

Chapter 9

Summary

Rapidly provided feedback by preview images using a graphical user interface (GUI) has proven to be a powerful and useful addition to the 3D MR DSA technique. This has overcome one of the principle shortcomings of the newly developed contrast-enhanced MR Angiography technique (namely the long delay-time between the scan and the first reconstructed images) and the fact that the reconstruction process was complex and could not be performed without significant technical support

All of these limitations have been overcome by

- the devised implementation and evaluation of preview image algorithms
- the implementation of the GUI
- and the integration of the preview images into the GUI

Delay in the off-line reconstruction of images is mainly due to the data transfer from the scanner to the workstation and the 3D Fourier transforms for the reconstruction of the images. Therefore, methods for rapidly generating preview images should need only a portion of the full raw data set and should need fewer Fourier transforms. Different methods (single and multiple slice reconstruction, Fourier projection with the projection-slice theorem, and reconstruction from reduced k -space) have been compared in terms of data volumes, number of operations, and image quality.

The preview images obtained by the Fourier projection worked well for the carotid artery. Different observers were asked to determine time frames containing specific information such as the peak arterial frame and the number of arterial-only frames in a blinded study. The result of the evaluation was

that the observers were able to identify these time frames using the rapidly generated preview images, even though these images were of lower quality. However, it was difficult to determine the specific time frames in regions with high background signals such as the lower extremities. In these cases, preview images generated from reduced k -space showed promising results.

The GUI itself was also evaluated. Each observer had to identify the specific time frames on the screen rather than from a film. Again, the preview image quality proved to be sufficient to find the time frames described above. The implemented user interface automatically starts the generation of preview images and assists in the reconstruction process, allowing others outside of the research-group to take advantage of 3D MR DSA. The GUI can be easily expanded for sophisticated visualization techniques, post-processing methods, and data-management.

The availability of rapid feedback on the scan and a graphical user interface may help 3D MR DSA to become more than just a research tool at the University of Wisconsin-Madison. The graphical user interface has been designed so that it may serve as a platform for future 3D MR DSA extensions and even more advanced research tools. For example, attempts have been made to incorporate some of the principles of 3D MR DSA into interventional MR.