Case Report

Differential diagnosis of a patient with low back and toe pain

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Low back pain is one of the most commonly treated conditions by outpatient orthopedic physical therapists. The management of low back pain is also responsible for a large economic burden in the United States and internationally, which highlights one of the many reasons why appropriate medical screening and referral is important in the physical therapy setting. The purpose of this case report is to describe the successful physical therapist screening and subsequent medical differential diagnosis of a 36- year-old male with chronic lower back and toe pain. Initial physical therapy evaluation supported a diagnosis of mechanical low back pain, but symptom progression through two treatment sessions indicated that a non-mechanical source of pain was instead the likely cause of the patient's symptoms. The referring physician was contacted by the physical therapist and the patient was scheduled for further medical examination. A consult to rheumatology was placed and through compilation of clinical, laboratory, and imaging findings, a diagnosis of human leukocyte antigen B-27-positive spondyloarthropathy was made. Even with physician referral, it is imperative for clinicians to be proficient in screening for non-mechanical low back pain that may mimic a musculoskeletal origin of symptoms.

Keywords: Medical screening, Non-mechanical back pain, Physical therapy, Psoriatic arthritis, Spondyloarthropathy

Background

Low back pain is one of the most commonly treated conditions by outpatient orthopedic physical therapists.[1–3] Approximately 85% of the population will experience low back pain,[4] the majority having no identifiable patho-anatomic cause for symptoms.[5] Low back pain is also responsible for a large economic burden, with management of the condition costing upwards of $50 billion each year.[6,7] The diagnostic challenges combined with high costs of treatment of low back pain highlight the difficult but important task of timely and accurate diagnosis in the physical therapy setting.

Diagnostic categories that describe low back pain include mechanical, non-mechanical, and visceral sources of low back pain.[8] While the overall lifetime prevalence of low back pain in the United States is high,[4] the prevalence of serious low back pain pathology (i.e. non-mechanical and visceral) is low.[9] Specifically, visceral disorders account for 2% while a non-mechanical etiology accounts for 1% of low back pain.[8] Although rare, serious pathology such as metastatic cancer and compression fractures can lead to significant mortality and morbidity.[10–12] Therefore, suspicion of non-mechanical or visceral causes of low back pain would warrant a physical therapy referral to a physician for further evaluation.

Of particular interest to this case is inflammatory arthritis, and more specifically spondyloarthropathy (SpA), which affects 1.2[13–16] to 1.9%[17] of the population and 5% of those with chronic low back pain.[18,19] SpA encompasses multiple diagnoses including ankylosing spondylitis (AS), reactive arthritis, psoriatic arthritis (PsA), and arthritis associated with inflammatory bowel disease. Inflammatory back pain (IBP) is the leading feature of SpA.[20,21] The condition often presents as low back and pelvic region pain, typically present for at least 3 months. Other common clinical features include sacroiliitis and asymmetrical arthritis that is frequently present in the lower extremities. A family history of inflammatory arthritis is also common.[20–23]

In the physical therapy setting, a diagnosis of SpA is difficult to make as differentiating between chronic low back pain and IBP can be challenging.[20] Appropriate and timely diagnosis is critical since those with SpA are at increased risk for cardiovascular

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complications such as aortic insufficiency,[24] heart conduction disturbances,[24] fibrotic lung disease,[25] uveitis leading to blindness,[26] and spinal compression fractures related to osteoporosis.[27] Furthermore, timely diagnosis of SpA is important as early disease management can lead to improved quality of life with appropriate intervention.[20,28,29] The purpose of this case report is to describe the differential diagnosis and management of a patient referred to physical therapy for treatment of mechanical low back pain that was eventually diagnosed as human leukocyte antigen B-27 (HLA-B27)-positive SpA.

To assist the reader in following the complex timing of events and clinical decision-making of the case that follows, a flow chart of events has been included (Fig. 1).

