

# Diagnositics

## for PT

ISSUE #9

2022 PRACTICE  
OF THE YEAR  
WINNER:  
EDDIE ST. CLAIR

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ULTRA-  
SONOGRAPHY  
AND ITS FUTURE

# Electrodiagnostic Testing of Patients

with Suspected Lumbar Radiculopathy



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**DR. MOHINI RAWAT SYMPOSIUM PRESENTATION**

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## EDITOR'S LETTER



# The Diagnostic Revolution in Physical Therapy is Here NOW!

Hands-On Diagnostics provides the Physical Therapist with an ability to better treat patients while securing a greater financial benefit.

If you're looking to grow your practice or trying to figure out a retirement solution for your practice, you've come to the right place at the right time.

Or maybe you're really just looking to learn more about diagnostics and see if "all the hype is real." Still, you've come to the right place. Why? Because the "hype" is real.

We've just concluded our 9th Annual Hands-On Diagnostics Symposium in Clearwater, FL and it was incredible on all levels. We are positioned as an organization and nationwide community of revolutionaries (our members and their teams) to carry the flame of diagnostics for physical therapy to the highest apex.

In this issue, you're going to get amazing content from qualified and esteemed contributors. It's full of articles and case studies for you to see for yourself just how effective, powerful, and efficient this approach really is.

Our goal is that you'll begin to get a clearer picture of just how important and necessary this is for your practice. If you want to be prepared for the ever-changing world of private practice physical therapy, having access to tools, education, and community like here at Hands-On Diagnostics is of the utmost importance.

As always, our goal is to give you the cutting-edge of physical therapy and we think we've met that goal. We know you'll love this issue.

Feel free to contact us if you want to know more about implementing diagnostics into your practice.

# Diagnostics for PT

**Bryson G. Baylor**  
Editor-in-Chief

**Diagnostics**  
for PT ★★ ★

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## THE ART & SCIENCE OF CLINICAL DIAGNOSTICS

In a Physical Therapy multi-center study<sup>1</sup>, 465 patients received electromyography (EMG) or musculoskeletal ultrasound (MSKUS) performed by their physical therapist. These diagnostic tests led to modifications of the patient's managements 62% of the time and resulted in achieving better patient outcomes.

In another study, Lindstrom et al<sup>2</sup>, reported a change in management of 63.4% post EMG/NCS testing in a primary care practice setting.

Armantrout et al<sup>3</sup>, demonstrated that Neurologists, Physical Therapists and Physiatrists have the same competencies in performing electrodiagnostic examinations.

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# The State of Ultrasonography and Its Future

Mohini Rawat,  
DPT, MS, ECS, OCS, RMSK

Diagnostic ultrasound is increasingly becoming preferred modality for neuromusculoskeletal system evaluation. The benefits of ultrasound are the low cost, portability, ability to provide real-time results and ease of comparison with contralateral side. This article presents the current use of ultrasonography followed by the future directions and new developments in the field.

The most common type of ultrasound imaging in neuromusculoskeletal ultrasound evaluation uses B mode or Brightness mode. There are other modes available in the ultrasound machine for various purposes like- M mode, Color Doppler mode, Power Doppler mode. You can see the brief description of these modes below-

**B mode:** Brightness mode US or Grayscale US

**M mode:** Motion mode reflects motion of connective tissue within muscles

**Color doppler US:** Converts doppler sounds into colors. These colors show the speed and direction of blood flow

through the vessel.

**Power doppler US:** Power doppler US is more sensitive than color US and helps in detection of smaller velocities than color Doppler.

Point-of-care ultrasound is becoming a new musculoskeletal physical examination and medical community embraces the potential of point-of-care ultrasound across medical specialties. When indicated and used in combination with other components of examination, musculoskeletal ultrasound imaging can have significant impact on patient management. Friedman et al in 2017 study reported statistically significant impact on patient treatment when ultrasound imaging was used as they report treatment was changed in 63% patients post ultrasound imaging.

Other than showing significant impact on clinical decisions making, research reports higher satisfaction reported by patients when ultrasound was used as point-of-care tool in the assessment of their problem. Patient reported

that they are:

- Better able to understand the problem
- More re-assured about the problem
- Better able to manage problem
- Greater patient satisfaction with the care provided

There are wide range of problems where ultrasound imaging is indicated. Patients with various pathologies may have similar symptoms or clinical presentation which is often confusing to arrive at an accurate diagnosis. With ultrasound imaging we can accurately assess the soft tissue structure and gain insight into pathophysiology.

With time technology is changing and there are new advancements in the field of ultrasound imaging. With the use of new techniques like elastography we can now measure the stiffness of the tissues. This technique has potential to quantify palpation skills.

Elastography helps with

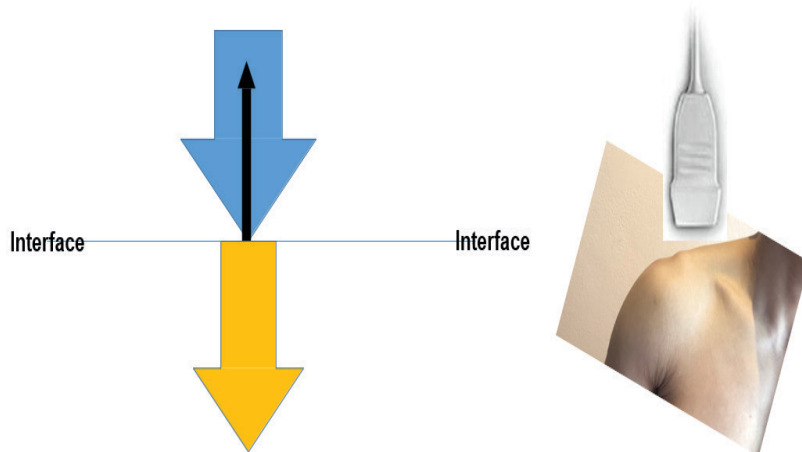
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- Real-time and direct measurements of muscle stiffness
- Monitor outcomes of interventions
- Better inform the functional prognosis.
- Direct measurement has the potential to quantify previously subjective clinical examination measurements and diagnoses

In future we will see advanced techniques like radiomics where we not just see the morphology of soft tissue but can measure the internal composition of the tissue. Another promising field in development is wearable ultrasound where real-time imaging of tissue can be obtained as patient engages in function movements. The possibilities are limitless and we cannot wait to see what future unfolds. •

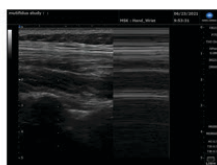


B mode US

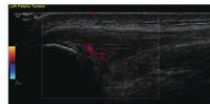


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M mode

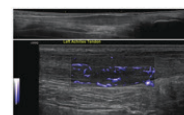


Color doppler US



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Power doppler US



Qin A, Li J. Ultrasonography. Sports Injuries. Musculoskeletal Diseases 2021-2024. Diagnostic Imaging (Internet). Chon: CMC Springer; 2021. Chapter 16. Springer; 2021.

No change



Conservative Mgmt.



