87. Carpal Tunnel Disease and Wrist Fractures

The small structures involved in wrist MR benefit from maximization of spatial resolution and SNR with dedicated surface coils and imaging at 3 T. The effect of such measures is shown by the ability to detect injuries to small structures and the median nerve, which is affected in carpal tunnel syndrome, illustrated in Fig. 87.1. Here (A) axial T1 and (B) FS T2WI demonstrate enlargement of the nerve as it courses between flexor tendons deep to the flexor retinaculum at the level of the hamate. Calculating ratios of ipsilateral nerve diameters at the pisiform or hamate versus at the distal radius may prove more useful in documenting enlargement than contralateral size comparisons, as carpal tunnel syndrome is bilateral in more than half of cases. Figure 87.1 B demonstrates high SI within the nerve correlating with edema and inflammation. Median nerve inflammation proximal to the actual carpal tunnel is termed pseudoneuroma. After surgical retinaculum release, nerve hyperintensity may persist, while chronic fibrosis is marked by hypointensity. Additional findings at the level of the hamate in carpal tunnel syndrome include nerve flattening and palmar bowing of the low SI flexor retinaculum. Secondary causes of carpal tunnel syndrome—scar tissue, tendon sheath fibrosis, and tumors—are easily detected with MR, as are long-term sequelae of denervation such as thenar atrophy—initially manifesting as

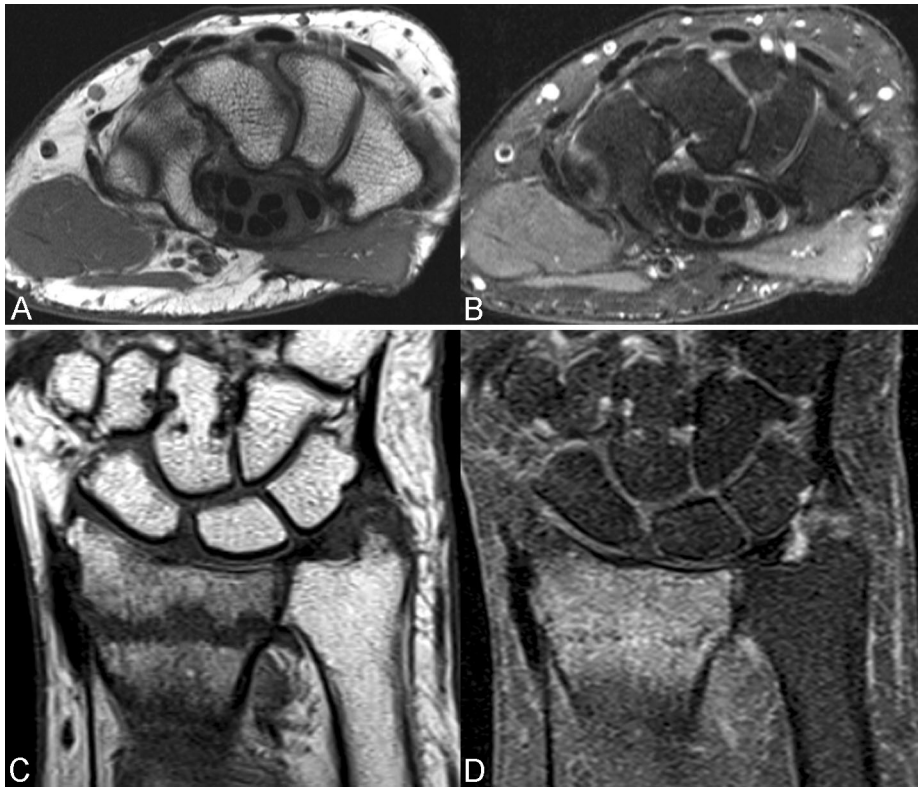

Fig. 87.1

intramuscular hyperintensity on FS PD and T2WI prior to fatty replacement which leads to hyperintensity on T1WI. The ulnar nerve may demonstrate similar SI characteristics when compressed within Guyon's tunnel, formed by the hamate and pisiform. Etiologies of such compression vary based on location: ganglion cysts and hook of the hamate fractures may affect the deep (motor) or superficial (sensory) nerve, while ulnar artery aneurysms tend to affect the superficial portion only.

Radiographically occult fractures of the forearm and wrist are also well-evaluated on MRI. The distal radial fracture illustrated in Fig. 87.1 on (C) T1 and (D) FS T2WI was radiographically occult. The low SI fracture line is flanked by edema-like SI on both images. In contrast to conventional radiography, imaging of a casted arm—as performed in this case—affects image quality relatively little in MR. Angulation is better demonstrated in sagittal planes, and coronal images may help detect concurrent carpal or carpal ligament injury. Carpal instability related to ligamentous disruption is termed dissociative, in contrast to less common nondissociative instability. Scapholunate ligamentous tears constitute stage 1 perilunate instability. Progression of this spectrum consists of progressive failure of the radioscaphocapitate (stage 2) and lunotriquetral ligaments (stage 3), followed eventually by complete dislocation of the lunate from the radiolunate fossa (stage 4). The scapholunate ligament ordinarily demonstrates low SI on T1, T2, and PDWI due to its low water content, consisting of membranous, dorsal, and volar portions. These components are best distinguished with axial imaging utilizing slice thicknesses under 3 mm. Membranous perforations are clinically insignificant, while the dorsal ligament is essential for stability. Complete ligamentous tears may be visible as osseous dissociation and ligamentous tissue defects. The latter appearance is also typical for partial tears. MR arthrography may aid in detection by demonstrating contrast penetration into an injured ligament in a partial tear or in a complete tear by showing contiguity of contrast between the midcarpal and radiocarpal joints. To appreciate widening of the scapholunate gap (> 3 mm) tears of both the volar and dorsal aspects of the scapholunate as well as radioscaphoid injury are often necessary. Dorsal intercalated segment instability (DISI) may occur with scapholunate tears, occasionally as the presenting finding. In this lesion, the lunate is tilted dorsally leading to capitolunate and scapholunate angles over 30 and 70 degrees, respectively (as measured in sagittal planes), along with proximal capitate migration. Scapholunate advanced collapse (SLAC) may ultimately result from degenerative disease related to scapholunate instability. Tears of the ordinarily linear or delta-shaped lunotriquetral ligament are less common and poorly visualized on MR due to the ligament's small size. Coronal imaging, especially utilizing high resolution 3D techniques, is useful, while axial images help distinguish the ligament's three components. Unlike the scapholunate, tears of the lunotriquetrum rarely

lead to visible osseous separation but are most commonly visualized as a fluid-filled gap within the ligament. Normal ligamentous discontinuity without alteration of SI may be seen at the insertion of the triangular fibroosseous cartilage complex. Disruption of the proximal line of Gilula may be seen, as may contrast extension from the radiocarpal to midcarpal joint on arthrography. Volar intercalated segment instability (VISI) may occur with these tears, manifesting as distal carpal row migration proximally as well as scapholunate and capitolunate angles greater than and up to 30 degrees, respectively.