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Case Report

Combination of Sac packing and liquid embolization using Double Microcatheter Technique for Renal Artery Aneurysm: A Case Report

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Abstract

Renal artery aneurysm (RAA) is one of the rare visceral aneurysms and has an estimated incidence of 0.1% in the general population. When the aneurysmal sac is irregular and larger than 2cm in diameter, treatment is needed for preventing its rupture. There are many methods for the treatment of RAA. Here we report the treatment of a RAA patient with a double microcatheter technique (DMT) to embolize renal hilar region aneurysm using coils and glue. Further, we also review the literature and propose that DMT is an effective and optional treatment for RAA.

Keywords: Renal Artery Aneurysm; Therapeutic Embolization; Endovascular Procedures

Introduction

Renal Artery Aneurysm, a type of aneurysms of the visceral arteries, is rare but clinically crucial vascular conditions. Most of the true visceral artery aneurysms are inherently degenerative or atherosclerotic, with histologic specimens demonstrating smooth muscle loss, elastic fibers disruption, and the arterial media's deficiency. Visceral aneurysms mostly remain asymptomatic and are diagnosed incidentally. Visceral artery aneurysms are routinely diagnosed with ultrasound, computed tomography angiography (CTA), magnetic resonance angiography (MRA), and invasive catheter digital subtraction angiography (DSA). In this case report, we report the treatment of an RAA patient with a double microcatheter technique (DMT) to embolize renal hilar region aneurysm using coils and glue. This report also reviews the literature to elaborate on this case.

Case report

A 54-year-old woman was presented to the department of Interventional radiology for a renal artery aneurysm. She had been suffering from functional constipation and gastric polyps for the last 8 years. A month ago, she went to the outpatient clinic for help with abdominal pain. An enhanced CT scan was performed for assessing suspected intestinal obstruction. A left hilum RAA measuring 23mm × 22mm in size was diagnosed incidentally. She had no history of microbial infections such as specific viruses. CTA examination suggested a regular and round saccular aneurysm with a narrow neck and a small branch on the sac (Figure 1). The abdominal pain significantly improved after symptomatic treatment. A month later, she was presented to the department of interventional radiology for a renal artery aneurysm. Although the abdominal pain was not

evidently related to the aneurysm and that there was no possibility of aneurysm rupture. However, the patient was under considerable psychological pressure and was worried about the aneurysm rupture therefore, demanded further treatment. The patient was subjected to, endovascular embolization after the multidisciplinary discussion and assessment (Figure 2).

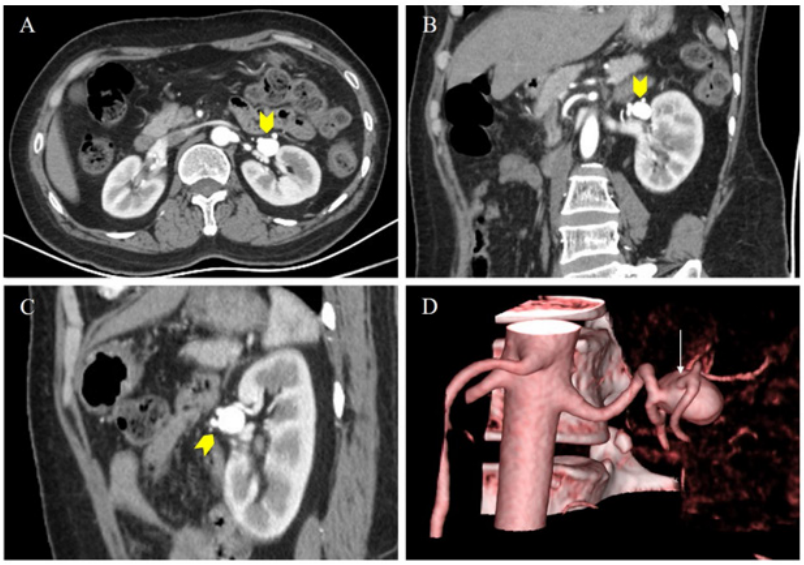

Figure 1.

