

Why Does a Man with Chronic Hypertension Post Rotor Cuff Repair Have Pulsation Over the Right Neck: MRI/MRA/MRV

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CLINICAL HISTORY

This is a 78-year-old right-handed business executive presenting with a three-year history of headaches, light headed sensations, and right arm pain that was thought to be bursitis. He went to his community hospital and was diagnosed with right rotator cuff injury requiring surgery. No X-rays or MRI studies and/or second opinion were obtained. Thereafter, he underwent right rotator cuff repair complicated by staphylococcus infection of the right acromioclavicular joint.

The surgeon had to operate to correct the above infection and in doing so “cut the right deltoid muscle”. Thereafter, he had difficulty using the right arm-elevating arm overhead. His primary physician referred him to an orthopedist who placed him on physical therapy ultimately gaining 75% return use of his right arm.

PAST HISTORY

About 35 years ago, he injured his back for which he received physical therapy with relief. He had no further complaints after executing prescribed exercises.

He also indicated he had received treatment for hypertension high blood pressure and a urinary problem-no details provided.

He awakened one morning unable to rise from sitting on the side of the bed. He felt very helpless. He was taken to a local hospital, treated and released without a diagnosis.

His primary physician referred him to a neurologist at the UCLA medical center. The neurologist performed a limited neck examination that revealed a pulsatile bulging over the right sternocleidomastoid muscle superior to the head of the right clavicle. He

had forward leaning posture left and was unable to elevate his right arm approximately 75% as compared to the left arm.

Physical examination: height 5 feet 8 1/2 inches, blood pressure left arm down 160/90 Hg, left arm up falling to 0/60; right arm down 180/85 Hg, right arm up falling to 40/65 triggering complaints of light headed sensation, dizziness, and pain over the right anterior chest wall, pulse 70 beats/min; temperature 96.7 °F; and respiratory rate, 18 breaths/min.

HEENT: unremarkable.

Shoulders: bilateral rounding with forward rotation leaning left with palpable pulsatile bulging over the right sternocleidomastoid muscle as per history above, and tenderness over a scar defect over the right acromioclavicular joint and deltoid muscle.

IMPRESSION(S)

- 1) Post right rotator cuff surgery complicated by staphylococcus infection as per history.
- 2) Chronic hypertensive cardiovascular disease.
- 3) Urinary problems without defined history.
- 4) Bilateral rounding of the shoulders as above.¹
- 5) Blood pressure recording triggered symptoms of vascular compression suggestive of thoracic outlet syndrome.

PLAN

- 1) Consider thoracic outlet syndrome.²
- 2) Request Bilateral MRI MRA MRV of the brachial plexus with Dr. Collins at UCLA.
- 3) Consider EMG/NCV studies of both upper extremities.

Because the neurologist suspected vascular compression of the brachial plexus and the clinical diagnosis of

thoracic outlet syndrome bilateral MRI MRA and MRV of the brachial plexus was requested to detect sites of brachial plexus compression.²

PA AND LATERAL CHEST RADIOGRAPHS

Comparison

No previous chest films are available for comparison.

Findings

The PA chest radiograph (Figure 1) displays left concave scoliosis of the cervicothoracic spine, C6-T12; anterior rotated asymmetric heads of the clavicles, right higher than left, over the posterior third asymmetric third ribs; high right first rib as compared to the low left first rib reflecting left concave scoliosis of the cervicothoracic spine; hazy density increasing the definition of the right lateral margin of the right peritracheal manubrium suspicious for enlarged brachiocephalic trunk; atheromatous calcification within the ascending and descending aorta; left ventricular enlargement; air fluid level over the region of the esophageal gastric junction consistent with a hiatal hernia; drooping small left shoulder as compared to the higher right shoulder; dystrophic calcification over the irregular resected right acromioclavicular joint extending into the margins of the right coracoid process with metal staples

and/or clips over the head of the right humerus, and mild degenerative changes along the lateral margins of the lower thoracic spine with normal aerated lungs.

The lateral chest radiograph (Figure 2) cross references the PA chest radiograph to display the forward shift of the cervicothoracic spine (kyphosis); anterior bridging osteophytes marginating the thoracic spine, enhanced by the atheromatous calcification in the descending aorta crossing the thoracic spine; calcification over the root of the aorta; backward displaced manubrium, accentuating the anterior rotated heads of the clavicles in close proximity to the first ribs; hazy density crossing anterior posterior to the trachea superior to the aortic arch suspicious for enlargement the brachiocephalic trunk, and rounding of the shoulders.

The AP cervicothoracic spine radiograph (not displayed) 15° angle to the chin arms at side displays left concave cervicothoracic spine scoliosis, C4-T5; convexed peritracheal density marginating the posterior right 3rd and

Figure 1. The PA chest radiograph displays the patient leaning left; elevated right shoulder as compared to the left; anterior rotated head of the clavicle right clavicle over the posterior right 3rd rib (C) as compared to left over the posterior left 3rd rib accentuating left concave scoliosis of the cervicothoracic spine, C6-T12 (not labeled); narrowing of the left intercostal spaces as compared to the right; hazy density extending from the dilated ascending aorta (A) crossing over the trachea over the posterior right 3rd rib posterior to the manubrium (not labeled) inferior to the head of the right clavicle (C) reflecting the region of the pulsatile brachiocephalic trunk (BR); left ventricular configuration (LV); dominant right shoulder as compared to the smaller left shoulder; irregular resected right AC joint with faint display of metal clips over osseous extension into the right coracoid process (CP), descending aorta (DA); first rib (FR), right lung (RL), trachea (T).

