MRA: why, where and how?

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Target Audience: Clinicians and researchers working with Magnetic Resonance Angiography (MRA).

Take home points:

- The utilization of Contrast Enhanced MR Angiography (CEMRA) has been negatively impacted by concerns of Nephrogenic Systemic Fibrosis (NSF), which has also provided impetus for the development of non-contrast MRA (NC-MRA) techniques.
- Workers have also focused on safer protocols for CEMRA, involving low doses of gadolinium, more stable gadolinium compounds and non-gadolinium agents.
- Rapid advances in CT angiography challenge MRA to push the boundaries for performance and reliability.

Until a decade ago, the second most common indication for Gadolinium use was CEMRA[1-2]. In 2006, gadolinium was implicated in the causation of NSF[3] and CEMRA was singled out as the main perpetrator[4]. The response of the MR community was swift and remarkably effective. As a result, Gd administration has since ceased to be routine and pre-testing of renal function has assumed an importance similar to that for X-ray contrast media[5]. For practical purposes, severe renal failure now contraindicates the use of Gd and even milder forms of renal impairment make many referring clinicians reluctant to order contrast MRI.

Not surprisingly, there has been an intense resurgence of interest in non-contrast MRA techniques[6-20], and in parallel, the pharmaceutical industry and academic practitioners have sought to minimize risk with CEMRA. Specific formulations of gadolinium based contrast agents (GBCA) have been touted as safer and more stable[21-23] and low dose GBCA protocols have been elaborated and validated[24-28].

Today, NC-MRA techniques are slowly gaining ground and low dose CEMRA protocols becoming standard. However, in the eight years or so since NSF was first recognized, the community remains sensitive and risk-averse to NSF[29-30]. In the interim, the speed, quality and acceptability of CT angiography have increased to the point where CTA has filled in many of the roles previously filled by MRA. Modern CTA is fast, practical, and involves increasingly lower radiation and iodine doses than previously[31]. The pre-testing of renal function that remains standard for CTA is now also a feature of CEMRA, eroding what had previously been an advantage for CEMRA, although the recent re-introduction of iron particles is opening up possibilities for a new wave of contrast enhanced techniques and applications[32-35].

The MRA of the future will need to compete with CTA on the basis of image quality, reliability, practicality, safety and cost. Which MRA approach to use will depend on the clinical questions and several illustrative examples will be discussed in this talk.

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