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Subacute Pulmonary Embolism Masquerading as Musculoskeletal Thoracic Back Pain: A Case Report

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Background: Thoracic back pain is an understudied clinical entity, and few evidence-based guidelines exist for its evaluation. Pulmonary embolism can present atypically with referred pain to the thoracic region if the visceral pleura becomes involved.

Case Report: A patient presented to the interventional pain clinic with 6 weeks of worsening multifocal back pain. Conservative management addressed his cervical and lumbar pain but did not improve his thoracic symptoms. A pulmonary embolism was incidentally found while evaluating unrelated intraabdominal complaints. Anticoagulation fully resolved the thoracic component of his pain.

Conclusions: Pulmonary embolism is a major cause of death and disability worldwide, and delays in diagnosis are associated with poorer outcomes. Atypical cases like this one highlight the need for clinical practice guidelines on the diagnosis and management of thoracic back pain.

Key words: Thoracic back pain, interventional pain, diagnostic pitfalls, visceral pain, red flags, referred pain

BACKGROUND

Back pain is extremely common worldwide, with a lifetime prevalence of low back pain estimated as high as 84% (1). Comparatively speaking, thoracic back pain is less common, with a lifetime prevalence estimated around 15% (2). This diminished prevalence correlates with a relative deficit in clinical research (3).

As of this writing, no major sports medicine, spine, or pain societies have produced clinical practice guidelines for workup and management of thoracic back pain. This deficit is unfortunate given the diagnostic complexity of the thoracic spine, with direct or referred pain potentially stemming from a variety of inflammatory, neoplastic, metabolic, infectious, and degenerative conditions (4). This complexity is particularly significant when the topic of pulmonary embolism is considered.

Most clinicians know the classic presentation of pulmonary embolism: abrupt-onset shortness of breath, tachycardia, and pleuritic chest pain (5). Unfortunately, even acute pulmonary embolisms can present in extremely diverse ways and even be asymptomatic, complicating efficient diagnosis and treatment (6). Subacute pulmonary emboli are even more insidious entities; their subtle symptoms can delay care, leading to decreased efficacy of anticoagulation and a high mortality rate (7).

The challenging nature of diagnosis in the thoracic region contributes to why "red flags" are popular clinical tools for clinicians trying to determine if thoracic pain may indicate a more serious pathology (4,8). The present case describes a patient with thoracic back pain that persisted despite optimal conservative management. His atypical response to treatment, coupled with identification of concerning clinical features, led to expansion of his diagnostic workup, ultimately leading to diagnosis

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of a subacute pulmonary embolism. Treatment of his pulmonary embolism with anticoagulation led to the resolution of his thoracic symptoms, highlighting the importance of maintaining a broad differential for refractory thoracic back pain.

CASE DESCRIPTION

This case report was produced as per CARE guidelines. The patient provided informed consent for publication.

The patient was a 71-year-old man with a past medical history, including anxiety, Lyme disease, gastroesophageal reflux disease, pancreatic intraductal papillary mucinous neoplasm, fibromyalgia, and chronic low back pain, who presented to the interventional pain clinic in March 2025 for worsening chronic low back and neck pain, as well as subacute thoracic back pain. The patient's thoracic pain began approximately 6 weeks prior to his presentation in concert with worsening dysphagia and unintentional weight loss. A summary of his overall clinical course is provided in a timeline in the Suppl. Fig. S1.

The patient complained of cervical, thoracic, and lumbar back pain with radiation into his bilateral arms, anterior right rib cage, and bilateral buttocks. The pain was described as 8 out of 10 on the numeric rating scale (NRS) severity and burning in nature, with axial pain exacerbated by movement in all planes of motion. Physical exam was notable for positive bilateral Spurling's test, positive bilateral seated slump test, and exquisite tenderness to palpation along the right costal margin.

The patient subsequently underwent a complete spinal magnetic resonance imaging, which showed mild-to-moderate broad disc bulges from L3-S1 with associated compression of the L3-L5 foraminal roots, left greater than right. He was recommended to pursue conservative management, demonstrating partial improvement of his neck and low back pain with duloxetine and physical therapy, but no substantial change in his right flank and anterior rib pain.

