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Retrospective Case Series on Patients with Chronic Spinal Pain Treated with Dextrose Prolotherapy

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ABSTRACT

Objectives: To determine the clinical benefits of dextrose prolotherapy in patients with chronic spinal pain.

Design: Retrospective case series.

Setting/location: During the first 2 years at an outpatient prolotherapy clinic.

Subjects: One hundred and seventy-seven (177) consecutive patients with a history of chronic spinal pain completed prolotherapy treatment and were followed for a period ranging from 2 months to 2.5 years.

Interventions: Patients were treated with a proliferant solution containing 20% dextrose and 0.75% xylocaine. One half milliliter (0.5 mL) of proliferant was injected into the facet capsules of the cervical, thoracic, and lumbar spine, or combinations of the three areas. The iliolumbar and dorsal sacroiliac ligaments were also injected in patient with low back pain. Injections were typically done on a weekly basis for up to 3 weeks. A set of three injections was repeated in 1 month's time if needed.

Outcome measures: Level of pain, and improvement in activities of daily living were measured on a five-point scale. Improvement in ability to work was also assessed.

Results: Ninety-one percent (91.0%) of patients reported reduction in level of pain; 84.8% of patients reported improvement in activities of daily living, and 84.3% reported an improvement in ability to work. Women required on average, three more injections than men. Cervical spine response rates were lower than thoracic or lumbar spine. No complications from treatment were noted.

Conclusions: Dextrose prolotherapy appears to be a safe and effective method for treating chronic spinal pain that merits further investigation. Future studies need to consider differences in gender response rates.

INTRODUCTION

Ligaments were first recognized as a source of spinal pain in 1930 when Lerich described them to be richly innervated with nociceptive nerve endings. When a weak or injured ligament fails to provide stability for a joint, normal tension will cause it to stretch. The sensory fibers, which do not stretch, are stimulated and pain occurs (Hackett et al., 1993). Because the injury repair process only restores 70% of pretensile strength (Frank and Amiel, 1985), what commonly follows is a pattern of ongoing laxity of the ligament, and chronic pain.

Prolotherapy is the injection of a solution to produce a proliferative response in tissue. The technique was developed by George Hackett, M.D., in the 1930s to treat chronic myofascial pain caused by ligamentous laxity. Prolotherapy triggers an inflammatory cascade similar to that seen in the normal healing process whereby fibroblastic hyperplasia and collagen formation contribute to thickening and strengthening of the ligaments or tendons injected (Hackett et al., 1993).

Biopsy studies demonstrate a transient inflammatory reaction, lasting less than 3 months, sufficient to create a fibroblast response (Hackett et al., 1993; Klein et al., 1989). There is microscopic evidence to support thickening of individual collagen fibers (Lui et al., 1983; Klein et al., 1989),

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Table 1. Ratio and Percentage of Spine Regions Treated with Prolotherapy

C	6/177 (3.4%)
CT	16/177 (9.0%)
CL	1/177 (0.6%)
CTL	8/177 (4.5%)
T	40/177 (22.6%)
L	79/177 (44.6%)
TL	27/177 (15.3%)

C, cervical spine; T, thoracic spine; L, lumbar spine.

thickening of whole ligament and tendons (Maynard et al., 1985; Lui et al., 1983), as well as enlargement of the tendino-osseous junction after injection of proliferant (Hackett et al., 1993). Ligament strength is improved (Lui et al., 1983). Studies by Ongley et al. (1988) and Reeves and Khatab (2000a) demonstrate tightening of the anterior cruciate ligament. More recent studies indicate the release of growth factors may also be a factor important in the response demonstrated with prolotherapy (Reeves and Khatab, 2000a; Reeves and Khatab, 2000b).

Numerous reports over the past 50 years have documented positive outcomes with prolotherapy treatment in the low back (Hackett 1962a; Myers 1961; Peterson 1963), sacroiliac ligament (Hackett, 1953; Schwartz and Sajedy, 1991), cervical spine (Dorman, 1999), headache (Hackett, 1962b), hand (Reeves and Khatab, 2000b), and knee (Ongley et al., 1988; Reeves and Khatab, 2000a).

