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Case Presentation

Thoracic Outlet Syndrome Causing Phantom Hand Pain in a Person With a Transradial Amputation: A Case Presentation

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Abstract

In this case, a 47-year-old commercial truck driver with a remote right transradial amputation presented with pain in the medial aspect of his right phantom hand. He was diagnosed with thoracic outlet syndrome (TOS). This was attributed to the muscular demands associated with using his body-powered prosthesis for many years. TOS remains a controversial diagnosis in the able-bodied population and a unique diagnostic challenge in a patient with a transradial amputation. In this case, consideration of TOS guided the rehabilitation and treatment plan. His pain improved with a conservative stretching program.

Introduction

Diagnosis and management of neuropathic pain in patients with upper extremity amputations can be challenging. Phantom limb pain is common initially after amputations but in most cases resolves with time [1]. New neuropathic pain in the residual and phantom limb should generate the same differential diagnosis as for a similar presentation in an able-bodied individual. This would include central neurological causes, cervical radiculopathy, brachial plexopathy, peripheral neuropathy, neuromas, or referred myofascial pain. We present a case illustrating the diagnostic challenges of suspected thoracic outlet syndrome (TOS) in a patient with a short transradial amputation.

Case Presentation

This patient is a 47-year-old commercial truck driver who experienced a traumatic amputation of the right forearm at age 16 years. He is a regular user of a body-powered prosthesis. His medical history also included hypothyroidism and borderline hypertension. He had long-standing mild phantom limb pain involving the entire phantom limb, and had a right ulnar neuroma resection. His only medication was levothyroxine.

Approximately 16 years after his amputation, he developed an achiness in his right neck that radiated to the right shoulder. This was associated with new paresthesias in the phantom wrist and hand, which were most pronounced in the fifth phantom finger. He rated this pain as 7/10 on a numerical rating scale. He reported that this pain was unequivocally different from his pre-existing phantom limb sensations. Over the years, no clear diagnosis was established. His family physician referred him to an outpatient physiatry clinic 31 years postamputation for assessment and pain management recommendations.

In clinic, physical examination revealed a short right transradial amputation at the proximal third of the forearm with well-healed skin. There was no palpable neuroma and no tenderness or reproduction of paresthesias with palpation of the residual limb. Cervical range of motion was full and the Spurling maneuver was negative. There was no Horner sign. Tone was normal. Biceps and triceps reflexes were normal. The patient had full power around the right shoulder and in elbow flexion and extension. He had decreased light touch sensation in the right arm primarily in a T1 distribution. He was tender to palpation diffusely in the right trapezius, right anterior neck, and posterior cervical spine musculature. Palpation of the anterior scalenes reproduced pain in his hand. A modified elevated arm stress test and Tinel sign at the right interscalene triangle provoked pain in his phantom medial hand.

Based on his history and physical examination findings, the suspected diagnosis was TOS; however, C8-T1

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radiculopathy and myofascial pain remained in the differential.

Needle electromyography studies of the right triceps, biceps, and C8 paraspinal muscles were normal. His right transradial amputation was short and precluded nerve conduction studies on that side. Magnetic resonance imaging of the cervical spine and brachial plexus demonstrated normal brachial plexus anatomy, with no cervical rib or fibrous bands and no nerve root compression. An ultrasound demonstrated no subclavian stenosis or altered flow in the brachial artery. A 2.5 × 1.1-cm mass in the right antecubital fossa contiguous with the ulnar nerve was identified.

Based on his presentation, physical findings and diagnostic tests, he was suspected to have TOS. He was prescribed a daily stretching routine focusing on the scalenes, trapezius, and pectoralis minor muscle groups. He was asked to perform 3 sets of these stretches, holding for 30 seconds each, repeated twice a day.

On follow-up 3 months later, the patient was pleased with his progress. He reported that his symptoms had reduced from constant, daily pain to intermittent pain occurring every 2 days. A focused daily conservative stretching routine provided him with relief of his phantom hand pain. Neuropathic pain medications were offered, but he preferred to continue with a conservative stretching routine due to his derived benefit.

Discussion

Thoracic outlet syndrome is defined as "upper extremity symptoms due to compression of the neurovascular bundle in the area of the neck just above the first rib" [2]. As with other syndromes, the diagnosis is clinical and is based on a characteristic constellation of symptoms. These include pain, paresthesias, and/or weakness in the medial arm, forearm, and hand [3].

Physical examination findings may include wasting and weakness of the thenar eminence and decreased sensation in the C8-T1/lower trunk distribution. Tinel sign at the interscalene triangle may be positive [2]. A number of provocative tests have been described. Unfortunately, there are no sensitivities or specificities available due to the lack of a gold standard for diagnosis of TOS. The goal of the provocative tests is to put tension on the neurovascular bundle, and a positive test result is reproduction of symptoms [3]. Three common provocative tests are the Adson, Allen, and elevated arm stress test (EAST).

This case is interesting because it highlights the challenges and unexpected joys in diagnosing and treating chronic neuropathic pain in the amputee population. We were presented with a man who was 31 years posttrauma with long-standing phantom-limb sensations, a known and previously resected ulnar neuroma, but "new" (ie, developing over the past 15 years) progressive phantom fifth finger neuropathic pain that was different from his baseline discomfort. These facts alone make the prospects of a successful treatment plan seem daunting. One is then confronted in clinic with the limited options for the examination of the amputated residual limb.

Challenges in the physical examination of the patient with a transradial amputation include the inability to map out sensory changes in the phantom forearm and hand, and the inability to palpate the radial pulse, which prohibits Allen and Adson tests (Figure 1). Similarly, examining for a finger flexor reflex (C8-T1) when considering radiculopathy is not possible. Our patient had decreased pinprick sensation in the T1 distribution, a positive Tinel sign at the interscalene triangle, and a positive modified EAST.

Nerve conduction studies in patients with surgically verified TOS have shown chronic axonal loss in the C8>T1 pattern (low median motor amplitude and low medial antebrachial cutaneous sensory amplitude) in 89% of patients [4]. An abnormal medial antebrachial cutaneous study is reported to be the most sensitive nerve conduction study for TOS [4]. Unfortunately for our patient, his amputation level precluded these tests. Needle electromyography of the available biceps, triceps, and C8 paraspinal muscles were helpful in ruling out a middle to lower cervical radiculopathy.

Other investigations are useful both for the etiology of TOS and the elimination of other diagnoses in the differential. Magnetic resonance imaging of the cervical spine is helpful to rule out compressive pathology of the C8 and T1 nerve roots. This was negative in our patient. Magnetic resonance imaging and high-resolution ultrasound of the brachial plexus ruled out a cervical rib or vestigial fibrous band, which could compress the neurovascular bundle. Vascular studies to look for blood flow abnormalities under the first rib were normal.

The patient was diagnosed with suspected TOS and was started on a conservative treatment program of stretching. We note that this would also be first-line treatment of myofascial pain. However, based on the distribution of his paresthesias, the reproduction of his symptoms with provocative tests for TOS, and his positive Tinel sign result at the interscalene triangle, we believe that his presentation is consistent with TOS rather than simply scalene myofascial pain.

The patient had had a neuroma resected in the remote past and was subsequently found to have an ulnar neuroma on recent ultrasound. Neuromas can produce ectopic discharges of pain in response to stimulation, or they can also be spontaneous [5]. It is unlikely to be the source of his pain, given that there was no reproduction of pain with palpation of the residual limb and based on his response to a neck and shoulder stretching routine; however, it certainly could be contributory and could constitute a "double-crush" phenomenon.