Compression of the median nerve at the wrist, or carpal tunnel syndrome (CTS), is the most common disorder affecting the median nerve. The etiology is multifactorial, with structural and genetic factors playing a much more significant role than the classic teaching of occupational factors such as repetitive hand use and microtrauma. However, infiltration of the transverse carpal ligament (as in amyloidosis or multiple myeloma) or thickening of the connective tissue (as occurs in rheumatoid arthritis, acromegaly, mucopolysaccharidosis, and hypothyroidism) can create median nerve impingement as well. This compression produces a syndrome of sensory loss and paresthesia affecting the palmar aspect of the thumb, index, and middle fingers, in addition to the radial half of the ring finger. Weakness and atrophy of intrinsic muscles of the hand innervated by the median nerve, such as the abductor pollicis brevis, typically occurs in advanced or prolonged cases of compression.

Diagnosis relies on clinical history, physical examination maneuvers such as the Phalen’s maneuver, and the presence of Tinel’s sign, though the diagnosis is typically confirmed via nerve conduction studies demonstrating a delayed impulse. Complex clinical presentations or cases that are refractory to standard treatment may warrant additional diagnostics and management as discussed in this case report of an atypical etiology for CTS.

Radiographic Evidence of Diffuse Large B-cell Lymphoma Presenting as Carpal Tunnel Syndrome

Anthony J. Horton, BS, and Jeffrey R. Wienke, MD

From the University of South Carolina School of Medicine Greenville, Greenville, SC (A.J.H., J.R.W.), and Department of Radiology, Greenville Health System, Greenville, SC (J.R.W.)

Abstract

Any space-occupying lesion in the carpal tunnel can present with median nerve compression and the symptomatology of carpal tunnel syndrome (CTS). Typically, history and physical examination reveal sufficient findings to warrant further investigation with electrophysiologic testing; imaging studies, however, are not routinely considered. Here, we present a case of CTS resulting from carpal tunnel infiltration by a soft-tissue, non-Hodgkin lymphoma as evidenced by non-contrast MRI (magnetic resonance imaging).

Case Description

M.R. is a 78-year-old Caucasian man with a past medical history of hypertension, hyperlipidemia, hemochromatosis, and left testicular lymphoma with disease-free status following orchiectomy, chemotherapy, and radiation therapy that began 3 years prior to presentation. Initially, M.R. presented to his primary care provider with right hand weakness, tingling, and occasional numbness. Physical examination was notable for reproducing paresthesias with wrist flexion, subtle thenar atrophy, and mild anterior wrist swelling without erythema.

Diagnostic work-up, including nerve conduction studies, revealed delayed nerve conduction of the median nerve across the carpal tunnel along with mild reduction in conduction velocity along the ulnar nerve at the cubital tunnel. The patient subsequently underwent elective right carpal and cubital tunnel release, during which the median nerve was found to be intact with nonspecific hyperemic changes beneath the transverse carpal ligament. Postoperative care was notable for acute, same-day right hand pain that was subsequently treated with pregabalin on an outpatient basis.

In the ensuing weeks after carpal and cubital tunnel release, the patient experienced moderate resolution of weakness and paresthesias of his right hand; however, on postoperative week 6, M.R. pre-
presented to his primary care physician with recurrent edema, new erythema, and significant pain in his right wrist with radiation into the hand in a median nerve distribution. Physical examination revealed a well-healed surgical scar with no signs of infection or dehiscence, but sensory loss along the distribution of the distal median nerve was noted.

Subsequent non-contrast MRI (magnetic resonance imaging) of the right upper extremity revealed mild median nerve thickening with extensive, lobulated soft-tissue abnormalities throughout the hand, particularly at the distal ulnar margin of the thenar eminence surrounding the flexor tendons. Insinuating extensions projected between the second, third, and fourth metacarpals. Lobulated soft-tissue abnormalities were further noted in the dorsum of the first web space and surrounding the hypothenar musculature.

Compared to surrounding musculature, this abnormal tissue presented with moderately increased signal intensity on T1 and T2 images (Figs. 1–2). Additionally, proton density fat saturation images of the lobulated masses revealed mildly increased signal compared to surrounding soft tissue (Fig. 3). No bony destruction or erosive changes were identified. Ultimately, the differential diagnosis based on the imaging studies included a recurrence of soft-tissue lymphoma, fibromatosis, or postoperative infection contributing to tenosynovitis.

Given the patient’s history of testicular lymphoma, new imaging findings, acute initial onset of symptoms, and recurrence of painful swelling at the right wrist following carpal and cubital tunnel release, an excisional biopsy of the mass was performed. Biopsy samples identified a diffuse large B-cell lymphoma, which likely represented a recurrence of his prior testicular lymphoma.

