

Fluoroscopically Guided Peritendinous Corticosteroid Injection for Proximal Hamstring Tendinopathy

A Retrospective Review

Luke T. Nicholson,* MD, Steven DiSegna,* MD, Joel S. Newman,*[†] MD, and Suzanne L. Miller,*^{‡§} MD

Investigation performed at New England Baptist Hospital, Roxbury Crossing, Massachusetts, USA

Background: Proximal hamstring tendinopathy is an uncommon but debilitating cause of posterior thigh pain in athletes subjected to repetitive eccentric hamstring contraction, such as runners. Minimal data exist evaluating treatment options for proximal hamstring tendinopathy.

Purpose: This retrospective study evaluates the effectiveness of fluoroscopically guided corticosteroid injections in treating proximal hamstring tendinopathy.

Study Design: Case series; Level of evidence, 4.

Methods: Eighteen athletes with 22 cases of magnetic resonance imaging–confirmed proximal hamstring tendinopathy were treated with corticosteroid injection and later contacted to evaluate the efficacy of the injection with the use of a questionnaire.

Results: The visual analog score decreased from 7.22 preinjection to 3.94 postinjection ($P < .001$), level of athletic participation increased from 28.76% to 68.82% ($P < .001$) at a mean follow-up of 21 months, and 38.8% of patients experienced complete resolution at a mean follow-up of 24.8 months. The mean lower extremity function score at the time of follow-up was 60.

Conclusion: A trial of fluoroscopically guided corticosteroid injection is warranted in patients presenting with symptoms of proximal hamstring tendinopathy refractory to conservative therapy.

Keywords: tendinopathy; corticosteroid; proximal hamstring

Tendon injury remains a leading reason for visits to sports medicine physicians and a major cause for missed playing time.¹ Tendon injury, or tendinopathy, includes tendinitis and tendinosis, the latter used to refer to the typical chronic overuse injury in athletes, which has been shown to not involve inflammatory mediators.⁹ The tendons most commonly afflicted by tendinopathy are

the rotator cuff, patella, Achilles, and extensor carpi radialis brevis tendons.¹¹ Extensive data have been published addressing management strategies for these commonly injured tendons. However, there are limited published data addressing treatment options for proximal hamstring tendinopathy.

Proximal hamstring tendinopathy, also known as high hamstring tendinopathy, is a relatively uncommon cause of posterior thigh pain. Frequently mistaken for the far more common myotendinous hamstring strain, tendinopathy affects a variety of athletes but is most common in runners. Typical presenting symptoms include deep buttock or posterior thigh pain that is made worse by repetitive eccentric hamstring contraction or prolonged sitting.^{13,17,18} Clinical diagnosis is frequently made on physical examination. Examination may reveal tenderness at the hamstring origin on the ischial tuberosity, and active hamstring stretches may re-create the pain.² Typically, there is no loss of strength with knee flexion or hip extension, and neurologic examination and electromyographic studies show no abnormalities.^{13,14,17}

[§]Address correspondence to Suzanne L. Miller, MD, Boston Sports and Shoulder Center, 830 Boylston Street, Suite 107, Chestnut Hill, MA 02467, USA (e-mail: drsuzanne4@gmail.com).

*Tufts University School of Medicine, Boston, Massachusetts, USA.

[†]Department of Radiology, New England Baptist Hospital, Roxbury Crossing, Massachusetts, USA.

[‡]Department of Orthopaedic Surgery, New England Baptist Hospital, Roxbury Crossing, Massachusetts, USA.

The authors declared that they have no conflicts of interest in the authorship and publication of this contribution.

Imaging is also important in making the diagnosis of proximal hamstring tendinopathy because of the broad differential diagnosis of posterior thigh pain. Other pathologies to be ruled out with the use of imaging include stress fracture, apophysitis, avulsion fracture, posterior trochanteric bursitis, piriformis syndrome, gluteus medius tendinitis, quadratus femoris muscle tear, and bone and soft tissue tumors.^{5,13,17} Magnetic resonance imaging (MRI) findings consistent with proximal hamstring tendinopathy include increased hamstring tendon size, increased peritendinous T2-weighted signal with distal feathery appearance, and ischial tuberosity edema.^{5,22} Interestingly, a study by De Smet et al⁵ compared MRI scans of symptomatic patients with those of asymptomatic patients and found that intratendinous T1- or T2-weighted signal on MRI was not associated with clinical symptoms of proximal hamstring tendinopathy.

