Physical Therapy Management of Patients With Chronic Low Back Pain and Hip Abductor Weakness

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ABSTRACT

Background and Purpose: Hip abductor dysfunction is common in individuals with chronic low back pain (CLBP). Previous research investigating abductor strengthening in the heterogeneous CLBP population is sparse and has failed to target those patients most likely to benefit. The aim of the current case series was to describe the physical therapy management and outcomes of 3 patients with CLBP matching a previously identified subgroup characterized by substantial hip abductor weakness.

Case Description: Three nonconsecutive patients with CLBP—a 77-year-old man, a 78-year-old woman, and an 85-year-old woman—were treated in an outpatient physical therapy clinic. All 3 patients matched a previously identified CLBP subgroup characterized by substantial hip abductor weakness.

Intervention: Patients were treated using a targeted exercise approach consisting mostly of hip abductor strengthening for 11 to 17 visits over 8 to 10 weeks. Patients received additional treatments including heel lift and pain neuroscience education when indicated.

Outcomes: By discharge, all patients had made clinically important improvements in pain (3- to 7-point reduction on the Numeric Pain Rating Scale), function (10- to 16-point change on the Modified Oswestry Disability Index), and perceived improvement (6-7 on Global Rating of Change Scale). Lumbar range of motion was painless, and hip abductor strength was improved from 2+/5 to 3+/5 in all 3 patients. These gains were maintained at 3-month follow-up.

Discussion: The current case series describes the use of a targeted exercise approach consisting mostly of hip abductor strengthening in a group of patients with CLBP and hip abductor weakness. The results indicated that this approach may be effective in reducing pain and improving function, particularly for older patients.

Key Words: older adult, muscle strength, back pain

(*J Geriatr Phys Ther* 2019;42(3):196-206.)

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Each participant was informed that data concerning the case would be submitted for publication and were actively engaged throughout the process. Patient confidentiality was protected.

The authors declare no conflicts of interest.

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Kevin Chui was the Decision Editor.

DOI: 10.1519/JPT.0000000000000148

BACKGROUND

The relationship between impaired gluteal function and low back pain (LBP) is well established. Weakness and tenderness of the gluteus medius muscle, responsible for abduction of the hip, is a common finding in individuals with LBP.[1-3] Nadler et al[4] showed an increased likelihood of future LBP in female athletes with hip abductor weakness. Studies have also associated impaired gluteus medius muscle endurance[5] and firing patterns[6] with the development of LBP. In cases of LBP and coexisting gluteal tendinopathy, which is present in about 35% of those with LBP, treatment of the gluteal tendon pain has led to improved functional outcomes.[3,7] This evidence points to a relationship between LBP and hip abductor weakness, although the precise nature of this relationship has not yet been determined.

Theories relating LBP and hip abductor weakness often focus on an inability of the gluteus medius muscle to laterally stabilize the pelvis during unipedal activities such as gait, and expert opinion commonly highlights the importance of this muscle in LBP rehabilitation.[8,9] Despite the established relationship between LBP and hip abductor weakness, little has been published describing physical therapy management of these patients. Current physical therapy guidelines for LBP recommend several treatment strategies depending on the patient's presentation,[10] but they primarily focus on trunk muscle strengthening and specific exercise. Few studies have investigated the effect of hip abductor strengthening in patients with LBP. In a small study Kendall et al[11] found a 48% reduction in nonspecific LBP when 10 participants performed a single standing hip abductor strengthening exercise for 3 weeks, but this difference did not reach statistical significance or affect the magnitude of pelvic drop. In a subsequent randomized controlled trial, Kendall et al[12] found no benefit of adding hip muscle strengthening to a lumbopelvic motor control exercise program (described as cocontracting the transversus abdominus, multifidus, and pelvic floor muscles during various tasks) in patients with nonspecific LBP. However, the hip muscle strengthening program was only described as "open and closed chain," and hip abductor strength measurements were not reported. Neither of these studies[11,12] made an effort to identify participants with impaired hip abductor strength before study inclusion. Therefore, lack of interventional success may be a result of failure to account for the existence of a potential subgroup within the LBP population, thereby diluting the treatment effect.

Currently, various LBP classification systems exist to identify subgroups of patients in a way that is descriptive, prognostic, or attempts to direct treatment.[13] Subgroup-matched treatment approaches have been shown to improve clinical outcomes when compared with nonmatched alternatives.[14-16] However, the benefit of using this approach in the chronic low back pain (CLBP) population is currently unclear.[17-19] Barriers frequently cited to using this approach in the CLBP population are higher frequency of psychosocial factors (eg, depression and fear-avoidance behavior) or the coexistence of contributing pathology.[20]

Recently, Cooper et al[1] were able to identify the existence of a descriptive subgroup of patients within the CLBP population presenting with significant gluteus medius muscle weakness (≤3/5 strength during manual muscle test), gluteal tenderness, and a Trendelenburg sign. However, no study has investigated or described treatment protocols in this subgroup, making evidence-based clinical management challenging. The aim of the current case series was to describe the physical therapy management and outcomes of 3 patients with CLBP matching a previously identified subgroup characterized by substantial hip abductor weakness.

