

# ANTERIOR HIP PAIN IN YOUNG ATHLETES

## A DIFFERENTIAL DIAGNOSIS CHALLENGE

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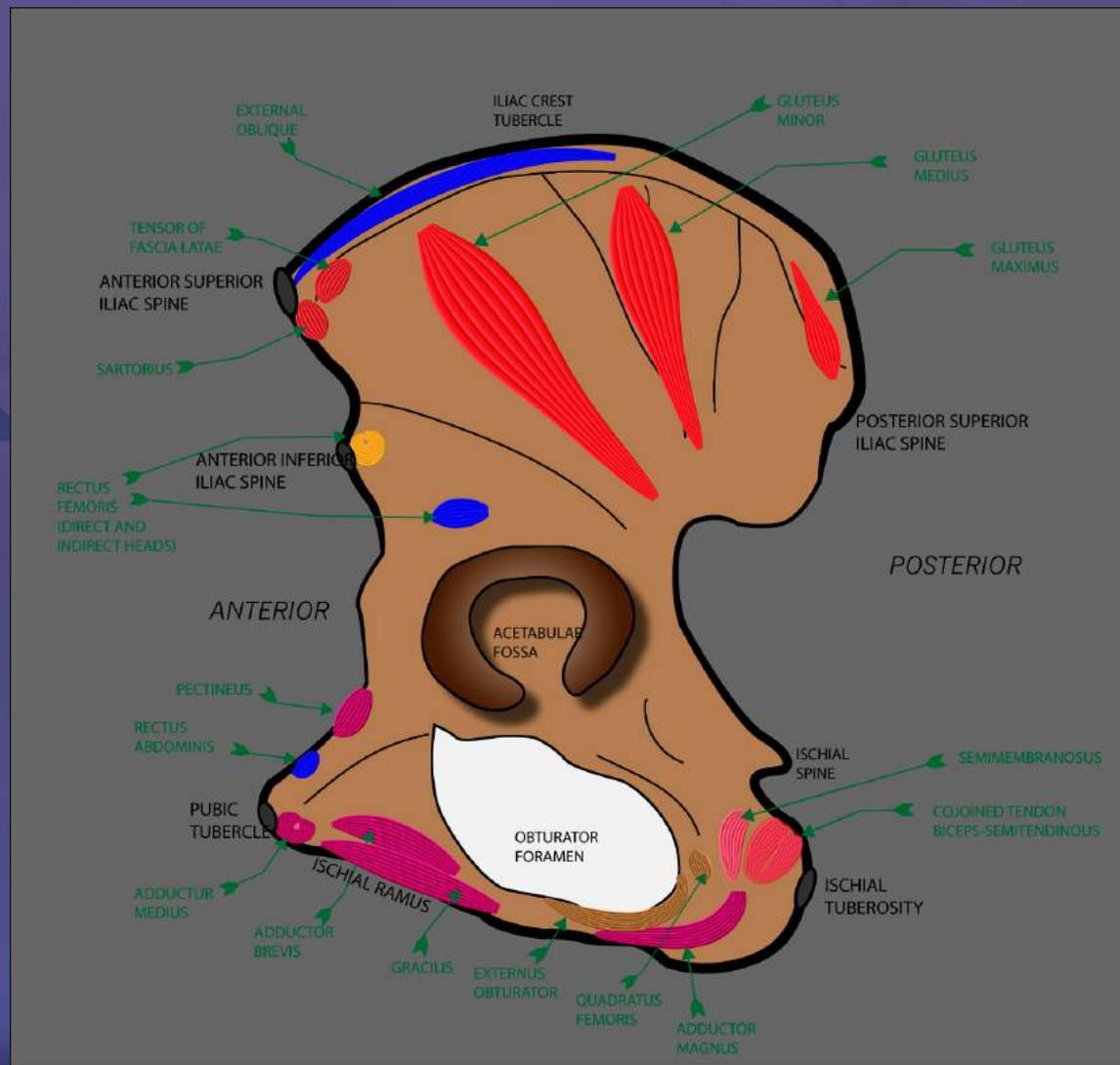
*MUSCULOSKELETAL IMAGING*

# INTRODUCTION

Hip pain is a well known limitation in young athletes and may be due to a wide range of acute and chronic injuries, many of which lead to prolonged time away from sport.

The differential diagnosis of anterior hip pain is broad and includes intra-articular and extra-articular pathology.

Additionally, there are mimickers like sports hernia.



## INTRAARTICULAR

Femoroacetabular impingement +++++  
Labral Tears +++  
Osteochondral lesions ++  
Ligamentum teres injuries ++  
Iliofemoral ligament injuries +  
Transient synovitis ++

## EXTRAARTICULAR

Iliopsoas tendonitis and muscle injuries ++  
Stress fracture ++  
Adductor and pectineus strains  
or tendinopathy +++++  
Osteonecrosis +  
Transient osteoporosis +

## MIMIKERS

Sports hernia ++  
Osteitis pubis ++

RSNA<sup>®</sup>  
Radiological Society  
of North America

*Diagnosis usually made by*

## MRI

Osteonecrosis-Transient osteoporosis  
Osteochondral lesions  
Ligamentum teres injuries  
Iliofemoral ligament injuries  
Transient synovitis  
Iliopsoas strains<sup>®</sup>  
Osteitis pubis and adductor tendinopathy  
Stress fractures-bone marrow edema

## MR ARTROGRAPHY

Femoroacetabular impingement  
Labral Tears  
Ligamentum teres injuries

## CT MULTISLICE

Stress fracture  
Osteochondral lesions-loose bodies

## ULTRASOUND

Adductor and pectineus injuries  
Iliopsoas tendonitis (internal snapping hip)  
Sports hernia

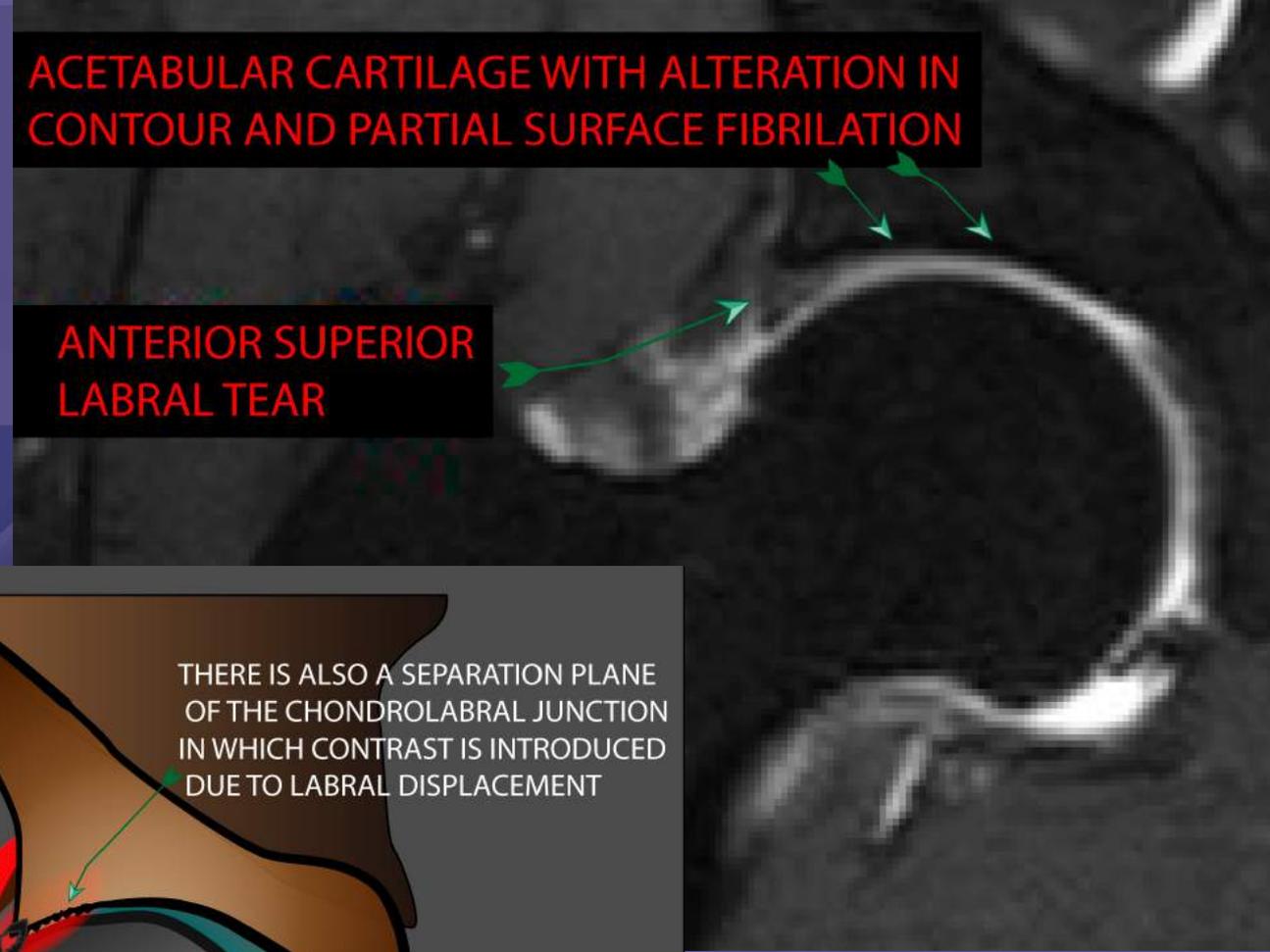
# LABRAL TEAR

## ANTEROSUPERIOR LABRAL TEAR

MR arthrography and original illustration

ACETABULAR CARTILAGE WITH ALTERATION IN CONTOUR AND PARTIAL SURFACE FIBRILATION

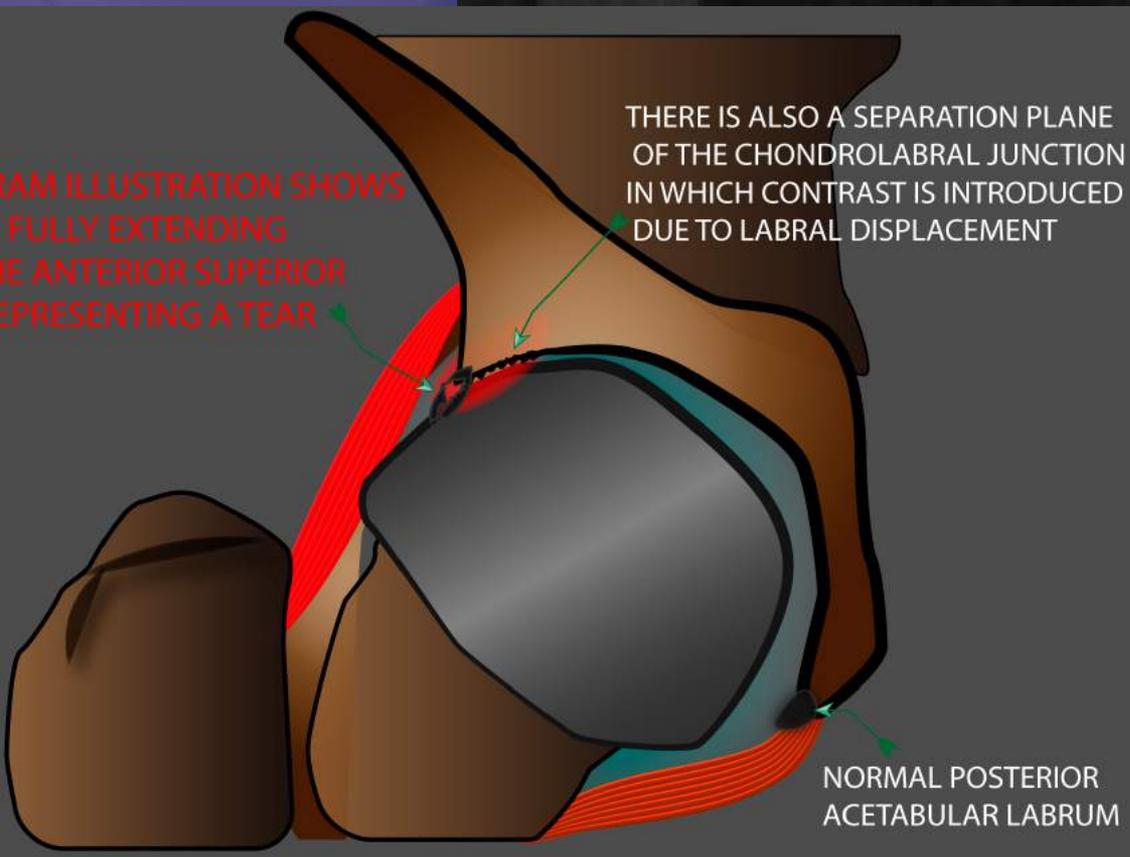
ANTERIOR SUPERIOR LABRAL TEAR



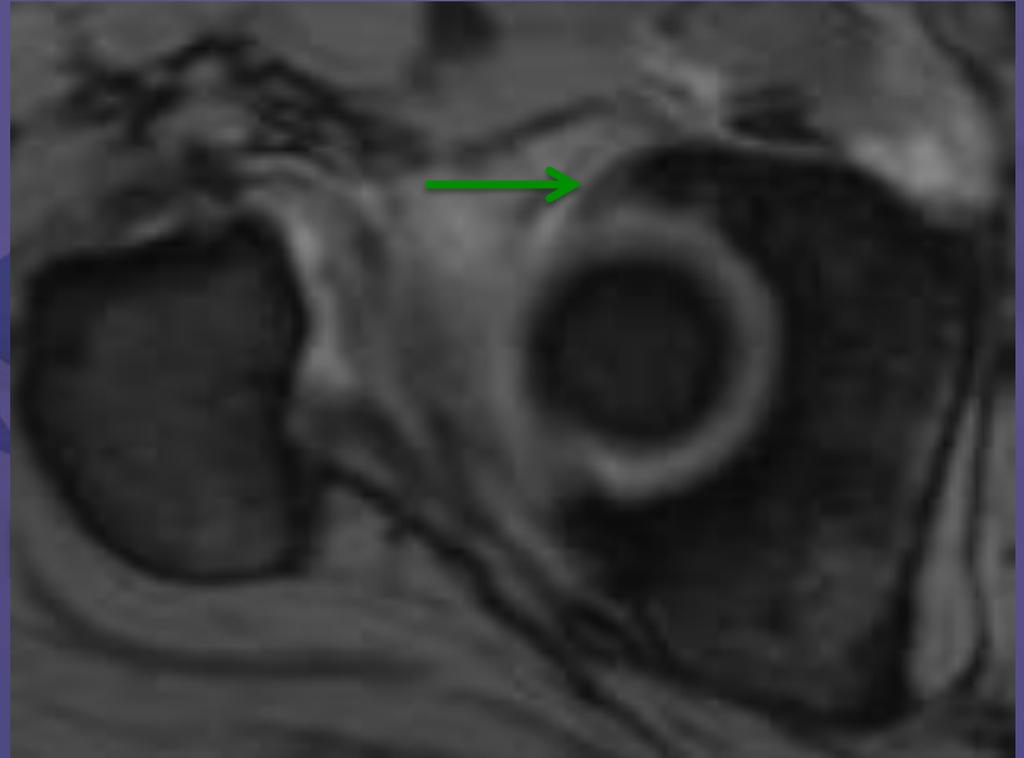
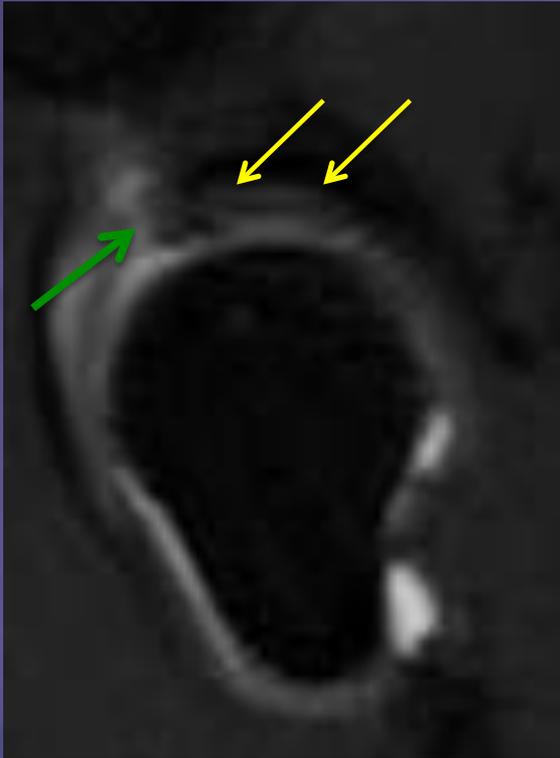
ARTHROGRAM ILLUSTRATION SHOWS CONTRAST FULLY EXTENDING ACROSS THE ANTERIOR SUPERIOR LABRUM REPRESENTING A TEAR

THERE IS ALSO A SEPARATION PLANE OF THE CHONDROLABRAL JUNCTION IN WHICH CONTRAST IS INTRODUCED DUE TO LABRAL DISPLACEMENT

