A Woman With Thoracic Outlet Syndrome and Difficulty Swallowing

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CLINICAL HISTORY

A 44-year-old right-handed female deputy sheriff was rear ended in an auto accident while stopped at a traffic light. She had her seatbelt on at the time of impact. She experienced immediate pain in the back of her head and neck exiting her car unassisted. On the following day, she consulted with a chiropractor, who prescribed treatment for approximately 2 months, which helped temporarily. X-rays were obtained but not available for review. She was eventually evaluated by a rheumatologist, who referred her for magnetic resonance imaging (MRI) of her cervical spine. He advised her of the findings recommending further care. Two months later, she was evaluated by an orthopedist, who also obtained x-rays providing physical therapy for an additional 2 months. Epidural injections were recommended but not administered. An electromyogram was obtained, described as unremarkable. Because of increasing neck pain, numbness in her left face, and drooping of her left eyelid, she was referred to another orthopedist.

REVIEW OF SYSTEMS

The orthopedist summarized her symptoms as positive for constant neck pain radiating into the mid-back, crunching neck sounds; limited range of motion, pain aggravated by sitting and lying down, full sensation in her right ear, and tickling with scratchy throat sensations. Her neurological examination was positive for numbness, tingling, and weakness of her left arm; swelling in the back of her neck; and diminished sensation to pinprick over the lateral aspect of the left hand. Reflex testing demonstrated biceps reflexes 1 on the right and trace on the left, while triceps muscle and periosteal radialis reflexes were 1 on the right and equal.

- Allergies: positive to penicillin, morphine, iron, melons, walnuts, and coconuts.
- Medications: prednisolone, Aciphex, and folic acid.
- Surgeries: hysterectomy and left arthroscopic shoulder surgery.
- Medical problems: lupus and avascular necrosis in the right hip (documents not available for review).

PHYSICAL EXAMINATION

Blood pressure in the left arm down was 130/78 mm Hg; left arm elevated overhead, 90/50 mm Hg; right arm down, 130/70 mm Hg; right arm up, 90/60 mm Hg. Having the left arm elevated overhead triggered complaints of tingling and numbness radiating down into the 4 to 5 digits of the left hand without loss of the radial pulse. Height, 1.65 m; weight, 65.32 kg; 6.8 kg gained in 8 weeks. The patient tested negative for edema, cyanosis, and loss of sensation, except as above described.

LABORATORY RESULTS.

With testing for lupus underway, all other laboratory results were within normal limits.

REVIEW OF OUTSIDE RECORDS

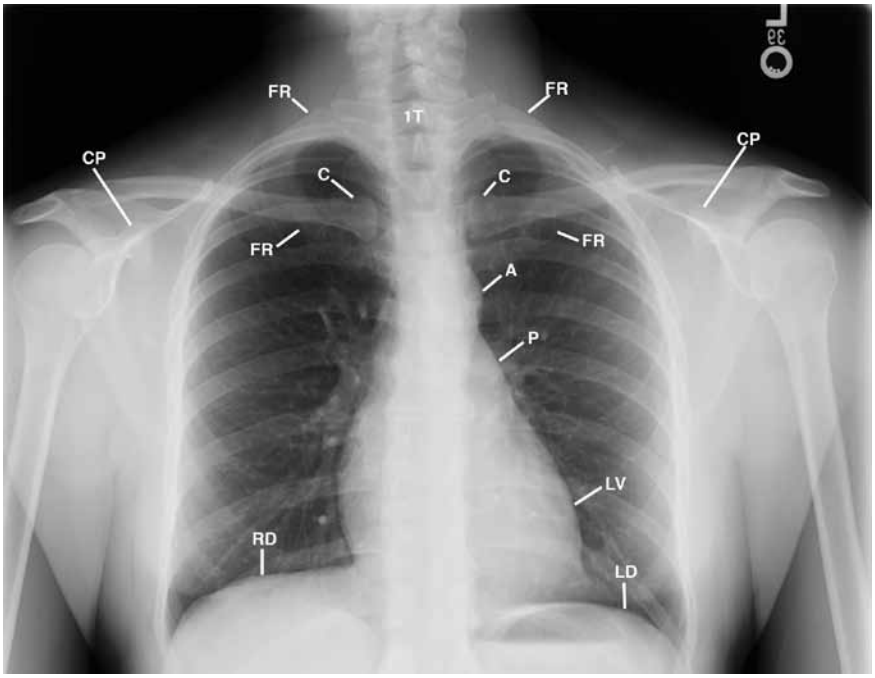
Electrodiagnostic testing of the upper extremities and neck and MRI reports of the cervical spine were reviewed by the orthopedist but not made available for review.