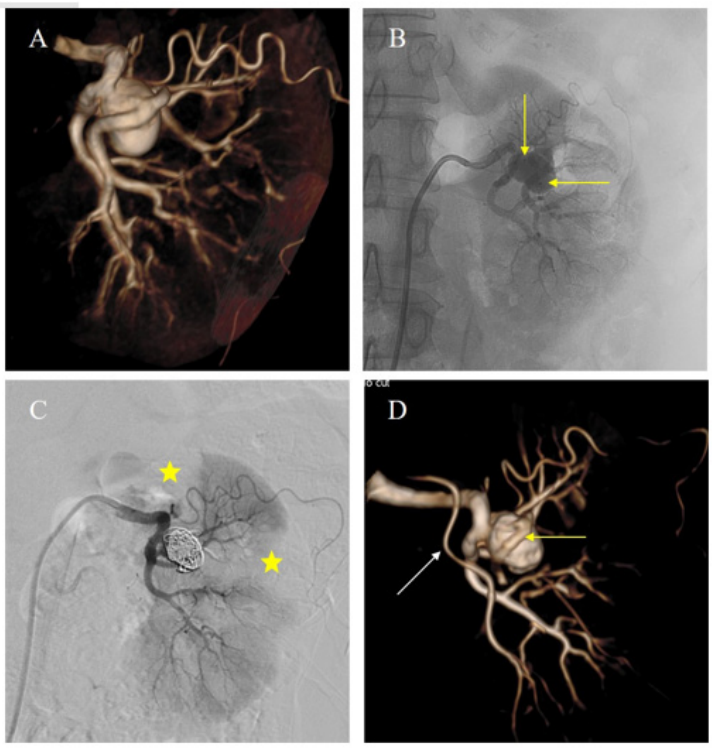

Figure 2.

Given the small branch of the aneurysm, occlusion of the branch was not expected to cause massive infarction of the renal cortex as seen later on the follow-up of 3 months after CT (Figure 3) and serologic renal function index (Table 1). The double microcatheter technique was used for endovascular embolization after obtaining the written informed consent.

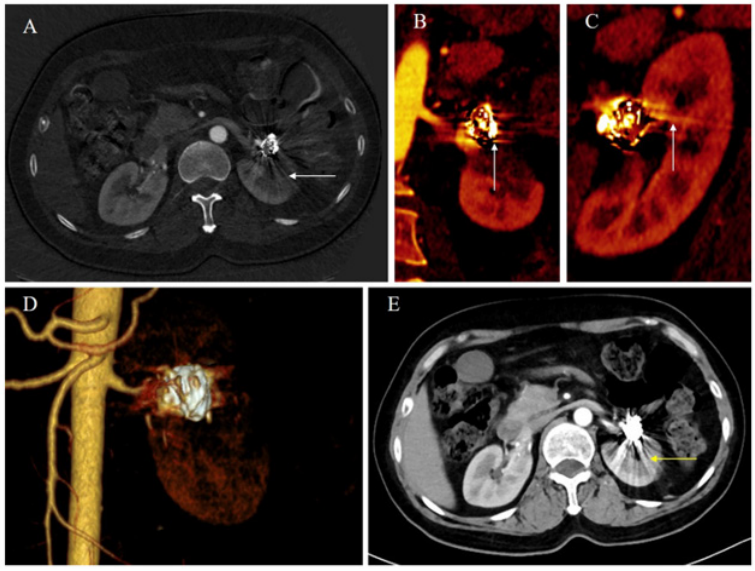

Figure 3.

RDC (Cordis VISTA BRITE TIP) guiding catheter was placed in the main left renal artery for conventional DSA and 3D-DSA. Volume Render (VR) was then performed to formulate the protocol for the next treatment. Two microcatheters, one placed at 10 o'clock and the other at 5 o'clock, were then implanted within the aneurysmal sac using the coaxial catheter technique. First, embolization was performed simultaneously with the sac packing technique through the double microcatheter using two detachable coil embolization systems (Interlock Fibered IDC occlusion system; 0.018 inches; Boston Scientific). After releasing the coils, a mixture of iodized oil (Lipiodol; Guerbet, Roissy, France) and n-butyl-2 cyanoacrylate (Glubran 2®, GEM, Viareggio, Italy) in a 3:1 ratio (33% concentration) was embolized via the 5 o'clock microcatheter. After satisfactory embolization and filling the sac with liquid embolization agent, the glue injection was stopped and the microcatheter at 5 o'clock was pulled out. This was followed by slowly injecting an emulsion of glue and iodized oil through the microcatheter at 10 o'clock. When the liquid embolization material was filled near the sac neck, the injection was stopped and the microcatheter was pulled out 50 seconds later. Immediate angiography was performed to confirm aneurysmal sac occlusion. 3D-DSA was taken to assess the renal cortex's infarct volume. Eventually, the residual renal preservation volume was about 90% (Figure2). There were no significant fluctuations in eGFR, Serum urea, Serum creatinine, and 99mTc-DMSA before the operation, and 1 month, and 3 months after operation (Table1).

Table 1: Pre- and post-procedural eGFR, serum parameters and 99mTc-DMSA.

