

# VENOUS Interventional Radiology

## With Clinical Perspectives

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# Venous Issues & Role of IR

Today while in clinical Practice I See.....\_

- Interventional Radiology is a Boon for Patients with Venous Problems.
- Open Surgery compared to IR Techniques for venous interventions has poor outcome.

# Venous Surgeries !

- Unlike arteries, the veins are difficult animals to tame surgically
- Post surgical failure rates are high
- Certain surgical methods have become obsolete in modern medicine

# The List of Venous IR procedures is too LONG.....

1. Varicose veins
2. VTE: DVT, PE, Sinus thrombosis etc
3. Hemodialysis access Interventions
4. Embolization & Sclerotherapy: Varicocele, PCS, VM
5. Hepatic & Portal Interventions: TIPSS, HVOTO, BRTO etc
6. Venous Access: PICC, Ports, Tunneled HD cath
7. Venous Sampling
- etc.....

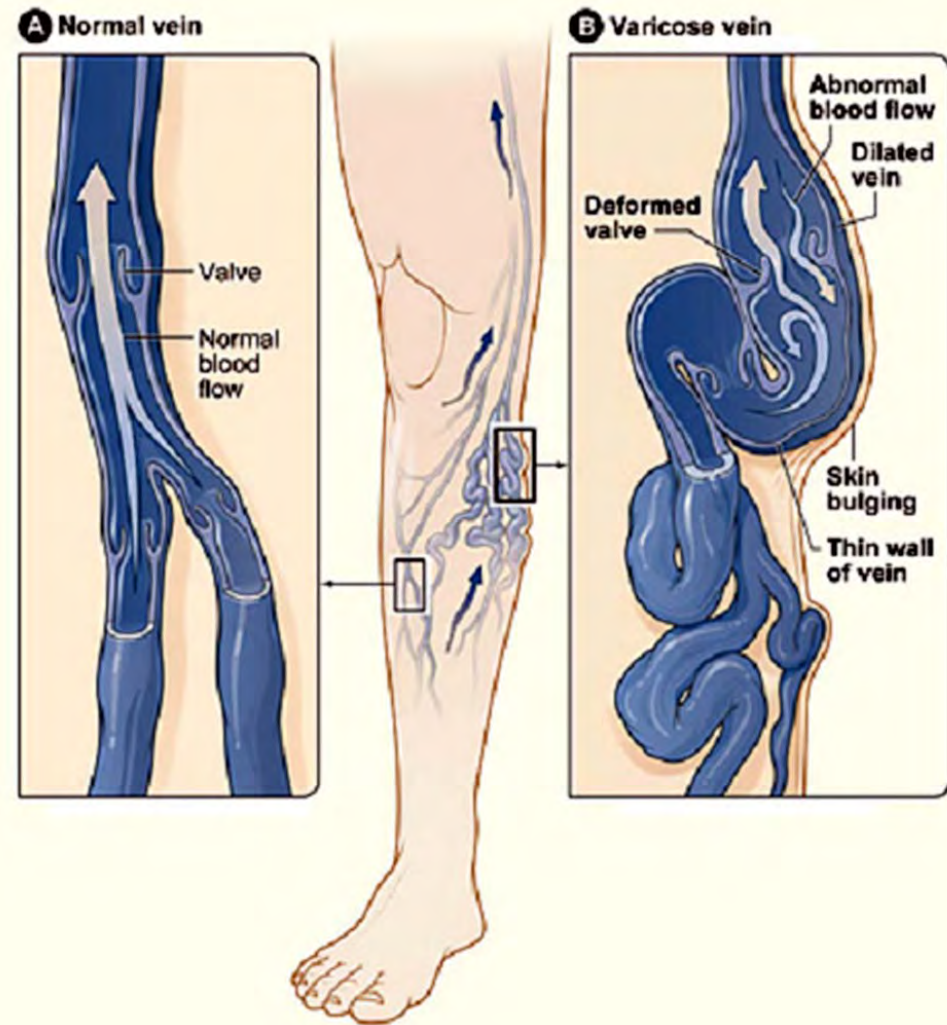
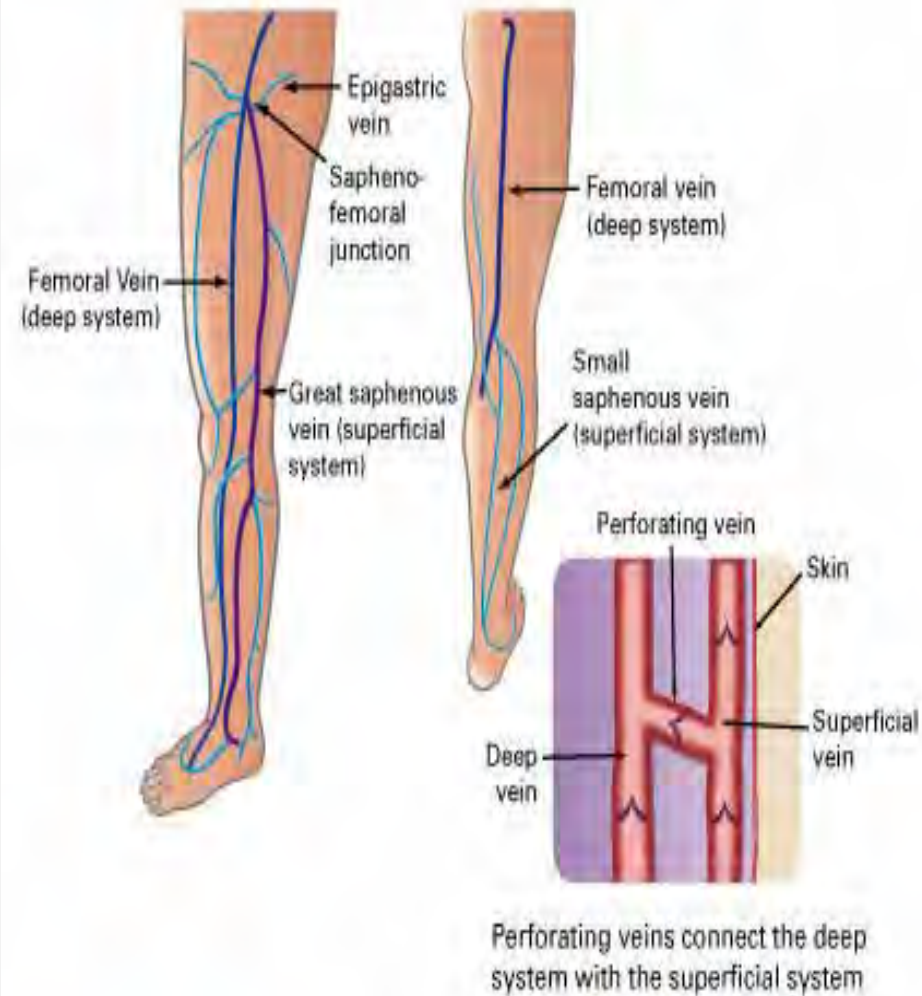


# Varicose veins: Definition

- Varicose veins are veins that have become
  - Long,
  - tortuous and
  - dilated
- due to **non-functional valves**



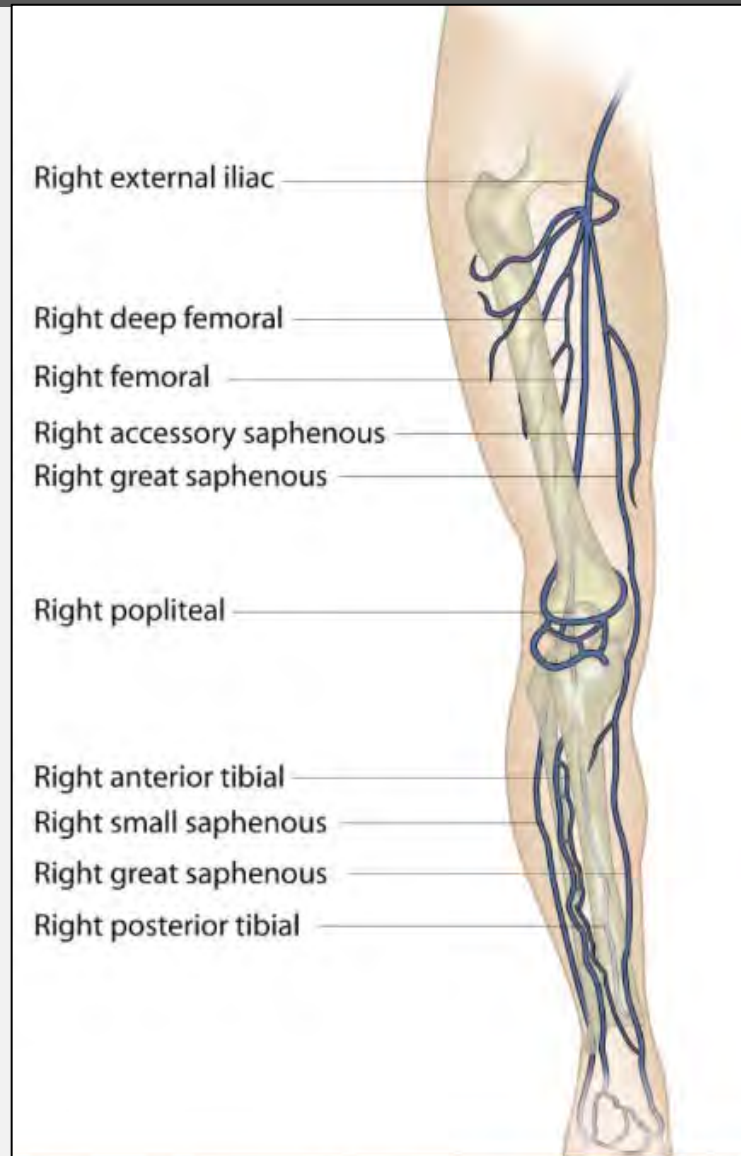
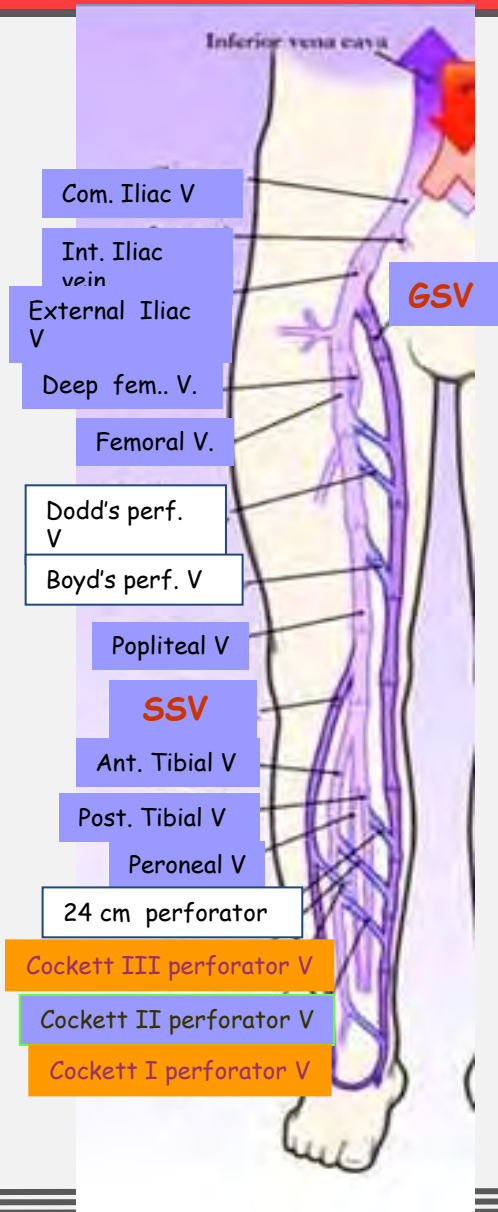
# Varicose Veins



# Veins of Lower Limb

- **Superficial veins:** Great Saphenous, Small Saphenous vein & their tributaries. Thick walled b'coz of presence of smooth muscle, some fibrous & elastic tissue in their wall.
- **Deep Veins:** ATV, PTV, Peroneal vein, PV and femoral veins & their tributaries. The Valves are more numerous in Deep veins.
- ☐ **Perforating Veins:** Their valves permit only one way flow of blood, from the superficial to the deep veins.
- ☐ **5 Perforators** along GSV.
- ☐ **1 Perforator** along SSV.

