Internal Carotid Pseudoaneurysm and Cerebral Infarction from Shotgun Pellet Penetration and Embolization

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A 33-year-old man was accidentally shot in the neck and face while hunting. Unenhanced head CT showed a single intracranial shotgun pellet without associated hemorrhage or skull fracture (Fig. 1A). Contrast-enhanced neck CT showed a hematoma surrounding the left internal carotid artery (ICA) (Fig. 1B). Rotational digital subtraction angiography revealed a small pseudoaneurysm of the left ICA (Fig. 1C), and conventional digital subtraction angiography revealed occlusion of an M2 segment (distal to the bifurcation) of the middle cerebral artery by an embolized shotgun pellet (Fig. 1D). Microsurgical embolectomy was performed (Fig. 1E); however, a left middle cerebral artery branch infarct developed that resulted in expressive dysphasia and right-sided weakness.

Embolization of a ballistic object in the intracranial circulation is rare, occurring most often from penetrating injuries to the thorax or face and neck, and usually occluding the middle cerebral artery. Although the entry point is often the common artery or the ICA, in most reported cases the entry site has been the thorax [1]. Neurologic symptoms from this peculiar event include death, coma, hemiplegia, hemiparesis, and, most commonly, aphasia; few patients completely recover and delayed deficit can occur. The neurosurgical management of an intracranially embolized pellet is selective, ranging from emergent microsurgical embolectomy to conservative medical management [2]. Rationale for microsurgical retrieval includes prevention of thrombus propagation that could extend the infarction; prevention of vessel erosion and subsequent catastrophic hemorrhage; and prevention of brain abscess, meningitis, or sepsis [3]. To our knowledge, these potential complications in patients treated with conservative management have not been reported. Surgical removal may not be indicated if distal embolization is present, if infarction is complete and neurologic deficit is stable, or if adequate collateral circulation is present. In our patient, although cerebral angiography suggested adequate compensatory circulation from anterior and posterior cerebral leptomeningeal collaterals, xenon CT and single-photon emission computed tomography of the brain revealed decreased cerebral perfusion in a larger middle cerebral artery territory than that outlined by head CT, prompting urgent microvascular pellet removal.

The imaging evaluation of vascular injury in penetrating neck trauma is evolving. In stable patients, in addition to standard conventional angiography, color Doppler sonography, CT angiography, and MR angiography are under investigation as techniques that can reliably detect arterial intimal flaps, pseudoaneurysms, and stenoses or occlusions from dissection. Missing small ICA pseudoaneurysms can be fatal for the patient. In our patient, spin digital subtraction angiography was helpful in detecting a small pseudoaneurysm of the distal cervical ICA.The appropriate management strategy for distal cervical ICA pseudoaneurysm is controversial and includes observation, follow-up imaging, anticoagulation, carotid artery ligation, endovascular balloon occlusion, stent or coil deployment, or microsurgical revascularization [4, 5].

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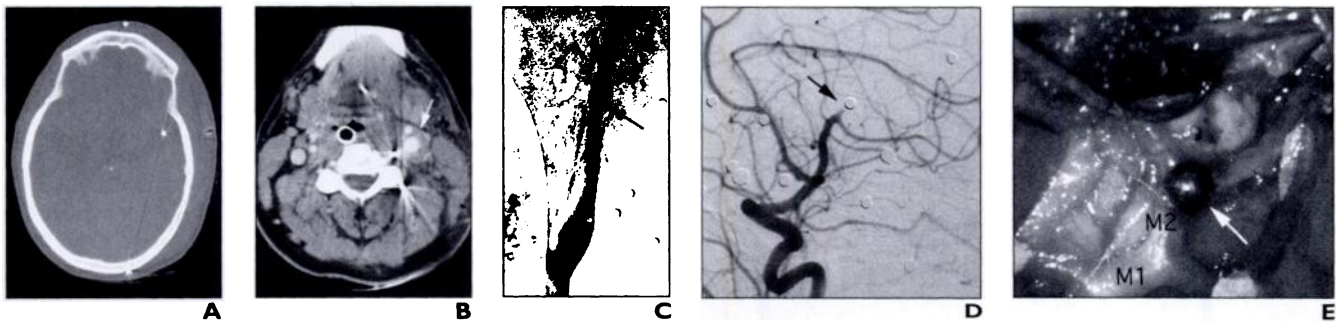

Fig. 1.—33-year-old man with gunshot wound to neck and face.
A, Unenhanced head CT image with bone algorithm and window settings. Single intracranial pellet is located in left sylvian fossa. No skull base or calvarial fracture was present.
B, Contrast-enhanced neck CT scan shows hematoma surrounding left internal carotid artery (ICA) (*arrow*).
C, Digital subtraction arteriogram of left common carotid artery shows subtle pseudoaneurysm of cervical segment of left ICA (*arrow*).
D, Oblique lateral digital subtraction arteriogram of left ICA shows abrupt cutoff of superior M2 segment of middle cerebral artery from embolized pellet (*arrow*).
E, Intraoperative photograph of embolized pellet (*arrow*) just beyond origin of occluded M2 segment. M1 = segment of middle cerebral artery proximal to bifurcation, M2 = segment distal to bifurcation.

This is another in the continuing series on radiology in trauma cases from the Harborview Medical Center. Editors: Fred A. Mann, Eric J. Stern, and Alexander B. Baxter.

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