DOWNLOAD PDF IMAGING OF RHEUMATIC DISORDERS

Chapter 1 : Radiological imaging in pediatric rheumatic diseases

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This article has been cited by other articles in PMC. Abstract Magnetic resonance MR is used more and more frequently to diagnose changes in the musculoskeletal system in the course of rheumatic diseases, at their initial assessment, for treatment monitoring and for identification of complications. The article presents the history of magnetic resonance imaging, the basic principles underlying its operation as well as types of magnets, coils and MRI protocols used in the diagnostic process of rheumatic diseases. It enumerates advantages and disadvantages of individual MRI scanners. Furthermore, views on the need to use contrast agents to optimise diagnosis, particularly in synovitis-like changes, are presented. As of today, it is the only group of rheumatic diseases with MRI findings included in its criteria. As for other disease entities mainly systemic connective tissue diseases , the diagnosis, apart from clinical and laboratory data, is based on radiographs, which, as is widely known, specifically present only late pathological changes. Despite this, MRI is more and more common in rheumatic patients at early stages of the diagnosis, for treatment monitoring, early detection of complications as well as in confirming remission [2]. In spondyloarthritides, MRI findings can be the basis for implementing biological treatment. The article presents the basic principles underlying MRI operation as well as types of magnets, coils and MRI protocols used in the diagnostic process of rheumatic diseases, particularly rheumatoid arthritis. Magnetic resonance imaging hardware and magnets Magnetic resonance imaging is based on the well-known physical phenomenon of resonance, in this case magnetic resonance, i. The frequency of these waves is consistent with the resonance frequency of the scanned area and shows linear dependence on the strength of the Bo magnetic field. A radiofrequency coil RF coil which generates an additional magnetic field B1 perpendicular to Bo is both the receiver and transmitter of an MRI scanner. They create a stable homogeneous magnetic field, stabilised by solenoid coils bathed in liquid helium. Area-dedicated E-MRI units contain an air gap between two magnetic poles. They may utilise permanent magnets or electromagnets with a permanent C-shaped magnet that operates at low-to-mid field strength of 0. These coils can be superconductive or resistive and range from 0. In addition, preclinical research and mainly animal studies utilise units of high fields of 4. Disadvantages of low-field scanners, which result in their rare usage, include [5]: Fat suppression FS requires a homogeneous field and high magnetic field strengths, which are not available in low-field units [6]. However, new E-MRI units are emerging, operating at 1â€”1. Advantages of low-field scanners include: Coils Magnetic resonance imaging of specific anatomical regions, including the spine, wrist, hand, knee, ankle, foot, finger as well as head, breast etc. The hand and wrist, followed by the foot and ankle and cervical spine, are the most frequent locations of rheumatoid arthritis RA , and, at the same time, these regions are the most frequently scanned by MRI in RA patients. That is why the most frequent coils used in rheumatic patients are: Other coils used are:

Chapter 2 : Imaging Modalities in Rheumatic Diseases | Musculoskeletal Key

Imaging in peripheral and axial psoriatic arthritis: contributions to diagnosis, follow-up, prognosis and knowledge of pathogenesis S. Felbo, L. Terslev, M. Ã˜stergaard â€º Free to View CER

Received Sep 24; Accepted Dec 6. Unrestricted non-commercial use is permitted provided the original work is properly cited. This article has been cited by other articles in PMC. Summary Radiological imaging plays a fundamental role in the diagnosis and monitoring of rheumatic diseases. The basic method of imaging is a classic X-ray picture, which for many years has been used as a single method for the recognition and evaluation of the effects of disease management. In clinical practice, X-ray imaging is still an important examination performed not only to recognize the disorders, but also to provide a differential diagnosis. It helps estimate disease progression and is used to monitor the effects of treatment and the development of possible complications. Differential diagnosis of rheumatic diseases is performed on the basis of localization and type of radiographic changes. The surrounding periarticular soft tissues, bone structures, joint space, with special attention to articular bone surfaces and epiphyses, are analyzed. The aim of this work is to describe characteristic inflammatory changes present on X-ray imaging typical for the most commonly diagnosed rheumatic diseases in children, such as juvenile idiopathic arthritis, systemic lupus erythematosus, systemic scleroderma, mixed connective tissue disease, juvenile dermatomyositis, juvenile spondyloarthropathy and systemic vascular disease. In Poland, the incidence is approximately 6â€”7 children per , per year. Inflammatory involvement of the motor system during the period of rapid growth may result in some children entering adulthood as disabled individuals. In the era of modern therapy for rheumatic diseases that offers a possibility of sustained remission, early diagnosis is essential. Despite the introduction of ultrasonography USG and magnetic resonance imaging MRI [1 , 2], radiographs X-rays remains the primary baseline study performed in any patient with clinical suspicion of rheumatic disease [3 â€” 14]. X-ray is performed to: In many cases, radiological signs are characteristic of the individual disease entity. However, only an analysis of the clinical picture combined with the results of additional tests help establish the diagnosis. Furthermore, a large number of rheumatic diseases, overlapping syndromes or coexisting diseases may require further imaging methods, including histopathology, for the final diagnosis. In children, X-ray examination is most commonly performed in the diagnostic workup for: Radiologic assessment of the joints analyzes periarticular soft tissue, structure of bones forming the joint, including articular surface and joint space width. Irregularities visible on plain radiographs include [6 â€” 14]:

Chapter 3 : Nuclear imaging of rheumatic diseases | Musculoskeletal Key

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View Large The majority of the imaging techniques in cardiology could be also applied in RD, with variable diagnostic accuracy. Imaging techniques are essential in the early detection of CVD in RD, having significant therapeutic implications and improving patients long-term outcome. Involvement of pericardium Inflammatory pericardial involvement is the most common cardiac manifestation in various forms of RD [2 , 3]. Echocardiography is the most widely used imaging technique in the evaluation of suspected pericardial disease. Transthoracic echocardiography represents the gold standard for diagnosis of pericardial abnormalities, demonstrating the location and amount of even minimal pericardial effusion. The echocardiogaphic features of pericardial effusion are the pericardial layer separation with an echo-free space and the decrease in the parietal pericardium motion. If tamponade develops, which is a rare complication of RD, a several echocardiographic signs can be appreciated such as diastolic compression of right heart chambers, lack of inspiratory collapse of the dilated inferior vena cava and the swinging of the entire heart [5] Fig. Doppler echocardiographic patterns of tamponade include marked respiratory variations of right and left ventricular LV inflow and pulmonary and hepatic venous flow velocities. Echocardiography is also very instrumental if combined pericardial and valvular pathology is observed Fig. Echocardiography, parasternal short axis view. Tamponade in SLE demonstrating diastolic right atrial free wall collapse arrow. Ao, aorta; ra, right atrium; la, left atrium. View large Download slide Transoesophageal echocardiography, four-chamber view. Pericardial effusion arrowheads and two endocardial vegetations arrows in SLE. The vegetations are localized on atrial side of the base of the mitral leaflets. Pericardial thickening resulting from fibrosis or calcification can be presented as a small echo-free space or a single dense band of echoes. Since the pericardium is the most echogenic structure in the image, sensitivity and specificity of transthoracic echocardiography for pericardial thickening is low. Doppler assessment of diastolic flow patterns and the respiratory changes in these patients can provide compelling evidence for pericardial constriction and rule out the diagnosis of restrictive cardiomyopathy and cardiac tamponade [6]. Both cardiac MRI and CT in RD can also be used to assess the size and location of pericardial effusions, although they tend to overestimate the amount of fluid in comparison with echocardiography [7] Fig. Pericardial effusion is hypodense in comparison with the myocardium, with radiodensity ranging from 10â€”40 Hounsfield units, depending on the protein content fibrin and admixture of blood. If the amount of blood in the pericardium is small, differentiation from fibrosis chronic constrictive pericarditis , which displays about the same density, may be impossible [8]. Cardiac MRI, four-chamber view. MRI is useful in patients with loculated or complex configurations of pericardial effusions, which can be often found in RD. MRI has an advantage over CT in differentiating small pericardial effusions from pericardial thickening. However, MRI cannot distinguish between chronic pericardial thickening and calcifications. CT and MRI diagnosis of constrictive pericarditis is established only if the findings of systemic venous hypertension are confirmed, such as dilated superior and inferior vena cava, ascites, hepatomegaly and pleural effusion. MRI has high diagnostic accuracy for the definitive non-invasive diagnosis of constrictive pericarditis and its separation from restrictive cardiomyopathy. Furthermore, MRI could quantify functional abnormalities, namely LV systolic and diastolic dysfunction, which may be associated with pericardial diseases [10]. Involvement of heart valves Echocardiography is superior and the most frequently used technique for the evaluation of the patients with valvular heart disease in RD. This method offers the non-invasive and reliable information about valve morphology, the severity of valve stenosis or regurgitation, and the impact of valvular lesion on LV size and function. Transoesophageal echocardiography is considered to be more sensitive than transthoracic echocardiography in revealing valve abnormalities in RD [11]. The haemodynamic data are derived from Doppler echocardiography, and valvular regurgitation can be assessed by colour flow imaging of regurgitant jet. Valvular disease can be frequently diagnosed in SLE, as valvular thickening, vegetations and valvular insufficiency. Lesions are easily echocardiographically detected and are usually attached to the basilar portion of the aortic and mitral valve leaflets.