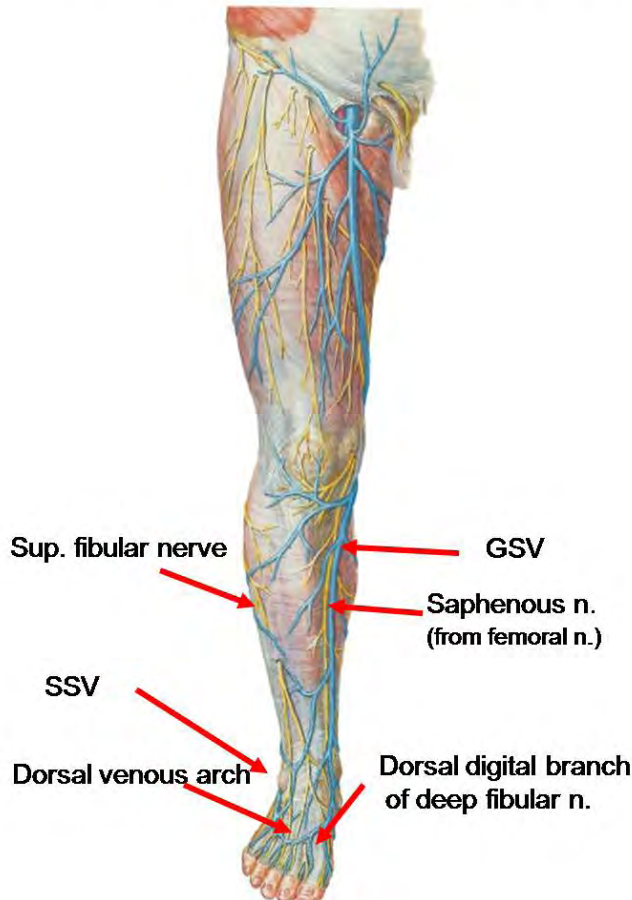
# Venous Anatomy Of Leg



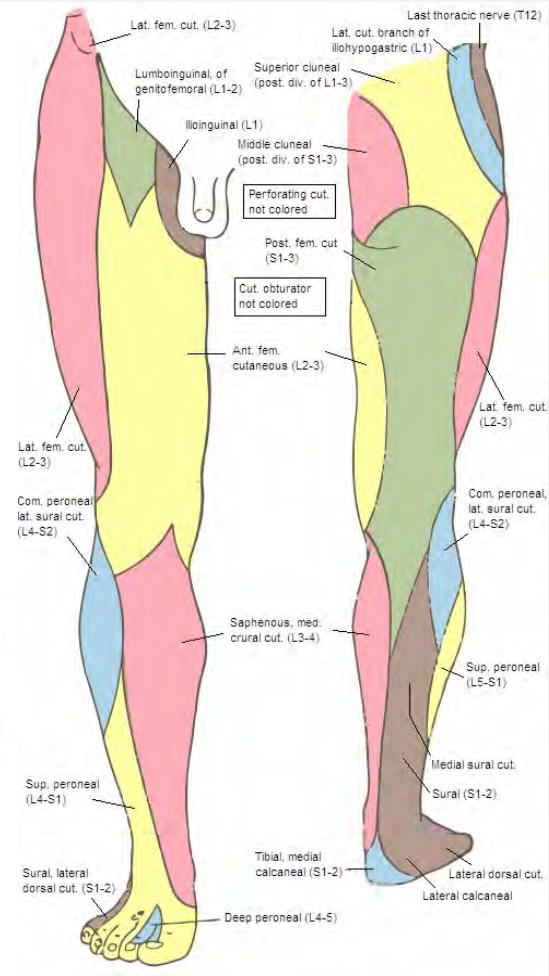
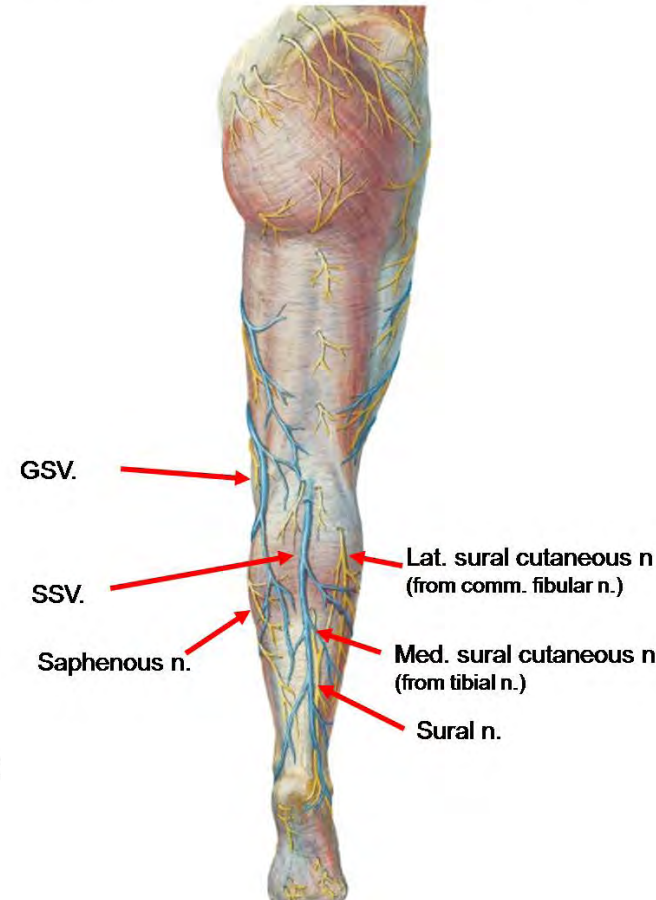


# Associated Nerve Anatomy Of The Leg

Superficial Nerves and Veins of Lower Limb  
Anterior View



Superficial Nerves and Veins of Lower Limb  
Posterior View



# VARICOSE VEINS: PATHOPHYSIOLOGY

PRIMARY

SECONDARY

CONGENITAL

DILATED  
VEINS

VENOUS VALVE  
DYSFUNCTION

CHRONIC VENOUS INSUFFICIENCY

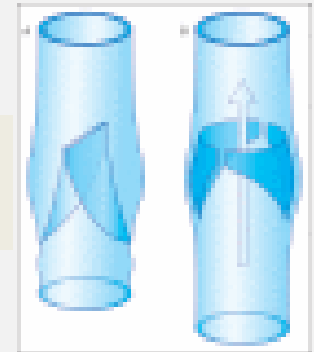
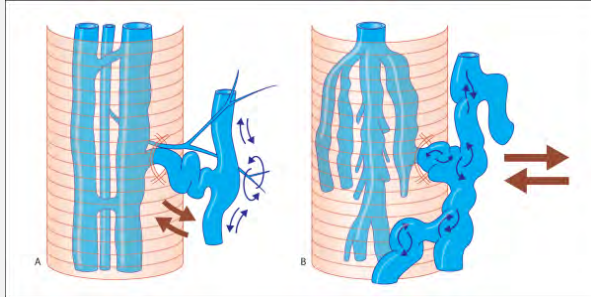
Symptoms

Dilated veins

- reticular veins / telangectasis(C1)
- varicose veins(C2)

Sequaele

- Edema (C3)
- Lipodermatosclerosis (C4)
- Pigmentation (C4)
- Stasis ulcer(C6)



# Risk Factors



Long hours of standing and sitting posture



Family history



Congestive heart failure



Increasing age

- Increasing age
- Family history
- Congestive heart failure and thrombus obstruction
- Obesity
- Long hours of standing and sitting posture
- Pregnancy

# Revised CEAP Classification for chronic venous diseases

## **Clinical classification**

C0: No visible or palpable signs of venous disease

C1: Telangiectasies or reticular veins

C2: Varicose veins

C3: Edema

C4a: Pigmentation or eczema

C4b: Lipodermatosclerosis or atrophie blanche

C5: Healed venous ulcer

C6: Active venous ulcer

S: symptomatic, including ache, pain, tightness, skin irritation, heaviness, and muscle cramps, and other complaints attributable to venous dysfunction

A: asymptomatic





## Etiologic classification

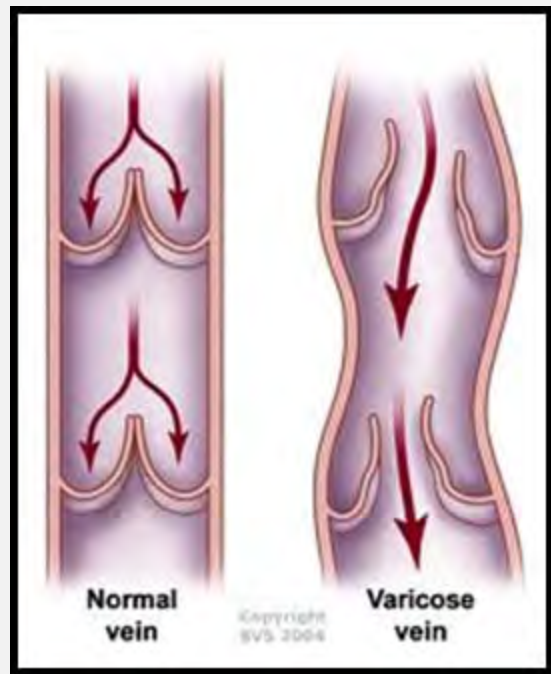
**Ec:** congenital

**Ep:** primary

**Es:** secondary

(postthrombotic)

**En:** no venous cause  
identified



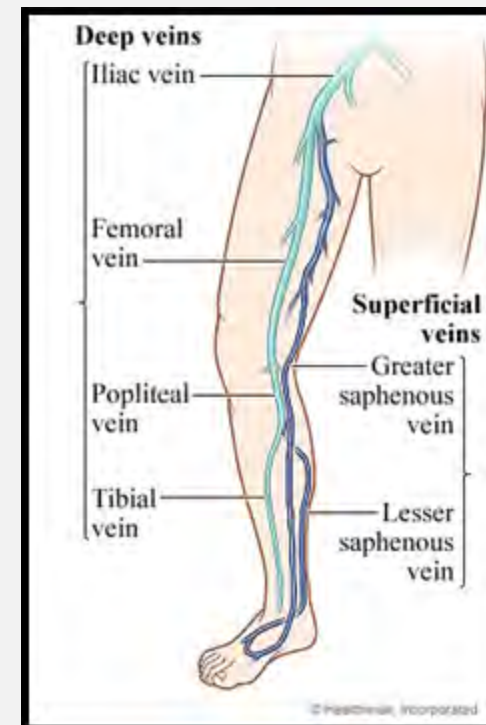
## Anatomic classification

**As:** superficial veins

**Ap:** perforator veins

**Ad:** deep veins

**An:** no venous location  
identified



# Pathophysiologic classification

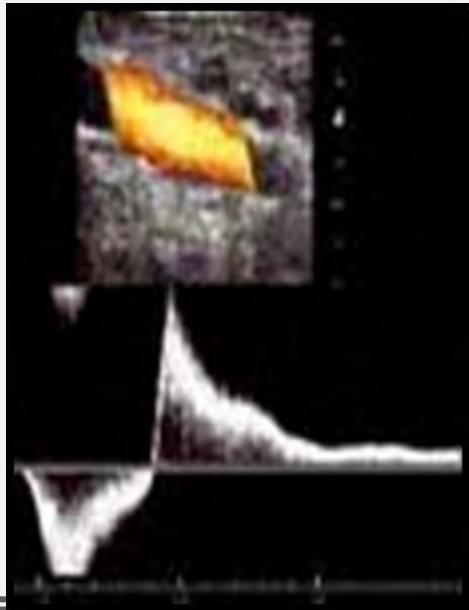
Basic CEAP

Pr: reflux

Po: obstruction

Pr,o: reflux and obstruction

Pn: no venous pathophysiology  
identifiable



# Signs and Symptoms of VV

- Burning or itching
- Night Cramps
- Throbbing pain
- Stinging sensation
- Swelling in the legs
- Leg heaviness or fatigue
- Skin discoloration



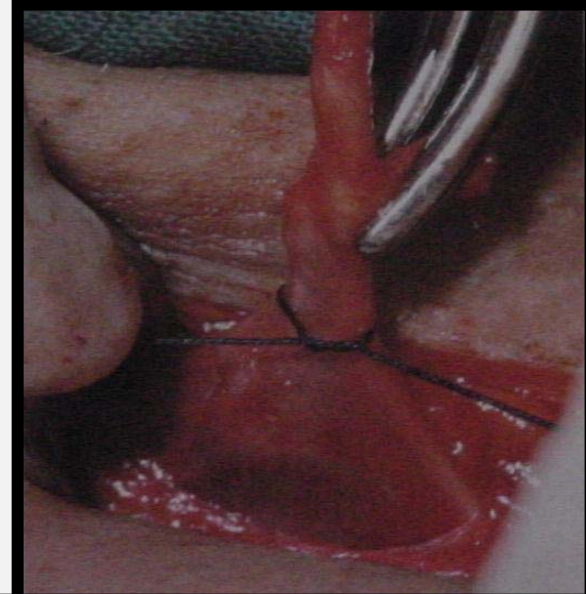
# Diagnosis

## ✓ DOPPLER

- $\geq$  0.5 second reflux (retrograde flow) on Valsalva maneuver is used to identify pathological reflux in patients with valvular incompetence.



