

A case of the paired inferior venae cavae

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Abstract : We encountered a case of duplication of the inferior vena cava in a cadaver. This was thought to be caused by persistence of the right and the left supracardinal veins, and this case was classified as type BC in the classification systems developed by McClure and Butler (1925) and Chuang et al. (1974). Double inferior vena cava is not a rare anomaly, and clinicians should be aware of this anomaly. Duplication of the inferior vena cava may cause other changes in the venous system, such as dislocation of the drainage position of the right gonadal vein from the inferior vena cava to the right renal vein. We also suggest that this anomaly causes duplication of the gonadal vein.

Key words : double inferior vena cava, supracardinal vein, gonadal vein, Japanese

Introduction

Duplication of the inferior vena cava has been seen in some cadavers. In Japan, quite a few number of cases have been reported¹⁻⁷⁾. This anomaly of the inferior vena cava is not rare, and Adachi (1940)⁸⁾ reported that the incidence of duplication of the inferior vena cava was 1.6% (23 cases out of 1,461 cadavers). Therefore, clinicians should keep in mind the possibility of anomalies of the inferior vena cava in patients undergoing abdominal surgery⁹⁾. It has been known that

there are variations in the venous architecture surrounding the duplicated inferior vena cava, and several classification systems have been developed⁹⁻¹¹⁾. These classification systems are based on the developmental origin of the duplicated inferior vena cava. The inferior vena cava consists of four components: the postrenal segment from the right supracardinal vein, the renal segment from the right sub-supracardinal anastomosis (renal collar), the prerenal segment from the right subcardinal vein, and the hepatic segment

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Fig. 1 a. Photograph of the double inferior vena cava and surrounding structures in the present case.

from the right hepatic vein¹¹. The double inferior vena cava results from the disorganization that occurs in the postrenal segment. This segment may be composed of up to four major veins, and the destinies of the four veins result in the variations in this area. McClure and Butler¹⁰ designated the right posterior cardinal vein, right supracardinal vein, left supracardinal vein, and left posterior cardinal vein as A, B, C, and D, respectively. They classified the various inferior venae cavae into the following 15 types based on the persistence of these four veins: types A, AB, ABC, ABCD, ABD, AC, ACD, AD, B (normal inferior vena cava), BC, BCD, BD, C, CD, and D. The classification system developed by Chuang *et al.* (1974)¹¹ was based on a similar idea as that of McClure and Butler (1925)¹⁰. Sarma (1966)⁹ roughly classified anomalous inferior

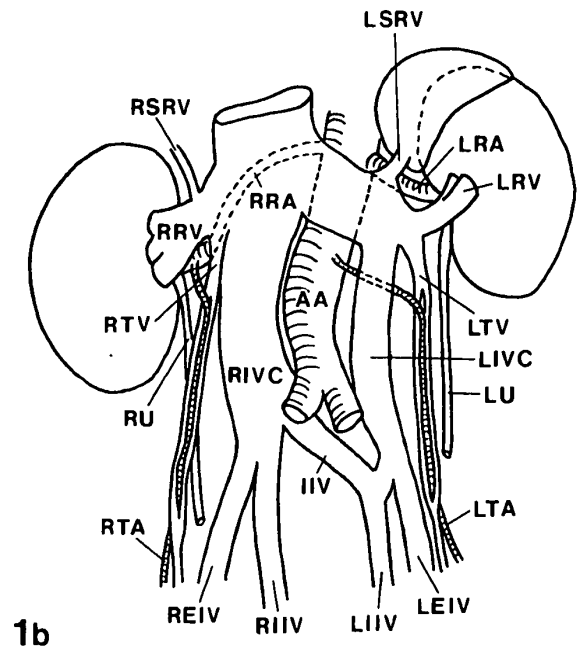


Fig. 1 b. Diagram illustrating the double inferior vena cava in the present case. AA, abdominal aorta; LTA and RTA, left and right testicular artery; LRA and RRA, left and right renal artery; LIVC and RIVC, left and right inferior vena cava; LSRV and RSRV, left and right suprarenal vein; LRV and RRV, left and right renal vein; LTV and RTV, left and right testicular vein; LEIV and REIV, left and right external iliac vein; LIIV and RIIV, left and right internal iliac vein; IIV, interiliac vein; LU and RU, left and right ureter.

venae cavae into two types: type I, duplication of the inferior vena cava; and type II, left inferior vena cava. We report the morphology of a case with duplication of the inferior vena cava, and discuss how it may have developed and the type to which it belongs. In addition, accompanying variations, such as dislocation of the drainage position and duplication of the gonadal veins, are discussed.