CASE DESCRIPTION

Three nonconsecutive patients with a chief symptom of CLBP were evaluated at an outpatient physical therapy clinic over 12 months. For the current case series, CLBP was defined as pain persisting for at least 3 months and on at least half the days in the previous 6 months.[20] In the current case series, CLBP will be used specifically to refer to LBP that has persisted for this length of time. To establish minimum homogeneity in clinical presentation, all 3 patients had met the criteria described by Cooper et al[1] (≤3/5 hip abductor strength, gluteal tenderness, and a positive Trendelenburg sign). None of the 3 patients had a history of lumbar surgery, lumbar fracture, hip surgery within the previous year, or signs or symptoms of upper motor neuron involvement. None of the patients were smokers, using pain medication, or long-term users of corticosteroids.

Patient Characteristics

Patient 1 was a 77-year-old man with right-sided LBP of 12 months' duration. The patient also noticed occasional (3 times a week) "burning" pain that would travel down the lateral aspect of his right leg into his foot. Leg pain and CLBP intensity were quantified with the 11-point Numeric Pain Rating Scale (NPRS), where 0 represents no pain and 10 represents the worst pain imaginable. He reported no pain as he sat in the examination room but rated his worst leg pain as a 7 and his worst LBP as a 9. His CLBP was aggravated by standing longer than 7 minutes and walking longer than 10 minutes. The patient reported having leg pain during these activities only when his LBP had been aggravated to 7 or greater. Sitting immediately relieved his pain. The patient reported having 4 episodes of LBP over the previous 50 years. Seventeen months before his initial physical therapy evaluation, he tripped while stepping off a curb, tearing his right gluteus medius muscle. The patient underwent gluteus medius repair surgery immediately after the fall. Three weeks after surgery, postoperative rehabilitation was initiated and continued for 8 weeks. The patient did not believe his gait pattern was fully normalized and began noticing LBP and leg pain about 5 months after surgery. During the subsequent 12 months, he worked as a grocery store salesman and noticed the CLBP gradually worsened until he had difficulty performing his job duties. His goal for physical therapy was to improve his pain-free standing and walking duration to 30 minutes to allow for less interference with his job duties. The patient's medical history included hypertension, atherosclerosis, and depression. He denied any recent changes in gait, bowel and bladder habits, strength, weight, or sleep patterns.

Patient 2 was a 78-year-old woman referred to physical therapy with sharp right-sided CLBP ranging from 0 to 9 on the NPRS. She also experienced tightness and numbness in her right buttock and lateral hip that was less frequent than her CLBP but could increase to a 6. Her CLBP was aggravated when standing from a seated position, whereas her CLBP and hip pain were both aggravated by walking or ascending stairs. Walking for 10 minutes increased both symptoms to their worst pain level, at which time 1 minute of sitting relieved the symptoms completely. As a result, the patient could not resume shopping, which was her main source of social engagement. The symptoms for which the patient was seeking treatment began 7 months prior after a chiropractic lumbar manipulation. The patient reported being the recipient of a lumbar manipulation to address gradual-onset LBP of about 3 weeks' duration, but the manipulation worsened her symptoms. Six months after the manipulation, she was still having LBP and lifted several large boxes from the floor of a grocery store. Her pain increased over the following 2 days, prompting her to visit a physical therapist. The patient had a history of hypertension and osteopenia. No radiographs had been taken. Her goals for physical therapy were to return to her functional status of 8 months prior, which included being able to stand from a chair without pain, navigate the 17 stairs in her home without pain, and shop for at least 30 minutes before having to sit. She denied any clumsiness of gait, unexpected weight loss, night pain, or bowel and bladder changes, and had no history of cancer.

Patient 3 was an 85-year-old retired woman with left-sided CLBP extending caudally to the gluteal fold and laterally to the flank and greater trochanter. She described the pain as varying from a 2 at best to a 5 at worst. Her pain was increased to a 5 within the first few steps after standing but settled to a 3 after about 10 steps. Her CLBP would increase after 10 minutes of walking, forcing her to sit and interfering with trips to the grocery store. Approximately once daily, standing caused pain rated 2 of 10 down the lateral aspect of her leg and into the anterior ankle. The patient's symptoms had developed gradually over 2 years. Her goals for physical therapy were to walk through the grocery store without being limited by her CLBP and to stand and walk without pain after sitting in a chair. Hip radiographs were negative for arthritic changes. Flexion-extension radiographs of the lumbar spine showed a stable 5-mm anterolisthesis of L4 on L5. Her medical history included hypertension, hypothyroidism, and osteoporosis. She denied any clumsiness of gait, unexpected weight loss, night pain, or bowel and bladder changes, and did not have a history of cancer.

