Comparison of Single versus Multiple Spontaneous Extra- and/or Intracranial Arterial Dissection

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Background: Anecdotal data suggest that approximately 20% of patients with a spontaneous extra- and/or intracranial arterial dissection have multiple arterial involvement. Limited data exist regarding the clinical and angiographic characteristics of patients with multiple arterial dissections. We compared the clinical and angiographic features of patients with spontaneous multiple extra- and/or intracranial arterial dissections with those who have a single arterial dissection. *Methods:* A retrospective chart review of the consecutive ischemic stroke database over a 7-year period, maintained at 2 institutions, was conducted to identify patients with spontaneous extra- and/or intracranial arterial dissection. The patients' clinical characteristics and angiographic features (including the artery affected, presence of pseudoaneurysm, fibromuscular dysplasia, and degree of stenosis) were analyzed. *Results:* A total of 76 patients were admitted with spontaneous extra- and/or intracranial arterial dissection; 46 dissections were confirmed with 4-vessel cerebral angiography. Multiple arterial dissections were found in a total of 10 (22%) patients. Involvement of multiple arteries was more prevalent in the young, when compared to a single spontaneous arterial dissection (7 [70%] in patients <45 years of age *v* 11 [31%]; $P = .03$). Patients with multiple arterial dissections had a higher proportion of pseudoaneurysms (9 [90%] *v* 11 [31%]; $P = .001$), a higher prevalence of underlying fibromuscular dysplasia (3 [30%] *v* 3 [8%]; $P = .11$), and were more likely to involve the posterior circulation ($P < .0001$). *Conclusions:* The presence of multiple, simultaneous spontaneous extra- and/or intracranial arterial dissections must be considered when a single spontaneous arterial dissection is identified. **Key Words:** Carotid artery dissection—multivessel vertebral dissection.

Spontaneous extra- and/or intracranial arterial dissections may be caused by several genetic and environmental factors, each having a modest and potentially synergistic effect.[1,2] Monogenic connective tissue diseases, such as Ehlers–Danlos syndrome, osteogenesis imperfecta, and Marfan syndrome, have been implicated in <2% of patients with spontaneous extra- and/or intracranial arterial dissection.[1-3] Isolated case reports also have implicated other monogenic disorders, such as autosomal dominant polycystic kidney disease,[4] alpha-1-antitrypsin deficiency,[5] or hereditary hemochromatosis,[6] but have also identified rare chromosomal disorders, such as Turner[7] or William syndrome.[8] Familial cases of extra- and/or intracranial arterial dissections in the absence of known connective tissue disease have also been reported.[9] High plasma concentrations of proteases such as matrix metalloproteinase-2 among affected patients suggest that there may an association between extra- and/or

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intracranial arterial dissection and the presence of an underlying extracellular matrix defect.[10] Given the underlying predisposition, it is likely that multiple arteries can be involved in patients with spontaneous extra- and/or intracranial arterial dissections.

Patients with multiple, simultaneous spontaneous extra- and/or intracranial arterial dissections have been included in a variety of case reports and retrospective case series of single extra- and/or intracranial arterial dissections, although there is limited reported data regarding their clinical and angiographic characteristics and outcomes.[11] It remains unclear whether the patients with multiple arterial dissections have other distinct attributes. We performed this retrospective study to report the prevalence and compare the demographic, angiographic, and clinical features of patients with spontaneous dissections who have involvement of multiple arteries with those who have single arterial dissections.

Methods

A retrospective chart review was conducted of all consecutive patients during a 7-year period at 2 different university affiliated academic institutions (University of Minnesota and Hennepin County Medical Centers) using the admission primary or secondary *International Classification of Diseases, 9th revision, clinical modification* (ICD-9-CM) codes for ischemic stroke (433, 434, and 436) and transient ischemic attack (435.0-435.9). A search was also performed using the admission primary or secondary ICD-9-CM codes for arterial vessel dissection (443.2, 443.21, and 443.24). The patients were also identified using a prospectively maintained registry that tracks all patients who undergo cerebral angiography and neuroendovascular procedures at both hospitals. Only patients with spontaneous arterial dissections were included after a review of admission history and physical examination, excluding patients with iatrogenic and traumatic dissections (Fig 1).

