

NEUROCIRCULATORY SCALENUS ANTICUS  
SYNDROME IN THE PRESENCE OF  
DEVELOPMENTAL DEFECTS OF  
THE FIRST RIB\*

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In years past, a rather voluminous literature has accumulated dealing with certain neurologic and circulatory deficits that occur in the upper extremities. Cervical rib syndrome, scalenus anticus syndrome, Naffziger syndrome, and scalenus neurocirculatory compression syndrome are among the names applied to the variable symptom complex found present in a small percentage of individuals with abnormal morphologic developments about the region of the thoracic operculum.

Because so few of those with developmental defects in that region have symptoms attributable to them, and these usually develop their symptoms relatively late in life, various hypotheses have been suggested as the mechanisms for production of the symptoms. Among these are: 1. Alteration in the relative positions of the subclavian structures and the first dorsal rib due to the gradually increasing dependency of the shoulder girdle as one grows older; with a resultant angulation of the vessel over the rib and a pressure of the rib upward against the brachial plexus.<sup>7</sup> 2. An abnormal development of the first rib or a cervical rib causing pressure upon the plexus.<sup>3</sup> 3. Variations in the constitution of the brachial plexus whereby the second dorsal segment takes a greater than normal part in the formation of the plexus.<sup>4</sup> 4. Theories taking into account the scalenus anticus muscle as a factor in compressing the nerves and artery against the abnormal rib or the normal first rib in cases where the relative positions of the rib and shoulder girdle are altered.<sup>3, 5, 6</sup>

While some would attribute the circulatory manifestations to direct compression of the subclavian artery, others believe them due to interference with the vascular innervation.<sup>2</sup>

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Two patients recently came under observation at The Mason Clinic with symptoms attributable to developmental defects of the first thoracic rib. They served to stimulate interest in this subject. In an effort to determine the comparative frequency between the occurrence of cervical ribs and abnormal first thoracic ribs, a series of 5000 x-ray films of the chest was reviewed. Of these patients, 38 (0.76 per cent) were found to have abnormalities of the first thoracic ribs, 19 of whom were males and 19 females. In the males, 2 were bilateral, 6 on the right side only, and 11 on the left. In the females there were no bilateral cases, 11 were on the right side only, and 8 on the left. Of these 5000 patients, 37 (0.74 per cent) were found to have cervical ribs, 11 of whom were males and 26 females. In the males, 8 had ribs on both sides and 3 were on the right side only. In the females, 15 cases were bilateral, 5 on the right side only, and 6 on the left.

A careful review of the case histories of all these patients was made. Only two of those with cervical ribs had any complaints or findings which could in any way be attributed to this anomaly, and these were so slight as to be questionable and to make any treatment unwarranted. None of those with abnormalities of the first thoracic rib, except the two cases herein detailed, had any symptoms or findings referable to their anomalies.

The first case demonstrates quite dramatically the rôle of the scalenus anticus in the production of the circulatory manifestations by direct compression of the subclavian artery.

CASE I. (No. A-50,558). Attacks of coldness, numbness, color changes, intermittent pain, and diminished circulation in the right hand and arm; x-ray demonstration of developmental defect, right first rib; section scalenus anticus; recovery.

In March, 1934, a 25-year-old female was admitted to The Mason Clinic complaining of attacks of coldness and diminished sensation in the right arm. In August, 1933, the patient first noticed that on occasion the index and middle fingers of the right hand would become pale and numb. At first the attacks would last a few minutes only and would recur at intervals of several days, but there was gradual increase in frequency and duration. The condition appeared to be aggravated by cold. In October, 1933, a toothache-like pain developed in the right wrist, became gradually more severe, and progressed to involve the elbow and shoulder. This aching pain disappeared in January, 1934, but the numbness and pallor extended until the whole hand was involved, and on one occasion, after exposure to cold, became blanched

and numb to a point above the wrist, was difficult to "thaw out," and quite painful. About February 1, 1934, the patient noticed difficulty in using her arm because of fatigue, and also for the first time became aware of an absence of the radial pulse. She had been treated before coming to us with contrast baths, hypertonic saline injections, and novocaine injection of the cervical sympathetics, apparently without any great influence on the condition.

