Case Report

Is Prolotherapy an Effective Long-term Management for Discogenic Low Back Pain? - A Case Study with 10 Year Follow Up

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Abstract

Discogenic low back pain (DLBP), has been reported to account for 39% of all chronic lower back pain. Several studies have also concluded that the presence of a high intensity zone (HIZ) in the annulus on T2-weighted sagittal lumbar MRI and in the context of a DLBP pattern, (88-99% correlation), suggest that an annular fissure of the disc is the main pain generator. Nevertheless, finding effective non-surgical long-term pain management solutions for chronic DLBP remains challenging.

Prolotherapy, also known as Sclerotherapy, 'Bongling' or Regenerative injections, commonly utilizes substances such as dextrose, dextrose-glycerol-phenol (Ongley's Solution or P2G), and sodium morrhuate. Targeted injections of these solutions into the tendon enthesis, facet joints space, and lumbosacral ligaments, aims to stimulate natural healing processes through inflammation, thereby optimizes lumbar motor unit stability, which in turn may relieve pain. Accurate lumbar ligament injection delivery requires practical knowledge of anatomical landmarks, but may also be performed under ultrasound or fluoroscopic guidance.

There are few studies reviewing the sustained effects of prolotherapy for the management of chronic low back pain. This case report with 10-year post spinal prolotherapy follow up, reviews a patient with MRI-confirmed lumbar degenerative disc disease and an annular tear.

Keywords: prolotherapy, sclerotherapy, lumbar disc annular tear, degenerative disc disease, discogenic, manipulation

Introduction

Prolotherapy (Proliferative Therapy) injections induce a controlled inflammatory response, stimulating the natural healing responses of injured or lax ligaments, other connective tissue elements, and degenerative conditions of the musculoskeletal system. Also referred to as Bongling, sclerotherapy, regenerative injection therapy, and nonsurgical ligament reconstruction, these solutions are injected into lax or weakened spinal ligaments and adjacent lumbosacral soft tissue structures, relieving back pain, by restoring normal motor unit stability.

Case Report

A 34-year-old professional cellist and music teacher, and mother of two, presented with a history of lower back pain since early childhood that had gradually worsened over time and was beginning to interfere with her ability to work and perform activities of daily living. She presented with copious medical records, beginning with a pre-adolescent orthopaedic consultation records documenting unexplained back pain. Initial lumbar MRI scans were reported as normal, and there were letters from various specialist's contacts and numerous treatment letters from emergency services, pain specialists, fibromyalgia consultants, physiotherapists, osteopaths, neurologists, psychologists, urologists, gynaecologists, cognitive behavioral therapists, spanning several years, and with a varied assortment of working diagnoses. She had also developed chronic finger pain managed with serial cortisone injections by an orthopaedic hand specialist and by Rheumatologists. She had been under several Rheumatology consultants and had undergone a wide array of exclusionary tests of inflammatory and auto-immune causation, including Lyme disease serology, some of which were repeated several times. Unfortunately, none of these diagnostic approaches, managements, which included codeine phosphate, tramadol, amitripitline, gabapentin, pre-gabalin, ibuprofen and naproxen, had afforded only temporary pain respite, with chronic back pain and flares following a trajectory of increasing intensity and frequency as the years passed. She described the back pain as a dull and constant ache with intermittent flares of 8/10 centralized non-radicular lower lumbar segment pain, associated with sleep disturbance, transient urine retention, and difficulty finding a position of ease. She had also begun to experience lower leg pain and stiffness, which was managed with regular baclofen. At times the low back pain was so severe that she had attended the Accident and Emergency departments where her pain was investigated managed with intra-venous opioids. Lumbar punctures reported normal cerebral spinal fluid findings. Serial lumbar MRI scans obtained over several years during times of severe pain flares, reported a progression of lower lumbar segment degenerative disc disease with L4-5 & L5-S1 annular tears. She was referred back to the pain team and underwent severe caudal epidurals and facet joint blocks with only temporary relief reported in the letters.