Spontaneous dissection was defined as the natural disruption of the vessel media and intima not secondary to iatrogenic or traumatic etiology. The diagnosis required a combination of the following (ZQSRC criteria): (1) age atypical for stenosis secondary to an atherosclerotic lesion; (2) clinical symptoms suggestive of dissection, such as neck pain or signs of Horner syndrome; (3) disruption of the arterial vessel wall on imaging studies: stenosis, intimal flap, false lumen, mural thrombus, and pseudoaneurysm; (4) location of lesion at high vulnerability arterial junctions; (5) absence of changes suggestive of atherosclerosis, such as calcification; (6) exclusion of vessel hypoplasia and pseudodissection.

The imaging studies that were reviewed to document the location of the dissection, presence of stenosis, intimal flap, pseudoaneurysm, and changes consistent with fibromuscular dysplasia were either a cerebral angiogram, magnetic resonance imaging (MRI) scan with T1 fat suppression

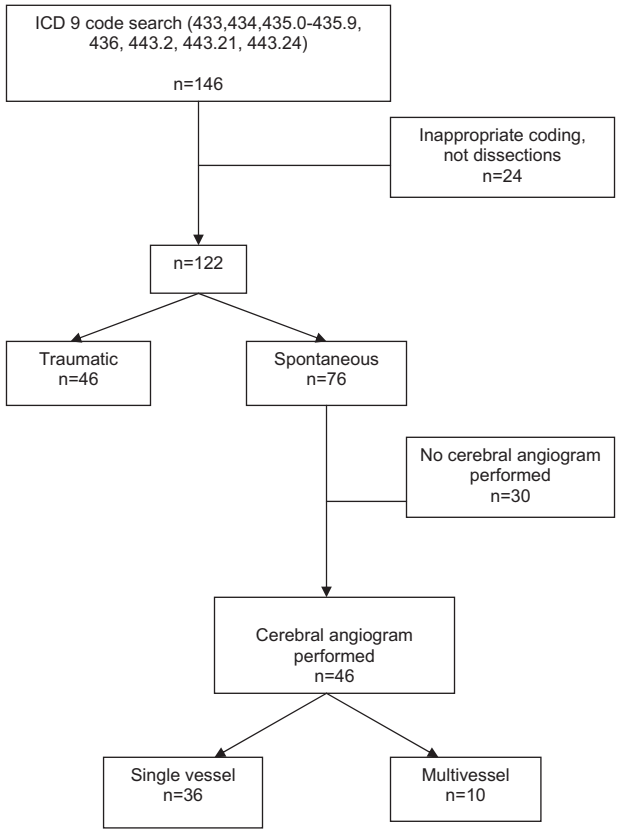

Figure 1. *Patient selection.*

sequences, magnetic resonance angiography (MRA), or computed tomography angiography (CTA). The protocol for collecting data was reviewed and approved by the institutional review boards at both institutions as part of a standardized database and approval from an ethical standards committee to conduct this study was received.

Patient Selection

The patients were included in this study if they had a 4-vessel cerebral angiogram as part of their diagnostic work up for their extra- and/or intracranial arterial dissection. The results of the MRI, CTA, and cerebral angiographic studies were reviewed by an Endovascular Surgical Neuroradiology attending and fellow, who documented the arterial dissection and presence of any vascular changes including stenosis, pseudoaneurysm, and angiographic characteristics of fibromuscular dysplasia. Simultaneous, multiple spontaneous arterial dissections were defined as arterial dissections involving 2 or more independent extra- and/or intracranial arteries (Fig 2). Similarly, the presence of multiple spontaneous arterial dissections was identified when a single extra- and/or intracranial artery was found to have 2 distinct noncontiguous affected segments separated by a segment of normal, intact artery. All dissections were reviewed in order to ascertain if multiple dissected segments were extensions of a previously noted dissection.