We report a 43-year-old woman who presented with a right frontoparietotemporal ischemic stroke. She had been diagnosed with Turner’s syndrome during childhood and had a history of chronic estrogen therapy. Cerebral angiography showed lesions characteristics of fibromuscular dysplasia involving the right internal carotid and right vertebral arteries. We are not aware of any previous reports describing an association between fibromuscular dysplasia and Turner’s syndrome. Although chronic estrogen therapy cannot be ruled out as a cause of this patient’s stroke, we suggest a possible etiologic relation between these two entities. (Stroke 1991;22:269–271)

Fibromuscular dysplasia is a noninflammatory, nonatherosclerotic vascular disease of unknown etiology that involves medium-size and small arteries. The renal and internal carotid arteries are the vessels most frequently affected. Fibromuscular dysplasia is an unusual cause of stroke.1–4 Several entities have been described in association with fibromuscular dysplasia suggesting the involvement of an important genetic factor.2,3 We describe a patient with Turner’s syndrome who was receiving chronic estrogen therapy, developed a stroke, and was then found to have fibromuscular dysplasia.

Case Report

The patient was a 43-year-old white woman diagnosed with Turner’s syndrome at the age of 6 years and treated with cyclic estrogen therapy. In November of 1987, she awoke with weakness of her left arm that lasted for 2 hours and then spontaneously improved. She was well until that afternoon, when she developed a left hemiplegia and was brought to our hospital. She was alert and oriented.

General examination revealed small stature, low hairline, cubiti valgus, vitiligo, scarce axillary hair, and poorly developed breasts. There were no symptoms or signs suggestive of coarctation of the aorta. A left homonymous hemianopsia was present, together with a left hemiplegia and left hemisensory loss. The results of laboratory tests (including complete blood count; hemoglobin concentration; hematocrit; urinalysis; bilirubin, serum glutamic oxaloacetic transaminase, alkaline phosphatase, albumin, and globulin concentrations; assays for rheumatoid factor, antinuclear antibody, and complement; prothrombin time; electrocardiography; and echocardiography) were all normal, as were tests of thyroid function and prolactin levels. The dosage of estradiol was diminished (10 pg/ml by RIE) and those of follicle-stimulating hormone and luteinizing hormone were increased (40 and 8 pg, respectively).

Cranial computed tomography performed 3 days after onset showed an area of decreased density affecting the right frontoparietotemporal region with no mass effect. Cerebral angiography revealed beading of the middle portion of the extracranial right internal carotid artery (Figure 1) and a stenotic lesion of the middle segment of the extracranial right vertebral artery (Figure 2). Aspirin (500 mg/day) was administered, and estrogen therapy was discontinued. She began rehabilitation and was able to ambulate with a walker 3 months after the onset of the stroke.

Discussion

Fibromuscular dysplasia is an unusual disease affecting predominantly women in the fifth decade of life.2,4 It most commonly affects the renal and internal carotid arteries, but many other vessels can be involved.2 The underlying pathogenesis is fibroblast-like transformation of smooth muscle cells, leading to the characteristic vessel wall changes.5

Fibromuscular dysplasia is diagnosed angiographically, the most striking feature being the classic “string-of-beads” stenosis.1,3,6,7 In our patient we observed this pattern at the middle segment of the extracranial right internal carotid artery and at the
A variety of entities (including coarctation of the aorta) have been described in association with fibromuscular dysplasia, but not, to our knowledge, with Turner's syndrome. On the other hand, Turner's syndrome, one of the most common forms of human aneuploidy (45 chromosomes, XO), has also been associated with coarctation of the aorta. This mutual association raises the question of a possible common mechanism accounting for both types of stenotic lesion.

Several hypotheses for the etiology of fibromuscular dysplasia have been proposed. The congenital hypothesis suggests that a vascular malformation explains the characteristic location of this lesion at the middle third of the carotid artery. The importance of genetic factors is also supported by the high familial incidence of fibromuscular dysplasia and the high prevalence of associated entities in individual patients. In this context, an association between fibromuscular dysplasia and Turner's syndrome, as in our patient, might be further evidence of the importance of genetic factors in the etiology of the former.
The humoral hypothesis\textsuperscript{12} is based on histopathologic studies in women taking oral contraceptives whose vessels show structural and histochemical changes in the intima and media similar to those found in fibromuscular dysplasia. Our patient was receiving chronic estrogen therapy, which might have played a role in the causation of fibromuscular dysplasia or stroke. Arterial stretching during extension and rotation of the head (the mechanical hypothesis) may also result in changes of the vessel wall compatible with fibromuscular dysplasia,\textsuperscript{3} as can a decreased blood supply to the vascular wall due to occlusion of the vasa vasorum (the ischemic hypothesis).\textsuperscript{13–15}

There was no evidence of either mechanical or ischemic mechanisms in our case.

Our patient had Turner’s syndrome, was taking oral contraceptives, and developed a stroke. Angiography showed changes characteristic of fibromuscular dysplasia. A relation among these four factors is difficult to establish since stroke can occur in otherwise healthy women taking oral contraceptives and in women with fibromuscular dysplasia alone. However, it is interesting to postulate a genetic predisposition leading to an association between Turner’s syndrome and fibromuscular dysplasia, with hormonal factors perhaps contributing to the stroke.

Acknowledgment

We thank Dr. Luis Catoggio for his help in the preparation of the manuscript.

References

10. Rushton AR: The genetics of fibromuscular dysplasia. \textit{Arch Intern Med} 1980;140:233–236

\textbf{KEY WORDS} • arterial occlusive diseases • Turner’s syndrome
Turner's syndrome, fibromuscular dysplasia, and stroke.
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doi: 10.1161/01.STR.22.2.269

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/22/2/269

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