Adrenal and Renal MRI

Advances in MRI have resulted in vastly improved images of the kidney and adrenals. Renal MRI typically consists of 2D and 3D T2W MRI slab volumes, Diffusion weighted imaging and dynamic contrast MRI. For tumor detection, the combination of high resolution T2 and contrast enhanced T1 weighted 3D images results in high quality images. The anatomic depiction of T2 allows for accurate mapping of tumors for enucleation/partial nephrectomy/focal therapy whereas serial contrast enhancement permits more accurate characterization of masses. This is usually not possible with CT without excessive radiation exposure. Most patients with renal insufficiency will still benefit from non contrast enhanced sequences. DWI and ADC measurements are particularly useful for identifying regional lymph node metastases. Iron oxide imaging can also be useful for regional staging. Tumor thrombi within the renal veins and IVC are readily identified on 3D sequences where normal blood flow is typically dark. Slow flow in the distal IVC can be problematic but this can usually be resolved on DWI.

Genetic renal parenchymal disorders associated with autosomal dominant, autosomal recessive polycystic disease, and hereditary renal syndromes are well recognized on MRI and it is the preferred modality because such patients often must undergo many studies over their lifetime, leading to relatively high cumulative exposures to ionizing radiation over a lifetime when CT is used instead.

Renal arterial evaluation has become routine for pre-transplant workups and for renal artery stenosis. Triggered dynamic imaging results in high resolution 3D T1 weighted MRAs of the renal arteries and accessory vessels are readily identified. The use of arterial spin labeling for quantitative renal perfusion has mainly been used in the research setting but is becoming more widely available.

There has been continuing interest in the assessment of renal function with MRI. Techniques include BOLD, DWI, DCE and arterial spin labeling. These methods will be discussed, however, they are considered research studies and have not yet entered the medical mainstream.

Although MRI is excellent for detecting renal obstruction, it remains limited in the detection of renal calculi and obstructing ureteral stones. Non contrast CT remains superior for this task.

The adrenal glands are readily evaluated on MRI. Adenomas containing lipid often demonstrate out of phase reduction in signal on gradient echo short TE images. This is highly diagnostic of a benign adenoma. Failure to suppress on out of phase imaging however, is not synonymous with malignancy as many adenomas do not contain high amounts of lipid. Keeping in mind that the prior probabilities of an adrenal metastasis in the absence of a known malignancy or a de novo adenocarcinoma are very low, lesions below 4cm in diameter are usually followed. Larger lesions can be resected using laparoscopic adrenalectomy. The incidence of adrenal adenocarcinoma is approximately 1: 1 million and is usually associated with a large heterogeneous mass in the adrenal. Pheochromocytomas demonstrate highly variable appearance but typically show increased signal on T2W scanning and enhance intensely after contrast media.

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