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EMG Case No. 74, August 2005

Presenting Symptom(s):

Pain in the right scapular region

This case is no longer available for CME credit.

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Disclosures: S. Ho, None; J. Albers, None.

Appropriate Audience: Residents and practicing physicians.

Learning Objectives: After completing this educational activity, participants will be able to: (1) Formulate a differential for nonspecific scapular pain; (2) Describe the difference in presentation of an isolated long thoracic mononeuropathy versus Parsonage Turner syndrome; (3) Use nerve conduction studies and electromyography to confirm the diagnosis of a brachial plexopathy.

Level of Difficulty: Advanced.

History

The patient is a 32 year old right handed man who presents to you with a history of right posterior shoulder pain that began 8 months prior to presentation. The pain began at work when he was clearing tables and noticed a sharp pain in his right scapular region.

- 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 be helpful in clarifying your differential list or changing its order of priority?

Commentary I

The differential diagnosis should include cervical radiculopathy (especially C6 and C7), neuralgic amyotrophy, rotator cuff pathology, myofascial pain, brachial plexopathy, isolated shoulder mononeuropathy, costochondral dysfunction, cervical spondylosis, and less likely adhesive capsulitis. Cervical radiculopathy should be considered since clinically, patients may present with a generalized ache in the scapular region that radiates into the arm. In addition to the pain, patients often report numbness that radiates into the arm. Neuralgic amyotrophy has a characteristic clinical presentation where patients have an acute onset of intense sharp or throbbing pain localized around the shoulder or scapular region[1]. Rotator cuff pathology (tendonitis, tendonosis, or tear) presents with an acute onset of pain, often associated with a certain activity, as in this case. Myofascial pain is often aggravated by activity. Adhesive capsulitis can be a cause of scapular region pain, although there is usually a history of immobility prior to the pain. This diagnosis is not as likely in this case since the pain is associated with a specific activity and is acute in onset.

Additional information that would be helpful to know include whether or not the patient had associated numbness or weakness, what the progression of the pain has been for the last 8 months, if any certain movements aggravate or alleviate the symptoms, and family medical history of any similar symptoms.

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History, continued

In addition to the pain, he had also noticed that his right shoulder blade looked a little different compared to the left when he stood in front of a mirror approximately 1 week after the pain started. He denied any numbness in his right upper extremity at the time of injury. Approximately 5-6 weeks prior to presentation, the right scapular region became more painful after doing yard work. Over the next several months, the pain improved. He also noted that over the last 7 months, the scapular asymmetry had decreased.

He has a history of multiple lipomas, several of which have been removed. His other interesting history dates to about 5 years ago when he developed a severe series of headaches, photophobia, and prominent generalized fatigue, which kept him out of work for nearly 6 months. He describes a 9-month period where he still had to be careful about his activity. This was eventually diagnosed as chronic Epstein-Barr virus infection.

- 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

An isolated lesion to the long thoracic or spinal accessory nerves must be considered with the patient's presentation of scapular winging. There is no history of trauma but the pain did present acutely while lifting a tray. A stretch injury is a consideration with this type of presentation although it is typically associated with a higher velocity activity such as a fall or a throwing activity. Neuralgic amyotrophy remains a consideration in the differential diagnosis. Although he does not present with numbness, it is noted in 67% of patients with neuralgic amyotrophy, most commonly in the axillary and lateral antebrachial cutaneous nerve distributions.[1] Improvement of symptoms is noted by most patients within the first month. Cervical radiculopathy is usually associated with pain and numbness in the affected shoulder and arm in a dermatomal pattern. The symptoms typically do not present in one specific nerve without affecting other nerves with the same nerve root. Cervical radiculopathy is still in the differential, but is not as likely as neuralgic amyotrophy. Rotator cuff pathology does not usually involve winging of the scapula, so this diagnosis is unlikely. In addition, he has a history of multiple lipomas being removed so one has to consider if he now has a lipoma compressing the long thoracic nerve.

