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# Vertebral Artery Embolization for Control of Massive Hemorrhage

Bjorner Bergsjordet,<sup>1</sup> Charles M. Strother,<sup>1</sup> Andrew B. Crummy,<sup>1</sup> and Allan B. Levin<sup>2</sup>

## Case Report

A 61-year-old man with a 6 year history of severe rheumatoid arthritis was evaluated because of cervical pain and progressive numbness and weakness of both arms. His symptoms were of 1 month duration. He had not walked for 3 years. There was no history of acute or remote trauma. For the last 3 months before admission, he had been on daily prednisone.

Physical examination revealed an alert and oriented cushingoid man in no acute distress. There was tenderness to percussion over the spinous processes of the midcervical vertebrae. Marked rheumatoid deformities of the wrist, shoulders, ankles, and knees were noted. The general physical examination was otherwise unremarkable. Cranial nerves were intact. Motor examination revealed weakness of all four extremities. This was most marked in the wrist flexors and extensors, where the patient had difficulty overcoming gravity. Position sense was abnormal in both hands, and there was hypalgesia in the C6–C8 distribution bilaterally. Stretch reflexes were difficult to evaluate because of joint deformity and immobility, but were graded as slightly hyperactive in both the arms and legs. Plantar response was equivocal on the left and extensor on the right.

Cervical spine films on admission revealed a fracture-dislocation at C4–C5 with marked narrowing of the spinal canal at the C3, C4, and C5 levels. Cervical traction did not improve the patient's symptoms, so after 5 days he underwent an anterior cervical decompression and strut fusion of C3–C5. The central portion of the body of C4 was removed. The right vertebral artery was visualized and no unusual bleeding was encountered. Initially the patient did well, however, on postoperative day 1, respiratory stridor developed, and, on physical examination, he was found to have diffuse neck swelling. Because of airway compression he was intubated for 2 days. Motor function was unchanged. On postoperative day 9, cervical spine films revealed displacement of the bone strut. Over the next 24 hr, respiratory distress increased and cervical spine films showed a retropharyngeal mass.

Twelve days after his first operation he was again returned to the operating room for reinsertion of the bone strut. When the wound was opened, marked bleeding was encountered and was controlled by packing. The source of bleeding was not identified, and the vertebral artery was not seen. A vertebral arteriogram revealed a false aneurysm of the right vertebral artery at the C5 level (fig. 1A). There was no extravasation of contrast medium from the aneurysm, so it was elected to treat the patient conservatively. One day later he

began bleeding from his neck wound to a degree impossible to control with local measures. An arteriogram demonstrated enlargement of the false aneurysm with extravasation of the contrast medium into the soft tissues of the neck and mediastinum (figs. 1B and 1C).

A 7 French occlusion balloon catheter was inflated in the proximal segment of the right vertebral artery. The point of hemorrhage was above the site of occlusion, and, because of retrograde flow from the left vertebral artery, hemostasis was not achieved. The catheter was then manipulated above the level of the false aneurysm, and the occlusion balloon was reinflated. Injection of contrast medium distal to the balloon revealed a normal-appearing artery. With the occlusion balloon inflated, a mini-Gianturco coil [1] was inserted to lie distal to the site of arterial injury (fig. 1D). After minimal deflation of the balloon so as to prevent antegrade flow in the vessel, the catheter was withdrawn into a slightly more proximal position, and, after reexpansion of the balloon, another Gianturco coil was inserted. This maneuver was repeated until seven coils had been positioned above, at, and below the injured segment of the vessel. Bleeding from the neck wound had ceased. A control arteriogram 30 min after placement of the last coil revealed occlusion of the right vertebral artery at its origin (fig. 1E). No neurologic change occurred as a result of occlusion of the vertebral artery. Six weeks after treatment, the patient was transferred to rehabilitation medicine for further therapy. At the time of transfer, his neurologic function had not changed from that noted on admission.

## Discussion

The use of embolization for control of hemorrhage following vascular injury was first reported by Margolis et al. in 1972 [2], and since then has been used with success after damage to vascular structures in the extremities, abdomen, thorax, and neck [3, 4]. Management of injury to the brachiocephalic vessels poses a particular challenge because of the care that must be taken to avoid embolization to the brain and the difficulties encountered as a result of collaterals that exist between the arteries of the head and neck. The direct surgical repair of an injured vertebral artery is difficult. Its origin within the thorax and its position within the foramina transversaria of the cervical vertebrae make rapid, direct exposure and control of the proximal and distal segments of an injured

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<sup>1</sup>Department of Radiology, University of Wisconsin Medical School, 600 Highland Dr., Madison, WI 53792.

<sup>2</sup>Department of Surgery, Division of Neurosurgery, University of Wisconsin Medical School, Madison, WI 53792.