Case Description

Patient history

A 36-year-old male was referred to physical therapy for evaluation and treatment of low back pain. At the time of his evaluation, the patient presented with a 12-month history of insidious onset of low back pain and bilateral second toe pain. The patient first sought care for his second toe pain from his primary care physician. He was referred to a podiatrist and diagnosed with 'metatarsalgia'. Despite conservative management, the pain persisted and a few months later, he reported development of low back pain.

During the initial evaluation, the patient described his low back symptoms as aching and constant, located centrally in the lower portion of the lumbar spine. Secondarily, he complained of tightness in his thoracic spine. He denied pain radiation and numbness or tingling into the buttocks or lower extremities. His symptoms were noted to be worse in the morning with improvement by mid-day; impact activities such as volleyball and running, bending forward, transitioning from forward flexion to upright, and lying prone increased his pain. On the numeric pain rating scale, the patient reported that his symptoms ranged from a 0/10 to a 6/10. Sitting relieved his pain, but overall symptoms remained despite reported activity reduction. The patient also expressed concern about his continued bilateral second toe pain located throughout the entire digit. He was unable to identify aggravating factors or a pinpoint location of his toe pain, but reported that the pain was worse in the morning.

Past medical history was unremarkable for significant illnesses or surgeries. Family history for illnesses, including inflammatory arthritis, was also unremarkable except for melanoma (maternal aunt). Review of systems was negative.

Physical examination

Observation of standing posture revealed slightly increased thoracic kyphosis with no other significant findings. The patient ambulated with no spasticity, ataxia, or antalgia during gait, with full and symmetrical ability to walk on heels and toes bilaterally. A neurological screen was completed; dermatomes, myotomes, and reflexes of the lower extremity were intact. The passive straight leg raise test was negative, helping to rule out a radicular cause for the patient's distal symptoms given the high sensitivity of the test.[30]

During active range motion of the lumbar spine, pain was reported during extension and right extension quadrant. All movements were within normal limits. Posterior to anterior spring testing centrally at L3–L5 produced central low back pain. The patient's subjective complaints of tightness in the thoracic spine were consistent with objective findings as spring testing revealed hypomobilty, most notably at the T7–T12 level. Other findings included decreased hip flexor and hamstring extensibility.

A screen of the sacroiliac joint (SIJ) region was completed using provocation tests as described by Laslett.[31–33] The thigh thrust was completed with reports of low back pain during the right and left thigh thrust; there was no complaint of SIJ pain with either test. Assessment of the bilateral first and second metatarsal phalangeal joint revealed decreased flexion and extension, but no provocation of symptoms occurred with toe movement. The toes were observed to be normal in appearance with no presence of redness or edema.

Clinical impression and treatment following initial physical examination

Results of the initial evaluation, including pain with lumbar spine extension and extension quadrant, indicated that the facet joint may be the source of the patient's current symptoms. These findings coupled with decreased hip flexor and hamstring extensibility indicated that the patient would likely benefit from stretching and strengthening of the core and proximal lower extremities to help improve muscular imbalances, thereby reducing stress on the facet region of the spine. The patient was prescribed exercises to address his impairments, which included core strengthening and ball rolling over the hip flexor region, used to assist in improving muscular extensibility of the proximal lower extremity.

It is important to note that the information from the initial evaluation was obtained through a chart review. The primary author (EW) did not complete the initial examination. Care was transferred to the primary author at the 2-week follow-up appointment as the examining therapist had recently begun work at a new clinic.

Physical therapy follow-up

Following the initial examination, the patient was seen for two follow-up visits prior to referral back to

