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WELCOME

Current Interventional Trends in Angiography

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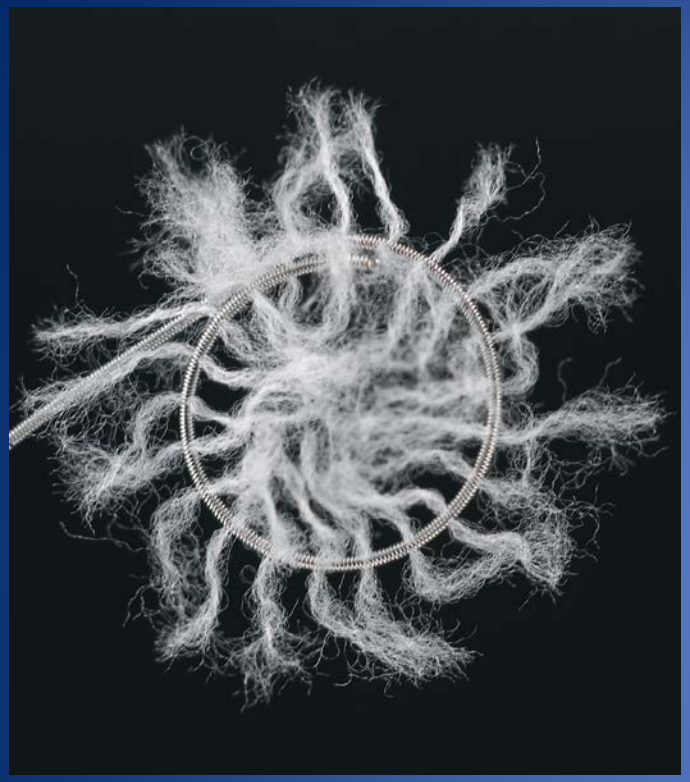
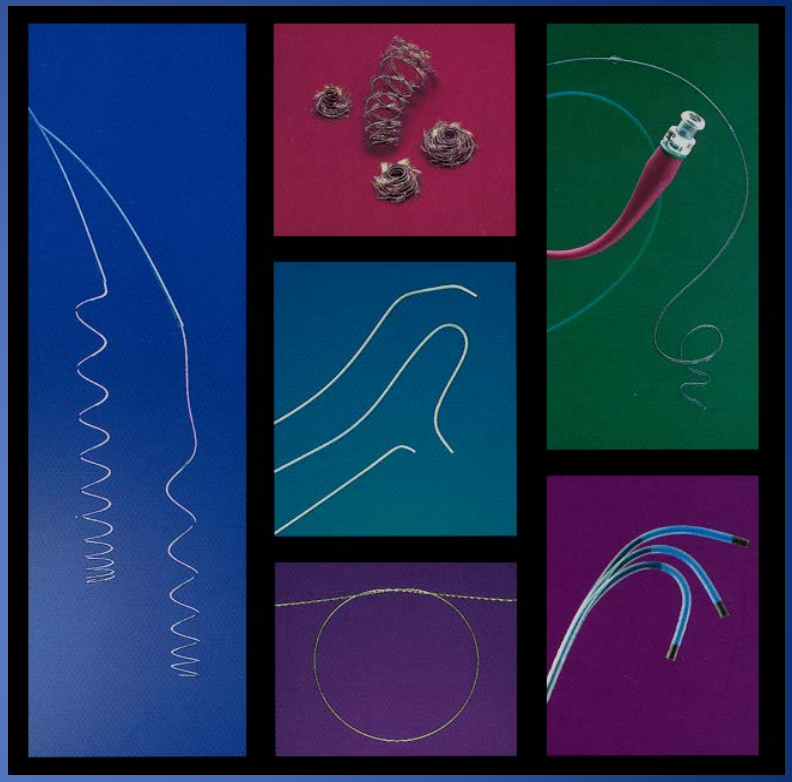




Closing a Vessel.

EMBOLIZATION

Embolization: The Basics

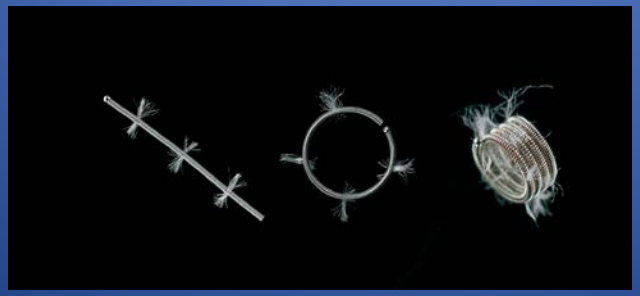
Definition

Embolization is defined as the therapeutic introduction of various substances into the circulation to occlude vessels, arrest or prevent hemorrhaging, or devitalize a structure or organ by occluding its blood supply.

Embolization: The Basics

Embolization devices can be broken down into three main categories:

- **Mechanical** (Coils / Balloons)
- **Particulate** (PVA / Spheres)
- **Liquids** (Absolute alcohol /Glues)



Embolization: The Basics

- Embolization substances are delivered via a catheter or sheath (spider) to various locations throughout the circulatory system.
- Embolization substances can be used in any portion of the circulatory system.

Indications for Embolization

Embolization is used to:

- Stop blood flow to tumors
- Stop blood flow into aneurysms
- Stop blood flow to organs prior to removal
- Stop abnormal blood flow like Arteriovenous Malformation (AVM) or Arteriovenous Fistula (AVF)
- Stop bleeding

Materials (substances)

Coils

Materials and Considerations

- Inconel
  - Most radial strength
  - Very radiopaque
  - Least expensive to manufacture
- Platinum
  - Less radial strength…good for packing
  - Very radiopaque
  - Less likely to back out catheter
- Dacron Fibers
  - Promote platelet aggregation

Our Products

Fibered Coils, Platinum or Inconel, spiral, straight, Tornado and Nester.

MR Compatible: This term indicates that the device, when used in the MR environment, is MR safe and has been demonstrated to neither significantly affect the quality of the diagnostic information nor have its operations affected by the MR device.

Our Products

Product Name	Order Number
Standard Embolization Coils	IMWCE-35(38)-XX-XX
Tornado Embolization Coils	MWCE-35-XX-XX-TORNADO
Tornado Embolization Microcoils	MWCE-18-XX-XX-TORNADO
Nester Embolization Coils	MWCE-35-XX-XX-NESTER
MicroNester Embolization Coils	MWCE-18-XX-XX-NESTER
Hilal Embolization Coils	MWCE-18-XX-XX-HILAL
Flipper Detachable Embolization Coil	IMWCE-35-XX-XX-PDAx
Jackson Detachable Embolization Coil	IMWCE-35(38)-XX-XX-Jackson
Detachable Coil System	DCS-11 / 18-XX-XX- J / Spiral / Tornado / MCJ

Catalog Numbers

Decoding the Catalog Number

- MWCE: Modified Wallace Coil Embolization
- IMWCE: Inconel Modified Wallace Coil Embolization
- DCS: Detachable Coil System

Catalog Numbers

NOTE: The first number after the prefix indicates the diameter of the coil wire, as well as the coil's catheter compatibility; the next number indicates the length of the coil; and the final number indicates the curled diameter of the coil. If there is a suffix on the order number, it will indicate a particular configuration of the coil (Tornado, Nester, and Hilal).

What's the fuzz all about?

- Dacron fibers help collect platelets which begin the thrombosing process, which ultimately leads to cutting off blood flow to the vessel.

Delivery of Micro Coils (Except for DCS)

Wire-push Technique:

For microcatheters 0.018”-0.024” ID using Coil pusher CP-18-180

Saline-flush Technique:

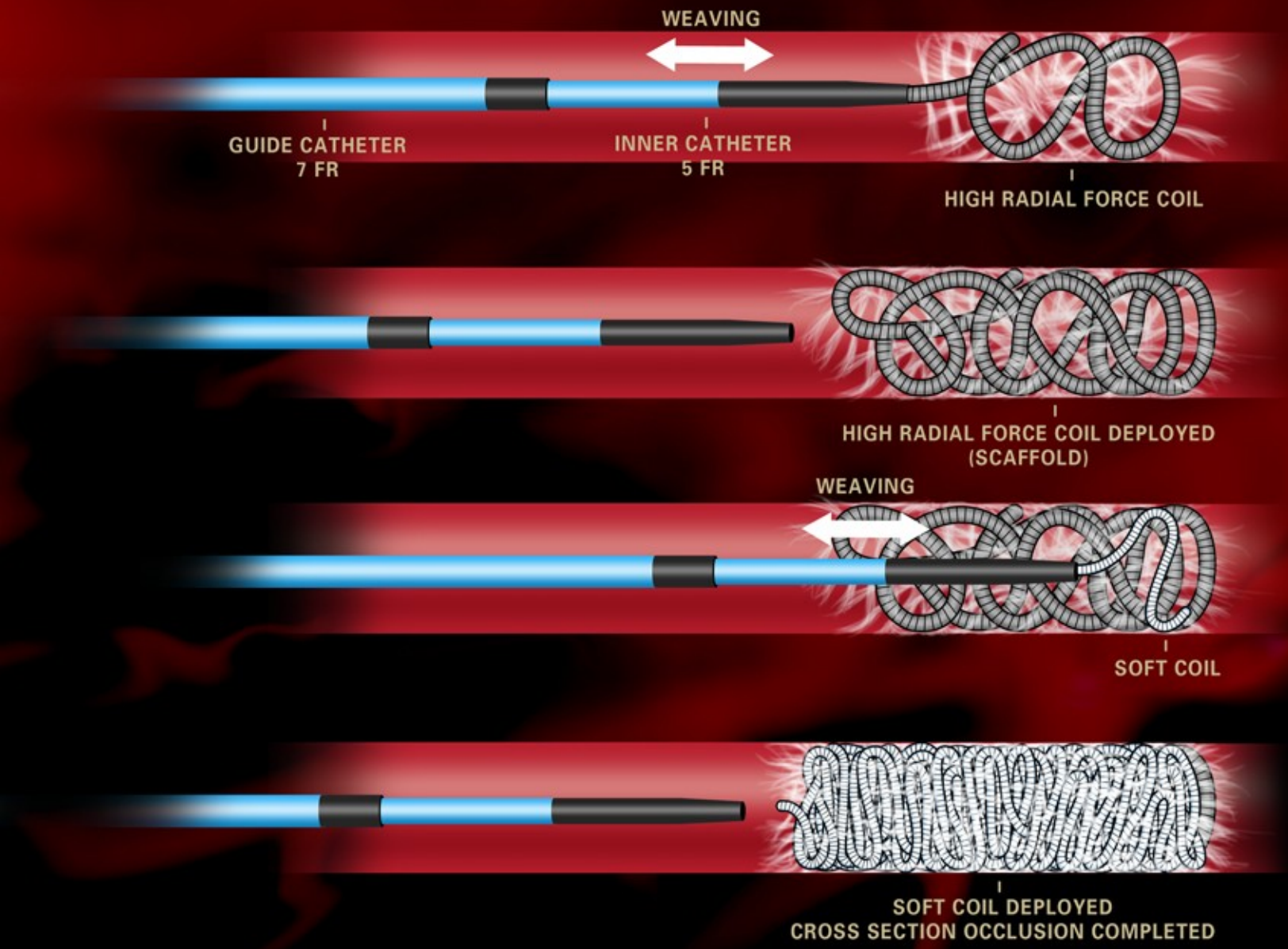
For microcatheters 0.024”-0.027” ID using 3ml Luer-Lock Syringe

Push Techniques

SCAFFOLD technique:

- Build “endoskeleton” with high radial force coil (IMWCE)
- Finish with nesting/packing technique

Scaffold Technique

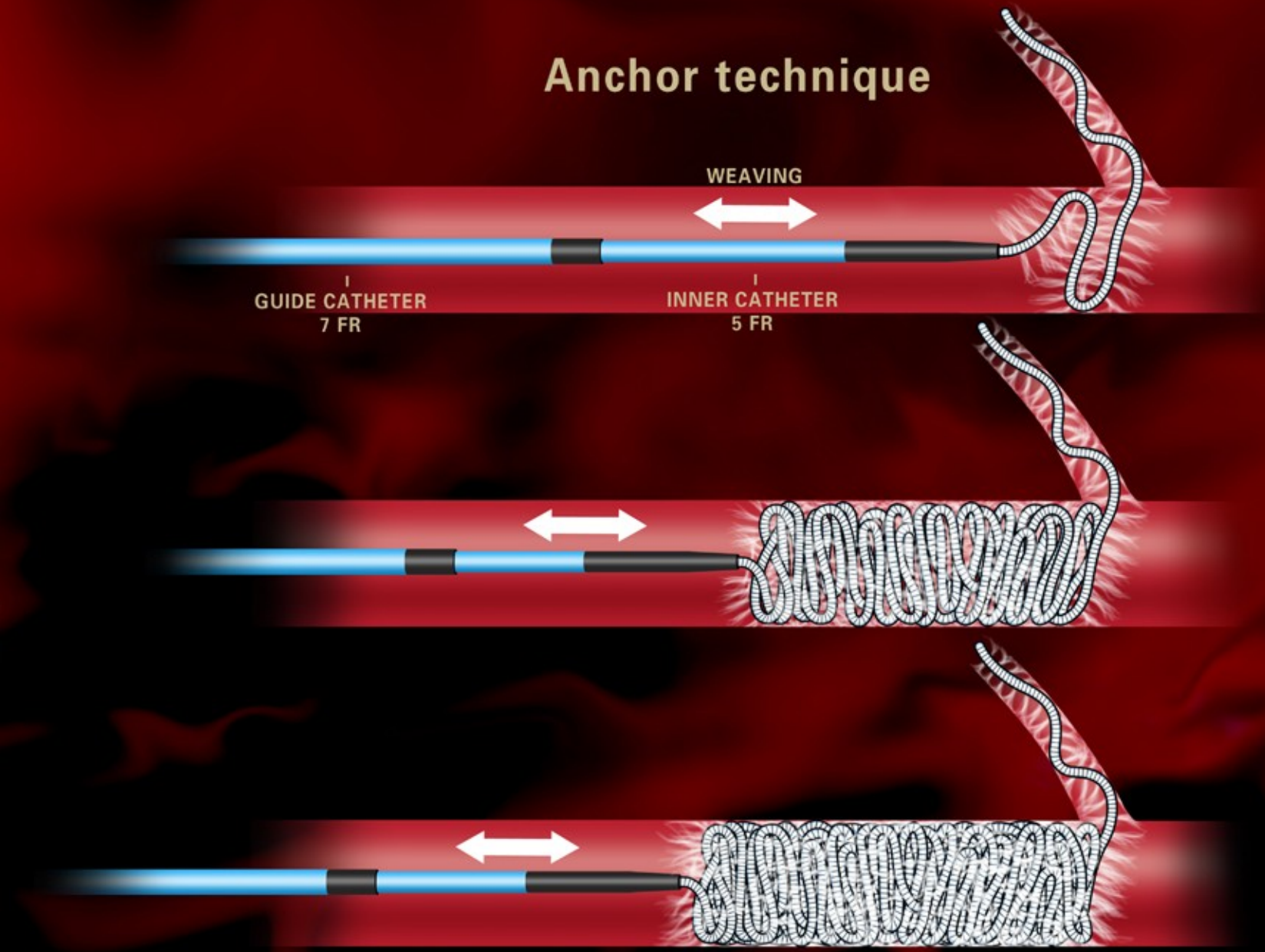


Push Techniques

ANCHOR technique:

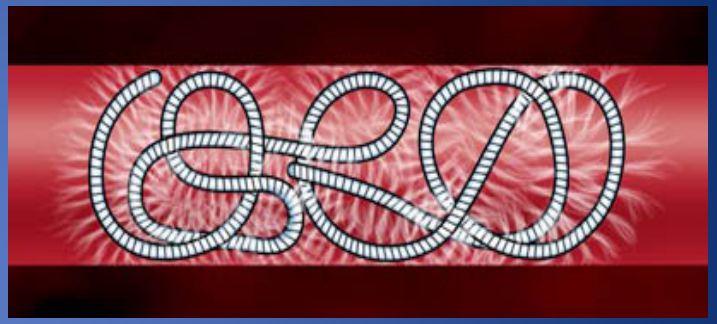
- Place the first 1-2cm of the coil in a side branch which would be occluded anyway to provide a safe fixation of the coil.
- Than pull the microcatheter a little bit back and place the rest of the coil in the target vessel.