Examination

Outcome measures were administered at baseline, 4 weeks, discharge, and 3-month follow-up. The NPRS was used to track changes in pain within and between sessions. It has a minimal clinically important difference (MCID) of 2 points in the LBP population.[6] The Global Rating of Change (GROC), a 15-point scale scored from −7 (a very great deal worse) to +7 (a very great deal better), was administered to quantify perceived level of improvement over time.[21] In existing research, GROC scores of +5 or greater have been used to indicate a meaningful change,[21] and an MCID of 3 has been reported.[22] Limitations in activities and participation were measured with the Oswestry Disability Index (ODI). The ODI consists of 10 items scored from 0 to 5 points for a total possible score of 50 points, with a higher score indicating greater disability. The ODI has been validated in individuals with CLBP and has an MCID of 10 points.[23] Finally, the Fear Avoidance Beliefs Questionnaire was administered at baseline to determine whether maladaptive beliefs were likely to influence prognosis. This questionnaire consists of physical activity and work subscales, where scores greater than 15 of 24 on the physical activity subscale are associated with worse outcomes.[24,25] All patients underwent a lower quarter neurological examination with unremarkable findings.

Patient 1 had a Trendelenburg sign during stance on the right leg, and walking 50 ft in the clinic produced CLBP rated 5 of 10 on the NPRS. The Trendelenburg sign was considered positive when the patient did not maintain a level pelvis or had to lean their trunk over the stance limb to pelvic drop during gait. The relative influence of hip abductor weakness on CLBP with gait was tested by having the patient place either arm overhead during gait (Figure 1). Placement of the ipsilateral arm overhead increased his CLBP, whereas placing the contralateral arm overhead

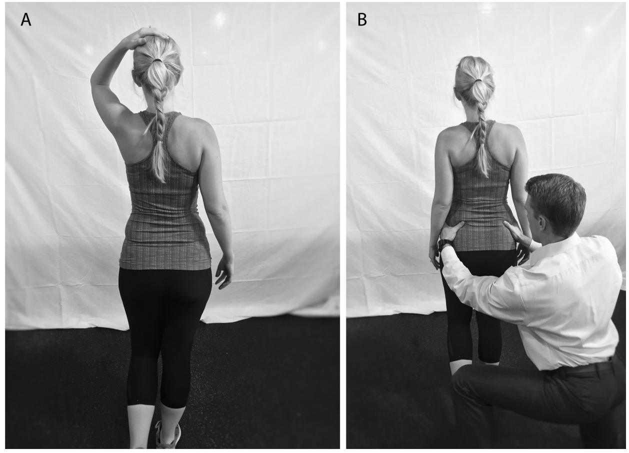

Figure 1. Assessing the impact of hip abductor weakness on gait. (A) The impact of hip abductor weakness on gait was assessed by asking the patient to place either arm overhead during gait. Reduction in pain with only the contralateral arm overhead was thought to result from reduced hip abductor requirements from translating the center of mass over the ipsilateral hip. (B) If no change was seen, testing was progressed by preventing frontal plane movement of the pelvis during a stepping task and assessing the response on the patient's low back pain.

immediately eliminated his CLBP. This response was thought to be a result of reduced load on the hip abductors from weight transfer over the right hip. However, reliability and validity of this test have not been examined, and reduced symptom secondary to trunk muscle activation was also considered. Lumbar active range of motion (AROM) reproduced his CLBP during extension and with right lateral flexion, both of which were visually estimated to be 50% limited. Straight leg raise testing (SLR) elicited symptoms in the posterior thigh at approximately 75° bilaterally, which was interpreted as normal. Active straight leg raise (ASLR) testing reproduced CLBP during elevation of the left leg and was relieved with abdominal bracing. Hip abduction manual muscle testing was performed using break tests as described by Kendall.[26] The patient was positioned in side-lying with the tested leg on top and the bottom knee slightly flexed for stability. The tested hip was tested in neutral rotation, slight extension and the pelvis rolled slightly forward. Downward pressure was applied in the typical fashion for a strength assessment greater than 3/5.[26] When a patient was unable to perform the test against gravity, a gravity-minimized supine testing position was used.[26] For patient 1, hip abductor strength was 2+ of 5 on the right and 4 of 5 on the left. Gluteal tenderness was noted during palpation. Passive accessory mobility testing at L4 and L5 produced sharp CLBP at the onset of resistance but was judged to have more excursion than adjacent, nonpainful segments.

