating her as soft tissue injury rather than a fracture.
The most specific testing method for intra-articular hip disorder is log rolling the hip back and forth because it twists the FH back and forth in reference to the acetabulum and capsule without affecting any of the surrounding extra-articular structures [15]. A more sensitive test for hip joint pain is Forced flexion with internal rotation, but it might be uncomfortable. However, neither of these physical results is specific for ligamentum teres abnormality. They are simply beneficial in attempting to identify an intra-articular source of the patient's complaints [7]. Also, the use of arthroscopic hip removal of the avulsed fracture was documented with great results [7].

Meanwhile, our patient was treated conservatively with initial bed rest for 2 weeks then to start mobilization as tolerated with physiotherapy assistant and close clinical follow up which showed great results and pain free outcomes. The patient there after returned to normal daily activities.

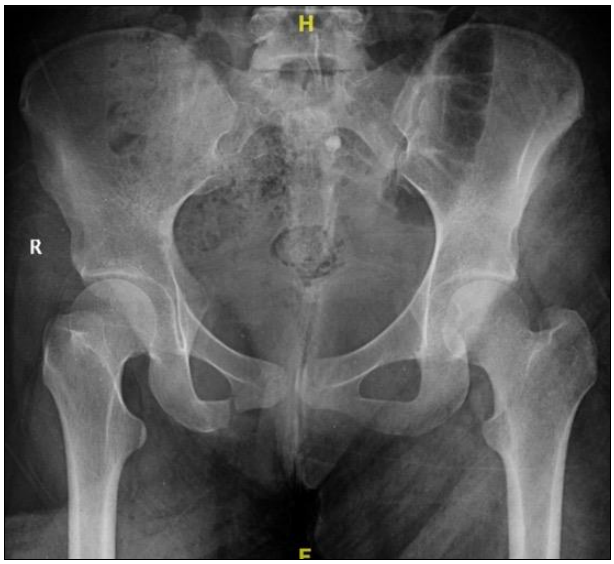

Fig 1: Pelvis X-Ray showing right inferior pupic rami fracture, congrouent hip joints bilaterally with no sign of clear fracture line

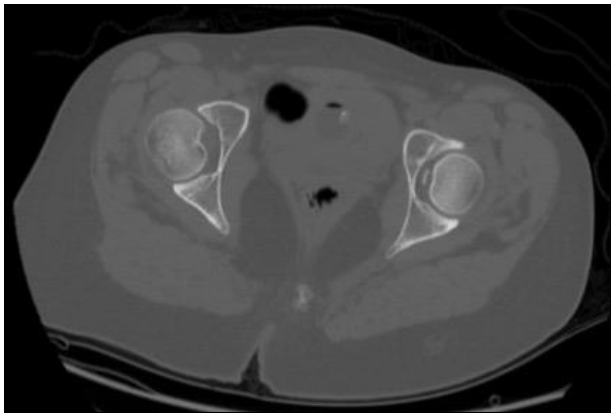

Fig 2-A: Axial Pelvis CT scan showing a fragment of the avulsed femur head fracture

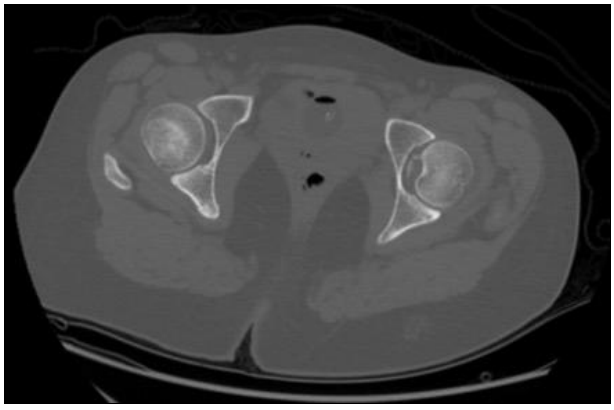

Fig 2-B: Axial Pelvis CT scan showing what looks to be two small fragments of the avulsed fracture in this cut

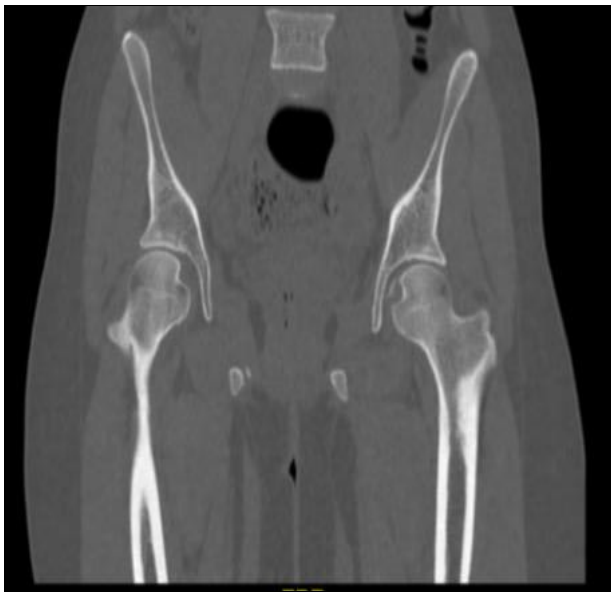

Fig 3A: Coronal Pelvis CT scan showing a fragment of the avulsed femur head fracture at the level of Fovea Capitis in this cut.

