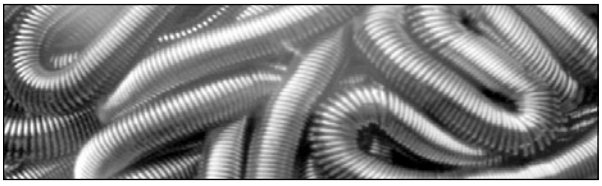
Clinical Techniques Utilizing the Ruby® Embolization Coil

Experts share clinical experiences demonstrating the unique qualities of this system.



Jafar Golzarian, MD
Professor of Radiology and Surgery
Director of the Division of Interventional Radiology & Vascular Imaging
University of Minnesota
Minneapolis, Minnesota
Dr. Golzarian has disclosed that he is a speaker for Penumbra, Inc.

Detachable coils offer control, and their use is growing significantly, not only in high-flow situations but in all indications. Although controlled detachment is important in many situations, the Ruby® embolization coil (Penumbra, Inc., Alameda, CA) offers more than precise placement.

Ruby couples the volume of a 035 coil while maintaining microcatheter compatibility. Therefore, these coils can occupy a large volume in a very short period of time, reducing radiation and cost. Despite the length of the coils, the pushability remains excellent. The 0.020-inch diameter of Ruby (Figure 1) allows it to be compatible with 0.025- to 0.027-inch high-flow microcatheters. The softness and complex shape allow good packing and therefore a stable permanent occlusion in vessels. In fact, the Ruby coils create a cross-sectional mechanical occlusion of vessels.

Some techniques can be used to optimize Ruby's utility. Angled-tip catheters help the coil start to form faster in the vessel by deploying the coil toward the vessel wall (Figure 2). A Ruby standard coil should be deployed first and then followed by soft coils if necessary. The soft coils will pack into the standard coil and fill the interstices (Figure 3).

The concept of packing density has not been commonly discussed in the visceral vessels. In the recent literature, we have seen evidence of better long-term results when a higher volume of the aneurysm is filled with embolic material.[1] A number of studies are looking into these results (Penumbra ACE study and EmboCoH registry). In recent years, many different coils and new technologies have been developed, allowing treatment of more complex anatomy and diseases. The Ruby coil's volume, flexibility, packability, different lengths, and high-flow microcatheter compatibility has filled an important gap in coil technology.

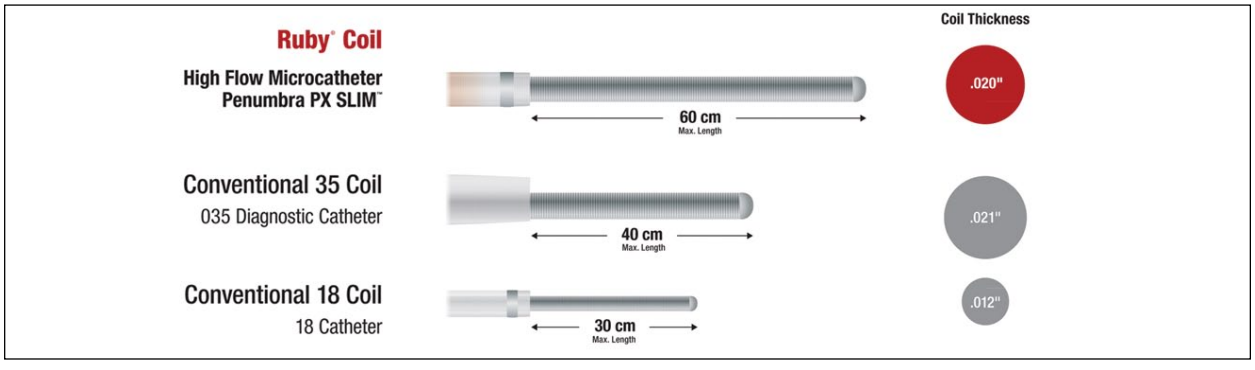


Figure 1. Size comparison of the Ruby coil, a 035 coil, and an 18 coil.

