Long thoracic neuropathy caused by an apical pulmonary tumor

Case report

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Long thoracic nerve palsy has been reported to have traumatic, iatrogenic, and idiopathic causes. The authors describe the case of a 62-year-old man who presented with progressively worsening right shoulder pain, winging of the scapula, and Horner syndrome. A chest CT scan revealed an apical pulmonary mass. To our knowledge, this is the first report of a long thoracic nerve palsy caused by an apical pulmonary tumor.

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Key Words • apical pulmonary tumor • electromyography • long thoracic nerve palsy • winging of the scapula

Long thoracic nerve palsy manifests with winging of the scapula caused by paralysis of the SAM. Traumatic (often sports-related), iatrogenic (from surgery or anesthesia), and idiopathic causes have all been reported.7,11 We describe the case of a patient who presented with an LTN palsy and was found to have an apical pulmonary tumor. To our knowledge, this is the first report of an LTN palsy caused by an apical pulmonary tumor.

Case Report

This 62-year-old, right-handed man presented with a 6-month history of progressively worsening right shoulder, scapular, and chest pain that radiated to his right elbow. The patient was a farmer and had a medical history significant for hypertension, hypercholesterolemia, and newly diagnosed diabetes mellitus. He initially presented to the emergency department 2 months after the onset of right back pain symptoms and was noted to have winging of the right scapula only. The scapula was displaced posteriorly. He had previously had a 15 pack-year smoking history, but had been abstinent since the age of 31.

Thoracic spine radiographs with views of the chest were nondiagnostic. Electromyography of the right upper extremity showed chronic neurogenic changes in the SAM. No specific fibrillations were noted, and there was no insertional or spontaneous activity. There was increased amplitude and duration of motor unit action potentials and a few polyphasic action potentials. There was no evidence of a right cervical root lesion. Nerve conduction studies revealed low sensory amplitudes and prolonged right median sensory and motor distal latencies suggestive of sensory neuropathy and carpal tunnel syndrome. There was also slowing of the right ulnar nerve conduction across the elbow. The patient had no symptoms related to these nerve conduction findings.

An MR image of the cervical spine showed degenerative disc changes most significant at C4–5 contributing to spinal canal stenosis without obvious cord compression.

The patient received physical therapy and medical management without improvement of his symptoms. On presentation to the neurosurgery service he complained of progressive pain in his right arm and over the right side of his chest. Physical examination revealed full range of motion of the neck and no right shoulder pain. A new right-sided Horner syndrome was noted. The patient had not noted any pupillary or eyelid changes but did report right facial anhidrosis. There was winging of the right scapula. The results of motor and sensory examinations were otherwise unremarkable.

A CT scan of the chest revealed a right apical lung mass with extension into and compression of the right brachial plexus (Figs. 1 and 2). There were multiple bone lytic lesions and mediastinal, subcarinal, and contralat-

Abbreviations used in this paper: LTN = long thoracic nerve; SAM = serratus anterior muscle.
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eral supraclavicular lymphadenopathy. Treatment options including surgical removal, chemotherapy, and radiation therapy were declined by the patient.

**Discussion**

Charles Bell first described the LTN in 1827, calling it the “external respiratory nerve.” Horwitz and Tocantis dissected this nerve in 100 cadavers and published a detailed anatomy in 1938.

The LTN is a motor nerve, a supraclavicular branch of the brachial plexus that measures 24–30 cm long and originates from the fifth, sixth, and seventh cervical roots. In rare instances the eighth cervical root also contributes fibers. The fifth and sixth cervical roots pass through the scalenus medius muscle to form the upper division of the LTN, while the seventh cervical root passes anterior to this muscle and joins the upper division of the LTN caudally in the axillary region. The trajectory of the LTN is deep to the clavicle, passing over the first rib. The nerve descends

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**Fig. 1.** Contrast-enhanced, axial CT scan of the chest showing a 6.3 x 5.6 x 4.6–cm soft tissue mass abutting the mediastinal pleura and right posterolateral wall of the trachea at the right lung apex.

**Fig. 2.** Contrast-enhanced, coronal CT scan of the chest demonstrating the soft tissue mass at the right lung apex. This mass surrounds and narrows the proximal portion of all the right upper lobe segmental bronchi.
dorsally, parallel to the brachial plexus and the first part of the axillary artery. The LTN then passes along the lateral aspect of the chest wall, extending to the ninth rib and supplying branches to each of the digitations of the SAM.

The thoracic inlet can be divided into anterior, middle, and posterior components. The anterior compartment extends from the sternum up to the anterior edge of the scalene muscle. The middle compartment extends from the anterior scalene up to the posterior border of the middle scalene. The posterior compartment extends behind the middle scalene muscles, and the LTN is located in the posterior compartment.

