

# Reverse Flow Embolic Neuroprotection with Transcarotid Arterial Revascularization

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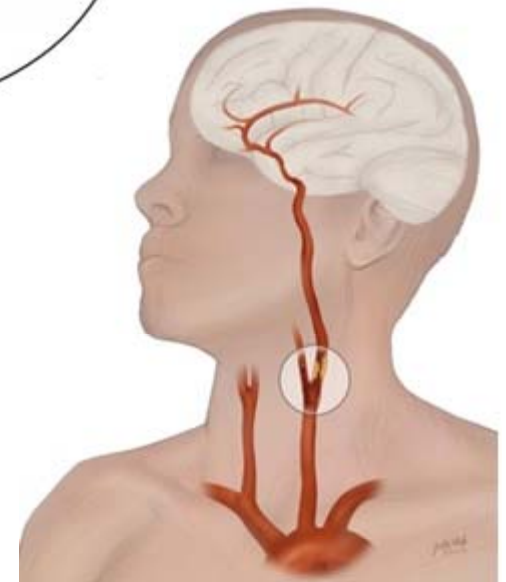
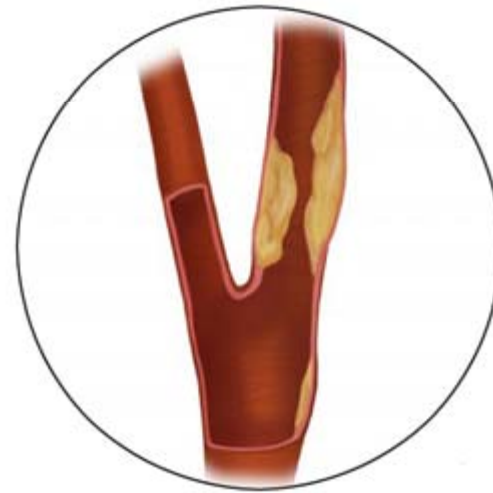
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# Carotid Artery Stenosis

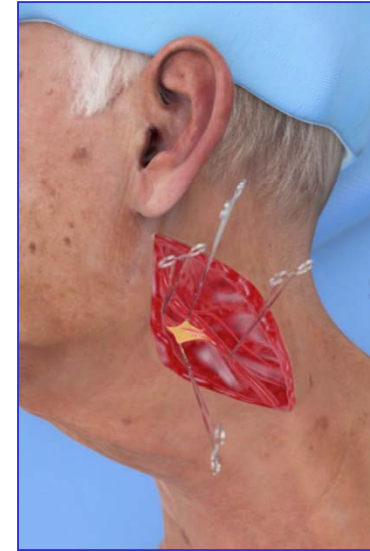
- Carotid artery stenosis is a narrowing of the main vessels supplying blood to the brain.
- Atherosclerotic plaque builds
- Carotid artery stenosis is a leading cause of stroke.
- Different treatments for carotid artery stenosis are available depending on severity and nature of the obstruction.



# Treatment Options

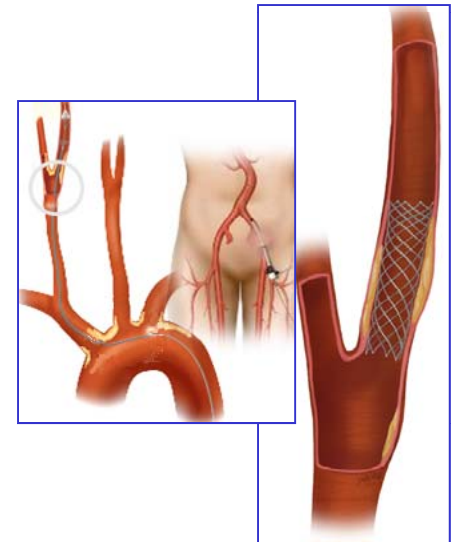
## *Carotid Endarterectomy*

- Open procedure, requires exposing and entering the carotid artery to remove plaque.
- May involve detaching, clearing, and reanastomosing a segment of the artery.
- Closure may be direct or via a patch.