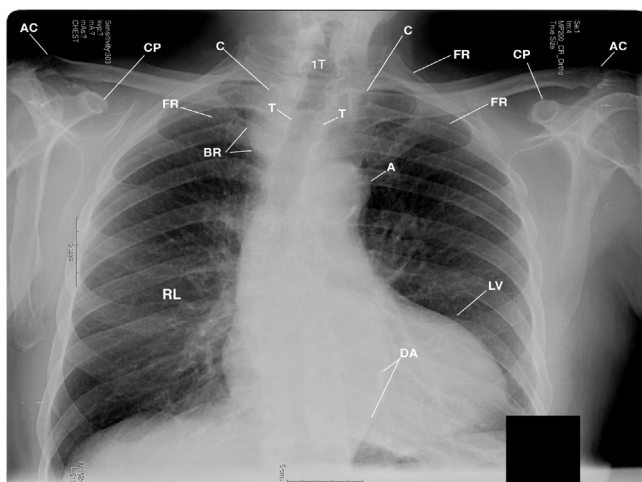
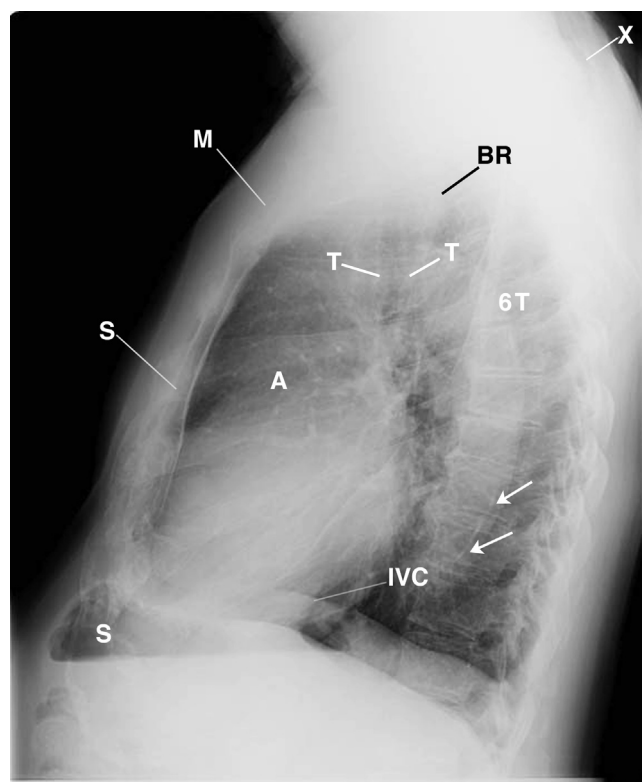


Figure 2. This lateral chest radiograph cross references the PA chest radiograph to display the muscular obese thorax; forward shift of the cervicothoracic spine (kyphosis) and rounding of the shoulders (X); mild anterior bowed body of the sternum (S) with backward displaced manubrium (M); hazy density extension from the ascending aorta anterior to the trachea (T) consistent with the dilated brachiocephalic trunk (BR). Observe the dilated ascending aorta (A) within the anterior mediastinum; enlarged left ventricle (not labeled) backwardly displacing the inferior vena cava (IVC). 6T-Sixth thoracic vertebra, ST-stomach. 2 arrows marginating atheromatous changes within the descending aorta.



4th left first ribs inferior to the head of the right clavicle; right first rib higher than the left first rib; atheromatous calcification over the region of the right common carotid artery adjacent to the right 5th cervical vertebra; degenerative changes of the joints of von Luschka at the level of C6-7 and C5-6, greater right than left and right C2-C3 joints of von Luschka.

CONCLUSION(S): FOR THE CHEST RADIOGRAPHS

- 1) Hypertensive cardiovascular disease as per history given.
- 2) Enlarged heart.
- 3) Right peritracheal density over the right lateral margin of the manubrium suspicious for the pulsatile enlargement of the brachiocephalic trunk as above described.¹
- 4) Atheromatous calcification over the right common carotid artery, aorta, and descending aorta (displayed on the AP cervicothoracic).
- 5) Left concave cervicothoracic spine kyphoscoliosis as above with mediastinal shift right.
- 6) Post-right rotator cuff repair.
- 7) *Post right rotator cuff surgery complicated by staphylococcus infection as per history.*
- 8) Bilateral rounding of the shoulders, left droops as compared to the anterior rotated right.¹
- 9) Degenerative changes cervical and thoracic spine as above described.

MAGNETIC RESONANCE IMAGING (MRI) FINDINGS:

The **coronal sequence** displays the backward manubrium with body of the sternum sloping posterior left with the asymmetric heads of the clavicles, right higher on the manubrium as compared to the left clavicle; backward manubrium displacing the dilated ascending aorta and the pulmonary trunk back and down crimping the dilated gray proton dense brachiocephalic trunk¹; enlarged left ventricle, right first rib higher than the left first rib; dilated gray proton dense left external jugular vein as compared to the smaller right (**Figure 3**); surgical defect in the dorsum of the right deltoid muscle accentuating the mildly dilated lateral ventricles with widen gyri, backward folding of the dilated first division of the right subclavian on the dilated brachiocephalic trunk, dominant left vertebral artery as compared to the left, degenerative changes of partial fused C4-5, dilated pulmonary veins, left atrium, and the dilated

