Heel lifts are commonly recommended for patients to manage the pain and discomfort of leg length discrepancies. However, used inappropriately, orthotics can create additional pain instead of alleviating it. In the case described, a 79-year-old male physician used a recommended heel lift for a perceived leg length discrepancy after right hip arthroplasty. Six months postsurgery, chronic, intractable pain developed in his hip and groin. He underwent a battery of tests to locate the pain, but its source remained elusive. Osteopathic evaluation and radiographic examination revealed an absence of leg length discrepancy and the presence of chronic psoas syndrome. Osteopathic manipulative treatment was prescribed and heel lift therapy discontinued, and the patient reported complete remission from pain.

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Leg length discrepancies contribute to myriad conditions in patients, including low back pain,1,2 knee pain,3 and abnormal gait.4 Such discrepancies, which can occur naturally5 or postsurgically,3,6 can often be resolved through the use of heel lifts. However, used inappropriately, these corrective devices can worsen—or even cause—leg length discrepancies, leading to somatic dysfunction. Although leg length discrepancies have not been reported previously in the medical literature as contributing to psoas syndrome, the current case illustrates the use of inappropriate heel lifts to be a plausible, underlying factor in the occurrence of this chronic condition.

Report of Case
A 79-year-old allopathic physician reported chronic pain in his right hip and groin that had been plaguing him for more than 6 months. The patient first experienced a similar type of pain following a game of golf. He did not recall any injury or precipitating event, but stated that the pain began gradually, “out of nowhere,” in the right inguinal and groin area. Initially, analgesics and maintaining a flexed position of the right leg relieved the patient’s pain. However, the pain returned intermittently, often after the patient had been sitting for prolonged periods. The pain prevented him from fully extending his right leg when standing.

The patient’s orthopedic surgeon examined him and ordered radiographs and a computed tomographic scan of the lumbar region to assess the prosthesis and other potential orthopedic sources for the pain. These tests showed some age-related degeneration of the spine, possibly with stenosis. Follow-up electromyography and magnetic resonance angiography tests were conducted to assess possible neuralgia due to nerve impingement, disk injury, or other soft-tissue sources. Although arthritic processes and degenerative changes were present, no etiology for the pain could be elucidated diagnostically.

The patient’s episodes of pain and flexion deformity in the right leg continued through the fall of 2003. At one point, the patient’s pain was so severe that he visited the emergency department. After initial evaluation, a flat plate radiograph of the abdomen was taken, and a referral was made to a general surgeon for a suspected inguinal hernia, which was later ruled out. The source of pain was not determined.

The patient, suspecting a possible renal or urologic etiology, visited a urologist. A complete urologic work-up was ordered, which included urinalysis, blood work, intravenous pyelogram, cystoscopy, and urine sedimentation tests. Again, nothing unusual was found and no etiology was determined.

Address correspondence to Christopher M. Rancont, DO, Pontiac Osteopathic Hospital, 50 N Perry St, Pontiac, MI 48342-2217.
E-mail: crancont@yahoo.com

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Christopher M. Rancont, DO

Chronic Psoas Syndrome Caused by the Inappropriate Use of a Heel Lift

Be sure the foundation is level and all will be well.
—Andrew Taylor Still, MD, DO
During a pain episode in which he was unable to stand unassisted, the patient described his medical history to the author of the current report. Suspecting iliopsoas spasm as the most likely source of dysfunction, I assisted the patient using the counterstrain technique, fully extending the patient's right leg. Because the procedure alleviated the patient's pain, he agreed to undergo a more complete osteopathic evaluation.

**Osteopathic Structural Examination**

The patient appeared well-nourished, mesomorphic, and in excellent health. Early in the day, he had a normal-to-anterior posture and walked with a slight shuffle, but with a symmetrical heel-toe gait. Hyperlordotic and kyphotic spinal features were not present. Later in the day, after sitting for a prolonged period, the patient had trouble standing erect unassisted. In addition, his right leg became flexed and internally rotated, and his gait became anteriorly deviated with limited forward step on the left and an internally rotated step on the right.

