The Use of Multi Detector Computed Tomography in Assessing the Retroaortic Left Renal Vein and Accompanying Vessel Anomalies

Retroaortic Sol Renal Ven ve Birlikte Görülebilen Damar Anomalilerinin Değerlendirilmesinde Çok Kesitli Bilgisayarlı Tomografinin Kullanımı

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Abstract

Objective: Because renal venous variations possess potential hazards during abdominal aortic surgery or laparoscopic donor nephrectomy, the detailed preoperative evaluation of the renal vessels with angiography should be performed to avoid vascular injuries. We present multidetector row computed tomography (MDCT) findings of the retroaortic left renal vein (RLRV) with other vascular variations.

Materials and Methods: Twenty-two patients with RLRV were evaluated with MDCT using multiplanar images, MIP images, and 3D volume rendering.

Results: The RLRVs with accessory renal vessels and other variant veins draining into the left renal vein were effectively evaluated in all patients.

Conclusions: MDCT angiography is an effective technique for evaluating abdominal vessels, and it presents adequate images of renal vessels and vascular variations, which pose importance before abdominal surgery.

Key Words: Multidetector row CT, Retroaortic left renal vein, Vascular anomalies

Introduction

Renal vessels may show many variations with respect to their origins and drainage patterns; these variations become important in surgical and endourologic procedures and vascular interventions. Although the most commonly encountered renal vascular variations are the numbers of the renal arteries [1], more uncommon variations are the renal vein variations with their numbers, course, origins, and drainage sites. Recently, these variations can be easily detected in modern imaging techniques. We present multidetector row computed tomography (MDCT) findings of the retroaortic left renal vein (RLRV) with other associated vascular variations.

Materials and Methods

Twenty-four patients with RLRV were evaluated with 16 row MDCT. The mean age was 49 years (range, 30–74 years). The RLRVs were detected on the CT scan in eleven patients with pelvic venous congestion, in seven patients with internal malignancies, and in six cases prior to renal transplantation. In five cases, the RLRV drained into the inferior vena cava at a normal level in fifteen patients, it joined at a lower level to the IVC in seven cases (Fig. 2a, b and c). In eight patients, there were dilatations of the left ovarian vein at the start of the contrast material injection with collimation of 1.5 mm, a 20-gauge catheter. CT scanning was obtained at 25 and 50 sec after the start of the contrast material injection with collimation of 1.5 mm, slice thickness of 1.0 mm, table speed of 7.5 mm per rotation with rotation time of 0.5 seconds, 120 kVp, and 250 mA. After scanning, axial, coronal, sagittal, maximum intensity projection (MIP), and 3D images were evaluated for the numbers and insertion-origin levels of renal arteries and veins with gonadal and adrenal veins.

Results

The RLRV was clearly detected in all patients using multiplanar images and 3D volume rendering images (Figure 1a, b). Although the RLRV drained into the inferior vena cava (IVC) at a normal level in fifteen patients, it joined at a lower level to the IVC in seven cases (Fig. 2a, b and c). In eight patients, there were dilatations of the left gonadal vein and adrenal vein due to renal vein compression by the aorta (Fig. 3a, b). One case showed an accessory vein on the right side (Fig. 4a, b and c). The accessory vein originated from the inferior pole of the right kidney and it drained into the inferior vena cava on the anterior side at lower level. One case had a supplementary artery on the right side and another showed an inferior supplementary artery on the left side with RLRV (Fig. 5). Two cases were presented as the circumaortic left renal vein.
Conclusions

Overall, 92% of people have one renal vein on each side. The left renal vein is approximately 7.5 cm long, and the right renal vein is approximately 2.5 cm long [2]. Variations in the course, number, and arrangement of the renal veins are less common from the renal arterial variations. Renal venous variations and multiple veins are seen more often on the right side than on the left side [2-4].