Conservative treatment options for proximal hamstring tendinopathy include complete rest from sport, icing, eccentric stretching, and strength training.¹³ To the best of our knowledge, no studies have specifically addressed the effectiveness of conservative management for proximal hamstring tendinopathy; however, studies have shown that up to 20% of patients with tendinopathies will still have symptoms after 3 to 6 months of conservative management.¹¹ Patients with symptoms nonresponsive to conservative management may require further intervention.

Only one other published study addressed guided corticosteroid injections of the proximal hamstring.²² The study by Zissen et al²² examined the relative sensitivity of MRI in comparison with ultrasound for the diagnosis of proximal hamstring tendinopathy and introduced ultrasound-guided corticosteroid injection as a treatment option. It did not, however, quantify pain relief or compare pre- and postinjection level of athletic participation or provide statistically significant outcomes data. The purpose of this retrospective study was to examine the efficacy of fluoroscopically guided peritendinous corticosteroid injection for proximal hamstring tendinopathy.

MATERIALS AND METHODS

Subjects

After obtaining institutional review board approval, a retrospective review of patient records at the New England Baptist Hospital was conducted. Patients were identified by radiology billing code for fluoroscopically guided proximal hamstring corticosteroid injections received between 2009 and 2012. This list was cross-referenced with clinical records indicating a diagnosis of proximal hamstring tendinopathy as the reason for injection. A clinical diagnosis of proximal hamstring tendinopathy was made in patients who presented with chronic deep buttock pain at the origin of the proximal hamstring made worse with hamstring contraction or prolonged sitting. Additionally, all patients received an MRI that

TABLE 1
Patient Demographics

Mean age, y (range)	51 (36-71)
No. of males (%)	8 (44)
No. of females (%)	10 (56)
Mean time to follow-up, mo (range)	21 (3-52)
Mean duration of symptoms prior to injection, mo (range)	28 (2-120)

confirmed proximal hamstring tendinopathy. MRI criteria used to diagnose tendinopathy included peritendinous T2-weighted signal and edema surrounding the ischial tuberosity without evidence of partial or complete tendon tearing. A total of 27 patients met the inclusion criteria; 18 of these patients with proximal hamstring tendinopathy were reached and gave verbal consent to participate in the study (Table 1).

Intervention

Written, informed consent was obtained prior to injection. With the patient prone, utilizing a sterile technique and infiltration of local anesthetic, a 22-gauge spine needle was advanced down to the lateral margin of the ischium at the location of the hamstring origin under fluoroscopic guidance. The needle was then withdrawn approximately 1 to 2 cm from the surface of the bone. Injection was performed at multiple sites along the hamstring origin. In total, 5 mL of bupivacaine 0.5% and 40 mg of triamcinolone were injected. All injections were performed by musculoskeletal radiologists with significant experience in fluoroscopically guided injection procedures.

Questionnaire

An online questionnaire was distributed to the 18 patients who met inclusion criteria and agreed to participate in the study (see the Appendix). The patients were instructed to retrospectively answer questions pertaining to their pre- and postinjection states. Questions included a pre- and postinjection visual analog scale (VAS) for pain and pre- and postinjection level of competition in sport, rated as a percentage of full activity. All patients were asked if they experienced improvement in their symptoms, how long improvement lasted, and whether their relief was ongoing since the injection. Patients reported satisfaction with the intervention as unsatisfied, satisfied, or very satisfied. In addition to the questionnaire, the lower extremity function score (LEFS) was calculated for all patients at the time of follow-up (21 months).

Statistical Analysis

The Student 2-tailed *t* test was used to compare pre- and postinjection levels of athletic competition and VAS pain scores.

TABLE 2
Pre- and Postinjection Comparison^a

	LEFS, mean + SD	VAS Score	Level of Competition
Preinjection	—	7.22	28.76%
Postinjection	60 ± 12	3.94	68.82%
P value	—	<.001	<.001

^aLEFS, lower extremity function score; SD, standard deviation; VAS, visual analog scale.

TABLE 3
Patient-Reported Outcomes^a

	Yes	No
Improvement	14 (77.8)	4 (22.2)
Improvement duration >3 mo	8 (44.4)	10 (55.6)
Symptom resolution at follow-up	7 (38.8)	11 (61.2)
Patient-reported satisfaction		
Very satisfied	10 (55.6)	
Satisfied	3 (16.7)	
Unsatisfied	5 (27.8)	

^aValues are expressed as n (%) unless otherwise indicated.

