Renal Artery Fibromuscular Dysplasia in 2,640 Renal Donor Subjects: A CT Angiography Analysis

Gavin A. McKenzie, MD, Gustavo S. Oderich, MD, Akira Kawashima, MD, PhD, and Sanjay Misra, MD

ABSTRACT

Purpose: To present the incidence, demographics, and clinical presentation of patients diagnosed with renal fibromuscular dysplasia (FMD) who underwent computed tomography (CT) angiography for evaluation of living renal donor protocol.

Methods and Materials: A retrospective review was performed from January 1, 2000, to December 31, 2011 on patients who underwent CT angiography for evaluation of living renal donor protocol. Of 2,640 patients identified, only patients with a diagnosis of FMD by the radiology report underwent independent reader evaluation of CT angiography for the presence of FMD and associated characteristics. The demographics, medical history, and presentation were reviewed using the electronic medical chart.

Results: The independent readers who evaluated CT angiography identified a diagnosis of FMD in 68 patients (2.6%; 59 female) with an average age of 52 years ± 10. Unilateral FMD was observed in 46 patients (68%), and bilateral FMD was observed in 22 patients (32%). Three patients had aneurysms of the renal artery. Comorbidities included hypertension (n = 21, 31%), dyslipidemia, (n = 13, 19%), history of migraines (n = 3, 4%), and history of smoking (n = 14, 21%). No patients had diabetes mellitus, coronary artery disease, or family history of FMD. Of 21 patients (31%) with a history of hypertension, 13 patients (62%) were treated with antihypertensive medications.

Conclusions: The incidence of FMD in patients who underwent CT angiography for evaluation of living renal donor protocol is 2.6%.

ABBREVIATIONS

DSA = digital subtraction angiography, FMD = fibromuscular dysplasia

The etiology of fibromuscular dysplasia (FMD) is largely unknown. It is well recognized that the incidence is higher in women, and the most common clinical presentation is hypertension. It is estimated that the incidence in the general population is 2%–3% (1). The incidence of FMD in potential living renal donors is reported to be 4%–6% (2–5). The purpose of the present study was to report the incidence of FMD in living renal donors undergoing computed tomography (CT) angiography of the abdomen and pelvis over an 11-year period. The patient demographics, CT angiography findings, and outcomes also are presented.

MATERIALS AND METHODS

Study Population

Institutional review board approval was obtained before conducting the study. From January 1, 2000, to December 31, 2011, the radiology information management system database was searched for an examination code of abdominal or pelvic CT angiography and a key phrase "potential renal donor." Cases of FMD were also searched using key words "fibromuscular dysplasia," "FMD," "beaded," "pearl," or "string," in any and all combinations within the interpretation of CT angiography. Patients with a diagnosis of FMD were identified, and the CT angiography scans were evaluated by

From the Department of Vascular and Interventional Radiology (G.A.M., A.K.), Division of Vascular and Interventional Radiology (S.M.), Division of Vascular and Endovascular Surgery (G.S.O.), and Vascular and Interventional Radiology Translational Laboratory (S.M.), Department of Radiology, Mayo Clinic, 200 First Street SW, Rochester, MN 55905. Received June 28, 2012; final revision received June 3, 2013; accepted June 3, 2013. **Address correspondence to** S.M.; E-mail: misra.sanjay@mayo.edu

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independent readers. The demographics, comorbidities, and family history also were reviewed.