Injection



Surgery



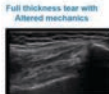
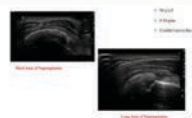
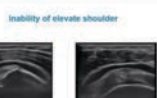
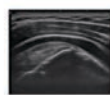
Change in Dx



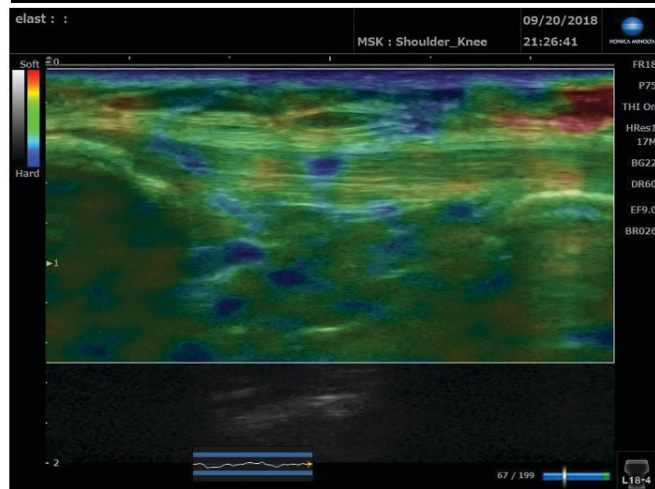
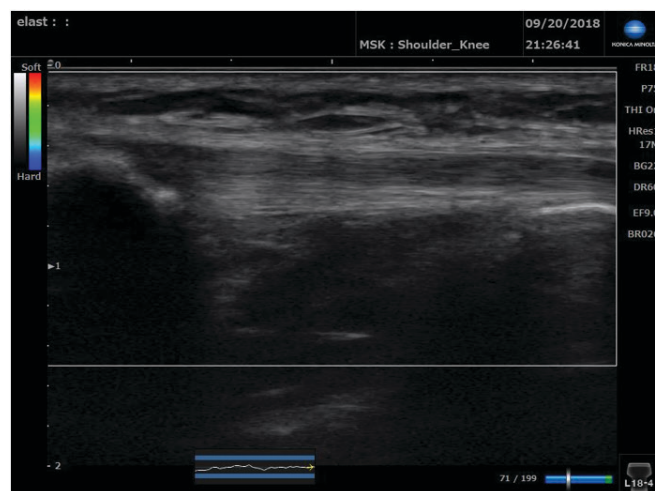
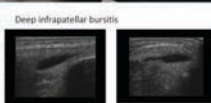
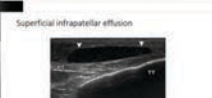
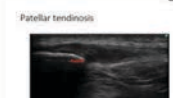
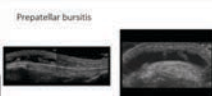
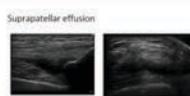
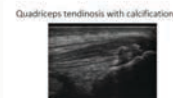
Need additional imaging



Unable to Elevate the shoulder?



Anterior Knee Pathology



DANIEL B. NEFF

# Electrodiagnostic Testing of Patients with Suspected Lumbar Radiculopathy



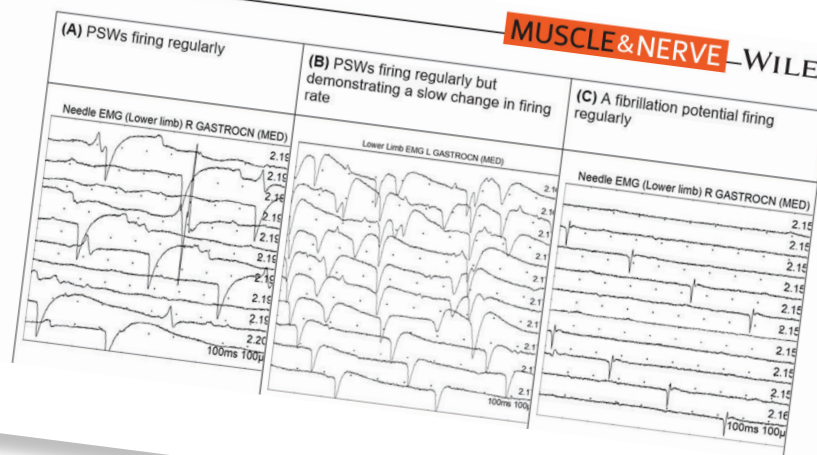
**Daniel B. Neff,  
DPT, COMT**

This article will focus on electrodiagnostic testing of patients with suspected lumbar radiculopathy. The Preston and Shapiro text, *Electromyography and Neuromuscular Disorders: Clinical-Electrophysiological-Ultrasound Correlations*, 4th Edition, 2021, chapter 32, Radiculopathy, will serve as the main source of information. A quality EDX study always begins with a directed history and clinical exam. We use dermatomes and myotomes to begin to clue us in on the integrity of the neural system. Given that dermatomes have a wide overlap with other adjacent dermatomes and myotomes also have considerable overlap in nerve root innervation, Preston and Shapiro state that it would be highly unusual for a patient with an isolated radiculop-

athy to develop a severe dense sensory numbness or a true paralysis of a muscle. As well noting, a dense numbness is usually more indicative of a peripheral nerve lesion than a radiculopathy.

Muscle Stretch Reflexes (MSR) are utilized in our exam to begin to clue us in on the integrity of a specific nerve root. Traditionally a Knee jerk MSR may be reduced or absent in a lesion of the L3 or L4 nerve roots and the Ankle Jerk MSR may be diminished or absent in a lesion of the S1 nerve root. Although the Knee Jerk is mediated by L3/L4 nerve roots, some research suggests that a diminished or absent Knee Jerk response may be observed exclusively in some cases of L5 radiculopathy. Federica Ginanneschi et al. performed a recent study using EDX, MRI and clinical



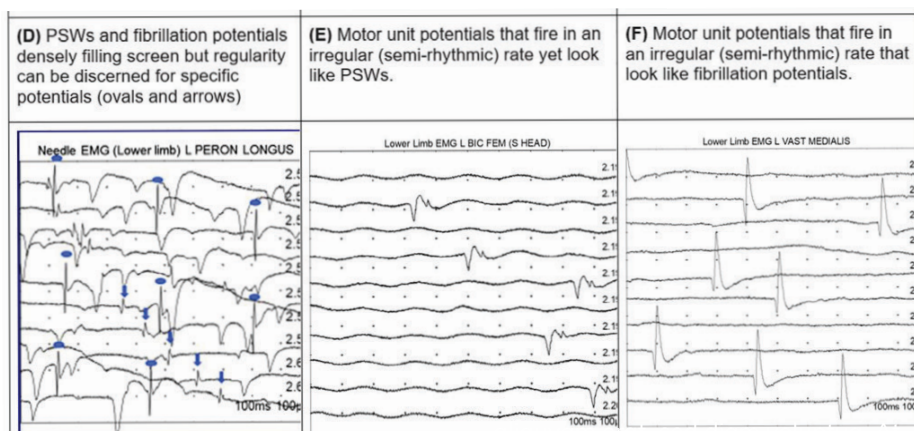


exam data, to identify patients with L5 monoradiculopathy. The authors demonstrated that 33% of those patients had an abnormal Knee Jerk response. Trond Iverson, et al. in 2013 also demonstrated abnormal Knee Jerk response in patients with L5 radiculopathy. The author's take home message was: Be careful using an abnormal Knee Jerk response to disprove the presence of an L5 radiculopathy.

In general nerve conduction studies (NCS) in cases of radiculopathy will be normal and our electrodiagnosis will be made with needle EMG. NCS are performed mainly to rule out other conditions that may mimic radiculopathy, especially entrapment neuropathy. When addressing numbness and tingling in the lower extremity, we must rule out a peroneal nerve entrapment at the fibular neck. Both conditions may present with leg pain, drop foot and sensory disturbance over the dorsum of the foot. Sensory studies are the most important part of EDX testing for radiculopathy. Sensory nerve action potentials (SNAPs) will remain normal in lesions proximal to the Dorsal Root Ganglia (DRG). Preston and Shapiro state that all radiculopathies, including those caused by herniated disc or spondylosis encroachment, will damage the nerve root proximal to the DRG. As well, lesions at or distal to the DRG will result in decreased SNAP amplitude if associated with axonal loss. Thus, in the presence of a normal SNAP, in

the distribution of the patient's sensory disturbance, this should always suggest a lesion proximal to the DRG.

