Ultrasound In the PM&R Specialty

• Better clinical outcomes.
• Improve efficiencies.
• Increase patient satisfaction.

A WHITEPAPER
INTRODUCTION

Chronic pain is a major public health issue. The National Institutes of Health’s National Center for Complementary and Integrative Health (NCCIH) estimates that 100 million adults in the US suffer from chronic pain at a cost of $560-$635 billion annually in healthcare and lost productivity. A 2015 study published in Pain Practice and conducted at Henry Ford Health Care System (Detroit, MI) found that chronic pain costs a healthcare system an average of $32,000 per patient, annually. The highest costs were associated with musculoskeletal (MSK) conditions.1

Chronic pain can also lead to other health issues, such as depression, anxiety, fatigue and difficulty walking or moving. Over time, it has also been shown that chronic pain causes negative changes to the brain.2

Physical medicine and rehabilitation (PM&R) physicians, also known as physiatrists, treat a wide range of MSK conditions that affect the spine, brain, joints, nerves, bones, ligaments and tendons, including treating patients in chronic pain. Increasingly, physiatrists are utilizing ultrasound in their daily clinical practice to diagnose and treat MSK abnormalities. Using ultrasound to supplement an MSK evaluation increases the level of patient care and improves practice efficiency by providing high-resolution, real-time images for diagnosis, interventional guidance and treatment management.

Why ultrasound

Ultrasound is a non-invasive imaging modality that does not use ionizing radiation and has an excellent safety record throughout decades of clinical use. According to the American Academy of Physical Medicine and Rehabilitation (AAPM&R), ultrasound is increasingly being utilized by physiatrists, as it can aid in the evaluation of soft tissue abnormalities in joints and structures. Ultrasound can also guide therapeutic interventions such as needle injections, aspirations and biopsies; ultrasound with needle visualization software further increases the accuracy in needle placement, making it ideally suited for pain management.3,4

Advancements in technology have led to more portable, accessible and affordable ultrasound systems. As a result, many physiatrists find ultrasound to be an invaluable tool that aids in diagnosis and treatment of a multitude of physical conditions.

Ultrasound has the ability to image dynamically and pinpoint exactly where patients are experiencing pain. It generates images of joints, tendons, ligaments, muscles and nerves that help provide solutions to patients at the point-of-care. Treatment options may be offered the same day, a convenience not available with more expensive and time-consuming imaging modalities such as MRI, which saves time for the patient and, more importantly, may lead to better outcomes, sooner.

Cliff Gronseth, MD, founder of Spine West Physiatry & Sports Medicine (Boulder, CO), says that physiatry is a very patient-centric specialty. In fact, many patients appreciate the added care they receive when ultrasound is used for diagnosis and for needle guidance – Dr. Gronseth adds that many patients like to watch the entire process. He finds that using ultrasound enhances the provider-patient relationship and builds trust.

“Ultrasound expands my referral base and diminishes my reliance on other specialists,” he explains. “It has been a significant contributor to staying independent and in my own practice. In fact, we collaborate with radiologists who refer patients to us because of our expertise in performing MSK ultrasound. We confer with the radiologists when we have questions about the MRI and ultrasound findings. Our services are very complementary and collaborative so we can get the right diagnosis and treatment plan.”

John M. Lesher, MD, MPH, a physiatrist at Carolina NeuroSurgery & Spine Associates (Huntersville, NC), also sees greater adoption of ultrasound by physiatrists for MSK evaluations, including tendinopathy, peripheral nerve evaluations and ultrasound guided injections.
“Ultrasound is a complementary tool to MRI and so we are using them together,” Dr. Lesher says.

**Growing use of ultrasound in physiatry**

MSK ultrasound is now a required component for PM&R residency training in the US. A recent survey of residency programs reports that 97.2% of respondents provide exposure to MSK ultrasound. However, only 44.4% had a formal curriculum.5

While physiatrists have historically relied on their understanding of anatomy and physical examinations, the use of ultrasound is growing in importance for diagnoses and treatment management decisions. With ultrasound, physiatrists can view tissues, tendons and ligaments statically and dynamically; visualize a target during interventional procedures; and instantly confirm a physical exam finding.

As both Dr. Gronseth and Dr. Lesher have found in their own practices, ultrasound is more than an additional source of revenue; it also assists with patient continuity and practice growth through new referrals.

“When we start going down the diagnostic path, the patients ask for ultrasound,” says Dr. Gronseth. “When they have an ache or pain, they will come to me for the ultrasound imaging and diagnosis.”

