

CASE REPORT

VARIATION IN THE OPENINGS (OSTIA) OF LEFT PULMONARY VEINS INTO THE LEFT ATRIUM: A CASE REPORT

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ABSTRACT: During early embryonic development, absorption of pulmonary venous network by the left primitive atrial chamber results in opening of four pulmonary veins which drain independently into its chamber. The extent of absorption and hence, the number of pulmonary veins which open into the left atrium, may vary. Here we report a variation in the opening of the Left upper (superior) pulmonary vein into the Left atrium. A total of six openings observed.

KEYWORDS: Pulmonary veins, Left atrium, Endocardial cushion.

INTRODUCTION:

NORMAL ANATOMY: Each lung presents two pulmonary veins, upper and lower. Upper vein of the Right lung drains the blood from upper and middle lobes, and that of Left lung from Upper lobe only. Lower vein drains blood from lower lobe of the respective lung. The pulmonary vein begins from the capillary plexus and terminates directly into the Left atrium.

The Left atrium has thicker walls. Its cavity and walls are largely formed by the proximal parts of the pulmonary veins, incorporated into the atrium during development.

Inferiorly, the four pulmonary veins open into the upper posterolateral surfaces of the Left atrium, two on each side. Their orifices are smooth and oval, the left pair frequently opening via a common channel.

DEVELOPMENT: The dorsal wall of the left atrium receives initially a single pulmonary vein, the embryogenesis of which is unsettled. The single vein divides into two branches, one from each lung. Each branch subdivides into upper and lower branches. (Fig. 10, 11, 12). Thereafter, all the four branches are incorporated to form the dorsal wall of the atrium in a manner similar to the development of the trigone of the bladder. Therefore the left atrium is developed from three sources.

- A) The posterior smooth part (between the openings of the pulmonary veins) develops from the incorporation of the endocardial cushions of the four pulmonary veins.
- B) The anterior part which is somewhat trabeculated including the left auricle develops from the left half of the primitive atrium.
- C) The most ventral part develops from the left half of the atrioventricular canal.

VARIATION: Variation in the openings of the pulmonary veins into the Left atrium is common. During routine cadaveric dissections in the department of Anatomy, Rangaraya Medical College, Kakinada, a variation in the opening of the Left upper (superior) pulmonary vein into the Left atrium is observed. Normally two Right pulmonary veins and two left pulmonary veins open into

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the Left atrium making four openings in left atrium. Instead of single opening the left upper (superior) pulmonary vein is trifurcated and is having three small openings into the left atrium in total. The left atrium is having six openings –one from right upper (superior) pulmonary vein, one from right lower (inferior) pulmonary vein, one from left lower (inferior) pulmonary vein and three from left upper (superior) pulmonary vein instead of one from left upper (superior) pulmonary vein.

CLINICAL SIGNIFICANCE:

- 1) The knowledge about this variation is a Useful guide while performing cardiac surgeries on Left atrium, coronary bypass surgery, while using heart lung machine and in Heart transplantations.
- 2) Embryological significance in studying the congenital malformations associated.

DISCUSSION: 70% of the general population has four pulmonary veins: right superior and inferior and left superior and inferior pulmonary veins, with four independent ostia.^[1,2,3] Remaining population showed variations. Variations in the right pulmonary vein drainage were more common than those on the left. Prasanna, D Souza in their study stated that twelve percent of the hearts showed 2 left and 3 right pulmonary veins, 14% of hearts showed 2 left and 1 right veins, 4% hearts showed 1 left and 2 right veins and 2% hearts showed 1 left and 4 right pulmonary veins opening into the left atrium. They found no variations in left pulmonary vein except for a single ostium.^[4] Marom, MD, and James E. Herndon, MD Proposed a classification system based on ct study for pulmonary venous openings in to left atrium.^[5,6] The endocardial cushion thickness reduces with the increasing number of pulmonary ostia.^[7] The number of total openings described by prasanna et al was limited to five.^[1] Marom and his co-workers, in their study which was done on CT imaging, showed 3 to 5 ostia on the right side in 26% patients and a single ostium on the left side in 14% of the patients.^[2] In another study, 9% of the hearts showed five veins, 4.5% showed three veins, 3% showed two anomalies each and 0.5% showed three anomalies.^[8,6]

CONCLUSION: Knowledge on such variations gains significance in isolation for radiofrequency ablation as a treatment for atrial fibrillation.^[9] The anomalies of the abnormal pulmonary veins may mimic a Pulmonary Arteriovenous Malformation on roentgenographic imagings of the chest. There is a substantial variation in pulmonary venous anatomy, with respect to their numbers and drainage patterns.^[10,11] Knowledge on such variations is significantly important for interventional radiologists and thoracic surgeons before performing procedures which directly or indirectly involve the pulmonary veins. Right-sided venous drainage is considerably more variable than left-sided venous drainage. One-quarter of patients have at least one separate ostium for the right middle lobe veins. A flexible classification system that clearly describes these variations in pulmonary venous anatomy is imminent and useful for better understanding and for proper planning and management for clinicians.