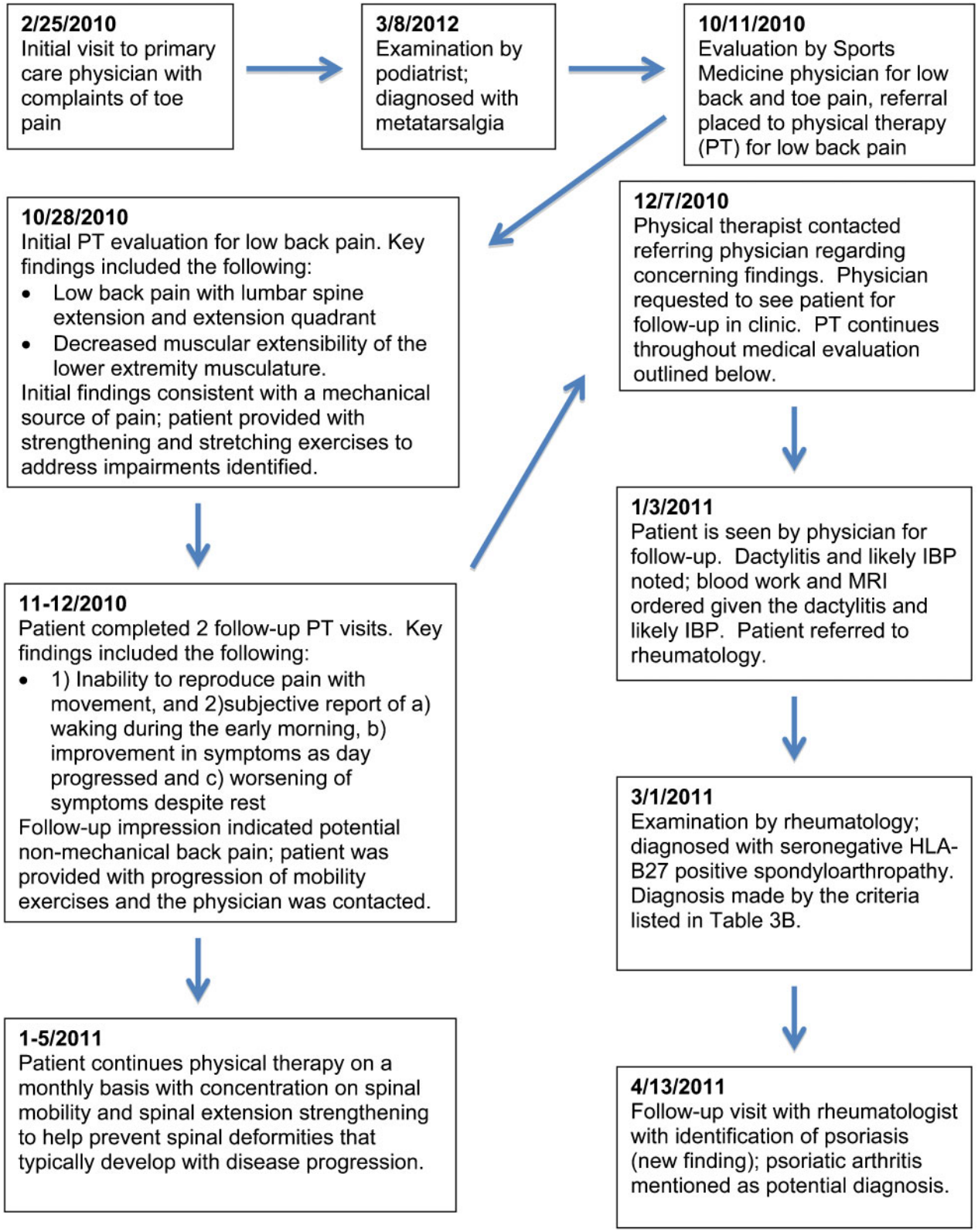

Figure 1 Flow chart demonstrating clinical decision-making and timeline of events.

the patient's physician. The clinical impression and treatment during these visits ensue.

Re-examination and clinical impression

Over the course of two physical therapy visits, the patient was treated for suspected mechanical low back pain. During these follow-up visits, he continued to complain of central low back pain, but specifically indicated concern over the increasing pain and stiffness in his thoracic spine and toes. His pain ranged from a 2–3/10 on the numeric pain rating scale at the time of his visits, but increased to a 6/10 during the early morning hours. He reported disrupted sleep with complaints of waking during the early morning hours and pain that was worse in the morning but diminished as the day went on. He was unable to

report specific positions or activities that provoked his pain. Objectively, the patient had continued pain with lumbar spine extension, but further clarification indicated that this was not the patient's concordant pain. Assessment of the thoracic spine through active range of motion and spring testing reproduced the patient's report of stiffness during thoracic spine flexion and central posterior to anterior mobilizations to T7–T12. The examiner also noted hypomobility in the same region of the thoracic spine.

