Deconstructing Chronic Low Back Pain in the Older Adult—Step-by-Step Evidence and Expert-Based Recommendations for Evaluation and Treatment: Part XII: Leg Length Discrepancy

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Funding sources: This material is based on work supported by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Rehabilitation Research and Development Service. The contents of this report do not represent the views of the Department of Veterans Affairs or the US government.

Abstract

Objective. To present the last in a 12-part series designed to deconstruct chronic low back pain (CLBP) in older adults. This article focuses on leg length discrepancy (LLD) and presents an algorithm outlining approaches to diagnosis and management of LLD in older adults, along with a representative clinical case.

Methods. Using a modified Delphi approach, the LLD evaluation and treatment algorithm was developed by a multidisciplinary expert panel representing expertise in physical therapy, geriatric medicine, and physical medicine and rehabilitation. The materials were subsequently refined through an iterative process of input from a primary care provider panel comprised of VA and non-VA providers. The clinical case was taken from one of the authors.

Results. We present an algorithm and illustrative clinical case to help guide the care of older adults with LLD, which can be an important contributor to CLBP. Firstline assessment includes referral to physical therapy or orthopedics, depending on the context of the LLD. A variety of nonsurgical interventions may ensue depending on the etiology of the LLD, including shoe inserts, customized shoes, manual therapy, or a combination.

Conclusions. To promote a patient-centered approach, providers should consider evaluating for leg length discrepancy when treating older adults with CLBP to help diminish pain and disability.
Key Words. Leg Length Discrepancy; Leg Length Inequality; Chronic Low Back Pain; Chronic Pain; Elderly; Older Adults

Introduction

One in three community–dwelling older adults experiences low back pain [1]. As part of the series to deconstruct chronic low back pain in older adults, we highlight leg length discrepancy (LLD; also referred to as leg length inequality) as a possible piece of the puzzle. Studies have shown that 60–90% of the general population is affected by LLD of 5 mm or more [2]. In 2004, Juhl and colleagues reported that 68 percent of 421 patients with low back pain had radiographically identified pelvic asymmetry, suggesting LLD [3]. While they commonly coexist, a causative association between LLD and CLBP has not been demonstrated in the context of high-quality studies [4–6]. It has been shown, however, that LLD is more common in those with CLBP than in those without CLBP [5,7]. In studies that focus specifically on sacroiliac joint syndrome as a cause of low back pain, LLD is an accepted contributor [6,8–12].

The magnitude of LLD that is clinically significant is debated. Some authors hold the view that LLD of less than 20 mm is clinically insignificant [13,14], but others suggest that any LLD is of clinical significance [2,7,8,15,16]. Despite the debate, inclusion of LLD in the evaluation of patients with low back pain is widely accepted [9,17] and, based on the collective experiences of the expert panel, we recommend screening for LLD in all older adults that present with CLBP. There are significant potential benefits for those who are diagnosed and treated for LLD, and the downside to screening is minimal, save for the negligible loss of time. Depending on the etiology of the LLD, intervention can be as simple as a heel lift.

There are two main classifications of LLD: structural and functional. Structural discrepancies can result from an actual anatomic shortening of one or more bones of the lower extremity from congenital, traumatic, or diseased origins. Surgical procedures such as total hip and knee replacements also can be responsible for acquired structural discrepancies and are an important consideration in older adults given the frequency at which these patients have comorbid knee and/or hip osteoarthritis and undergo total joint replacement [18–24]. Functional LLD, more common than structural LLD, may be due to altered mechanics of the lower body such as foot hyperpronation/supination, scoliosis, pelvic obliquity, muscle imbalance, poor trunk stabilization, genu varum, valgum, and/or genu recurvatum [18–20,25,26]. Both structural and functional LLD will lead to anatomical compensation and potential pain of the low back, hip, knee, and/or ankle as well as associated functional impairments.

We present a clinical case and offer an algorithm to assist in the evaluation and treatment of the older adult with LLD and CLBP.

Methods

A detailed description of the modified Delphi process used to create the algorithm (Figure 1) is provided in the series overview [27]. The expert panel team leader (MH) drafted the initial algorithm based upon a comprehensive review of the literature and his experience in clinical practice. The expert panel, which consisted of geriatricians, physical therapists, and a physiatrist, refined the algorithm then distributed it to the primary care panel for feedback, as described previously [27].