Patient 2 had CLBP rated a 7 of 10 on the NPRS during a sit-to-stand transition, but the pain settled immediately to her resting pain level of 4. Static postural examination revealed a kypholordotic posture and a pes planus foot posture. During gait examination, a Trendelenburg sign was evident during stance on the right leg. While walking, the patient reported CLBP rated a 7 of 10 and right buttock symptoms rated a 5. Placement of the contralateral arm overhead during gait reduced these symptoms to 5 and 3, respectively. She was able to navigate an 8-inch step with her right lower limb, but vaulting from the left lower limb was observed. This task also produced LBP and buttock pain rated a 9 and 6, respectively. Lumbar flexion AROM was full with LBP reproduced at end range. During lumbar extension AROM, hinging at L4 to L5 was observed. The SLR testing elicited symptoms in the posterior knee and was approximately 80° bilaterally. ASLR testing reproduced right-sided LBP with elevation of the right leg, which improved with manual compression of the pelvis. Hip abduction strength was a 2+ of 5 on the right and 3+ of 5 on the left. Gluteal tenderness was present. Hip mobility testing was deemed full and was pain-free bilaterally. Passive accessory mobility testing produced LBP during central and right unilateral pressure at L4, L5, and S1. Excursion of L4 and L5 was deemed hypermobile compared with adjacent segments. The upper lumbar spine and thoracic spine were hypomobile in the presence of a pronounced kyphosis but produced no pain.

Patient 3 had a pronounced kypholordotic posture. Standing from a chair revealed a weight shift away from the left lower limb and caused CLBP rated a 4 of 10. Stepping with her right lower limb was more painful than stepping with her left leg when first walking. Gait examination revealed a Trendelenburg sign during stance on the left lower limb that caused pain rated a 4 of 10. When placing the contralateral arm overhead, her pain with gait was not altered. Differentiation testing was progressed by manually stabilizing the patient's pelvis as she took a forward step, which reduced her pain from a 4 to a 2 (Figure 1). Lumbar AROM was limited in flexion but caused no pain. All other directions were full and painless except for left lateral flexion, which generated mild pain at end range. The SLR testing produced posterior thigh symptoms bilaterally but was approximately 50° on the left and 65° on the right. ASLR testing was painful when lifting the right lower limb and improved with abdominal bracing. Hip range of motion was full and painless in all directions. Gluteal tenderness was present in the left hip. Hip abduction strength was 2+ of 5 on the left and 3+ of 5 on the right. Passive accessory mobility testing produced pain only during left unilateral pressure at L4 and L5, which appeared to be hypermobile compared with adjacent segments.

INTERVENTION

On the basis of the clinical examination of the patients alongside current evidence, interventions were administered using an impairment-based model of clinical reasoning (Appendix 1). Test-retest assessment was used frequently because it was believed that within-session changes would influence prognosis.[27] Given the substantial hip abductor weakness in these 3 patients, trial treatment consisted of manually resisted hip abduction and extension in supine, eliciting a gluteus medius muscle contraction with the elimination of gravity (Figure 2). Once the quality of this contraction was judged to be improved, gait was reassessed. The CLBP with gait improved from a 5 to a 1 in patient 1, from a 7 to a 4 in patient 2, and from a 4 to a 1 in patient 3. These rapid improvements were thought to confirm the hypothesis of CLBP related to hip abductor weakness. Given the substantial hip abductor weakness present in these patients, initial management consisted of gravity-assisted, non–weight-bearing exercises with the goals of improving motor control and dissociation of hip and lumbar extension. Exercises were progressed once the patient was able to perform the new exercise through a full range of motion with proper hip abductor recruitment. A detailed description of the exercise progression is provided in Appendix 2. A resisted posterior pelvic tilt (Figure 3) and other motor control exercises were used with all patients to address impaired trunk control and elicit an abdominal contraction in a pain-free direction (Appendix 1). Finally, weight-bearing exercises were added to improve gluteus medius muscle activity in standing once the Trendelenburg sign had improved and patient symptoms with prolonged standing had diminished. Weight-bearing exercises were progressed from bipedal to unipedal when patients could control frontal plane excursion of the pelvis without discomfort. Home exercises were updated routinely to reflect the most challenging exercises that could be successfully completed by the patient. Home exercises never exceeded 4 in number, which was thought to improve the chance of adherence.

Placement of an adjustable heel lift in the shoe of the contralateral foot was attempted during the second visit in all patients as a means of reducing the load on the gluteus medius muscle via weight transference over the symptomatic hip joint.[28] The heel lift reduced CLBP with gait by 50% in patients 1 and 3. Patient 2 noticed no change. Patients 1 and 3 were instructed to wear the heel lift and begin to decrease its size over time, as hip strength improved and CLBP resolved. Pain neuroscience education consisting of neurophysiology of pain processing, peripheral sensitization, and hurt not equaling harm[29] was administered to patient 2 to address her apparent high levels of fear-avoidance beliefs.