Initially, pain with lumbar spine extension and extension quadrant indicated a likely mechanical cause of symptoms, but reassessment indicated that the pain produced with these movements was not the same pain experienced during the early morning and upon waking. The inability to reproduce the patient's pain with active movement of the lumbar spine, in conjunction with the presence of hypomobility in the thoracic spine,[34] the patient's age, gender, morning pain and stiffness, worsening symptoms despite rest, and improvement of symptoms as day progressed suggested a non-mechanical cause of the patient's symptoms.

Treatment

During the follow-up visits that preceded referral back to the physician, the patient's impairments were addressed through strengthening and stretching exercises. In clinic, strengthening exercises targeting the thoraco-lumbar region of the spine were added to his program and included extension-based strengthening (i.e. prone chin tuck with lift of trunk off table). Strengthening exercises were indicated given the kyphotic posture of the patient, and to help prevent potential future deformity that may occur if a non-mechanical cause of symptoms was confirmed. To address the stiffness in the thoracic spine, the patient was treated with grade III+ mobilizations, as described by Maitland,[35] targeting the hypomobile regions. At home, the patient competed thoracic extension over a chair and side-lying rotation of the thoracic spine to address spinal hypomobility in addition to his prescribed strengthening program.

The bath ankylosing spondylitis functional index (BASFI) and the bath ankylosing disease activity index (BASDAI) were administered to obtain a baseline reading of the disease process and functional status of the patient given a potential non-mechanical cause of symptoms. An outcome measure specific to AS was chosen because AS has been reported to be the most common subtype of SpA.[17] These indices are scored on a 0–10 scale and have been found reliable and sensitive to change in those with AS.[36,37] The patient scored a 1.0 and a 3.4, respectively. Higher numbers indicate greater functional deficits or disease activity.[38] Active disease process is considered with a score of 4 or greater on the BASDAI.[38]

Conclusion of initial physical therapy follow-up visits

At the conclusion of the two follow-up visits, it was noted that the symptoms present may be indicative of IBP. Initially described by Calin *et al.*,[39] IBP is considered if a patient meets at least four of the following five features: (1) age of onset <40 years; (2) duration of back pain >3 months; (3) insidious onset; (4) morning stiffness; and (5) improvement with exercise (Table 1). This patient met four of the five characteristics of IBP, suggesting that IBP should be considered as a differential diagnosis. Inflammatory back pain is a leading symptom in those with SpA[20,21,40] and has been cited to be present in up to 85% of those with SpA,[41] indicating that a systemic cause of the patient's symptoms may be present. The referring physician was contacted by the physical therapist regarding a potential non-mechanical cause of pain. The patient was scheduled with his physician for further examination.

Medical referral and diagnostic testing

The patient was seen for a physician follow-up visit to thoroughly evaluate for SpA. Radiographs of the spine were completed and were negative for findings consistent with SpA. A bilateral L5 pars interarticularis defect was noted, an interesting finding which may help explain the complaints of pain with extension and extension quadrant upon previous clinical examination. Pertinent findings noted by the physician included the likely presence of IBP and toe swelling consistent with left greater than right dactylitis, ('sausage digit') an often subtle feature of SpA (Fig. 2).[15] The dactylitis was a new finding, not present during previous physician or physical therapy examination.

Given these findings, blood work was ordered to further screen for SpA. Results revealed a positive HLA-B27 antigen, a blood marker often present with SpA.[15] Although the presence of the HLA-B27 antigen is significant, it is also very sensitive,[15] meaning that a positive finding can be present in those without the disease. Additional findings are typically needed to establish a diagnosis of SpA,[15] and, therefore, a magnetic resonance imaging (MRI)

Table 1 Characteristics of inflammatory back pain as described by Calin *et al.*[39]

Features:
1. Age of onset <40 years
2. Duration of back pain >3 months
3. Insidious onset
4. Morning stiffness
5. Improvement with exercise

Note: If four out of five features are present, the sensitivity and specificity has been reported to be as high as 95% and 85% respectively.

