

The Neurological Implications of Fibromuscular Dysplasia

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Abstract

Fibromuscular dysplasia is a noninflammatory segmental disease of the arteries, of unknown origin. While the renal arteries are most commonly affected, other larger vessels, including the carotid and vertebrals, may be involved. Fibromuscular dysplasia has been implicated as a cause of stroke in adults and (on rare occasions) in children. The classic angiographic presentation is that of a string of beads. The condition frequently requires surgical or interventional radiological treatment. These approaches most commonly lead to long-term neurological improvement. Five cases with typical angiographic appearance are presented.

Key Words: Cerebrovascular accident, hypertension, fibromuscular dysplasia.

IN 1938, LEADBETTER AND BURKLAND (1) published the first report of fibromuscular dysplasia (FMD) of the human vascular system. They described it as a nonatheromatous segmental disease of the renal arteries. About a quarter century later, Palubinskas and Ripley (2) reported angiographic evidence of this disease entity in the literature, citing autopsy and surgical histologic findings. FMD is a nonatherosclerotic, noninflammatory condition involving elastic, muscular and fibrous elements mainly of the extracranial vessels. Involvement of both cervicocranial and renal vessels with FMD carries neurological implications. Such involvement may also cause: (a) secondary hypertension when the renal arteries are involved; (b) the stuttering, stroke-like syndromes, i.e., transient ischemic attacks (TIAs) and, at times, progressive stroke resulting from occlusive FMD of the cervicocranial vessels; or (c) associated aneurysm which may rupture and produce the devastating effects of subarachnoid hemorrhage.

The constellation of signs and symptoms runs the gamut from the common complaint of dizziness to TIAs, intracerebral hemorrhage, rupture of an intracranial aneurysm, or occlusion of a major cerebral vessel.

FMD is an uncommon vascular disorder that occurs in young to middle-aged individuals, especially women. The disease consists of a heterogeneous group of histologic changes, which ultimately lead to arterial narrowing. Clinical manifestation reflects the arterial bed involved, most commonly hypertension (renal) and strokes (carotid). Fibromuscular dysplasia is a pathological diagnosis in the appropriate clinical setting. This noninflammatory disease is a common mimic of vasculitis.

While this disease is principally found in the extracranial vessels of the cervical region, it may affect other arteries of the body, including the renal and coronary arteries. Sudden death in a previously healthy individual may, at necropsy, show myocardial infarction caused by occlusion of a vital coronary artery by FMD, again emphasizing the lethal nature of this disease. Sudden, unexpected death may occur during exercise, and the patient may have had no previous cardiac history. At autopsy, there may be marked intramural coronary artery dysplasia of the ventricular septum, which may be accompanied by myocardial fibro-

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sis. The arterial dysplasia can be characterized by severe medial thickening, with smooth muscle cell disorganization and marked luminal narrowing. There may be no evidence of myofiber disarray or asymmetric septal hypertrophy to suggest hypertrophic cardiomyopathy. There may also be no associated cardiac or extracardiac lesions found at complete autopsy of these individuals. It can be concluded that small vessel disease of the intramural coronary arteries of the ventricular septum may be an isolated finding leading to sudden cardiac death in young adults.

In reported cases of fibromuscular dysplasia, the preponderance is women:men in the ratio of 6:1. Surgical intervention is frequently necessary, but antithrombotic agents may be an alternative when patients prefer to avoid surgical or interventional radiological treatment.

Case Reports

Case 1

A 58-year-old Caucasian female presented with a sudden onset of aphasia and an associated left-sided paresis and hypesthesia to pinprick, maximal in the upper extremity. Historically, she had several prior episodes of left hemiparesis but no prior aphasic episodes. All neurological symptoms regressed within 24 hours. Subsequent angiography revealed fibromuscular dysplasia of the right internal carotid artery over a 4 cm segment. She was treated with aspirin and dipyridamole, and has been asymptomatic since investigation.

Case 2

A 65-year-old female presented with transient visual disturbances consisting of central scotomata. Each episode lasted approximately ten minutes and was associated with a fuzzy feeling in her head or slight dizziness. The first episode was three months prior to investigation. Angiography demonstrated bilateral distal internal carotid artery FMD. Conservative medical care was given.