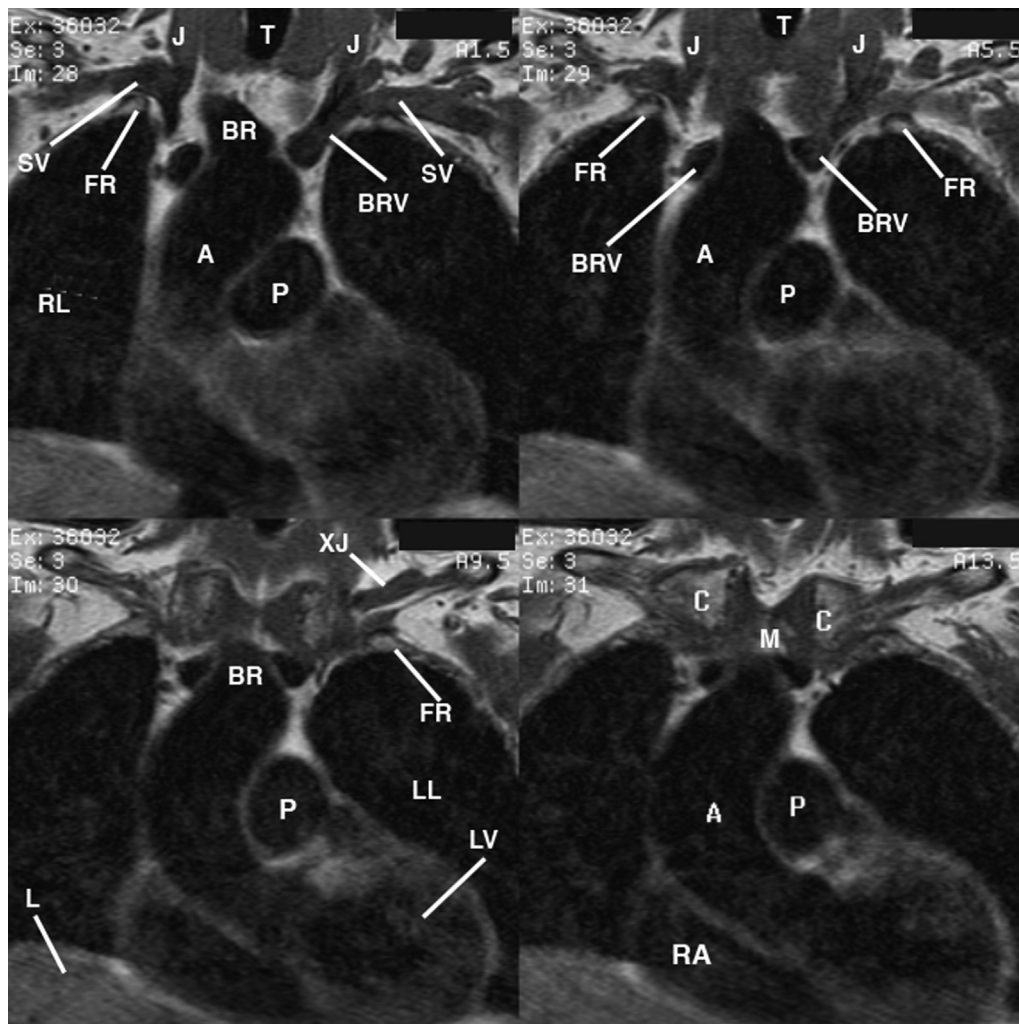
second divisions of the subclavian arteries with binding nerve trunks, right greater than left (**Figure 4**).

The **transverse sequence** displays the backward manubrium compressing the dilated crimped brachiocephalic trunk in common origin with the left common carotid artery against the trachea accentuating the anomalous posterior right lateral downward course of the brachiocephalic trunk against the right lung as the faint display of the gray proton dense right common carotid artery exits the right lateral margin of the brachiocephalic trunk ascending into the right carotid sheath posterior to backward right sternocleidomastoid muscle causing the backward folding of the dilated gray proton dense first division of the right subclavian artery to compress the gray proton dense descending right vertebral vein against the brachiocephalic trunk (**Figure 5**, images 16, 17, 20); gray proton dense left common carotid artery extending s in common from the dilated gray proton dense brachiocephalic trunk within the mediastinum posterior lateral on the fascia of the dilated gray proton dense crimped first division of the left subclavian artery ascending anteriorly enhanced by the left clavicle with the subclavius muscle compression of the inferior bicuspid valve within the left internal jugular vein; prominent vertebral venous plexus/Batson's plexus marginating the thoracis and cervicis muscles of the vertebral column with faint display of the right and left axillary arteries compressing the axillary veins in the supraclavicular fossae (**Figure 5**, images 16, 17, 20).¹

The **right and left transverse sequences** (not displayed) cross referenced the coronal sequence.

The serial images of the right sagittal sequence displayed the backward sternum with the backward manubrium compressing the gray proton dense brachiocephalic trunk ascending against the trachea; dilated first division of the gray proton dense right subclavian artery backwardly folding on the gray proton dense dilated brachiocephalic trunk; anterior rotated head of the right clavicle (C) on the backward manubrium (M) with the body of the sternum (not labeled) as the backward right sternocleidomastoid muscle compresses the region of the inferior bicuspid within the descending right internal vein against the intermediate gray proton right internal jugular vein (J) against the ascending (not labeled) on the common carotid artery against the first division of the ascending right subclavian artery (SA); backward dilated aorta compressed against the dilated pulmonary trunk downward course of the dilated gray proton dense brachiocephalic trunk (BR) displaced against the right lung (RL) causing the backward folding of the dilated gray proton dense first division of right subclavian artery (SA) on the gray proton dense as the right common artery ascends from the brachiocephalic trunk; first division of the right subclavian artery ascending

Figure 3. This consecutive coronal series of T1 weighted images (31, 30, 29, 28) displays the backward manubrium (M) with the asymmetric heads of the clavicles (C) sloping posterior left displacing the dilated ascending aorta (A) and pulmonary trunk (P) down and back as the proximally dilated gray proton left brachiocephalic vein (BRV) obliquely descends compressing the crimped (like a water hose) dilated brachiocephalic trunk (BR) crosses against the trachea (not displayed); elongation of the dilated brachiocephalic trunk against the right lung (RL) which backwardly folds the first division of the gray proton dense right subclavian artery on the brachiocephalic trunk. Observe the dilated gray proton dense left external jugular vein (XJ) descending compressed on the bicuspid valve within the left subclavian vein (SV) as the clavicle (C) with the subclavius muscle compresses the left cephalic vein (image 28) on the left axillary vein (not labeled). Low left first rib (FR); as compared to the right; Liver (L), enlarged gray proton dense left ventricle (LV).

