RESIDENT & FELLOW SECTION

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Clinical Reasoning: An unusual lung mass causing focal weakness

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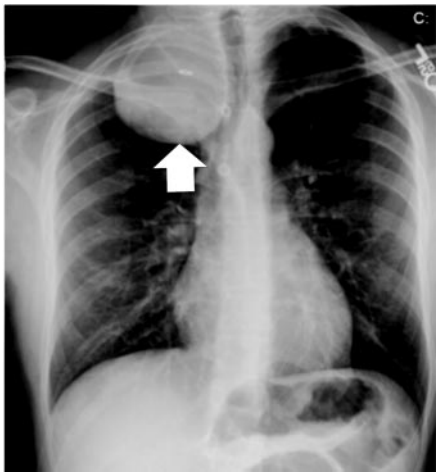
SECTION 1

A 30-year-old right-handed man presented to the emergency room with right forearm numbness and elbow pain for 7 months. For the past 4 weeks he could not write or hold anything with his right hand. His primary care physician referred him to the hospital for further workup after noticing thenar atrophy in that hand. He also described decreased sensation over the ventromedial aspect of his right forearm. He denied any neck pain, changes in urinary or bowel habits, or other neurologic complaints.

Initial inspection showed significant atrophy of the thenar muscles. Neurologic examination showed mild weakness in the right arm and wrist extension and in the abductor pollicis brevis, all interossei (including the first dorsal interosseus), lumbricals I–IV, and the abductor digiti minimi of the right hand. He had diminished pinprick and temperature sensation over the ventromedial aspect of his right forearm, from the elbow to the fourth and fifth digits, without splitting of the fourth digit. The right biceps reflex was normal, the brachioradialis was diminished, and the triceps reflex could not be elicited. The remainder of the neurologic examination, including mental status, cranial nerves, coordination, and gait, was normal. There was no Horner syndrome on the right. His general physical examination demonstrated a well-built man with no skin lesions, edema, or protrusions. The muscles involved and the sensory distribution implied involvement of multiple nerves, possibly by compression of the lower trunk of the brachial plexus. Subsequently, a chest X-ray was performed by the emergency room physician to screen for a mass lesion compressing the brachial plexus. The X-ray showed a large mass in the apex of the right lung (figure 1).

Figure 1 Unusual finding on chest X-ray



Chest x-ray shows a round circular mass (large arrow) in the apex of the right lung.

Questions for consideration:

1. What are the possible etiologies of the mass?
2. What would be the next step?

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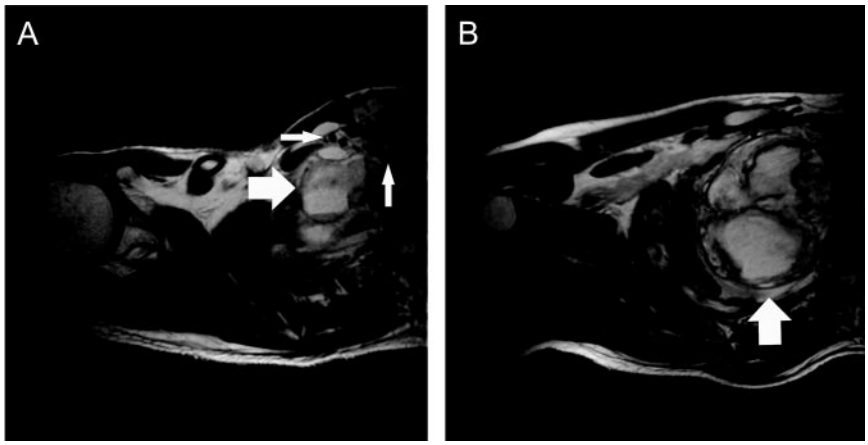
Figure 2 MRI of the mass



Coronal MRI T2-fast spin echo sequence shows rounded mass with fluid–fluid levels in the apical pleural space of the right lung measuring 9.2 × 7.8 × 8.4 cm. The first image (A) shows the mass (large arrow) compressing the nerve roots (small arrows). The second image (B) shows the mid border of the mass with central mixed density, resting on the apical surface of the lung.

