

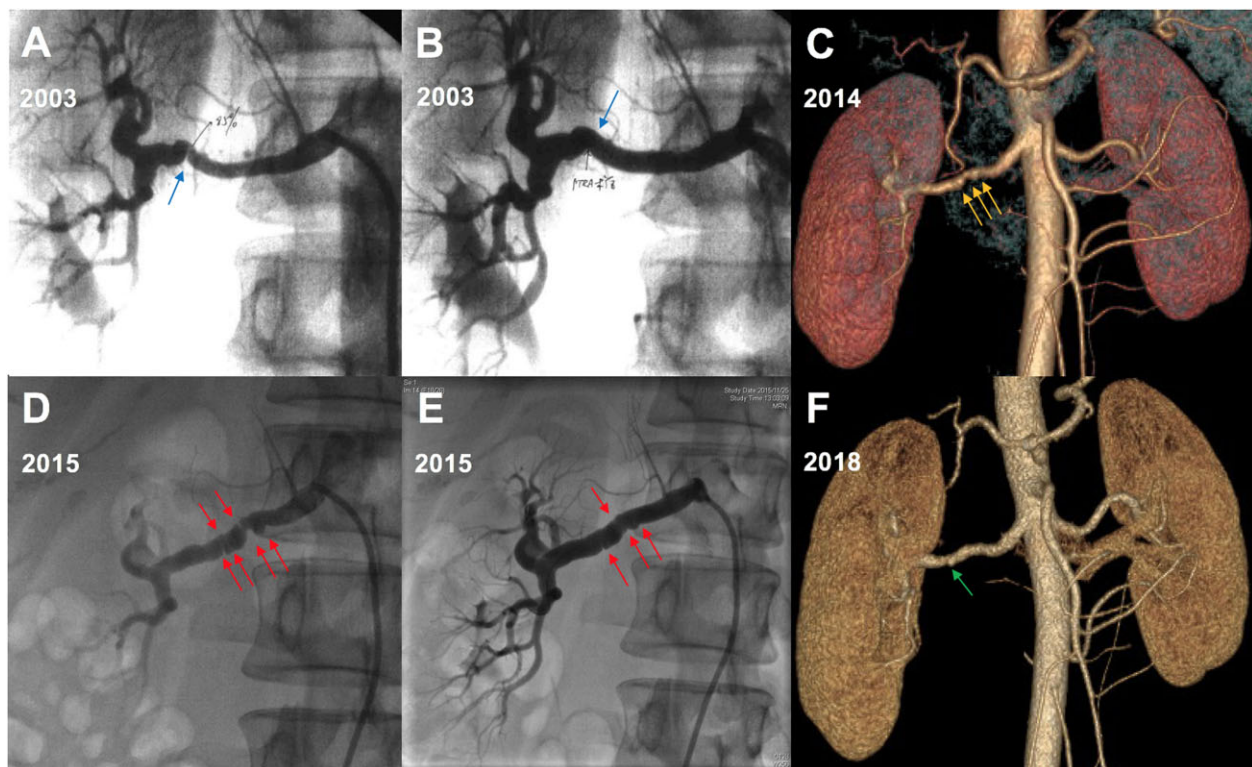
# Unifocal progressed to multifocal renal artery fibromuscular dysplasia

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A 24-year-old Chinese female patient with refractory hypertension had no risk factors for atherosclerosis, negative physical examination, and normal inflammation index. In 2003, the first catheter angiography revealed distal unifocal stenosis of the right renal artery



**Figure 1** Progress in subtypes of renal artery fibromuscular dysplasia. (A) The first catheter angiography revealed distal unifocal stenosis of the right renal artery. (B) The renal artery stenosis was relieved after percutaneous transluminal angioplasty. (C) Computed tomographic angiography showed new middle multiple stenoses of the same renal artery. (D) The second catheter angiography confirmed a middle typical string-of-beads appearance of the right renal artery without the distal unifocal stenosis. (E) The renal artery stenosis was relieved after percutaneous transluminal angioplasty again. (F) Computed tomographic angiography at the last follow-up showed the normal right renal artery.

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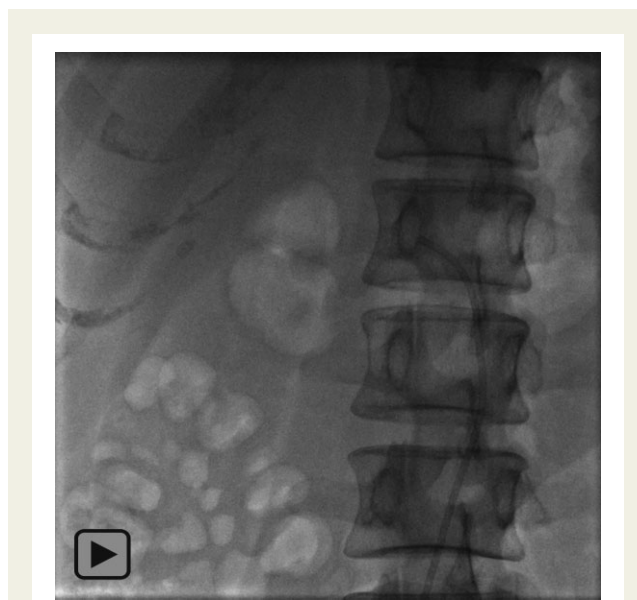
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(Figure 1A) without other artery lesions, consistent with unifocal fibromuscular dysplasia (FMD). The renal artery stenosis was relieved (Figure 1B) and blood pressure returned to normal without any anti-hypertension drug after percutaneous transluminal renal angioplasty (PTRA). The stent was not recommended for renal artery stenosis caused by FMD in this patient because she was young and the lesion was in the distal segment of the right renal artery, and the stent might have restenosis in the future. Stents are often only used for dissection or repeated restenosis after PTRA in young patients with renal artery stenosis caused by FMD.<sup>1</sup> However, hypertension appeared again after childbirth in 2005. She only used an anti-hypertensive medication to control hypertension and did not see a doctor in our hospital until the blood pressure was difficult to control by drugs in 2014, which meant the patient was lost to follow-up. Computed tomographic angiography (CTA) showed new middle multiple stenoses of the same renal artery (Figure 1C) in our hospital; however, she refused catheter angiography suggested by the doctor. Next year, a second catheter angiography confirmed a middle typical string-of-beads appearance (multifocal FMD) of the right renal artery after intra-arterial injection of nitroglycerine, while the distal unifocal stenosis did not recur (Figure 1D and Video 1). Heavy translesional pressure gradients (47 mmHg) confirmed that the lesion needed to be treated. Therefore, PTRA was performed again with improvement in the angiographic appearance (Figure 1E) and translesional pressure gradient (6 mmHg). In addition, no abnormalities were found in other artery screening procedures, such as electrocardiogram and coronary CTA; carotid, vertebral, and subclavian artery ultrasound; and synchronous limb blood pressure detection. In 2018, CTA showed a normal right renal artery (Figure 1F). The progression of FMD in the same renal artery with two subtypes in different positions has not been reported. This is the first report revealing that distal unifocal FMD progressed to middle multifocal FMD of the same renal artery over time, which challenges previous viewpoints that these two FMD subtypes may be two independent diseases<sup>2-4</sup> or that FMD is a congenital disease.

**Consent:** The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.



**Video 1** Catheter angiography confirmed a middle typical string-of-beads appearance of the right renal artery.

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