Anchor technique

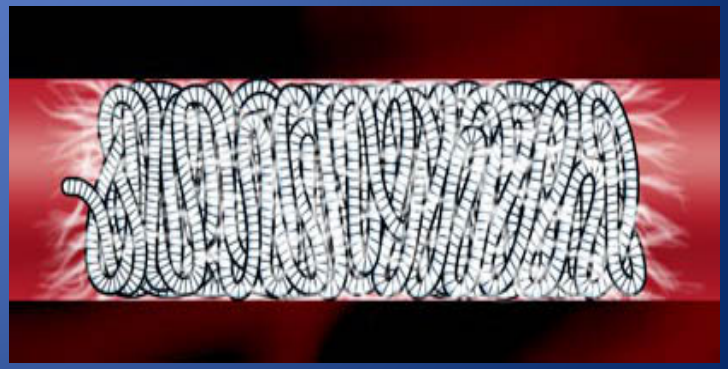


Drawbacks of Fibered Microcoils

- Short length
- Risk of migration
- Many coils needed
- Cost



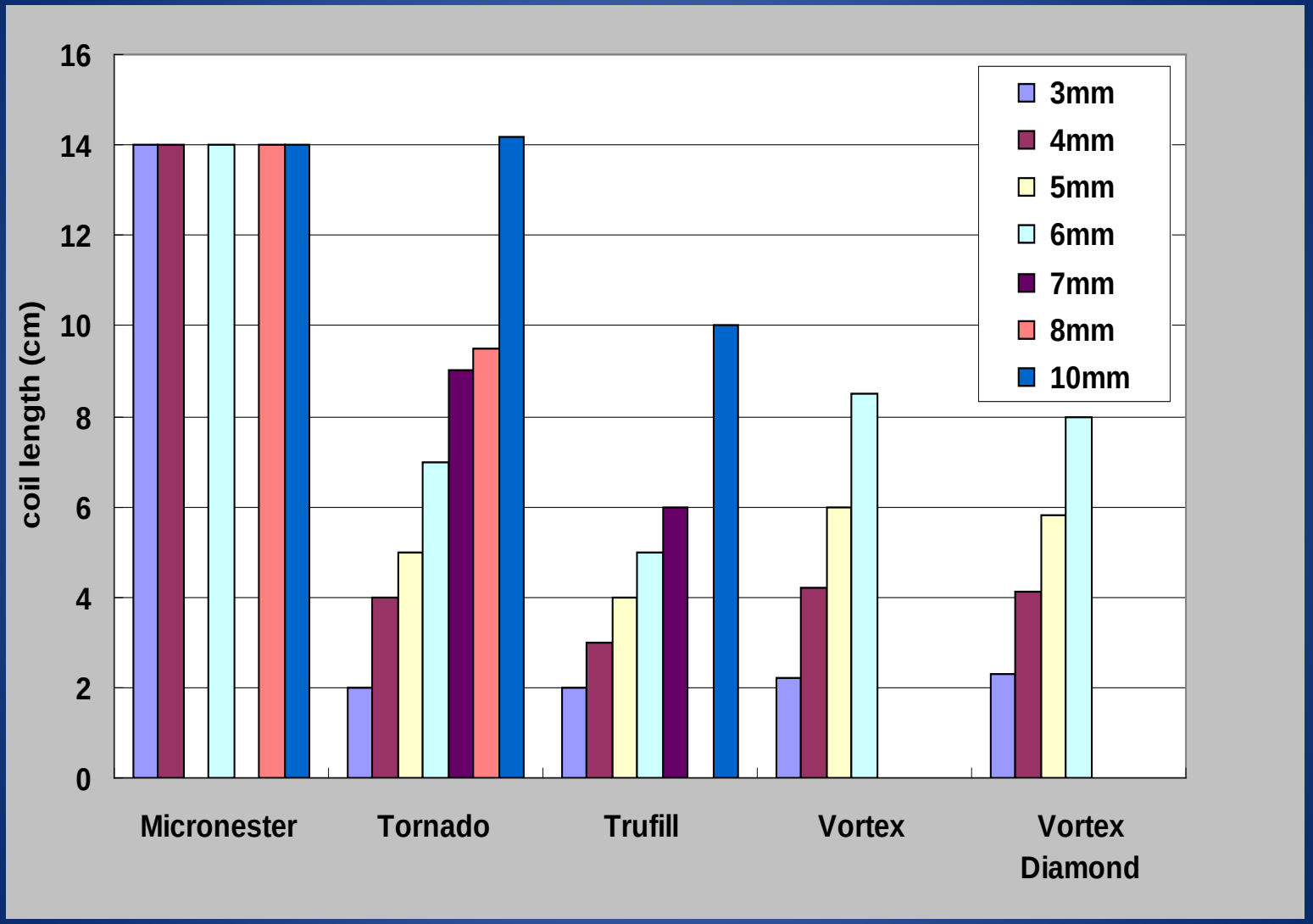
Inadequate packing



Dense packing

Need immediate cross-sectional occlusion!

Length of Fibered Microcoils



Nester Coils

- Always 14cm long!!!
- Diameter 3,4,6,8,10mm
- Very soft Platinum
- O.O18 & 0.035
- Long and dense Dacron fibres
- Different from all other competitors

- Tight packing/ quick occlusion
- Optimal in tortuous vessels
- Accept easier being oversized
- Very thrombogenetic and MRI compatible
- Safety - easier sizing
  - no risk of migration

Materials (substances)

PVA

Polyvinyl Alcohol Foam Particles

Overview

- Ground polyvinyl alcohol
- Available in 9 different sizes
- Mixed in vial with saline / contrast
- Ideal for hypervascular embo
- History of biocompatibility since 1949
- Introduced as embolic agent in 1974
- Permanent (not biodegradable)

Overview

- Used for permanent embolization of hypervascular lesions, e.g. hemangiomas and arteriovenous malformations.
- Sterile mixing environment.
- Ideally mixed with 80% 300 contrast – 20% saline to achieve ideal suspension of 240.
- Drawn into a syringe system and injected through a catheter.
- Excellent to mix with a therapeutic agent.

Overview

Order Number	Color Code	Size Range	Global Number
PVA-50	White	47-90 mic	G09661
PVA-100	Black	90-180 mic	G09662
PVA-200	Green	180-300 mic	G09663
PVA-300	Purple	300-500 mic	G09664
PVA-500	Red	500-710 mic	G09665
PVA-700	Blue	710-1000 mic	G09666
PVA-1000	Orange	1000-1400 mic	G09667
PVA-1500	Yellow	1400-2000 mic	G09668

Overview

Histologically

- Initially causes platelet aggregation and thrombus formation
- Becomes surrounded by fibrous connective tissue and produces a chronic inflammatory response

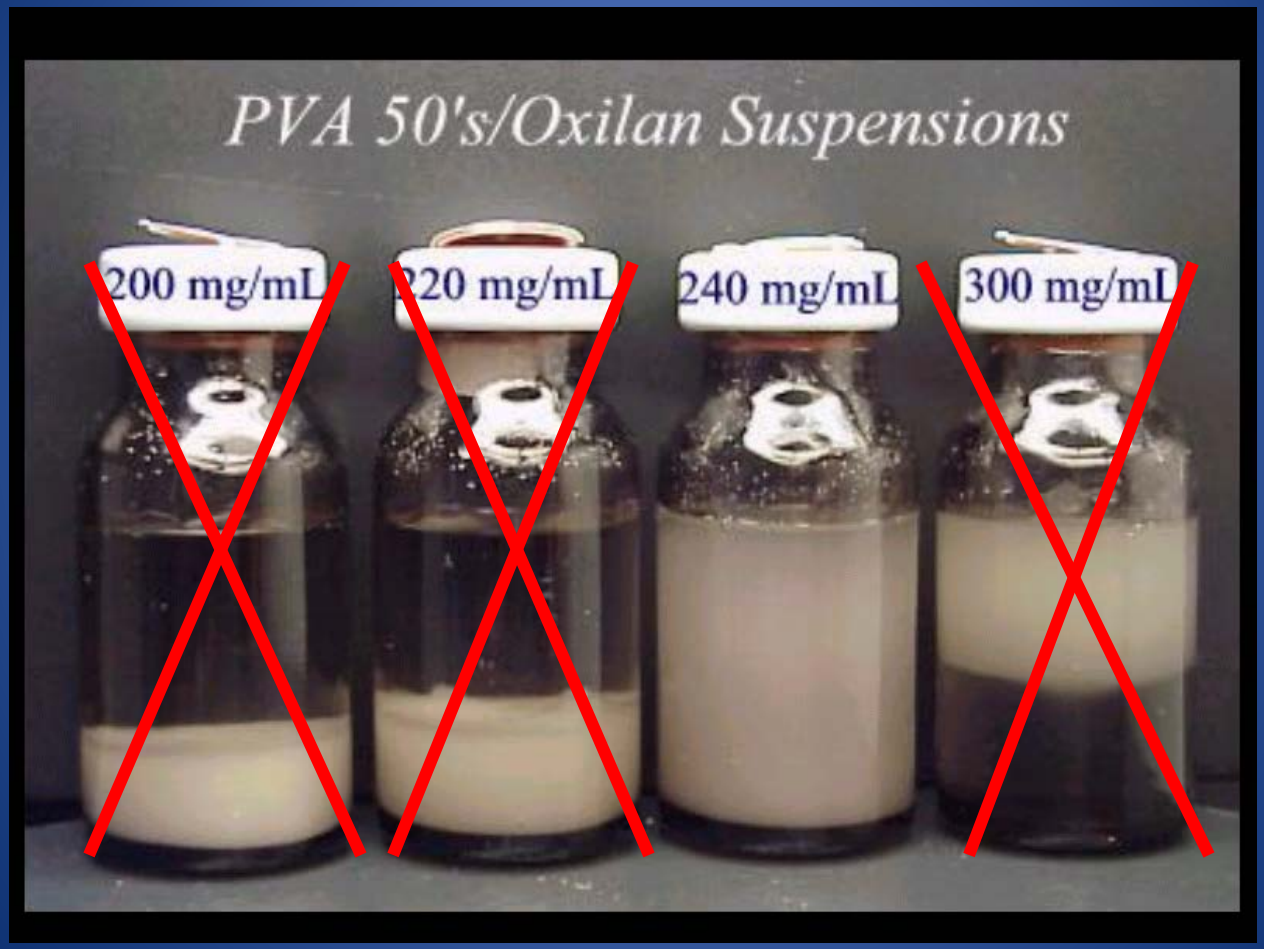
Mechanically

- Physically blocks blood flow distal to particles

Preparation & Usage

- Mix PVA with 10 (20)cc of 240 concentration contrast agent
  - 16 (8)cc of 300 contrast
  - 4 (2)cc of normal saline
- Draw into 20cc syringe
- Hydrate for 10 minutes with intermittent agitation
- Agitate between syringes via a stopcock prior to delivery
- Infuse until forward blood flow is reduced to 1 cm/sec

Preparation & Usage

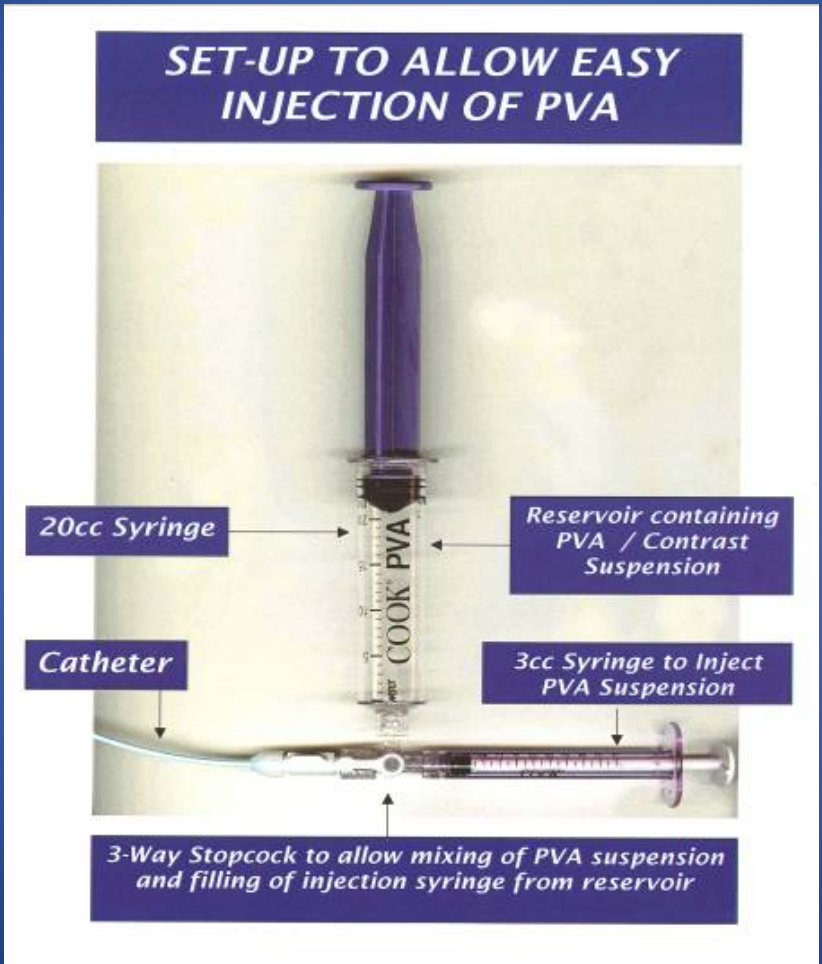


Preparation & Usage

Catheter Compatibility

- 50 to 500 micron particles are compatible with an .018” ID catheter.
- 700 to 1500 micron particles are compatible with an .038” ID catheters.