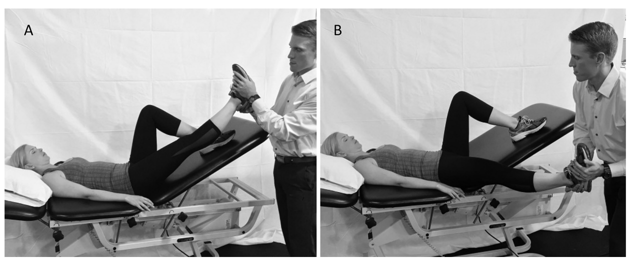

Figure 2. Manually resisted hip abduction exercise. Manually resisted hip abduction and extension were performed in supine to elicit a contraction of the gluteus medius muscle in a gravity-minimized position. The patient's contralateral hip was positioned in flexion to minimize stress on the lumbar spine.

These concepts were reiterated during the course of her care. Once patients had met their goals for physical therapy and were independent with a home exercise program that included weight-bearing exercises, they were discharged.

OUTCOMES

All 3 patients demonstrated significant improvements in pain, disability, and perceived level of improvement over 8 to 10 weeks of physical therapy. Discharge occurred after 11 visits for patient 1, 17 visits for patient 2, and 12 visits for patient 3. The magnitude of change surpassed the MCID for all subjective outcome measures at discharge (Table 1). Occasional mild LBP was still present in all patients at discharge, but the worst pain level had improved quickly, surpassing the MCID of 2 points in all 3 patients by week 4. The GROC and ODI met clinical significance by week 4 in all patients except for patient 3, where the ODI did not meet the MCID until discharge. All patients met the subjective goals agreed upon at the initial physical therapy evaluation: Patient 1 could stand all day at work without pain, patient 2 could navigate steps painlessly, and patient 3 could walk through a grocery store without pain.

At discharge, all 3 patients had 3+ of 5 hip abduction strength, no gluteal tenderness, and a Trendelenburg sign that was improved but not resolved (Figure 4). Provocative lumbar movements had improved in all patients by week 4 and were painless by discharge. Three months later, all patients maintained significant improvements in pain, disability, and perceived level of improvement over time (Table 2). Only patient 2 reported having a recurrence of LBP during the 3-month follow-up period, which had mostly resolved with adherence to her home program.

DISCUSSION

The aim of the current case series was to describe the physical therapy management and outcomes of 3 patients with CLBP and substantial hip abductor weakness. Utilizing a primary hip abductor exercise approach, all patients demonstrated clinically meaningful improvements on the GROC and ODI by discharge and had maintained these improvements after 3 months. Improvements in gluteus medius muscle strength, the Trendelenburg sign, and lumbar AROM were also seen at discharge. These results conflict with a randomized controlled trial by Kendall et al,[12] which found participants with CLBP did not benefit from the addition of undefined hip muscle strengthening to a lumbopelvic motor control program. However, Kendall et al[12] did not identify hip abductor weakness in their inclusion criteria, and the exercise program was neither described nor referenced in the study and was not supervised by a physical therapist. Kendall et al[12] also excluded patients older than 65 years, a population that has been regularly excluded from studies investigating the subgrouping of LBP.[14,32] Exclusion of these patients may be important because prevalence of gluteus medius tendon pathology and muscle atrophy increases with advancing age,[33] suggesting individuals with hip abductor dysfunction tend to be older. A retrospective study of 185 magnetic

Table 1. Subjective Outcome Measures of Patients in the Current Case Series

Subjective Outcome Measure	Baseline	Week 4	Discharge	3-mo Follow-up
Worst pain reported[a]				
Patient 1	9	5	2	3
Patient 2	9	6	2	2
Patient 3	5	4	2	2
Oswestry Disability Index[b]				
Patient 1	20	10	3	4
Patient 2	22	18	9	7
Patient 3	18	16	10	8
Global Rating of Change[c]				
Patient 1	NA	6	7	6
Patient 2	NA	6	7	6
Patient 3	NA	4	6	7
FABQ-PA[d]				
Patient 1	9	NA	NA	NA
Patient 2	24	NA	NA	NA
Patient 3	6	NA	NA	NA

Abbreviations: FABQ-PA, Fear Avoidance Beliefs Questionnaire Physical Activity; NA, not applicable.
[a]The patient's worst pain level in the last 24 hours was recorded using the 11-point Numeric Pain Rating Scale, where 0 equals no pain and 10 equals the worst pain imaginable.[30]
[b]The raw scores from the Oswestry Disability Index are reported. Scores can range from 0 to 50 points, and higher scores indicate greater disability.[23]
[c]The raw Global Rating of Change scores are reported. Scores can range from −7 (a very great deal worse) to +7 (a very great deal better).[31]
[d]The FABQ-PA is scored from 0 to 24 points, and higher scores indicate greater fear avoidance beliefs.[19]