Whole-body nuclear medicine positron emission tomography (PET) with overlying computed tomography (CT) images were obtained for staging purposes. Multifocal hypermetabolic activity was noted throughout the right upper extremity, including the right wrist and numerous lymph nodes tracking to the right axilla. Further hypermetabolic activity was noted in a right adrenal mass, proximal right tibial shaft, distal left thigh in the anteromedial subcutaneous tissue, and the left orbit (Fig. 4). With this advanced stage and tumor burden, chemotherapy with rituximab, etoposide, steroid (methylprednisolone), Ara-C (cytarabine), and platinum (cisplatin) (R-ESHAP therapy) and palliative upper extremity radiation therapy were initiated.

Discussion
Lymphomas are an assorted group of malignancies classically arising from lymph nodes or lymphatic tissues such as the spleen, Waldeyer’s ring, and the thymus. However, extranodal presentations of non-Hodgkin lymphomas occur at reported incidence rates of 25%–40%. When they occur, extranodal lesions are more common in
men and have been documented in almost every organ system.³

Most commonly, extranodal presentations of non-Hodgkin lymphoma occur with simultaneous involvement of lymphatic structures, and an extranodal site is only considered to be the primary lesion if no additional evidence of neoplasia is discovered during staging.⁴ Even so, the presence of a tumor or mass outside of lymph node tissue is often not considered a lymphoma until after tissue biopsy and histopathology establish the diagnosis, with the most common histological subtypes being follicular and diffuse large B-cell lymphomas. Specific to this case, only 0.2% of extranodal non-Hodgkin lymphomas present with hand involvement.⁵

Imaging characteristics of lymphoma vary depending on location and specific subtype of disease. Computed tomography is the mainstay of imaging, specifically for its role in tumor staging. However, MRI has particular utility in central nervous system lymphomas, and ultrasound (US) techniques can be used to access disease with lymph node involvement.⁶

For the patient presenting with median nerve compression, imaging studies are neither explicitly necessary nor routinely ordered. Still, imaging may be useful when there is a suspicion for local structural disease such as bony deformity, primary bone or joint disease, or tumor. Wrist films and CT are only indicated to evaluate carpal tunnel stenosis or bone tumors, with MRI or high-frequency US being more useful for direct visualization of the median nerve and other soft tissues.

Use of MRI or US is appropriate to identify a space-occupying lesion in the soft tissue such as a tumor, ganglion cyst, lipoma, or muscle fiber hypertrophy, with MRI in particular having a 96% sensitivity and 33%–38% specificity for this purpose.⁷ More recently, several studies have demonstrated the utility of ultrasonography to detect CTS due to the apparent increase in cross-sectional area of the median nerve in the diseased state, though a defined cut-off for diagnosis has not been adequately determined.⁸

For this case of rapid recurrence of CTS following surgical correction, detailed imaging of the affected hand, including MRI of the wrist or US of the carpal tunnel, was warranted to evaluate for atypical etiologies of median nerve compression, especially given the patient’s history of lymphoma and lack of structural abnormalities on

**Figure 3**
Axial proton density fat saturation MRI demonstrates extensive, lobulated soft-tissue abnormality throughout the right hand, particularly at the distal margin of the thenar eminence surrounding the flexor tendons insinuating between the second to fourth metacarpals. The lesion is isointense to surrounding soft-tissue structures.

**Figure 4**
Whole-body Nuclear Medicine Positron Emission Topography with overlying Computed Tomography (NM PET/CT) demonstrates multifocal hypermetabolic activity in the right hand, right upper-extremity lymph nodes, right adrenal gland, and subcutaneous proximal right thigh among other scattered foci.
physical exam. Review of the literature reveals that this instance is not an isolated presentation of disease, as there have been case reports of other neoplastic processes, including T-cell lymphoma and primary non-Hodgkin lymphoma, infiltrating the distal median nerve and leading to CTS.9,10

Consistent with the images in this case, nonosseous musculoskeletal lymphomas present with isointense or intermediate hyperintensity on T1 and T2 images when compared to surrounding muscle and fat tissue. This finding is reiterated on proton density fat saturation MR images, where soft-tissue lymphoma may be isointense to surrounding soft tissues as in this case.

Fibromatosis and tenosynovitis were considered in the differential of this patient’s imaging findings. However, fibromatosis more classically presents with isointense to intermediate hyperintensity on both T1 and T2 images when compared to surrounding muscle and fat tissue, while tenosynovitis may present with intermediate signal debris in the tendon sheath itself plus high intensity on T2 weighted images.6

Conclusion
Neoplastic processes, including primary and metastatic non-Hodgkin lymphomas, can infiltrate the wrist, compress the median nerve, and present as CTS; thus, neoplastic disease should remain in the differential diagnosis for all patients, particularly when disease is unilateral. When an infiltrative process is suspected, MRI is the imaging modality of choice, though high-frequency US of the median nerve traversing the carpal tunnel is another viable option.

References