Case report

Diverticulum of the descending aorta related to aortic arch anomaly

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Abstract

Diverticulum of the descending aorta with mirror branching right aortic arch was incidentally detected in a 64-year-old woman on screening chest radiograph and further radiographic examinations. Diverticula of the descending aorta related to aortic arch anomaly have been reported previously despite the rarity of the phenomenon. However, this report is the first to have investigated the condition utilizing three-dimensional computed tomography (3DCT).

Key words: aortic diverticulum, aortic arch anomaly, right aortic arch, double aortic arch, three-

Introduction

Diverticulum of the descending aorta related to aortic arch anomaly is a rare occurrence, with almost all of the previously reported cases having been identified in cadavers. Recent developments in imaging technique have allowed the aortic structure to be investigated using simple non-invasive procedures. Incidental detection of asymptomatic aortic diverticula might now become

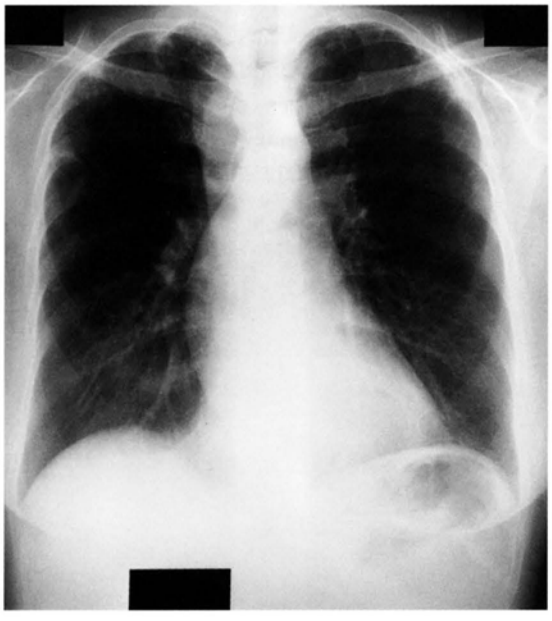

Fig. 1
Aortic knob is seen on right, not left. Descending aorta is displaced to the right.

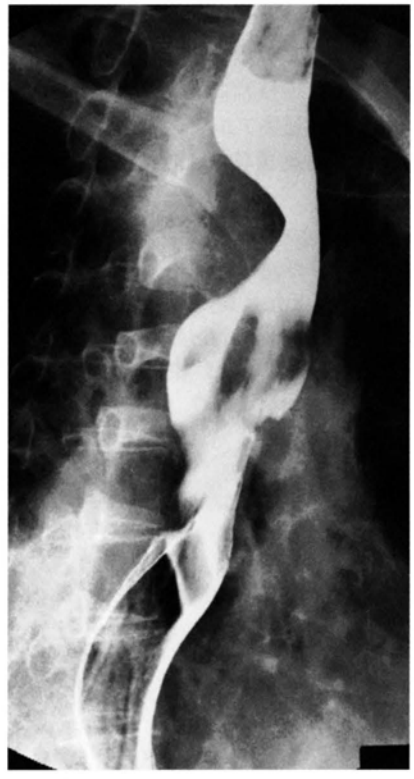

Fig. 2
Lateral oblique views. Esophagus is displaced anteriorly and indentation of the posterior wall is identified.

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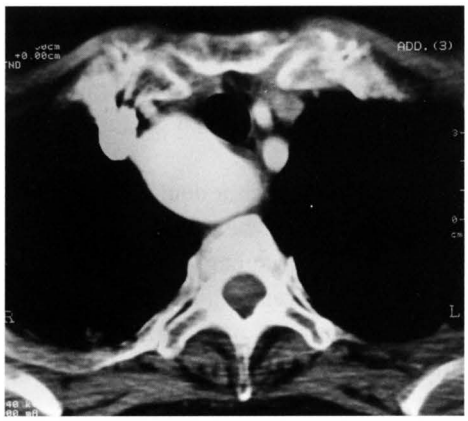

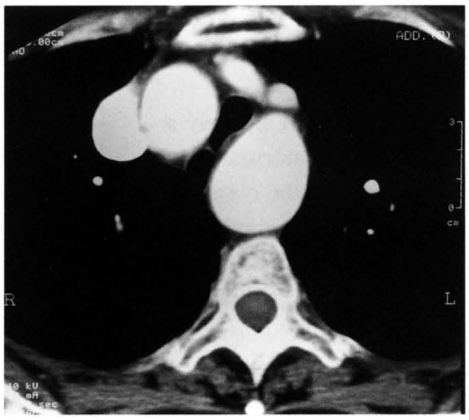

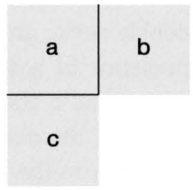

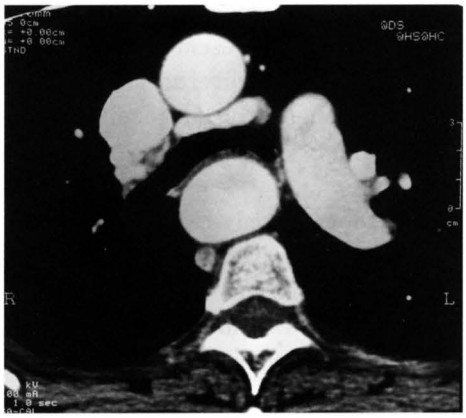

Fig. 3
a. CT through upper mediastinum shows right-side aortic arch extending the branch posterior to the trachea and esophagus.
b. Outpouching from the descending aorta adjacent to but completely separated from the left brachiocephalic artery.
c. The left brachiocephalic vein enters the aortopulmonary windows, anterior to the trachea and posterior to ascending aorta, crossing anterior to the trachea and joining the right brachiocephalic vein.