Case Presentation

Relevant History

The patient is an 84-year-old male who lives independently with his wife. He was referred to physical therapy by his primary care physician who had concerns about the patient’s balance and potential for falls. The patient described the presence of low back pain as a constant nag and is concerned about his ability to stand up straight. It is affecting his ability to garden, specifically with his ability to get on and off the ground. He is not using an assistive device. He rates the pain intensity at 3–4/10 when standing and describes it as a constant ache along the lumbosacral junction with occasional radiation into the posterior thighs. The pain becomes progressively more intense the longer he stands in one place. He notices approximately 30 minutes of morning stiffness. Sitting or lying down relieves the pain. He denies change in his bowel or bladder habits, fever, trauma, weight loss, or recent cancer associated with the worsening of his pain. He has tried aspirin, ibuprofen, naproxen, and acetaminophen. He has also tried chiropractic care, without improvement in function or reduction of pain. A previous provider had recommended off-the-shelf heel lifts for both shoes to improve his balance.

Relevant Physical Examination

A thorough objective functional evaluation was completed by a physical therapist. The patient is awake, alert, and oriented x3. He is cooperative and in no apparent distress. Standing forward flexion, extension, right side bending, and right/left axial rotation all were painless. Left side bending was associated with low back pain. Ankle range of motion reveals a 10-degree deficit in dorsiflexion bilaterally. Quadriceps and foot dorsiflexion/plantar flexion strength are 5/5. Hip flexion strength is 5/5 bilaterally; hip extension 3/5 bilaterally, and hip abduction 4/5 bilaterally. Single-limb heel raises to test functional calf strength are normal [28]. Light touch in all dermatomes was normal. Deep tendon reflexes are intact and equal bilaterally. The unipedal stance test to measure postural stability (i.e., balance) is administered and the patient is able to stand on his right
leg for 25 seconds and on his left leg for 18 seconds, which is within normal limits for his age [29]. The left quadratus lumborum is tender to palpation. Measurement of leg length in supine position (from anterior superior iliac spine to medial malleolus) demonstrated the left leg to be 0.5 inches (approximately 13 mm) shorter than the right. When comparing the patient’s iliac crest heights in the standing position, it was noted that the right side was higher than the left. Sacroiliac (SI) joint provocation tests (compression/distraction, FABER, thigh thrust), Scour test (for hip capsule), straight leg raise (for sciatica), and FAIR test (for piriformis pain) were all negative.

**Clinical Course**

Following evaluation by the physical therapist, the patient was educated on the diagnosis and treatment of LLD (Figure 1). The patient was very motivated to improve his low back pain and balance in order to maintain an active lifestyle. He was given a 7/16th-inch heel lift to be worn in the left shoe only. He started his first of eight physical therapy sessions to restore lower extremity strength, improve balance, and to ensure independence in a home balance and lumbar stabilization program. He also was assigned daily flexibility exercises to be performed each morning.

**Approach to Management**

Our algorithm suggesting approaches to screening and managing LLD is shown in Figure 1. Methods of assessing LLD include radiographic and direct and indirect assessment during physical examination. Radiographic measurements performed with the patient in either the supine or standing position are the most accurate [10,27], but radiography is expensive, not without risk (i.e., exposure to radiation), and may be time consuming [30]. Direct assessment of LLD during physical examination is performed with the patient supine and the distance between the anterior superior iliac spine and the medial malleolus (identified by palpation) is measured [30,31]. While this method is clinically practical, it is less reliable than radiographic

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**Figure 1** Algorithm for the evaluation and treatment of LLD in an older adult with CLBP.
measurement [32–34]. Direct assessment of apparent LLD during physical examination is performed with the patient supine and involves measuring from the umbilicus to the medial malleolus (Figure 2). Apparent LLD measurement removes the potential uncertainty of accurate identification of the anterior superior iliac spine [35]. Indirect assessment of potential LLD during physical examination is performed with the patient standing. While kneeling or squatting behind the patient, the clinician places their palms on the patient’s left and right pelvic brim (iliac crests) and observes for the presence of symmetry (i.e., thumbs are even) or asymmetry (i.e., thumbs are uneven) [36]. This method is shown in Figures 3 and 4.

If at least 0.5 inches (approximately 13 mm) of LLD is suspected based on one of the above methods, further evaluation is warranted. When older adults have had prior total hip or knee arthroplasty and there are signs or symptoms of prosthetic loosening (e.g., new or increased pain in the prosthetic joint region and/or warmth/swelling in the case of a total knee arthroplasty), they should be evaluated by an orthopedic surgeon. If prosthetic loosening is identified, surgical treatment is warranted. If surgical assessment indicates no such loosening, patients should be referred to the physical therapist (PT), who may recommend heel lifts or orthoses or may employ manual techniques, depending on the cause. Depending on the outcome, the PT may further recommend referral to a podiatrist and/or physiatrist.

