Imaging of Tendinopathy: A Physician's Perspective

BRADLEY BLEY, *DO, FAAP, RMSK, CSCS*
Primary Care Sports Medicine, Delaware Orthopaedic Specialists, Newark, DE.
Primary Care Sports Medicine Fellowship, Christiana Care Health System, Newark, DE.

WAQAS ABID, *MD, FCPS*
Department of Radiology, Christiana Care Health System, Newark, DE.

J Orthop Sports Phys Ther 2015;45(11):826-828. doi:10.2519/jospt.2015.0113

Imaging plays an important role in the clinical evaluation of patients with musculoskeletal-related pain, but its utility for the management of tendinopathy is debatable. As noted in the article by Docking et al[9] in this special issue of *JOSPT*, findings on ultrasound and magnetic resonance imaging (MRI) may not correlate with clinical symptoms, and it is not uncommon to find anatomical changes associated with tendinopathy in tendons of asymptomatic individuals. Likewise, patients with clinical symptoms of tendinopathy can present with normal imaging evaluation.[1] In longitudinal studies, it has been shown that evidence of tendinosis on ultrasonography can resolve, remain unchanged, or expand without predicting changes in clinical symptoms.[14]

That being said, imaging is very important when evaluating for other potential causes of pain. Initial diagnostic tests and treatment options depend on the overall clinical presentation. Radiographs are often needed in patients who present with severe pain or weakness and may reveal evidence of calcific tendinosis, arthritis, fractures, or other bony lesions. In patients with suspected tendinopathy and little concern for a complete tear, advanced imaging, such as ultrasound and MRI, is often delayed until after a trial of conservative management, which may include physical therapy, rest, nonsteroidal anti-inflammatory drugs (NSAIDs), bracing, or corticosteroid injections.

When tendinopathy is suspected, the first line of treatment should be nonoperative and focus on limiting the causes of repetitive microtrauma and strengthening the tendon with exercises. This may be achieved by correcting biomechanical factors, addressing kinetic-chain deficits and training errors, activity modifications, bracing, physical modalities, and a combination of stretching, strengthening, endurance, and proprioceptive exercises. Unfortunately, there are patients who don't respond to conservative management. Advanced imaging is often obtained at this time to confirm the clinical diagnosis of tendinosis, to evaluate the extent of tendon injury, or to look for the presence of other abnormalities, such as bursitis or adhesive capsulitis.[16]

The underlying pathophysiology of tendinopathy is covered in the contribution by Scott et al[17] in this special issue of *JOSPT*. In summary, current evidence suggests that it involves a process of inflammation in small amounts in acute reactive bouts, with repetitive microtrauma leading to scar tissue formation and eventual mechanical breakdown of the tendon. The use of anti-inflammatory agents, such as corticosteroid injections and NSAIDs, may therefore have a place in the management of tendinopathy in the acute reactive phase.

On the other hand, NSAIDs may mask symptoms and do not appear to heal tissue in tendinopathy. Recent concerns regarding the overall safety of nonaspirin NSAIDs have caused physicians to use caution when prescribing these medications.[19,20] Corticosteroid injections are beneficial in patients with associated bursitis and adhesive capsulitis,[13] but their utility in the management of tendinopathy is questionable. Corticosteroid injections have a powerful anti-inflammatory effect and have traditionally been used in cases in which nonsurgical interventions have failed. Over the last several years, studies have shown that corticosteroid injections may be beneficial in the short term for the treatment of chronic (nonreactive stage) tendinopathies, but may be worse than other interventions in the intermediate and long term.[12] Studies have also indicated that, despite the clear pain-reduction benefit associated with steroid injection in the short term, this benefit, in comparison with normal saline injection, fades by the 24th week of follow-up.[18]

Furthermore, other studies have shown worse clinical outcomes 1 year after corticosteroid injections.[6] In comparison with placebo injections, corticosteroid injections were associated with an increased risk of atrophy for Achilles and patellar tendons.[12] Corticosteroid injections into tendons of the lower extremities can also lead to rupture of the tendon.[21] Dean et al[7] recently proposed that glucocorticoids' deleterious effects in tendinopathy may be related to ion channel–mediated toxicity.