NORMAL POSTERIOR ACETABULAR LABRUM

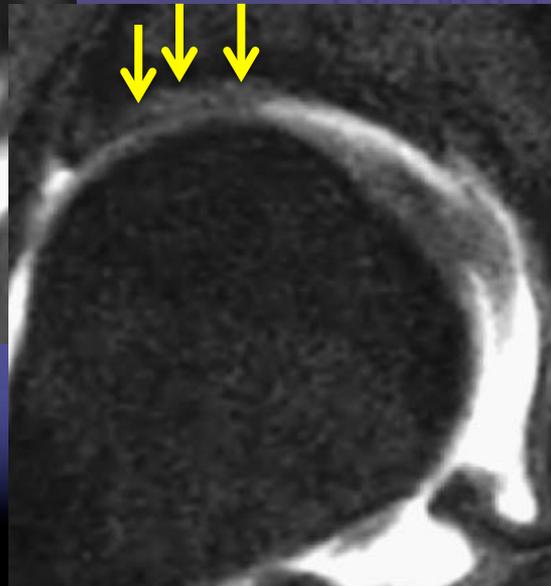
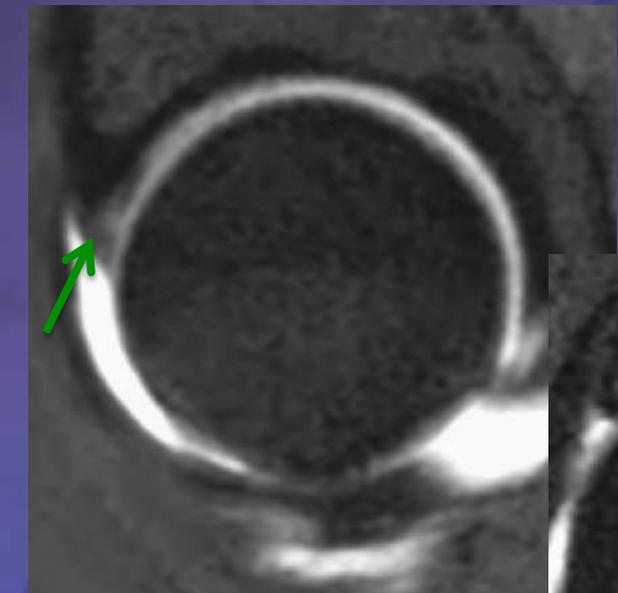
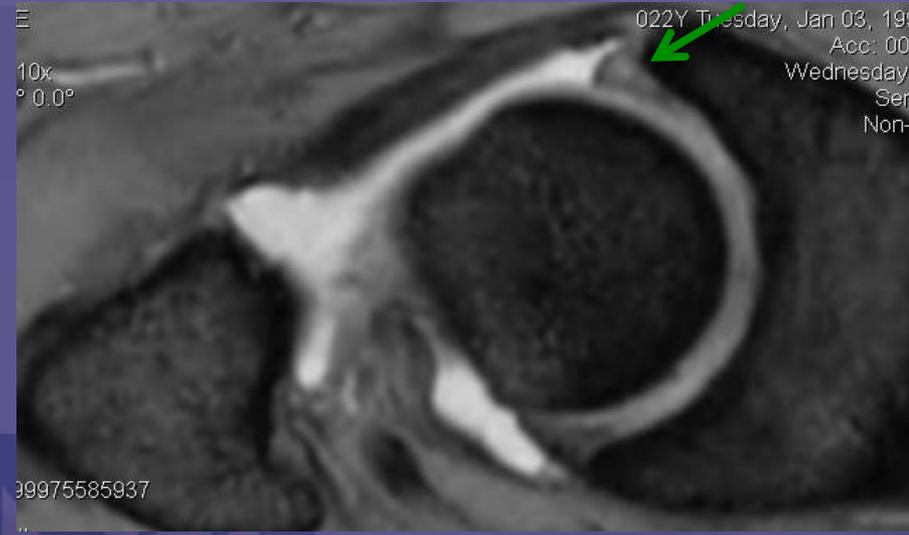


# LABRAL TEAR



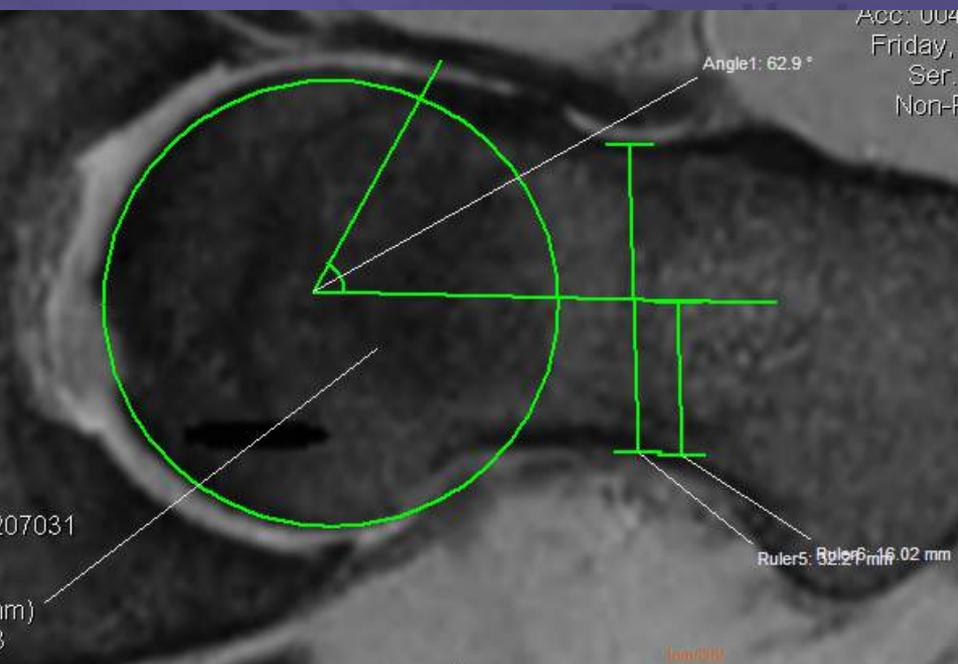
A 29-year-old female with 1 year of progressive hip pain. Sagittal and axial T1 fat-suppressed MR arthrogram images exhibit anterosuperior labral tear (*green arrow*). There is also relatively chondral damage in which contrast is introduced (*yellow arrow*)

# LABRAL TEAR



A young female karate athlete with 2 month of progressive groin pain and no relief with steroid intraarticular injections. Axial T2 FFE; sagittal and coronal T1 fat-suppressed MR arthrogram images demonstrate a complete superior labral tear (green arrows) with contrast fully extended along the chondrolabral junction (red arrows)

# FEMOROACETABULAR IMPINGEMENT



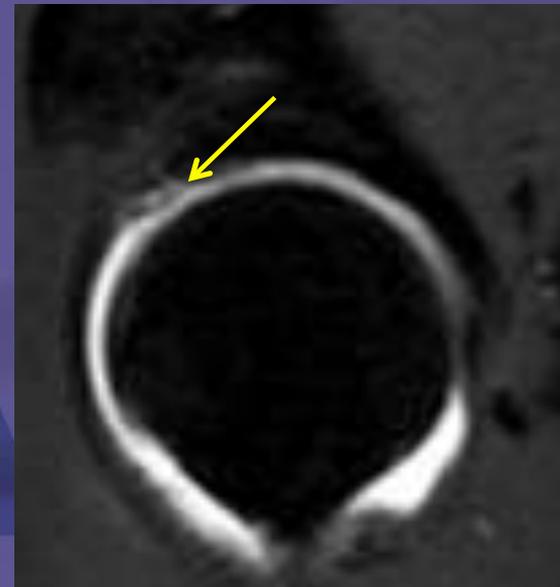
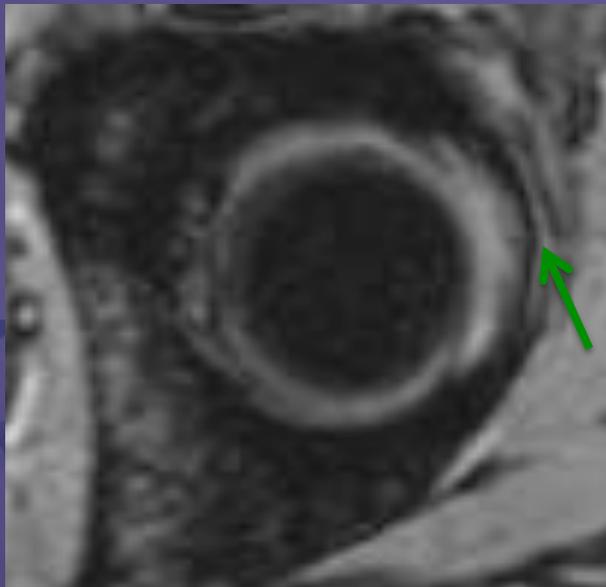
A 22 year old soccer player with left groin pain presenting popping and catching.

The oblique axial PD FS image shows a bump (red arrow) at the anterior aspect of the femoral head-neck junction that is characteristic of cam-type FAI.

Abnormal alpha angle measurement of 62 degrees (normal < 55 degrees) is also seen

Flattening/asphericity at the femoral head periphery (green arrow) is visible on coronal T1 FS image

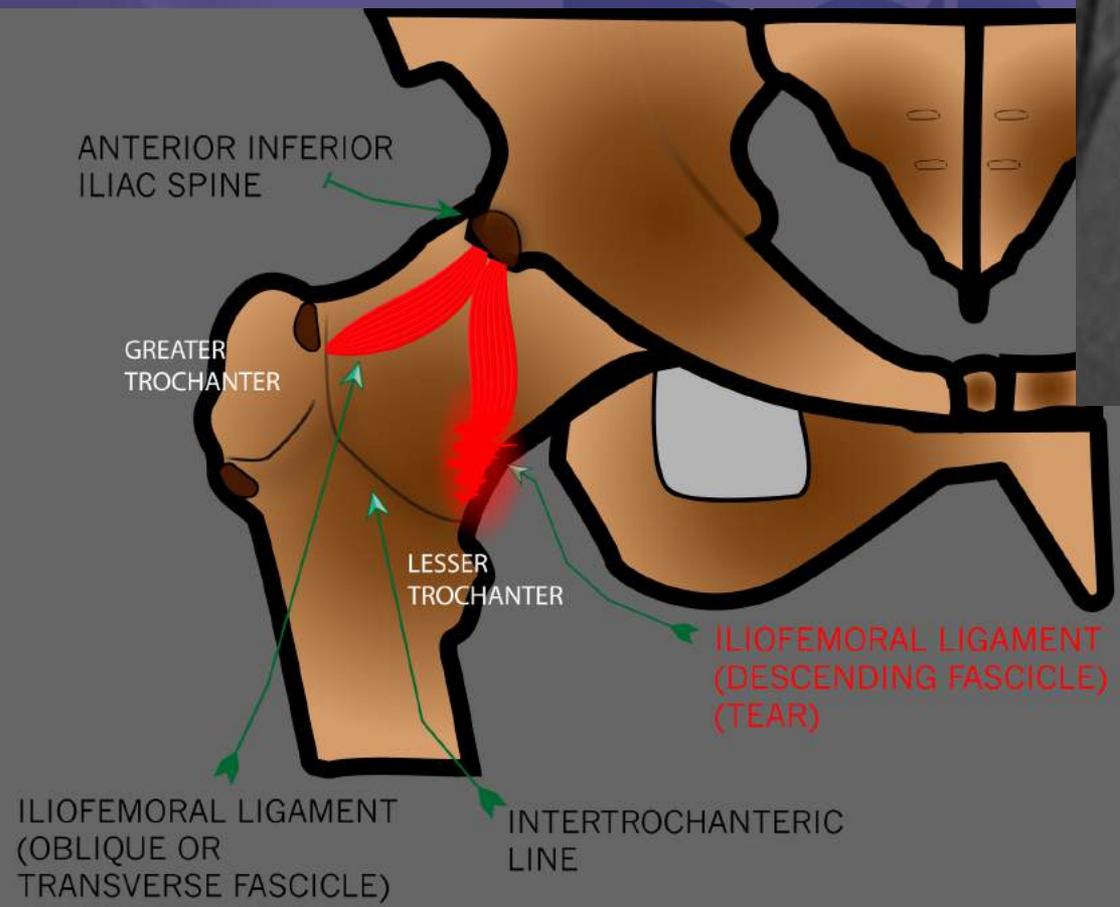
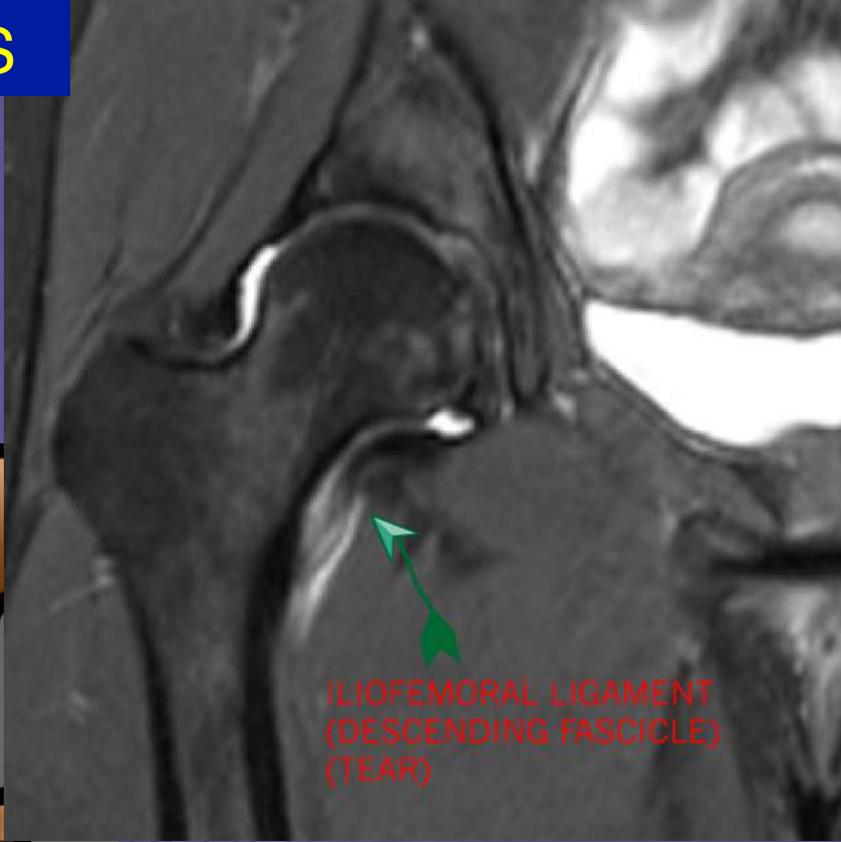
# LABRAL TEARS- FEMOROACETABULAR IMPINGEMENT



A 29-year-old female with 1 year of progressive hip pain. Coronal T1 FS and axial FFE MR arthrogram images exhibit anterosuperior labral tear (*green arrow*). There is also relatively chondral damage in which contrast is introduced seen on sagittal T1 FS image (*yellow arrow*).

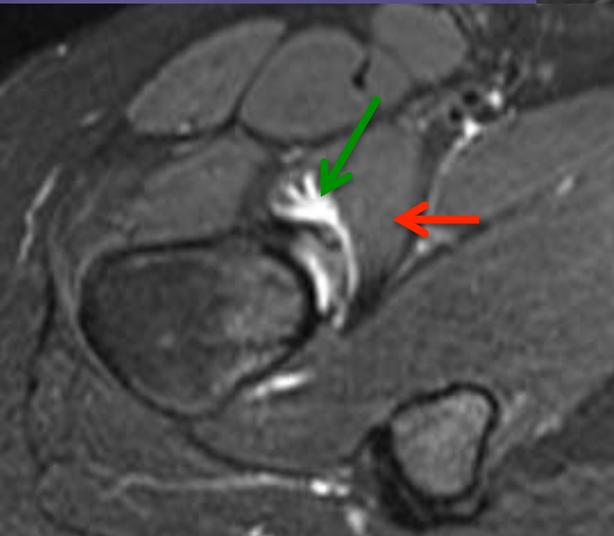
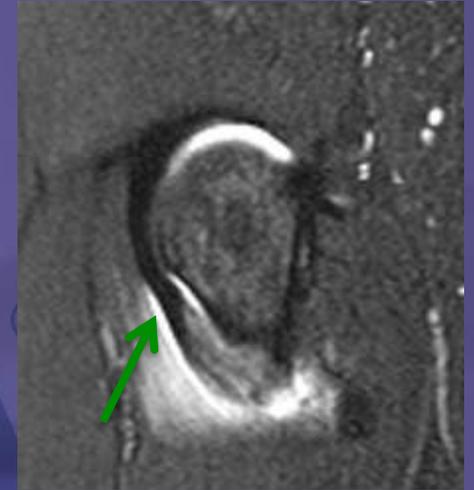
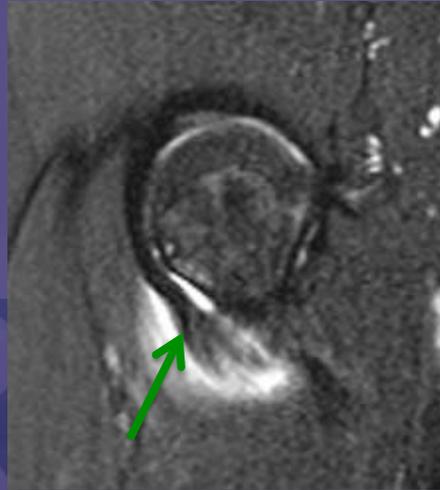
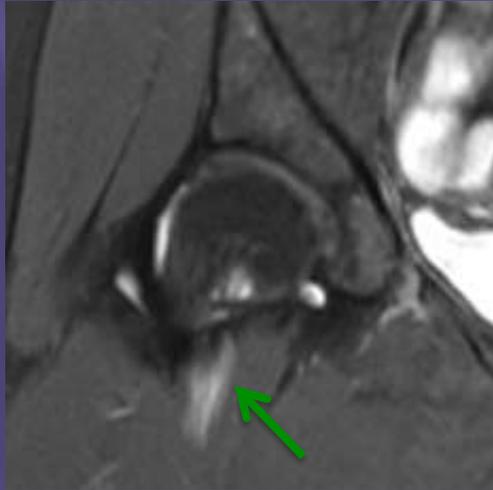
There is also a bump of the femoral neck accompany with cystic changes best seen on Coronal T1 image (*red arrow*)

