Injection Therapy of Periosteal Trigger Points With Steroids or Prolotherapy

Failure to correctly diagnose periosteal trigger points—anatomically small areas of tenderness between ligaments or tendons and the periosteum—can result in unsuccessful treatment.

Harold A. Wilkinson, MD, PhD
Chief, Neurosurgical Division, Newton-Wellesley Hospital, Newton, Massachusetts
Karen Wei-Chung Kwok, BS
University of Massachusetts Medical School, Worcester, Massachusetts

Controversy surrounds trigger points and their treatment with steroid or prolotherapy injection. The diagnosis, treatment, and even the existence of trigger points have been challenged, especially by surgeons. Few if any laboratory tests are available to bolster the subjective, but consistent, reports of afflicted patients and the objective findings of the examining clinician. Trigger points, however, are considered a viable clinical entity, at least among algologists, physiatrists, osteopathic physicians, and rheumatologists.[1-27] Training the examining clinician can significantly improve inter-tester reliability in the diagnosis of trigger points.[18] Three double-blinded clinical studies and several observational studies support the benefit of prolotherapy and trigger point injection therapy for myofascial pain.[3,6,7,9,11,13,14,19-22,28-32] Periosteal trigger points (ie, painful and tender areas at fibro-osseous junctions) can produce symptoms that mimic those of other spinal conditions; this is especially true of trigger points in the lumbosacral area. Failure to diagnose periosteal trigger points leads to improper spinal surgery or other unsuccessful therapies.[1-3,5,7,11,15-17,19,23-26,28-30,32-35]

Failure to diagnose periosteal trigger points leads to improper spinal surgery or other unsuccessful therapies.

The majority of patients in this study were referred to a neurosurgeon (the senior author) for consideration of spinal surgery; however, many of these patients responded well enough to injection therapy that surgery was not necessary. Thus, it is important for neurosurgeons, orthopaedists, and others who treat spinal problems surgically to diagnose periosteal trigger points when they are encountered and to provide treatment using the minimally invasive technique.

Periosteal trigger points differ significantly from muscle trigger points.[17,19,21,23,25,26] These trigger points most likely have different pathologies; however, little histologic evidence is available for either condition. Sustained contraction and focal ischemia likely cause the tender and painful areas in muscle bellies, while ligamentous or periosteal stretch injuries at the site of insertion of muscles, ligaments, or tendons into periosteum, generically referred to as fibro-osseous junctions, seem to be the basis for periosteal trigger points. Muscle trigger points and periosteal trigger points result chiefly from muscular weakness and ligamentous laxity, especially when muscle tension is heightened by anxiety or depression.[1,6,7,11,19-21,24,28,32] Both types of trigger points, however, can develop in otherwise healthy individuals following extreme or unexpected effort. Many patients develop trigger points while recovering from lumbar disc disease and spinal surgery when they resume physical exertion after often prolonged prescribed periods of physical inactivity.

Muscle trigger points and periosteal trigger points result chiefly from muscular weakness and ligamentous laxity, especially when muscle tension is heightened by anxiety or depression.

If the two types of trigger points have different pathologies, it follows that they will respond differently to therapy. Massage (including deep myotherapy) and dry needling might increase circulation in muscular trigger points and provide relief, but these forms of therapy are likely to be ineffective for the treatment of periosteal trigger points. Periosteal trigger points respond best to therapeutic injections along periosteal insertion sites, if the injection includes the entire tender area. Injections of prolotherapy or sclerosing solutions into muscle bellies could cause muscle necrosis and are best avoided. Repeated injections of corticosteroids into a focal area can cause tissue weakening.[35,36] In contrast, prolotherapy (so named because it causes proliferation of collagen tissue), also called sclerotherapy (referring to its tissue-hardening properties), has the advantage that repeated administration produces cumulative benefit.[6,7,9,11,13,14,18,19,21,22,30,35-38] Prolotherapy provides sustained pain relief through tissue toughening by initiating fibroblast proliferation, which is improved by repeated injections, and by long-lasting interruption of nerve fiber transmission by the phenol and glycerol included in one of the commonly employed formulations of prolotherapy solution.[30,35,37,38] Unfortunately, even though muscle trigger points and periosteal trigger points seem to differ in pathology, clinical presentation, and response to therapy, many publications fail to distinguish between the two conditions, making evaluation of therapeutic results difficult.[3-5,12,22,23,30,35] Some contend that responses to injection therapy of trigger points are merely placebo effects. The need for quantitated clinical data led to this study.

Periosteal trigger points respond best to therapeutic injections along periosteal insertion sites, if the injection includes the entire tender area.

