Multidetector Helical CT Angiography: Poor Cousin or Contender?

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CT angiography (CTA) is an intriguing example of a seemingly new imaging method that is a modern application of a technique first proposed in the nascent years of CT. Development of CTA was necessarily deferred until the advent of helical (spiral) CT scanning to achieve its promise as a noninvasive angiographic alternative to MR angiography (MRA). The first references in our literature to its application to extracranial and intracranial carotid disease date from 1992, and there has been progressive refinement of the technique since. But has it achieved its full potential, or is the technique fated to be the poor cousin to MR angiography?

In this issue of the *AJNR* (page 791) Skutta et al present their provocative experience with multidetector helical CTA in diagnosing intracranial steno-occlusive disease. They evaluated a large number of intracranial vascular segments for the presence and degree of stenosis; double-detector CT technology was combined with a special postprocessing multiplanar reformatting program. All vessel segments were compared with intraarterial angiography as the standard of reference. They conclude that their technique is comparable to the recently published advanced MRA techniques in depicting intracranial vessels of the anterior and posterior circulation.

Although these authors use a double-detector technology, another major CT manufacturer has just made available a scanner with four contiguous and parallel detectors, enabling acquisition rates four-fold that of present helical scanners. With the capability to acquire four contiguous slices in the same time as the standard scan, data acquisition is four times faster. This speed translates into CT angiographic images that can cover more anatomic territory with higher spatial resolution. Submillimeter resolution of intracranial vessels, covering the entire circulation from the skull base to well above the circle of Willis, is now a reality. Second- and even third-order vessel stenoses, as well as the smallest intracranial aneurysms, can now be imaged reliably. Obvious applications are evaluations of intracranial vessel stenoses for treatment with coumadin, vascular occlusions in the setting of acute stroke for thrombolytic therapy decision-making, and detection of aneurysms rivaling that of standard angiography.

Before one can confidently predict that multidetector CTA will rival or even replace much of MRA, several cautions are in order. Postprocessing methods are critical to this technique, and are time-consuming, labor-intensive, and highly operator-dependent. If one has the luxury of a dedicated 3D imaging laboratory, much of this postprocessing can be done offline by a trained technologist, and the results made available soon after the completion of the examination. Nonetheless, this is rarely the case in practice. Many different postprocessing algorithms exist, including shaded surface display, maximum intensity projection, planar and curved planar reformation, or volume rendering. There is no consensus about the optimal postprocessing method. Similarly, there is no agreement in the literature about the optimal CTA parameters, and even at our institution, our multidetector CTA protocols continue to evolve. CTA, unlike MR imaging, cannot determine direction of flow or velocity, and therefore cannot depict intracranial collateral pathways as MRA can. Calcification, particularly skull base bony artifact, limits assessment of the vessels at the skull base, which can be only partially overcome by scrupulously analyzing the source images. Analysis of source images, especially with multidetector CT technology, is laborious and time-consuming, and yet it is almost uniformly stated that this is necessary in the literature.

None of these obstacles are insurmountable. The CT manufacturers can emulate the MR manufacturers who have made available user-friendly postprocessing algorithms for MRA. Calcifications and bony artifacts may be subtracted automatically. Optimal scanning parameters and postprocessing algorithms will be forthcoming as multidetector technology is widely disseminated.

As CTA technology advances, so too does MRA. Gadolinium-enhanced MRA is simply the latest in a series of continuous advances. Does this mean that multidetector CTA will always be its poor cousin, or will it be a true head-to-head contender? Whatever the answer, these exciting techniques will continue to improve our diagnostic and therapeutic powers.

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