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CASE REPORT

Multiple Variations in the Paired Arteries of Abdominal Aorta – Clinical Implications

SONI S*, WADHWA A**

ABSTRACT

Introduction - The knowledge of the commonest pattern of the arterial supply of the abdomen and the deviants thereof is mandatory in various diagnostic, interventional and surgical procedures.

Methods - Multiple variations in the origin of the lateral branches of the abdominal aorta were observed during the routine dissection of the abdominal cavity in an adult male cadaver in the Department of Anatomy, Govt. Medical College, Amritsar.

Results – The variations encountered during the dissection were-

1) Double renal arteries were seen on the left side.
2) Double testicular arteries were seen on the left side, with the superior testicular artery arising from the inferior renal artery and the inferior testicular artery arising directly from the abdominal aorta.
3) Triple renal arteries were seen on the right side.
4) The right inferior phrenic artery was found to originate from the celiac trunk and the left inferior phrenic artery was found to arise directly from the abdominal aorta.

Conclusions - Accessory renal arteries may constitute a danger in nephrotomy and in the partial resection of the kidney. The presence of triple renal arteries is infrequent, with a reported incidence of 1-2%. A gonadal artery originating from an inferior renal artery may be injured during the percutaneous treatment of the syndrome of pelvi-ureteral junction and so it may become a major contraindication. Also, this anatomical variation enhances the importance of arteriography or the Doppler ultrasound examination of the renal hilum.

Key Words: renal artery variants, renal vascular variations, testicular artery variants, vascular variations, inferior phrenic artery.

*Deptt. Of Chest & T.B , Adesh Institute of Medical Sciences & Research, Bathinda.
** Deptt. Of Anatomy , Adesh Institute of Medical Sciences & Research, Bathinda.
Corressponding Author;
Dr. Ambica Wadhwa
Deptt. Of Anatomy,
Adesh Institute of Medical Sciences & Research
Barnala Road,
Bathinda.
Ph. 09876005162
E-mail – ambicasoni02@yahoo.com

Introduction

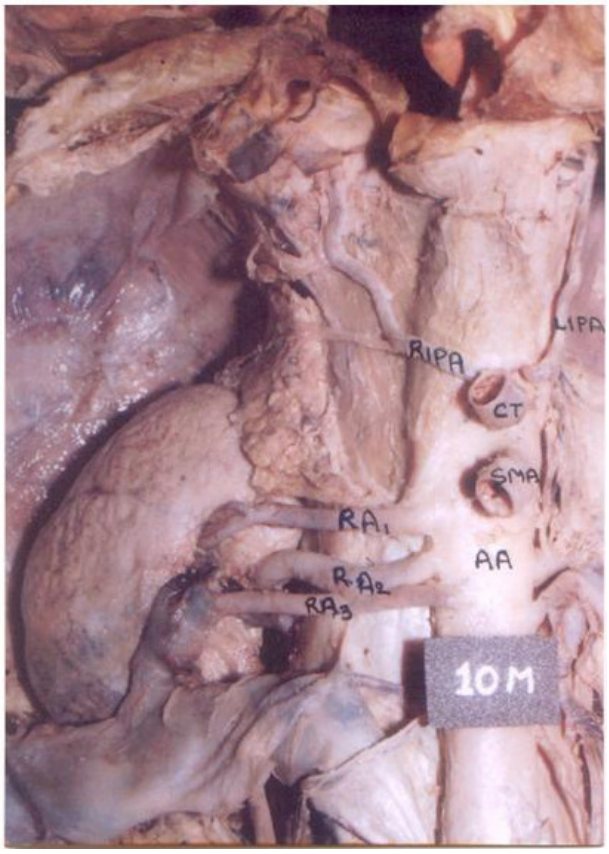
The testicular arteries are paired vessels that usually arise from the abdominal aorta at the second lumbar vertebral level. Each artery passes obliquely downwards and posterior to the peritoneum. Descending on the posterior abdominal wall, it reaches the deep inguinal ring where it enters the spermatic cord [1],[2]. There are reports about the variant origin of these arteries. Awareness of variations of the testicular arteries such as those presented here, becomes important during surgical procedures like varicocele and undescended testes.

Renal arteries are a pair of lateral branches from the abdominal aorta. Normally, each kidney receives one renal artery. Variations in number, source and course of the renal arteries are common. The renal artery may give rise to branches normally derived from other vessels, such as the inferior phrenic, hepatic, suprarenal, gonadal, pancreatic and lumbar arteries [3]. Familiarity about the possible variations in the renal arterial pattern is especially important for the personnel dealing with kidney retrieval and transplantation, various endourological procedures and innumerable interventional techniques. In most of those situations, it is the comprehensive knowledge of the renal arterial pattern which remains the key issue in determining the technical feasibility of surgical interventions as well as the post operative management [4].

