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·Case Report·

Left testicular artery arching over the ipsilateral renal vein

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Abstract

Aim: To report two cases of the left testicular artery arching over the left renal vein (LRV) before running downward to the testis. **Methods:** The subjects were obtained from two Japanese cadavers. During the student course of gross-anatomical dissection, the anatomical relationship between the testicular vessels and the renal vein was specifically observed. **Results:** The arching left testicular artery arose from the aorta below the LRV and made a loop around the LRV, which appeared to be mildly compressed between the arching artery and the psoas major muscle. **Conclusion:** Clinically, compression of the LRV between the abdominal aorta and the superior mesenteric artery occasionally induces LRV hypertension, resulting in varicocele, orthostatic protenuria and hematuria. Considering that the incidence of a left arching testicular artery is higher than that of a right one, an arching left artery could be an additional cause of LRV hypertension. *(Asian J Androl 2006 Jan; 8: 107-110)*

Keywords: anatomy; testis; blood vessels

1 Introduction

The anatomical relationship between gonadal arteries and renal vessels varies according to a number of patterns. To our knowledge, these patterns were first described by Notkovich [1], who classified them into three principal types: type I, the gonadal artery descends directly without contact with the renal vein; type II, the gonadal artery arises from a higher level than the renal vein and crosses in front of it; and type III, the gonadal artery arises from a lower level than the renal vein and arches around it. It is clinically known that varicocele, orthostatic protenuria and hematuria can be induced by renal vein hypertension. In particular, left renal vein (LRV) hypertension, caused by compression of the LRV between the abdominal aorta and the superior mesenteric artery, is called the "nutcracker syndrome" [2]. It was previously thought that cases of this syndrome were rare, but it is now evident that the syndrome is probably more common than first thought [3–6].

In this paper, we reported two cases of the left testicular artery arching over the LRV, and discussed the clinical significance from the anatomical point of view that LRV compression between the arching artery and the psoas major muscle may be a cofactor for LRV hypertension.

2 Case report

During the student course of gross-anatomical dissection in Kagawa Medical University, Japan, the anatomical relationship between the testicular vessels and

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the renal vein was specifically observed using 59 male cadavers. Two cadavers in particular (one aged 84, died of cancerous pleurisy, and the other aged 96, died of cardiac failure) were carefully dissected. Left testicular arteries arching over the ipsilateral renal vein were present in 4 of 59 (6.7 %) cadavers, but the arching artery on the right side was not found. In each case, the left testicular artery originated from the abdominal aorta approximately 3 cm inferior to the origin of the LRV, then ran upward behind the LRV. Thereafter, the artery made a loop over the LRV proximal to the termination of the left testicular vein before running downward to the left testis (Figures 1 and 2). It appeared that the LRV was somewhat compressed between the arching testicular artery and the psoas major muscle. The gross anatomy of the two cases is summarized in Figure 3. The left testicular vein appeared to be longer than the right vein. In contrast to the right testicular vein, which connected directly

