Ultrasonography of the Accessory Nerve

Normal and Pathologic Findings in Cadavers and Patients With Iatrogenic Accessory Nerve Palsy

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Objective. To determine feasibility of ultrasonography in detecting the normal accessory nerve as well as pathologic changes in cases of accessory nerve palsy. Methods. Four patients with accessory nerve palsy were investigated by ultrasonography. Three cases of accessory nerve palsy after lymph node biopsy and neck dissection were primarily diagnosed on the basis of ultrasonography using a 5- to 12-MHz linear transducer. In addition, we performed ultrasonography in 3 cadaveric specimens to show the feasibility of detecting the accessory nerve. Results. Nerve transection (n = 2), scar tissue (n = 1), and atrophy of the trapezius muscle (n = 4) were confirmed by electroneurographic testing and surgical nerve inspection. In 1 case in which a patient had a whiplash injury with accessory nerve palsy, ultrasonography showed atrophy of the trapezius muscle with a normal nerve appearance. Conclusions. Ultrasonography allows visualization of the normal accessory nerve as well as changes after accessory nerve palsy. Key words: accessory nerve; lymph node biopsy; muscular atrophy; ultrasonography.

Iatrogenic accessory nerve lesions occur most often after lymph node biopsy at the lateral cervical triangle.1 Because of its superficial course, the nerve is easily injured during this procedure.2 Other accessory nerve lesions are associated with neck dissection, whiplash injury, and direct nerve trauma.3–8 Accessory nerve palsy results in atrophy of the trapezius muscle, with resulting scapular instability, limited shoulder elevation, and impaired muscle function. The patient’s clinical manifestation is often nonspecific, with nuchal or shoulder pain being the main finding.

With the use of high-frequency linear array transducers working at 5 to 12 MHz, direct imaging and evaluation of peripheral nerves has become feasible. In our department, high-resolution ultrasonography (HRUS) is routinely used in the diagnosis of peripheral nerve lesions such as carpal tunnel syndrome, ulnar nerve syndrome, and radial nerve palsy as well as other peripheral nerve lesions.9–13 In this case series, typical ultrasonographic features of the accessory nerve are presented in correla-
tion with its appearance on dissected cadaveric specimens. In addition, ultrasonographic findings of 4 patients with accessory nerve lesions (lymph node biopsy in 2, neck dissection in 1, and whiplash injury in 1), which were confirmed by surgery, electrodiagnosis, or both, are presented.

Anatomy of the Accessory Nerve

The accessory nerve is formed by fusion of a cranial and a cervical root. The nerve trunk exits from the skull base through the jugular foramen and divides into 2 branches. The internal branch fuses with the vagal nerve. The external branch is mainly a motor nerve containing some sensory nerve bundles, arising from C1 through C3 spinal roots. It runs between the occipital artery and the internal jugular vein and passes underneath the digastricus muscle and the sternocleidomastoideus muscle and runs on the levator scapulae muscle downward. This area is called the lateral cervical triangle, which is bordered ventrally by the sternocleidomastoideus muscle, dorsally by the trapezius muscle, and caudally by the clavicle. In the lateral cervical triangle, the accessory nerve has a superficial course immediately beneath the superficial cervical fascia, adjacent to a group of 5 to 10 superficial lymph nodes. The nerve enters the trapezius muscle at the ventral side of the muscle (Figs. 1 and 2, A and B) and innervates the muscle together with branches of the cervical plexus.

Normal Regional Ultrasonographic Anatomy

High-resolution ultrasonography of the neck area was performed in 3 randomly selected fresh cadavers (2 male and 1 female, age range, 68–76 years; mean age, 72 years) with a 5- to 12-MHz linear transducer (Philips Ultrasound, Bothell, WA). After localizing the accessory nerve with HRUS, blue ink was injected close to the nerve to guarantee exact correlation of ultrasonographic findings with anatomic structures after anatomic dissection (Fig. 2B).

On HRUS, the accessory nerve appears as a small hypoechoic tubular structure in the transverse plane and as a hypoechoic linear structure in the longitudinal plane (Fig. 2A). It is best identified at the lateral cervical triangle. After identification of the trapezius and sternocleidomastoideus muscles, which aid as a guiding structure, the transducer is moved upward toward the localization of the nerve. In our series, the accessory nerve was correctly identified bilaterally in all specimens. The diameter of the nerve was approximately 1 mm in all specimens. Ultrasonographic examinations on specimens and patients were performed by a senior staff radiologist with several years of experience in small-part ultrasonography.

Case Reports

Clinical and diagnostic findings are summarized in Table 1.

Two patients (patients 1 and 2) had increasing pain and weakness in their right shoulder and neck area. Clinical investigation indicated a rotor cuff disorder. Radiography and ultrasonography of the rotor cuff yielded normal results. In both cases, additional HRUS of the painful neck and supraclavicular area was performed, and an atrophic hypoechoic trapezius muscle was shown on the affected side. In both patients, a hypoechoic mass of approximately 1 cm was found in the superficial layer of the right lateral cervical triangle, interpreted as scar tissue. In both cases, HRUS revealed a small tubular structure of approximately 1 mm in diameter reaching from the trapezius muscle and ending in the scar (Fig. 3). When questioned, both patients reported having lymph node biopsies 4 (patient 1) and 6 weeks (patient 2) before the HRUS investigation at the same location. Subsequent electroneurog-
raphy and electromyography confirmed accessory nerve palsy in both cases. Surgery revealed a transected accessory nerve at the right lateral cervical triangle (Fig. 4), and nerve repair with a suralis nerve graft was performed in both patients.