Sponsored by Penumbra, Inc.

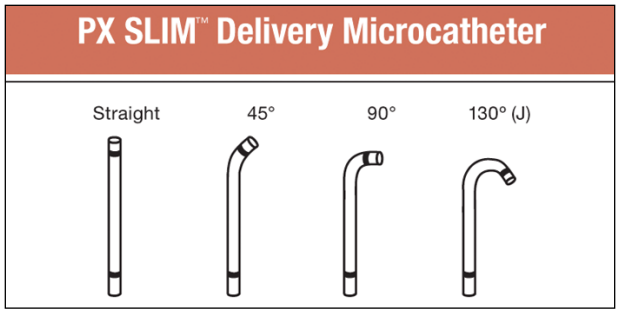


Figure 2. PX SLIM tip shapes.

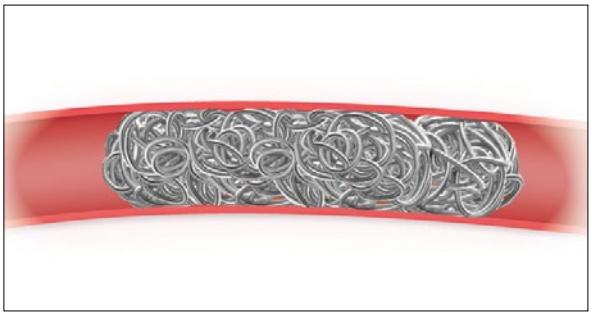


Figure 3. Tight coil packing.

CASE REPORT

The following case illustrates the packability of the Ruby coil. The patient had a large visceral aneurysm (Figure 4). We began with a large-diameter, long standard Ruby coil (32 mm X 60 cm) to create a good frame and to cover the outer walls of the aneurysm. The next standard coil (Figure 5) was slightly downsized in diameter (28 mm X 60 cm). After three standard coils were placed, we utilized the soft packing coils (Figure 6). These soft coils minimize catheter back out and pack much more densely. With both levels of softness available in large diameters and long lengths, we are able to occlude even large spaces very efficiently and quickly.

1. Yasumoto T, Osuga K, Yamamoto H, et al. Long-term outcomes of coil packing for visceral aneurysms: correlation between packing density and incidence of coil compaction or recanalization. J Vasc Interv Radiol. 2013;24:1798-1807.

Figure 4. A hepatic artery aneurysm is measured at 25.2 mm using angiography.

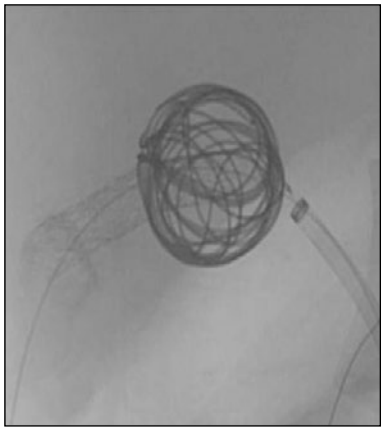


Figure 5. Ruby standard coils frame the aneurysm.

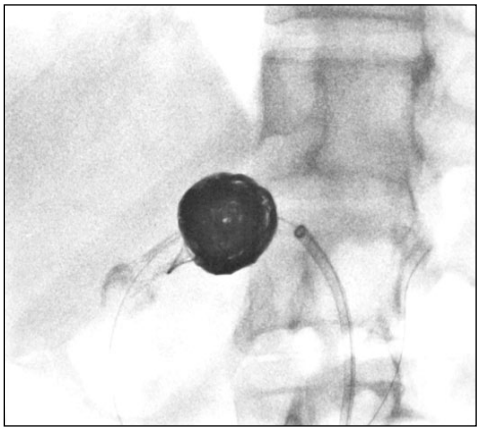


Figure 6. Ruby soft coils pack fill and pack the aneurysm to occlusion.

Parag J. Patel, MD
Assistant Professor of Radiology
Vascular and Interventional Radiology
Medical College of Wisconsin
Milwaukee, Wisconsin

Dr. Patel stated that he has no financial interests related to this article.

