

Fibromuscular Dysplasia of the Iliac and Renal Arteries: A Rare Case Report and Literature Review

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Abstract

Fibromuscular dysplasia(FMD) is a non-atherosclerotic arteriopathy affecting approximate all-sized vascular beds predominantly among women aging from 20 to 60 years. Iliac arterial FMD has not been precisely described regarding demographic, imaging and clinical features. We herein report the first case of bilateral common and internal iliac arterial FMD in China, with renal artery involvement discovered by computed resonance angiography(CTA) and contaminant stenosis, aneurysm and dissection. We then review all available cases concerning iliac arterial FMD particularly associated with dissection.

A total of 111 cases(female, 84.7%), including the present case, have been reported. Median patient age was 52±12.8 years. Asymptomatic condition(49.5%) and claudication(40.5%) consisted the majority of clinical presentations, while bruit was the most frequent sign(64.9%) of 94 patients with physical examination data. External iliac artery involved was approximate threefold of common and internal iliac arteries. Other arteries particularly renal artery were also largely affected, alarming a system screening typically by CTA among iliac arterial FMD. Dissection accounted for 16.2% of iliac arterial FMD undergoing imaging, usually presenting ischemia symptoms with an inclination to young male patients. Conservative medication was efficient among 61.3% of reported iliac arterial FMD patients and percutaneous transluminal angioplasty(PTA) operated in 15 patients with satisfactory outcomes in 86.7%. Our patient was managed satisfactorily with angioplasty in renal artery and stenting in left iliac artery, presenting normotensive and asymptomatic off antihypertensive agents at 8-month follow-up. It is recommended that PTA is reasonable for renovascular hypertension with FMD and stenting seems to be promising for iliac arterial FMD with dissection.

Keywords: Fibromuscular dysplasia; Iliac artery; Dissection; Aneurysm

Introduction

Fibromuscular dysplasia (FMD), predominantly in women aged 20-60 years, is a heterogeneous group of non-atherosclerotic and non-inflammatory vascular diseases of unknown etiology. FMD is reported in virtually every arterial bed but most frequently affects renal and carotid arteries, with anatomic and angiographic manifestation of stenosis primarily and secondary events including beading(poststenotic dilation), aneurysm, dissection and tortuosity [1]. The clinical presentations of FMD vary from an asymptomatic condition, hypertension to a multisystem disease resembling vasculitis, determined largely by the distribution, type and severity of involved lesions [2].

Case Report

A 31-year-old Chinese man was referred because of 3-month-ago onset hypertension, with blood pressure of 207/170 mmHg, a serum potassium level of 3.2 mmol/L and an abdominal ultrasound that revealed a small-size right kidney(8.3 cm×5.0 cm×4.9 cm) with abnormal thin cortex but normal bilateral renal arteries. His past medical history, life history and family history were unremarkable. He was initially suspected of primary aldosteronism and prescribed with sole spiro lactone 40 mg three times a day. However his blood pressure still fluctuated around 150/110 mmHg. Spiro lactone was alternated after admission by benidipine 8 mg per day for future tests.

Upon physical examination, he had a blood pressure of 120/90 mmHg on both arms and a hear rate of 87 beats per minute. Cardiac and abdominal examination were unremarkable. The upper and lower extremity arterial pulses were palpable and symmetric bilaterally.

Ambulatory blood pressure monitoring presented an average 24-hour blood pressure of 130/90 mmHg. Routine laboratory tests including blood chemistry(such as creatinine and potassium), liver function test, C-reactive protein, and immunological evaluation such as rheumatoid factor, erythrocyte sedimentation rate, were within normal ranges. Screening tests relevant to primary aldosteronism and Cushing's Syndrome were negative except for a high serum renin level of 62.3 uIU/ml (normal, 4.4-46.1 uIU/ml). Renal scintigraphy showed normal left renal perfusion and function and a small-size right kidney, while both kidneys were determined with decreasing glomerular filtration rate(GFR, left kidney, 33.6 ml/min, right kidney, 20.4 ml/min). A contrast-enhanced computed tomography scan and three-dimensional reconstruction of the whole aorta showed an aneurysm formation involving the right common iliac artery (CIA) and extending into the internal iliac artery, which was consistent with left CIA dissection and

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an aneurysm continued with obvious stenosis among distal segment of right renal artery (Figure 1). Small size and thin cortex of the right kidney, and left adrenal pump were also observed. Other arteries including supra-arch artery proved with no abnormality.

