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Shandong Medical Imaging Research Institute explores DWIBS for MR neurography in extremities

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MR neurography allows clear visualization of peripheral nerves

Shandong Medical Imaging Research Institute explores DWIBS for MR neurography in extremities

Patients with unexplained pain in the extremities often suspect a muscle, tendon or ligament injury, particularly when exams prove inconclusive. However, at times the actual culprit is pathology of the nerves. At Shandong Medical Imaging Research Institute (PR China), MR neurography is illuminating nerve pathology, making a clinical impact by adding significantly to the findings collected via ultrasound or electromyography.

"MR neurography has high spatial resolution and a large field of view, so it can help to confirm ultrasound findings when they are inconclusive."

The Shandong Medical Imaging Research Institute uses four MR systems to provide MR imaging to approximately 200 patients each day. Affiliated with Shandong Medical School, the Shandong Medical Imaging Research Institute is one of the largest medical imaging institutes integrating medical imaging diagnosis, interventional treatment, scientific research and talent training in China.

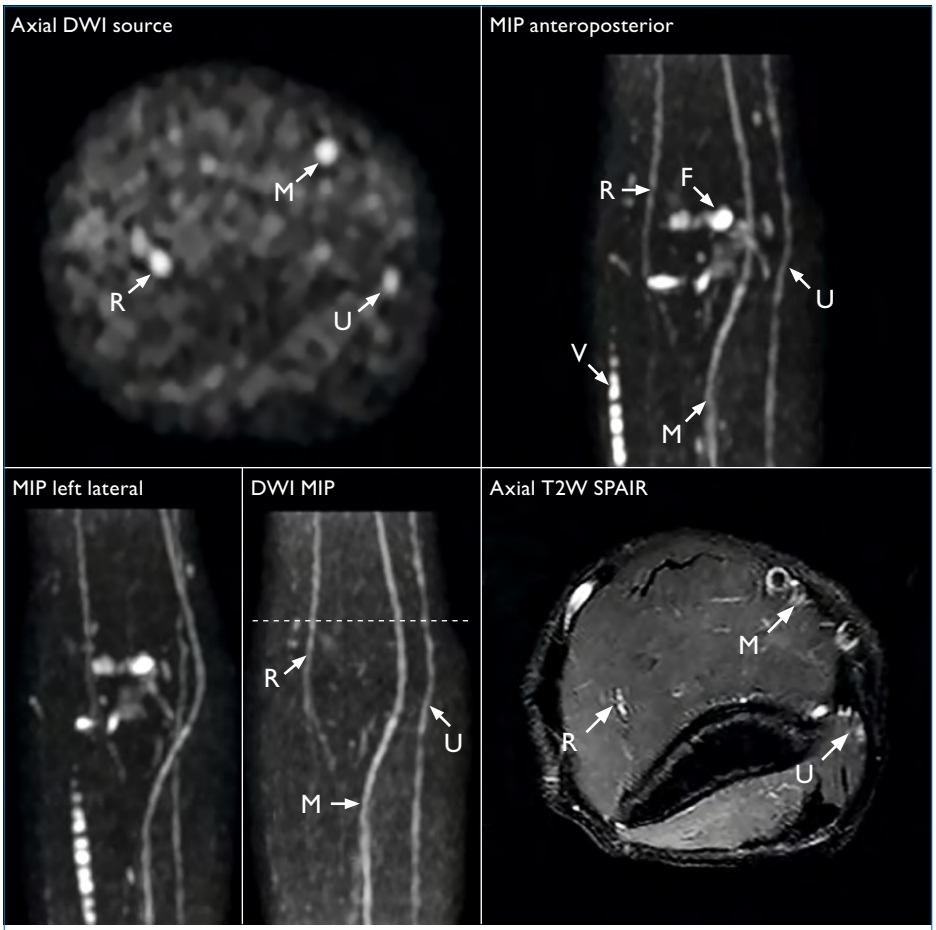
MR is important adjunct

Guangbin Wang, MD, PhD, Professor of radiology and chief of MRI at the research institute, has recently been exploring how DWIBS (diffusion weighted whole body imaging with background body signal suppression) can be used for MR neurography (MRN) of the peripheral nervous system.

Large FOV DWIBS is already in use for imaging patients with multiple lesions, for instance oncology patients. Its high contrast-to-noise ratio makes it particularly valuable when evaluating small lesions. This strength is also what makes it valuable in MR neurography, which has become an adjunct to ultrasound and electromyography in diagnosing peripheral nerve problems.