*On examination*, there was a reddish discoloration and slight mottling of the right hand at the wrist level. On elevation, the hand became chalky white; when dependent it became congested. Very slight pulsation was felt over the antecubital fossa, at the wrist in the midline, and over the ulnar artery. The radial pulse was not felt. The blood pressure was not obtainable in any part of the right arm. There was apparent a deformity of the thoracic cage in the upper right quadrant and a peculiar appearance of the general setting of the shoulders and neck.

The color changes in the right hand were not typical but definitely reminiscent of Buerger's rubor on dependency and blanching on elevation. No vasomotor phenomena were made out in other parts of the body. A definite difference in the palpebral apertures was noted, the right being the narrower. A moderate weakness was noted in the right arm. Adduction and abduction of the fingers were weaker on the right than on the left. The ulnar paper sign was weaker on the right.

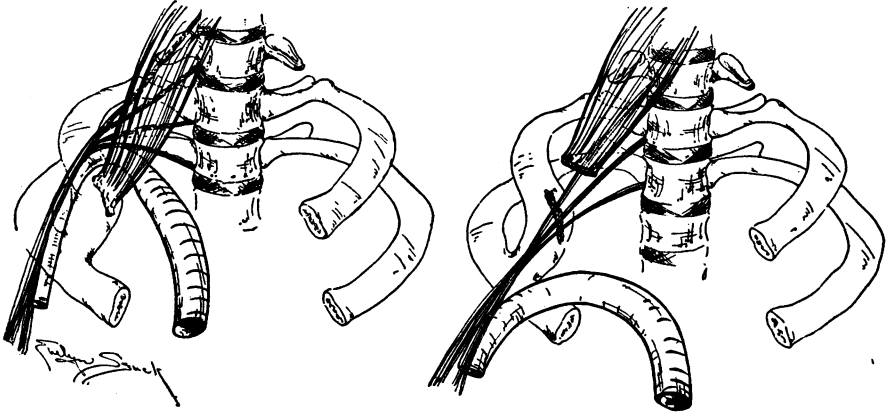
*X-rays* revealed an anomalous formation of the right first rib, which was enlarged and short, and instead of continuing around to the sternum formed a synostosis with the second rib at its termination about one-third short of reaching the sternum.

*Diagnosis.* The weakness of the small hand muscles without definite objective sensory change was considered evidence of a brachial plexus lesion involving mainly the ulnar division. Upon this evidence, coupled with the x-ray findings and the circulatory change, a diagnosis of scalenus neurocirculatory compression syndrome was made and surgery advised.

*Operation.* On March 23, 1934, under local anesthesia, the right scalenus anticus muscle was exposed at its insertion on the superior and posterior aspect of the first rib. The artery and nerve structures appeared to be pulled upward and laterally by the anomalous formation forcing them out of normal position. The artery was dilated and full proximally, but quite small and non-pulsating distal to the muscle insertion. After section of the fibrous attachment of the muscle to the first rib, the subclavian artery and brachial plexus slipped forward and down from above the curved end of the first rib, and pulsations in the artery became strong and fairly forceful past that point. The arm and hand immediately became warmer and of a better color.

*Postoperative Course.* After a short hospitalization, the patient was allowed to become ambulatory, and moderate progressively increasing exercise

of the right arm was advised. It was felt that the subjective manifestations which she had formerly experienced and the mild neurologic findings would take some time to disappear completely.



CASE I. Diagrammatic sketch of the relative position of the parts before and after section of the scalenus anticus.

*Subsequent History.* On examination April 9, 1936, a definite pulse was noted at the right wrist, and blood pressure readings were obtainable on the right arm. The patient stated that there were no more symptoms whatever. She had had one attack of blanching and numbness during the preceding winter, which had occurred while she was skiing in very cold weather. Late reports are those of complete recovery.

