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Pancoast Tumor Presenting as Neck Pain in the Chiropractic Office: A Case Report and Literature Review

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Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Patient: Male, 59-year-old
Final Diagnosis: Adenocarcinoma of the lung • pancoast tumor
Symptoms: Cough • neck and shoulder pain and numbness
Medication: —
Clinical Procedure: Magnetic resonance imaging (MRI) of the cervical and thoracic spine
Specialty: Infectious Diseases • Pulmonology • Radiology • Rehabilitation

Objective: Rare disease

Background: Pancoast tumors, also called superior sulcus tumors, are a rare type of cancer affecting the lung apex. These tumors can spread to the brachial plexus and spine and present with symptoms that appear to be of musculoskeletal origin.

Case Report: A 59-year-old Asian man presented to a chiropractor in Hong Kong with a 1-month history of neck and shoulder pain and numbness that had been treated unsuccessfully with exercise, medications, and acupuncture. He had an active history of tuberculosis, which was currently treated with antibiotics, and a 50-pack-year history of smoking. Cervical magnetic resonance imaging (MRI) was performed urgently, revealing a small cervical disc herniation thought to correspond with radicular symptoms. However, as the patient did not respond to a brief trial of care, a thoracic MRI was urgently ordered, revealing a large superior sulcus tumor invading the upper to mid-thoracic spine. The patient was referred for medical care and received radiotherapy and chemotherapy with a positive outcome. A literature review identified 6 previously published cases in which a patient presented to a chiropractor with an undiagnosed Pancoast tumor. All patients had shoulder, spine, and/or upper extremity pain.

Conclusions: Patients with a previously undiagnosed Pancoast tumor can present to chiropractors given that these tumors may invade the brachial plexus and spine, causing shoulder, spine, and/or upper extremity pain. Chiropractors should be aware of the clinical features and risk factors of Pancoast tumors to readily identify them and refer such patients for medical care.


Keywords: Chiropractic • Lung Neoplasms • *Mycobacterium tuberculosis* • Neck Pain • Pancoast Syndrome • Shoulder Pain

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Background

Pancoast tumors, also called superior sulcus tumors, are a rare type of lung cancer that invade the apical chest wall [1]. These tumors can be challenging to identify in practice and are often misdiagnosed, as their symptoms often resemble benign musculoskeletal conditions [2]. Pancoast tumors may invade the brachial plexus, sympathetic chain, and/or vertebral bodies, causing a constellation of symptoms termed Pancoast syndrome, which may include spinal, shoulder, and upper extremity pain and/or weakness, as well as Horner's syndrome [1,3]. The most common initial symptom of Pancoast tumors is shoulder pain [1].

Chiropractors only rarely encounter patients with undiagnosed cancer, yet these patients are important to identify and refer for medical care. In a 2012 survey of chiropractors in the United States, respondents reported encountering a patient with undiagnosed cancer about once every 8 years on average [4]. In another United States survey from 2014, chiropractors reported seeing patients with a bone tumor or metastasis less than once per year [5].

In the Hong Kong Special Administrative Region (HKSAR), the setting of the current case, it is unclear if chiropractors encounter a relatively higher or lower rate of cancer patients than in other countries. However, the incidence of tuberculosis in HKSAR is 10 times greater than that Western developed countries, with 0.6 of every 1000 persons developing tuberculosis per year [6]. Importantly, as illustrated in the current case, tuberculosis is a significant independent risk factor for lung cancer (hazard ratio of 1.6) [7].

Given the potential for chiropractors to rarely encounter patients with undiagnosed cancer, we present a case of Pancoast tumor invading the spine, which was first identified in a chiropractic office.

Case Report

Patient Information

A 59-year-old Asian man presented to a chiropractic clinic in HKSAR with a 1-month history of aching and numbness of his posterior neck and bilateral shoulders. He had an active 6-month history of tuberculosis, which caused an occasional productive cough, and was under medical treatment with a spectrum of antibiotics during this time (ie, isoniazid, rifampin, pyrazinamide, and ethambutol), as supervised by a specialty chest hospital with monthly follow-up visits and serial chest radiographs every 1-2 months.