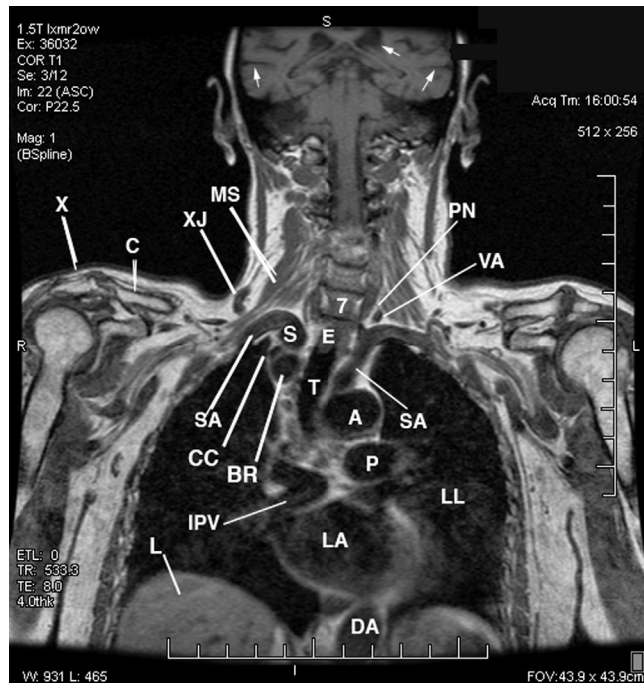


against the gray proton dense right common carotid artery (CC) as the first division of the right subclavian artery also ascends into the right scalene triangle; intermediate gray proton dense right vertebral vein (not labeled) displaced by right common carotid artery (CC) against the posterior descending right internal jugular vein (J). First Rib (FR), Internal Thoracic Vein (ITV).

The 2D TOF MRA/MRV displayed 3D reconstructed coronal images confirming the T1 weighted images displaying the dominant left internal jugular vein as compared to the smaller right; dominant high signal intensity of the left external jugular vein dilating as it crossed over the dilated second division of the subclavian artery as it enters the subclavian vein over the bicuspid valve of the

subclavian vein at the junction of the internal jugular and subclavian veins; tortuous dilated left common carotid artery taking origin from the dilated aorta; proximal dilated first division of the left subclavian artery, gives off the tortuous crimped course left vertebral artery; tortuous dilated brachiocephalic trunk gives off the dilated crimped right common carotid artery as the tortuous first division of the right subclavian artery enters the scalene triangle; dominant left sigmoid sinus draining into the dominant left internal jugular vein, as compared to the smaller right; low proton densities mixed within the gray proton density of the deltoid muscle reflecting the resected site of right AC joint, and the anterior facial vein draining the angular and ophthalmic veins of the right eye.

Figure 4. This coronal T1 weighted MRI displays the patient leaning to the smaller left shoulder as compared to the dominant right shoulder (not labeled); resected distal right clavicle (C) with scarring and (not labeled) and the right deltoid muscle (not labeled). Observe the dilated posterior right lateral course of the crimped (like a water hose) dilated brachiocephalic trunk (BR) displaced by the right lung against the trachea (T) as it gives origin to the right common carotid artery (CC) compressed by the right lung anterior medially ascending into the right carotid sheath; backward folding of the dilated gray proton dense first division of the right subclavian artery (S) on the brachiocephalic trunk against the right lung downwardly compressing the brachiocephalic trunk as the first division of the dilated right subclavian artery (S) enters the scalene triangle as the dilated second division of the gray proton dense dilated right subclavian artery (SA) with binding nerve trunks. Observe the prominent gyri and the mildly dilated lateral ventricles within the brain reflecting mild cerebral atrophy (small arrows). Aorta (A), Descending Aorta (DA), Esophagus (E), Left atrium (LA), Left lung (LL), Middle scalene muscle (MS), First division of the right subclavian artery (S), Pulmonary artery (P), Phrenic nerve (PN), Vertebral artery (VA), Seventh cervical vertebra (VA).



Bilateral abduction external rotation coronal sequence displayed the mixed signal intensity of the resected acromioclavicular joint; mixed signal intensities over the right head of the humerus; left shoulder drooping as compared to the elevated right and the left concave scoliosis of the cervicothoracic spine, unchanged significantly from that of the coronal sequence.

This sequence displays the posterior inferior rotation of the clavicles with the subclavius muscles and the posterior anterior medial rotation of the coracoid processes enhancing costoclavicular compression³ of the draining tortuous veins of the neck, supraclavicular fossae and the tortuous dilated areas of the neurovascular bundles with the binding nerves, right greater than left.

Bilateral abduction external rotation (AER) of the upper extremities triggered no complaints. The posterior inferior

rotation of the clavicles with the subclavius muscles and the posterior anterior medial rotation of the coracoid processes with the coracobrachialis, biceps tendon muscle, pectoralis minor muscle and the sternocleidomastoid muscles did not significantly increase compression of the tortuous vascular supply above described.