Preparation & Usage



Preparation & Usage

Catheter Recommendations

- Slip-Cath® (SCR,SCBR)
  - **Braided Shaft** = Excellent Tracking and Torque Control
  - **Hydrophilic Coating** = Reduced Friction
  - **Beacon Enhanced Radiopaque Tip** = Improved Visibility
  - **Large ID**
    - 5F- Tapered Tip ID of 0.038”
    - 4F- Tapered Tip ID of 0.038”
    - 3F-.025 ID
  - Diverse selection of curve configurations

Preparation & Usage

Microcatheter Recommendations

Cook	Target (BSC)	Cordis
Slip-Cath (SCR)	**Renegade Hi-Flo**	**Mass Transit**
.025” I.D.	.027” I.D.	.027” I.D.
MiraFlex		
.021” I.D.		
Microferret	**Renegade**	**Prowler Plus**
.018” I.D.	.021” I.D.	.021” I.D.

Clinical Application

Common Applications

- Uterine Fibroids
- Hypernephromas
- Renal Angiomyolipomas
- Gastric, Duodenal, Mesenteric, Colonic, Bronchial, Hepatic, Pelvic, and Renal Bleeding
- Hypersplenism
- AVM
- Hypervascular Tumors (Malignant & Benign)

Clinical Application

Determining PVA size is dependent on…

- **flow characteristics**
- **type of target lesion**
- **target vessel size**
- **requirements of embolization (slow flow or stop flow)**
- **proximity and size of side branches**

Clinical Application

- AVMs require larger size PVA to prevent embolization beyond the target lesion
- Tumors require smaller sizes in order to necrose tissue
- Remember, PVA will take path of least resistance
  - Reflux around catheter
  - Passing through AVM
  - Venous: back-flow

Clinical Application

Points to Consider

- Capillary beds are 7um
- Arterioles are 50-150um
- Small particles stop flow thus killing tissue
- Large particles slow down the flow
  - Maintains tissue
  - Allows for healing

The Global Marketplace

- **Cook - *PVA Foam***
- **Cordis - *TruFill***
- **Boston Sci. – *Contour & Contour SE***
- **Biosphere - *Embosphere***
- **Angiodynamics – *PVA Plus***

- **Other materials include thrombin, glue, silk**

Competitive Review

Boston Scientific – Contour SE

Competitive Review

Boston Scientific – Contour SE

- PVA formulation – spherical design
- Provides more distal embolization
- Requires more vials than standard PVA
- Has produced “unacceptably high rate of failed tumor infarction in UFE” (Spies Article)
- Due to continued compression after initial occlusion.

Competitive Review

Biosphere - Embosphere

Competitive Review

Biosphere – Embosphere

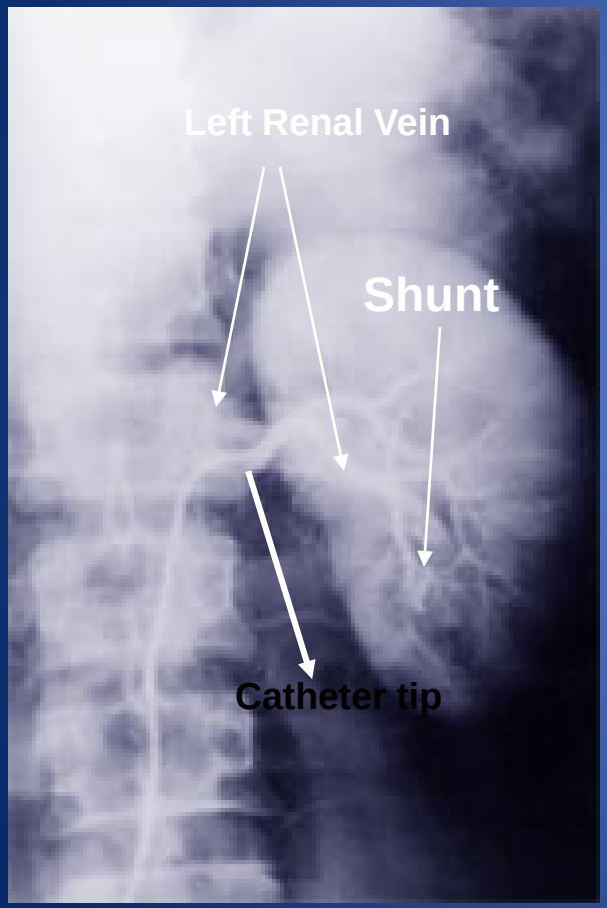
- Gelatin formulation – spherical design
- Provides more distal embolization
- Requires more vials than standard PVA
- Has produced "…No substantive difference in outcomes when compared to PVA particles..." (Spies Article)
- Substantially more costly with no proof

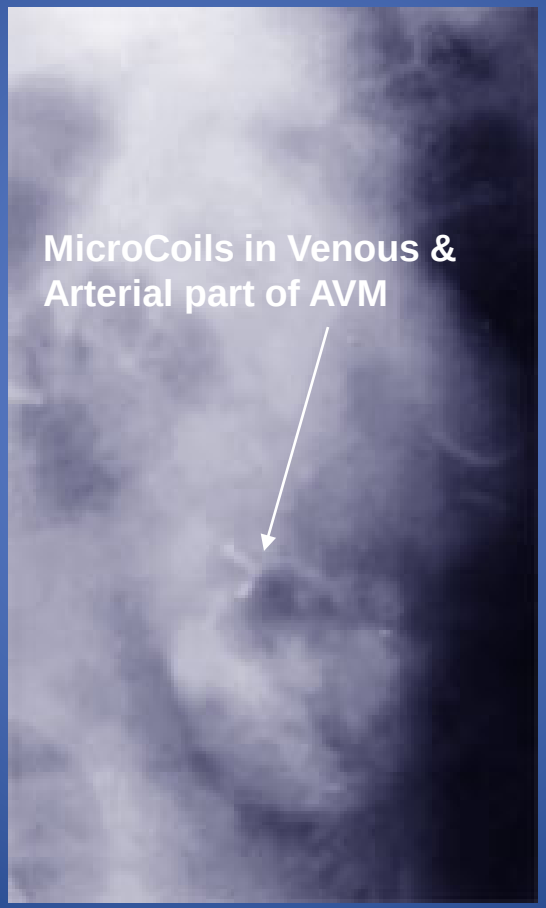
Indications for Embolization

- AVM's & AV Fistula's
- Aneurysms
- Organ Ablations
- Tumors
- Bleeding
- Varicoceles

Indications

Renal AVM embolization





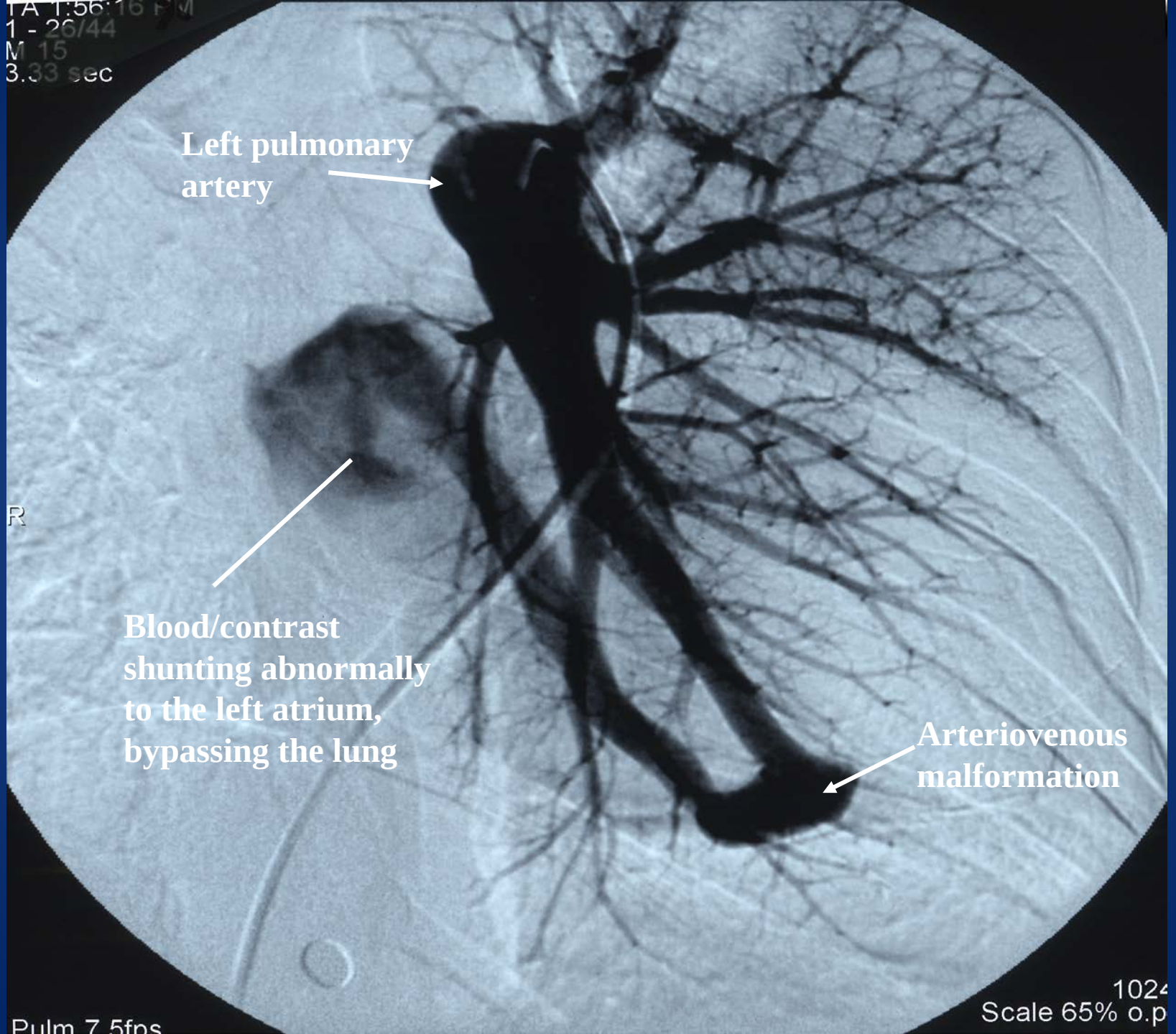
Indications

Pulmonary AVMs

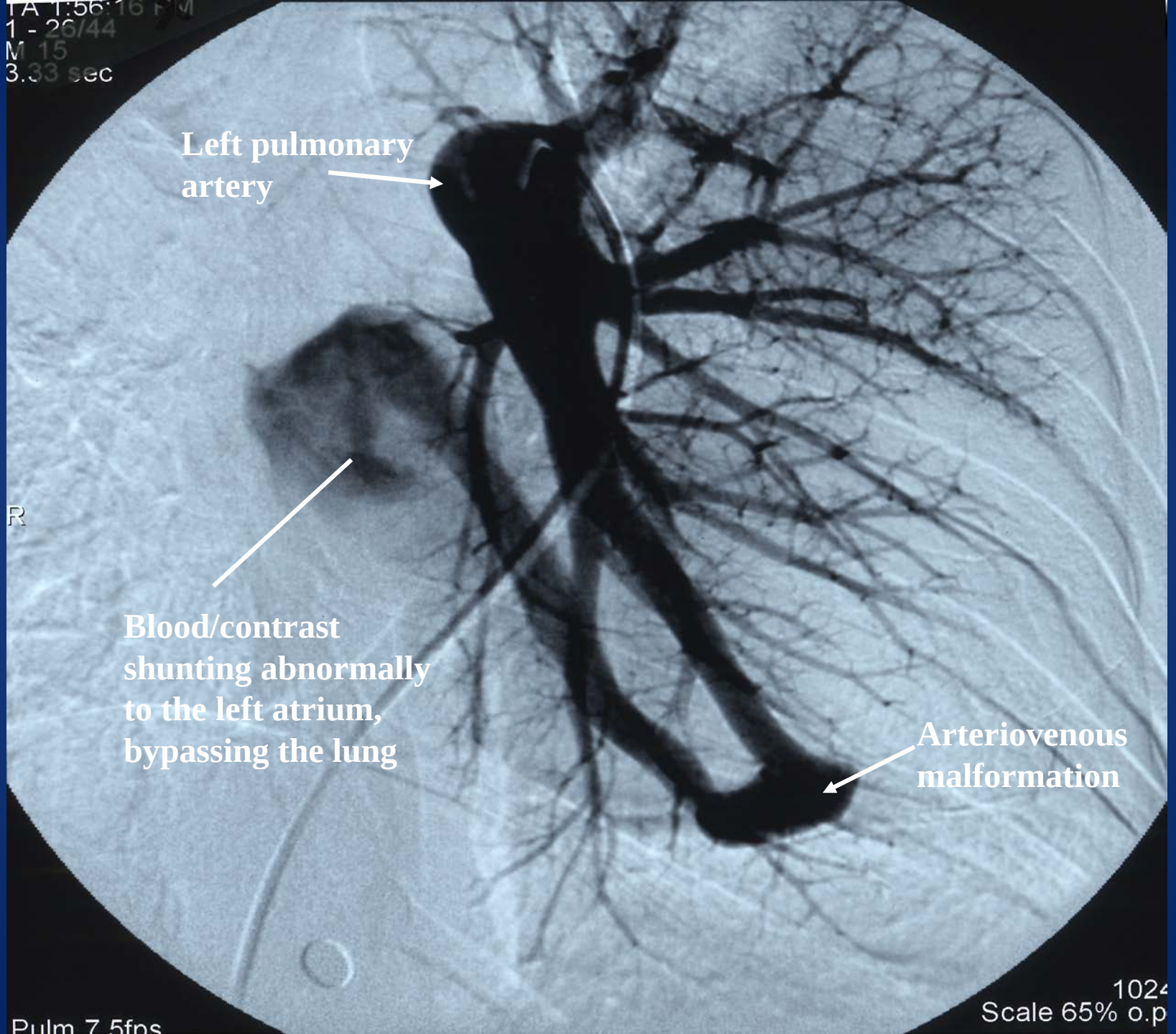
Most pulmonary AVMs (80%) are simple.