During the structural examination, the standing flexion test\(^8-11\) was positive for iliosacral dysfunction on the right, and the seated flexion test\(^8-11\) was positive for sacroiliac dysfunction on the left. Thomas test,\(^9\) performed with the patient in a supine position, was positive for psoas shortening. The patient was unable to extend his right leg beyond 160 degrees (flexion deformity). Tissue tenderness and ropiness were palpable along the right iliopsoas from the point of its insertion on the femur, and proximally through the belly of the muscle, superior to the inguinal ligament. Right anterior superior iliac spine (ASIS) was 2 cm inferior to the left ASIS, and the right posterior superior iliac spine (PSIS) was 1 cm superior to the left PSIS. Superior sacral sulcus was deep on the left, shallow on the right; inferior sacral sulcus was deep on the left and shallow on the right. Motion (springing) of the left sacral base and limited motion of the right sacral base were present. Lumbar vertebra 5 (L5) was sidebent right and rotated left. The medial malleoli were compared and found to be equidistant from the pelvis. The greater trochanteric and iliac crest heights in the standing position were compared with no appreciable discrepancy noted. After osteopathic evaluation was complete, the initial differential diagnoses were chronic psoas syndrome, right anterior innominate rotation, and forward sacral torsion (asymmetric oblique axis; ie, right-on-right torsion). Tissue tenderness and ropiness were palpable along the right iliopsoas from the point of its insertion on the femur, and proximally through the belly of the muscle, superior to the inguinal ligament. Right anterior superior iliac spine (ASIS) was 2 cm inferior to the left ASIS, and the right posterior superior iliac spine (PSIS) was 1 cm superior to the left PSIS. Superior sacral sulcus was deep on the left, shallow on the right; inferior sacral sulcus was deep on the left and shallow on the right. Motion (springing) of the left sacral base and limited motion of the right sacral base were present. Lumbar vertebra 5 (L5) was sidebent right and rotated left. The medial malleoli were compared and found to be equidistant from the pelvis. The greater trochanteric and iliac crest heights in the standing position were compared with no appreciable discrepancy noted. After osteopathic evaluation was complete, the initial differential diagnoses were chronic psoas syndrome, right anterior innominate rotation, and forward sacral torsion (asymmetric oblique axis; ie, right-on-right torsion).

**Osteopathic Manipulative Treatment**

A sequence of indirect osteopathic techniques were initially attempted to treat the psoas spasm during the acute exacerbation, but were unsuccessful. Counterstrain\(^8-11\) reduced the pain during treatment but did not allow for increased extension of the leg. Facilitated positional release (FPR)\(^8-11\) and articulatory technique (also known as **springing technique**\(^8-12\)) allowed the patient to achieve a slight increase in leg extension (ie, approximately 10 degrees), but this position remained uncomfortable for the patient. The direct osteopathic technique of muscle energy\(^8-11\) proved painful for the patient and did not appreciably increase the resting length of his psoas muscle. Muscle energy to the anterior right innominate rotation with direct manipulation of the pelvis to minimize tension on the prosthetic hip resulted in reduction of pelvic dysfunction and eventual restoration of pelvic symmetry.

Following this restoration, the patient’s pain from the psoas spasm was relieved and he was then able to lie supine with his right leg fully extended. At this point, osteopathic manipulative treatment (OMT) used for treating the psoas muscle was repeated (ie, counterstrain, FPR, articulatory techniques, and muscle energy), providing positive relief and an increase in functional range of motion to greater than 180 degrees.

**Radiographic Findings**

A standing postural radiograph of the pelvic region and hips was obtained (Figure 1) with the patient standing barefoot on a level surface with his feet in line with his shoulders. The radiologist reported a difference of 2 mm in femoral head height and concluded that there was “no appreciable leg length discrepancy.” The prosthetic hip and degenerative changes of the spine were observed, but no considerable sacral base tilting was noted.

The methods described by Kuchera and Kuchera\(^9\) for evaluating leg length discrepancy and resultant sacral base unleveling (Figure 2) were applied using a high resolution inverted radiograph (Figure 3). The right femoral head was 3 mm higher than the left, but the greater trochanteric and iliac crest heights were equal for each leg. Sacral base unleveling was minimal at 4.4 mm toward the right. In general, the sacral base unleveling that occurs as a result of leg length discrepancy is toward the shorter leg,\(^9,11\) the opposite of the finding in the current case. Using the Heilig formula,\(^11\) it was determined that a 2.2 mm lift on the right leg would be appropriate—the opposite leg for which the lift was originally recommended.

