

CT ANGIOGRAPHY IN EVALUATION OF LIVE KIDNEY DONORS

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ABSTRACT

INTRODUCTION: CT angiography is a feasible diagnostic and noninvasive exam in pre and postoperative kidney transplantation. This study aimed to evaluate the value of CT angiography in assessment of potential donor for kidney transplantation as regards anatomic evaluation and vascular mapping. **METHOD:** Totally 115 patients underwent CT angiographic (GE Light speed QXI/4-row- detector scanner) who candidate for kidney donation, were retrospectively enrolled in this descriptive study at the Tooska medical imaging center between March 2007 and March 2009. The contrast enhanced scans were achieved using 1.25 mm collimation with a table feed of 7.5mm (Pitch of 1.5) from the level of diaphragm to iliac crest. **RESULTS:** We studied 115 patients (91male (79%) and 24 female (21%)) with mean age 30.12±10.27. The incidence of renal accessory artery in our patients was 38.2% (cranial 25%, caudal 16% and middle pole 3%). Also, renal accessory vein was detected in 12 patients (10.4%) (8 cases in Right, 1 case in left and 3 cases bilateral). Moreover, we identified early branching renal artery in 16.5% (10 cases less or equal to 10mm and 9 cases 10-20 mm to origin). In addition, 6.1% of cases showed late confluence renal vein, 3.5% retro or circum-aortic renal vein, 0.9% renal stone, 3.5% decrease of renal function and 7.8% of cases revealed other abnormalities. **CONCLUSION:** Our findings showed CT angiography could be one of the most important exams in the preoperative evaluation of renal donor's candidates. As well it is a reliable and accurate noninvasive evaluation for the revealing of renal artery and vein variations, as well as anatomic and pathologic details of kidneys. **Keywords:** CT Angiography, Kidney, Transplantation.

Introduction

Kidney transplantation is a successful therapeutic option for patients with multiple irreversible acute and chronic kidney diseases and living donor renal transplantation has been shown to offer better graft survival than cadaver donor renal transplantation.^{1,2} However, adequate preoperative living kidney donor evaluation is mandatory to reduce the possible occurrence of surgical complications that can threaten the graft, and sometimes the survival of the recipient.^{3,4}

Successful transplantation requires thorough evaluation of the condition of transplantation candidate, anatomic variations and abnormalities that may alter the surgical approach.⁵

CT angiography is a feasible diagnostic tool in pre and postoperative kidney transplantation. It is also a reliable noninvasive exam for the detection of the vascular anatomy and kidney parenchyma.^{6,7} Moreover, CT angiography is an important part of the preoperative evaluation of patients for laparoscopic nephrectomies and the postoperative evaluation of complications comprising hemorrhage, urinoma, pseudoaneurysm, etc.^{8,9}

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The aim of this study was to evaluate the value of CT angiography in evaluation of potential donor for kidney transplantation as regards anatomic evaluation and vascular mapping.

Method

Totally, 115 patients who candidate for kidney donation at the Tooska radiographic center, between March 2007 and March 2009 were retrospectively enrolled in this descriptive study. The contrast-enhanced scans were achieved using 1.25mm collimation with a table feed of 7.5 mm (pitch of 1.5) from the level of the diaphragm to iliac crest. One hundred milliliters of nonionic contrast material (visipaque 320 mg) was injected at 5 ml/sec through a 19-gauge cannula into the antecubital vein. Delay time between the start of the injection and the beginning of the data collection was determined by bolus tracking technique. The scans were attained during suspended inspiration after hyperventilation. Immediately after the acquisition was completed, the patient underwent conventional abdominal radiography to assess the calices and ureters. The helical axial data were reconstructed with a 0.6 mm overlapping reconstruction. The data were transferred to a 4.1 advanced workstation and curved multiplanar reconstructions were generated using the axial, coronal, and sagittal data, and were viewed in the coronal and oblique planes oriented along the line of the renal arteries, as well as 3D volume rendering and MIP images. Number of Renal artery, veins, prehilum branching of renal artery, late confluence renal vein, any other normal variant and pathology in kidney or abdomen were observed by an experienced radiologist.