Although a surgical approach (thoracotomy and resection) is the traditional mode of therapy, transcatheter embolization is currently a preferred alternative.

Transcatheter embolization offers significantly reduced morbidity and mortality rates.


Left pulmonary artery
Blood/contrast shunting abnormally to the left atrium, bypassing the lung
Arteriovenous malformation
R
Pulm 7.5fps
Scale 65% o.p

Possible complications of embolization include nontarget embolization in the systemic circulation (through the AVM shunt) or in other noninvolved pulmonary arteries.
Therefore, properly sizing the coil to the feeding artery is essential.
A preliminary detailed angiography is essential for mapping the feeders and draining veins, paying particular attention to the size of the feeders.
Basically, a successful embolization is accomplished by nesting 1 or more coils in the feeding artery, which occludes flow through the AVM shunt.


Left pulmonary artery
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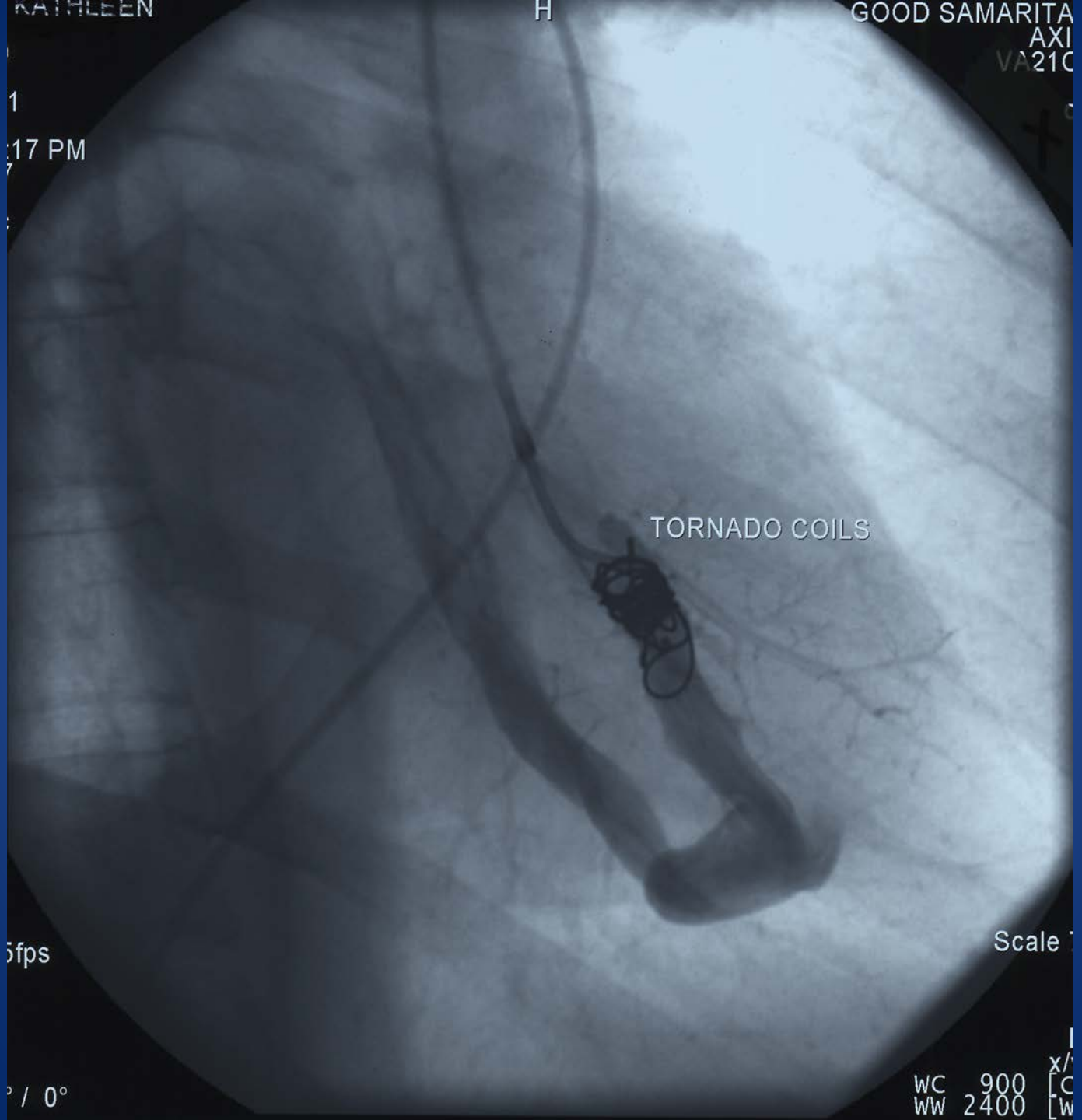
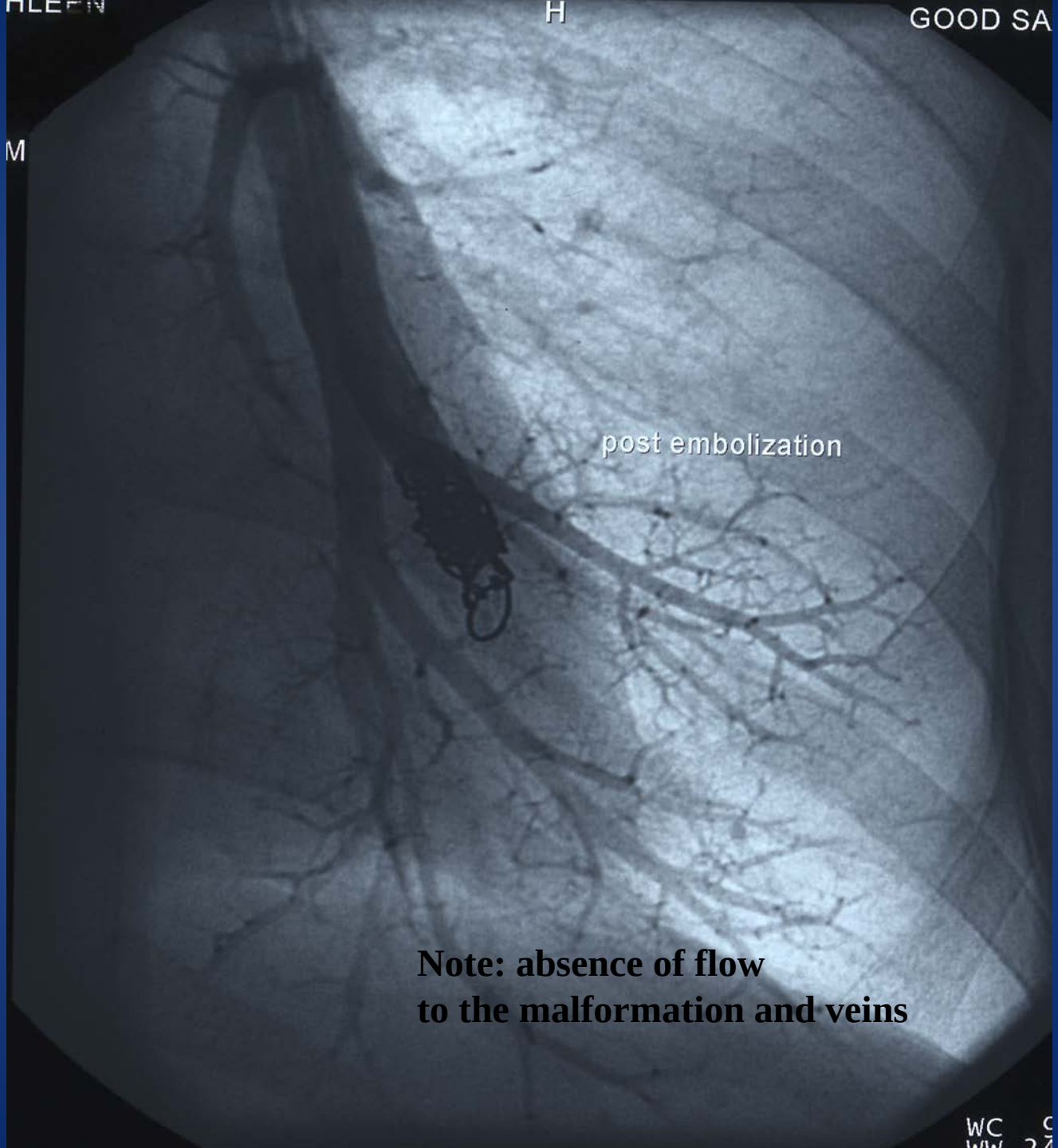
R
Pulm 7.5fps
Scale 65% o.p


KATHLEEN
H
GOOD SAMARITA
AXI
1
17 PM
TORNADO COILS
5fps
Scale
° / 0°
WC 900
WW 2400

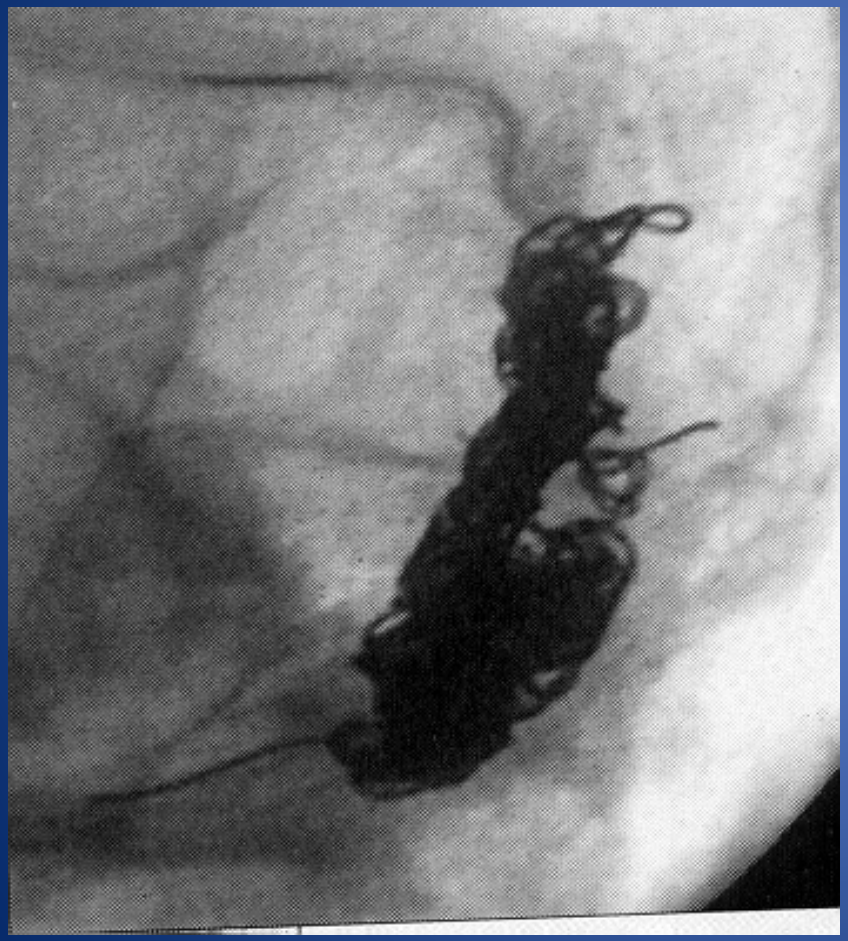

LEEN
H
GOOD SAM
WC
WW



Note: absence of flow to the malformation and veins

Indications

Intra-Cranial Artereo-Venous Fistula

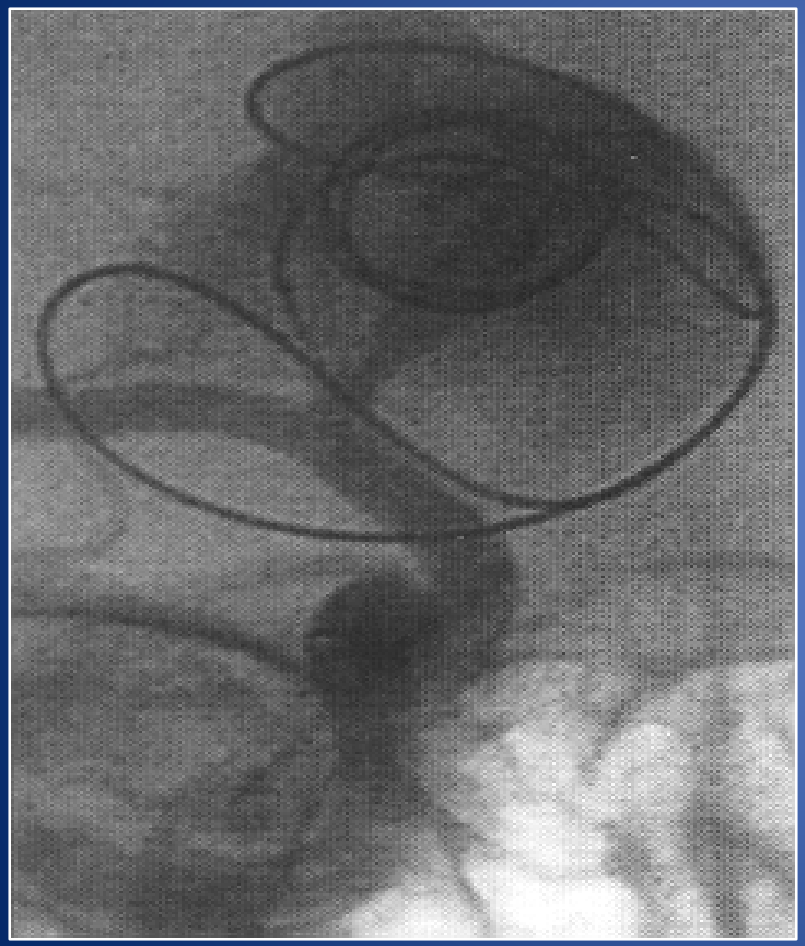


J-shaped Detach Coils are used to coil this Artereo-Venous Fistula.