DIAGNOSIS

- Cervical strain.
- Degenerative cervical disc disease at C5-C6 with mild central disc bulging.
- Left C8 radiculopathy (chronic).
- Rule out thoracic outlet syndrome.

Comments and conclusions by the orthopedist included: thoracic outlet syndrome suspected on the left with ongoing complaints.[1] Although her Adson's test in the office failed to identify loss of radial pulse with abduction and external rotation of the left upper

Figure 1. Drooping of the shoulders, right greater than left; anterior-rotated heads of the clavicles (C), low over the posterior 4th ribs (not labeled). Observe the patient leaning right; mild concave right scoliosis of the cervicothoracic spine (not labeled), C4-T7; thin subcutaneous tissues and normal lungs.



Abbreviations: 1T, first thoracic vertebra; A, aorta; CP, coracoid process; FR, first rib; LD, left hemidiaphragm; LV, left ventricle; P, pulmonary artery; RD, right hemidiaphragm.

extremity in the upright position, left-sided complaints were triggered with the arms overhead maneuver reflecting costoclavicular compression of the vascular supply to the brachial plexus nerves.[2-4]

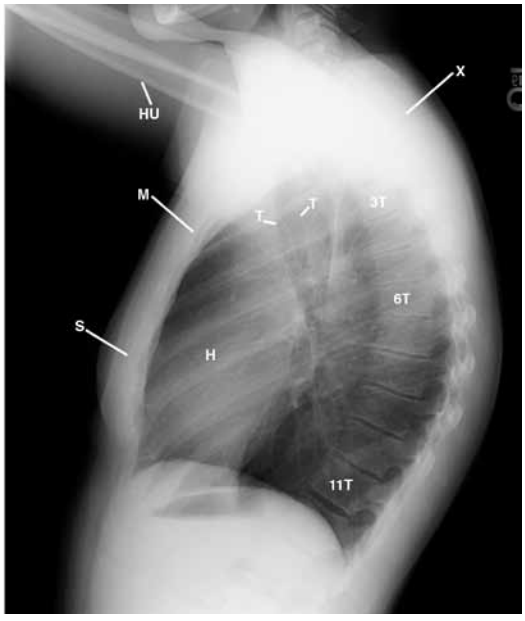
RECOMMENDATIONS

MRI of the thoracic outlets by Dr Collins at University of California, Los Angeles, with restrictions of her activities in the interim.