Aspects of the physical examination that would help elucidate the proper diagnosis include a detailed sensory exam focusing on specifically C5, C6, and C7 dermatomes, manual muscle strength testing looking for any weakness in any other muscles, Spurling's maneuver assessing for cervical radiculopathy, range of motion of the shoulder with the scapula stabilized to assess for adhesive capsulitis, provocative maneuvers testing the rotator cuff muscles, and techniques that would differentiate between a spinal accessory nerve lesion, dorsal scapular nerve lesion, and a long thoracic nerve lesion. Such maneuvers that would differentiate between a lesion of the spinal accessory nerve and the long thoracic nerve include assessing the movement of the scapula with resisted shoulder forward flexion and shoulder abduction.

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Physical Examination

He has 5/5 strength bilateral shoulder abduction, elbow flexion, elbow extension, wrist extension, finger extension, finger flexion, and finger abduction. He has full active range of motion of bilateral scapula with active shoulder abduction. There was no scapular winging noted with right shoulder abduction. In addition, he has full passive range of motion of the right shoulder with the scapula stabilized. Spurling's maneuver is negative bilaterally. Sensation to light touch is intact in bilateral upper extremities from C4-T1 dermatomes.

- 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?

Commentary III

With the patient's history of acute onset of right scapular region pain, isolated right scapular winging, 5/5 strength in bilateral upper extremities, and an intact sensory examination, an isolated long thoracic nerve injury is the most likely etiology. Neuralgic amyotrophy continues to be in the differential diagnosis since it can occasionally involve only an isolated long thoracic nerve. A lesion to the right spinal accessory nerve is not as likely as a lesion to the right long thoracic nerve since there was no scapular winging seen with active shoulder abduction. Cervical radiculopathy is still a possibility since he may have a mild radiculopathy without loss of strength at this time as Spurling's maneuver may not necessarily be positive in a radiculopathy.

Additional physical examination testing that would help determine the proper diagnosis includes resisted shoulder forward flexion and checking for symmetry of the deep tendon reflexes in the upper extremities.

Physical Examination, continued

With resisted shoulder forward flexion, he has partial winging of the medial border of the scapula on the right with medial displacement and mild medial rotation of the inferior angle of the scapula as compared to the left. In addition, there was slight elevation of the superior border of the right scapula with resisted shoulder forward flexion. Deep tendon reflexes are 2+ and symmetric in bilateral upper extremities at the biceps, brachioradialis, and triceps.

- If necessary, revise your differential diagnosis based on the additional physical findings.
- Design your approach to the electrophysiologic examination based on the existing data.

Commentary IV

With the additional information of the partial right scapular winging, a lesion affecting the right long thoracic nerve is the most likely diagnosis. The maneuvers that would allow one to differentiate between a long thoracic nerve lesion, dorsal scapular nerve lesion, and a spinal accessory nerve lesion would be shoulder abduction and shoulder forward flexion. With a long thoracic nerve lesion affecting the serratus anterior, one would expect to see winging of the medial border of the scapula, medial displacement, mild medial rotation of the inferior angle, and slight elevation of the superior border of the scapula with shoulder

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forward flexion. With a dorsal scapular nerve lesion, one would expect a displacement of the scapula downward and laterally with shoulder forward flexion since the rhomboids would be affected. With a lesion to the spinal accessory nerve affecting the trapezius, one would expect to see an elevation of the superomedial border of the scapula, lateral displacement and medial rotation of the inferior angle of the scapula with shoulder abduction[2].

Electrophysiologic Data

MOTOR NERVE CONDUCTION STUDIES							
NERVE	**SIDE**	**STIM SITE**	**RECORD**	**cm**	**AMPL**	**LAT**	**CV**
Median	R	Wrist	Thenar	7	8.3	3.3	
Median	R	Elbow	Thenar	28.6	8.3	8.4	56.1
Ulnar	R	Wrist	Hypothenar	7	10.8	3.4	
Ulnar	R	Below elbow	Hypothenar	24.2	10.6	7.6	57.6
Ulnar	R	Above elbow	Hypothenar	10	9.6	9.3	58.8
Long thoracic*	R	Erb's point	Anterior chest	31.0	0.9	4.5	
Long thoracic*	L	Erb's point	Anterior chest	33.0	4.5	4.1	

*** See Figure 1 for setup of this nerve conduction study**

Figure 1: Photograph of technique used to evaluate the long thoracic nerve conduction

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SENSORY NERVE CONDUCTION STUDIES							
NERVE	**SIDE**	**STIM SITE**	**RECORD**	**cm**	**AMPL**	**LAT**	**CV**
Median	R	Wrist	Index	14	28.0	3.2	53.8
Ulnar	R	Wrist	5th	14	14.6	3.7	48.3

