

# Brachial plexus schwannoma mimicking cervical lymphadenopathy

## A case report with emphasis on imaging features

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### Abstract

**Rationale:** Brachial plexus schwannomas are rare benign tumors that are derived from Schwann cells. Because they are rare, and because of the complexity of the anatomy of the neck, these tumors can be a challenge to diagnose for radiologists and clinicians. In the present study, we describe a clinical case of brachial plexus schwannoma detected on ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI), and presenting as a palpable neck mass.

**Patient concerns:** A 49-year-old woman had a palpable mass in the right neck, which had been there for the last 1 year. Metastatic cervical lymphadenopathy was suspected in the primary health clinic; therefore, the patient was referred to our hospital.

**Diagnoses:** The right neck mass was a well-circumscribed oval soft tissue mass on US, CT, and MRI. US-guided core needle biopsy was performed and the mass was proved to be a schwannoma.

**Interventions:** The patient did not undergo surgical excision because the brachial plexus schwannoma was small and there was no accompanying neurological symptom.

**Outcomes:** The patient is being followed up regularly at the outpatient department.

**Lessons:** Brachial plexus schwannoma should be considered for a differential diagnosis in patients with a palpable neck mass, and imaging studies play an important role in diagnosing the brachial plexus schwannoma.

**Abbreviations:** FNA = fine-needle aspiration, US = ultrasonography.

**Keywords:** brachial plexus, neck, schwannoma, ultrasonography, ultrasound

### 1. Introduction

Schwannomas are slow-growing benign tumors that are derived from Schwann cells in the nerve.<sup>[1,2]</sup> They are relatively rare tumors that usually occur in the head and neck, and they usually develop cranial nerves and the sympathetic chain, with relative sparing of the brachial plexus.<sup>[3–5]</sup> Therefore, cervical schwannoma arising from the brachial plexus is a diagnostic challenge in the clinical practice; they can easily be misdiagnosed as enlarged lymph nodes. Herein, we present a clinical case of brachial plexus schwannoma in the neck, mimicking a cervical lymphadenopathy, with imaging features on ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI). Also,

using relevant literature review, we provide a brief summary of the brachial plexus schwannoma, and we highlight the clinical importance of the role of imaging in diagnosis with its anatomical background.

### 2. Case report

This was purely an observational case study, and the patient's management and outcome were unaltered. Therefore, no ethical approval was required for this case report. Written informed consent was obtained from the patient for publication of this case report and accompanying images.

A 49-year-old woman visited a primary health clinic with a palpable mass in the right neck, which had been there for the last 1 year. In the previous hospital, an oval hypoechoic nodule was detected in the palpable site, with a left thyroid nodule revealed by US examination. Thyroid cancer with metastatic cervical lymphadenopathy was suspected; therefore, the patient was referred to our hospital. A thyroid nodule was detected in the left lobe during US. She had no history of trauma, pain, fever, or systemic illness, or weakness, and she had experienced no sensory change or loss of function of the upper limbs. On a physical examination, she had a 1.5 × 1.0 × 1.0 cm firm, mobile, and solitary mass in the right neck, without other palpable lesions. No visible abnormality was revealed by the laryngoscopic examination, and a further physical examination was noncontributory. Routine laboratory tests were also normal. US examination was performed with a 5 to 12 MHz linear-array transducer and an EPIQ 7 scanner (Philips Medical Systems, Bothell, WA). The transverse scan revealed a well-circumscribed, oval, homogeneously

