Imaging findings of an extramedullary epidural metastatic small cell lung cancer tumor: a case report

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Abstract

Background: Extramedullary epidural metastatic tumors of small cell lung cancer (SCLC) are rare, and their clinical symptoms and imaging features lack specificity. This study was aimed at improving understanding of epidural metastatic SCLC tumors.

Case report: We present the case of a 75-year-old patient with an extramedullary epidural metastatic SCLC tumor that was misinterpreted as a primary intraspinal tumor according to preoperative CT and MRI resonance imaging. Laboratory test results for CA-153 (28.30 U/mL) were substantially abnormal. A solid, well-defined, soft tissue mass approximately 0.3 cm × 1.5 cm in diameter at the seventh and eighth thoracic canals was observed on CT and MRI images. A dural tail sign was observed on contrast-enhanced magnetic MRI. Because the tumor compressed the spinal cord, the intraspinal mass was resected, and the vertebral canal was decompressed. Pathological examination confirmed the diagnosis of an extramedullary epidural metastatic SCLC tumor.

Conclusions: Extramedullary epidural metastatic SCLC tumors lack clinical specificity. Imaging is helpful for early diagnosis, treatment, prediction of the disease course, and evaluation of curative effects. Ultimately, pathological examination and biopsy are required to confirm the diagnosis.

Keywords: Small cell lung cancer, intraspinal epidural metastatic tumor, radiologic features

1. INTRODUCTION

Lung cancer is the main cause of cancer-related mortality worldwide, and 2.1 million new cases and 1.8 million deaths were estimated to have occurred in 2018 [1]. Small-cell lung cancer (SCLC) is responsible for approximately 15% of lung cancer cases. This high-grade neuroendocrine carcinoma is characterized by an unusually high proliferation rate, a strong propensity for early metastasis, and an unusually poor prognosis [2]. SCLCs are observed predominantly in current or former smokers [3]. SCLCs have a wide range of metastatic sites, including the lungs, liver, brain, bone, adrenal glands, and lymph nodes [4]. Intraspinal and extramedullary metastatic SCLC tumors are rare [5]. Between 2010 and 2023, only eight cases were reported in the literature. Intraspinal metastatic tumors are relatively more likely to occur in older people with high-risk factors for malignant tumors [6], are more common in men than women, and are always observed at the level of the thoracic vertebra [7].

The clinical manifestations of intraspinal metastatic lung cancer are caused primarily by spinal cord compression. Patients can present with a variety of symptoms, including lumbar or neck pain, limb pain, limb weakness, paresthesia, sphincter dysfunction, and other sensory symptoms, which may eventually lead to urinary incontinence. More than 95% of patients experience back pain at the time of diagnosis [8]. Imaging is helpful for early diagnosis, treatment, prediction of the disease process, and evaluation of curative effects. The imaging and clinical data of a patient with an extramedullary epidural metastatic SCLC tumor diagnosed in our hospital were retrospectively analyzed to improve understanding of the disease.
2. CASE DESCRIPTION

A 75-year-old man was admitted to the hospital with backache and progressive weakness in both lower limbs. The patient was on bed rest and experienced sudden weakness in both lower limbs, accompanied by abdominal distension, urine retention, and limb numbness and discomfort below the costal margin, which manifested as progressive aggravation. The patient was admitted to our hospital for diagnosis and treatment. Physical examination revealed tenderness and percussion pain in the spinous and paraspinal process of the seventh and eighth thoracic vertebrae, and a positive Babinski sign in both lower limbs. The laboratory test results for CA-153 (28.30 U/mL) were substantially abnormal. The patient had no history of malignancy but had smoked for more than 50 years.

