Unexplained pain and weakness, i.e., without obvious predisposing factors, are often encountered by physiatrists and efforts should be made to determine the cause. A 63-year-old male presented with radiating pain in his right arm and mild weakness of the right hand. An electrodiagnostic examination revealed distal symmetric sensory polyneuropathy in the upper and lower extremities, and denervation potentials in the forearm muscles, which were inconsistent with the cervical spine MRI images and symptoms. A predisposing undiscovered disease was revealed, i.e., squamous cell carcinoma in the lung; brain metastasis affecting the left primary motor cortex was also detected. Therefore, we concluded that the pain and weakness were related to paraneoplastic syndrome and brain metastases of the hand knob. The observed denervation potentials were characterized as trans-synaptic changes in the brain metastasis. This case highlights the importance of unexplainable focal pain and weakness in the increasing prevalence of cancer. (Clinical Pain 2019;18:88-91)

**Key Words:** Lung cancer, Squamous cell carcinoma, Paraneoplastic syndrome

### INTRODUCTION

Unexplained pain and weakness are often encountered by physiatrists in the clinic; incidental sensory polyneuropathy and incidental denervation potentials are also frequently detected. The clinical importance of sensory only polyneuropathy and incidental denervation potentials tend to be overlooked by clinicians due to its typically benign course and the absence of proper treatment. However, pain and weakness are common symptoms of sensory neuropathies caused by paraneoplastic syndrome. Thus, sensory polyneuropathy, or a subtle change in incidental denervation potentials, may suggest a hidden disease.

This case report describes incidental sensory polyneuropathy caused by paraneoplastic syndrome. The weakness was finally determined to be caused by trans-synaptic denervation of brain metastases in the primary motor cortex area corresponding to the hand. This case highlights the importance of checking for incidental sensory polyneuropathy and denervation potentials when seeking to determine the cause of unexplained focal pain.

### CASE REPORT

A 63-year-old male visited the Department of Neurosurgery for radiating pain in his right arm and elbow with mild weakness of the right hand, especially in the fourth and fifth fingers. Cervical spine magnetic resonance imaging (MRI) showed minimal central disc protrusion at C6 7, mild central disc protrusion, and C6 7 spondylosis. He was referred for an electrodiagnostic study to evaluate weakness inconsistent with the MRI findings. The weakness had been present for 1 month. Weakness of the right upper limb was diffuse, but was more severe in the right hand. The degree of weakness was stable and had not progressed rapidly dur-
ing the past month. Physical and neurological examinations revealed no Hoffmann reflex in either hand. The deep tendon reflexes of the biceps and triceps brachii muscles were normal. A manual muscle test revealed a fair to fair + grade for the right elbow flexor and wrist extensor, a fair grade for the elbow extensor and finger flexor, and a poor + grade for the finger abductor.

Nerve conduction studies revealed distal symmetric sensory polyneuropathy in both the upper and lower extremities (Table 1). Needle electromyography showed a denervation potential of the right pronator teres and extensor carpi radialis longus muscles. The patient was diagnosed with mid to C6 and C7 radiculopathies. However, the findings were inconsistent with his symptoms.

The patient's sensory polyneuropathy could not be explained by his medical or social history, which was characterized by the absence of diabetes, vascular disease, heavy alcohol use, and poisoning. Thus, a physiatrist and a neurosurgeon analyzed the abnormal electrodiagnostic findings.

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Site</th>
<th>Latency of onset (ms)</th>
<th>Amplitude (μV)</th>
<th>NCV (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rt. median sensory</td>
<td>Wrist</td>
<td>2.6</td>
<td>12.5 μV</td>
<td>53.8</td>
</tr>
<tr>
<td>Rt. ulnar sensory</td>
<td>Wrist</td>
<td>2.7</td>
<td>6.6 μV</td>
<td>52.0</td>
</tr>
<tr>
<td>Rt. sural</td>
<td>Calf</td>
<td>3.2</td>
<td>6.3 μV</td>
<td>43.0</td>
</tr>
<tr>
<td>Lt. sural</td>
<td>Calf</td>
<td>3.2</td>
<td>2.5 μV</td>
<td>43.0</td>
</tr>
<tr>
<td>Rt. ulnar motor</td>
<td>Wrist</td>
<td>2.5</td>
<td>9.8 mV</td>
<td></td>
</tr>
<tr>
<td>(recorded on ADM)</td>
<td>Elbow</td>
<td>6.3</td>
<td>8.6 mV</td>
<td>56.0</td>
</tr>
</tbody>
</table>

NCV: nerve conduction velocity, Lt.: left, Rt.: right, ADM: abductor digiti minimi.

