CASE REPORT

Management of a Patient with Lumbar Segmental Instability Using a Clinical Predictor Rule

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Abstract The diagnosis of low back pain is a common and costly condition in primary healthcare, which is often grouped into a homogeneous category. It has been suggested that the population of patients with low back pain are not a homogenous group and that they should be classified into subgroups. One subgroup identified in the literature is patients thought to have lumbar segmental instability. The patient in this case report is a 59-year-old female who presented with the four predictors of success demonstrated by Hicks et al. for implementing a lumbar stabilization program for a patient with lumbar segmental instability. With conservative treatment utilizing a lumbar stabilization program, the patient was able to regain strength, lumbar stability, and demonstrate functional improvement evidenced by an improvement in her Oswestry score. It is recommended that knowledge of current literature including clinical predictor rules can help to improve clinical decision making along with treatment of patients.

Keywords Oswestry · Prone instability test · Lumbar stabilization · Physical therapy

Introduction

Low back pain (LBP) is a common and costly condition in primary care [12, 25]. It has a lifetime prevalence of over 70% in industrial countries and accounts for considerable healthcare and socioeconomic costs [4, 39]. In the past,

patients have been grouped as a diagnostic homogeneous group. Therefore, clinicians and researchers have had some difficulty identifying specific, structural faults in most cases of LBP that correlate with the patient's dysfunction, impairments, and pain. Therefore, evidence-based practice for effective treatment of LBP has been difficult to fully implement. More recently, researchers have suggested that the population of patients with low back is not a homogenous group, but that they should be classified into subgroups that share similar impairments, dysfunction, and clinical characteristics [11, 29].

One subgroup identified in the literature consists of patients thought to have lumbar segmental instability (LSI) [14, 16, 33, 34]. Many clinicians believe that patients with LSI respond to a specific rehabilitation approach and therefore the ability to accurately identify these patients could improve treatment outcomes. Panjabi [33, 34] proposed that the total range of motion of the spine consists of the neutral zone and the elastic zone. The spinal stabilizing system is described as consisting of the active and passive subsystems, as well as the neural control unit. Passive components include the discs, ligaments, and facet joints of the lumbar spine, and the active components are the muscles surrounding the spinal column. The neural control unit uses kinesthetic input to coordinate the muscle's stabilizing function [35]. Panjabi's definition of lumbar segmental instability maintains that a loss of the ability of the lumbar spine to maintain a neutral zone within the body's physiologic limit could lead to deformity, neurologic deficit, or incapacitating pain during everyday activities [33, 34].

The diagnosis of LSI has traditionally relied on the use of flexion and extension radiographs [24, 37, 40]. Arriving at accurate radiographic diagnostic criteria has been complicated by high false-positive rates and significant variation among asymptomatic persons [17, 36]. It has been suggested by Hicks et al. [18] that if lumbar segmental instability could be accurately diagnosed, the conservative treatment of choice would be a lumbar stabilization program.

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Clinical prediction rules (CPR) have become popular in the physical therapy literature. A clinical prediction rule as defined by McGinn et al. [28] is a clinical tool that narrows components of the history, physical examination, and basic laboratory results to assist in making decisions regarding the diagnosis, prognosis, or a likely response to treatment in an individual patient. The intent of CPRs are to assist clinicians in making a diagnosis, establishing a prognosis, or implementing an intervention [3, 28]. Hicks et al. [18] developed a CPR to predict treatment response to a stabilization program for patients with low back pain who fell into a subgroup of patients with lumbar segmental instability. They conducted a prospective cohort study involving patients referred to physical therapy for low back pain. Four variables were identified that were significantly related to success and potential predictors: age <40 years, straight leg raise >91°, the presence of aberrant movement during lumbar range of motion, and a positive prone instability test [18]. According to their research, the best rule for predicting success was the presence of three or more of the four variables, which translated to a positive likelihood ratio of four; and 95% confidence interval (CI) [18]. Aberrant motions during lumbar spine mobility testing include an instability catch [30, 31], painful arc of motion [10], “thigh climbing” (Gower's sign), or a reversal of lumbo-pelvic rhythm [5, 6].

