Use of the Interlock Fibered IDC Occlusion System in Clinical Practice

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ABSTRACT

The use of coils in embolotherapy has been extensively described. Many different types of coils are commercially available for use. In 2006, the Interlock Fibered IDC Occlusion System (Boston Scientific, Natick, MA) was introduced to clinical practice. In this article, embolotherapy with coils in general is discussed, and the use of the Interlock coils in particular is described in different clinical scenarios.

KEYWORDS: Embolization, detachable coils, pseudoaneurysm, endoleak

Objectives: Upon completion of this article, the reader should be able to (1) describe the mechanism for the controlled release of the Interlock coil, (2) list clinical scenarios when use of the Interlock coils is appropriate, and (3) list the advantages of using a controlled-release coil.

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Embolotherapy comprises a significant portion of the practice of interventional radiology. This applies both to the number of cases and to its important contribution to the clinical management of patients in a variety of settings. Needless to say, the training involved in embolotherapy is intensive to assure clinical efficacy and to reduce complications; this is perhaps why this segment of interventional radiology has not seen significant encroachment by other fields. When performing embolotherapy, two important factors have to be considered. First, the clinical scenario and underlying pathological process have to be taken into account to achieve the desired outcomes, that is, the goal of the embolotherapy. Second, the selection of appropriate embolic agents is critical to achieving desired outcomes (Table 1). Typically, the clinical scenarios and desired

outcomes dictate the use of particular embolic agents.¹ Sometime more than one embolic agent is required.

Coils are available in a variety of configurations and sizes and cause permanent proximal occlusion. Therefore, they are not used in situations where distal occlusion, such as at the precapillary or capillary level, is required. Examples of where coils are used include the control of hemorrhage in trauma, gastrointestinal hemorrhage, pseudoaneurysms, and the treatment of varicoceles. For more distal and end organ embolization, such as uterine artery embolization, particulate agents are appropriate. Coils require local thrombosis for the occlusion of intended vessels.

The use of coils is widespread in embolotherapy. Ideally, a coil must have enough strength to hold up against hemodynamic forces pushing it distally and yet

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Table 1 Embolic Agents Commonly Used in Embolotherapy

Embolic Agents	Comments	
Gelfoam	Pledgets, slurry, powder	Temporary
Polyvinyl alcohol	Irregular, spherical	Permanent
Trisacryl gelatin	Spherical, compressible	Permanent
Drug-eluting beads	Targeted drug delivery	Permanent
Coils	Many sizes and configuration	Permanent
Ethanol	Inexpensive; capillary level occlusion	Permanent
Glues	Can be difficult to control, expensive	Permanent

have characteristics that prevent injury to vessel walls, such as dissection or penetration.² Additional characteristics, such as ease of deployment and tractability, are also desirable. The controlled-release coil allows for retraction of the coil prior to complete deployment. The prototype, the Guglielmi Detachable Coil (GDC;

Figure 1 Schematic drawings of the mechanical connection between the coil pusher and the coil. Note that as long as this connection remains in the catheter, the connection stays intact and the coil will not be released.

Target Therapeutics, Fremont, CA), mainly employed in intracerebral aneurysms, uses a small electrical current to release a microsoldered joint.³ Guido Guglielmi invented the GDC in 1990, and it was gradually introduced as an alternative to surgical clipping for intracranial cerebral aneurysms. The Interlock Fibered IDC Occlusion System is another type of controlled-release coil that relies on a mechanical connection.⁴

INTERLOCKING DETACHABLE COILS

Like other platinum coils, the Interlock coil has high memory performance and is able to retain its original

Figure 2 Patient with a Mallory-Weiss tear. (A) Selective celiac arteriogram showed a prominent left gastric artery (arrow). (B,C) Unsubtracted and subtraction selective left gastric arteriograms showed feeders to the distal esophagus with a small area of contrast extravasation seen only on the subtracted image (arrow). (D) Angiogram after embolization was performed with Interlock coils (arrow) showed no flow in the left gastric artery.

Figure 3 Patient with bleeding duodenal ulcers. (A) Celiac arteriogram showed questionable blush in the gastroduodenal artery (GDA) distribution (arrow). (B) The GDA was selected using coaxial technique with a Renegade STC catheter, and selective arteriogram was performed showing an area of contrast extravasation, compatible with active bleeding (arrow). (C) The GDA was occluded with several Interlock coils (arrow), as demonstrated on the postembolization angiogram.

shape. It is also easily bendable and therefore able to track easily through curvatures. The interlocking detachable coil has seen more commercial use recently, but its first clinical use was reported in 1996. Interlocking coils uses platinum coils, with a mechanical connection made between the pusher and the pusher wire.⁵ The coil and pusher have interlocking mechanical arms (Fig. 1). The design allows for the coil to be retracted prior to final placement as long as the mechanical connection between coil and pusher remains within the delivery catheter. The coils are designed for use with a 0.021-inch inner diameter catheter (Renegade Microcatheter; Boston Scientific, Natick, MA). The coil and pusher wire system come preloaded in an introducer sheath. It is recommended that a flush system be set up primarily to prevent

thromboembolic complications, especially premature coil thrombosis, when the coil is exposed to blood by retrograde blood flow back into the catheter. Once the embolization site has been selected by the microcatheter and the appropriate flush system has been set up, deployment of the coil starts with seating the coil introducer tip firmly within the hub of the microcatheter. A twist-lock mechanism on the back end of the introducer sheath is rotated counterclockwise, and the pusher-coil combination is advanced into the microcatheter. When the pusher-coil combination is well within the microcatheter, the introducer sheath is removed and saved, in case the coil has to be removed later on. The coil is advanced to the site of embolization through the microcatheter. As long as the mechanical