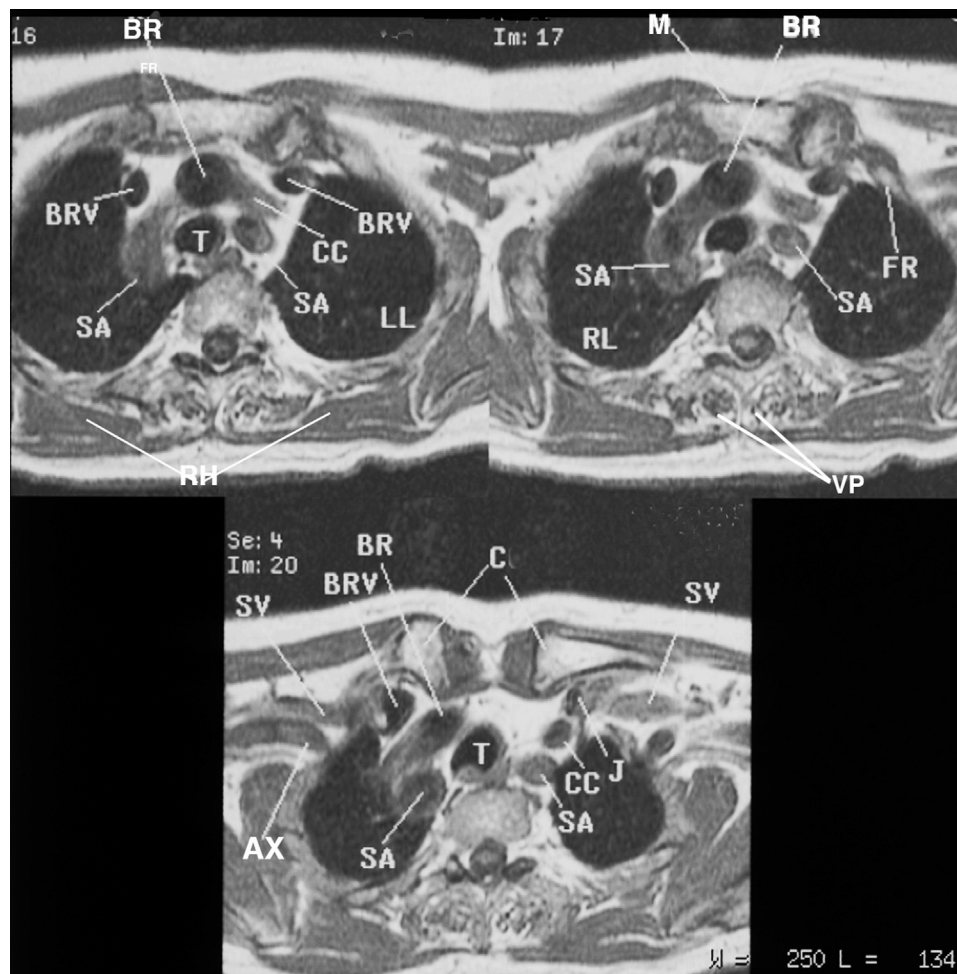
COMMENT

The PA chest radiograph (Figure 1) displays left concave scoliosis of the cervicothoracic spine, C6-T12; anterior rotated asymmetric heads of the clavicles, right higher than left, over the posterior third asymmetric third ribs; high right first rib as compared to the low left first rib reflecting left concave scoliosis of the cervicothoracic spine; hazy density increasing the definition of the right lateral margin of the right peritracheal manubrium suspicious for enlarged brachiocephalic trunk; atheromatous calcification within the ascending and descending aorta; left ventricular enlargement; air fluid level over the region of the esophageal gastric junction consistent with a hiatal hernia; drooping small left shoulder as compared to the higher right shoulder; dystrophic calcification over the irregular resected right acromioclavicular joint extending into the margins of the right coracoid process with metal staples and/or clips over the head of the right humerus, and mild degenerative changes along the lateral margins of the lower thoracic spine with normal aerated lungs.

The lateral chest radiograph (Figure 2) cross references the PA chest radiograph to display the forward shift of the cervicothoracic spine (kyphosis); anterior bridging osteophytes marginating the thoracic spine, enhanced by the atheromatous calcification in the descending aorta crossing the thoracic spine; calcification over the root of the aorta; backward displaced manubrium, accentuating the anterior rotated heads of the clavicles in close proximity to the first ribs; hazy density crossing anterior posterior to the trachea superior to the aortic arch suspicious for enlargement the brachiocephalic trunk, and rounding of the shoulders.

The AP cervicothoracic spine radiograph (not displayed) 15° angle to the chin arms at side displays left concave cervicothoracic spine scoliosis, C4-T5; convexed peritracheal density marginating the posterior right 3rd and 4th left first ribs inferior to the head of the right clavicle; right first rib higher than the left first rib; atheromatous calcification over the region of the right common carotid artery adjacent to the right 5th cervical vertebra; degenerative changes of the joints of von Luschka at the level of C6-7 and C5-6, greater right than left and right C2-C3 joints of von Luschka.

Figure 5. This T1 weighted transverse sequence of magnetic resonance images, 16/75-17/75 and 20/75, cross referencing the coronal sequence to display the backward manubrium (M) sloping posterior left with the asymmetric heads of the clavicles (C) compressing the dilated gray proton dense crimped brachiocephalic trunk (BR) that descends back and down right lateral to the trachea (T) as the dilated first division of the crimped right subclavian artery (SA) acutely ascends posterior anterior laterally on the T1-T3 vertebrae medially as the dilated second division of the right subclavian artery (not displayed) enters the scalene triangle with binding nerve trunks. Observe the crimped gray proton dense common carotid artery (CC) in common origin with the dilated crimped brachiocephalic trunk as the left common carotid artery ascends against the dilated gray proton dense crimped first division of the left subclavian artery (SA) ascending posterior to the descending left vertebral vein (not labeled) draining compressed by the anterior rotated head of the left clavicle against mildly compressed inferior bicuspid valve in the descending left internal jugular vein (J). Observe the compressed fascial plane of the right brachiocephalic vein (BRV) in close proximity to the gray proton dense brachiocephalic trunk (BR) as the first division of the dilated gray proton dense right subclavian artery (SA) folds back on the brachiocephalic trunk ascending medial to the 2nd and first thoracic vertebrae (not labeled); compressed right axillary artery (AX) on the axillary vein (not labeled), and the gray proton dense vertebral venous plexus (VP) marginating the cervicis and thoracis muscles of the vertebral column (not labeled) reflecting impedance to vertebral vein drainage into the compressed brachiocephalic veins. Rhomboid muscle (RH, Left and Right lungs (LL) (RL)).