Warren Slaten, MD, Medical Director, Regenerative Healing Center (Ridgewood, NJ), agrees, yet adds that physiatrists need to carefully evaluate an ultrasound system and its capabilities. He uses the analogy of recommending a treadmill to his patients. If they purchase the least expensive, it may not be a good experience or pleasant to use, especially at higher speeds. He says the same can be said of an ultrasound system: purchasing the lowest cost system without the necessary MSK features and capabilities, superior image quality and appropriate transducers may result in a machine that is less effective and less enjoyable to use, so it may not be used as much.

**Ultrasound for diagnosis**

Dr. Lesher believes that ultrasound helps him provide a more comprehensive evaluation of MSK conditions. He also uses it as an adjunct to nerve conduction/EMG studies, particularly when the results are equivocal and do not match the physical exam findings and symptoms.

Even with rehab inpatients, there is clinical utility for using ultrasound in physiatry. Adds Dr. Lesher, “Whether it is spinal cord, stroke, EMG-guided botox and phenol injections or neuromas in amputees, we use ultrasound to assist with the diagnosis as well as injection guidance.”

Dr. Gronseth also finds that ultrasound is an excellent adjunct to EMG nerve conduction studies. In his practice, all patients scheduled for carpal tunnel surgery first undergo an ultrasound to verify location of the median nerve. “The thenar motor branch of the median nerve usually branches toward the thumb (radial direction), but in some cases, it goes the other way (ulnar direction) and we don’t want the surgeon to accidently cut the motor branch of the nerve. We can also determine where the nerve is likely being pinched, proximal, mid or distal part of the carpal tunnel. The surgeons appreciate knowing precisely where the compression is occurring.”

With ultrasound, Dr. Gronseth can see some structures in finer resolution than with MRI. He recalls a case where the radiologist thought it was impressive that ultrasound could see a small...
rotator cuff tear that was missed on MRI. Ultrasound enhanced the diagnosis when the radiologist re-read the MRI. Also, in many cases, making the diagnosis with ultrasound avoided the need for an MRI.

**Ultrasound for intervention**

Ultrasound for needle guidance is used to pinpoint the location of tissue for testing or treatment. Ultrasound systems, such as the SONIMAGE® HS1 Compact Ultrasound System by Konica Minolta Healthcare, uses an advanced algorithm based on the movement of the needle and tissue. Therefore, visibility is enhanced in both in-plane and out-of-plane needle approaches, especially beneficial in steep needle angles. Visualization software increases needle placement accuracy, making it the ideal solution for guided injections in pain management.\(^3\)\(^4\) According to Dr. Gronseth, in the state of Colorado ultrasound is a standard of care for regenerative medicine. “If you are taking stem cells out and injecting them back into the body, you’d better know exactly where you are putting them.”

Dr. Slaten agrees, adding, “In the last three years, I’ve decided to dedicate my practice to regenerative medicine, and early on I recognized that ultrasound is essential.”

In fact, he believes so strongly in the clinical utility of ultrasound that he uses it on all patients with MSK conditions other than the spine. “All peripheral joints are evaluated with ultrasound – it has really become an extension of my physical exam. I’m seeing more, doing more, and my patients really appreciate it.”

In Figure 3, the SONIMAGE® HS1 Simple Needle Visualization (SNV™) software incorporates an advanced algorithm that enhances needle visibility for both in-plane and out-of-plane approaches.

In Figure 4, the resulting clarity of the needle, both tip and shaft, enables increased accuracy in needle placement, making the SONIMAGE® HS1 an ideal solution for pain management guided injections.

Dr. Slaten is providing prolotherapy to patients with tendon and ligament tears. The target area for prolotherapy is where the tendon or ligament attach to bone. Ultrasound guides the needle placement for injection. “The procedure has become quicker as I can see that the needle is in the right place with ultrasound, so it has definitely improved the efficiency and accuracy of prolotherapy. When placing a PRP solution, a quality machine helps visualize and target the area of pathology in the tendon or ligament,” he adds.

Nerve identification and nerve hydrolysis, where fluid is placed around the nerve to “free it up” for different pain conditions, are two procedures that Dr. Slaten commonly utilizes ultrasound to visualize the nerve. He is also performing Lyftogt Perineural Injection Treatments with ultrasound guidance.

**Education and training**

Education and training on the use of ultrasound is an important component for any physiatry practice. While many physiatrists receive some education and training on ultrasound in residency programs, systems vary across manufacturers. Therefore, on-site training is an important component that should be included in any ultrasound system purchase.

