Case reports

Chiropractic management of mechanical low back pain secondary to multiple-level lumbar spondylolysis with spondylolisthesis in a United States Marine Corps veteran: a case report

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Abstract

Objective: This case report describes the evaluation and conservative management of mechanical low back pain secondary to multiple-level lumbar spondylolysis with spondylolisthesis in a United States Marine Corps veteran within a Veterans Affairs Medical Center chiropractic clinic.

Clinical Features: The 43-year-old patient had a 20-year history of mechanical back pain secondary to an injury sustained during active military duty. He had intermittent radiation of numbness and tingling involving the right lower extremity distal to the knee. Radiographs of the lumbosacral region demonstrated a grade I spondylolisthesis of L3 in relation to L4 and a grade II spondylolisthesis of L4 in relation to L5 secondary to bilateral pars interarticularis defects. There was marked narrowing of the L4-5 disk space with associated subchondral sclerosis.

Intervention and Outcome: A course of conservative management consisting of 10 treatments including lumbar flexion/distraction and activity modification was provided over an 8-week period. Despite the long-standing nature of the complaint and underlying multiple-level lumbar spondylolysis with spondylolisthesis, there was a 25% reduction in low back pain severity on the numeric rating scale and a 22% reduction in perceived disability related to low back pain on the Revised Oswestry Disability Questionnaire.

Conclusions: Conservative management is considered to be the standard of care for spondylolysis and should be explored in its various forms for symptomatic low back pain patients who present without neurologic deficits and with spondylolisthesis below grade III. The response to treatment for the veteran patient in this case suggests that lumbar flexion/

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distraction may serve as a safe and effective component of conservative management of mechanical low back pain for some patients with spondylolysis and spondylolisthesis.

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Introduction

Although lumbar spondylolysis is generally attributed to repetitive stress imposed by physical activity resulting in fatigue fracture of the pars interarticularis,^{1,2} the etiology is likely multifactorial with elements of both inherited predisposition and repetitive trauma.³⁻⁵ One study of elite athletes found a higher prevalence of lumbar spondylolysis in sports that involve elements of lumbar hyperextension, rotation, and/or torsion against resistance.⁶ The prevalence of lumbar spondylolysis in the general population is estimated to be between 3% and 11.5% with a male-female ratio as high as 3:1.⁷⁻¹⁴ An estimated 90% of pars defects occur at L5, and most defects at L5 are bilateral.¹⁵ According to Ravichandran,¹⁶ spondylolysis of more than 1 vertebral level in the same individual is rare, with a prevalence of multiple-level lumbar spondylolysis in the general population estimated at between 0.2% and 2.8% and with a higher prevalence among Alaskan natives estimated at 5.6%.^{7,16-18}

There is a paucity of literature regarding the prevalence of multiple-level lumbar spondylolysis with spondylolisthesis among military and/or veteran patient populations. A single report of 6 cases out of Taiwan between 1992 and 1998 of bilateral multiple-level lumbar spondylolysis involving Republic of China Army personnel (4 infantry and 2 from an armored unit) was published in 2001.¹⁹ Each of the Republic of China Army personnel involved denied a specific history of traumatic injury during their military service, but took part in physically demanding training including a 500-m obstacle course and long-distance marches with a full pack, which were considered to be precipitating factors.¹⁹ Surgical intervention was successfully carried out in each of the 6 cases after a minimum of 6 months of failed conservative management including bed rest, medication, bracing, or rehabilitation.¹⁹

The purpose of this report is to present a case of evaluation and conservative management of mechanical low back pain (LBP) secondary to multilevel lumbar spondylolysis with spondylolisthesis in a United States Marine Corps veteran treated at the chiropractic clinic at the VA of Western New York. A review of the literature pertaining to lumbar spon-

dylosis and spondylolisthesis among military personnel is provided.

Case report

A 43-year-old United States Marine Corps veteran was referred by his primary care physician to the chiropractic clinic with chronic LBP, dull in quality, rated 4/10 on a numeric rating scale upon presentation. The patient described a history of intermittent radiation of numbness and tingling involving the right lower extremity distal to the knee. The veteran patient described an over 20-year history of LBP extending back to a fall he sustained off of an amphibious vehicle during the second of his 4 years as an active-duty Marine. He denied a history of parachuting, but was active with the physical nature of his military work and training. The patient reported that restful sleep had at times been impacted by his LBP. He denied bowel or bladder dysfunction. He denied increased LBP with cough, sneeze, or strain.

