Original Article

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Study of Abnormal Origin of Subclavian Artery

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Abstract

Background: In about 80% of individuals, 3 branches arise from the arch of aorta; the branches from right to left are brachiocephalic artery, left common carotid artery, left subclavian artery. In the present study, we found an aberrant right subclavian artery arising from arch of aorta distal to left subclavian artery. *Aims and Objectives*: Variations in branching pattern of arch of aorta are frequently identified by imaging studies.The clinicians should be aware of abnormalities occurring in arch of aorta and its branches. This could help in managing these variations in emergency approaches to the arch of aorta and the great vessels. The aim of present study is to report the occurrence of abnormal origin of subclavian artery. *Material and Methods*: In department of Anatomy, I.G.G.M.C., Nagpur, the present study was conducted on embalmed cadavers. *Results*: Out of 48 cadavers, which were dissected, in 1 cadaver, we found an abnormal origin of right subclavian artery from arch of aorta distal to left subclavian artery. (i.e. 2.08%). The aberrant artery was passing behind the oesophagus. The origins of left subclavian artery in all cadavers were found to be normal. *Conclusion*: The retroesophageal right subclavian artery is important to the angiographer who use right axillary, brachial or radial approach to ascending aorta. Knowledge of this abnormality is important while evaluating the patient with difficulty in deglutition.

Keywords: Subclavian Artery; Arch of Aorta; Aberrant.

Introduction

In about 80% of individuals, 3 branches arise from the aortic arch ; the brachiocephalic trunk, the left subclavian artery and the left common carotid artery [1]. Normally right subclavian artery arises from brachiocephalic trunk and passes towards the arm [2]. Congenital failure in development of the primordial aortic arch result in various vascular anomalies [3]. Adachi first described this branching pattern as type A [4]. Another 11% of reported cases exhibit Adachi's pattern type B, which consists of a common trunk for the left common carotid artery and the subclavian artery . This branching pattern results in only two trunks originating from the aortic arch. The third most common pattern, type C , is characterized by vertebral artery, originating proximally to the left subclavian artery as a fourth branch of aortic arch. The remaining 1% of cases are composed of numerous other aortic arch branching pattern variations [3].

The aberrant vessel arises from the aortic arch or proximal descending aorta distal to left subclavian artery [2]. An aberrant right subclavian artery is a rare vascular anomaly that is believed to induce feeding and swallowing difficulties in 20% of the patients, caused by dorsal compression of esophagus by anomalous artery. Recently it has been suggested that the prenatal occurrence of this vascular anomaly is substantially increased in Down syndrome where it can be found in upto 19-36% of cases [5]. It may also be seen in patients with tetralogy of Fallot, pulmonary atresia and major aorticopulmonary collateral arteries [6]. Feeding problems in infants and young children with Down syndrome are frequent may lead to failure to thrive [2].

Failure to recognize such variations may lead to damage to this artery during esophageal surgery or

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vascular surgery with disastrous complications [2]. Because of the rarity of the anomaly, pre-operative diagnosis may not be always possible [2]. Further, dysphagia, if present, may well be because of esophageal pathology and therefore may not help in diagnosis [2].

Materials and Methods

The present study was conducted on 48 embalmed cadavers . The cadavers were utilized for dissection for M.B.B.S. students at Indira Gandhi Govt. Medical College, Nagpur. The arch of aorta and its branches were exposed to observe any variation in the origin of right subclavian artery.

Result

Out of 48 cadavers, in one cadaver we found four branches arising from the aortic arch , from right to left, (1) Right common carotid A (2) Left common carotid A (3) left subclavian artery (4) aberrant right subclavian artery. The anomalous artery passed obliquely toward the right side behind oesophagus. Origin of left subclavian artery did not show any variation. Left subclavian artery show normal origin and course.