The patient's tuberculosis was first suspected 6 months prior after he developed a cough and underwent chest radiography. This was followed up by a Mantoux test, which was strongly positive. His previous providers also initially scheduled a flexible fiberoptic bronchoscopy, but later canceled it as his sputum culture was positive for *Mycobacterium tuberculosis*, and chest computed tomography (CT) findings were compatible with tuberculosis. At this point he began pharmacologic treatment for tuberculosis with directly observed therapy, which continued through presentation to the chiropractic office.

He described that the neck pain began secondary to episodes of coughing and had negatively impacted his sleep quality. The patient reported an 8 out of 10 pain severity on the numeric rating scale. He had a 50-pack-year history of smoking, was a social drinker, and worked as an interior decorator. The patient had a medical history of hereditary elliptocytosis, and at age 33 had a spontaneous pneumothorax. He denied having a history of cancer. His family history was significant for lung cancer (mother) and hereditary elliptocytosis (father). The patient endorsed occasional hoarseness but denied any bowel or bladder symptoms.

Previous treatment for his neck pain directed by his primary care provider included prescription pain medications (nonsteroidal anti-inflammatory drugs and acetaminophen) and rehabilitation exercises provided by a physical therapist. The patient also had received acupuncture for his neck pain. As no previous treatments provided the patient relief, he sought out chiropractic care (Figure 1).

The patient's most recent chest radiograph report from 1 month prior reported patchy airspace opacities with a nodular appearance in the right upper lung zone, suggestive of pneumonia. Review of a report of his high-resolution computed tomography (CT) of the thorax from 6 months prior noted right apical fibrocalcific changes, mild bronchiectasis, tiny nodules up to 2 millimeters in both lungs, and shotty non-enlarged mediastinal and hilar lymph nodes. There was no mention of a suspicious lung mass or tumor in these reports.

Clinical Findings

On physical examination, the patient appeared physically fit. The chiropractor noted muscle hypertonicity of the paraspinal muscles from C5 to T2, rhomboids, and teres minors. Cervical range of motion was severely restricted in extension and right rotation and moderately restricted in all other planes. Maximal foraminal compression testing on each side exacerbated the patient's shoulder pain and paresthesia. A motor examination revealed 4/5 strength (Medical Research Council Scale) of the right deltoid, with pain.

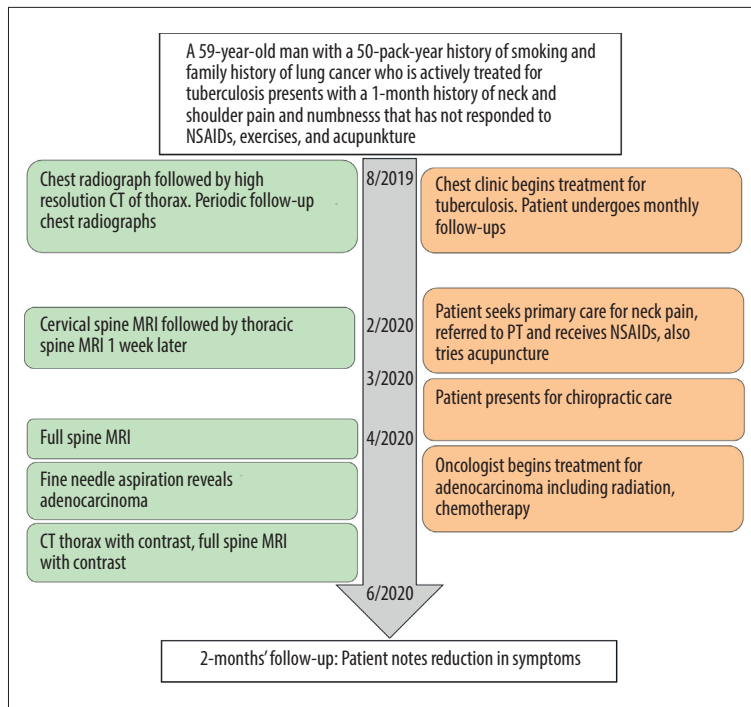


Figure 1. Clinical care timeline. Left – diagnostic testing. Right – treatments and visits. CT – computed tomography; MRI – magnetic resonance imaging; NSAIDs – nonsteroidal anti-inflammatory drugs; PT – physical therapy.

