What Is New and Better in the Treatment of Chronic Venous Insufficiency

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Imaging has become critical to the endovascular interventionalist when addressing aortic problems. The basic concept of developing an operative plan when you visual a normal aorta is now past. The entire plan, meaning the device selection, sizing, and bailout options for a procedure, must be established prior to performing the procedure itself. Several imaging options exist for the aorta. They include computed tomography (CT), magnetic resonance imaging (MRI), angiography, transesophageal echocardiography, and intravascular ultrasonography, to name a few. Although 5 to 8 years ago, angiography was a primary player in terms of the evaluation of aortic disease in sizing for endovascular grafts, it is now unnecessary in the vast majority of cases. High-quality CT and MRI using specific three-dimensional reconstruction techniques have supplanted the need for any percutaneous procedures that both carry risk and have the potential for delaying the procedure. The acquisition of the data, be it by CT or MRI, is of the utmost importance. I will concentrate most of the discussion on CT scan, given that it is the primary method by which most aortic patients are evaluated.

There are two types of CT scans in terms of acquisition: a CT scan that is gated and a CT scan that is not gated. The gated CT scans visualize the aorta only at a specific point in the cardiac cycle and rely on a relatively low heart rate to evaluate a relatively small volume of aortic tissue. Nongated CT scans can evaluate larger segments of the aorta at a higher resolution. The two techniques are useful for different purposes. In our practice, when we are looking at the ascending aorta or the aortic valve or trying to differentiate proximal and distal dissections, we use a gated CT scan; when evaluating more distal pathology, we use a nongated CT scan. In general, our nongated CT scan is a three-phase CT scan including noncontrast, arterial, and 5-minute delayed phases. These are done typically with a 0.75 mm collimation on a 16-row scanner or a 0.6 mm collimation on a 64-row scanner. We do diagnostic with a 3 mm slice thickness and a 3 mm reconstruction interval. We tend to reconstruct the native images if the patient has already had a stent graft placed, using a high-resolution kernel or filter so that we can apply our edge-detection algorithms to look for the integrity of the device while the arterial phase of the scan is constructed with a smoothing kernel or filter, which is a lower-resolution filter. Both the native and arterial phase reconstructions have 1 mm slice thicknesses with a 0.8 mm reconstruction interval. We store 1 mm images for later analysis.

I will concentrate primarily on aneurysms as opposed to dissections as there are significant differences between those areas, but ultimately with respect to evaluating aortic aneurysms, the objectives are to identify the healthy versus the unhealthy aortic tissue, size the aneurysm in a consistent manner, and design the device based on the anatomy at hand. Evaluating the disease within the aorta requires knowledge of the normal aortic anatomy. The aorta is typically visualized at some point during the patient work-up from the heart through the ascending arch and descending visceral, infrarenal, and iliac segments so that a complete picture of the disease is understood at baseline. Following this, the categorization of the aneurysm follows. Aneurysms obviously can be infrarenal, suprarenal, thoracoabdominal, and so on, but the overall context of the repair must be kept in mind. The centerline of flow reconstructions remains critical in terms of looking at appropriate diameter measurements. All of this requires the ability to use three-dimensional imaging technologies to assess diameters and pathology perpendicular to a centerline of flow, to measure lengths within the aorta, and to understand the orientation of the vessels and the branches. This becomes increasingly more important as the level of complexity of repairs becomes greater.

Ultimately one has to be facile with the assessment of conventional two-dimensional, axial, coronal, and sagittal images as well as the construction of centerline of flow images and obtaining images perpendicular to a centerline of flow in addition to assessing lengths between the various branches of the aorta, should that be necessary for such an endovascular repair. These overall concepts of image analysis are not new; they are just somewhat new to surgeons. However, as we venture into the world of less invasive procedures, we need to improve our diagnostic abilities. We will no longer have the ability to bevel an anastomosis during a procedure; this will have to be done ahead of time in terms of the planning. We will have to assess the ability of devices to seal and fixate within the aorta in an accurate and reproducible manner, and also in a manner that is predictable so we do not run into problems later on. This is relatively new to our practice as well.

In 2001 when I started doing fenestrated grafts, I became increasingly aware of three-dimensional techniques. Again, we are no longer simply accounting for longitudinal device sizing and position in addition to the diameter measurements; now we are concerned with the orientation of the different branches from each other and from the aneurysm itself. However, once you have worked with the three-dimensional workstation for a number of years, it becomes part of your practice, and it is hard to go back to another method of planning.