The screening process of a patient with low back pain and suspected thoracic myelopathy: a case report

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ABSTRACT

Background: Thoracic disc herniations are rare and difficult to diagnose. Myelopathy is a potential consequence that can lead to irreversible neurological impairment if not treated appropriately. It is incumbent on all clinicians who see patients with low back pain (LBP) to be aware of such pathologies. This case describes a screening process in the detection of a rare serious spinal pathology and discusses the use of red flags and central nervous system signs and symptoms in the decision leading to immediate referral.

Case Description: The subject in this case was a 69-year-old male referred to physical therapy for the treatment of LBP after having seen two medical doctors. He presented with severe spinal pain with gait disturbance, postural balance deficits and bilateral loss of plantar flexor strength. Decreased sensation in the buttocks and a subtle episode of urinary incontinence were also present.

Outcomes: Based on the results of the history and physical examination, the patient was referred back to his medical practitioner, who ordered magnetic resonance imaging. A thoracic disc herniation associated with spondyloarthritis at T10–11 causing myelopathy was detected, and the patient underwent immediate decompressive surgery. One month following initial evaluation, the patient had completely recovered without any neurological compromise.

Discussion: This case highlights the importance of the screening of serious pathologies and the assessment of central nervous impairments in certain cases of LBP. The integration of a cluster of subjective and physical examination findings led to the prompt referral of this patient for urgent medical attention.

Level of Evidence: 4.

KEYWORDS

Case report; clinical reasoning; diagnostic tests; red flags; spine

Background

Symptomatic thoracic disc herniation (TDH) has been previously described as rare, occurring in one patient in a million [1]. However, this figure may be underestimated, as other studies report an incidence of symptomatic TDH of 1 in 1000 [2]. Furthermore, the prevalence of asymptomatic TDH is suggested to be as high as 37% [3]. Myelopathy is considered a potentially serious consequence of TDH, as well as of thoracic spinal stenosis [4,5]. Thoracic myelopathy may have disastrous and irreversible neurological consequences if it is not identified and treated promptly and appropriately [5,6]. The rarity of the condition is compounded by its diagnostic challenge which may delay the surgical intervention and lead to permanent disability [6,7].

Even though most cases of spinal pain are described as non-specific and are considered benign, it is recommended by most guidelines that screening for serious pathology is an essential step of the examination process [8]. Physical

therapists (PT) and other clinicians play an important role in screening for serious spinal pathologies, and it is essential that they are vigilant for signs and symptoms that may lead to the decision to refer a patient for further investigation [9–12]. To assist in this process, red flag screening is recommended by most guidelines to identify patients at risk of having serious medical conditions [8,13].

However, the large number of red flags listed in these guidelines, the lack of consensus on their definition, the difficulties related to their use by PTs, and the high prevalence of single red flags among patients with non-specific low back pain (LBP) have raised questions about their utility in clinical practice [8–10,14]. Referring every patient with a single red flag for further investigation is not practical and would lead to considerable increases in costs and unnecessary patient concern [15]. Therefore, the decision to refer is much more complex and requires that subjective and objective findings be integrated into the clinical reasoning process.

Figure 1. Body Chart.

The purpose of this case report is to highlight the importance of screening for central nervous system (CNS) impairment in cases of apparent musculoskeletal disorders and discuss the decision-making process in determining when to refer a patient back for medical review.

Case description

A 69-year-old male patient was referred to the first author's private physical therapy practice by his medical practitioner for LBP. On initial consultation, he complained of severe back pain. The patient had been seen by the same physical therapist one year prior for management of foot pain, which had resolved. During initial observation, the patient walked from the waiting room with a stick and demonstrated substantial gait difficulties, which had not been present a year previously. This was the first aspect of the clinical examination that raised the potential for serious pathology in this case.

