

High Spatial and Temporal Resolution MRA (syngo TWIST) in Acute Aortic Dissection*

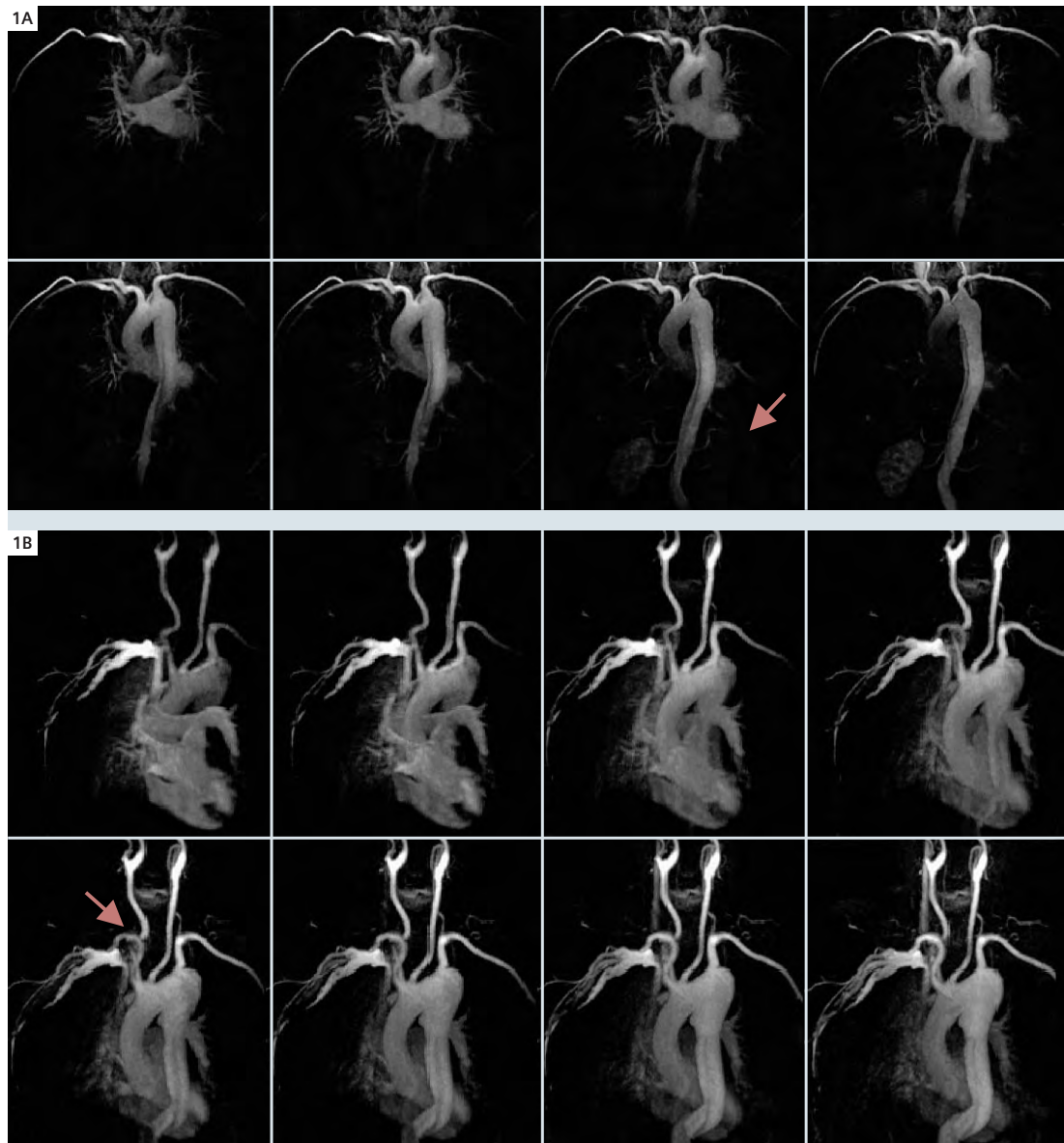
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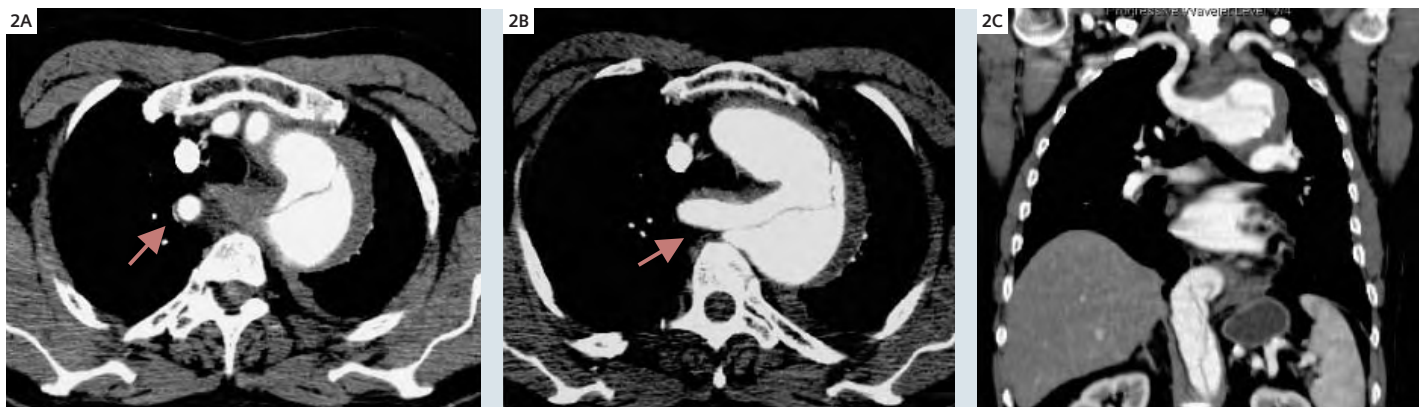
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1 Coronal Maximum Intensity Projections (MIPs) of subsequent time frames (time delay 3.3 s between single frames) acquired in a 55-year-old male patient with acute aortic type B dissection. The high temporal and spatial resolution allows visualization of delayed filling of the false aortic lumen. The left renal artery originating from the false lumen results in a delayed perfusion of the left kidney (arrow).



