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### Use of coils for transcatheter carotid occlusion.

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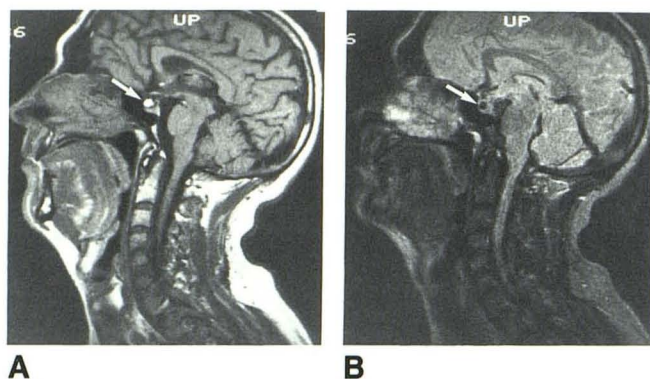


Fig. 1.—Area of increased signal (arrow) was seen in sella on TR = 500 TE = 30 msec image (A), which is seen as relatively low signal (arrow) on TR = 2500 TE = 80 msec image (B). CT scan showed Pantopaque in sella.

weighted images. In our paper [3] we included images of a patient with metastatic disease to the spine in which Pantopaque was helpful in demonstrating compression of the spinal canal. While we agree that the definition used by Braun et al. reflects the popular view on the subject, we feel it is quite premature to limit the definition in this fashion. Certainly, conventional radiology embraces a variety of contrast agents, including air, barium, and iodine, without too much semantic quibbling.

In their conclusions, the authors limit their remarks to intraspinal Pantopaque. We would like to emphasize that Pantopaque may be confused with fat or hemorrhage anywhere in the subarachnoid space. It is particularly important to understand the T1 and T2 properties of Pantopaque when it appears in unexpected places (Fig. 1, above).

Finally, the authors suggest in their introduction that they "discovered" these properties of Pantopaque and that they "were subsequently reported by Mamourian and Briggs." We would like to point out that they presented their results at the RSNA 5 months after our article was submitted to *Radiology*, as the printed submission data attests. It is difficult to understand how the authors presume to claim this observation with this chronology in mind.

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#### Reply

We would like to assure Mamourian and Briggs that it was not our intent to "prematurely limit the definition" of an MR contrast agent. We simply opted for the "popular" (most widely accepted) definition of an MR contrast agent in the hopes of providing a clear and unambiguous presentation, without getting distracted with a discus-

sion that is really not germane to the essence of the study—namely, the behavior of Pantopaque on MR.

We appreciate the authors pointing out to us that Pantopaque has similar relaxation characteristics anywhere in the subarachnoid space, including inside the cranial vault. Finally, nowhere in our manuscript do we say we were the first to discover this phenomenon. In addition, if the authors would like to quibble about dates of submission of abstracts or articles, we would like to remind them that the deadline for abstracts submitted for presentation at the 1985 RSNA was April 26th two months before the submission of their article.

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#### Use of Coils for Transcatheter Carotid Occlusion

I agree with Braun et al. [1] in their proposed use of coils for transcatheter carotid occlusion. We have similarly treated a 30-year-old man with a giant, unruptured, partially thrombosed fusiform aneurysm of the cavernous segment of the right carotid artery that was considered unsuitable for surgery [2]. After an uneventful, long-lasting temporary closure of the right internal carotid artery by a non-detachable balloon catheter, and with monitoring of clinical and EEG findings, a small Gianturco coil was released 8-cm distal to the origin of the artery, followed by a second "security" coil, which resulted in complete closure of the aneurysm (Fig. 1). The postoperative course was uneventful and the cavernous sinus syndrome disappeared almost completely during the next 5 months. Angiographic controls (Fig. 2) confirmed exclusion of the aneurysm from the circulation, thrombosis of the right internal carotid artery with sparing of the ophthalmic artery, and complete vascularization of the right hemisphere by the left carotid artery through hypertrophied right anterior

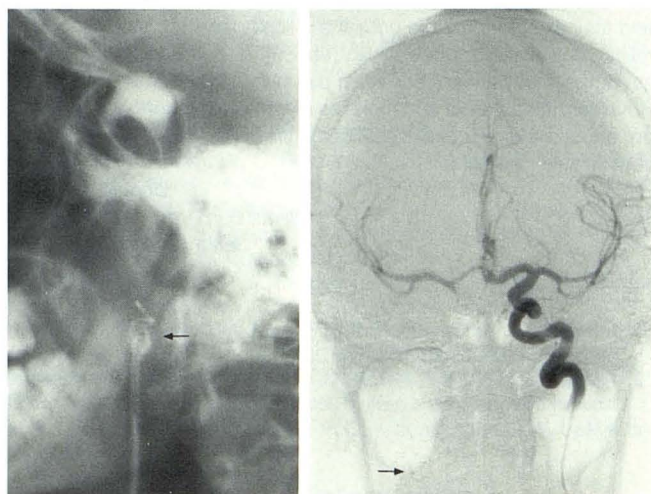


Fig. 1.—Small Gianturco coil (arrow) released 8-cm distal to origin of artery followed by second "security" coil resulted in complete closure of aneurysm.

Fig. 2.—Angiographic controls confirm exclusion of aneurysm from circulation.



cerebral and anterior communicating arteries. The coils remained in the same position (arrow in Fig. 2).

