Two Cases of Double Superior Vena Cava

Chisato Mori, M.D., D.Med.Sc.,
Hisashi Hashimoto, D.D.S., D.Med.Sc.,

SUMMARY

Two cases of double superior vena cava were found among 300 Japanese cadavers dissected at Kyoto University from 1980 to 1989. Case 1 was an 82-year-old male patient who died of cerebral infarction. Case 2 was a 39-year-old well-developed male patient who died of sepsis. They had no history of cardiovascular disorders. Common features in both cases are as follows: In addition to a right superior vena cava with normal appearance located in the normal position, on the left side, a normal-looking extra superior vena cava persisted and descended vertically in front of the aortic arch between the left pulmonary vein and the left auricle, traversed the coronary sulcus and finally drained into the right atrium. No differences in diameter were found between right and left venae cavae. No communicating vessels were present between them. Therefore, both cases, which had a persistent left superior vena cava draining into the coronary sinus, may be classified as McCotter's 1st type (1916) or Donadio's 3rd type (1925). Furthermore, in Case 2, the double azygos vein persisted symmetrically, suggesting the 4th type of Nandy and Blair (1965). In addition to venous anomalies, Case 2 had arterial anomalies such as the right subclavian artery arising as the last branch of the aortic arch similar to the G type of Adachi (1928), and the right vertebral artery arising from the right common carotid artery. The present cases are considered to be the 53rd and 54th cases of double superior vena cava found in Japanese cadavers, and the 18th and 19th cases of double superior vena cava without communicating vessels between them.

Additional Indexing Words:
Superior vena cava  Human cadaver

A number of cases of anomalous superior vena cava have been reported in the literature. In Japan, Miura1 reported the first case, and thereafter 52 cases have been reported from anatomical laboratories.2-9 Recently, in roentgenograms some of these anomalies were identified as a
vertical shadow present in the left mediastinum (Fig. 1), or sometimes by cardiac catheterization and angiocardiography (Fig. 2).

In the dissection room at Kyoto University, 2 cases of double superior vena cava were found among 300 Japanese cadavers examined over 10 years from 1980 to 1989. Case 1 was an 82-year-old male patient who died of cerebral infarction. Case 2 was a 39-year-old well-developed male patient who died of sepsis. They had no history of cardiovascular disorders.

In the present paper, these 2 cases will be described and their morphological aspects and clinical significance discussed.

**Case Report**

*Case 1* (Figs. 3 and 4)

The left superior vena cava was formed by the union of the left internal jugular vein and the left subclavian vein behind the left sternoclavicular joint. It descended in front of the aortic arch along the descending aorta, perforated the pericardium passing through it between the left pulmonary vein and the left auricle, and finally ended at the coronary sinus. It was about 14 mm in diameter at its origin, and became gradually larger as it descended, reaching about 20 mm at its opening at the coronary sinus. The length of the left superior vena cava was about 93 mm.

In the course of the left superior vena cava, it received the left inferior
thyroid vein close to its origin as its first intercostal vein 37 mm below its origin, and the left azygos vein as its last tributary 55 mm below its origin.

The coronary sinus, about 85 mm long, was much dilated and traversed about 85 mm horizontally rightward and drained into the right atrium with an opening of about 26 mm in diameter. In the coronary sulcus, the coronary sinus received the great cardiac vein, the posterior vein of the left ventricle and the middle cardiac vein, in a normal manner.

The right superior vena cava was formed by the union of the right internal jugular vein and the left subclavian vein, and appeared completely normal with regard to its origin, course, tributaries and termination. It descended along the lateral side of the brachiocephalic trunk, and entered the right atrium from its posterosuperior direction. It was about 14 mm in diameter at its origin, and became gradually larger as it descended, reaching about 16 mm in diameter at its opening into the right atrium. The right superior vena cava was about 110 mm long and received the right azygos vein about 60 mm below its origin.

No communicating vessel was present between the left and right superior
venae cavae, and no difference was found in their diameters. Therefore, this case, which had the persistent left superior vena cava draining into the coronary sinus, may be classified as McCotter’s 1st type10) or Donadio’s 3rd type.11)

In addition, the azygos system in this case showed abnormal features that will be described later together with those of Case 2.

No other anomaly was found in the heart, blood vessels and other viscerae in this cadaver.

Case 2 (Fig. 5)
The left superior vena cava was formed by the union of the left internal jugular vein and the left subclavian vein just posterior to the left sternoclavicular joint. The left superior vena cava descended vertically in the superior mediastinum lateral to the arch of the aorta and anterior to the root of the left lung, then turned rightward behind the left auricle, and drained into the coronary sulcus. The dilated coronary sinus, with a diameter of 16 mm, traversed 59 mm in the coronary sulcus horizontally rightward along with the circumflex branch of the left coronary artery, and drained
into the right atrium. The diameter of its opening was about 26 mm which is almost equal to the normal atrial opening of either the superior or inferior vena cava. In the coronary sulcus, it received the great cardiac vein, the posterior veins of the left ventricle and the middle cardiac vein as usual.

