INTRODUCTION

The horseshoe kidney is a well known congenital fusion anomaly of the kidneys. The frequency of horseshoe kidney incidence ranges from 1/400 to 1/1800 [1]. During the gross anatomy course at Kurume University School of Medicine in 2001, the sixth case of horseshoe kidney was found in our laboratory. This horseshoe kidney had a tumor mass on the left upper side of the isthmus and a rare arterial anomaly of the celiac trunk.

CASE REPORT

This report describes an kidney anomaly found in an 81-year-old Japanese male cadaver who had died of bladder cancer. The lower ends of the kidneys were fused and thus formed a horseshoe kidney. The horseshoe kidney was located ventral to the abdominal aorta and inferior vena cava. A huge tumor mass was present on the left side of the isthmus to the upper pole of the left kidney with accretion. After removal of the tumor mass, the boundaries between the isthmus and the kidneys were indistinct. The long axes of both kidneys ran from the outer upper side to the inner lower side. The surfaces of the kidneys were smooth (Fig. 1 A and B).

Size and position of the horseshoe kidney

The upper poles of the left and right kidneys were positioned at the level between the first and second lumbar vertebrae. The upper edge of the isthmus was at the level of the third lumbar vertebra. The lower edge of the isthmus was at the level between the fourth
and fifth lumbar vertebrae. The sizes of the kidneys and the lengths of each section were measured (Fig. 2 and Table 1).

Renal hilum, pelvis and ureter

Both renal hila opened very widely in the ventral direction, and the left hilum was larger than the right hilum. The right pelvis consisted of six major calyces, while the left pelvis was enlarged because of the tumor. The left calyces could not be observed clearly due to the tumor. Both ureters descended from the ventral side of each kidney and penetrated normally into the bladder.

Arterial system

After passing through the aortic hiatus of the diaphragm, the aorta descended, turned slightly to the right and passed through the dorsal side of the isthmus of the horseshoe kidney. Subsequently, it diverged into the left and right common iliac arteries. The arterial system of this horseshoe kidney is shown in Fig. 3 A

![Diagram showing arterial system](image)

**Fig. 2.** Various measurements of the horseshoe kidney. The result of the measurements are shown in Table 1. A. Distance between the tops of the left and right kidneys. B. Distance between the aortic hiatus and the top edge of the isthmus. C. Distance between the lower edge of the isthmus and the divergent Points of the common iliac arteries. D. Width of the left kidney. E. Width of the right kidney. F. Width of the isthmus. G. Major axis of the hilum of the left kidney. H. Minor axis of the hilum of the left kidney. I. Major axis of the hilum of the right kidney. J. Minor axis of the hilum of the right kidney.

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**Table 1.** Results of the measurements of each region shown in Fig. 2

![Image showing measurements](image)
and B. The left and right renal arteries branched from the abdominal aorta. Moreover, a surplus arteries from the renal arteries and three surplus arteries from the abdominal aorta penetrated into the horseshoe kidney. The first surplus artery branched from the right renal artery and became distributed to the upper pole of the right kidney. The second surplus artery arose from the ventral side of the aorta below the origin of the superior mesenteric artery and became distributed to the inferior pole of the right kidney. The third surplus artery arose from the ventral side of the abdominal aorta below the origin of the inferior mesenteric artery and became distributed to the inferior pole of the left kidney and part of the isthmus. The fourth surplus artery branched from the left side of the abdominal aorta superior to the origin of the left renal artery and became distributed to the upper pole of the left kidney (Fig. 3 B).

Moreover, the usual celiac trunk was not identified in the present case. The splenic artery arose from the superior mesenteric artery, forming a lienomesenteric trunk, and the left gastric and common hepatic arteries, forming a gastrohepatic trunk.

Venous system

The inferior vena cava formed from the junction of the right and left common iliac veins. It ascended to the right side of the abdominal aorta behind the isthmus. In the left kidney, two veins arose from the left hilum and joined into one vein that opened into the inferior vena cava. In the right kidney, two veins arose from the right hilum and joined into one vein that opened into the inferior vena cava. Other surplus veins arose the right hilum and directly opened into inferior vena cava.

Histological observation of isthmus

In order to observe the tissue of the isthmus, some paraffin-embedded preparations of part of the isthmus were stained with H&E. Many renal corpuscles and renal tubules were observed in this area (Fig. 4). The isthmus consisted of kidney substance in the present case.

DISCUSSION

A horseshoe kidney is the most frequent disease among dysraphia of kidney. The incidence of horse-
shoe kidneys in Japanese is 0.15-0.48% [1-3]. Sex differences are seen, similar to other types of dysraphia, and men are twice as likely to have a horseshoe kidney than women [1,4,5]. This is the sixth case in our laboratory, representing a frequency of 0.1% (6 of 1902 bodies) from 1952 to 2001 [6].

Matsumoto et al. [2] classified horseshoe kidneys into the following five types: type A(a), fused at the superior poles; type A(b), fused at the inferior poles; type B(a), fused by fibrous tissue; type B(b), fused directly; and type B(c), fused by mediators. In the present case, the isthmus consisted of kidney substance and the extremitas inferior of both kidneys carried out the coalescence, since the dorsal metanephric tissue showed excrescence in most cases, which have a bridge part of substance nature, is also presented [10,17].

There are many opinions that the surplus arteries observed as features of horseshoe kidneys are vestigial remnants of an embryo term [9,12,18,19]. There are many views about the cause, in which a kidney is fixed too low because the rise of the kidney is barred by the surplus arteries [13,15] and also barred by the origin of the inferior mesenteric artery or abnormal growth of the early developmental renal tissue [14,15,20].

Moreover, horseshoe kidneys show great individual arterial variations, and this is supposed to be accompanied by variation in the branches of the abdominal aorta in many cases [5]. In the present case, a rare arterial anomaly was observed in the celiac mesenteric region. The usual celiac trunk was not identified, and the gastrohepatic trunk and splenomesenteric trunk independently arose from the abdominal aorta. The classification for this type of arterial anomaly is type V" in Morita’s classification, but does not belong to Adachi’s classification [21,22].

REFERENCES