Chapter 4 : Magnetic resonance imaging in inflammatory rheumatoid diseases

Rheumatic diseases affect your joints tendons, ligaments, bones, and muscles. Among them are many types of arthritis, a term used for conditions that affect your joints. Sometimes they're called.

Menu Nuclear imaging of rheumatic diseases Advanced imaging techniques are promising tools to assist in the early diagnosis and monitoring of therapy in various rheumatic diseases. As there is now increasing emphasis on diagnosing inflammatory rheumatic disease in the pre-clinical stages, so that treatment may be instituted early and ideally prevent irreversible tissue damage, highly sensitive techniques are needed to detect subclinical inflammation. Moreover, there is an increasing need to develop individualised treatment protocols at reasonable cost and with optimal therapeutic effect. Tools are required that can image the therapeutic target and sensitively trace changes in disease activity. Nuclear imaging techniques have the potential to fulfil these clinical needs. Positron emission tomography is emerging as an important modality as it provides highly sensitive, quantitative imaging at a molecular level, to reveal the important pathophysiological processes underlying inflammation. This chapter provides an overview of currently available nuclear imaging techniques, including recent technical developments, and discusses their role in the diagnosis and monitoring of rheumatic disease. Introduction Timely diagnosis and early effective treatment can improve the outcome of various inflammatory rheumatic diseases. To enable early diagnosis and develop individualised therapeutic protocols, sensitive monitoring tools such as advanced imaging techniques are needed. Promising results have already been obtained with anatomical imaging modalities including magnetic resonance imaging MRI and ultrasound US , with highly sensitive detection of synovitis and bone marrow oedema in inflammatory arthropathies and vascular thickening in systemic vasculitides. Each technique, however, has drawbacks and limitations, as MRI usually produces images from only a limited field of view and US is operator-dependent and laborious if multiple sites need to be examined. Since the diagnosis of rheumatic disease and the assessment of disease activity are moving towards the subclinical end of the disease spectrum, nuclear imaging techniques may assume increasing importance. These techniques rely on visualisation of pathophysiological changes in tissues. In the 60s, nuclear imaging, that is, planar bone scintigraphy was introduced for the imaging of arthritis. This was followed by the development of more specific radiolabelled agents such as radiolabelled immunoglobulin in the 80s, then the introduction of single photon emission computed tomography SPECT and subsequently, in the 90s, positron emission tomography PET. In the first part of the chapter section Nuclear medicine imaging techniques , the different nuclear imaging techniques are explained, including strengths and weaknesses relevant to their use in rheumatic disease. Most of the summarised data are derived from feasibility studies in clinically active disease. However, nuclear imaging techniques are most likely to find their place as tools for early diagnosis, in particular in the preclinical phase, and in monitoring of therapy. These data, if available, are also included in the relevant sections. Nuclear medicine imaging techniques General characteristics Nuclear medicine imaging is based on the detection of gamma rays sometimes also called photons. Some unstable isotopes emit gamma rays when they decay to the ground state. Based on details of the composition of the unstable isotope, this decay can be accomplished by either the direct emission of a single gamma ray as is the case for 99mTc or the indirect emission of two gamma rays as is the case for 18F, which is a positron emitter. A combination of a biologically active molecule and such an unstable isotope is called a radiopharmaceutical. It is important to note that although the number of radioisotopes having properties that make them useful for imaging is limited, the potential number of radiopharmaceuticals is very large. This will be illustrated further on in this chapter. To begin the imaging procedure, the patient is injected with a radiopharmaceutical and, as a result, gamma ray emissions originating from within the patient can be detected by an external detector. This is in stark contrast to the X-rays of a CT scan, where the source and the detector are outside the patient and the patient is only subjected to radiation as long as the X-ray source is turned on. In order to do so, the gamma rays emitted from the patient need to be measured for a number of projections a projection refers to gamma rays travelling with a known and fixed