Fibered And Non-Fibered Coil Embolism Technology: Which Type Of Coils Are Best For Different Indications

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DISCLOSURES

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Considerations between Fibered Coils vs Non-Fibered Coils

- Mechanical vs Thrombogenic Occlusion
- Volume
- Cost
- Softness and Deliverability

Mechanical Occlusion vs Thrombogenic Occlusion

Thicker and softer coil loops are designed to densely pack, creating a mechanical occlusion

a. Boston Scientific® Interlock™ 2D Helical Coil 4 mm × 15 cm delivered through Tracker® Progreat® Microcatheter into 4 mm glass tube.
b. Terumo AZUR™ 18 System HydroCoil 4 mm × 20 cm delivered through Terumo Progreat Microcatheter into 4 mm glass tube.
c. 2D Helical Packing Coil delivered through Penumbra LANTERN High Flow Microcatheter into 4 mm glass tube.
Photographs taken by and on file at Penumbra, Inc. Tests performed at Penumbra, Inc. Bench test results may not be indicative of clinical results.

Non Fibered Soft Metal Coils

Behave like a viscous liquid filling side branches and packing densely

Traditional Technology:

Recanalization Rates with Fibered Coils

Fibered Coils
Recanalization Rate (20%)[a]
a. n=142 patients, 3 month mean follow-up

Gastroduodenal artery recanalization after transcatheter fibered coil embolization for prevention of hepaticoenteric flow: incidence and predisposing technical factors in 142 patients

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Enriquez J, Javadi S, Murthy R, et al. Gastroduodenal artery recanalization after transcatheter fibered coil embolization for prevention of hepaticoenteric flow: incidence and predisposing technical factors in 142 patients. Acta Radiol 2013;54(7):700–704. doi:10.1177/0284185113491696.

The clinical results presented herein are for informational purposes only, and may not be predictive for all patients. Individual results may vary depending on patient-specific attributes and other factors.

Mechanical Occlusion Technology:
Recanalization Rates with Bare-Platinum Coils

Design

- Single Center, Retrospective
- 90 patients
- 13.4 month mean follow-up
- GDA coil embolization

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Research Article

Packing density and long-term occlusion after transcatheter vessel embolization with soft, bare-platinum detachable coils

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Mechanical Occlusion Technology:
Recanalization Rates with Bare-Platinum Coils

2.2%
Recanalization Rate

ABSTRACT

Objective: The objective of this study was to examine packing density and long-term recanalization rates after embolization with soft, bare-platinum ruby coils in the gastroduodenal artery (GDA).

Materials and Methods: Retrospective case review of patients with hepatic malignancy who underwent coil occlusion of the GDA for radioembolization or hepatic arterial infusion chemotherapy between November 2013 and July 2018. Data on patient demographics, GDA diameter, length of coil pack, and distance between GDA origin and most proximal coil were collected. Packing density was calculated as the ratio between the volume of inserted coils and the volume of the vessel area that were filled with coil. The primary outcome was the rate of GDA recanalization, determined by review of hepatic arteriograms at follow-up.

Results: Long-term occlusion free of recanalization was observed in 97.8% (88/90) of patients over a median follow-up time of 13.4 ± 11.3 months. Median vessel packing density was 55% (interquartile range 41–71) and procedural technical success was achieved in 100% (90/90) of patients. Of the 90 patients (72 men; mean age 65.8 ± 7.5 years), mean GDA diameter was 4.8 ± 0.8 mm and the proximal coil distance from GDA origin was 8.6 ± 3.0 mm. Mean coil pack length was 21.2 ± 7.8 mm. Recanalization occurred in 2.2% (2/90) of patients. No increase in recanalization rates with distal coil placement was observed.

Conclusions: The study demonstrates high levels of technical success and low rates of recanalization (2.2%) when high packing densities (55%) are achieved using soft, bare-platinum ruby coils. The rate of recanalization at follow-up compares favorably to previously reported literature.