Konica Minolta provides an exceptionally robust platform of educational offerings, customized to a physician’s needs. Start-up support with every ultrasound system sale includes system installation, applications training, customized exam presets and menus, physician training and assistance with patient cases. Other educational offerings include webinars and procedural...
videos, physician preceptorships, hands-on workshops and
off-site training at regional facilities. Technical support at Konica
Minolta is dedicated to maintaining each system to run at peak
performance, with a call center that is available 24x7.

Ultrasound can also help physiatrists educate patients on their
conditions and treatments. Dr. Slaten regularly uses ultrasound
images to help explain to patients their clinical situations and how
best to treat their symptoms. For example, he can demonstrate
to a patient either tendon swelling or an area of partial tear.
Dr. Slaten explains, “It clarifies for the patient what the target
treatment is and what we are trying to accomplish [with the
treatment]. Getting patient buy-in helps motivate patients to
follow through with their treatments.”

The technology – SONIMAGE HS1
The SONIMAGE HS1 has advanced MSK imaging functionality,
allowing for superior image detail and contrast resolution. With high
image quality and needle visualization, physiatrists can obtain the
information they need to make a confident patient care decision.

“The image quality of the SONIMAGE HS1, especially at the price
point, is phenomenal,” says Dr. Gronseth.

Enhanced signal penetration, increased color flow sensitivity
and improved resolution deliver detailed tissue differentiation,
enabling clinicians to detect structures as small as several hundred
microns. In conjunction with beam-steering technology, the HS1
incorporates an advanced algorithm that utilizes both the in-plane
and out-of-plane methods to improve needle visibility, especially in
steep angle approaches. The resulting clarity of the needle enables
increased accuracy in needle placement, making the portable
system an ideal solution for pain management guided injections.

Dr. Slaten has experience using other high-end ultrasound
equipment in addition to the SONIMAGE HS1. “With the HS1, I’ve
seen comparable, and in some cases, better image quality than
the other high-end systems and can visualize many of the same
structures. The fact I can achieve the same results drew me to this
system. I feel the SONIMAGE HS1 is a high-end ultrasound system
without that high-end price, and that made it an easy
decision to invest in it for my practice.”

Yet, ease of use does not compromise Dr. Gronseth’s ability to
perform more advanced procedures. “With the SONIMAGE HS1,
I can reduce keystrokes, preset a hip exam and quickly adjust the
main image parameters like gain, frequency, depth and focus to
optimize each image,” says Dr. Gronseth.

“That’s the really nice thing about this system: for beginners, it is
easy to adjust the basic image optimization parameters. But if you
want to go further, you can do that easily. With the HS1, I like the
quick access to compound imaging, trapezoid view and dynamic
range. We’ve created quick keys for changing probe types and
other settings we frequently use.

“The image quality is amazing. I can see small tears in tendons
that I cannot see with our other ultrasound systems,” Dr. Gronseth
says. “My patients really appreciate the images I show them
because they are so clearly visible with the HS1.”
Dr. Lesher has experienced similar imaging results with the SONIMAGE HS1, including elbow and gluteal tendons and even small defects in rotator cuff tendons. “The high frequency linear transducer is like the zoom-in lens of a camera for soft tissue and superficial structures,” he adds.

For many physiatrists, an external monitor is useful during interventional procedures. Dr. Slaten calls the use of a wall monitor a “game-changer,” and after connecting his HS1 ultrasound system to a wall monitor, he has noticed that needle guidance is much more effective.

The SONIMAGE HS1 has a full suite of compatible transducers. The HL18-4 hockey stick linear transducer is especially useful to physiatrists for MSK and pain management applications. This small footprint probe easily maneuvers to reach difficult-to-access areas. It is an ideal transducer to help clinicians evaluate joints in the fingers and ankle more readily with the probe’s angulation, improved control and greater contact with the anatomy. The high frequency probe provides excellent resolution in the near field for tissue differentiation and visualizes color flow with outstanding Doppler sensitivity.

**Conclusion**

Physiatrists are recognizing the clinical and economic value of ultrasound in their practice, with many finding ultrasound an invaluable tool that aids in diagnosis and treatment of a multitude of physical conditions. Providing point-of-care diagnostic and guided interventions using advanced ultrasound solutions enhances patient care, treatment decisions and, in many cases, might help avoid additional testing or procedures. Whether ultrasound is used to guide injections, evaluate MSK injuries or as an adjunct to EMG studies, systems such as the SONIMAGE HS1 enable physiatrists to do more in their practices by streamlining patient care and increasing revenue.

**References**


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