Lesions located in each distinct region of the thoracic inlet can give rise to slightly different clinical presentations depending on the location and structures involved. The LTN can be compressed if a tumor is in the posterior compartment of the thoracic inlet.

Injuries or neuropathies of the LTN can lead to SAM palsy, which causes winging of the scapula; this was first reported by Velpeau in 1825. In 1913, Skillern proposed its correction and Thorec reported a postoperative occurrence in 1926. If the scapula is fixed, this muscle may act as an inspiratory muscle by elevating the ribs, which explains the ancient name, “external respiratory nerve,” given to the long thoracic nerve. When SAM functioning is impaired, the vertebral border of the scapula protrudes dorso-medially (hence the term “winging”), the shoulder droops, and the arm cannot be raised above 90° when extended laterally.

Long thoracic nerve palsy is often sports related. Another cause of LTN is blunt-force or penetrating trauma, and the superficial anatomical location of this nerve makes it more susceptible to injury. Iatrogenic causes account for 11% of LTN palsies; posterolateral thoracotomies for apical lung tumors or cardiac congenital anomalies are known to have this complication. About 17% of cases are idiopathic. Other rare reports include hematoma and serratus anterior nerve palsy. In their series of 197 patients, Vastamäki and Kauppila described the causes of LTN palsy as acute trauma in 26%, strenuous work or sports activities in 35%, locally invasive procedures in 11%, infection in 6.6%, idiopathic causes in 15%, and miscellaneous reasons in 1.5%. In 5% of their patients, paralysis occurred after general or spinal anesthesia. The median age of patients in their series was 29 years, which makes sense given that most LTN palsies are caused by work and sports activities, and therefore LTN paralysis is not unexpected among young adults. Vastamäki and Kauppila strongly believe that trauma is the main causative factor in LTN palsy. These authors believe that even cases that occur during anesthesia are more the result of arm positioning during the procedure than of the toxic effect of anesthetic agents or an infectious neuropathy.

There are no reports of LTN palsy secondary to apical lung tumor, and this condition is probably underrecognized because winging of the scapula is missed by the patient, physician, or both because of the distracting severity of the coexisting lung cancer.

The LTN palsy in our patient was caused by an apical mass called a Pancoast tumor. This lesion is classically defined as a mass involving the apex and lower roots of the brachial plexus, causing radiating pain down the arm, and involving the stellate ganglion, which is in turn responsible for Horner syndrome. Most current reports include any patient with a tumor in the lung apex with or without Horner syndrome or brachial radiculopathy. The pulmonary mass grows at the posterior compartment of the thoracic inlet, incorporating the portion of the LTN that passes through the inlet and causing damage to the nerve. The mass in our patient also involved sympathetic ganglia C8–T2 and was responsible for the finding of Horner syndrome.

We discovered the LTN palsy during evaluation for a possible cervical spine lesion. This patient presented with a winged scapula due to LTN palsy. Because this patient is a farmer, traumatic causes were initially considered. Cervical spine MR images did not show spinal cord injury or proximal nerve root compression that could be the cause of the clinical manifestations of this nerve injury in our patient. Associated symptoms such as Horner syndrome, which caused us to suspect an upper thoracic lesion, were definitely the main reason for further exploration of the causes of winging, and the patient’s chest CT scan revealed a right apical pulmonary mass involving the LTN, confirming our suspicion of the cause of injury. Tumor removal, radiation, and chemotherapy were all suggested, but the patient declined treatment.

Serratus anterior muscle palsy can be difficult to identify and its misdiagnosis, leading to inappropriate treatment and surgery, has been reported. Obtaining a thorough and meticulous patient history including past surgeries, familial, and social history is important in the diagnosis of LTN palsy. Physical examination will most often reveal winging of the scapula, and other associated symptoms can be very helpful in the differential diagnosis and decision as to what other diagnostic tests are needed. The diagnosis of LTN palsy is largely clinical and includes radiographs of the shoulders, cervical spine, and chest to evaluate for any other contributing pathological entity. Electromyography and nerve conduction studies as well as CT and MR images of the cervical and thoracic spine and chest are helpful. The fact that 17% of cases of LTN palsy are idiopathic requires careful examination with a wide range of diagnostic tests so that true underlying causes are not missed.

Conclusions

Long thoracic nerve palsy results in SAM paralysis and presents with winging of the scapula. Our patient presented with LTN palsy, winging of the scapula, and associated Horner syndrome caused by a right apical pulmonary mass. We believe that ours is the first report of an LTN palsy caused by a Pancoast tumor or apical pulmonary mass. Patients with LTN palsy require careful examination and diagnostic testing to discover or exclude all possible underlying causes.

Disclaimer

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.
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