Whole-body MR Angiography with parallel imaging – benefit of a dedicated 32 channel whole-body MR scanner equipped with a matrix coil system at 1.5 and 3.0 Tesla

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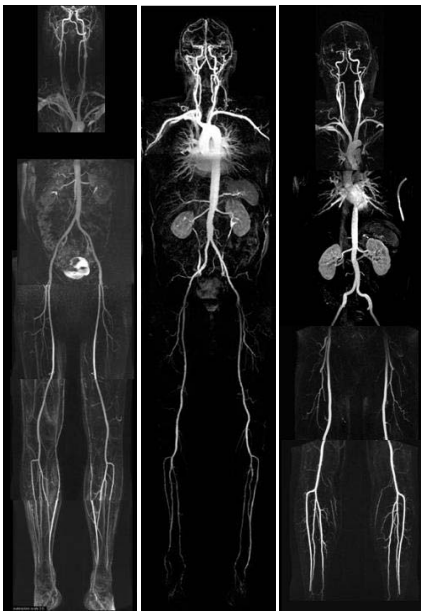
Purpose: In the last years MRA has become a serious alternative to other imaging methods [1]. However, a drawback of this method was the restricted field of view of maximal 50cm. Recent developments in MR system technology helped to overcome this limitation and thus not only imaging of circumscribed vessel territories but also whole-body (WB) MRA is possible [2]. The aim of the study was to evaluate the increase of image quality of a dedicated whole-body MR system equipped with 32 receiver channels and a matrix coil system in 3D CE MRA with parallel imaging at 1.5 and 3T compared to a standard 1.5T MR system.

Materials and Methods: 126 individuals participating in a healthcare program underwent a WB MR examination including WB 3D CE MRA. Group A (n=42) was examined on an 8 channel standard 1.5T MR system (150cm table movement), group B (n=42) on a 32 channel dedicated whole-body 1.5T MR system (205cm table movement) and group C (n=42) on a 32 channel dedicated whole-body 3.0T MR system (185cm table movement). Due to the different capabilities of the MR systems different injection and scan schemes had to be used on the three scanners to get best image quality. In group A patients had to be repositioned during the exam because of the limited range of table movement and the restricted FoV of 350mm compared to 500mm in Group B and C, MRA was performed in two steps with two contrast agent (CA) injections. For groups B and C a dedicated WB MRA injection protocol also with two CA applications was used to avoid venous enhancement (**figure 1**). In group A scan time was 72s, in group B 88s, in group C 85s (times are the sum of four to five single steps for each system respectively). On all MR systems parallel imaging was used and spatial resolution was less than 1.4 x 1.0 x1.6 mm^3 in every station (**table 1**) [3]. For image evaluation all WB MRA were divided into 24 vessel segments from the skull base to the distal calf. Image quality was rated on a three point scale in terms of vessel conspicuity whether good, moderate or poor; venous overlay and artifacts were judged as none / absent, mild or major. All datasets were read by two different radiologists working independent and blinded to each other. Inter-reader-agreement was calculated by the kappa-statistics.

Results: On the standard MR scanner 73% of all vessel segments were rated as good, nearly 80% showed no artifacts and more than 85% exhibited no venous overlay. On the dedicated whole-body 1.5T scanner more than 80% of all vessel segments showed a good vessel conspicuity, more than 90% showed no artifacts and more than 95% had no venous overlay due to the improved MRA protocol. On the 3.0T system values could be further increased, 88% showed good vessel conspicuity.

Conclusion: Because of the greater flexibility while scanning with a whole-body imager equipped with a matrix coil system image quality increases in terms of vessel conspicuity, artifacts and venous overlay. The problem of venous overlay in step by step MR angiography could be solved due to a dedicated imaging and CA injection protocol.



A) B) C)

Figure 1: Examples of the three different Groups. A) 1.5T standard MR system, B) 1.5T dedicated WB MR system and C) 3.0T dedicated WB MR system.

	Group A		Group B		Group C	
	acq. time	spat. res.	acq. time	spat. res.	acq. time	spat. res.
carotids	19s	0.9x1.7x1.3	21s	1x1x1	20s	1x1x1
abd. aorta	21s	1.6x0.8x1.5	15s	1.6x1x1.5	18s	1.4x1.1x1.1
pelvis	10s	1.4x1.0x1.5	na	na	na	na
thigh	10s	1.3x0.9x1.3	15s	1.6x1x1.5	21s	1.4x1.1x1.1
calf	21s	1.2x1.0x0.9	37s	1.2x1x1	26s	1x1x1

Table 1: Acquisition time for all different MR systems used in the different groups. In group B and C only four stations were necessary to cover the entire arterial vasculature due to a FoV of 500mm. Pelvic arteries are displayed in the abdominal and thigh station. Different parallel imaging acceleration factors were used, thus spatial resolution at the same acquisition time and vice versa can differ.

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