Vertebral Artery Injury and Cerebellar Stroke While Swimming: Case Report

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BENJAMIN LEE, M.D.,† AND JOHN CARONNA, M.D.*

SUMMARY A twenty-five year old woman suffered the acute onset of dysequilibrium followed by headache, nausea, vomiting, vertigo, and slurred speech while swimming. Brain imaging revealed a right cerebellar infarct. Intravenous digital subtraction angiography showed a hypoplastic right vertebral artery and focal narrowing of the dominant left vertebral artery at the level of the C1-C2 junction. The patient was treated with aspirin and dipyridamole and immobilized for two weeks. She achieved almost complete recovery. Repeat angiography showed resolution of the left vertebral artery defect. Other cases of posterior circulation infarction associated with head turning during sports and ordinary activities are reviewed.

Stroke Vol 16, No 6, 1985

OBSTRUCTION TO VERTEBROBASILAR PERFUSION resulting from cervical rotation was first documented during the early part of this century in the German literature.1 There have since been numerous reports of cerebral, cerebellar, and spinal cord infarction associated with head movement. The most common setting is chiropractic manipulation of the neck; three hundred sixty such cases have been registered with the Stroke Council of the American Heart Association2 and thirty-eight documented in the literature.34 Sports and ordinary activities involving head turning have also been associated with vertebrobasilar insufficiency (table 1). We report the first case of posterior circulation stroke during swimming.

Case Report

A twenty-five year old lefthanded woman was transferred from another hospital with headache, vomiting, and loss of balance.

The previous day she had been swimming freestyle in a pool with her face kept continuously rotated approximately ninety degrees to the left for about an hour. She was forced to make an abrupt change in direction to avoid a child and suddenly felt as if an undercurrent were pulling her down and to the right. Nauseated, she struggled to poolside, suffered a brief episode of vertigo, and vomited. She had a full cervico-occipital ache, slurred speech, and right-sided clumsiness with loss of equilibrium. Over the subsequent twenty-four hours her speech and balance improved, but her headache worsened and she vomited repeatedly.

The general medical examination was normal. The patient’s speech was dysrhythmic and side-to-side alternating movements of the tongue were slow and uneven. There was no bulbar weakness. She held her head tilted approximately thirty degrees to the right and had a broad-based, unsteady gait with a tendency to fall to the right. There was right arm and leg dysmetria and dysdiadochokinesis.

Computerized transaxial tomography (CT) one day after onset revealed a low-density area in the right cerebellum extending anteriorly and to the midline which did not enhance following intravenous contrast (fig. 1). Nuclear magnetic resonance imaging two days later showed involvement of the right cerebellar hemisphere without primary injury to or impingement upon the brainstem (fig. 2). Plain films and CT of the cervical spine were unremarkable. Intravenous digital subtraction angiography (DSA) demonstrated focal narrowing of the left vertebral artery at the C1-C2 level; the right vertebral was hypoplastic (fig. 3).

The patient was kept on strict bedrest in a hard cervical collar for two weeks and maintained on aspirin 80 mg per day and dipyridamole 25 mg three times a day. Over this time her neurologic signs resolved almost completely, the residua being a head tilt and gait unsteadiness when fatigued. Repeat DSA four weeks after the onset of symptoms revealed resolution of the defect in the left vertebral artery (fig. 4).

Discussion

Swimming involves a variety of head movements which could lead to compromise of vertebral artery flow. Our patient was swimming a modified crawl in which she kept her head in continuous rotation to the left at angles greater than those necessary to produce vertebral artery obstruction in the cadaver,1 11 during arteriography,12 and intraoperatively as measured by an electromagnetic flowmeter.13 Dissection of the extracranial internal carotid artery during swimming has recently been encountered by the present authors and reported by Luken, et al.14