Keywords: Bare-metal coils, Peripheral embolization, Vessel sacrifice

Volume Advantage

Volume ratio was calculated using the formula:

VR=(D/2)^2 × L

D = Primary diameter
L = Coil length

Conclusion

Bare platinum coils had a higher volume ratio at each measured diameter

Data suggests that fewer bare platinum coils may be needed to achieve the desired clinical outcomes, possibly reducing procedure time and cost

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Volume ratio comparison between four types of detachable endovascular coils

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#GEST2022

Volume Advantage

Volume Ratio (VR):

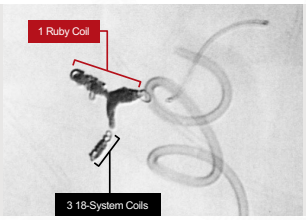
VR=(D/2)^2 × L

D = Primary diameter
L = Coil length

Coil	Thickness	4 mm Coil	8 mm Coil	12 mm Coil
Penumbra® **Large Volume Ruby Coils**	.020"	1 Ruby	1 Ruby	1 Ruby
		4 mm × 35 cm	8 mm × 60 cm	12 mm × 120 cm
Medtronic® **Concerto™**	.0115 – .0145"	9 coils 1 Ruby	6 coils 1 Ruby	3.5 coils 1 Ruby
		4 mm × 10 cm	8 mm × 30 cm	12 mm × 30 cm
Boston Scientific® **Interlock™**	.012"	6.5 coils 1 Ruby	9 coils 1 Ruby	5.5 coils 1 Ruby
		4 mm × 15 cm	8 mm × 20 cm	12 mm × 30 cm
Boston Scientific **Embold**	.015"	4.1 coils 1 Ruby	5.3 coils 1 Ruby	2.1 coils 1 Ruby
		4 mm × 15 cm	8 mm × 20 cm	12 mm × 50 cm
Terumo® **AZUR® CX**	.014 – .015"	5.5 coils 1 Ruby	4.5 coils 1 Ruby	3 coils 1 Ruby
		4 mm × 13 cm	8 mm × 28 cm	12 mm × 38 cm
Bal® **Prestige Plus**	.014"	5.5 coils 1 Ruby	4.1 coils 1 Ruby	3.1 coils 1 Ruby
		4 mm × 15 cm	8 mm × 30 cm	12 mm × 48 cm

Data on file at Penumbra, Inc. Coil volumes were calculated using cylindrical volume, $\pi r^2 h$, where radius is equal to half of the coil thickness and height is equal to coil length. Using calculated coil volumes, quantity of competitor coil of equal shape (complex) required to equal a single Ruby Coil was determined. Results may not be indicative of clinical performance.

Volume + Cost Advantage
Renal Artery Branch (3 mm)



Softness Improves Packing Density
Published Jan 2024

Design

- Single Center, Retrospective
- Compared high volume Ruby coils to traditional coil technology
- 272 PAVMs in 108 patients

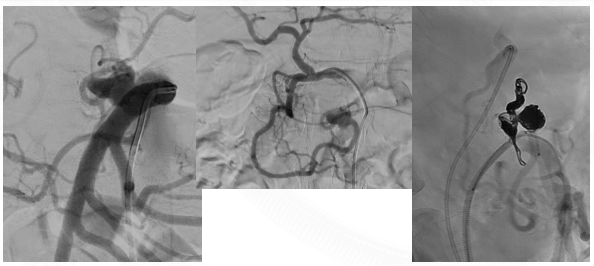
McWilliams J. UCLA experience with PAVMs: technical tips & long term outcomes. Presented at: Global Embolization Symposium & Technologies' Virtual Webinar; June 24, 2020.

Summary Findings:

- PAVM embolization was historically performed with detachable balloons or fibered, pushable coils
- The use of **high-volume detachable non-fibered coils** was associated with higher persistent-occlusion rates (96.3%) when compared with traditional coil technology (81.8%)
- HVDNF (Ruby) are non-fibered and engineered to maximize volume and packing density, which have previously shown to predict persistent occlusion of PAVMs

Considerations between Fibered Coils vs Non-Fibered Coils

Coil Type	Mechanical Occlusion	Volume	Cost	Softness and Deliverability
Bare-Platinum	✓	✓	✓	✓
Fibered	✗	✗	✗	✗



Conclusions

- Non fibered coils provide complete packing and are not dependent on inherent clotting
- The volume advantage suggests that cases can potentially be done with less coils translating into lower cost, shorter procedures and less radiation for patients, staff and physicians
- The softness advantage allows for easy delivery and less kick back potentially making cases safter and more predictable