NEEDLE ELECTROMYOGRAPHY

INSERTional activity: N, sust, unsust
FIB: 0, 1+, 2+, 3+, 4+
OTHER: 0 or fascic, myotonia, myokymia
EFFort: N,
RECruitment: N, â or á 1+, 2+, 3+, 4+
AMPlitude: N, â or á 1+, 2+, 3+, 4+
DURation: N, â or á 1+, 2+, 3+, 4+
POLyphasia: N, á 1+, 2+, 3+, 4+

R/L	MUSCLE	INSERT	FIB	OTH	EFF	REC	AMP	DUR	POL
R	Biceps	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	Serratus anterior	Sust	2+	0	N	↓3+	↑2+	↑1+	↑1+
R	Cervical paraspinal	N	0	0	N	N	N	N	N

- 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.
- 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.)

Electrophysiologic Data, continued

At this time, all the information is present to make a diagnosis. The muscles tested on concentric needle examination make a C5, C6, or C7 radiculopathy unlikely. The amplitude difference seen in the long thoracic motor nerve conduction studies also points towards an isolated long thoracic mononeuropathy.

- Make the final revisions of your diagnostic impression(s).

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Diagnostic Impression

Long thoracic mononeuropathy.

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

Commentary V

There is electrodiagnostic evidence of an isolated long thoracic mononeuropathy. It is possible that this was caused by a stretch injury while lifting at work. The temporal relationship of acute pain while waiting tables would support this diagnosis, but this is atypical of the types of stretch that commonly are reported causing a long thoracic nerve injury. The more common causes of an isolated long thoracic nerve injury are related to high velocity activities such as a fall, motor vehicle accidents, overhead throwing activities and abrupt de-acceleration movements. The likelihood of a lipoma compressing the long thoracic nerve is considered small. If his symptoms did not improve, an MRI of the right brachial plexus may be warranted to assess for possible masses, although the history is not that of a slowly progressive compressive lesion. Neuralgic amyotrophy (also known as acute brachial neuropathy/plexitis/neuritis, idiopathic brachial plexopathy/plexitis/neuritis, Parsonage-Turner Syndrome, shoulder girdle neuritis/syndrome, and paralytic brachial neuritis) classically presents as a sudden onset in pain in the shoulder or scapular region without inciting trauma and this case could be an atypical presentation. The patient did present with pain during a specific activity, but the particular activity may or may not have precipitated the pain. With Parsonage-Turner syndrome, occasionally the pain and subsequent atrophy can affect the more distal muscles of the forearm or hand. In a case series reported by Vanneste et al., patients presented with shoulder girdle or arm pain with resultant forearm or hand muscle atrophy only without muscle atrophy of the shoulder girdle.[4] The duration of pain can last from several hours to several weeks.

The etiology of neuralgic amyotrophy is unknown, although several mechanisms have been proposed. One of the mechanisms proposed is a viral etiology where the patients have a viral prodrome prior to the presentation of symptoms. There have been several cases reported with neuralgic amyotrophy associated with different viruses including EBV and CMV.[5,6,7,8] Autoimmune mechanisms with an associated inflammatory and/or ischemic component as well as a hereditary etiology have also been proposed.[1,5] Others have suggested that the etiology is a combination of all of the aforementioned whereby a susceptible individual is eventually exposed to a virus which triggers a response leading to neuralgic amyotrophy. Well known precipitating events include childbirth, trauma, surgery, infections, and various inoculations.[1] The most common mononeuropathies associated with neuralgic amyotrophy are the radial nerve, long thoracic nerve, axillary nerve, and suprascapular nerve. Sensory symptoms are seen in approximately 67% of patients with the most common being in the axillary and lateral antebrachial cutaneous nerve distributions. Sixty-six percent of patients present with unilateral lesions with 54% being on the right side and 34% of patients have bilateral neuralgic amyotrophy.[1] In this case, to further differentiate whether or not an inflammatory mononeuropathy was the etiology, a Lyme titer as well as screening rheumatological laboratory studies were obtained. All results were normal.