Parameters	Pre-Embolization	1-Month post Embolization	3 Months post Embolization
eGFR (mL/min/1.73 m2)	80.2	70.7	78.8
Serum urea (mmol/L)	6.9	5.8	6.5
Serum creatinine (μmol/L)	93.5	88.4	89.9
99mTc-DMSA (%)	98	93	89

Note: eGFR: estimated glomerular filtration rate; Hb: hemoglobin; Htc: hematocrit; 99mTc-DMSA: technetium-99m dimercaptosuccinic acid.

Discussion

In clinical practice and autopsies, less than 0.1% of patients with ruptured or unruptured renal aneurysms are admitted [1], however, this can be an underestimated number. The number of such patients has recently increased owing to the use of more effective diagnostic tools such as CTA and angiography [1-3]. Though CTA and enhanced CTA have been highly sensitive, specific, and accurate in the diagnosis of vascular disease [4,5], however they do not provide a complete blood supply to the renal parenchyma of the small efferent branch of the sac. DSA, especially 3D-DSA, can provide more anatomical information for further evaluation during endovascular treatment [6]. In our center, 3D-DSA is often used as the auxiliary diagnostic tool [7].

Although renal artery aneurysm is rare, it can be life-threatening if not treated properly or intervened. The indications of RAA are still controversial [8,9]. Studies have shown that a RAA with a diameter of larger than 2cm is the critical value for intervention [8]. The detection of its size or whether there is a rupture trend seems to be a time-consuming process. Aneurysm morphology is an essential factor for immediate intervention, but the patient's

age, blood pressure, blood glucose, and childbearing age still need to be considered comprehensively [1,9-12]. RAA-related mortality may be low in the general population, however, it can be higher in emergencies, such as a sudden increase in abdominal pressure [10]. Furthermore, renal aneurysms with functional renal artery stenosis may be at higher risk [1,3,13]. However, aneurysms of any size can be treated therapeutically in cases the patients know about aneurysm in the body and they are under apsychological burden [14,15].

Various treatment modalities are currently employed for aneurysms. Aneurysm clipping, aneurysmal parent artery resection, angioplasty, and bypass grafting are the most classical treatment modalities with high success rates and low complications [16-20]. A review of the literature over the last 4 years shows that renal aneurysms are increasingly treated with endovascular techniques [11,21-39] (Table 2). The techniques used in endovascular therapy are varied, including endovascular coiling, remodeling techniques (such as balloon- and stent-assisted coiling), covered stent implantation, and flow diverter [8, 21,40-45]. This patient had a tortuous course of the aneurysm parent artery, and peritoneal stenting was difficult and more costly. The aneurysmal neck was narrow and the branch of the aneurysmal sac was delicate, making it unsuitable to use remodeling techniques and flow diverter. Thus, Sac packing was the best treatment option for this patient.

Table2: Literature review of Renal Artery Aneurysm.

Author, year	Sample size (n)	Age, Sex	Aneurysm location	Etiology	Treatment	Outcomes
Rodriguez Rapale VA, et al. [21]	3	61, Male	Right Hilar Renal Artery	NA	Coil embolization and covered stent	Renal preservation 75%-80%
		61, Male	Right	NA	Coil embolization and covered stent	Renal preservation 65-70%
		65, Male	Right	NA	Coil embolization and covered stent	Renal preservation 90%
Zhang B, et al. [22]	1	23, Female	left anterior superior segmental artery	Neurofibromatosis type 1 (NF-1)	Coil embolization	Uneventful recovery
Hongsakul K, et al. [23]	1	64, Female	left upper polar renal artery	RAA and AVF	Embolization using Coil, NBCA and Plug	Uneventful recovery
Alexandria M Hertz, et al. [24]	1	56, Male	left	Malignant Solitary Fibrous Tumor of the Renal Vein	Coil embolization and radical nephrectomy DOI: 10.1177/1066896918787650	Uneventful recovery
Yub Raj Sedhai, et al. [25]	1	55, Male	Posterior superior segmental branch of the right renal artery	End-stage renal disease (ESRD)	Coil embolization	Uneventful recovery
Kallie Roberts, et al. [26]	1	44, Female	left accessory renal artery	neurofibromatosis type 1 (NF1)	Coil embolization	30% area of renal cortical ischemia
Zhenjiang Li, et al. [27]	1	31, Female	a transplant renal artery after transplantation	renal transplantation	Noncovered Stent-Assisted Coil Embolization	Uneventful recovery
Konstantinos Tigkiropoulos, et al. [28]	1	60, Female	left renal artery aneurysm	left renal artery aneurysm+AVF	Covered stent	Uneventful recovery
Yosuke Igarashi, et al. [29]	1	48, Female	Left and Right renal artery aneurysm.	Multiple visceral artery aneurysms	Hybrid Surgery (aneurysm clips and Coil Embolization)	Uneventful recovery
Evaldo Favi, et al. [11]	1	41, Female	Left	Second trimester (21-Week)/ Ruptured renal artery aneurysm	hand-assisted retroperitoneoscopic nephrectomy, ex-vivo repair and autotransplantation	Uneventful recovery
Alexander Ivandaev, et al. [30]	1	36, Female	left upper pole renal artery	Left renal artery aneurysm+AVF	ex vivo technique Coil embolization	Uneventful recovery
Jian-Zhong Zhang, et al. [31]	1	40, Female	Left RAA	Elusive etiology	Covered stent and salvage embolization with coils and thrombin	Uneventful recovery
Minoru Yabuta, et al. [32]	1	26, Female	Left	Generalized lymphatic anomaly (GLA)	Coil embolization	Uneventful recovery