RADIOGRAPIC AND MRI/ MRA/MRV FINDINGS

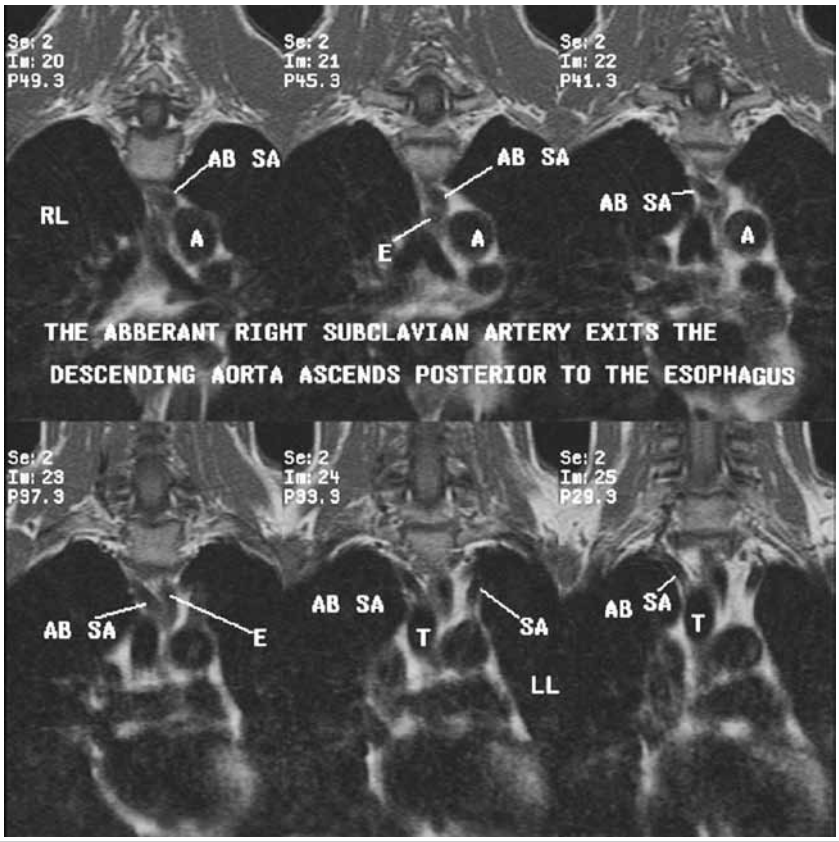
The posterior-anterior chest radiograph (Figure 1) displays forward drooping of the shoulders, right greater than left; anterior-rotated heads of the clavicles low over the posterior 4th ribs; patient leaning right; mild concave right scoliosis of the cervicothoracic spine, C4-T7; thin subcutaneous tissues, and normal lungs. The lateral chest radiograph (Figure 2) cross-references the posterior-anterior chest radiograph to display kyphosis of the cervicothoracic spine; increased slope of the first and second ribs; anterior bowed body of the sternum backwardly displacing the manubrium, and incomplete elevation of the arms overhead. The anterior-posterior cervicothoracic spine radiograph (not displayed) 15º angled to the chin with arms at the side displayed the patient leaning right, and the anterior-rotated heads of the clavicles over the posterior third intercostal spaces.

Figure 2. Kyphosis of the thoracic spine (3T, 6T, 11T) increasing the slope of the first and second ribs (not labeled) backwardly displacing the manubrium (M), anterior bowing the body of the sternum (S). Observe the incomplete elevation of the arms overhead.



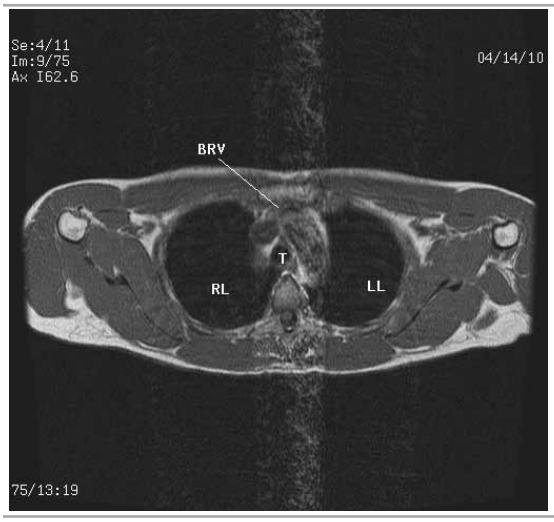
Abbreviations: H, heart; HU, humerus; T, trachea; X, round shoulders.

Figure 3. First series of 6 coronal T1-weighted MRI images (20-25) that display the origin of the unsuspected aberrant right subclavian artery (AB SA) from the posterior arch of the displaced aorta (A) as it ascends posterior to the compressed esophagus (E) into the region of the right scalene triangle.



Abbreviations: LL, left lung; RL, right lung.

Figure 4. Transverse image of the second series of T1-weighted MR images that displays the manubrium (unlabeled) compressing the gray proton-dense left brachiocephalic vein (BRV) against the ascending aorta posterior left of midline.

