Diagnosis of a Displacement of Guglielmi Detachable Coils by Transcranial Color-Coded Sonography

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In recent years, intracranial aneurysms that cause subarachnoid hemorrhage have been treated by an endovascular approach. The use of endovascular Guglielmi detachable coils (GDCs) has improved the radiologic and neurologic outcome of these patients, reaching results similar to those of craniotomy.1

This technique implies certain risks that are decreasing because of the development of new delivery systems and softer GDCs and the increasing experience of neuroradiologists.2 Displacement of coils is not an uncommon complication after endovascular embolization of cerebral aneurysms.3 Transcranial color-coded sonography (TCCS) is a noninvasive reliable bedside technique that allows an anatomic and hemodynamic follow up after embolization of aneurysms.4,5

We report the case of a patient in which a displacement of the coil occurred after GDC treatment of a cerebral aneurysm. A segment of the coil invaded the cerebral vessel, causing a partial blockage of blood flow. This complication was correctly diagnosed by TCCS, permitting a posterior endovascular solution.

Case Report

A 41-year-old woman was admitted to our hospital because of syncope. Cranial computed tomography showed a subarachnoid hemorrhage of Hunt and Hess grade II. Twenty-four hours later, magnetic resonance imaging (MRI) angiography showed an aneurysm arising from the left middle cerebral artery (MCA), in the M1 segment, with a maximal diameter of 6.6 mm. The aneurysm was treated with GDCs. At the end of the procedure, control angiography revealed a partial prolapse of the coils, producing the closure of the left M2 segment, which was resolved by replacing the coils with balloon angioplasty (Magellan 4.5 × 20; Balt, Montmorency, France), obtaining a good anatomic result. At this time, the patient remained conscious with paralysis of the left sixth cranial nerve previously present and no other neurologic deficit.
Nine days after embolization, the patient had sudden deterioration of her consciousness, right hemiparesis, and Broca aphasia. Conventional transcranial Doppler (TCD) sonography showed systolic flow in the left MCA of 300 cm/s, suggesting a vessel vasospasm according to criteria described by Lindegaard et al. Subsequent MRI angiography showed a segmental lack of flow in the left MCA (Figure 1). Hypertension-hypervolemia-hemodilution therapy was initiated with a good neurologic response, but some days later, the patient had new deterioration of her consciousness with hemiparesis and aphasia, so she was transferred to the intensive care unit for better control.

At this time, a TCCS examination (Vingmed System FiVe sonography unit with a 1.5-MHz probe; GE Healthcare, Milwaukee, WI) was done, and it showed an aliasing image of only 5 mm length in the left MCA with high flow (mean velocity, 220 cm/s; pulsatility index [PI], 0.62; Figure 2) and hyperechoic structures in the 2-dimensional mode. The localization of the hyperechoic structures and the presence of high-velocity flow only in 5 mm of the left MCA, in the M1 segment where the former aneurysm was present, suggested a mechanical problem, probably caused by a displacement of the coils.

A new cerebral angiographic examination confirmed the coil displacement that invaded the left MCA (Figure 3), so balloon angioplasty was done, and the coils were replaced, yielding a good angiographic result (Figure 4) and avoiding implantation of an intracranial stent. A new study by TCCS showed normal flows without any aliasing image (Figure 5) in this area with a mean velocity of 79 cm/s and a PI of 0.81. The patient had a good clinical recovery and was discharged conscious and without any neurologic deficit.

Discussion

Transcranial color-coded sonography is a noninvasive bedside technique that allows hemodynamic evaluation of the circle of Willis. Its use in the diagnosis and treatment of cerebrovascular disease is common, and it has high sensitivity and specificity in intracranial stenosis detection. Moreover, in past years, intracranial aneurysms have been studied by TCCS. In 1996, Wardlaw et al. used TCCS in the power mode during coil delivery and at the end of the procedure observed the presence of residual flow within the aneurysm in 2 of 7 cases. One year later, Linder et al. published a pilot study of 10 patients with intracranial aneurysm embolization, and they observed residual flow within the aneurysm after the procedure. The limitations of this technique
were the acoustic window of each patient and some locations of the aneurysms where the TCCS could not reach. The platinum coils used appeared as hyperechoic images similar to the skull. Schuknecht et al\(^5\) showed that TCCS was a valid technique for coil visualization in 95% of cases.

More recently, a study showed that TCCS was useful for assessing intracranial aneurysms after endovascular treatment,\(^4\) with good results in those aneurysms that were completely occluded and in those that had residual flow that was moderate or extensive. Nevertheless, that study has been criticized because there were technical difficulties in those cases with low residual flow, a fact that could reflect the limited spatial resolution of TCCS.

In our opinion, the advantages of TCCS over conventional TCD are evident. In our patient, MRI angiography showed a segmental lack of flow in the left MCA, and a vasospasm was suspected because of the TCD findings. Our patient had symptoms that were compatible with a vasospasm, but the TCCS examination suggested a probable stenosis caused by the GDCs because in the 2-dimensional mode we observed a hyperechoic structure in the left MCA area and because the presence of high-velocity flow in only 5 mm of the MCA could not be explained by a vasospasm. Angiography confirmed the diagnosis.

Transcranial color-coded sonography is a noninvasive reliable bedside technique that allows a complete study to be performed in patients with intracranial aneurysms, avoiding transfer of these patients to the radiology department. This technique is especially useful in patients admitted to the intensive care unit, where transportation of the patients implies some risks.

References


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