Demonstrates both lesions and nerve damage caused by trauma

Because ultrasound is convenient and less costly, it is a natural first choice for nerve imaging. "However, sometimes ultrasound cannot demonstrate nerve lesions clearly, and the field of view isn't large," Dr. Wang says. "MR neurography has high spatial resolution and a large field of view, so it can help to confirm ultrasound findings when they are inconclusive."



MR neurography in right elbow

A 26-year-old healthy male volunteer was examined on Achieva 3.0T TX with SENSE Flex L coil, patient in head-first position, scan time 3:54 min.

The axial DW source image shows the median (M), ulnar (U), and radial (R) nerves. On postprocessed full-volume MIP images in anteroposterior and left lateral projections nerves, articular fluids (F) and vessels (V) show hyperintensity. However, nerves can be easily separated from articular fluids and vessels by rotating in different projections. The postprocessed DW image with MIP reconstruction and volume editing in anteroposterior projection demonstrates the median (M), ulnar (U), and radial (R) nerves. Articular fluids and vessels were removed from this image during postprocessing. Axial T2-weighted SPAIR obtained at same level also shows the median (M), ulnar (U), and radial (R) nerves, but not clearly as MR neurography.

Lumbar MR neurography

DWIBS of the lumbar nerve in a 23-year-old healthy male volunteer. Achieva 3.0T TX with 16-channel SENSE XL Torso coil, scan time 3:54 min.

Dr. Wang notes that even when ultrasound or electromyography results in a conclusive diagnosis, MR can be useful to add information for surgical planning. "If ultrasound or electromyography cannot demonstrate the exact position of the lesion, it is difficult to do surgery," he explains. "But after an MR examination, we can demonstrate the lesion's position and shape which can help us determine which type of lesion it is. We give the MRI images to the surgeon to review before the operation."

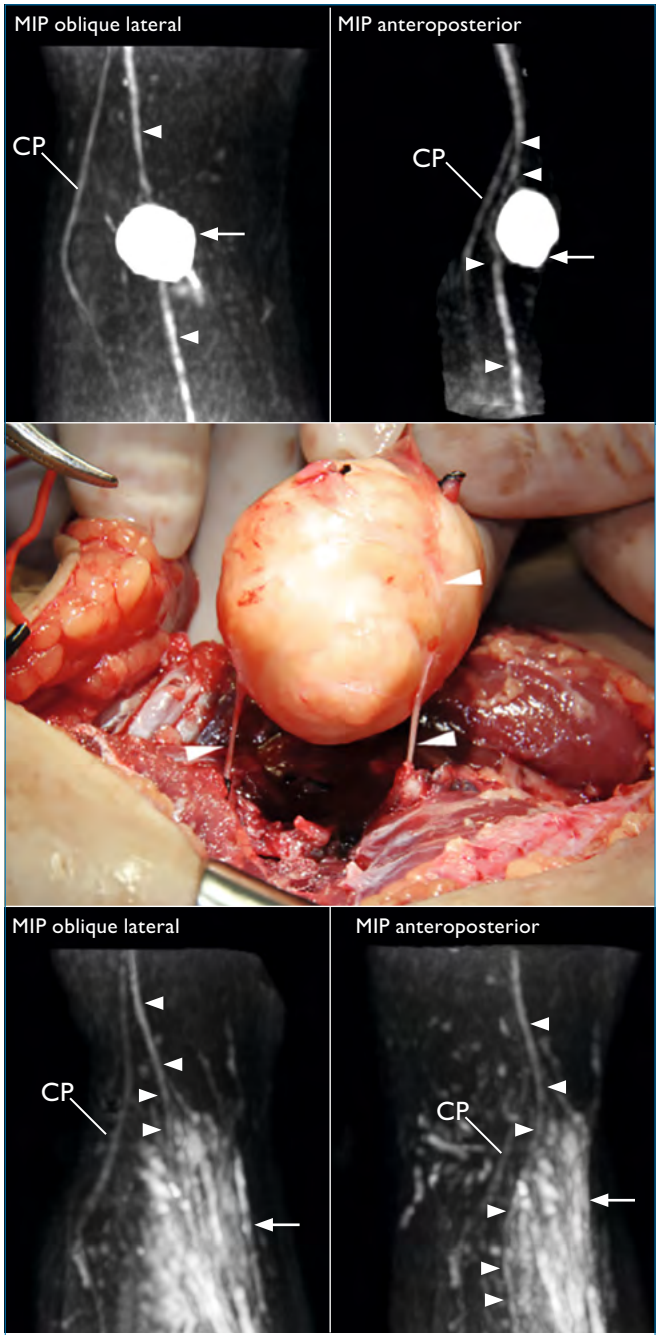
"MR neurography is also used for patients who have nerve damage as a result of trauma," he adds. "When a patient presents with pain or paralysis, we try to pinpoint the cause." In some cases, the patient history can be used to determine if the pain or paralysis was caused by trauma. "But in other cases, the problem cannot be traced back to a single incident," Dr. Wang says. "In those cases, MR can sometimes help to visualize tumor or inflammation when ultrasound cannot."