# Treatment : Why not Open Sx



# Endovascular Options

Diode Laser

Wave lengths

1470nm, 980nm, 810nm



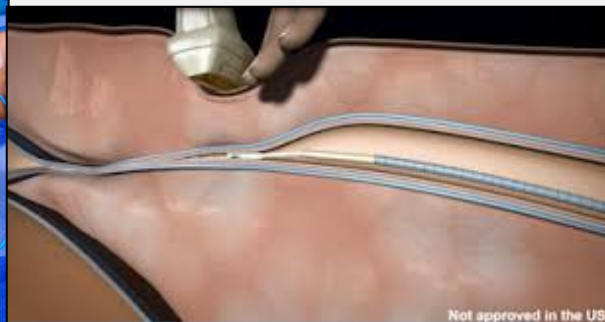
RFA



Thermal  
energy



NTNT: Venaseal (Glue)



Not approved in the US



# IR way



# Sclerotherapy





# LASER ABLATION

Case 1



PRE - ABLATION  
CEAP class: C2EpAsPr  
VDS=2



POST - ABLATION  
Clinical CEAP class: C0  
VDS=0

## Case 3

### LASER ABLATION



60 yr old male patient from Orissa  
With Non-healing Venous Ulcer  
C6 Ep As Pn

PRE - ABLATION  
VDS=2

POST - ABLATION  
VDS=0

# LASER ABLATION

Case 5

PRE

POST



PRE

POST  
1 MTH

POST  
3MTH

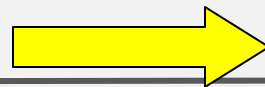


VDS 1



VDS 0

CEAP GRADE C2



CEAP GRADE C0



# LASER ABLATION

Case 6



# LASER ABLATION

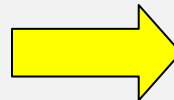
Case 10

POSTOPERATIVE

PREOPERATIVE



VDS 2



VDS 0

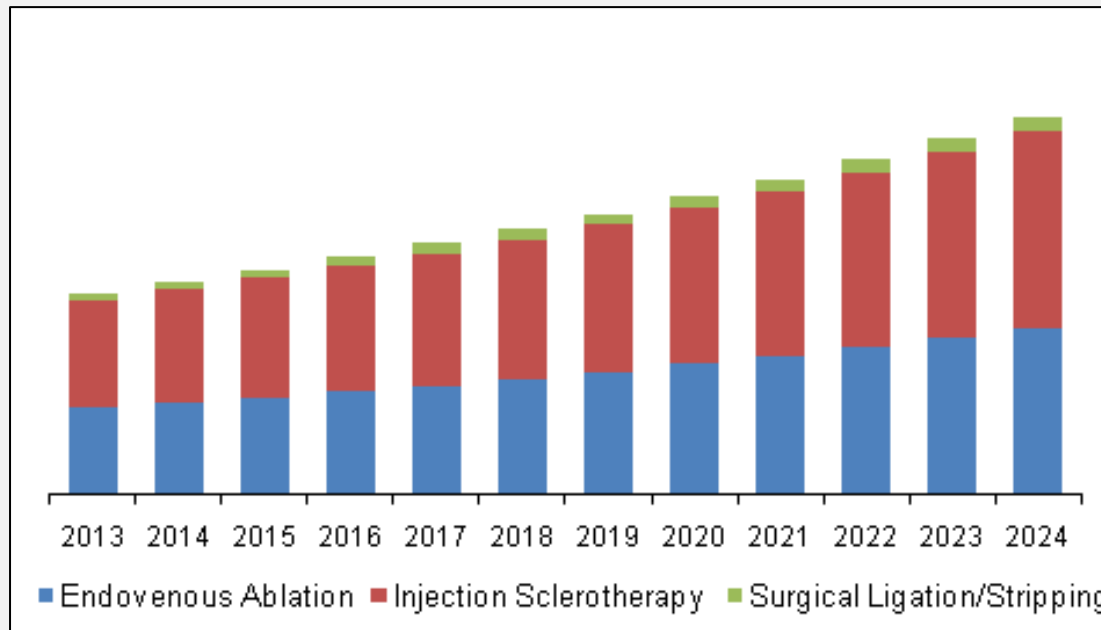
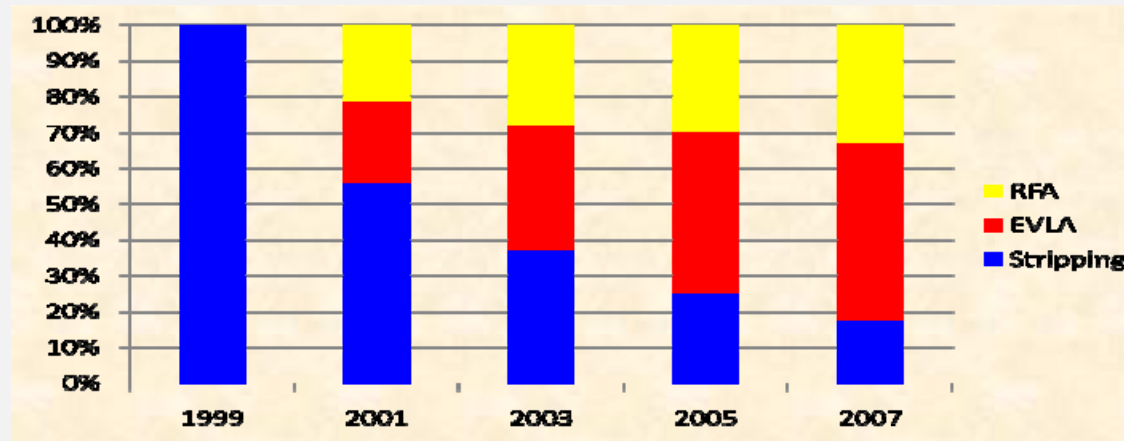


# Advantages of IR are Obvious

- Minimally invasive and better alternative to vein stripping.
- Day Care Procedure.
- Post-procedure Early ambulation and Less pain/bruising.
- No Major complications if performed by an expert.

# No Doubt!

## Changing Trend of Surgical Interventions for Varicose Veins



# Interventional Radiology in VTE

- Acute DVT
- Chronic DVT
- Pulmonary Embolism
- Role of IVC Filter



# DVT: Hits Twice !!!!

- 1<sup>ST</sup> Hit: Acute DVT : Sudden Onset  
Pain, Swelling , SOB , Risk of PE ( Comes as a Surprise to Patient)
- 2<sup>nd</sup> HIT: Chronic DVT: Swelling, Leg  
Claudication Pain, Ulcers, PTS,  
Poor QOL, Depression etc

# 2<sup>ND</sup> HIT= Chronic DVT = PTS= BIGGER Problem

Very Few Physicians anticipate these during Acute phase !

## PTS:

1. Claudication Pain
2. Persistent Swelling
3. Leg Heaviness
4. Leg Ulcers
5. Severe Morbidity, Poor Quality of Life
6. Depression etc

IR can Prevent this 2<sup>ND</sup> HIT  
which is much worse



# ACUTE DVT: “Quick Bite”

- Except in few Situations ( i.e Absolute Contraindications)  
.....**Acute DVT** for sure needs something better than “Just Anticoagulation”

# Phlegmasia Cerulea Dolens

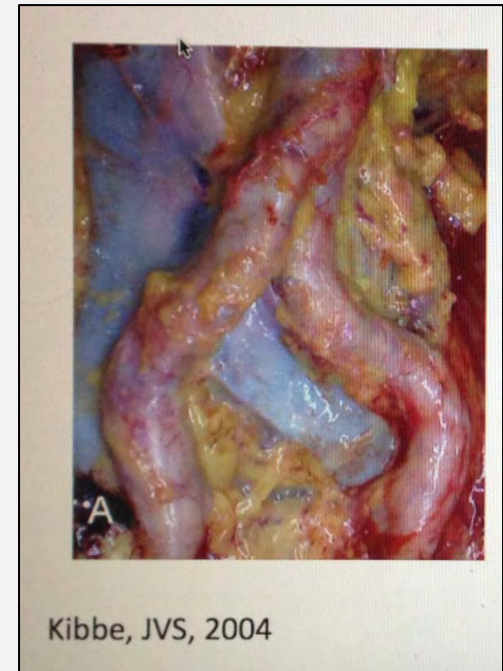
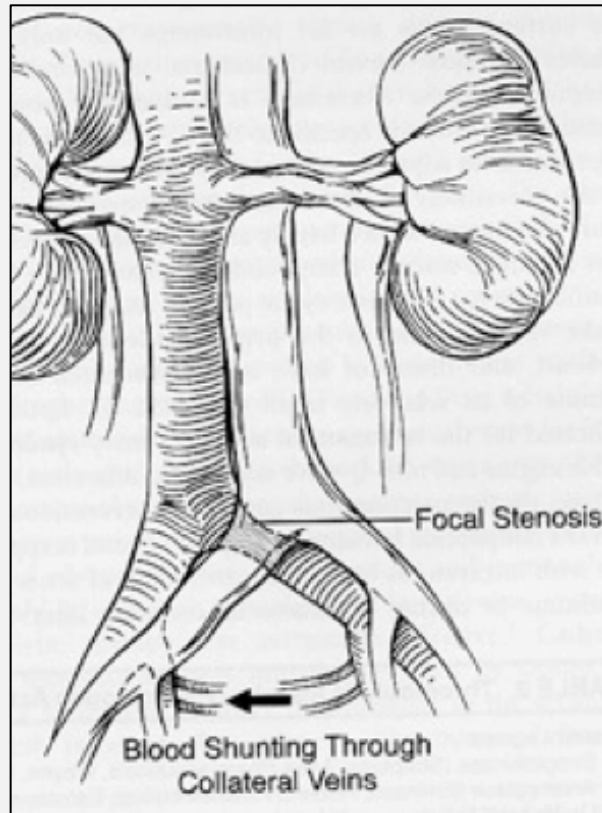
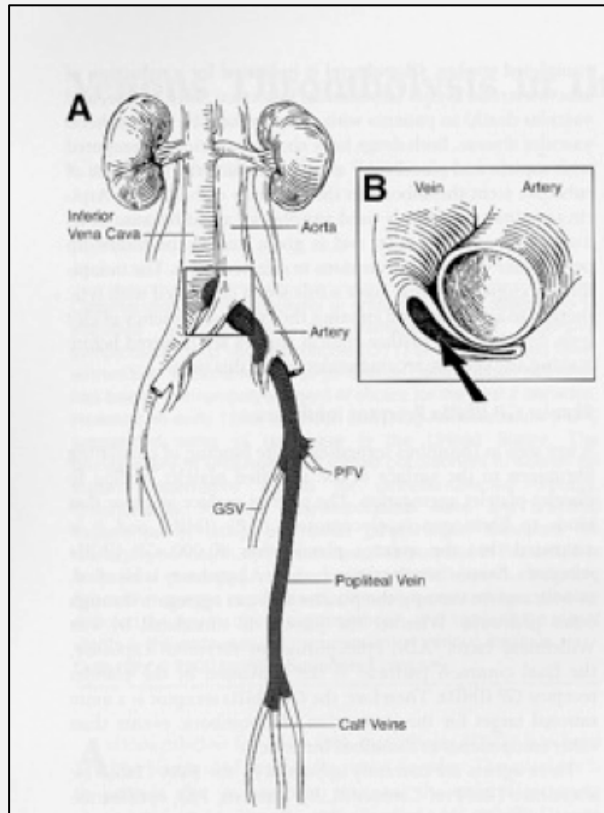