(Fig.1) reveals MPR in MIP with VR in some normal variation renal arteries.

All analyses were performed using SPSS software, version 18 (SPSS Inc, Chicago, Ill). Continuous variables are presented as mean±SD values, and categorical data are presented as proportions. A result was considered significant if its probability of occurrence by chance was less than 5% (P< 0.05). The study was approved by the institutional research ethics review committee.

Results

We studied 115 patients (91male (79%) and 24 female

(21%) with mean age 30.12±10.27. We detected renal accessory artery in 44 patients (38.2%) (cranial 2, caudal 15 and middle pole 3). Also, renal accessory vein was detected in 12 patients (10.4%) (8 cases in right side, 1 case in left side, and 3 cases bilateral). Moreover, we identified early branching renal artery in 19 patients (16.5%) 6 patients right, 12 patients left and 1 case bilateral. (10 cases less or equal to 10mm and 9 cases 10-20 mm to origin).

In addition, 7 cases (6.1%) showed late confluence renal vein, 4 patients (3.5%) retro or circumaortic renal vein, 1 patient 0.9% renal stone, 4 patients (3.5%) decrease of renal function and 9 patients (7.8%) revealed other anomaly like renal artery stenosis and renal cyst. Other incidental abdominal findings include mesenteric & paraaortic lymph nodes in four cases, origin of phrenic artery from renal artery in 1 case, liver nodules in 1 case, gallbladder stone in 1 case, calcified adrenal nodule in 1 case, common origin of celiac artery & superior mesenteric artery in 1 case, were detected in 9 (7.8%) kidney donors. The results showed no cases of renal hydronephrosis, renal space occupying lesion or bilateral IVC (Tab.1).

CTA Findings	Rates
Renal accessory artery	44(38.5%)
Renal accessory vein	12(10.4%)
Early branching renal artery	19(16.55)
Late confluence renal vein	7(6.1%)
Retro or circumaortic renal vein	4(3.5%)
Renal stone	1(0.9%)
Decrease of renal function	4(3.5%)
Other anomaly	9(7.8%)
Other incidental abdominal findings	9(7.8%)

Table 1: CT angiography findings

Discussion

The complex vascular anatomy of the kidney and the high prevalence of vascular variations reinforce the need for accurate preoperative vascular imaging in transplantation. In this study we showed CT angiography can provide surgeons with most of the necessary preoperative vascular and volumetric data required for renal donation. In addition, the results of our study support that the use of CT angiography as an extensive evaluation tool to assessment of the renal parenchymal morphology and detailed analysis of its anatomy and possible pathologies. Moreover, the CT examinations were well tolerated by all the candidates with no detected adverse reaction. We examined CTA on 115 patients (91male (79%) and 24 female (21%))

with mean age 30.12 ± 10.27 . Our findings were in line with previous reports in some cases. For instance, the incidence of renal accessory artery in our patients was 38.2%, and in earlier studies were about 23-40%.^{10,11,12,13} In addition the incidence of renal accessory vein in some studies was 9-28%^{11,13,14,15,16} and in our study was (10.4%). More over we detected retro or circumaortic renal vein in 3.5% also, other reports in this case were 3-17%.^{17,18} However, our findings in some cases were different from other studies; for example, the incidence of early branching renal artery in our study was higher than previous reports (16.5% vs.12%),^{19,16} and prevalence of late confluence renal vein in our survey (6.1%) was

lower than earlier studies (16%).¹ These difference may be because of subtle differences in definition of late confluence vein and early artery branching and difference in race between our study and previous reports.

Conclusion

Our findings supported the results of earlier studies and showed CT angiography is one of the most important tools in the preoperative evaluation of renal donor's candidates. As well it is a reliable and accurate noninvasive exam for the revealing of anatomic renal artery variations.

