Outcomes of Hypertensive Patients with Renal Fibromuscular Dysplasia Compared with Patients with Concomitant Atherosclerotic Renal Artery Stenosis following Endovascular Therapy

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ABSTRACT

Purpose: To examine if the outcomes after endovascular treatment in hypertensive patients with renal artery fibromuscular dysplasia (FMD) and incidental atherosclerotic renal artery stenosis (ARAS) differ from the outcomes in patients with FMD alone.

Materials and Methods: All cases of patients with renal artery FMD undergoing percutaneous transluminal angioplasty during the period 2002–2012 were reviewed. The patients with complete data before and after the procedure were identified (N = 84). Based on the procedural reports, these patients were separated into two cohorts: patients with isolated FMD (n = 59) and patients with concomitant atherosclerotic renal artery stenosis and FMD (ARAS-FMD) (n = 25). The medical record of each patient was reviewed for baseline blood pressure, antihypertensive medication use, and renal function data and the same data after the procedure. Procedural details including the angiographic findings, the number of stents placed, the average number of revascularization procedures, and the number of patients requiring more than one revascularization procedure were noted.

Results: The study population included 68 patients (FMD, n = 46; ARAS-FMD, n = 22). Patients in the FMD and ARAS-FMD cohorts experienced comparable significant decreases in systolic and mean arterial pressures after endovascular intervention. There was no change in the number of antihypertensive medications after the procedure within or between groups. Patients in the ARAS-FMD cohort had lower baseline estimated glomerular filtration rates ($P = .007$); however, renal function stabilized in both groups after endovascular therapy.

Conclusions: Patients with ARAS-FMD respond to endovascular therapy with outcomes similar to patients with isolated renal artery FMD.

ABBREVIATIONS

ARAS = atherosclerotic renal artery stenosis, CI = confidence interval, CKD = chronic kidney disease, DBP = diastolic blood pressure, eGRF = estimated glomerular filtration rate, FMD = fibromuscular dysplasia, MAP = mean arterial pressure, SBP = systolic blood pressure

Renovascular disease is estimated to be a contributing factor in 10% of the 50 million patients with hypertension in the United States (1). Atherosclerotic renal artery stenosis (ARAS) is the most common cause of renal artery stenosis, responsible for approximately 90% of cases (2). ARAS primarily affects the ostial and proximal portions of the renal arteries and is typically seen in patients older than 50 years of age with no sex predilection. Fibromuscular dysplasia (FMD) is the second most common cause of renal artery stenosis, accounting for approximately 10% of cases. In contrast

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to ARAS, FMD predominantly affects women between the ages of 15 and 50 years of age and has a characteristic distribution within the renal arteries, most commonly affecting the middle or distal portions (3,4). The incidence of concomitant ARAS and FMD (ARAS-FMD) has been the subject of limited investigation, but the diagnosis appears to be more common than previously thought (1). In one study of patients with FMD undergoing angioplasty, 22.8% of the study population had concomitant ARAS (5).

Although several reports have examined the response of patients with either renal artery FMD or ARAS to endovascular treatment, no studies have specifically analyzed the clinical response of patients with ARAS-FMD to endovascular therapy. The purpose of this retrospective study was to compare outcomes after endovascular intervention in hypertensive patients with ARAS-FMD with outcomes of patients with isolated renal artery FMD.

MATERIALS AND METHODS

Patient Population

The Division of Vascular and Interventional Radiology at the University of Virginia maintains a clinical database for all patients undergoing angiographic procedures. A retrospective chart review of these cases was granted a waiver by the institutional review board and conducted in accordance with the Health Insurance Portability and Accountability Act. From this database, consecutive patients with a documented diagnosis of FMD who underwent angiography between January 1, 2002, and June 1, 2012, were identified. The medical records of these patients were reviewed for patients with renal artery FMD diagnosed via selective renal arteriograms and treated with endovascular therapy for hemodynamically significant lesions ($>$ 60% diameter stenosis as determined by visual inspection with or without pressure measurements or quantitative vascular analysis). All patients were referred for angiography for diagnosis and treatment because of a recent clinical history of hypertension that was either labile or refractory to medical therapy, with hypertension defined as systolic blood pressure (SBP) greater than 140 mm Hg or diastolic blood pressure (DBP) greater than 90 mm Hg despite medical therapy. In all patients, FMD was confirmed by angiography. Patients were included in the ARAS-FMD group if both FMD and ARAS lesions were identified in either renal artery without regard to whether the lesions were ipsilateral or contralateral. In addition, ARAS was an incidental finding and not an indication for angiography. In the ARAS-FMD group, all stents were placed to treat atherosclerotic lesions and never solely to treat the associated FMD lesions.

Of the 84 patients eligible for inclusion in this study (FMD, n = 59; ARAS-FMD, n = 25), 68 patients (FMD, n = 46; ARAS-FMD, n = 22) had complete data for the primary outcome variables before and after the procedure. The remaining patients were excluded because of a lack of blood pressure and renal function data after the procedure.

The baseline patient characteristics for all included patients are provided in the **Table**. The patients in the ARAS-FMD cohort were older than the patients in the FMD cohort ($P < .001$), and the patients in the FMD cohort had a higher estimated glomerular filtration rate (eGFR) before the procedure than the patients in the ARAS-FMD cohort ($P = .007$). The chronic kidney disease (CKD) stage frequency distributions before the procedure also differed between the two groups of patients ($P = .010$), with patients with CKD stage 3 and 4 being more highly represented in the ARAS-FMD cohort ($P = .002$).

Percutaneous Transluminal Angioplasty

On the day of the procedure, antihypertensive medications were administered to patients according to their usual regimens. Baseline blood pressure readings were obtained and monitored closely throughout the procedure. The angioplasty and renal artery stent procedures were performed in compliance with national guidelines, procedural technical success was defined, and patients were managed and followed as previously described (6,7).

Measured Outcomes

The FMD and ARAS-FMD groups were compared regarding five primary variables: (i) demographic data (sex, age, all-cause mortality); (ii) angiographic findings, number of stents placed, average number of revascularization procedures, and number of patients requiring more than one revascularization procedure; (iii) average change in SBP, DBP, and mean arterial blood pressure (MAP) before and after the procedure within and between groups; (iv) average change in the number of antihypertensive medications before and after the procedure within and between groups; (v) average change in eGFR before and after the procedure within and between groups; and (vi) change in CKD stage. The eGFR was calculated using the Modification of Diet in Renal Disease equation (8). All available studies were reviewed and classified according to the American Heart Association angiographic classification system for FMD subtyping (9).

Statistical Methods

Statistical analyses were performed using various methods depending on the nature of the variables. A two-sided $P \leq .05$ decision rule was used as the null hypothesis rejection criterion for all between–study group comparisons, and the statistical software package SAS