One of the biggest advantages of the Ruby coil is its size and length offerings. Whereas most other coils have a maximum diameter of 20 mm, Ruby goes up to 32 mm in diameter and 60 cm in length. This is very useful in our technique for balloon retrograde transvenous obliteration. Although the standard procedure requires a balloon to be left inflated for hours after the procedure, there has been literature demonstrating the use of coils after injecting sclerosant to enable balloon removal postprocedure.[1] We have now completed four procedures using this technique with the Ruby coil.

CASE REPORT

A 6-F-long sheath was placed in the left renal vein via the right femoral vein. A Neuron™ MAX catheter (Penumbra, Inc.) was used due to its proximal support but extremely flexible distal zone. A 6-F balloon guide was placed

Sponsored by Penumbra, Inc.

through the long sheath, and then a high-flow microcatheter was placed through the balloon guide (Figure 1A). Two large-diameter, long Ruby coils were placed distally in the gastric varices to act as a scaffold for the foamed sclerosant. The balloon was inflated, and the foamed sodium tetradecyl sulfate was injected. Next, a nest of Ruby standard coils was placed just outside the tip of the balloon guide. Finally, Ruby soft coils were placed within the gastric varices just proximal to the first set of coils (Figure 1B). As seen in the final image, the contrast was not able to penetrate the coil mass (Figure 1C), and the balloon was removed. Avoiding lengthy stays in the intensive care unit while achieving similar results to our traditional approach, this technique has changed my practice for the better.

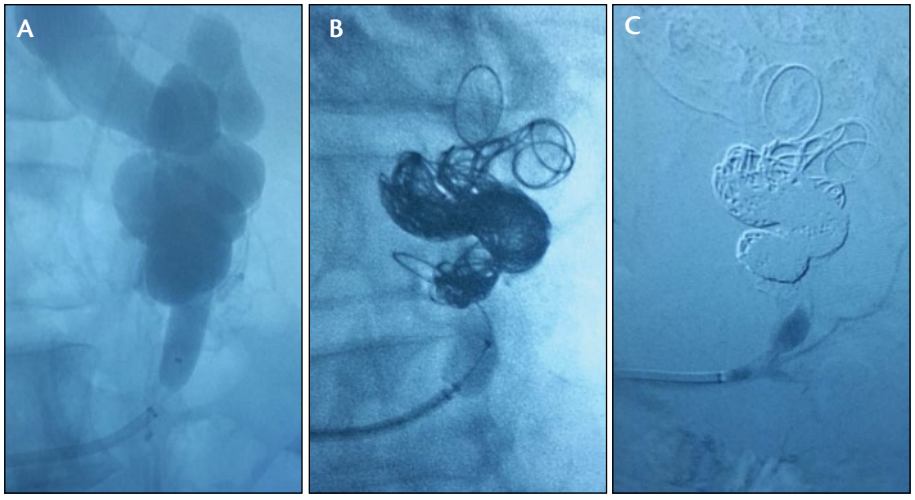


Figure 1. Angiography performed through an 0.088-inch lumen of the NeuronMAX 6-F-long sheath (A). Standard Ruby coils placed to create scaffolding for sclerosant while soft Ruby coils were used to fill the interstices and create complete cross-sectional occlusion (B). Final angiogram shows zero contrast penetrating the tightly packed coil and sclerosant combination (C).

1. Saad WE, Nicholson DB. Optimizing logistics for balloon-occluded retrograde transvenous obliteration (BRTO) of gastric varices by doing away with the indwelling balloon: concept and techniques. Tech Vasc Interv Radiol. 2013;16:152.

Robert Beasley, MD
Section Chief, Vascular/Interventional Radiology
Director, Vascular/Interventional Radiology Lab
Mount Sinai Medical Center
Miami Beach, Florida

Dr. Beasley has disclosed that he is a speaker for Penumbra, Inc.

