

Variants of the left aortic arch branches

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shall make use of the classification as described in the *Atlas of Neuro-radiologic Embryology, Anatomy and Variants*¹ that describes seven variant types from A to G below (Figs 1-7).

Abstract

The normal aorta has three branches from its arch, but variations in this pattern are not uncommon. Our interest was to correlate the documented statistics to the variants observed in our patients. This was done by randomly selecting 60 patients on whom arch aortograms were performed.

Our patients did not demonstrate all of the variants described. There was close correlation between the documented values and our patients except for the aberrant right subclavian artery which was more than three times more common in our patients.

Introduction

Our study was limited to variants of the left aortic arch branches as none of the patients demonstrated a right-sided arch.

Numerous variations of the aortic arch branches have been described in different texts.

For the purposes of this study we

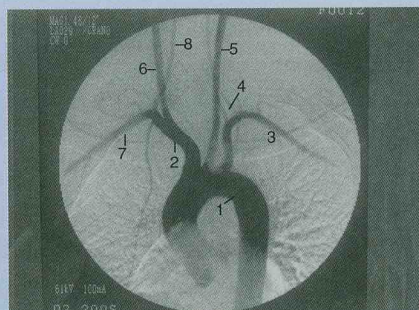


Fig. 1. Type A.

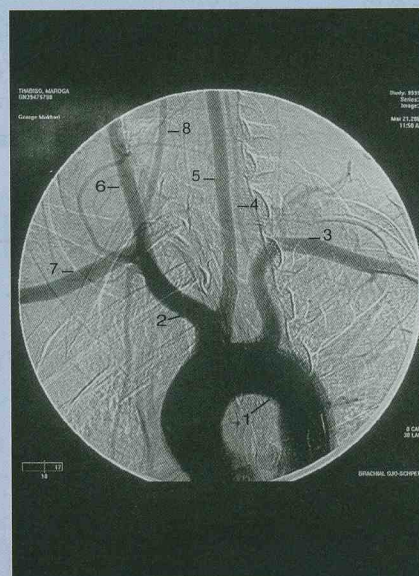


Fig. 2. Type B.

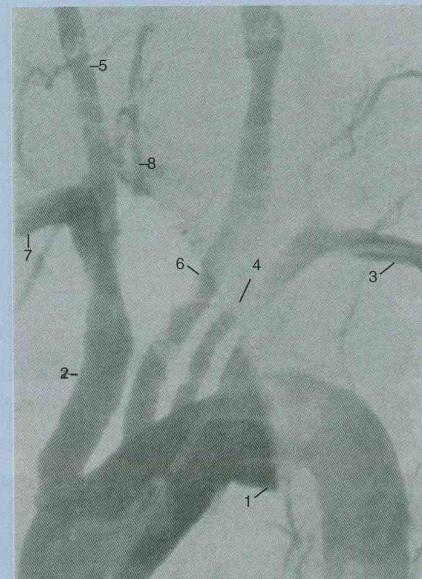


Fig. 3. Type C (Courtesy of Rutherford. Vascular Surgery. 4th ed. Philadelphia: Saunders, 1995²)

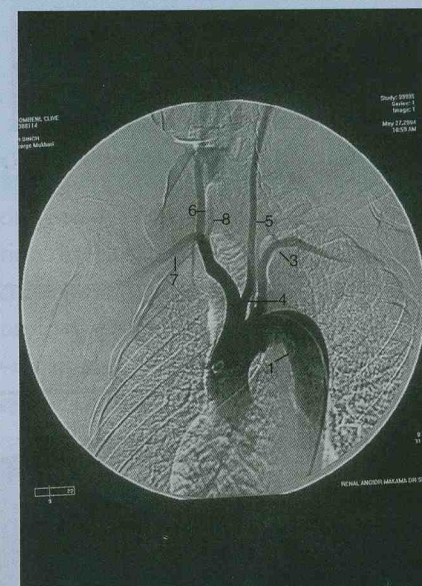


Fig. 4. Type D.

