

HIGH ORIGIN OF THE RIGHT TESTICULAR ARTERY COURSING THROUGH A HIATUS IN THE INFERIOR VENA CAVA

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ABSTRACT

During routine dissection we observed a high origin of the right testicular artery from the abdominal aorta in a middle-aged formalin-fixed male cadaver of indigenous Kenyan descent. The artery arched above the right renal vein to course through a hiatus in the inferior vena cava at its confluence with the right renal vein. In this case, the renal artery gave long tortuous segmental branches, one of which did not pass through the hilum but pursued a course towards the superior pole of the kidney. The high origin and arching of the testicular artery has previously been reported. However, its association with the course of the testicular artery through a hiatus in the inferior vena cava together with the long tortuous course of the renal artery and a polar segmental artery is, to the best of our knowledge, a unique finding that should be noted. The possible embryologic basis for this variation as well as its clinical significance is discussed.

Keywords: Testicular artery, inferior vena cava.

INTRODUCTION

Testicular arteries (TAs) usually arise from the anterolateral aspect of the abdominal aorta inferior to the origin of the renal arteries. This is normally at the level of the second lumbar vertebra between the level of origin of the renal artery (RA) cranially and that of the inferior mesenteric artery caudally (Standring, 2008). This origin is however variable as these vessels have been reported to arise from the renal artery, middle suprarenal, one of the lumbar arteries, common or internal iliac artery and sometimes from a higher level than the renal artery (Notkovich, 1956; Bergmann et al., 1988). The origin of the TA is classified as type I or II depending on whether they originate below or above the renal pedicle

respectively and as type III, if they pursue an arched course around the renal vein (Notkovich, 1956). Of the three types, type III variation is the least common with its incidence ranging from 1.6-23.8% (Notkovich, 1956; Grine and Kramer, 1981; Gupta et al., 2011). However, this variation is the most significant clinically due to the higher likelihood of renal vein compression with consequent hematuria (Nishimura et al., 1986). Though variations of the TA are relatively common, cases of an arching TA that pursues a course through a hiatus in the inferior venacava (IVC) have not been reported in literature.

CASE REPORT

During routine dissection of middle-aged male formalin fixed cadaver at the Department of Human Anatomy, University

of Nairobi, we observed a case of a high origin of TA at the level of L₁/L₂ vertebral junction. The TA then arched over the right

renal vein (RRV) and coursed through a hiatus in the IVC. This hiatus, which was flattened, had a diameter of 1.2 cm. The RA gave long (mean length 10.5 cm) and tortuous segmental branches, one of which did not pass through the hilum but pursued a course towards the superior pole of the

kidney (Figure 1). The rest of the intra-abdominal course of the right testicular artery was normal.