PATIENTS AND METHODS

Periosteal trigger points are anatomically constant small focal areas of marked tenderness at junction points between ligaments or tendons and the periosteum, generically referred to as fibro-osseous junctions, from which pain seems to radiate spontaneously. The pain is markedly aggravated by or after activity, and there is no underlying fracture or radiographically evident bone lesion. Periosteal trigger points can be diagnosed on physical examination by careful palpation to detect and delineate the tender area. Diagnosis is confirmed by reproduction of the usual pattern of radiation of pain by needling the periosteal area and by achieving relief of all or most of the local tenderness, spontaneous pain, and pain on motion at that site, when the periosteal area is adequately and thoroughly infiltrated with local anesthetics.

A retrospective chart review was conducted on 89 patients who had received injection therapy for painful periosteal trigger points between 1979 and 1995 and for whom adequate follow-up data were available. Outcomes were quantified by record review by an independent observer who had not participated in the patients' therapy. If patients who received injections between 1979 and 1995 had received earlier injections, the results of those earlier injections were also analyzed. Sixty-seven patients were female and 22 were male. Patients ranged in age from 28 to 87 years (average age, 48 years).

Many patients develop trigger points while recovering from lumbar disc disease and spinal surgery when they resume physical exertion after often prolonged prescribed periods of physical inactivity.

Sixty-five patients (73%) had previously undergone a variety of types of spinal surgery in an adjacent spinal area. Many of these were referred to the senior author for evaluation of "failed back syndrome" and assessment of the need for and advisability of further neurosurgical operative intervention. All of the patients were included because they had painful periosteal trigger points at one or more sites, though many of these patients also suffered from other painful disorders, usually in the lower lumbar or lumbosacral spine. Some had radicular pain as well as pain of the axial spine. This study focused on the patient's trigger points and the specific therapy they received for it. Periosteal trigger points of these patients presented a major source of pain and physical incapacity, which had not responded to an exercise program, anti-inflammatory

drugs, or other therapy, and which interfered with or prevented exercising and activities of daily living. All patients were taking analgesic medications; most were taking narcotics, and all had attempted a physical rehabilitative and restorative exercise program.

The degree of pain relief provided by the injection was characterized as excellent, good, partial, or poor. These definitions rather than the visual analog pain score were used for three reasons: (1) The magnitude of the pain produced by trigger points did not correlate well with the disability they produced, since the intensity of pain varies with the level and type of activity; (2) Periosteal trigger points are distressing to patients because they produce local tenderness, in addition to pain, and because tenderness and pain interfere with functional activities; and (3) Trigger point pain and tenderness are commonly encountered in patients with other pain-generating abnormalities, so that even completely eradicating the trigger point pain and tenderness would provide limited functional improvement and eliminate having to take pain relieving medications. "Excellent relief" described greatly decreased pain (analog score for pain at the trigger point site equal to or less than 3) and overall tenderness, greatly improved functional status, marked reduction in analgesic requirements, and no need for narcotics. For patients reporting excellent relief of pain, the trigger point was usually the patient's chief pain generator. "Good" referred to greatly decreased pain (analog score for pain at the trigger point site equal to or less than 3) and tenderness in the area of the trigger point, usefully improved function, and decreased medication intake, but narcotics still often required. "Partial" referred to decreased pain (analog score for pain at the trigger point site equal to or less than 6) and tenderness, but little reduction in medication, and/or little functional improvement. These patients nonetheless requested repeat trigger point injections when their trigger point pain and tenderness recurred. "Poor" was used to describe pain that was not usefully relieved subjectively or objectively and for which patients did not request, or declined, repeat injections. The duration of relief obtained was defined either as the maximum duration of relief until the time of pain recurrence or the longest time of follow-up when relief was maintained, thus somewhat underestimating the duration of relief.

The goal of injection therapy was to relieve pain and tenderness, rather than to toughen tissue or facilitate healing of acute sports injuries.

A total of 757 therapeutic injections were given to the 89 patients. The goal of injection therapy was to relieve pain and tenderness, rather than to toughen tissue or facilitate healing of acute sports injuries. Injections were given as needed for recurrence of pain and tenderness, rather than planned at weekly intervals. After identifying the trigger point, the diagnosis was confirmed by local infiltration with 1% lidocaine without epinephrine along the area of periosteal tenderness. If this injection relieved most or all of the local tenderness and spontaneous pain, the same area was injected with one of two therapeutic agents.