Concerns regarding NSAIDs and corticosteroid injections, along with a desire to avoid surgery, have led to increased interest in and research into alternative medical treatment options for the management of tendinopathy. Ultrasound-guided interventions have accordingly received increased attention, especially as these can be used in the clinic. Ultrasound at the point of care allows for an immediate confirmatory diagnosis and enables the practitioner to guide musculoskeletal interventional procedures. Ultrasound enables the clinician to move and stress musculoskeletal structures and to directly identify calcium deposits, soft tissues, bony landmarks, and the needle. Ultrasound does not expose the patient to radiation, it is relatively low cost, and it is not limited by motion of the patient.[3] Color-flow Doppler studies can also be performed to provide a measure of neovascularization. Furthermore, there are no known contraindications to ultrasound, unlike other imaging modalities. However, there is a steep learning curve and image presentation is not as clear as that of MRI.

The American Medical Society for Sports Medicine recently published a position statement[11] on the use of interventional musculoskeletal ultrasound in sports medicine and specifically addressed the accuracy, efficacy, and cost-effectiveness of ultrasound-guided injections. The review suggested that ultrasound-guided interventions may be more accurate than landmark-guided interventions for tendon and tendon-sheath injections, but evidence of their efficacy and cost-effectiveness is needed.[11]

The use of diagnostic and interventional ultrasound has significantly increased over the past decade in a bid for better treatments of tendinopathy. Injections that were routinely performed without imaging guidance (such as joint and peritendinous injections) and the injection of newer therapeutic and regenerative agents (such as dextrose, autologous blood, platelet-rich plasma, and stem cells) now frequently rely on ultrasound to increase the accuracy of the injection to improve effectiveness.

Due to the ability to visualize the procedure in real time, newer techniques for the management of tendinopathy have also been developed, including needle tenotomy/fasciotomy for chronic tendinosis/fasciosis and neovessel ablation through sclerosing-agent injection. That being said, the initial success of some newer therapeutic and regenerative agents is highly variable, and the ideal timing and utilization of the various procedures are still up for significant debate.[5,10]

Percutaneous ultrasound-guided fenestration and aspiration (ie, barbotage) of calcific tendinosis, on the other hand, has become a very useful tool in the management of calcific tendinosis. Although originally described as a fluoroscopic procedure, the role of fluoroscopy has been reduced due to the excellent safety profile and clinical efficacy of ultrasound imaging. Image-guided needle irrigation and aspiration of calcifications have been shown to be an effective, minimally invasive technique, with 91% of patients experiencing significant or complete improvement in range of motion, pain, and disability when aspiration was performed under ultrasound guidance.[8]

The utilization of ultrasound in the management of tendinopathy and other musculoskeletal disorders can be expected to expand further as specialized surgical tools and devices are developed to perform specific ultrasound-guided procedures. For example, tools have been developed to perform an A1 pulley release for trigger finger and a carpal tunnel release for carpal tunnel syndrome under ultrasound guidance.[4] Also, devices utilizing ultrasonic energy to debride tissue are being used for tenotomy/fasciotomy of chronic tendinosis/fasciosis.[2,15]

These newer techniques are being employed to further shorten recovery and minimize potential complications of surgery. In addition, the imaging modalities discussed in the article by Docking et al,[9] such as ultrasound tissue characterization and sonoelastography, may allow further diagnostic accuracy and improve the overall results of some of these interventional procedures.

Despite the limitations of traditional imaging in the diagnosis and management of tendinopathy, interventional procedures that utilize ultrasound hold promise. As training and imaging modalities improve, costs decrease, complication rates improve, and recovery times decrease, physicians will increasingly turn to ultrasound for targeted procedures and injections in patients who have failed to respond to other treatments.

REFERENCES

1. Alfredson H, Cook J. A treatment algorithm for managing Achilles tendinopathy: new treatment options. *Br J Sports Med*. 2007;41:211-216. http://dx.doi.org/10.1136/bjsm.2007.035543
2. Barnes DE, Beckley JM, Smith J. Percutaneous ultrasonic tenotomy for chronic elbow tendinosis: a prospective study. *J Shoulder Elbow Surg*. 2015;24:67-73. http://dx.doi.org/10.1016/j.jse.2014.07.017
3. Blankstein A. Ultrasound in the diagnosis of clinical orthopedics: the orthopedic stethoscope. *World J Orthop*. 2011;2:13-24. http://dx.doi.org/10.5312/wjo.v2.i2.13
4. Capa-Grasa A, Rojo-Manaute JM, Rodríguez FC, Martín JV. Ultra minimally invasive sonographically guided carpal tunnel release: an external pilot study. *Orthop Traumatol Surg Res*. 2014;100:287-292. http://dx.doi.org/10.1016/j.otsr.2013.11.015
5. Chiavaras MM, Jacobson JA. Ultrasound-guided tendon fenestration. *Semin Musculoskelet Radiol*. 2013;17:85-90. http://dx.doi.org/10.1055/s-0033-1333942
6. Coombes BK, Bisset L, Brooks P, Khan A, Vicenzino B. Effect of corticosteroid injection, physio-

therapy, or both on clinical outcomes in patients with unilateral lateral epicondylalgia: a randomized controlled trial. *JAMA*. 2013;309:461-469. http://dx.doi.org/10.1001/jama.2013.129