He was therefore diagnosed with highly susceptible FMD and scheduled for angiographic evaluation and possible revascularization. We performed intra-arterial digital subtraction angiography (DSA) above the suprarenal abdominal aorta, demonstrating that he had FMD with a 80% stenosis of distal segment of right renal artery in a 10mm length and a proximal aneurysm (Figure 2A). The dissection located in middle and distal segments of left CIA and vessel dilation of right CIA to internal iliac artery were simultaneously confirmed (Figure 2B). Given the early-onset age, the short duration of hypertension and the presence of aneurysm, balloon angioplasty of right renal artery was performed and a stent was deployed in left CIA. Completion digital subtraction angiography demonstrated a widely patent right renal artery with brisk flow of contrast and disappearance of dissection in left CIA (Figure 3). The antihypertensive agents were withdrawn after operation and the postoperative recovery was uneventful. The patient was discharged in following days with an even 24-hour blood pressure of 125/87 mmHg. At 8-month follow-up, his blood pressure remained well-controlled out of any antihypertensive medication and periodic imaging is now recommended.

Literature Review

The demographic and clinical characteristics of FMD may be underestimated in general population, since circumscribed cognition of FMD and designated vascular beds imaged without uniform system screening. The United States Registry for FMD shows lower extremity

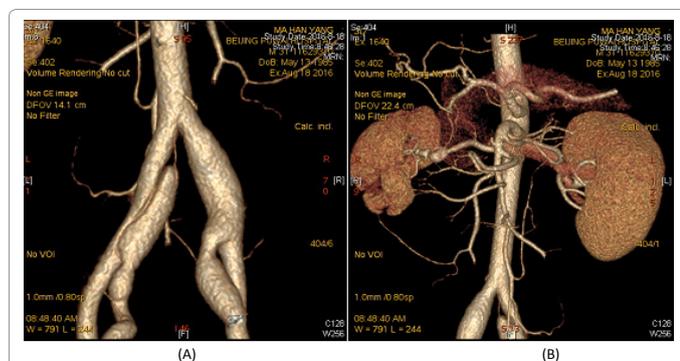


Figure 1: Contrast-enhanced computed tomography scan and three-dimensional reconstruction of the whole aorta. (A) Aneurysm involving the right common and internal iliac artery, and left common iliac artery dissection. (B) Aneurysm continued with stenosis of distal segment of right renal artery and small-sized right kidney.

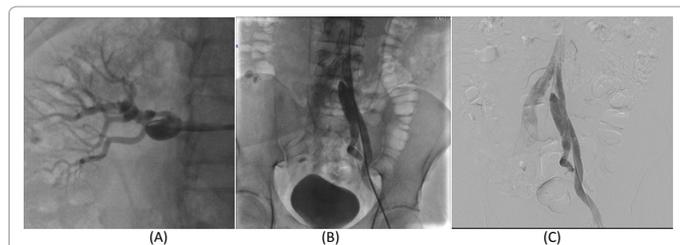


Figure 2: (A) Right renal angiography showing 80% stenosis of distal segment of main renal artery in a 10 mm length and a proximal aneurysm. (B) and (C) Iliac angiographic images presenting dissection in middle and distal segments of left CIA and vessel dilation of right CIA to internal iliac artery.