Subjective interview

The patient described LBP that was of insidious onset commencing 15 days prior to evaluation. Since this

onset, the patient had seen two physicians. The first suspected renal colic and sent the patient for an abdominal CT-Scan, which had been carried out a week previously and was reported as normal by the radiologist. The second physician, who was consulting the patient for other un-associated problems, had diagnosed the patient with acute lumbago. The patient reported that severe LBP together with a feeling of lower limb weakness during walking and gait disturbance had been present initially. However, the gait disturbance had worsened over the three days prior to assessment, suggesting that the patient's condition had deteriorated.

Pain was described as very severe resulting in substantial limitation of normal activities of daily living. Symptoms were located in the lower back and the lower thoracic region with radiation to the right thorax as shown in Figure 1. There was no radiation into the legs. Other symptoms included a feeling of pins and needles in both feet and decreased sensation in the buttocks. Symptoms were present all day and woke the patient at night around 4–5 am. He noticed a change in his gait since the onset of his LBP, and this had worsened in the past 3 days requiring him to use a walking stick. Further questioning raised more suspicion when the patient said that he felt a subjective reduction in strength in both legs and indicated that during last the two months he had a

Table 1. Diagnostic accuracy of clinical tests for myelopathy.

Test	Thoracic myelopathy	Cervical myelopathy	Comment	Result in this case
<i>Tests used in this case</i>				
Gait abnormality	ND	SV: 19–60, SP: 94	More standardized procedures for gait observation are needed [34]	+
Walking Romberg test		LR+: 3.4, LR–: 0.85 [31,34] SV: 74 [18]		+
Romberg Test	ND	SV: 34–44 [18,31] SP: 100% [41]	Not sensitive. Not specific to any cause of balance deficit or ataxia [16]	+
Babinski sign	SV: 40 [6]	SV: 13–53, SP: 92–100 LR+: 4.0, LR–: 0.7–0.93 [17]	Specific, but not sensitive. If one test is negative, it cannot rule out myelopathy	–
Clonus test	SV: 43 [6]	SV: 7–35, SP: 96–100 LR+: 2.7–5.4, LR–: 0.87–0.94 [17]		–
Heel–shin test Joint position sense	ND	ND SV: 25	Not appropriate to screen for myelopathy	–
<i>Other common tests</i>				
Hyperreflexia	SV: 68	SV: 22–94, SP: 33–97	Specific, but not sensitive. If one test is negative, it cannot rule out myelopathy	
Patellar tendon	SV: 57 [6]	LR+: 0.8–6.9, LR–: 0.81–1.3		
Achilles tendon		SV: 15–26, SP: 81–98 LR+: 1.4–7.8, LR–: 0.87–0.91 [17]		
Hoffmann sign	ND	SV: 31–94, SP: 71–90 LR+: 0.96–4.9; LR–: 0.49–1.01		
Inverted supinator sign	ND	SV: 18–61, SP: 72–99 LR+: 2.6–29.1; LR–: 0.5–0.82		
<i>Cluster of tests</i>				
Gait deviation; positive Hoffmann's test; inverted supinator sign; positive Babinski sign; and age > 45 years	ND	<i>One or less positive findings:</i> SV: 0.94, LR–: 0.18 <i>Three or more positive findings:</i> SP: 0.99, LR+: 30.9, post-test probability of 94–99% [34]	Cluster of tests demonstrated promising results in ruling in or out cervical myelopathy	
Hoffman's test and Walking Romberg test	ND	<i>All negative:</i> SV: 0.96 [18]	Useful to rule out myelopathy if both tests are negative	

Notes: ND: not described; SV: sensitivity; SP: specificity; LR+: Positive likelihood ratio; LR–: Negative likelihood ratio. See Cook and colleagues systematic review for further details [17].

few episodes of difficulty holding back the flow of urine. He did not describe any urinary retention.

The patient also described chronic neck pain that had very low impact on his activities of daily living. In the past, he had two total hip replacements due to arthritis. Moreover, the patient was known to have lumbar and cervical arthritis. In general, the patient was in good health and physically active. Prior to this episode, he regularly went hiking for a couple of hours in the mountains. No other medical co-morbidities were reported.