Results associated with shoe inserts vary widely [37]. Correction of pelvic obliquity appears to improve pain and functioning in patients with CLBP [38]. Relief of back pain has been documented in descriptive studies, case reports, and one small uncontrolled trial, but well-controlled trials are lacking [36,38–40]. Preliminary data by Golightly and colleagues demonstrated that heel lifts for those with LLD and CLBP are associated with significant reduction in pain and disability [41]. It should be highlighted that heel lifts and shoe inserts do not necessarily need to equalize the LLD completely to provide benefit. There appears to be consensus among authors that heel lifts should be implemented gradually and in small increments, especially for older adults [42–44]. This may be important for older patients with lifelong LLD as heel lifts could disrupt postural compensation and temporarily increase muscle soreness as the individual adapts to new position. Our patient was educated to ease into use for a few hours at a time. If an acute LLD is present following surgical procedure or trauma, heel lifts should be implemented quickly and without gradual implementation.

Practitioners should use their clinical judgement when selecting heel lifts, always weighing their risks and benefits. As noted earlier, potential benefits in patients with CLBP are reduction in pain and disability. Golightly and colleagues demonstrated in patients with CLBP and LLD substantial pain reduction (i.e., 75% less intense pain in the standing position) and clinically significant improvement in function as measured by the Modified Oswestry [41]. Potential risks include presetting the ankle in a plantar-flexed position that may predispose to ankle injury because of the relative instability of the lateral joint and weakness of the lateral ankle ligaments [45]. Increased callusing also may develop.
addition, tightness/shortening of the Achilles and/or hamstring tendons may result from the preset plantarflexion. The patient’s existing footwear also should be considered carefully, as well as whether a lift may cause excessive foot pressure. This may be relevant for those with diabetes mellitus or skin vulnerability related to other conditions.

The patient with LLD may benefit from a number of other interventions depending on the cause of the discrepancy, and treatment decisions should be determined collaboratively with the patient and be guided by their goals. Structural discrepancy related to prosthetic loosening requires orthopedic surgery evaluation and treatment as outlined in Figure 1. Functional LLD can be caused by alterations related to positioning of the foot (i.e., hyperpronation/supination), pelvic obliquity (e.g., related to muscular imbalance involving the quadratus lumborum, hamstrings, rectus femoris), and other muscle and/or joint imbalances (i.e., tightness or weakness), and treatment should be tailored accordingly. Some patients may benefit from custom shoe inserts or shoes that have been externally modified by an orthotist or a combination of shoe modification and manual therapy. It is recommended that clinicians with expertise in manual techniques treat patients with a goal of improving spine and hip mobility and that manual therapy should be combined with exercise [41]. To address any strength deficits in patients with CLBP, moderate- to high-intensity exercise is recommended. Progressive, low-intensity submaximal fitness and endurance activities also should be incorporated both for pain management and overall health promotion [41].

No matter what the intervention, a patient-centered treatment approach should drive decision-making, with careful consideration of risks, benefits, and costs. Patients should be reexamined four to six weeks following initiation of any new modified footwear to determine outcome of the intervention, assess skin integrity, and adjust the treatment plan if necessary. Similarly, careful follow-up during manual therapy or a multifaceted approach represents standard of care.

**Resolution of Case**

The patient has LLD, left leg shorter than right, and with correction there was some improvement in his constant back pain and, more importantly, function. The patient’s LLD is considered functional. During his final physical
therapy visit, the patient reports 0/10 pain in his lower back while sitting and 3/10 with prolonged standing. The patient is able to demonstrate a safe independent floor-to-stand transfer. He has been educated about the importance of self-management, and he continues with his morning stretches. He is independent in all exercises and plans to continue to perform his daily early-morning stretching program and a lumbar stabilization and balance program three to four times per week. He maintains realistic treatment expectations, he has embraced self-management of his pain, and he is satisfied with his increased function. He was pleased with his decrease in pain from a constant state to only with prolonged standing.

Summary

Leg length discrepancies are associated with numerous postural alignment challenges that may lead to low back pain. The goal of the presented algorithm is to provide an evidence-based instrument to aid the clinician in a practical approach to evaluation and treatment. The case presented underscores that the older adult with CLBP may prioritize goals other than pain management per se, which include improving balance, reducing stiffness, and improving function. As with all older adults, utilization of a patient-centered approach is critical. We have developed this series of algorithms on CLBP to facilitate such an approach.

Key Points

1. Older adults with CLBP should be screened for leg length discrepancy (LLD) as a possible treatment target to reduce pain and, most importantly, to enhance function.

2. Leg length discrepancy can be structural or functional; both can cause postural compensations that contribute to pain and/or functional compromise.

3. Except in postsurgical patients, heel lifts should be implemented gradually and in small increments, especially for older adults.

4. Treatment of LLD should be tailored to the causative factors and the magnitude of the discrepancy and may include physical therapy to address muscular imbalance, a shoe lift or customized orthotics, and surgical intervention.

References