There have been three randomized controlled trials reporting benefit with prolotherapy. Studies by Ongley et al. (1987) and Klein et al. (1993) demonstrated that prolotherapy, exercise, manipulation, and trigger point injection were effective in 87.5% and 77% of the treatment groups. Yelland et al. (2004) reported a 46% response rate with prolotherapy alone. Our study helps to isolate prolotherapy as an independent variable in the treatment of chronic spine pain. Exercise, manipulation, and trigger point injection were constant before and during injection. Further improvement was noted after adding prolotherapy.

The data collected allowed us for the first time to report on response rates in the thoracic spine, compare responses between genders, and different regions of the spine.

MATERIALS AND METHODS

Patients with chronic low-back pain that did not recover with a trial of exercise, manipulation, and dry needling of trigger points by a manual therapist were referred for prolotherapy if manual assessment demonstrated laxity in the spine, the iliolumbar ligament, or the sacroiliac ligament (Laslett and Williams, 1994; Oxland and Panjabi, 1992). Patients selected for prolotherapy were injected with a 20%-dextrose and 0.75%-xylocaine solution. Injections were usually done on a weekly basis for up to 3 weeks. A set of three injections was repeated in 1 month if needed. Depending on patient tolerance, some injections were completed on a monthly basis. One-half milliliter (0.5 mL) of proliferant was injected into facet capsules of the cervical, thoracic, or lumbar spine. The iliolumbar ligament insertions on the iliac crest and dorsal sacroiliac ligaments were also injected in patients with low back pain. Injection techniques are described in Hackett et al. (1993). During the course of prolotherapy patients were restricted from taking nonsteroidal anti-inflammatory medications.

Statistical analysis included univariate analysis of demographic variables and outcomes, as well as cross-tabulation of outcomes by symptoms, gender, duration of symptoms, and length of follow-up. Analysis included comparison of separate treatment areas (cervical, thoracic or lumbar) and multiple treatment areas (combined cervical versus combined thoracic/lumbar).

RESULTS

A total of 238 consecutive patients were seen over the 2-year period. One hundred and seventy-seven (177) of 184 patients who completed treatment returned the questionnaire. Twelve (12) patients were diagnosed with other mechanical causes for back pain and were subsequently excluded from the trial. Thirty-eight (38) patients did not complete treatment Seven (7) were still undergoing active treatment at the conclusion of the study period.

Patient demographics included a predominance of females (71%). Mean age upon entry into the study was 39.5 years. Mean duration of symptoms prior to initiating therapy was

Table 2. Patient Response to Prolotherapy Based on Symptoms

	C	*T*	*L*	*TL*
Worse	0 (0.0%)	0 (0.0%)	2 (2.5%)	0 (0.0%)
Same	7 (22.6%)	4 (10.0%)	2 (2.5%)	1 (3.7%)
Somewhat better	4 (12.9%)	7 (17.5%)	21 (26.6%)	5 (18.5%)
Moderately better	14 (45.2%)	15 (37.5%)	22 (27.9%)	11 (40.7%)
Much better	6 (19.4%)	14 (35.0%)	32 (40.5%)	10 (37.0%)
Total	31	40	79	27

C, cervical spine; T, thoracic spine; L, lumbar spine.

Table 3. Patient Response to Prolotherapy Based on Function

	C	*T*	*L*	*TL*
Worse	0 (0.0%)	1 (2.5%)	2 (2.5%)	0 (0.0%)
Same	8 (28.5%)	7 (17.5%)	5 (6.3%)	4 (14.8%)
Somewhat better	4 (12.9%)	8 (20.0%)	18 (22.8%)	4 (14.8%)
Moderately better	14 (45.2%)	15 (37.5%)	23 (29.1%)	8 (29.6%)
Much better	5 (16.1%)	9 (22.5%)	31 (39.2%)	11 (40.7%)
Total	31	40	79	27

C, cervical spine; T, thoracic spine; L, lumbar spine.