Though severe pain flares occurred randomly, she also developed increased low back pain symptoms with prolonged standing and sitting greater than ten minutes, domestic activities, and manually handling her cello, which she transported in a wheeled case. She had a history of acute on chronic recurrent bladder infections with corresponding mild ESR elevations, which were managed but never cured with courses of various oral and IV antibiotics along with bladder washouts. There was some speculation that these bladder infections were related to her lower back pain. However, flares of back pain and finger pain seemed to occur randomly and independently of the acute bladder infection flairs.

On examination her postural alignment and gait were generally unremarkable with the exception of a slight left hip elevation. Range of lumbar spinal motion was globally restricted with extension limited to 10 degrees. She was able to fully squat, and serial unilateral heel raises were achieved albeit with some balance difficulty. Bilateral slump tests flared her symptoms of lower back pain and reproduced ipsilateral left hamstring radicular pain. She displayed a left anterior pelvic tilt, and her left leg was 1.5 cm longer. The lower limbs were neurovascularly intact. Ankle, knee and hip range of motion were full, unrestricted and pain free with all joints stable on testing. The left leg was stiff on active left straight leg raise, reproducing lower back pain at 30 degrees. Lumbar palpation elicited pain and discomfort of the central lower lumbar segments, interspinous spaces and iliolumbar ligaments on the left greater than the right. Sacral shearing tests were unremarkable. There were no gross signs of hypermobility using the Beighton scoring system.

She was consented for a course of prolotherapy and was advised not to take any non-steroidal anti-inflammatory medications so as not to interfere with the desired inflammatory response [1].

On telephone follow up after the initial session, she reported some side effects from the injections, which included transient skin irritation, slight transient nausea and also urine retention. She continued to receive side posture lumbar osteopathic manipulations prior to the first few prolotherapy sessions, until her leg length equalized and remained stable. The aim being, to sustain optimal spinal alignment [2], and disrupt any soft adhesions and scar tissue present. She received a functional Mackenzie-based spinal rehabilitation exercise program [3-5] to carry out between injections in order to augment organized tissue remodeling during the inflammatory response. Unfortunately, urology review concluded that the urine retention was associated with chronic antibiotic-resistant urinary tract infections requiring ongoing management. Scheduled prolotherapy sessions had to be cancelled, as post voiding urine retention and intermittent bladder infections continued. Despite severe stops and starts, the patient was nevertheless keen on continuing prolotherapy sessions as she had begun to notice some relief of back pain. With urologist's agreement, further ad hoc injections were carried out during periods of bladder infection remissions. Though she continued to suffer from continued left leg stiffness and recurrent bladder infections, 6 weeks following a total of 30 injections over a 2-year period, she reported that her low back pain completely abated. The patient followed up after ten years, reported that she her lower back had remained pain-free for an entire decade.

On follow-up she reported having continued acute on chronic urinary tract infections along with progressive urine retention, left leg pain and stiffness, and she had also been diagnosed with mild to moderate hip and knee osteoarthritis. A random occurrence of left leg pain and spasms with eye symptoms, and urine retention, eventually led visual evoked potential tests, which diagnosed Neuromyelitis Optica, a rare form of Multiple Sclerosis [6].

She continued to experience chronic finger pain and intermittent tendonopathies in various other joints including her knees, toes, fingers, hips which were managed by periodic low dose corticosteroid injections of her fingers and various joints by orthopaedic hand specialists and sports medicine doctors and dermatologists. The dermatology consultant whose has most recently taken over her hand injections has also performed a finger skin biopsy with the results pending. However, despite this complex health history, her lower back has remained pain free. She also reported sustained improvement in spinal mobility, allowing her to get on activities of daily living, University studies, and continued on with her teaching and performing music career as her hand pain permits.

Method

A typical series of 8 lumbar P2G spinal injections were planned at one to two-week intervals with follow-up 6 weeks after the last injection. However, there were recurrent schedule interruptions due to bladder infections, and the planned series could not be completed. These bouts of infections continued resulting in several stop-starts, and the patient received a total of 30 ad hoc lumbar prolotherapy sessions during episodes of infection remission over a 2-year period before the desired pain relief was achieved.