As a self-reported outcome measure, his baseline Revised Oswestry Low Back Pain Disability Questionnaire score was 36/100.²⁰ The patient had a body mass index of 28 kg/m² and reported strict adherence to regular exercise while taking part in physically demanding work and splitting wood. Active lumbar ranges of motion were within normal limits and nonprovocative.²¹ Physical examination revealed that the neurovascular integrity of the bilateral lower extremities was maintained, as distal pulses at the posterior tibial arteries were 2/4, motor strength rated 5/5 for L1 through S1, sensation was intact to pinwheel L1 through S1, and deep tendon reflexes rated 2/5 for L4 through S1. Straight leg raise was negative to 90° bilaterally. Orthopedic testing was largely nonprovocative except for seated axial loading with lateral bending and rotation that produced localized right-sided LBP without radiation. Soft tissue hypertonicity was localized to the right quadratus lumborum, with passive end range extension loading at the lumbosacral junction proving provocative.

Radiographs of the lumbosacral region demonstrated a grade I spondylolisthesis of L3 in relation to L4 and a

Fig 1. Spondylolysis evident at L3 and L4 with a grade I spondylolisthesis at L3 and a grade II spondylolisthesis at L4.

grade II spondylolisthesis of L4 in relation to L5 secondary to bilateral pars interarticularis defects (Fig 1). There was marked narrowing of the L4-5 disk space with associated subchondral sclerosis. A computed tomographic scan was ordered for further evaluation but not obtained by the patient.

Management consisted of prone lumbar flexion/distraction (FD) with a focus on myofascial release directed at the right quadratus lumborum. Activity modifications were prescribed including avoidance of overhead activities and lumbar extension movements. Additional exercises specific to the core were not prescribed because the patient already adhered to an exercise regimen inclusive of abdominal strengthening. During the course of care, the patient provided a subjective report of an increase in his activity level without an associated increase in back pain severity. After a course of care consisting of 10 treatments over an 8-week period, LBP severity was reduced to 3/10; and there was a 22% reduction in perceived disability related to LBP according to a discharge Revised Oswestry Low Back Pain Disability Questionnaire score of 28/100. Owing to the decreased severity of symptoms, improvement in the disability index, and strict utilization management practices secondary to limitations in available appointments within this clinic, the patient was discharged from care with an anticipated

need for episodic follow-up for pain management as appropriate and as resources allow.

Discussion

Although many of the studies and case reports among military personnel with spondylolysis involve parachutists, reports have also been published involving nonparachutist military personnel from the Republic of China Army,¹⁹ the Israeli Defense Forces,^{22,23} the United States Army Green Berets,²⁴ and the British Army.²⁵ As the most commonly suspected etiologic component of spondylolysis is stress (fatigue) fracture of the pars interarticularis,¹ the relationship between spondylolysis and military parachutists is supported by the repetitive heavy axial compression and twisting of the spine associated with landing.^{26,27} In a radiographic study of the lumbar spine in military parachuting instructors (N = 74) having performed an average of 410 jumps, Bar-Dayana et al²⁸ concluded that parachuting predisposes to spondylolysis and to degenerative changes of the lumbar spine. The authors also concluded that degenerative changes of the lumbar spine were correlated with age and the number of jumps and that the prevalence of spondylolysis among the sample of parachuting instructors was 13.6%.²⁸ Furthermore, the severity of the radiographic changes was not correlated with either the prevalence or the severity of LBP within this sample of parachuting instructors.²⁸

A rare case presentation of unilateral spondylolysis with contralateral lumbar pediculolysis at L5 was reported in a 34-year-old military parachutist with greater than 300 jumps over a 5-year period.²⁹ The patient was managed with posterior interbody fusion using carbon cages packed with iliac bone graft and posterior transpedicular screw fixation at L5-S1. A more common expression of this spinal condition was presented as a collection of 3 case reports of military parachutists with bilateral pars defects at L5 with spondylolisthesis.³⁰

With regard to management for chronic spondylolysis and spondylolisthesis, recommended approaches vary from conservative management to surgical intervention. Conservative management generally consists initially of activity restriction or modification with a graded increase in activity along with therapeutic exercises including low-impact aerobic conditioning and core stabilization.³¹ Although most patients with lumbar spondylolysis and/or spondylolisthesis respond to conservative measures,³² surgical management is

generally indicated in patients with greater than grade II spondylolisthesis or persistent LBP or neurologic symptoms despite an adequate course of nonoperative treatment.³ In a recent nonmilitary report of surgical outcomes with 5 cases of 2-level lumbar spondylolysis and 2 cases of 3-level lumbar spondylolysis that had failed conservative management, segmental wire fixation and bone grafting were shown to be an effective form of management for multiple-level lumbar spondylolysis.³³

