

Notes of a case of double aortic arch / by M. Watson.

Contributors

Watson, Morrison.
Doran, Alban H. G. 1849-1927
Royal College of Surgeons of England

Publication/Creation

[London] : [publisher not identified], [1877]

Persistent URL

<https://wellcomecollection.org/works/pa5n9sp4>

Provider

Royal College of Surgeons

License and attribution

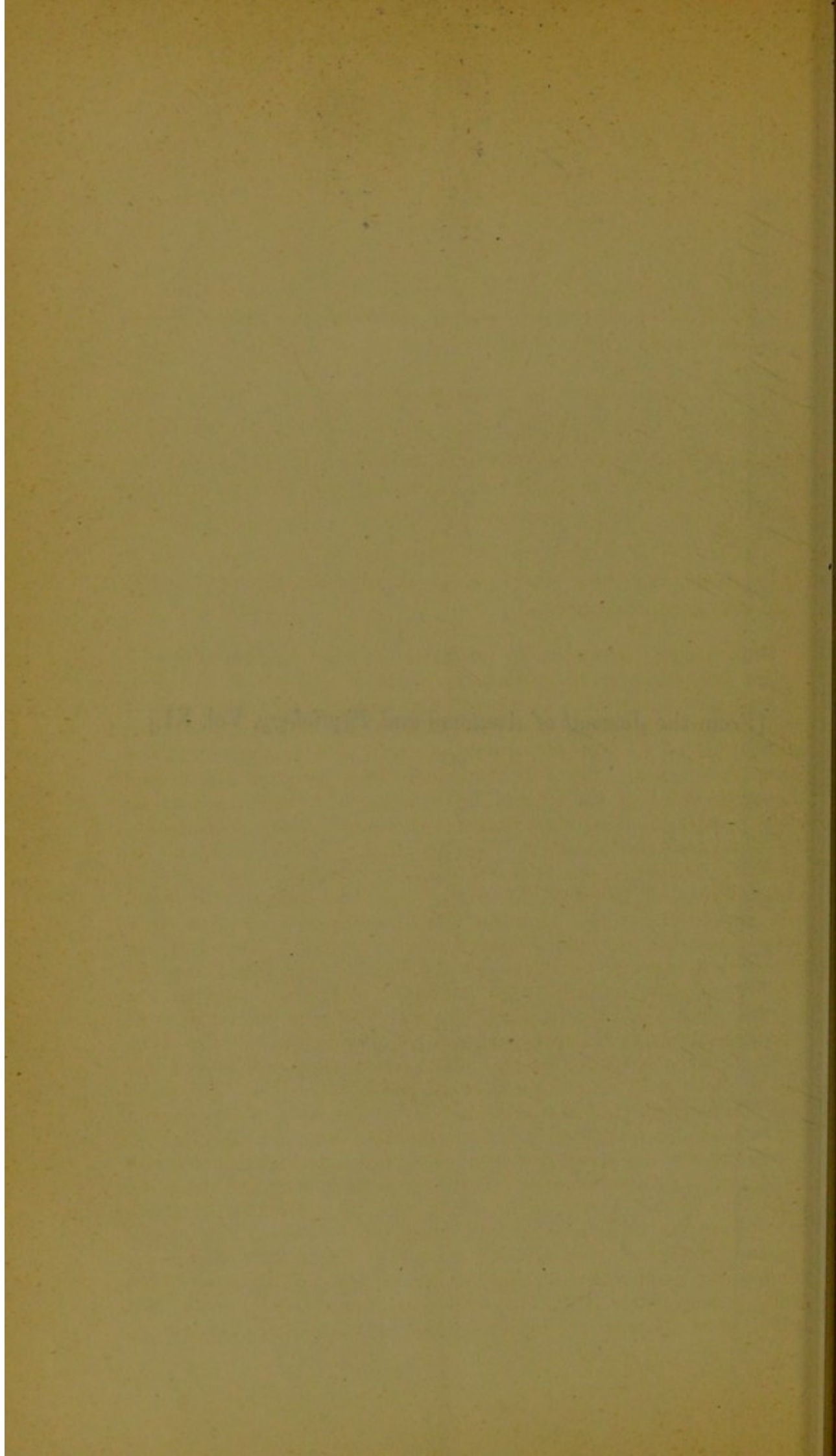
This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.



Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

[From the *Journal of Anatomy and Physiology*, Vol. XI.]





7.

NOTES OF A CASE OF DOUBLE AORTIC ARCH. By
M. WATSON, M.D., *Professor of Anatomy, The Owens College,
Manchester.* (Plate VIII.)