# ILIOFEMORAL LIGAMENT INJURIES



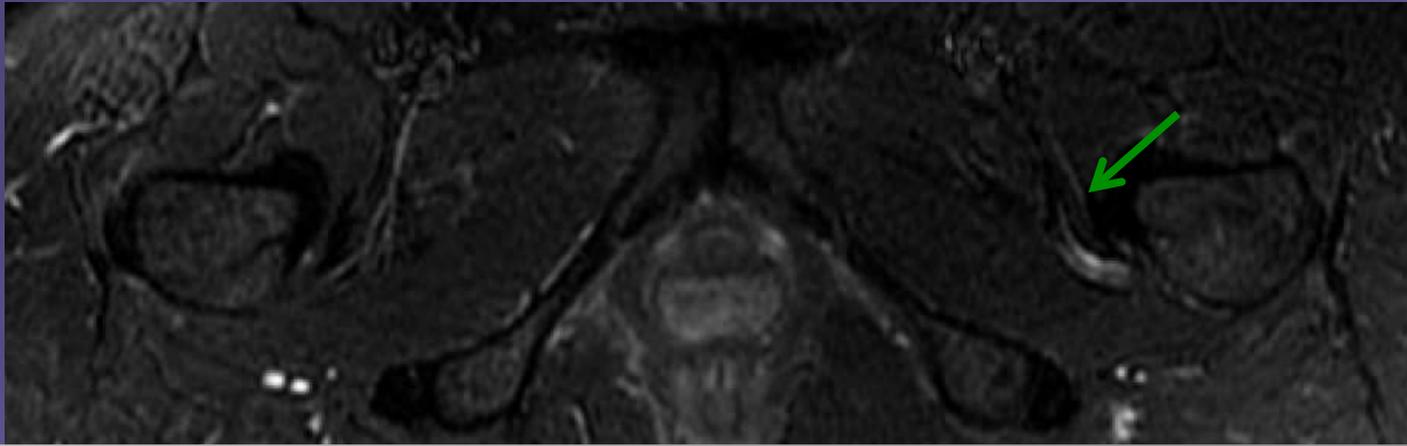
**TEAR OF ILIOFEMORAL LIGAMENT (MR image and correlate illustration)**

# ILIOFEMORAL LIGAMENT INJURIES

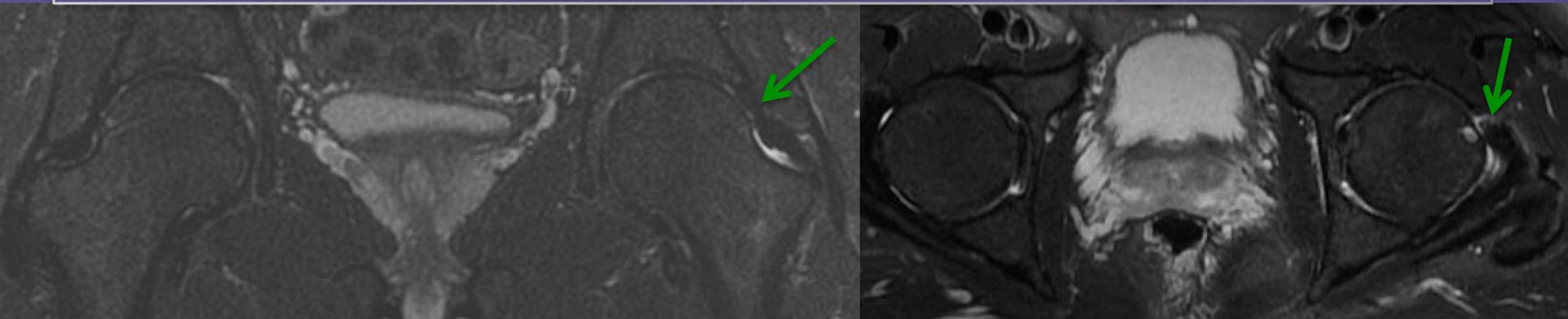


Complete tear of the descending fascicle of the iliofemoral ligament. Coronal, sagittal and axial DP fat-suppressed images depict the injury at the level of its insertion in the lesser trochanter (arrow). The iliopsoas tendon is intact (red arrow).

# ILIOFEMORAL LIGAMENT INJURIES

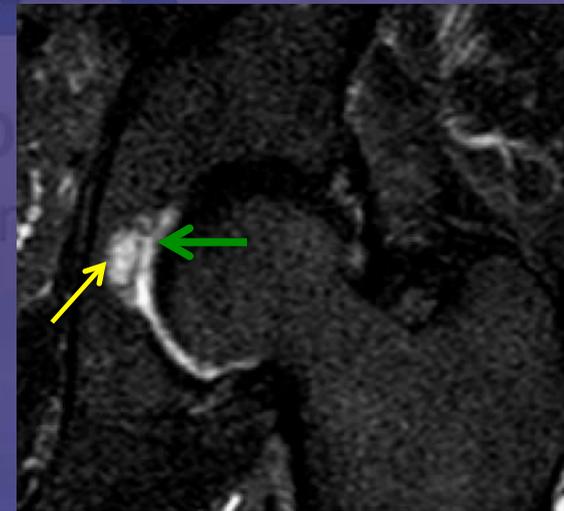
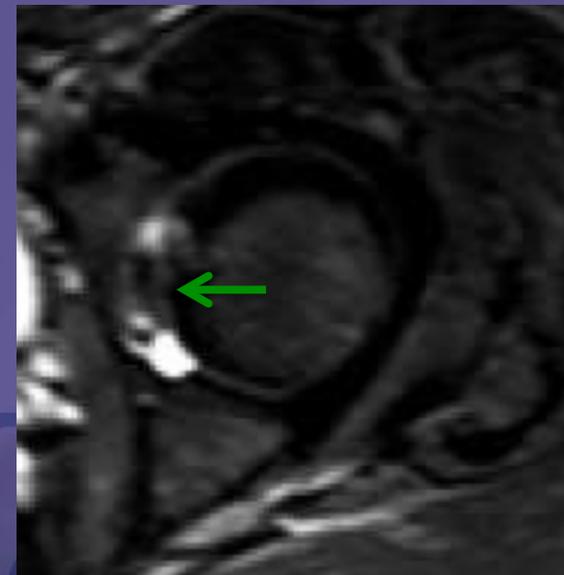
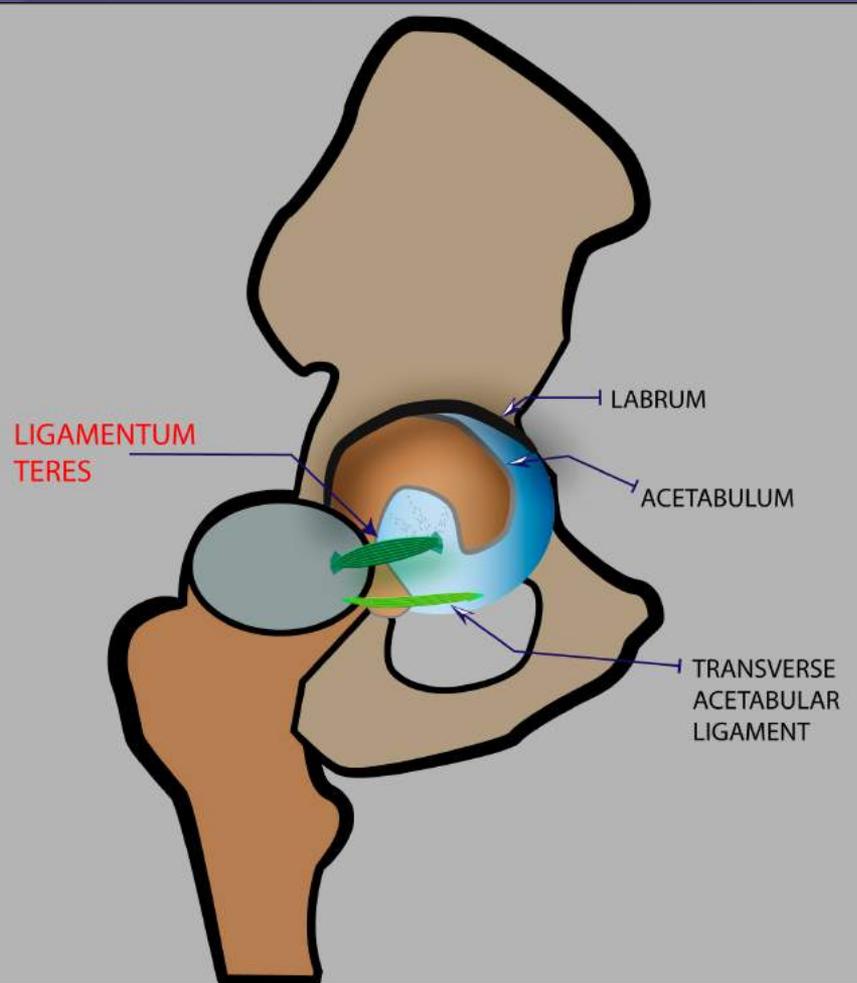


**Partial tear of the descending fascicle of the iliofemoral ligament.** Axial fat-suppressed T2-weighted demonstrates fluid within a mildly distended iliofemoral ligament in the descending fascicle (arrows).



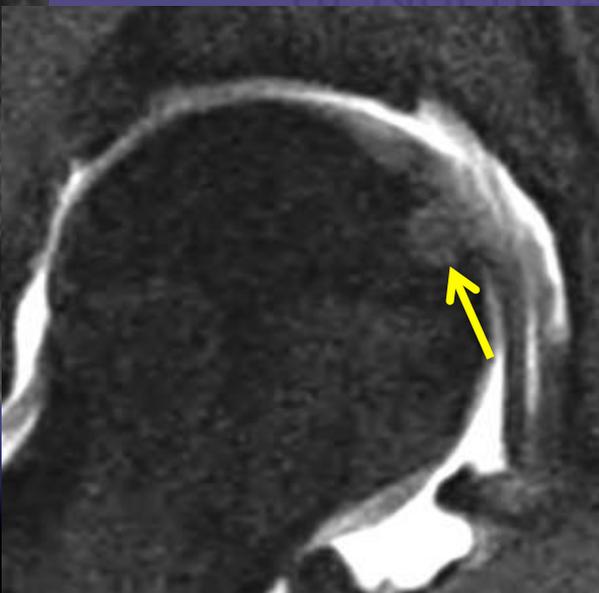
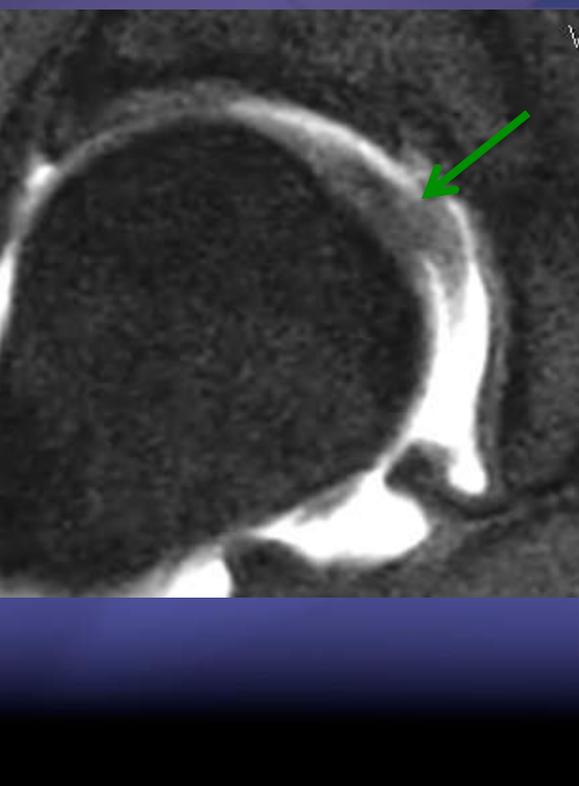
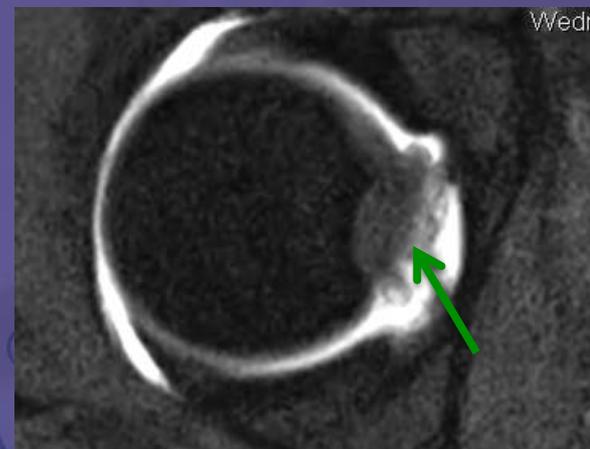
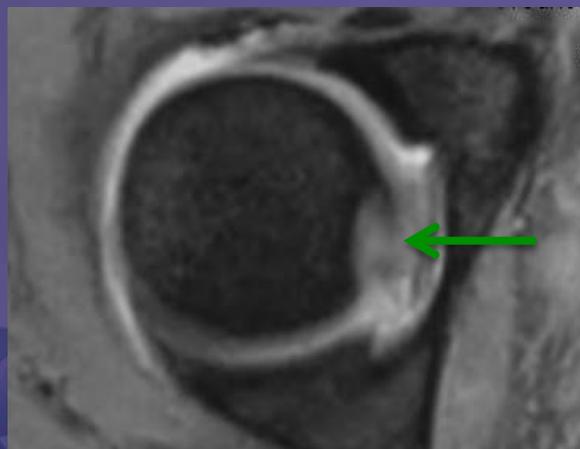
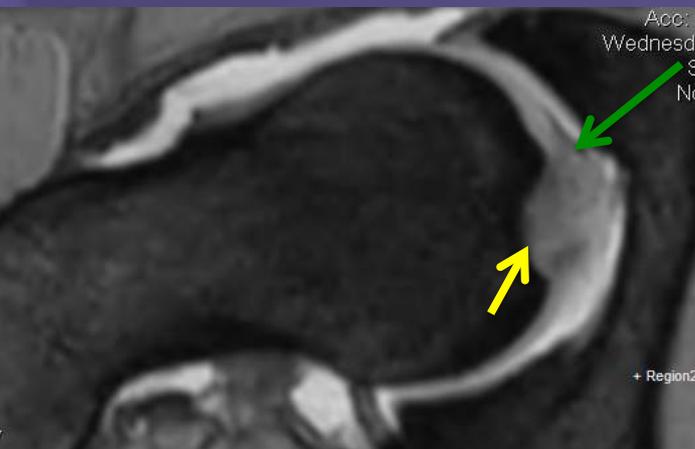
**Partial tear of the transverse fascicle of the iliofemoral ligament.** Coronal and axial fat-suppressed T2-weighted reveal fluid within a distended iliofemoral ligament in the transverse or oblique fascicle (arrows).

# LIGAMENTUM TERES INJURIES



Partial tear of ligamentum teres in a running sportswoman. Axial and coronal T1 fat-suppressed images and sagittal T1 exhibit thickening with increase of intensity of teres ligament (*green arrow*) with a small foveal tear (*yellow arrow*).