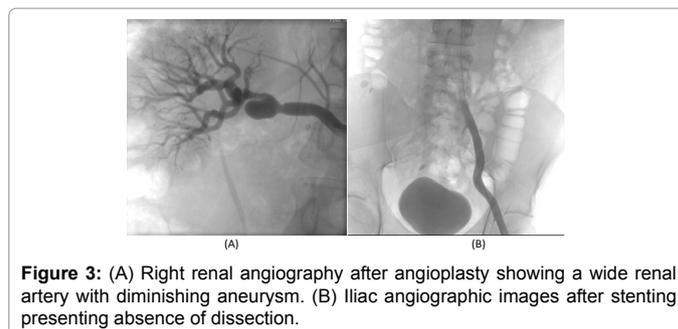


Figure 3: (A) Right renal angiography after angioplasty showing a wide renal artery with diminishing aneurysm. (B) Iliac angiographic images after stenting presenting absence of dissection.

(LE, primarily iliac arteries) FMD occurred in 9.4% (42/447) of patients [3]. The current literature on iliac arteries FMD, including the present case, is particularly uncommon with limited case reports or small series [4-24] (Table 1). To our knowledge, this is the first reported case of bilateral iliac arterial FMD in China.

Of referred cases, the mean age at diagnosis was 52 ± 12.8 years, and 84.7% were female. In terms of clinic presentation related to iliac arteries, approximately half of patients ($n=55$; 49.5%) presented as asymptomatic, while 45 (40.5%) patients involved intermittent claudication or leg pain (an atypical symptom of claudication). Eighteen (16.2%) patients complained of pain in other positions, among which were three microembolism, one acute ischemia and one shock. Hypertension, a common cardiovascular factor, was observed in 57 (51.4%) patients. Data relevant to physical examination and imaging features of FMD could merely be extracted from records of 94 and 105 patients separately. Sixty-one (64.9%) patients had lower abdominal or iliofemoral bruits and 37 (39.4%) had ≥ 1 pulse deficits of the lower extremity arteries. Seventeen (16.2%) patients had spontaneous dissection of iliac arteries, and 3 of them progressed to rupture with 2 died postoperatively. Only 14 FMD cases of iliac artery dissection had available, detailed reports. Ten of them were male and four were female. The mean age was 40 years, and the age range was 21-56 years. The majority of patients ($n=13$; 92.8%) presented with intermittent claudication or pain, underwent open air surgery or medication therapy with consequently improved conditions. Up to now, the external iliac artery was the most common location of iliac FMD ($n=95$; 85.6%), whereas common iliac artery and internal iliac artery represented 18.9% and 9.9% lesions respectively. Bilateral iliac arterial involvement were presented in 59 of 97 FMD patients with approachable data. Affected arteries outside iliac vascular beds were reported in renal artery($n=79$; 71.2%), carotid artery($n=56$; 50.5%), vertebral artery ($n=28$; 25.2%), mesenteric artery ($n=17$; 15.3%), coronary artery ($n=2$; 1.8%) and other arteries ($n=9$; 8.1%). A total of 68 (61.3%) iliac arterial FMD patients was managed conservatively. Twenty-seven (24.3%) patients underwent bypass or resection and interposition, and had satisfactory outcomes, while angioplasties with or without stenting were operated in 15 (13.5%) patients with 13 (86.7%) reaching symptom resolution.

Discussion

FMD is an idiopathic arteriopathy traditionally involves medium-sized vascular territories especially renal artery and causing renovascular hypertension. The prevalence of FMD is 3.34% among the whole kidney donor population ($n=8029$) merely with few comorbid health conditions [25], but is not known in general population. In the United States Registry, female accounted for 91% FMD registrants, and the clinical phenotype of FMD expanded from a rare cause of renal hypertension to now various anatomic distributions and clinical manifestations [3]. Of patients with imaging, a proportion of 79.7%

