Discovery* MR750

3.0T High-resolution Carotid Plaque MR

With 3.0T, 6-channel Carotid Coil and MR PlaqueView Analysis

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Carotid atherosclerosis may be responsible for as much as one-third[1] of all strokes. To better gauge risk of stroke from carotid atherosclerosis, clinicians are beginning to look beyond traditional risk factors such as carotid artery narrowing (stenosis) to identify high-risk features of the atherosclerotic plaque itself.[1, 2, 3] MR plaque characterization can play a key role identifying vulnerable plaques in these patients, especially those with transient ischemic attack or in the sub-acute stage.

Patient history

A 72–year-old with asymptomatic right carotid stenosis. The patient has a history of hyperlipidemia, hypertension, and tobacco use, and has a BMI of 30.2. The patient's hyperlipidemia is well controlled (LDL-C = 88 mg/dL) with statin use since 2005. Despite meeting current AHA cholesterol guidelines, the patient has a moderately sized deep necrotic core with hemorrhage involving the right carotid bifurcation. MR carotid plaque imaging scans were performed in 2010 and in 2011 as a follow up.

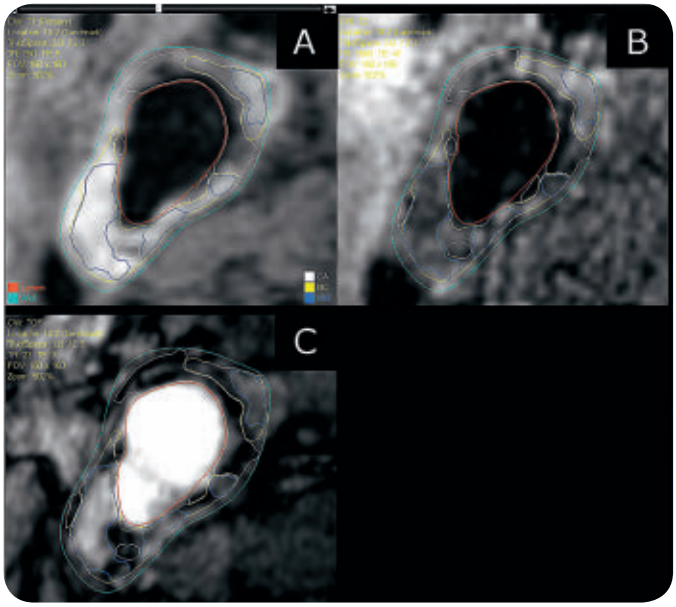

Figure 1. MRI-PlaqueView delineates plaque components such as calcium (white), necrotic core (yellow), and hemorrhage (blue). (A) T1w (B) T2w (C) TOF.

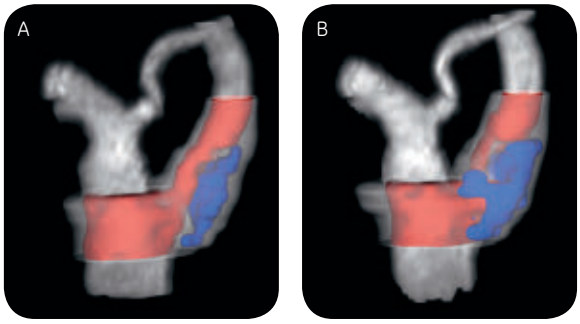

Figure 2. Hemorrhage area (blue) expanded from 2010 (A) to 2011 (B).

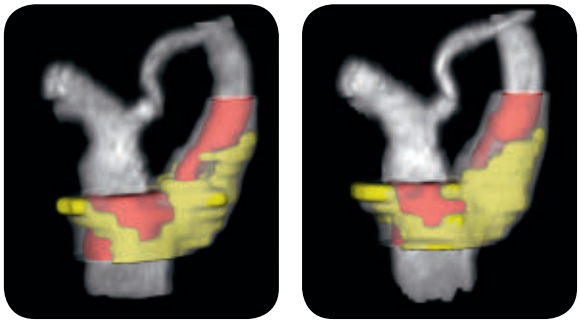

Figure 3. Necrotic core area increased.