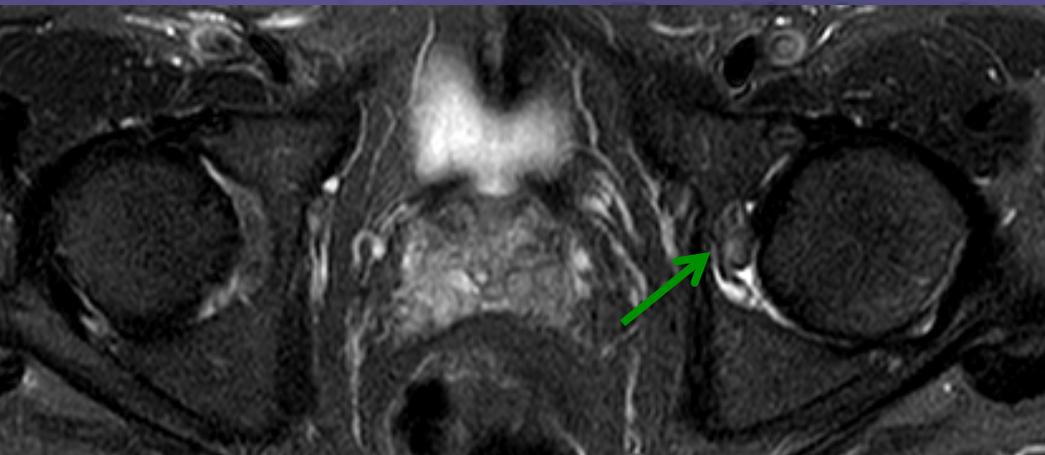
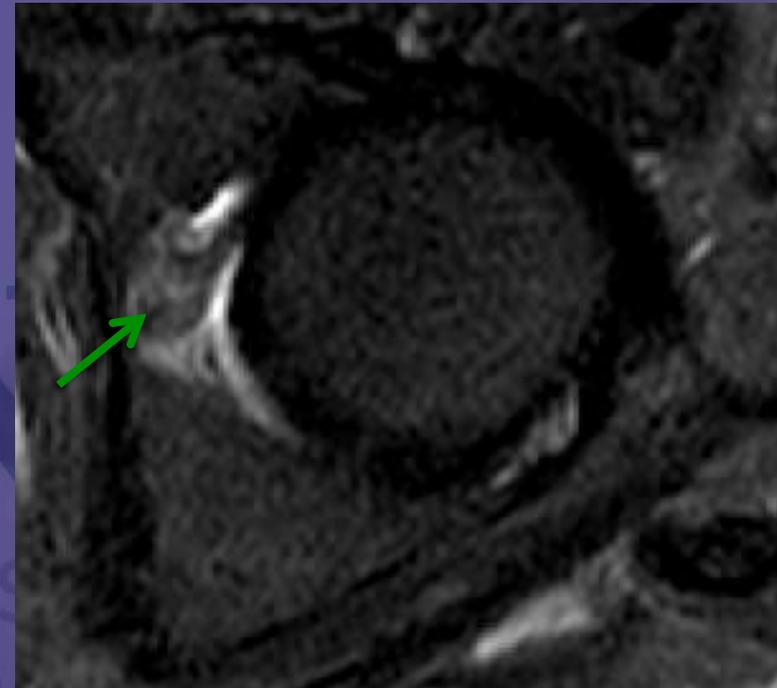
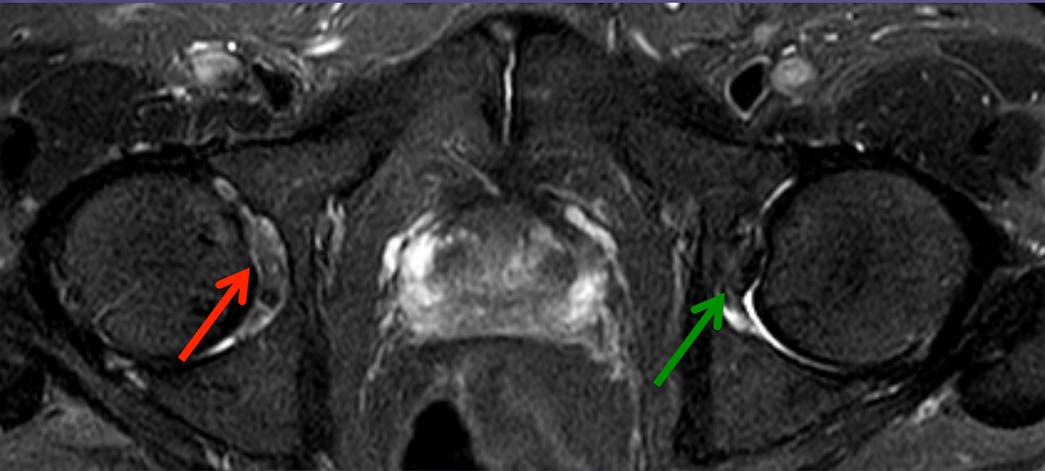
# LIGAMENTUM TERES INJURIES



**Direct arthrography performed with leg traction in a running sportswoman.**

Axial and coronal T1 fat-suppressed images exhibit marked enlargement with increase signal and irregular margins of a ligamentum teres (*green arrow*). There is also a small foveal tear (*yellow arrow*).

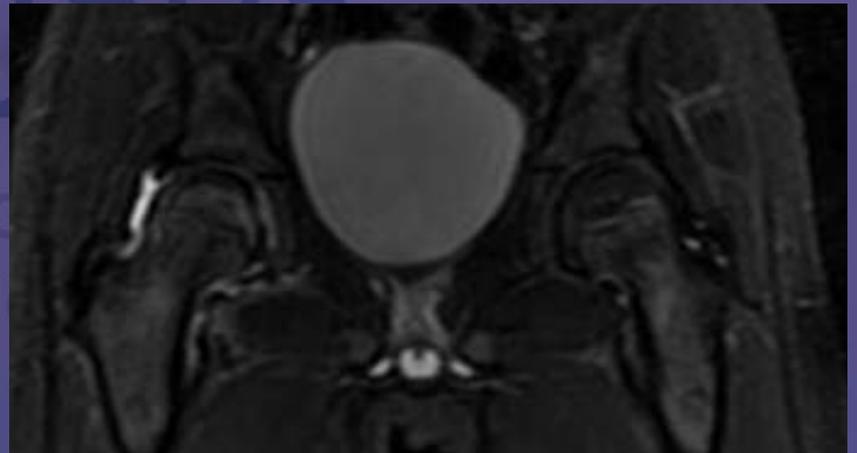
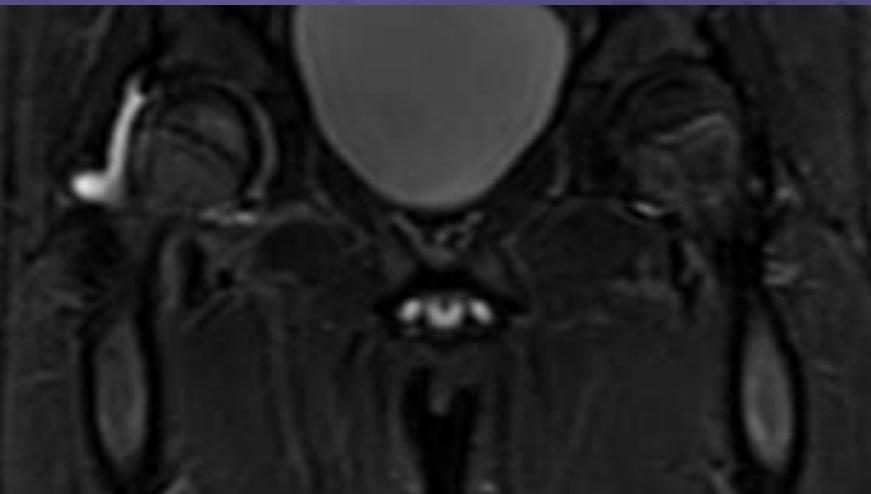
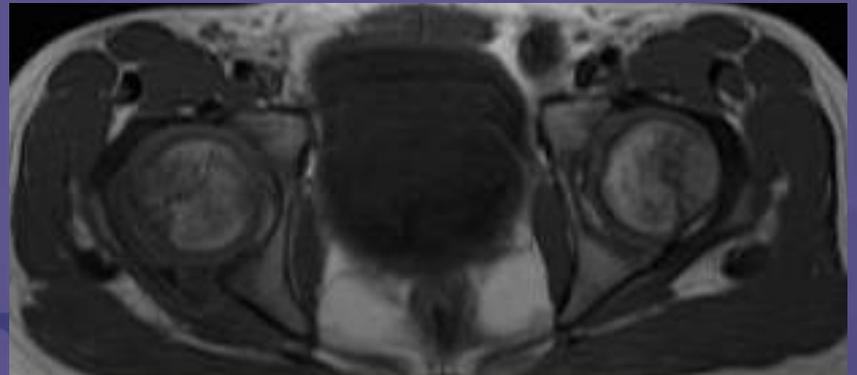
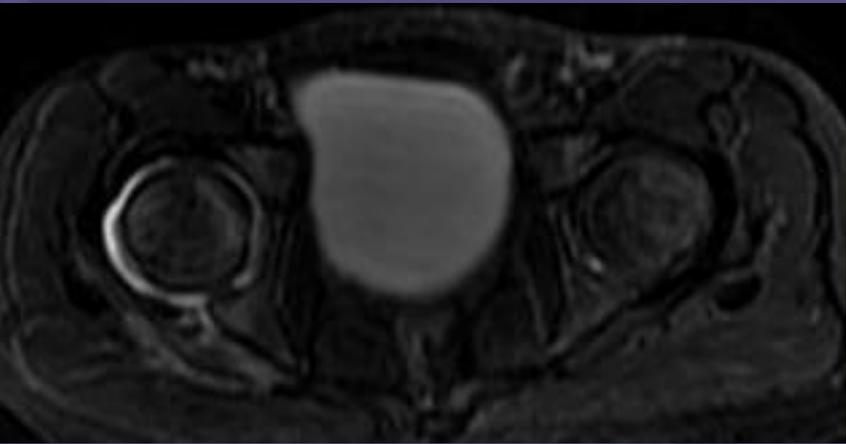
# LIGAMENTUM TERES INJURIES



Thickening of left ligamentum teres in a soccer player with chronic hip pain. Axial T1 fat-suppressed images exhibit thickening of teres ligament (*green arrow*).

Notice the difference with the right ligament (*red arrow*)

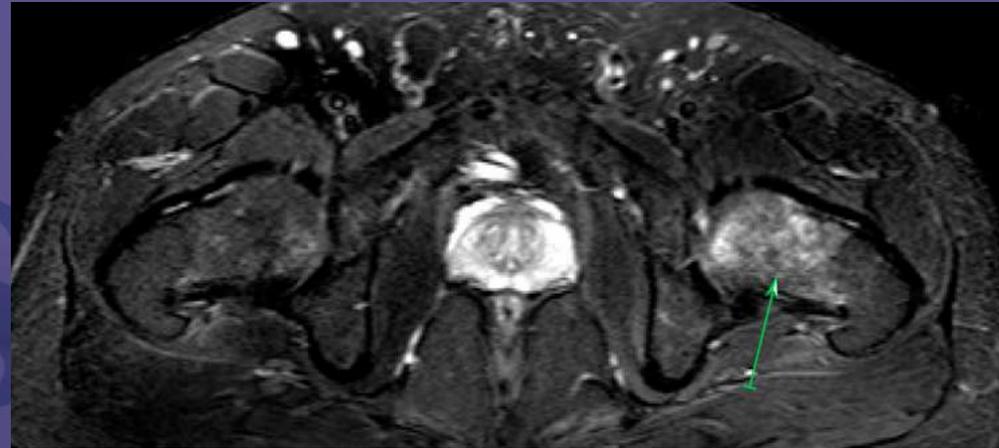
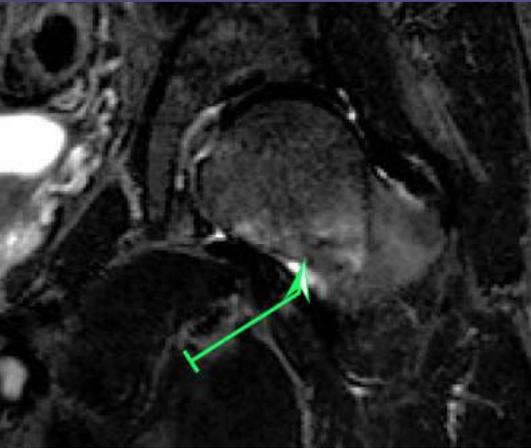
# TRANSIENT SYNOVITIS



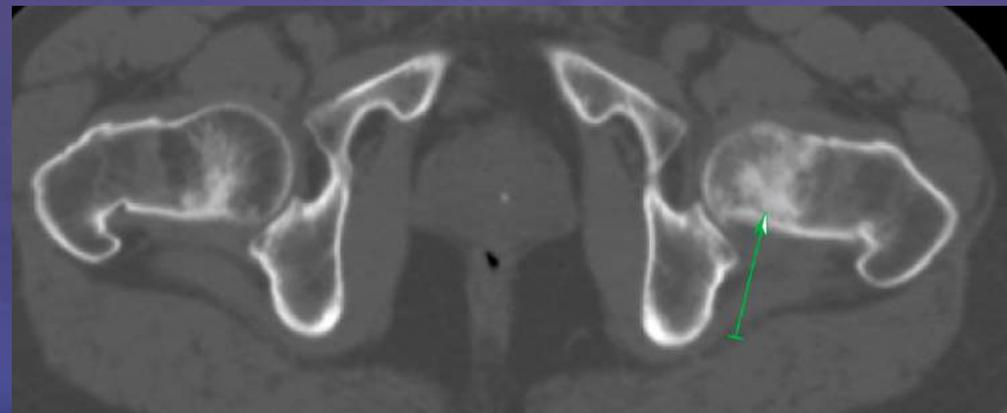
Transient right synovitis in 10 year old soccer player with hip pain. Axial, coronal T1 fat-suppressed images and axial T1 image demonstrate a large amount of fluid within the joint. It represents the most common cause of hip pain in small children.

# STRESS FRACTURE

**COMPRESSION FRACTURE** located on the inner side of the femoral neck (low risk of complicated healing)

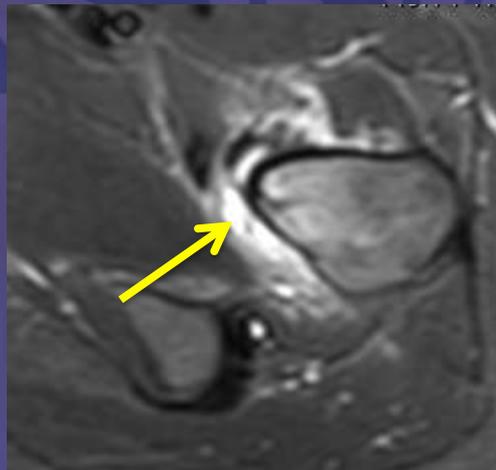
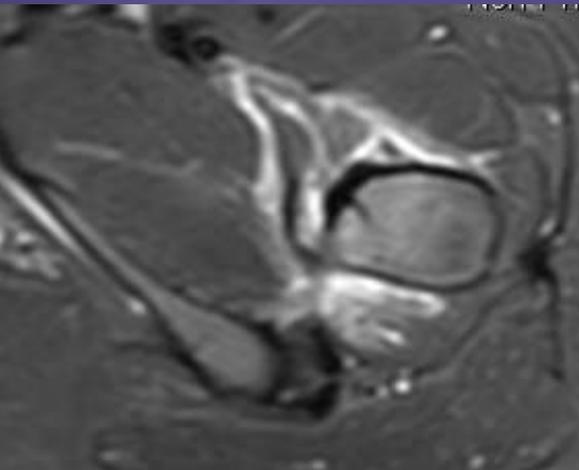
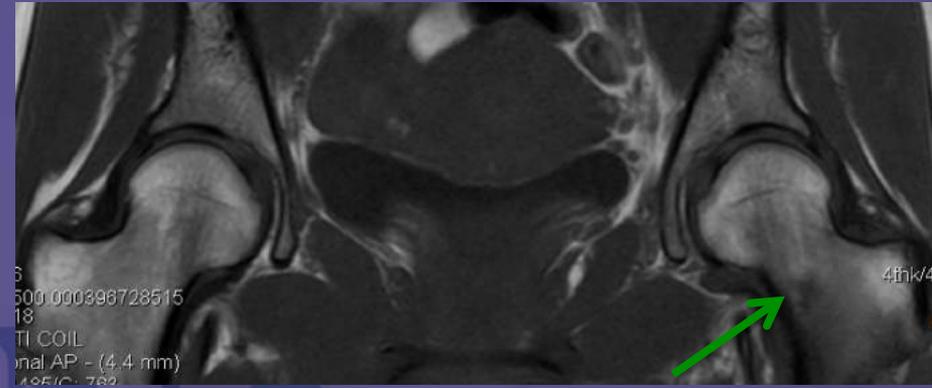
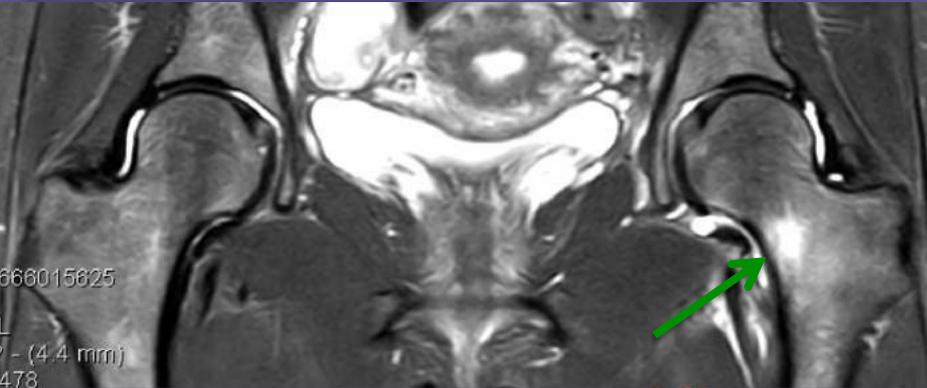


Coronal and axial STIR images demonstrate osseous edema within the medial aspect of the right femoral neck, along with a low signal line representing a stress fracture (arrow).