"If the patient has a tumor, surgery may be needed. If the pain is caused by inflammation or distortion of the nerve, there are drug treatments available," he says. "The patient history is very important for a clinical diagnosis, but a physician cannot make diagnosis only on history."

Diagnosing twisted nerves

Dr. Wang points to twisted nerves as a good example of how DWIBS contributes to diagnoses that were very difficult to make without MR neurography. "In cases in the past, we suspected something could be wrong with the nerve, but we didn't realize it was twisted, because we couldn't visualize that on images," he says.

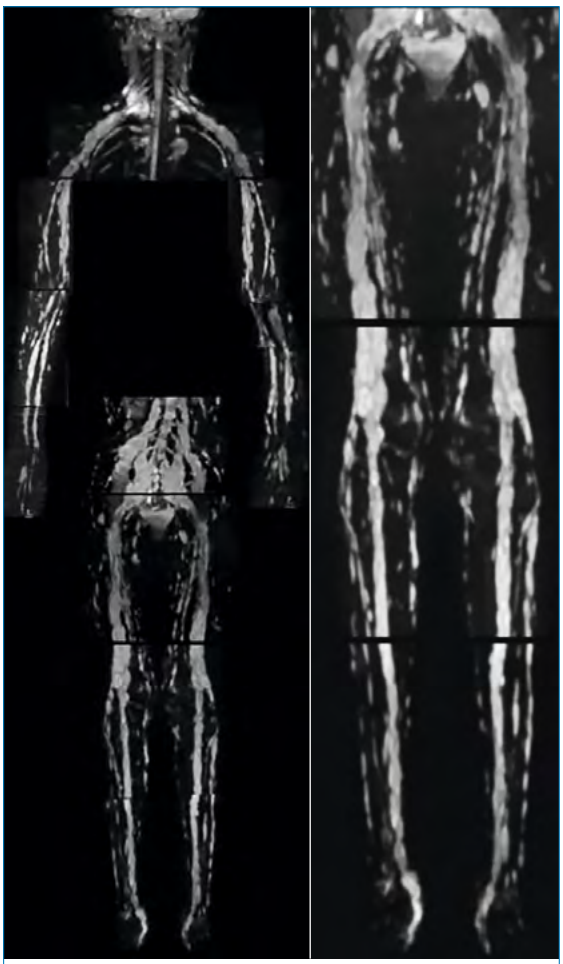
CONTINUE



Tibial nerve schwannoma

A 31-year-old man with a painless mass in the right leg underwent MR neurography on Achieva 3.0T TX with 8-channel SENSE Knee coil, scan time 3:54 min. MIP in oblique lateral and anteroposterior projection shows extrinsic appearance of the mass (arrow) relative to a compressed and anteriorly displaced right tibial nerve (arrowheads). The common peroneal nerve (CP) is normal. The intraoperative photograph shows the proximal tibial nerve entering the mass and the distal tibial nerve exiting the mass and fascicles (arrowheads) running over surface of mass. Histology demonstrated tibial nerve schwannoma.

