DOWNLOAD PDF MR AND CT ANGIOGRAPHY OF PERIPHERAL ARTERIES MARTIN N. WASSER AND ALBERT DE ROOS

Chapter 1 : Angiography - Wikipedia

Thanks to its expert analysis, procedural guide to implementation, and profound understanding of the recent advances in cardiovascular imagining, MRI and CT of the Cardiovascular System gives you all the tools necessary for powerful screening, diagnosis, and cardiovascular care.

Faster imaging, the ability to cover larger body volumes, and thinner section thickness with improved image quality 6. Faster imaging results in substantial reduction of acquisition time 7. Imaging of the abdominal aorta and iliac arteries can be performed in approximately 20 seconds with a 4-row MDCT depending on slice thickness and volume coverage and in usually less than 10 seconds with a more than 4-row MDCT, thereby generating less motion artifacts because of imaging in a single breath-hold and less pulsation artifacts because of reduced rotation time. The possibility to cover larger anatomic areas allows for new applications, such as evaluation of the entire thoracoabdominal aorta in a single breath-hold and imaging of the aortoiliac system and lower extremities in one acquisition with high spatial resolution 7. Thinner section thickness improves image quality and allows acquisitions with isotropic or near isotropic spatial resolution 1 , 7. Three-dimensional 3D visualization can facilitate image interpretation and might improve diagnostic accuracy. MDCT is superior to single-slice CT for nearly all applications, especially for imaging the vascular system 1 , 8. Compared with single-slice CT, there is a reduction in radiation dose, except when thin sections of high quality are acquired or when multiphase imaging is performed 3. Compared with single-slice CT, the injected volume of contrast medium can be reduced substantially by using more than row MDCT technology. MDCT has replaced x-ray angiography in many clinical vascular applications 6. Another advantage of MDCT for vascular imaging is that mural calcifications can be assessed, which are usually not well recognized with MRI. Disadvantages of CT are the use of ionizing radiation and the administration of a potentially nephrotoxic iodinated contrast medium. In this chapter the abdominal CTA technique will be discussed. Practical applications of MDCT for assessing the abdominal aorta and renal and mesenteric vessels will be reviewed. Both technical factors and patient-related factors affect the process of contrast enhancement. It is important to achieve homogeneous intravascular enhancement during imaging. Arterial enhancement depends on iodine concentration of the contrast medium used and the injection protocol 9. More enhancement is achieved with higher iodine concentration. Faster injection rates rather than increased contrast medium volume also provide more enhancement, because a higher concentration of iodine is injected over time 9. Several contrast injection protocols have been used for CTA. Uniphasic injection protocols with fixed scan delay, injection volume, and injection rate usually result in sufficient aortic enhancement An interactive protocol, in which the injection of contrast medium is stopped manually, can be used to reduce the volume of contrast medium administered Uniform, plateau-like arterial enhancement can only be achieved using a biphasic injection protocol A biphasic injection protocol starts with a small bolus with a high flow rate, followed by a larger bolus with a lower flow rate A saline flush is recommended to flush the veins and push the contrast column into the circulation to reduce the amount of contrast agent 6. Contrast injection for abdominal imaging is preferably administered in a cubital vein. Coronal curved planar reformation CPR presentation in the abdominal aorta and right iliac artery in a patient with an abdominal aortic aneurysm AAA. Inhomogeneous enhancement in the abdominal aorta and iliac arteries because of turbulent flow. Major patient-related factors determining contrast enhancement are body habitus and cardiac status. In case of an abdominal aortic aneurysm AAA , enhancement can be inhomogeneous because of turbulent flow Fig. Because of these and other differences in circulation dynamics between patients, scanning with a fixed delay is not recommended In addition contrast volume and injection rate need to be adjusted according to patient weight to achieve optimal vascular enhancement. Solutions to optimize scan delay for determination of the optimal enhancement phase in a single patient are bolus triggering and the use of a test bolus. With the first technique, a region of interest is placed in the distal descending aorta for abdominal CTA. During contrast injection, low-dose nonincremental scans are obtained in a dynamic fashion. The attenuation is monitored in the region of interest and when a predefined enhancement threshold is reached, for example, HU, the CT scan starts automatically with a delay of a few seconds, depending on the type of CT scanner 6. A region of interest is placed in the distal descending aorta for abdominal CTA and during injection of to mL contrast medium, the test bolus, a series of low-dose nonincremental CT scans are obtained. An enhancement curve is then automatically calculated, and the time to maximum enhancement equals the mean contrast transit time. The time to maximum enhancement is set as the scan delay. However, scanning should be started after an extra delay of approximately 10 seconds, because with a large contrast bolus maximum enhancement is achieved later compared with a test bolus because of the accumulation of the contrast agent in the blood vessels 6. With shorter acquisition times, the amount of contrast agent to be injected can be reduced, but higher injection rates are required for optimal enhancement. When parenchyma imaging is also required e. Oral contrast administration is not advisable for