Recent Developments in Contrast-enhanced Body MR Angiography

Contrast enhanced MR angiography (MRA) has experienced significant improvements over the recent years. The objective of this presentation is to review and discuss the most pertinent recent achievements in contrast enhanced abdominal and pelvic MRA. Typical indications for abdominal and pelvic MRA include detection, quantification and assessment of arteriosclerotic plaques in the aorta and its major branches. The presence of aneurysms, dissections or vasculitic changes needs to be evaluated. Special focus is placed on renal artery disease.

Improvements in hardware such as high performance gradients, high field MR scanner, and multiple receive and dedicated coils systems will be discussed. Next, improvements in sequence design such as innovative k-space sampling strategies, parallel imaging techniques and image reconstruction algorithms will follow.

A special focus will be placed on the benefits and utility of time-resolved contrast-enhanced MRA (tr-CE-MRA) (1) that has continuously gained importance in clinical MRA protocol. Even in a large field of view tr-CE-MRA has demonstrated constantly high-quality MRA. In addition, the dynamics of tr-CE-MRA separate arteries from veins and offer additional information on vascular pathologies (2).

Furthermore, innovative contrast agents such as high relaxivity contrast agents have lead to significant improvements in abdominal and pelvic MRA and have facilitated the use of lower contrast agent doses needed. For example one study demonstrated that gadobenate dimeglumine (Gd-BOPTA) at a dose of 0.1mmol/kg was comparable to gadopentetate dimeglumine (Gd-DTPA) at 0.2mmol/kg for contrast-enhanced renal MR angiography (3).

In the context of nephrogenic systemic fibrosis (NSF) and its association with gadolinium based contrast agents the potential of low dose CE MRA has been investigated recently. This presentation will not elaborate NSF in greater detail, as this topic will be covered elsewhere during this conference. However, with recent evidence that suggest a dose dependency of the NSF risk the idea of low dose contrast enhanced MRA has become more and more pertinent (4).

In this circumstance the utility of MR scanner with higher field strengths such as 3 Tesla will be discussed. Background suppression is improved at 3 Tesla, the SNR is almost doubled as compared with 1.5Tesla (5), and with prolonged T1 times of most tissues the effectiveness of contrast enhanced MRA is significantly increased. For example, in a head to head comparison MRA at 3.0 T provided better vessel visibility and SNR than did that at 1.5 T, although voxel size and imaging time were reduced (6).

Finally, the introduction of the blood pool agent gadofosveset that reversibly binds to albumin yielded extended intravascular enhancement. This opened the potential for increasing the spatial resolution and facilitating the examination of multiple vascular beds (7).
References:


