Comparison of Renal MRA/CTA and DSA in CORAL Study

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Purpose: Angioplasty and stent for renal artery stenosis is controversial since several trials have shown similar benefits with medical therapy alone. The CORAL (Cardiovascular outcomes in Renal Atherosclerosis Lesions) study randomizes patients with atherosclerotic renal artery stenosis to either medical therapy or balloon angioplasty/stent and follows these patients up to 10 years to determine which therapy has best outcome. The purpose of this paper was to compare the MRA/CTA and DSA results in patients randomized to angioplasty.

Methods: CORAL is a prospective, multi-center study randomizing patients with systolic hypertension and severe renal artery stenosis to either medical therapy or medical therapy with renal artery stenting. Outcomes including death, dialysis, blood pressure control are monitored for up to 10 years. Patients can be randomized into CORAL if renal MRA or CTA within 6-month meets the criteria for hemodynamic significance including 80% stenosis on a good quality MRA/CTA; or 70% stenosis with 2 additional imaging features of functional changes such as spin dephasing, post stenotic dilatation, decreased kidney size or enhancement and delayed excretion of gadolinium. The data in patients randomized into stenting pathway were compared to DSA. In addition the results of outside review of MRA/CTA images were compared to core lab reviews.

Results: A total of 132 renal MRA studies and 64 CTAs interpreted locally as significant renal artery stenosis have been reviewed by the MRA/CTA core lab, of which 5 MRAs and 3 CTAs were identified as non-diagnostic. Only 85 (61 MRA, 24 CTA) were confirmed to have $\geq$ 60% stenosis. In the 63 patients who were successfully randomized into the CORAL study (46 via MRA and 17 via CTA), 28 patients were in the angio/stenting pathway. In addition 2 patients failed the stenting procedure and 1 patient withdrew from the study prior to stenting.

Local radiologist reports were available in 77 MRAs and 29 CTAs. Local readings agreed with core lab results in 51% of MRA (n = 39) and 41% (n = 12) of CTA. Local radiologists overestimated the severity of renal artery stenosis in 29 of 170 arteries on MRA and 24 of 69 arteries on CTA. Accessory arteries were missed in 7/16 arteries on MRA and 2/11 arteries on CTA. Other errors included failure to identify post-stenotic dilatation (26/28 and 9/9 on MRA and CTA respectively), asymmetry of enhancement (14/14 on MRA) or kidney size (15/23 and 6/9 on MRA and CTA respectively).

DSA correlation was available for 29 (6 CTA, 23 MRA) patients, 38 arteries, randomized to stent. CTA correctly diagnosed the severity of luminal stenosis in 7 of the 8 renal arteries with 1 false positive, accuracy = 88%. MRA correctly identified 26 lesions in 30 arteries with an accuracy of 87%. MRA/CTA overestimated stenosis severity in 26 of the 38 arteries (68%).

Conclusion: CORAL is an important study for assessing how to treat renal artery stenoses and thus far, MRA/CTA has proven to be accurate methods for identifying patients eligible for study randomization when interpreted by experts at MRA/CTA core laboratory. High number of local radiologist errors, 51% of cases, suggests an opportunity for improving MRA/CTA through continuing medical education.

Table 1: Accuracy of MRA/CTA on identifying renal artery stenosis using angiography as standard of reference.

	# of arteries	False positive	False negative	Accuracy	Average stenosis severity	
					Core lab	Angio
MRA	30	1	3	87%	72%	68%
CTA	8	1	0	88%	68%	65%

Figure 1:

Renal MRA showed 90% left renal artery stenosis as compared to 71% stenosis on renal angiography.

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