Very dense packing is mandatory.

Indications
Aneurysms

Indications
Aneurysms



6cm Giant Aneurysm.
A 50cm long Detach Coil is placed as « basket » for further packing.

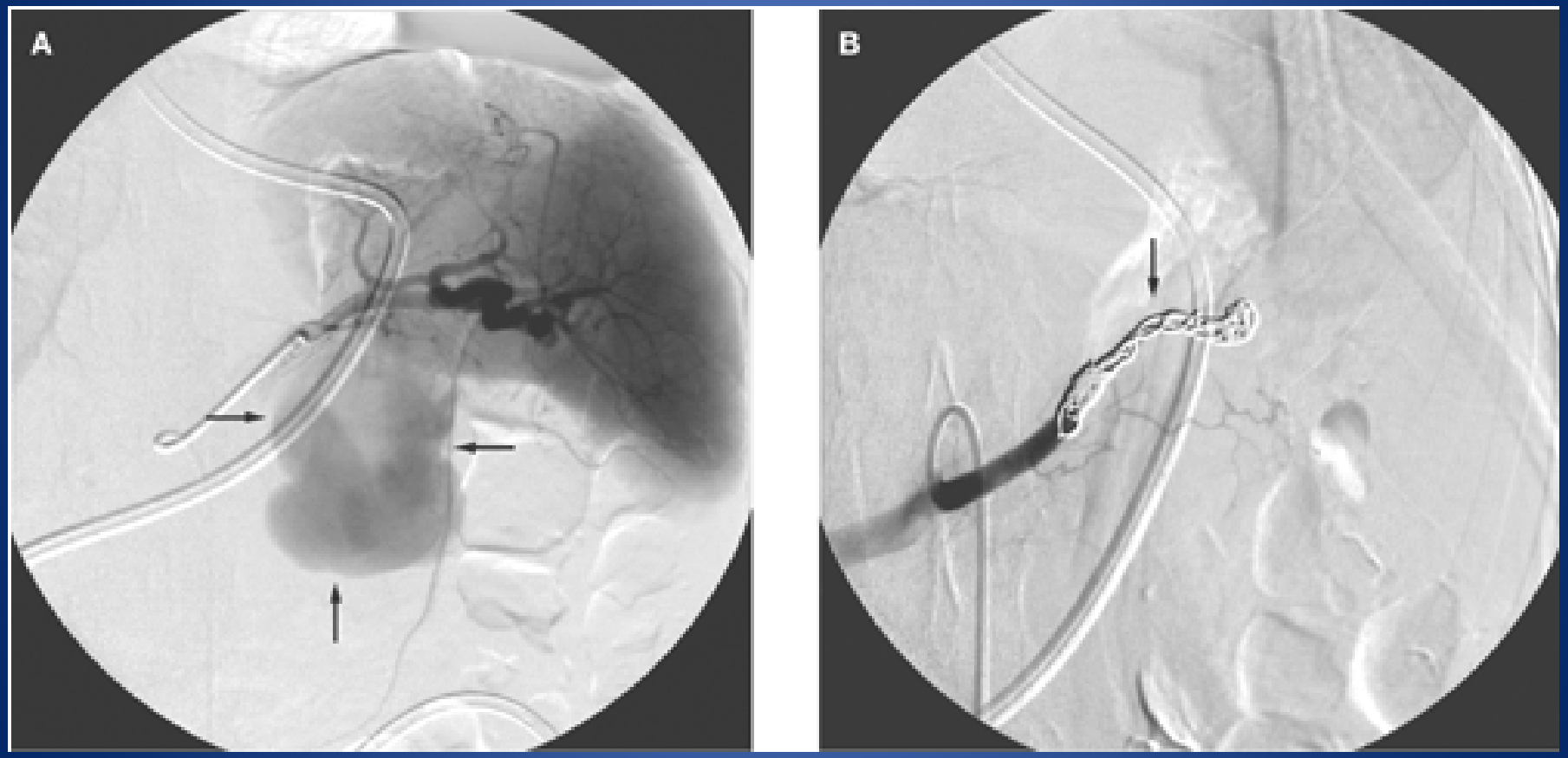
Note that the tip of Micro Catheter is

Indications

Organ Ablation

Splenic embolization can be used as a preoperative therapy or as an alternative to the surgical removal of the spleen.
Indications include posttraumatic bleeding, variceal bleeding secondary to portal hypertension or splenic vein thrombosis.
Embolotherapy is performed with superselective catheterization /embolization of the splenic artery by using embolic particles while the tip of the catheter is beyond the caudal pancreatic artery.
Careful fluoroscopic control of the splenic area is required to limit the total infarction to approximately 60% of the spleen.

Organ Ablation (Spleen)

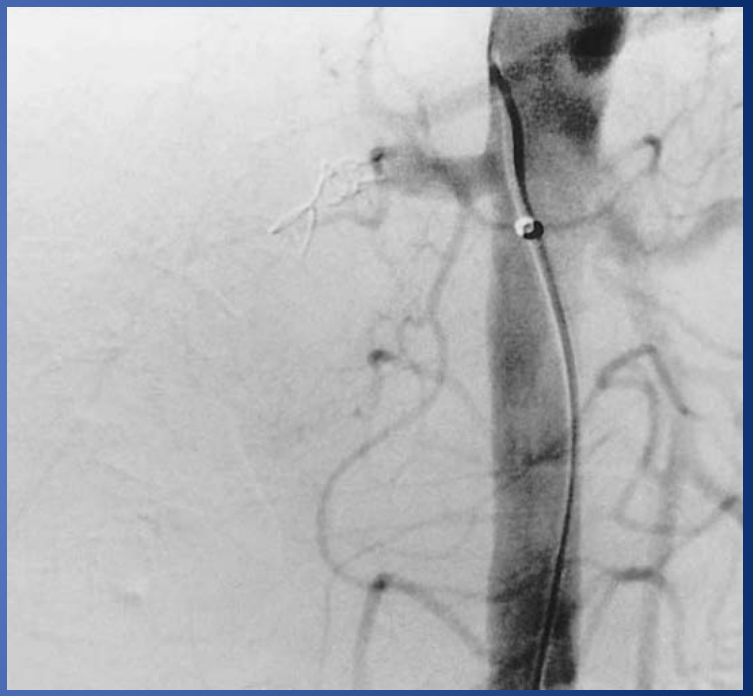


Renal Ablation

- **Renal embolization** is an alternative to surgical removal of the kidney, and indications include end-stage renal disease or renovascular hypertension requiring unilateral or bilateral nephrectomy and renal transplant with native kidneys in situ. The procedure requires selective catheterization of the renal artery with further advancement of the catheter so that the catheter is wedged to minimize the possibility of embolic material spillage into the aorta. The preferred embolic agents are particles (eg, PVA) and/or liquid agents such as ethanol or NBCA.

Renal Ablation

PVA is injected to block the small peripheral



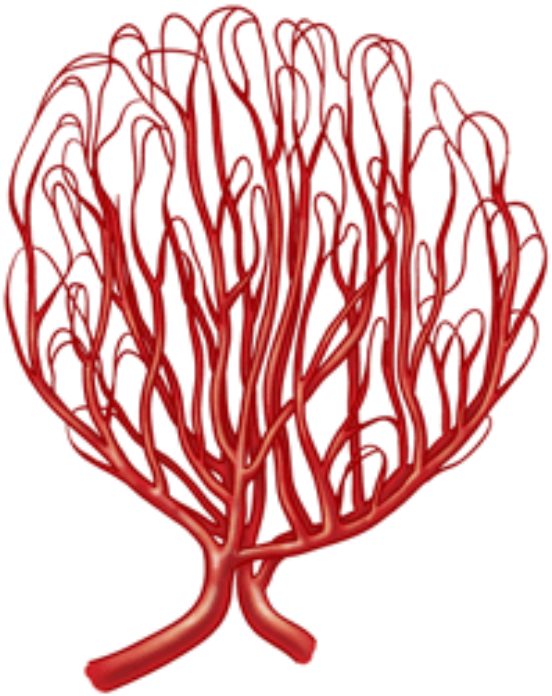
Ending with coiling of the right renal

Indications
Tumors

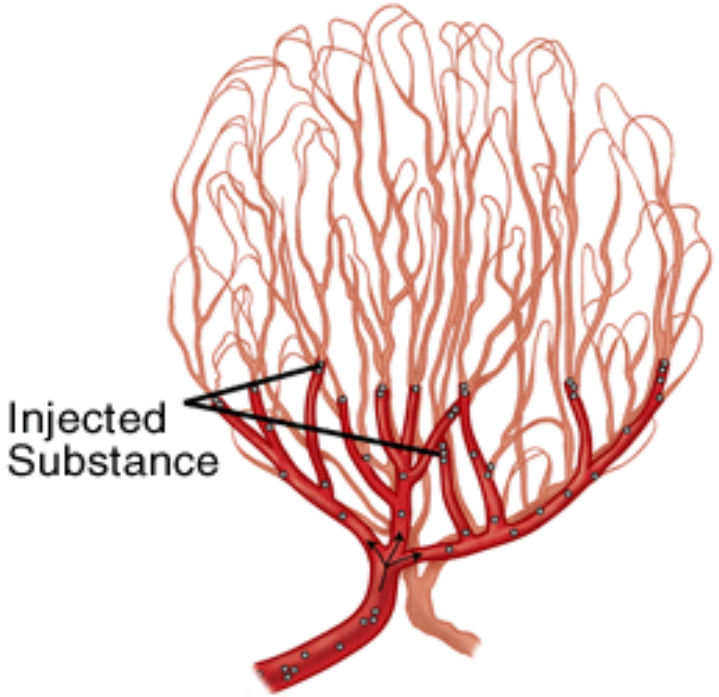
Tumor Embolization

Tumors

Tumors that are very vascular (have many blood vessels) are often difficult or dangerous to remove surgically, and patients with these tumors require a multidisciplinary team of specialists for treatment. Prior to surgery, endovascular embolization of the tumor, performed by a team of endovascular specialists, can shrink the tumor and decrease its blood supply.



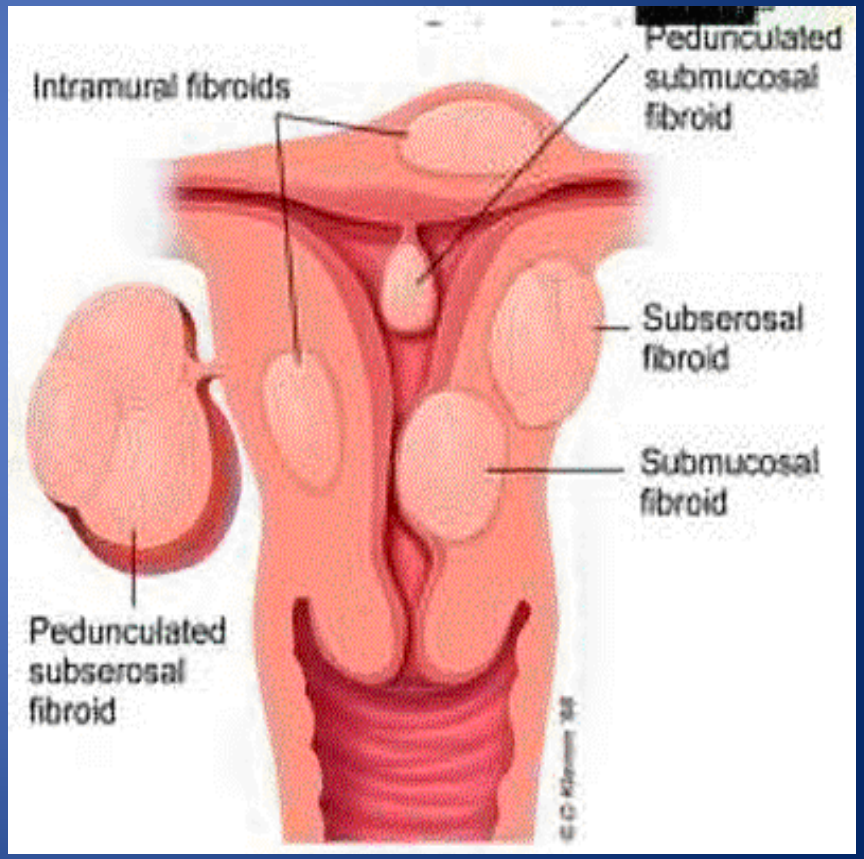
Tumor Vasculature



Blood vessels embolized to prevent blood flow within tumor

Uterine Artery Embolization for Treatment of Uterine Fibroids

- Myomata of the uterus, most common benign tumor
- Occur in ~40% of women over 40
- Account for 1/3 of the 600,000 hysterectomies in the U.S.