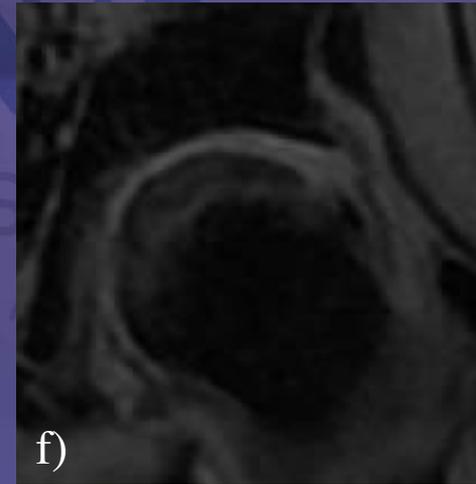
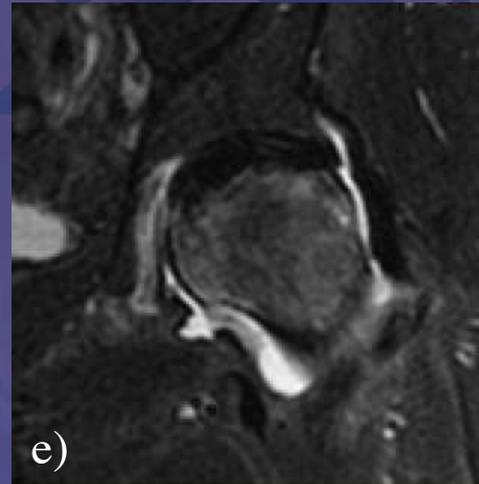
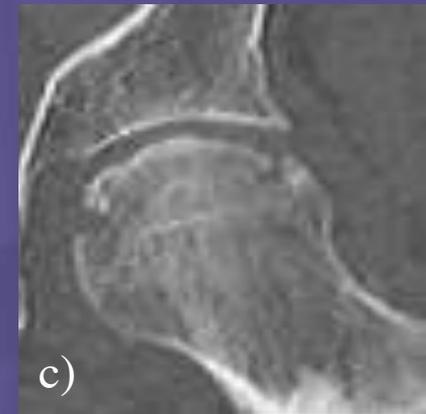
Coronal and axial reformatted helical CT scan 21 days after the MRI demonstrate the stress fracture with a sclerotic line in the medial femoral neck (arrow).

# STRESS FRACTURE



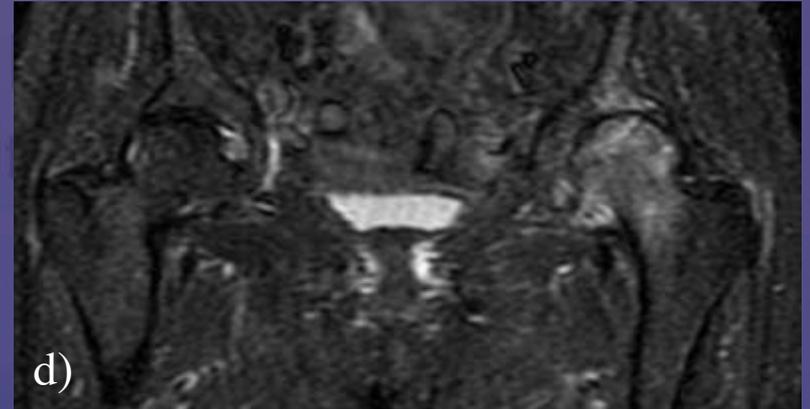
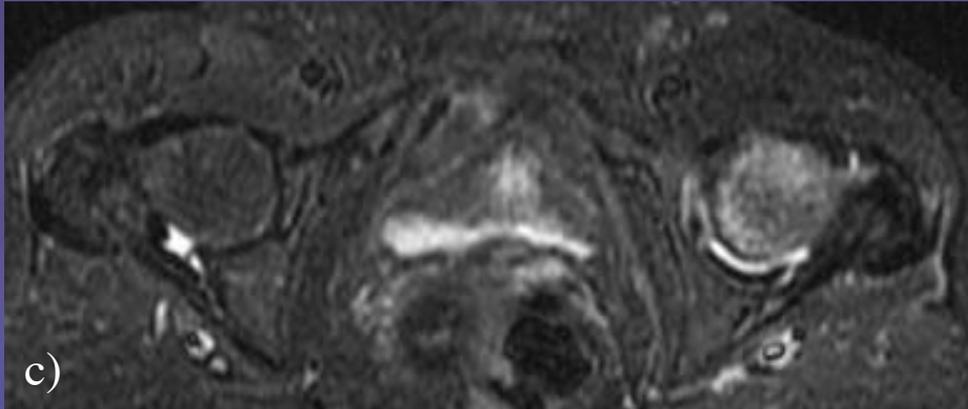
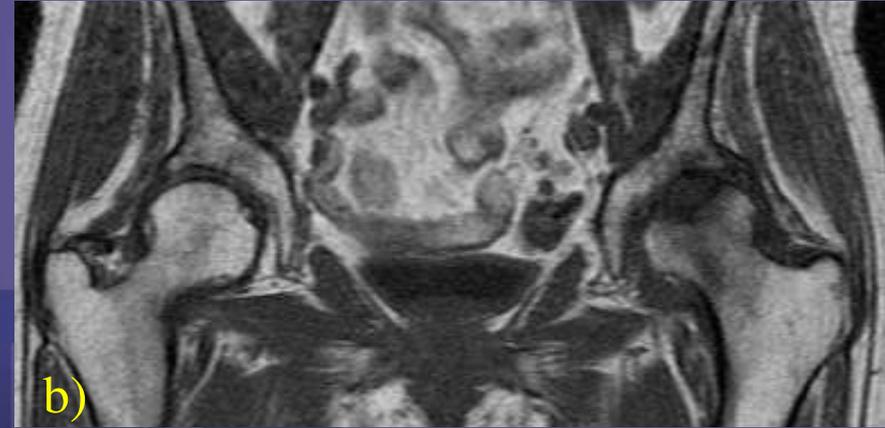
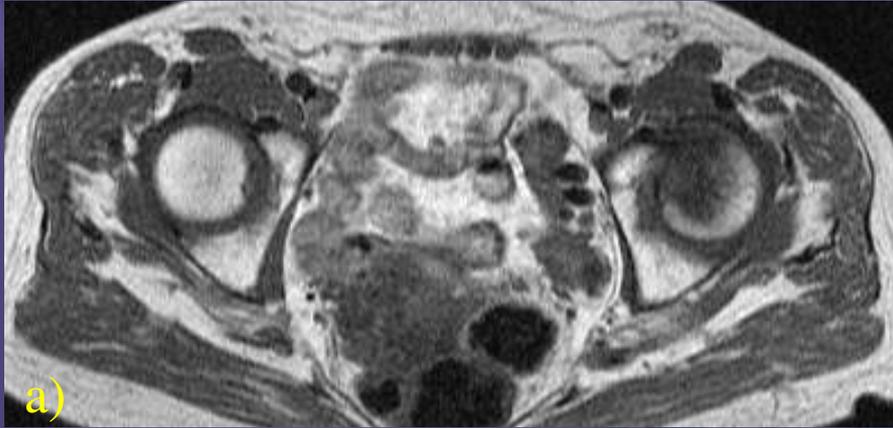
**Compression Fracture:** Coronal and axial DP FS images show osseous edema within the medial aspect of the left femoral neck. Low signal line on coronal T1 representing the stress fracture (green arrows). There is also high signal intensity in the left iliopsoas muscle with surrounding fluid and edema interpreting as a strain (yellow arrows).

# AVASCULAR NECROSIS



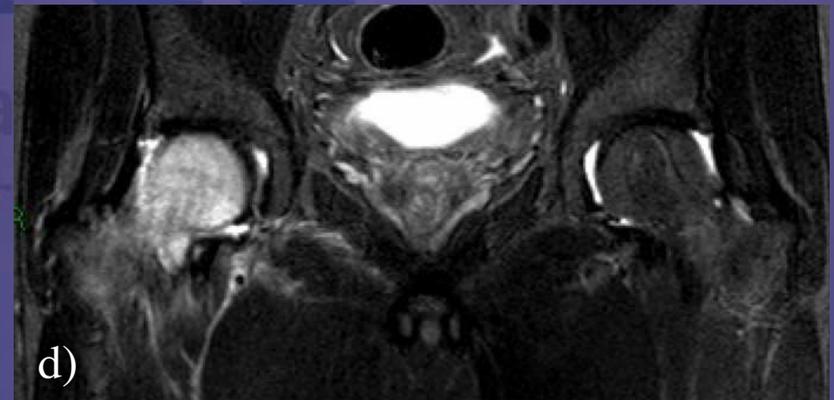
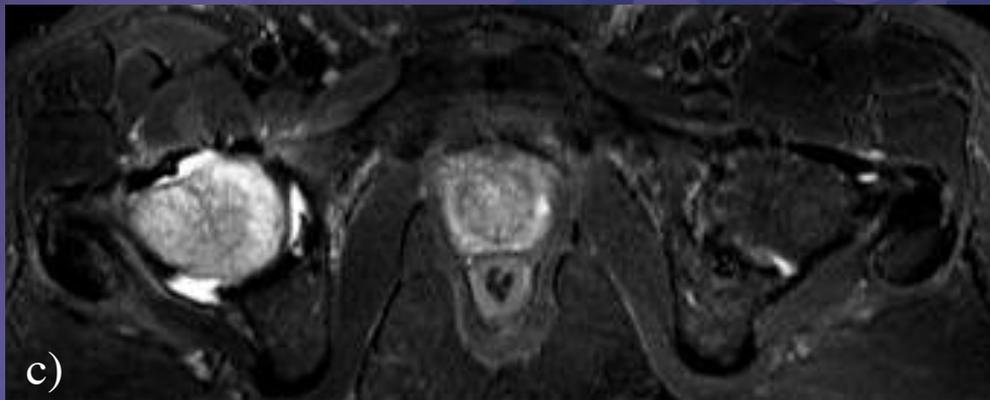
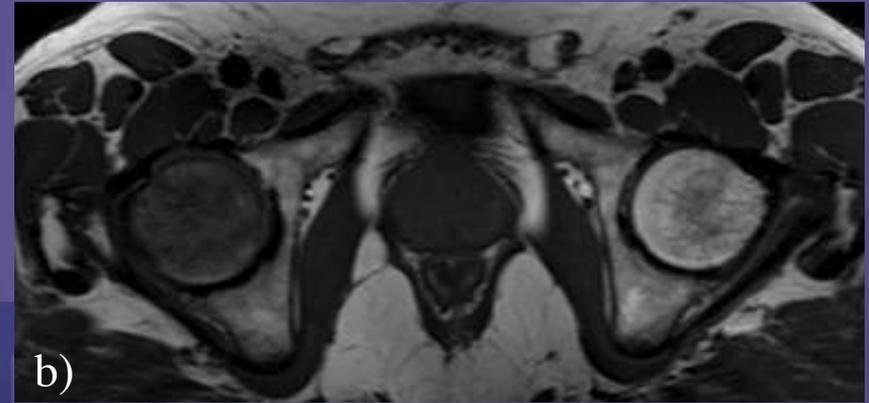
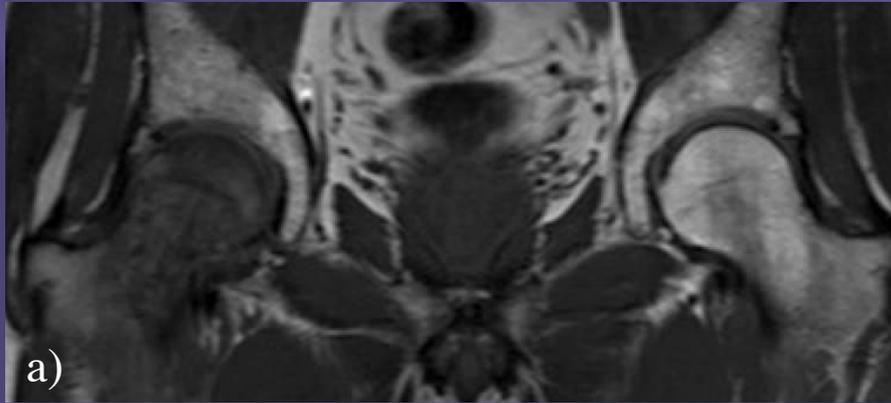
AVN stage B. Radiograph shows involvement of left femoral head with sclerosis changes (a). CT scan depicts increase of density and cystic changes in the anteromedial femoral head (b-c). MRI demonstrates a serpiginous band of low intensity signal on T1 image (d). There is a “double line sign” (classic sign of AVN) on STIR (e) and particularly on T2 FS (f) images: a second high signal intensity within the line seen on T1 image. It represents hypervascular granulation tissue

# AVASCULAR NECROSIS



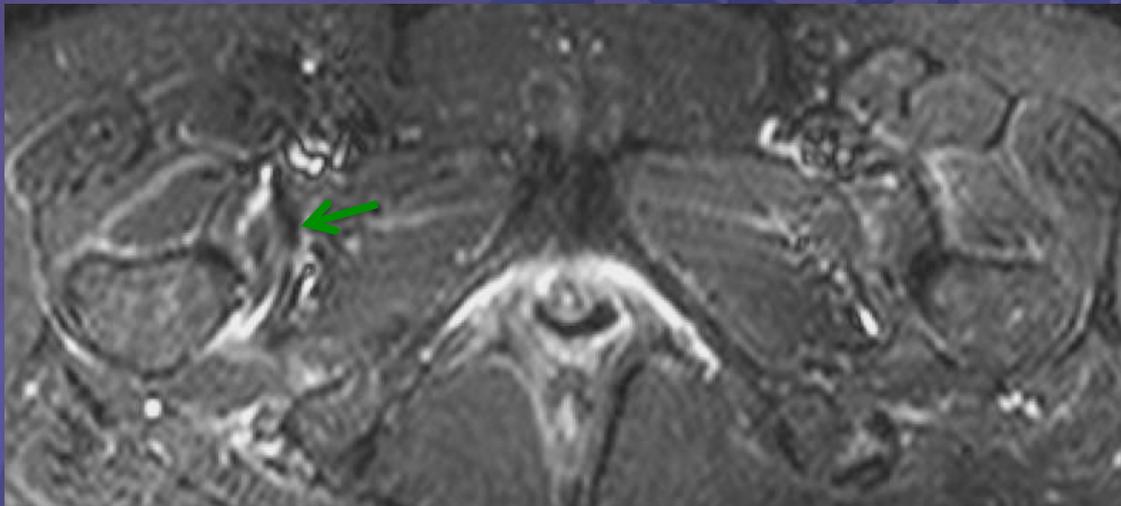
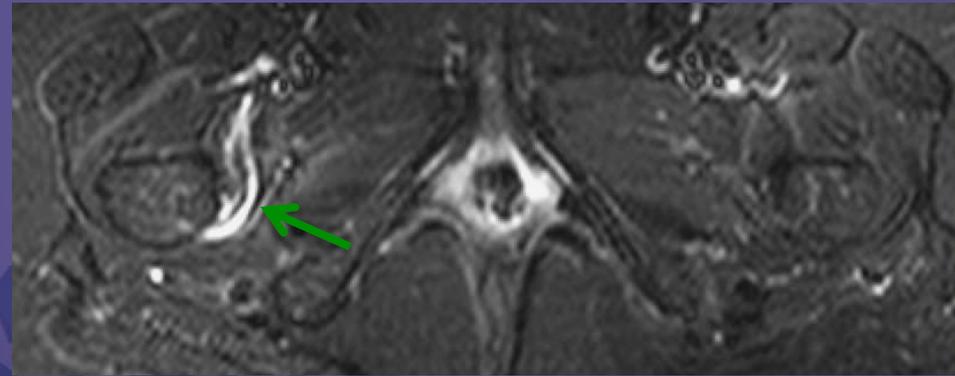
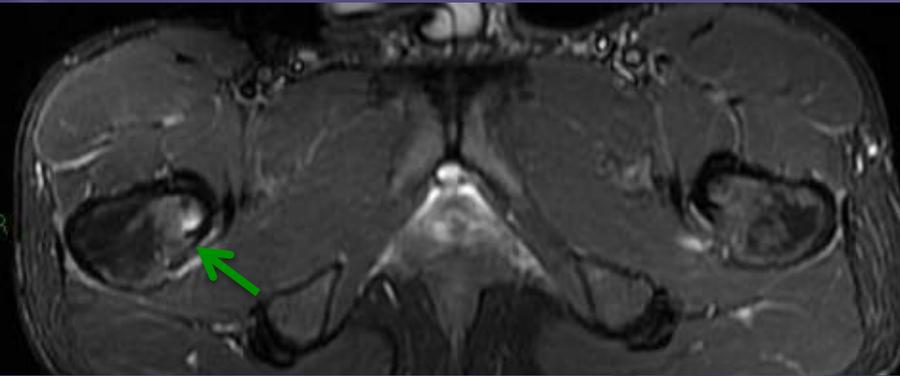
Patient 39 years old with use of high dose of corticosteroids. Avascular necrosis stage C (fluid-like) in left femoral head, with decreased signal intensity on T1W presenting sclerotic margins and some cortical collapse (a-b). There is increased signal on T2 FS images (c-d).