A plain CT scan of the spine revealed a round epidural soft tissue density mass in the seventh and eighth thoracic spinal canal, with clear boundaries and a smooth appearance (Figure 1). A magnetic resonance imaging (MRI) plain scan showed that the seventh and eighth thoracic spinal epidural round mass presented as an isosignal on T1-weighted imaging and was slightly hyperintense on T2-weighted imaging, with a clear boundary and smooth shape. The lesion was approximately 1.4 cm × 0.3 cm × 1.5 cm, and showed clear uniform enhancement on contrast-enhanced MRI. The spinal canal and right foramina at the level of the seventh and eighth thoracic vertebrae were enlarged, the spinal cord was compressed and flattened, and the right nerve root was invaded by compression. The bone of the tenth thoracic vertebra was notably hypointense on T1-weighted imaging and markedly enhanced on contrast-enhanced MRI (Figure 2). The nature of the seventh and eighth thoracic epidural soft tissue masses needed to be combined with histological biopsy for a definite diagnosis. What’s more, destruction of the T10 vertebral body was observed.

The patient underwent resection of the thoracic seventh and eighth intravertebral masses to relieve spinal canal decompression, under general anesthesia. Intraoperatively, seventh and eighth intravertebral tumors with bleeding and necrosis were observed. Postoperative gross pathological examination revealed a well-defined solid grayish soft-tissue mass with bleeding and necrosis. Microscopic examination revealed that the tumor cells had a nest-like distribution and invasive growth. The cell morphology showed either bare or oat-like nuclei. The atypia of substantial cells was observed, and the mitotic figures was easily visible (Figure 3). Immunohistochemistry findings indicated CD20(-), CD3(-), CD56(+), CD99(-), CgA(+), CK-P(±), EMA(-), Ki-67(+70%), neuron-specific enolase (NSE) (+), Syn(+), Vimentin(-), and TTF-1(+). The patient was pathologically diagnosed with an intraspinal metastatic (seventh and eighth thoracic epidural) SCLC tumor. The patient underwent a chest CT examination, and the chest CT plain scan and contrast-enhanced CT examination showed irregular soft tissue density mass (CT value of approximately 26.8 Hu) in the dorsal segment of the left lower lobe of the lung, with uniform density and regular boundaries. The maximum cross section size was approximately 6.3 cm × 5.1 cm, and no clear enhancement was observed on the contrast-enhanced CT (CT value of approximately 44.0 Hu). A small low-density patellar shadow was observed in the mass, which was clearly demarcated from the thoracic aorta and adhered to the adjacent pleura (its nature is yet to be confirmed; Figure 4). The patient and the patient’s family refused further diagnosis. The patient died 1 year after discharge because of discontinuation of treatment.

3. DISCUSSION

Lung cancer is the leading cause of cancer-associated deaths worldwide. Lung cancer is divided into two subtypes: SCLC, accounting for approximately 15% of all lung cancers, and non-small cell lung cancer [9]. SCLC tumors have high malignancy and invasiveness, and tend to undergo early distant metastasis. In most cases, the initial manifestation is a metastatic tumor rather
than a primary tumor. SCLC grows rapidly; some patients without tumors show formation of tumors in the lungs within 1 year. Nervous system metastasis is relatively common in the brain but rarely occurs in the spinal canal [10]. Intramedullary metastatic tumors can be divided into intramedullary, extramedullary, and extradural epidural metastatic tumors. Intramedullary and intradural metastatic tumors are rarer than epidural metastatic tumors and account for only 5% of all spinal metastatic tumors [11]. The main routes of metastasis