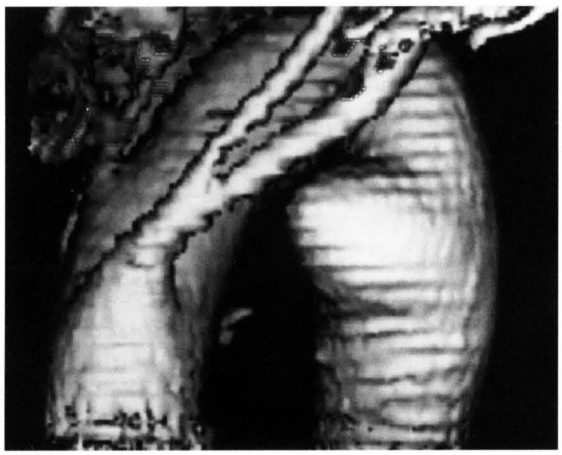

Fig. 4
First branch of the aorta forming left brachiocephalic artery with accompanying outpouching of the descending aorta.

more frequent. Aortic diverticulum related to aortic arch anomaly is radiologically important, as familiarity with 3D images of aortic diverticula and the relationships to embryological development facilitate differentiation from other diseases.

CASE REPORT

A 64-year-old woman underwent chest radiography as a screening test for the presence of lung cancer. The patient was asymptomatic, with no history of cardiac or other diseases. Aortic arch shadow was observed on the right side and the thoracic aorta descended to the right of the spine (**Fig.1**). The esophagus was displaced anteriorly, with slight indentation of the posterior wall on esophagogram (**Fig.2**). Further investigation using computed tomography (ProSeed, GE-Yokogawa Medical System, Japan) and 3DCT (3mm collimation, pitch 1.0, 1.0sec/rotation, 1.0mm reconstruction) revealed outpouching of the descending aorta and mirror-image branching right aortic arch with the first branching at the left brachiocephalic artery (**Fig.3, 4**). No additional abnormalities other than an anomalous left brachiocephalic vein were observed.

Consequently, based on clinical, radiographic and embryological findings, the outpouching of the descending aorta was diagnosed as diverticulum

related to aortic arch anomaly.

DISCUSSION

Aortic diverticulum related to aortic arch anomaly is rare phenomenon resulting from abnormal fetal development[1]. Aortic diverticula can be classified into two groups according to Edward's hypothetical double aortic arch[2]. One of them depends on the presence of a left or right aberrant subclavian artery and a conical or round outpouching at the origin of the aberrant vessel. The other one was pertinent to the present case, with the presence of mirror branching right aortic arch and double aortic arch.

Ninety-eight percent of mirror branching has been reported as accompanying congenital heart disease[1], although mirror branching related to diverticulum is embryologically differentiated from those associated with congenital heart disease[3]. Both types of mirror branching aortic arch result from interruption of the primitive aortic arch distal to the left subclavian artery. The interruption related to diverticulum occurs proximal to the ductus arteriosus, whereas that associated with congenital heart diseases occurs distally. Diverticulum of the descending aorta is reported to represent a remnant of the infundibular part of the ductus arteriosus in right aortic arch, and is synonymous with ductus diverticulum and ductus bulge, The diverticulum is considered to appear only in cases of right aortic arch, because ductus arteriosus is always present on the left side regardless of translocation of the arch, unless situs inversus or anomaly of heart is also present[3,4]. Position of the aortic arch could therefore be important in diagnosing outpouching of the descending aorta.

However, the right aortic arch is generally larger in double aortic arch[5], and partial atresia of the left arch could form diverticulum. A partially atretic double aortic arch accompanying diverticulum has been reported as radiographically indistinguishable from mirror branching right arch accompanying diverticulum[3].

Patients with diverticulum in a double aortic arch are considered to usually be symptomatic with presentations such as dysphagia from complete vascular ring[4,6], whereas those with mirror branching right aortic arch are typically asymptomatic[7,8]. Anatomical study has been reported as the single reliable method of differentiating both these diverticula[4]. We could not confirm the type of the present case. However, categorization of the type of diverticulum is not as important as differentiation of the condition from aneurysm, traumatic aneurysm or aortic coarctation.

Thoracic aneurysm commonly results from aortic sclerosis, although our patient did not have risk factors such as hypertension or hyperlipidemia, and arteriosclerosis with calcification was not observed on CT. Furthermore aortic coarctation or chronic traumatic aneurysm was ruled out by radiographic imaging and history.

Diverticula may develop aneurysmal changes[9] but the wall structure has been reported as not demonstrating deficiency[10]. Additional surgery and examinations are therefore not necessary.

Another anomaly, anomalous left brachiocephalic vein has an incidence of 1 in 500 and was reported an association with right aortic arch[11].

CT and MRI have recently enabled non-invasive 3D imaging, and numerous disease status that had previous been largely unobserved in vivo can now be easily identified[12]. Correlation of aortic diverticulum with anomaly of the aortic arch is radiographically important.

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