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A STUDY OF ANOMALOUS ORIGIN OF OVARIAN ARTERIES AND ITS CLINICAL SIGNIFICANCE IN HUMAN CADAVERS

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ABSTRACT: Background: The Gonadal Arteries most commonly arise from the abdominal aorta at the level of the second lumbar (L2) vertebra, supplying the testes and ovaries. The gonadal arteries variations are commonly seen in males on right side however there are few instances where there is variation in ovarian arteries seen in females which could be of importance. **Aim of the Study:** To re-evaluate the origin and courses of gonadal arteries in human cadavers and explain the developmental anatomy and its clinical significance. **Materials and Methods:** During routine educational dissection of 24 cadavers in the Department of Anatomy, K.A.P.V. Government Medical College, Trichy, the origin and course of gonadal arteries were observed. I found the variants in 2 female cadavers aged over 60 years. **Results:** The present study showed variation in the origin of ovarian arteries in 2 female cadavers (8.33%) out of 24 cadavers. I observed, a rare anatomical variant of left ovarian arteries were found, originating from the left accessory renal arteries, just below and behind the left main renal vein of 60 years and 68 years old female cadavers respectively. The variants were unilateral in origin. **Conclusions:** The knowledge of anatomical course and variations of the ovarian artery is important for surgeons and radiologists during invasive and non-invasive arterial procedures.

INTRODUCTION: The gonadal arteries are long and slender paired arteries usually arising from the anterolateral aspect of the abdominal aorta at the level of L2, caudal to the renal arteries but above the origin of the inferior mesenteric artery. Each artery passes obliquely downwards in the retroperitoneum on the psoas major muscle and enters the posterior abdominal wall. In the female, the ovarian arteries corresponding to the testicular arteries of the male [1], descend with the gonadal vein and ureter, pass into the pelvis and run anterior to the iliac vessels. In the pelvis, it takes a medial path through the suspensory ligament towards the uterus and anastomoses with the ovarian branch of the uterine artery.

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Then it runs medially below the uterine tube and turns backwards into mesovarium. Finally it reaches the ovary at the hilus [2]. In male, the testicular arteries are also known as internal spermatic arteries. The arteries pass inferolaterally in the retroperitoneum on psoas major. The right testicular artery lies anterior to the inferior vena cava and posterior to the horizontal part of the duodenum. The left testicular artery lies posterior to the inferior mesenteric vein and the lower part of the descending colon. Each testicular artery crosses in front of the respective genitofemoral nerve and ureter and passes through the deep inguinal ring and enter the spermatic cords.

Along with the other contents of the cord, they enter the scrotum via the inguinal canal. In the inguinal canal it supplies the cremaster muscle. The gonadal artery variations are well known. The gonadal arteries variations are seen in their origin, course and number. The frequency of variations are more in males than the females and more common

on right side. Cicekabari *et al* showed gonadal artery variations in 8.8% cases [3]. According to Notkovich gonadal arteries of renal origin were found in 14% of cases taking origin either from the principal renal artery or from its branches or from an accessory renal artery [4].

Soja *et al* named the gonadal artery origin from accessory renal artery as aberrant gonadal artery [5]. The gonadal artery has a high origin (superior to L2) in 5-20% of cases 3, 6, 7, and in 5-6% of cases it originates from the main or accessory renal artery5.Singh et al reported bilateral origin of the ovarian arteries from the accessory renal arteries [8]. The variations in testicular artery origin were reported as either absent or doubled, tripled or quadrupled [9]. A care talreported a variation in the course of the left testicular artery [10]. Rarely it may arise from the superior epigastric, common or internal iliac artery [11].

MATERIALS AND METHODS: During routine dissection for undergraduate students, in the Department of Anatomy, K. A, P. V. Government Medical College, Trichy, in 24 human cadavers, the abdominal cavity was opened by routine dissection procedure and the retroperitoneal structures were exposed. The great vessels and their branches and tributaries were exposed removing the surrounding connective tissue to provide a clear field of vision. The origin and course of gonadal arteries were observed, when we found the variants in two female cadavers aged over 60 years.

RESULTS: The present study showed variation in the origin of the gonadal artery in 2 cadavers (8.33%) out of 24 cadavers. Both the variations were found in female cadavers and no variation was present in males and both of them were on the left side. The left ovarian arteries were originated from the left accessory renal arteries between the abdominal aorta and hilum of the left kidney.