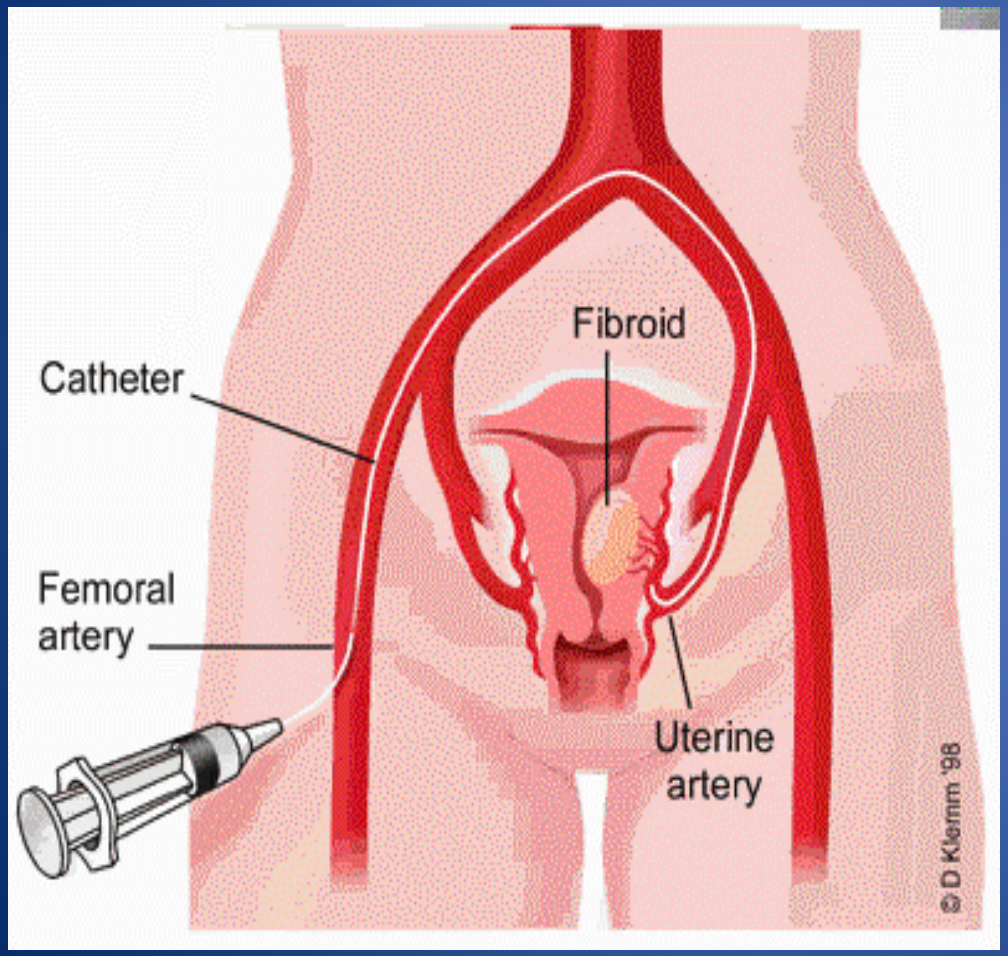
Uterine Fibroid Treatments

- Surgical removal of fibroid – ***myomectomy***
- Surgical ***ligation*** of the hypogastric or uterine arteries
- ***Hysterectomy*** - removal of the uterus
- ***Medical therapy*** - may temporarily shrink fibroid after 6 months at maximum dose
- Uterine artery ***embolization***

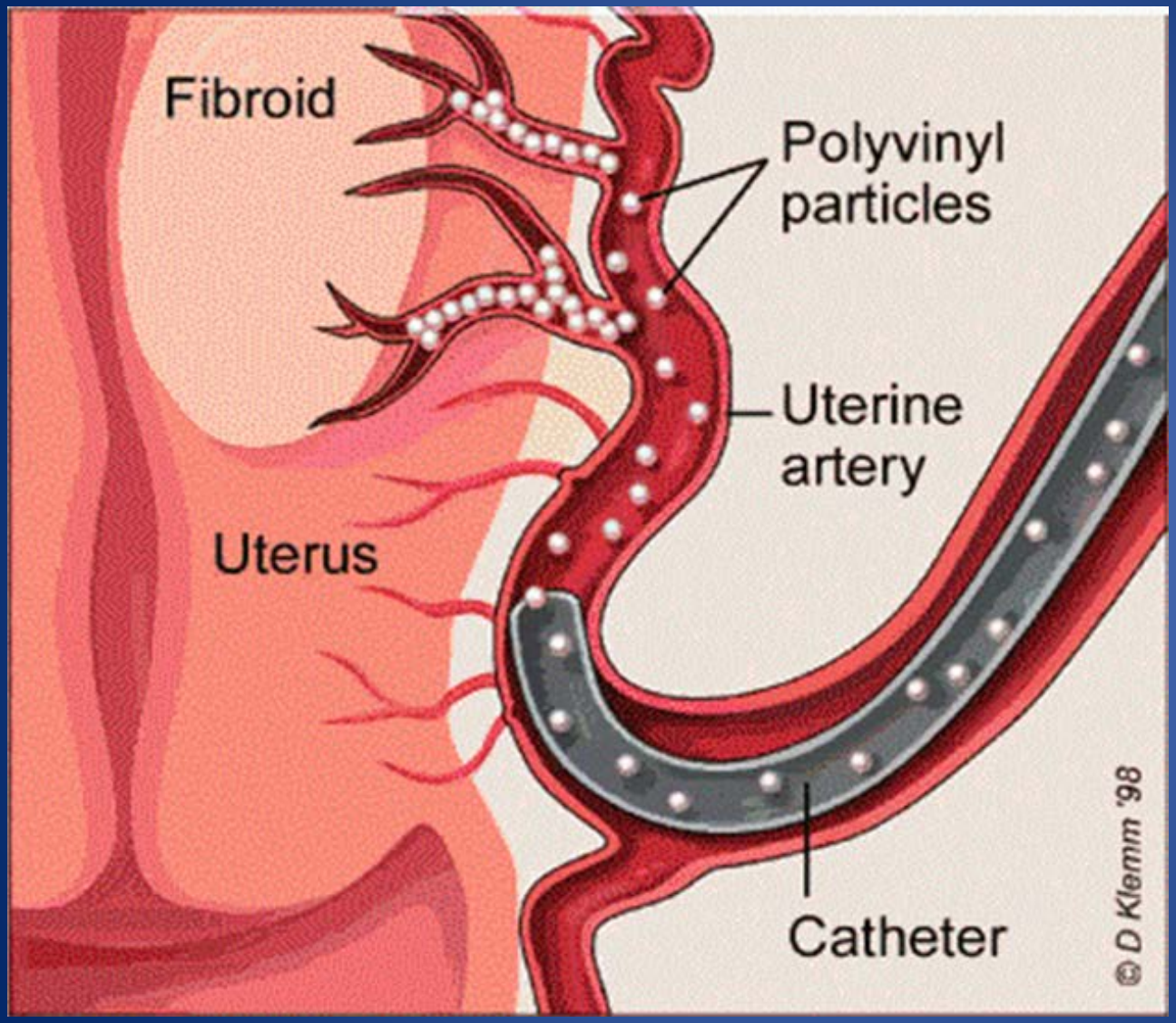
Indications for Embolization

- Bleeding fibroids
- Bleeding from complicated birth
- Post-surgical bleeding
- Trauma
- Arteriovenous malformation
- Pre-surgical embolization of hyper-vascular masses

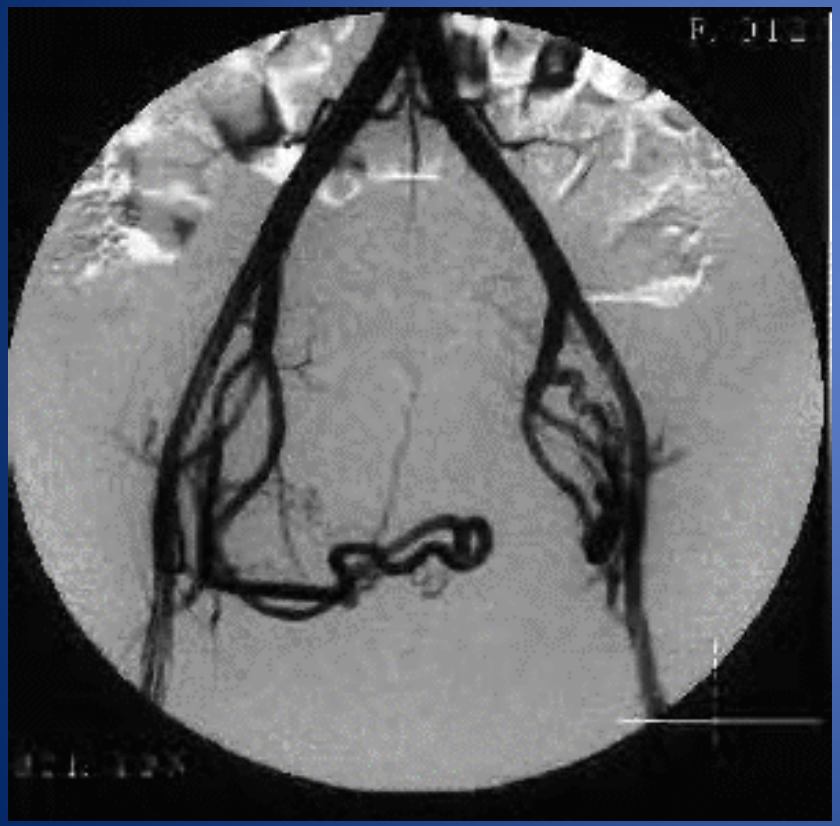
Catheterization



Embolization



40 Y.O. Woman

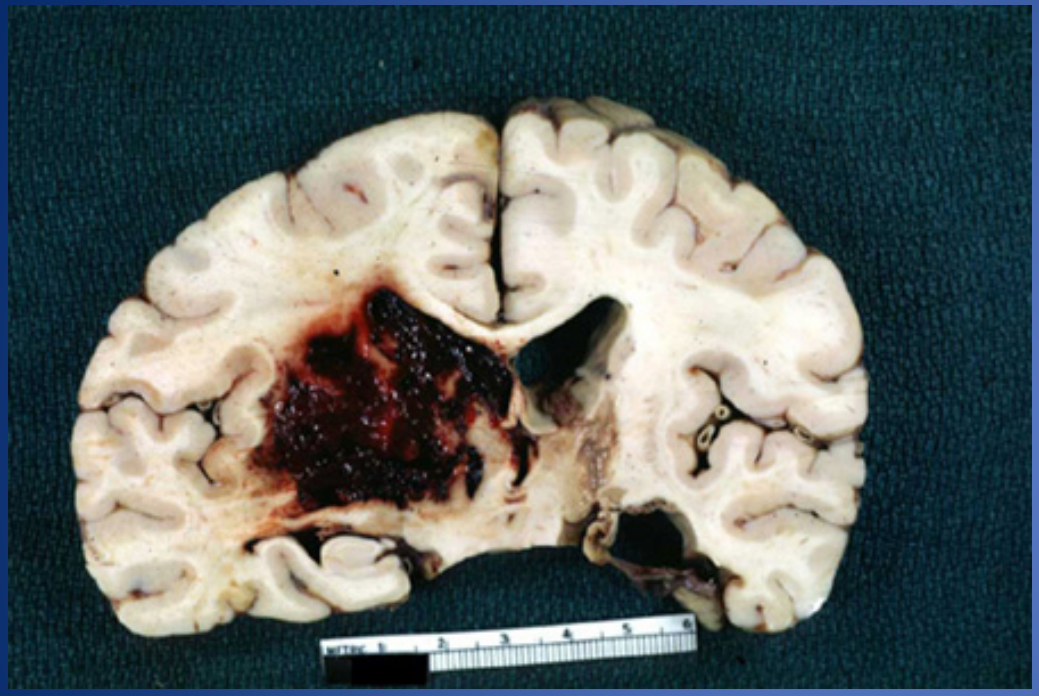


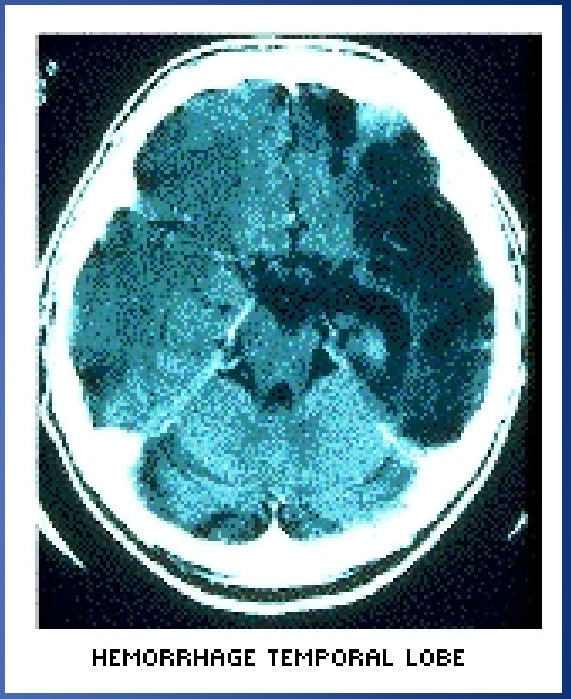
- 10 mo. Hx of menorrhagia and chronic pelvic discomfort
- Physical revealed enlarged uterus of ~15 week gestational size
- US revealed multiple fibroids
- Uterine Artery embolization performed

Hemorrhage

- Hemorrhage = Bleeding
- Bleeding can be caused by a trauma or can occure spontaneously.
- Spontaneous bleedings occure mostly in
  - the brain
  - intestines

Hemorrhage in the brain

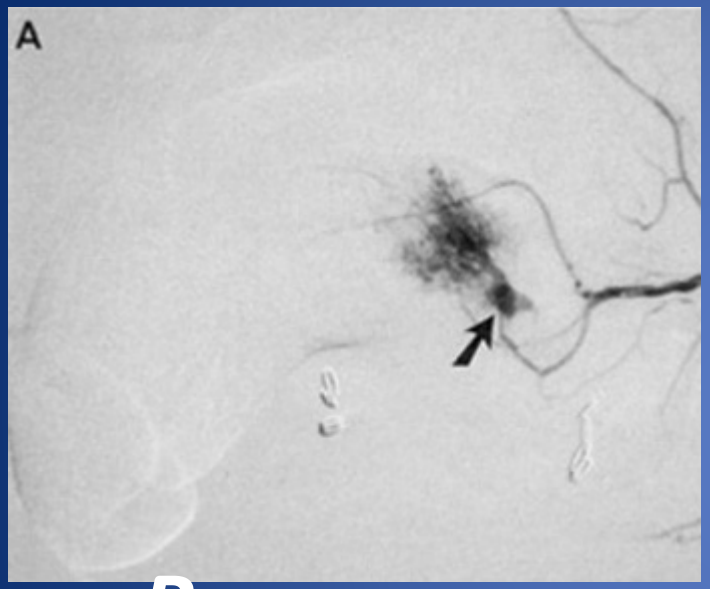


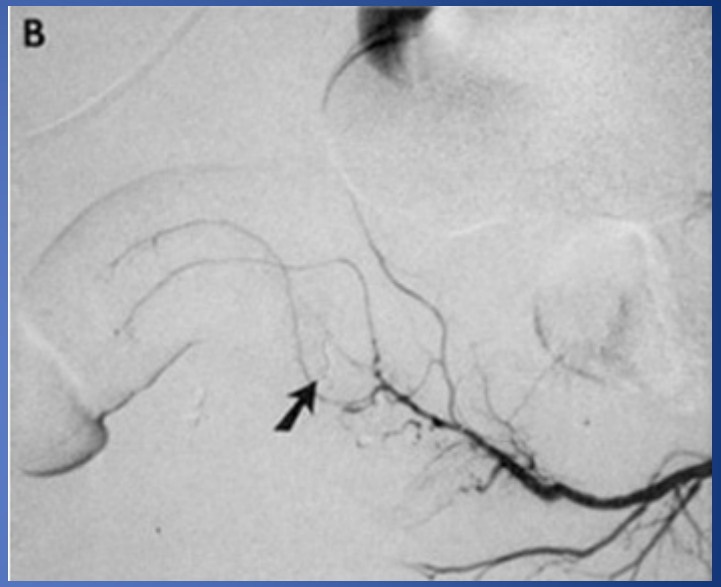


HEMORRHAGE TEMPORAL LOBE

Possible causes are: - Hypertension (ruptured aneurysm)
- Trauma

Indications
Bleeding (Blunt Trauma)





