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Mini-Review

Abnormal Gait: How Lower Extremity Joint Pathology Leads to Low Back Pain

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ABSTRACT

Low Back Pain (LBP) is a common and debilitating condition that often arises due to lower extremity joint pathologies that alter body mechanics and the gait cycle. There is an abundance of evidence linking pathologies of the ankle, knee, and hip to altered body mechanics, abnormal gait cycle, antalgic gait, and LBP. Here we describe the antagonistic relationship between lower extremity joints with significant pathology and altered gait, leading to LBP. Physiatrists should always address lower extremity joint integrity in patients with LBP.

Keywords: Low back pain; Abnormal gait; Body mechanics; Gait; Pain; Osteoarthritis

INTRODUCTION

Low Back Pain (LBP) is a debilitating condition that can arise for a host of reasons. For those living in industrialized nations, the likelihood of suffering from LBP is greater than 70% [1]. While LBP can strike at any age, it is the most common reason that activity is limited in those younger than 45 in the U.S [2].

In addition to affecting activity, LBP also impairs sleep, diminishes quality of life, and is associated with overall health deterioration [3,4]. Most treatments tackle acute flare ups but unfortunately do not provide long-term solutions to LBP [5]. To better address LBP, it is critical that patients and providers understand and treat its underlying cause.

Interestingly, most LBP cases occur independent of any serious insult to the back [1]. This observation has led researchers to note that the biomechanics of the lower body is critical for spine functioning and that dysfunction in the lower extremities may thus be a commonly overlooked cause for LBP [1]. A link between podiatric deviations and LBP had indeed been established in several studies [5-11].

Investigations into this link have helped to clarify not only the association between lower extremity joint dysfunction and LBP but have also helped to reveal the likely mechanisms by which joint pathologies lead to LBP – namely, via altered body mechanics and altered gait cycle. Even in cases where there is no pain or injury in lower extremities, abnormal biomechanics in lower extremity joints can adversely impact the lower back, thereby causing LBP [1,12]. Specifically, the abnormal gait patterns interfere with movements of spinal segments, which lead to serial postural distortions, imbalances in muscle movements, and dysfunction of spinal joints [1].

LITERATURE REVIEW

Lower extremity joint dysfunction alters gait and causes LBP

Experts contend that joint function should not be assessed in isolation but instead in the context of a 'kinematic chain' where joint dysfunction causes or results in additional joint problems [13]. There is an abundance of evidence to suggest that the health of lower extremity joints is indeed linked and that the more abnormal these joints, the higher the likelihood of LBP. Even in healthy athletes, problems in both the knees and ankles are associated with LBP [14].

Problems in the ankle and foot alter posture, impacting gait and causing LBP: Disruption to the foot and ankle have been

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established as causes for LBP that occur through changes in gait biomechanics. For instance, people with plantar heel pain are at an increased risk for LBP [15]. In cases where they suffer LBP, their resulting disability depends on the level of dysfunction in the foot and ankle. In addition, pronation has been demonstrated to lead to postural problems in the waist, hip, and knee, as well as discrepancies in leg length that promote pelvic tilts as well as LBP [1,16].

Improving gait through custom-made foot orthoses has been shown to improve LBP to a greater extent and for a longer duration than standard care methods [5]. Research into the mechanism by which foot orthoses achieve success in relieving LBP has shown that foot wedging changes the onset of muscle activity in both the pelvis and the low back during gait cycle [8].

The LBP and gait alterations that accompany knee pain are reversed with knee surgeries: Patients who suffer from knee pain are significantly more likely to also suffer from lumbar pain compared to controls [17]. The intensity of knee pain and low back pain also interact and has been shown to contribute to disability level [18]. Further, knee instability is associated with alterations in the functioning of other joints that are important for gait, including the hip and ankle and has been shown to specifically affect these joints during walking [19]. The literature on knee osteoarthritis helps to highlight the way knee pathology can alter gait and thereby cause LBP. In addition to pain, aberrant biomechanics is a key characteristic of knee osteoarthritis, along with slow gait speed [20,21]. LBP has been observed in more than half of patients with osteoarthritis of the knee, which has also been identified as the most common contributor to walking disturbances [20,22]. In those with knee osteoarthritis, varus thrust of the knee during gait is associated with worsening knee pain, demonstrating that altered gait not only leads to LBP but also exacerbates knee pain [23].