CASES in which there is persistence throughout life of both the vascular arches by the union of which the aorta is formed during intra-uterine existence are sufficiently uncommon to justify the publication of one which I had an opportunity of examining during last winter session. The case presents moreover some points of interest which do not appear to have been observed in those which, most closely resembling it, have been previously described.

This unusual arrangement of parts occurred in the body of a female between seventy and eighty years of age which had been sent to the anatomical room of the College for purposes of dissection. On opening the chest the trunk of the ascending thoracic aorta, instead of passing upwards and to the right, was observed to ascend exactly in the middle line, lying parallel to and directly in front of the trachea for a distance of three inches, and then to subdivide into two branches of unequal size. This trunk, which formed the ascending portion of the double arch, to be presently described, was situated entirely within the sac of the pericardium. *In front* of its origin from the base of the heart was the trunk of the pulmonary artery which almost at once passed to its left side, whilst *behind* it was the right branch of the same vessel, together with the left innominate vein, which, crossing from left to right to unite with its fellow, intervened between the ascending aorta and the trachea. On its *right* side were the right innominate vein and superior vena cava, and on its *left* the bifurcation of the pulmonary artery. Of the two branches into which this trunk divided, one, the calibre of which was about four times that of the other, passed backwards lying to the *right* of the trachea and œsophagus, arched over the right bronchus, and gained the middle line of the dorsal vertebræ, where it became continuous with the descending thoracic aorta. This branch along with the ascending aorta thus formed a true right aortic arch, the relations of which as respects its transverse portion were the following. It passed almost transversely backwards, extending from the trachea in front to the middle line of the anterior surface of the body of the fourth dorsal vertebra behind, and was crossed on its *outer* side from before backwards by the right pneumogastric nerve, the

right innominate vein, and close to its termination by the vena azygos major, which turned forward at this point to open into the superior vena cava. Its terminal portion was moreover invested by the right pleural membrane. To its *inner* side were the trachea, œsophagus, and right recurrent laryngeal nerve, the last of which ascended in the internal between the two tubes. In the *concavity* of the arch were situated the commencement of the superior vena cava and the right recurrent nerve, whilst from its *convexity* the following branches were given off from before backward. 1. The *Right common carotid* which was given off half an inch from the bifurcation of the ascending aorta, and passed obliquely upward and backward to gain its usual position in front of the cervical portion of the vertebral column. 2. The *right vertebral* artery which, separated at its origin by half an inch from the carotid artery, passed upwards and backwards, lying parallel to and behind that vessel as high as the fourth cervical vertebra, into the foramen transversarium of which it entered. 3. The *Right Subclavian*, which, arising from the highest point of the arch, and being closely applied at its origin to that of the right vertebral artery, arched upwards and outwards to gain the upper surface of the first rib over which it passed. On reaching the neck it gave off from its *first* part the internal mammary and inferior thyroid arteries, and from its *second* the superior intercostal and deep cervical branches. The transverse cervical and supra scapular arteries had been in all probability given off from its *third* portion; but this I could not determine by reason of the latter part of the artery having been removed previous to my examination of the dissection.

Passing now to the examination of the *left* aortic arch, it was seen to be composed of two parts, an *anterior pervious* represented by the smaller of the two trunks into which the ascending aorta divided, and a *posterior impervious*, represented by a thick fibrous band continuous in front with the arterial portion of the arch and attached posteriorly to the commencement of the descending thoracic aorta. These two parts thus completed an aortic arch lying to the *left* of the trachea and œsophagus, which corresponded exactly to the arch of the opposite side already described, as may be clearly seen by considering its relations. On its *outer* side the arterial portion of the arch was crossed from before backwards by the left innominate vein and left pneumogastric nerve, whilst the terminal impervious portion, measuring five-eighths of an inch in length, and three-eighths in breadth, was invested by the left pleural membrane. To the *inner* side of the arch were the trachea and œsophagus, the former lying in relation to its pervious, the latter to its impervious portion, whilst the left recurrent nerve ascended in the internal between them. In the *concavity* of the arch was situated the ductus arteriosus, represented by a stout fibrous cord attached below immediately to the left of the bifurcation of the trunk of the pulmonary artery and blending above with the commencement of the impervious portion of left aortic arch. The recurrent nerve