Physical examination can help with determining which muscles and nerves are more affected. In this case presentation, the physical examination pointed more towards a long thoracic mononeuropathy. The maneuvers that allow identification of abnormalities

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indicating long thoracic, dorsal scapular, or spinal accessory nerve involvement include evaluation of shoulder abduction and shoulder forward flexion. A long thoracic nerve lesion producing serratus anterior weakness produces winging of the medial border of the scapula, medial displacement, mild medial rotation of the inferior angle, and slight elevation of the superior border of the scapula with shoulder forward flexion. A dorsal scapular nerve lesion producing rhomboid weakness results in displacement of the scapula downward and laterally with shoulder forward flexion. A lesion to the spinal accessory nerve affecting the trapezius, results in elevation of the superomedial border of the scapula, lateral displacement and medial rotation of the inferior angle of the scapula with shoulder abduction.[2]

The evaluation of suspected neuralgic amyotrophy includes an electrodiagnostic evaluation to confirm that the symptoms and signs are not due to another diagnosis such as cervical radiculopathy. Findings on NCS and EMG are dependent on the affected nerves (primary motor, primary sensory, or mixed). The injury is usually axonal, although some cases have been presented where the findings suggest the presence of acquired demyelination characterized by conduction block. On needle examination, typically find positive waves and fibrillations due to the axonal loss. SNAPs can be used to differentiate between a cervical radiculopathy and neuralgic amyotrophy. In this case, there was a significant difference seen between the amplitudes of the long thoracic nerves with a comparable latency indicating axon loss. With a cervical radiculopathy distal to the dorsal root ganglion, one would expect that the sensory responses would be intact while the CMAPs would be affected.

The treatment plan for a long thoracic mononeuropathy is typically supportive and deals with the biomechanical alterations at the shoulder. The winging of the scapula can cause significant pain and occasionally an external shoulder harness is used to stabilize the scapula although this is not very effective. Taping the shoulder is another alternative but is poorly tolerated by most patients. If there is nerve recovery, physical therapy is useful to help re-stabilize the shoulder. Surgical grafting for repair of the long thoracic nerve has been successful in some cases but is rarely done prior to 6 months of conservative care. Surgical fusion of the scapula or tendon transfer is occasionally considered if nerve repair is not an option.

Treatment for neuralgic amyotrophy is usually supportive as the majority of patients do not have any residual deficits from this. Initially pain control is important. Once patients are able to tolerate movement without pain, range of motion should be initiated to prevent any further restrictions such as adhesive capsulitis and contractures. Strengthening exercises (especially addressing the affected muscles in addition to the surrounding musculature such as scapular stabilizers) should eventually be incorporated into the home exercise program. Approximately 36% of patients recover functionally within the first year, 75% by the end of the second year, and 90% by the end of the third year[1]. If the patient does not recover much in terms of strength and motion, surgical intervention can be considered. Surgical options can include tendon transfers to improve function.

The patient presented was provided reassurance and physical therapy was continued. A month later, he continued to have functional difficulty using the right arm and continued scapular winging, although he had improved. He was rescheduled for a repeat EMG 4 months later but given the option to cancel the appointment if he continued to improve. He reported ongoing improvement and canceled the repeat EMG appointment.

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Bibliography

1. Dimitru D, Amato AA, Zwarts MJ. Electrodiagnostic Medicine, 2nd ed. 2002. Hanley & Belfus, Inc. Philadelphia, PA
2. Frontera WR and JK Silver. Essentials of Physical Medicine and Rehabilitation. 2002. Hanley & Belfus, Inc. Philadelphia, PA
3. Braddom RL et al. Physical Medicine and Rehabilitation, 2nd ed. 2000. W. B. Saunders Co. Philadelphia, PA
4. Vanneste, JAL et al. Distal Neuralgic Amyotrophy. J Neurol (1999) 246;399-402
5. Misamore GW and DE Lehman. Parsonage-Turner Syndrome. J Bone Joint Surg [Am] (1996) 78-A; 1405-1408.
6. Vanpee D et al. Viral Brachial Neuritis in Emergency Medicine. J Emerg Med (2000) 18(2);177-179.
7. Post JJ, AR Lloyd, and PD Jones. Acute Q Fever and Brachial Neuritis: Case Report and Literature Review. Infection (2002) 30;400-402.
8. Tsao, BE, R Avery, and RW Shields. Neuralgic Amyotrophy precipitated by Epstein-Barr virus. Neurology (2004) 62;1234-1235.