The third patient had whiplash trauma from a car accident and had complete accessory nerve palsy, which was diagnosed on the basis of electroneurography. Ultrasonographic comparison with the noninjured contralateral side showed a hyperechoic and atrophic trapezius muscle. The accessory nerve itself appeared normal on both sides. Conservative therapy was initiated.

The fourth patient underwent radical neck dissection. Three weeks after surgery, he had nuchal pain and weakness in his right shoulder. On clinical inspection, accessory nerve palsy was indicated. High-resolution ultrasonography showed the accessory nerve embedded inside the scar at the right lateral cervical triangle. Physical therapy was instituted as primary treatment.

Discussion

The trapezius muscle is one of the major muscles that stabilize the scapula during rotation, elevating the upper limb and retracting the scapula. Consequently, accessory nerve palsy causes dysfunction, weakness, and pain of the trapezius muscle. The patient normally has a dropping shoulder, winging of the scapula, and weakness during forward elevation. Iatrogenic accessory nerve lesions after surgical procedures such as lymph node biopsy, neck dissection, and carotid endarterectomy are the most common causes for this type of nerve palsy.3,4,6,7,14,15 Direct trauma to the nerve such as a glass cut or gunshot injury has also been reported to be a cause of accessory nerve palsy.8,16

Iatrogenic accessory nerve palsy in general has to be treated with microsurgical nerve reconstruction within 12 months; otherwise, the motoric end plate of the affected muscle is permanently destroyed. When primary nerve reconstruction is not accomplished because of delayed diagnosis, surgical procedures must include rearranging of the muscle insertion on the scapula.

Early diagnosis is usually delayed, because unclear clinical signs such as atrophy of the trapezius muscle are not easily visualized at early clinical inspection. Electrodiagnosis is currently the only method for diagnosing accessory nerve palsy. To our knowledge, no other noninvasive diagnostic methods are clinically used.

Development of new ultrasonographic equipment and high-frequency transducers has greatly improved the impact of HRUS on imaging of small soft tissue structures, which is why HRUS of peripheral nerves has become feasible. The general echo structure of a peripheral nerve on longitudinal sonograms consists of multiple parallel hypoechoic linear areas separated by hyperechoic bands. In a transverse plane, it appears as an oval structure containing multiple rounded areas on a hyperechoic background. This appearance was previously reported by Silvestri et al,17 who stated that the appearance would most probably be caused by a number of neuronal fascicles embedded in the epineurium. Furthermore, they stated that a small nerve such as the recurrent laryngeal nerve appears hypoechoic because of a lesser number of single fascicles.17 This observation is confirmed by our findings. In our study, the accessory nerve
High-resolution ultrasonography showed a hyperechoic and atrophic trapezius muscle in all 4 cases with complete or partial nerve palsy. Without HRUS was not able to visualize the transection itself, it was able to show the scar and the course of the nerve beyond. In the case in which the patient had a whiplash injury, a normal accessory nerve was shown.

Table 1. Clinical, Ultrasonographic, Electrophysiologic, and Surgical Findings in 4 Patients

<table>
<thead>
<tr>
<th>Patient/Sex/Age, y</th>
<th>Cause of Nerve Palsy</th>
<th>Clinical Findings</th>
<th>ENG and EMG Findings</th>
<th>Ultrasonographic Findings</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/F/42</td>
<td>Lymph node biopsy</td>
<td>Pain, weakness in right shoulder, inability to lift right arm</td>
<td>Trapezius muscle atrophy, partial accessory nerve palsy</td>
<td>Nerve dissection, nerve embedded in scar, hyperechoic atrophic trapezius muscle</td>
<td>Sural nerve interposition</td>
</tr>
<tr>
<td>2/F/47</td>
<td>Lymph node biopsy</td>
<td>Nuchal pain, weakness in right shoulder</td>
<td>Trapezius muscle atrophy, complete accessory nerve palsy</td>
<td>Nerve dissection, nerve embedded in scar, hyperechoic atrophic trapezius muscle</td>
<td>Sural nerve interposition</td>
</tr>
<tr>
<td>3/F/28</td>
<td>Whiplash trauma</td>
<td>Pain, weakness in right shoulder</td>
<td>Trapezius muscle atrophy, complete accessory nerve palsy</td>
<td>Hyperechoic atrophic trapezius muscle</td>
<td>Conservative</td>
</tr>
<tr>
<td>4/F/62</td>
<td>Neck dissection</td>
<td>Pain, weakness in right shoulder</td>
<td>Trapezius muscle atrophy, partial accessory nerve palsy</td>
<td>Nerve embedded in scar, hyperechoic atrophic trapezius muscle</td>
<td>Conservative</td>
</tr>
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</table>

EMG indicates electromyographic; ENG, electroneurographic; and F, female.

Figure 3. A. Longitudinal sonogram from a 42-year-old female patient after lymph node biopsy. An atrophic trapezius muscle is shown on the right side, compared with the normal trapezius muscle on the left side. B. Longitudinal sonogram showing a hypoechoic mass at the right lateral cervical triangle with the nerve (small arrows) embedded in the scar (large arrows), suggesting nerve transection.

Figure 4. Intraoperative nerve inspection confirms accessory nerve transection. The proximal stump appears thicker (large arrow) than the distal stump (small arrow).
In conclusion, accessory nerve palsy should be considered when an atrophic trapezius muscle is found during ultrasonographic examination in patients with shoulder and neck pain who have a history of lymph node biopsy. As shown in our cadaveric study and in 3 of our cases, HRUS is able to visualize the normal accessory nerve and the accessory nerve embedded in the scar.

References


