

## CASE REPORT

# Non-contrast-enhanced magnetic resonance angiography as part of a kidney pretransplantation work-up in a 19-month-old boy – a case report

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## ABSTRACT

Kidney transplantation (KT) is the optimal method of renal replacement therapy in children with end-stage kidney disease. An assessment of the anatomy of the recipient's abdominal and pelvic vasculature is an element of the pre-KT work-up. We present an uncommon application of non-contrast-enhanced magnetic resonance angiography (NC-MRA) within a pre-KT work-up of a young child with residual kidney function. Due to the history of multiple cannulations of the patient's femoral veins and the possible risk of inferior vena cava thrombosis, performance of contrast-enhanced computed tomography angiography (CCTA) was requested by the transplantation center. However, considering the significant risk of post-contrast loss of the patient's residual kidney function, we decided to perform NC-MRA. It accurately confirmed the preserved patency of the arterial and venous vessels of the abdomen and pelvis. We believe that NC-MRA may be considered as an alternative method to CCTA in selected pediatric KT candidates.

## KEY WORDS:

**magnetic resonance angiography, kidney transplantation, non-contrast.**

## INTRODUCTION

Kidney transplantation (KT) is the best mode of renal replacement therapy in children with end-stage kidney disease. Depending on the recipient's weight and the donor's kidney size, extra- or intraperitoneal spaces are used for the graft's placement. In the former approach, vascular anastomoses are typically made to iliac vessels, whereas in the latter one, the recipient's inferior vena cava (IVC) and aorta may be used [1]. Although KT may be successful in patients with vascular abnormalities, pathology of the vasculature can have an influence on technical procedures and graft survival [2–5]. Therefore, an assessment of the recipient's abdominal and pelvic vascular anatomy is an important part of the kidney pretransplantation (pre-KT) work-up [3–5]. Although Doppler ultrasound is

usually sufficient, the performance of contrast-enhanced angiographic imaging modalities is proposed in selected cases.

In this report, we describe an uncommon application of non-contrast-enhanced magnetic resonance angiography (NC-MRA) within a pre-KT work-up of a young child with residual kidney function.

## CASE REPORT

The boy was born at the 37th gestational week with severe asphyxia (Apgar score 0, 1, 3, 3 at 1, 3, 5 and 10 minutes, respectively) due to placenta abruption, congenital sepsis and pneumonia. To prevent hypoxic ischemic encephalopathy he was immediately treated with therapeutic hypothermia. Due to oliguric renal failure,

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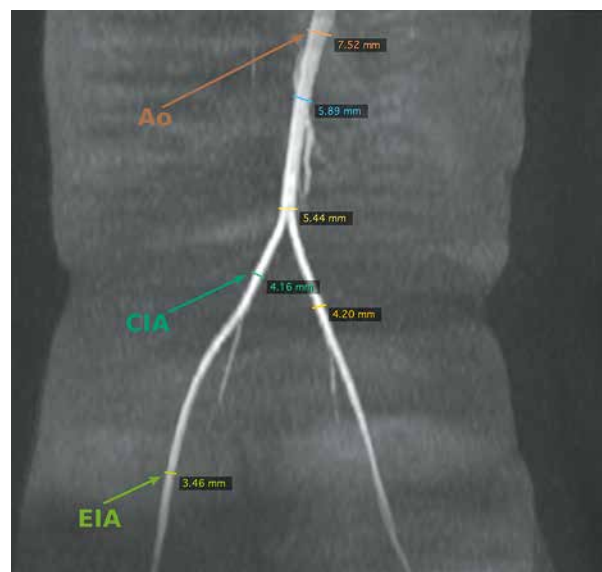
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on the 4<sup>th</sup> postnatal day, continuous peritoneal dialysis (CPD) was started.

Within the first months of life, he was treated at the intensive care unit due to his poor general condition and multiorgan complications, including several sepsis episodes. During this time the boy underwent multiple cannulations of the femoral veins to obtain central venous access. At the age of 4 months his renal function slightly improved (eGFR ca. 10–15 ml/min/1.73 m<sup>2</sup>) and discontinuation of CPD was possible. Since then, the conservative treatment of chronic kidney disease (CKD) grade 5 has been continued and satisfactory physical and psychomotor development was observed. As at the age of 19 months his weight reached 9 kg, pre-KT work-up, including assessment of possible vascular access for kidney graft, was started. Although abdomen and pelvis vasculature in Doppler ultrasound was assessed as normal, considering possible case-related limitations of imaging accuracy, performance of contrast-enhanced computed tomography angiography (CCTA) was requested by the transplantation center. However, considering the significant risk of post-contrast loss or deterioration of the patient's residual kidney function, we decided to perform non-contrast enhanced magnetic resonance angiography (NC-MRA) as an alternative. The examination was conducted under general anesthesia using the SIGNA Artist 1.5T GE scanner at the Department of Radiography, Medical University of Lublin. The study protocol comprised 3D Heart, 2D FIESTA sequences obtained in axial and coronal planes. The arterial and venous vessels of the abdomen, pelvis and femoral area were visualized including the abdominal aorta, IVC, common iliac arteries and veins, external and internal iliac arteries and veins as well as femoral arteries and veins (Figures 1–3). The examination was completed without complications and confirmed the preserved patency of the assessed vessels. The accuracy of NC-MRA scans was considered fully satisfactory. Finally, the patient was enrolled on the national transplant waiting list as a candidate for KT.

