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Shotgun Pellet Embolus to the Posterior Cerebral Artery

G. Douglas Hungerford,1 H. David Reines,2 James M. Powers,3 and H. Biemann Otherson, Jr.4

The embolization of a cerebral artery by a bullet or metallic fragment is rare; we found reports of 13 previous cases, all of which involved the carotid circulation. This report describes the first known case of embolization of the vertebrobasilar circulation by a metallic embolus.

Case Report

An 8-year-old boy was seen 1 hr after a shotgun injury at point-blank range to the left side of his neck and face. There was extensive soft tissue injury, and parts of the left brachial plexus and left side of the mandible had been shot away. Several cervical vertebrae were exposed and there was severe bleeding. The patient was nonresponsive and his left arm was completely paralyzed. He was in shock and was resuscitated, and then was taken to the operating room for debridement and control of the bleeding. The major blood vessels showed no sign of injury, but there was bleeding from small arteries.

Postoperative computerized tomography (CT) (fig. 1A) showed a left cerebellar infarct and a metallic object posterior to the clivus. Postoperatively he was awake and responded to verbal commands and moved all limbs except the left arm. Twelve hours after admission he suddenly became unresponsive and developed severe arterial hypertension and pulmonary edema. He became apneic and had bradycardia. Corrective therapy was rapidly begun and the hypertension and pulmonary edema were controlled, but he remained unconscious.

Fourteen hours after admission, cerebral angiography and a repeat CT scan were obtained. CT (fig. 1B) showed enlargement of the cerebellar infarct and moderate hydrocephalus. Cerebral angiography (fig. 1C) showed complete occlusion of the left posterior cerebral artery 2 mm distal to its origin by a shotgun pellet. However, beyond this point, the left posterior cerebral artery was again filled via the left posterior communicating artery. On both sides, the superior cerebellar arteries arose from the posterior cerebral arteries. There was a paucity of branches of the left superior cerebellar artery to the superior surface of the left cerebellar hemisphere and there was poor perfusion of this region. The cerebellum was swollen. Several thalamoperforate arteries were visible and there was a substantial thalamic blush. The left vertebral artery showed no abnormality at fluoroscopy and was normal on films, where it could be seen down to the C6–C7 intervertebral disc. Bilateral carotid arteriograms showed no abnormality of the internal carotid or common carotid arteries in the neck. Cerebral circulation was slow, consistent with raised intracranial pressure. The patient was treated conservatively; he died on day 4.

At autopsy, there was infarction of the left cerebellar hemisphere.

Fig. 1.—A, CT scan. Shotgun pellet (arrow) behind clivus. B, 14 hr after admission. Large left cerebellar infarct (arrows). C, Vertebral angiogram. Shotgun pellet occludes left posterior cerebral artery (short arrow). On each side, superior cerebellar arteries arise from posterior cerebral arteries (long arrows). Reduced filling of branches of left superior cerebellar artery.

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TABLE 1: Cerebral Embolization by Bullets or Metallic Fragments

<table>
<thead>
<tr>
<th>Reference</th>
<th>Artery</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>[2]</td>
<td>Left middle cerebral</td>
<td>Shell fragment entered left carotid; onset of hemiplegia 24 hr later</td>
</tr>
<tr>
<td>[3]</td>
<td>Right sylvian vessels</td>
<td>Steel splinter entered carotid artery; almost immediate onset of hemiplegia</td>
</tr>
<tr>
<td>[4]</td>
<td>Left middle cerebral</td>
<td>Shotgun pellet entered carotid artery with immediate hemiplegia</td>
</tr>
<tr>
<td>[5]</td>
<td>Right middle cerebral</td>
<td>Buckshot pellet entered either the neck or the chest</td>
</tr>
<tr>
<td>[6]</td>
<td>Both internal carotids</td>
<td>Shotgun pellets entered heart and then embolized</td>
</tr>
<tr>
<td>[7]</td>
<td>Right common carotid</td>
<td>Bullet probably entered the left ventricle and embolized</td>
</tr>
<tr>
<td>[8]</td>
<td>Left middle cerebral</td>
<td>Shotgun pellet entered carotid artery</td>
</tr>
<tr>
<td>[9]</td>
<td>Right middle cerebral</td>
<td>Metallic fragment entered chest and embolized 4 months later</td>
</tr>
<tr>
<td>[10]</td>
<td>Right middle cerebral</td>
<td>Grenade fragment entered carotid artery</td>
</tr>
<tr>
<td>[1]</td>
<td>Internal carotid</td>
<td>Missile entered heart</td>
</tr>
</tbody>
</table>

and the midbrain. On each side, the superior cerebellar artery and the midbrain perforating arteries arose directly from the posterior cerebral artery rather than the basilar artery. A shotgun pellet was lodged in the left posterior cerebral artery proximal to the midbrain perforating arteries and adjacent to the origin of the left superior cerebellar artery. The midbrain perforating arteries were completely occluded by clot and the left superior cerebellar artery origin was almost completely occluded by clot. There were small areas of hemorrhagic necrosis in the right parietal and left occipital lobes.

Discussion

Intravascular migratory bullets or metallic fragments are rare. Mattox et al. [1] reviewed the literature up to 1979 and found reports of 113 cases of bullet emboli to which they added 28 of their own. Of the 141 cases, 54% entered the venous system, 33% entered the heart or aorta, and only 2% entered an artery and travelled distally.

We have found descriptions of 13 cases of cerebral embolization in which a bullet or metallic fragment was the embolus (table 1). Including our case, seven entered an artery in the neck, four entered the heart or a thoracic vessel, and in three cases the source was either unknown or not stated. In all previous cases, the metallic emboli have been found in the carotid circulation; our case is the first in which the embolus has been carried into the vertebrobasilar territory.

The shotgun pellet in our case entered the left vertebral artery and was carried distally until it impacted in the pos-
terior cerebral artery. Ordinarily, impact at this site would not cause cerebellar ischemia, but the anomalous origin of the superior arteries from the posterior cerebral arteries, which occurs in 4.2% [12], permitted the pellet to occlude the superior cerebellar artery with resultant cerebellar infarction. The primary cause of death was apparently midbrain infarction following occlusion of midbrain perforating arteries. It is not clear why this occurred, suddenly, 13 hr after the injury. In the previous cases, cerebral embolization occurred at the time of the injury in nearly all instances, although in one it was delayed 4 months [9].

It is noteworthy in this case, as in the great majority of previously reported cases, vessel embolization resulted from a small metallic fragment which had a low incident velocity. Large caliber or high velocity missiles, as would be expected, are rarely the cause of vessel embolization.

The shotgun pellet was deemed to be inaccessible in the present case and no surgical removal was attempted. The results of previous attempted embolectomies in five cases have not been very encouraging [5, 7–9]. In those cases in which the embolus had impacted in a cerebral artery, removal did not favorably affect the outcome. In one instance, however, removal from the common carotid artery may have prevented further complications [7]. In a sixth case [1], the internal carotid artery was ligated but the patient died. Three of the 14 patients with metallic cerebral embolus died [1, 2]. Four of the survivors were normal [6, 7, 9, 10], five had varying degrees of neurologic deficit [3–5, 8, 9], and in two cases the detailed outcome is not known [11].

REFERENCES