There is one rare exception, and it occurs with the superficial peroneal SNAP and cases of L5 radiculopathy. In cadaver studies, 10-40% of individuals have a DRG that is located proximal to the intervertebral foramen. This proximal anatomic location can expose the DRG to compression by a discal structure. In the cadaver studies, when this proximal location is observed, this compression is visually described as an "Indented" L5 DRG. Thus, if everything in your study is pointing toward an L5 radiculopathy except you have an abnormal superficial peroneal SNAP,



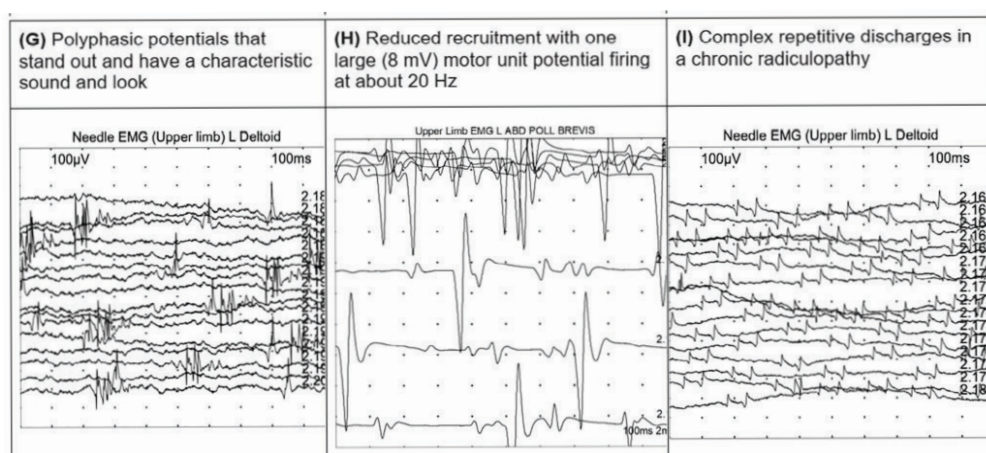
**"NCS ARE PERFORMED  
MAINLY TO RULE OUT  
OTHER CONDITIONS  
THAT MAY MIMIC  
RADICULOPATHY,  
ESPECIALLY  
ENTRAPMENT  
NEUROPATHY."**



Preston and Shapiro recommend adding into the impression: “Possibility of an unusual variant of L5 radiculopathy with superficial peroneal sensory fibers involved”.

We know that a needle EMG is considered confirmatory for a radiculopathy, if abnormalities are found in two or more muscles innervated by the same nerve root, but different peripheral nerves. Yet, the adjacent nerve roots are normal. But how do we get there? How do we get this confirmatory evidence in from our EMG? In the 2020 AANEM monograph on radiculopathy, Dillingham provides some take home clinical pearls to help accurately identify abnormalities in our needle EMG. Dillingham writes, when analyzing polyphasic potentials, they should be easily recognizable, meaning having many phases, and are even more compelling

when they are of long duration and firing with a reduced recruitment pattern. When analyzing the paraspinals, Dillingham cautions not to over diagnose paraspinal EMG findings by mistaking an irregular firing potential for regular firing fibrillation potentials (fibs) or positive sharp waves (PSW). Distal motor units or end-plate spikes can look like fibs/PSW depending on the proximity of the needle to the depolarizing wave (See graphs below). The authors take home message was to analyze the regularity of the firing rates of the potentials. Abnormal fibs/PSW will have a regular firing rate. If you are having difficulty hearing the regularity of firing rate, most modern EMG units will have a raster option, which when employed will split the screen and show the potentials firing rate. By consistently analyzing needle EMG findings in this fashion and applying the proven EDX principles of NCS in cases of radiculopathy, this will allow us to more accurately identify abnormalities in our needle EMG and enhance the confidence of the impression. •



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**“BY CONSISTENTLY ANALYZING NEEDLE EMG FINDINGS IN THIS FASHION AND APPLYING THE PROVEN EDX PRINCIPLES OF NCS IN CASES OF RADICULOPATHY, THIS WILL ALLOW US TO MORE ACCURATELY IDENTIFY ABNORMALITIES IN OUR NEEDLE EMG AND ENHANCE THE CONFIDENCE OF THE IMPRESSION.”**





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"When would you like to come in?"

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- ☐ New patients cancel or no-show the day of their eval.
- ☐ Our team struggles to handle patient objections.
- ☐ Patients want to drop out due to cost of care.
- ☐ Patients aren't scheduling out their POC
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## ANATOMY

The Achilles tendon is the strongest tendon in the body and is the primary plantarflexing mechanism of the ankle. However, it is also the most frequently ruptured tendon in the body. The Achilles tendon is a conjoined tendon formed by the fusion of the distal tendon of the laminae of the soleus and the gastrocnemius muscles<sup>11</sup>. While most tendons are surrounded by a sheath, the Achilles is surrounded by a paratenon. Normal thickness of an Achilles tendon should not exceed 6 mm<sup>4</sup> and on musculoskeletal ultrasound will present as a hyperechoic, fibrillar structure coming from the calcaneus.

The Achilles receives blood supply from 3 major sources<sup>4</sup>. One being longitudinal vessels that cross the myotendinous junction. Another source is the anastomoses with periosteal vessels at the osseous insertion and the last source is from the paratenon by branches from the Posterior Tibial artery. The fibers of the Achilles spiral 12-15 centimeters proximal to the calcaneal insertion where the soleus then contributes to the tendon<sup>4</sup>. The medial fibers of the tendon rotate posteriorly, while the posterior fibers rotate laterally resulting in less buckling when the tendon is lax.

Important structures in the area of the tendon include Kager's Fat Pad and the Retrocalcaneal Bursa. Kager's Fat Pad is a triangular region made up of the Achilles tendon, Flexor Hallucis tendon and a wedge of fat adjacent to the calcaneus bone. During plantarflexion, Kager's Fat pad will extend into the retrocalcaneal bursa as far as the enthesis. In neutral, this pad gets retracted so the tendon is against the bone (the superior tuberosity of the calcaneus).

The Retrocalcaneal Bursa overlies the superior facet of the calcaneus lying between the Achilles tendon and the calcaneus. The bursa is horseshoe in shape and is bounded anteriorly by fibrocartilage and it blends posteriorly with the paratenon. It is normal to see distension in the bursa up to 2.5mm anteroposteriorly.

## DISORDERS

There are various common disorders to the Achilles tendon that can be detected by use of the musculoskeletal ultrasound. They include Insertional Achilles Tendinitis, Achilles Tendinosis, Paratenonitis, Retrocalcaneal Bursitis, Achilles Rupture and Haglund's Syndrome.

Insertional Achilles Tendinitis (Fig 1) occurs at the attachment site of the tendon on the posterior aspect of the calcaneus<sup>17</sup>. Degeneration of the tendon is noted as well as varying degrees of calcification at the insertion of the tendon. This tendinitis is usually atraumatic in onset and occurs in older patients. These patients will present with pain at the posterior heel and tenderness at the insertion of the Achilles tendon may be present when more chronic inflammation is present. Patients will report pain and stiffness upon arising from bed or after sitting for a long period of time. There may be some pain with passive dorsiflexion of the foot as well as tenderness to palpation<sup>17</sup>.