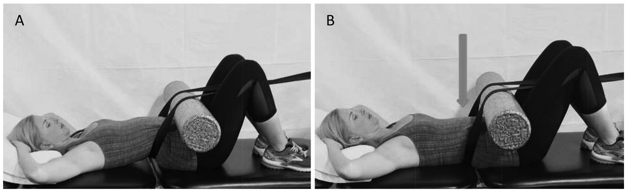

Figure 3. Manually resisted posterior pelvic tilt. A strap-resisted posterior pelvic tilt was performed to elicit an abdominal contraction in a painless direction (arrow).

resonance images by Chi et al[33] found tendinopathy to be present in 54% of those in their 60s and 81% of those in their 70s. Furthermore, low-grade partial tears were common, but high-grade tears were uncommon and full-thickness tears were nonexistent.[33] These findings suggest that gluteal tendon pathology is common in older adults, but the majority of such pathology should be amenable to treatment. The 3 patients in the current case series were all older than 65 years and responded well to high-intensity strengthening of the hip abductors. This outcome supports a previous study that found improved muscle strength, size, and functional mobility in older adults after 8 weeks of high-intensity strength training.[34] However, the older age and tendon quality of patients in the current case series may have limited their strength improvements, considering they were all discharged at lower than normal levels.

To our knowledge, the current case series is the first to describe in detail the physical therapy management, particularly the exercise prescription, of patients with CLBP and coexisting hip abductor weakness. Cooper et al[1] identified a descriptive CLBP subgroup characterized by a hip abductor manual muscle test grade of less than or equal to 3 of 5, gluteal tenderness, and a positive Trendelenburg sign. According to Cooper et al,[1] the interrater reliability of the Trendelenburg sign and gluteal tenderness was perfect and reliability of the hip abductor manual muscle test grade was good (intraclass correlation coefficient = 0.597). The strongest single predictor of LBP in the study's population was the gluteus medius manual muscle test grade of less than or equal to 3 of 5 ($\Delta R^2 = 0.461$, $P = .001$),[1] which is consistent with other studies.[6] Although the Trendelenburg sign appears clinically useful in cases of severe hip abduction weakness, such as those in the current case series, its ability to predict more modest gluteus medius muscle weakness is questionable.[35] In a 2013 study,[35] an ultrasound-guided block of the superior gluteal nerve in healthy participants resulted in a 52% decrease in hip abductor strength but still did not alter frontal plane motion of the pelvis. This evidence further supports a large variation in strength between the subgroup identified by Cooper et al[1] and the healthy population.

The current case series has several limitations that warrant consideration. Because it is a case series, broad conclusions cannot be made regarding a cause-and-effect relationship or efficacy of this approach. Exercises addressing impairments of motor control and endurance of the trunk muscles were cointerventions administered to all patients during their episode of care, making it difficult to determine any influences these exercises may have had on their LBP

Table 2. Objective Outcome Measures of Patients in the Current Case Series

Objective Outcome Measure	Baseline	Week 4	Discharge
Provocative lumbar movements			
Patient 1	Extension (50% limited), right lateral flexion (50% limited)	End-range right lateral flexion	None
Patient 2	End-range flexion	None	None
Patient 3	End-range left lateral flexion	None	None
Gluteus medius strength, involved[a]			
Patient 1	2+	3	3+
Patient 2	2+	3	3+
Patient 3	2+	3−	3+
Gluteal tenderness			
Patient 1	Present	Present	Absent
Patient 2	Present	Present	Absent
Patient 3	Present	Present	Absent
Trendelenburg sign			
Patient 1	Present	Present, improved	Present, improved
Patient 2	Present	Present, improved	Present, improved
Patient 3	Present	Present, improved	Present, improved

[a]Hip abduction strength was tested manually and graded using a scale ranging from 0 to 5, where 0 represents no palpable muscle contraction and 5 represents the ability to hold the test position with maximal resistance from the therapist.[26]

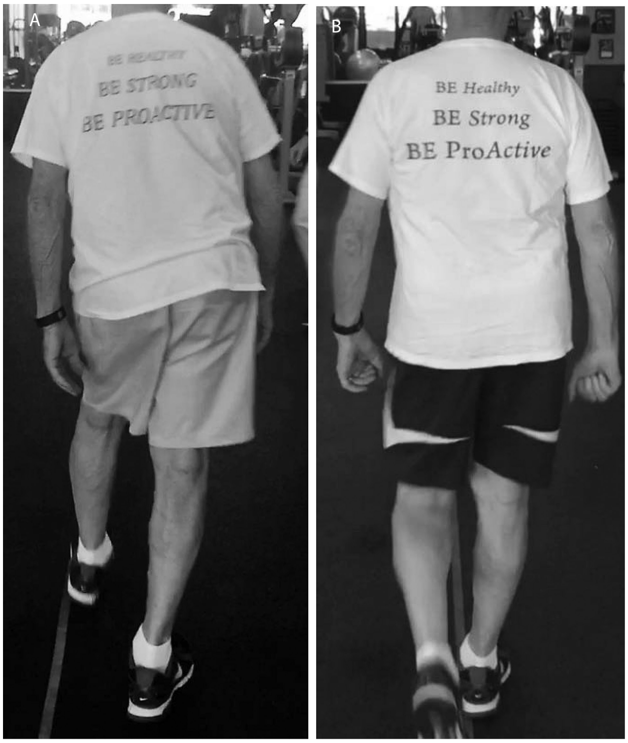

Figure 4. Improvement in the Trendelenburg sign for patient 1 from baseline (A) to discharge (B).

