

## Magnetic Resonance Intraplaque Hemorrhage Is Associated With Cerebrovascular Outcomes in Asymptomatic Male Patients with Non-Severe Stenosis

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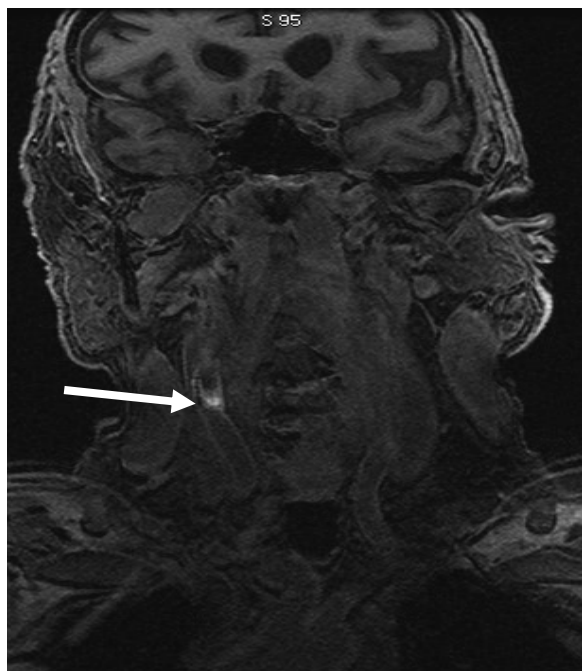
**Introduction:** Intraplaque hemorrhage (IPH) occurs frequently during the development of atherosclerotic lesions and is an emerging marker of plaque instability [1]. Severe carotid artery stenosis (>70%) and cerebrovascular symptoms are clear indications for carotid endarterectomy [2] though patients without either indication may suffer cerebrovascular events (i.e., stroke, amaurosis fugax (amF), and transient ischemic attacks (TIA)). In this study, patients with asymptomatic non-severe stenosis were followed to investigate the relationship between magnetic resonance imaging (MRI) detected IPH and cerebrovascular outcomes.

**Methods:** Patients (n=144) without symptoms of carotid disease being investigated for peripheral vascular disease were consecutively enrolled between February 2003 and September 2006. All patients were screened for carotid artery IPH, on a GE 1.5T MR and an 8 channel neurovascular coil array (USA Instruments, USA) using a 3D T1-weighted, fat-suppressed spoiled gradient echo sequence. Patients were classified as IPH positive after detection of a signal hyperintensity within the atherosclerotic vessel wall (Figure 1). Patients were followed for cerebrovascular outcomes for a minimum of one year through regular clinic visits and telephone interviews. Exclusion criteria for patients' arteries included: i) history of carotid endarterectomy either before or after MR IPH screening, ii) female sex since natural history of plaque progression is known to differ from males [3], and iii) stenosis >70% determined by Doppler ultrasound. Relative risk and odds ratio of a cerebral vascular outcome were calculated for IPH positive vs. negative patients.

**Results:** Of the 77 arteries that qualified for inclusion, 3.9% were lost to follow up. The group with IPH (n=30) had six events (2 strokes, 1 amF, 3 TIAs) compared to no events in the MR IPH negative group. IPH is significantly associated with risk of cerebrovascular outcomes even though one false positive event in the IPH negative group had to be included to allow for calculations (RR = 9.60, 95%CI 1.21 to 75.9, p=0.0320; OR = 11.75, 95%CI 1.34 to 103, p=0.0263). The group with and without MR detected IPH had similar baseline characteristics.

**Discussion:** While limited in sample size, this study shows that MR detected IPH in the carotid arteries is associated with future cerebrovascular outcomes suggesting that IPH is a marker for plaque instability. Larger prospective medical and/or surgical intervention trials are warranted to determine the utility of a MR detected IPH in determining outcomes.

**Conclusions:** Asymptomatic males with non-severe carotid stenosis identified by MR to have IPH may be at an increased risk of cerebrovascular events.



**Figure 1:** Hyperintensity in the right carotid artery vessel wall signifying intraplaque hemorrhage

**References:** 1] Virmani, *Arterioscler Thromb Vasc Biol*, 2005;25: 2054-61 2] Barnett, *N Engl J Med*, 1998; 339:1415-25 3] Burke, *Circulation*, 2000;102:II-774