SECTION 2

The differential of the mass includes primary tumors of the thyroid, larynx, and pleura; sarcoma; infections such as tuberculosis and echinococcus; and bone tumors such as enchondroma and osteochondroma.[1] A chest CT with contrast showed a 9.7 cm × 6.6 cm right apical pulmonary mass, extending into the supraclavicular fossa. Initial CT-guided biopsy was nondiagnostic. Staining for AFB and echinococcus antigen testing were negative. A PET scan showed increased activity in the right apical lung. MRI of the brachial plexus showed a 9.2 × 7.8 × 8.4 cm mass with hemorrhage, mixed signal intensity (fluid–fluid levels), and homogeneous enhancement. The mass, centered in the right apical pleural space, appeared to upwardly displace the lower trunk of the brachial plexus (figure 2, A and B). As the primary preoperative diagnosis was a pleural based tumor and the clinical picture and imaging findings were strongly suggestive of a compressive lower trunk lesion, a preoperative EMG/NCS was not considered necessary by his primary team.

QUESTIONS FOR CONSIDERATION:

1. What is your differential diagnosis at this point?
2. What would you do next in the management of this patient?

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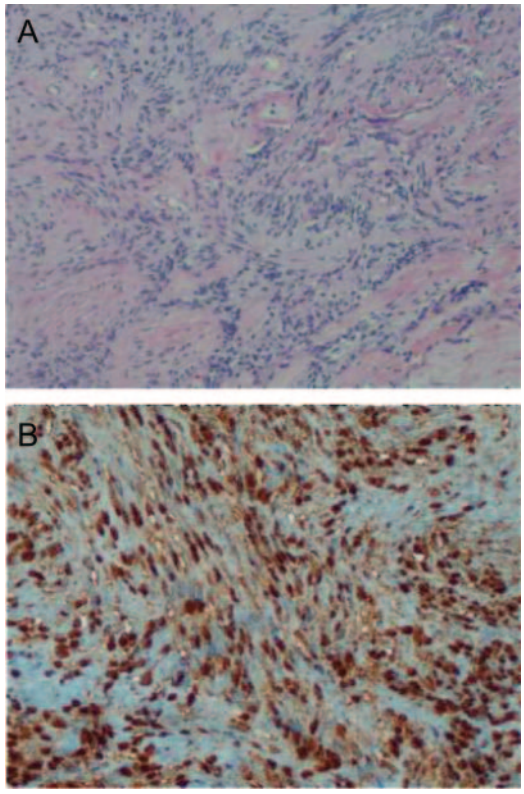
Figure 3 Typical pathologic appearance



(A) Spindle-shaped tumor cells in a palisading fashion. Verocay bodies in between the interposed palisading nuclei. (B) S-100 positive tumor cells.

SECTION 3

Since the potential infectious etiologies were ruled out with both a negative AFB and an echinococcus antigen, tumors of the pleura, lung, and bone were considered. The patient underwent a right anterior thoracotomy, right video-assisted thoracic surgery, and median sternotomy with right extrapleural mass resection and cervical neck dissection. The dissection around the nerves was incomplete to preserve function. Gross pathology demonstrated a $13 \times 9 \times 9$ cm mass with a smooth surface. The cut surface showed multiloculated cysts filled with blood clots and necrotic tissue. Immunostaining was S-100 positive with Antoni A and B histology (figure 3, A and B). The mass was negative for AE1/3, chromogranin, and synaptophysin. Pathology was consistent with a brachial plexus schwannoma. Superior mediastinal, lung, and scalene lymph nodes were all normal. The patient had an uncomplicated postsurgical course and was discharged 5 days later.

During follow-up, the patient reported some improvement in right hand strength with continued numbness in the medial portion of the arm and hand. Motor nerve conduction studies showed decreased amplitude and conduction velocities in the median and ulnar compound muscle action potentials (CMAPs). Sensory nerve action potentials (SNAPs) were absent in the right ulnar nerve and present in the right median nerve. EMG at Erb's point could not be performed due to the extensive surgery, including open thoracotomy and significant lymph node dissection, with a presumed increased risk of infection. While radial motor conduction and EMG were not performed, nerve conduction and clinical findings showing weakness in arm/wrist extension were most consistent with dysfunction of lower trunk of the brachial plexus involving radial, median, and ulnar innervated muscles. A lesion of the medial cord would not produce weakness in muscles innervated by the radial nerve.