The second case shows how, in the absence of the scalenus activity, the plexus may be pressed upon quite strongly without the production of untoward symptoms.

CASE II. (No. A-67,927). Limitation of movement of left arm; occasional paresthesias, left arm; x-ray demonstration of developmental defect, left first rib; removal of portions of rib; recovery.

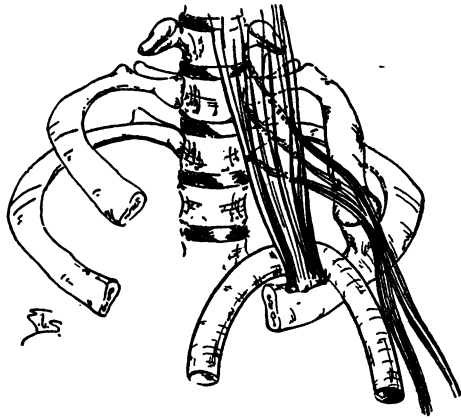
In August, 1938, a 23-year-old male was first seen at the clinic, complaining of an inability to raise his left arm above his head. He had first noticed this 18 months previously when he had reached for a fly while playing baseball. Since then he had been aware of the inability to raise his left arm above his head in any position other than when reaching far forward. Any attempt to raise the arm in other directions resulted in a tingling sensation over the deltoid region or at times a sensation of numbness, "like having struck my crazy-bone," down the ulnar aspect of the left arm. He had noticed a lump in the left supraclavicular region as being present for over five

years. On close questioning, he thought perhaps his left hand tended to get cold more easily than did the right in cold weather, but was rather indefinite in this respect.

*On examination*, there was a firm lump palpable just above the middle of the left clavicle. Pressure over this elicited a tingling sensation referred down the patient's left arm. The limitation of motion in the arm was obviously caused by impingement of the clavicle on this mass. There were absolutely no objective neurologic findings in the left arm or referable to the left brachial plexus. The blood pressure was practically the same on both arms, and oscillographic readings on both arms showed no differences.

*X-rays* revealed an abnormality of the first left thoracic rib. The rib seemed to arise in the usual manner from the vertebra, but just before passing under the clavicle it ended in a cup-shaped manner over a projection of bone growing upward from the second rib. Complete x-rays of the vertebral column showed 7 cervical vertebrae, 5 lumbar vertebrae, but only 11 thoracic vertebrae, and the patient had only 11 ribs on each side.

*Operation.* On February 17, 1939, the left brachial plexus and anomalous rib were exposed. The scalenus anticus muscle was identified and found completely medial to the anomalous rib and attached to the anteromesial portion of the second rib. The subclavian artery came out from behind the muscle and passed anterior to the bony mass projecting upward from the second rib. The cords of the plexus were stretched rather tightly over the bony lump of the synostosis between the first rib and the bone projecting up from the second. The anterior two-thirds of the malformed first rib were removed in one piece and a major portion of the bony projection from the second rib resected away. This left the plexus in a relaxed state and permitted free elevation and backward movement of the clavicle.



CASE II. Diagrammatic sketch of the relative position of the parts as found at operation.

*Postoperative Course.* The patient made an uneventful recovery from the operation and when last seen, three weeks later, had a full range of motion of the left arm and was free of any subjective neurologic complaints.

Adson<sup>1</sup> has recently reported a case not unlike the first case above, in which the same factors as regards production of the vascular

symptoms were operative. It would seem advisable, as recently suggested by Ochsner, Gage, and DeBaKey,<sup>5</sup> and emphasized by Spurling and Bradford,<sup>6</sup> that in cases of circulatory deficiencies in the upper extremities more attention be paid to the so-called scalenus angle region.

Two cases are reported which emphasize the necessity of scalenus anticus activity for the production of both circulatory and nervous symptoms in so-called scalenus neurocirculatory compression syndromes.

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