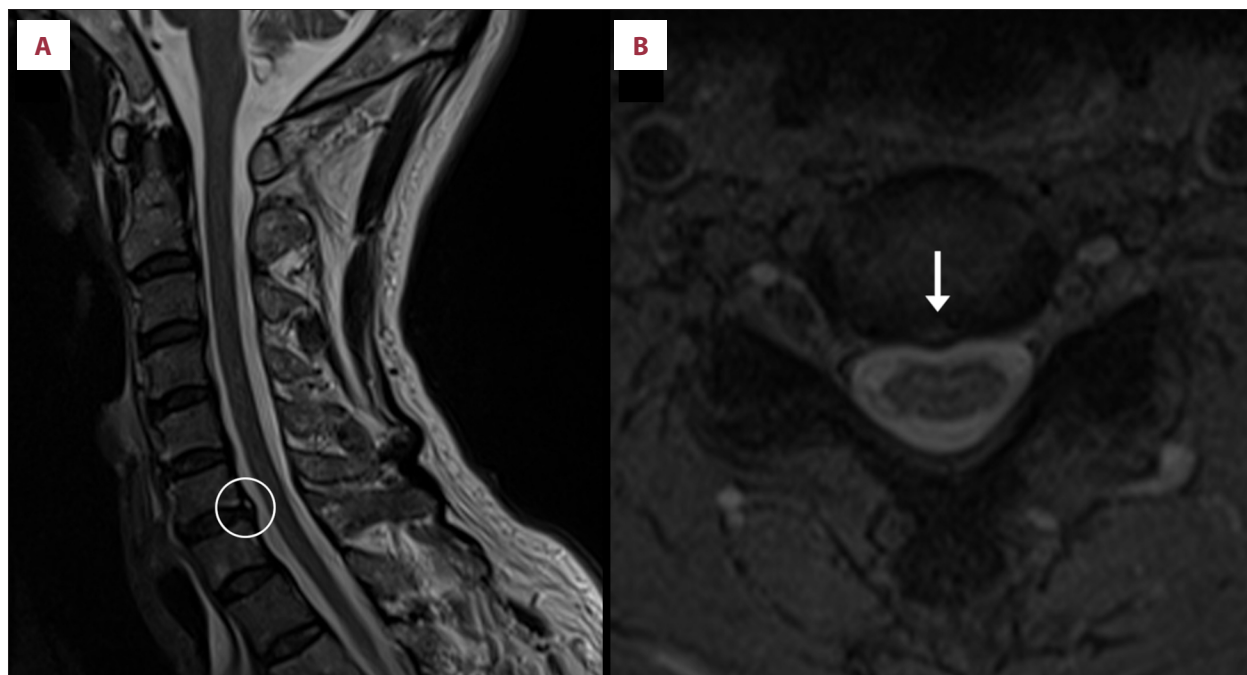


Figure 2. Cervical spine MRI. The T2-weighted mid-sagittal view (A) reveals a small cervical disc displacement at C6-7, with an annular fissure evident as a small area of high T2 signal within the outer intervertebral disc. The T2-weighted axial view at C6-7 (B) reveals a central disc protrusion of 2 millimeters in anteroposterior dimension and shows the annular fissure (arrow). There is no central canal or neuroforaminal stenosis at this level or other cervical levels (not shown).

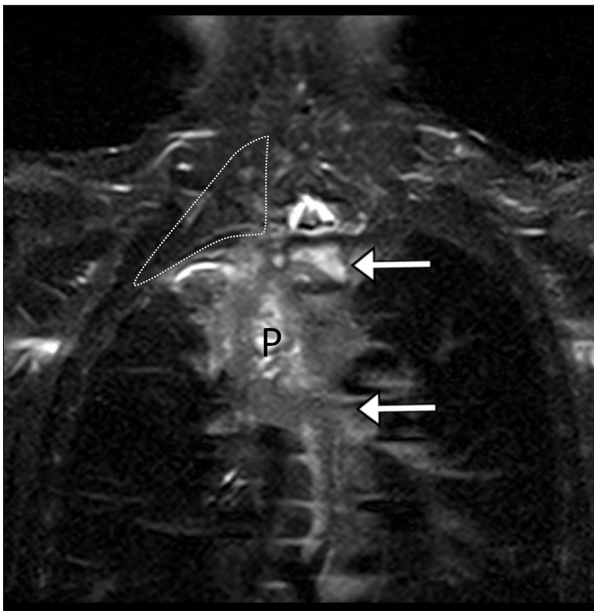


Figure 3. Thoracic spine short tau inversion recovery (STIR) MRI, coronal view. The Pancoast tumor (P) is visible as an abnormal, hyperintense mass in the medial right lung apex, superior mediastinum, and superior sulcus with associated vertebral infiltration which is visible from the spinal levels T2 (upper arrow) through T6 (lower arrow). Although the mass approximates the brachial plexus, which is faintly visible in the area within the dotted line, the extent of plexus involvement is difficult to evaluate as it is not well delineated in this thoracic MRI series. The mass measures 7.5 centimeters in the transverse plane (measurement not shown).