Physical examination

After the interview, a further evaluation of the patient's gait pattern was conducted. A lack of balance and deficit of coordination in leg movement was observed, suggesting ataxia. This required him to use a walking stick or the support of the PT to walk without falling, even for a short distance. Due to this abnormal gait pattern, and the information from the subjective interview, a neurological examination was performed early, to see if there were any other signs of CNS or peripheral nervous system compromise. The Romberg test, which can suggest loss of postural control when positive, was the first test performed. This simple test requires the patient to stand tall with eyes closed and feet together. A positive test is described when the patient is not capable of standing still, but sways or falls [16]. In patients with

cervical myelopathy, this test was described to have low sensitivity but high specificity [17,18]. The Romberg test confirmed that the patient's balance was strongly affected. As the balance impairments commenced at the same time as the LBP, it was hypothesized that the presence of ataxia during walking and the Romberg test was linked to spinal-related CNS impairment and was therefore strong justification to suspect serious pathology. Further tests for CNS compromise were also performed to corroborate this reasoning, included the Babinski sign, Clonus test and the Heel–shin test (see Table 1 for further details on diagnostic accuracy and results) [19]. The Babinski sign is positive when the great toe extends with fanning of the second through fifth toes following the stimulation of the plantar aspect of the foot with a sharp object. The Clonus test is positive when there are repetitive calf muscle jerks/contractions after a rapid stretch in ankle dorsiflexion [19]. The Heel–shin test requires the patient to lie supine and to slide one heel from the opposite knee down the shin to the foot. Normally, the heel should not deviate from the shin, while abnormal movements suggest impairment in coordination [20]. All three tests were negative. Skin sensation to light touch was decreased in the plantar aspect of both feet, with the rest of the legs considered as normal. The patient had also painless strength impairments of ankle plantar flexion bilaterally, rated at 3/5 bilaterally. No other physical tests were performed.

Outcomes

At this time, the patient's presentation was sufficiently clear to alert the PT to a potential serious condition. The presence of a change in bladder function, combined with bilateral loss of sensation in the feet and buttocks, reduced bilateral leg strength and more importantly, the ataxic gait disturbance and balance issues that occurred at the commencement of LBP, raised the suspicion of serious pathology. No attempt was made to examine the musculoskeletal system, including the lumbar spine, as it was deemed not safe to do so until the status of the CNS had been confirmed. Moreover, the PT believed that he had sufficient information to guide his clinical reasoning, and further negative tests would not have changed his decision to refer the patient back to his physician. Therefore, deep tendon reflexes or other myotomal strength tests were not performed. At the end of the physical examination, the PT called the patient's family physician, who had seen the patient two weeks prior, and described to him the neurological findings. A magnetic resonance imaging (MRI) scan was completed that day, according to the American College of Radiologist guidelines [21]. These guidelines recommend urgent MRI when there is the suspicion of cauda equina syndrome or other progressive neurologic deficit, such as myelopathy.

The MRI scan revealed a TDH associated with spondyloarthritis causing myelopathy at the T10–11 level (Figure 2). The patient underwent emergency spinal cord decompression surgery that night. The T10–11 herniated disc compressing the spinal cord was removed as well as multiple other disc fragments at that level. A T10–11 laminectomy was also performed. No surgical procedure was performed at the lumbar spine. Two weeks after surgery he returned to PT in order to remediate residual impairments, including balance deficits. One month later, balance and gait were considered normal and the patient had made a full functional recovery with no evidence of neurological compromise, and this outcome was maintained at 6 and 12 months.