The aim of this case report is to show that the use of a clinical prediction rule can be very beneficial when used correctly. As it is in this case, the knowledge of the CPR along with which patient presentations were most likely to place the patient in LSI subgrouping, resulted in an efficient and successful outcome.

Patient Profile

The patient is a 59-year-old female who is self-employed as a textile designer. She does most of her work at the computer and therefore spends a lot of time sitting. She came to physical therapy in April 2012 after having pain for about 3 months. The patient reported her pain was located in her right lumbar spine region and also reported an “ache” in the posterior lateral region of her hip. Overall, her medical/surgical history was unremarkable, with no impact on her current condition. At the time of her evaluation, the patient was not using any medication and rated her general overall health as excellent. She rated her pain on a verbal analog pain rating scale as an intermittent achy pain, 0/10 at its best and 5/10 at its worst. The patient's chief complaints were pain with sitting, lying down, and when picking up her 15-lb dog. Her goal was to eliminate her pain, to learn how to self manage her symptoms, and to keep her back healthy.

Analysis of Findings

Visual observation of standing posture indicated a swayback posture and no lumbar range of motion limitations. When examined, the patient demonstrated a Gower's sign when returning from flexion. Light touch, which was intact, was assessed to rule out the possibility of a peripheral nerve injury.

The patient's lower extremity's range of motion was also assessed to be within functional limits. Using a goniometer to measure the patient's hamstrings range of motion, they were both found to have 100° of mobility. Positive special tests included the Faber's test, for hip tightness [26] and a positive prone instability test, for lumbar spine instability [19]. Muscle performance of the patient's lower extremities were examined by manual muscle testing [23]. Hip extension and abduction muscles were tested to be a 4-/5 bilaterally. The patient was also given a modified Oswestry Scale questionnaire during her initial visit, which was scored to be 16% [2].

The presence of a positive prone instability test, H/S flexibility >91°, and a positive Gower's sign led to the placement of this patient into the subgroup of lumbar segmental instability. Recent studies by Hicks et al. [18, 19] suggested that the presence of these findings help to distinguish low back pain patients into a subgroup of lumbar segmental instability. According to preliminary work of Hicks et al. [18], this subgroup was shown to have positive outcomes with a lumbar stabilization program.

Intervention

The plan of care for this patient included a lumbar stabilization program, proximal hip strengthening, and body mechanics training. The patient was treated for eight sessions including her physical therapy evaluation. On her initial visit, the patient was instructed on how to perform an abdominal brace. The method of teaching the patient was instruction to “pull her navel towards her spine [32].” The purpose was to help the patient improve the performance of her core muscles and to learn to contract the abdominal muscles to prevent unnecessary motions of the spine during movements of the lower extremities [38]. Sessions one through eight were focused on a progression of stabilization exercises as described below. When the patient demonstrated good understanding and per-

Fig. 1. Model demonstrating Sahrman level 2 core exercise: Begin with lying on the floor with your knees bent. Tighten your core and slowly lift one leg toward your chest, keeping your knee bent. Raise the other leg in the same manner. Keeping knees bent, slowly lower the first leg to the starting position and then, do the same with the other leg.

Fig. 2. Model demonstrating modified side bridge exercise with the trunk in neutral spine.

formance of an exercise, it became part of her home program. When she was able to demonstrate good endurance with the exercise; demonstrating stability with ten repetitions $\times 3$, she was progressed to a more difficult exercise. The exercises were progressed from non-weight bearing, to weight bearing, to functional activities.

Using the Sahrman [38] progression, the patient advanced to level 1B (refer to Fig. 1) The patient was also instructed in a modified side bridge and the bird dog exercises (refer to Figs. 2 and 3) [8, 21].

These exercises have been shown to create lower spine loads then other stabilization exercises [8, 21]. The patient began the bird dog exercise by alternatingly lifting her left and right arms, respectively. She then progressed to extending her left and right leg, respectively. Her next progression was to lift her left upper extremity and extend her right leg and vice versa. The patient was also instructed the side bridge exercise using the modified version, keeping her knees flexed.

Weakness in the hip abductors, extensors, and external rotators, has also been associated with the population of

Fig. 3. Bird-dog with the trunk in neutral spine alignment.

