Imaging of the hip and groin

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Abstract

Hip pain often poses a diagnostic challenge. History, clinical examination and imaging play a synergistic role in diagnosis. We will review a broad spectrum of diseases that contribute to hip and groin pain. In particular, we will illustrate the role of the various imaging modalities from the established to current most state of the art imaging.

Keywords diagnostic imaging; groin; hip joint; musculoskeletal pain

Introduction

The cause and investigation of hip or groin pain often poses a diagnostic challenge.[1] There are wide ranges of presenting symptoms including pain, inability to lie on one side, difficulty in walking, and gait abnormalities. The patient may present acutely, often secondary to trauma, or with more chronic symptoms. Aetiology may be developmental, traumatic, infective, inflammatory, or neoplastic in origin.[2] Hip pain is not just a manifestation of pathology within the hip joint but is often referred from other sources, a number of which are included in Table 1. Accurate clinical history and examination together with targeted imaging is essential. The benefits of this multidisciplinary approach should not be underestimated in this patient cohort.

A wide range of imaging modalities have a role in the diagnosis of musculoskeletal problems. The radiograph should still be the mainstay examination for any musculoskeletal problem. It is invaluable as a baseline investigation, providing bony definition and confirming alignment. Ultrasound is a safe, powerful tool providing exquisite soft tissue detail with the added advantage of providing a dynamic assessment. It is cheap, quick and lacks ionising radiation, however it can be highly user dependent. Magnetic resonance imaging (MRI) is also a powerful tool providing excellent spatial resolution, and delineation of soft tissue structures including muscles, tendons, and cartilage. It allows for multi-format tomographic imaging of these structures. This modality is limited by its availability and it can be time consuming. Use of contrast can further increase the sensitivity of the examination due to enhancement of vascular lesions and in the assessment of avascular necrosis. Multi detector computerized tomography (MDCT) provides excellent bony definition and endures a road map in surgical planning using reconstructed imaging. Lack of soft tissue definition and inherent small risks associated with ionising radiation limit this modality. Radioisotope study, positron emission tomography-computed tomography (PET-CT) and single photon emission computed tomography (SPECT) provide functional imaging. PET-CT and SPECT studies have the added advantage of incorporating bony definition of CT.

Common causes of coxalgia

Children	Developmental hip dysplasia (DDH)
	Legg Calve Perthes disease
	Slipped capital femoral epiphysis (SCFE)
	Juvenile idiopathic arthritis (JIA)
Children and adults	Transient synovitis
	Septic arthritis
	Osteomyelitis
	Fractures
	Malignancy/metastasis
	Avascular necrosis
Adults	Femoral-acetabular impingement (FAI)
	Sportman's hernia
	Muscle tears
	Arthropathy including inflammatory and seronegative arthritis
	Osteoarthritis
	Bursitis
	Tendinopathy
	Hernia
	Transient osteoporosis of the hip
	Intra-pelvic organ pathology
	Nerve entrapment
	Snapping hip syndrome
	Osteitis pubis

Table 1

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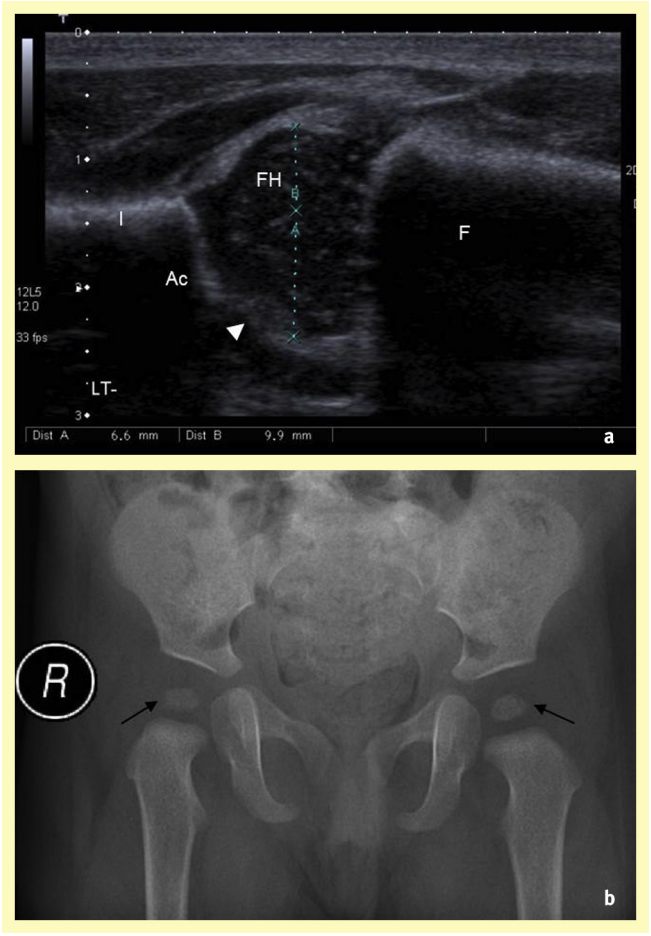