Description of CT Angiography Protocol

During the time period from January 1, 2000, to December 31, 2011, various multidetector CT scanners were used to perform examinations, including the following: 4 multidetector row CT (LightSpeed QX/i; GE Medical Systems, Milwaukee, Wisconsin), 16 multidetector row CT (Somatom Sensation 16; Siemens Medical Solutions, Forchheim, Germany), and, more recently, 64 multidetector row CT (Somatom Sensation 64; Siemens Medical Solutions) or 64 dual-source multidetector row CT (Somatom Definition, Somatom Definition Flash; Siemens Medical Solutions) scanners. CT angiography parameters using 4 multidetector row CT included thickness 1.25 mm, increment 0.75 mm, field of view 25 cm, rotation time 0.8 second, and scan delay 18 seconds after starting intravenous (IV) injection of 140 mL of iopamidol (300 mgI/mL) at an injection rate of 5 mL/s using a mechanical power injector. CT angiography parameters using state-of-the-art 64 multidetector row CT scanners included thickness 1.5 mm, increment 0.8 mm, field of view 25 cm, rotation time 0.5 second, collimation of 64 × 0.6, and scan delay triggered by automatic bolus tracking (Care Bolus; Siemens Medical Solutions) after IV injection of 140 mL of iohexol (350 mgI/mL) at an injection rate of 5 mL/s using a mechanical power injector. Contrast agent dosing was also adjusted based on patient weight. A combination of axial and multiplanar reconstructed images was used for interpretation.

A diagnosis of medial fibroplasia subtype of FMD was made based on the "string of beads" appearance, defined as alternating segments of concomitant stenoses and poststenotic dilatation involving the renal artery. The study team independent of the original reading then reviewed only the CT angiography scans, which were identified as having FMD. Unilateral or bilateral involvement of the renal artery with FMD was noted. Bilateral lesions were divided further into which renal artery, right or left, had a greater extent of involvement, taking into account both length and degree of beading. Length of involvement was measured on axial or coronal images from origin to distal point of beading. Degree of involvement was determined by visual inspection of the severity of beading in each artery. In addition, aneurysm and ectasia were noted. Aneurysm was defined as a focal vessel dilatation that was more than two times the proximal luminal diameter of the nondiseased renal artery, and ectasia was defined as less than or equal to two times the proximal luminal diameter of the nondiseased renal artery.

Statistical Analysis

Categorical variables were expressed as ratios and percentages. Continuous variables were expressed as mean ± standard deviation or median (range). SAS version 9 (SAS Institute Inc, Cary, North Carolina) was used for all statistical analyses.

RESULTS

Patient Characteristics

As part of a renal donor protocol, 2,640 patients underwent CT angiography scans of the abdomen and pelvis. The CT angiography report identified a diagnosis of FMD in 68 (2.6%) patients with an average age of 52 years ± 10 ; 59 patients (87%) were women (Table 1). Cardiovascular risk factors included hypertension (n = 21, 31%), dyslipidemia (n = 13, 19%), history of smoking (n = 14, 21%), and history of migraines (n = 3, 4%). Five patients (7%) had a history of use of oral contraceptive pills or hormone replacement therapy or both, and eight patients (12%) used nonsteroidal anti-inflammatory drugs. The mean body mass index was 27 kg/m^2 ± 4. No patients had a history of diabetes mellitus or coronary artery disease. One patient (age, 68 y) was a smoker and had peripheral arterial disease with a history of dyslipidemia requiring a statin at the time of diagnosis with FMD. A family history of coronary artery disease was present in 15 patients (22%); however, no patients had a family history of FMD. Five patients (7%) had a family history of polycystic kidney disease.

Table 1. Study Group Demographics

Study Variable	Study Group, no. (%)
Number	68
Women (%)	59 (87%)
Mean age at diagnosis (y)	52 ± 10
BMI	27 ± 4
White	57 (84%)
Risk factors	
Hypertension	21 (31%)
Dyslipidemia	13 (19%)
Peripheral arterial disease	1 (1%)
Statin usage	5 (7%)
Smoking (current or past)	14 (21%)
Diabetes	0 (0%)
Stroke	0 (0%)
Coronary artery disease	0 (0%)
Chronic renal insufficiency	0 (0%)
Carotid disease	0 (0%)
Family history of coronary artery disease	15 (22%)
Chronic renal insufficiency	0 (0%)
NSAIDs	8 (12%)
Estrogen use (OCPs or HRT)	5 (7%)
Migraines	3 (4%)

BMI = body mass index, HRT = hormone replacement therapy, NSAIDs = nonsteroidal anti-inflammatory drugs, OCPs = oral contraceptive pills.