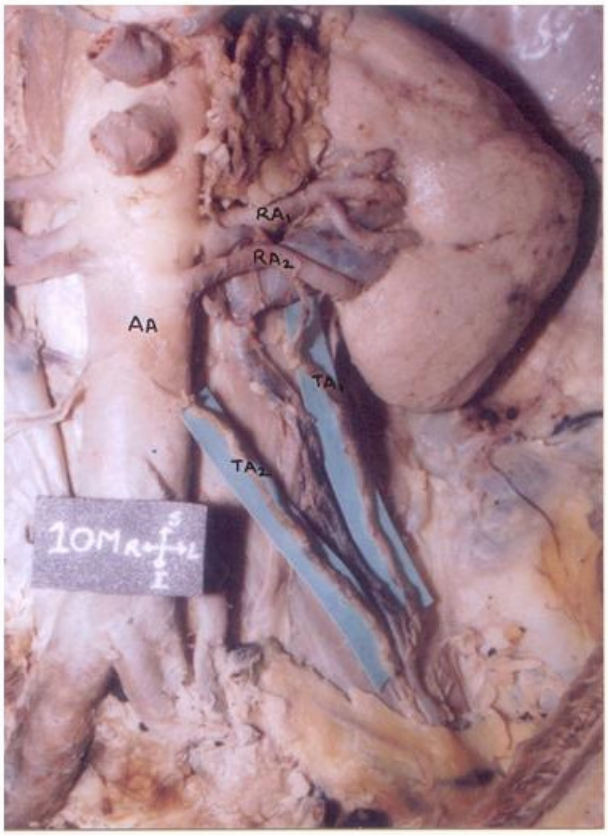
The inferior phrenic arteries usually originate from the aorta or the celiac artery, and less frequently from the renal, hepatic or left gastric arteries. The roentgenographic anatomy of the phrenic arteries has been described in detail by Kahn et al.[5].

Case Report

The study involved the abdominal dissection of a 60 – year – old male cadaver. The present report is about the occurrence of double testicular arteries and double renal arteries on the left side and triple renal arteries on the right side. Also, the right inferior phrenic artery took origin from the celiac trunk and the left inferior phrenic artery originated directly from the abdominal aorta [Table/Fig 1]. The right kidney received three renal arteries, two of which took their origin from the lateral aspect and one from the anterior aspect of the abdominal aorta [Table/Fig 1]. The left kidney received two renal arteries, one from the lateral aspect and one from the anterior aspect. The inferior renal artery gave origin to the superior testicular artery. The inferior testicular artery arose normally from the abdominal aorta [Table/Fig 2]. Also, the right inferior phrenic artery arose from the celiac trunk and the left inferior phrenic artery arose directly from the abdominal aorta.



(Table/Fig 1) Right inferior phrenic artery (RIPA) arising from coeliac trunk (CT) and left inferior phrenic artery (LIPA) arising directly from abdominal aorta (AA). Triple renal arteries on right side.



(Table/Fig 2)Double renal arteries (RA_1, RA_2) seen on the left side Double testicular artery (TA_1, TA_2) seen on left side with superior testicular artery (TA_1) taking origin from inferior renal artery (RA_2) and the inferior testicular artery (TA_2) arising directly from abdominal aorta (AA)

Discussion

Some knowledge about the embryology of the renal vasculature and the structural development of the kidney is essential for the understanding of the multitude of anomalies that may occur. The abnormalities in the renal arteries are mainly due to the various developmental positions of the kidney [6]. The kidneys begin their development in the pelvic cavity and then ascend to their final position in the lumbar region. When the kidneys are situated in the pelvis, they are supplied by the branches of common iliac arteries. While the kidneys ascend to the lumbar region, their arterial supply also shifts from the common iliac artery to the abdominal aorta. Accessory renal arteries arise from the abdominal aorta, either above or below the main renal artery and follow it to the hilum. It is important to be aware that accessory renal arteries are end arteries; therefore, if an accessory artery is damaged, the part of the kidney which is supplied by it is likely to become ischaemic. Variations in the origin, course and branches of the testicular arteries are attributed to their embryological origin. During embryological development, the lateral splanchnic arteries on each side supply the mesonephros, metanephros, the testis or the ovary and the suprarenal gland; all these structures develop, in whole or part, from the intermediate mesenchyme of the mesonephric ridge. One testicular or ovarian artery and three suprarenal arteries persist on each side [7]. In the study by Notkovich, which included 405 testicular or ovarian arteries, the gonadal arteries of renal origin were found, to take their origin from the principal renal artery, from its branches or from an accessory renal artery, as well, in 14 percent of the specimens [8]. In our case, the left testicular artery originated from the superior accessory renal artery. Knowledge of these variations may also provide safety guidelines for endovascular procedures like therapeutic embolisation and angioplasties. Multiple vascular variations near the hilum of the kidney are present in seemingly normal patients and a sound knowledge of possible variations is very useful for radiologists, urologists and surgeons The reported incidence of additional renal arteries has a wide range between 8.7% and 75.7% and they can cause hydronephrosis by compressing the ureter [9]. This anomaly is important in surgical procedures related to the posterior abdominal wall, renal transplantation, abdominal aortic aneurysm, ureter surgery and the vascular pedicles of the kidney. It may also be of practical importance for the correct interpretation of roentgenographic examinations in angiographic procedures. In our case, the relationship between the accessory renal artery and the testicular artery may be important for surgical view; especially in operative or postoperative bleeding. The computed tomography (CT) study described these arteries with slightly greater detail and included actual percentages. It was found that the most frequent origins were from the aorta and the celiac trunk, with 46% of specimens presenting an aortic origin, most commonly on the right side and a celiac origin, most commonly on the left (52%). It was also observed that the right inferior phrenic artery arose from the right renal artery in 9% of the cases studied.

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