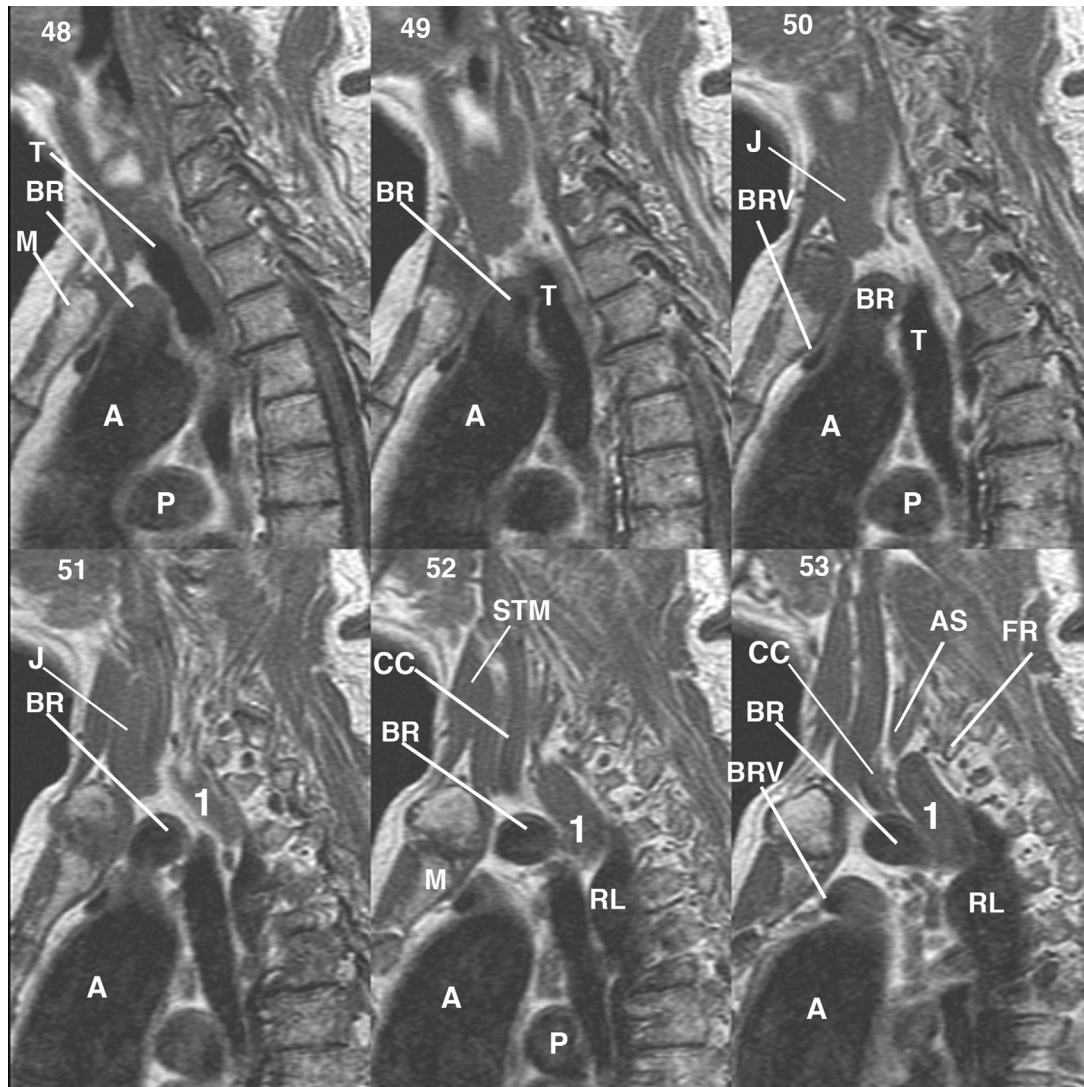


Multiplanar MRI sequences cross-referenced the crimped tortuous course of the great vessels compressing the draining veins within the neck, supraclavicular fossae with lymphatics and compression of the subclavian and axillary arteries with binding nerves, right greater than left.

The coronal, transverse and sagittal sequences best displayed the backward manubrium with the asymmetric heads of the clavicles sloping posterior left displacing the dilated ascending aorta (A) and pulmonary trunk down and back as the proximally dilated gray proton left brachiocephalic vein obliquely descends compressing the crimped (like a water hose) dilated brachiocephalic trunk crossing

against the trachea (not displayed) (Figures 3–6); elongation of the dilated crimped brachiocephalic trunk against the right lung with the backward folding of the dilated the first division of the gray proton dense right subclavian artery on the brachiocephalic trunk (Figure 7); dilated gray proton dense left external jugular vein descending compressed on the bicuspid valve within the left subclavian vein as the clavicle with the subclavius muscle compress the left cephalic vein on the left axillary vein; marked dilation of the backward aorta against the dilated compressed dilatation of the pulmonary trunk and pulmonary veins.

Figure 6. This is a series of right sagittal T1 weighted magnetic resonance images (48, 49, 50, 51, 52, 53) through the ascending crimped gray proton dense brachiocephalic trunk (BR) as displayed on Figure 3 and as brachiocephalic trunk courses posterior right lateral to the trachea and posterior to the head of the right clavicle (C) compressed by the backward folding of the gray proton dense dilated first division of the right subclavian artery¹ against the right lung. Observe the backward manubrium (M) compressing the gray proton dense left brachiocephalic vein (BRV) against the dilated ascending aorta (A) against the dilated pulmonary trunk (P) and the crimped dilated origin of the brachiocephalic trunk (BR); compressed by the left brachiocephalic vein (BRV) joining the gray proton dense right brachiocephalic vein (not labeled), images 51–53, to form the superior vena cava (not labeled) and the gray proton right common carotid artery ascending superior to the compressed brachiocephalic trunk (BR), image 53, against the descending gray proton right internal jugular vein (J) by the backward folding of the dilated gray proton dense first division of the right subclavian artery¹ compressed against the right lung (RL). Sternocleidomastoid muscle (STM).