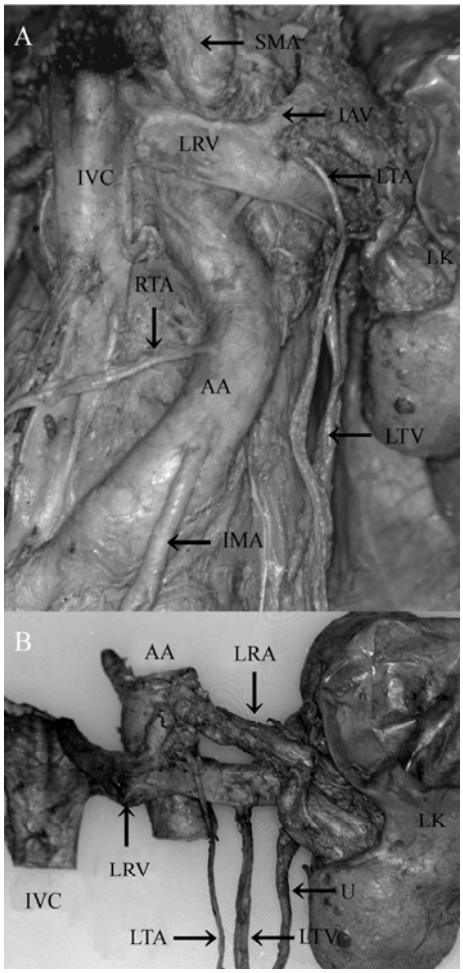

Figure 1. Gross appearance of the left arched testicular artery of an 84-year-old male cadaver (A) *in situ* and (B) removed. AA, abdominal aorta; IAV, inferior adrenal vein; IMA, inferior mesenteric artery; IVC, inferior vena cava; LK, left kidney; LTA, left testicular artery; LTV, left testicular vein; LRA, left renal artery; LRV, left renal vein; RTA, right testicular artery; SMA, superior mesenteric artery; U, ureter.

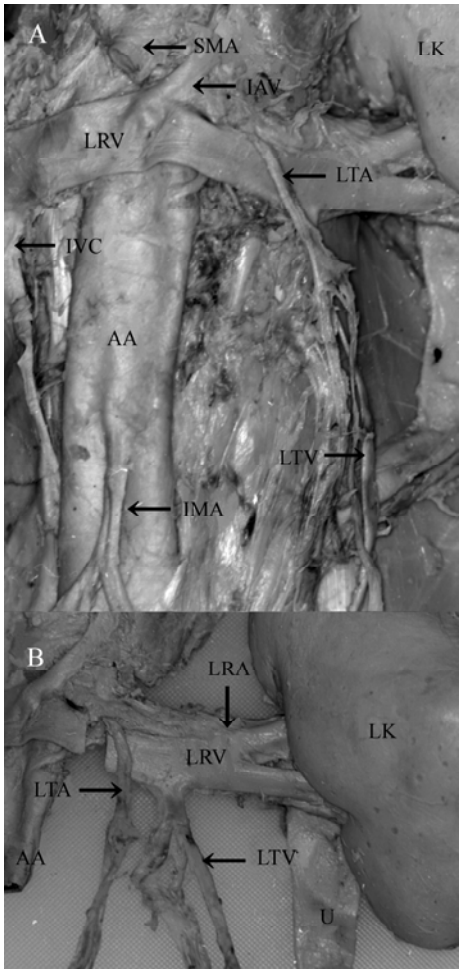

Figure 2. Gross appearance of the left arched testicular artery of a 96-year-old male cadaver (A) *in situ* and (B): removed. AA, abdominal aorta; IAV, inferior adrenal vein; IMA, inferior mesenteric artery; IVC, inferior vena cava; LK, left kidney; LRA, left renal artery; LRV, left renal vein; LTA, left testicular artery; LTV, left testicular vein; RTA, right testicular artery; SMA, superior mesenteric artery; U, ureter.

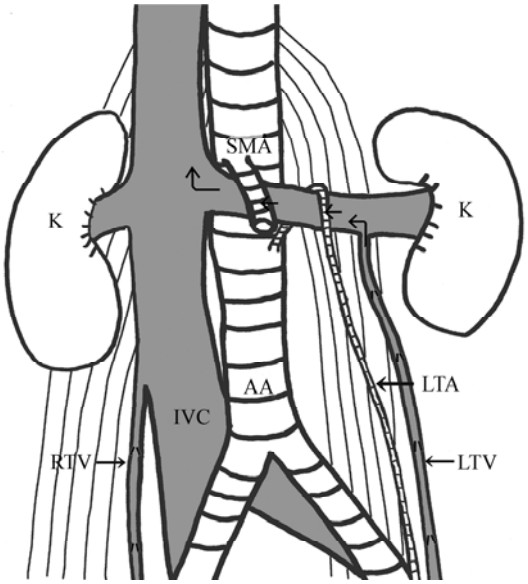

Figure 3. Schematic diagram of two cases of left arched testicular artery. The venous flow from the left testicular artery vertically curves to enter the left renal vein, passes under the arched testicular artery and superior mesenteric artery and curves again at a right angle to enter the inferior vena cava. In contrast, the right testicular vein directly connects with the inferior vena cava at an acute angle. AA, abdominal aorta; IVC, inferior vena cava; K, kidney; LTA, left testicular artery; LTV, left testicular vein; P, psoas muscle; RTA, right testicular artery; SMA, superior mesenteric artery.

and made an acute angle with the inferior vena cava, the left testicular vein vertically joined with the LRV, and made a right angle again at the confluence with the inferior vena cava. Furthermore, differing from the right renal vein, the LRV was compressed between the arched testicular artery and the psoas major muscle, and also between the superior mesenteric artery and the abdominal aorta.