Antony Aziz, et al. [33]	1	21, Female	lower pole segmental renal artery.	NA	Embolization using Coil, NBCA and Plug	Uneventful recovery
Piotr Skoniecczny, et al. [34]	1	50, Male	Right	Granulomatosis with polyangiitis (GPA)	Coil embolization	Died due to septic shock
Naiem Nassiri, et al. [35]	1	52, Female	Left	NA	Self-expanding stent-assisted detachable platinum microcoil embolization.	Minimal parenchymal loss /Uneventful recovery
Umberto Marcello Bracale, et al. [36]	3	64, Male	Left	Hypertension, chronic obstructive pulmonary disease	Stent-assisted coil embolization	Uneventful recovery
		79, Male	Left	Hypertension and hepatitis C virus-related liver disease	Stent-assisted coil embolization	Uneventful recovery
		40, Male	Right	Cardiovascular risk factor	Stent-assisted coil embolization	Uneventful recovery
Naoya Harada, et al. [37]	1	37, Female	Left	First trimester and ruptured renal artery aneurysm	Angiographic embolisation	left kidney was slightly stained
J Sousa, et al. [38]	1	33, Female	Right	NA	Self-expandable open-cell nitinol stent and coil embolization	Uneventful recovery
Maingard J, et al. [38]	2	40,Female	Right renal artery	Right	Two Comaneci neck-bridging devices deployed in a Y-configuration with successful coil packing of the aneurysm sac through a third microcatheter placed within the aneurysm sac.	Uneventful recovery
		34, Female	Splenic artery aneurysms	Splenic artery aneurysms	Coil embolization assisted by stent	Uneventful recovery

Nevertheless, for bi - / trifurcation aneurysms, coil embolization alone can neither achieve dense embolization nor protect small branches [45,46]. The use of microcoils and liquid embolic agent can achieve complete occlusion and aneurysm isolation. The double microcatheter technique [47], which was first applied for the treatment of intracranial aneurysms, is less risky than surgical management in treating visceral aneurysms. Further, it is cost-effective for patients who refuse open operation and are not candidates for other endovascular techniques [48]. However, extensive experience in embolizing liquid embolic materials is required to avoid reflux misembolism [49-51]. Successful cases of percutaneous direct intra-aneurysmal injection of glue or thrombin have been reported, however, they are more appropriate for superficial aneurysms and pseudoaneurysms [52-54]. Visceral aneurysms are located deeply and are difficult and risky for percutaneous thrombin and glue injection under the influence of respiration and other factors.

Imaging plays a pivotal role in detection, follow-up of RAA, but in conventional CT, the effects of beam hardening, and photon starvation make noticeable banding artifacts around the microcoils, thus seriously affecting the observation of peri-aneurysm structures and the assessment of postoperative efficacy [55,56]. The metal artifact reduction (MAR) technique can significantly reduce the metal artifact on CTA images and accurately assess the effect of intracavitary embolization of visceral aneurysms. Therefore, MAR has a high clinical application value for postoperative follow-up [57,58]. We adopted the MAR technique for follow-up observations for 3 months, and no signs of aneurysm remnants or recurrence were observed. Technetium Tc 99m dimercaptosuccinic acid (99mTc-DMSA) is a commonly used radiopharmaceutical and is equally reliable in calculating relative renal function [59]. The value of 99mTc-DMSA in this patient did not fluctuate significantly, indicating that our treatment strategy was effective and safe.

Conclusion

In conclusion, simultaneous embolization with coil and liquid embolic material via a double microcatheter is technically safe, and effective for the treatment of RAA, however, it should be carefully selected after a thorough evaluation.

Ethics

This study was approved by the Ethics Committee of the Affiliated Hospital of North Sichuan Medical College (Nanchong, China).

Consent for Publication

Written informed consent for publication of anonymized case details, which included accompanying images, was obtained from the patient.

Disclosure

The authors report no conflicts of interest in this work.

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