# ### Pressure Cooker Technique (PCT) in Endovascular Embolization

#### 1. What is the Pressure Cooker Technique (PCT)? The Pressure Cooker Technique (PCT) is an advanced endovascular embolization strategy used to improve the penetration of liquid embolic agents (e.g., Onyx, n-BCA) into high-flow vascular lesions while minimizing reflux and preventing non-target embolization.

It is particularly useful for treating: - Dural arteriovenous fistulas (dAVFs) - Arteriovenous malformations (AVMs) - High-flow fistulas in dural sinus malformations (tDSM)

By creating a **proximal plug**, the technique increases **intravascular pressure**, facilitating deeper and more controlled embolic delivery.

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**#### 2. Why Use PCT?** In **high-flow vascular malformations**, standard embolization techniques may lead to: - **Poor penetration** of embolic agents into the lesion. - **Significant reflux** of liquid embolic material into normal vessels. - **Non-target embolization**, risking ischemia or neurological damage. - **Residual arteriovenous shunting**, requiring repeat procedures.

PCT addresses these limitations by: [] Enhancing forward embolic penetration. [] Preventing reflux into normal arteries. [] Reducing the risk of embolization in unwanted areas. [] Allowing controlled occlusion of high-flow shunts.

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#### 3. How is the Pressure Cooker Technique Performed? PCT involves creating a temporary plug in the feeding artery using detachable coils, a balloon, or glue, before injecting the liquid embolic agent.

# ##### Step-by-Step Process: 1. Microcatheter Positioning:

- 1. A dual-lumen balloon catheter or a regular microcatheter is advanced into the arterial feeder of the fistula or AVM.
- 2. Proximal Plug Formation:
  - 1. A detachable coil or glue (n-BCA) is deployed just proximal to the target embolization zone, forming a temporary plug.
  - 2. This prevents **proximal reflux** of the embolic material.

# 3. Injection of Liquid Embolic Agent:

- 1. Onyx (ethylene vinyl alcohol copolymer) or n-BCA (n-butyl cyanoacrylate) is injected distally beyond the plug.
- 2. The embolic agent **penetrates deeply** into the vascular lesion.

# 4. Controlled Expansion & Deep Embolization:

- 1. The plug **increases pressure distally**, pushing the embolic agent **deeper into the fistula or AVM nidus**.
- 2. This enhances **complete occlusion** of the abnormal vascular network.

# 5. Final Catheter Removal:

1. After embolization, the catheter is gently withdrawn, leaving the embolic material **in place**.

**#### 4. Benefits of the Pressure Cooker Technique** [] **Improved Embolic Penetration** - The plug forces the embolic agent **deeper** into the lesion rather than allowing it to reflux backward.

**Minimized Reflux** - Prevents liquid embolic material from **flowing retrogradely** into normal arteries.

Greater Safety in High-Flow Lesions - Reduces the risk of non-target embolization, which could lead to stroke or ischemia.

□ Allows for Complete Occlusion - Helps achieve near-total closure of the arteriovenous shunt, reducing the likelihood of recurrence.

**Facilitates Multi-Stage Treatments** - In cases requiring staged embolization, PCT ensures **better control over successive interventions**.

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#### 5. Clinical Applications PCT is widely used in complex neurovascular procedures, particularly in: - High-flow dural sinus malformations (tDSM) - Dural arteriovenous fistulas (dAVFs) - Brain and spinal AVMs - Carotid-cavernous fistulas (CCFs) - Congenital high-flow fistulas in neonates

It is **especially beneficial in redo embolization cases**, where previous treatments have left residual shunts.

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#### 6. Limitations & Risks [] Catheter Entrapment - If Onyx solidifies too extensively around the catheter, removal may be difficult.

**Risk of Vessel Rupture** - High-pressure embolization may cause **vascular rupture** if not carefully controlled.

**Technical Expertise Required** - PCT is a **complex technique** requiring an experienced neurointerventionalist.

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### 7. Conclusion The Pressure Cooker Technique (PCT) is a powerful embolization strategy for high-flow neurovascular malformations, significantly improving embolic agent delivery while reducing reflux and enhancing safety. It is particularly valuable in redo embolization cases of dural sinus malformations (tDSM) with high-flow fistulas.

Would you like a comparison of PCT with other embolization techniques, such as **dual-lumen balloon-assisted embolization**?

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Last update: 2025/01/31 08:16