3 Discussion

In the present study, two cases of the left testicular artery arching over the LRV were anatomically examined. We noted that the LRV proximal to the confluence of the left testicular vein was the site of the loop of the left testicular artery. Therefore, the flow of venous blood from the left testis might be interrupted not only by the long course and two curves at right angles of the leading vein, but also by compression of the vein with the superior mesenteric artery and/or the testicular arching artery.

The prevalence rate of varicocele is approximately 15 % in healthy men and 40 % in infertile men. Varicocele occurs mainly on the left side. In particular, palpable unilateral varicocele occurs on the left side in 85–90 % of the cases [7–9]. The high incidence of varicocele on the left side, compared with that on the right, is often attributed to the following causes:

1 The left testicular vein ends in the LRV, however, the right testicular vein ends in the inferior vena cava. The left vein is a few centimeters higher than the right one with a higher hydrostatic pressure. Moreover, the blood flow from the left testicular vein curves at two right angles before reaching the right atrium, indicating the presence of higher hemodynamic pressure in the left testicular vein than in the right.

2 The compression of the left renal vein by the abdominal aorta and the superior mesenteric artery increases the pressure in the LRV with consequent dilation of the left testicular vein. This theory is called “nutcracker phenomenon”.

3 The absence or incompetence of valves in the left testicular vein is responsible for insufficient blood flow. However, it remains unclear whether the valve insufficiency is a cause of the varicocele or a result of high venous pressure of the LRV in the “nutcracker phenomenon”. To our knowledge, there has been no statistical study on the numbers and structures of venous valves between the right and left testicular veins [10–14].

We propose that the arching left testicular artery could also be an additional possible cause of the LRV compression [15, 16]. Surprisingly, in a study of 183 cadavers in the USA, Notkovich [1, 17] reported that the left gonadal arteries arched over the LRV in 20.7 % of observed cases, whereas the right gonadal arteries arched over the right renal vein in 8 % of cases. However, we have not encountered the left arching artery as often in Japanese cadavers. Four of 59 (6.7 %) male cadavers had left arching arteries and none had right arching arteries, showing that the incidence of arching testicular arteries in Japanese men is less than that in the USA, and the reason is unclear. It might because that the time course of fetal development in regard to rising kidneys and descending gonads slightly differ between Japanese and Americans. It also remains unknown why the incidence of left arching testicular arteries is higher than that of right arching arteries in both countries. A position of inferior vena cava developing at the right of abdominal aorta might be

involved in producing the difference of incidence. Clinically, persistent LRV hypertension can cause the development of collateral veins and varicocele. Unfortunately, we do not have clinical data on the two men described in this study when they were alive. Recently, developments in radiography have led to a more detailed diagnosis of LRV hypertension. Nishimura *et al*. [18] reported that 88 % (14 of 16) of patients with left renal bleeding of unknown origin had LRV hypertension. The results suggest that LRV hypertension is a cause of hematuria in a large percentage of the patients with left renal bleeding of unknown origin. Later, Igari [19] reported that 50 % (19 of 38) of patients with left renal bleeding of unknown origin were diagnosed with the "nutcracker syndrome", suggesting that this syndrome is a cause of hematuria in a percentage of the patients with left renal bleeding of unknown origin. At present, Doppler ultrasonography, enhanced helical computed tomography, magnetic resonance imaging, selective left renal vein phlebography and renal vein pressure measurement are recommended to establish the diagnosis of the nutcracker syndrome [20]. However, the diagnostic possibility of LRV hypertension resulting from an arched left testicular artery using these methods has not been reported until now. Additionally, clinicians need to pay attention to the possible presence of arching testicular arteries during surgical operation on the kidney and renal vessels.

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