3D CT angiography of infrarenal abdominal aortic aneurysm with associated ectopic pelvic kidney: A case report of rare concomitance

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ABSTRACT

The association of abdominal aortic aneurysm (AAA) with congenital pelvic kidney is an uncommon condition. We present a case of an infrarenal AAA with associated congenital left pelvic kidney followed up for 5 years, which was managed by regular surveillance. We describe this case to assist physicians and radiologists to recognize small aneurysms by computed tomography angiography (CTA) with low radiation dose and low iodine dose. To the best of our knowledge, this is the first case report by using CTA with the combination of low-concentration contrast medium, low radiation dose and iterative reconstruction.

Key words: Abdominal aortic aneurysm, Congenital anomaly, Pelvic kidney, computed tomography angiography

INTRODUCTION

Association of abdominal aortic aneurysm (AAA) with congenital pelvic kidney is an extremely rare clinical finding. To our knowledge, only 29 previous cases have been reported in the literature [1-12]. Nowadays, ultrasonography, computed tomography angiography (CTA) and invasive angiography are the commonly used imaging modalities of detecting this anomaly. The conventional methods of diagnosis are ultrasound and CTA.

Previous reports have described various methods of aneurysm repair, such as conventional open surgical repair and endovascular aneurysm repair. The technical challenge is to preserve the function of the pelvic kidney [5]. However, small AAAs (3.0–5.4cm in diameter) are usually asymptomatic and managed by regular surveillance until they grow to a diameter threshold (commonly 5.5 cm) at which surgical intervention or endovascular repair is considered [13]. We report a case of small AAA with congenital pelvic kidney. In particular, in this case report, we demonstrate the feasibility of using low-dose, low concentration contrast medium CTA in the diagnostic assessment of both aortic disease and associated other pathologies.

CASE REPORT

Patient consent was obtained for using the de-identified images and patient information. Upon routine clinical health examination 4 years ago, a 64-year-old woman was noted to have a left-sided pelvic kidney and an infrarenal AAA of 4 cm in diameter detected by ultrasound examination. Her medical history included hypertension and hyperlipidaemia, which were well controlled on monotherapy, without presenting with any symptoms and diabetes. Presently, the patient was referred to undergo follow-up CTA which was performed on a 128-slice dual-source computed tomography (DSCT) (SOMATOM Definition Flash, Siemens Healthcare, Germany) whole aortic angiography for regular surveillance. The scanning parameters were as follows: prospective electrocardiogram-triggered Flash protocol; slice collimation, 128×0.6mm; pitch, 3.2; tube voltage 100kV; sonogram- affirmed iterative reconstruction, vascular kernel (I26f). The patient received low-concentration contrast medium (270mg I/mL, Iodixanol270, GE Healthcare), the contrast medium dose was tailored to patient body weight using 1mL/kg. Injection rate was 4mL/s. The iodine flux was 1.08g iodine/s and iodine load was 20.25g. The effective radiation dose was 4.14 mSv. With the use of axial data, reconstruction was performed to generate volume rendering (VR, Fig 1A), multiplanar reformation (MPR, Fig 1B) images.

CTA revealed the AAA of the distal aorta, and the renal artery of the pelvic kidney originated from the AAA. The maximum diameter of AAA was measured 4cm. The right kidney and its renal artery were normal as shown in the figure.

Because the aneurysm diameter is 4cm, and it has remained unchanged for 5 years, it is managed by regular surveillance until the aneurysm grows to a diameter threshold at which surgical intervention or endovascular repair is considered.

DISCUSSION

The occurrence of a pelvic ectopia renis (pelvic kidney) is an uncommon condition with an incidence of 1 in 2100—3000 births [8]. Congenital pelvic kidney is the most uncommon of the six types of renal ectopia (pelvic, lumbar, abdominal, cephalad, thoracic and crossed). Congenital pelvic kidney results from failure of embryological kidney to ascend during 4th–8th weeks of gestation [1]. It is associated with a short ureter, entering the bladder on the same side as the kidney. The arterial supply can arise from distal aorta, its bifurcation, common or external iliac arteries. In this case report, the arterial supply of the pelvic artery arises from the aortic bifurcation as shown in the figure.