Key for Figs 1 - 7.

1. Aortic arch
2. Innominate artery (brachiocephalic trunk)

3. Left subclavian artery
4. Left vertebral artery
5. Left common carotid artery
6. Right common carotid artery
7. Right subclavian artery
8. Right vertebral artery
9. Right internal carotid artery
10. Right external carotid artery.¹

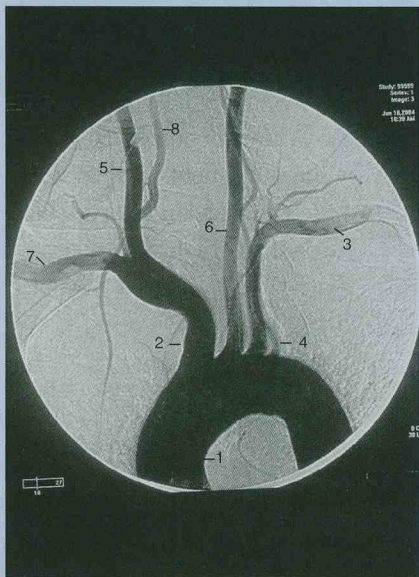


Fig. 5. Type E.

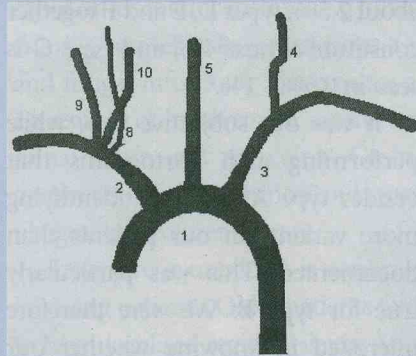


Fig. 6. Type F.

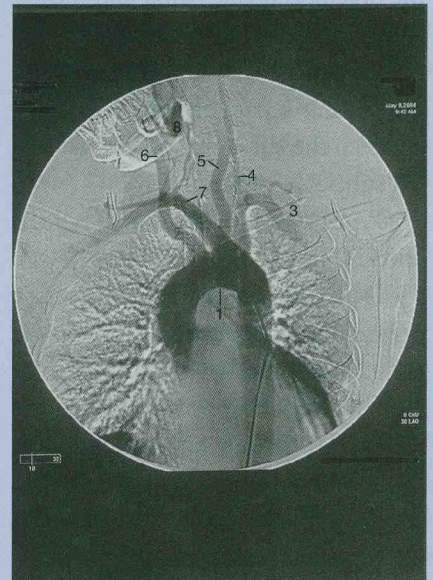


Fig. 7. Type G.

Case material

An arch aortogram was performed on all patients booked for angiographic studies. The patients were selected randomly irrespective of age. Sixty cases were accumulated between February and June 2004.

Method

We made use of our newly installed digital subtraction angiogram machine (Shimadzu Angiography Digital System, Kyoto, Japan) for imaging. All patients were examined in the supine position. Arterial

catheterisation was achieved using the Seldinger's method. A 5F 'pigtail' catheter was placed in the ascending aorta, proximal to the origin of the right innominate artery. Forty millilitres of contrast (Jopamiron 300 mg) was injected using a power injector at a rate of 20 ml/second for 2 seconds. The X-ray tube was angulated in the left anterior oblique position. The results are given in Table I below.

Discussion

The normal development of the aortic arch and great vessels requires

the formation and selective regression of six paired vascular arches. These arches connect the ventral aorta to paired dorsal aortas. The aortic arch develops from the persistence of the fourth left arch.²

In type A, the aorta commonly has three major branches originating from the superior surface of the arch. Starting from the right side, these are the brachiocephalic trunk (innominate artery), left common carotid artery and left subclavian artery (Fig. 1).

