Role of Multidetector Computed Tomography for Evaluation of Living Kidney Donors

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Background: Kidney transplantation from living donors has been increased recently. Preoperative evaluation of living donor is important to select the appropriate kidney for transplantation and to decrease donor surgical complications.

Objectives: The aim of this study was to compare the accuracy of the use of multidetector computed tomography (MDCT) to evaluate vascular anatomy in living kidney donors with traditional angiography.

Patients and Methods: A total number of 60 living kidney donors who underwent open surgical approach for transplantation were selected: Kidney anatomy of donors evaluated by CT angiography (group 1) or traditional angiographic examination (group 2). Renal vessels anatomy was compared with surgical findings in both groups.

Results: The accuracy for detecting number of main renal arteries were not different in both groups which were 96.7% in CT angiography group and 90% in traditional angiography group (P = 0.15). The accuracy for detection of main renal veins were 100% in group 1 and 96.7% in group 2 (P = 0.31).

Conclusions: MDCT has the same accuracy as traditional angiography to detect renal abnormalities in living kidney donors.

Keywords: Kidney Transplantation; Multidetector Computed Tomography; Tissue Donors
2 respectively. All patients underwent open nephrectomy in our institute transportation program manner.

Patients in group 1 were examined by Phillip Brilliance 64-slice MDCT with 0.6 mm collimation 120 kVp 0.75 mm slice thickness and rotation speed of 33 gantroy. Sequence was performed after a delay of 20 arterialis following the commencement of an infusion of 120-150 mL non-ionic contrast medium (4 mL/s) via an antecubital vein. The time of maximum aortic enhancement in the era of read arteries was detected and scanning continued for 5 seconds after that time to view renal cortical perfusion. Patients in group 2 underwent standard selective renal angiography with femoral access. Renal vessels anatomy was compared with surgical findings in both groups.

4. Results

Thirty patients in each group underwent open donor nephrectomy. As mentioned in Table 1, sensitivity, specificity and accuracy for detecting number of main renal arteries were 96.7% in group 1 and 90%, 100% and 90% in group 2, respectively (P = 0.15). Sensitivity, specificity and accuracy of two modalities for detecting early arterial branch was 100% in both groups (P = 0.21). Sensitivity and accuracy for detecting accessory artery were 50% and 93.3% in CT angiography group and 28.6% and 83.3% in selective angiography group respectively while specificity was 100% in both groups (P = 0.23).

Sensitivity and specificity for determination of main renal veins were 100% in group 1 and 96.7% in group 2 (P = 0.31). 76.7% of gonadal veins were detected in group 1 compared with 22.3% in group 2 (P < 0.001). CT angiography and conventional angiography revealed 30% and 33.3% of lumbar veins respectively (P = 1). 40% of suprarenal veins were detected by CT angiography and 6.7% were detected by selective angiography (P = 0.005).

Table 1. Report of Sensitivity, Specificity and Accuracy and Comparison of Two Methods

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity, %</th>
<th>Specificity, %</th>
<th>Accuracy, %</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detecting Number Of Main Renal Arteries</td>
<td>96.7</td>
<td>90</td>
<td>96.7</td>
<td>100</td>
</tr>
<tr>
<td>Detecting Early Arterial Branch</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Detecting Accessory Artery</td>
<td>50</td>
<td>28.6</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Determination Of Main Renal Veins</td>
<td>100</td>
<td>96.7</td>
<td>100</td>
<td>96.7</td>
</tr>
</tbody>
</table>

* Abbreviation: MDCT, multidetector computed tomography; TAE, traditional angiographic examination

5. Discussion

Detection of the anatomy of renal arteries and confirmation of the absence of any parenchymal critical disease or tumors is essential for preoperative evaluation of potential renal donors. In a healthy donor the left kidney is usually harvested because of its longer pedicle. Digital subtraction angiography (DSA) has been used to recognize the number and length of renal arteries and assessment of unsuspected renal artery diseases such as atherosclerosis, aneurysm, fibromuscular dysphasia and arteriovenous malformation. Multiple renal arteries are the most important frequent finding in potential read donors and have been reported in 24-27% of renal arteriograms (11, 12).

Near half of the multiple rend arteries enter the polar region (13). The sensitivity of conventional angiography in visualizing total renal arteries in autopsy is 90% (12).

Previous studies have been shown that CT angiography is a non-invasive technique with appropriate sensitivity and specificity to distinguish significant renal artery stenosis (14-18). Beregi et al. (15) showed that CT angiography had a sensitivity of 100% and 98% specificity for main renal artery stenosis. Limitation of CT angiography is in the diagnosis of fibromuscular hyperplasia and use of contrast media in it (19).

Another new imaging modality which has been used for evaluation of kidney donors with reported sensitivity and specificity for main renal stenosis of 93-100% and 92-98% respectively is magnetic resonance angiography (20-24). Low ability to determine calcifications, high cost...
and limited access to MRI centers are limitations of MR angiography.

Zhang J et al. in their paper showed that multidetector-row computed tomography is helpful in accurately evaluating the renal anatomy of potential donors, thus facilitating planning of surgery (25).

Hänninen EL and colleagues in a study on 51 living kidney donors concluded that MDCT demonstrated superior accuracy compared with non-selective DSA for the pre-operative assessment of renal anatomy in living kidney donors, and for the distinction of supernumerary arteries versus early branching patterns, 64-channel CTA data were better than those of the four-channel system (26).

Kawamoto S et al. in their paper mentioned that multi-detector row CT scanners offer shorter image acquisition time, narrower collimation, better spatial resolution, and less tube heating than single-detector row CT scanners. Multi-row scanners also provide more complete anatomic coverage, increased contrast enhancement of the arteries, and greater longitudinal spatial resolution, all of which are important both for accurate imaging of the renal vasculature and for three-dimensional post-processing of image data. They also recommended making the most effective use of this method; radiologists must be familiar with its technical aspects, advantages, and potential pitfalls. They also must be able to identify variations in vascular, renal and extra renal anatomy that are important for laparoscopic donor nephrectomy (27).

In conclusion, CT angiography is an accurate, safe and non-invasive imaging modality for detection of renal artery and vein abnormalities in potential living kidney donors. MDCT has the same accuracy as traditional angiography for detecting renal abnormalities in living kidney donors.

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Authors’ Contribution

Baratali Aghsari: design of study, Mansour Babaei: data collection, Alireza Vaziriya: data analysis and writing, Abdolreza Babamahmoodi: revising and scientific writing and publish management.

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References


