MR detects coronary vessel wall imaging with age in healthy subjects

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Introduction

Autopsy studies[1,2] and x-ray CT in older subjects with suspected disease[3] have demonstrated increasing coronary vessel thickness with age. There is, however, a need for a radiation-free non-invasive technique for use in longitudinal studies of coronary vessel wall morphology and for monitoring response to treatment. Recently 3D MR coronary vessel wall imaging with retrospective beat-to-beat respiratory-motion-correction (B2B-RMC)[4], which uses respiratory motion information derived from 3D low resolution data acquired immediately before the main imaging data to retrospectively correct respiratory motion, has demonstrated great promise[5]. We propose that 3D high resolution MR with B2B-RMC can demonstrate coronary vessel wall thickening with age in healthy subjects.

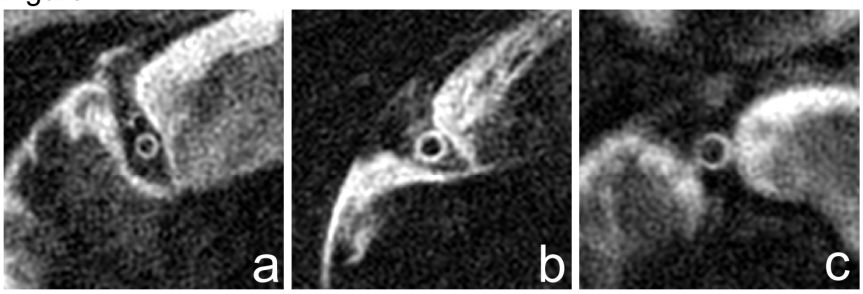
Methods

21 healthy subjects with no history of cardiovascular disease (mean age 39±13, range 22-62, 11 female) were recruited. Studies were performed on a 1.5T Siemens Avanto scanner. Cross-sectional vessel wall imaging was performed in the proximal right coronary artery (<40mm from origin) using a 3D spiral acquisition with B2B-RMC (0.7x0.7x3mm resolution, 8 slices reconstructed to 16x1.5mm, duration 600 cardiac cycles assuming 100% respiratory efficiency) and alternate R-wave cardiac gating. Data were acquired in the coronary rest period, as determined from a cine acquisition in the imaging plane. Data acquired at extreme respiratory positions was excluded using a navigator and the rest was corrected using B2B-RMC (typically >99% efficient[5]). Circular regions of interest were drawn around the inner and outer coronary vessel wall on one central slice from each 3D acquisition. Average vessel wall thickness and wall/outer wall (lumen + vessel wall) area (W/OW)[6] were calculated.

Results

Example images are shown in figure 1. In three subjects (14%) the images were rejected due to poor image quality caused by cardiac or respiratory motion. In the remaining 18 subjects, mean vessel wall thickness was 1.14±0.22mm and mean W/OW was 0.727±0.085. Vessel wall thickness and W/OW increase by 0.088mm (R=0.53,p=0.024,figure 2.a) and 0.031 (R=0.48,p=0.048,figure 2.b) per decade respectively.

Figure 1

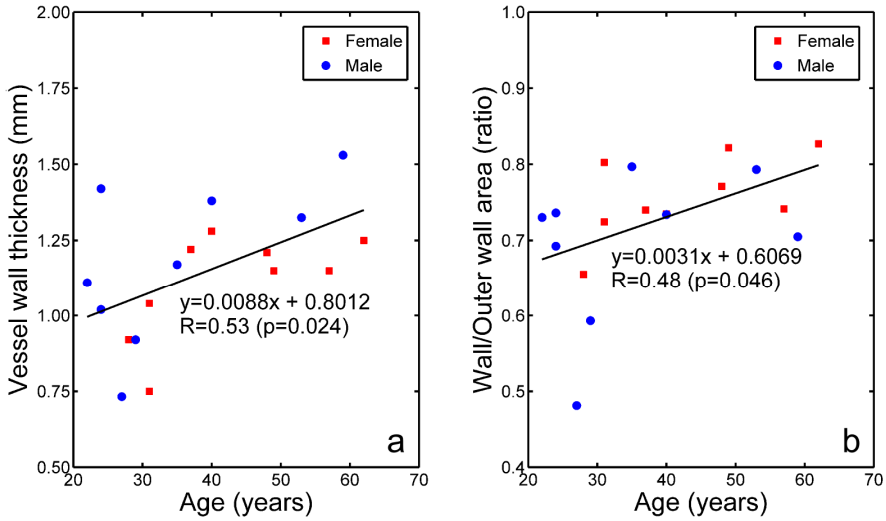


Example images obtained from three male healthy subjects aged 24 (wall thickness 1.02mm, W/OW 0.69) (a), aged 40 (wall thickness 1.38mm,W/OW 0.73) (b) and aged 59 (wall thickness 1.53mm, W/OW 0.70) (c).

Discussion

For the first time using MR, we have demonstrated significantly increasing vessel wall thickness with age in a small cohort of healthy subjects at 0.088mm per decade. The proportion of vessel that is vessel wall (W/OW) also increases with age at 0.031 per decade (R=0.48). The strength of this correlation is similar to that obtained in larger studies of carotid wall thickening in healthy subjects (R=0.50 males and R=0.46 females[7]).

Figure2



The effects of ageing on the coronary vessel wall as assessed by high resolution MR imaging. Vessel wall thickness (a) and W/OW (b) demonstrate a significant positive correlation with age.

References

1.Velican,Atherosclerosis 1980.
2.Ozolanta,Med Eng Phys1998.
3.Matsunaga,Circulation J 2009.
4.Keegan,JMRI 2007.
5.Scott,JMRI In Press.
6.Saam,JCMR 2005.
7.Keenan,Atherosclerosis 2009.