

Single Anomalous Pulmonary Vein Opening in the Left Atrium

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ABSTRACT

The four pulmonary veins carry oxygen-rich blood from the lungs to the left atrium of the heart. They are the only veins in the post-fetal human body that carry oxygenated blood. They commence in a capillary network upon the walls of the air sacs, and join together form one vessel for each lobule. These vessels unite successively and form a single trunk for each lobe (three for right and two for left lung). The vein from middle lobe of the right lung generally unites with that from the upper lobe, so that ultimately two trunks from each lung are formed. They open separately into the upper and back part of the left atrium. Occasionally, three veins on the right side remain separate, and not infrequently the two left pulmonary veins end by a common opening into the left atrium. The number of pulmonary veins opening into the left atrium can vary between three and five in the healthy population. Here we are discussing single anomalous pulmonary vein opening in the left atrium.

Key Words: Anomalous vein, Left Atrium, Pulmonary veins.

INTRODUCTION

The pulmonary veins carry oxygen-rich blood from the lungs to the left atrium of the heart. They are the only veins in the post-fetal human body that carry oxygenated blood. They are four in number, two from each lung, and are destitute of valves. They are right inferior, right superior, left inferior and left superior.^[1]

They commence in a capillary network upon the walls of the air sacs, where they are continuous with the capillary ramifications of the pulmonary artery, and, joining together, form one vessel for each lobule.

These vessels uniting successively form a single trunk for each lobe, three for the right, and two for the left lung.^[1]

The vein from the middle lobe of the right lung generally unites with that from the upper lobe, so that ultimately two trunks from each lung are formed; these perforate the fibrous layer of the pericardium and open separately into the upper and back part of the left atrium.

Occasionally, three veins on the right side remain separate, and not infrequently the two left pulmonary veins end by a common opening into the left atrium.

At the root of the lung, the superior pulmonary vein lies in front of and a little below the pulmonary artery; the inferior is situated at the lowest part of the hilus of the lung and on a plane posterior to the upper vein. Behind the pulmonary artery is the bronchus.

Development of veins associated with the heart

Three paired veins drain into the tubular heart of a 4-week-old embryo.^[1]

a) Vitelline veins return poorly oxygenated blood from the yolk sac

b) Umbilical veins carry oxygenated blood from the chorionic villi of the embryonic placenta; only the left umbilical vein persists.

c) Common cardinal veins return poorly oxygenated blood from the body of the embryo.

The vitelline veins follow the yolk stalk into the embryo. After passing through the septum transversus, the vitelline veins enter the venous end of the heart (the sinus venosus). As the liver primordium grows into the septum transversum, the hepatic cords anastomose around preexisting endothelium-lined sinusoids.

The umbilical veins run on each side of the liver and carry oxygenated blood from the placenta to the sinus venosus. As the liver develops, the umbilical veins lose their connection with the heart and empty into the liver. The right umbilical vein disappears at the end of the embryonic period, leaving the left umbilical vein as the only vessel carrying well-oxygenated blood from the placenta to the embryo.^[2]

The cardinal veins constitute the main venous drainage system of the embryo. The anterior and posterior cardinal veins drain cranial and caudal parts the embryo, respectively. The anterior and posterior cardinal veins join the common cardinal veins, which enter the sinus venosus. During the eighth week of embryonic development, the anterior cardinal veins become connected by an oblique anastomosis, which shunts blood from the left to the right anterior cardinal vein. This anastomotic shut becomes the left brachiocephalic vein.

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The pulmonary veins are not assigned to any of the three systems just mentioned because they develop independently. With further development of the heart, more and more of the pulmonary veins are incorporated into the left atrium, so that at the end of the embryonic period 4 independent pulmonary veins empty into the atrium.^[3]

CASE REPORT

The presented case shows two pulmonary veins entering the left atrium on the right side. On the left side, however, there is only single pulmonary vein emptying into the left atrium. This is at variance with the normal anatomy of venous return to the heart, which has two pulmonary veins on each side [Figure 1].

A look at the hila of the two lungs revealed the following:

(a) On the right hilum the superior and inferior pulmonary veins were seen to be originating separately. The right principal bronchus was seen dividing into two (eparterial and hyperarterial) before entering the right lung. The eparterial bronchus was above the right pulmonary artery and the hyperarterial bronchus was located between the pulmonary artery and superior pulmonary vein. The right lung itself showed three lobes and two fissures (oblique and transverse).

(b) The left hilum shows single pulmonary vein emerging from the lung, with the left principal bronchus and two branches of right pulmonary artery below [Figure 2]. The division of the principal bronchus into eparterial and hyperarterial does not occur here.

DISCUSSION

This variation is significant in that the two pulmonary veins (superior and inferior) have united within the lung substance and have then opened into the left atrium. But the lumen of this single left pulmonary vein (1.8 cm) is only slightly larger than that of right superior pulmonary vein (1.6 cm) and right inferior pulmonary vein (1.4 cm).

Another noteworthy finding was that the weight of the two lungs was almost the same (580 gm for right and 565 gm for left). The left lung is normally lighter than its counterpart is heavier by at least 50 gm. It is possible that the increase back-pressure in the single left pulmonary vein caused this similarity of weight to occur.

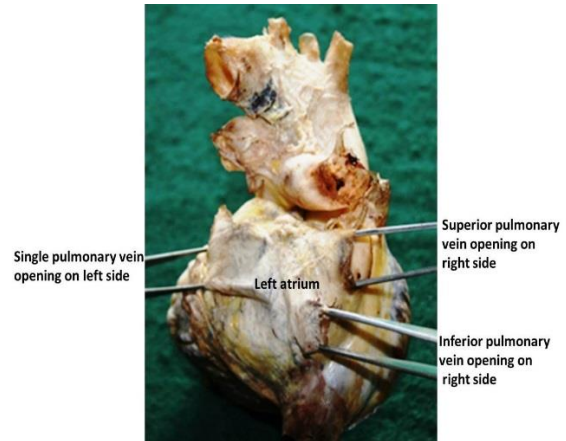


Figure 1: Single pulmonary vein emptying into the left atrium



Figure 2: Variation in hilum of both lungs

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