The use of transvascular methods to occlude the internal carotid artery in treating giant aneurysms is advantageous compared with surgical ligation or progressive clamping of the vessel because the occlusion may be realized more distally, which reduces the length of the thrombus, and because the procedure may be performed in an alert patient, testing his condition during a temporary occlusion. Furthermore, since it is generally believed that the ischemic events occurring after iatrogenic carotid occlusion are of embolic origin, there are no advantages in performing a gradual closure that increases the risk of dislodgement of emboli.

In those cases in which a complete, abrupt, proximal occlusion of the internal carotid artery is required, the stainless steel coil is, perhaps, the most suitable device; it is fast, safe, simple, and stable. There is no advantage under such conditions for using detachable balloons, which require larger catheters, are more expensive, are not always available, tend to deflate, and exert a less thrombogenic effect. Hence, the steel coils might be preferred both in an emergency and when a detachable balloon is not available, as well as in all cases in which the purpose is only to close the carotid artery proximally.

The usefulness of extracranial-intracranial bypass as a preamble to carotid artery occlusion is disputable, especially in young patients. The natural pathways of supply are usually more effective than any bypass, compensating for the perfusion deficiency in the carotid territories, as a complete angiographic exploration and a temporary occlusion of the artery may demonstrate. The problem is obviously quite different when the preoperative evaluation discloses that the physiological short-term anastomoses are unable to supply the new needs, making a bypass operation obligatory. The risk of another operation that is even more invasive than the principal one and the questionable short-term prophylactic effect on ischemia, are important issues that still need to be resolved, as shown by Braun et al. [1]. Despite a well-functioning superficial temporal artery to middle cerebral artery (STA-MCA) bypass, performed at a suitable time (just before the carotid ligation), ischemia developed in the cerebral carotid territory. Recent reports, carefully reviewed by Heros [3] in his article detailing the experience of 30 neurosurgeons, actually suggest that a patent extracranial-intracranial bypass graft is not sufficient to protect the hemisphere against the effect of thromboembolism. On the contrary, a recently performed bypass operation may prevent us from carrying out the more effective prophylactic measure, which is systemic anticoagulation.

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## Abbreviated Reports

### Cervicocephalic Fibromuscular Dysplasia and Fenestration of the Vertebral Artery

Fibromuscular dysplasia (FMD) of the cervicocephalic arteries is not rare; more than 400 cases have been reported. FMD's association

with aneurysms or arteriovenous malformations has been documented [1]. However, FMD's association with fenestration or partial duplication of the cervicocephalic artery has not been reported in the scientific literature.

## Case Report

A 65-year-old hypertensive woman was admitted for evaluation of intermittent transient dysesthesia of the right side of her face and right upper extremity. A physical examination on admission revealed no significant neurologic abnormalities, nor was any significant abnormality detectable on CT of the brain.

Bilateral carotid and left vertebral angiograms and an arch aortogram showed the "string of beads" appearance and tubular stenosis characteristic of FMD in the internal carotid and vertebral arteries (Fig. 1A). A small saccular aneurysm was also noted in the cavernous segment of the right internal carotid artery. In addition to these findings, there was localized fenestration in the left vertebral artery at the level of the third and fourth cervical vertebrae (Fig. 1B).

## Discussion

Cervicocephalic FMD most frequently involves the internal carotid artery. Characteristically, angiography reveals a "string of beads" appearance or tubular stenosis, which is pathognomonic of FMD. FMD of the cervicocephalic artery is frequently associated with intracranial aneurysms in 39-51% of cases [1].

Fenestration of the vertebral arteries is observed in 0.2-5% of cases on angiography or at autopsy. It is more frequently reported in Japan [2-4]. The association of fenestration of the vertebral artery and intracranial aneurysms has been observed in approximately 20% of cases [4].

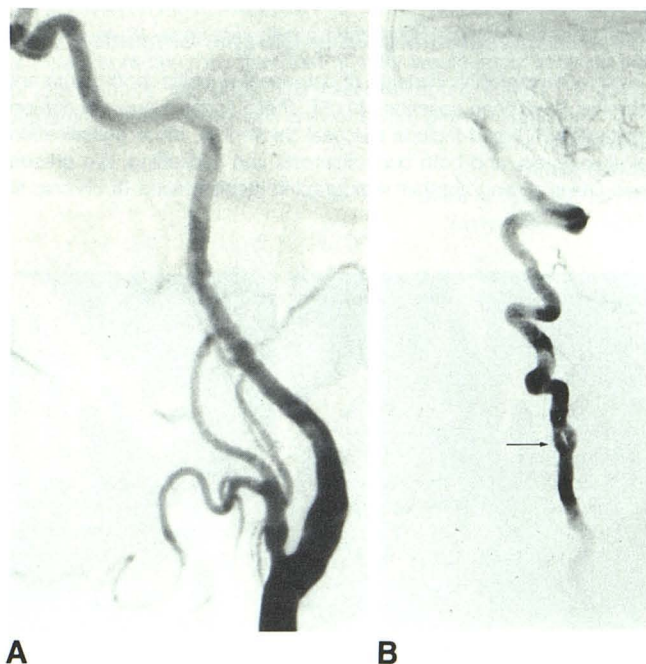


Fig. 1.—A, Common carotid angiograms, left lateral projections, reveal characteristic "string of beads" appearance of fibromuscular dysplasia involving cervical portions of internal carotid arteries.

B, Left vertebral angiogram, lateral projection, shows localized fenestration of vertebral artery at level of third and fourth cervical vertebrae (arrow).