American Academy of Physical Medicine and Rehabilitation

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EMG Case No. 51, May 2001

Presenting Symptoms: Right-Sided Shoulder Pain, Weakness with Pushing and Lifting, Winging of the Scapula

This case is no longer available for CME credit.

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Appropriate Audience: Residents and practicing physicians

Learning Objectives: After completing this educational activity, participant will be able to (1) identify symptoms and signs pertaining to scapular winging, shoulder pain, and upper extremity weakness, (2) utilize the patient's history and physical to devise an appropriate differential diagnosis of shoulder and upper extremity symptoms, and (3) perform appropriate nerve conduction studies and needle examination to evaluate for scapular winging, shoulder pain, and upper extremity weakness.

History

A 37-year-old man presented for electrodiagnostic evaluation of dull pain in his right shoulder blade and weakness with pushing and lifting using the right upper extremity. He denied any symptoms of neck pain, numbness, tingling, or any symptoms affecting the left upper extremity. The symptoms arose after a 2-week backpacking excursion 5 months ago and have worsened since then. He was carrying 40-50 pounds while walking 7-10 miles per day. The patient denied any history of trauma to the area and has never had similar symptoms.

- *Prior to continuing, please develop a differential diagnosis and list each possible diagnosis in order of likelihood.*
- *Is there any additional information regarding the clinical history that might behelpful in clarifying your differential list or changing its order of priority?*

Commentary I

At this point, the differential diagnosis includes:

- Brachial Plexopathy
- Cervical radiculopathy
- Suprascapular nerve palsy
- Accessory nerve palsy
- Axillary nerve palsy
- Long Thoracic nerve palsy
- Dorsal Scapular nerve palsy
- Rotator cuff tendinopathy
- Myofascial pain syndrome
- A-C joint separation

With the history of backpacking, shoulder pain, and weakness, various nerves can be affected individually and brachial plexopathy has been known to occur. With his symptoms of shoulder pain and arm weakness with pushing and lifting, a cervical radiculopathy is possible although a lack of neck pain makes that less likely. With shoulder pain and weakness, a rotator cuff tendinopathy is also possible. The pain could also arise from

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myofascial pain syndrome or a musculoskeletal cause such as an A-C joint separation. A CNS disorder or myelopathy is unlikely, given the patient's history and symptomatology, therefore it is not included in the differential.

History, continued

The patient has a medical history of asthma, a lipoma removed from his occipital region, and a tonsillectomy as a teenager. He denied any history of hypertension, diabetes, or myocardial infarction. He also states he was diagnosed 4 months ago with winging of the scapula by his local physician.

Family history is significant for diabetes and is otherwise negative.

The patient had no allergies to medication.

The only medication the patient took needed was Asthmacort. The patient was not taking any pain medication.

The patient works as a manager and his right upper extremity impairment did not interfere with his typing or computer work. It did not interfere with his sleeping.

- *If necessary, revise your differential diagnosis based on the additional clinical history.*
- *On which details of the physical examination should you focus at this point?*

Commentary II

The history of scapular winging helps narrow the differential diagnosis to the following disorders:

- Spinal Accessory nerve palsy
- Long thoracic nerve palsy
- Brachial plexopathy
- Dorsal scapular nerve palsy

However, cervical radiculopathy, rotator cuff injury, myofascial pain syndrome, and A-C joint separation are still possible, although less likely.

Physical Examination

The left upper extremity had normal strength, muscle stretch reflexes were 2+/4, and sensation to pinprick and light touch was intact.

The right upper extremity had winging of the inferior border of the scapula, and winging was more prominent with resisted shoulder protraction and less so upon shoulder abduction. Muscles testing revealed weakness with shoulder protraction on the right. Sensation was intact to pinprick and light touch and muscle stretch reflexes were 2+/4. There was minimal discomfort with the empty can test and no weakness or pain with resisted right shoulder internal and external rotation. There was no pain with passive range of motion of the right shoulder. There were no trigger points in the paraspinal, rhomboid, or trapezius muscles. Spurling's sign was negative bilaterally for radicular pain.