RESULTS

Of 27 patients who met the inclusion criteria, 18 were contacted and agreed to participate in the study. Mean follow-up from injection was 21 months (range, 3-52 months). Of the 18 patients, 16 had tried conservative management, including physical therapy, for a clinical diagnosis of proximal hamstring tendinopathy. Fourteen patients had a single injection, of which 8 were right-sided and 6 were left-sided, and 4 had multiple injections. Three of these 4 patients had a single injection bilaterally, and 1 patient had 2 injections on the left and 1 on the right.

Preinjection VAS score was 7.22 compared with a postinjection VAS score of 3.94 ($P < .001$). Preinjection level of competition in athletics was 28.7% compared with a postinjection level of 68.8% ($P < .001$) (Table 2). Fourteen (78%) patients experienced an overall improvement in symptoms, with 8 patients (44.4%) experiencing an improvement >3 months and 7 (38%) experiencing complete resolution of symptoms. Overall, 10 (55.6%) patients were “very satisfied” with the injection, 3 (16.7%) were “satisfied,” and 5 (27.8%) were “unsatisfied.” At the time of follow-up, the LEFS (mean ± standard deviation) was 60 ± 12 (Table 3). All patients were seen at follow-up after the procedure; no short- or long-term complications were noted to occur, including infection, tendon rupture, mechanical damage to the sciatic nerve, or the inadvertent contact of local anesthetic to the sciatic nerve.

DISCUSSION

Tendon injury remains an elusive source of pain for both patient and treating physician. Far less common than a

myotendinous hamstring strain, proximal hamstring tendinopathy is a source of significant morbidity, particularly in athletes subjected to repetitive eccentric hamstring contraction, such as runners. Conservative treatment modalities constitute the majority of treatment options for tendon pathology and include rest, ice, nonsteroidal anti-inflammatory drugs (NSAIDs), stretching, and physical therapy. However, a significant percentage of patients fail conservative management and require more invasive intervention. While no studies have specifically addressed proximal hamstring tendinopathy, in other tendinopathies, up to 20% of patients will remain symptomatic after 3 to 6 months of conservative treatment.¹¹

In this study, patients who received fluoroscopically guided peritendinous corticosteroid injection for hamstring tendinopathy benefited from pain improvement, with the average VAS score decreasing from 7.22 to 3.94 ($P < .001$), and an increased level of athletic competition, with subjective level of function increasing from 28.76% to 68.82% ($P < .001$) at a mean follow-up of 21 months. Thirteen patients (72.2%) were very satisfied or satisfied with the injection, and 7 patients (38.8%) experienced complete resolution of symptoms at a mean follow-up of 24.8 months. No patients experienced complications from injection, including tendon rupture or infection. These data are encouraging given the lack of proven treatments for proximal hamstring tendinopathy that has failed conservative management.

In the only other published study evaluating corticosteroid injection as treatment for proximal hamstring tendinopathy, Zissen et al²² reported results for ultrasound-guided corticosteroid injections of 38 patients with a follow-up time ranging from 6 months to 8 years. They reported complete and sustained resolution of symptoms in 28.9% of patients in comparison with our finding of 38.8% resolution. Their study qualified pain relief as mild, moderate, or complete, with pain relief results of 26.3%, 21%, and 28.9%, respectively. This compares to our study’s demonstration of a significantly decreased VAS score from 7.22 to 3.94. Of note, the 2 studies demonstrate a similar non-response rate to treatment, with their study finding no symptom resolution in 23.7% of patients and our study finding no response in 22.3% of patients. In terms of duration of symptom resolution, a topic widely debated regarding corticosteroid use, Zissen et al²² found that 23.7% of patients will experience relief for greater than 6 months, while our data show that 44.4% of patients will experience relief for greater than 3 months.

A fundamental difference in technique between our article and that of Zissen et al,²² as well as others addressing guided injection for tendinopathies,^{6,7,12} is our preference for fluoroscopic guidance over ultrasound. While cross-sectional imaging modalities like ultrasound and computed tomography are commonly used to guide soft tissue injections, fluoroscopic guidance offers potential advantages when performing hamstring injections. Principally, fluoroscopic guidance is unaffected by body habitus, which may limit visualization of deep structures via ultrasound. Moreover, using fluoroscopic guidance, the procedure can be performed efficiently without the compression of soft tissues by the ultrasound transducer. This both maximizes patient

comfort and allows for the maintenance of a sterile technique. Additionally, the risk of intratendinous steroid administration can be minimized by dividing the administered dose about the ischial tuberosity. One study described using a similar technique when injecting patients with Achilles tendinosis.¹⁹