Surgical procedures including the relatively new proximal fibula osteotomy have been shown to significantly improve gait biomechanics in patients with knee osteoarthritis. The improvements include better gait symmetry, knee peak flexion angle and sagittal range of motion, peak anterior and posterior ground reaction forces, and peak external knee and hip adduction moments [24]. Additionally, knee surgeries have been shown to improve LBP, with one study reporting that approximately 33% of those who had undergone a total knee arthroplasty experienced improvements in their LBP [25].

Poor hip health leads to asymmetric gait and LBP, which can be successfully treated: The observation of unilateral LBP in the context of simultaneous excessive lateral rotation of the hip and excessive foot pronation on the same side has led to research into the connection between lower extremity dysfunction and LBP and revealed that successful treatment of lower extremity joints can alleviate LBP [26]. The overall health and functioning of the hip, for instance, are critical for avoiding LBP. Indeed, both hip asymmetries and hip strength are associated with LBP [26-28].

In the case of the hip, the osteoarthritis literature is again rife with evidence for the interplay between lower extremity joint health, low back pain, and gait alterations. Greater gait asymmetry is observed in hip osteoarthritis patients than in controls, as is slower walking speed [29].

It is thus not surprising that hip osteoarthritis and LBP are common comorbidities, with more than half of those with hip osteoarthritis reporting LBP [30]. As hip osteoarthritis is a common cause of gait disorders, restoring gait symmetry is a stated goal of physiotherapy in those with the disease [31-33]. Hip range of motion has also been established to greatly influence LBP in those with hip osteoarthritis and should thus also be a target of therapy in these patients [34].

Total hip arthroplasty has been shown to restore hip function and relieve both hip pain and LBP [35]. Specifically, symptomatic LBP has been shown to resolve in 82% of hip osteoarthritis patients following total hip arthroplasty, pointing to the hip dysfunction as the underlying pathology driving LBP [36].

In many cases, improving joint health is the key to alleviating LBP

LBP often results from altered gait biomechanics that accompany lower extremity joint pathology. In this context, therapies that provide general pain relief or that specifically target the lower back are inadequate long-term solutions. Instead, to disrupt the negative feedback loop whereby lower extremity joint pain alters gait, which exacerbates joint pain and causes LBP - further altering gait - the emphasis must be on restoring joint health [37].

In the context of unhealthy joints, biased joint movements and inappropriate muscle activity not only alter gait but also lead to early joint breakdown via high stress on tissues and high shearing forces on cartilage [20,38,39]. At the same time, the adjustments in joint biomechanics as well as neuromuscular asymmetries that occur during altered gait patterns lead to instability that drives further gait function deterioration [38,40-42]. When LBP occurs, gait changes in predictable ways that contribute uniquely to antalgic gait and the resulting pain [43-45].

CONCLUSION

Long-term alterations in gait biomechanics resulting from lower extremity joint pathologies leads to LBP. Because even short-term musculoskeletal dysfunction in lower extremity joints can contribute significantly to LBP, physicians should always assess the integrity of these joints in patients who present with LBP. Physiatrists, who have extensive knowledge of body mechanics and musculoskeletal abnormalities, are specially trained to identify the types of musculoskeletal deficits that drive many cases of LBP.

When physiatrists determine that a patient with LBP suffers from compromised joints and altered body mechanics, they should be able to advise a course of therapy that aims to alleviate LBP via effective joint treatment and restoration of normal gait biomechanics. While there are both non-surgical and surgical options to treat lower extremity joints to improve LBP, physiatrists should be able to identify the most efficacious treatments needed for each case. For instance, physiatrists should be able to readily identify patients who are not responding adequately to conservative care and refer them for appropriate surgical interventions such as osteotomy, cartilage preservation, arthroscopic surgery, and total joint replacement so that patients can correct the driver of their LBP, obtain significant pain relief, and improve their quality of life.

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