Fig. 4. The Clam Shell: side-lying with hips flexed to approximately 45° , knees flexed, and feet together, externally rotating the top hip to bring the knees apart with the hip rotating back.

patients who have low back pain [9, 22]. To address this issue, the patient was given the clam shell (refer to Fig. 4) and bridge exercises [34]. She was later progressed to side-lying hip abduction, and a single-legged bridge (refer to Fig. 5) to target her hip musculature [6, 13].

One of the patient's chief complaints was pain in the lower back when picking up her 15-lb dog. The patient was asked to demonstrate how she would pick up her dog. She demonstrated a flexed lumbar spine motion with no bend in either hips or knees. This motion has been associated with an excessive anterior shear load on the spine [6, 27]. The patient was educated on the use of a squat lift technique to decrease the spinal load [1]. This maneuver was taught to the patient with the focus on flexing at the hips while maintaining the spine in a neutral position. The patient also began each session with 10 min of aerobic exercises and was encouraged to continue to do so when discharged. Evidence

Fig. 5. Single-limb bridging. Begin in hook-lying, bridge with both legs keeping the feet on the surface and raising the hips off the ground maintaining neutral trunk, hip, and knee alignment. From this position, extend one knee fully while keeping both femurs parallel and then repeating on the opposite side.

supports the role of aerobic exercises in reducing the incidence of low back injury [7].

Results

After eight sessions of physical therapy, the patient reported that she had no pain for the past 7 days and that she was comfortable with her home exercise program. On her last visit, the patient was reassessed to have a negative prone instability test and no longer demonstrated a Gower's sign with return from flexion. Utilizing a manual muscle test, the patient was now 4+/5 strength for her right hip abductors, extensors, and external rotators. The patient was also given a modified Oswestry. Her score upon discharge was 0 vs the 16% she had initially scored on her initial visit. This change met the minimum clinically important change for the Oswestry which is 6 points [2, 15]. The patient was discharged at this time, with a home program consisting of lumbar stabilization and hip exercises as described in the [Intervention](#). She was contacted via phone 3 months post discharge and at that time, the patient reported that she continues to experience very little to no pain, and continues to do her HEP. The patient was also given a follow up Oswestry, which was scored as 0% disability 3 months after discharge.

Discussion

Conservative rehabilitation of low back pain patients with exercises designed to improve stability have recently become more popular [20]. Given the increasing likelihood of low back pain patients to develop chronic issues who fail to recover quickly [39], the initial treatment stage is the most opportune time for clinicians to make their best impact on keeping this from happening. Improved decision making through subgrouping during the initial treatment stage may have important long-term effects for low back pain patients. Current research has led to the recommendation that general activity within the limitations of pain is the best initial management for patients with acute low back pain [39]. Patients with low back pain constitute the largest outpatient population served by physical therapists. It is imperative to screen these patients for red flags, which can be any patient presentation that suggests a need for physician referral or further testing.

When lumbar segmental instability is accurately diagnosed, and the patient is neurologically intact and without anatomic abnormalities better served by surgery, the treatment of choice that has been shown to be most effective is lumbar stabilization [18]. The goals of a stabilization exercise program are to challenge and to restore the primary stabilizing muscles of the spine. As in the case of this patient, the use of the Hicks et al. Clinical Prediction Rule helped to identify her as an ideal candidate for a stabilization program [18]. According to Hicks [18], the individual predictor variable for greatest success was age <40 with a likelihood ratio of 3.7 and a CI of 95%. The patient in this case report was then >40 years old, but with conservative

management focusing on lumbar stabilization exercises, hip strengthening, and body mechanics training, the patient was discharged from physical therapy meeting all of her goals.

Physical therapists need to be aware that low back pain patients are not a homogenous group and therefore need to be screened appropriately and placed in their proper subgroup. Currently, there are many clinical prediction rules to assist physical therapists in their clinical decision making. Although it is the CPR's intent to assist clinicians in making a diagnosis, or implementing an intervention, there is a lack of consensus as to what makes up a methodologically sound clinical prediction rule [2, 40]. Various clinical prediction rules can help to categorize lumbar spine patients and ultimately make physical therapy interventions more successful.

Disclosures

Conflict of Interest: Anna Ribaud, PT, DPT has declared that she has no conflict of interest.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Informed Consent: Informed consent was waived from all patients for being included in the study.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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