Discussion

The lower thoracic spine is the most frequent site for TDH and spinal stenosis [2,4]. This case report highlights the important role PTs and other clinicians have in screening for potentially serious pathology associated with such a rare condition as thoracic myelopathy. In this case, the patient's major complaint was LBP, even though the disc herniation was located in the thoracic spine. Importantly however, most patients with thoracic myelopathy at the T11–12 level also complain of LBP [6]. Different theories exist to explain referred pain from the lower thoracic spine to the lumbar region. It has been hypothesized that as T12–L3 nerve roots flank the spinal cord at this level, the upper lumbar roots may be a source of LBP [6,22]. Referred pain from the medial branches of the dorsal

Figure 2. Sagittal T1-weighted (A) and Axial T2-weighted (B) magnetic resonance image showing the disc herniation with spondyloarthritis compressing the spinal cord at the T10–11 level. Lumbar spinal stenosis (L2–5) is also visible on the sagittal image.

rami or the zygapophyseal joints at the thoraco-lumbar junction may be another explanation for the lumbar symptoms [23]. Furthermore, the lumbar spinal stenosis shown in the patient's MRI might also have been a source of LBP. However, due to the concomitant onset of neurological symptoms and severe LBP, it is possible that both issues found their origin at the lower thoracic spine.

It is difficult to determine why serious pathology was not identified by the two physicians who saw the patient initially. It may be that the patient's status had worsened since visiting these practitioners, which had made the neurological status more obvious to the last clinician, even though the patient already presented neurological symptoms during his visits to the physicians. Nevertheless, all clinicians need to be prepared

to identify patients with suspected thoracic myelopathy, as these cases may rapidly worsen (with potentially irreversible consequences) [5,24,25].

Screening for red flags is recommended by clinical practice guidelines to help identify serious spinal pathology [8,13]. The accuracy of red flags in isolation and combination has been evaluated for common serious pathologies of the spine, vertebral fractures and malignancy [26,27]. It has been suggested that single red flags may not be indicative of serious pathology, but that multiple red flags increase the probability of serious pathology [8]. With respect to this case, red flags for possible spinal cord compression or cauda equina syndrome, such as bowel/bladder dysfunction or saddle sensory disturbance, have low sensitivity (0.27) and only modest predictive value (positive likelihood ratio: 3.46), but high specificity (0.92) when identified [25]. In this case, the episodes of urinary incontinence and decreased sensation in the buttocks were therefore important elements in the decision for referral back to the medical practitioner. Urinary retention has sensitivity and specificity as high as 0.9 and 0.95, respectively [28]. Interestingly, incontinence is thought to be a consequence of urinary retention. In patients with thoracic myelopathy, lower limb numbness has been reported to be described by up to 78% of cases and subjective lower limb weakness by up to 67%, with higher percentages when pathology had progressed [6]. The patient in this case described lower limb weakness during walking which had worsened in the days leading to the physical therapy appointment, suggesting that his condition had progressed from when he saw the previous clinician. Importantly, the high variation in the prevalence of serious pathology reported in previous studies affects the predictive value of red flags [8]. Therefore, the clinical utility of red flags must be interpreted cautiously by clinicians depending on the setting in which they practice.

Of all the physical tests that were performed on this patient to test the integrity of the CNS, only one was positive. Both the Babinski sign and Clonus test were found to be negative. The accuracy of these tests has been studied with regard to cervical myelopathy, with both tests shown to demonstrate low sensitivity but high specificity [19,29,30]. Moreover, in a report of 205 patients with thoracic myelopathy, only 40% had a positive Babinski sign or Clonus test [6]. This suggests that these tests should not be used alone as screening tests, as they could miss a high percentage of patients that have myelopathy, as was the case with the patient described here. No figures related to the accuracy of the Heel–shin test have been reported in the literature. However, tests of joint position sense have been shown to have poor sensitivity to detect cervical myelopathy, suggesting that these tests should not be used as diagnostic tools for spinal-related CNS impairment [18]. In this case, the presence of ataxia during walking and the positive Romberg test played a large