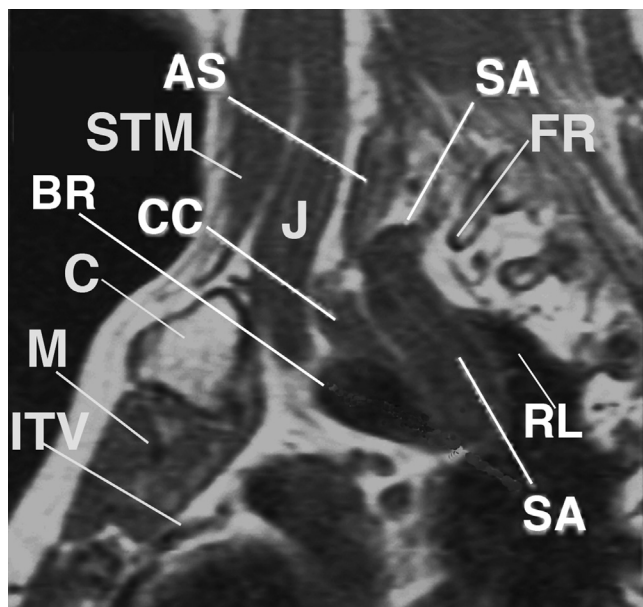


The transverse and right sagittal sequences enhanced the coronal sequence to the display the dilated crimped **anomalous course of the brachiocephalic trunk** displaced against the trachea accentuating the backward manubrium with the body of the sternum compressing the gray proton dense left brachiocephalic against the ascending dilated aorta; backward right sternocleidomastoid muscle compressing the gray proton dense descending right internal jugular vein against the ascending right common carotid artery; backwardly folding of the dilated gray

proton dense first division of the gray proton dense right subclavian artery on the downward course of brachiocephalic trunk (Figures 5 and 6), and the dilated first division of the right subclavian artery advancing from the posterior medial margins of the thoracic vertebrae anteriorly dilated as the second division of the right subclavian artery with binding nerve trunks posterior to anterior scalene muscle.

The 2D TOF stacked and 3D MRI/MRA reconstructed images confirmed the T1 weighted images and best

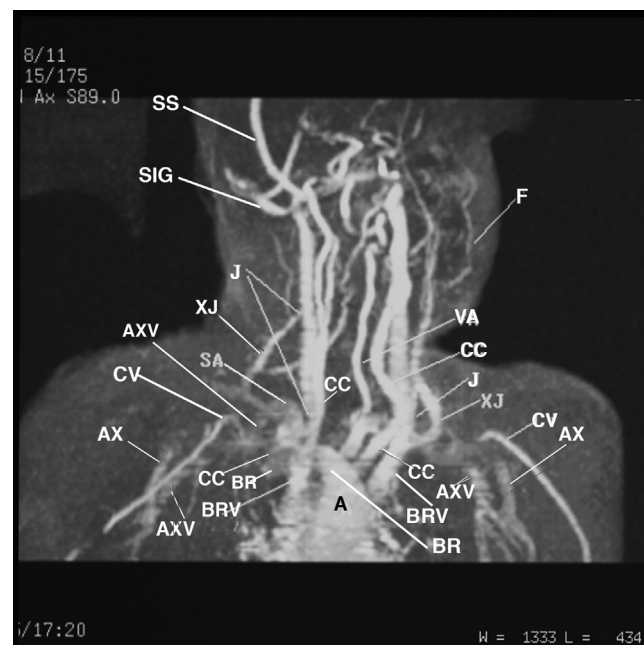
Figure 7. This is the enlarged 53rd image of (Figure 6) the T1 weighted right sagittal sequence that displays the anterior rotated head of the right clavicle (C) on the backward manubrium (M) with the body of the sternum (not labeled) as the backward right sternocleidomastoid muscle compresses the region of the inferior bicuspid within the descending right internal jugular vein against the intermediate gray proton right internal jugular vein (J) against the ascending (not labeled) on the common carotid artery against the first division of the ascending right subclavian artery (SA). Observe the downward course of the dilated gray proton dense brachiocephalic trunk (BR) displaced against the right lung causing the backward folding of the dilated first division of right subclavian artery (SA) on the gray proton dense as the right common artery ascends from the brachiocephalic trunk; first division of the right subclavian artery ascending against the gray proton dense right common carotid artery (CC) as the first division of the right subclavian artery also ascends into the right scalene triangle; intermediate gray proton dense right vertebral vein (not labeled) displaced by right common carotid artery (CC) against the posterior descending right internal jugular vein (J). First Rib (FR), Internal Thoracic Vein (ITV).



displayed the crimped dilated brachiocephalic trunk (BR) compressed by the gray proton dense left brachiocephalic vein; dominant high proton dense descending left internal jugular vein draining into the high proton dense proximal left brachiocephalic vein (BRV) accentuating the descending dilated left external jugular vein (XJ) compressed on the bicuspid valve region of the left subclavian vein (SV) (Figure 7); hypertensive elongated anomalous course of the dilated brachiocephalic trunk (BR) compressing the right internal jugular vein and brachiocephalic vein as the brachiocephalic trunk obliquely becomes compressed by the backward folding of the dilated gray proton dense first division of the right subclavian artery (SA) as displayed on Figure 6; gray proton dense diminished proton dense brachiocephalic trunk reflecting the high proton dense turbulence with the first division of the right subclavian artery (SA) folding back on the

compressed gray proton dense dilated brachiocephalic trunk enhanced by the high proton dense ascending right common carotid artery (CC) (Figure 7); high proton dense turbulence of the left brachiocephalic vein (BRV) reflecting compressing against the aorta as the vein joins the high proton dense turbulence of the right brachiocephalic to