The chiropractor's differential diagnosis chiefly included discogenic C6 radiculopathy given the patient's neck and shoulder symptoms, deltoid weakness, and other examination findings. More serious pathology, including spinal tuberculosis, was also considered as a possibility. Considering the patient had severe pain, neurologic deficits, had failed previous conservative care, and had red flags including active tuberculosis, a family history of lung cancer, and history of smoking, the chiropractor ordered a cervical spine MRI on the day of the first visit, which was performed within the facilities' imaging center on an urgent basis. A cervical spine MRI was ordered initially as the patient's symptom distribution, sensory loss, and motor deficit suggested a mid- to lower cervical radiculopathy, involving the lateral regions of both shoulders and right deltoid weakness.

The cervical spine MRI revealed no serious pathology but did identify a small cervical disc protrusion at C6-7, without corresponding central canal or neuroforaminal stenosis (Figure 2). This was considered to correlate with the patient's suspected radicular symptoms. The patient consented to a trial of chiropractic care which began 2 days later, consisting of instrument assisted soft tissue manipulation, gentle spinal manipulative

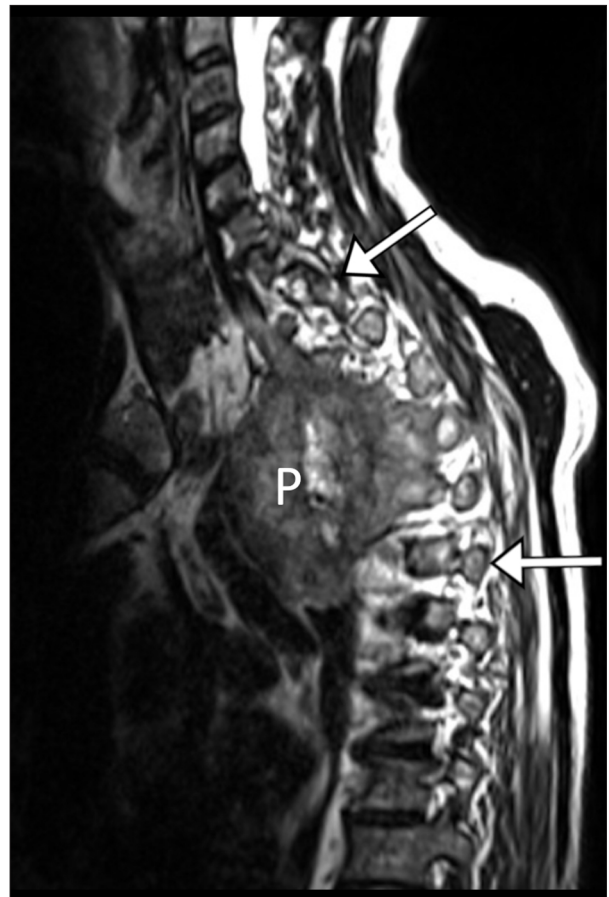


Figure 4. Thoracic spine T2-weighted MRI, right parasagittal view. The Pancoast tumor (P) is evident as a paraspinous mass anterior to and invading the upper-to-mid-thoracic spine. An abnormal hyperintense signal is seen in the thoracic vertebrae and/or ribs from T1 (upper arrow) through T6 (lower arrow), suggestive of tumor infiltration. The craniocaudal dimension of the mass is 8.7 centimeters (measurement not shown).

therapy via non-thrust joint mobilizations, and mechanical cervical flexion-distraction therapy. These therapies were applied daily for 4 consecutive days. Treatments were well-tolerated, and the patient reported that his pain severity initially reduced to a 4 out of 10 after treatments, but quickly returned to a severe level without lasting relief.

Given the patient's lack of response to care as well as his other risk factors and red flags for serious pathology, the chiropractor conferred with the supervising chiropractic clinician and a decision was made to arrange for an urgent thoracic spine MRI. The thoracic spine MRI was completed 1 week after the patient's initial presentation and revealed an abnormal mass in the medial right lung apex and superior mediastinum, which extended into the right paraspinous region and infiltrated the upper to mid-thoracic vertebrae (Figures 3-5).