Given the data reported here and in the study by Zissen et al,²² we believe corticosteroid injection to be a promising treatment for proximal hamstring tendinopathy. However, any discussion of corticosteroid injection must address the risks affiliated with steroid therapy. Cited risks include local irritation, skin depigmentation, and rarely, tendon avulsion.¹⁶ Tendon avulsion has been reported following corticosteroid injections of the Achilles, patellar, and common extensor tendons.^{3,10,15,20} However, the clinical evidence for damaging effects on human tendon is predominantly based on uncontrolled studies and case reports.⁸ Two large studies showed no significant association between local corticosteroid injection and tendon avulsion. In one recent systematic review of corticosteroid injection for tendinopathy, 991 patients who received peritendinous corticosteroid injections noted just 1 case of tendon (Achilles) rupture.⁴ Additionally, a review by Nichols¹⁶ found no tendon ruptures in 983 patients treated with local corticosteroid injections for epicondylitis, shoulder injuries, or Achilles paratendonitis. Importantly, some authors suggest that intratendinous injections may increase the risk of tendon avulsion more than peritendinous injection,⁸ which is the main reason our study utilized fluoroscopy to allow peritendinous guidance. Given the widely discussed risk of tendon rupture on exposure to corticosteroids, we recommend advising patients of potential risks with proximal hamstring injection, despite a lack of proven association. Finally, given the proximity of the sciatic nerve to the injection site, the inadvertent exposure of local anesthetic and corticosteroid to the sciatic nerve is possible, although no such complication was noted by us.

Finally, a discussion of proximal hamstring tendinopathy treatment options would be incomplete without addressing other invasive treatment options, such as platelet-rich plasma (PRP) therapy and surgical debridement. One study evaluated PRP as a treatment for proximal hamstring tendinopathy and showed a significant reduction in VAS score, Nirschl phase rating scale, and time to return to sport when compared with conservative treatment consisting of 6 to 12 weeks of physiotherapy and NSAIDs.²¹ To our knowledge, there are no studies comparing corticosteroid injections to PRP injections for proximal hamstring tendinopathy. The most invasive management strategy for proximal hamstring tendinopathy is surgical debridement, which has been shown to offer good functional outcomes and a low complication rate¹³ but predisposes the patient to the obvious risks of surgery. One study evaluated surgical management of proximal hamstring tendinopathy in patients who have failed conservative management and showed an excellent or good outcome in 89% of patients, with a less than 1% complication rate.¹⁴

Weaknesses of this study include its retrospective nature, lack of a control population, and the subjective reporting of symptoms by patients. The study was

conducted months after the injection was performed and thus relied on the recall of symptomology by our patient cohort. We did choose to include level of athletic ability and percentage participation as more objective measures to help offset this bias, however. Additionally, we chose to include the LEFS to allow comparison to alternative treatment methods found in the literature. Given the limited data available on corticosteroid injection for proximal hamstring tendinopathy, this study adds substantially to the current literature on treatment options despite its inherent weaknesses. Future randomized controlled trials are needed to evaluate the effectiveness of corticosteroid injections in comparison with other noninvasive techniques, such as conservative management and PRP injection, as well as with surgical debridement.

Given the limited number of treatment options available for hamstring tendinopathy, we recommend a trial of fluoroscopically guided corticosteroid injection for patients presenting with clinical symptoms of hamstring tendinopathy.