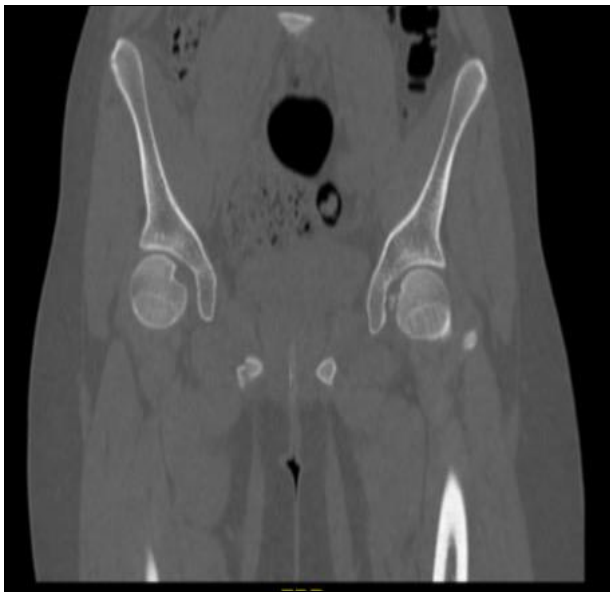

Fig 3B: Coronal Pelvis CT scan showing the fragment going more posterior-inferior in this cut

Fig 4-A: Saggital Pelvis CT scan showing the fragments in relation to the femur head located anterior-superior in this cut

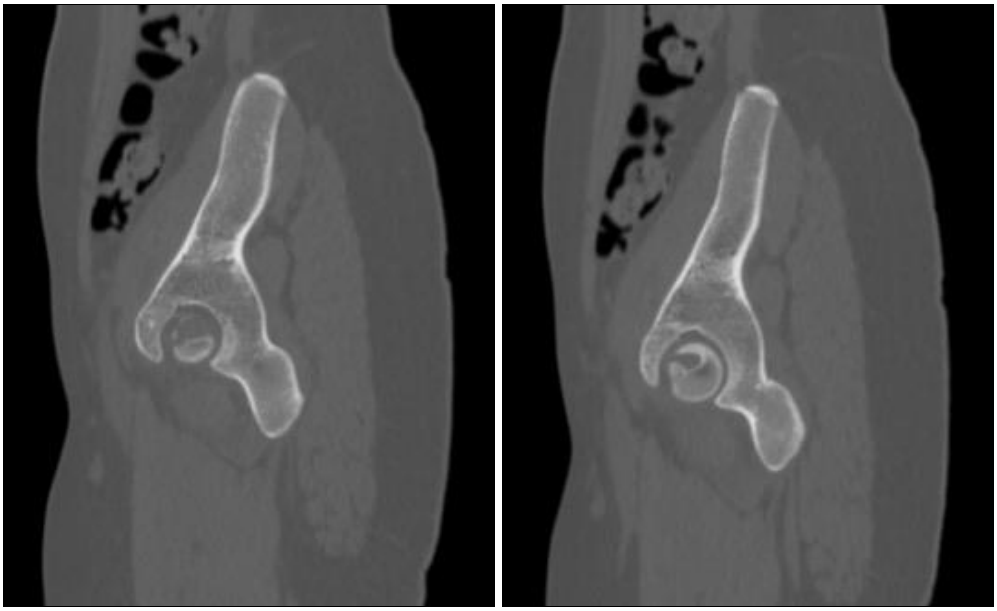

Fig 4-B and C: Saggital Pelvis CT scan showing the fragments in relation to the femur head while going more laterally in cuts

Table 1: Published studies of femoral head fractures

Source	Year	# Patients	Without dislocation	Type of fracture	Intervention	Avulsion fracture?
Barrett, I R; Goldberg, J A. [7]	1989	1	No	Avulsion	Open reduction	No
Sontich, John K.; [8]	2002	1	Yes	Femoral head	Debridement	No
PiL Whan Yoon [11]	2011	1	Yes	Wedge Shape depression	ORIF	No
Chris van der Werken [12]	1987	1	Yes	Femoral head	ORIF	No
Delcamp,D [13]	2014	2	Yes	Acetabular fracture	ORIF	Yes

Conclusion

Avulsion fracture of the FH is an extremely rare entity, most of these cases can be missed if not examined thoroughly. Such pathology is almost exclusively associated with other injuries such as dislocation of the hip or pertrochnteric fractures. Early identification is a key point in proper management especially in high-energy trauma scenario which emphasis the importance of pan CT scan to avoid missing critical findings. Finally, conservative treatment in avulsion fracture of the head can be successful with precautions.

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