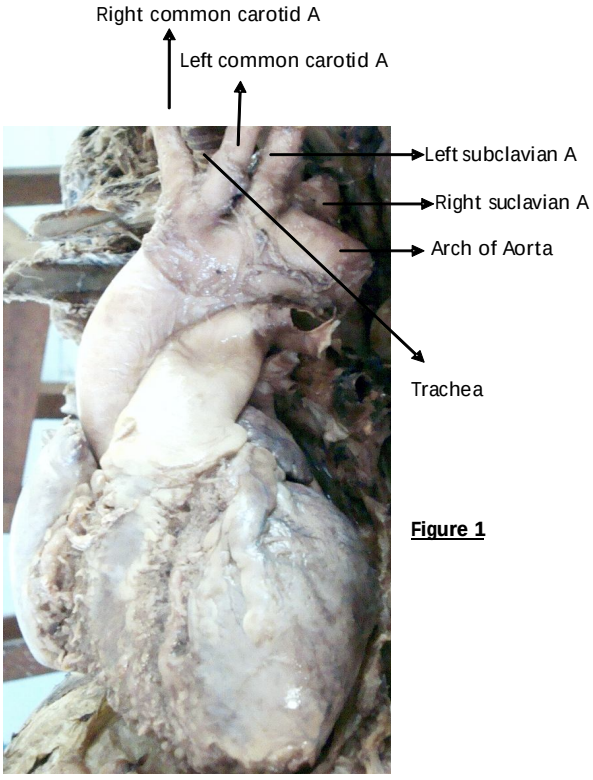

Figure 1

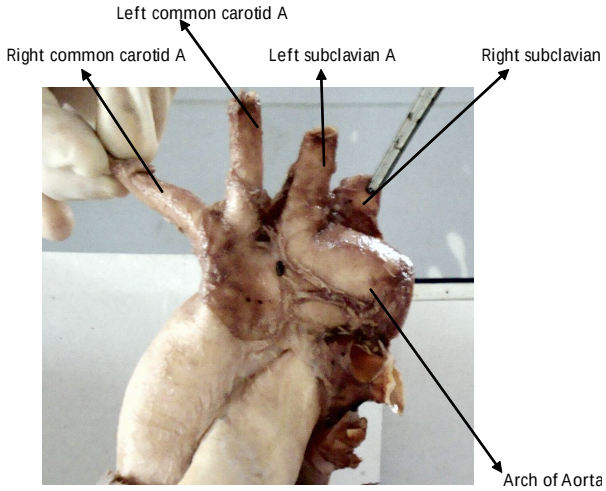

Fig. 2:

Discussion

The right subclavian artery usually develops during sixth to eighth week of gestation from 1) the right fourth aortic arch artery (forms the proximal part) and 2) the right dorsal and right seventh intersegmental artery(form the distal part) [7.8].

Under normal conditions, the right fourth aortic arch artery and / or the right dorsal aorta involute cranial to the seventh intersegmental artery; i.e. the connection between the aortic sac and the origin of the right subclavian artery disappears [1]. Consequently , the right subclavian artery develops from 1) the right seventh intersegmental artery and 2) the distal segment of right dorsal aorta. As development proceeds and the arch of aorta forms , differential growth shifts the origin of the right subclavian artery cranially, so that it comes to lie close to the origin of the left subclavian artery [1]. As a result of its dorsal origin , the artery necessarily passes behind oesophagus [1].

The most common embryologic abnormality of aortic arch is an aberrant right subclavian artery which occurs in 0.5% to 1.8% of the population [9]. The aberrant right subclavian artery arises from arch of aorta distal to left subclavian artery and most frequently passes behind oesophagus to the right arm. Rarely, it passes between the oesophagus and the trachea or in front of trachea [10-12]. Therefore anomalous artery in present study took the most common course.

Normally, this anomaly causes no symptoms unless there is compression on the trachea or the oesophagus . When present in isolation , it may cause dysphagia (dysphagia lusoria). David Bayford (1761)

was the first to note the association of dysphagia with oesophagial compression caused by an aberrant right subclavian artery [13]. Dysphagia lusoria is the descriptive term for dysphagia resulting from oesophageal compression caused by an aberrant right subclavian artery (arteria lusoria) [14]. The dilated proximal ARSA is also known as diverticulum of Kommerell. In some patients this diverticulum may become aneurysmal. Almost all cases of distal arterial embolisation from an anomalous right subclavian artery have been associated with a right subclavian artery aneurysm. This anomaly is complicated by aortitis, dysphagia, chronic cough and intermittent dysnoea. Dysphagia caused by this anomaly in older patients may be due to increased rigidity of the oesophagus itself or vessel wall and elongation of the aorta. Infact patient with arteria lusoria have symptoms of stidor or recurrent respiratory infections due to compression of trachea [15]. In adults the trachea is more rigid, therefore, respiratory symptoms are rare. When symptoms occur in adults, oesophageal complaints (dysphagia) predominate. In addition, the risk of iatrogenic injury to subclavian artery could increase.Therefore, an aberrant right subclavian artery can sometimes be a challenging problem for surgical correction.

The incidence of ARSA in Down Syndrome has been reported in upto 16-39% of cases by Chaoui et al. [9]) Recognition of this association is of importance when evaluating feeding or swallowing difficulties in Down syndrome patients. Most studies evaluating radiologic investigations have been performed on proven cases of an aberrant right subclavian artery or with an intention of finding this anomaly and therefore may not actually translate into picking this rare anomaly preoperatively. Previous reports document a 30% to 45% incidence of limb ischemia in patients undergoing ligation (without reconstruction) of an aberrant right subclavian artery [16,17]. Hence prompt reconstruction of the artery is necessary to prevent critical limb ischemia.

Conclusion

Clinicians performing imaging studies and catheter based techniques for aortic arch and great vessels should be aware of retroesophageal right subclavian artery to decrease the risk of iatrogenic injury. Knowledge of this anomaly, pre-operative identification and careful dissection especially in a thoracoscopic mobilization will help in preventing disastrous vascular complications in patients with an aberrant right subclavian artery.

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