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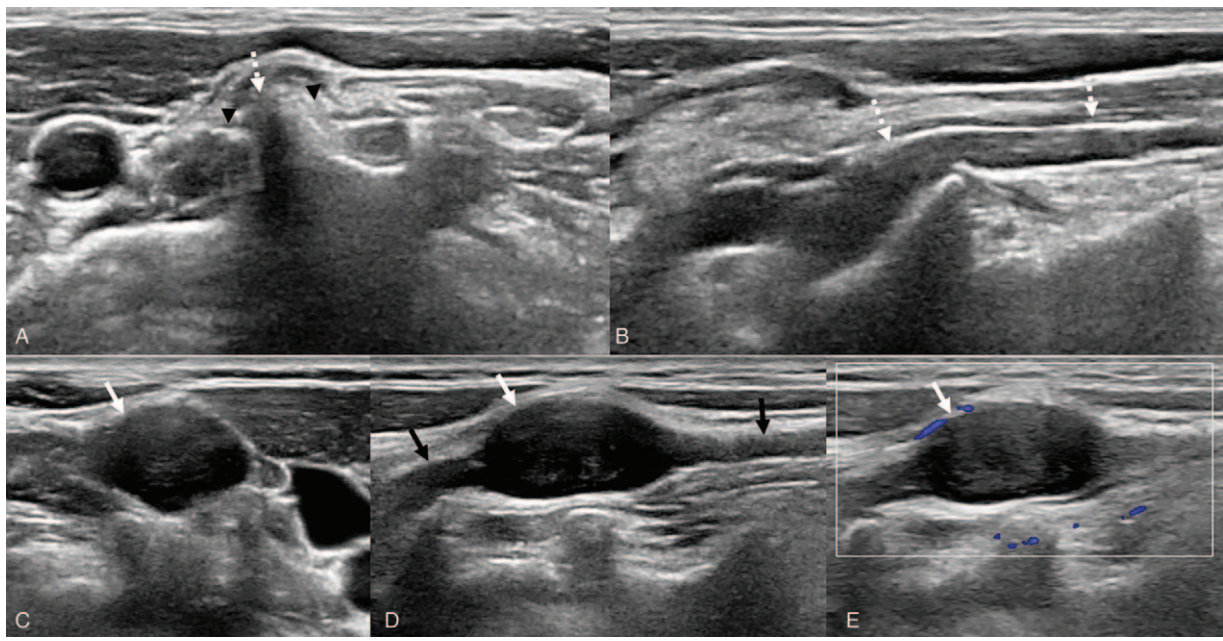
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**Figure 1.** A and B, Normal left cervical/brachial plexus. A, Axial ultrasonography image showing left cervical nerve (dashed arrow) passing between anterior and posterior tubercles (black arrowheads) of the transverse process. B, Nerve (dashed arrows) passes between the prevertebral muscles and paravertebral muscles deep to the sternocleidomastoid muscle. C–E, A palpable mass in the right neck of a 49-year-old woman. Axial (C) and longitudinal (D) ultrasonography images showing a well-circumscribed, oval, homogeneously hypoechoic mass (white arrows) in the right neck. The mass has a continuity with hypoechoic linear structure suggestive of brachial plexus (black arrows). Longitudinal color Doppler image (E) showing no definite vascularity in the mass.

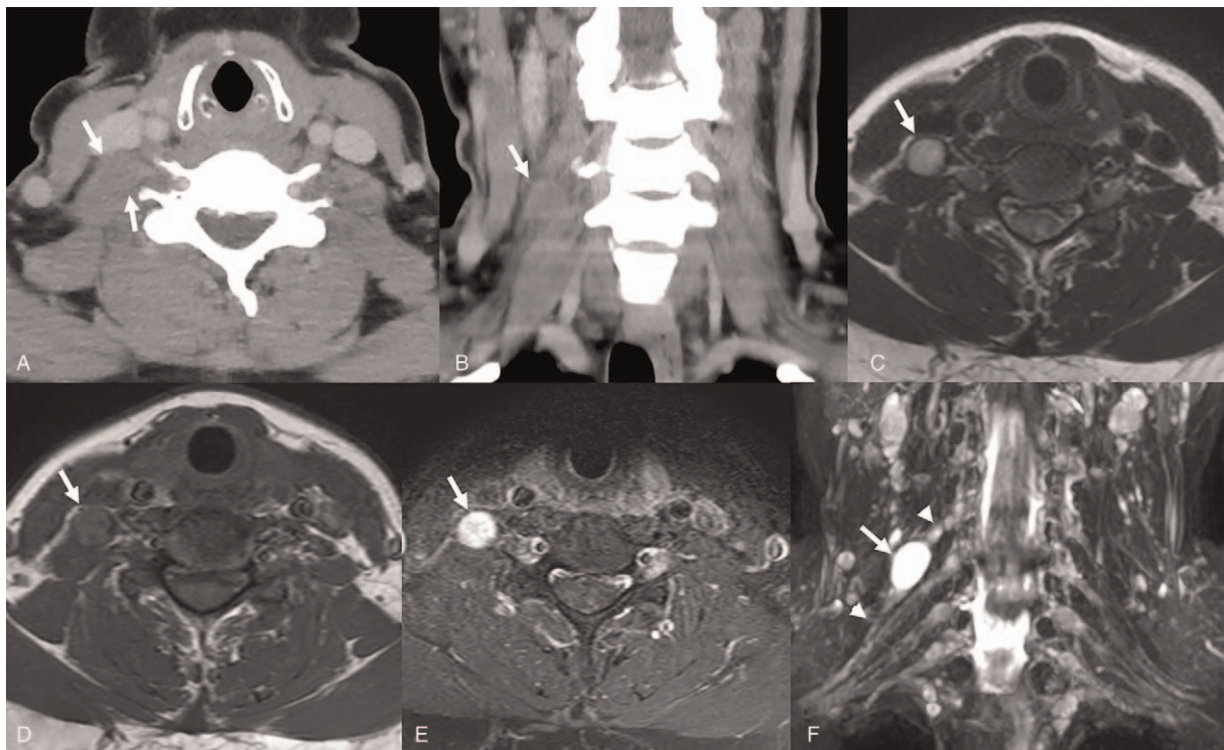
hypoechoic mass in the right neck (Fig. 1C). Color Doppler images showed no definite vascularity within the mass (Fig. 1E). A longitudinal scan (Fig. 1D) revealed that the mass had a central continuity at the proximal and distal ends, with a hypoechoic linear structure arising from the transverse process, suggesting the brachial plexus. The left thyroid gland had a well-circumscribed, oval, slightly hypoechoic nodule with increased intranodular vascularity, suggesting category 4 on the Korean Thyroid Imaging Reporting and Data System on US. To obtain an exact diagnosis, a US-guided core needle biopsy was performed for the palpable mass in the right lateral neck using a disposable 18-gauge double-action spring-activated needle (1.6 cm excursion; TSK Acecut; TSK Laboratory, Tochigi-Ken, Japan) after local anesthesia with 1% lidocaine. Three pieces of tissue cores were obtained based on visual inspection for specimen adequacy. In addition, US-guided fine-needle aspiration (FNA) was also performed 1 time for the category 4 thyroid nodule in the left lobe. During the biopsy and FNA, there was no immediate procedure-related complication. Upon pathological examination of the biopsy cores of the right neck mass, they proved to be a schwannoma (Fig. 2A and B), and the thyroid nodule was proven as a follicular neoplasm on the cytologic examination. After pathological confirmation of the schwannoma, CT and MRI were also performed for further evaluation, and they showed a well-circumscribed oval soft tissue mass. A contrast-enhanced neck CT (Fig. 3A and B) demonstrated a hypoattenuating mass with poor enhancement within the muscle-fascia plane of the right neck. A contrast-enhanced MRI (Fig. 3C–F) of the cervical spine revealed a well-defined, T1 isointense and T2 hyperintense mass with homogenous enhancement, and the mass is contiguous with the right C5 nerve. Because the brachial plexus schwannoma was small and there was no accompanying neurological symptom, the clinician decided to do regular follow-ups without surgical excision.