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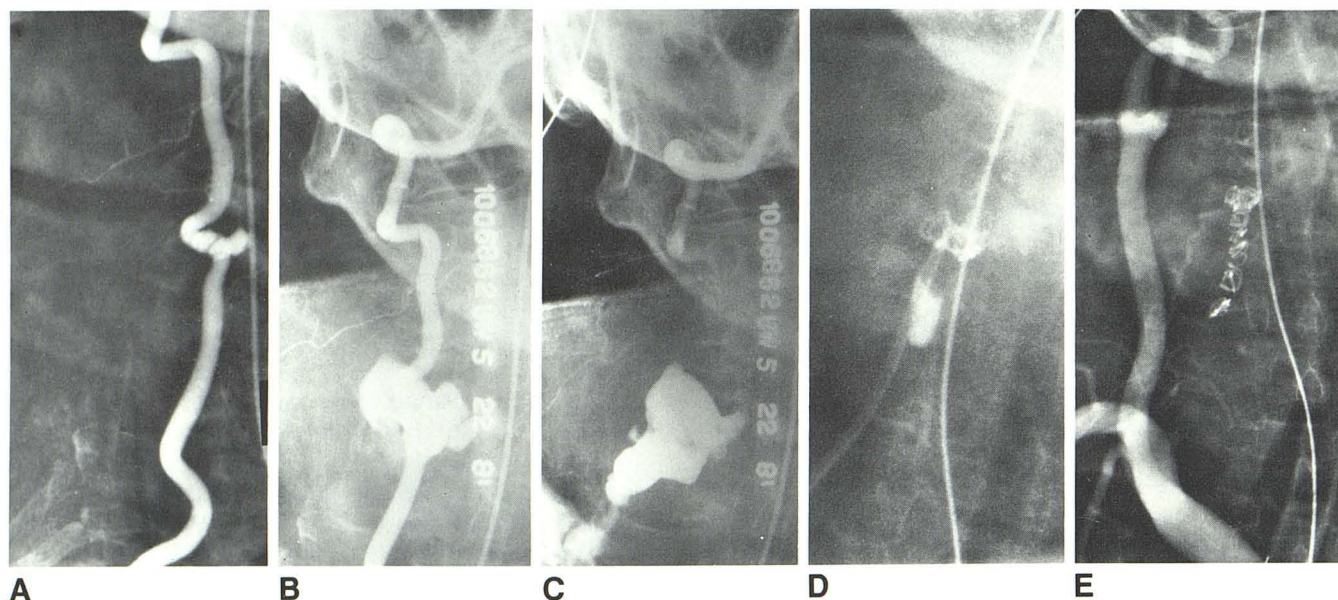


Fig. 1.—A, Right vertebral arteriogram. False aneurysm at C5 level. B, Early arterial phase of right vertebral arteriogram. Enlargement of false aneurysm. C, Later arterial film. Extravasation of contrast medium into soft tissues of neck and mediastinum. D, Tip of double-lumen occlusion balloon catheter positioned above site of arterial injury. Balloon is inflated and is occluding artery. Mini-

Gianturco coil has been inserted through distal lumen of catheter. E, Subclavian artery arteriogram 30 min after placement of last Gianturco coil. Coils have been positioned above, at, and below site of arterial injury. Right vertebral artery is occluded.

vessel difficult. This is illustrated by our patient, where exposure of the injured vessel failed because of the inability to control blood loss during the attempt to isolate the vertebral artery.

With rare exceptions, the vertebral arteries communicate directly at the level of the origin of the basilar artery. Because of this, proximal occlusion of an injured vertebral artery will result in retrograde flow and therefore would not be effective in controlling hemorrhage. Successful treatment therefore requires isolation of the injured vascular segment from the circulation.

Currently, the endovascular treatment of injuries to large arteries of the head and neck requires that the vessel be occluded. As has been discussed, proximal occlusion alone cannot be expected to be effective in the control of hemorrhage. Thus, for success to be achieved, embolic material must be positioned both above and below the site of arterial injury, thereby isolating the damaged segment of the vessel from the circulation. As long as there is antegrade flow in the vessel, particulate emboli are not satisfactory because they may migrate distally. Both particulate emboli and Gianturco coils have been used with success to obliterate posttraumatic vertebral artery arteriovenous fistulas when there was no antegrade flow past the site of arterial injury [5, 6]. The use of such an approach in the presence of antegrade flow carries the risk that either the embolic particles themselves or fresh thrombus forming within a now partially occluded vessel may migrate distally. Through the use of a double-lumen occlusion balloon catheter, however, embolic agents may be introduced into the lumen of an artery while the occlusion balloon is inflated, thus preventing their distal passage. By slightly deflating the balloon, the position of the catheter may be

changed as more embolic agents are introduced until the full length of the injured vascular segment has been isolated. As illustrated by the case presented here, this technique offers significant advantages over other methods of trying to repair such an injured vessel. In some circumstances, a detachable balloon system may be used, but it may often prove inadequate because of an inability to position a balloon(s) so as to isolate the injured segment of the vessel.

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#### Comments

This case report represents another example of permanent occlusion of the vertebral artery with Gianturco coils. This is

certainly an acceptable alternative of treatment, but not the only one and probably not the best. In this particular case, I think that there was a substantial risk to navigate with a 7 French rigid double-lumen catheter through the tortuous and injured vertebral artery. I do not agree with the author's statement: "In some circumstances, a detachable balloon system may be used, but it may often prove inadequate because of inability to position a balloon(s) so as to isolate the injured segment of the vessel."

In my experience, traumatic vertebral aneurysms or fistulas have always proven easy to treat with detachable balloons, and I never had any difficulty in positioning a balloon above the site of the aneurysm or the fistula when it was necessary

to permanently occlude the vertebral artery. The balloon technique seems to me the method of choice. It is atraumatic and it is the only way to preserve the vertebral artery whenever it is possible. I am extremely concerned by the fact that many people will take a risk to treat cases with Gianturco coils and will sacrifice a vertebral artery that often could be saved. Gianturco coils should be used in cases where it is necessary to permanently occlude the vessel. The indication to do this is certainly low in the hands of someone who routinely uses the detachable balloon technique.

Gerard Debrun  
*Massachusetts General Hospital  
Boston, MA 02114*