**Fig. 1.** Computed tomography scan showed a 7.2 cm heterogeneously enhancing mass with necrosis in the right lower lobe anterobasal segment. (A, B) Axial images of the lung, (C) coronal image of the lung, (D) sagittal image of the lung.
and referred the patient to the internal medicine department for a work up of the malignancy. Chest computed tomography (CT) performed by a pulmonologist revealed a 7.2-cm heterogeneously enhancing mass in the right lower lobe anterobasal segment (Fig. 1) that was diagnosed as squamous cell carcinoma on biopsy.

After diagnosing lung cancer, enhanced brain MRI was performed to evaluate the metastasis. Brain MRI revealed a 2.4 × 2.0 × 2.5-cm necrotic mass with vasogenic edema in the left ‘hand knob’ of the primary motor cortex (Fig. 2). The metastatic lesion was consistent with the motor area corresponding to the patient’s weak right arm and hand. Thus, we concluded that the weakness in the right upper limb was induced by a brain metastasis in the primary motor area. In addition, peripheral neuropathy and paraneoplastic syndrome may have contributed to the pain. Despite not testing for the anti-Hu antibody or other paraneoplastic syndrome antibodies, due to a lack of insurance coverage, we concluded that the sensory polyneuropathy was related to paraneoplastic syndrome, and that the hand weakness was caused by brain metastases in the primary motor cortex corresponding to the hand. Indeed, denervation potentials in the right forearm were not explained by MRI images of the cervical spine, nor by any other nerve conduction studies. The physiatrist presumed that the cause of the incidental denervation potentials in the right forearm was trans-synaptic denervation with brain metastasis. However, the exact cause of the denervation potentials was not fully revealed. The patient was referred to another hospital for further radiotherapy and oncological treatment.

DISCUSSION

Focal radiating pain and mild weakness is commonly seen by clinicians. Focal radiating pain of an upper limb and mild weakness may typically present as cervical radi-
culopathy, and the radiating area would differ with the standard radicular patterns.\(^5\) On the other hand, weakness after severe pain, pain without weakness, and sudden, painless weakness due to neuralgic amyotrophy are only occasionally encountered by clinicians.\(^6\) Focal neurologic deficit, manifesting as pain or focal weakness, is the second most common symptom (seen in 40% of cases) of intracranial metastasis. An intracranial malignancy may initially present as an occult malignancy (precocious presentation) in up to 10% of patients.\(^7,8\) In this case, unilateral hand clumsiness was part of the initial presentation, with metastasis in the hand knob (primary motor cortical area corresponding to the hand) being diagnosed in association with non-small-cell lung cancer. We characterized the unexplained focal weakness of the upper limb, based on an electrodiagnostic study, as incidental un-explainable sensory neuropathy, following which we detected the primary cancer and brain metastasis.

Sensory neuropathy is the most prevalent paraneoplastic neurological syndrome. This type of paraneoplastic neuropathy may be associated with T-cell-mediated processes in the dorsal root ganglia. Small-cell lung cancer is most frequently associated with paraneoplastic neuropathy. Non-small-cell lung cancer has been reported in 7.9% of cases of total paraneoplastic neuropathy.\(^9\) In this case, when we found unexplained sensory neuropathy, we used CT to examine the possibility of hidden malignancies of the lung. We did not test for paraneoplastic antibodies, such as the anti-Hu antibody, as this was not covered by the patient’s national insurance. Instead, we sought to determine the origin of the cancer, and the non-small-cell lung cancer and metastasis were thus revealed. Pain developed in 57.6% of patients with peripheral neuropathy caused by paraneoplastic syndrome. In addition, pain is the second most common initial manifestation of paraneoplastic peripheral neuropathy.\(^1\) Thus, in this case the physiatrist investigated the unexplained pain and incidental sensory neuropathy to determine whether there was a hidden disease.

Unexplained polyneuropathy or incidental denervation potentials is uncommon. When axonal sensory polyneuropathy or denervation potentials do not correlate with a patient’s symptoms, clinicians should keep other less commonly sought etiologies in mind. This case highlights the importance of proper concern on the part of physicians with regard to unexplained focal weakness and subtle changes in nerve conduction studies and needle electromyography.

**DISCLOSURE STATEMENT**

The authors declare no financial or other conflicts of interest.

**REFERENCES**