# Enhancement of the atherosclerotic plaque and the vessel wall of the carotid artery after injection of a blood-pool contrast agent.

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## Introduction

Atherosclerotic plaque rupture leading to thromboembolisation occurs in a specific type of atherosclerotic plaque (vulnerable plaque). Quantification and characterisation of atherosclerotic plaque may improve risk prediction.

Magnetic resonance imaging has a great potential to provide high resolution imaging of vessel wall for quantitative assessment of plaque burden and the proportion of the different plaque components like calcification, lipid, fibrous tissue, intraplaque hemorrhage. Because the enhancement pattern of the atherosclerotic plaque components may differ, dynamic information may be important in characterisation of the plaques. The higher relativity and the prolonged vascular lifetime may make blood-pool agents (Gadofosveset, Vasovist®, Schering, Germany) an optimal contrast agent for plaque imaging.

## Purpose

We hypothesized that a blood-pool agent enhances the outer wall of the carotid artery and specific parts of the atherosclerotic carotid plaque.

## Materials and Methods

We studied 26 atherosclerotic plaques of 15 consecutive patients (14 male; mean age 65.3 ± 10.1 years, range 47-80 years) with severe carotid stenosis (>50%) and cerebrovascular symptoms. MRI was performed on a 3.0T scanner (Signa Excite, GE Healthcare, USA) with a 4-channel bilateral coil positioned over the carotid bifurcation We injected 0.03 mmol/kg of Vasovist®, (Gadofosveset, Schering, Germany) and an axial 3DT1-weighted scan was performed before injection and 20 minutes after injection: 3D-T1w-GRE (TR/TE 15/3, flip angle 16°, slice thickness 1.0 mm, BW 13.9 kHz, FOV 18x18 cm, matrix 256 x 256, NEX 1).

We used a custom-made 3D point-based registration tool to match the images before and after contrast injection in order to correct for patients movements (Fig. 1). In the axial images of the 3DT1-weighted scans we measured the signal intensity (SI) of the sternocleidomastoid muscle (SCM), the non-calcified part of the plaque and the vessel wall (outer border) of the carotid artery. The percentage contrast enhancement was calculated as: SI (enhanced)-SI (unenhanced) / SI (unenhanced) x 100.

## Results

In all carotid arteries enhancement of the vessel wall was detected. The mean enhancement on the 20 minute delay scan was 24.6% ± 17.5% in the SCM, 40.9% ± 32.5% (range 1-120%) in the non-calcified part of the plaque and 60.0% ± 21.7% in the vessel wall of the symptomatic carotid arteries.

## Conclusions

The atherosclerotic plaque and the vessel wall of the carotid artery enhances after injection of Vasovist® (Fig. 1). The enhancement of the non-calcified part of the plaque has a large range which may reflect differences in plaque composition (Fig. 2).

## Clinical Relevance

Assessment of plaque volume may be improved with Vasovist® injection because of the enhancement of the outer vessel wall. Images obtained before and after injection of contrast may improve atherosclerotic plaque characterisation.

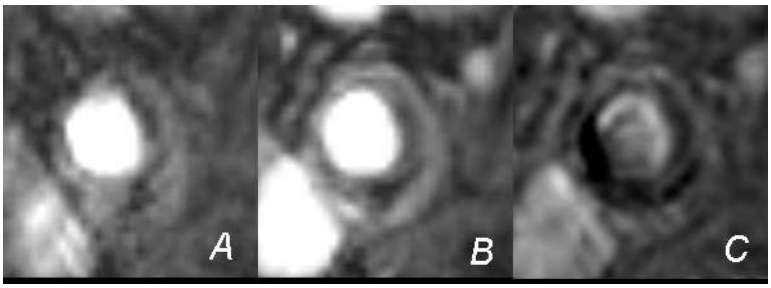


**Figure 1**. Pre- and post contrast-enhanced images after registration show enhancement of the vessel wall. (A) in vivo scan: fat-suppressed 3D T1w-GRE scan; pre contrast ; (B) enhancement of the vessel wall 20 minutes post contrast; (C) image B subtracted from image A after registration of the pre contrast and post contrast scan shows regional enhancement

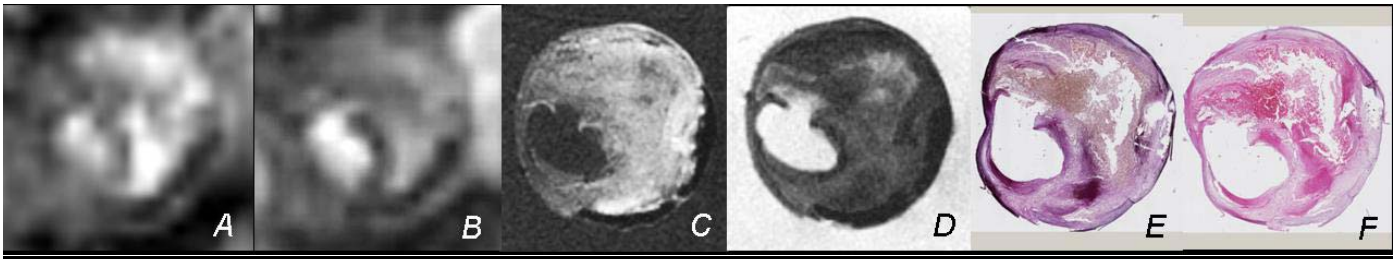


**Figure 2.** Pre- and post-CE images show regional variation in contrast enhancement**.** (A) in vivo scan: fat suppressed 3DT1w-GRE scan pre contrast; (B) fat suppressed 3DT1w-GRE scan post contrast (C) corresponding T1w MR imaging section from the specimen and (D) T2w section (E, F) corresponding histologic sections.