On musculoskeletal ultrasound one will note a thickened tendon at the insertion of the calcaneus that is hypoechoic in nature with some loss of the fibrillar pattern. In a more chronic state, cortical changes or calcifications may be noted at the enthesis.

Treatment for Insertional Achilles Tendinitis consists of anti-inflammatory medication and footwear modification. Heel lifts may alleviate pain by reducing tension on the tendon by elevating the heel<sup>17</sup>. This may also decrease shoe irritation over the bony prominence posteriorly. Immobilization with a boot brace or cast may be necessary. Physical therapy is beneficial and can include stretching to the tendon which helps to reduce inflammation and pain. Surgery may be indicated when conservative treatment is not beneficial. It would include debridement of the degenerated tendon and resection of the bony deformity<sup>17</sup>. In rare instances, a tendon transfer is necessary to restore adequate plantarflexion strength<sup>17</sup>. This is



usually preformed using the flexor hallucis longus tendon.

Achilles Tendinosis (Fig 2) is described as degeneration of the tendon most often in the mid-substance of the tendon. On gross examination, the tendon appears as a yellowish, thickened tendon from accumulation of mucinous material within the diseased area<sup>17</sup>. Achilles tendinosis can occur in runners as well as patients with systemic diseases such as Lupus or Rheumatoid Arthritis. Factors such as taking Fluoroquinolone antibiotics, HTN, hormone replacement therapy and obesity have also been known to be contributors as well as mechanical issues such as foot pronation<sup>17</sup>. The Achilles tendon becomes thickened about 5 to 8 centimeters proximal to the insertion at the calcaneus and swelling often accompanies the



thickened tendon with tenderness to palpation over the affected area<sup>17</sup>. Achilles tendinosis is generally insidious in onset and without trauma. Patients will note pain upon arising from bed or after sitting for long periods of time and also have pain/difficulty with completing stairs and walking.

On musculoskeletal ultrasound the tendinosis will appear as a hypoechoic lesion with or without intratendinous calcification. Loss of fibrillar structure is also noted.

Treatment includes immobilization in a cast or boot brace. Rest, NSAIDs and ice are also helpful to reduce the pain and inflammation. Patients can benefit from Physical Therapy with modalities to assist in decreasing inflammation. Full length semi-rigid orthotics assist with correction of any present foot pronation<sup>17</sup>. Heel lifts may also provide some symptomatic relief. Cortisone injections should be avoided to prevent frank rupture to the Achilles tendon. However, platelet rich plasma injections have shown some promise. Surgery is indicated in those patients who have not benefitted from conservative treatment. This includes debridement of the diseased portion of the tendon and suturing of the remaining tendon which is done with absorbable suture<sup>17</sup>. If greater than 50% of the tendon is debrided, augmentation with a flexor hallucis longus tendon transfer is recommended<sup>17</sup>.

Paratenonitis (Fig 3) is inflammation of the tissue surrounding the Achilles tendon. It generally occurs in conjunction with Achilles tendinosis, but is known to occur in isolation<sup>17</sup>. Capillary proliferation and inflammatory cells are present within the paratendinous tissue<sup>17</sup>. Myofibroblasts in the paratendinous tissue synthesize collagen in response to stress, leading to constriction of the paratenon and decreased blood supply to the Achilles tendon<sup>17</sup>. Patients will experience tenderness and swelling both medial and lateral to the Achilles tendon and there will be tightness of the gastrocnemius-soleus complex. The tenderness and thickness will remain fixed with ankle motion in isolated paratenonitis. In a patient with gastrocnemius tightness, ankle dorsiflexion will increase when the ipsilateral knee is flexed compared with the knee extended<sup>17</sup>. As it progresses, the tendon itself becomes thickened in a fusiform shape.

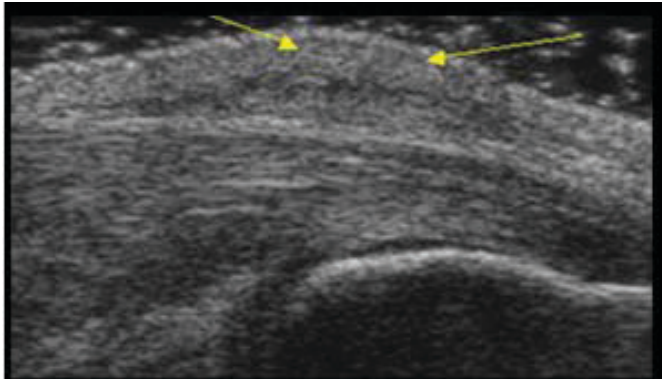
Musculoskeletal ultrasound can show fluid surrounding the Achilles tendon in this paratenon region and also show adhesions around the tendon when more chronic inflammation is present. The fluid will appear as hypoechoic to anechoic signal surrounding the tendon (above/below) and can also be best seen in the short axis view.

Paratenonitis is often treated with immobilization in a boot brace or solid ankle/foot orthosis. NSAIDs, ice and Physical Therapy are also mainstays of treatment to assist with decreasing the inflammation. Younger, more active patients benefit from activity medication along with a cushioned heel lift or shock-absorbing orthotic in their running shoe. Brisement can be used to assist with breaking up the adhesions in the paratenon. Brisement consists of slowly injecting 5-10mL of either lidocaine or saline into the paratenon sheath<sup>17</sup>. MSKUS can be helpful with this procedure by providing visualization to assist with avoiding the intratendinous sheath during the injection. Surgery is infrequent and consists of debridement of the adherent paratenon from the posterior, medial and lateral aspects of the Achilles tendon<sup>17</sup>. The anterior portion is avoided to prevent disruption of the blood supply to the tendon.

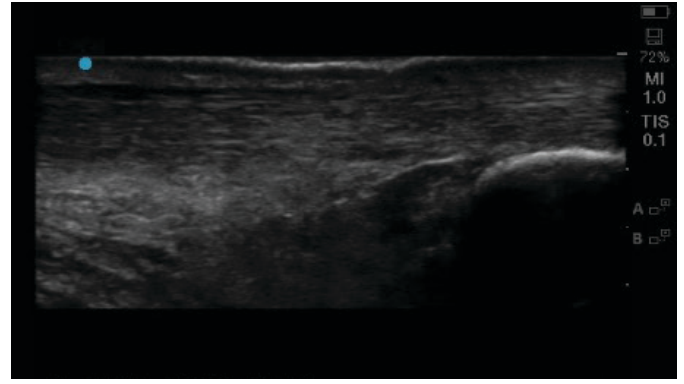
Retrocalcaneal bursitis (Fig 4) involves inflammation of the retrocalcaneal bursa anterior to the Achilles tendon. The bursa can become hypertrophied and inflamed, resulting in adhesion to the Achilles tendon, which causes degenerative changes within the tendon<sup>17</sup>. This often occurs in conjunction with Haglund's deformity with the bursa being compressed with ankle dorsiflexion. The patient will have tenderness just anterior to the Achilles tendon at the level of the insertion. Medial and lateral compression to the ankle will elicit pain in the posterior aspect of the ankle.

MSKUS is used to determine the presence of inflammatory fluid anterior to the Achilles tendon and any associated degeneration of the tendon or ossification. When looking at Retrocalcaneal Bursitis on MSKUS, it will appear as a hypoechoic to anechoic region under the Achilles tendon just proximal to the calcaneus.