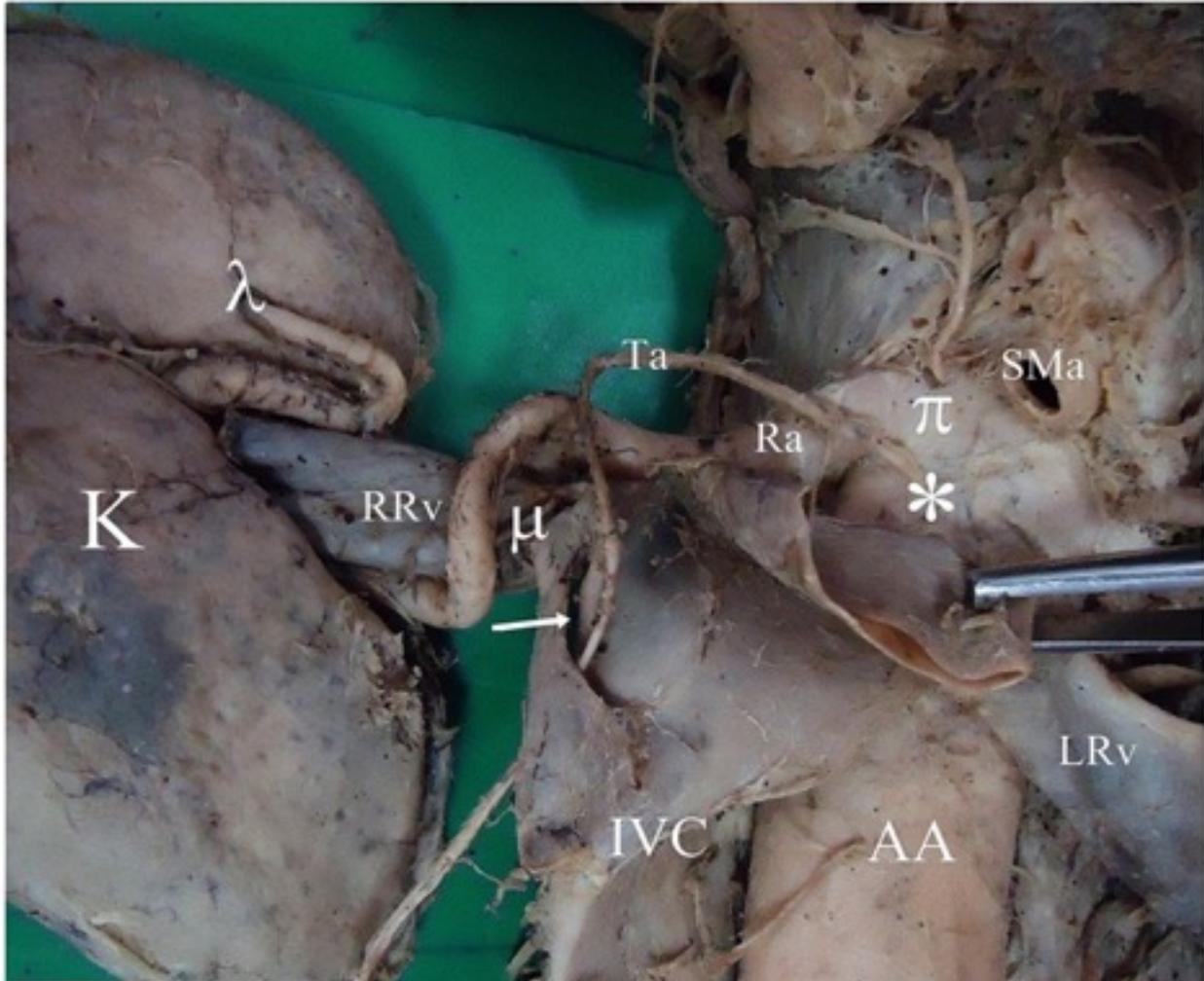


Figure 1: Dissection displays the origin (*) of the right testicular artery (Ta), from the abdominal aorta (AA). The inferior vena cava (IVC) has been sectioned and, together with the left renal vein (LRV), reflected to display this origin. Note that the testicular artery then arches over the right renal vein (RRV) and passes through a hiatus (arrow) in the inferior vena cava (IVC) at its confluence (μ) with the right renal vein. The origin of the right renal artery (Ra) from the abdominal aorta is also shown. Note the tortuous course of the segmental branches of this artery and the segmental branch entering the kidney above the hilum (λ).

DISCUSSION

The occurrence of a TA coursing through a hiatus in the right renal vein has been reported once in literature (Mirapeix et al., 1996). However, the occurrence of a hiatus in the IVC conveying the TA is, to the best of our knowledge, a unique finding that has not been reported previously. This variation is compounded by the high origin and arching of the TA above the right renal vein. The incidence of arched gonadal arteries ranges from 1.6% to 23.75% (Notkovich, 1956; Grine and Kramer, 1981; Cicekcibasi et al., 2002; Gupta et al., 2011) and is higher in people of African descent (Grine and Kramer, 1981). However, this variation is more common on the left hence its occurrence on the right as in this case is noteworthy. Further, the long and tortuous course of the segmental branches of the renal artery, which is a rare variation (Weinberger, 2005), together with the polar segmental branch present a rare and noteworthy ensemble.

Variations in the course of the TA and RA are explained embryologically. Gonadal arteries are persistent branches of the mesonephric arteries that develop cranial and caudal to the renal pedicle. If the kidney ascends much higher, carrying the renal vein to a higher level than the origin of the gonadal artery, the gonadal artery follows an arched course around that vein, giving rise to the type III variant (Notkovich, 1956). Since the left kidney ascends higher than the right kidney (Moore and Persaud, 2007), such variants in gonadal arteries are commoner on the left (Nayak, 2008). A long RA with long segmental arteries may be due to persistence of a lower mesonephric artery as the definitive renal artery such that as the kidney rises the RA elongates. This argument, which has not been posited previously, is in our case supported by the fact that the testicular artery arose at a higher level than the renal artery.

The hiatus in the IVC, close to its junction with the right renal vein (RRV) could also have an embryological basis. The IVC arises embryologically from the development, regression, anastomosis and replacement of the posterior cardinal, subcardinal and supracardinal veins. Bilateral anastomoses between the supracardinal and the subcardinal veins form the renal segment of the IVC (McClure and Butler, 1925). The right lateral splanchnic artery, which persists in the adult as the right testicular artery, passes caudal to this anastomosis. Pertinent to this is the presence in the embryo of 2 renal veins, one dorsal and the other ventral, on each side of the body. These venous channels form a single renal vein by the regression of the dorsal channel (McClure and Butler, 1925; Shimada & Fukuyama, 1975). It is likely that the hiatus in the IVC at its junction with the RRV represents the persistence of the posterior vein as the definitive RRV and the anterior vein remaining to encompass the hiatus in the IVC. Since during development the gonadal artery reaches the gonad after passing between the 2 embryonic renal veins (Mirapeix et al., 1996), the persistence of both veins, as in our case, forms a hiatus in the renal portion of the IVC and explains the passage of the testicular artery through this hiatus.

Clinically, hematuria may result from compression of the renal vein by an arching TA (Nishimura et al., 1986). Moreover, since the TA passes very close to the medial border of the kidney, such variant vessels are endangered during kidney transplants or any other surgeries of kidney (Gupta et al., 2011). The long and tortuous course of the RA, which could be misdiagnosed as an aneurysm (Awadalla et al., 2004), could result in hypertension (Weinberger, 2005). Thus the variations reported in the present case are important and should be noted to

prevent injury during surgery as well as misdiagnosis of renal artery aneurysms in renal arteriograms.

The occurrence of an arching testicular artery coursing through a hiatus in the

inferior vena cava together with long segmental branches of the renal artery are unique anatomical variants with significant clinical implications in renal hilar dissections and retroperitoneal surgery.

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