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MR Parameters

Sequence:	Non-contrast MRA 3D TOF	Black-blood T1w 2D DIR FSE	Black-blood T2w 2D FSE
Scan time:	4:46	7:00	6:18
TR:	23	750 (1RR)	1500 (2RR)
TE:	3.9	6	48
Flip:	20	N/A	N/A
BW:	31.2	41.7	41.7
ETL:	N/A	12	16
FOV:	16	16	16
Slice thickness:	2 mm/1 mm ol	2	2
Frequency:	288	256	256
Phase:	256	224	224
Freq dir:	L/R	L/R	L/R
Phase FOV:	1	1	1
NEX:	1	2	1
# RR:	N/A	1	2

MR technique

3D TOF MRA, T1w Black-blood DIR FSE, and T2w Black-blood DIR FSE were performed using a 6-channel carotid coil. 3D TOF was used for assessing degree of stenosis, while T1w and T2w imaging were used to differentiate plaque components.

DIGITAL DIVE
Click to view remaining parameters on-line.

MR findings

The total volume of necrotic core was estimated at 30.1% volume in 2010 with 9.3% volume of hemorrhage. In 2011, his moderately sized hemorrhage now extended from deep in the plaque to be juxtaluminal with a new rupture of his fibrous cap. The lumen of the right ICA went from a 50% diameter stenosis by NASCET criteria with irregular narrowing to a 58% stenosis and a new ulcer in 2011. There was a much smaller hemorrhagic necrotic core involving the left ICA (not shown) with no change in the percentage of stenosis (21% in 2010 and 24% in 2011).

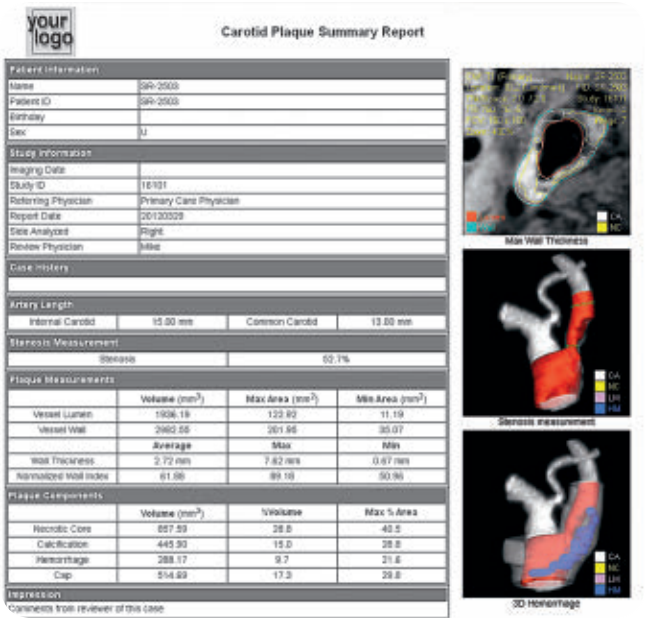

Figure 4.

3.0T Carotid Coil

A 6-channel array (3-channels per side) dedicated for high-resolution carotid imaging. It features a concentric design for deep tissue penetration and excellent SNR. ASSET is supported for accelerated imaging.

MRI-PlaqueView from VP Diagnostics

Provides visualization and quantitative analysis of multi-contrast carotid plaque MR data. Helps delineate vessel wall, calcifications and soft plaque.

Discussion

This case illustrates the potential for carotid plaque imaging to give the clinician additional information to stratify risk and help guide medical therapy. Despite very good therapeutic control of the patient's hyperlipidemia, there is evidence of ongoing carotid plaque disease with hemorrhagic necrotic core and an increase in the right carotid stenosis, as well as the development of a new ulceration. The additional information provided by 3.0T MR carotid plaque imaging could help identify patients with ongoing plaque pathology, despite adequate therapy by current standards that may benefit from new medical treatments.

References:

1. Altaf N, Daniels L, Morgan PS, et al. Detection of intraplaque hemorrhage by magnetic resonance imaging in symptomatic patients with mild to moderate carotid stenosis predicts recurrent neurological events. J Vasc Surg. 2008;47:337–42.
2. Takaya N, Yuan C, Chu B. Association between carotid plaque characteristics and subsequent ischemic cerebrovascular events: A prospective assessment with MRI—initial results; Stroke 2006; 37:818-23.
3. Singh N, Moody A R, Gladstone B J. Moderate Carotid Artery Stenosis: MR Imaging-Depicted Intraplaque Hemorrhage Predicts Risk of Cerebrovascular Ischemic Events in Asymptomatic Men. Radiology 2009; 252:502-8.

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