# Traditional methods of Rx- ACUTE

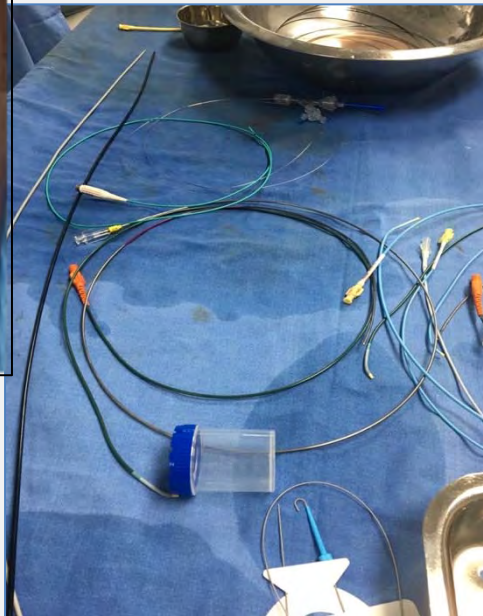
- Anticoagulate
- Rest
- Elevation
- Majority resolve only Clinically (Valve function is lost , Recanalization of lumen is just partial)
- When treated with anticoagulation alone, at 5 years:
  - 90% venous insufficiency
  - 15% stasis ulcers
  - 15% venous claudication
  - 40% have restricted ambulation



# Does Laterality matters: MAY THURNER SYNDROME

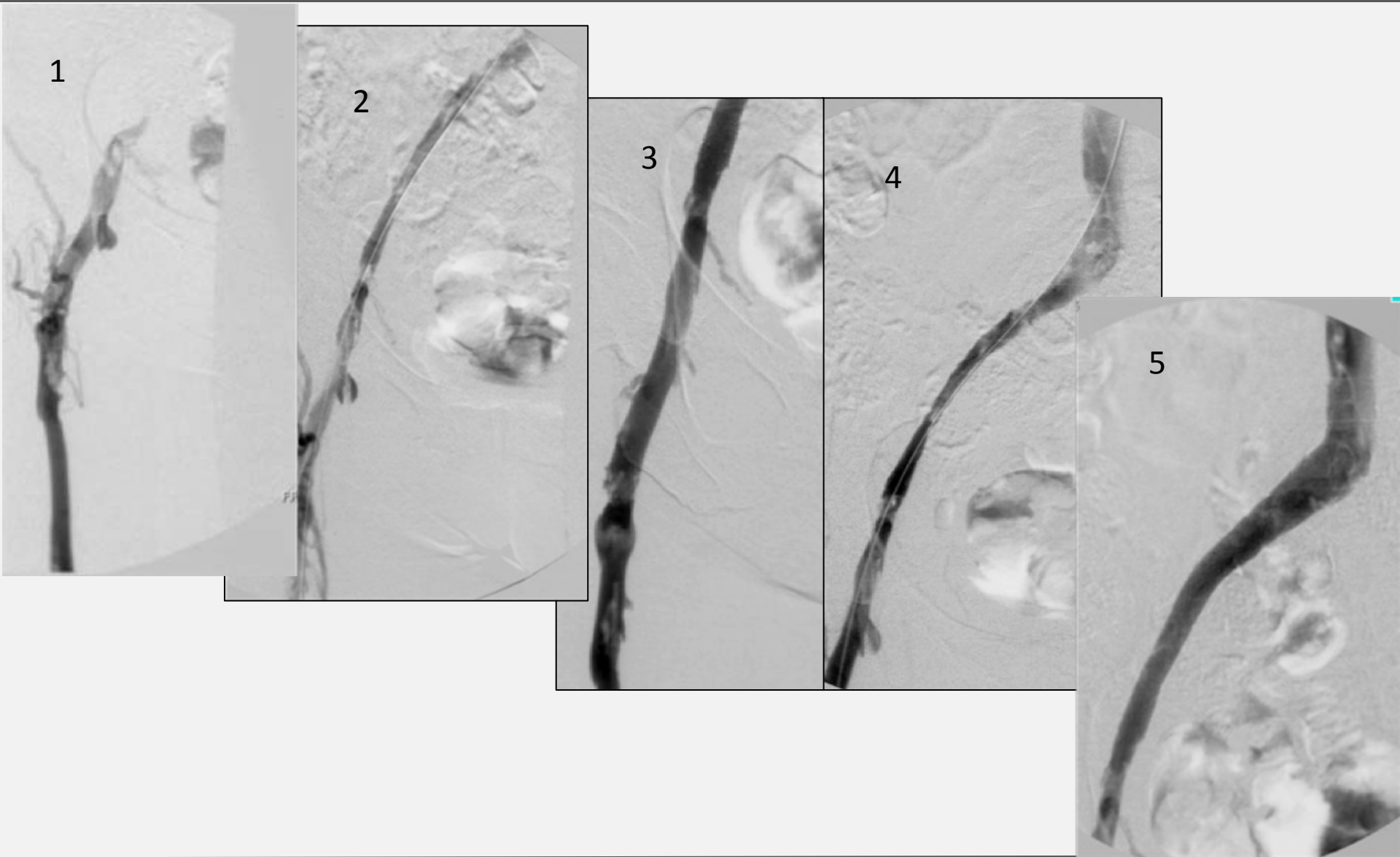


# CDT Technique: Pharmacomechanical thrombolysis/thrombectomy





# How Black n White Improvement is seen!





# Role of endovascular approach (CDT)

- ✓ Major benefit is the alleviation of acute symptoms within a span of 1-2 days.
- ✓ Prevents clot to hardens
- ✓ Prevents permanent damage to the vein valve
- ✓ No need to wait for clot to lyse, which can take months or years or maybe never happens.

**“So the real benefit is that CDT can eliminate the clot early, maintain the valves, maintain the vein function, and potentially ward off PTS”.**

# PRE & POST CLINICAL IMAGES

PRE



Post

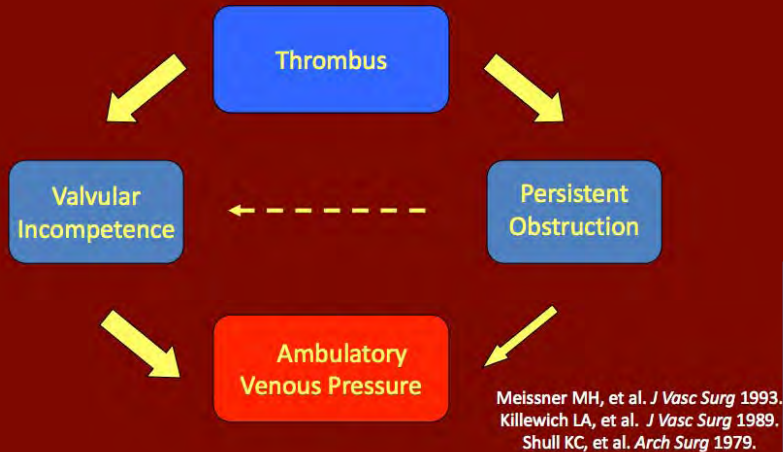


# PRE & POST CLINICAL IMAGES

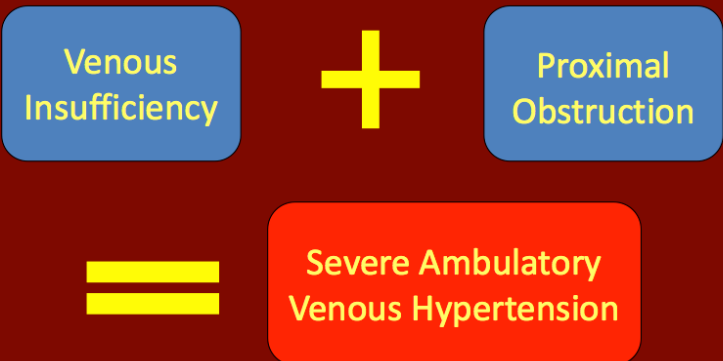


# Chronic DVT: What causes PTS?

## Pathophysiology of Post-Thrombotic Syndrome



Ambulatory venous hypertension is most severe when venous insufficiency and proximal obstruction coexist





# Chronic DVT:

Radiology & IR again plays very Imp role ..

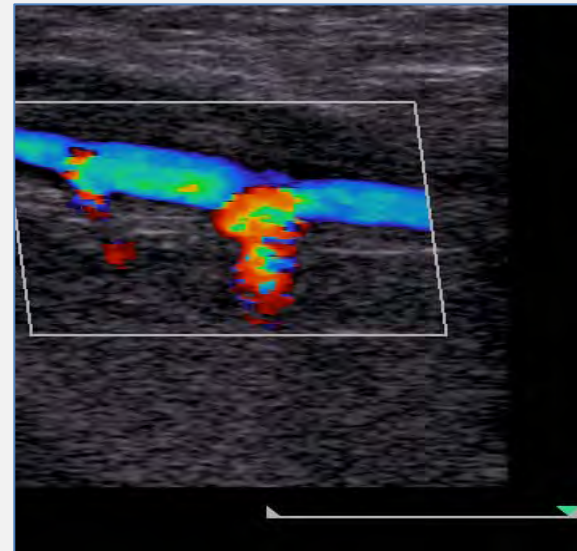
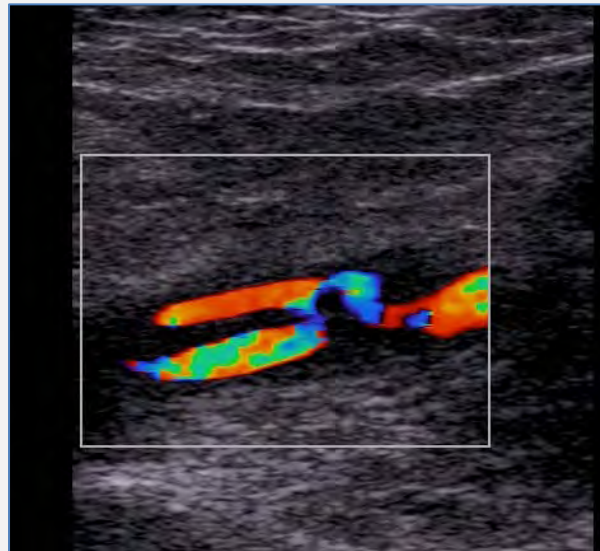
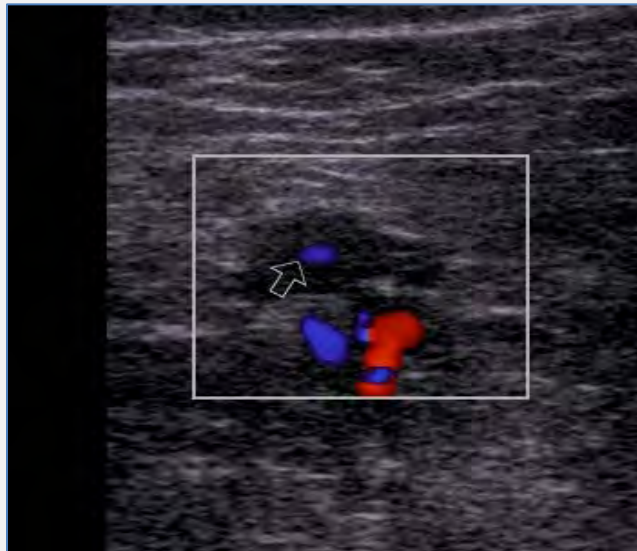
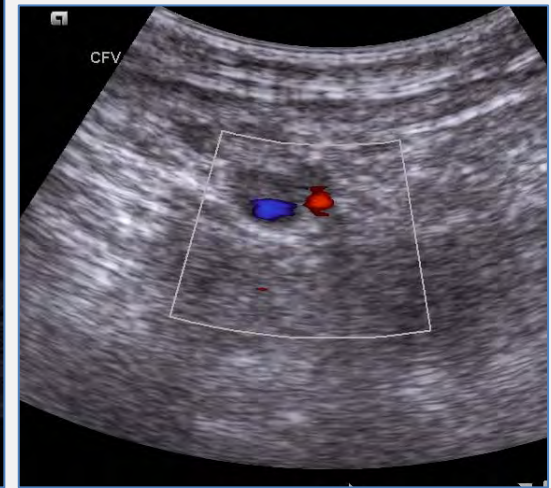
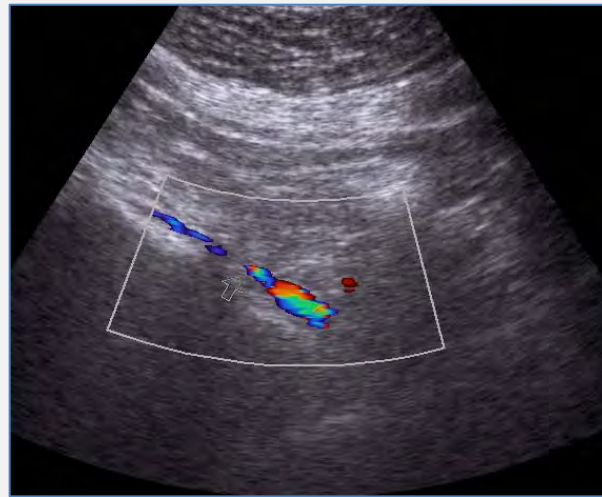
## VENOUS US/DOPPLER:

- Quick, Access planning, Surveillance
- Iliac/IVC imaging is difficult (obesity, bowel gas)

## CT AND MR VENOGRAPHY:

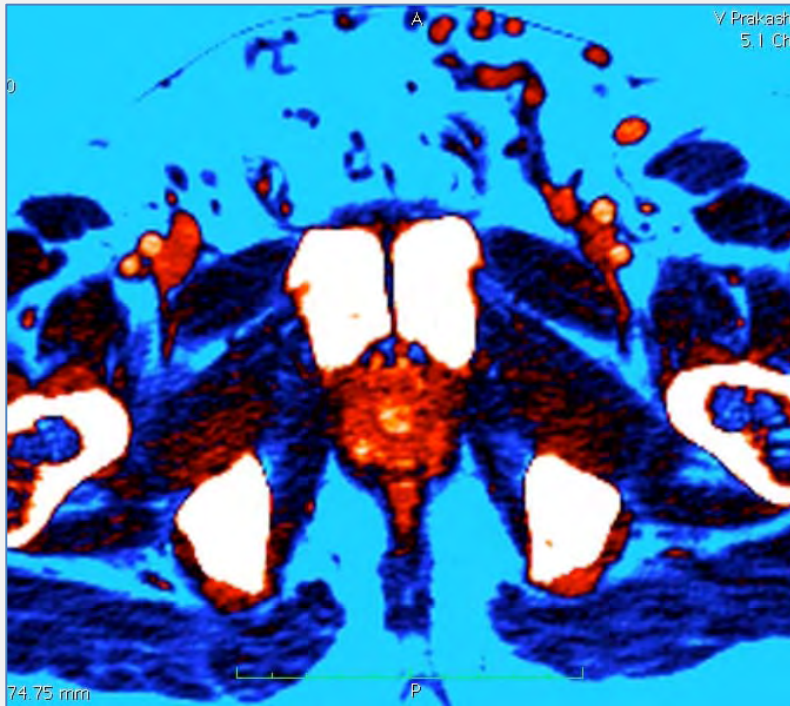
- Very useful for planning intervention
- Status of IVC/Iliac veins/ Profunda
- Try to apply tourniquet/DVT pump during scan

# US/Doppler

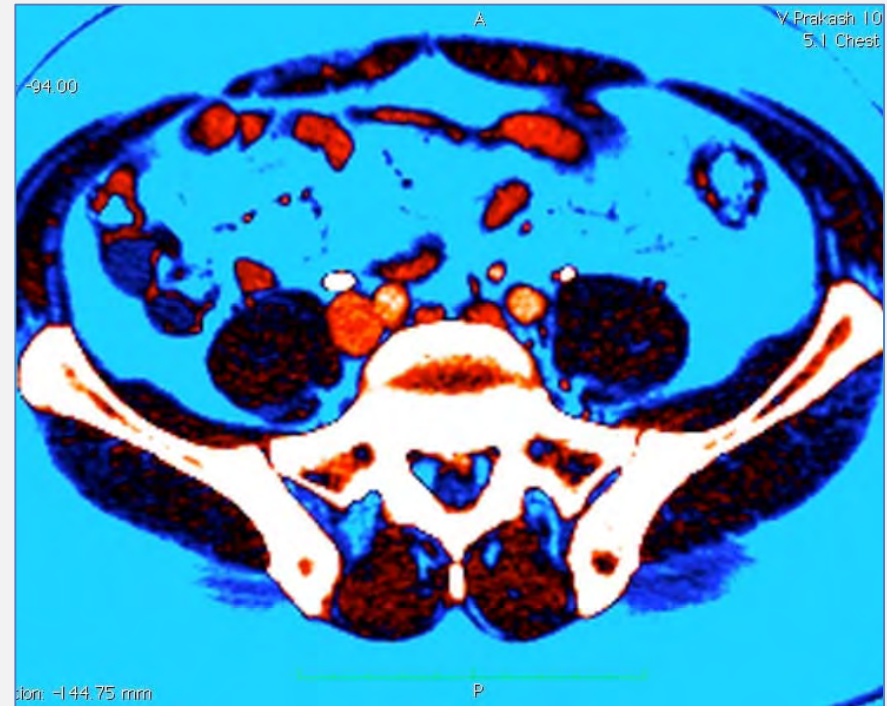


# CT Venography

Cross pubic collaterals



Stenotic iliac vein





# CT Venography





# Position, Drape & Access

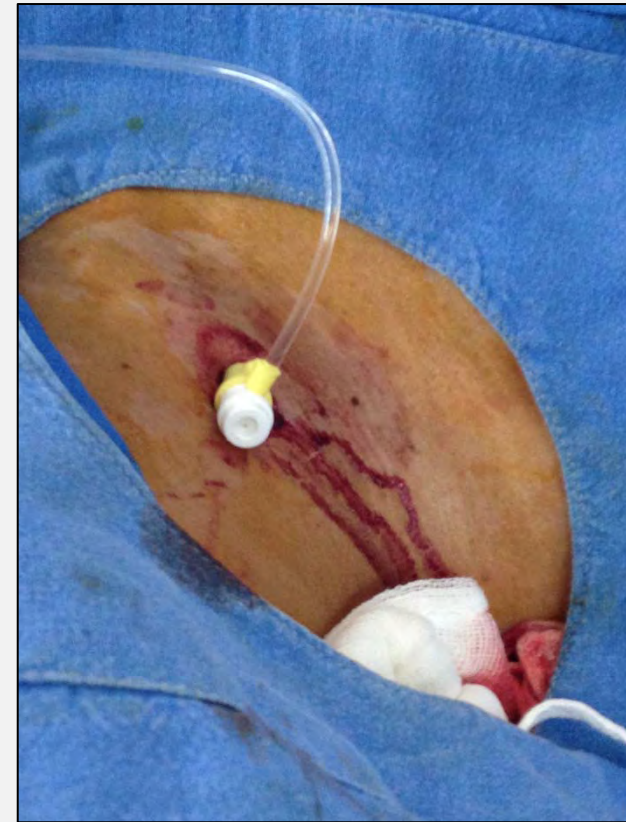
Left Leg Venous Ulcer



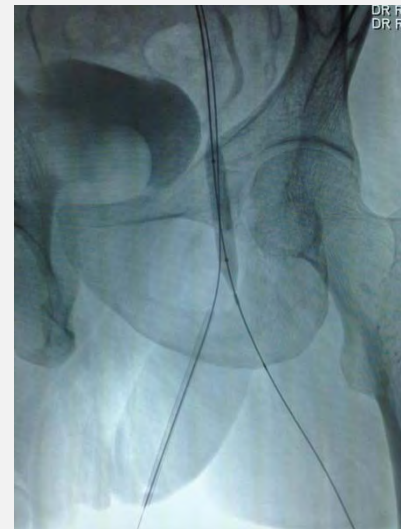
Right CFV & Left GSV Access



Right IJV Access

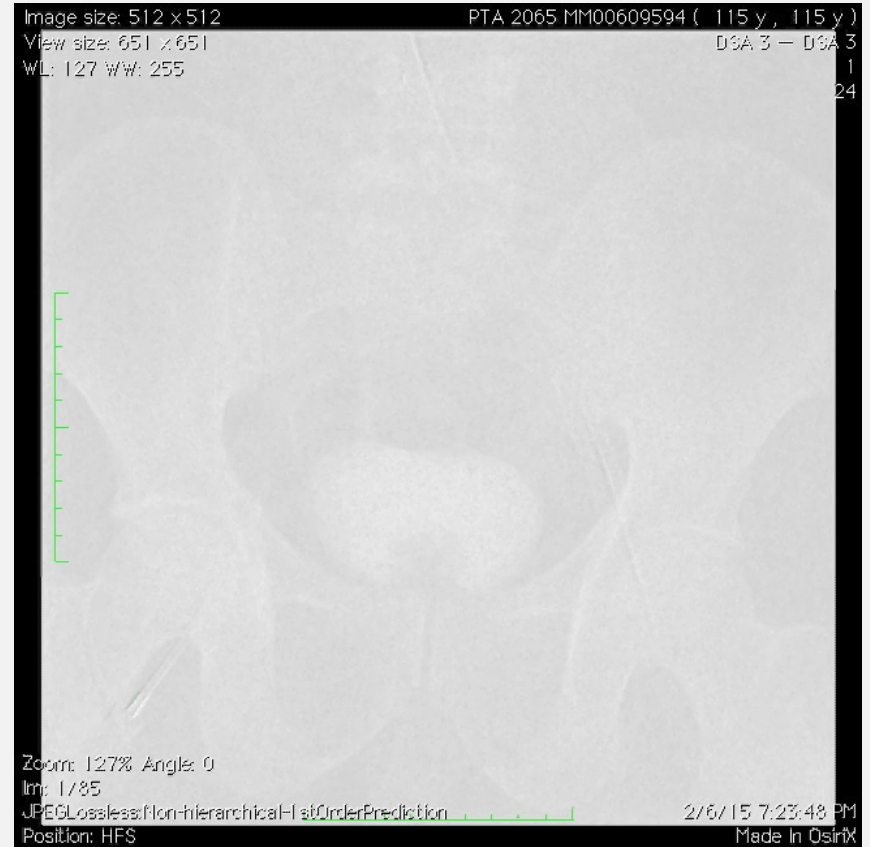
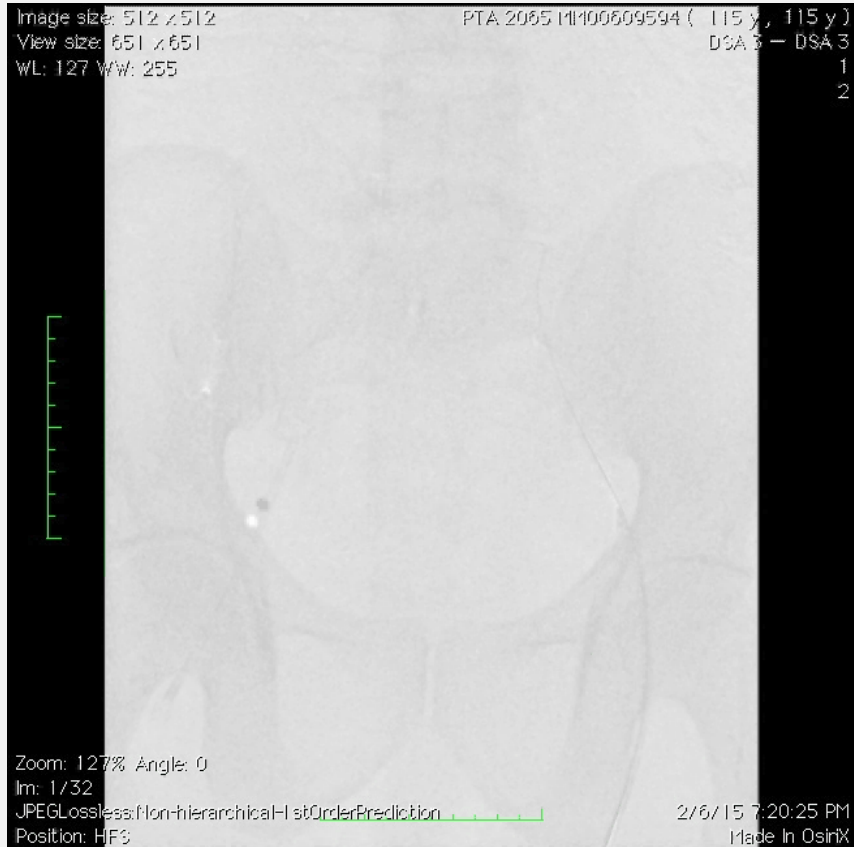