The minimal differences in leg lengths (2-3 mm) as measured by the radiologist and by application of subsequent measurement techniques are not of the magnitude that would require correction with the use of a heel lift.\(^7,11,13,14\) In addition, as a result of the inability to distinguish the prosthetic femoral head from the acetabular prosthesis, it was not reliable to compare the two femoral head heights when evaluating leg length discrepancies. Therefore, more confidence in this case should be given to comparing sacral base unleveling in combination with greater trochanteric and iliac crest heights, all of which showed no appreciable difference.

The structural examination findings, correlating history and flexion deformity, and resolution of symptoms after OMT confirm that the principle dysfunction causing the patient’s pain...
and deformity was a psoas spasm. Physical examination and radiographic evidence do not support the presence of a significant leg length discrepancy and therefore do not support the use of a heel lift. The patient’s minimal sacral base unleveling was toward the right, which would be consistent with compensation for a short right leg or compensation for the inappropriate use of a heel lift on the left.

After two sessions of OMT as previously described, the patient experienced relief from symptoms and a decrease in their recurrence. He was then instructed on how to perform self-counterstrain and contract opposing muscles (hamstrings) to block pain in returning the psoas to its resting length while standing up. The patient followed up with a physical therapist who was osteopathically trained and who continued to treat his pelvis, sacrum, and psoas during the time the patient transitioned from using the heel lift. The physical therapist also gave him a series of psoas-stretching techniques to perform daily at home. The patient reported a gradual decrease in the severity and frequency of the pain over several weeks, with complete remission of symptoms within 2 months.

**Discussion**

Psoas syndrome can be defined as a muscular imbalance, strain, spasm, tendonitis, or flexion contracture of the iliopsoas muscle (consisting of the iliac and psoas major). This syndrome may result in a number of symptoms including:

- flexion deformity of the leg on the affected side
- increased pain when standing or walking
- lordosis when supine
- nonneutral somatic dysfunction of the lumbar vertebra 1 or 2 (L1 or L2)
- pain in the lower back, pain radiating anteriorly toward the groin, or both
- pelvic shift to the opposite side
- point tenderness medial to the ASIS or femoral triangle
- “psoas gait”
- sacral dysfunction on an oblique axis
- spasm of the contralateral piriformis muscle

The most common causes of psoas syndrome are direct muscular dysfunctions arising from iliopsoas spasm or strain. Spasm of the iliopsoas often occurs after a position with a shortened psoas (eg, sitting, kneeling, crouching) has been maintained for an extended period of time. Strain of the iliopsoas can result from forceful contraction of these muscles when the thigh is in a fixed or extended position. For example, this forceful contraction may occur while running uphill, performing straight-legged sit-ups, stumbling with one leg extended, or kicking a ball. In iliopsoas strains, the pain begins as a sharp stab in the groin and increases with active resisted hip flexion or passive external rotation. In adolescents, the injury may produce avulsion of the lesser trochanter; in adults, the result may be a complete or partial tear at the muscle-tendon junction.

Other causes of psoas syndrome include irritation to the psoas muscle directly or through viscerosomatic reflexes.
CASE REPORT

Organic causes of psoas syndrome, some of which may be serious or life-threatening, include abdominal aortic aneurysm, intra-abdominal abscess, appendicitis, diverticulitis, inguinal hernia, prostate or sigmoid colon cancer, prostatitis, salpingitis, ureteral calculi, and Crohn disease.11

In the case described, the right sacral base unleveling and right anterior innominate rotation most likely resulted from compensating for the use of an inappropriate heel lift. The innominate rotation lengthened the resting length of the psoas muscle, placing it under constant strain. The onset of the psoas dysfunction probably began during a golf game, when the patient forcefully contracted the iliopsoas with the thigh in a fixed or extended position. This strain in the context of a chronically lengthened psoas initiated the chronic psoas syndrome. As illustrated in the current case, the long-term consequences of compensating for an inappropriate orthotic lift or of actual leg length discrepancy can become deleterious and even disabling.

Conclusion

The diagnosis of psoas syndrome may be elusive because the syndrome can masquerade as many different medical conditions that could distract a practitioner from making an accurate diagnosis. In addition, perceived leg length discrepancies should be carefully interrogated and managed properly. The long-term consequences of compensating for a leg length discrepancy or of using an improper lifting device can have serious, detrimental effects. Further research into leg length discrepancy as a cause of chronic psoas syndrome is recommended. Through conscientious appreciation of symptoms combined with an osteopathic structural examination and contemplating the whole person, the practitioner can facilitate proper diagnosis and treatment.

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