# TRANSIENT OSTEOPOROSIS



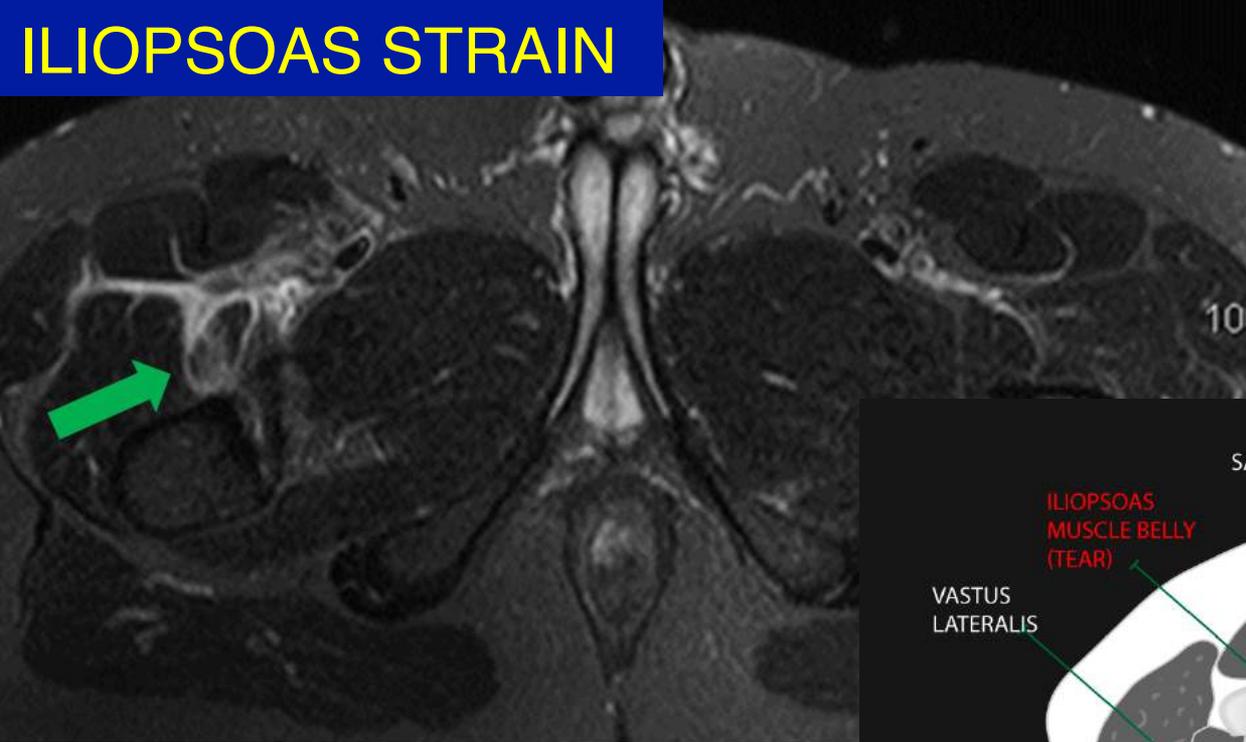
Patient 30 years old. Idiopathic transient osteoporosis in right femoral head, with decreased diffuse signal intensity on T1W without sclerotic margins (a-b) and extensive bone marrow edema on T2 FS images (c-d). There are also extensive intraarticular fluid. There is no sclerotic margins or double line sign

# ILIOPSOAS TENOSYNOVITIS

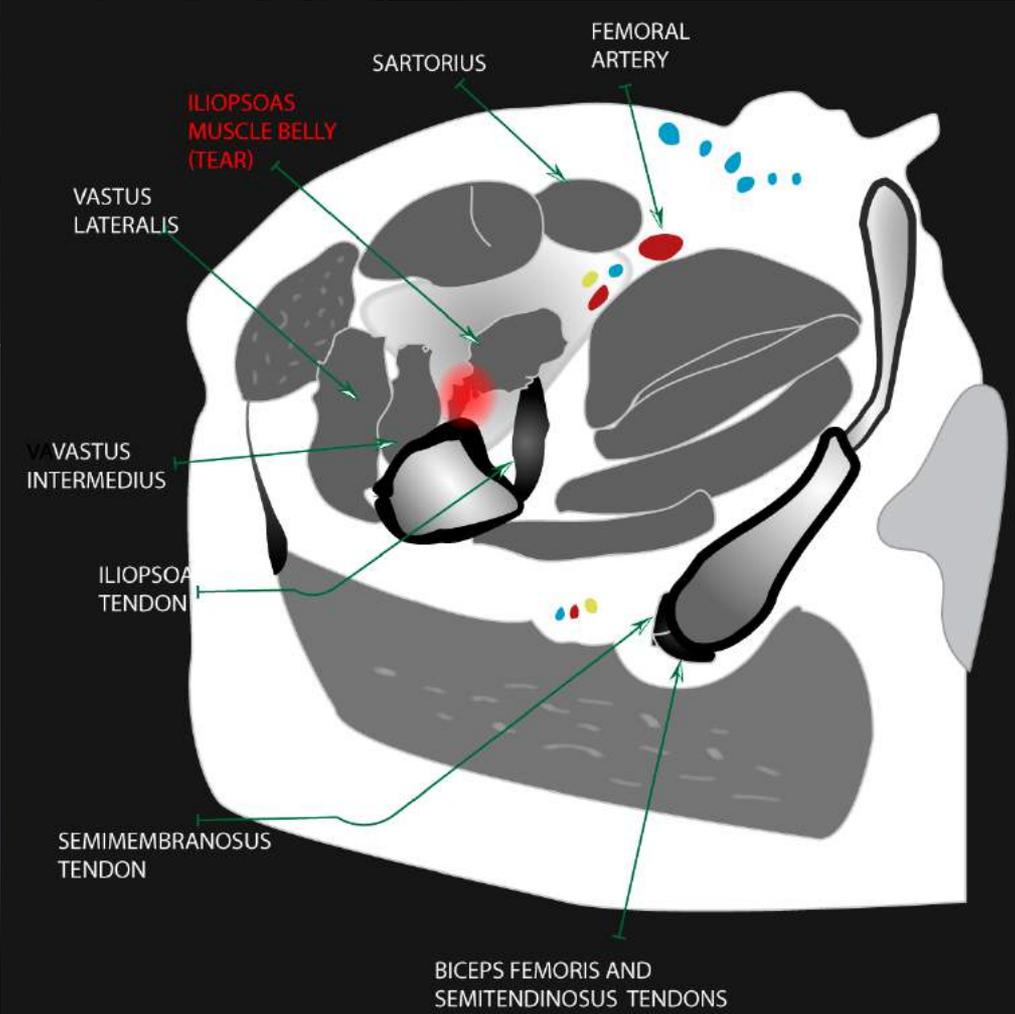


**Iliopsoas tenosynovitis.** Axial FS FSE T2 and axial and sagittal STIR images depict thickening with an increase in fluid within the right iliopsoas tendon (arrow). There is also small marrow edema. The muscle belly is not affected.

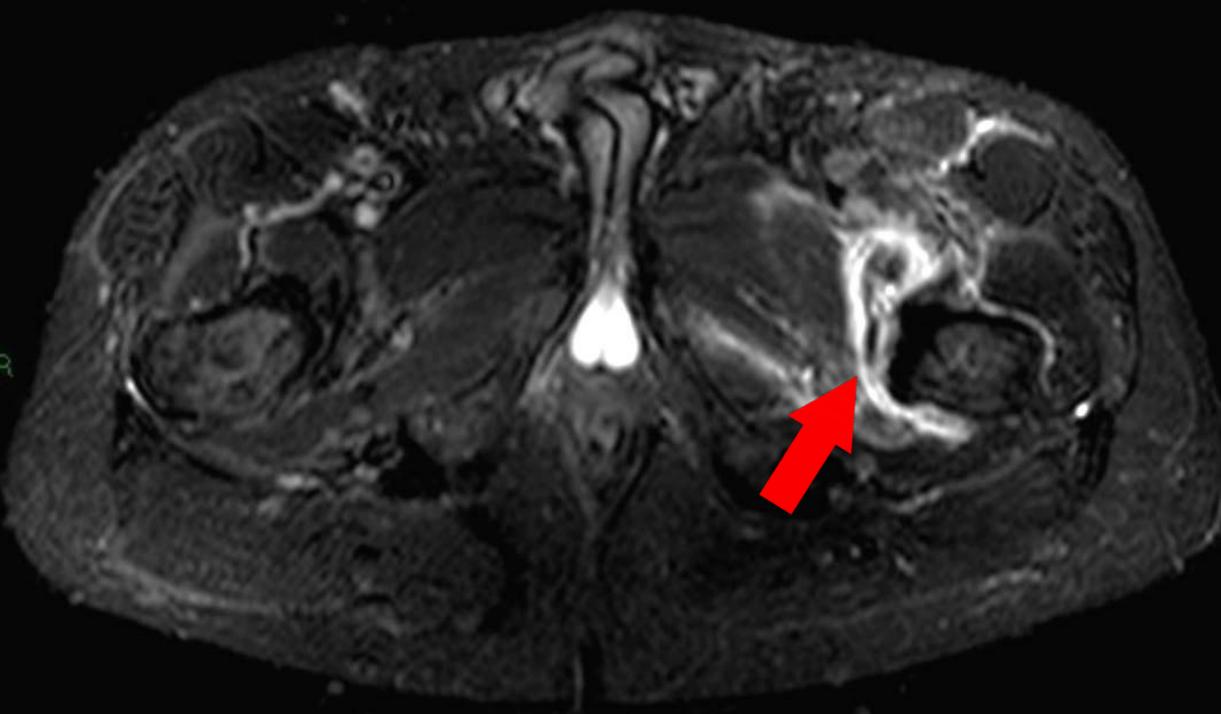
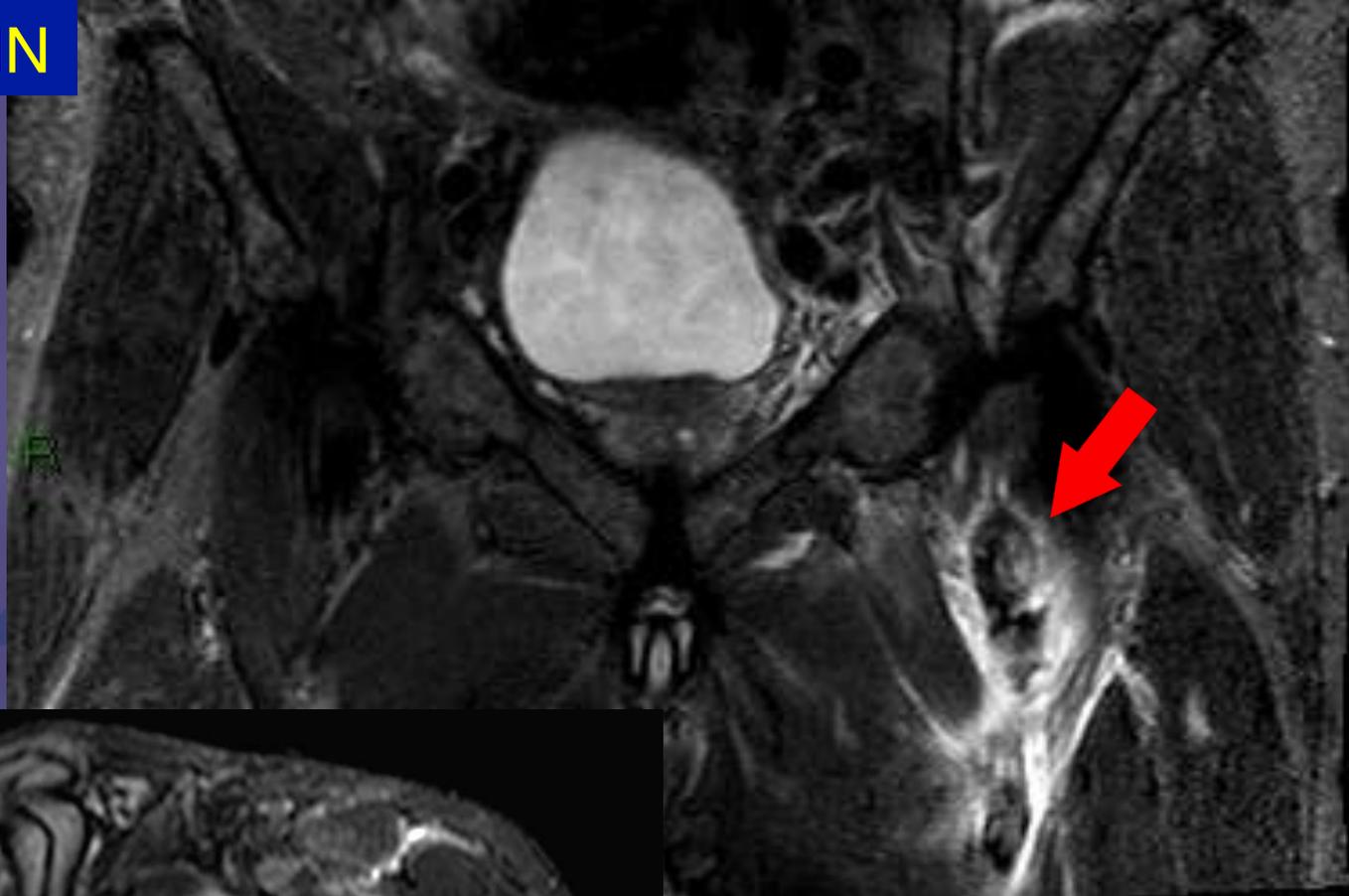
# ILIOPSOAS STRAIN



**Strain of iliopsoas muscle belly.**  
Axial FS FSE T2-weighted image and anatomic illustration depict high signal intensity in the right iliopsoas muscle (arrow) with surrounding fluid and edema. The tendon is not affected from its insertion onto the lesser trochanter.



# ILIOPSOAS STRAIN



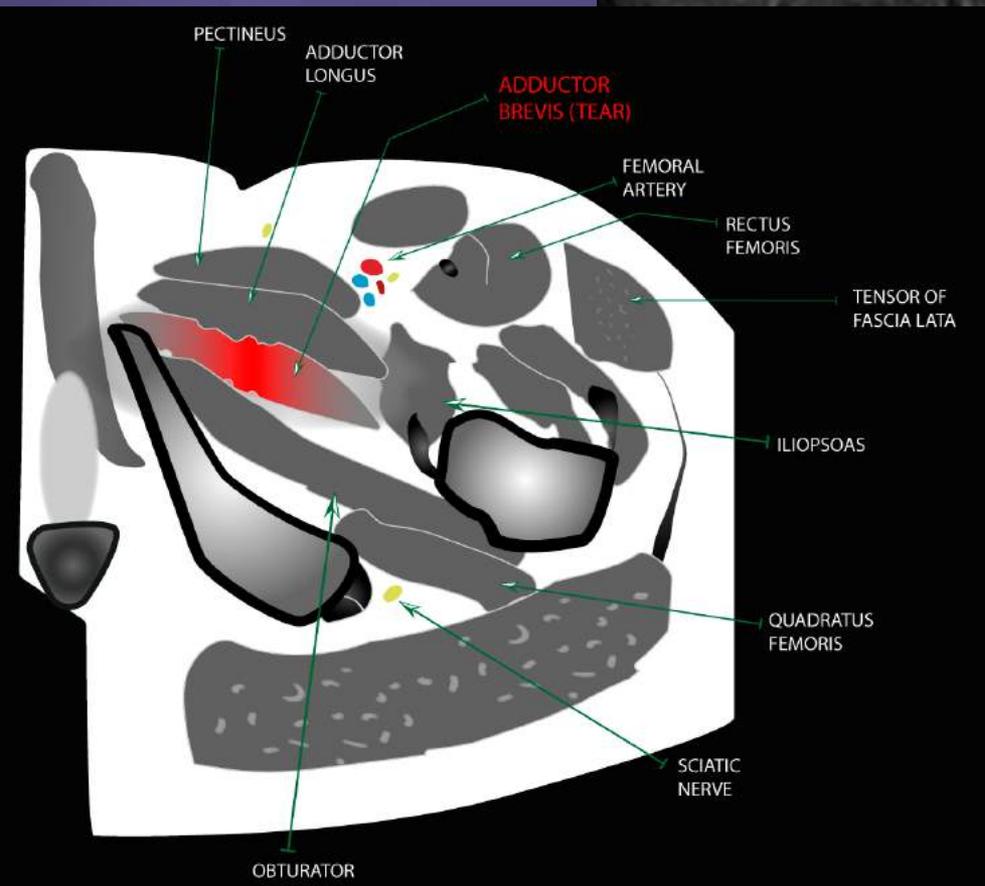
Avulsion tear from the iliopsoas tendon of the lesser trochanter.  
Coronal and axial STIR images

# THE ADDUCTOR GROUP

- The adductor brevis, adductor longus, adductor magnus, pectineus, and gracilis make up the adductor group. The adductors all originate on the pubis and insert on the medial and posterior surface of the femur, with the exception of the gracilis which inserts just below the medial condyle of the tibia.
- The strains involving the adductor longus and then the pectineus and adductor brevis are the most frequent as a part of the athletic pubalgia spectrum.