when compared with hip abductor strengthening alone. The passage of time may also have played a role in the resolution of symptoms for these patients, although their long-standing history of CLBP (7-24 months) makes this less likely. Another limitation is the continued hip weakness present in these patients at discharge. Although improvements in hip abductor strength were seen, all patients had only 3+ of 5 for strength and a continued Trendelenburg sign. It is unclear whether such strength impairments would place these patients at risk of recurrence beyond 3 months. It is also unclear whether patients with CLBP and more modest hip abductor weakness would benefit from the program described in the current case series. Previous schemes to subgroup nonspecific LBP have been widely adopted, yet their credibility has repeatedly been called into question.[36,37] The CLBP subgroup described by Cooper et al[1] is merely a preliminary descriptive subgroup and still needs validation and further rigorous testing. However, the growing evidence highlighting gluteal dysfunction in the CLBP population lends support to the possible existence of a clinically relevant subgroup.

Current research continues to investigate whether hip abductor strengthening will benefit all patients with LBP. Considering that LBP constitutes the most common reason to seek physical therapy care[38] and is known to consist of many subgroups,[39] future studies should focus on validating the finding of a clinically relevant CLBP subgroup characterized by significant hip abductor weakness that would benefit from a targeted therapeutic exercise approach. Future investigations should also consider including individuals older than 65 years.

CONCLUSION

The current case series described the physical therapy management and outcomes of patients with CLBP and substantial hip abductor weakness treated primarily with hip abductor strength training. All 3 patients had decreased CLBP, increased gluteus medius muscle strength, and increased functional ability over 8 weeks. These gains were maintained at 3-month follow-up. In the future, well-designed clinical trials should seek to validate this subgroup within the CLBP population and determine whether those individuals would benefit from hip abductor strengthening in addition to evidence-informed physical therapy management.

ACKNOWLEDGMENTS

The authors would like to acknowledge Tim Fearon, PT, DPT, FAAOMPT, as integral to developing several of the concepts described herein and for having reviewed an earlier copy of this article.

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APPENDIX 1

Description of Common Exercises Used in the Current Case Series

Exercise 1. Abdominal Brace with March

Purpose: To train and challenge the ability of the abdominals to stabilize the trunk during leg movement.
Performance: Positioned in hook lying, the patient first engaged the transversus abdominus and then performed a posterior pelvic tilt into the table. The patient lifted 1 lower limb from the table until the hip reached 90° of flexion. The limb was then lowered back to the starting position, avoiding any movement in the trunk.

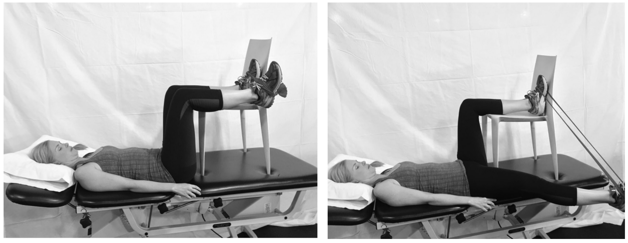
Exercise 2. Bridge With Gluteal Emphasis

Purpose: To strengthen the gluteal muscles while improving the patient's ability to dissociate lumbar extension and hip extension.
Performance: Positioned in hook lying with the feet elevated, the patient performed a posterior pelvic tilt and lifted the pelvis from the table as far as possible without lumbar extension. A strap was usually placed around the knees to elicit a simultaneous isometric contraction into hip abduction.

Exercise 3. Bridge With Segmental Lowering

Purpose: To improve motor control of the trunk muscles and the patient's ability to dissociate lumbar extension and hip extension.
Performance: Positioned in hook lying, the patient maintained a posterior pelvic tilt while lifting the pelvis from the table. The patient then lowered the pelvis by bringing each spinal segment back to the table in a craniocaudal direction (arrow).

Exercise 4. Supine Hip Abduction and Extension



Purpose: To use the assistance of gravity to strengthen the hip abductors and improve dissociation of the hip and lumbar spine in a well-tolerated position for the lumbar spine.
Performance: The patient was positioned in supine with the hips flexed and legs supported on a chair. Using an exercise band for resistance, the patient extended and abducted the hip as far as possible without lumbar extension.