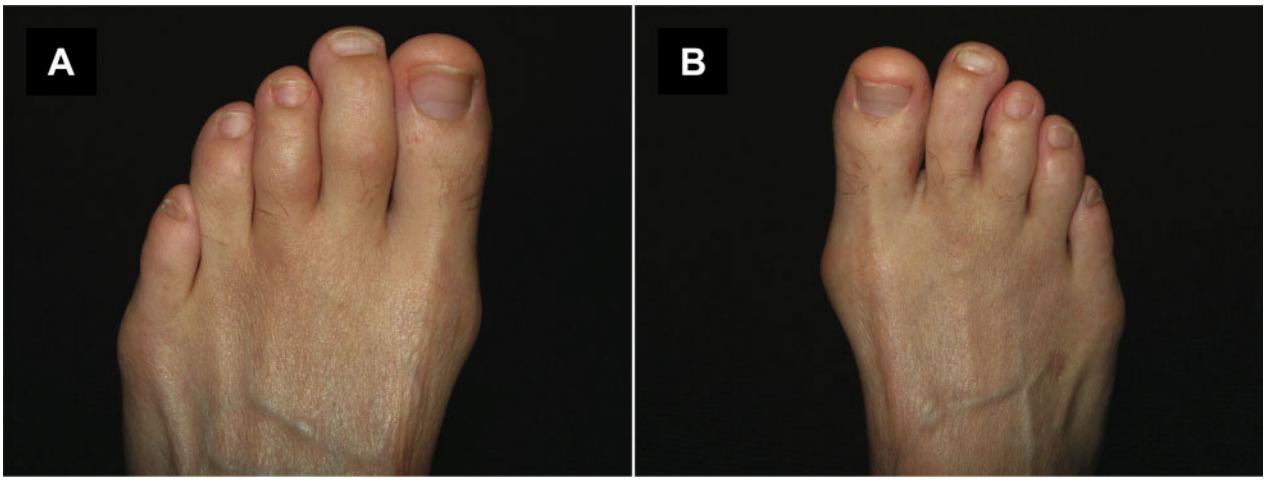

Figure 2 Image demonstrating left second and third toe dactylitis (A) and right third and fourth toe dactylitis (B) of the patient described in this case.

of the pelvic region to screen for sacroiliac involvement that was not present on radiographs was completed. Referral for advanced imaging in cases of suspected SpA may be indicated as diagnosis can be delayed by 8–11 years due to lack of radiographic changes early in the disease process when using plain imaging in isolation.[15,23,42,43] Results of the MRI demonstrated mild edema and enhancement of the left SIJ with small erosions, potentially representing early inflammatory sacroiliitis.

Conclusion of initial medical work-up

Compilation of all present clinical, laboratory, and imaging findings suggested a medical diagnosis of SpA. When diagnosing SpA, a combination of findings is necessary. Literature has suggested that the probability of disease should be at least 80% prior to considering a diagnosis of SpA.[15] No greater than 5% of the chronic low back pain population suffers from SpA,[19] thus establishing the pre-test probability. A combination of clinical features (Table 2) is used to increase the pre-test probability of 5% to a $\geq$80% post-test probability.[15,18] In this particular case, the patient demonstrated characteristics consistent with IBP, HLA-B27 (+), MRI (+), and dactylitis, suggesting up to a 98% probability of SpA [Table 3(A)]. The BASFI and BASDAI were re-administered; scores of a 1.57 and a 6.06 were reported respectively indicating worsening of disease activity. Given this patient's clinical presentation, a consult to rheumatology was obtained.