## *Carotid Artery Stent, Transfemoral (TF)*

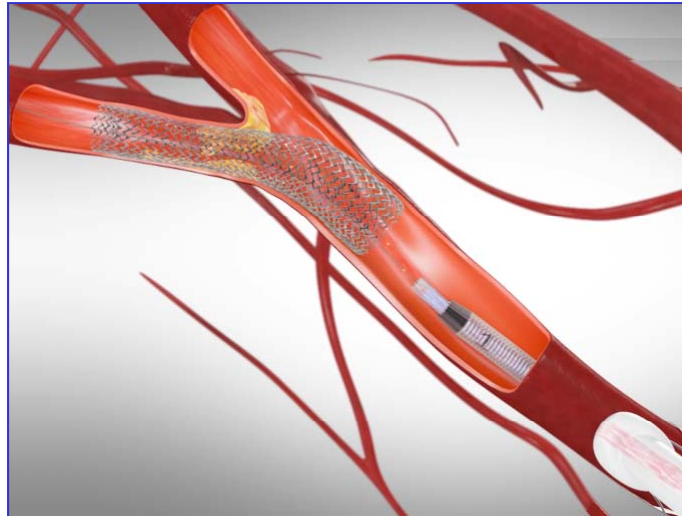
- Endovascular procedure, involves puncturing the femoral artery and advancing instruments through the vasculature under fluoroscopy.
- Requires traversing the aortic arch.
- Stent placement re-opens the carotid artery lumen for blood flow.



# Treatment Options (continued)

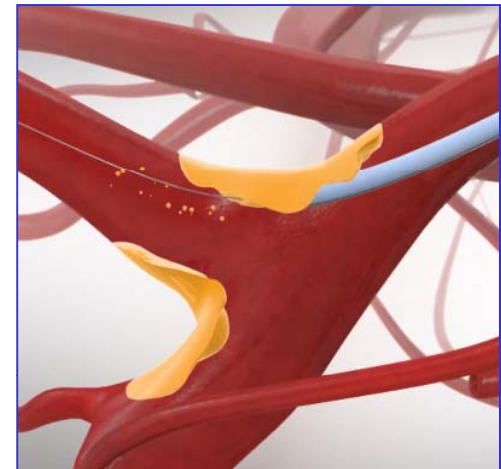
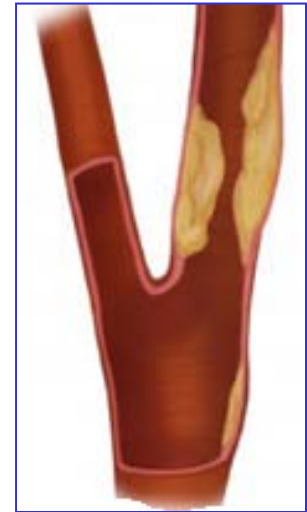
## Carotid Artery Stent, Transcarotid (TCAR)

- Endovascular procedure, involves directly puncturing the common carotid artery to place the stent.
- Temporary reverse blood flow during the intervention.
- Avoids traversing the aortic arch and reduces fluoroscopy time.
- Stent placement re-opens the carotid artery lumen.



# TF Carotid Artery Stenting, Neurologic Complications

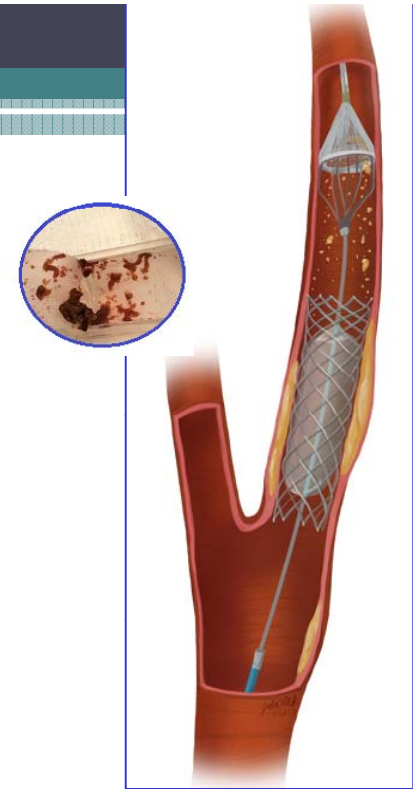
- Carotid artery stenting is performed to prevent stroke due to reduced blood flow to the brain caused by obstruction.
- However, stroke is also a known complication of the procedure itself, due to emboli created when the instruments and devices are introduced.
- Peri-procedural stroke can result when debris breaks loose during carotid artery dilation and stent placement and then travels to the brain with the regular blood flow.



