

## Answer to quiz on page 240-cardiovascular surgery: Three-dimensional inspection of the internal vascular structure

The correct answer is:

C. Pulmonary artery bifurcation into the right and left pulmonary arteries. The abnormality is the patent arterial duct.

The diagnosis is the patent arterial duct.

Patent arterial duct is a vessel connecting the proximal descending aorta with the origin of the left pulmonary artery. In practice, however, this is not the vessel itself but the abnormal blood flow that is visualized on routine echocardiogram. From its specific color Doppler echocardiography pattern the investigator concludes that the patent vessel is present.

When the investigator wants to assess three-dimensional anatomy of the duct, challenges are met because standard imaging investigations (computed tomography (CT), magnetic resonance imaging (MRI), echocardiography) present results with two-dimensional images which correspond to slices of the organ in certain planes. The investigator needs to use advanced image processing technologies that have been developed recently to create three-dimensional reconstructions from these data. The constructed models allow the viewer to appreciate the normal spatial alignments of structures, walls, angles and abnormal findings. The advantage of three-dimensional reconstruction is the ability to view the area of interest stereoscopically. In other words, the inspector observes the anatomy as it is, there is no need to build mental visions from two-dimensional scans.

In Videos 1 and 2 virtual reality reconstructions from MRI data are shown. In Video 1, the observer is inside the major vessel looking into the bifurcation with two smaller vessels. The two vessels at the bifurcation are aligned to create an obtuse angle. This finding is a contrast to the most common bifurcation pattern seen in the arterial system, when the subsidiary vessels form an acute angle, seen for the common carotid artery bifurcation, bifurcation of the abdominal aorta and renal artery bifurcation. This rule is not strict for the coronary arteries since the circumflex artery usually shows near straight-angle take off from the left main – left anterior descending artery axis.

Video 2 differs from Video 1 by an additional finding, which is an origin of a vessel (See videos at [www.hvt-journal.com](http://www.hvt-journal.com)). The orifice is not located in the middle of the bifurcation, it is shifted a little to the left pulmonary artery. This is the typical place for the patent arterial duct mouth.

Three-dimensional reconstructions may be inspected both from the inside and outside. Video 3 (see videos at [www.hvt-journal.com](http://www.hvt-journal.com)) shows the external appearance of the patent arterial duct as well as virtual 'entry' from the descending aorta through the duct into the pulmonary artery.

**Video 1. Normal vascular anatomy of pulmonary artery bifurcation**

**Video 2. Patent arterial duct**

**Video 3. External appearance of the patent arterial duct and virtual 'entry' from the descending aorta through the duct into the pulmonary artery**

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