Radiologic findings of anomalous pulmonary venous drainage (APVD) on multi-detector row CT (MDCT)

Poster No.: C-0149
Congress: ECR 2013
Type: Educational Exhibit
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Keywords: CT, Pulmonary vessels, Thorax
DOI: 10.1594/ecr2013/C-0149

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Learning objectives

- Know the different types of pulmonary anomalous venous drainage (DVAP).

- Describe the radiologic findings by MDCT of the various types of anomalous venous drainage (DVAP).
**Background**

*Total anomalous pulmonary venous drainage (TAPVD)*

It is a malformation in which there is no direct connection between the pulmonary veins and the left atrium: all pulmonary veins connect to the right atrium or a vein tributary. Heart disease is rare, with an incidence of 1.5 to 3% of all congenital heart disease occurs more frequently in males. This entity does not constitute grounds for review.

*Partial anomalous pulmonary venous drainage (PAPVD)*

Consists of relatively common congenital anomaly (0.5% of the general population) in which one or more of the pulmonary veins are connected to a systemic vein (left to right shunt). Usually produce symptoms when associated with other malformations or shunt of importance. The partial anomalous drainage comprises a wide spectrum of anatomical shapes. Generally the left pulmonary veins connect with derivatives left cardinal system (coronary sinus and left innominate vein) and the rights to the right cardinal system (SVC or IVC). The most common forms are the pulmonary vein draining the upper lobe on the right superior vena cava and the pulmonary vein draining the left upper lobe to the vein vertical, which subsequently flows into the left brachiocephalic vein (Fig. 1).

PAPVD are divided into:

*Supracardiac* (45% of cases), in which the connection is usually a left vertical vein draining to an innominate vein (Fig. 2); less frequent is the connection to the superior vena cava or at the junction of this with the right atrium (heterotaxy syndrome) and drainage is very rare in the azygos vein (Fig 3).

*Cardiac* (25% of cases). The connection is typically the coronary sinus, or more rarely, directly in the right atrium.

*Infracardiac* (25% of cases). Usually the pulmonary veins drain into the portal system and the ductus venosus, less common are gastric veins drains, liver and inferior vena cava.

*mixed* (5%). In which part of the pulmonary venous system drains into a territory and part in another. The most common type is the drainage of the left lung (upper lobe vein usually) left vertical vein and the left coronary sinus.

Regardless of what is the connection with systemic venous structures, usually pulmonary veins converge to form a breast (or collector) common pulmonary veins.
**Right pulmonary veins to SVC.**

They are generally upper lobe veins which drain into the SVC, is often accompanied by an atrial septal defect, (rarely intact ventricular septum). Sometimes there left SVC. The anomalous connection of a vein to the SVC can only be an isolated injury or be part of the sinus venosus defect.

**Right pulmonary veins to IVC.**

All or only veins of right middle and lower lobe enters the IVC just above or below the diaphragm. Generally the atrial septum is intact. This malformation known as scimitar syndrome and is associated with other extracardiac anomalies (hypoplasia of the right lung, bronchial system alteration, horseshoe lung, secondary dextrocardia, hypoplasia of the right pulmonary artery, aorta collaterals to right lung, pulmonary sequestration, vertebral abnormalities, scoliosis, horseshoe kidney and other) and heart (ventricular septal defect, patent ductus arteriosus, aortic coarctation, tetralogy of Fallot or double outlet right ventricle).

**Left pulmonary veins to IVC.**

They are rare, not associated with intracardiac defect and normal lungs.

**Left pulmonary veins to innominate vein.**

The veins of the upper lobe or entire lung are connected to said innominate vein through a pathway present in the embryonic period, the vertical vein, the vein in TC might look similar to a left superior vena cava, has a trajectory crossing the upper lobe bronchus passes before and follows a curve of the aortic arch, and there is an absence of the upper lobe vein (Figs 5-6). In RM and allows a detailed assessment of anatomy, it is possible to quantify the left to right shunt, volume and right ventricular function and show associated anomalies such as the CIA (rarely the septum is intact).

Other locations of veins left: coronary sinus, SVC right, left subclavian vein, azygos vein (Fig. 7).

Partial anomalous pulmonary connection can be associated with other heart defects, usually in patients with visceral heterotaxy and polysplenia due to malposition of septum primum. It is also associated in patients with Turner syndrome and Noonan and rarely the tetralogy of Fallot (0.6%).
Fig. 1: Axial contrast-enhanced CT image shows the drainage of the pulmonary vein upper lobe of left lung to vein vertical (arrow) which subsequently flows into the left brachiocephalic. A.A Ascending aorta. A.D Descending Aorta. A.P Pulmonary trunk. VCS Superior vena cava.

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Fig. 2: Axial CT image shows anomalous venous drainage of the left upper lobe to vertical vein (arrows) and subsequently brachiocephalic vein. A.A Ascending Aorta. A.D Descendig Aorta. VCS Superior vena cava.

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**Fig. 3:** Axial (A y B) contrast-enhanced CT image shows anomalous venous drainage of the right upper lobe with dilated azygos vein (arrows) and then to SVC. A.A Ascending Aorta. AP Pulmonary trunk. A.D Descendig Aorta. V.A Azygos vein.

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Fig. 4: Axial (A) and coronal (B) contrast-enhanced CT image shows anomalous pulmonary venous drainage of the middle lobe and right upper (arrows) into the superior vena cava.

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**Fig. 5:** Sagital (A) and Axial(B) contrast-enhanced CT image shows the drainage of the pulmonary vein upper lobe of left lung to vein vertical (arrows) which subsequently flows into the left brachiocephalic. A.A Ascending Aorta. A.D Descending Aorta. A.P Pulmonary Trunk. VCS Superior vena cava.

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**Fig. 6:** Coronal (A and B) contrast-enhanced CT image obtained in the arterial phase shows the drainage of the pulmonary vein upper lobe of left lung to vein vertical (arrows) which subsequently flows into the left brachiocephalic. A.A Ascending Aorta. A.P Pulmonary Trunk. VCS Superior vena cava.

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Fig. 7: Axial (A y B) contrast-enhanced CT image shows anomalous venous drainage of the right upper lobe with dilated azygos vein (arrows) and then to SVC. A.A Ascending Aorta. AP Pulmonary trunk. A.D Descending Aorta. V.A Azigos vein.

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Imaging findings OR Procedure details

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![CT Image](image1)

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Conclusion

- Partial anomalous pulmonary venous drainage (PAPVD)) is a relatively common congenital anomaly among the general population (0.5%).

- The most common forms are supracardíacas (right upper lobe into superior vena cava and left upper lobe to vertical vein).

- Recognize malformations associated.

- MDCT Identify the different types of pulmonary anomalous venous drainage (DVAP) and congenital anomalies associated with.

- Assessing the consequences of left to right shunt by CT.
References