## DISCUSSION

In comparison to adults, KT in children is characterized by a unique approach, mainly due to the different etiology of CKD, specificity of developmental age and smaller recipients' body size. KT is usually performed at a minimal recipient weight of 10 kg but it may be considered below this threshold in selected cases [6]. Nevertheless, KT in such patients may be technically challenging for anatomical reasons, including small vessel sizes, making the creation of sufficient vascular anastomoses with renal graft problematic. A particular problem is pre-existing IVC thrombosis, which may be asymptomatic due to collateral venous flow and may be occasionally discovered only at the time of KT, leading to its interruption [5]. Obviously, this scenario would be especially dramatic in

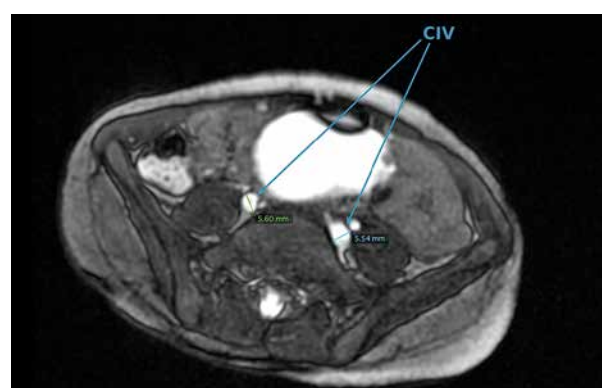


**FIGURE 1.** Measurement of aorta and common iliac arteries. Phase contrast (inhance velocity – GE, phase contrast – Siemens, Philips). Coronal plane

*Ao – abdominal aorta, CIA – common iliac arteries, EIA – external iliac arteries.*



**FIGURE 2.** Measurement of inferior vena cava (IVC). Balance steady state (TrueFISP – Siemens/FIESTA – GE/balanced FFE – Philips). Axial plane



**FIGURE 3.** Measurement of common iliac veins (CIV). Balance steady state (TrueFISP – Siemens/FIESTA – GE/balanced FFE – Philips). Axial plane

the case of living donor KT. IVC thrombosis in children is mainly a complication of indwelling catheters inserted into the femoral vein, sepsis, disseminated intravascular coagulation, nephrotic syndrome, or congenital thrombophilias [3, 5, 7]. Therefore, there is no doubt that pe-

diatric KT candidates, especially those with risk factors such as our patient, should be carefully screened for vascular inflow abnormalities which may affect the surgical technique and impair graft survival [1]. However, to our knowledge, there is no general consensus regarding which imaging modality is preferable in this issue, especially in patients with residual kidney function.

The Doppler ultrasound examination is the first line modality in the pre-KT evaluation of the recipient's deep abdominal vessels, particularly IVC and both iliac veins' patency [8]. However, its accuracy may be dependent on the patient's age and abdominal status, as well as the operator's experience [3, 9]. Therefore, it seems to be advisable to perform a more detailed evaluation in patients with a high risk of thrombotic complications and obviously in all cases with abnormal results of vascular ultrasound screening [2, 3, 5]. As methods of choice, providing more detailed anatomic information, contrast-enhanced CTA or MRA is usually proposed [3, 10]. Administration of an iodine-based contrast medium during CTA may lead to acute deterioration of residual kidney function, and exposure to gadolinium-based contrast agents required for MRA may induce nephrogenic systemic fibrosis [11, 12]. Therefore, non-contrast, high-resolution imaging techniques such as NC-MRA could be a beneficial alternative. However, data on the utility of NC-MRA in pre-KT work-up are sparse and limited to adults. In one study, NC-MRA was efficient in the detection of iliac artery stenosis but, as expected, failed to reveal small arteriosclerotic changes or vascular calcifications [13]. NC-MRA was also reported as a feasible modality for vascular visualization in liver transplantation recipients with impaired renal function [14]. Recently, NC-MRA was shown to be a reliable, valid and safe alternative to contrast-enhanced MRA for identifying crossing renal vessels in young children with hydronephrosis [15].

## CONCLUSIONS

To the best of our knowledge, our report shows for the first time the application of NC-MRA within a pre-KT work-up of a young child with residual kidney function. We believe that this technique may be an alternative to CCTA in selected pediatric KT recipients, but further experience is needed to confirm this opinion.

## DISCLOSURE

The authors declare no conflict of interest.

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