Consult to rheumatology

The patient was evaluated by the rheumatologist and was diagnosed with HLA-B27-positive spondyloarthropathy. He was started on indomethacin, an anti-inflammatory drug, and was scheduled to follow up with the rheumatologist 6 weeks later. At follow-up, the patient reported no change in symptoms; various areas of red patches were noted over the scalp, knee, and elbow consistent with psoriasis, another feature of SpA (Fig. 3).[15] The presence of psoriasis suggested that the patient may be suffering from PsA, a specific type of SpA. Given the lack of symptomatic relief with anti-inflammatories, the patient was prescribed Humira, an anti-tumor necrosis factor injectable medication administered subcutaneously every 2 weeks. Complete resolution of symptoms was reported with regular use of Humira.

Continued physical therapy intervention

Throughout the medical examination leading to a diagnosis of SpA and beyond, the patient described in this case continued in physical therapy on a monthly basis to track progress, address spinal hypomobility and progress spinal strengthening exercises. Monthly

Table 2 Additional SpA features[15]

Additional SpA feature	(+) LR*	Additional SpA feature	(+) LR*
Heel pain (enthesitis)	3.4	Psoriasis	2.5
Dactylitis	4.5	Peripheral arthritis	4.0
Uveitis	7.3	Positive response to NSAIDs	5.1
Positive family history	6.4	Elevated CRP/ESR	2.5
Crohn's disease/IBD	4.0	Alternating buttock pain	4.0
Inflammatory back pain	3.1	HLA-B27-positive	9.0
(+) MRI	9.0		

Notes: SpA, spondyloarthropathy; IBD, inflammatory bowel disease; MRI, magnetic resonance imaging; NSAIDs, non-steroidal anti-inflammatory drugs; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; HLA-B27, human leukocyte antigen B-27.
*Above values are mean (+) LR compiled from a variety of diagnostic accuracy studies, modified from Rudwaleit *et al.*[15]

follow-ups permitted the patient to focus on independent management of his symptoms at home while still allowing for clinic time to progress exercises and provide education.[44,45] In addition to progression of extension-based strengthening exercises, the patient was treated with grade III to IV mobilizations[35] to the thoracic spine. At home, the patient continued with his strengthening exercises and was encouraged to keep an active life-style. The patient purchased a foam roll to independently work on spinal mobility.

In combination with pharmacological management, the patient was discharged from physical therapy 7 months after initial evaluation with complete resolution of his symptoms. He understood the importance of continued home intervention and was independent in its completion.

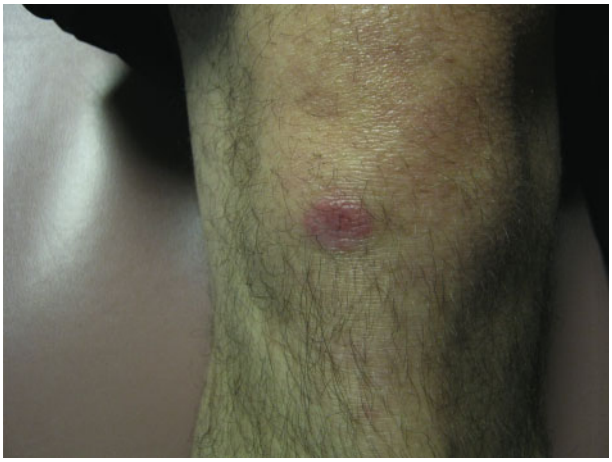

Figure 3 Demonstration of psoriasis over the right knee of the patient described in this case.

Discussion

Few case studies have been published within the physical therapy literature regarding a diagnosis of SpA. Law and Haftel[46] published a case study describing a patient with a diagnosis of juvenile AS presenting with initial symptoms involving the hip, knee, and shoulder joints. Coronado *et al.*[47] documented a case of SpA with alternating buttock pain and concurrent Crohn's disease. To the best of our knowledge, no case report has been published in the physical therapy literature describing SpA with toe involvement.

