Ultrasound of the joints

Abstract High-frequency ultrasound is now considered an excellent modality to image normal tendons, muscles, and peripheral nerves as well as to diagnose a wide variety of pathological conditions affecting these structures. Although US is limited in the visualisation of some intra-articular structures, it can be a useful tool in joint disease assessment. Ultrasound has some advantages over other imaging modalities including time- and cost-effectiveness, superior spatial resolution, dynamic examination and the possibility to perform the examination in a comfortable position for the patient. The aims of this review are twofold: firstly, to present the normal US appearance of the joint structures that are susceptible to US examination, and discuss the role of US in the imaging strategy of joint disorders.

Keywords Ultrasound · Joint disorders · Sonography · Joint · Tendons

Introduction

Ultrasound provides useful information in assessing a wide range of joint disorders. Although US is not capable of visualizing some intra-articular structures due to shadowing of the overlying bone, it has some advantages over other imaging modalities in this field including time- and cost-effectiveness, superior spatial resolution, dynamic examination and the possibility to perform the examination in a comfortable position for the patient.

In this paper we review the normal US appearance of the anatomic structures located in and around the joints that are amenable to US examination, and discuss the US appearance of the most commonly encountered joint disorders.

Normal US anatomy

Ultrasound can evaluate the joint surfaces only in part, depending on the individual joint examined. Tight joints are most difficult to evaluate. The assessment of the articular surfaces of the hip, for example, is limited to the anterior portion of the femoral head. The posterior head and the acetabular surface are not visible at US due to a too deep location and posterior shadowing of the inter-
vening bones. Large and lax joints can be better examined by means of different manoeuvres that increase the extension of the articular surfaces to be explored. The articular surface of the humeral head, for example, can almost completely be evaluated if US scanning includes different approaches (anterior, posterior, axillary) with the arm at different degrees of rotation (internal, neutral and external rotation) and abduction. Similarly, forceful flexion of the knee joint, when achievable, allows evaluation of the trochlear surface by sonograms obtained over the suprapatellar region [1]. The US analysis of the joint surfaces reveals the subchondral bone plate as a regular, continuous hyperechoic line, covered by a hypoanechoic smooth and regular linear structure relative to the hyaline cartilage (Fig. 1) [1, 2]. The variations in the cartilage thickness are well detected and can be measured with US.

Because of their deep location and close contact with the bone, the menisci and the glenoid labrum can be evaluated only in part with US. Both structures are made of fibrocartilage and appear as hyperechoic triangular images adherent to either the bone (labrum) or the peripheral joint capsule (menisci) [3]. Dynamic examination of the posterior glenoid labrum shows changes in shape of the fibrocartilage during different degrees of rotation of the arm. Because the joint capsule inserts into the labrum, this latter structure is stretched in internal rotation and appears pointed and triangular in shape, while it assumes a more globular appearance in external rotation (Fig. 2). Nevertheless, the portions of the labrum that are more commonly injured as a result of trauma or sport activities are barely assessed by US. The anterior labrum is commonly torn in anterior shoulder dislocations while the superior labrum is detached in SLAP (superior labrum anterior posterior) lesions. In shoulder dislocation, US is not so accurate to evaluate labral tears, because of the deep location of the labrum and oblique orientation of the tear. In addition, the superior labrum cannot be assessed due to the intervening shadowing of the coracoacromial arch. Although the knee menisci can be depicted with US, they are quite difficult to evaluate in certain areas, such as the anterior horn of the lateral meniscus. Menisci appear as triangular hyperechoic structures with their base located superficially and the apex directed towards the inner joint. Because of their deep location and shadowing from adjacent bones, the apex of the menisci is difficult to assess. Other fibrocartilaginous structures, such as the triangular fibrocartilage at wrist, can be hardly evaluated with US as well.

The joint capsule appears at US as a hyperechoic line bordering the joint cavity and merging with the pararticular tissues.

Ultrasound depicts the ligaments as hyperechoic lamellar structures (Fig. 3) [4, 5, 6]. Ligaments are anisotropic and, therefore, are subjected to changes in echogenicity depending on the angle of incidence of the US beam. The typical fibrillar echotexture is well demonstrated only if the incidental beam is perpendicular to the