June 2012 Case Study of the Month

Author: Eric Bowman, DO

CC: Left Shoulder Pain

HPI:
A 16 year old male baseball (P/CF) and soccer player presents with left sided neck, shoulder, and arm pain that began about 6 months ago without antecedent trauma. He was initially seen at that time for shoulder and forearm pain causing problems with pitching. He underwent functional rehab (including a throwing progression) and occupational therapy. He progressed well in both treatments and reports that he was pain free upon their completion. He returns to clinic now because he has started to have increased pain in the left neck, shoulder, and entire upper limb. He participated in a showcase about 2 weeks prior to this visit and notice pain the next day. The pain progressed throughout the week as he was preparing for a second showcase during which he was only able to throw about 20 pitches before he developed severe pain and had to stop. He has continued to have shooting pain into the 4th and 5th fingers with associated numbness and coolness. He has also noticed swelling in his arm after activity which resolves within about 15-20 minutes of rest.

PHYSICAL EXAM:
General: Happy, healthy appearing, in no apparent distress, alert and oriented times three

Left Shoulder Exam:
Inspection:
Visible muscle atrophy in the infraspinatus and supraspinatus muscles. Swelling of left thoracic paraspinals and rhomboids without erythema or ecchymosis.
Palpation:
Tenderness over supraspinatus only
ROM:
Flexion, abduction, external rotation: full; Internal rotation: reaches T2 on the right and T4 on the left
Strength
Flexion, abduction, internal rotation, external rotation of shoulder all 5/5
Biceps and Triceps strength: 5/5
Special tests:
Hawkins test: negative
Neer’s test: negative
Speed’s test: negative
Crank test: negative
O’Brien’s test: negative
Load and shift: negative
Sulcus sign: negative
Apprehension test: negative
Supraspinatus (Jobe) test: positive for pain and mild weakness
Lift-off test: negative
Wright’s test and Adson’s test: Demonstrated decreased radial pulse on the left
Roos’ test: Reproduced coolness of the 4th and 5th fingers on the left
Neurovascular Exam: Sensation intact in all upper extremity dermatomes, but subjectively decreased on left compared to right. 2+ pulses at the radial artery with 2 second capillary refill in all digits

Neck Exam:
No spinous process tenderness but left cervical paraspinal tenderness
Full ROM, but pain with flexion on the left
5/5 strength in all directions
Spurling’s test positive on the left with pain shooting into the 4th and 5th fingers

Left Forearm/Elbow/Hand Exam:
No atrophy, swelling, or ecchymosis
No tenderness noted at any bony or soft tissue structure
Mildly firmer soft tissues of left forearm compared to right
Noted to have colder 4th and 5th fingers of the left hand
Tinel’s test of the ulnar nerve at the elbow positive into the 4th and 5th fingers

DIFFERENTIAL DIAGNOSIS:
Cervical strain
Cervical radiculopathy
- Disk protrusion or osteophytes
Cervical cord tumor
Brachial plexus neuritis
Trapezius strain
Rotator cuff tendonitis
Thoracic outlet syndrome
Suprascapular nerve syndrome
Quadrilateral space syndrome
Rheumatologic causes
- Fibromyalgia, myositis, Raynaud’s syndrome
Peripheral nerve tumor
Thromboangiitis
Ulnar nerve compression
- Cubital or ulnar tunnel syndrome
IMAGING:

AP/lateral cervical spine x-rays: normal

MRI of the cervical spine revealed subtle edema within the left posterior paraspinal muscles at the C2-C4 level suggesting possible muscular injury. In addition there is subtle increased T2-weighted signal within and adjacent to the midportion of the left brachial plexus suggesting localized edema and possible injury. No visible herniated disc. No nerve root compression or visible avulsion. Normal appearing cervical spinal cord.
MRI of chest wall performed with shoulder abducted and adducted demonstrates a loss of normal flow within the left subclavian vein in both positions. The site of compression appears to be at the costoclavicular level. However, no mass is identified. Compression does correspond to the inferior attachment of the anterior scalene muscle at this site.

**Arrow shows lack of subclavian vein on the left side with shoulder adducted. Arrow shows lack of subclavian vein on the left side with shoulder abducted.**

**FINAL DIAGNOSIS:** Thoracic Outlet Syndrome that appears to be venous in nature of unclear etiology. Possibilities include hypertrophy of scalenus anterior secondary to increased weight training or a congenital cause (fibrous band or attachment variation).

**TREATMENT:** Initial trial of PT for cervical stretching and upper extremity stability for 8 weeks produced only minimal relief. He was subsequently referred to a vascular surgeon who performed a partial resection of the scalenus anterior muscle with removal of first thoracic rib.

**OUTCOME:** He was placed in a sling initially with limited ROM of the arm for 3-4 weeks for ADLs only with gentle active ROM encouraged. He has been undergoing PT to work on ROM, scar tissue management, and strengthening. He has been progressing well and denies any return of symptoms with ADLs currently (3 months post-op). Plan is for full return to sport after approximately 6-8 months.