Pre-Embolization

Post Embolizatio n

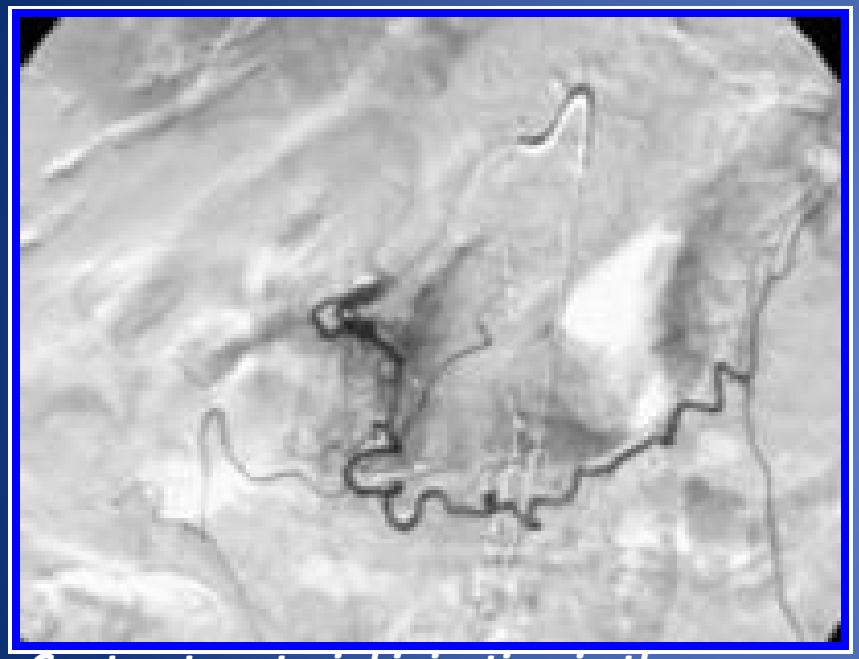
Basket Ball player, after a blunt trauma.

Indications

Bleeding (Penetrating Trauma)

Pre- and Post embolization of left kidney, afte
core biopsy.

Indications
Bleeding (Gastro-Intestinal)



Contrast material injection in the gastroduodenal artery via a microcatheter demonstrates a tiny saccular aneurysm in a patient who presented with upper gastrointestinal bleeding.

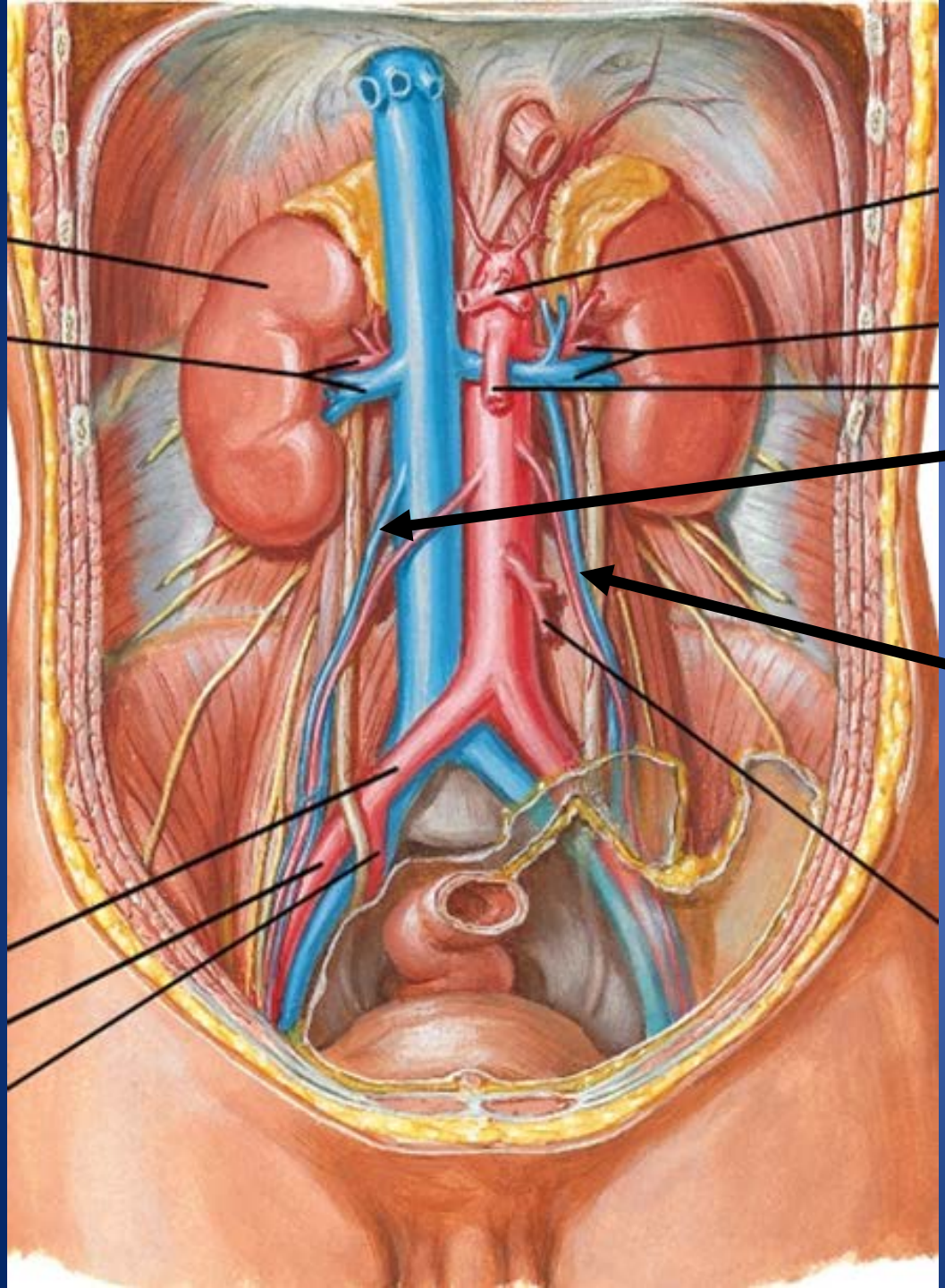
Postembolization with coils. The involved proximal segment of the gastroduodenal artery was embolized with several microcoils. The patient's bleeding episode ceased immediately.

Indications
Varicoceles

- Varicoceles are a common cause of male infertility and can be characterized by abnormally dilated veins in the pampiniform plexus.

- Primary varicoceles are due to a retrograde venous flow in the spermatic vein (due to incompetent valves), whereas secondary varicoceles are due to abdominal masses (venous outflow obstruction).

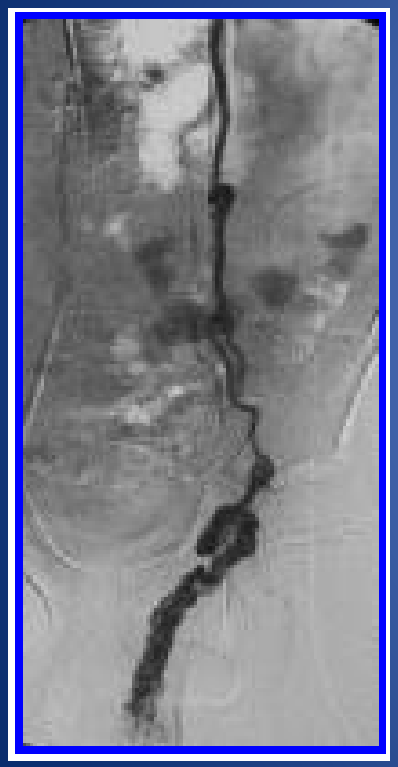
- Most varicoceles are located on the left side, because the left spermatic vein drains into the left renal vein, whereas the right spermatic vein drains directly into the inferior vena cava (IVC)



Right Spermatic Vein

Left Spermatic Vein

Indications
Varicoceles



Contrast injection in the left spermatic vein fills the vein below the inguinal ring. This finding is consistent with a varicocele..

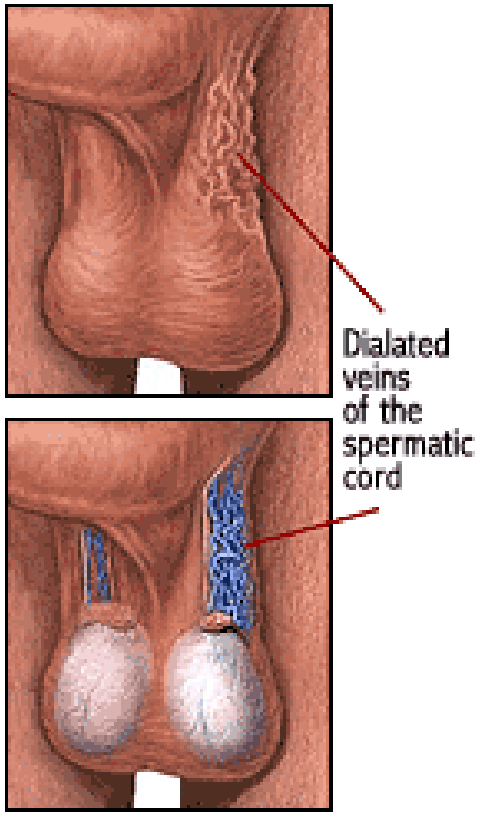
Embolotherapy was successfully performed by means of sclerotherapy with sodium tetradecyl and coil embolization, both proximally and distally.

Varicocele Embolization

What is Varicocele?

A varicocele is a varicose vein of the testicle and scrotum that may cause pain, testicular atrophy (shrinkage) or fertility problems. Veins contain one-way valves that work to allow blood to flow from the testicles and scrotum back to the heart. When these valves fail, the blood pools and enlarges the veins around the testicle in the scrotum to cause a varicocele.

Approximately 10 percent of all men have varicoceles. Among infertile couples, the incidence of varicoceles increases to 30 percent. The highest occurrence is in men aged 15-35. As many as 70-80,000 men in America may undergo surgical correction of a varicocele annually.



(MedlinePlus)

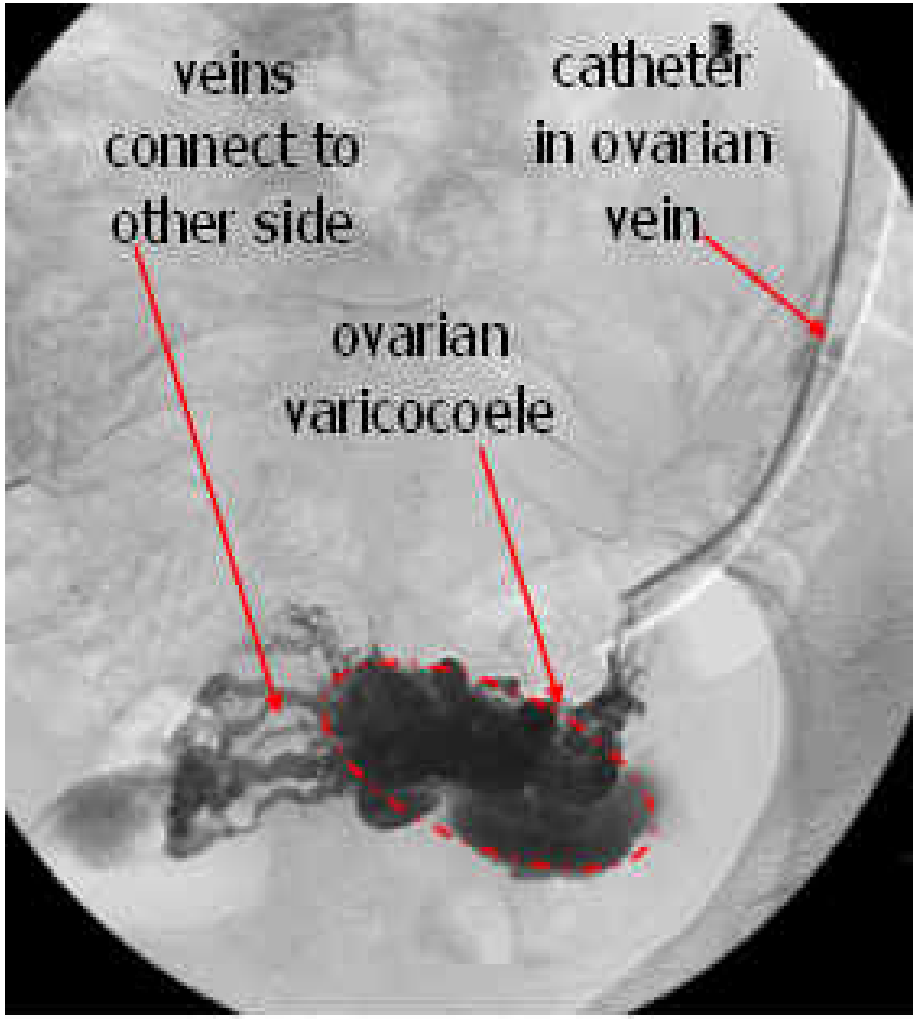
Pelvic Congestion Syndrome

What is Pelvic Congestion Syndrome (PCS)?