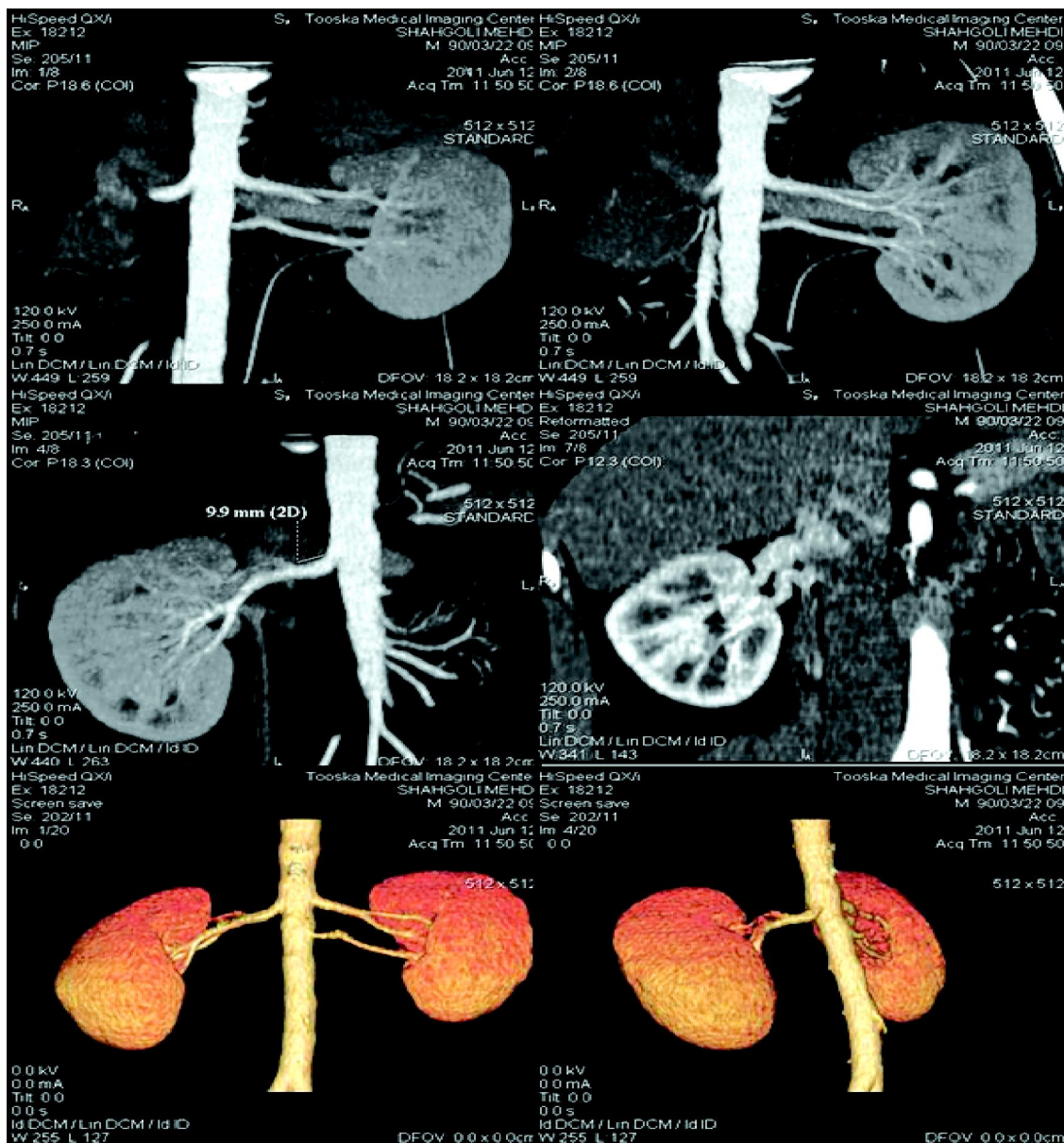


Figure 1: MPRs and VR images show early branched Rt. renal artery, duplicated Lt. renal artery, duplicated Rt. renal vein.

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