**DISCUSSION:** Thoracic Outlet Syndrome (TOS) is a condition producing UE symptoms from compression of the subclavian artery or vein and the brachial plexus at the thoracic outlet. There are several different known etiologies including congenital cervical rib or fibrous extension of cervical rib (present in 0.5% to 1% of population); abnormal scalene muscle insertion or hypertrophy/spasm; drooping of shoulder girdle from generalized hypotonia or
trauma; narrowed costoclavicular interval as a result of downward/backward pressure on shoulder (heavy backpacks); acute venous thrombosis w/ exercise (effort thrombosis); bony abnormalities of first rib (high); abnormal fibromuscular bands or connections including tight compression of the axillary artery by the pectoralis minor as it courses over the neurovascular bundle (best tested with Wright’s hyperabduction maneuver); malunion of clavicle fracture. Females are affected more often at 3.5:1 and it is typically rare in those aged < 20 years.

TOS may present in different ways depending on the underlying cause. Arterial compression can result in pallor, paresthesias, diminished pulses, coolness, digital gangrene, supraclavicular bruit or mass. TOS caused by venous compression usually presents with edema and pain, and sometimes superficial venous dilation in shoulder area from thrombosis. Finally, TOS caused by neural compression most often involves the lower trunk (C8, T1) and presents with findings of intrinsic weakness and diminished sensation to the 4th and 5th finger and ulnar aspect of forearm. Occasionally, however, the upper plexus is trapped between the scalene muscles and presents with symptoms of median nerve compression. Isolated venous or arterial compression is uncommon, accounting for only about 2% of the cases of TOS, while neurologic involvement is present over 97% of the time. Mixed presentations are not unusual. Symptoms are often most pronounced with arm elevation above the level of the shoulder, especially with throwing, combing the hair, or sleeping with the arm above the head.

When evaluating for TOS, the shoulder should be observed for slouching or asymmetry with hypertrophy or drooping of the shoulder girdle. Other things to look for include venous engorgement or arm swelling, clavicle deformity or cervical rib (possibly present on physical exam, but more likely to be seen with x-ray), and decreased sensation tested with 2 point discrimination in the ulnar or median nerve distribution. Motor weakness may be present but very subtle.

Provocative tests for TOS include:

**Adson’s test:** Shoulder abducted 30 degrees and maximally extended. Neck extended and turned towards ipsilateral shoulder. Patient takes deep breath. Decrease in radial pulse considered positive (tests anterior scalene compression of axillary artery)

**Reverse Adson’s test:** Same as above but neck turned toward contralateral shoulder (tests middle scalene)

**Wright’s test:** Similar to Adson’s test with shoulder abducted 90 degrees

**Halstead’s maneuver:** Patient stands with arm at his side. Turns head away from affected shoulder and extends neck. Traction is applied to arm. Decrease in pulse or reproduction of symptoms considered positive test

**Roos’ test:** Shoulder’s abducted 90 degrees and elbows flexed 90 degrees. Patient opens and closes hands 15 times. Reproduction of symptoms considered positive test

**Retroclavicular Spurling’s test:** Examiner compresses brachial plexus and vascular structures in the retroclavicular space with thumb. Reproduction of symptoms considered positive test

**Hyperabduction test:** Examiner fully abducts both arms and feels for radial pulse. Decrease in pulse on affected side (compared to resting position) considered positive test
It is important to note that diminution in pulse can occur in asymptomatic patients in a number of these tests, so reproduction of symptoms may be the better predictor of TOS.

When provocative tests are positive and the clinical picture suggests TOS there are a variety of diagnostic imaging techniques that can be utilized to help make a diagnosis. These include: arteriography or venography when vascular pathology is strongly suggested; MRI of UE and chest wall with shoulder abducted and adducted; cervical spine imaging to look for cervical rib or cervical disk disease; EMG, nerve conduction velocity studies; diagnostic lidocaine injection in the to scalene to monitor for any pain relief.

An initial approach to treatment is based on good pain management including NSAIDs or oral steroids for nerve irritation, sleep hygiene, correcting driving habits, and stopping overhead sports. Therapy starts with shoulder and scapular exercises to restore movement and create more space for neurovascular structures. Exercises primarily focus on stretching that involves upper trapezius, SCM, levator scapulae, pectoralis minor and serratus anterior. With conservative management, improvement in symptoms should be seen in 1-3 months.

If conservative management isn’t effective, or venous/arterial impairment is present, surgical referral is appropriate. Surgical management typically includes resection of scalenus anterior and/or removal of 1st thoracic rib. Pectoralis minor tenotomy has also been described. Post-op recommendations may vary depending on the exact procedure but generally include a period of immobilization followed by Physical therapy to regain motion and strength. The patient should have full use of the extremity by 2 months post-op.

Return to play guidelines are relatively vague, but depends on return of the ROM, strength, endurance of the shoulder girdle and upper extremity. Recovery of 6 months to 1 year is usually needed to maximize functional return in competitive athletes. If the TOS is caused by effort thrombosis, it’s recommend that retirement from competitive swimming take place.

References
1. Bo Povlsen, et al., Treatment for thoracic outlet syndrome, Cochrane Review, 2010
2. DeLee and Drez’s Orthopaedic Sports Medicine, 3rd ed., 2009; DeLee, Jesse, David Drez, and Mark Miller