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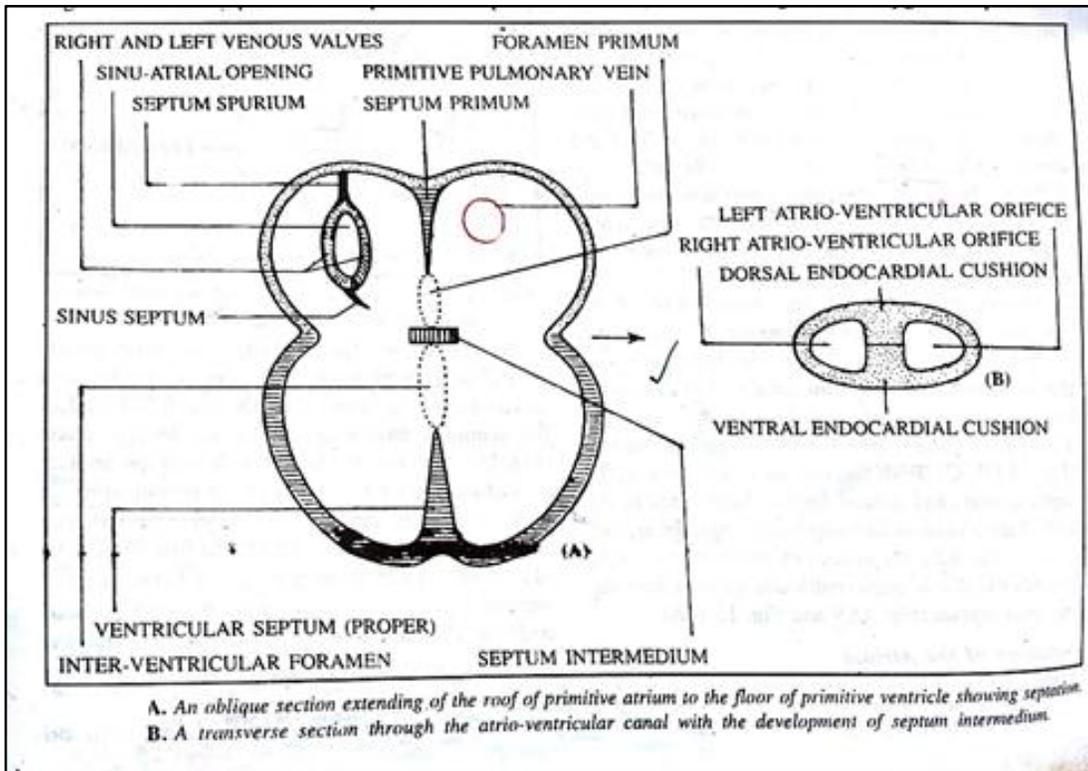