### 3. Discussion

Brachial plexus tumors are uncommon, comprising only 5% of the upper limb tumors.<sup>[6]</sup> Schwannomas occur commonly in the head and neck region, and they are slow-growing, benign tumors arising from the nerve sheath with neuroectodermal origin.<sup>[1,2,5,7]</sup> When they occur in the head and neck, schwannomas usually develop cranial nerves and the sympathetic chain with relative sparing of the brachial plexus.<sup>[3–5]</sup> In the clinical practice, cervical schwannoma arising from the brachial plexus is a diagnostic challenge because they can be easily misdiagnosed as enlarged lymph nodes due to their rare incidence and complex anatomical location.

The brachial plexus is formed from the ventral nerve roots of C5 to T1. The roots increase in size from C5 to C7 then decrease from C8 to T1. These ventral roots unite to form the trunks. C5 and C6 give rise to the upper trunk, C7 to the middle trunk, and C8 and T1 to the lower trunk.<sup>[8,9]</sup> They are easily detected on US as thin, cord-like, hypoechoic structures between the anterior and middle scalene muscles (Fig. 1A and B).<sup>[10–12]</sup> After passing through the transverse process of the vertebra, between the anterior and posterior tubercles of the vertebra, they course between the prevertebral muscles (longus colli, longus capitis, and anterior scalene muscles) and paravertebral muscles (middle/posterior scalene, splenius cervicis, and levator scapulae muscles) deep to the sternocleidomastoid muscle. Subsequently, they are located in the posterior cervical triangle on the surface of the middle scalene and levator scapulae muscles.<sup>[13,14]</sup> Knowledge of the anatomical location of the brachial plexus can be helpful for diagnostic and therapeutic purposes of various pathologic conditions in the neck.