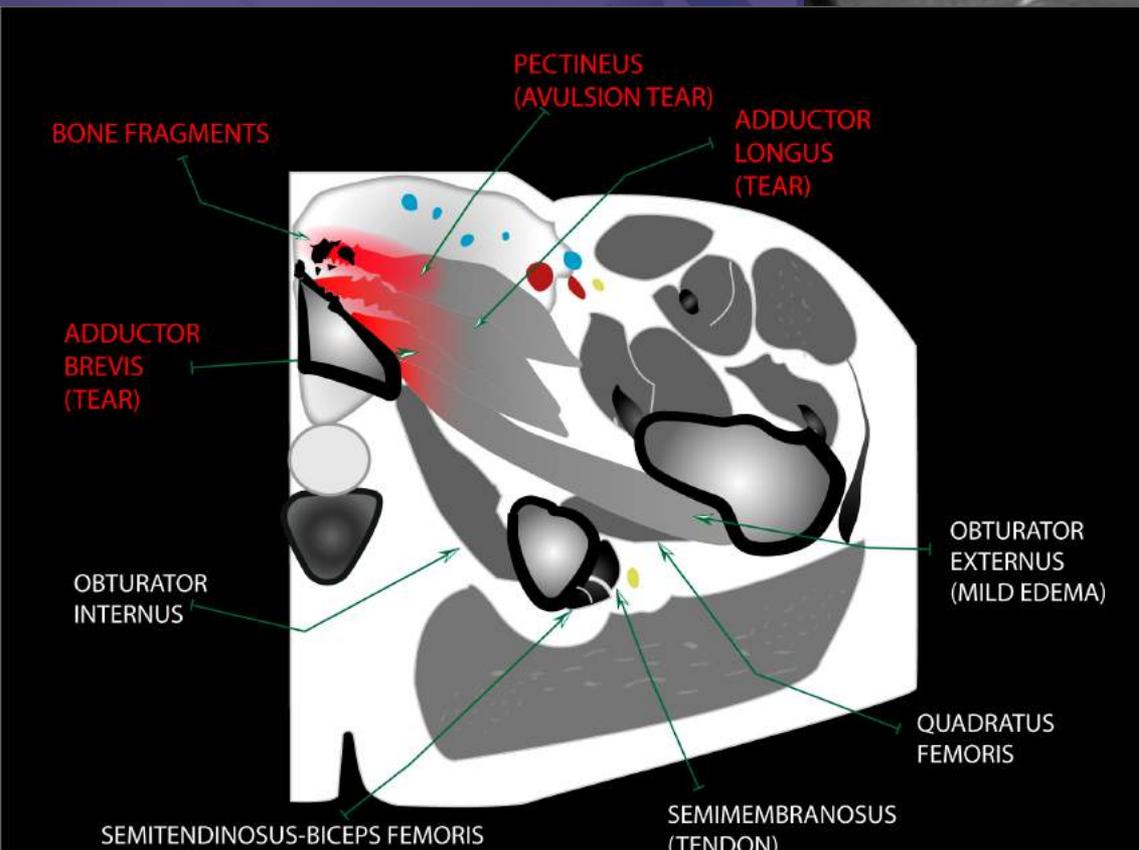
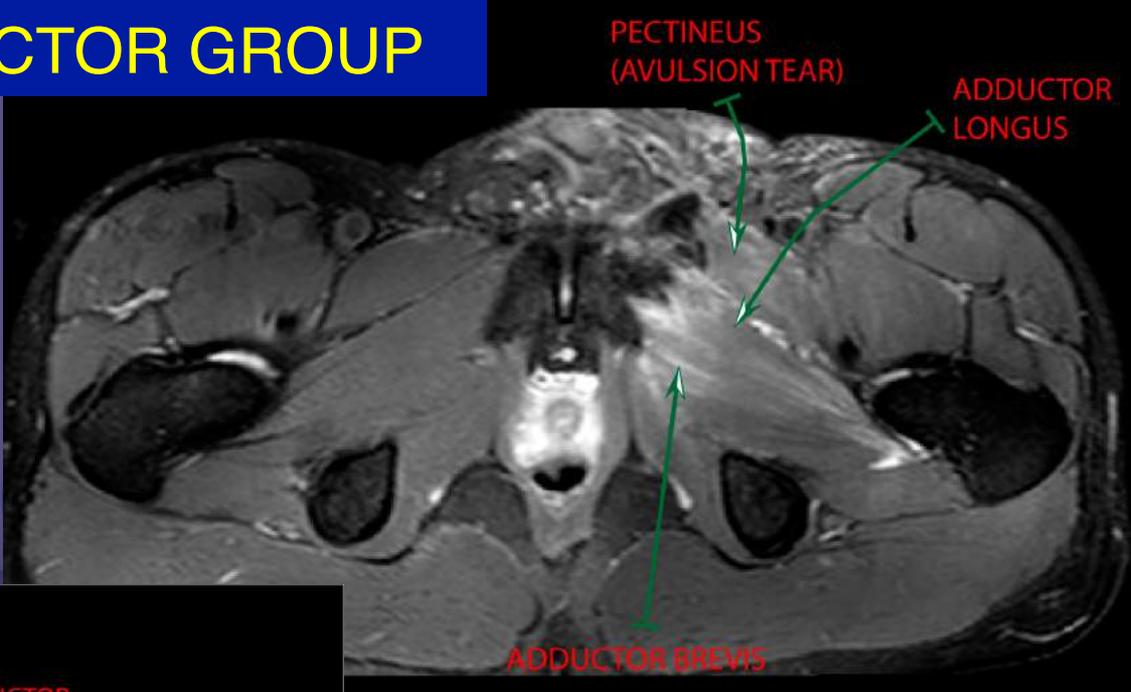


# ADDUCTOR MUSCLE STRAINS



**Strain of the adductor brevis.** Axial STIR image and anatomic illustration depict high signal within the left muscle and tendon junction (arrow) prior to its insertion at the middle front of the pubic bone.

# AVULSION OF THE ADDUCTOR GROUP

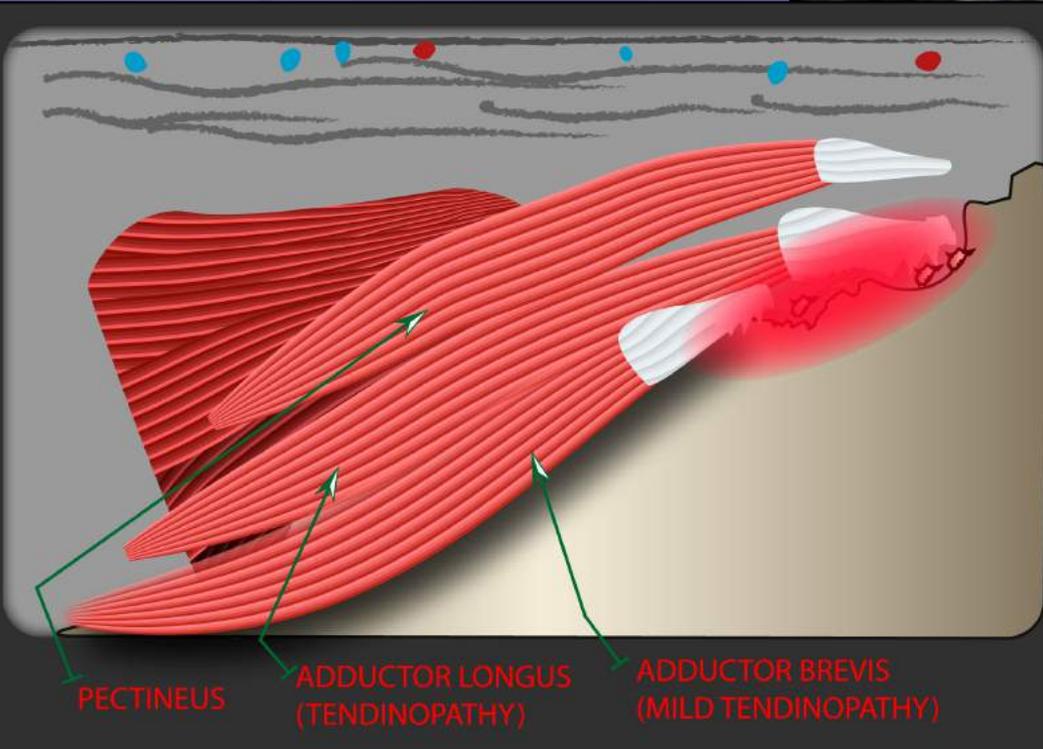
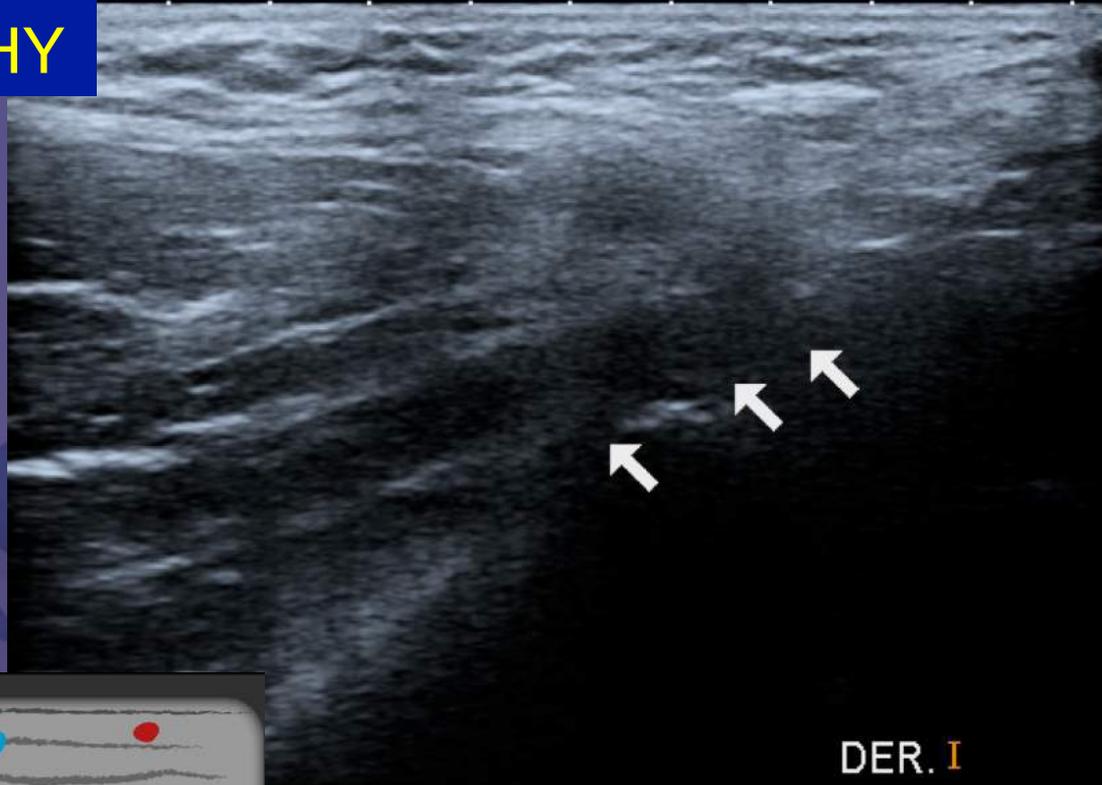


AVULSION TEAR OF PECTINEUS WITH INSERTIONAL STRAIN OF ADDUCTOR LONGUS AND BREVIS (MR image and anatomic illustration)

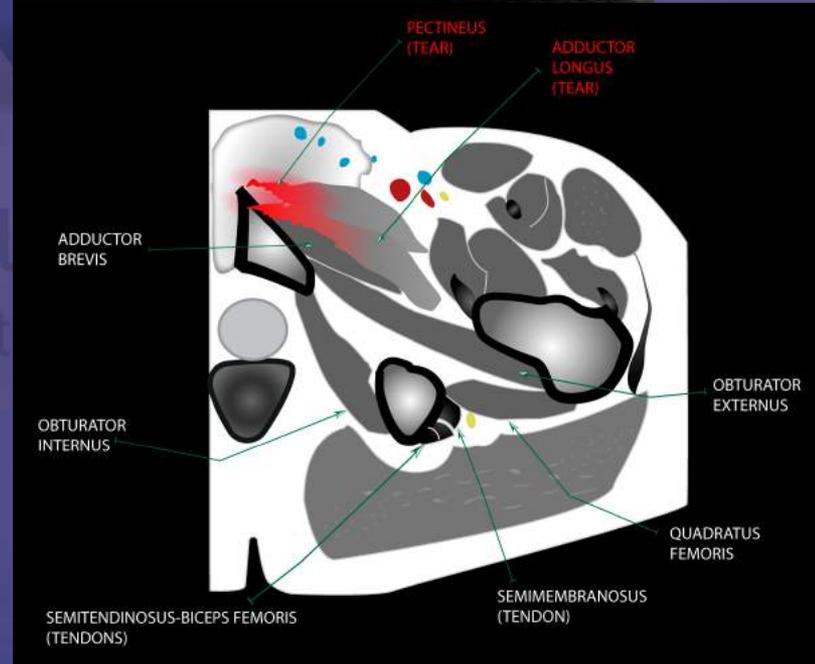
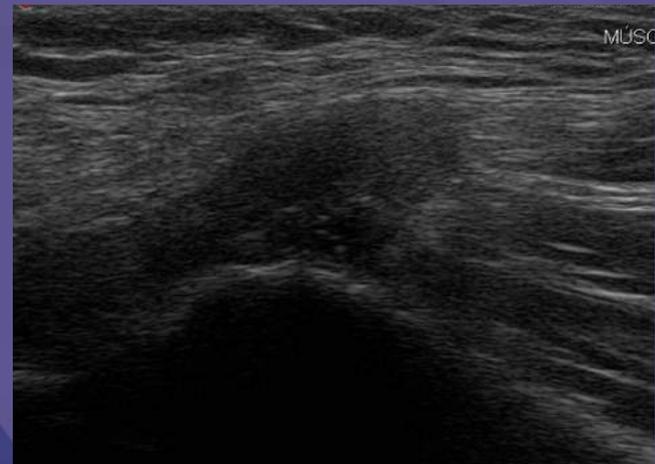
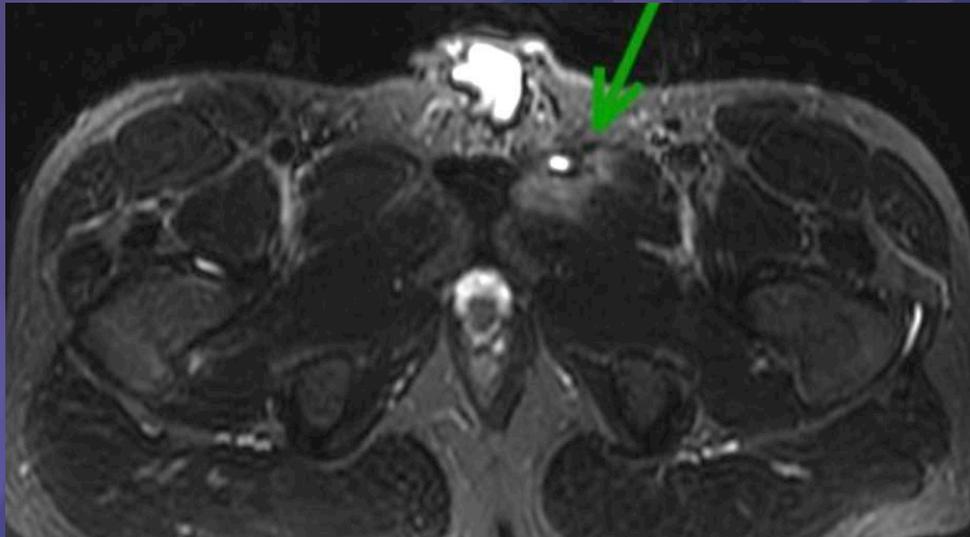
# ADDUCTOR TENDINOPATHY

## INSERTIONAL TENDINOPATHY OF THE ADDUCTORS

Ultrasound scan, illustration  
and probe position  
to evaluate the adductor group



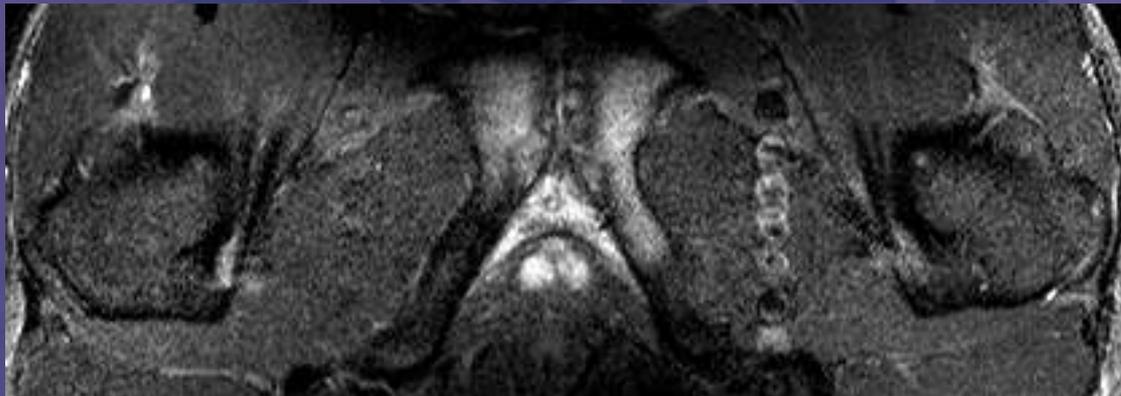
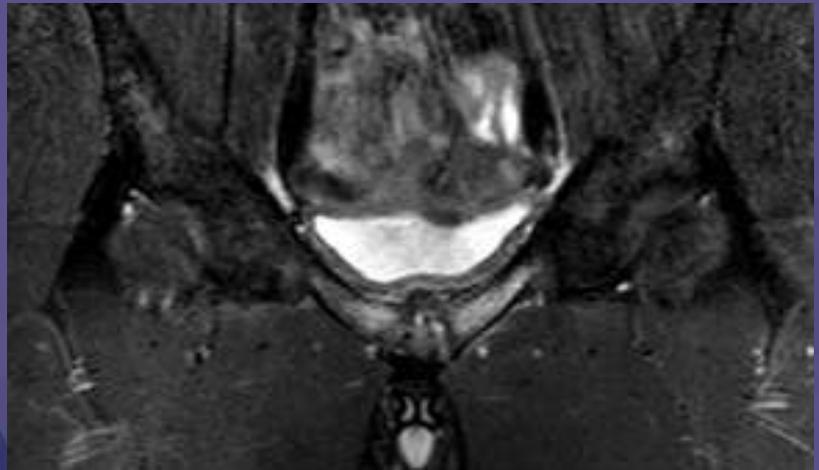
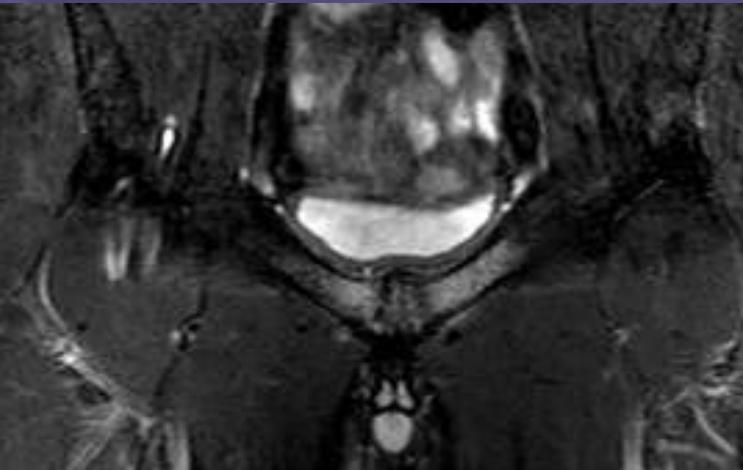
# ADDUCTOR TENDINOPATHY



## INSERTIONAL TENDINOPATHY OF THE ADDUCTORS

Ultrasound scan, MRI and original illustration with images of thickening of adductor longus, pectineus and adductor brevis.