Treatment includes NSAIDs, activity modification and bracing to decrease the pain and inflammation. Cortisone injection should be avoided to prevent frank rupture. Surgery to remove



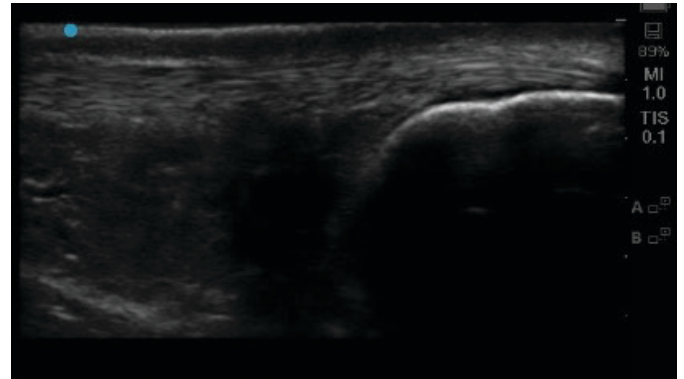
→ **Fig 1. Insertional Achilles Tendinitis**



→ **Fig 2. Achilles Tendinosis**



→ **Fig 3. Paratenonitis**



→ **Fig 4. Retrocalcaneal Bursitis**



→ **Fig 5. Achilles Tendon Rupture**



→ **Fig 6. Haglund's Deformity**

the bursa is rarely necessary but occasionally required to remove the inflamed bursa and associated bony prominence<sup>17</sup>.

An Achilles Tendon Rupture (Fig 5) usually occurs as a result of a sudden contraction of the gastrocnemius soleus muscle complex and often occurs during sports such as tennis, basketball, soccer and badminton<sup>17</sup>. It can also occur as a result of corticosteroid use. A rupture is often suspected based on the history of the injury. The patient is usually able to walk immediately after rupture of the Achilles. A palpable gap will

be noted in the Achilles tendon at the point of the rupture. The most common site of rupture is approximately 6 cm proximal to the insertion of the tendon on the calcaneus<sup>17</sup>. A Thompson test will be positive with a complete rupture. If a calcaneal avulsion fracture is suspected, radiographs should be obtained.

Musculoskeletal ultrasound demonstrates an anechoic space where the tendon should be and is at the end of the tendon stump. The tendon is generally hypoechoic. It shows up in



the middle with residual stumps at each end and the anechoic space of absent tendon in the middle. On dynamic examination, the Achilles tendon does not demonstrate any movement, however, one is able to see the plantaris tendon moving under the Achilles tendon.

Clinical studies support both nonsurgical treatment with immobilization and surgical repair<sup>17</sup>. Most studies report a slightly lower re-rupture rate with surgical repair<sup>8</sup>. Patients can be immobilized with casts or braces. Care should be taken to make sure the torn ends of the tendon are closely apposed in the brace or cast. MSKUS has been shown to be helpful in confirming apposition of the tendon ends/stumps<sup>17</sup>. Surgical repair is performed using either open technique or percutaneous methods. Injury to the sural nerve should be avoided<sup>17</sup>.

Chronic Achilles Tendon Rupture is defined as a rupture that is neglected for more than 4 weeks. These ruptures typically occur 3 to 6 centimeters proximal to the calcaneal insertion<sup>17</sup>. Patients will have difficulty with push off of the affected limb and will usually recall some pain and swelling in the posterior ankle. There is thickening of the Achilles tendon in the region of the injury. The Thompson test is most likely positive and a palpable gap may be present with varying degrees of tenderness. Patients will be unable to complete a single leg heel raise.

The goal of treatment is to adequately restore the optimal length and continuity of the gastrocnemius -soleus complex. With gaps of up to 4 cm, end to end tendon repair is usually possible. In larger defects a V-Y advancement procedure or turndown of the central slip is used to restore the integrity of the tendon<sup>17</sup>. Most authors recommend flexor tendon augmentation in conjunction with a V-Y advancement or central

turndown; this approach is usually performed using a flexor hallucis longus tendon transfer<sup>17</sup>. Synthetic materials and collagen allografts are also available to augment the tendon repair. Achilles allografts have been used to reconstruct very large defects, usually greater than 10 centimeters<sup>17</sup>.

Haglund's Syndrome (Fig 6) is also known as a 'pump bump'. It is a prominence of the posterior superior tubercle of the calcaneus that is located more lateral. This prominence becomes symptomatic due to an ill-fitting shoe, resulting in an insertional tendinosis (more laterally) and retrocalcaneal and subcutaneous bursitis<sup>4</sup>.

Treatment includes appropriately modifying the back of the shoe to prevent contact with the lesion. A heel lift can be used to decrease contact with the shoe and loosening the shoe counter will decrease tension on the foot. NSAIDs help with inflammation. Surgical treatment options include retrocalcaneal decompression and calcaneal osteotomy or osteotomy and have varying results<sup>4</sup>. Inadequate bone resection can lead to recurrence of symptoms, with other postsurgical complications potentially including scar formation with nerve entrapment, weakening or rupture of the Achilles tendon, and nonunion of the calcaneal osteotomy.

Other possible diagnosis involving the Achilles tendon that can be visualized with the MSKUS are as follows: Achilles Partial Tear, Osteophytes, and Bone Spurs.

Musculoskeletal ultrasound is a beneficial tool for looking at the integrity of the tendon, determining the thickness of the tendon, and identifying any inflammation or effusion in the region while remaining quick, non-invasive and cost effective. •

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# Your Practice Sale

If you have owned a healthcare practice for any length of time, there have undoubtedly been moments when you contemplated selling. The reasons for selling will vary from person to person, but essentially it all boils down to a fundamental desire to change the game of life – end one chapter and engage in something new. This decision doesn't come lightly. It's not like you just wake up one morning and say, "I think I want to sell my practice today."

Over the last 10+ years, I have had the good fortune to have over 20,000 conversations with practice owners regarding finances and business. In the last 4 years we have seen an uptick of our clients getting purchase offers or wanting to sell their practices for a purchase price anywhere from \$300,000 to \$25,000,000. Needless to say, I have seen just about every scenario. I have seen it go well...and not so well and here's what I've learned: **THE MORE YOU PLAN YOUR TRANSITION PROCESS THE EASIER IT WILL BE TO SELL YOUR PRACTICE TO THE RIGHT BUYER FOR A PREMIUM.**

Your practice sale is likely to be the single largest financial transaction of your life so you must ensure you are doing it for ALL the right reasons. Fundamentally the sale of your business should benefit you, your buyer, your employees, your patients or clients, and

the community. This is not a zero sum game – you should do what you can to be sure everyone wins. Those who sell their practice to the highest bidder without taking all those other people into consideration will inevitably lose in the long run. Trust me, I've seen the results.

The environment for selling a practice is excellent. In many sectors, private equity groups are still popping up, practice brokers are abundant, and multiples for what businesses are selling for is still higher than years past. In truth, there are over 100 things I could suggest you analyze before you go through the sales process, but for the sake of brevity, I want to provide you the top 5 most important things you should focus your efforts on before you consider looking for the right buyer and decide, "I want to sell my practice today."

1.) Make sure you are not selling your medical practice in a condition of weakness. If you want to sell your practice because you are feeling "burned out," trapped, fearful of some "doomsday" event, or in some sort of a scarcity mindset, then you need to give yourself a check-up from the neck-up (or call me and I'll help you through it). You will ultimately regret this decision and it will hurt your financial and emotional well-being. Consider hiring a practice management coach to help you with HR policies and procedures, training, patient

care, and building an independent practice. It may not always be possible to sell out "on top", but you should be exiting your practice with your head held high and not with a whimper or out of relief.