4.81 years (range, 3 months to 27 years). Areas treated, included cervical, thoracic, and lumbar spine, or combinations of the three regions (Table 1). Patients were given a 5-point scale to rate their symptoms and function with activities of daily living (Appendix 1). Tables 2, 3, and 4 indicate the number and percentages of patient response based on symptoms, function, and ability to work. Ninety-one percent (91.0%) of patients reported reductions in their level of pain, 84.8% of patients had improvement in function with activities of daily living. Of those patients working outside the home, 84.3% had improvement in their ability to work.

Average number of injections required was three for males and six for females (standard deviation, 1.95 for male, 2.41 for females, $p = <0.0001$). There was no difference in outcome based on gender, duration of symptoms, etiology of symptoms (traumatic versus nontraumatic), or duration of follow-up. Mean length of follow-up was 9 months with a standard deviation of 5 months.

Comparison between regions treated indicated no difference between patients with thoracic or lumbar treatments. Cervical spine treatments were less likely to report an improvement in symptoms compared to thoracic or lumbar patients (77.4% versus 93.8%, $p = 0.0004$), or improvement in ability to work (70.8% versus 87.4%, $p = 0.05$). The difference between cervical and thoracic or lumbar regions for function with activities of daily living was not statistically significant (74.2 versus 87%, $p = 0.072$).

DISCUSSION

This study is consistent with the results of earlier studies demonstrating significant improvements in pain and disability in patients treated with prolotherapy. Gender should be a factor considered in future studies. This may explain why Dechow et al. (1999) found no improvement with prolotherapy after three injections.

The outcomes of 67 thoracic spine patients are no different than lumbar spine. However, the poorer response of cervical spine patients indicates better selection criteria or treatment techniques are required. We plan to test whether sedated overpressure flexion/extension x-rays are a better assessment of laxity and whether intra-articular prolotherapy provides better results than unguided injection.

Patients with traumatic and nontraumatic pain responded equally well. The majority of trauma patients were whiplash injuries. Unfortunately, we did not track litigation status. Determining responses between litigants and nonlitigants is of interest for future studies.

Another area requiring further study is patient selection and exclusion. Clinically we observed the areas diagnosed with ligament laxity correspond to the areas of maximal tenderness, were concordant with pain diagram drawings, and responded to taping or bracing. These factors are easier to reproduce than stress testing for ligament laxity. Travell and Simon (1983) noted a high incidence of deficiency of hormonal or nutritional factors such as thyroid, testosterone, vitamin B_{12}, or ferritin in patients with chronic myofascial pain. Our numbers were too low for analysis; however, anecdotally it was noted a few slow responders response improved with supplementation of these factors. History, examination, and radiologic procedures can exclude other causes of pain to help ensure good outcomes.

Patients generally find the injections uncomfortable and report 1–2 days of stiffness afterward. No complications such as nerve damage, pneumothorax, or infection were encountered with the treatments administered in this case study. In light of the demonstrated safety and efficacy of

Table 4. Patient Response to Prolotherapy Based on Ability to Work

	C	*T*	*L*	*TL*
Improved	17 (54.8%)	28 (70.0%)	46 (58.2%)	16 (50.3%)
Unchanged	7 (22.6%)	6 (15.0%)	4 (5.1%)	3 (11.1%)
Not applicable	7 (22.6%)	6 (15.0%)	29 (36.7%)	8 (20.6%)
Total	31	40	79	27

C, cervical spine; T, thoracic spine; L, lumbar spine.

prolotherapy, the shortage of alternative options in the management of chronic spine pain, and the huge toll this illness plays on our health care system, this approach warrants further examination.

REFERENCES

Dechow E, Davies RK, Carr AJ, Thompson PW. A randomized, double blind, placebo-controlled trial of sclerosing injections in patients with chronic low back pain. Rheumatology 1999:38: 1255–1259.

Dorman TA. Whiplash injuries: Treatment with prolotherapy and a new hypothesis. J Orthop Med 1999;21:13–21.

Frank C, Amiel D. Normal ligament properties and ligament healing. Clin Orthop Rel Res 1985;196:15–25.

Hackett GS. Joint stabilization through induced ligament sclerosis. Ohio State Med J 1953;49:877–884.

Hackett GS. Prolotherapy in whiplash and low back pain. Postgrad Med 1962a;27:20–28.