It is well known that schwannomas are well circumscribed and hypoechoic masses with posterior acoustic enhancement and peripheral nerve continuity on US.<sup>[15,16]</sup> The presence of an

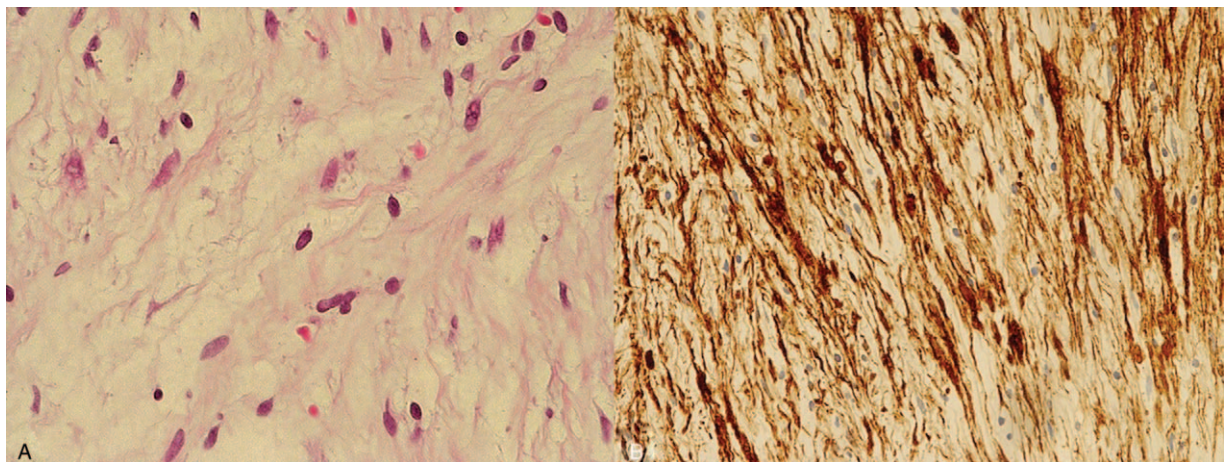


**Figure 2.** The pathologic specimen of the mass; A. In higher magnification, several pleomorphic cells of elongated nuclei with pinkish cytoplasm and a few sprinkled fibroblastic cells and inflammatory cells are seen (original magnification  $\times 400$ ); B. The elongated pleomorphic cells show diffuse positive expression for S-100 protein (original magnification  $\times 100$ ).

echogenic ring within the mass is a pathognomonic finding of the schwannomas and neurofibromas.<sup>[15,17]</sup> The schwannomas show no appreciable intratumoral vascularity on color Doppler US.<sup>[17]</sup> In addition, they usually show hypoattenuation with poor enhancement compared with adjacent skeletal muscle on CT,<sup>[18]</sup> T1 isointensity and T2 hyperintensity with strong enhancement on MRI.<sup>[17]</sup> In the present study, US, CT, and MRI findings correlated well with previous studies.<sup>[15–18]</sup> We were also able to

successfully evaluate the direct association between the parent nerve and the tumor because we kept in mind a schwannoma as possible diagnosis due to the location of mass.

In the clinical practice, it may be difficult to differentiate between the brachial plexus schwannomas and pathologic lymph nodes, because the latter, such as metastasis or lymphoma, can also show a loss of normal fatty hilum, hypoechogenicity, and posterior acoustic enhancement. However, pathologic lymph



**Figure 3.** Axial (A) and coronal (B) computed tomography (CT) images showing well-circumscribed, oval, hypoattenuating mass (arrows) with poor enhancement within the muscle-fascia plane of the right neck. Axial fat-suppressed T2-weighted image (WI) (C) showing a hyperintense mass (arrow). Axial T1WI (D) showing an isointense mass (arrow). Axial contrast-enhanced T1WI (E) showing a homogeneous enhancement of the mass (arrow). Coronal fat-suppressed T2-weighted maximum intensity projection (MIP) image (F) showing the continuity of the mass (arrow) with the right C5 nerve (arrowheads).

nodes have a tendency toward multiplicity, bilaterality, and nodal or perinodal change, which can be a radiological point for differential diagnosis. In the diagnosis of the brachial plexus schwannoma, it is extremely helpful and important to identify a direct continuity and association between the tumor and the parent nerve. However, it may be difficult to evaluate the direct association of the brachial plexus on US because US is an operator-dependent imaging modality and the brachial plexus has a complex anatomy within the muscle-fascia plane. Therefore, an accurate diagnosis in the clinical practice is dependent upon clinical suspicion and awareness of the normal imaging anatomy of the brachial plexus, with imaging features of the cervical schwannoma.

In conclusion, we present a clinical case of brachial plexus schwannoma in the neck, mimicking a cervical lymphadenopathy with imaging features on US, CT, and MRI. Through this report, we suggest that the brachial plexus schwannoma should be considered for a differential diagnosis in patients with a palpable neck mass, and imaging studies play an important role in diagnosing the brachial plexus schwannoma.

### Author contributions

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