The patient subsequently received a computed tomography (CT) abdomen/pelvis after reporting abdominal pain with associated weight loss, incidentally finding bilateral lower lobe hypodense filling defects. He then underwent a dedicated CT angiography, which confirmed bilateral segmental pulmonary emboli as seen in Fig. 1. He was started on apixaban, which led to resolution of his thoracic pain. He continues to follow with interventional pain management; as of 6 weeks since initiation of anticoagulation, the patient continues to endorse resolution of his thoracic back pain. Furthermore, the patient's cervical and lumbar pain remains adequately controlled with conservative management alone as of this writing.

DISCUSSION

The atypical presentation of pulmonary embolism in this case offers multiple teaching points with respect to thoracic back pain. These include 1) referral patterns from intrathoracic pathologies, 2) pitfalls of clinical practice and the role of "red flags" in identifying serious thoracic pathology, and 3) the need for evidence-based clinical guidelines for thoracic back pain.

Intrathoracic Pathology and Referral Patterns

Thoracic pain can be produced by musculoskeletal or visceral etiologies. Within musculoskeletal pathology, the differential is broad and can include facet arthropathy, degenerative disc disease, spinal stenosis, nerve root compression, compression fractures, vertebral endplate disease, primary or metastatic spinal malignancy, myofascial pain, as well as tendinous/ligamentous injury, among others. Furthermore, musculoskeletal pain from adjacent structures can refer to the thoracic region and includes the cervical or upper lumbar spine, the proximal upper extremities and shoulders, and overlaying myotendinous structures.

Regardless of the etiology, pain referral patterns can be grouped based on whether they involve visceral vs somatic sensory pathways. Visceral pain from organs, such as the heart or lungs, generally presents with deep, difficult-to-localize, and diffuse pain (8). By contrast, somatic pain from the chest wall or pleura is generally intense and more delineated. As with intraabdominal pathology, vague visceral pain can evolve into sharp and better-localized pain if the disease process progresses to involve structures innervated by somatic nerves (e.g., invasion of tumors into the chest wall or development of a pleural effusion) (9).

This framework also applies to pulmonary embolism. Lung parenchyma and the visceral pleura overlaying lung tissue are innervated by autonomic fibers from the pulmonary plexus, including contributions from the sympathetic trunk and vagus nerve (10). This visceral innervation provides the sensation of stretch but not pain per se. By contrast, the sharp, inspiratory chest pain classically associated with a pulmonary embolism is mediated by somatic innervation of the parietal pleura (11).