# Embolic Filtration

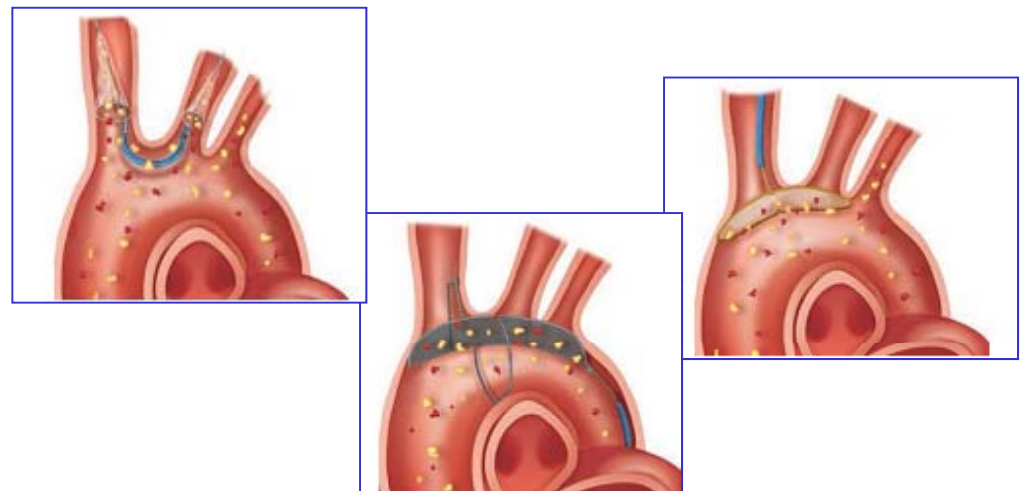
## TF Carotid Artery Stenting

- To protect against stroke during carotid artery stenting, a filter is intraoperatively placed distal to the site of intervention.
- The filter strains out and captures emboli from the blood flow to the brain.



## Other Procedures

- Emboli are a known complication of other procedures (eg, TAVR) and similar strategies are employed.





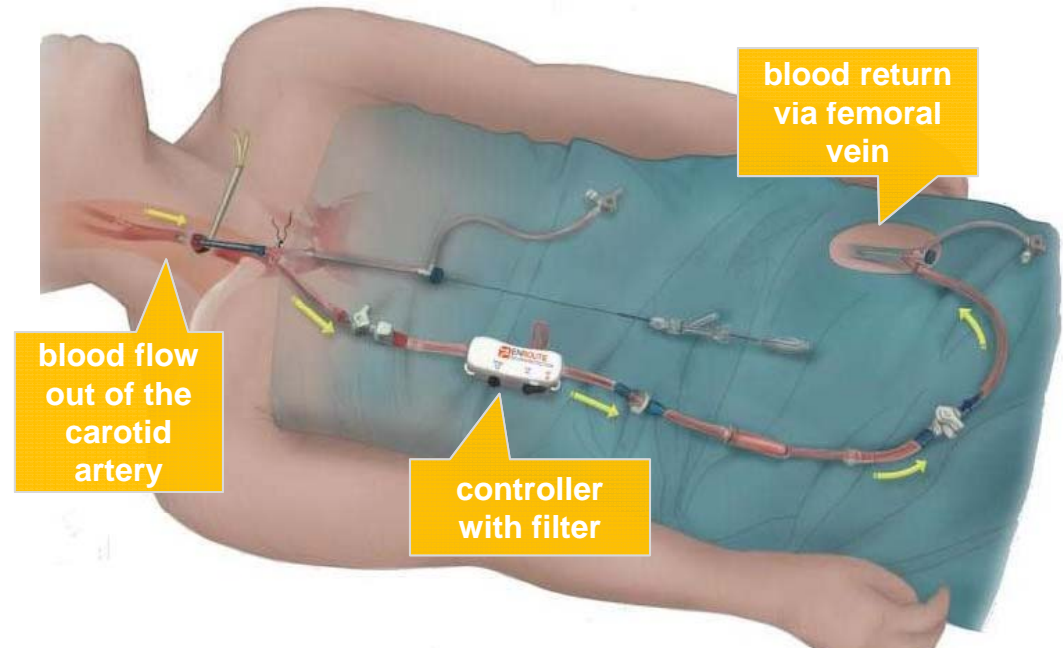
# Reverse Flow Embolic Neuroprotection

- Reverse flow embolic neuroprotection accomplishes the objective of protecting against emboli but uses a different technique.
- It is currently used specifically with transcarotid carotid artery stent (TCAR) procedures.
- Rather than placing a filter within the vasculature during the procedure, embolic neuroprotection employs an extracorporeal circuit and reverse blood flow.



# Extracorporeal Circuit

- The extracorporeal circuit is established at the beginning of the TCAR procedure.
- Following cut-down and puncture of the common carotid artery, a sheath is placed and connected to the previously assembled circuit.
- The circuit runs from the common carotid artery in the neck to the femoral vein at the groin.
- The external controller houses a filter to continuously capture emboli throughout the stenting procedure.

