Case Report

Congenital Systemic-Pulmonary Collateral Vein Unexpectedly Noticed after Central Venous Catheter Insertion

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Congenital systemic-pulmonary collateral vein (i.e. levoatriocardinal vein) is an uncommon cardiac anomaly. We report a rare case of congenital systemic-pulmonary collateral vein incidentally noticed after accidental migration of a central venous catheter. Cardiac CT showed the vertical vein connected to the left upper pulmonary vein (LUPV) and another thin abnormal vessel was shown running caudally from the LUPV, connecting to the coronary sinus. Furthermore, the normal connection between the LUPV and the left atrium remained. There were two levoatriocardinal veins from the LUPV without atrial egress failure. To our knowledge, this might be the first report of such a case.

Keywords: central venous catheter, migration, congenital systemic-pulmonary collateral vein

INTRODUCTION

Central venous (CV) catheters are frequently used for administration of chemotherapeutic agents, parental nutrition, and vascular access. Various complications have been reported in the literature,¹ with migration being a major complication. We report a case of migration of the CV catheter tip into the congenital systemic-pulmonary collateral vein.

CASE REPORT

A 66 year-old woman who had non-viral liver cirrhosis was admitted to our hospital for liver transplantation.

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She had massive ascites and pyelonephritis and had been treated with antibiotics for a few weeks. A CV catheter was inserted into the left internal jugular vein by bedside. A chest radiograph after the procedure showed the CV catheter tip was located in the left side of the chest (Fig. 1), which led us to suspect migration to unexpected vein instead of the superior vena cava (SVC). We reviewed previous chest computed tomography (CT) images, which showed a small vein running lateral to the aortic arch, presenting as the vertical vein. Existence of an abnormal connection between the vertical vein and the left upper pulmonary vein (LUPV) was suspected. Venography obtained while contrast material was injected from the CV catheter showed the vertical vein, followed by the LUPV, the left atrium (LA), the left ventricle (LV) and the ascending aorta (Fig. 2). In addition, it showed the innominate vein (i.e. left brachiocephalic vein) and the superior vena cava (SVC) following the vertical vein. Furthermore, another small vessel that was running caudally from the LUPV was observed. At this time, we could not understand the detailed anatomy. However, we feared that complications, such as brain infarction and arterial embolism, might occur if the CV catheter were left in this position. Hence, we inserted a CV catheter from the right subclavian vein under ultrasonographic guidance,
and indwelled it at the SVC with X-ray fluoroscopy, and removed the CV catheter previously inserted at the vertical vein. To evaluate the precise anatomy of abnormal vessels, a contrast-enhanced cardiac multi-detector row CT examination was performed. According to these CT images, the vertical vein was shown to be connected to the LUPV. The normal connection between the LUPV and

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**Fig. 1** Chest radiograph after the procedure. The central venous catheter tip is located in the left side of the chest (arrow).

**Fig. 2** Venography obtained while contrast material was injected from the central venous catheter.

*a*: Early phase. The vertical vein (narrow white arrow) is shown, which is followed by the left upper pulmonary vein (large white arrowhead) and the left atrium. Another small vessel (wide white arrow) is running caudally from the left upper pulmonary vein. In addition, the innominate vein (black arrow) and the right superior vena cava (black arrowhead) are shown.

*b*: Late phase. The left ventricle and the ascending aorta are shown, consecutively.
the LA remained, and another small vessel arising from the LUPV was shown running caudally. This small vein was connected to the coronary sinus and drained into the right atrium (RA) (Fig. 3).

In a summary obtained from various radiographic images, the vertical vein and the small vessel also was revealed as congenital systemic-pulmonary collateral veins. The direction of blood flow was considered from the LUPV to the vertical vein, draining to the RA via the innominate vein. Other than this abnormal connection, the direction of blood flow of the small vessel was observed from the LUPV to the coronary sinus, draining to the RA. These results indicated that the hemodynamics was a left-to-right shunt.

Echocardiography showed Qp/Qs was 0.85 with no right ventricular failure. Arterial blood gas analysis showed no cyanosis. No risks for liver transplantation were detected, and, therefore, the operation was performed without any problems.