The Ruby coil has increased the number of embolization procedures I perform. When using some of the older coils on the market, I did not always feel comfortable and sometimes referred these cases onto institutions that were more specialized in embolization. My practice consists mainly of peripheral vascular disease, but with this new tool, I am keeping all of the embolization pro-

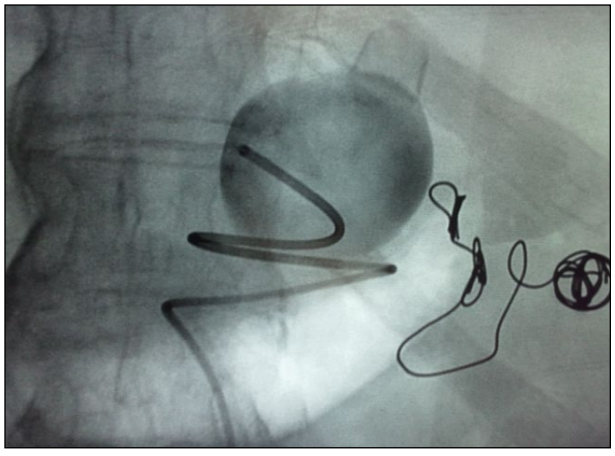


Figure 1. Coils from a previous embolization attempt migrated distal to the aneurysm. A Neuron 070 6-F guide easily negotiated the tortuous splenic artery.

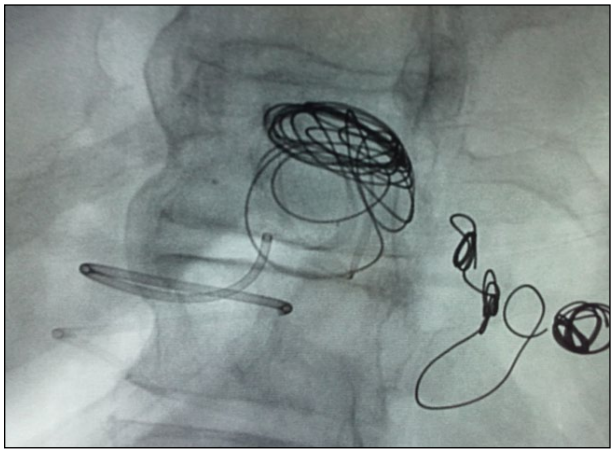


Figure 2. The first Ruby standard coil was placed with excellent wall opposition.

Sponsored by Penumbra, Inc.

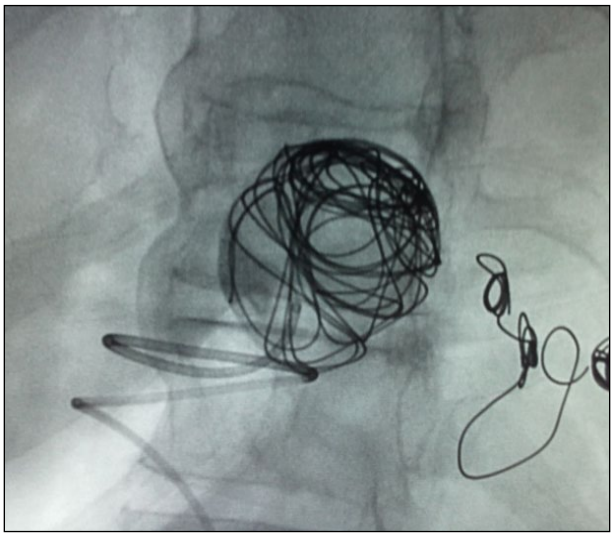


Figure 3. A second standard coil seeking the outer wall to continue to construct a framing basket.