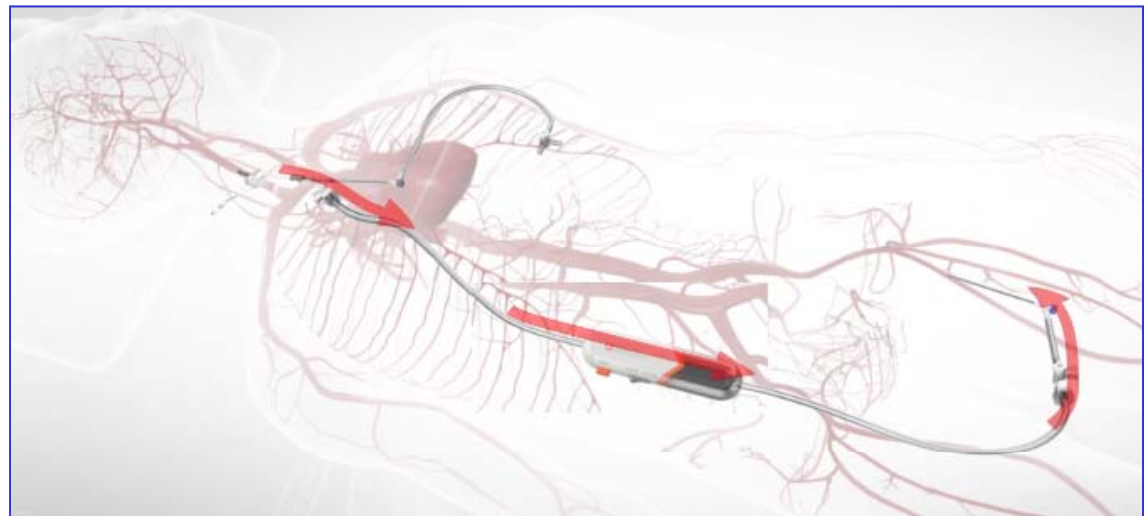




# Reverse Blood Flow

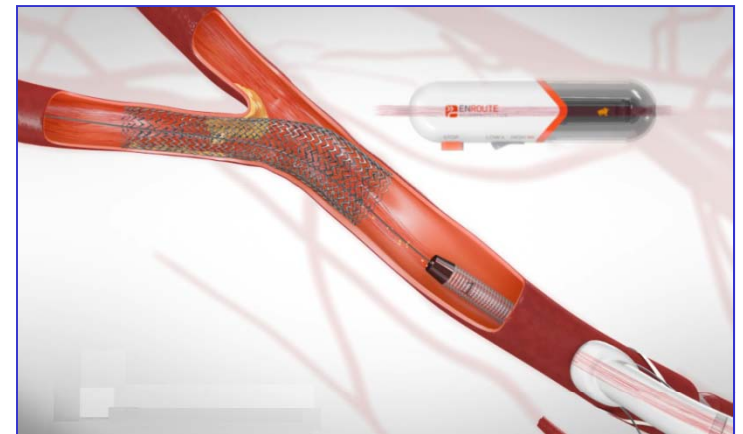
- Instead of continuing to flow up to the brain, blood is redirected out of the carotid artery and into the circuit.
- The circuit works by pressure gradient, without a pump.
- Blood from the high pressure carotid artery flows through the filter and into the low-pressure femoral vein.
- There is

carotid artery  
throughout the  
stenting  
procedure.



# TCAR Carotid Artery Stenting

- After reverse blood flow is established, a balloon is advanced through the same carotid access and sheath into the carotid artery.
- The site of obstruction is pre-dilated by the balloon.
- The stent is deployed within the carotid artery at the site of obstruction.
- Reverse blood flow continues throughout the procedure, moving debris away from the brain and out of the body.



# Completion

- The physician confirms placement of the stent and patient neurological status.
- The sheath is disconnected

carotid artery to the brain.



- The temporary reversal of blood flow on one side does not cause neurological injury.
- During the procedure, the brain continues to be supplied by arteries on the contralateral side as well as collateral circulation.

# Documentation

- The components of the extracorporeal circuit are the transcarotid arterial sheath, flow controller, and venous return sheath.
- Early in the procedure, flow reversal is confirmed by saline bolus into the venous flow line followed by angiography.
- At completion of the procedure, restoration of antegrade flow is documented.
- The model name for the system is ENROUTE.
- The abbreviation NPS (Neuroprotection System) may also be used.



# Data Issues

Having unique ICD-10-PCS codes for embolic neuroprotection via an extracorporeal circuit and reverse blood flow will allow:

- identification and differentiation of this procedure from other embolic filtration techniques
- tracking and measurement of utilization
- meaningful outcomes analysis based on nationwide data
- development of recommendations for additional clinical applications as supported by data analysis



**QUESTIONS?**