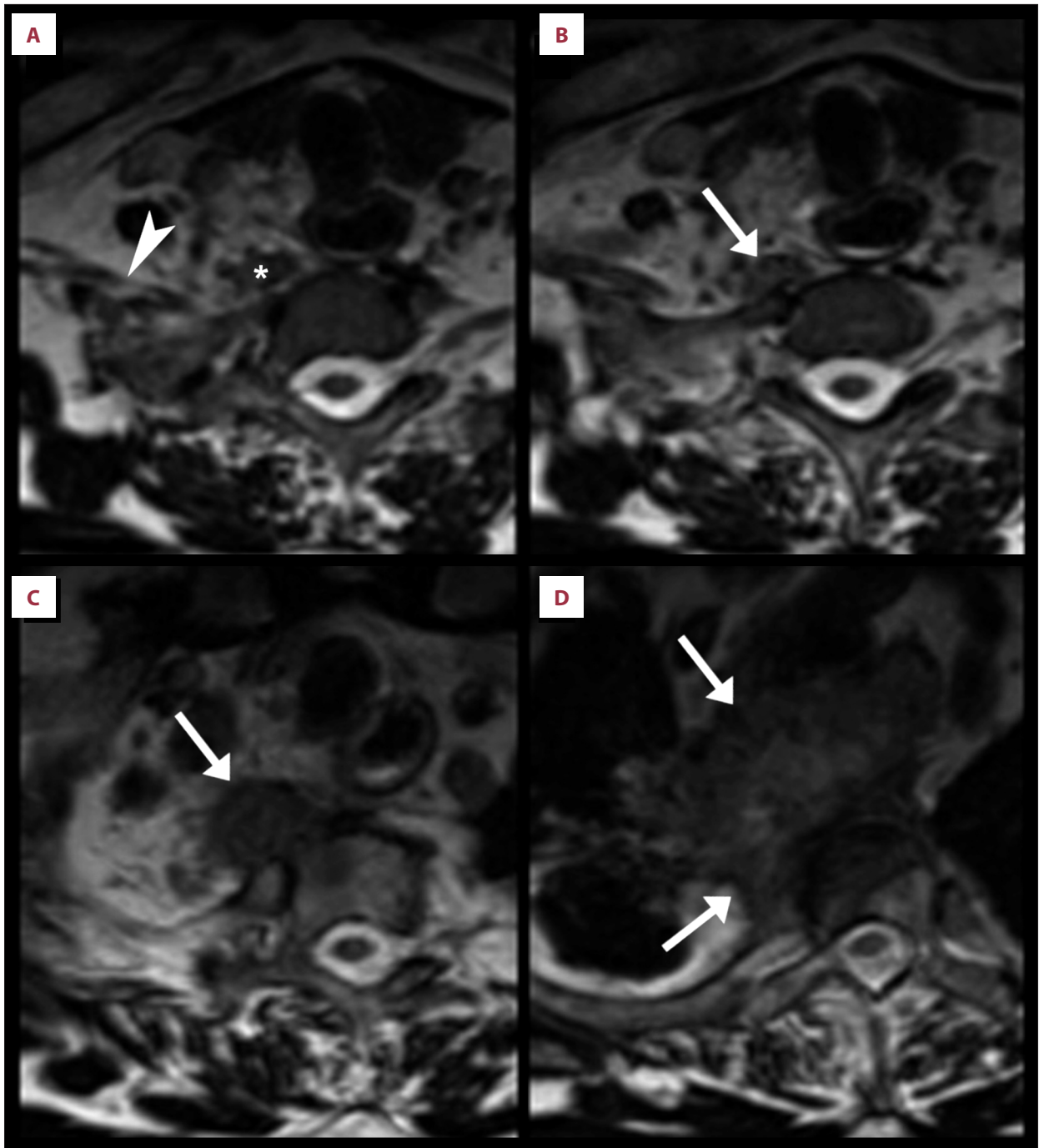


Figure 5. Upper thoracic axial T2-weighted MRI sections. An axial at the level of the first thoracic vertebra (A) shows part of the right brachial plexus (arrowhead) and a segment of swollen prevertebral muscle (*) just cranial to and likely related to the most superior aspect of the Pancoast tumor. The remainder of the brachial plexus is not well visualized due to being out of the field of view. Axials at the second thoracic (B), third thoracic (C), and fourth thoracic (D) show the Pancoast tumor as it becomes larger caudally (arrows).

