Comparison of nylon fibered versus nonfibered coils for embolization in an ovine venous model

NEW PRE-CLINICAL DATA

Article

Comparison of fibered versus nonfibered coils for venous embolization in an ovine model.
White SB, Wissing ER, Van Alstine WG, Trerotola SO. *J Vasc Interv Radiol.* 2023;34:888–895.

Purpose

To compare nylon fibered (F) versus nonfibered (NF) embolization coils in an ovine venous model. Previous data in the arterial system has shown the benefit of fibered coils. This new study sought to confirm these findings in the venous system.

Materials and methods

4–8 mm 0.035 inch F and NF coils were deployed in 24 veins in 6 sheep. The number of coils, total length of coils, and length of implanted coil pack required to achieve complete stasis were recorded, as were vessel diameter, radiation dose, ease of packing, damage to embolized vessel, and time to stasis. Venography at 1 and 3 months assessed migration and durability of vessel occlusion. Veins were harvested at 3 months.

Initially, an 8 mm coil was placed, followed by the placement of 6 and 4 mm coils. These sizes were chosen to make certain that there was appropriate oversizing of the coils and nesting of the smaller coil within the larger, outer coil to ensure adequate vessel occlusion. The operators were blinded to the type of embolization coil. If there was persistent flow through the coil pack, additional 4 or 6 mm coils could be placed per the discretion of the operator.

Results

- F and NF coils were deployed in 24 veins, and stasis was achieved without immediate coil migration or vessel damage. The mean number of coils per vein was 5 F vs 8.75 NF (p=0.007).
- Vessel diameter between the groups was not statistically different.
- Total coil length (70 cm F vs 122.5 cm NF, p=0.0007), coil pack length (29.3 mm F vs 39.4 mm NF, p=0.003), time to stasis (5.3 min F vs 9.0 min NF, p=0.008), and radiation dose (25.3 mGy F vs 34.9 mGy NF, p=0.037) were significantly different between the groups.
- Challenges with the animal model prevented conclusive long-term results.
- Migration occurred with 8/11 (72%) coil packs in the femoral veins and with 0/13 (0%) coil packs in the internal iliac and deep femoral veins.
- Venography demonstrated that 11/16 remaining coil packs were occluded at 1 month, and 10/16 remained occluded at 3 months.

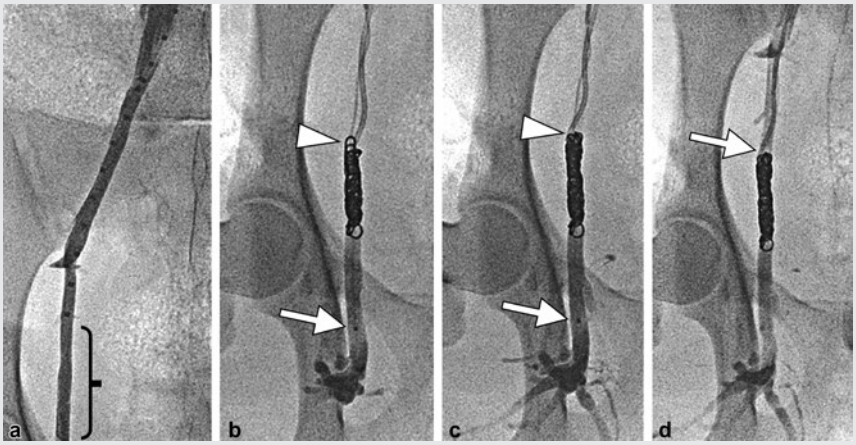
From the discussion section

The ovine model was chosen because there have been many prior studies[1,2] where endovascular devices were implanted in sheep, and this model has been used for venous disease because of their similarity with coagulation in humans. The animals used were also adult animals; so, the growth of veins was not an issue for the implanted coils.

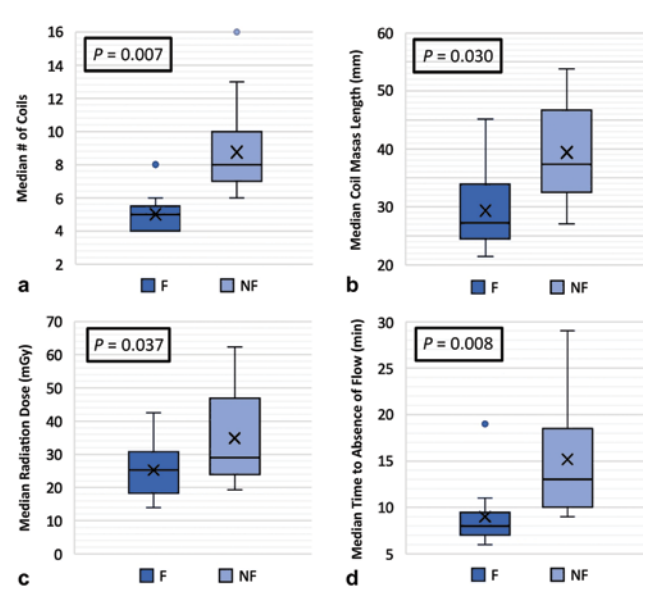
Acutely, the results of this study showed vessel occlusion with both F and NF embolization coils with fewer F coils needed to achieve occlusion than NF coils. This was similar to an arterial study.[3] However, the current study also demonstrated a faster time to occlusion, less total length of coil, shorter coil mass length, and overall reduction in radiation dose when F coils were used.

Conclusion

This study demonstrated that acutely, nylon fibers allow for a significantly decreased number of coils, shorter coil pack length, faster time to occlusion, and reduced radiation dose to achieve immediate vessel occlusion. This is likely translatable to shorter procedure times, less radiation exposure, and fewer devices used during procedures in clinics.



Implant procedure. (a) Sheep underwent catheterization of the right internal iliac vein, and contrast injection was performed using a calibrated wire to determine the vessel size and intended size of the implant (bracket). (b) The initial 3 fibered coils were placed per protocol, followed by contrast injection via the microcatheter, which was deep with respect to the coil pack (white arrow) and the base catheter above the coil pack (arrow head), to determine whether stasis had been achieved. (c) After completion of the placement of the final 6 mm coil, antegrade contrast injection via a Cantata® microcatheter (white arrow) demonstrated no flow beyond the coil pack. (d) Additional contrast agent was injected via the base catheter, and no contrast was seen flowing retrograde through the coil pack.



Fibered versus nonfibered results. Statistically significant differences were noted between the 2 groups when the (a) mean coil length, (b) mean coil mass length, (c) mean radiation dose, and (d) mean time to absence of flow were compared.

1. Brountzos EN, Kaufman JA, Venbrux AC, et al. A new optional vena cava filter: retrieval at 12 weeks in an animal model. *J Vasc Interv Radiol.* 2003;14:763–772.
2. Tayagi R, Carr DC, Stibbs P, et al. Ovine iliac vein model for endovascular thrombectomy of acute deep venous thrombosis. *J Vasc Interv Radiol.* 2022;33:249–254.
3. Trerotola SO, Pressler GA, Premanandan C. Nylon fibered versus nonfibered embolization coils: comparison in a swine model. *J Vasc Interv Radiol.* 2019;30:949–955.

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