2.) Make sure the financial terms of the practice sale is enough. While it may not always be correct to sell your practice for the highest purchase price, let's face it, the final price tag does matter. The amount of money you receive for the transaction must be able to provide enough cash flow in order allow you to live the lifestyle you need and want. The practice sale will almost never provide you as much income as if you continued to operate the business in the long term, but that doesn't mean you are trapped. You must be prudent about creating OTHER income sources outside of the business – while you still own it – so that when you decide the time is right to sell, the net sale proceeds should provide more than enough income (in addition to your other sources) so you can comfortably live the rest of your life without ever running out of money. This must be calculated years before you decide to sell to ensure your needs will be met. Without a plan on how to create additional income streams during your working years, you will be destined to live a fixed income lifestyle in retirement that most likely will be way





below what you are accustomed to.

3.) Know exactly where the sale proceeds will be invested BEFORE the transaction occurs. It's no secret that the reason celebrities and athletes go broke shortly after they "retire" from their main cash flow source is largely because they are lousy at managing money. This comes down to simple financial planning during working years. You should start by getting a practice valuation, and then create a written financial plan of how to allocate the proceeds at the time of sale.

It will take expert help and a little time and attention on your part, but most importantly this planning should be done BEFORE the money hits your account. **THIS IS THE SINGLE BIGGEST MISTAKE I HAVE SEEN PRACTICE OWNERS MAKE WHEN SELLING THEIR BUSINESS.** After you sell your practice and the proceeds are deposited in your account, you will have the best intentions of managing that money to last your lifetime. I have observed the behavior of people when they come into enormous sums of money; they either

become a super spendthrift or they are overly protective of spending. Either way of handling proceeds of the sale are detrimental to your future success in the transition process. The moment you are in practice sale negotiations, you should be getting all of your future investment and cash flow channels lined up so the money can flow easily into them as soon as you leave the closing table so that you can get on with the next phase of your life.

4.) Know the Tax implications. Most practice owners start their business

from scratch. If this is you then when you sell your practice, you are likely to have the majority the sale subject to capital gains tax. The rate you will pay can vary from state to state and from year to year (depending on politics), but recent history the rate has been 25-35% tax of the sale. So for example, if your sale is \$10,000,000 and you live in California, get ready to pay north of \$3,000,000 in tax. Ouch. But there is good news – currently there are a few different methods to defer and/or reduce the capital gain tax on a sale but must be planned in advance of a triggering event. It is your responsibility to know the tax liability on a practice sale and have a plan for how to pay the taxes and additional fees. This is where future planning can truly save your bacon and potentially help you keep more of the value you have created in this tangible and intangible asset. Tax savings opportunities are a moving target as tax laws can change yearly. Don't wait to learn what you "coulda, woulda, shoulda" and give a large percent of your life's work to the IRS.

5.) Have your next game in life ready to start the day after your practice sale. If you own a business, then you are not hardwired to simply do nothing in "retirement". There is no faster way to the grave than to have

no purpose in life – especially if you have been on the go for 20+ years with a mountain of responsibility and then suddenly have tons of "free time" with nothing to do. Retirement is a dangerous status for a practice owner. Don't worry, I am not suggesting you start another business just to keep busy. However, I am suggesting that you have a meaningful purpose you still want to accomplish in life after ownership. You will have free time open so be sure to line up activities that you enjoy but make sure at least one of them is aligned with creating some sort of value to others like volunteer or philanthropic work. You will thank me for this final piece of advice!

If you find yourself wondering, "What will my financial life look like if I sell my practice," and you need some help doing the math and looking at all the scenarios of the best option and timing to "retire" from practice ownership, I'm happy to help. We advise practice owners at every phase of ownership – from start-up, through the expansion and practice transition years, all the way through practice sale and exit and beyond. If you are serious about finding potential buyer and selling your medical practice, then you should have someone do a practice valuation, analyze your current financial situation and advise you

on next steps to ensure a successful and profitable exit with ease for your household. Selling your practice does not signify the end, it simply is the start of a new journey. Make sure you don't leave the selling process up to chance or wait until it's too late to maximize the biggest transaction of your life. Hire an expert guide who will work alongside you and help you confidently navigate the process. Schedule your free 30 minute consultation with an Econologics® Specialist to get your questions answered about selling your practice and download your free checklist on Exit Planning today! •

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# Ensuring the Standard for the Fibular Nerve Patient

**Scott McCauley**

Patients with fibular neuropathy will be a hallmark of any clinical electromyographer's career. The presentation can often be overlapped with the differentiating L5 radiculopathy. Presentations for both can be very similar however there are certain benchmarks in a patient's history, physical exam and EMG/NCS that can easily differentiate between L5 and the fibular nerve. The purpose of this article is to show and explain the reasoning behind those benchmarks and ensure the standard that a fibular nerve patient's report should present with.

Anatomically the L5 nerve root is a very large contributor to the common fibular nerve for both the motor and sensory fibers, so it isn't a wonder that the presentation is not too dissimilar. The most common presentation that gets consideration for the differentiation is foot drop. Both the nerve root and the peripheral entrapment could result in this. The accompanying numbness and tingling in the lateral leg and dorsal foot are also a part of it. So with that simple presentation there are a few key questions that should be a part of every report. First,

would be confirming or denying the presence of any radicular lumbar spine pain. This can sometimes be muddled as a person with drop foot will ultimately have abnormal gait mechanics that could feasibly cause low back pain and the patient might be vague on their answer. Regardless this needs to be detailed. The other key questions would consist of getting the fullest detail possible of the sensory deficits experienced. Is the other side affected? The affirmation on that could lead to other differentiating questions. More specifically to the fibular nerve the written history on a report needs to be detailed if the patient frequently crosses their legs, have lost a significant amount of weight in a short time, any event/occurrence of prolonged squatting or stairs, and if the patient has had any recent surgery.

Having patient confirmation or denial that they cross their legs frequently with sitting is a must have in any report as it certainly is an action that leads to direct compression to the nerve





in question. What may be less obvious is the questioning of rapid weight loss. Rapid weight loss through bariatric surgery, illness or even diet and exercise, does a few things to the nerves and surrounding structures. A study in 2011 by Meylaerts et al in the Journal of Skeletal Radiology, used ultrasonography that showed that those with lowered BMI had less intraneural fat in the perineurium. Couple this with a diminished protective fat pad around the fibular head resulting in easier compression between the fibular head and the fibularis longus tendon. Also with less food intake there is a risk for inadequate nutrition and vitamin nourishment to the reach the nerves and thereby a generalized polyneuropathy can develop. This compromised system can contribute to vulnerability to withstanding compressional forces. The positioning of prolonged or frequent deep squatting can also place a compression between the fibular head and the fibularis longus tendon. Surgical procedures may accidentally place excessive compression on the lateral knee/proximal leg. Of course this is something the patient cannot speak to specifically, but the correlation of symptoms onset to the time of surgery is a follow up question and clarification that is helpful and should be written in any report.

The physical exam should have a standard neuro screen and detailing any weaknesses or deficits; most notable would be if the patient has a clear border and outline for the sensory loss. If it's a clear border that fits the superficial fibular sensory nerve branch this needs to be detailed in the history and sets up the expectation of an abnormal peripheral nerve when tested. Additional tests that should be included and noted in the exam would be: Tinel's test at the fibular head, straight leg raise, foot inversion, eversion, toe extension and hip abductor strength, extensor digitorum brevis (EDB) atrophy, and positional descriptions if they do report to crossing their legs or squatting frequently. Assuming in most cases of foot drop the dorsiflexion is unilaterally weak, what can be most helpful in the L5 vs fibular nerve differentiation is the other strength testing. Both would

display weakness in toe extension, but weakness in inversion while stronger in eversion can suggest more of an L5 origin, because tibialis posterior is heavily innervated by L5 but is from the tibial nerve where fibularis longus can be contributed proportionally more by S1 nerve root. Hip Abduction can also help confirm or deny L5 contribution based on it's strength and would be weaker in those patient's with L5 origins. All of this can set up expectations for your nerve conduction exam.

