Contrast-Enhanced Ultrasound of Carotid Artery Wall in Takayasu Disease

First Evidence of Application in Diagnosis and Monitoring of Response to Treatment

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A 35-year-old woman with chronic anterior cervicalgia was referred to our institution for an ultrasound of the neck. The B-mode ultrasound (Siemens S 2000, linear phased array probe 9 to 13 MHz) revealed a 1.6-mm hyperechoic circumferential wall thickening of the right common carotid artery, involving the whole artery, without evidence of stenosis (Figure 1). The other supraaortic arteries appeared normal. Positron-emission tomography and computed tomography scans demonstrated further localizations of arterial wall thickening in the right brachiocephalic artery, the aortic arch, and the abdominal aorta. The patient’s long medical history of hypertension, carotidynia, radial pulse asymmetry, and biological inflammatory syndrome along with the imaging results led to the diagnosis of Takayasu disease.1

Contrast-enhanced ultrasound of carotid arteries was then performed (T0) before the patient started steroid treatment. We used a Siemens S 2000, 9- to 13-MHz probe, and a 3-second intravenous (IV) bolus of 1.5 mL of Sonovue (Bracco, Altana Pharma, Konstanz, Germany) flushed with 5 mL of saline. A picture was taken 1 minute post-IV and a 30-second movie was recorded 15 seconds post-IV, at the beginning of arterial opacification. Pictures were then post-processed by Adobe Photoshop CS4 extended software to measure the gray scale median (GSM) of the right common carotid wall. The use of this software to calculate the GSM has been shown to provide a reproducible gray scale numeric evaluation of a selected area,2 ranging from 0 (black) to 255 (white), validated as an objective measure of echogenicity.

The same protocol of contrast-enhanced ultrasound was performed 3 months (T1) and 6 months (T2) after the beginning of treatment, by the same operator in identical technical conditions. During that time, under steroid treatment, the patient’s symptoms improved dramatically and the biological inflammatory syndrome resolved.

The B-mode ultrasound appearances did not change during the 6 months, showing a stable 1.6-mm hyperechoic circumferential wall thickening of the right common carotid artery. On contrast-enhanced ultrasound, however, the pretreatment scan showed a marked arterial wall enhancement with direct visualization of multiple opacified vasa vasorum (Figure 2 and Movie I in the online-only Data Supplement). These appearances changed progressively at T1 (Movie II in the online-only Data Supplement) and T2 (Movie III in the online-only Data Supplement) with the impression of marked diminution of arterial wall enhancement and vasa vasorum opacification. That was confirmed by the GSM measures, which significantly decreased during the 6 months: GSM at T0, 80.58 (Figure 2); at T1, 42.09 (Figure 3); at T2, 5.05 (Figure 4), illustrating the lowering echogenicity of the pathological arterial wall under treatment.

B-mode ultrasound and GSM index are currently used to assess the stability of atherosclerotic plaques.3 With contrast-enhanced ultrasound imaging, the GSM increases in atherosclerotic disease with the degree of enhancement of the parietal wall, which itself reflects the neovascularization and

Figure 1. Mode-B ultrasound: right common carotid artery circumferential wall thickening suggesting inflammatory arteritis.

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the degree of inflammation of the plaque; the hyperechoic microbubbles are caught within the vasa vasorum of the intima-media complex without any diffusion to the interstium, reinforcing the echogenicity of the area. To our knowledge, there has been no previous clinical evaluation of contrast-enhanced ultrasound in inflammatory arteritis in the literature. However, in comparison with previous studies of atherosclerotic disease, our results in this case of Takayasu disease suggest that there was significant inflammation of the carotid arterial wall at the time of diagnosis, and this decreased progressively under steroid treatment. Contrast-enhanced ultrasound could therefore prove to be a very useful tool in the diagnosis and follow-up of inflamma-

Figure 2. Contrast-enhanced ultrasound (1 min post-IV) at T0: pretreatment scan. GSM measure, 80.58. IV indicates intravenous bolus; GSM, gray scale median.

Figure 3. Contrast-enhanced ultrasound (1 min post-IV) at T1: 3 months posttreatment scan. GSM measure, 42.09. IV indicates intravenous bolus; GSM, gray scale median.
tory arteritis as a noninvasive, nonexpensive, and easily reproducible measure of arterial wall inflammation, given that, in the vast majority of cases, supraaortic vessels are involved. It seems to be the only imaging technique that allows direct visualization of parietal vasa vasorum and neovascularization, therefore providing real-time information about the inflammatory response to treatment.

Disclosures

None.

References


Figure 4. Contrast-enhanced ultrasound (1 min post-IV) at T2: 6 months posttreatment scan. GSM measure, 5.05. IV indicates intravenous bolus; GSM, gray scale median.
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