An Anatomic Variant with a Complication of Cardiopulmonary Resuscitation

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A 58-year-old man with known cardiomyopathy came to the emergency room complaining of increasing shortness of breath. Shortly after arrival, he suffered cardiopulmonary arrest. During the resuscitation procedures, he received closed chest heart massage, intracardiac medication, and placement of a central venous line via percutaneous subclavian vein puncture. Central venous pressure after resuscitation was 54 cm H2O. Pericardiocentesis yielded 200 ml of bloody fluid and an emergency thoracotomy was performed. Figure 1 is a baseline film four months prior to admission. Figures 2 and 3 were obtained after operation and attempts at balloon flotation pulmonary artery catheter placement.

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Diagnosis: Left superior intercostal vein; bilateral superior vena cavae; and avulsion of inferior vena cava from right atrium following cardiopulmonary resuscitation

Figure 1, the baseline film, demonstrates a bulge on the aortic knob that has been called the aortic nipple. Anatomically, this is a normal shadow, that of the left superior intercostal vein which is formed by the union of the second, third, and fourth posterior intercostal veins. This vein passes adjacent to the aortic arch before emptying into the innominate vein. It is seen on supine tomograms in 4 percent of normal individuals and 7 percent of patients with suspected chest disease. Its only significance is that it may be mistaken for a small tumor or lymphadenopathy. As with other venous structures in the chest, it should change appropriately with maneuvers that augment or reduce venous return to the thorax. Figure 2 shows the Swan-Ganz catheter on its descent in the mediastinum bending into the aortic nipple.

Figure 3 shows a central venous line descending from the right arm along the right mediastinal border, and the Swan-Ganz catheter descending from the left arm along the left mediastinal border, crossing the cardiac shadow, and coiling over the right atrium. Since both lines should be passing from the right and left innominate veins, respectively, into the superior vena cava, separation of the two catheters can only be explained by an aberrant vascular channel or a disruption of the normal venous pathway. A persistent left superior vena cava was suggested from the radiographic findings.

At operation, a persistent left superior vena cava in addition to a normal right-sided vena cava was documented. The cause of the cardiac tamponade was found to be avulsion of the inferior vena cava from the right atrium, an extremely rare complication of cardiopulmonary resuscitation.

Left superior vena cava is found in approximately 0.5 percent of the normal population and about 3 percent of patients with congenital heart disease. Embryologically, the left superior vena cava is the result of persistence of the left anterior cardinal vein. There are several anatomic variants: 1) separate bilateral superior vena cavae with no intercommunication; 2) a rudimentary or well-established innominate vein connecting bilateral superior vena cavae; 3) a rudimentary left superior vena cava with the majority of blood being carried in the right superior vena cava; and 4) a left superior vena cava that drains the whole brachiocephalic system. Persistent left superior vena cava is a bland lesion except in the occasional incident in which it drains into the left atrium, producing a right-to-left shunt.

With the increasing use of cardiac catheterization and transvenous cardiac pacing, left-sided superior vena cava has been diagnosed more frequently and has taken on more clinical significance. The abnormality may increase the difficulty of passing a catheter or guide wire and complications, such as chest pain, ECG changes, arrhythmia, and cardiopulmonary arrest, may ensue.

The PA chest film may be helpful in making the diagnosis. About half the cases show a crescent-shaped shadow extending from the upper aspect of the aortic shadow towards the midpoint of the clavicle. It has also been reported that 60-77 percent of patients with a persistent left superior vena cava have a ratio of vascular pedicle to transverse diameter of the chest measured at the third rib of greater than .27.

REFERENCES

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