

# Neuroimaging Highlight

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## Spontaneous Extra-Cranial Vertebral Artery Dissection

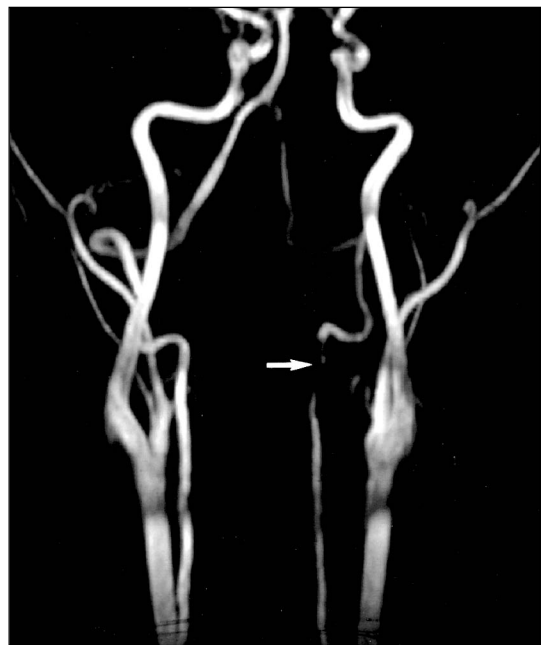
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A 35-year-old doctor was on duty when she felt a moderately severe left sided neck pain. Although the pain was only partially relieved with simple analgesics, she was able to continue and finish her shift. The next day, she developed an occipital headache; at this point she sought neurologic advice for persistent head and neck pain. Physical examination was unrevealing. There was no fever, meningeal signs and no focal neurological deficits were found. A computed tomographic scan of the brain was normal while a cervical spine X-ray revealed loss of cervical lordosis. One week after the onset of neck pain a magnetic resonance arteriogram (MRA) demonstrated narrowing of the left vertebral artery at C2 to C4 (Figure 1). Fat suppression images demonstrated a rim of hyper-intense signal surrounding the vertebral artery at the level of arterial narrowing (Figure 2). Conventional catheter angiography was not performed as the diagnosis was clear on the MRA. Low-molecular weight heparin was given subcutaneously in view of the diagnosis of vertebral artery dissection. Three months afterwards anticoagulation was stopped when repeat MRA showed resolution of the lesion. The patient made an uneventful recovery. Magnetic resonance imaging (MRI) of the brain revealed no areas of silent infarction.

Vertebral artery dissections can be divided anatomically into those that occur in the extracranial and the intracranial portions of the vertebral artery. The annual incidence is estimated at 1 per 100,000 but dissections are important causes of young stroke.<sup>1</sup> Spontaneous dissection is twice as common in women as in men. Patients with mild disease are increasingly diagnosed with the rise in noninvasive imaging. Intracranial vertebral artery dissections present with subarachnoid haemorrhage or vertebrobasilar ischemia. Extracranial vertebral artery dissections (ECVADs) usually present with occipital headache or neck pain, but vertebrobasilar ischemia may result, mostly resulting in lateral medullary, pontine, midbrain, cerebellar or thalamic infarcts. In patients presenting with severe occipital headache, especially if accompanied with neck pain, a high index of suspicion is required to prevent missing the diagnosis of an ECVAD. A history of sporting activities, chiropractic manoeuvres or neck injury may be elicited.<sup>2-5</sup>

Traditionally the diagnosis of an ECVAD is established by conventional or digital subtraction catheter angiography. Abnormalities include focal arterial narrowing (string sign), a double lumen (intimal flap formation), segmental dilatation (pearl sign), or a tapered occlusion.<sup>6,7</sup> In approximately 15-20% of cases, fibromuscular dysplasia can be diagnosed with angiography.<sup>1</sup> The C1-C2 level is most vulnerable to injury as here the vertebral artery exits the transverse foramen and turns at an acute angle to enter the intracranial cavity. MRI has emerged as an alternative non-invasive method to diagnose vertebral

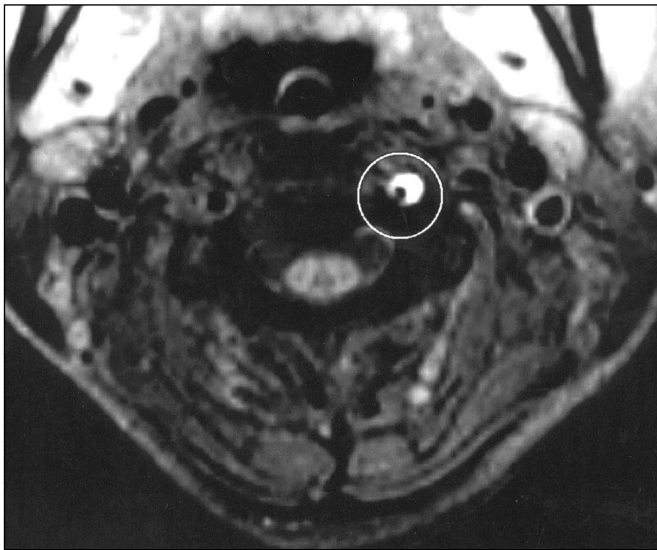


**Figure 1:** Three dimensional time-of-flight MRA showing irregular narrowing of the left vertebral artery at levels of C2-C4.