Figure 2 | Extramedullary epidural metastases from small cell lung cancer on plain MRI.
(a) T1-weighted imaging. (b) T2-weighted imaging. (c) T2-weighted imaging in the coronal position. (d) Contrast-enhanced T1-weighted imaging in the sagittal position. (e) T1-weighted imaging in the axial position. (f) Contrast-enhanced T1-weighted imaging in the axial position. The extramedullary epidural tumor is clearly visible (white arrow) in a), b), and c). This mass was isointense on T1WI and slightly isointense on T2WI, and was well demarcated from the surrounding tissue. The spinal cord is shown to be compressed and displaced (white arrow) in b), c), e), and f). The tumor is clearly and uniformly enhanced in d). In addition, a clear dural tail sign indicated that the mass was not located in the spinal cord. The intensity of the tenth thoracic vertebral body was abnormal. The hypointensity on T1WI and T2WI in a) and b) is significantly enhanced (white arrow) in d).
may be transarterial metastasis, transvertebral venous metastasis, spread through the subarachnoid space, or adjacent lesions directly invading the spinal canal [12]. Although our patient had no clear history of SCLC, the diagnosis was confirmed by pathological examination after surgery. Therefore, the likelihood of tumor cells spreading through the cerebrospinal fluid (CSF) circulation into the spinal cord subarachnoid space was high. However, an abnormal signal shadow was also found in the T10 vertebra, and the possibility of coexisting vertebral metastases could not be ruled out.

Clinical manifestations of extramedullary epidural metastatic SCLC tumors are atypical and are caused mainly by spinal cord compression. Depending on the tumor location, various symptoms may be present, including back or neck pain, limb pain in the arms and legs, upper and lower limb weakness, paresthesia, sphincter dysfunction, and other sensory symptoms leading to incontinence. Some lesions may also be asymptomatic and discovered incidentally [13]. In patients with SCLC, NSE levels are often elevated in laboratory tests [14]. The main clinical symptoms of the patient reported in this study were lumbago, progressive lower limb weakness, and a slight increase in CA153. In addition, the patient presented no clear symptoms or signs, and had no history of tumors. In a reported case of an epidural metastatic SCLC tumor, the patient had a history of malignancy [15]. Our patient had no history of malignancy before surgery. When patients with extramedullary epidural metastatic SCLC do not have a clear tumor history, misdiagnosis is likely to occur in clinical practice, thus resulting in missed opportunities for patients to receive the best treatments.

MRI is the preferred imaging method for the diagnosis of intraspinal lesions, because of its excellent soft-tissue contrast at high spatial resolution. However, the imaging findings of intraspinal epidural metastatic lung cancer tumors lack specificity and usually manifest as intraspinal epidural soft tissue masses. In our patient, MRI showed a fusiform isosignal or hypointensity on T1-weighted imaging; and an isosignal or hyperintensity on T2-weighted imaging, with clear and smooth edges, spinal cord compression and displacement, a relatively limited lesion area, often accompanied by ipsilateral subarachnoid space narrowing, and substantial enhancement on contrast-enhanced MRI. In addition, a dural tail sign was seen, thus indicating that

Figure 3 | Microscopic examination of extramedullary epidural metastases from small cell lung cancer.
Microscopy revealed a nest-like distribution of tumor cells and invasive growth. The cell morphology showed either bare or oat-like nuclei. The atypia of substantial cells was observed, and the mitotic figures was easily visualized. Hematoxylin and eosin staining, original magnification × 200.

Figure 4 | Extramedullary epidural metastases from small cell lung cancer on spinal CT.
(a) Lung window. (b) Arterial phase. (c) Delayed phase. An irregular large mass was observed in the dorsal segment of the left inferior lobe (white arrow) on the chest CT. This mass wrapped around the descending aorta, and its density was similar to that of the descending aorta in a). Its boundary was regular, and the maximum cross section size of the mass was approximately 6.3 cm × 5.1 cm. This mass is not clearly or uniformly enhanced in b) and c), and substantial areas of unenhanced tissue, which might have been necrotic, were observed. The lesion was delimited from the thoracic aorta and adhered to the adjacent pleura.
the mass was not located in the spinal cord. Positron emission tomography can contribute to the diagnosis of intraspinal metastatic tumor of lung cancer and may aid in evaluating disease spread [16]. In our case, imaging examination revealed a rounded mass with smooth edges, was initially misdiagnosed as a primary intraspinal tumor, owing to the absence of a history of primary tumors. At present, the gold standard for final diagnosis of intraspinal epidural metastatic lung cancer relies on pathological biopsy. The tumor in our patient was located outside the spinal cord. The main surgical method was tumor removal, with the aims of relieving the compression of the spinal cord and alleviating the patient's symptoms.