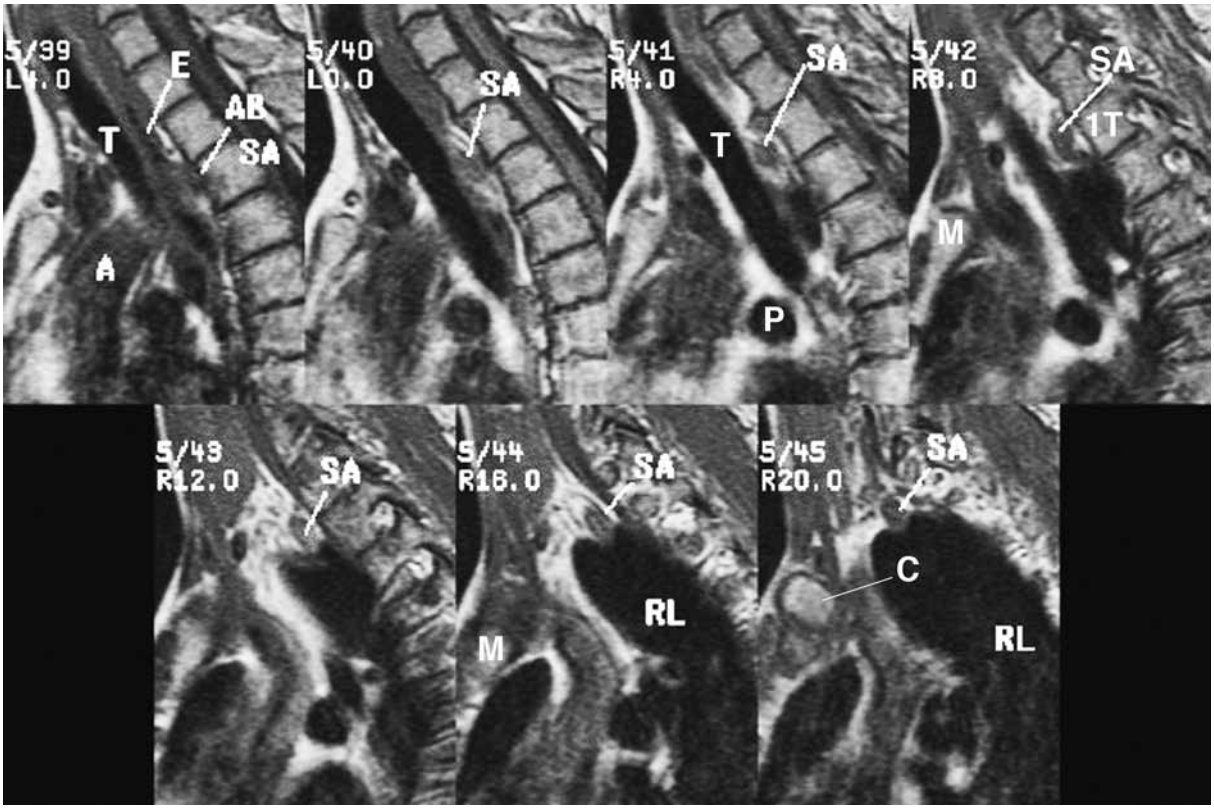


Abbreviations: LL, left lung; RL, right lung; T, trachea.

Multiplanar MRI-captured images displaying thin subcutaneous tissues; patient leaning right; right concave cervicothoracic spine kyphoscoliosis increasing the slope of the first ribs;[2] backward displaced the manubrium compressing the ascending aorta posterior left of the midline mildly crimping (like a water hose) the great vessels ascending into the neck; particularly the aberrant right subclavian artery (Figures 3 and 4) ascending from the posterior displaced aorta posterior to the esophagus (Figure 5) compressed against the trachea, ascending into compressed second division of the right subclavian artery with binding nerve trunks within the scalene triangle.[3]

Dilatation of the right vertebral vein reflected impedance to venous return into the gray proton-dense right brachiocephalic vein. The backward sternocleidomastoid muscles on the manubrium and clavicles medially compressed the inferior bicuspid valves within the internal jugular veins proximal to the brachiocephalic veins, right greater than left, and costoclavicular compression of the bicuspid valves within the gray proton-dense subclavian veins, right greater than left. The high proton-dense first division of the left subclavian artery (Figure 6) reflected

Figure 5. Serial (7) sagittal T1-weighted MR images (5/39-5/45) that display the forward shift of the cervicothoracic vertebrae (not labeled) aberrant subclavian artery (AB/SA) ascending posterior to the compressed esophagus (E) and the trachea (T) over the apex of the pleura of the right lung (RL) into the region of the right scalene triangle, image 5/48.