Author	Year	Age (yr)	Gender	Symptom	Sign	Iliac artery involvement	Other artery involvement	Angiographic changes	Treatment	Outcome
Burri et al.	1983	45	F	Left inguinal pain	N/A	Left EIA	Bilateral renal	Dissection	Iliofemoral bypass	Improved
Sauer et al.	1990	67	M	Left distal extremity microemboli	None	Left EIA	None	String-of-beads	Resection and Dacron graft	Improved
		55	M	Distal extremity microemboli	None	Bilateral EIA	None	String-of-beads	Resection with end to end anastomosis	Improved
		71	M	Left distal extremity microemboli	None	Left EIA	Bilateral renal	String-of-beads	Resection and Dacron graft	Improved
		56	F	Right thigh and leg claudication	Bruit Pulse deficit	Right EIA, Left iliac	Left renal	Dissection	Conservative	Improved
		62	F	Left thigh and calf claudication	Bruit Pulse deficit	Bilateral EIA	Bilateral renal internal carotid vertebral	Stenosis	Open surgery with dilation	Improved
		45	F	Bilateral claudication	Pulse deficit	Bilateral EIA	Bilateral renal Right superficial femoral	N/A	Open surgery with dilation	Improved
		61	F	Left calf claudication Left malleolar ulcer	None	Bilateral EIA	Right renal	N/A	Aortobifemoral bypass	Improved
		35	F	Bilateral claudication	None	Bilateral EIA	Bilateral renal	N/A	Open surgery with dilation	Improved
Patel et al.	1990	39	M	Left inguinal pain	N/A	Left EIA	Bilateral renal	Dissection Aneurysm	Iliofemoral bypass	Improved
Thevenet et al.	1992	45	F	Lower limb acute ischemia	Pulse deficit	Bilateral EIA	None	Dissection	Aortobifemoral bypass	Improved
		63	F	Bilateral recumbent pain	None	Bilateral EIA	None	N/A	Bypass	Improved
		48	F	Claudication Pelvic pain	None	Bilateral EIA	None	N/A	Aortoiliac bypass	Improved
		51	M	Claudication	None	Bilateral EIA	Right renal	Dissection	Iliofemoral bypass	Improved
		47	F	Abdominal pain	Bruit	Right EIA	None	Stenosis	Bypass	Improved
		54	F	Claudication Recumbent pain Hypertension	None	Bilateral EIA	Bilateral renal	N/A	Bypass	Improved
		29	F	Iliac fossa pain	None	Left EIA	Left thyrocervical trunk	Dissection Aneurysm Stenosis	Interposition with vein	Improved
		53	M	Claudication	None	Right EIA	None	Dissection	Iliofemoral bypass	Improved
Mandke et al.	1993	18	F	Left leg claudication Hypertension	Pulse deficit	Left CIA	Left renal	Stenosis	Nephrectomy Atherectomy	Improved
Tsukamoto et al.	1995	49	F	Asymptomatic	Pulsatile mass	Bilateral iliac	Coronary	Aneurysm	Resection and reconstruction with a Y graft	Improved
Tsatalpas et al.	1997	48	F	Sudden abdominal pain	Peritonism	Bilateral CIA Left IIA	Bilateral renal	Aneurysm	Aortoiliac bypass	Improved
Luck et al.	2002	45	M	Claudication	N/A	Right EIA	Distal aorta	Dissection	Thrombendarterectomy	Improved
Atsuta et al.	2003	69	F	Abdominal pain	Pulsatile mass	Right CIA Left IIA	None	Aneurysm	Resection and reconstruction with a Y graft	Improved
Honjo et al.	2004	30	M	Abdominal pain Shock	None	Left CIA EIA	None	Dissection Rupture	Delayed surgery	Dead
Yoshioka et al.	2007	21	M	Sudden abdominal pain	None	Left CIA	None	Dissection Rupture	Axillo-femoral Bypass	Dead
Chin et al.	2009	50	F	Asymptomatic Hypertension	Bruits	Bilateral iliac	Bilateral renal	String-of-beads	Conservative	Improved
Akashi et al.	2010	49	M	Right leg claudication Right abdominal pain	Bruits Pulse deficits	Right CIA, EIA	None	Dissection	Replacement with Dacron prosthesis	Improved
Sugiura et al.	2011	30	M	Sudden abdominal pain	None	Right EIA	Bilateral renal Superior mesenteric	Dissections Stenosis	Conservative	Improved
Okazaki et al.	2011	63	F	Left leg claudication, Hypertension	Pulsatile mass Pulse deficit	Bilateral CIA	Internal carotid superficial femoral popliteal	Aneurysm Stenosis	Resection and reconstruction with a Y graft, Bypass	Improved
		37	M	Sudden back pain	None	Bilateral EIA	None	Dissection Rupture	Interposition with ePTFE	Improved
Rastogi et al.	2012	88	F	Right posterior ankle ulcer Hypertension	Pulse deficits	Bilateral EIA	None	String-of-beads	Balloon angioplasty Stent angioplasty	Improved