Figure 4 Patient with renal pseudoaneurysm after partial nephrectomy for renal cell carcinoma. (A,B) Axial and coronal computed tomography images showed large pseudoaneurysm (arrow) of the left kidney. (C,D) Arterial phase and parenchymal phase arteriogram showing the pseudoaneurysm (arrow). (E) After Interlock coil embolization (arrow), the angiogram showed no evidence of a pseudoaneurysm.

Figure 5 Patient with nonmaturing forearm brachial artery to cephalic vein arteriovenous fistula. (A) Angiogram performed through a retrograde venous access through the cephalic outflow vein (dashed arrow) showed patent arterial anastomosis (arrow). Prominent collateral outflows were present. (B) Embolization was performed of the large collateral vein with two 7 mm $\times$ 10 cm Interlock coils (arrow), and follow-up venogram showed no flow in this vessel. The main outflow vein was better opacified. (C) Venogram after additional embolization was performed (arrows) showed outflow was now through the main channel.

interlocking arms are within the microcatheter, the coil can be retracted back into the microcatheter for reposition. Once the coil is in the desired position, the coil is released by pushing the interlocking arms past the tip of the microcatheter.

CLINICAL USE

Use of the Interlock coils should be the same as for other fibered platinum coils. Advantages include the ability to retract the coil for repositioning prior to complete deployment. In addition, the availability in large sizes allows for more extensive embolization with less coils, saving time and money. A few clinical scenarios where Interlock coils were used are discussed later.

Left Gastric Embolization for Mallory-Weiss Tears

The patient was an 80-year-old woman with hematemesis after an episode of vomiting after eating. The hematemesis was associated with a drop in hemoglobin and required a transfusion. At endoscopy, arterial bleeding was seen at the distal esophagus. The patient was

immediately sent to interventional radiology for angiography. At angiography, the celiac trunk angiogram and subsequent selective left gastric angiography showed contrast extravasation in a tiny feeder to the distal esophagus seen only on the subtracted images. The left gastric artery was embolized (Fig. 2). The patient stabilized after the procedure and was discharged to home the next day.

Gastroduodenal Artery Embolization for Bleeding Duodenal Ulcers

The patient was a 30-year-old woman without significant past medical history who presented with melena. She was found to have orthostatic hypotension and a hemoglobin of 6.8 mg/dL, requiring a blood transfusion. At endoscopy, the patient was found to have bleeding duodenal ulcers that were resistant to endoscopic treatment. The patient was then transferred to the interventional suite for angiography (Fig. 3). At angiography, contrast extravasation was found in the gastroduodenal artery (GDA) distribution. The GDA was embolized. The patient was stabilized and discharged the next day.

Figure 6 Patient with abdominal aortic aneurysm repair with stent graft and has type 2 endoleak. (A,B) Computed tomographic (CT) angiogram showed contrast in the excluded sac (arrow) anteriorly. (C,D) Selective superior mesenteric arteriogram showed a feeder to the sac (arrow).

Renal Artery Embolization for Pseudoaneurysm Formation After Partial Nephrectomy

The patient was a 64-year-old man with a partial nephrectomy on the left for renal cell carcinoma. A subsequent follow-up computed tomography (CT) examination demonstrated a 3-cm pseudoaneurysm at the site of resection (Fig. 4). The urology service referred the patient for embolization of the pseudoaneurysm. At angiography the pseudoaneurysm was identified and the vessel leading to the pseudoaneurysm was embolized.

At 1-month follow-up, there was thrombosis of the pseudoaneurysm.

Arteriovenous Fistula Collateral Embolization

The patient was a 48-year-old woman with end-stage renal disease who had placement of an arteriovenous fistula in the right forearm. After 2 months, the fistula failed to mature and the patient was referred for a diagnostic angiogram that showed two main outflows,

Figure 6 (Continued) (E) The feeder to the sac was selected with a microcatheter, and a contrast injection confirmed the findings (arrow). (F) Superior mesenteric arteriogram after embolization with Interlock coils (arrow) showed occlusion of the feeder. (G) Follow-up CT angiogram showed resolution of the leak.

one superficial and one deep, based on the physical examination (Fig. 5). The deep outflow vein was embolized. Further embolization of the smaller collaterals was performed. The patient was able ultimately to use the fistula for dialysis.

Type 2 Endoleak Embolization

The patient was a 82-year-old man with a repaired abdominal aortic aneurysm. On follow-up CT, a type 2 leak was identified (Fig. 6). An angiogram was performed. The source of the leak was identified, arising from a branch of the superior mesenteric artery, and

embolized. On follow-up CT, there was resolution of the leak.

CONCLUSION

The Interlock coil is a retractable coil that has a mechanical type of connection, allowing for control release. As such, there is flexibility in its deployment. It can be retracted and repositioned as long as complete deployment has not occurred by maintaining the mechanical hinge within the delivery microcatheter. Due to the size of the system, an appropriately sized microcatheter is critical for proper deployment.

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