2 78-year-old male patient with aortic dissection of the descending thoracic aorta and aberrant right subclavian artery originating from the false lumen. Coronal MIPs of subsequent time frames show delayed contrast filling of right subclavian artery (arrow). Corresponding axial CT images (B) and coronal MPR (C) confirm aberrant right subclavian artery.

Introduction

Endovascular treatment of descending thoracic and abdominal aortic dissection has emerged as an alternative to open surgery. In terms of endovascular aortic stent-graft placement planning, MRI appears to be particularly useful as it can provide a comprehensive preinterventional diagnostic evaluation of the vascular aortic morphology. However, standard MRA techniques provided no information on flow and tissue perfusion. Therefore, time-resolved MR-angiography (MRA) techniques have recently been introduced to overcome these limitations. Until now sufficient temporal resolution and coverage for the assessment of aortic dissection could only be achieved sacrificing special resolution, thus requiring an additional high resolution MR angiography. Our study aimed to evaluate the image quality and the diagnostic accuracy of a recently developed time-resolved 3D MR angiography technique (*syngo* TWIST) combining high spatial and temporal resolution for the pre-interventional assessment of aortic dissection.

Methods

Ten patients (mean age 58 years) with acute dissection of the descending thoracic and/or abdominal aorta underwent time-resolved 3D ce MR Angiography. All imaging was performed on a 1.5 T scanner (MAGNETOM Avanto, Siemens, Medical

Solutions, Erlangen, Germany) equipped with two flexible phased array coils and the integrated spine coils for signal reception. Following automatic injection of 5 ml Gadovist (Schering, Berlin, Germany) at 3 ml/sec, 15 consecutive coronal T1-weighted 3D datasets (TR/TE 2.8/1.2 ms; FA 25°; slices 64; matrix 231 x 320; spatial resolution 1.9 x 1.6 x 2.1 mm³, true temporal resolution 3.3 s) were acquired using the TWIST sequence and parallel imaging technique (GRAPPA; R = 2). Following the acquisition of an entire non-enhanced dataset (A and B) within one breathhold (23 s), 14 consecutive undersampled datasets were obtained. After a short pause, a conventional high spatial resolution MRA (low dose Gadovist®) was acquired (breathhold 25 s) using a 3D spoiled gradient-echo sequence (TR/TE 3/0.97 ms, FA 25°, slices 72, matrix 289 x 384; voxel size 1.4 x 1.3 x 1.8 mm³). Both MR data sets were evaluated and compared for image quality and visualization of vascular details. A radiologist and an interventional cardiologist assessed the additional diagnostic information of *syngo* TWIST concerning contrast enhancement and tissue perfusion

Results

syngo TWIST MRA could successfully be performed in all patients; no technical or reconstruction problems occurred. Image

reconstruction time amounted to 5 minutes for the TWIST sequence. The image quality of the source images of the TWIST protocol was rated comparable to those of the conventional MRA. The presence of artifacts was comparable for both sequences. Due to the dynamic character of the TWIST sequence no venous overlay hampered the assessment of the arterial system. TWIST-MRA characterized true and false lumen as well as the origin of the branch vessels correctly in all patients. The temporal resolution of the TWIST-MRA allowed visualizing the transit of the contrast agent bolus within the true and the false lumen (Figs. 1, 2) and provided additional information compared to the static MRA in 3/10 patients. These findings had impact on therapy planning and the combined morphologic and dynamic imaging of the TWIST MRA provided reliable information for successful planning of endovascular stentgraft repair in all patients.

Discussion

syngo TWIST MRA is a robust technique that combines functional and morphological information. Thus the time-resolved TWIST MRA provides information for treatment planning in patients suffering from acute aortic dissection.

*Some of the concepts and information presented in this paper are based on research and are not commercially available in the U.S.