Figure 1 (**a**) Ultrasound shows normal left hip joint in an infant <6 weeks. Standard plane used for measuring coverage includes visible tri-radiate cartilage (white arrowhead) coinciding with a horizontal ilium (I). Note the speckled appearance of the unossified head (FH) enables correct interpretation of the ultrasound. Image illustrates a normal femoral capital epiphysis with more than 50% coverage and a well-rounded acetabular cup (Ac). F- Femoral shaft. (**b**) Normal radiograph of a child (note the ossified femoral heads in keeping with an infant >6 months in age) (black arrows).

Developmental hip dysplasia

Developmental hip dysplasia (DDH) is the most common congenital hip condition with under development of the acetabulum resulting in an abnormal relationship between the femoral capital epiphysis and the acetabulum. It is associated with instability, subluxation and dislocation. Early diagnosis is crucial in treating and limiting significant long term disability. At risk infants (family history, breech presentation and unstable hip at birth) are screened by early ultrasound at 3–6 weeks[3] (Figures 1 and 2). The examination includes both static and dynamic testing. Ultrasound is also used to evaluate patients with DDH treated with harness to assess hip stability with treatment. Patients who are not diagnosed early can present with pain, limp and deformity.[2] Patients presenting late require radiographic examination (Figure 3) rather than ultrasound as the femoral head is ossified by 4–6 months which makes evaluation of the femoral head's relationship to the acetabulum extremely difficult with ultrasound. Three-dimensional (3D) CT in older children for operative planning and 3D MRI have recently been suggested.[4] MRI and CT also have a role in post-operative assessment of the hip.

Slipped capital femoral epiphysis (SCFE)

SCFE is a common adolescent condition, especially in boys. It results in posterior and inferior positioning of the capital femoral epiphysis relative to the proximal metaphysis, through the physeal growth plate. It is a cause of hip pain in 8–15 year olds, who are commonly obese.[5] 20–30% of cases are bilateral and usually asymmetrical.[2] The SCFE is classified as stable or unstable, the latter requiring urgent fixation. Unstable slips are prone to avascular necrosis (AVN) of the femoral head.

Radiographic imaging plays a crucial role in diagnosing SCFE. The standard views acquired are anterior–posterior (AP) and frog-leg lateral views of both hips. The radiological signs (Figure 4) used in diagnosing SCFE on the AP radiograph are:

(1). 'Metaphyseal blanch sign of Steel' – blurring of proximal femoral metaphysis
(2). Widening of the physis

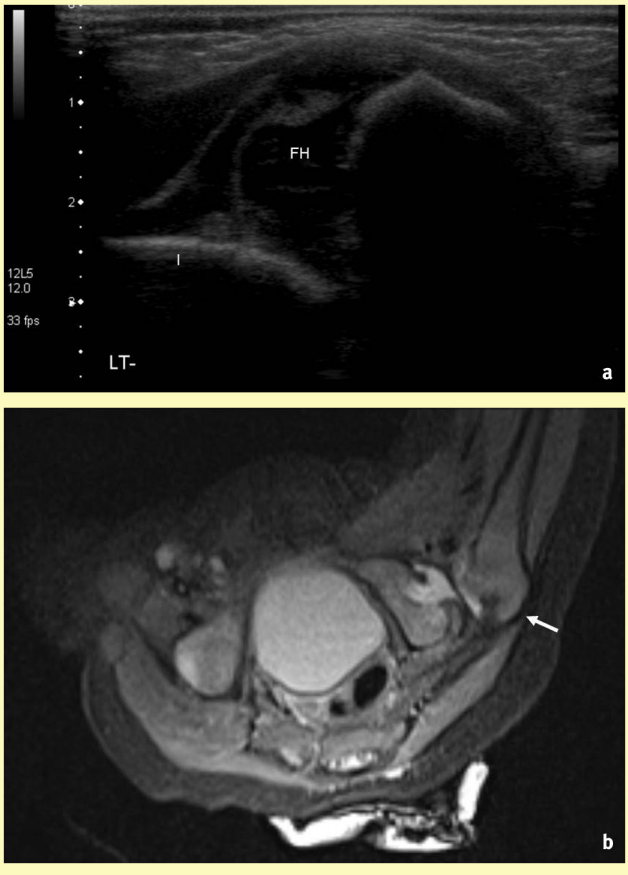

Figure 2 (**a**) Ultrasound shows dislocated left hip in a 4 day old infant. Note the speckled appearance of the head (FH), which lies away from the ilium (I) and dysplastic acetabulum. (**b**) Axial T2w fat suppressed MRI of the same patient shows the left femoral head is dislocated posteriorly (white arrow).