

# Vascular Wall Area Measurement in Atherosclerotic Carotid Artery: Comparison between CTA and High-Resolution MRI

J. Cai<sup>1</sup>, L. Yang<sup>1</sup>, Y. Cai<sup>1</sup>, C. Yuan<sup>2</sup>

<sup>1</sup>Radiology, The Chinese PLA General Hospital, Beijing, China, People's Republic of, <sup>2</sup>Radiology, University of Washington, Seattle, Washington, United States

## Introduction

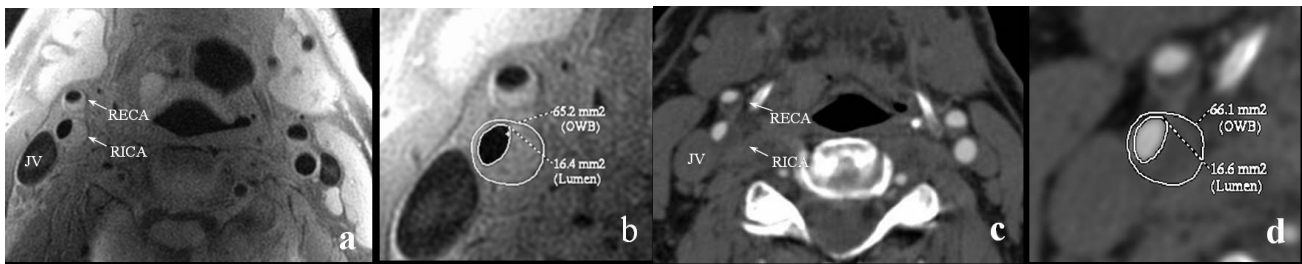
High-resolution MRI has been shown to be capable of accurately measuring the wall area of atherosclerotic human carotid artery [1,2]. Using the new generation of multi-slice-spiral-CT-scanners, CTA of the carotid arteries is possible with improved spatial resolution and coverage. In this study, we assess the accuracy of CTA in quantifying the vascular wall area in atherosclerotic carotid artery.

## Methods and Materials

**Eighteen** subjects (male 15, female 3, aged 63±8 years) with ≥50% stenosis in at least one side of the carotid artery were recruited for the study. CTA and high-resolution MRI scans (in-plane pixel size is 0.25mm×0.25mm for both) were conducted within 1 week on a multi-slice-spiral-CT scanner (Lightspeed 16, GE Medical Systems) and a 1.5T MR scanner (Signa, GE Medical Systems), respectively. For CTA examination, a total volume of 100 ml of nonionic contrast material (Omnipaque 300; Nycomed) was administered at a rate of 3 ml/sec by using a power injector. MR sequence was double inversion recovery (DIR) fast spin echo (FSE) T1W images [TR/TI/TE: 800/650/9]. Informed consent for CTA and MRI was obtained from all of the patients. **For** each patient, ten matched slices (2mm thickness, 5 slices below and 5 slices above the bifurcation) were selected from bilateral carotid arteries to measure the outer wall boundary (OWB) area, lumen area and wall area. All the data were measured by GE workstation (ADW4.1 platform). **Bland** and Altman analysis and the correlation coefficients were used to analyze the relationships of the area measurements between CTA and high-resolution MRI.

## Results

A wide range of lesion size (vessel wall area) was encountered. Strong correlations were found between CTA and high-resolution MRI with the correlation coefficients for OWB area, lumen area and wall area are 0.98, 0.98 and 0.96, respectively. The standard deviation of mean differences (95%CI) were 2.5~5.5 mm<sup>2</sup>, 1.7~3.2 mm<sup>2</sup> and 0.8~2.3 mm<sup>2</sup>, respectively (**Figure 1 a-d**).



**Figure 1** **a:** Source image of MRI; **b:** Drawing of the lumen and OWB of the RICA on MRI; **c:** Source image of CTA; **d:** Drawing of the lumen and OWB of the RICA on CTA. JV=jugular vein; RICA=right internal carotid artery; RECA=right external carotid artery

## Conclusion

Carotid vascular wall area (a measure of atherosclerotic plaque burden) can be measured by both CTA and high-resolution MRI with comparable results. Scan time is shorter and coverage is bigger with CTA; therefore, CTA might become an alternative examination technique to high-resolution MRI for the follow-up of the burden of the patients with atherosclerotic carotid artery – especially in uncooperative patients or patients with MR contra-indications.

## References

1. Zhang S, et al. Radiology 2003; 228(1): 200-205.
2. Yuan C, et al. Circulation 1998; 98(24): 2666-71.