On the Horizon: Imaging of Vulnerable Plaques

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CHICAGO — Intriguing invasive methods of identifying vulnerable coronary plaques include vaso vasorum imaging, intraarterial MRI, and several variants of optical coherence tomography, according to speakers at the annual meeting of the Society for Cardiovascular Angiography and Interventions.

► **Vaso vasorum imaging.** The vaso vasorum—the microcapillaries that form in the adventitia adjacent to atherosclerotic plaque in response to vascular injury—become more dense as inflammation due to macrophage activity increases. And this inflammation is a key factor in plaque rupture, said Dr. Stephane Carlier of Columbia University, New York.

He and his coworkers have developed an intravascular ultrasound–based technique that uses gas-filled microbubbles for contrast enhancement to assess vaso vasorum density and identify areas of intraplaque leakage or hemorrhage.

The hypothesis is that these findings will correlate with high likelihood of plaque rupture, said Dr. Carlier, who is also director of intravascular imaging and physiology at the Cardiovascular Research Foundation in New York.

► **Intraarterial MRI.** Conventional MRI using a big external magnet is not well suited for evaluating the composition of atheromatous plaques. Adequate resolution is difficult because the coronary arteries are small, are situated deep in the thorax, and move with respiration and systolic motion of the heart.

Intraarterial MRI is a novel imaging method that sidesteps these obstacles. There is no external magnet. Magnet and coil are incorporated within the probe, which also contains radiofrequency transmission and receiver units.

Unlike conventional MRI, the intraarterial version doesn't provide pictures of the arteries in cross section; instead, it is designed specifically to analyze the lipid content within the arterial wall.

The current device is No. 6 French and deployed in a No. 8 French guiding catheter. A balloon is inflated to push the probe against an arterial plaque. Interrogation of the lesion takes about 25 seconds, according to Dr. Robert L. Wilensky, a cardiologist at the University of Pennsylvania, Philadelphia.

With optical coherence tomography, 'you could image a whole coronary artery in 5 or 6 seconds and get incredibly high-resolution images.'

A 29-patient phase I study has been completed. A larger phase II international trial evaluating higher-risk patients will begin soon.

Efforts are also underway to streamline the delivery catheter from No. 8 to No. 6 French, added Dr. Wilensky, who heads the scientific advisory board for TopSpin Medical, the Israeli company developing intraarterial MRI.

► **Optical coherence tomography.** This extremely high-resolution broadband light-based imaging method provides tremendous structural detail.

With a theoretic resolution of 5-7 micrometers and somewhat less in actual practice, optical coherence tomography (OCT) is well-suited for in-depth morphologic evaluation of thin-capped fibroatheromas, the plaque type believed to be at greatest risk of rupture and resultant MI, said Dr. Gregg W. Stone, professor of medicine at Columbia University and vice chairman of the Cardiovascular Research Foundation.

There is a daunting obstacle to commercial development of OCT, however: At present, the intravascular probe requires arterial occlusion, as do OCT's variants, including optical frequency domain imaging and polarization-sensitive OCT.

Optical frequency domain imaging "is basically OCT on steroids," according to Dr. Stone. "It allows much, much faster acquisition rates.

"In fact, you can pull back at up to 12 mm/second, so you could image a whole coronary artery in 5 or 6 seconds and get incredibly high-resolution images," he added.

Polarization-sensitive OCT takes advantage of the birefringence of collagen fibers, enabling physicians to readily separate collagen from noncollagen tissues. ■

Pages 38a—38b