- *At this point, review your differential diagnosis and revise as appropriate.*
- *Are there additional observations on physical examination that might be helpful in narrowing your differential list?*

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Commentary III

At this point, the most likely diagnoses include:

- Long Thoracic nerve palsy
- Accessory nerve palsy
- Dorsal Scapular nerve palsy
- A combination those described above

The physical examination findings are less supportive of a brachial plexopathy (focal weakness with protraction with no sensation loss), cervical radiculopathy (normal MSRs and sensation, focal weakness, negative Spurling's), or rotator cuff tendinopathy (focal findings, negative empty can test, and no significant pain with resisted muscle testing or ROM), myofascial pain disorder (focal findings and negative test for trigger points), and A-C joint separation (focal findings).

The most likely diagnosis is long thoracic nerve palsy, with the possibility of a coexisting accessory nerve palsy, however the physical examination findings differentiate the two. Testing indicated weakness with shoulder protraction and more prominent scapular winging upon resisted shoulder protraction, connoting a weak serratus anterior muscle innervated by the long thoracic nerve. There was less scapular winging with shoulder abduction. In contrast, winging that is most pronounced upon shoulder abduction indicates weakness of the trapezius and possible spinal accessory nerve injury. When testing in both these positions, the test that produces the more prominent scapular winging points to the muscle and nerve involved.

Electrophysiologic Data

SENSORY NERVE CONDUCTION STUDIES							
NERVE	**SIDE**	**STIM SITE**	**RECORD**	**cm**	**AMPL uV**	**LAT msec**	**CV M/sec**
Median	Right	Wrist	Index	14	36.0	2.9	63.6
Ulnar	Right	Wrist	5th Digit	14	34.0	3.0	60.9
Temperature	Right	Midpalm	33.1 degrees	-	-	-	-

MOTOR NERVE CONDUCTION STUDIES							
NERVE	**SIDE**	**STIM SITE**	**RECORD**	**cm**	**AMPL mV**	**LAT msec**	**CV M/sec**
Median Motor	Right	Wrist	Thenar	7.0	10.0	2.7	-
Median Motor	Right	Elbow	Thenar	25.5	10.0	7.4	54.3

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Ulnar Motor	Right	Wrist	Hypothenar	7.0	10.9	2.8	-
Ulnar Motor	Right	Below elbow	Hypothenar	25.0	10.1	6.9	61.0
Sp Acc Motor	Right	Neck	Trapezius	-	10.7	1.8	-
Long Thoracic Motor	Right	Erb	Anterior chest	-	0.6	3.4	-
Long Thoracic Motor	Left	Erb	Anterior chest	-	3.1	3.7	-
Ulnar F-response	Right	Wrist	Hypothenar	-	-	30.0	-

NEEDLE ELECTROMYOGRAPHY

INSERtional activity: N, sust, unsust
FIB: 0, 1+, 2+, 3+, 4+
OTHER: 0 or fascic, myotonia, myokymia
EFFort: N, decr
RECruitment: N, inc or dec 1+, 2+, 3+, 4+
AMPlitude: N, inc or dec 1+, 2+, 3+, 4+
DURation: N, inc or dec 1+, 2+, 3+, 4+
POLyphasia: N, inc or dec 1+, 2+, 3+, 4+

R/L	MUSCLE	INSER	FIB	OTH	EFF	REC	AMP	DUR	POL
R	Serratus Anterior	Incom	Plete	Relaxation	N	Dec1+	N	inc1+	inc2+
R	Upper Trapezius	N	0	0	N	N	N	N	N
R	Biceps Brachii	N	0	0	N	N	N	N	N
R	Deltoid	N	0	0	N	N	N	N	N
R	Triceps	N	0	0	N	N	N	N	N
R	Flexor Carpi Radialis	N	0	0	N	N	N	N	N
R	FDIH	N	0	0	N	N	N	N	N
R	Cervical Paraspinals	N	0	0	-	-	-	-	-

- *On the basis of both the clinical and electrophysiologic evaluations, formulate your diagnostic impression. List the most likely diagnosis first and follow in order with the other possibilities that are not excluded by the data. Eliminate those diagnoses not supported by the data.*