1. Side posture lumbo-pelvic cavitation manipulations were initially performed pre-injection, which leveled her pelvis and equalized her leg length.

2. Each site was then injected with 1-2 ml of a hyperosmolar solution of P2G, comprised of dextrose 25%, glycerol 25% and phenol 2%, mixed with 1% lidocaine in equal parts (50/50) to a total volume of 20 ml [7]. The injections targeting each of the anatomical landmarks locations outlined in Figure 1, which included the bilateral posterior sacroiliac ligaments, iliolumbar ligaments, lower 2 segment facet joint capsules, tips of the transverse processes, and the supraspinous and interspinous ligaments

She was also advised to perform daily Mackenzie exercises both during and after the period of prolotherapy treatment.

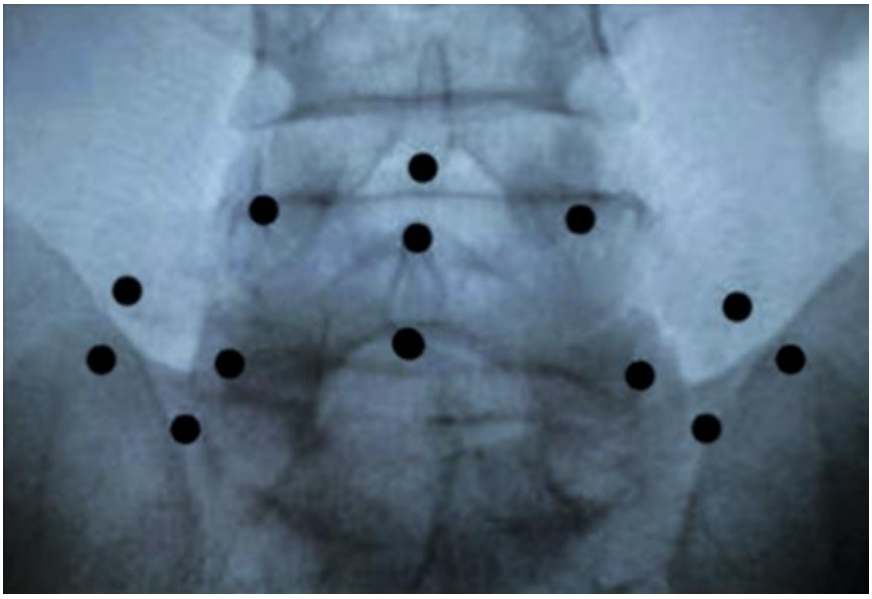

Figure 1: Black dots represent the solution injection points.

Discussion

Alpers [8] in 1952 concluded that prolotherapy results in rearrangement of tendonous and ligamentous structures resulting in the stabilization of unstable joints.

Bongling a portmanteau for 'Bud Ongley,' combines procedures of initial lumbar spine manipulations, P2G prolotherapy injections, in conjunction with Mackenzie stabilization exercises in order to optimize this regenerative response. Initial side posture manual thrust manipulations aim to ready the target ligamentous structures by optimizing spine alignment, and to break up any pre-existing adhesions or scar tissue, which may interfere with the healing process. The object of the daily Mackenzie exercises is to generate vector force stresses upon the soft tissues structures targeted by injections, while they are reacting to the inflammatory stimulus of the prolotherapy, in order to optimally guide, align, and organizes taut lumbosacral ligament regeneration. It is speculated that the regenerative injection response coupled with on-going exercise, promotes an end effect of functional spinous ligament type II collagen and connective tissue healing, unachievable by inflammatory injections alone. As remodeling occurs via the inflammatory cascade, analgesia medications if required, should not be of the anti-inflammatory variety [9,10].