Case 3

A 74-year-old female presented with complaints of transient episodes of right-sided numbness, right arm transient paresis, lightheadedness, headaches, nausea, and occasional vomiting. Dysplasia of the left internal carotid artery was found at angiography.

Case 4

A 76-year-old female complained of transient episodes of feeling faint—as if she would “black out”—although she never lost consciousness. She also complained of numbness and tingling in her upper extremities for 1–5 minute periods. Angiography showed bilateral carotid FMD. She was placed on a regimen of aspirin and dipyridamole and has done well since initial evaluation.

Case 5

A 66-year-old, right-handed Caucasian male presented with a history of progressive mental deterioration characterized by confusion and poor memory retention. In addition, he reported a long history of right facial pain and right occipital neuralgia. Previously, he had undergone a right subtemporal craniotomy for partial obliteration of the right Gasserian ganglion, with a subsequent right facial hypesthesia. Computerized tomography of the brain showed a multiple infarct pattern of low densities, more prominent in the right hemisphere than the left. Cerebral angiography revealed bilateral internal carotid and left vertebral FMD (Figure). The right vertebral artery was not visualized.

Discussion

The clinician depends primarily on angiography for the diagnosis of fibromuscular hyperplasia, either renal or cervicocranial. The medical or surgical neurologist who evaluates patients with TIAs will occasionally encounter a patient who has no evidence of occlusive disease but has the stigmata of FMD. There may be stenosis or turbulent blood flow and consequent platelet aggregation resulting in platelet embolization to the intracranial vessels.

FMD may be associated with intracranial aneurysms. There may be a systemic dysplasia of vessels including the renovascular system. When the latter is affected, hypertension ensues, making the likelihood of subarachnoid hemorrhage from ruptured aneurysm a greater possibility. The disease may affect splenic, celiac, mesenteric, axillary, and other extracranial arteries, including the superficial temporal, as noted by Patchefsky and Paplanus (3). Hartman et al. (4), in 1971, reported the case of a 29-year-old female with generalized FMD and bilateral internal carotid artery occlusion. She had been taking oral contraceptives and was also on anticonvulsants. Whether or not the medications and the progression of her disease were related is unclear. Her regimen becomes significant, however, in an age when oral contracep-



Figure. Note “string of beads” appearance of distal vertebral artery.

tives have been implicated in the genesis of strokes.

Visually, FMD has been described as a “string of beads,” the most common location being the distant two thirds of the internal carotid and the renal arteries. Pollack and Johnson (5) emphasized that the tubular form of FMD may be mimicked by diffuse carotid artery spasm following arteriographic manipulation. The latter, however, will disappear with time, contrasting with the permanence of the dysplastic changes.

From the reports of Kincaid et al. (6), there is evidence that internal radiographic examination shows progression of the disorder in at least one third of their cases. The accepted classification of FMD follows four subdivisions, based on the pathologic findings:

1. Arteries with only fibroplasias of the intima,
2. Maldevelopment or malformation of the media, with fibrosis and thinning of the arterial wall and resultant aneurysm formation,
3. Fibromuscular changes associated with disorganized muscle fibers and fibrosis, and
4. Collagenous changes with ring-like constriction around the media. These changes are segmental, affecting small and medium-sized vessels, especially those that are paired.

The affected arteries frequently show cushion-like outpouchings of the intima. Occasionally, arterial dissections have been seen. At the present time, there appears to be no plausible explanation for FMD, and speculation has included a congenital etiology, inflammatory origin, or even classification with the collagen diseases. Hormonal factors have also been suggested, particularly since there is a definite female preponderance.

The surgical correction of FMD (7) may be accomplished by end-to-end anastomosis after resecting the diseased portion of vessel, vein graft anastomosis using autogenous saphenous vein, arteriotomy, artificial graft anastomosis, and resection of fibrotic tissue from the affected section of artery. The use of stents by the vascular radiologist is a popular new method for treating FMD of the carotid arteries. It has been very effective in treating the major vessels of the trunk and periphery, but especially the carotid arteries. In general, early detection of this vascular disorder followed by appropriate treatment increases the likelihood of a satisfactory outcome.

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