Clinical and imaging manifestations of intraspinal epidural metastatic SCLC lack specificity. Therefore, intraspinal epidural metastatic SCLC tumors must be differentiated from primary epidural tumors, such as lymphomas and cavernous hemangiomas. Lymphoma usually occurs in men 50–70 years of age, and is relatively more common in the epidural space, in which it presents as an epidural soft tissue mass with vertebral bone destruction. Because of the limited spinal canal space and rapid tumor growth, most intraspinal lymphomas involve a wide range of sites. The tumor is observed as an isosignal or slight hypointensity on T1-weighted imaging, or isosignal or slight hyperintensity on T2-weighted imaging, and is significantly enhanced on contrast-enhanced MRI. This signal characteristic may be associated with the high cell composition and low interstitial, and relatively low water content of lymphomas [17]. If a lymphoma involves vertebral osteopathy, and no primary tumor lesion is found in the metastatic tumor, distinguishing between diseases is difficult. Cavernous hemangioma is commonly seen in young and middle-aged adults; the disease manifests as an epidural fusiform space mass with clear boundaries, which can grow across the intervertebral foramen, is progressively uniform, and shows substantial enhancement on contrast-enhanced MRI. The spinal cord is wrapped by a pincer-like shape, and consequently is compressed and displaced, and no clear bone destruction, what's more, it can be combined with adjacent vertebral hemangioma with adjacent vertebral hemangioma [18], whereas metastatic tumors are commonly seen in older people with multiple primary tumor lesions. In addition, the neoplastic marker NSE in SCLC aids in differential diagnosis. Imaging examination is helpful for early diagnosis, treatment, prediction of the disease course, and evaluation of treatment efficacy for intraspinal epidural metastatic SCLC tumors. Diagnosis should be comprehensively considered in combination with clinical manifestations, imaging findings, laboratory examination findings, and epidemiological data; moreover, the final diagnosis should be confirmed through pathological examination and biopsy.

When the possibility of spinal cord compression by a metastatic tumor is found, glucocorticoid therapy should be administered in a timely manner to decrease inflammation and edema in patients [19]. The main treatment methods for intraspinal metastatic tumors are surgery and radiotherapy. Radiation myelopathy is one of the most serious complications associated with radiotherapy [20]. In summary, the overall prognosis of intraspinal metastatic tumors is extremely poor. In traditional surgery, an appropriate approach and vertebral body fixation should be selected according to the tumor site and adjacent tissue structure, and a combined approach can be used if necessary. Minimally invasive treatment of metastatic tumors may result in a similar prognosis but fewer surgical complications than conventional surgery; however, this modality is relatively less studied. Low-dose radiotherapy can be used in patients with a short expected survival time who wish to relieve their symptoms, whereas high-dose radiotherapy is recommended for patients with longer expected survival, to decrease the recurrence rate. After radical surgical excision and sequential radiotherapy, patients remain at risk of short-term recurrence, and follow-up is recommended within 1–3 months. Subsequently, follow-up examinations should be performed every 3–4 months for 1 year and continued according to clinical needs thereafter [21].

In conclusion, the clinical and imaging features of intraspinal metastatic SCLC tumors lack specificity, and the disease is relatively rare. Owing to the unclear nature of lung neoplastic lesions before surgery, misdiagnosis of intraspinal epidural metastatic tumors is possible. In older patients with intraspinal tumors, intraspinal metastatic lung cancer should be included in the differential diagnosis.

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CONFLICTS OF INTEREST

The authors have no potential conflicts of interest.

ABBREVIATIONS

CT, computed tomography; MRI, magnetic resonance imaging.

REFERENCES