A total of 293 injections were provided with depository methylprednisolone (Depo-Medrol), nearly always using 40 mg in 1 mL of solution, after further infiltrating the area with a volume of 0.5% plain bupivacaine equal to the volume of lidocaine injected. Four hundred sixty-four injections were given with prolotherapy in a volume equal to the volume of lidocaine injected. Although a variety of different formulations have been used as prolotherapy solutions,[11,30,35,37] in this study all prolotherapy injections were done with a solution composed of 1% phenol and 20% glycerol in 0.5% plain bupivacaine. In nearly every instance, the patient's initial injection was with depository steroid. If the patient obtained useful pain relief from the first injection, but for a duration less than 4 months, repeat injections were nearly always given with prolotherapy. Exceptions were made for patients who reported that the steroid injection had been more successful or less painful for them than the prolotherapy injection. If good relief from the initial injection lasted more than 6 months and repeat

Patients were assessed for improvements in range of motion immediately after each injection.

injections were needed, steroids were usually provided. The volume of lidocaine and prolotherapy solution injected varied with the size and location of the trigger point, but generally varied between 5 mL and 12 mL of each solution (usually 10 mL of each) in the posterior pelvic area. Patients were assessed for improvements in range of motion immediately after each injection and at each follow-up. Patients received a median of three injections each, but the range of injections per patient varied from 1 to 134 injections for a single patient over a 16-year period. One patient received injections into multiple sites since her condition evolved during the course of treatment of disc disease, first in the lumbar area then in the cervical area. Even though she was unable to return to her physically demanding job, she remained generally functional during most of this time and ascribed her functional capacity to the trigger point injections. Eleven patients received 20 or more injections into various sites over an average of 14 years each (range, 6 to 16 years), obtaining sufficient relief that they requested additional injections when periosteal trigger points persisted, recurred, or surfaced in new areas.

RESULTS

Overall, 86% of the 757 injections provided useful relief of pain and local tenderness, with a median duration of relief for 4 months. Pain relief lasted for 1 year or more in 23% of patients. Thirty-one percent of injections provided excellent

Overall, 86% of the 757 injections provided useful relief of pain and local tenderness, with a median duration of relief for 4 months.

relief, indicating that the trigger point was the principal source of pain. Excellent pain relief lasted for 1 year or more in 7% of patients. Twenty-seven percent of patients who received fewer than 20 injections each experienced relief for a minimum of 1 year. Eleven patients who received 20 or more injections each (a total of 510 injections) had requested repeated prolotherapy injections for 65% of their injections. Only 7% of injections resulted in poor pain relief compared with 27% of injections in patients who received fewer than 20 injections. Relief lasted only 3 months in patients who received 20 or more injections, compared with 7 months in patients who received fewer than 20 injections. Relief did not correlate with the volume of the injection, which was determined principally by the size and site of the tender area and the bulk of the patient.

By far the most common site of injection was at or near the posterior iliac spine, accounting for 70.8% of injections (Table 1). Depository corticosteroids were used in 187 injections (24.7%) and prolotherapy was used in 349 injections (46.1%). Injections at this site provided useful relief of pain and local tenderness in 86% of instances. Useful pain relief lasted for 1 year or more (median, 4 months) in 22% of patients (Table 2). Thirty-two percent of these injections provided excellent relief, implying that the trigger point was the patient's principal source of pain.

Two hundred twenty-one injections (29.2%) were given into other periosteal trigger point sites. These injections provided useful relief for 87% of patients with a median of

TABLE 1 Number of injections by site and agent.

Site	Agent	Number of injections
Posterior iliac 536 (70.8%)	Depo-Medrol	187 (24.7%)
	Prolotherapy	349 (46.1%)
Other pelvic areas 60 (7.9%)	Depo-Medrol	26 (3.4%)
	Prolotherapy	34 (4.5%)
Coccyx (periosteum or joint) 11 (1.5%)	Depo-Medrol	8 (1.1%)
	Prolotherapy	3 (0.4%)
Spinous processes 100 (13.2%)	Depo-Medrol	36 (4.7%)
	Prolotherapy	64 (8.5%)
Subocciput 38 (5.0%)	Depo-Medrol	25 (3.3%)
	Prolotherapy	13 (1.7%)
Extremities 12 (1.6%)	Depo-Medrol	11 (1.5%)
	Prolotherapy	1 (0.1%)

TABLE 2 Comparison of outcome of periosteal trigger point injection by type of therapy and site of injection.