Table 1. Patients with an undiagnosed Pancoast tumor presenting to a chiropractor.

Author	Year	Patient age	Sex	Symptoms	Risk factors or red flags	Initial means of diagnosis
Berntheizel	2021	52	M	Cervicothoracic pain with upper extremity radiation	Smoking	Identified via radiography
Chu (current case)	2022	59	M	Shoulder and neck pain and numbness	Smoking, tuberculosis	Identified via spinal magnetic resonance imaging
Deltoff	1985	68	M	Pain radiating into the C6, C7, and C8 dermatomes	NR	Not diagnosed by chiropractor, but after seeking medical care
Downs	1990	48	F	Neck, shoulder, axilla, and upper extremity symptoms	Smoking	Identified via cervical spine radiograph
Kim	1993	48	M	Neck and arm pain	Smoking	Not identified by chiropractor or cervical spine imaging. Patient diagnosed by neurosurgery
Patel	2003	51	M	Shoulder and arm pain	Smoking	Referred for medical workup by chiropractor
Weiner	2001	47	M	Neck and shoulder stiffness	Unintentional weight loss	Identified via radiography (spine, chest)

F – female; M – male; NR – not reported.

The radiologist noted the possibility of a Pancoast tumor and recommended further evaluation.

The chiropractor immediately referred the patient back to the chest hospital for further testing, which confirmed the diagnosis of a Pancoast tumor. The patient’s case was evaluated and managed by several specialists, including oncology and orthopedic spine surgery. CT-guided fine-needle aspiration was performed, revealing a histopathologic diagnosis of adenocarcinoma. The patient underwent follow-up CT of the thorax with contrast, which revealed areas of vertebral necrosis from T1 to T6. He also underwent full-spine MRI with gadolinium contrast, which additionally revealed an enhancing right epidural extension seen at the T2/3 to T5/6 disc levels causing cord compression and displacing the spinal cord to the left. Erosion and destruction of the corresponding head and contiguous part of right 3rd-5th ribs was also noted.

The spine surgery team deemed the patient to be ineligible for spine surgery due to the extent of the tumor invasion and necrotic involvement of multiple vertebral levels. The patient was initially treated with oral dexamethasone 4 mg qid and radiotherapy, then received ongoing chemotherapy under the care of an oncologist. After starting chemotherapy and radiotherapy, at 2 months’ follow-up the patient noted he currently felt lighter and had less severe neck and shoulder pain and numbness. He noted he could sleep longer but still had severe pain upon waking for 2-3 hours, which subsided through the day. Written informed consent was obtained from the patient to publish this case report and any accompanying images.

Discussion

In this case, the patient’s cervical disc herniation was likely not the cause of symptoms as it was small and not causing nerve compression. If the C6-7 disc had caused nerve compression, this would have more likely presented as a C7 radiculopathy with further distal symptoms [8]. While annular fissures can cause discogenic pain, these are frequently asymptomatic [9]. While neck pain was briefly reduced, it is possible this was due to a generalized hypoalgesic effect of spinal manipulation [10]. Conversely, the patient’s symptoms were improved with lasting effects via radiotherapy and chemotherapy, suggesting that the Pancoast tumor was responsible for his symptoms.

More specifically, the patient’s symptoms were likely caused by tumor invasion of the brachial plexus (ie, Pancoast syndrome). This is a common phenomenon in Pancoast tumors, which often involves the middle and inferior trunks of the brachial plexus [11]. In the current case, the middle trunk was potentially involved, as this gives rise to the axillary nerve and axillary superior lateral cutaneous nerve, and could account for both the patient’s deltoid weakness and shoulder numbness, respectively.

Pancoast tumors may be suspected via their risk factors, such as smoking, male sex, age in the 6th decade, clinical features of Pancoast syndrome, and imaging findings [11]. Radiographic series, in particular the anteroposterior lordotic view, may be a first step in evaluating for a Pancoast tumor [11]. However, these lesions can be missed by chest X-rays [1]. Chest CT can

be used to confirm the presence of an apical mass, while MRI may be used to characterize any brachial plexus or spinal involvement [1]. As in the current case, when neck, shoulder, and/or upper extremity symptoms and examination findings are not explained by cervical spine MRI, thoracic and/or brachial plexus MRI could be considered as next steps.