Hackett GS, Raftery A. Prolotherapy for headache. Headache 1962b;2:20–28.

Hackett GS, Hemwall GA, Montgomery GA, eds. Ligament and Tendon Relaxation Treated by Prolotherapy. Oak Park, Illinois: Hemwall, 1993.

Klein RG, Dorman TA, Johnson CE. Proliferant injections for low back pain: Histologic changes of injected ligaments and objective measurements of lumbar spine mobility before and after treatment. J Neurolog Orthopaed Med Surg 1989;10:141–144.

Klein RG, Bjorn CE, DeLong B, et al. A randomized double-blind trial of dextrose-glycerine-phenol injections for chronic low back pain. J Spinal Disord 1993;6:23–33.

Laslett M, Williams M. The reliability of selected pain provocation tests for sacroiliac joint pathology. Spine 1994;11:1243–1249.

Leriche R. The effect of Novocaine anesthetic on ligaments and periarticular tendon insertions of diseased joints with abnormal range of motion [in French]. Gazette Des Hopitaux 1930;103: 1294.

Lui YK, Tipton CM, Matthes RD, et al. An in-situ study of the influence of a sclerosing solution in rabbit medial collateral ligaments and its junction strength. Connect Tissue Res 1983;11: 95–102.

Maynard JA, Pedrini VA, Pedrini-Mille A, et al. Morphological and biochemical effects of sodium morrhuate on tendons. J Orthopaed Res 1985;3:236–248.

Myers A. Prolotherapy treatment of low back pain and sciatica. Bull Hosp Joint Dis 1961;22:48–55.

Ongley MJ, Klein RG, Dorman TA, Eck BC, Hubert LJ. A new approach to the treatment of chronic low back pain. Lancet 1987;2:143–146.

Ongley MJ, Dorman TA, Bjorn CE, Lundgren D, Klein RG. Ligament instability of knees: A new approach to treatment. Manual Med 1988;3:152–154.

Oxland TR, Panjabi MM. The onset and progression of spinal injury: A demonstration of neutral zone sensitivity. J Biomech 1992;25:1165–1172.

Peterson TH. Injection treatment for back pain. Am J Orthoped 1963;Nov:320–325.

Reeves KD, Khatab H. Randomized prospective double-blind placebo controlled study of dextrose prolotherapy for knee osteoarthritis with or without ACL laxity. Altern Therap 2000a;6: 68–80.

Reeves KD, Khatab H. Randomized, prospective, placebo-controlled double-blind study of dextrose prolotherapy for osteoarthritic thumb and finger (DIP, PIP, and trapeziometacarpal) joints: Evidence of clinical efficacy. J Altern Complement Med 2000b:311–320.

Schwartz RG, Sagedy N. Prolotherapy: A literature review and retrospective study. J Neurol Orthop Med Surg 1991;12:220–223.

Travell JG, Simons DG. Myofascial Pain and Dysfunction: The Trigger Point Manual. Baltimore, MD: Williams & Wilkins, 1983.

Yelland M, Glasziou P, Bogduk N, Schluter P, McKernon M. Prolotherapy injections, and exercises for chronic low-back pain: A randomized trial. Spine 2004;29:9–16.

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Appendix 1. Patient Questionnaire

Please complete one questionnaire for each region treated.

NAME Gender Male Female

This questionnaire refers to the following area treated.

Number of treatments to region indicated above.

Age at start of prolotherapy.

Date of last prolotherapy for this region (mth/yr)

Duration of symptoms before starting prolotherapy in this region (yrs)

Cause of symptoms (0) traumatic (1) nontraumatic

1. Since completing prolotherapy on this region did your **symptoms** in this region:

(a) get worse (b) stay the same (c) get somewhat better
(d) get moderately better (e) get much better

2. Since completing prolotherapy, would you describe your overall **function** (ability to perform activities such as, regular daily chores, work or play) as:

(a) worse (b) same (c) somewhat better
(d) moderately better (e) much better

3. If you are working outside the home, did prolotherapy improve your ability to **work** (e.g., return to work, increase from modified to regular duties, increase hours, able to work longer before having to stop)?

Yes No Not applicable (do not work outside the home)