- A cause of chronic pelvic pain
- In 75% of women, no definite cause for symptoms is found
- This syndrome was first described in 1857
- It is associated with dilation of the pelvic veins, specifically the ovarian veins
- Ligation (blockage) of the veins has been shown to reduce pain

Pelvic Congestion Syndrome

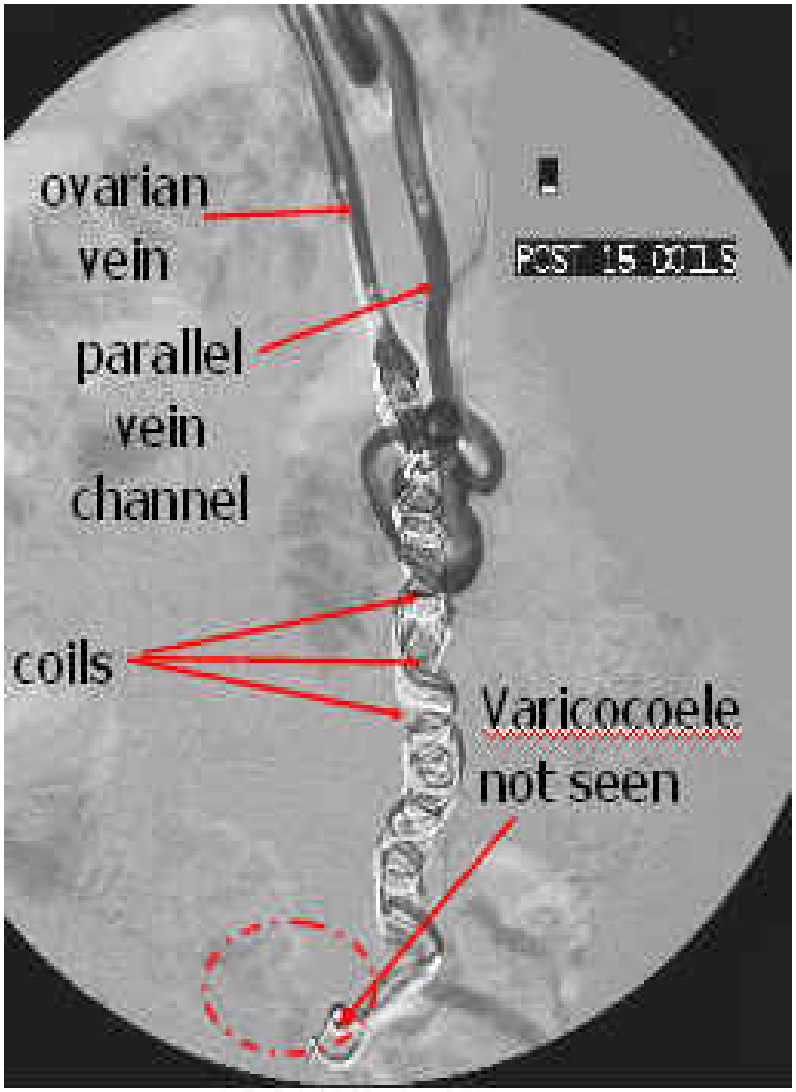
before embolization



- A catheter is seen in left ovarian vein
- Large collection of x-ray dye indicates large ovarian plexus varicocoele
- Vessels cross midline
  - varices communicate with right ovary or uterus

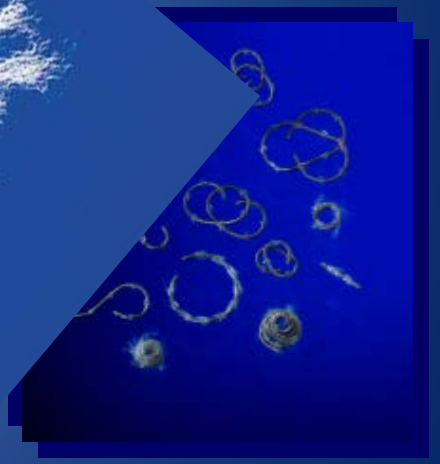
Pelvic Congestion Syndrome

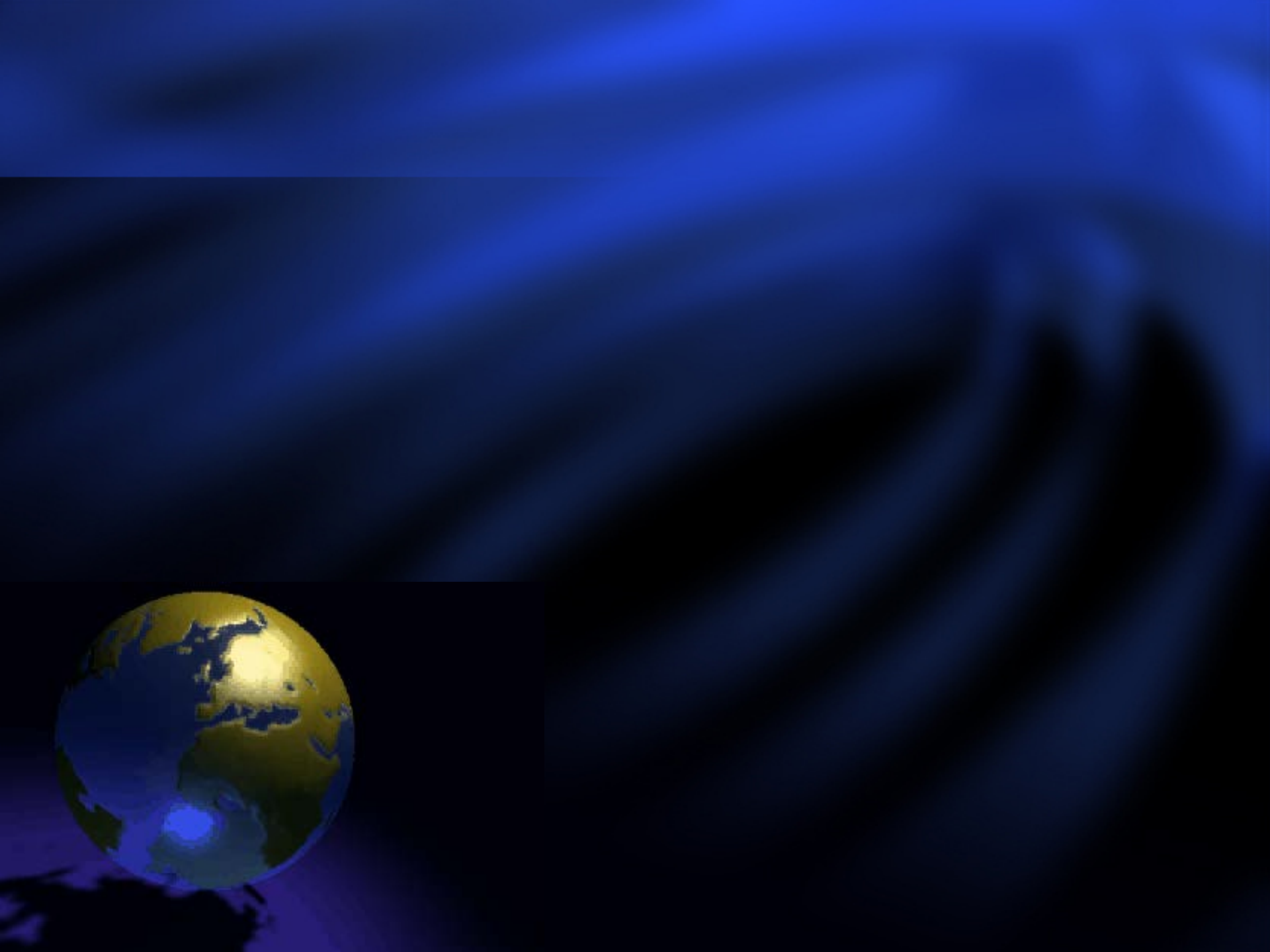
after embolization

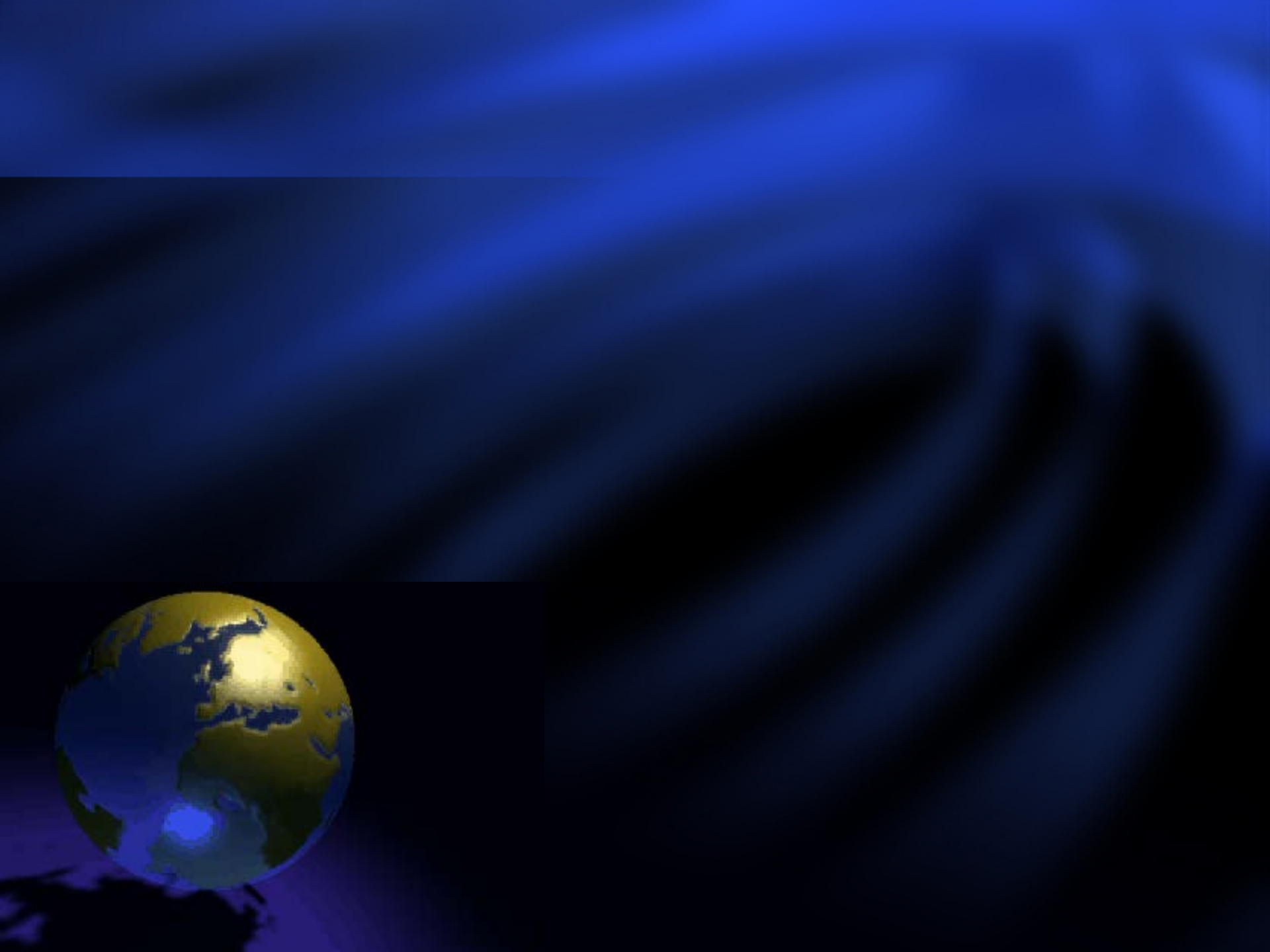


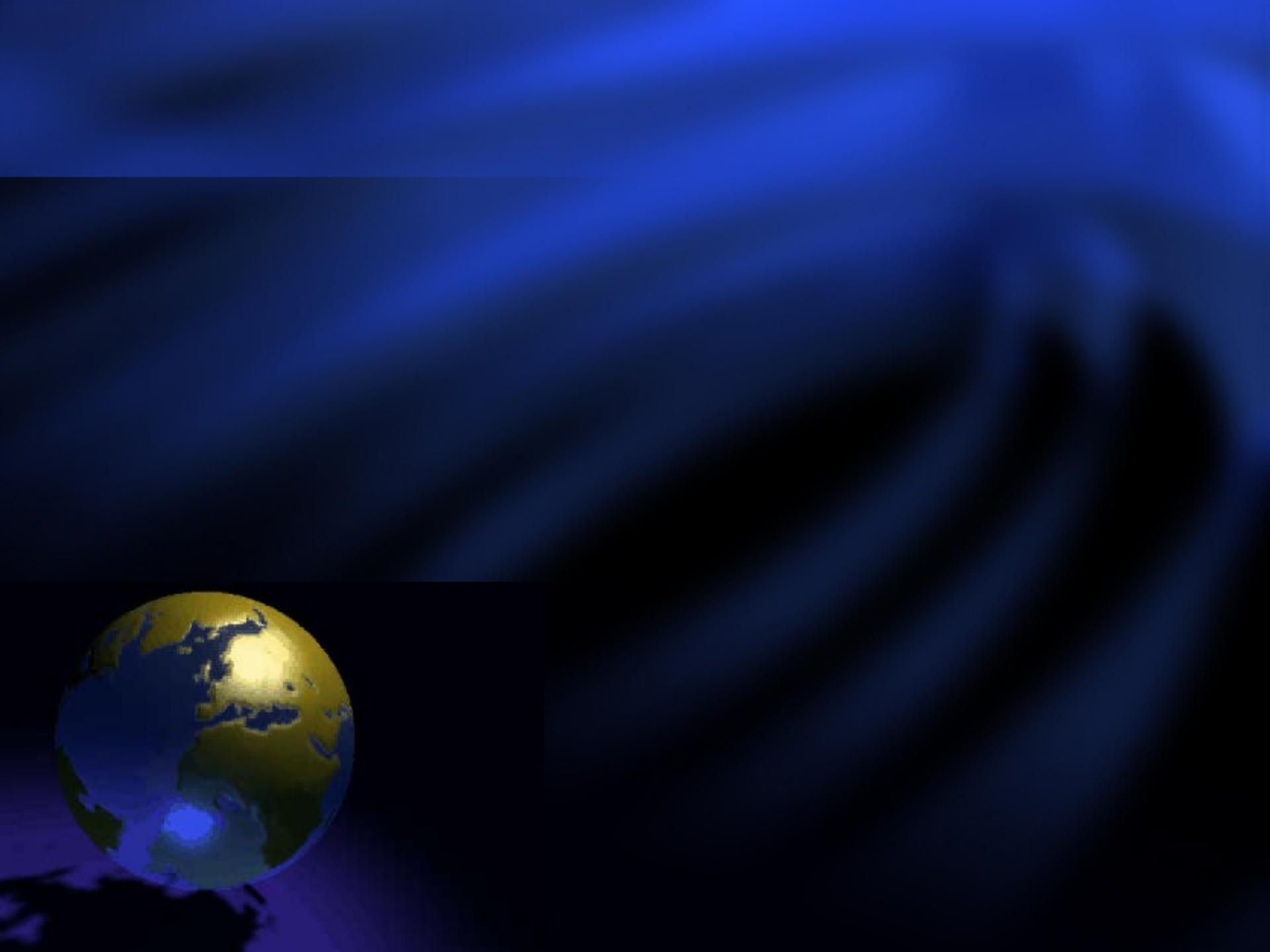
- Coils are visible in the ovarian vein
- No flow is seen in the blocked vein or varicocoele
- Above the level of blocked vein, there is an open vein and a parallel ovarian vein channel (a normal variation)

Go for it!!









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