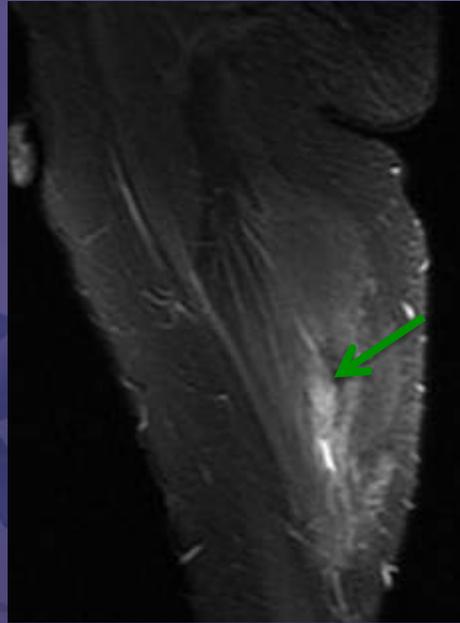
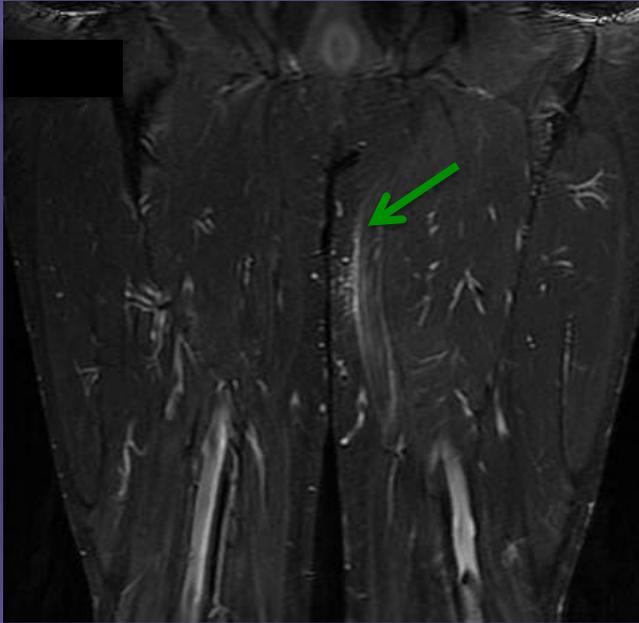
# OSTEITIS PUBIS



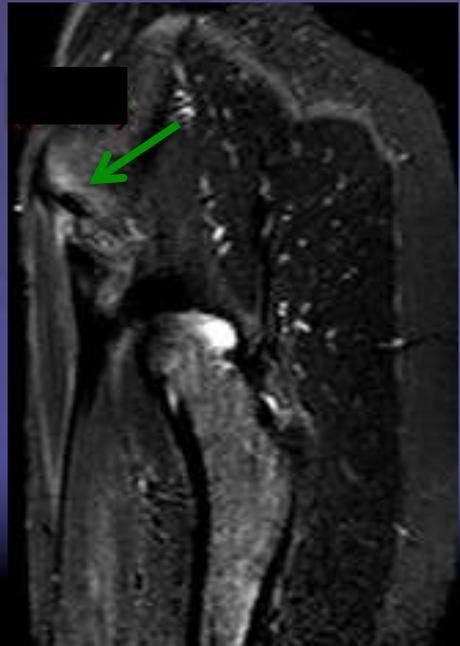
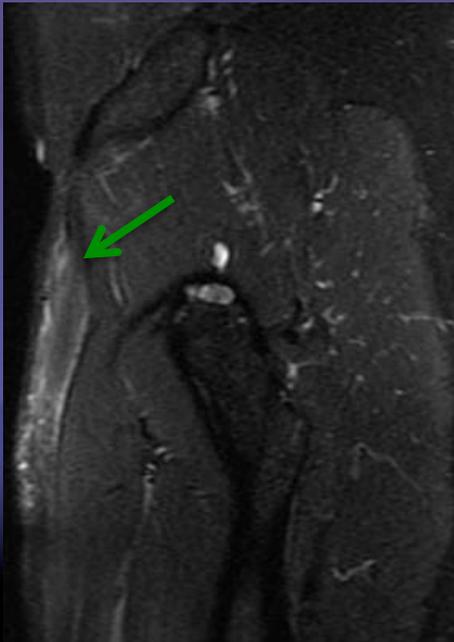
Osteitis pubis in a 23 year old soccer player with groin pain. Coronal and axial T1 fat-suppressed images demonstrate a joint space alteration, articular surface irregularity and bone marrow edema

There is no adductor tendon injury

# OTHER HIP MUSCLE INJURIES

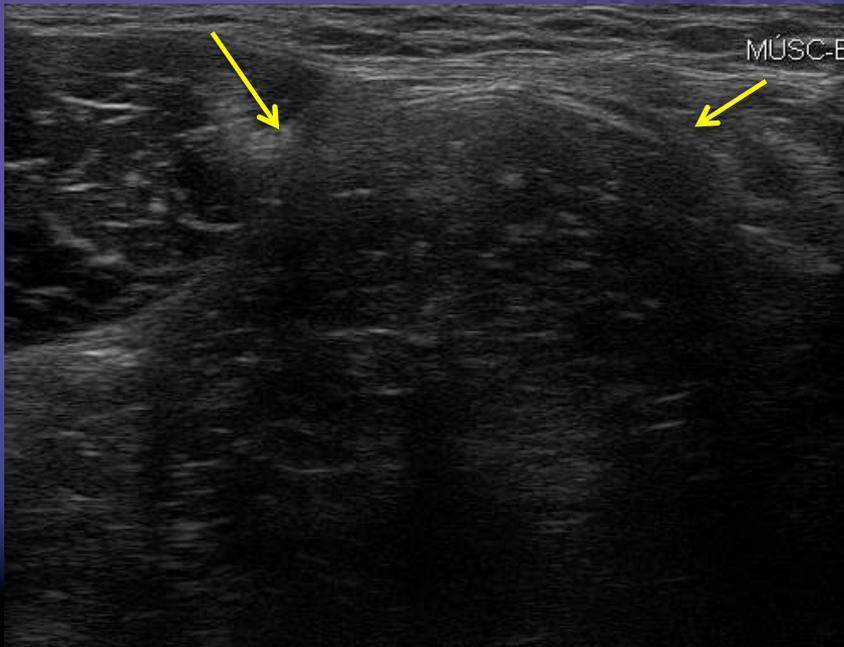
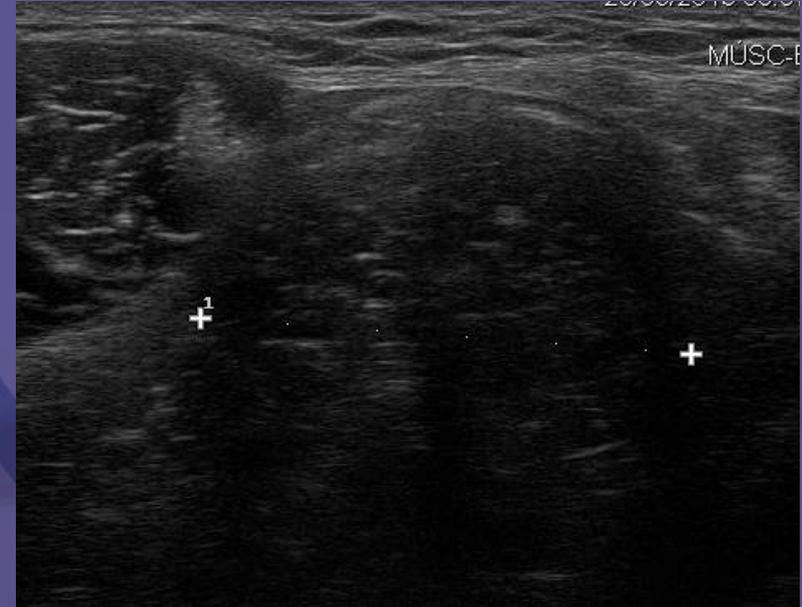
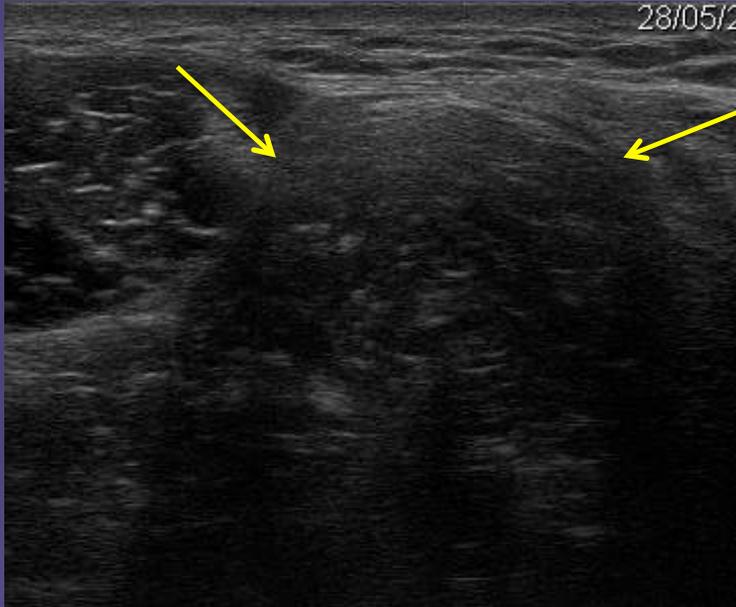


**Strain of gracilis muscle belly.** Coronal and sagittal FS FSE T2-weighted images depict high signal intensity in the left gracilis muscle (arrows) with surrounding fluid and edema. The muscle's fibers run vertically downward, ending in a rounded tendon.



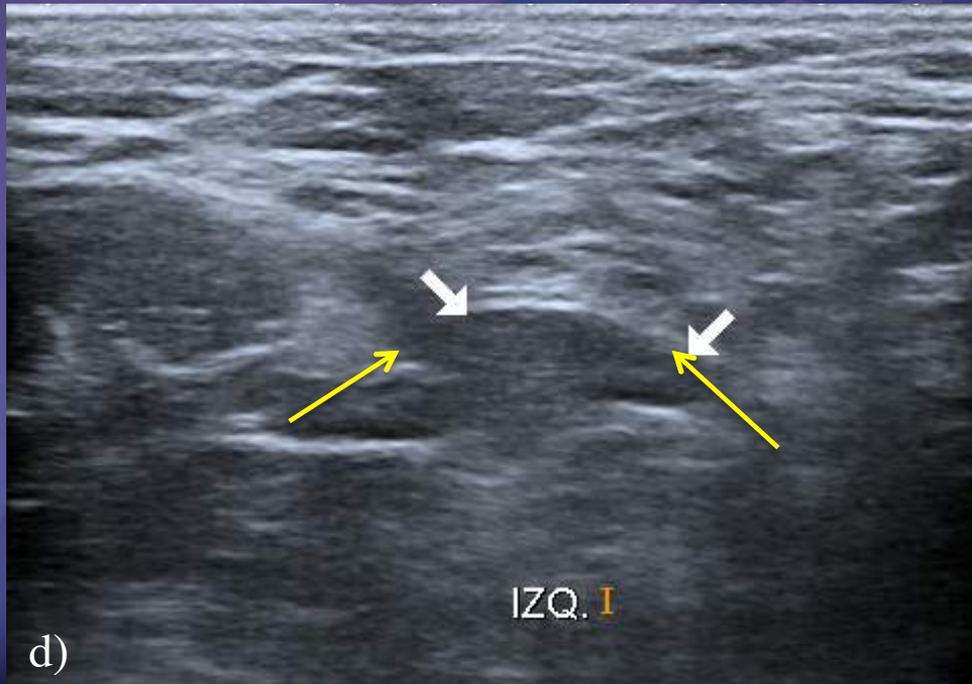
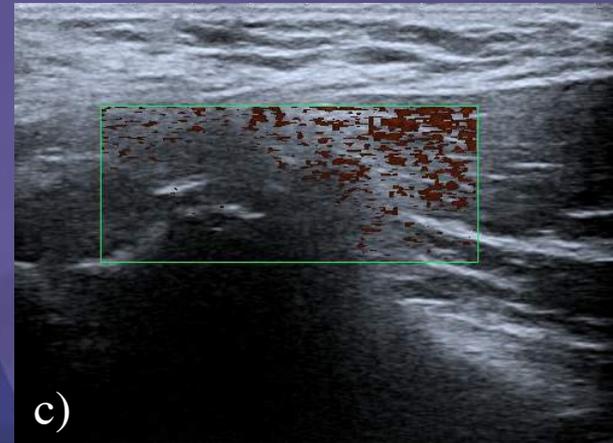
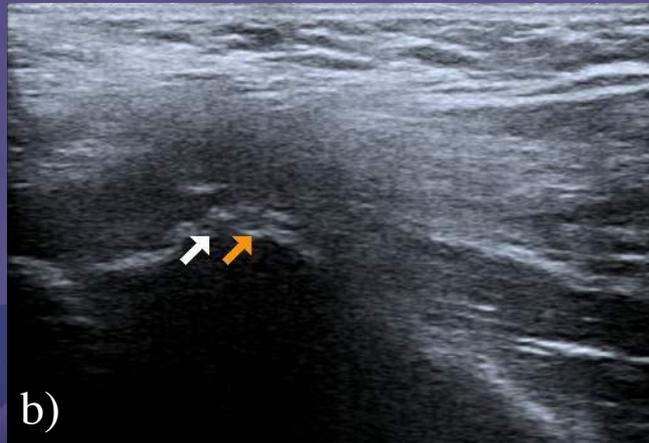
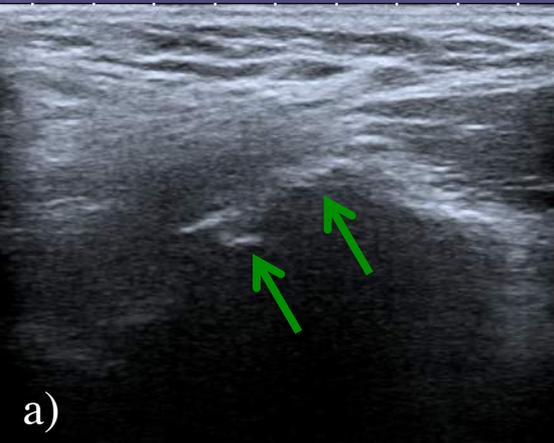
**Strain of sartorius and rectus femoris.** Sagittal FS FSE T2-weighted images and anatomic illustration picture increase signal intensity at the level of its insertions in the ASIS and AIIS respectively (arrows).

# INGUINAL HERNIA



A 30 year old football player. There is a right inguinal hernia during supine Valsalva maneuver. A conspicuous hernia passes medial to inferior epigastric vessels. Urinary bladder and mesenteric fat are not introduced within the hernia.

# SPORTS INGUINAL HERNIA



**Sports hernia patient with associated left adductor longus origin tendonitis.** The left adductor longus origin was tender over a zone of hypoechoic thickening that most conspicuously involved the more profound fibres with cortical irregularity. There is also increase blood flow within the tendons in the Doppler examination (a-b-c). The posterior inguinal wall on straining manoeuvre displaces anteriorly as a convex bulge (d) (yellow arrows).

# Summary

- The differential diagnosis of hip pain in young athletes is extensive and include intra and extraarticular pathologies. Furthermore, many potential causes have overlapping symptoms
- The compound of multimodality image methods (include MR, ultrasound and arthrography) along with a thorough physical examination help to determine a precise diagnosis in order to start the correct treatment in the shortest time as possible.
- Regarding the intraarticular injuries labral tears and femoroacetabular impingement are by far the most frequent causes, follow by ligament injuries.
- As for the extraarticular pathology adductor tendinopathy and muscle strains are the most usual conditions. Iliopsoas pathology, sports hernia and stress fractures come after.
- On the other hand, osteonecrosis as well as transient osteoporosis are not so common in young athletes.

 Deragopyan

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