This case report highlights the importance of continued re-examination throughout an episode of care. While the patient in our case initially demonstrated characteristics consistent with a mechanical cause of pain, subsequent re-examination findings raised suspicion of a non-mechanical, inflammatory cause for his symptoms. The examination findings of concern included morning pain and stiffness that improved by mid-day, worsening of symptoms with rest, sleep disturbances, toe dactylitis, and psoriasis. The above combination of findings, along with the inflammatory changes of the SIJ present on MRI and the positive HLA-B27 antigen, led to the eventual diagnosis of HLA-B27-positive spondyloarthropathy. A more specific diagnosis of psoriatic arthritis was also suggested given the presence of psoriasis.

Diagnosis of SpA is often difficult as there is no single finding that points towards this diagnosis.[15,48] Instead, symptoms are variable, inconsistent, and subtle or fleeting early in the disease process, leading to a delay in diagnosis.[15,23,42,43] Consequently, there have been many proposed criteria aimed to assist clinicians in diagnosing SpA. Until recently, a popular and established set of criteria was the Modified New York Criteria. The criteria considered clinical signs, symptoms, and radiographic findings of sacroiliitis when making a diagnosis.[48–50] Unfortunately, appropriate and timely diagnosis may be limited when using the Modified New York Criteria due to diagnostic delays associated with use of plain imaging and the variability in grading of sacroiliitis.[51]

Most recently, the Assessment of SpondyloArthritis International Society proposed criteria to assist in the

Table 3 Pre- and post-test probability of SpA in the patient described in this case (A)[15,18] with comparison to the Assessment of SpondyloArthritis International Society classification criteria (B)[48,52]

A

Pre-test probability	Clinical, laboratory, and imaging findings				Post-test probability
5%	IBP (+)	HLA-B27 (+)	MRI (+)	Dactylitis (+)	98%*

B

For patients with LBP ≥3 months duration and symptoms onset at <45 years of age

Sacroiliitis on imaging (plain radiograph or MRI) PLUS ≥1 additional SpA features**	OR	HLA-B27 PLUS ≥2 additional SpA features**

Notes: SpA, spondyloarthropathy; IBP, inflammatory back pain; HLA-B27; human leukocyte antigen-B27; MRI, magnetic resonance imaging.
*Calculated using +LR for each finding. Pre-test probability of 5% has been determined as the maximum percentage of those with chronic low back pain that have SpA.
**See Table 2 for a list of additional SpA features.

diagnosis of SpA, taking into consideration the increased utilization of MRI in medicine. It concluded that a diagnosis of SpA could be made two different ways [Table 3(B)]. If option 1 is met, the sensitivity and specificity are 66.2 and 97.3%, respectively, with a positive likelihood ratio [(+) LR] of 25.5[52] and a post-test probability of 97.5%. For option 2, the sensitivity and specificity values are 82.9 and 84.4%, respectively, with a [(+) LR] of 5.3[52] and a post-test probability of 89%.[48,52] This study found that only 30% of those diagnosed with axial SpA demonstrated plain radiographic findings consistent with SpA.[52] The proposed clinical criteria are similar to those proposed by Rudwaleit *et al.*,[15] which suggested the probability of disease be at least 80% prior to making the diagnosis.

A more specific diagnosis of PsA was considered for our patient; similar to SpA, many criteria have been proposed to aid in the diagnostic process. Unfortunately the literature has not demonstrated clearly superior criteria.[53] Therefore, in an attempt to standardize the diagnosis of PsA, an international group of psoriatic arthritis researchers created the ClASsification criteria for Psoriatic ARthritis (CASPAR). The criteria, 91.4% sensitive and 98.7% specific, require a cumulative score of ≥ 3 to diagnose PsA in the presence of inflammatory articular disease involving the spine, joints, or entheses.[54] A score of ≥ 3 may be obtained by meeting a variety of characteristics with assigned point values (Table 4). Although the proposed criteria aim to bridge the gap in the diagnosis of PsA, it is not without its limitations. The most notable limitation using the CASPAR criteria is the longer duration of disease in the study subjects. On average, the patients enrolled in this study had symptoms for approximately 12 years.[54] This limitation questions the sensitivity and specificity of the criteria in patients early in the disease process.