hooked round the arch lying to the outer side and in contact with the ductus arteriosus. From the *convexity* of the arch the following branches were given off from before backwards. 1. The *Left Common Carotid*, which arose half an inch from the bifurcation of the ascending aorta, and passed upwards and backwards to gain its usual position at the root of the neck. 2. A very small artery which exactly corresponded in its place of origin to that of the vertebral artery from the arch of the opposite side. It passed obliquely upwards and backwards, and followed a precisely similar course to that of the right vertebral, lying behind and parallel to the left common carotid. It was pervious for only half an inch from its origin and degenerated into a delicate fibrous cord which, upon careful dissection, could be traced upwards lying upon the prevertebral fascia covering the longus colli and rectus major muscles as high as the 4th cervical vertebra, where it again became pervious, and entering the foramen transversarium of the 3rd cervical vertebra, terminated by joining the trunk of the left vertebral artery, to be presently described. 3. The *left subclavian artery*, which arched upwards and outwards to gain the upper surface of the first rib, over which it passed. From the first part of this artery in the neck were given off as distinct branches from its anterior aspect, the internal mammary, the inferior thyroid, and transversalis colli arteries, whilst from its posterior aspect the left vertebral artery took its rise. The latter branch, normal in respect to size, entered the foramen transversarium of the 6th cervical vertebra, beyond which its course and relations presented nothing remarkable.

The *descending thoracic aorta* formed by the union of the right and left aortic arches in front of the body of the fourth dorsal vertebra, passed downwards lying directly in front of the vertebral column, as low as the ninth dorsal vertebra, where it passed to the left of the middle line and disappeared from the chest by passing through the diaphragm.

From what has been said it will be observed that the right and left aortic arches were almost symmetrical, and together formed an arterial collar (obliterated certainly to some extent on the left side), including the trachea and œsophagus. The only deviation from complete symmetry consisted in the altered relations of the pneumogastric nerve and innominate vein of opposite sides, but this is sufficiently accounted for by the oblique course of the left innominate vein in order to unite with that of the opposite side to the right of the middle line. The pulmonary artery was normal, its left branch being connected, as already described, with the impervious portion of the left aortic arch by means of the ductus arteriosus. The right innominate vein followed the usual course, and crossed the right aortic arch from above downwards. The left innominate vein, formed in the usual manner, crossed the left aortic arch from above downward, but instead of passing from left to right on a plane *anterior* to that of the ascending aorta, it crossed *behind* that trunk so as to intervene between the aorta and the trachea. The superior

vena cava, by reason of this unusual course of the left innominate vein, was extremely short, but otherwise normal. The vena azygos major opened into the junction of the right and left innominate veins. The remaining veins of the thorax were normal.

The thoracic duct after entering the thorax maintained its usual relation to the aorta and vena azygos major as high as the termination of the latter, behind which, as well as the right aortic arch, it then passed. At the root of the neck it lay behind the first part of the right subclavian artery, and arching forwards, opened into the junction of the *right* subclavian and jugular veins. The duct, therefore, was *not* included within the aortic collar. Each pneumogastric nerve crossed the corresponding aortic arch, giving off its recurrent branch in the concavity of the same, that on the left side coming into relation with the ductus arteriosus, as already described. The phrenic nerve of each side passed *in front* of the corresponding subclavian vein at the root of the neck. With this exception their course was normal. There was no transposition of the viscera.

Comparing now the case just described with those which most closely resemble it, we find that cases of persistent double aortic arch have been reported by Malacarne¹, Hommel², Bertin³, Siebold⁴, Hyrtl⁵, Zagorsky⁶, Cruveilhier⁷, Curnow⁸, and Allen Thomson⁹. In all of these, with the exception of the last, both aortic arches were pervious throughout. In *it* a portion of the left aortic arch, as in the case just detailed, was obliterated, and formed a fibrous band, connected by one extremity to the subclavian artery, and by the other to the commencement of the descending thoracic aorta, thus forming, as Professor Thomson remarks, "a transition between the more common cases of right aortic arch without union to the left part of the aorta, and such cases as those of Hommel," and the other authors just mentioned, in which two aortic arches of nearly equal size closely encircled either the trachea alone or both trachea and œsophagus. In *it*, however, there was a considerable bulging or dilatation of the upper part of the descending aorta toward the left, to the point of which the impervious portion of the left aortic arch was attached, which is absent in my own case. And this is not without interest when viewed in connection with the development of the parts. As is well known, a complete double aortic arch presents a permanent condition of that early embryonic arrangement in which the fourth right and left vascular arches unite to form the descending thoracic aorta. Each of these arches consists of three portions,—an anterior, which forms the ascending or ventral aortic root; a transverse, formed by

¹ *Osservaz. in Chirurg.* 1788, II. 119.

² *Commercium literarium*, Norimb. 1737, p. 161.

³ *Maladies du Cœur*, p. 433.

⁴ *Journal für Geburtshülfe*, 1836. XVI.

⁵ *Oesterr. medic. Jahrb.*, 1841. XXIV.

⁶ *Mém. de l'Acad. des Sc. de St Pétersbourg*, 1824.

⁷ *Cruveilhier*, 1867, p. 51.

⁸ *Trans. Path. Soc. Lond.* 1875.

