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Short Communication

An Accessory Inferior Pulmonary Vein: A Variation in the Pulmonary Venous Formation in the Left Atrium and its Importance

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ABSTRACT

Development of heart along with its vascular system is a complex process taking place throughout the gestation era. Formation of pulmonary veins is rather more intricate as it involves the connection of growing lung bud to the heart tube.

Developmental anomalies of the pulmonary veins are rare but significant congenital malformations that affect the embryonic development of the pulmonary vascular system. One such anomaly was found during the dissection of an eighty-eight year old cadaver. The article demonstrates the congenital anomaly of the pulmonary vein, its possible cause, its effect on the health of the patient and its clinical importance.

KEYWORDS

• Congenital • Development • Pulmonary veins • Deformation

INTRODUCTION

Pulmonary veins are the channels transporting oxygenated blood from both the lungs to the left atrium. These are the only veins in the human body to carry oxygen rich blood. Although there are disputes about the development of the primitive pulmonary vein as to whether it originates from the systemic venous sinus ("sinus venosus") of the heart or appears as a new structure from the mediastinal mesoderm draining to the left atrium, the anatomy of pulmonary veins is quite clear in the developed heart.

There are four pulmonary veins. Pairs of two emerge from each of the hila of the lungs.The pulmonary veins originate from individual alveoli within the lung as capillary vessels. These capillary systems converge into larger veins called the interlobar pulmonary veins. Further convergence of the interlobar

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pulmonary veins creates the subsegmental veins. The subsegmental veins may drain multiple segments of the same lobe of the lung. There is limited literature on the total drainage of lobe segments by numerous subsegmental veins. However, some evidence suggests that 33 to 55% of people have middle lung segments drained by one subsegmental vein. Another 45 to 67% of having a middle lung segment with two or more subsegmental veins.The subsegmental veins form a conflux into the pulmonary veins.

Pulmonary vein developmental anomalies occur mostly when the blood vessels connecting the growing lung buds to the heart start differentiating into four major pulmonary veins during Carnegie stage 15 to the term. The possible developmental malformations can be Partial anomalous pulmonary venous return (PAPVR), Total anomalous pulmonary venous return (TAPVR), Cor triatriatum, Scimitar syndrome, Pulmonary vein stenosis, Pulmonary vein atresia or there can be a condition where the connection between the growing lung bud and heart fails to develop further leading to underdeveloped pulmonary venous connection.

In anatomical terms, pulmonary venous anomalies are classified as anomalous connections, anomalous drainages, or abnormal numbers of pulmonary veins. The number of pulmonary veins which drain into the left atrium can vary from one to five.These variations are not always problematic, but they may interfere with clinical decisions especially in surgical procedures.

METHOD

The cadaver of an eighty-eight year old was dissected during which the abnormality of the pulmonary veins was found.

OBSERVATIONS

During cadaveric dissection, a thorough examination of the heart was done.

- The heart was found to be conical in shape having four heart chambers (two atrium and two ventricles). The atria situated above and behind the ventricles. On the external surface, the atrial chambers were separated from the ventricles by an atrioventricular groove. The two atria were seen separated by the interatrial groove and two ventricles by the interventricular groove.
- The apex of the heart was formed by the left ventricle directed downwards and forwards. The base was seen to be formed mainly by the left atrium and by a small part of the right atrium.
- The right atrium was intact along with the superior and inferior vena cava at the upper and lower end of the chamber respectively. The right atrium was connected to the right ventricle by an atrioventricular orifice guarded by the tricuspid valve.
- The right ventricle along with the pulmonary trunk was also found intact.
- The interior of the left atrium was majorly smooth walled. The rough part having musculi pectinati was present only in the auricle(appendage of the left atrium). The ostium of pulmonary veins were found on each side of the posterior wall.
- Two ostium were found on the right side of the posterior wall of the right atrium- one ostia of the right superior pulmonary vein and another of the right inferior pulmonary vein.
- On the left side of the posterior wall of the right atrium (*Figure 1*), three ostium were found. One ostia of the left superior pulmonary vein and two ostium of the left inferior pulmonary vein (*Figure 2*), one being smaller in size than the other and divided by one shared wall (*Figure 3*).
- The musculature of the left ventricle of the heart was found degenerated.