Prolotherapy targeting to the lumbar spinal ligaments may facilitate a regenerative process via the inflammatory cascade, by stimulating leukocyte and macrophage migration, increasing platelet derived growth factor (PDG), and interleukin-1B (IL-1B) to stimulate fibroblastic proliferation to lay down the matrix of ligamentous thickness, mass-strength regeneration, and promote the glycosaminoglycan rehydration nutrient flow into the ligaments [11].

DLBP accounts for up to 39% of all chronic lower back pain. Unlike disc herniations, which have the capacity to resolve with time (average 18 months) [12], annular tears have a poor capacity for healing and have the capability to produce symptoms indefinitely. Studies have demonstrated that annular healing may result in a thin layer of biomechanically inferior fibrous scar tissue [13] which may seal the leak, but may leave the disc highly susceptible to re-tearing.

Provocative discography, (PD), a method of confirming discogenic pain generation, utilizes intradiscal injections and CT discogram to confirm discogenic pain against the negative pain response of injecting an adjacent normal disc [14].

It is considered to be a safe procedure. However, the very act of needling the annulus of a normal test disc is in itself not without sequella, with 10-year follow-up studies reporting an acceleration of disc degeneration of the normal needled disc post PD [15].

For this reason, some clinicians will limit test disc injection to one level, and reserve, the procedure for those contemplating interbody spinal fusion. However, the rational for its use and accurate in identification surgical candidates may be controversial [16].

As most patients with suspected DLBP are probably not PD candidates, and confirmation of discogenic pain generation must be achieved in other ways. Bogduk et al, has reported on the lumbar HIZ as an 88% predictor that the disc is the main pain generator in those suffering back pain. The Bogduk was clear that the HIZ had correlative value only in the context of low back pain [17].

Figure 2: T2-Weighted sagittal MRI lumbar spine: The white area at the posterior aspect of the L5-S1 disc is a high intensity zone, which is a hallmark of annular disc tear. Note the L4-4 and L5-S1 discs are darker, in keeping with disc dehydration and degeneration.

Nevertheless, other researchers continued to discount the HIZ's significance, cited the fact that many pain free spines have an incidental HIZ on MRI [15]. There is however a Delphi consensus, which recognizes a unique discogenic LBP pattern [18], and also physical exam techniques such as Mackenzie centralization testing [5] and

Heller procedures [19], that may offer further means of distinguishing discogenic pain for other pain generators, as well as selectively identifying patients who may candidates for prolotherapy.

It has also been hypothesized that lumbar degenerative disc disease (DDD) with its attendant loss of disc height and hydration, may slacken the intervertebral ligaments [20,21]. Disc degeneration alters spinal ligaments function leading to excessive vertebral translation, overloading the fact joint capsules, while transferring stabilization loads to the ligaments, adjacent fascias and paraspinal postural musculature [22].

There may also be a link between joint hypermobility syndrome and discogenic lower back pain (DLBP) [23].

Spinal ligamentous laxity accompanied by excesses in vertebral translation may exert coronal shearing force upon known nociceptively innervated structures such as the outer one-third of the disc annulus, the facet joints, ligamentum flavum, and interspinous ligament [24].

Targeted injections of proliferative substances into the tendon enthesis, joint spaces, and ligaments, aims to stimulate natural healing processes through inflammation. Proliferative functional regeneration and tautening of the ligament collagen under exercise guidance, may compensate for disc degeneration, optimizing lumbar motor unit joint stability, which in turn relieves pain. Eight sessions of prolotherapy along with exercise are typically recommended to achieve the optimal effect. It may be that the interruptions in injection sessions and the recurrent infections prolonged the treatment response in this case. However, this case report with 10-year follow-up may demonstrate that a treatment approach, which combines initial spinal manipulations, proliferant injections, and rehabilitative exercise, may yield an effective means for the management of chronic discogenic lower back pain.