Results

Duplication of the inferior vena cava was found in an 88-year-old Japanese male cadaver with accompanying changes in the venous architecture (Fig. 1 a). The left

internal iliac vein (14 mm in width) bifurcated into two branches (Fig. 1 b). The left branch of the left internal iliac vein (15 mm in width, 21 mm in length) joined the left external iliac vein (15 mm in width) to form the left inferior vena cava (14 mm in width). After ascending 160 mm, the left inferior vena cava joined the left renal vein. The left renal vein was thick (26 mm in width, 23 mm in length) in the segment between the right and the left inferior venae cavae, and thin (11 mm in width, 50 mm in length) in the segment between the left inferior vena cava and the left kidney. The right external iliac vein (16 mm in width) and the right internal iliac vein (16 mm in width) joined to form the right common iliac vein (18 mm in width). The right branch (interiliac vein, 9 mm in width, 85 mm in length) of the left internal iliac vein joined the right common iliac vein to form the right inferior vena cava (23 mm in width). After ascending 97 mm, the right inferior vena cava branched to form the right and left renal veins. The right and left testicular veins joined the right and left renal veins, respectively. As to the right and left renal veins, each bifurcated into two branches in the central region and the branches again joined to form single veins. The left and right testicular arteries ran through the space between the two branches of the bifurcated left or right testicular veins, respectively. The left testicular artery originated from the abdominal aorta; however, the right testicular artery originated from the right renal artery. The right and left ureters ran in front of the respective inferior venae cavae.

Discussion

The developmental origin of the vena cava inferior is complex. It is formed by the fusion of the posterior cardinal vein, the supracardinal vein, the subcardinal vein and the hepatic segment. It is thought that duplication of the inferior vena cava is caused by the persistence of an extra left vein besides the right supracardinal vein, which forms the normal inferior vena cava. The relative position of the persistent veins with respect to the ureter, i.e., whether the ureter runs in front of or behind the persistent vein, distinguishes the vein. For instance, in the case in which the right ureter runs behind the right inferior vena cava, the vena can be identified as the right posterior cardinal vein⁶⁾. In the present case, the right and left ureters ran in front of the right and left inferior vena cava, respectively. Therefore, the inferior venae cavae in the present case are identified as persistent right and left supracardinal veins. The present case was classified as the BC type^{10,11)}. McClure and Butler (1925)¹⁰⁾ mentioned that types BC and C were most commonly found in adult man and type BC was more common of the two.

It was reported that the drainage position shifts from the inferior vena cava to the right renal vein, accompanied by an increase in the factor of the left inferior vena cava¹²⁾. According to Sasaki (1986)¹²⁾, the left inferior vena cava has the strongest, the double inferior vena cava has intermediate, and the right (normal) inferior vena cava has no "left sided-factor". Takemoto et al. (1978)³⁾ reported 3 cases of double inferior vena cava and one case of left inferior vena cava. In all four cases, the right gonadal vein joined to the right renal vein. Takagi et al. (1982)⁵⁾ reported a case of double superior

venae cavae with bilateral inferior venae cavae. In this case, both the right and left ovarian veins were duplicated. One of the right ovarian veins joined the right renal vein, and the other joined the right inferior vena cava. Kobayashi (1968)¹⁾ reported a case of paired inferior venae cavae. Although the testicular veins were not discussed in that report, the diagram in the report showed that the right testicular vein joined the right renal vein. It can be said that dislocation of the position of drainage of the right gonadal vein tends to occur in cases of double inferior venae cavae and left inferior vena cava. In the present case, the right testicular vein drained into the right renal vein, similar to the case reported by Sasaki (1986)¹²⁾.

In the present case, both the right and left testicular veins bifurcated in their central region and the two branches again joined to form single veins, and each testicular vein ran beside the respective testicular artery. Attention has not been paid to duplication of the gonadal veins, although such cases have been reported^{3, 5)}. The double inferior venae cavae may induce double gonadal veins, although the embryological mechanism is not known.

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重複下大静脈の1例

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抄録: 解剖実習遺体に重複下大静脈の1例を見い出した。この例は左右の上主静脈の残存に起因するものと考えられ, McClure と Butler (1925), 及び Chuang ら (1974) の分類法の BC 型に分類される。重複下大静脈はさほど稀な変異ではなく, 臨床家は注意を払う必要がある。下大静脈の重複は, 右精巣または卵巣静脈の流入部位が下大静脈から右腎静脈に移行するなどの, 静脈系の他の変化を誘因するかもしれない。また, この変異は精巣または卵巣静脈の重複を引き起こすことを示唆する。

キーワード: 重複下大静脈, 上主静脈, 精巣または卵巣静脈, 日本人