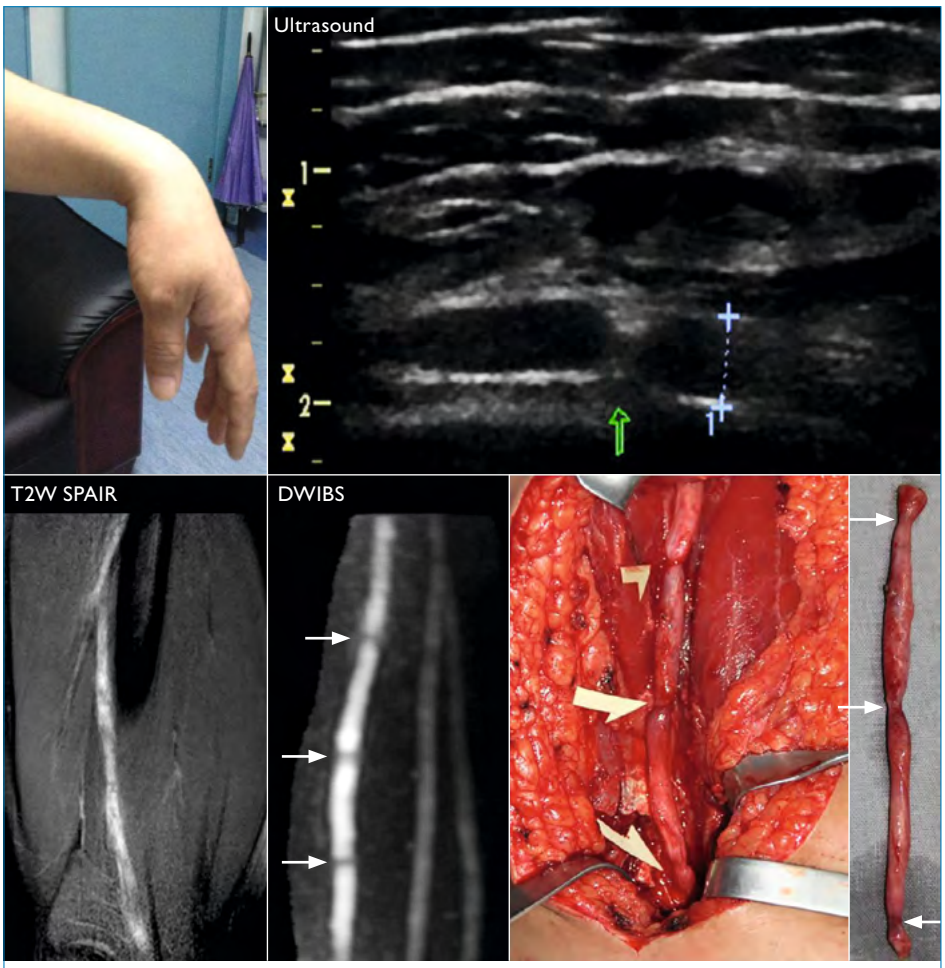
Two months after surgery, follow-up MR neurography in oblique lateral and anteroposterior projection show that it is difficult to differentiate the tibial nerve (arrowheads) from surrounding hypertense tissues in the surgical area.



Whole body MR neurography in neurofibromatosis

A 21-year-old woman with multiple masses and atrophy of upper and lower extremities. Plexiform masses along upper and lower extremity nerves and discrete masses in lower extremities are clearly displayed on the anteroposterior projection DWIBS image. Pathological diagnosis is neurofibromatosis (Achieva 3.0T TX).

"Radiologists are beginning to recognize that we can view disease with a new angle using MR neurography."



Paralysis of hand due to radial nerve fascicle torsion
A 23-year-old male miner with left hand paralysis for three 3 days. Ultrasound shows one hourglass-shaped appearance in the radial nerve fascicle. Coronal T2-weighted SPAIR MRI shows multi-segmental hypointensities. DWIBS demonstrates three segmental hypointensity lesions on the left radial nerve fascicle (Achieva 3.0T TX with Flex L coil, scan time 3:54 min.). Intraoperative photographs shows three segmental hourglass-shaped lesions on the left radial nerve, correspondings to the DWIBS findings. Pathological diagnosis is left radial nerve fascicle torsion.

"An MR examination can demonstrate the lesion's position and shape. We give the MRI images to the surgeon to review before the operation."

"Before we started using DWIBS for MR neurography, we were using both T1 and T2 STIR," he explains. "However, we were not satisfied with these STIR techniques for demonstrating lesions near nerves. Using DWIBS, we have even been able to image the ulnar nerve, over its full length, which is about 2 mm in diameter."

Achieva well-suited for MR neurography

To date, Dr. Wang has studied 51 patients, as well as approximately 50 normal volunteers. All studies were conducted on the Achieva 3.0T TX system, with scan times of 3-5 minutes. Although Shandong has two other 3.0T systems, as well as a 1.5T system, Dr. Wang says that the Achieva 3.0T TX is the only one currently being used for MR neurography. "MultiTransmit helps to shortens scan times and avoid distortion. We get very good contrast between nerves and other soft tissues," he says. Achieva features high gradient linearity, which is particularly important in diffusion weighted imaging for consistent contrast and low geometrical distortion.

"Radiologists are beginning to recognize that we can view disease with a new angle using MR neurography," Dr. Wang concludes. "While ultrasound may always be used first, I think MR neurography can also become common clinical practice."