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- *Are there additional electrophysiologic data that you feel would further delineate the diagnosis? (Remember, collecting data that are not needed for the diagnosis is costly and uncomfortable for the patient.)*

Commentary IV

The long thoracic nerve does not have established normal values for amplitude on nerve conduction studies, therefore side-to-side comparison is warranted. The first surface recording electrode was utilized and positioned over the fifth or sixth rib at the mid-axillary line, with the second recording electrode positioned several centimeters anteriorly. Stimulation was carried out at Erb's point in the supraclavicular fossa with an intensity and duration delivering a supramaximal excitation. The nerve conduction studies revealed an amplitude of 3.1 mV on the left and 0.6 mV on the right, indicating an abnormality on the right. The latencies were within the normal limits of 2.6-4.0 ms. The needle examination revealed decreased recruitment in the right serratus anterior with polyphasic motor units of increased duration. The patient had difficulty relaxing, therefore an adequate sampling of insertional activity could not be achieved. The motor unit changes are consistent with the presence of axon loss with reinnervation of the long thoracic nerve.

Diagnostic Impression

There is electrodiagnostic evidence of a severe, right, long thoracic nerve palsy, characterized by axon loss and ongoing reinnervation. There was no electrodiagnostic evidence of a right upper extremity plexopathy or radiculopathy. The long thoracic nerve is derived from the anterior divisions of the C5, C6, and C7 roots shortly after they exit the neuroforamina. The C5 and C6 roots enter the scalenus medius muscle, where they join to a form a common trunk. This trunk unites with the C7 root after it emerges from the lateral border of the scalenus medius. The nerve then descends dorsal to the brachial plexus and the first part of the axillary artery to the lower border of the serratus anterior, where it is superficial and susceptible to local trauma. Contraction of the serratus muscle causes the scapula to move anteriorly, holding it against the thorax during shoulder protraction. The serratus acts also as an upward rotator of the scapula during the entire arc of abduction. It is most likely that this patient sustained a compression or traction injury to the nerve from wearing a backpack for prolonged periods. Cases related to chronic knapsack use have been previously reported.

- *What other diagnostic procedures (laboratory tests, etc.), if any, are needed?*
- *What treatment would you recommend?*

Commentary V

Other causes of long thoracic nerve palsy are trauma (sports injuries, motor vehicle accidents, birth), pressure with crutch walking, cast application, carrying weights, and bursitis. It has also been associated with surgical procedures (mastectomy, radical neck dissection), toxins such as serum injection, poliomyelitis, overstretching (sleeping with an outstretched arm, performing a particular job), and cold exposure. In many cases, no clear cause can be found. These latter patients may represent a variant of neuralgic amyotrophy. The source of the problem may be difficult to discern, but an accurate history will often elicit the etiology. In this case, the patient's backpacking likely caused local trauma to the long thoracic nerve. The prognosis for long thoracic nerve palsy is generally good, with a recovery period of 6 months to 2 years, averaging nine months.

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Treatment of long thoracic palsy is directed at maintaining range of motion and increasing strength. Initial management consists of relative rest and avoidance of the precipitating activity. It is important to perform active exercises in the supine position during the early phases of recovery. This will prevent any further winging and overstretching of the serratus anterior by keeping the scapula close to the thorax. The patient should also be instructed to restrict everyday activities that cause overstretching of the serratus anterior muscle, especially those that require the arm to assume a forward flexed position. Stretching of the latissimus dorsi, levator scapula, pectoralis minor, and rhomboid muscles is important as well. As strength improves, more advanced scapular stabilization exercises can be added.

Orthotic devices have been advocated to stabilize the scapula and may be helpful in some patients.

Various surgical procedures have been proposed to substitute for the serratus anterior muscle. The most commonly performed procedures are transposition of the pectoralis major, pectoralis minor, rhomboids, or teres major. Stabilization of the scapula using fascial slings has also been performed. Surgery should generally not be performed in the early stages of recovery and is recommended after two years have passed without apparent recovery.

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