A literature search using the search terms “chiropractic,” “chiropractor,” “superior sulcus,” and “Pancoast” was conducted via PubMed, Google Scholar, and the Index to Chiropractic Literature on April 18, 2022, to identify other cases in which patients with an undiagnosed Pancoast tumor presented to a chiropractor. In addition, review articles on the topic of chiropractic case reports [12] and chiropractic care and cancer [13,14] were hand-searched for relevant cases. This search identified 6 articles [15-20], each describing a single patient with an undiagnosed Pancoast tumor who presented to a chiropractor. The clinical features of each previous case, including the current case (in total 7), were summarized (Table 1).

Among the previously published cases and current case, patients were predominantly male (6 of 7 cases), with a mean age of 53 (SD)±8 years. This limited sample is concordant with the epidemiologic features of Pancoast tumors, which have a male predominance and most often present in the 6th decade of life [11]. Multiple patients had a risk factor or red flag for lung cancer, which was commonly smoking (5 of 7 cases), while in the current case both smoking and tuberculosis were risk factors. In 5 cases [15,17,19,20], including the current case, the chiropractor identified the Pancoast tumor or referred the patient for medical evaluation, while in 2 cases the chiropractor did not identify or suspect the Pancoast tumor [16,18].

An important finding noted among these cases of Pancoast tumor presenting to chiropractors is that each patient presented with shoulder, spine, or upper extremity symptoms. While these are common symptoms of Pancoast tumors [1,11], they are also frequent concerns that prompt patients to seek chiropractic care in general [21]. It is thus possible that patients seek chiropractic care because they believe the symptoms to be benign and of a musculoskeletal origin.

The role of chiropractors involves not only treatment but examination, diagnosis, and case management. Importantly, chiropractors must conduct a thorough history and examination to assess for serious pathology. This helps guide the treatment and determine whether to administer high-velocity, low-amplitude spinal manipulation, which is contraindicated in the case of spinal malignancy [22]. In the current case, gentle manual therapy techniques were used as a precaution until there was more diagnostic information given the patient's extensive red flags.

Limitations

First, as a single case, the course of care may not be broadly generalizable, especially to countries with a low incidence of tuberculosis or different chiropractic practice characteristics. While chiropractors have the authority to order MRI in HKSAR and the United States [23,24], they may not be able to in other countries, given the scope of practice. Diagnostic imaging may be more commonly used by HKSAR chiropractors, with 36% using MRI at least sometimes [24], compared to 1% of chiropractors in other countries [21], which could have affected the diagnostic pathway in the current case. Alternatively, chiropractors who do not have MRI readily available may refer patients suspected of having Pancoast tumor to other medical specialists for further evaluation. Second, our conclusion that the patient's brachial plexus was involved was based on the available clinical and radiologic evidence, whereas electrodiagnostic testing and brachial plexus MRI could have made the exact neuroanatomical site(s) of involvement of the tumor clearer. Third, it is unclear if the patient's Pancoast tumor was simply missed in his previous chest imaging or was not readily visible, as images were unavailable from his chest hospital upon request and only imaging reports could be obtained. Likewise, exact details regarding the patient's chemotherapy, radiotherapy, and post-treatment imaging were unavailable. Fourth, the chiropractic clinician may have accelerated the diagnosis of Pancoast tumor by ordering thoracic MRI in addition to cervical MRI on the initial day of consultation, but the patient's clinical features guided the clinician's working diagnosis toward a cervical radiculopathy. While cost and scanning time of MRI may be general factors to consider, a more comprehensive, multi-region imaging strategy could be useful in patients at risk for lung cancer [25].

Conclusions

Chiropractors should be aware that patients may present to their office with shoulder, spine, or upper extremity pain caused by a previously undiagnosed Pancoast tumor, as its symptoms often resemble those of common musculoskeletal conditions. Typical risk factors for Pancoast tumor are illustrated in the current case, including male sex and smoking, while tuberculosis is another important risk factor in regions where it is endemic. Chiropractors should refer patients suspected of having Pancoast tumor in a timely manner for appropriate medical care.

Department and Institution Where Work Was Done

New Chiropractic and Physiotherapy Centre, EC Healthcare, Hong Kong.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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