The aim of this study was to demonstrate the feasibility of high-resolution 3-dimensional aortic vessel wall imaging using a novel elastin-specific magnetic resonance contrast agent (ESMA) in a large animal model. The thoracic aortic vessel wall of 6 Landrace pigs was imaged using a novel ESMA and a nonspecific control agent. On day 1, imaging was performed before and after the administration of a nonspecific control agent, gadolinium diethylenetriamine pentaacetic acid (Gd-DTPA; Bayer Schering AG, Berlin, Germany). On day 3, identical scans were repeated before and after the administration of a novel ESMA (Lantheus Medical Imaging, North Billerica, Massachusetts). Three-dimensional inversion recovery gradient echo delayed-enhancement imaging and magnetic resonance (MR) angiography of the thoracic aortic vessel wall were performed on a 1.5-T MR scanner (Achieva; Philips Medical Systems, the Netherlands). The signal-to-noise ratio and the contrast-to-noise ratio of arterial wall enhancement, including the timecourse of enhancement, were assessed for ESMA and Gd-DTPA. After the completion of imaging sessions, histology, electron microscopy, and inductively coupled plasma mass spectroscopy were performed to localize and quantify the
gadolinium bound to the arterial vessel wall. Administration of ESMA resulted in a strong enhancement of the aortic vessel wall on delayed-enhancement imaging, whereas no significant enhancement could be measured with Gd-DTPA. Ninety to 100 minutes after the administration of ESMA, significantly higher signal-to-noise ratio and contrast-to-noise ratio could be measured compared with the administration of Gd-DTPA (45.7 ± 9.6 vs 13.2 ± 3.5, P < 0.05 and 41.9 ± 9.1 vs 5.2 ± 2.0, P < 0.05). A significant correlation (0.96; P < 0.01) between area measurements derived from ESMA scans and aortic MR angiography scans could be found. Electron microscopy and inductively coupled plasma mass spectroscopy confirmed the colocalization of ESMA with elastic fibers. We demonstrate the feasibility of aortic vessel wall imaging using a novel ESMA in a large animal model under conditions resembling a clinical setting. Such an approach could be useful for the fast 3-dimensional assessment of the arterial vessel wall in the context of atherosclerosis, aortic aneurysms, and hypertension.