Figure 1

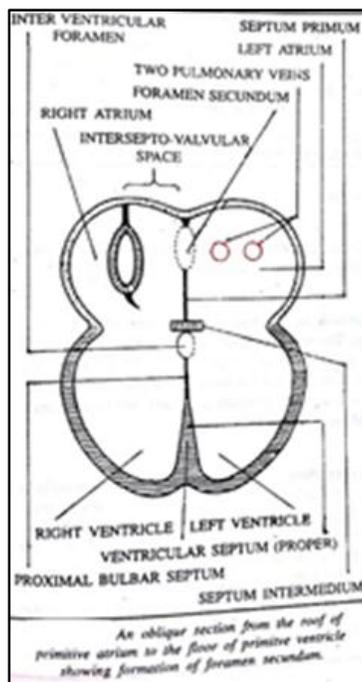


Figure 2

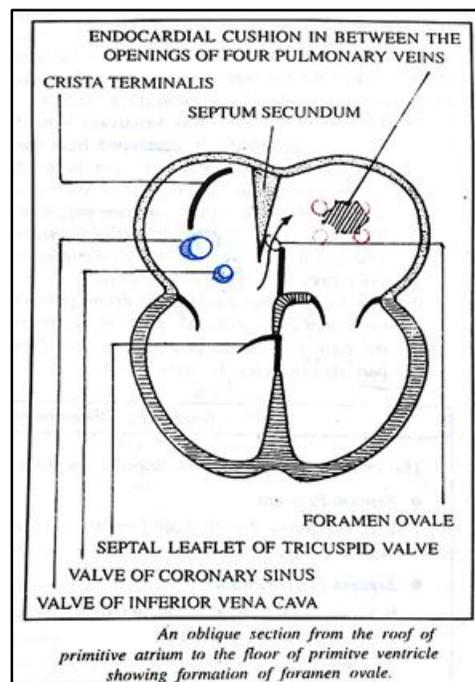


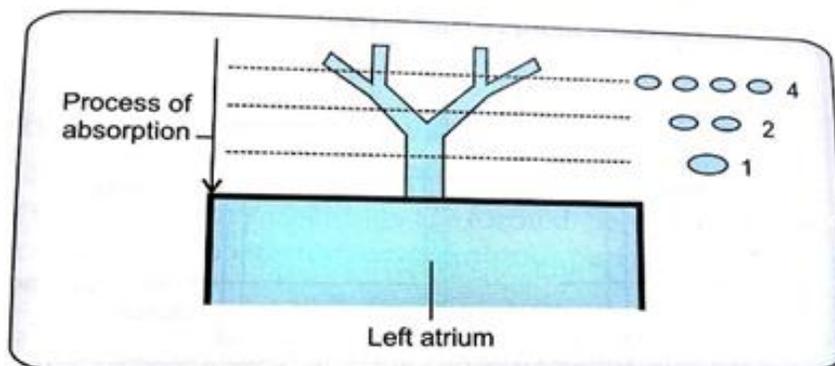
Figure 3

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Absorption of Pulmonary Veins

Earlier, only one pulmonary vein opens into the left atrium. The single pulmonary vein divides into two which undergo further division forming four pulmonary veins. During the process of absorption of the pulmonary veins, the part up to the four pulmonary veins gets absorbed into the left half of the primitive atrium. Now the posterior wall of left atrium shows four openings of the pulmonary veins.

In total anomalies of the pulmonary vein, none of the pulmonary vein gets connected with the left atrium. However, they open into the right atrium.



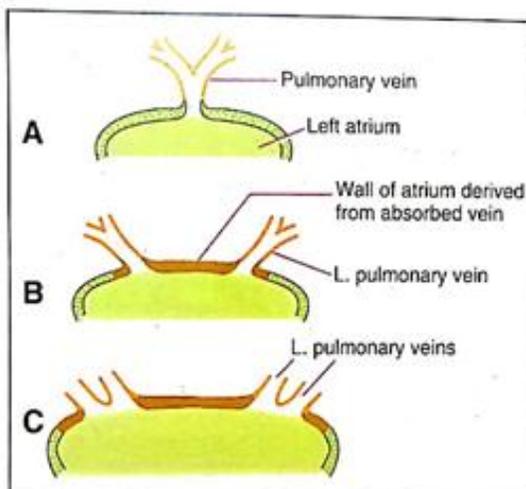
Absorption of pulmonary veins into posterior wall of left atrium

Figure 4

Absorption of Pulmonary Veins

At the time when the septum primum is just beginning to form (Fig. 15.6A), a single pulmonary vein opens into the left half of the atrium. When traced away from the heart (Fig. 15.9), the vein divides into a right and a left branch each of which again bifurcates, to drain the corresponding lung bud.

Gradually, the parts of the pulmonary veins nearest to the left atrium are absorbed into the atrium, with the result that four separate veins, two from each side, come to open into it (Fig. 15.9).



Absorption of pulmonary veins into the left atrium. At first only one vein from the lungs enters the left atrium. The proximal part of the vein is gradually absorbed and is incorporated into the wall of the atrium. As a result of continued absorption of tributaries, four veins (two right and two left) finally open into the atrium.

Figure 5

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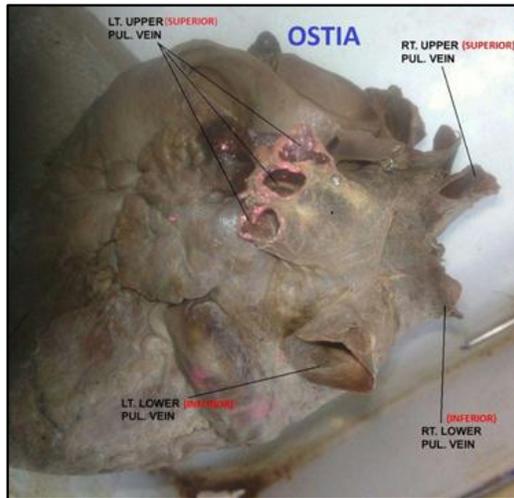


Figure 6



Figure 7

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