vascular imaging; superposition of bowel loops filled with contrast medium can hamper the evaluation of the contrast-enhanced blood vessels, especially when reconstructions are obtained. However, when oral contrast administration is required for imaging, negative contrast medium e. In addition, the use of negative oral contrast agents facilitates assessment of the bowel wall when bowel ischaemia is suspected. Two-dimensional 2D and 3D reconstructions of high quality can be produced from this dataset. With 4- or row MDCT, section thickness of 1 to 1. With thinner section thickness, scanning is not fast enough for covering the entire body volume of interest, whereas with row MDCT, section thickness of 0. Our standard scan protocol for the Aquilion 64 Toshiba Medical Systems, Toshiba cooperation, Tokyo, Japan for the abdominal aorta and mesenteric vessels is performed in the supine position, with the arms elevated. Scanning is performed during a breath-hold. Section thickness is 0. The selected kV is , the milliampere varies per patient because tube current modulation is used, and the rotation time is milliseconds. Contrast agent volume and flow is adjusted according to patient weight. Delay is determined by bolus triggering, and scanning starts with a delay of 10 seconds when an enhancement increase of HU is reached. Multiplanar reformation MPR presentation in the mid-sagittal pane. Patient with an AAA and penetrating ulcers anteriorly arrow. The focus of interest penetrating ulcer is clearly depicted with this MPR technique, although the larger part of the aorta is not visualized in this plane. For the renal arteries slice thickness is 0. Tube current modulation is used resulting in different milliampere per patient; kV , and rotation time milliseconds is unchanged. Standard vascular protocols for the Aquilion Toshiba Medical Systems routinely use a slice thickness of 0. Helical pitch is 65, and reconstruction index and interval are 1 and 0. For example, routine multislice CTA of the abdominal aorta with a scan range of 30 cm performed with 1-mm collimation and a reconstruction index of 1 mm and reconstruction interval of 0. Using slice CT scanners, collimations of 0. Using these parameters, images are generated for the same scan volume. However, in our opinion, using slice thickness of 0. Imaging the peripheral arteries generates even more images, because the scan volume is much larger. Workstation-based review is necessary not only to evaluate the axial images, which still remains the primary mode for evaluating the abdominal aorta 14 , but also to generate reconstructed and 3D images Several reconstruction techniques can be used, which allows better evaluation of the entire vasculature. Same patient as in Figure CPR presentation in the sagittal plane through the aorta and right iliac artery. CPR presentation allows better evaluation of the vascular system through the entire dataset, especially with tortuous atherosclerotic arteries. An MPR is a 2D reconstruction in any coronal, sagittal, or oblique plane. MPR presentation is easy to use, but restricted to a single 2D plane. Therefore it is of limited value for vascular imaging, especially in tortuous arteries Fig. A more sophisticated technique is curved planar reformation CPR. With CPR reformation, the display planes curve along an anatomic structure through the entire dataset 16 , for example, the abdominal aorta and a single iliac artery Fig. This technique is a valuable tool for vascular imaging. At the same time, additional perpendicular images are displayed, allowing better evaluation of diameters, stenosis, and thrombus composition, thereby improving visualization of eccentric lesions. Maximum intensity projection MIP presentation in the anteroposterior plane in a patient with occlusion the left iliac arteries arrows and left superficial femoral artery dotted arrow. Editing was performed to remove overlying bone. MIP presentation shows an angio-like image. MIP presentation visualizes only the brightest structures in a selected plane e. Thick- or thinslab MIP images can be obtained. Thin-slab images allow better visualization of complicated anatomic structures. A limitation of the MIP technique, because it is a projection technique, is that more attenuated structures like bones obscure the contrast-enhanced blood vessels Editing to remove overlying structures from the MIP images is usually time consuming. Another limitation of MIP presentation is the absence of the appreciation of depth relationships, especially in regions with a complex anatomy MIP presentations are sometimes inadequate for visualizing small vascular structures, for example, accessory renal arteries in living-related kidney donors. The latter can include multiple vessels in a single image with improvement of the interpretation efficiency VR is the most complex technique Fig. With VR, every voxel value is assigned an opacity level, ranging from opacity to transparency. The opacification function can be applied to a selected region in the histogram of voxel opacity values, thereby visualizing the selected tissue of interest, for example, blood vessels Colors can be applied to the attenuation histogram, to differentiate voxel values and, for instance, to distinguish a calcified plaque from enhancing arterial lumen. VR presentations can be used for virtual endoscopy to evaluate the internal surface of tubular structures 13 , Mostly basic VR presentations are provided by dedicated post-processing software without prior editing. In addition, smaller regions of interest can be isolated from the scan volume manually by using dedicated software. Basic volume rendering VR presentation of abdominal computed tomographic angiogram CTA directly provided by dedicated postprocessing software without editing. Note the infrarenal aortic aneurysm. Additional visualization techniques like MIP and VR presentations are most often used in vascular imaging.