# Procedure: Step by Step



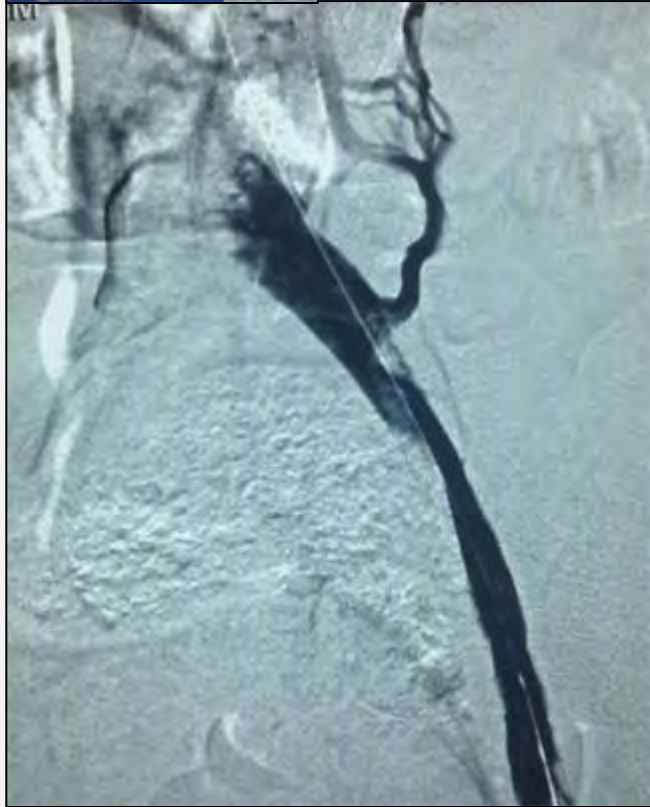


# COMPARISON: Pre vs POST



# Case 1: Only CIV-IVC confluence Occlusion (Left Leg)

32/M with Chronic DVT & PTS





## Case 2: Again Proximal Occlusion (Right Leg)

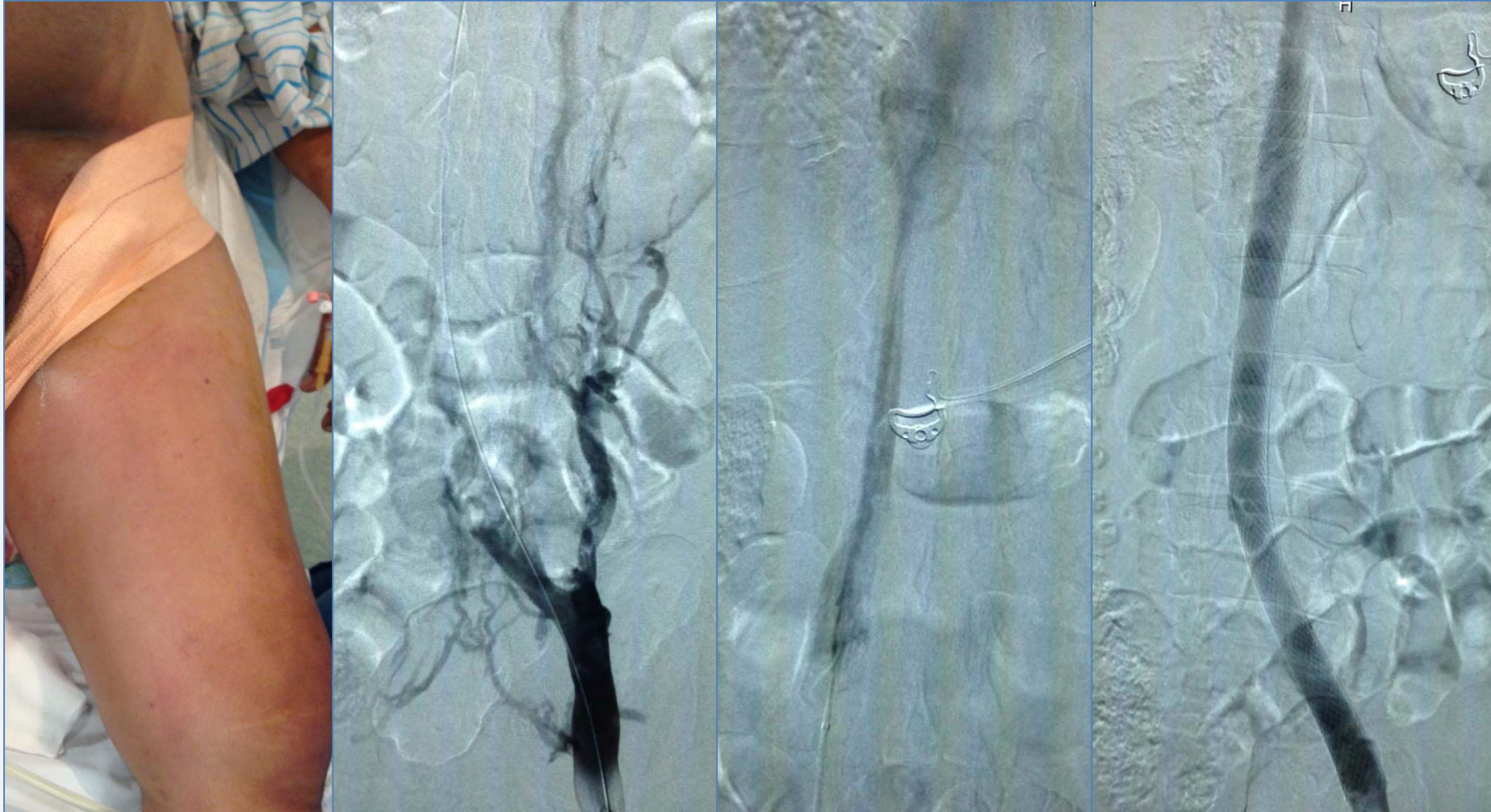
24y/M with h/o DVT with PE 3 years ago, now comes with constant swelling right leg & venous Claudication



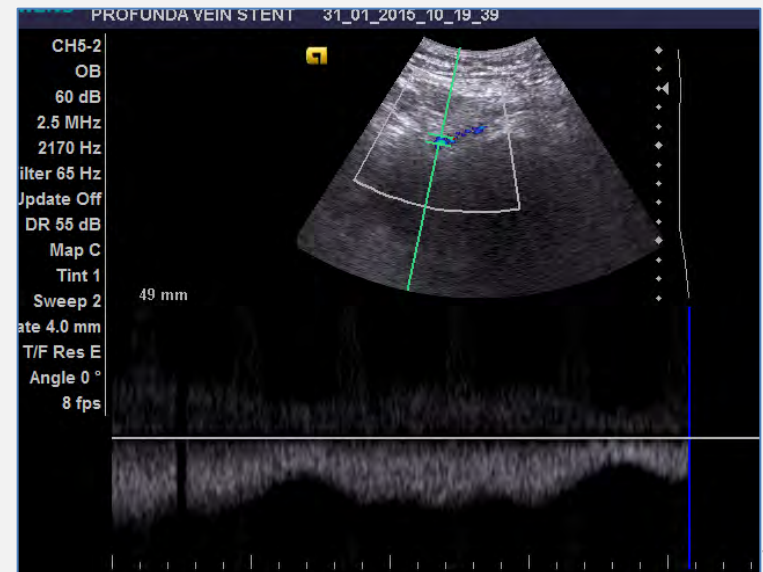
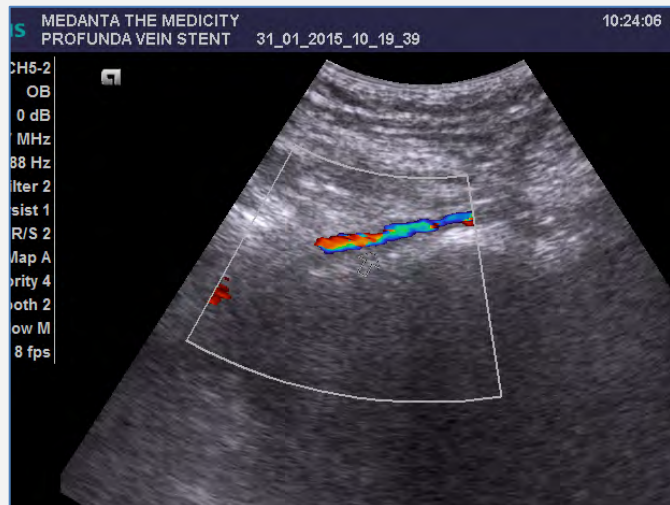
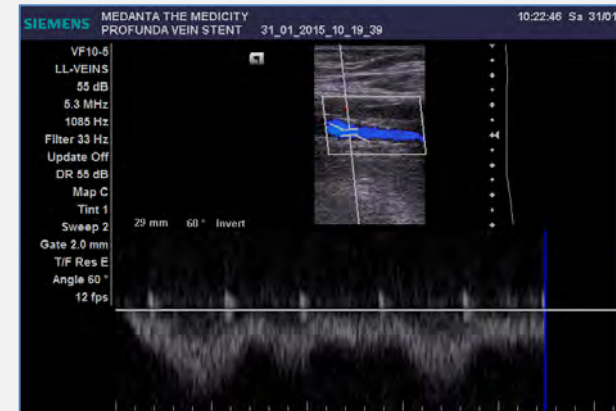
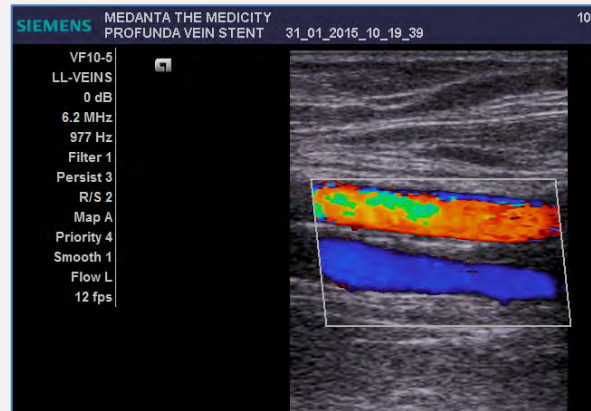


