Unsolved Problems in MSK MR: Clinical Wrist Abnormalities Not Detectable on MR Imaging

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While there has been tremendous progress made in recent years in MRI of the wrist there still are many clinical situations where MRI of the wrist of doubtful value in the management of patients in the view of the clinicians caring for them. As with all tests involving advanced technology (and high costs) it is critical to show value and relevance to clinical care. The focus of this talk will be to identify problem areas in current wrist imaging with some proposed solutions.

Ulnar-sided wrist pain

Ulnar sided wrist pain is a common clinical complaint but a difficult problem for the clinician since the possible sources of pain in the ulnar side of the wrist are myriad. Pain generators may include joints (pisotriquetral, radiocarpal, distal radioulnar), ligament injuries or tears (intrinsic and extrinsic), the ulnar nerve and its branches, the bone itself and surrounding soft tissues such as muscle. Hand surgeons have developed many tests and "signs" to describe their clinical exams of the ulnar wrist but these are typically non-specific in identifying the source of pain.

The triangular fibrocartilage complex (TFCC) is complicated structure that may have a significant contribution to ulnar pain and instability of the distal radioulnar joint. This can be a difficult area to evaluate with MRI unless dogmatic attention is paid to technique of acquisition (including magnet and protocols, but especially the coil) to optimize spatial resolution. MRI is quite sensitive for TFCC tears but less so for the adjacent lunotriquetral ligament. This is an area where 3T truly makes a difference, both in terms of diagnosis and confidence and where using the appropriate coil will make a significant difference in the quality of the examination.

Scapholunate Ligament Tears

The scapholunate interosseous ligament (SLIL) can be challenging to assess on MRI. It has 3 components (dorsal, volar and membranous), all of which may have abnormal signal even when intact. In addition, a secondary sign such as widening of the scapholunate interval may not be helpful as it can be seen with an intact, but redundant, ligament. This is an area where MR arthrography can be an important addition to the basic wrist MRI examination, particularly when combined with the findings from the injection under fluoroscopy.

SLIL tears are often associated with tiny, painful ganglia which themselves can be difficult to identify unless spatial resolution and tissue contrast are optimized. High resolution imaging with true T2 contrast and robust fat suppression are required to better delineate these tiny structures which can significantly improve confidence regarding the presence of an SLIL tear.

Avascular Necrosis

Avascular necrosis (AVN) is an important clinical question that can be difficult to answer with conventional MRI. After trauma, for instance in the case of an ununited scaphoid fracture, x-ray and CT may both show increased density in the proximal fragment which can be mistaken for AVN but in fact usually represents reactive change. MRI is more sensitive for the edema seen with this and the presence of normal marrow fat effectively excludes AVN but there are many cases where the findings are more subtle or where there is more than edema but less than marrow replacement. Since the management of patients is very different depending on the preservation of vascularity it would be ideal to be able to make this diagnosis in a non-invasive and reliable way. Careful examination of images obtained with optimized technical parameters is important but the addition of dynamic contrast enhancement is of potential benefit. Older studies using standard contrast enhancement failed to show any improvement in diagnosis with MRI but those studies typically relied on hand injections of contrast with imaging delayed anywhere from 3-10 minutes after the injection. For dynamic enhancement to really be effective a power injector is required and images must be obtained at baseline and then at successive intervals of 45 seconds or less. Subtraction images can be generated and an enhancement curve can be created. A spike in the cure and visible enhancement on the first phase helps to assure that the arterial supply is intact. Late phase (greater than 2 minutes) enhancement is not a reliable sign of intact vascularity but may instead represent diffusion of contrast. This technique can also potentially be used to follow the viability and incorporation of vascularized bone grafts.

Carpal Tunnel Syndrome

Carpal tunnel syndrome (CTS) is a very common clinical problem which has not really benefited from advanced imaging in terms of diagnosis. The diagnosis is currently based on electromyography and clinical findings with no indicated for pre-operative imaging; in fact, recent guidelines from the American Society for Surgery of the Hand on the management of CTS includes no imaging whatsoever. In those rare instances where MR exams are requested prior to surgery the median nerve can appear flattened within the carpal tunnel and there are often secondary signs such as enlargement of the nerve in the distal forearm proximal to the carpal tunnel and denervation changes in the affected thenar muscles. Currently even high resolution, high field MRI is probably not of value for the diagnosis and management of typical CTS. When atypical findings are present on the clinical exam MRI is helpful to exclude other pathology such as the rare mass

(usually ganglia or giant cell tumor of the tendon sheath) causing median nerve compression. Work is being performed using diffusion tensor imaging which may be a test for nerve function that would make MRI useful as a routine test for CTS but currently it is best used for failed carpal tunnel release with recurrent symptoms or when clinical diagnostic confidence is not high.

There are many other complex clinical problems where conventional wrist MRI has seemed to add little to patient care. Some of this is attributable to indifferent technique when imaging the wrist, some perhaps to an incomplete understanding of the clinical questions by radiologists and some to the historical treatment patterns of clinicians who have not relied on imaging. Communication with clinicians, optimizing imaging technique, the use of 3T scanners with appropriate coils and the judicious use of contrast will all improve the utility of wrist MRI and hopefully come to obviate the need for diagnostic wrist arthroscopy in some cases.

References:

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