7. Dean BJ, Franklin SL, Murphy RJ, Javaid MK, Carr AJ. Glucocorticoids induce specific ion-channel-mediated toxicity in human rotator cuff tendon: a mechanism underpinning the ultimately deleterious effect of steroid injection in tendinopathy? *Br J Sports Med*. 2014;48:1620-1626. http://dx.doi.org/10.1136/bjsports-2013-093178
8. del Cura JL, Torre I, Zabala R, Legórburu A. Sonographically guided percutaneous needle lavage in calcific tendinitis of the shoulder: short- and long-term results. *AJR Am J Roentgenol*. 2007;189:W128-W134. http://dx.doi.org/10.2214/AJR.07.2254
9. Docking SI, Ooi CC, Connell D. Tendinopathy: is imaging telling us the entire story? *J Orthop Sports Phys Ther*. 2015;45:842-852. http://dx.doi.org/10.2519/jospt.2015.5880
10. Finnoff JT, Fowler SP, Lai JK, et al. Treatment of chronic tendinopathy with ultrasound-guided needle tenotomy and platelet-rich plasma injection. *PM R*. 2011;3:900-911. http://dx.doi.org/10.1016/j.pmrj.2011.05.015
11. Finnoff JT, Hall MM, Adams E, et al. American Medical Society for Sports Medicine (AMSSM) position statement: interventional musculoskeletal ultrasound in sports medicine. *PM R*. 2015;7:151-168.e12. http://dx.doi.org/10.1016/j.pmrj.2015.01.003
12. Hart L. Corticosteroid and other injections in the management of tendinopathies: a review. *Clin J Sport Med*. 2011;21:540-541. http://dx.doi.org/10.1097/01.jsm.0000407929.35973.b9
13. Kelley MJ, McClure PW, Leggin BG. Frozen shoulder: evidence and a proposed model guiding rehabilitation. *J Orthop Sports Phys Ther*. 2009;39:135-148. http://dx.doi.org/10.2519/jospt.2009.2916
14. Khan KM, Cook JL, Kiss ZS, et al. Patellar tendon ultrasonography and jumper's knee in female basketball players: a longitudinal study. *Clin J Sport Med*. 1997;7:199-206.
15. Koh JS, Mohan PC, Howe TS, et al. Fasciotomy and surgical tenotomy for recalcitrant lateral elbow tendinopathy: early clinical experience with a novel device for minimally invasive percutaneous microresection. *Am J Sports Med*. 2013;41:636-644. http://dx.doi.org/10.1177/0363546512470625
16. Moosikasuwan JB, Miller TT, Burke BJ. Rotator cuff tears: clinical, radiographic, and US findings. *Radiographics*. 2005;25:1591-1607. http://dx.doi.org/10.1148/rg.256045203
17. Scott A, Backman L, Speed C. Tendinopathy: update on pathophysiology. *J Orthop Sports Phys Ther*. 2015;45:833-841. http://dx.doi.org/10.2519/jospt.2015.5884
18. Tahririan MA, Moayednia A, Momeni A, Yousefi A, Vahdatpour B. A randomized clinical trial on comparison of corticosteroid injection with or without splinting versus saline injection with or without splinting in patients with lateral epicondylitis. *J Res Med Sci*. 2014;19:813-818.
19. US Food and Drug Administration. FDA Drug Safety Communication: FDA strengthens warning that non-aspirin nonsteroidal anti-inflammatory drugs (NSAIDs) can cause heart attacks or strokes. Available at: http://www.fda.gov/Drugs/DrugSafety/ucm451800.htm. Accessed September 8, 2015.
20. Wehling M. Non-steroidal anti-inflammatory drug use in chronic pain conditions with special emphasis on the elderly and patients with relevant comorbidities: management and mitigation of risks and adverse effects. *Eur J Clin Pharmacol*. 2014;70:1159-1172. http://dx.doi.org/10.1007/s00228-014-1734-6
21. Woon CY, Phoon ES, Lee JY, Ng SW, Teoh LC. Hazards of steroid injection: suppurative extensor tendon rupture. *Indian J Plast Surg*. 2010;43:97-100. http://dx.doi.org/10.4103/0970-0358.63971