REFERENCES

- Almekinders LC. Tendinitis and other chronic tendinopathies. *J Am Acad Orthop Surg.* 1998;6:157-164.
- Cacchio A, Borra F, Severini G, et al. Reliability and validity of three pain provocation tests used for the diagnosis of chronic proximal hamstring tendinopathy. *Br J Sports Med.* 2012;46:883-887.
- Chen SK, Lu CC, Chou PH, Guo LY, Wu WL. Patellar tendon ruptures in weight lifters after local steroid injections. *Arch Orthop Trauma Surg.* 2009;129:369-372.
- Coombs BK, Leanne B, Vicenzino B. Efficacy and safety of corticosteroid injections and other injections for the management of tendinopathy: a systemic review of randomized controlled trials. *Lancet.* 2010;376:1751-1767.
- De Smet AA, Blankenbaker DG, Alsheik NH, Lindstrom MJ. MRI appearance of the proximal hamstring tendons in patients with and without symptomatic proximal hamstring tendinopathy. *AJR Am J Roentgenol.* 2012;198:418-422.
- Fredberg U, Bolvig L, Pfeiffer-Jensen M, Clemmensen D, Jakobsen BW, Stengaard-Pedersen K. Ultrasonography as a tool for diagnosis, guidance of local steroid injection and, together with pressure algometry, monitoring of the treatment of athletes with chronic jumper's knee and Achilles tendinitis: a randomized, double-blind, placebo-controlled study. *Scand J Rheumatol.* 2004;33:94-101.
- Fredericson M, Moore W, Guillet M, Beaulieu C. High hamstring tendinopathy in runners: meeting the challenges of diagnosis, treatment, and rehabilitation. *Phys Sportsmed.* 2005;33(5):32-43.
- Gill SS, Gelbke MK, Mattson SL, Anderson MW, Hurwitz SR. Fluoroscopically guided low-volume peritendinous corticosteroid injection for Achilles tendinopathy. A safety study. *J Bone Joint Surg Am.* 2004;86:802-806.
- Khan KM, Cook JL, Bonar F, Harcourt P, Astrom M. Histopathology of common tendinopathies: update and implications for clinical management. *Sports Med.* 1999;27:393-408.
- Kleinman M, Gross AE. Achilles tendon rupture following steroid injection. Report of three cases. *J Bone Joint Surg Am.* 1983;65:1345-1347.
- Krausshar BS, Nirschl RP. Current concepts review: tendinosis of the elbow. *J Bone Joint Surg Am.* 1999;81:259-278.
- Labrosse JM, Cardinal E, Leduc BE, et al. Effectiveness of ultrasound-guided corticosteroid injection for the treatment of gluteus medius tendinopathy. *AJR Am J Roentgenol.* 2010;194:202-206.
- Lempainen L, Sarimo J, Mattila K, Orava S. Proximal hamstring tendinopathy—overview of the problem with emphasis on surgical treatment. *Oper Tech Sports Med.* 2009;17:225-228.

14. Lempainen L, Sarimo J, Mattila K, Vaittinen S, Orava S. Proximal hamstring tendinopathy: results of surgical management and histopathologic findings. *Am J Sports Med.* 2009;37:727-734.
15. Mahler F, Fritschy D. Partial and complete ruptures of the Achilles tendon and local corticosteroid injections. *Br J Sports Med.* 1992;26:7-14.
16. Nichols AW. Complications associated with the use of corticosteroids in the treatment of athletic injuries. *Clin J Sport Med.* 2005;15:370-375.
17. Orava S. Hamstring syndrome. *Oper Tech Sports Med.* 1997;5:143-149.
18. Puranen J, Orava S. The hamstring syndrome. *Am J Sports Med.* 1988;16:517-521.
19. Sanjitpal GS, Gelbke MK, Mattson SL, Anderson MW, Hurwitz SR. Fluoroscopically guided low-volume peritendinous corticosteroid injections for Achilles tendinopathy. *J Bone Joint Surg Am.* 2004;86:802-806.
20. Smith AG, Kosygan K, Williams H, Newman RJ. Common extensor tendon rupture following corticosteroid injection for lateral tendinosis of the elbow. *Br J Sports Med.* 1999;33:423-424
21. Wetzel RJ, Patel RM, Terry MA. Platelet rich plasma as an effective treatment for proximal hamstring injuries. *Orthopaedics.* 2013;36:e64-e70.
22. Zissen MH, Wallace G, Stevens KJ, Fredericson M, Beaulieu CF. High hamstring tendinopathy: MRI and ultrasound imaging and therapeutic efficacy of percutaneous corticosteroid injection. *AJR Am J Roentgenol.* 2010;195:993-998.

APPENDIX

Proximal Hamstring Tendinopathy Survey

The following was taken from an online survey provided to study subjects.

1. For how many months had you experienced symptoms of hamstring tendinopathy BEFORE the injection? Please be specific.
2. On a scale of 1-10, with 10 being the worst, what was your pain level BEFORE and AFTER the injection?
3. If you play a sport, please indicate what % of normal athletic function you were able to achieve BEFORE and AFTER the injection. Please leave blank all sports that you do not play.
4. If you tried physical therapy BEFORE or AFTER the injection, what is the approximate number of physical therapy sessions you attended? If you did not try physical therapy, please leave blank.
5. AFTER the injection, did you experience an improvement in your symptoms? If yes, for how long did your symptoms improve (if continuous, please write "continuous")?
6. AFTER the injection, did your symptoms completely resolve? If yes, for how long did they completely resolve (if continuous, please write "continuous")?
7. Overall, how satisfied were you with the injection? very satisfied; satisfied; unsatisfied
8. Did you have surgery on your hamstring after the injection? If you had any other type of treatment before or after the injection (other than physical therapy), please indicate that below.