orientation with respect to the origin of the field of view of the camera. This contrasts with planar scintigraphy, which only allows for 2D images to be acquired single projections. Until recently, there was hardly any exception to the rule that all measuring equipment was based on the combination of a scintillation crystal and a photomultiplier tube. In the scintillator, a gamma ray is converted into optical photons. The photomultiplier tube converts optical photons into photo-electrons, which are subsequently multiplied to yield a signal that is proportional to the energy of the incoming gamma ray and large enough to be processed by standard electronics. Introduced in the s, this measurement technique is still ubiquitous in every clinical nuclear medicine department. A number of excellent books exist that discuss the physics and some other general aspects of nuclear medicine imaging. The reader is referred to those for a more in-depth discussion of the topics briefly mentioned above. Single photon imaging planar scintigraphy and SPECT Single photon imaging was the first clinically relevant imaging technique. In order to acquire a single projection of gamma ray data, the detection of gamma rays needs to be limited to those with a well-known orientation in space. In single photon imaging, this is accomplished by placing a collimator in front of the scintillation crystal. A collimator ensures that incoming gamma rays are only detected when they travel perpendicular to the detector. This works well, but comes with a clear disadvantage: Typically, single photon imaging is performed with a camera that consists of one or more panel detectors. Where a stationary panel is used, the technique is called planar scintigraphy. Since only one projection is obtained, only planar images result. Usually, an anterior and a posterior image together form the basis for the diagnostic process. By rotating the panels, more than one projection can be acquired, allowing for full tomographic reconstruction of the emission data and therefore producing a 3D image. There is another dimension that is sometimes of interest â€" time. It is sometimes helpful to monitor the presence of activity over time in a certain region. With scintigraphy, such an approach is possible, assuming that the panel detector covers the complete region of interest. SPECT approaches require multiple projections and therefore the detection panels need to rotate, thereby limiting the temporal resolution. A positron loses its energy due to collisions with atoms and electrons and, after almost all energy is lost, it annihilates with an electron to form two gamma rays. These two gamma rays will be travelling back to back from the point of annihilation. This is not the case for a single gamma ray emission. Coincidence detection is therefore the outstanding requirement for PET imaging. These corrections include normalisation for detector or line of response , efficiency, scatter and attenuation correction. Contrary to the situation in single photon emission, attenuation and scatter correction can be carried out accurately in PET, leading to the claim that PET imaging is quantitative. Knowledge of the attenuation properties of the object being measured is necessary. Until the s, attenuation was measured with radionuclides, which were produced by an external gamma ray source. Since the CT image not only defined the attenuation properties, but also allowed for spatial localisation of the PET signal, it did not take long before it became virtually impossible to buy a stand-alone PET scanner. Strengths and weaknesses Table 1 presents a rather coarse overview of strengths and weaknesses of the various techniques that were briefly introduced above. In the text below the table the various issues are briefly discussed. Table 1 Only gold members can continue reading. Log In or Register to continue Share this:

Chapter 5 : Imaging Rheumatic Diseases

Advanced imaging techniques are promising tools to assist in the early diagnosis and monitoring of therapy in various rheumatic diseases. As there is now increasing emphasis on diagnosing.

Chapter 6 : Cardiac imaging in rheumatic diseases | Rheumatology | Oxford Academic

This issue of Rheumatic Disease Clinics includes articles such as: Imaging of inflammatory arthritis in adults: status and perspectives on the use of ultrasound, radiographs, and magnetic resonance imaging; Imaging of inflammatory arthritis in children: status and perspectives on the use of ultrasound, radiographs, and magnetic resonance.

Chapter 7 : Update on Imaging in Rheumatic Diseases

Key Points. X-ray is relatively inexpensive, easily available, and reliable. X-ray provides information on bone damage and, indirectly through joint space narrowing, on cartilage damage, whereas x-ray is neither sensitive nor specific for soft tissue change.