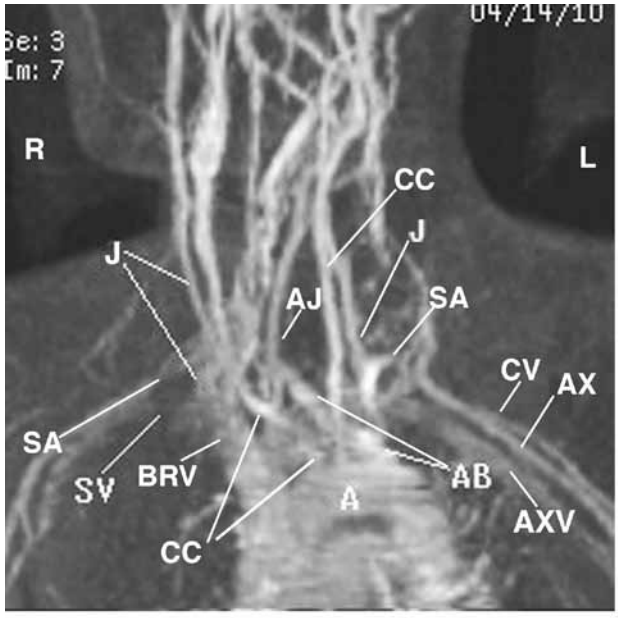
Abbreviations: 1T, first thoracic vertebra; C, clavicle; M, manubrium; P, pulmonary artery.

costoclavicular compression of the second division of the subclavian artery with binding nerve trunks.[5] Both subclavian veins diminished signal intensity into the compressed junction with the internal jugular veins. Dilated valveless right anterior jugular vein diverted venous return from the compressed right external jugular and subclavian veins as compared to the smaller left valveless anterior jugular vein (not labeled). Hazy gray fibrosis marginated the second division of the right subclavian artery with binding nerve trunks (not displayed) within the scalene triangle into the supraclavicular fossa.

The 2-dimensional time-of-flight magnetic resonance angiography (MRA) and magnetic venography (MRV) stacked with 3-dimensional reconstructed images confirmed the high proton-dense crimped ascending aberrant right subclavian artery (AB), right common carotid artery (CC), and the left subclavian artery (SA), with mild compression of the second division of the left subclavian artery from the backward displaced ascending aorta (A) without contrast (Figure 6); medial compressed descending right internal jugular vein at the inferior bicuspid valve laterally extended into the decreased signal intensity of the right brachiocephalic vein (BRV), and the intermediate high proton-dense proximal left axillary vein (AXV) decreasing signal intensity inferior to the third division of the left subclavian artery (not labeled). The proximal right subclavian vein (SV) diminishes signal intensity as it drains into the junction of the right internal jugular and right brachiocephalic veins (BRV).[6]

Bilateral coronal abduction external rotation (AER) sequence of the upper extremities enhanced costoclavicular compression of the draining veins within the neck, supraclavicular fossae with lymphatics and compression of the subclavian and axillary arteries with binding nerve roots (not displayed). The posterior-inferior displaced clavicles with subclavius muscles and posterior-anterior medial rotation of the coracoid processes with attached muscles diminished arterial flow to the brachial plexus and diminished venous return from the brachial plexus, right greater than left, that triggered complaints of pain over the right trapezius and deltoid muscles that stopped.[6] No left-triggered complaints, headache, and/or left-sided complaints developed.