role in the decision to refer the patient back to the physician. A positive Romberg sign and gait abnormalities have been shown to be present in 44 and 60% of patients with cervical myelopathy, respectively [31]. It has been reported that the sensitivity of the Romberg test may be improved by changing the position of the feet (e.g. with heel-to-toe position) or by adding an unstable surface under the feet [32]. In patients with thoracic myelopathy, an unsteady gait has been reported in 17% of patients at the onset of symptoms and in 41% just before surgery, demonstrating a progressive worsening of the gait with this condition, as was the situation in this case. Moreover, the Walking Romberg Test was described in patients with cervical myelopathy [18]. In this test, patients were asked to walk 5 m with their eyes open and then the same distance with their eyes closed. A positive test was defined as patient swaying, falling or impossibility to walk due to instability [18]. Interestingly, this test seemed to be more sensitive than the traditional Romberg Sign, as it was positive in 74% of patients with cervical myelopathy. In this case, the patient had both a positive Romberg sign and features suggesting a positive Walking Romberg Sign due to the unsteady gait. Other clinical tests that can be performed when suspecting myelopathy are Hoffmann's reflex and examining for the presence of hyperreflexia on lower limb tendon reflex testing, but the accuracy of these tests is not better than the tests performed on this patient, as there are often false negatives [6,19,29,33]. Performing a cluster of tests might help to increase the accuracy of diagnosis, as has been reported in cervical myelopathy. Cook and colleagues [34] reported that a cluster of clinical findings (gait deviation; positive Hoffmann's test; inverted supinator sign; positive Babinski sign; and age > 45 years) can help the clinician to rule in or rule out cervical myelopathy. One or less positive findings may help to rule out cervical myelopathy, with a sensitivity of 0.94 and a negative likelihood ratio of 0.18, whereas three or more out of five may rule in the condition, with a specificity of 0.99, a positive likelihood ratio of 30.9 and a post-test probability of myelopathy of 94–99%. Unfortunately, no cluster of tests has been reported for thoracic myelopathy. Therefore, clinicians should use a variety of tests that focus on CNS integrity, including observation of gait, when they suspect serious pathologies.

The lack of diagnostic accuracy of single red flags and other test and measures suggests that clinicians should integrate a cluster of subjective and physical examination findings in order to determine the need for further referral. Indeed, due to the poor sensitivity of most of the subjective information and physical tests, these cannot be used alone as screening tools [17–19,25,29]. In this case, the association of gait abnormalities with the onset of LBP, in association with the positive Romberg test, the deficit of strength and sensation and the subtle urinary incontinence episodes were determinant in the decision

for referral. Clinical reasoning related to the screening of serious pathology is complex and cannot be solely linked to a list of red flags, as recommended by various guidelines [14,35,36]. In this case, the patient did not mention the lack of lower limb strength or the bladder impairments early in the interview, suggesting that he did not link these signs together. The clinician had to ask specific questions to obtain this information. He then used multiple tests and measures to strengthen the hypothesis of CNS impairment. This type of hypothetico-deductive reasoning is important to help identify potentially serious pathology [37]. If serious pathology has been excluded, then clinicians may use other type of reasoning, such as narrative reasoning, to assess patient beliefs and attitudes about LBP and reassure them that most LBP is benign [38–40]. This is possible only if the therapist is confident that serious pathology is not present.

Conclusion

Even though thoracic myelopathy due to TDH is rare, this condition is often misdiagnosed and may potentially result in irreversible disability for the patient. In this case, the clinical clues led to an appropriate referral and surgery was undertaken less than 12 h after the clinician raised suspicion of myelopathy, which resulted in very positive outcomes. This case highlights the essential role that all clinicians play in the screening for serious pathology. When there is clinical suspicion of serious pathology, the history and physical examination should be focused to screen all aspects of the involved systems, including the CNS. The interpretation of these clusters of subjective and physical examination findings may lead to the decision to refer on for further medical investigation.

Informed consent

The patient signed an informed consent form and granted permission for the publication of the information related to this case.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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