Previously reported 29 cases showed larger AAAs than the one reported in this case, with 28 cases undergoing open surgical repair, while the remaining one case was treated with customised endovascular prosthesis. In this case report, the AAA is a small one (3.0–5.4cm in diameter) and it is usually managed by regular surveillance. Thompson SG, et al. in their meta-analysis demonstrated that most of the small AAAs remain quiescent over many years, and are usually managed by regular surveillance until they grow to a diameter threshold (5.5cm) at which surgical intervention is considered [13]. Their analysis showed that lengthening the surveillance intervals from 1 year to the diameter of 3.0–4.4-cm AAAs was cost-effective. Certainly, the choice of appropriate surveillance intervals is governed by the growth and rupture rates of small AAA. This meta-analysis provides strong evidence that the growth rate for a 3.5-cm aneurysm is estimated at 1.9 mm/year, whereas that for a 4.5-cm aneurysm is 3.5 mm/year. It would take on average 6.2 years for a 3.5-cm aneurysm to grow to 5.5 cm, whereas a 4.5-cm aneurysm would take only 2.3 years. So surveillance intervals for a 4.5-cm aneurysm should be of the order of one-third of those for a 3.5-cm aneurysm. In our case, the aneurysm of 4 cm remained unchanged within 4 years, indicating the slow grow rate. In addition to the aneurysm diameter, follow-up and management of small AAAs could potentially be tailored to factors such as

current smoking, diabetes and blood pressure.

Preoperative diagnosis is necessary in order to plan the surgical treatment which is closely related to the anatomical variant encountered in each individual patient, as well as the follow-up of small AAA. Ultrasound scanning is the routine method for an AAA, as it is simple, safe, inexpensive and readily accessible. However, the measurement of infrarenal aortic diameter by ultrasound can differ from CT by ±2 mm, indicating the underestimation of aneurysm diameter by ultrasound. CT measurements are appropriate for follow-up of fast growing AAA of 4–4.9 cm, which are very likely to reach a surgical size in the short-term. The AAA smaller than 4 cm expands slowly, thus they are very unlikely to require a surgical repair in 5 years [14].

CT and magnetic resonance angiography (MRA) provide information about both an AAA anatomy and ectopic pelvic kidney with feeding arteries and veins. Current advancements in the CTA and MRA techniques have significantly improved the sensitivity and specificity of these methods. Conventional intra-arterial angiography is the gold standard technique which allows studying the renal artery anatomy with the highest sensitivity, identifying even small branches or accessory renal arteries that may be misdiagnosed with other techniques, however, it is an invasive procedure [7]. Intravenous pyelography may provide further information about the path of the ureters. It has been shown in the previous 29 cases that CT is the method of choice for preoperative identification of both the AAA and any associated renal anomaly, and three-dimensional CT was helpful for the accurate planning of the operation [3,12]. For this case, it is reasonable that CTA were performed. To reduce the X-ray radiation hazards and the amount of iodine hazards, high-pitch scanning mode, lowering tube voltage and low-concentration CM are combined. IR technology is used to overcome a limitation that low tube voltage may result in increased noise, and to improve image quality [15]. To our knowledge, this is the first report of demonstrating the use of CTA of low-concentration CM (270mg I/mL) combined low radiation dose and IR showing the rare concomitance with good image quality, and the recorded case of AAA regular surveillance with a native pelvic kidney.

CONCLUSION

We present a case report of infrarenal AAA with congenital pelvic kidney that was managed by regular surveillance by using CTA of low- concentration contrast medium combined low radiation. It not only offers benefit for the patient, but also provides the diagnostic images for the case with

excellent demonstration of 3D relationship between the ectopic kidney and aortic aneurysm as well as aortic branches. This case report highlights the feasibility of using aortic CT angiography in the follow-up of AAA while in the meantime detecting other associated anomalies such as pelvic kidney as seen in this case, and providing guidance on management of e the small AAA.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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Declared none.

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Figure legends

Figure 1A. Volume rendering of CT angiography revealed the small AAA of the distal aorta, the right kidney, the pelvic kidney, and the inferior mesenteric artery (IMA).

Figure 1 B. Multiplanar reformation showed the renal artery of pelvic kidney originated from the AAA, and thrombus in the AAA.

Figure 1A

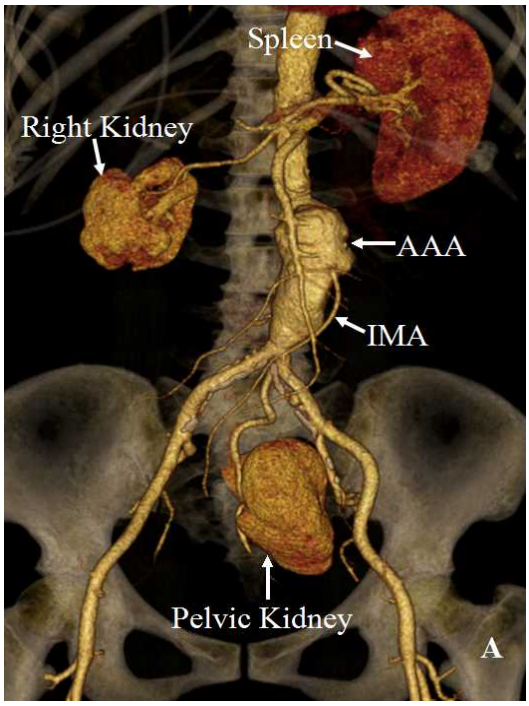

Figure 1B