Figure 8. This 2D Time Of Flight 3D reconstructed MRA MRV, image 15/175, displays the crimped dilated origin of the brachiocephalic trunk (BR) from the aorta (A) that compresses the medial margin of the right brachiocephalic vein (BRV) and the inferior bicuspid valve within the descending right internal jugular vein (J) as the brachiocephalic trunk courses posterior and downward decreasing proton density as it gives origin to the gray dense right common carotid artery (CC) that ascends anterior medially into the right carotid sheath marginating the medial margin of the descending right internal jugular vein; decreased proton dense ascent of the dilated first division of the right subclavian artery ascending into the decreased proton dense dilated 2nd division of the artery (site of the binding nerve trunks) in the scalene triangle mildly dilating into the 3d division of the subclavian artery (SA) as the gray proton dense right axillary artery (AX) proximal to the downwardly compressed the gray proton dense right axillary vein within the right supraclavicular fossa by the overlying clavicle and subclavius muscle (not displayed) The high proton dense right cephalic vein reflects impedance to venous return as it becomes compressed draining into the right axillary vein (AXV). The reciprocally dilated high proton dense axillary artery reflects impedance to arterial flow secondary to venous compression. Observe the high proton dense proximally dilated left brachiocephalic vein (BRV) is compressed against the ascending aorta (A) reflecting impedance to venous return secondary to the backward manubrium (not displayed) sloping posterior left with the anterior rotated head of the clavicle and the backward sternocleidomastoid muscle as displayed in Figure 5 accentuated by the dilated high proton dense dominated left internal jugular vein (J) and the high proton dense mildly dilated high proton dense left external jugular vein (XJ) draining over the anterior medial margin of the left subclavian vein into left brachiocephalic vein; costoclavicular compression of the gray proton dense left axillary artery (AX) on the axillary vein accentuated by the high proton dense left cephalic vein reflecting impedance to venous drainage into the segmented compressed axillary vein (AXV) as the high proton dense left axillary artery (AX) crosses over the axillary vein (AXV) into the axilla. Facial vein-F, Sigmoid sinus-Sig, Superior sagittal sinus-SS, Vertebral artery-VA exiting the first division of the high proton dense left subclavian artery (not labeled).



form the superior vena cava (not labeled), and the proximal high proton dense smaller right external jugular vein (XJ) decreasing proton density into the compressed right subclavian vein (not labeled) as displayed on [Figure 5](#), image 20.⁴

Bilateral abduction external rotation coronal sequence (AER) documented enhanced costoclavicular compression without significant change in the crimping of the great vessels without triggering complaints ([Figure 8](#)).

CONCLUSION(S)

- 1) Post-resection right rotator cuff repair complicated by staphylococcus infection of the right acromioclavicular joint.
- 2) Bilateral round shoulders.
- 3) Low left first rib increasing tension on anterior scalene muscle compared to the high right first rib.
- 4) Left concave kyphoscoliosis of the cervical thoracic spine enhancing costoclavicular compression as above described in detail.
- 5) Degenerative changes with forward shift of the cervicothoracic spine.
- 6) Atrophy right shoulder with fat infiltration as above.
- 7) Hypertensive arteriosclerotic vascular disease.
- 8) Backward displaced Manubrium with the body of the sternum sloping posterior left displacing the dilated aorta and the pulmonary trunk crimping the great vessel as above described contributing to impedance to venous return as described in detail.
- 9) Dilated crimped **anomalous course of the brachiocephalic trunk** displaced against the trachea extending into the right lung backwardly folding on the dilated first division of the gray proton dense right subclavian artery on the brachiocephalic trunk.
- 10) Bilateral costoclavicular compression (laxity of the Sling/erector muscles of the shoulders-trapezius, levator scapulae and the serratus anterior muscles) of the of the bicuspid valves within the draining veins of the neck, supraclavicular fossae with lymphatics, and the compression of the subclavian and axillary arteries with binding nerves, right greater than left.
- 11) The 2D Time of Flight MRA MRV cross referenced the findings on the T1 weighted images. See detailed description above.
- 12) Bilateral abduction external rotation of the upper extremities (AER) triggered no complaints. See detailed description above.

Take-home message

The knowledge of anatomy is essential in the interpretation of plain chest radiographs. Nerves do have a blood supply.¹ Monitored MRI of the brachial plexus at the imaging console displayed altered fascial planes within the deep neck fascia (pathology) from the rotator cuff repair and obstruction to venous return at the inferior bicuspid valve in the small right internal jugular vein and compression of the right thoracic lymph duct impeding lymph flow; high proton density of impedance to venous drainage within the dominant left internal jugular vein and the proximal high proton dense left brachiocephalic vein. Any decrease in venous return increases intrathoracic, intraabdominal and intracranial pressures.⁵ Our patient displayed crimping (like a water hose) of the great vessels and the unsuspected anomalous course of the crimped downward dilated brachiocephalic trunk obliquely compressing the right internal jugular at the inferior bicuspid into the right lung causing the backward folding of the dilated gray proton dense first division of the right subclavian artery decreasing arterial flow within the right brachiocephalic trunk supplying arterial flow to the right upper extremity with bilateral costoclavicular compression of the axillary arteries against the axillary veins. In addition to the above, scarring of the resected distal right clavicle and deltoid muscle limited right shoulder rotation causing atrophy and fat filtration of the right deltoid muscle as above presented.⁶

This anomalous course of the brachiocephalic trunk on MRI MRA is the only case that I have encountered, not displayed in the literature.

REFERENCES

1. Collins JD. www.tosinfo.com. Accessed June 2016.
2. Atasoy, E. (1996). Thoracic outlet compression syndrome. *Orthop Clin North Am*, 27, 265–303.
3. Collins, J. D., Shaver, M., Disher, A., & Miller, T. Q. (1997). The costoclavicular syndrome as displayed by MRI and MRA: Reformat and 3D graphic display. *Clin Anat*, 10, 131.
4. Sunderland, S. (1945). Blood supply of the nerves to the upper limb in man. *Arch Neurol Psych*, 53, 91–115.
5. Collins, J. D., Saxton, E., Miller, T. Q., Ahn, S., Gelabert, H., & Carnes, A. (2003). Scheuermann's disease as a model displaying the mechanism of venous obstruction in thoracic outlet Syndrome and migraine patients: MRI and MRA. *J Natl Med Assoc*, 4, 298–306.
6. Collins, J. D., Shaver, M., Disher, A., & Miller, T. Q. (1995). Compromising abnormalities of the brachial plexus as displayed by magnetic resonance imaging. *Clin Anat*, 18, 1–16.