

# Dynamic Computed Tomographic Angiography after Endovascular Aneurysm Repair: Cine-imaging and Consequences for Different Stent Graft Designs

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## Background

Computed tomographic angiography (CTA) is the most frequently used imaging modality for planning and follow-up of endografts for the treatment of aortic aneurysm disease. Current CTA protocols produce static images, neglecting the inherent dynamics of the human aorta throughout the cardiac cycle. The consequences of endograft implantation on the native aortic pulsation and the effect of this pulsation on different endograft skeletons are unclear. We studied the postimplantation effect of the endograft design on the aortic movements using electrocardiogram (ECG)-gated dynamic 64-slice cine-CTA.

## Methods

Patients who had undergone endovascular aneurysm repair (EVAR) using different devices (Talent, Excluder, Life-Path, and Zenith) were included. All ECG-gated data sets using a 64-slice Philips CT-scanner were stored. A breath-hold scan with a standard radiation dose of 17.5 to 21 mGy, 1.25 mm collimation, and a pitch of 0.2 to 0.3 was performed. Scan duration was recorded. Eight gated data sets, covering the heart cycle with 12.5% steps, were reconstructed. Image quality of gated scans was graded on a 5-point scale (1 = poor; 5 = excellent). At various anatomic reference points we evaluated maximum displacement of the aorta, renal and iliac arteries, the aneurysm, and the stent in a cardiac cycle. The direction of the movement was also recorded.

## Results

There was no significant difference in compliance between the IP and MS areas preoperatively (Ep 23.2 versus 27.3, b 15.5 versus 18.7;  $p > .05$  Wilcoxon). However, the neck region (N) was significantly more compliant than the former (Ep 12.7, b 8.5;  $p < .001$ ).

After surgery there was a significant difference in strain parameters between OR and EVAR (0.071 versus 0.010;  $p < .001$ ). There was also a significant difference in strain estimates between EVAR without endoleak and EVAR with endoleak (0.027 versus 0.0163;  $p < .001$ ). In addition, strain measurements were carried out on 10 patients before and after EVAR. Of eight patients without endoleakage, four exhibited a fall and four showed an increase in strain. In two patients with endoleakage, one showed a fall, and one showed increased strain.

## Conclusions

ECG-gated, dynamic CTA with a standard radiation dose is feasible and provides real-time cine imaging on a 64-slice scanner. This provides insight into the (patho) physiology of abdominal aortic and iliac pulsations. Furthermore, it gives insight in the complex dynamics following the endoluminal treatment of AAAs showing distinct differences between different types of endografts. These marked differences in movement throughout the cardiac cycle between different endograft designs, might have an impact on the stent graft integrity and its long-term outcome.