The nerve conduction needs to consist of superficial sensory comparison from left to right (assuming presentation is unilateral) as there can be a significant difference. The amplitude if present may or may not be 50% less. The prognosis would be more favorable in patients that do display a symmetrical amplitude as it would imply that there is mostly conduction block proximally. If there is a significant difference from side to side, then comparing the sural sensory nerve would be the next step in showing if there is something broader going on.

The deep fibular motor exam off of EDB is the first benchmark exam to discovering demyelination at the fibular head. If this is discovered it is recommended that this is shown to affect the superficial motor branch. This means testing off of the fibularis longus/brevis with stimulations below and above the fibular head. This typically is affected as well in fibular neuropathies but not always. Testing off of the tibialis anterior is also a good way to ensure that the deep branch is affected to the muscle that seems most functionally problematic. Testing at least the ipsilateral tibial nerve is a prudent way to ensure that there is not anything broader that is affecting a larger bundle of nerves. One important note to all of this, is that proper technique must be implemented with all of the fibular recordings. If the examiner is careless with their stimulations inadequate stimulation at the fibular head would show artificial diminished values. Similarly if excessive stimulation at the popliteal fossa is given, the tibial nerve can be co-stimulated with those findings over flowing into the fibular wave form and compro-

mising the segmental velocities. The goal mostly for the nerve conduction is to either prove or disprove any fibular nerve entrapment. None of this fully rules out L5 nerve root or more proximal origins. Only the EMG can do that more definitively.

A thorough EMG evaluation would have enough to encompass differentiation between L5 and even more detail with the fibular nerve. The muscles to help rule in/out L5 contribution would be the lower lumbar paraspinal muscles, tibialis posterior and gluteus medius. To prove other nerve roots aren't at play adding gastrocnemius and quadriceps would be helpful. The best differentiators for the fibular nerve would be tibialis anterior, fibularis longus and the biceps short head. The last three muscles here essentially help show that the common fibular nerve is affected and does not go proximal to the posterior/lateral knee; as assuredly the biceps femoris short head (1st muscle of fibular division of the sciatic nerve) would be intact. A patient of course can have both L5 and fibular neuropathy at the same time. These muscles lend themselves to either showing their co-existence if it were to be the case. Not coincidentally the muscles mentioned above in the physical exam are again highlighted here. They are key muscles for differentiation and confirmation.

Throughout the exam there should always be a line of logic that is easy to follow from start to finish. Not all cases are clear cut and dry, and any examiner needs to have level of consistency but also flexibility if the patient presentation or nerve findings take things in a different direction. Just show the logic through the exam and ensure that any reader can clearly understand why. Adding the above elements to fibular nerve exams will go a long way to showcasing the thoughtful pursuit to the case. •



**Will Humphreys**

## The Root Of All Evil Or Our Only Hope?

I will never forget being a third-year student in PT school when my professor taught us how "some PT practices" were truly evil. She taught us how these evil practices were doing all they could to make a profit. She illustrated how these companies made their physical therapists treat more patients in an effort to cash out on the system.

I was disgusted by the very thought it. I would NEVER by a PT who cared more about money

than the patients. In my first job I billed only the bare minimum per visit since I was there for my patients and not the paycheck.

When I opened my first practice. I found how thin the profit margins were as a PT practice owner. I saw how hard I had to work just to keep my doors open. I quickly had this realization, "Money is not why I do physical therapy, but it is what I do it for!"

Physical therapists have a poor understanding of the role of money in our industry. We don't truly understand what a healthy relationship with money looks like and as a result we fear it. After all, we always fear what we don't understand.

The only way we are going to save our profession from an inevitable implosion is by learning how to use money as a tool. The difference is as subtle as realizing we don't do physical therapy to make money. Rather, we make money to do more physical therapy!

When we ethically find ways to make greater profits, we take a stand for our patients, our families and the industry at large. We then can become stewards of this sacred resource called cash and use it to end pain and suffering in the darkest corners of the country.

Saving PT begins with us saving pennies. If we create profitability in our practices and as an industry, I know we will then discover what's possible. •

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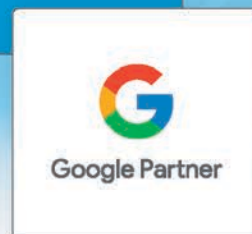
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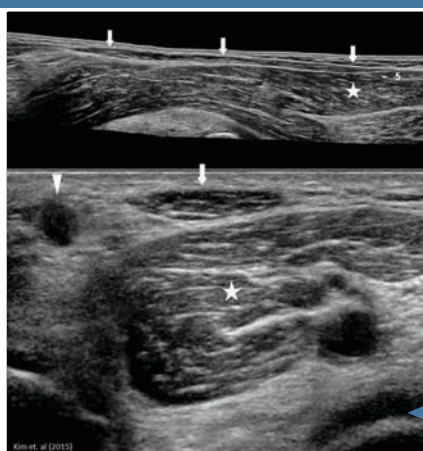
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# Ultrasound of Accessory Ossicles and Muscles of the Lower Extremity: Normal Anatomical Variants Mistaken for Pathological Musculoskeletal Conditions

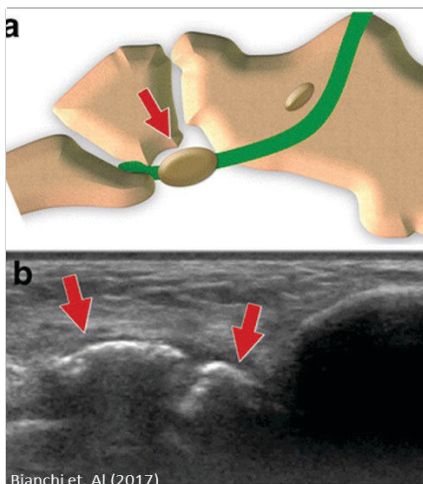
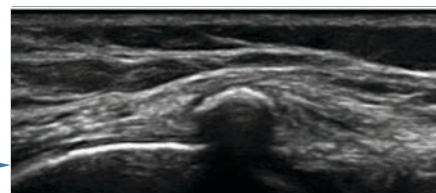
Dr. Andrea R. Cahoon, PT, DPT, CLT, RMSK, Cert. DN, Cert. FMT

Accessory ossicles are secondary ossifications that are separate from the adjacent main bony cortex, and accessory muscles are additional distinct muscles adjacent to normal muscle tissue. These anatomical variants may be encountered during scanning when using musculoskeletal ultrasound.. The importance of knowing the common locations of normal anatomical variants is to ensure pathological conditions are not diagnosed for normal conditions.<sup>1,2</sup>

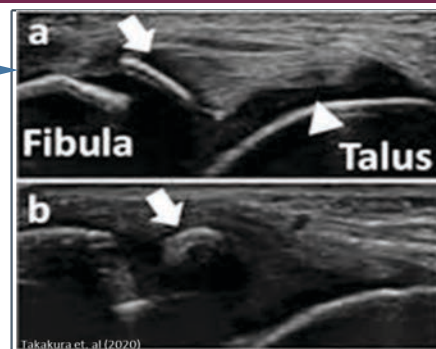


**Hip**  
Os acetabuli  
Gluteus medius accessories  
and quartus scansorius

**Knee**  
Os fabella  
Bipartite patella  
Accessory semimembranosus  
Tensor fasciae suralis



**Ankle**  
Os peroneum  
Os subtibiale  
Accessory navicular  
Os trigonum  
Os subfibulare  
Multipartite hallux sesamoid  
Accessory soleus  
Accessory flexor digitorum longus  
Peroneus quartus  
Extensor hallucis capsularis tendon



