Evaluation of Cranial MRA using the novel technique SLINKY and comparison with standard 3D Time of Flight MRA

A.M. Obuchowski,1 D.L. Lefkowitz,1 L.S. Kode,1 K. Liu,2 R.P. Gullapalli,1
1University of Maryland School of Medicine, Baltimore, MD; 2Picker International, Highland Heights, OH

INTRODUCTION

Sliding Interleaved k (SLINKY) is a new time of flight technique that uses sliding interleaved multiple thin slab excitation.1 Since thin slabs are excited, the saturation effects seen on standard single slab 3D-TOF technique are minimized. In addition the slab boundary artifacts (or venetian blind artifacts) which are commonly seen in multiple overlapped thin slab acquisition (MOTSA) technique are eliminated.2,3 The purpose of this study was to evaluate the ability of SLINKY in discriminating small peripheral cranial vessels in comparison to the standard 3D TOF MRA with magnetization transfer contrast (MTC) sequence on patients referred for MRA. In addition, the performance of SLINKY was evaluated with and without the use of MTC.

METHODS

All imaging was performed on a 1.5T Picker Edge Eclipse scanner equipped with high performance gradients using the standard head coil. 3D-TOF flight angiogram of the circle of Willis was obtained using a single slab containing 60 slices of 1mm each. The sequence parameters were TE/TR/flip 6.71/40/30 at a FOV of 20 cm and a resolution of 192x512. MTC was applied at 1.5 kHz from the resonance frequency. Similar parameters were used for SLINKY and MOTSA except that the single slab was partitioned to five slabs of 12 slices each. For SLINKY without MTC, a TR of 29 ms and a flip of 24° was used which reduced the scan time by 2 minutes compared to SLINKY with MTC. MR angiograms of the circle of Willis were performed in sixteen unrandomized consecutive patients referred for MRI/MRA of the brain. Separating anterior and posterior circulations yielded 32 angiograms for review by three neuroradiologists.

RESULTS

Figure 1 shows comparison of images obtained with standard 3D-TOF and SLINKY with MTC. As can be seen, the standard 3D-TOF flight suffers from saturation effects in the small peripheral vessels and even in the major vessels superior to the slab. These effects are minimized to a great extent in both SLINKY acquisitions where the peripheral vessels are very clearly visualized. In addition the slab boundary artifacts are eliminated as is commonly seen with the MOTSA technique. SLINKY with MTC provided only a marginally better background suppression compared to SLINKY without MTC at shorter TR’s suggesting shorter acquisition times can be achieved compared to conventional 3D-TOF angiograms. In these initial 16 patients, the three neuroradiologists agree that in all cases, the SLINKY images consistently, better demonstrated the branches of the anterior circulation, specifically the insular branches of the middle cerebral arteries. In all territories the SLINKY images allowed increased conspicuity of all major branches and visualization of small peripheral branches not seen on the 3D-TOF angiograms. Subsequent scanning of a patient with a small 3x4x5 mm left posterior frontal-parietal superficial AVM nidus revealed similar results. Only the SLINKY images were able to visualize the feeding arteries. Findings from catheter angiograms better correlated with SLINKY angiograms compared to 3D-TOF angiograms.

CONCLUSION

Smaller distal vessels were better seen using multiple thin slab SLINKY compared to those obtained using single slab 3D-TOF technique even when used in conjunction with ramped RF pulses. These preliminary findings suggest that in patients with TIA’s or anterior circulation syndromes, SLINKY MRA is the optimal imaging technique. The ability of SLINKY MRA to visualize smaller vessels along with its increased conspicuity and improved edge enhancement of larger vessels, may allow us to diagnose smaller aneurysms (in both anterior and posterior circulations). SLINKY MRA may provide the ability to consistently diagnose and, perhaps more importantly, provide the ability to exclude the presence of aneurysms as small as 2 mm. Clinically, this may translate into the more selective use and reduced complexity of catheter angiography studies.

REFERENCES


Figure 1. Comparison of single slab 3D-TOF with 5 thin slabs of SLINKY covering the same area.