A review of the literature revealed only a limited number of case reports that address chiropractic management for lumbar spondylolysis,³⁴⁻³⁶ with only 1 case report involving multiple-level lumbar spondylolytic spondylolisthesis.³ Spinal manipulative therapy (SMT) directed above or below the involved spinal region has demonstrated short-term effectiveness for patients with lumbar spondylolysis in reducing chronic LBP.³⁷ In the current presentation of a case of multiple-level lumbar spondylolysis, FD was used in favor of SMT to avoid direct manipulation of the spondylolytic segments and the potential risk of aggravation.³⁷ Flexion/distraction is a commonly used manual traction procedure that is both slow and controlled, which varies from traditional high-velocity, low-amplitude SMT.³⁸ It is estimated that 58% of chiropractors in the United States use FD for the management of LBP.³⁹ In a randomized clinical trial, subjects who received FD had significantly greater relief of chronic LBP than subjects who received an active trunk exercise protocol, with sustained findings at 1-year follow-up.^{40,41}

Many cases of spondylolysis and spondylolisthesis occur in asymptomatic patients without associated pain or disability.^{9,10,12} In a study by Belfi et al,⁴² computed tomographic scans were performed on 510 consecutive patients for conditions unrelated to lumbar pathology, demonstrating a 5.7% prevalence of spondylolysis and a 3.1% prevalence of spondylolisthesis in asymptomatic patients. Although the exact etiology of LBP in patients with symptomatic spondylolysis and spondylolisthesis remains unclear, histologic studies have demonstrated that neural elements of the pars defect are capable of nociceptive function and may be a source of LBP.^{43,44} As innervated structures within the motion segment and associated tissues are possible pain generators, multifactorial causes of LBP in patients with spondylolysis and spondylolisthesis have been suggested.⁴⁵

The mechanisms of LBP relief with FD are theorized to be both mechanical and neurologic in nature.⁴⁶ In addition to the mechanical effects of apophyseal joint opening and reduced intradiskal pressure associated

with FD,^{38,47} the flexion component of FD has been shown to inhibit lumbar spinal reflex excitability.⁴⁶ This attenuation may contribute to a reduction in LBP associated with hypertonicity and activation of paraspinal musculature.⁴⁸ The stimulation of mechanoreceptors in apophyseal joint capsules, muscle spindles, intervertebral disks, and spinal ligaments is further theorized to contribute to the neurophysiologic response with spinal manipulation and mobilization procedures.⁴⁶ In the case presented, the intended goal of manual conservative treatment with FD was the reduction of LBP and limitations related to LBP through the mechanical action of lumbar flexion with a gentle distractive force, the stimulation of mechanoreceptor afferents, and the reduction of hypertonicity of the paraspinal musculature. Further investigation into this conservative treatment approach appears warranted for this unique patient presentation.

Limitations

The limitations present are consistent with case report design in that the findings are anecdotal in nature, should be interpreted with caution, and cannot be generalized beyond this individual case. Although the outcome measures were used to reflect objective changes from baseline to discharge, the potential for bias in obtaining or influencing outcomes cannot be excluded because the primary author both provided the treatments and collected outcomes in this case report. Although the scores from the outcome measures represent a level of improvement, the degree to which that improvement could be considered clinically meaningful was not specified. The concept of *minimally clinically important difference* (MCID), considered to be a threshold value of important improvement for an outcome measure,⁴⁹ should ideally be sensitive to baseline values, the cost of involved treatments, the risk to benefit ratio of specific management approaches, and the nature of presenting conditions. According to a published estimate, a 30% reduction from baseline to discharge is considered to be the MCID, also referred to as the *minimal important change*, for commonly used back pain outcome measures.⁵⁰ The authors suggest that this estimate of MCID should perhaps be reduced in this case based upon the long-standing nature of the complaint, the nominal cost of care to the veteran patient, the low level of risk with applied conservative management, and the underlying multiple-level spondylolysis with spondylolisthesis. Further investigation appears warranted regarding the estimation of MCID for various

conservative pain management approaches in a complex veteran patient population with high levels of illness burden and service-connected disability.^{51,52}

Conclusion

A review of the literature identified a variety of studies and case reports of lumbar spondylolysis with and without spondylolisthesis in military populations, with only 1 case series reflective of involvement at multiple levels. The case presented in this report represents a unique presentation of multiple-level lumbar spondylolysis with spondylolisthesis in a United States Marine Corps veteran. As with certain types of athletes, military personnel involved in parachuting and related physical demands may have a higher incidence of lumbar spondylolysis and spondylolisthesis. Conservative management is generally considered to be the standard of care and should be explored in its various forms for symptomatic patients who present without neurologic deficits and with spondylolisthesis below grade III.³ The proposed mechanisms of FD and the response to management for the veteran patient in this case report suggest that FD may serve as a safe and effective element of conservative management for some patients with mechanical LBP secondary to multiple-level lumbar spondylolysis with spondylolisthesis.

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