Use of the GDC crescent for embolization of tumors fed by cavernous and petrous branches of the internal carotid artery

Technical note

GUIDO GUGLIELMI, M.D.

Division of Interventional Neuroradiology, University of California Los Angeles School of Medicine, Los Angeles, California; University of Rome “La Sapienza” Division of Interventional Neuroradiology, Department of Neurological Sciences, School of Medicine, Rome, Italy

This report presents two cases of hypervascular tumor in which the cavernous and petrous internal carotid artery feeding vessels were successfully occluded using a new endovascular device, the crescent-shaped platinum Guglielmi detachable coil (GDC). With this new embolic agent the risk of unwanted embolization of normal intracranial arteries was significantly reduced. The GDC “crescent” seems particularly useful when distal, superselective, and controllable occlusion of small arterial feeding vessels is the goal of the treatment.

KEY WORDS • internal carotid artery • brain tumor • embolization • Guglielmi detachable coil

Description of the Embolic Device

The overall physical structure of the embolic device is similar to that of the Guglielmi detachable coil ([GDC]; Target Therapeutics, Fremont, CA), which is an electrolytically detachable platinum coil that is used to treat brain aneurysms. Unlike the GDCs used for aneurysms, which are formed by many centimeters of helical platinum coil, this version of the GDC is short and slightly curved (Fig. 1). The crescent-shaped, detachable occlusive platinum coil is soldered to the distal end of a delivery wire. The coil can be 4 or 6 mm in length and 0.010 or 0.018 in (0.25 or 0.45 mm) in diameter. The stainless steel delivery wire has a 0.010-in diameter and is 175 cm long. Its distal 0.5-mm portion is uninsulated to allow electrolytic breakdown with consequent detachment of the platinum coil (Figs. 1 and 2). The crescent shape of the coil allows it to be steered by torquing the delivery wire. The coil is maneuverable and can be guided into the targeted vessel beyond the tip of the microcatheter. The device can also be re-
retrieved and/or repositioned at will. Once the selected placement is achieved, the coil is detached from the delivery wire. This is accomplished by applying a 1-mA positive direct electrical current to the proximal, uninsulated end of the delivery wire. A subcutaneous needle constitutes the grounded negative electrode. Besides initiating detachment, the positive current induces the formation of an endovascular “electrothrombus.”^4,7^ The smaller-sized coils (0.010 in) are used for occlusion of smaller vessels (≤ 0.4 mm), whereas the larger coils (0.018 in) are used for vessels larger than 4 mm.

The GDC crescent has already been used in seven cases in which distal and controllable occlusion of small arterial branches was needed. Of these seven patients, three had arteriovenous malformations fed by the anterior choroidal artery (unpublished data), two had peripheral intracranial aneurysms,^2^ and a dural fistula of the cavernous sinus^8^ and an arteriovenous fistula of the spinal cord were present in one each (unpublished data).

In this report two additional cases are described in which the GDC crescent was used as the embolic agent in hypervascular tumors.
Embolization using the GDC crescent

Fig. 3. Case 1. Left: Right ICA angiogram, anteroposterior view, in which the tumor blush from a sphenopetrosclival meningioma is clearly visible. Center: Angiogram showing four GDC crescents (arrows) that were detached in the cavernous ICA tumor feeding vessels. Right: Postembolization angiogram demonstrating complete elimination of the ICA supply to the tumor.

Fig. 4. Case 2. Left: Right ICA angiogram, lateral view, showing the vidian artery (arrow) feeding a juvenile angiofibroma. Center: Angiogram showing one GDC crescent (arrow) that was detached in the feeding artery. Right: Postembolization angiogram showing complete elimination of the ICA supply to the tumor.
blood supply. This may be accomplished preoperatively or as a palliative treatment. Preoperative embolization should be performed the day before surgery. It may decrease surgical morbidity by reducing blood loss, shortening operating time, reducing the risk of damage to surrounding structures, and increasing the chances of complete tumor resection. However, elimination of the ICA contribution to these hypervascular tumors is difficult to achieve.

Currently, embolization of small ICA branches can be achieved by performing a superselective microcatheterization of these small branches, followed by injection of liquid or particulate embolic agents. However, often the microcatheter is not in a stable enough position to allow the surgeon to perform a safe embolization, and reflux of embolic agents into the main stream of the ICA is a major concern. As an alternative, a nondetachable balloon can be temporarily inflated in the ICA, occluding the artery just distal to the intracavernous branches. Particulate emboli are then injected into the ICA through a microcatheter positioned at the petrous or the proximal C-5 portion. Prior to balloon deflation, multiple aspirations and rinsing of the ICA are necessary; after balloon deflation, despite these precautions, particles still lying in the stagnant ICA may occlude normal cerebral arteries. Functional embolization has been proposed as another alternative. It consists of performing temporary balloon occlusion of the ICA across the origin of the supplying cavernous or petrous branches, thus changing the hemodynamics as described earlier and allowing embolization of the entire tumor via the ECA system.

All these techniques involve the risk of unwanted embolization of normal intracranial arteries either because of the unstable position of the microcatheter or because the inflation of balloons in the ICA combined with the use of two systems may increase the rate of thromboembolic complications. Because of these limitations, often only ECA embolization is performed, leaving the ICA feeding vessels untouched.

With the embolic device described here it was possible to eliminate the ICA supply to hypervascular tumors in a safe and controllable manner. The GDC crescent can be positioned and repositioned at will, can be extended beyond the tip of the microcatheter in a controlled fashion, and can then be detached without the risk of dislodging it and without exerting mechanical force.

References


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