Exercise 5. Clamshell

Purpose: To improve motor control and strengthening of the hip abductors while moving against gravity with a shortened lever arm.
Performance: The patient was positioned in side-lying with the knees flexed to 90° and the hips flexed to 30°. Keeping both feet together, the patient lifted the top knee as far as possible without moving from the lumbar spine. Hip flexion was progressed to 60° when possible. Resistance was applied only after appropriate motor control had been established.

Exercise 6. Tandem Balance

Purpose: To address balance deficits while introducing a stabilizing task on the trunk and hip abductors in a weight-bearing position.
Performance: The patient stood with 1 foot positioned directly in front of the other as if standing on a balance beam. This position was held for 30 seconds before being progressed to an unstable surface.

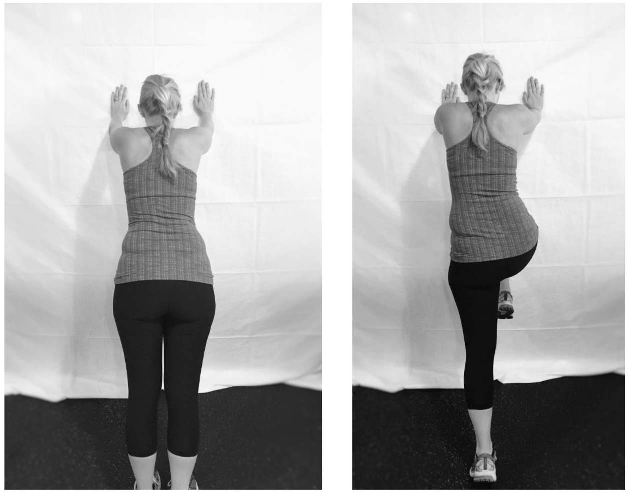
Exercise 7. Lateral Ball Press

Purpose: To perform an isometric contraction of the gluteus medius muscle while in a weight-bearing position.
Performance: In a stable standing position, the patient pressed laterally (arrow) into an exercise ball positioned at her opposite hip until a good isometric contraction of the gluteus medius muscle was perceived. This position was held for varying lengths depending on patient response.

Exercise 8. Squat With Lateral Ball Press

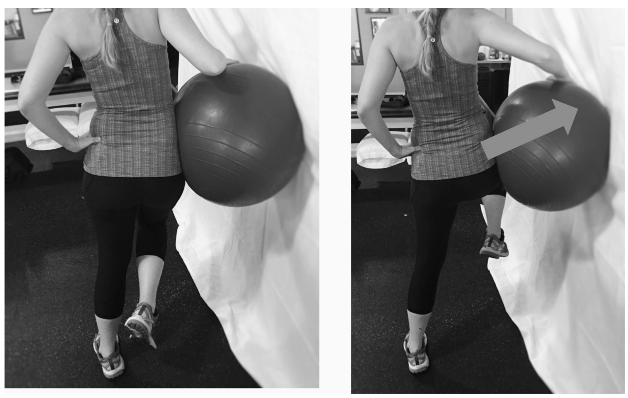
Purpose: To increase the demand on the gluteus medius muscle while performing a squat.
Performance: The patient was standing with an exercise ball positioned at her opposite hip. The patient pressed laterally into the exercise ball while simultaneously performing a squat (arrow).

Exercise 9. Hip Hike



Purpose: To improve the ability of the hip abductors to laterally stabilize the pelvis in a weight-bearing unipedal position similar to gait.
Performance: The patient stood facing a wall. With a slight forward lean, the patient flexed the contralateral hip and elevated the contralateral ilium. Dorsiflexion of the contralateral ankle and plantar flexion of the ipsilateral ankle were also encouraged.

Exercise 10. Hip Hike With Exercise Ball



Purpose: To further strengthen the hip abductors in a position that challenges the muscles to control and reverse a contralateral pelvic drop.
Performance: The patient was standing with an exercise ball positioned at her opposite hip. The patient stood on the involved limb. While pressing laterally into the ball, the patient flexed the contralateral hip and elevated the contralateral ilium, rolling the ball upward (arrow).

APPENDIX 2

Exercise Progression by Patient

Exercise[a]	Exercises Added for Each Patient by Visit		
	1	2	3
Non–weight-bearing			
Abdominal brace with march	2	2	4
Bridge with gluteal emphasis	2	1	2
Bridge with segmental lowering	1	3	2
Supine hip abduction and extension	3	2	3
Clamshell	4	3	3
Weight-bearing (bipedal)			
Tandem balance	3	3	3
Lateral ball press	4	3	4
Squat with lateral ball press	5	6	6
Weight-bearing (unipedal)			
Hip hike	9	10	8
Hip hike with exercise ball	11	Not applicable[b]	10

[a]Exercises were added once the patient was able to perform the exercise through a complete range of motion with good muscle activation. Exercises were modified for each patient, including repetitions and hold times.
[b]The patient was unable to perform this exercise with good control and muscle activation before discharge.