Ketha et al. (14 cases)	2014	56±12	F (12;86.0%)	Asymptomatic (8;57%) Claudication/leg pain (6;53%) Hypertension (11;79%)	N/A	EIA (14;100%) CIA (1;7.1%) IIA (1;7.1%)	Renal (12;85.7%) Carotid (5;36%) Coronary (1;7%) Peripheral (2;14%)	No dissection	Conservative (4;28.6%) Balloon angioplasty (8;57.1%) Stent angioplasty (2;14.3%)	Symptom resolution (8/10;80%)
Olin et al.	2014	52	F	Right buttock and thigh claudication Hypertension	Bruit	Right EIA	Right renal	Stenosis	Stent angioplasty Balloon angioplasty	Improved
Tanka et al.	2014	47	F	Claudication Hypertension	Pulse deficits	Bilateral EIA	Renal	Stenosis	Balloon angioplasty	Improved
Niizeki et al.	2015	60	F	Bilateral claudication	None	Bilateral EIA	None	String-of-beads	Balloon angioplasty	Improved
Brinza et al.	2016	52±11.3	F (60; 96.8%)	Asymptomatic (44;71.0%) Claudication/leg pain (23;37.1%)	Bruits (55;88.7%) Pulse deficits (28;45.2%)	EIA (54;87.1%) CIA (12;19.4%) IIA (7;11.3%)	Renal (50;80.6%) Carotid (49;79.0%) Vertebral (27;43.5%) Mesenteric (16;25.8%)	Dissection (3;4.8%)	Conservative (61;98.4%) Open surgery and interposition graft and angioplasty (1;1.6%)	N/A
Present case	2017	31	M	Asymptomatic Hypertension	None	Bilateral CIA IIA	Right renal	Dissection Aneurysm Stenosis	Balloon angioplasty Stent angioplasty	Improved

M=Male, F=Female, EIA=external iliac artery, CIA=common iliac artery, IIA=internal iliac artery, N/A=Not applicable

Table 1: Reported cases and case series of iliac arteries fibromuscular dysplasia.

(294/369) was renal artery FMD mainly presenting hypertension and 60.0% (42/70) affected lower extremity arteries (LE, primarily iliac artery) probably with claudication symptoms [3].

The patient herein reported is a young male who had no symptoms but new onset hypertension without other cardiovascular risks. CTA and DSA showed rare features that FMD simultaneously affected right renal artery and bilateral common and internal iliac arteries, sparsely co-existing with stenosis, aneurysm and dissection. Brinza et al recently reported 13.8% (62 of 449) LE (mainly iliac) arterial FMD from Cleveland Clinic's FMD single-center registry database, which might be underestimated for only 100 patients underwent LE arteries imaging [24]. Upon our literature review of iliac arterial FMD (Table 1, including Brinza's report), patients were overwhelmingly female with mean age of 52 ± 12.8 years, similar to enrolled FMD population in United States Registry. Asymptomatic condition and claudication consisted the majority of clinical phenotype associated with iliac arterial FMD, whereas mere 25 (5.6%) patients were asymptomatic and 23 (5.2%) presented claudication in general FMD population at the time of diagnosis [3]. Hypertension was diagnosed in majority of general and iliac arterial FMD patients (63.8%; 51.4%). Common and internal iliac artery FMD were only around one thirds of external artery FMD. Vascular beds in addition to iliac arteries, primarily renal and carotid arteries, were involved in 87.4% of iliac arterial FMD, corresponding to popular hypertension and convincingly indicating the importance of system screening among iliac or renal artery FMD patients. A recent study retrospected 360 patients enrolled in a FMD registry center and figured out 113 underwent one-time screening under a specialized CTA protocol of chest, abdomen and pelvis. The findings were incremental that new arterial beading, new aneurysm and new dissection were respectively observed in 49%, 19% and 3% of patients. Reformatted images were crucial and affecting final assessment of the readers [26]. These conclusions underpin the recommendation of high-resolution CTA screening and reconstruction from neck to pelvis among FMD patients while Doppler is slower acquisition and operator dependent. Magnetic resonance angiography (MRA) without ionizing radiation is suggested for head screening because aneurysms (the most common manifestation of intracranial FMD) can be accurately identified [27]. Besides, one dissection, generally presenting ischemia symptoms, was observed in approximate six iliac FMD patients from our review. Other recent report of 921 patients from the United States FMD Registry