Type B has a common origin of

Table I. Association between documented and calculated values

Type of variant	Total number of patients (60)	Calculated values (%)	Documented values (%)
A	39	65.0	65.0
B	17	28.3	27.0
C	0	0.0	2.5
D	1	1.7	
E	1	1.7	≤ 4
F	0	0.0	
G	2	3.3	0.5 - 1.0

the brachiocephalic trunk and the left common carotid artery (Fig. 2).

Type C has the left vertebral artery originating separately from the arch between the left common carotid and left subclavian arteries (Fig. 3).

Type D is a combination of types B and C (Fig. 4).

Type E has the left vertebral artery originating independently from the arch distal to the origin of the left subclavian artery (Fig. 5).

Type F has low bifurcation of the right internal and external carotids, which may have separate origins from the brachiocephalic trunk (Fig. 6).

Type G has an aberrant right subclavian artery arising as a last branch distal to the origin of the left subclavian

artery (Fig. 7).

Type A is documented as occurring in about 65% of the population. Type B is seen in about 27%, type C in about 2.5%, types D, E and F together constitute almost 4%, and type G is seen in 0.5% - 1%.³

It was our subjective view while performing arch aortograms that besides type A, we were identifying more variants in our patients than documented. This was particularly true for type B. We were therefore interested in knowing whether our presumption was statistically correct.

Conclusion

There was good correlation between the documented and calcu-

lated values seen in type A. We demonstrated 1.3% more type B than documented. No patients examined showed types C and F. Types D and E were also within documented limits. Two of the 60 patients displayed an aberrant left subclavian artery, which was a surprisingly high percentage.

References

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In the 6 years since the publication of the first edition of *Textbook of Gastrointestinal Radiology*, much has changed in our discipline. Technical advances have led to the development of magnetic resonance cholangiopancreatography, helical computed tomography, virtual colonography, power color Doppler and harmonic ultrasound, breath hold abdominal magnetic resonance imaging, and digital fluoroscopy. Liver-specific magnetic resonance contrast agents and ultrasound contrast agents are now being used more widely. Tremendous strides have also been made in our understanding of the pathophysiology of a number of diseases—from the role of genetics in the etiology of colon cancer to an appreciation of the importance of *Helicobacter pylori* in the development of benign and malignant gastroduodenal disease. To keep pace with these technologic and scientific advances, every chapter in the second edition has been updated and significantly revised, several have been added or deleted, and nearly one third of the chapters have new authors to provide their topics with fresh insight.

Throughout this new edition, we have taken great care to maintain the fundamental goals of the first edition: to provide complete and up-to-date coverage of the state of knowledge in gastrointestinal radiology in a practical and useable way. As in the first edition, our basic organizing principle is the integration of rapidly changing information, common sense, and good judgment into an orderly and practical approach to radiologic diagnosis and treatment. To this end, the text contains sections on general radiologic principles for evalu-

ating the hollow viscera and solid organs, as well as for performing and applying specific imaging and therapeutic techniques. Other sections present the clinical, radiologic, and pathologic aspects of disease in the various gastrointestinal organs. These chapters are designed to illustrate and integrate the spectrum of abnormalities seen on all diagnostic modalities available to the radiologist: plain films, barium studies, cholangiography, computed tomography, ultrasonography, magnetic resonance imaging, scintigraphy, and angiography. To make the book more user friendly, the authors and editors have worked diligently to eliminate redundancies and produce a shorter, more compact text.

Once again, we have been able to assemble an outstanding group of internationally recognized authors for the second edition. Their time, effort, cooperation, and expertise are greatly appreciated. As editors, we have tried to strike a balance between uniformity of style and individuality of authors, so that each contributor is allowed to speak with his or her unique voice.

We hope the collective efforts of the authors of the 131 chapters and the two of us who have edited this second edition have succeeded in our objective to provide a valuable educational resource for students and practitioners of gastrointestinal radiology that is clear, interesting, and enjoyable to read.

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