**DISCUSSION**

Pulmonary blood flow to the systemic vein occurs with partial anomalous pulmonary venous connection (PAPVC), in which the normal connection between the pulmonary vein (PV) and LA usually disappears. The connection between the PV and systemic veins with normal drainage to the LA has been named congenital systemic-pulmonary collateral vein. Congenital systemic-pulmonary collateral vein is a rare venous anomaly, first reported by McIntosh in 1926.2)

In the early stage of fetal development, peripheral pulmonary veins develop from the capillary plexus surrounding the embryonic foregut, forming the main pulmonary vein, and finally connecting the LA.3) At first, the capillary network anastomoses to the cardinal, umbilical and vitelline veins. During this development, anastomoses between the pulmonary and systemic veins disappear. Sometimes peripheral pulmonary veins connect the cardinal veins instead of the LA. This is called total anomalous pulmonary venous connection (TAPVC) or PAPVC, depending on whether there is complete or partial pulmonary venous connection failure, respectively. Rarely, although the connection between the PV and the LA is formed normally, pulmonary venous drainage fails within the heart. The embryonic pulmonary systemic venous anastomosis remains and forms a congenital pulmonary systemic collateral vein. This resulting anastomosis is called levoatriocardinal vein.4)

Most cases of levoatriocardinal vein connect LA to derivatives of cardinal veins or their tributaries, instances of the SVC or the innominate vein.

Most cases of levoatriocardinal vein have left atrial egress failure including multiple levels of obstruction to left-sided outflow, such as mitral atresia, aortic atresia and coarctation.5–8) However, 8 cases were reported without left atrial egress.6) Moreover, 3 cases without other cardiac anomalies were reported, found by angiogram or MRI incidentally, as in the current case.5,8,9) In most cases, there are no clinical symptoms caused by levoatriocardinal vein itself.

The levoatriocardinal vein should be considered different from the left superior vena cava (LSVC).8) Usually, the LSVC connects to the RA through the coronary sinus. In the early embryonic stage, there is a symmetrical precardinal vein system, and the left precardinal vein disappears. LSVC occurs when the left precardinal vein remains.10) Fujiwara described the levoatriocardinal vein mimicking the LSVC, running dorsal of the LUPV.7) Harris reported a patient with both the levoatriocardinal vein
and the LSVC draining to the coronary sinus normally.\textsuperscript{10) These are ways to distinguish the LSVC and the levoatriocardinal vein. In the present case, although the vertical vein was similar to the LSVC, the normal connection to the coronary sinus was missed, which led to misidentifying the vertical vein as the LSVC. Meanwhile, there was an additional connection between the LUPV and the coronary sinus. Levoatriocardinal vein has various types of connection in literatures.\textsuperscript{8) Levoatriocardinal vein is defined as connection between PV or LA to systemic vein such as SVC, internal jugular vein and innominate vein. Besides coronary sinus is one of systemic vein, which arises from the left common cardinal vein, this additional connection was regarded as another levoatriocardinal vein. In summary, two levoatriocardinal veins from the LUPV without atrial egress failure were observed in this case. When a CV catheter is inserted, we should be aware of rare, abnormal anatomy, in addition to complications of puncture, such as pneumothorax and hemothorax.\textsuperscript{11)}

**Conclusion**

This is a rare case of migration of the CV catheter tip into a congenital venous anomaly. To our knowledge, this might be the first report of such a case.

**References**


2) McIntosh CA. Cor biatriatum triloculare. Am Heart J 1926; 1: 735-44. [CrossRef]


5) Jaecklin T, Beghetti M, Didier D. Levoatriocardinal vein without cardiac malformation and normal pulmonary venous return. Heart 2003; 89: 1444. [Medline] [CrossRef]


10) Harris HA, Gray SH, Whitney C. The heart of a child aged twenty-two months presenting an anomalous vein from the pulmonary auricle to the right internal jugular vein, transposition of the great vessels and left superior vena cava. Anat Rec 1927; 36: 31-49. [CrossRef]