observed that 25.7% had a dissection and 5.8% had both dissection and aneurysm identified by the time they were evaluated [28]. FMD patients with a dissection was younger at presentation (48.4 vs 53.5 years) , resembling our description in iliac arterial FMD (mean age, 40 years) [28]. Another sub-study of the United States Registry presented male recruits suffering a twofold higher prevalence of arterial dissection than female registrants, similar to findings in our review(male,72.4%) [29]. These findings suggest that dissections with an acute and progressive presentation inclined to affecting young male FMD with early recognition. Notably, our young male case showed no iliac arterial symptoms such as claudication, reminding of more attention to iliac arterial FMD with asymptomatic dissection.

Furthermore, the renal artery disorder of this patient was initially neglected through ultrasound examination, which circumscribed our precise diagnosis and subsequently implying limitation of ultrasound in screening distal renal artery manifestation. CTA is therefore recommended for asymmetric kidneys suspected of renal artery changes. This patient also presented long-term hypokalemia, resulting in primary inclination to primary aldosteronism however with poor spiro lactone efficiency. The initial increased aldosterone were actually secondary to renal artery stenosis. Secondary hypertension are consequently suggested to undergo systematic and precise evaluation among the young hypertension population.

Given therapeutic methods, revascularized renal artery FMD patients were reported more often focal (presence of a single stenosis on a given vessel, regardless of its length) and men at a younger diagnostic age with FMD, a higher BP-level hypertension and a higher prevalence of renal asymmetry than patients with conservative therapy [30]. According to the sole systematic review summarizing outcomes of 47 published series with percutaneous transluminal renal angioplasty (PTRA), the combined rate of cure or improvement of hypertension was 86.4% (95%CI, 83.2-89.3) and improved among younger patients with shorter-duration hypertension [31]. Therefore, renal artery angioplasty was suggested for high likelihood of improvement or cure of new-onset renal hypertension, renal artery aneurysm and renal function loss in our young patient [1]. There were no clear guidelines for iliac arterial FMD or dissections. In terms of our review, 61.3% iliac artery FMD patients were controlled with mere medications and 86.7% of those experiencing angioplasty released from severe symptoms,

whereas iliac arterial dissection progressing to rupture resulted in 66.7% death. Angioplasty with stenting was decided in our patient from the progressive enlargement of the dissected pseudolumen and possible catastrophic consequences of ruptured dissecting aneurysm although asymptomatic, followed by disappearance of the dissection.

Conclusion

The prevalence of iliac arterial FMD have been overlooked. Iliac arterial FMD usually presents asymptomatic or claudication with coexisting hypertension as a consequence of renal artery involvement. Other vascular beds are also popularly affected and a system screening among iliac arterial FMD patients is therefore suggested. CTA screening is preferred from the thoracic inlet to the ischial tuberosities and MRA screening is recommended in head for accurately detecting aneurysms. Dissection in FMD inclined to occur in young male patients and generally showing acute ischemia or chronic claudication symptoms. PTA is the first choice of short-duration renovascular hypertension due to FMD especially in young patient and stenting is an optimal recommendation of iliac artery FMD with progressive dissection.

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