

Dynamic Magnetic Resonance Angiography of the Aneurysm Neck: Changes in Configuration during the Cardiac Cycle with Possible Consequences for Endograft Sizing and Future Design

NOTES

Hence J.M. Verhagen, MD, Utrecht, the Netherlands; L. Bartels; K. Vincken. A. Teutelink; M. Proko; W. Mali; F. Moll, MD, PhD, Utrecht, the Netherlands

Background

The durability of endovascular aneurysm repair (EVAR) relies importantly on the proximal fixation and seal of the stent graft in the aneurysm neck. Computed tomographic angiography (CTA) is the “gold standard” for preoperative sizing of endograft diameters, but the accuracy of these measurements is uncertain since they rely on static images of a dynamic process. It is likely to assume that the aortic configuration and diameter may change during the cardiac cycle. We studied these phenomena using dynamic magnetic resonance angiography (MRA).

Materials and Methods

From January to June 2005, 10 patients with suitable anatomy for EVAR were included. Preoperatively, the proximal aneurysm neck configuration was determined by dynamic ECG-triggered MRA. Configuration changes were measured 10 mm below the lowest renal artery in transverse aortic sections. For data analysis, specialized software (imageXplorer, Image Sciences Institute, Utrecht, the Netherlands) was used. Transverse aortic surface and diameter changes were measured in 180 directions. Aortic compliance and movement was also evaluated.

Results

In all patients, changes in configuration of the aneurysm neck were seen during the cardiac cycle. Pulsatile aortic distension was not equal in each direction and was different between patients. Diameter of the aneurysm neck changed 0 to 27% during the cardiac cycle. For each patient, the median diameter change ranged from 2.8 to 14.3%. The median change in diameter during a cardiac cycle for all patients was 7.4%.

Aortic neck area changed 2.6 to 14.6% during the cardiac cycle. The median area change was 10.0%.

Conclusion

In patients with (atherosclerotic) aneurysm disease, the aortic dimensions change during the cardiac cycle. With a median diameter change of 7.4%, a standard regime of 10 to 15% oversizing of an endograft based on static CTA images may be inadequate for some patients. Furthermore, noncircular stent graft designs should be considered in the future since aortic distension in the aneurysm neck is not evenly distributed.