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**"THIS IS HOW I'VE CREATED  
THE PT PRACTICE OF THE  
FUTURE, TODAY!"**



**LEARN MORE!**



*"It is with extreme gratitude that we enjoy the daily mentorship and association with Hands-On Diagnostics that has opened the doors to a truly superior PT practice."*



- Bart McDonald, PT, MPT, ECS, FMSK - HODS Member

**WE'LL BE BACK IN 2023!**

**JOIN US AT THE 10TH  
ANNUAL HODS  
SYMPOSIUM**

**SEPTEMBER 16 & 17, CLEARWATER, FL**

**OWNERS' FORUM: SEPTEMBER 15**

**SAVE THE DATE!**





A photograph of three people celebrating. In the center is a man with glasses and a beard, wearing a light blue shirt and a patterned tie, holding a glass trophy. To his left is a woman with long brown hair, wearing a black dress and a white cardigan. To his right is a woman with curly brown hair, wearing a black dress. All three have their arms raised in celebration. They are standing in front of a white fence and lush green tropical plants.

# 2022 PRACTICE OF THE YEAR AWARD

EDDIE ST. CLAIR  
WEST PARK REHAB &  
DIAGNOSTICS

Congratulations to Eddie St. Clair and his team at West Park Rehab, Physical Therapy and Diagnostics for winning the Hands-On Diagnostics 2022 Practice of the Year Award!



# "Through my participation in HODS, I'm with a WINNING TEAM."

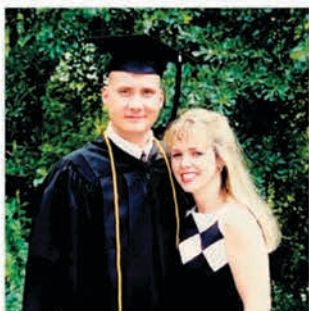
Learn why Eddie loves being a HODS Member in this video feature!



Eddie is the founder of West Park Rehab & Diagnostics located in Franklin, Pennsylvania, a small rural town between Pittsburgh and Erie. The proud owner of 2 locations with over 10 therapists and an ever-growing diagnostics business, Eddie has found his place in the Franklin community as a healthcare provider.



Eddie discovered physical therapy to be his passion after being introduced to the medical field through his time in the military, where he was a combat field medic in the Air Force in addition to working in the base hospital.



*"Using diagnostic information helps our therapists give their patients a deeper perspective and clarification of the problem that they have."*

In 2019, Eddie became a Hands-On Diagnostics member and began to establish a diagnostic business within the 4 walls of West Park Rehab & Diagnostics.

As of this year, West Park Rehab & Diagnostics now provides EMG testing for multiple well-respected medical organizations in western Pennsylvania. Eddie and his team of therapists set an extraordinary example, demonstrating how a private practice of the future operates.



Congratulations to Eddie and the entire West Park Rehab & Diagnostics team!



# Focus on Your Franchise and Leave Payroll and HR to Us.



If payroll and HR administration tasks present time-consuming challenges that keep you from focusing on growing your franchise, Paychex can help. Paychex Flex®, our all-in-one HR solution, helps simplify the process and helps you to effectively manage workers across the entire employee lifecycle.

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Diagnostics*  
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FRAGALA-PORIES**  
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Diagnostics*  
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Virginia



**ROY ADAMS**  
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Diagnostics*  
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Iowa



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New York



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MCGILVREY**  
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 & Diagnostics*  
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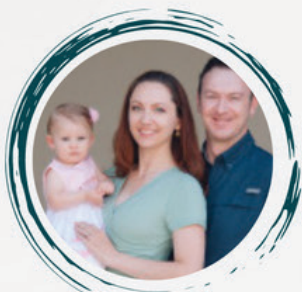
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# Highlights from the 2022 HODS Symposium!







SCAN TO VIEW DETAILS



**THANK YOU** to all who Attended  
**The 2022 HODS Symposium!**  
**Join us in 2023!**







**+315**  
PRACTICES/CLINICS

**+2520**  
PRACTITIONERS CERTIFIED

**+12**  
UNIVERSITIES

**+16**  
PRO SPORTS TEAMS

# The Ultimate in NEUROMUSCULAR RE-EDUCATION



**The Neubie ("Neuro-Bio-Electric")** is a patented and FDA-cleared direct current (DC) stimulation device.

The Neubie device has been proven to provide significantly better outcomes and patient satisfaction—leading to greater completion of care plans, repeat business, extended care opportunities, and referrals.

In addition, the Neubie, when paired with the NeuFit Method, delivers consistent outcomes, which helps in training and quality control with your practitioners.

“



*In addition to using the Neubie in our PT practice, we've hired a strength and conditioning coach who uses the Neubie on the performance side, so now we're able to expand our scope to serve patients all the way from the rehabilitation side through to elite sports performance, using NeuFit throughout that whole continuum.*

”

**Angie and Joe McGilvrey**  
Owners of Apex Physical Therapy and Concepts in Rehab



Time and time again, we hear from practices who have implemented the NeuFit Method that their patients are experiencing tangible results after their first session with the Neubie device -- as well as significantly faster and stronger outcomes over the course of patient care!

How could your practice benefit from the Neubie?

- ✓ Improve Patient Outcomes
- ✓ Boost Client Retention
- ✓ Increase Revenue
- ✓ Multiple Referrals

*We surveyed over a hundred practices that have incorporated the Neubie into their patient's care, and here are some of the results:*



**83%**

have **received referrals** specifically for use of the Neubie



**94%**

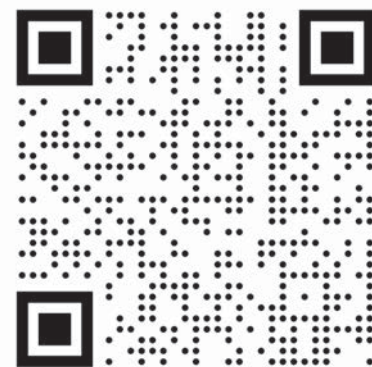
report an **increase in patient satisfaction** since adding the Neubie device



**90%**

of patients noticed **tangible progress** in their first Neubie session

# INTERESTED IN 3 - 10 TIMES HIGHER REIMBURSEMENT FOR YOUR PT PRACTICE?



**LEARN MORE!**

**LEARN HOW HANDS-ON DIAGNOSTICS IS REVOLUTIONIZING  
THE PHYSICAL THERAPY PROFESSION ACROSS THE COUNTRY**



*"After receiving our initial training under HODS in EMG, my team and I were able to really help several patients by identifying the root of the problem and then applying the most effective treatment for this problem. EMG and MSK Ultrasound allowed us to have total certainty in our PT diagnosis. And the best of all is that insurance reimbursement for diagnostic testing is 3,5,7 or even 10 times higher than the reimbursement of a PT session. The HODS training in diagnostics is the best kept secret for practice advancement and financial affluence."*

- Christina Panetta, PT, D-EDX - Founder Panetta Physical Therapy and Diagnostics - HODS Member

## THE HODS DIFFERENCE:



**Increased  
Revenue**



**Better  
Patient  
Outcomes**



**Greater  
Clinical  
Competency**



**Higher  
Insurance  
Reimbursements**