# CASE 3: ILIO+CAVAL OCCLUSION

48/M with B/L leg swelling & Left leg recurrent venous ulcers



# US/DOPPLER- Post Stenting



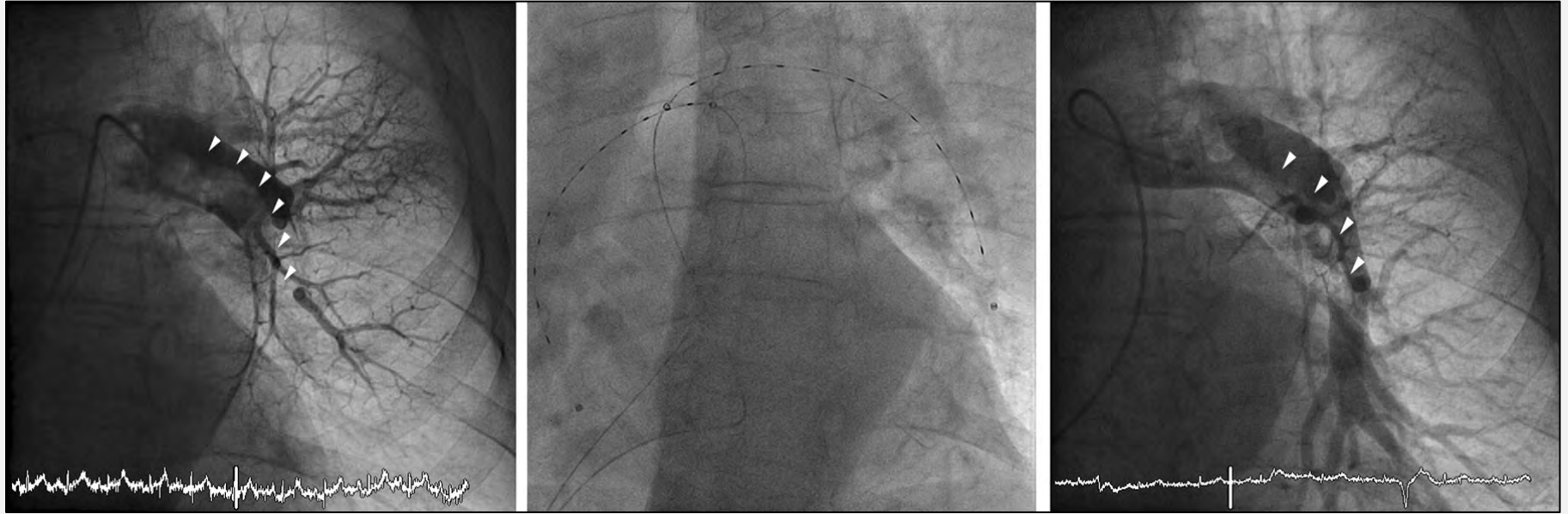


# Literature Review: Iliac & IVC Occlusions

				Patency
O'Sullivan 2000	39	May-Thurner	Iliac	87% 30-d
Neglen 2000	59	May-Thurner	Iliac	60% 2-yea
Abu Rahma 2001	18	May-Thurner	Iliac	83% 1-yea
Kolbel 2009	66	Post-Thrombotic	Iliac	67% 2-yea
Wahlgren 2010	21	Post-Thrombotic	Iliac	61% 1-yea
Abu Rahma 2001	78	Post-Thrombotic	IVC & Iliac	52% 2-yea
Raju 2002	38	Post-Thrombotic	IVC & Iliac	49% 2-yea
Paulsen 2004	41	Post-Thrombotic	IVC & Iliac	58% 6-mo
Raju 2009	139	Post-Thrombotic	IVC & Iliac	44% 2-yea



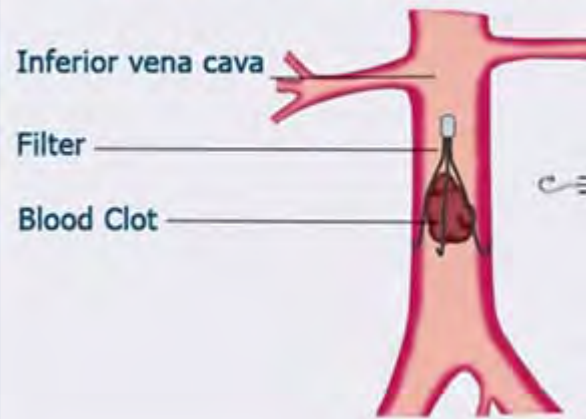
# CDT for B/L Massive PE



- CDT is potentially life-saving in selected patients with massive or submassive PE.
- Can be performed when there are contraindications in systemic thrombolysis or when emergency surgical thrombectomy is unavailable or contraindicated.
- Catheter interventions can also be performed when thrombolysis has failed to improve hemodynamics in the acute setting.
- Both catheter-based clot fragmentation and local thrombolysis is strategy.
- The goals of CDT are (1) rapidly reducing pulmonary artery pressure, RV strain, and pulmonary vascular resistance (PVR); (2) increasing systemic perfusion; and (3) facilitating RV recovery.

# IVC Filter

## Inferior vena cava



- Retrievable
- Non Retrievable

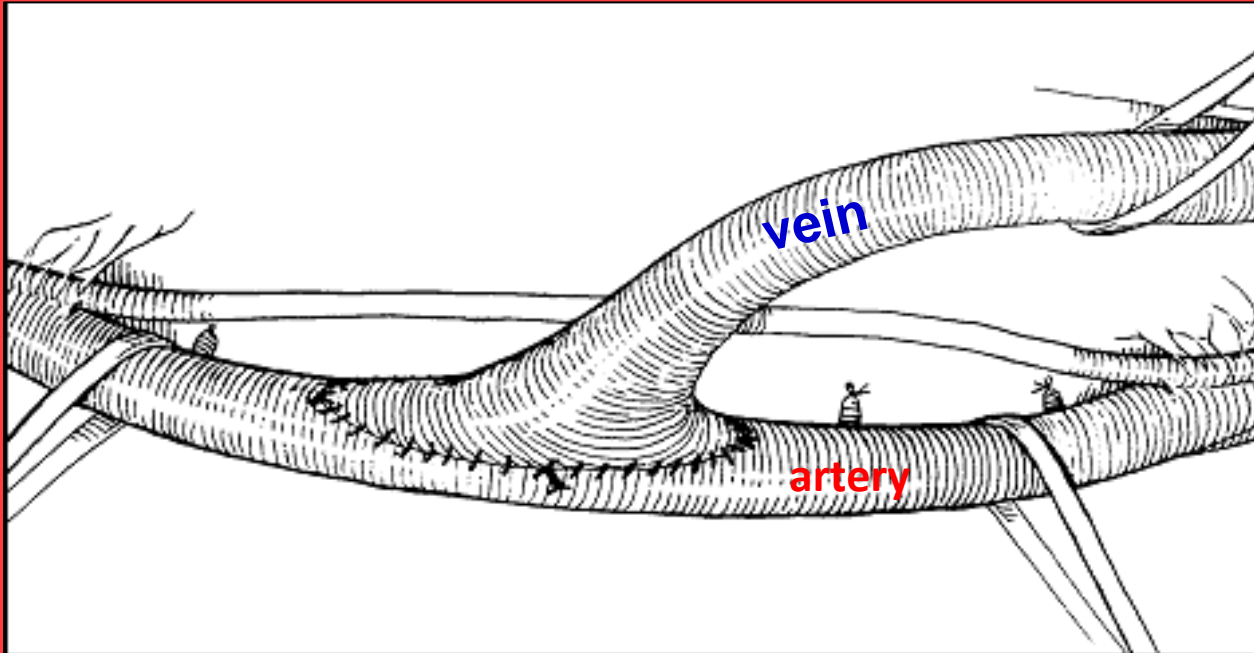
## Indications for IVC filter

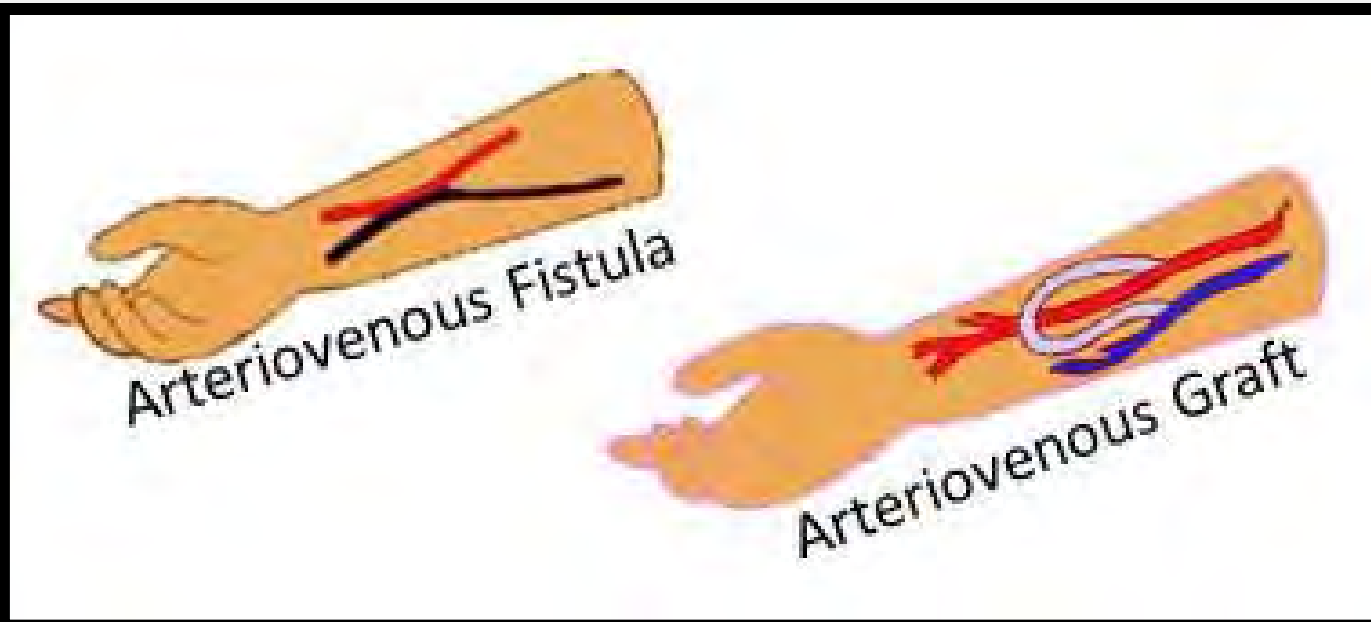
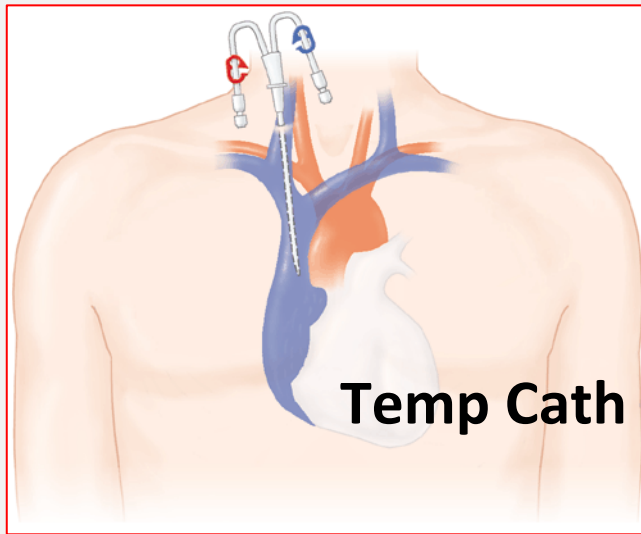


1. At risk for DVT/PE with absolute contraindication to anticoagulants
2. Recurrent DVT/PE in spite of anticoagulation

[www.drsvenkatesan.co.in](http://www.drsvenkatesan.co.in)

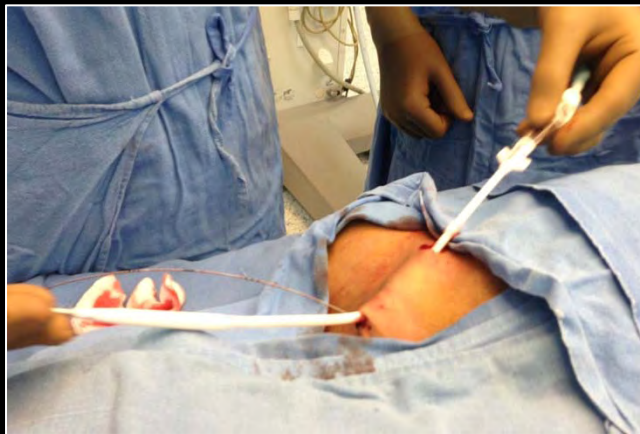
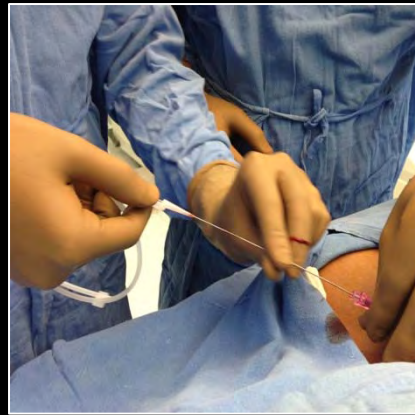
# **VENOUS INTERVENTIONS IN HEMODIALYSIS ACCESS**