Sequelae of pulmonary emboli, including, but not

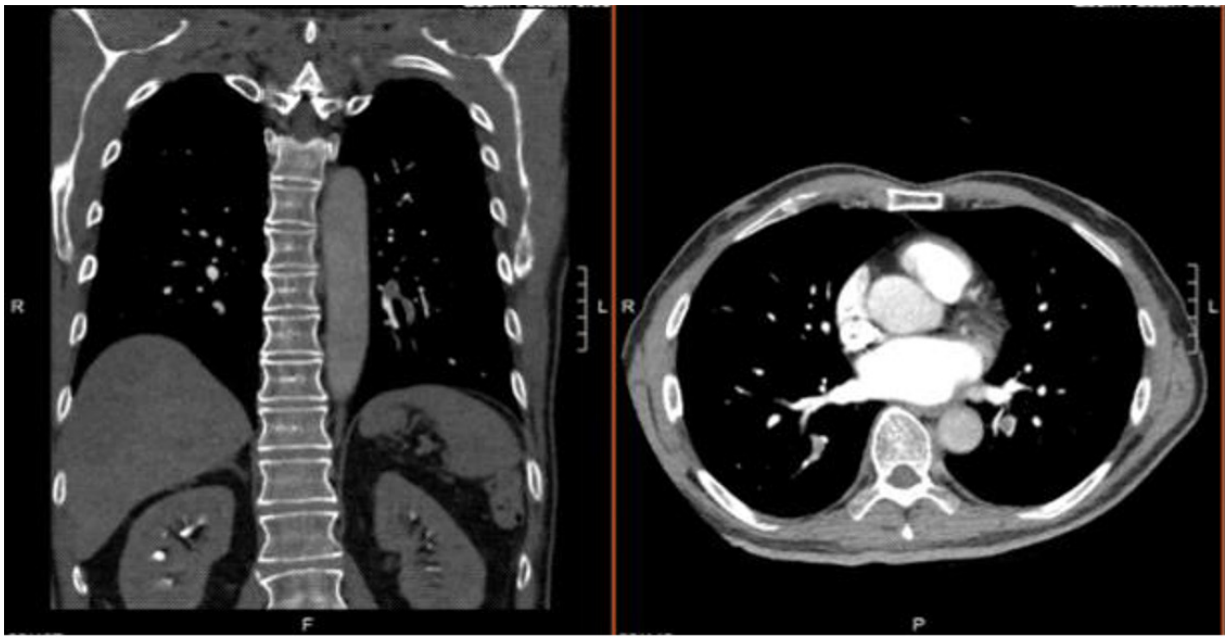

Fig. 1. CT pulmonary angiography, performed July 1, 2025, showing multiple bilateral segmental pulmonary emboli; no concurrent pleural effusion is present. CT, computed tomography.

limited to, pleural effusion, can lead to stimulation of fibers from the phrenic and adjacent intercostal nerves—this is likely the basis of prior case reports (12-14) describing shoulder, neck, and flank pain in acute pulmonary embolism. This complexity, along with the possibility of pain referral from nonthoracic structures, contributes to the diagnostic challenge of working up thoracic back pain.

Pitfalls of Clinical Practice and "Red Flag" Signs

A major pitfall in this case was the patient's concurrent cervical and lumbar spine complaints. The partial improvement of these symptoms with duloxetine could have misled the team into assuming the primary etiology of his symptoms was being addressed. Anchoring in this manner could have led to escalation of medication dosing or interventional procedures, further delaying effective diagnosis. Ultimately, "red flags" in the history and physical exam helped to establish the correct diagnosis.

As discussed, pathology involving thoracic structures can present in extremely diverse ways. The concept of "red flags" has been present in medicine for decades, indicating details that should trigger further workup once identified, but it should be realized that no universal list of "red flags" for the spine exists. A 2016 review (15) identified 46 discrete red flags across 16 sets of guidelines for the lower back and spine, with the authors grouping these under 4 categories of concern: malignancy, fracture, cauda equina syndrome, and infection.

In thoracic back pain suspected secondary to spinal pathology, the American College of Radiology guidelines recommend stratification of symptom duration as acute (0-4 weeks), subacute (4-12 weeks), or chronic (> 12 weeks) (4). These guidelines recommend monitoring thoracic back pain for up to 6 weeks before pursuing imaging unless certain risk factors are identified, as summarized in Table 1.

It is worth noting that an alternative set of red flags has been identified for serious pathology mimicking thoracolumbar spine pain, also summarized in Table 1. Though of limited value in isolation, the presence of multiple positives from this set of red flags has been shown to have diagnostic value for nonmusculoskeletal thoracic back pain (16).

In the presented case, the patient's "red flags" included: suspected malignancy (due to unintended weight loss and a family history of malignancy), constant pain, and reflux symptoms. These symptoms prompted the abdominal CT, which incidentally identified the pulmonary emboli. It is notable that appropriate escalation of

Table 1. This table summarizes different "red flags" of thoracic back pain in suspected spinal vs nonspinal origin. Abbreviation: CP, chest pain.