Research focusing on physical therapy and inflammatory arthritis is limited. Most of the research available has focused on AS and the benefit of exercise on function. The literature has reported that exercise in combination with pharmacological management is considered the standard of care,[55] but exercise specifics are not well documented through numerous studies. Key findings have indicated that home therapy is helpful in improving function and spinal mobility when compared to no treatment,[34] while significant improvements in pain or function were not demonstrated when comparing supervised exercise to home exercise.[34] Other benefits of home therapy included a lower economic burden, as well as improved convenience and time effectiveness in the treatment of AS when treatment consisted of recreational/cardiovascular exercises and specific back exercises.[56] Although there are many documented benefits of home physical therapy, it is interesting to note that group therapy was found to be more effective than home therapy for improving spinal mobility and global assessment.[34] Other important findings from the literature included improvements in pain, stiffness, and function with completion of least 200 minutes of activity weekly.[56] In addition, manual therapy and self-mobilizations were reported to improve spinal mobility, posture, and chest expansion.[57] Manual therapy treatment included passive range of motion exercises, soft tissue mobilization to the spine and stretching of tight muscles using a contract-relax method.[57] It should be noted that further research is required to determine optimal duration, frequency, and type of exercise in the treatment of AS and SpA.[58]

In summary, this case illustrates some of the inherent challenges associated with diagnosing patients with SpA. The presence of dactylitis is a unique feature of this case. Although this feature is a characteristic of SpA, it is typically not thought of as a hallmark sign as are features such as a history of inflammatory bowel disease, family history of inflammatory conditions, uveitis and large joint involvement.[15,21,59] In fact, these previously listed characteristics, commonly seen in SpA, were absent in the patient described in this case. A specific diagnosis of PsA, suggested by rheumatology, may help to explain the distal symptom of toe dactylitis, a more common feature of PsA than the other diagnoses included under the SpA umbrella.[60] Gender differences also play a role in the presentation of SpA. A recent study found that males diagnosed with SpA were more likely to have IBP as an initial

Table 4 CAPSAR[54]*

Category	Point
Current or personal history of psoriasis, or a family history of psoriasis	2
Psoriatic nail dystrophy including oncholysis, pitting, and hyperkeratosis	1
A negative test result for the presence of RF	1
Current or past history of dactylitis	1
Plain radiographic evidence of juxtaarticular new bone formation appearing as ill-defined ossification near joint margins of the hands or foot	1

Notes: CAPSAR, ClASsification criteria for Psoriatic ARthritis; RF, rheumatoid factor.
*To meet the CAPSAR criteria, a patient must have inflammatory articular arthritis involving the spine, joint or entheseal with ≥ 3 points in the following five categories. Modified from Taylor *et al.*[54]

symptom[61] and while peripheral joint pain is less common in males, when peripheral joints are involved, the hips, shoulders, and feet are more commonly affected.[16] Furthermore, the absence of SIJ findings upon clinical examination is an interesting feature of this case. When this patient initially presented to physical therapy, he only complained of central low back pain with no indication of SIJ pain subjectively. Although low back pain is commonly seen in those with SpA,[23] the most common symptom of early SpA is sacroiliitis.[23,43,62,63] Despite this, during the medical and physical therapy clinical examination, which included plain imaging, this patient did not demonstrate findings consistent with SIJ pathology, while advanced imaging revealed subtle early involvement.

Given the variability in diagnosis of SpA, determining when medical referral is necessary for non-mechanical causes of low back pain can be difficult. In the case of inflammatory arthritis, we recommend medical referral in the presence of IBP. The Calin criteria (Table 1), one of many criteria used to diagnose IBP, is a sensitive measure that may help to serve as a starting point for a clinician, indicating when medical referral may be necessary.[64]

Conclusion

This case report describes the clinical reasoning process for a patient referred to physical therapy with a diagnosis of low back pain with eventual diagnosis of SpA. This case highlights the diagnostic difficulty along with many common signs and symptoms consistent with a diagnosis of SpA. Progression of this disease often results in significant morbidity highlighting the importance of appropriate and timely patient referral to a physician.

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