Chapter 2 : MRI and CT of the cardiovascular system (edition) | Open Library

MR and CT angiography of peripheral arteries / Martin N. Wasser and Albert de Roos MRA and CTA of the extracranial carotid arteries / Pierson Chiou and Charles M. Anderson Catheter tracking and devices / Harald H. Quick.

Received Jan 14; Accepted Aug This article has been cited by other articles in PMC. Abstract Background Endovascular or intra-arterial treatment IAT increases the likelihood of recanalization in patients with acute ischemic stroke caused by a proximal intracranial arterial occlusion. However, a beneficial effect of IAT on functional recovery in patients with acute ischemic stroke remains unproven. The aim of this study is to assess the effect of IAT on functional outcome in patients with acute ischemic stroke. Additionally, we aim to assess the safety of IAT, and the effect on recanalization of different mechanical treatment modalities. IAT may consist of intra-arterial thrombolysis with alteplase or urokinase, mechanical treatment or both. Mechanical treatment refers to retraction, aspiration, sonolysis, or use of a retrievable stent stent-retriever. Electronic supplementary material The online version of this article doi: Alteplase, Urokinase, Endovascular treatment, Acute ischemic stroke, Randomized controlled trial, Stent, Thrombectomy Background Intravenous thrombolysis Treatment with intravenous IV alteplase, aiming at early reperfusion, has been proven effective for patients with acute ischemic stroke when they are treated within 4. The number of patients eligible for treatment with IV alteplase is limited because of the restricted time window [1 â€” 3]. The likelihood of a proximal occlusion increases with severity of neurological deficit at presentation [5 , 6]. In patients without recanalization outcome is generally poor [7]. Intra-arterial treatment Delivery of the thrombolytic agent at the site of the occlusion may improve the likelihood of recanalization, reperfusion of still viable tissue and, hence, recovery of neurological deficits. Several randomized clinical trials of intra-arterial treatment IAT for acute ischemic stroke have been conducted and published [8 â€” 10]. Although the results of these trials suggested a benefit, they have to be interpreted with care and cannot be extrapolated to the current clinical situation since IV alteplase was not an option, neither as pre-treatment nor as part of the control treatment. The sponsor terminated the trial prematurely because of futility; there were no safety concerns. Several factors may have contributed to the absence of a treatment effect: In the intervention group, 4. In this study, confirmation of an occlusion at the time of randomization was not required and only a small group of patients was treated with a stent-retriever 23 patients, Intravenous and intra-arterial thrombolytic treatment The combination of IV and intra-arterial alteplase has been described in observational studies and in one other randomized controlled trial [13]. Some studies adjusted the intravenous dose to 0. The incidence of hemorrhages was no larger than in studies of treatment with IV thrombolysis only [14 â€” 18]. In case series, IAT with low dose intra-arterial alteplase was preceded by full dose IV alteplase that is, 0. These studies suggest that, in patients who have been treated this way, recanalization rates can be high without unacceptably high risks of complications. This study showed no beneficial effect of the intervention overall, or in the pre-stratified subgroup of patients with penumbra [22]. Since the first application of IAT for acute ischemic stroke, new techniques for mechanical treatment have been developed. Mechanical treatment is a promising approach, either as a primary intervention or as secondary treatment in patients who fail IV thrombolysis, or in patients for whom thrombolytic agents are contraindicated. Mechanical techniques include retraction, aspiration, stenting and other techniques, such as local ultrasound-augmented fibrinolysis. Studies suggest that, in experienced hands, mechanical thrombectomy devices can be safe and may lead to substantial recanalization rates [23]. The results of two randomized clinical trials comparing retrievable stents with a retraction device suggest that use of a retrievable stent leads to recanalization more often than use of a retraction device. No comparison was made with standard treatment [24 , 25]. The treatment is provided in addition to best medical management according to national and international guidelines, and may include IV thrombolysis. Patient inclusion started in December

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Chapter 3 : MRI and CT of the Cardiovascular System

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