⁹ Described in Prof. Turner's Memoir in *Brit. and For. Med. Ch. Rev.* 1862, p. 184.

the fourth visceral artery ; and a posterior descending, or dorsal aortic root, composed of the dorsal anastomosing vessel, between the fourth and fifth visceral arteries, together with the continuation backward of the same vessel to unite with that of the opposite side, in the formation of the thoracic aorta. All of these portions on both sides remain pervious in cases of complete double aortic arch. In Prof. Thomson's case, again, the whole of these portions remained pervious on the right side, whilst on the left, the first and second, in addition to the upper and lower thirds of the third portion (these last being represented respectively by the artery above the ductus arteriosus, and the lateral bulging or dilatation of the descending thoracic aorta) remaining pervious, the rest of the arch was obliterated. In the case above related, however, the pouch-like dilatation of the descending aorta was wanting, the obliterated portion of the left arch being attached directly to that vessel. In it, therefore, we have an example of still greater obliteration of the left aortic arch than occurred in Prof. Thomson's case, the lower two-thirds of the dorsal aortic root having become impervious in the former, whilst only one-third of that root—the middle third—underwent complete obliteration in the latter. With regard to the relation of the thoracic duct to the arterial collar, both cases exactly correspond.

Turning now to the branches which are given off from the aortic arches, so far as one can judge from the comparatively few cases of double aortic arch which have been put on record, the most common arrangement appears to be, as indeed one would, on developmental grounds expect, that from each a carotid and subclavian artery is given off. The cases of Malacarne and Zagorsky, however, form exceptions to this rule. My own case appears to be the only one in which, in addition to the branches just named, a right and left vertebral artery was given off from the corresponding arch between the carotid and subclavian of the same side. That such is really the case there can be no doubt, as, although the left vertebral arising from the left arch was reduced to a mere fibrous cord in the greater part of its course, yet, having regard to its origin, relations, and termination, it was evidently homologous with the artery of the opposite side, the origin of each having been transferred from the subclavian artery of its own side to the corresponding aortic arch. The additional left vertebral artery arising from the left subclavian, corresponded as regards its origin, position, and relations, to the vertebral artery, as we usually see it; and inasmuch as the left side of the neck was thus supplied with *two* vertebral arteries, this case is to be grouped along with those, of which several have been reported, in which an accessory vertebral was present. In the cases in which this occurs on the left side, the usual arrangement is that one of the roots of the vertebral artery arises from the arch of the aorta, whilst the other is given off by the subclavian; and to this rule the present case forms no exception.

Lastly, with reference to the unusual position of the left innominate vein lying as it did *behind* the ascending aorta, the case presents a very unusual arrangement, as I have been unable to find any

account among the numerous recorded venous abnormalities, apart altogether from arterial irregularities, of such an occurrence. The explanation of its unusual position must, in the present state of our knowledge regarding the development of the large veins, be almost entirely hypothetical. Marshall¹ states that the transverse vein which in the fœtus unites the jugular veins of opposite sides at the lower part of the neck, and which ultimately forms the left innominate vein, is in the sheep formed by the junction of two small spur-shaped points, which project toward one another from the inner borders of the jugular trunks, immediately above the pericardium, on a level with the subdivision of the ascending aorta, and that these points ultimately coalescing, form the vein in question. The development of this transverse vein has not been studied in the human subject, but in all probability it resembles that of the corresponding vessel in the sheep. Now in the present case it is necessary to suppose that the above-mentioned spur-shaped projections, instead of uniting *in front* of the ascending aorta, extended inwards *behind* that trunk, and so gave rise to the anomalous position above described of the left innominate vein. That the plane of junction of these spur-shaped projections is not invariable, although *rarely* removed backwards, is proved not only by the present case, in which they appear to have united between the aorta and trachea, but also by two cases reported by Weese², in both of which they had united on a plane posterior to both trachea and œsophagus, the left innominate vein having been observed to cross from left to right behind both of these structures.

DESCRIPTION OF PLATE VIII.

R. C. A., L. C. A., Right and Left Common Carotid Arteries. R. V. A., L. V. A., Right and Left Vertebral Arteries. The accessory vertebral artery of the left side is not figured. R. S. A., L. S. A., Right and Left subclavian arteries. R. I. V., L. I. V., Right and Left innominate veins. R. S. V., L. S. V., Right and Left subclavian veins. I. J. V., Left internal jugular vein. D. A., Ductus arteriosus. R. Ph. N., Right phrenic nerve. R. P. N., L. P. N., Right and Left pneumogastric nerves. The hook in the right-hand figure indicates the œsophagus.

¹ *Phil. Trans.* 1850, (Part 1).

² *De ectopia cordis*, Berolini, Sect. 37, 48.