Therapy and location	Response group	Number of injections (%)	Median duration of relief (months)	Relief of 1 year or more
Steriods	Total	293 (100%)		
All sites	Excellent	87 (30%)	6.0	12%
	Excellent + Good	203 (69%)	6.0	25%
	Exc + Good + Partial	237 (81%)	5.0	26%
	Poor	56 (19%)		
Prolotherapy	Total	464 (100%)		
All sites	Excellent	147 (32%)	2.5	5%
	Excellent + Good	352 (76%)	3.0	15%
	Exc + Good + Partial	415 (90%)	3.0	20%
	Poor	49 (10%)		
Posterior iliac	Total	536 (100%)		
All therapy	Excellent	142 (32%)	2.5	6%
	Exc + Good	387 (72%)	5.0	18%
	Exc + Good + Partial	459 (86%)	4.0	20%
	Poor	77 (14%)		
Other sites	Total	221 (100%)		
All therapy	Excellent	94 (43%)	6.0	13%
	Exc + Good	168 (76%)	3.0	20%
	Exc + Good + Partial	193	3.0	24%
	Poor	28		

3 months of relief, and 23% enjoyed useful relief for a year or longer (Table 2). Forty-three percent of patients enjoyed excellent relief, indicating that the periosteal trigger point was the major pain generator for that patient. Injections into sites other than posterior iliac periosteal trigger point sites provided somewhat better results and generally higher percentages of relief lasting 1 year or more for patients in each therapy group (Tables 2 and 3).

Patients were initially given depository corticosteroid injections. If useful pain relief lasted less than 4 months and tenderness persisted at the trigger point site despite continuing restorative exercise programs and other prescribed therapy, prolotherapy was initiated. Repeat steroid injections were given only if the useful relief lasted more than 4 months or if the patient specifically requested steroid injection. Repeated steroid injections into ligaments or tendons can cause local tissue weakness,[35,36] whereas frequent and multiple injections of prolotherapy can strengthen tendons and ligaments in the painful area.[6,7,9,11,13,14,18,19,21,22,30,35,38] Prolotherapy was, therefore, given to patients who had obtained useful, but shorter relief from initial injections, compared with corticosteroid injections. This difference in clinical usage prevented direct statistical comparisons between the two groups; however, prolotherapy injections provided a slightly greater percentage of useful relief per injection than did steroid injections (90% vs 81%), but the median duration of relief was shorter (3 months vs 5 months). Sustained relief of 1 year or more was somewhat less common following prolotherapy than steroid therapy (20% and 26%, respectively; Table 2).

Repeat steroid injections were given only if the useful relief lasted more than 4 months or if the patient specifically requested steroid injection.

TABLE 3 Outcomes of periosteal trigger point injections with corticosteroids or with prolotherapy by injection site.

Therapy and location	Response group	Number of injections (%)	Median duration of relief (months)	Relief of 1 year or more
Posterior iliac	Total	187 (100%)		
Steroid	Excellent	42 (22%)	4.0	7%
	Exc + Good	122 (65%)	7.0	24%
	Exc + Good + Partial	146 (76%)	6.0	25%
	Poor	41 (22%)		
Posterior Iliac	Total	349 (100%)		
Prolotherapy	Excellent	100 (29%)	2.0	4%
	Excellent + Good	265 (76%)	4.0	15%
	Exc + Good + Partial	323 (93%)	3.0	17%
	Poor	26 (7%)		
Other Site	Total	106 (100%)		
Steroid	Excellent	45 (42%)	4.0	19%
	Excellent + Good	81 (76%)	4.0	25%
	Exc + Good + Partial	91 (86%)	4.0	27%
	Poor	15 (14%)		
Other Site	Total	115 (100%)		
Prolotherapy	Excellent	49 (43%)	4.0	8%
	Excellent to Good	87 (76%)	3.0	16%
	Exc + Good + Partial	102 (89%)	3.0	21%
	Poor	13 (11%)		

The percentage of excellent results obtained was similar with both injections: 30% with steroid injections versus 32% with prolotherapy injections. This comparison did not differ strikingly whether the injections were into the posterior iliac spine or into other sites (Table 3).

Complications were rare in this series. Local pain and tenderness, rarely severe, were commonly experienced for 3 to 7 days after injection therapy. Pain and tenderness were slightly greater after prolotherapy injection than after corticosteroid therapy. Only one patient developed painful necrosis following an injection of prolotherapy solution into fatty tissues. No patients developed new neurologic deficits, infection, or obvious allergic reactions.

DISCUSSION

Diverse etiologies can cause low back pain or lumbago, especially following lumbar spine surgery, and painful and tender trigger points can cause pain in the lower back and in other sites.[1-3,5-8,10-16,19-28,31-35,39] Many of the patients in this study were referred to neurosurgeons as "failed back syndrome" patients. All were diagnosed with painful periosteal trigger points as at least one cause of their pain and functional impairment. Muscular and periosteal trigger points probably differ significantly in pathophysiology as well as in the type of tissue affected. When other painful conditions coexist, the periosteal trigger point might be more difficult to diagnose, but it can still be an important secondary or even primary source of pain and incapacity.

Prolotherapy traces its roots to the technique used by Hippocrates to treat chronic shoulder subluxations—insertion of red-hot wires into the shoulder capsule. Evolution into its present form began with the studies