"Red Flags" Warranting Expediting Imaging for True Thoracic Spine Pain[4]	"Red Flags" for Serious Pathology Mimicking Thoracolumbar Spine Pain[16]
Known or suspected malignancy	Known or suspected malignancy
Presence of myelopathy	Myelopathic symptoms
Infection	Signs of infection or recent infection
Trauma	Trauma
Immunosuppression	Corticosteroid use
Prior thoracic spine fusion	Female gender
	Constant pain
	Family or personal history of heart or pulmonary diseases
	Tachycardia, exertional pain, diaphoresis, dyspnea
	Postprandial CP, reflux symptoms
	Hemoptysis
	Retrosternal pain
	Hypotension

imaging for thoracic pain, as outlined by the American College of Radiology's criteria, was unable to identify the source of his thoracic back pain; this case thus provides evidence of a gap that should be addressed in updated formal clinical practice guidelines (4).

The Need for Evidence-Based Guidelines for Thoracic Back Pain

Although no formal guidelines exist for the general management of thoracic back pain in the current leading sports, orthopedic, neurosurgical, or pain societies, there are some external societal guidelines that describe a general approach to thoracic back pain.

As previously referenced, the American College of Radiology has developed appropriateness criteria for various imaging modalities in the evaluation of thoracic back pain. These guidelines are extremely thorough and evidence-based in describing the sequence of imaging to be pursued while working up thoracic back pain secondary to spinal pathology; however, they do not provide any description of therapeutic modalities and cannot exclude mimics of thoracic spine pain such as pulmonary embolism (4).

From a clinical standpoint, the American College of Occupational and Environmental Medicine (ACOEM) has published a 2018 set of guidelines (17) on management of cervical and thoracic spine disorders. This set of criteria does have recommendations on therapeutic measures, but notably recommends against most traditional percutaneous modalities, including, but not limited to, medial branch ablation (17). Furthermore, though the ACOEM guidelines do have a brief section on pneumonia as a potential referred source of thoracic back pain, these too lack any description of referred pain from pulmonary embolism, and thus would not have been useful in the presented case or recent analogous cases (12-14).

It is hopefully clear, based on the analysis, that a formal committee review and updated clinical practice guidelines are needed for thoracic back pain. Providers catering to the back pain population are limited by the relative deficit of systematic research on thoracic spine pathology. Current applications of interventional spine procedures in the thoracic spine are based on a relatively sparse literature basis as compared to the cervical and lumbar spine (17,18).

It is for this reason that we present this case as a call to action for formal society review to produce evidence-based guidelines for management of thoracic back pain and to identify the most pressing literature gaps to target in this patient population.

Limitations

This case has inherent limitations as a single-patient case report. We are unable to provide commentary on the incidence of pulmonary embolism in interventional pain clinics or extrapolate our physical examination findings to provide recommendations for differentiating mimics from true thoracic spinal pain. Ultimately, the identification of pulmonary embolism in this case was incidental

while evaluating for an an unrelated set of gastrointestinal complaints. With the benefit of hindsight, a dedicated physical exam of the chest with earlier imaging to rule out a potential intrathoracic source would have been ideal. Furthermore, it is assumed that the patient's thoracic symptoms were primarily driven by his pulmonary emboli based on his symptom resolution after anticoagulation; it is presumed the pulmonary emboli developed at the onset of his thoracic pain, but this cannot be conclusively proven without preceding imaging.

CONCLUSIONS

The successful outcome of this case highlights the importance of allowing evolving complaints to change the differential for patients with persistent pain. Production of formal society guidelines for thoracic back pain may provide valuable guidance, given the complexity of diagnosis in this region of the body. Ultimately, this patient presents a valuable lesson on avoiding anchoring and broadening scope in patients with complex pain complaints.

