Duplication of IVC (inferior vena cava) is rare. The embryogenesis of IVC is a complicated process. Disruption of this process in various stages can result in the majority of IVC abnormalities. We herein present a case of a 76-year-old man who had a preoperative computed tomography (CT) examination to evaluate for a renal mass in his left kidney. An incidental finding of a duplicated infrarenal IVC with azygous continuation of left IVC was noted. Three-dimensional CT reconstruction images enhanced visualization of the anatomical anomalies. Awareness of the IVC anomalies can help clinicians avoid diagnostic pitfalls and reduce complication of abdominal surgeries.

Key words: Abnormalities, Computed tomography; Inferior vena cava

With the advent of computed tomography (CT) and magnetic resonance (MR) imaging, anomalies of the inferior vena cava (IVC) have become easily recognized in asymptomatic patients, or as an incidental finding in patients with other complaints. Although these anomalies are generally free of symptoms, they can have important clinical ramifications in certain settings and can become diagnostic pitfalls. The anomalies of IVC have many variations, including the formation of several anastomoses between three pairs of embryonic veins.

We herein present a case of a 76-year-old man who had a preoperative CT examination to evaluate for a renal mass in his left kidney. A duplicated infrarenal IVC with azygous continuation of the left IVC was incidentally noted.

CASE REPORT

A 76-year-old man with a left renal mass was referred for preoperative CT examination. CT scan of the abdomen was performed by a spiral scanner (CT/i, General Electric, WI, USA) with slice thickness of 7 mm. An enhancing soft-tissue mass, measured 6 cm in long axis, in left kidney was noted. Also, there was an incidental finding of a duplicated infrarenal IVC (Fig. 1). The left renal vein drained into the left IVC that crossed the midline through the retroaortic region, and finally emptied into the azygous vein. The right IVC had a normal anatomic morphology and course. No other congenital anomaly was noted.

The patient received left nephrectomy three days after the CT examination. Surgical findings revealed a mass in the left kidney and confirmed the findings of the IVC anatomic variations as shown on the CT images. The renal mass was later diagnosed as a renal cell carcinoma on histology.
DISCUSSION

The IVC is formed by the successive and orderly development and regression of three paired veins (Fig. 2) [1,2]. Early in the embryogenesis, the posterior cardinal and more anterior subcardinal veins are formed. Later, the most caudal segment of the right supracardinal vein evolves. Subsequently they form four components of the normal unilateral right-sided venous system namely, the hepatic vein from the
hepatic segment, the prerenal segment from the subcardinal vein, the renal collar from the right subcardinal anastomosis, and the postrenal segment from the supracardinal vein. Interruption of normal regression of any of these venous structures results in different anomalies.

Variations of the IVC anatomy have been classified into 15 types [3], but some of them were hypothetical and occurred only in animals. The incidence of the duplicated IVC accounted for 0.2-0.3% [3, 4] in patients with congenital heart malformations. Duplicated IVC results from a persistence of both the right and left supracardinal veins. Left IVC typically ends at the left renal vein, which crosses anterior to the aorta in the normal fashion to join the right IVC. However, there are several variations to this arrangement, such as azygous continuation of the left IVC.

A double IVC with azygous continuation of the left renal vein is a rare combination. It can result from developmental persistence of the dorsal limb of the renal collar and failure to form the subcardinal-hapatic anastomosis.

We incidentally observed such a rare case with CT scan and reconstructed these images with a computer-assisted 3-D multiplanar reformatting technique to enhance illustration of the anatomic anomalies. Awareness of this IVC anomaly has significant implication, such as avoiding the diagnostic pitfall of para-aortic lymphadenopathy and inadvertent ligation of the left IVC which may impede venous return of the lower extremities. Our surgeon also found that the preoperative CT scan could assist surgical planning to reduce complication of the surgery.

On the other hand, clinicians should be aware of such anatomic variability of the renal veins when obtaining blood samples for localization of adrenal tumors or for the diagnosis of renovascular hypertension. In selective renal vein sampling for hypertensive patients, the presence of double IVC will dilute the left renal vein sample because of the blood flow carried by the left IVC. Surgeons need to recognize anomalies of the IVC in order to perform safe dissection of the retroperitoneum in patients undergoing aortic reconstruction, or renal surgery, as well as accurate insertion of a filter in the IVC of patients.
with pulmonary embolism or deep vein thrombosis, and venous cannulation for cardiopulmonary bypass [5, 6, 7].

In summary, we present a rare case of a duplicated IVC with azygous continuation of the left renal vein. Knowledge of this anomaly is essential to avoid diagnostic pitfalls and reduce complications of abdominal surgeries.

REFERENCES

下腔靜脈複製合併有奇靜脈連經：手術前電腦斷層於三維重組影像的發現

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下腔靜脈複製之發生是罕見的。下腔靜脈的胚胎發生過程複雜，不同時期的發育中斷會導致下腔靜脈發生異常。我們在此報告一位患有左腎靜脈瘤之76歲男性，手術前電腦斷層掃描影像偶然發現併有下腔靜脈複製合併奇靜脈連經，3D重組影像加強呈現解剖上的變異。臨床上認知下腔靜脈的變異可避免診斷的陷阱和降低腹部手術的合併症。

關鍵詞：發育異常；電腦斷層；下腔靜脈