With an incidence of 1.2%-3.3% [2, 3], the retroaortic left renal vein is a more frequently encountered variation in abdominal surgery or routine cadaveric dissections and in radiological investigations. It consists of the left renal vein crossing posterior to the aorta and has potential hazards to the surgeon during abdominal aortic surgery [4]. It is accepted that a retroaortic left renal vein forms if the dorsal part of the sub-supracardinal anastomosis and the intersupracardinal anastomosis persist. Although a retroaortic left renal vein usually drains into the IVC at a normal level or at a lower level (Fig. 4), it may join with the left common iliac vein and may present with a history of hematuria, dysuria, or recurrent flank pain [5].

The presence of accessory arteries is 32.25% and that of accessory veins is 14.4% [2, 3]. When any accessory vein emerges separately from the kidney and has a separate opening into the inferior vena cava, it is termed an additional renal vein, supernumerary vein, or accessory vein [3]. Accessory veins are seen more frequently on the right side (4.2-26.27.8%) than on the left side (0.1-2.6%). One case in the presented study also showed an accessory renal vein on the right side. While the accessory veins may emerge from kidneys with different origins, they may also show various drainage patterns. They may present one fused opening or separate insertions in the IVC or in another vein. An accessory vein can act as an alternate channel, and its presence or absence can influence the technical feasibility of surgical procedures, such as renal transplantation and endourologic procedures. A large accessory vein could also result in significant bleeding during and after surgery or ureterorenoscopy [3].

We detected two supplementary renal arteries in two cases. The supplementary renal arteries most commonly arise from the abdominal aorta and supply the inferior pole. However, they can also originate from the celiac, superior mesenteric, inferior mesenteric, or iliac arteries. The accessory arteries, which traverse the renal hilum before entering the renal parenchyma, are called polar arteries. They directly enter the renal parenchyma and virtually always supply the superior renal pole [6].

Because renal vascular variations may be responsible for the failure of vascular restoration such as in the resection of a renal tumor or in renal transplantation, or in abdominal aortic surgery, prior knowledge of possible variations of the renal arteries and veins is important to avoid an eventful postoperative course due to inadvertent injury and unwelcome bleeding [4]. Especially, laparoscopic donor nephrectomy with limited operative visibility requires detailed preoperative evaluation of the renal arteries, veins, and collecting system. Therefore, an angiographic evaluation prior to renal surgery should be performed to assess possible renal vascular variations or lesions. The left adrenal and gonadal veins must be evaluated preoperatively because preoperative imaging of these veins may facilitate the dissection of these veins and avoid vascular injury.

Spiral computed tomographic (CT) angiography, a less invasive technique than standard angiography is a generally accepted method in the evaluation of the renal vessels. CT angiography is a technique that is safe, fast, minimally invasive, and relatively inexpensive, and it presents excellent agreement with both catheter angiography and surgery in predicting the variations of the renal vessels. It can also provide preoperative information about other renal vascular diseases, such as aneurysm, arteriovenous malformation, or stenosis [2]. Kim et al. reported that the respective sensitivity and specificity of CT angiography were 86% and 100% for supernumerary arteries, 100% and 100% for early-branching arteries, and 75% and 100% for supernumerary veins [7]. With short data acquisition time, narrow collimation, good spatial resolution, and detailed data sets, MDCT presents excellent anatomic information, increased contrast enhancement of the arteries and veins, thinner section imaging, and improved longi-
Therefore, it provides reduced motion and partial volume artifacts during a single breath hold [7].

CT images of renal arteries and veins are usually obtained at 25 and 55 sec from the start of IV contrast injection, respectively [8]. If a short scanning delay is used, supernumerary veins and early venous bifurcations are missed due to poor opacification of the venous system. A delayed topogram may be obtained 5 minutes after intravenous contrast material administration for evaluation of the renal collecting system and ureters [2].

In conclusion, preoperative evaluation of the renal vasculature due to its complex nature and composition is essential in correct surgical planning and in avoiding serious vascular injury. Especially MDCT with multiplanar and 3D reformatted images can help assess well the renal vasculature and variations with renal anatomy, urinary tract, and renal parenchyma [2, 6, 7].

**Conflict of interest statement** The authors declare that they have no conflict of interest to the publication of this article.

**References**