They were located behind and just below the left renal vein respectively and further passed downwards, just medial to the ureter and left ovarian vein. Then they crossed the left psoas major muscle and genitofemoral nerve. At the pelvic brim, they crossed the external iliac vessels in proximity to the ureter. Here, the ovarian arteries entered in to the lesser pelvis and passed between the two layers of ovario pelvic ligament and of the broad ligament of the uterus and finally supplied the ovary.

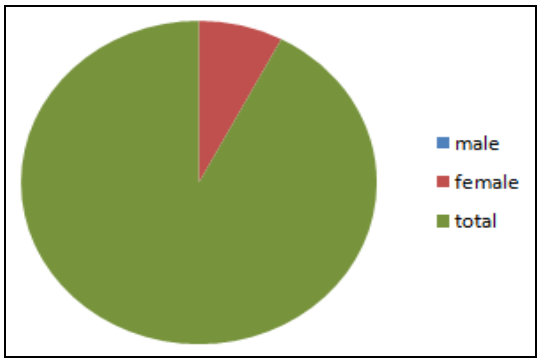

CHART 1: INCIDENCE OF VARIATION IN THE ORIGIN OF GONADAL ARTERY

In these two cadavers, left ovarian artery took origin from left accessory renal artery (**Fig. 1** and **2**). Besides variations in the origin, the course of the gonadal arteries, were normal otherwise.

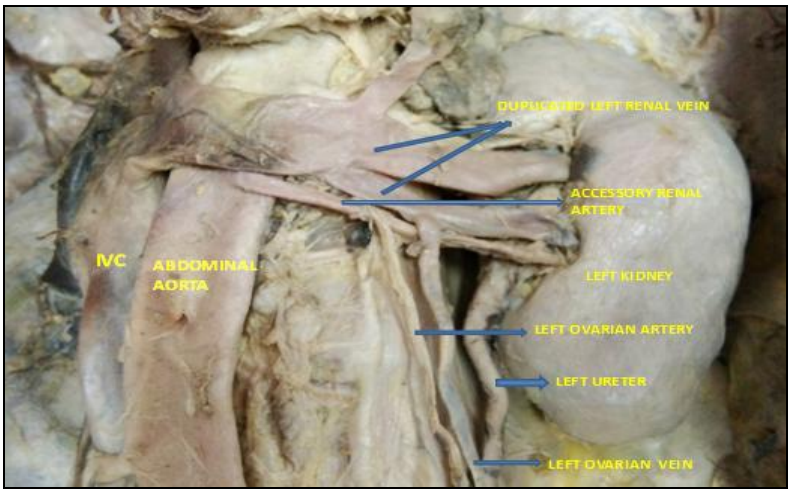

FIG. 1: ORIGIN OF LEFT OVARIAN ARTERY FROM LEFT ACCESSORY RENAL ARTERY COEXIST WITHURO-VASCULAR MALFORMATION (DUPLICATED LEFT RENAL VEIN)

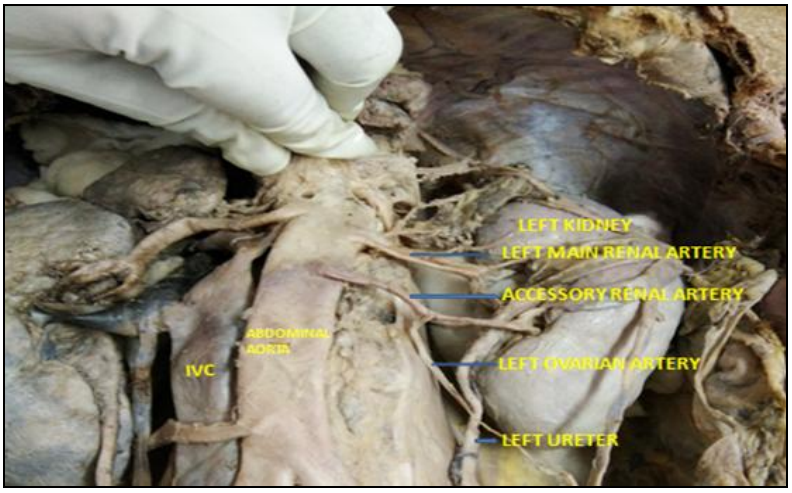

FIG. 2: ORIGIN OF LEFT OVARIAN ARTERY FROM THE LEFT ACCESSORY RENAL ARTERY

DISCUSSION: The frequency of gonadal artery variation is most common on right side and more in males. There are only a few cases of variation of ovarian arteries present in the literature as compared to variation of testicular arteries. The course of the gonadal arteries can be explained embryologically. The gonadal arteries are persistent branches of mesonephric arteries that develop cranially and caudally to the renal pedicle. These mesonephric arteries supply the developing gonads, diaphragm suprarenal glands and the kidneys. There are 9 lateral mesonephric arteries dividing into cranial, middle and caudal groups in early developing stages.

