AN ANOMALOUS RIGHT SUBCLAVIAN ARTERY

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TWO FIGURES

Among the variations in the arrangement of the branches of the aortic arch in man, there is an unusual anomalous condition in which the right subclavian artery arises from the arch distal to the left subclavian. An example of the aforementioned anomaly was met with by the writer in the dissecting room of the Yale Medical School during the session of 1912-1913.

A description of the specimen, with an attempt to explain the embryology thereof and with a suggestion of symptoms that might arise therefrom, is offered here in brief.

DESCRIPTION

The anomaly to be considered was noted in the dissection of a male, negro cadaver, aged approximately forty-five years. The right subclavian artery, instead of arising normally in conjunction with the right common carotid from the innominate artery, came off as an entirely separate artery from the descending limb of the aortic arch on the left side of the body after the left subclavian artery was given off (fig. 1). The anomalous vessel reached the right arm by passing dorsal to the trachea and the esophagus across the vertebral column.

The right subclavian took its origin from a point on the dorsal aspect of the descending limb of the aortic arch $\frac{1}{2}$ inch distal and to the right of the normally placed left subclavian artery (fig. 1). Leaving the aorta, it passed at an angle of 45 degrees to the right and cephalad between the esophagus and the bony vertebral column. This direction was maintained in its further course through the neck with but a slight lateral curve to the point where the first branches arose from it.

As is indicated (fig. 1), the right vertebral artery was the first branch of the anomalous right subclavian and it came off at a distance of $4\frac{1}{2}$ inches from the origin of its parent from the aorta. It therefore corresponded to the normal position for the vertebral artery—a fact worthy of note on account of differences in the position of the vertebral artery in cases of anomalous subclavian arteries like this. The right subclavian artery was crossed in the root of the neck by the right pneumogastric (vagus) nerve, but the inferior (recurrent) laryngeal branch of the vagus did not hook around the subclavian artery as usual,—that is, it was not recurrent, as shown in figure 1.

There was no innominate artery present in the subject, both common carotid arteries arising separately from the arch of the aorta. The relations of the second and third parts of the right subclavian artery and the origin and distribution of its branches were perfectly normal.

EMBRYOLOGIC EXPLANATION

Embryology readily explains the anomaly described above by assuming a defect in the absorption of the primitive right aortic arch in the embryo. Absorption occurs ordinarily distal to the point of origin of the right subclavian artery (*a* to *b*, fig. 2 *B*). In the case in question the position of absorption was along the fourth branchial arch (*a* to *c*, fig. 2 *C*). The embryonic right aorta became the right subclavian artery (*a* to *x*, fig. 2 *C*).

The position of the right subclavian so far cephalad on the left arch (arch proper) of the aorta may be explained in two ways: Either there was a positive migration of the artery from point *X* in figure 2 *C* to point *x* in figure 2 *D*, or the migration is only apparent and the real change was a dragging down of the aortic arch in the mid-line by a downward movement of the heart and pulmonary system. Probably both processes progressed *para passu* and had a share in bringing about adult conditions found in this case. The second view gives a reason for the position of the right subclavian artery dorsal to the trachea. The pulmonary system descends ventrally with the heart through

Fig. 1 Drawing from a dissection of the ventral aspect of the neck and thorax showing origin, course, and relations of the anomalous right subclavian artery. A window is cut into the aorta to show point of origin of anomalous vessel.

<i>a</i> , recurrent (inferior) laryngeal nerve	<i>m</i> , trachea
<i>b</i> , vagus nerve	<i>n</i> , left common carotid artery
<i>c</i> , phrenic nerve	<i>o</i> , left subclavian artery
<i>d</i> , inferior thyroid artery	<i>p</i> , superior vena cava
<i>e</i> , sympathetic cord	<i>q</i> , aorta
<i>f</i> , anterior scalene muscle	<i>r</i> , origin of anomalous right subclavian artery
<i>g</i> , vertebral artery	<i>s</i> , left bronchus
<i>h</i> , transverse cervical artery	<i>t</i> , pulmonary artery
<i>i</i> , suprascapular artery	<i>u</i> , descending thoracic aorta
<i>j</i> , internal mammary artery	<i>v</i> , heart
<i>k</i> , anomalous right subclavian artery	
<i>l</i> , right common carotid artery	

the heart-shaped space (figs. 2 *C* and 2 *D*) which is surrounded by the two embryonic aortae, so that the trachea comes to lie ventral to the anomalous subclavian artery when this is formed. The esophagus necessarily occupies the same position because, since the large blood vessels in the region develop around the fore-gut, the latter lies from the first in the loop ventral to the

Fig. 2 Series of diagrams of the embryonic arterial arches for comparison of the normal with the abnormal development of the right subclavian artery. Dotted lines indicate points of absorption.

A Diagram representing primitive conditions.

B Diagram representing the usual development.

C Diagram showing the anomalous right subclavian artery (diagrams *A*, *B*, and *C* were modified from Piersol's Anatomy).

D An original diagram to illustrate subsequent change in position of anomalous right subclavian artery to condition described in text. The formation of the right vertebral artery should be noted also.

ic, internal carotid artery

ec, external carotid artery

cc, common carotid artery

raa and *laa*, right and left aortic arches respectively

i, innominate artery

rs and *ls*, right and left subclavian arteries respectively

ao, aorta

p, pulmonary artery

v, vertebral artery

x, point of origin of anomalous right subclavian artery

dorsal aortae, and will therefore be ventral to an anomalous right subclavian artery as found in this cadaver, since the artery represents in part the original right dorsal aortic arch.

The exact extent and position of the absorption would appear to determine the point of origin of the right vertebral artery. That is, if the absorption of the right arch were not complete

medially, as in figure 2 *C*, the unabsorbed portion would persist as the right vertebral artery which might thus arise from the aorta or even from the right common carotid artery. In my specimen the absorption was apparently complete, however, and the vertebral artery arose directly from the right subclavian (fig. 2 *D*).

The frequency with which such anomalies of the subclavian artery occur is represented in a report published by Arthur Thomson. This report is the result of the efforts of a committee of collective investigation for the Anatomical Society of Great Britain and Ireland. Five hundred cases in all were examined and, of these, five (1 per cent) presented the anomalous condition in which the right aortic arch persisted distally.

APPLICATION

It is within the range of possibility that the pressure exerted upon the right subclavian artery in its position dorsal to the trachea and esophagus, as reported above, might produce symptoms resembling those of cervical rib. The natural inference would be that owing to pressure on the artery there would result a strong pulsation of the vessel and maybe trophic changes in the arm, forearm, and hand. Other symptoms and conditions associated with pressure on large blood vessels might be expected.

Anatomically the right arm appeared perfectly normal and further dissection of the body showed no other anomalies.

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