In the course of the left superior vena cava, it received four tributaries: the left inferior thyroid vein at its origin, next the left internal thoracic vein 11 mm below its origin, thirdly the left supreme intercostal vein 36 mm below, and lastly the left azygos vein 44 mm below its origin.

The right superior vena cava was normal and 54 mm long, and its diameter varied from 15 to 17 mm. The azygos vein drained into it 36 mm below its origin. The azygos system in this case also appeared anomalous and will be described later together with that in Case 1.

As in Case 1, no communicating vessel was present in Case 2 between the left and right superior venae cavae and no difference was found in their diameters. Therefore, Case 2, which had the persistent left superior vena cava draining into the coronary sinus, may also be classified as McCotter’s 1st type or Donadio’s 3rd type.

In addition to venous anomalies, Case 2 had two arterial anomalies:
the right subclavian artery arising as the last branch of the aortic arch (Fig. 6) classified as G type by Adachi\textsuperscript{12}; and the right vertebral artery arising from the right common carotid artery. In this case, the right recurrent laryngeal nerve crossed in front and hooked around the right subclavian artery (Fig. 7).

On retrospective study of Case 2, conventional chest x-ray revealed the tip of the catheter in the left superior vena cava (Fig. 8).

**Anomalous features of the azygos system in Cases 1 and 2 (Fig. 9)**

**Case 1:** On the left side, the left azygos vein was formed by the union of the left subcostal vein and the left ascending lumbar veins, and communicated with the left renal vein. On the right side, the right subcostal vein joined with the right ascending lumbar veins and formed the right azygos vein. The right azygos vein ran transversely beyond the median line and united with the left azygos vein to form a single short trunk of the common azygos vein.

The common azygos vein soon divided into right and left branches which resembled the double azygos veins except for the beginning portions immediately after bifurcation from the common azygos vein. Both branches of the common azygos vein measured 7 mm in diameter, ascended parallel to the vertebral column medial to the right and left thoracic sympathetic trunks and drained into the right and left superior venae cavae, respectively. The right 11th intercostal vein drained into the common azygos vein. Nine pairs of intercostal veins, from the 3rd to the 10th drained into the right and left branches of the common azygos vein, except that the right 9th and 10th
intercostal veins drained into the right branch of the common azygos vein via their common vessel.

The communication between the left and the right branches of the common azygos vein was made by a slender vessel with a diameter of 2 mm in front of the 7th thoracic vertebra.

**Case 2:** Double azygos veins persisted symmetrically, and ascended parallel to the vertebral column medial to the right and left thoracic sympathetic trunks and drained into the right and left superior venae cavae, respectively. The right azygos vein with a diameter of 8 mm drained into the right superior vena cava 36 mm below the origin of the latter. The left azygos vein with a diameter of 6 mm drained into the left superior vena cava 44 mm below the origin. The right and the left azygos veins received the intercostal veins and subcostal vein. There was no communication between the left and the right azygos.

**DISCUSSION**

Many authors reviewed the literature and classified anomalies of the superior vena cava. According to the conditions of the anastomosis between the right and left superior venae cavae or the conditions of the superior venae cavae, McCotter\(^{10}\) classified the anomaly into the five types and Donadio\(^{11}\) into four. Nandy and Blair\(^{13}\) offered four categories from the embryological point of view. The present 2 cases in which the left superior vena cava was the same size as the right without a communication between them, belong to the 1st type of McCotter\(^{10}\) and the 3rd type of Donadio.\(^{11}\) Further, Case 2 belongs to the 4th type of Nandy and Blair.\(^{13}\) In Japan, 52 Japanese cadavers with a double superior vena cava have been reported. Therefore, the present cases are the 53rd and 54th Japanese cadavers with a double superior vena cava and the 18th and 19th cases without an anastomosis.

It is usually considered that a double superior vena cava is caused by the persistence of both the left anterior cardinal vein and the left duct of Cuvier and the absence or incomplete formation of the left brachiocephalic vein. Thus from the embryological as well as the morphological point of view, the present cases which have double superior vena cava and double azygos veins represent the most primitive arrangement of these veins found in the class Mammalia.

Adachi\(^{3}\) found the frequency of double superior vena cava to be 4 in 821 Japanese adults (0.49%), Aso\(^{2}\) 1 in 60 cases (newborns and fetuses) (1.6%), and Yamada\(^{4}\) 2 in 125 cases (newborns and fetuses) (1.6%). Judg-
ing from these reports, the frequency of the double superior vena cava seemed to be much higher in fetuses and newborns than in adults. This is probably because fetuses and newborns die of coexisting serious malformations which prevent their growth, or of their weak vitality, with the result that they are more often submitted to dissection. On the other hand, the low frequency of double superior vena cava in adults may be explained by the fact that its persistence has little negative influence on the circulatory system, with the result that it rarely causes death. Therefore, the double superior vena cava is found only by systematic dissection. Hereafter, the double superior vena cava will be more frequently observed clinically than at post mortem.

References