The middle and cranial groups of arteries mostly disappear while the caudal group gives rise to gonadal artery. If the caudal mesonephric arteries disappear, cranial or middle mesonephric arteries are persistent and may give rise to GA. If the middle mesonephric arteries persist, the gonadal arteries arise at the level of renal pedicle. If the cranial mesonephric artery persists, then the gonadal artery arises at the level of superior mesenteric artery and coeliac trunk, which gives rise to high level origin of gonadal artery (GA). Previous studies showed that the gonadal artery may originate from the aorta, renal artery, accessory renal artery and suprarenal artery [12]. The high origin of the ovarian artery [3, 6, 7], the rare origin of the inferior suprarenal artery from the ovarian artery [7] and a supernumerary inferior phrenic artery occur due to lack of formation of the lateral mesonephric arteries and their connecting channels which supply the structures that arise from the mesonephros, i.e. the, gonads and suprarenal glands. The variation in suprarenal arteries was often correlated to variations in inferior phrenic and gonadal arteries [13]. Kurtoglu *et al* reported an ovarian artery that originated from an accessory renal artery, then passed posterior to the inferior vena cava [14]. Kumar *et al* stated that right and left ovarian arteries were arising from right and left internal iliac arteries respectively in 2 cases [15]. Roy *et al* found that bilateral four renal arteries were seen in his study, in right side the ovarian artery originated from third renal artery from above and in left side from the lower most one [16].

According to Notkovich, the gonadal arteries are classified into 3 types based on their anatomical relationship with renal vein [4]. In type I, the gonadal arteries arise from aorta behind or below the renal vein, passes downward and laterally. In type II –it arises from aorta above the level of renal vein and crosses in front of it. In type III-it arises from aorta behind or below the renal vein and runs upwards to arch over the renal vein. The gonadal arteries develop from mesonephric arteries that appear cranially and caudally to the renal pedicle. If it persists caudally, they become type II by crossing the renal pedicle with the descent of the gonads. If the kidney ascends higher along with renal vein than the origin of the gonadal artery, it gives rise to type III. The fact that generally the kidney ascends on the left side higher than the right, gives the explanation for the higher frequency of the type-iii on left side. Apart from the morphological and developmental interest in arching gonadal arteries, they are of practical importance from a clinical and surgical point of view.

Arched course of the gonadal artery is commonly reported in male. There are not many reports on this variation in the female [17]. According to Anupama's study, the variations found in the gonadal arteries arching over the renal vein are (1.6%), arising from the renal arteries (6.6%) and passing through a hiatus in the renal vein [18]. The arching course of the left ovarian artery might compress the left renal vein. The hypertension in left renal vein can produce hematuria and can cause the dilatation of the left ovarian vein. Since the ovarian artery passes very close to the medial border of the kidney, it might be endangered during kidney transplants or any other surgeries involving ovaries [17, 19, 20].

As per Prasad *et al*, the variations found in the gonadal arteries arising from the renal artery in 4 (10%) cadavers and according with course, arching of left gonadal artery over the left renal vein seen in 1 (2.5%) cadaver [21]. The ovaries receive their arterial blood supply predominately from the ovarian artery (OA) but also from the ascending branches of the uterine artery [22]. A very rare case report of atypical double arterial anastomosis (the first and second variant artery) between the right limb of the omental arcade of Barkow, uterus, and right ovary, which was found during a routine student anatomical dissection course [23]. Abnormal origin of the left ovarian arterial tortuosity was apparent in the lower region of the vessels [18, 19]. Rare presentation of spontaneous rupture of an OA aneurysm, can lead to retroperitoneal hemorrhage [24].

CONCLUSION: A knowledge of the variations in the origin and course of the ovarian artery is important for surgeons, urologists and radiologists for interventional procedures and surgeries. The anatomical knowledge of the variations of the ovarian artery is useful to clinicians and vascular surgeons while performing the invasive techniques. Care must be taken not to damage the ureters during oophorectomy especially during the ligation of the ovarian arteries.

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CONFLICT OF INTEREST: I have no conflicts of interest regarding this study.

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