Figure 1: Left Superior & Inferior Pulmonary veins draining into the Right Atrium.

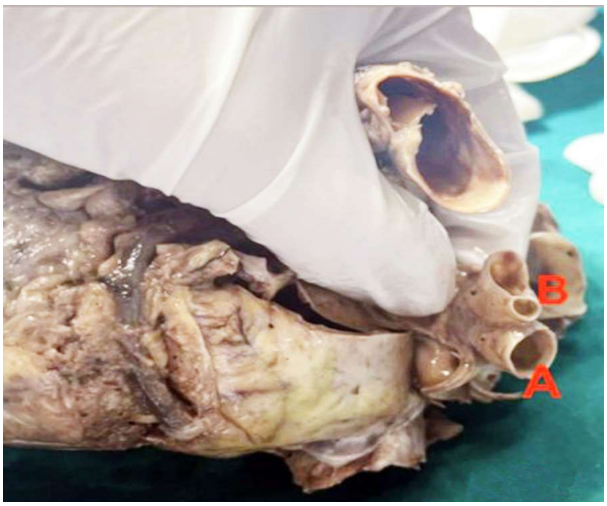

Figure 2: A-One ostia of the left superior pulmonary vein, **B-**Two ostium of the left inferior pulmonary vein

Figure 3: C-The septa dividing the left inferior pulmonary vein causing the formation of an accessory inferior pulmonary vein

DISCUSSION

The dissected cadaver was an eighty eight year old male. The cause of his death was unknown. The left ventricle of the heart was degenerated. The ridges and bridges of the trabeculae carneae were not clearly visible and the papillary muscles were also deteriorated. The cause of such degeneration can be old age.

As we already know that there are four pulmonary veins that enter the left atrium of the heart, two from each lung hila. Therefore in normal anatomy, the posterior wall of the left atrium is presented with four ostium (two on the right side and two on the left). But in the heart of the dissected body, the posterior wall of the right atrium was presented with five ostium. Two ostium were present on the right side, one ostia of the right superior pulmonary vein and another of the right inferior pulmonary vein. Three ostium were found on the left side of the posterior wall, one ostia of the left superior pulmonary vein, one ostia of the left inferior pulmonary vein and one ostia of an accessory pulmonary vein. This accessory pulmonary vein was found attached superiorly to the left inferior pulmonary vein and the vicinity of its ostia corresponded to the left superior pulmonary vein and left atrial appendage (LAA).

The ostia of the accessory pulmonary vein was smaller in diameter than the major superior and inferior pulmonary veins and such type of congenital anomaly can occur by over-incorporation of the pulmonary veins beyond their first division.

In a study done in 2014 on "Variations in the Pulmonary Venous Ostium in the Left Atrium and Its Clinical Importance" it was concluded that out of fifty formalin fixed adult cadaveric hearts studied for variations in the opening of the pulmonary veins into left atrium, thirty-four heart specimens (68%) had normal four pulmonary veins and in 16 (32%) out of 50 specimens, variations in the number of pulmonary veins and the pulmonary ostia were observed either on one side or on both sides of the left atrium.

However, the majority of variations were found in the right pulmonary veins and not in the left.[1] But in the above discussed specimen the difference in the number of ostium involved the left inferior pulmonary vein which can be considered a rare case.

CONCLUSION

Such pulmonary venous anomalies may or may not be problematic depending upon their hindrance in the functioning of the heart. The above discussed variation may not have caused any health problem as the pulmonary veins were not stenosed at any site and were draining into the left atrium.

However, the ostia of the identified accessory pulmonary vein was found to be opening in the vicinity of left atrial appendage. There has been increasing interest in the anatomy of LAA, primarily because over 90% of thrombi in patients with atrial fibrillation occur in the

LAA and thrombus formation in the structure increases the risk of stroke threefold.[2] The ostia of pulmonary veins (major or accessory) receives the extension of myocardial tissue, hence the ectopic atrial activity and bears the capability of contracting in atrial fibrillation if received precipitating factors.

Knowledge of separate openings of the LA with typically narrower atriovenous junctions can be useful to facilitate ablation, to avoid their inadvertent injury, and to assess the possibility that they might be a focus of automatism.

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