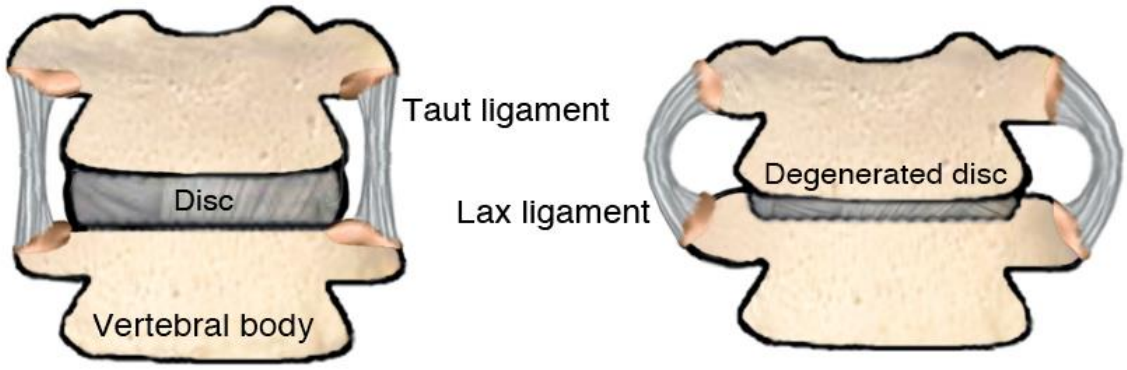

Figure 3: The left image illustrates a normal disc with taunt ligaments while the image on the right illustrates a degenerate disc with loss of height and loose ligaments.

Ongley's method requires practitioner skills in spinal manipulation, journeyman experience for achieving accurate needle placement, based on advanced palpatory skills and a practical knowledge of surface anatomy. Milne Ongley worked closely with Robin Mackenzie in the early 1960's, incorporated lumbar exercises for use in conjunction with prolotherapy [5].

Other authors in attempting to quantify the efficacy of prolotherapy, have been critical of Ongley's methods of combining injections with exercise [25]. However, the importance of the mechanical stimulation through exercise on regenerating aligned and organized spinal ligament regeneration both during and for at least 6 weeks following final injections are probably integral to optimize functional healing, optimal structural integrity and segmental stability.

There are anecdotal observations from surgeons to suggest that immature type III collagen forms rapidly following proliferant knee injections. It may be that prolotherapy injections, absent the stimulus of exercises to augment and guide natural healing mechanisms, fails to convert the proliferating type III collagen into mature and stronger type I collagen.

The management of discogenic lower back pain is challenging, having significant disability quality of life and economic impact [26]. The aim of Bongling is therefore to induce a controlled inflammatory process, and in conjunction with exercise, regenerate spinal ligaments making them taunt again, thereby improving their ability to stabilize the spine.

Conclusion

There are few studies on the long-term effects of prolotherapy for the management of chronic low back pain and to the author's knowledge, none with follow up beyond 2.5 years [27,28].

Though the reclining lumbar MRI findings in this patient to not demonstrate any frank loss of disc height, significant lumbar segmental instability has been demonstrated in normal disc height with mild degeneration [29].

This may be due to functional loss of the degenerative disc to resist compressive axial loading. Upright MR images of the lumbar spine under back-back load have demonstrated transitory increase in lumbar lordosis and loss of disc, particular involving the anterior portion of the disc [30]. It may therefore be that degenerate loss of disc height may be underestimated with conventional MR imaging.

Prolotherapy in conjunction with pre-treatment manipulation followed by an exercise program may be an effective and safe means for the long-term management of DLBP. Initial pre-injection manipulation(s) may aid in normalizing spinal alignment. Under the principle of specific adaptation to imposed demands, rehabilitation exercises performed both between and after completion of prolotherapy sessions, are likely integral to re-establishing functional and organized spinal ligamentous stability and integrity. Prior studies have noted limited efficacy of prolotherapy as a stand-alone treatment, while others have been critical of a combined methods approach of using manipulation and exercise adjunctively with prolotherapy. However, later Cochrane reviews seem to have supported the utility of Ongley's method [31]. Though combined modalities may create challenges to future clinical trial design, this approach may nonetheless be vital for prolotherapy discogenic back pain management.

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