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**Figure 2:** Spin-echo T1-weighted axial MRI (fat suppression sequence), reveals a hyper-intense signal which represents a rim of methemoglobin at the corresponding level of the vertebral artery with narrowing of the lumen.

artery dissections.<sup>5,8-10</sup> MRI shows morphological detail while MRA can demonstrate the narrowed lumen in the pathological segment of the artery. It can also be combined with a conventional T1-weighted axial imaging of the neck which may show the hyper-intense signal of an intra-mural thrombus surrounding the flow void of the narrowed arterial lumen; this combination of findings is highly suspicious of a vertebral artery dissection.<sup>11,12</sup> Repeat MRA may also be useful in evaluating the progress of arterial repair.

MRI/MRA is specific but the sensitivity has been reported to be as low as 20%. False positive scans may be due to slow flow in the perivascular venous plexus giving rise to a hyper-intense signal, asymmetrical vertebral arteries as well as spin dephasing due to turbulent flow in the region of acute bends in the artery.<sup>13</sup> One of the pitfalls in the use of MRI/MRA in the diagnosis of vertebral artery dissections lies in confusing these “false positive” areas with true dissections. The flow abnormality in the MRA of the distal left vertebral artery in Figure 1 is an illustration of such a false positive area. The use of T1-weighted images to demonstrate the hyper-intense signal of an intra-mural thrombus or a T2-weighted image to look for an intimal flap may help to differentiate true dissections from false positive areas. In addition, MRA using contrast-enhanced images or 3-D spoiled

gradient-recalled acquisition may also be useful in differentiating true dissections from false positives.<sup>14-16</sup>

The treatment of ECVADs has not been evaluated in a randomized controlled trial.<sup>17</sup> Practices vary significantly worldwide; aspirin or anticoagulation for up to three months are used to prevent thromboembolic events. This period may be extended if follow-up radiological investigation demonstrates incomplete resolution of the pathological process.

## REFERENCES

- Schievink WI. Spontaneous dissections of the carotid and vertebral arteries. *N Eng J Med* 2001;344:898-906.
- Silbert PL, Mokri B, Schievink WI. Headache and neck pain in spontaneous internal carotid and vertebral artery dissections. *Neurology* 1995;45:1517-1522.
- Rothwell DM, Bondy SJ, Williams JI. Chiropractic manipulation and stroke: a population-based case-control study. *Stroke* 2001;32:1054-1060.
- Norris JW, Beletsky V, Nadareishvili ZG. Sudden neck movement and cervical artery dissection. *CMAJ* 2000;163:38-40.
- De Bray JM, Penisson-Besnier I, Dubas F, Emile J. Extracranial and intracranial vertebrobasilar dissections: diagnosis and prognosis. *J Neurol Neurosurg Psychiatry* 1997;63:46-51.
- Saeed AB, Shuaib A, Al-Sulaiti G, Emery D. Vertebral artery dissection: warning symptoms, clinical features and prognosis in 26 patients. *Can J Neurol Sci* 2000;27:292-296.
- Chang AJ, Mylonakis E, Karanasias P, De Orchis DF, Gold R. Spontaneous bilateral vertebral artery dissections: case report and literature review. *Mayo Clin Proc* 1999;74:893-896.
- Hosoya T, Adachi M, Yamaguchi K, et al. Clinical and neuroradiological features of intracranial vertebrobasilar artery dissection. *Stroke* 1999;30:1083-1090.
- Kirsch E, Kaim A, Engelter S, et al. MR angiography in internal carotid dissection: improvement of diagnosis by selective demonstration of the intramural haematoma. *Neuroradiology* 1998;40:704-709.
- Levy C, Laissy JP, Raveau V, et al. Carotid and vertebral artery dissections: three-dimensional time-of-flight MR angiography and MR imaging versus conventional angiography. *Radiology* 1994;190:97-103.
- Kasner SE, Hankins LL, Bratina P, Morgenstern LB. Magnetic resonance angiography demonstrates vascular healing of carotid and vertebral artery dissections. *Stroke* 1997;28:1993-1997.
- Auer A, Felber S, Schmidauer C, et al. Magnetic resonance angiographic and clinical features of extracranial vertebral artery dissection. *J Neurol Neurosurg Psychiatry* 1998;64:474-481.
- Bloem BR, Van Buchem GJ. Magnetic resonance imaging and vertebral artery dissection. *J Neurol Neurosurg Psychiatry* 1999;67:691-692.
- Hosoya T, Watanabe N, Yamaguchi K, Kubota H, Onodera Y. Intracranial vertebral artery dissection in Wallenberg syndrome. *Am J Neuroradiol* 1994;15:1161-1165.
- Hosoya T, Adachi M, Yamaguchi K, et al. Clinical and neuroradiological features of intracranial vertebrobasilar artery dissection. *Stroke* 1999;30:1083-1090.
- Touze E, Randoux B, Meary E, et al. Aneurysmal forms of cervical artery dissection. *Stroke* 2001;32:418-423.
- Blunt SB, Galton C. Cervical carotid or vertebral artery dissection. *Br Med J* 1997;314:243.