DISCUSSION Schwannomas are rare tumors, which usually present in the third or fourth decade of life.[1] Schwannomas can be divided into intracranial and extracranial masses. Intracranial schwannomas can involve all cranial nerves except the second, which is myelinated by oligodendrocytes. Extracranial schwannomas can arise from any peripheral nerve. In fact, 25%–45% of extracranial schwannomas arise from nerves in the head and neck, with 65% arising from the face region and 35% from the neck.[2] The most common locations include the vagus, hypoglossal, and lingual nerves; sympathetic trunk; cervical plexus; and brachial plexus.[1,3] Extracranial schwannoma are generally solitary benign lesions, which grow insidiously and rarely undergo malignant transformation. They can present with a variety of signs and symptoms, including neck pain, dysphagia, dyspnea, numbness, weakness, or nasal obstruction.[3]

The MRI findings, as seen in our patient, are nonspecific and are seen in multiple bone and soft tissue tumors.[4] With more specific MRI findings giving a correct presurgical diagnosis, a microsurgical dissection using intraoperative nerve action potential recordings would have been the procedure of choice because it produces a more favorable outcome.[5] Another treatment option, producing minimal functional loss, is tumor enucleation from adjacent healthy nerves. Studies of enucleation surgery have had mixed outcomes.[1] The factors likely to decrease the likelihood of complete enucleation are preoperative pain, loss of mobility, sensory deficit, size greater than 4 centimeters, and location in the proximal upper arm. Proximally located tumors involve more fascicles, making surgical damage to the nerves more likely.

Benign schwannomas are encapsulated tumors arising from the nerve sheath with 2 histologic patterns. The first pattern consists of a highly ordered cellular component (Antoni A area) with palisading

nuclei surrounding the central mass of the cytoplasm. Verocay bodies in the Antoni A pattern consist of 2 rows of palisading nuclei separated by pink fibrillary material.[6] The second pattern is a looser myxoid type (Antoni B area), in which the stroma and fibers form no distinct pattern. Antoni B type areas are rich in foamy histiocytes and contain few lymphocytes.[3] Schwannomas strongly express S-100 protein staining. Negative staining for chromogranin, AE 1/3, and synaptophysin suggests that a mass is not a neuroendocrine tumor of the thymus.[7]

Pathologic diagnosis is crucial, as schwannomas are often misdiagnosed on imaging.[8] Typically on MRI the schwannoma appears as an encapsulated structure displacing fascicles to one side.[9] Schwannomas appear heterogenous because of both their mixed nature and degenerative changes, such as cyst formation. However, MRI is not reliable in differentiating between benign and malignant soft-tissue tumors.[9] CT-guided fine needle aspiration is limited as the sample may not be representative of the tumor.[8] Magnetic resonance neurography, which evaluates nerve morphology, may assist in determining tumor extent and improving the safety and accuracy of nerve biopsies. Even neuronal ultrasound has been used to distinguish between extrinsic and intrinsic lesions and between tumors and neuromas of traumatic origin.[9,10]

AUTHOR CONTRIBUTIONS

Dr. Yasir El-Sherif wrote the hospital course and much of the discussion, with the exception of Dr. Sarva's contributions. Dr. Sarva wrote the initial presentation and the description of the pathology and radiologic features of schwannomas. Dr. Valsamis oversaw and proofread the paper.

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MYSTERY CASE RESPONSES

The Mystery Case series was initiated by the Neurology® Resident & Fellow Section to develop the clinical reasoning skills of trainees. Residency programs, medical student preceptors, and individuals were invited to use this Mystery Case as an educational tool. Responses were solicited through a group e-mail sent to the AAN Consortium of Neurology Residents and Fellows and through social media.

All the answers that we received for this Mystery Case came from individual residents rather than groups and they were all well-reasoned and thoughtful. The majority of respondents (83%) localized the lesion at the level of the lower trunk of the brachial plexus.

All respondents considered in the differential diagnosis a tumor, as well as infectious processes. Dr. Marco Luigetti specifically indicated schwannoma as the most likely diagnosis.

This Mystery Case illustrates a rather rare type of tumor that should be considered in a young patient with an apical lung mass involving the brachial plexus.

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