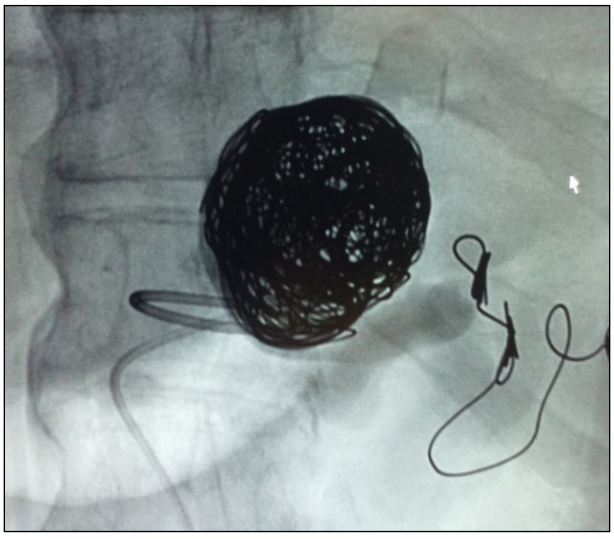


Figure 4. The final coil was placed in < 30 minutes from the first coil deployment.

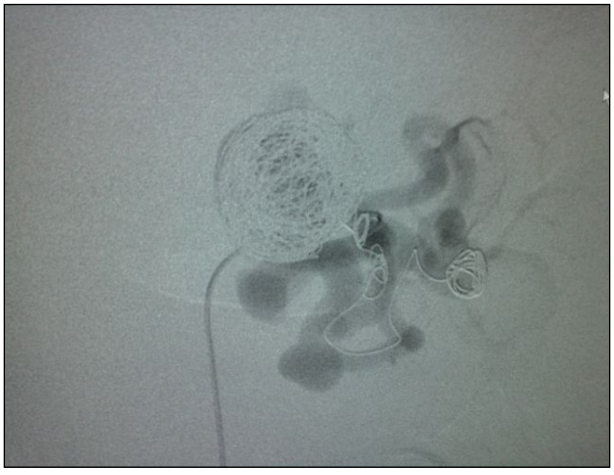


Figure 5. Angiography demonstrates exclusion of the aneurysm while maintaining distal flow.

cedures at my hospital. The following case is an example that illustrates the difference the Ruby coil can make.

CASE REPORT

A 60-year-old man with a medical history of cirrhosis, splenomegaly, splenic and epigastric varices, recanalization of his umbilical vein, and portal hypertension presented from a referring institution with symptoms of abdominal pain. He was admitted at our institution with an aneurysm arising from the splenic artery approximately 4 to 5 cm distal to its origin. The aneurysm measured 4.5 cm and had been increasing in size. There were multiple dislodged conventional detachable microcoils within the splenic artery distal to the aneurysm from a previous failed embolization procedure (Figure 1). The previous coils were not large enough in diameter or long enough to hold within the aneurysm sac.

A 6-F sheath was inserted into the right femoral artery, and an H1H Head Hunter selective angiographic catheter was used to select the celiac artery. The Head Hunter catheter was used to select the splenic artery over a 0.035-inch wire. It was then advanced into the proximal portion of the splenic artery. A 6-F Neuron™ guide (Penumbra, Inc.) was then advanced over the selective catheter into the splenic artery. The splenic artery was extremely tortuous; however, the flexibility of the Neuron catheter easily negotiated the 360° loops. This allowed for a stable construct before coil embolization. Using the PX SLIM™ microcatheter (Penumbra, Inc.), multiple Ruby coils were detached within the aneurysm.

Embolization was performed with placement of a total of 15 Ruby coils in < 30 minutes: 32 mm X 60 cm (four), 28 mm X 60 cm (four), 24 mm x 57 cm (four), 22 mm X 60 cm (three) (Figures 2 through 4). The distal flow into the remainder of the splenic artery and into the hilum of the spleen was well visualized. Multiple angiograms were obtained after embolization of the splenic artery aneurysm documenting complete embolization with no contrast flow into the sac (Figure 5). No procedural complications were experienced.

Three-month follow-up revealed that the aneurysm remained completely occluded. The large 32-mm diameter of the Ruby coils and the long 60-cm lengths enabled secure embolization of this difficult lesion following a failed previous attempt with conventional microcoils. Since using this new coil technology, I have noticed a significant decrease in procedure time for embolization procedures. ■