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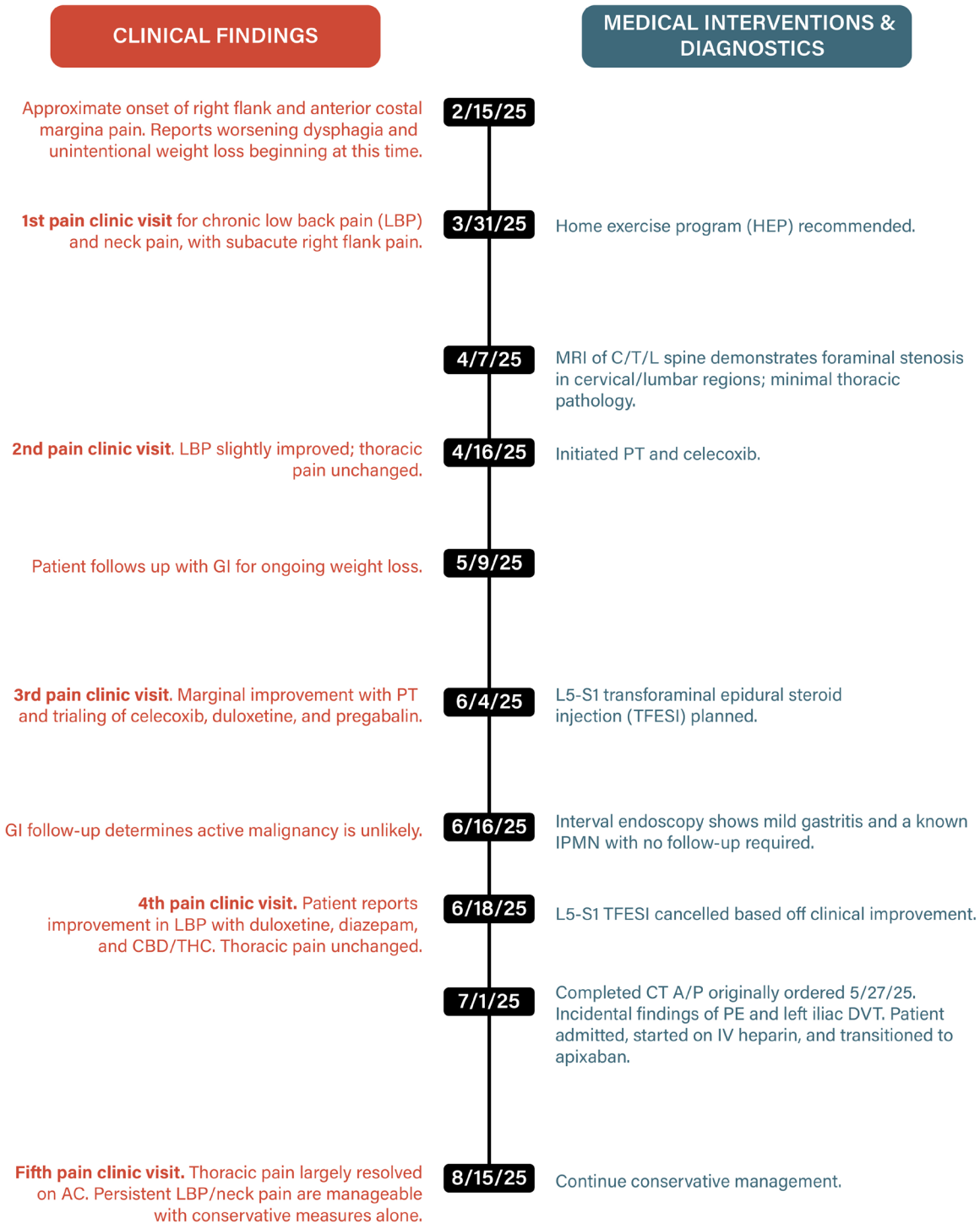

Suppl. Fig. S1. This figure describes the patient's overall timeline of care from the estimated onset of his thoracic back pain until his most recent visit postanticoagulation. Abbreviations: LBP, low back pain; GI, gastrointestinal; PT, physical therapy; CBD, cannabidiol; THC, tetrahydrocannabinol; AC, anticoagulation; HEP, home exercise program; MRI, magnetic resonance imaging; C/T/L, cervical, thoracic, lumbar; TFESI, transforaminal epidural steroid injection; IPMN, intraductal papillary mucinous neoplasm; CT A/P, computed tomography abdomen/pelvis; PE, pulmonary embolism; DVT, deep vein thrombosis.