Figure 6. 3-Dimensional reconstructed magnetic resonance angiography and magnetic venography series 3 without contrast. The high proton-dense aberrant right subclavian artery (SA) ascends compressed by the left brachiocephalic vein (not labeled) as the aberrant subclavian artery (AB) ascends posterior to the parallel ascending high proton-dense right common carotid artery (CC).



Abbreviations: A, aorta; AJ, valveless right anterior jugular vein; AX, axillary artery; AXV, axillary vein; BRV, right brachiocephalic vein; CV, cephalic vein; J, internal jugular vein; L, left; R, right; SV, subclavian vein.

CONCLUSION

- Thin subcutaneous tissues.
- Bilateral round shoulders, right droops greater than left.
- Right concave kyphoscoliosis increased the slope of the first ribs, backwardly displacing the manubrium compressing the bicuspid valves within the draining veins of the neck, supraclavicular fossae with lymphatics and compression of the subclavian and axillary arteries with binding nerve roots, right greater than left.
- Aberrant right subclavian artery caused difficulty in swallowing.
- Fibrosis second division of the right subclavian artery.
- Bilateral costoclavicular compression (laxity of the sling/erector muscles-trapezius, levator scapulae, and the serratus anterior muscles) of the bicuspid valves within the draining veins of the neck, supraclavicular fossae with lymphatics and compression of the subclavian and axillary arteries with binding nerve roots, was displayed right greater than left, as above described, diminishing venous return and arterial flow to the brachial plexus.
- Bilateral abduction external rotation of the upper extremities (AER) captured images that displayed enhanced costoclavicular compression of the internal jugular veins, right greater than left, and triggered complaints only on the right.

DISCUSSION

Thoracic outlet syndrome is a clinical diagnosis that has a pathological cause. Patients with the diagnosis of thoracic outlet syndrome display laxity of the sling/erector muscles forward-rotating the round shoulders, increasing the asymmetric slope of the first ribs, backwardly displacing the manubrium, posterior right and/or left that crimps the great vessels (like a water hose). Our patient presented with kyphosis of the cervicothoracic spine that increased the slope of the first ribs as described above.[2] The resulting costoclavicular compression crimped the great vessels (Figure 6), diminishing nutrient arterial, venous, and lymphatic circulation to the 5 senses (hearing, sight, smell, taste, touch), triggering patient complaints.

The referring orthopedic surgeon was very familiar with the symptoms of patients with thoracic outlet syndrome. The arms-overhead maneuver (AER) diminished the blood pressure as compared to the arms down, triggering complaints from the clavicles and subclavius muscles compression of the bicuspid valves within the draining veins of the neck, supraclavicular fossae, and compression of the subclavian and axillary arteries with binding nerve roots. The captured images supported the above.

The entire procedure was monitored at the imaging console that detected costoclavicular compression of the brachial plexus and the aberrant right subclavian artery that coursed posterior to the compressed esophagus contributing to difficulty in swallowing—the history of

which was not provided by the patient. On completion of the MRI procedure, the radiologist reviewed with the patient the landmark anatomy and physiology that contribute to symptoms of thoracic outlet syndrome. However, the patient received a telephone call that required her immediate attention and therefore did not witness the aberrant right subclavian artery that caused difficulty in swallowing. Preliminary findings were reported to the requesting physician after review of the entire procedure. Annotated images were also provided to the requesting physician. The radiologist called the patient the next morning. She responded by saying she had wanted to discuss her swallowing difficulties and was very sorry that she did not think it was important at the time of the initial examination.

TAKE-HOME MESSAGE

Plain radiographs should be obtained to display osseous and soft-tissue abnormalities, as in kyphotic deformities of the thoracic spine that reflect rounding of the shoulders. Our patient did not provide a complete history to the referring physician. Blood pressure recordings are often obtained by assistants that do not report triggered complaints to the examining physician. In our patient, the orthopedist obtained the blood pressure recordings that triggered complaints. The radiologist monitored the MRI at the imaging console that immediately detected the aberrant right subclavian artery. Often, this is not the case, as the technologist obtains the images and the radiologist reviews the images at a later date. The patient and referring physician should be informed of any abnormal finding at the time of the procedure.[6]

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