That clinical sequelae of head rotation are rare suggests that predisposing factors are necessary for ischemia to occur. Various authors have stressed the association of vertebral artery anomalies, tortuosity, and atherosclerosis as well as the duration and force of head rotation,12 15 16 but these have not been consistent features.3 In the present case the vertebral artery ipsilateral to the side of cerebellar infarction was hypoplastic while the contralateral, dominant vertebral was focally narrowed at the C1-C2 junction. The patient made a sudden forceful movement in an unspecified...
This is the first case in which DSA has been used to document vertebral artery injury associated with head rotation. We chose DSA because vertebral arteriography in patients with recent infarction carries a greater risk of central nervous system complications relative to non-vertebral arteriography and because DSA is associated with a low risk of procedure-related CNS complications. DSA images the posterior circulation well and should prove useful in demonstrating lesions at all levels of vertebral artery injury associated with head rotation — C1-C2, C6, and the occipitoatlantal joint.

This is also the first case in which resolution of such a lesion following treatment with anti-platelet agents and immobilization has been angiographically documented. We administered aspirin and dipyridamole rather than heparin because focal neurologic symptoms and signs had not progressed over the twenty-four hours prior to admission. While clinical data are limited and therapeutic approaches must be individualized, in selected cases anti-platelet therapy may be beneficial.

**FIGURE 1.** CT of head without contrast (GE8800 scanner) with 5 mm sections through the posterior fossa. Arrow indicates infarct in right cerebellum.

**FIGURE 2.** NMR scan (0.5 Tesla Superconducting Technicare scanner) using spin echo SE 30/500 shows area of decreased signal in right cerebellum (arrow) consistent with infarction.

**FIGURE 3.** DSA showing focal narrowing of the left vertebral artery at the level of the C1-C2 junction (arrow). The right vertebral artery is hypoplastic.
TABLE 1  Sports and Ordinary Activities Associated with Posterior Circulation Infarction During or Following Head Rotation

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Age/Sex</th>
<th>CNS Findings</th>
<th>Vascular Pathology</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gymnastics (5) (parallel bars)</td>
<td>18/M</td>
<td>spinal cord infarction, lower cervical</td>
<td>anterior spinal artery occlusion</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Calisthenics (5)</td>
<td>55/M</td>
<td>spinal cord infarction, lower cervical</td>
<td>anterior spinal artery occlusion</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Calisthenics (6) (stretching exercises)</td>
<td>15/M</td>
<td>spinal cord infarction, lower cervical</td>
<td>anterior spinal artery thrombosis</td>
<td>autopsy</td>
</tr>
<tr>
<td>Yoga (5)</td>
<td>28/F</td>
<td>left cerebellar infarct</td>
<td>left vertebral artery narrowed at C1-C2</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Yoga (7)</td>
<td>25/M</td>
<td>left dorsolateral medullary syndrome, onset 2 hrs after at exercise</td>
<td>left vertebral artery obstruction at C1-C2</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Archery (8)</td>
<td>39/M</td>
<td>right dorsolateral medullary syndrome, evolving over minutes</td>
<td>right vertebral artery spasm aneurysm distal to spasm</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Driving (9)</td>
<td>38/F</td>
<td>pontine, cerebellar, and occipital infarcts</td>
<td>right vertebral artery narrowing with thrombosis at the occipito-atlantal junction</td>
<td>autopsy</td>
</tr>
<tr>
<td>Driving (9) (in reverse)</td>
<td>58/M</td>
<td>right pontine infarction</td>
<td>left vertebral artery hypoplasia</td>
<td>neurological examination and arteriography</td>
</tr>
<tr>
<td>Painting (10) (ceilings)</td>
<td>43/M</td>
<td>right lateral medullary syndrome evolving over 18 hours</td>
<td>right vertebral artery occlusion at C1-C2 and left vertebral artery stenosis at foramen magnum</td>
<td>neurological examination and arteriography</td>
</tr>
</tbody>
</table>

References

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Figure 4.  DSA showing resolution of the left vertebral artery defect (arrow) illustrated in Figure 3.
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Vertebral artery injury and cerebellar stroke while swimming: case report.
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Stroke. 1985;16:1039-1042
doi: 10.1161/01.STR.16.6.1039

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:
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