# RADIOLOGY SKILLS: USG & Fluro

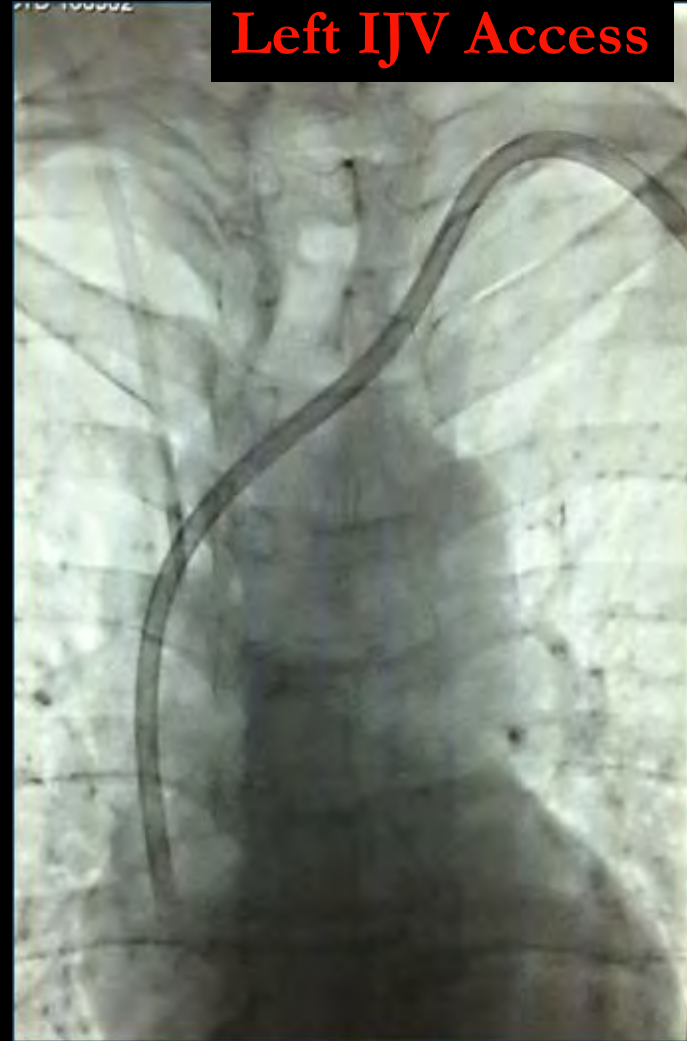


# PERMACATH

**Right IJV Access**



**Left IJV Access**





# Groin Permacath



# **AVF/AVG Interventions**

## **Case Scenarios**

1. Cannulation Zone Pseudoaneurysms In AVF
2. Juxta-Anastomotic/Swing segment Stenosis In AVF
3. Venous Anastomotic Stenosis In AVG
4. AVG Thrombosis
5. Central Venous Stenosis: Swelling, SVC Syndrome & Non usable AVF/AVG
6. Competing Vein “Steal” Phenomenon



# Black & White!

**PRE**



**POST**



# Real Benefit!

PRE



POST





# Black & White

PRE

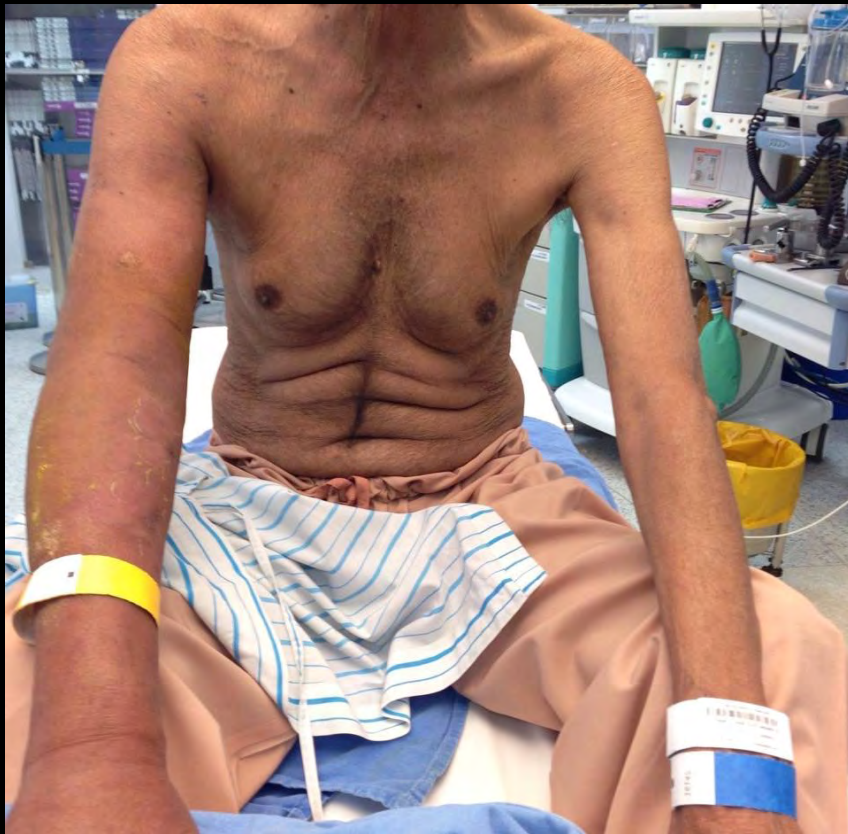


POST



# Clinical

Pre

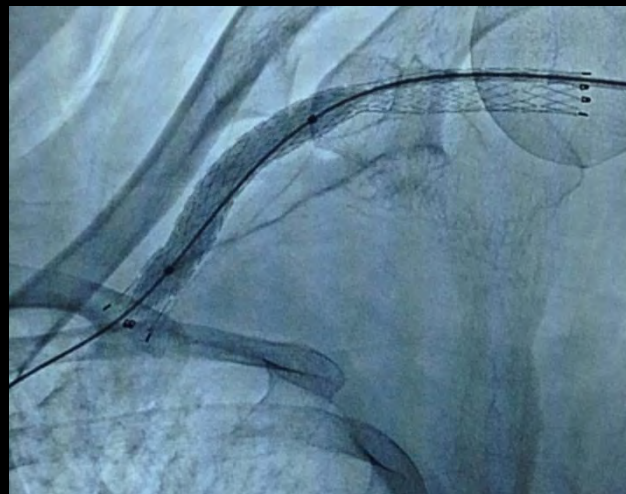
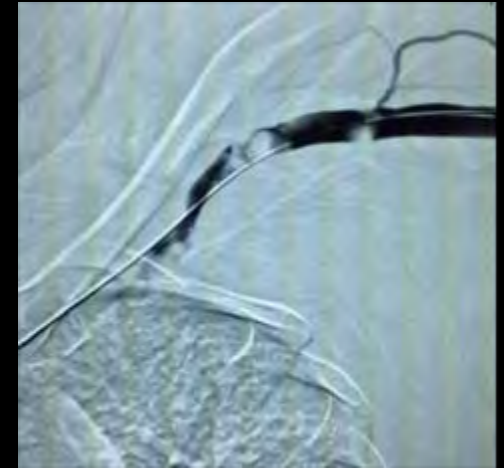


Post



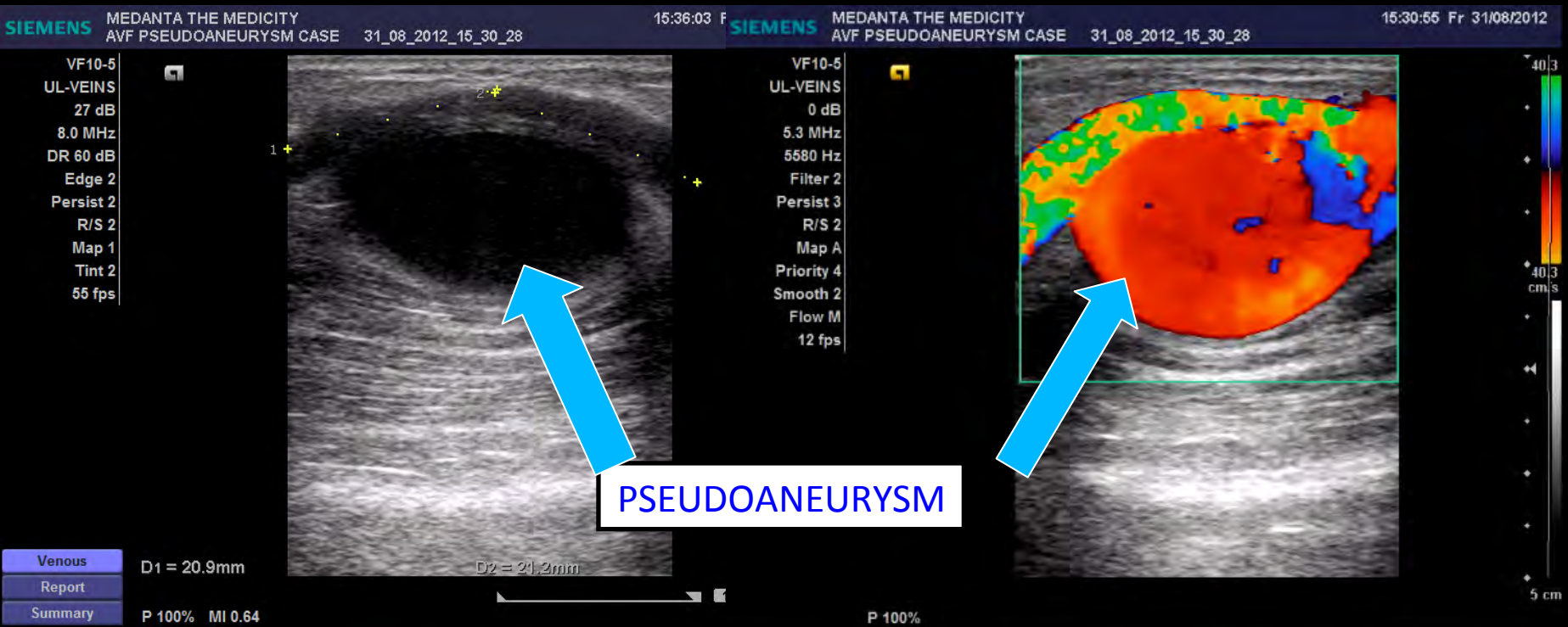


# Cephalic Arch Lesions

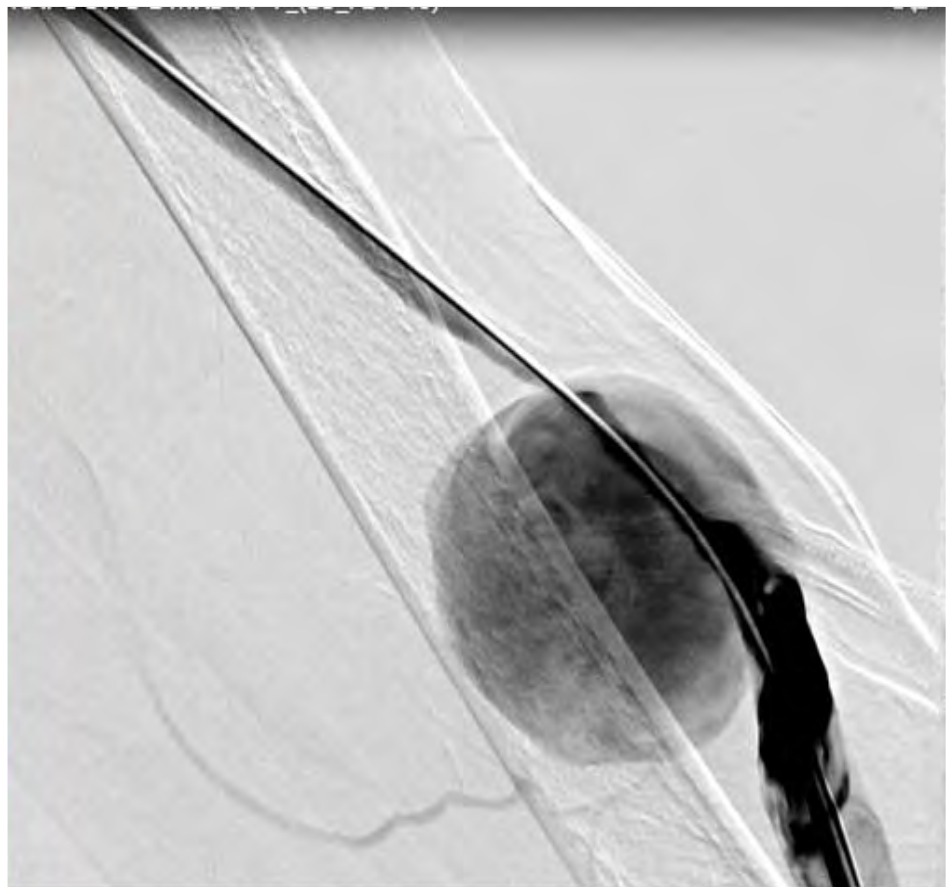
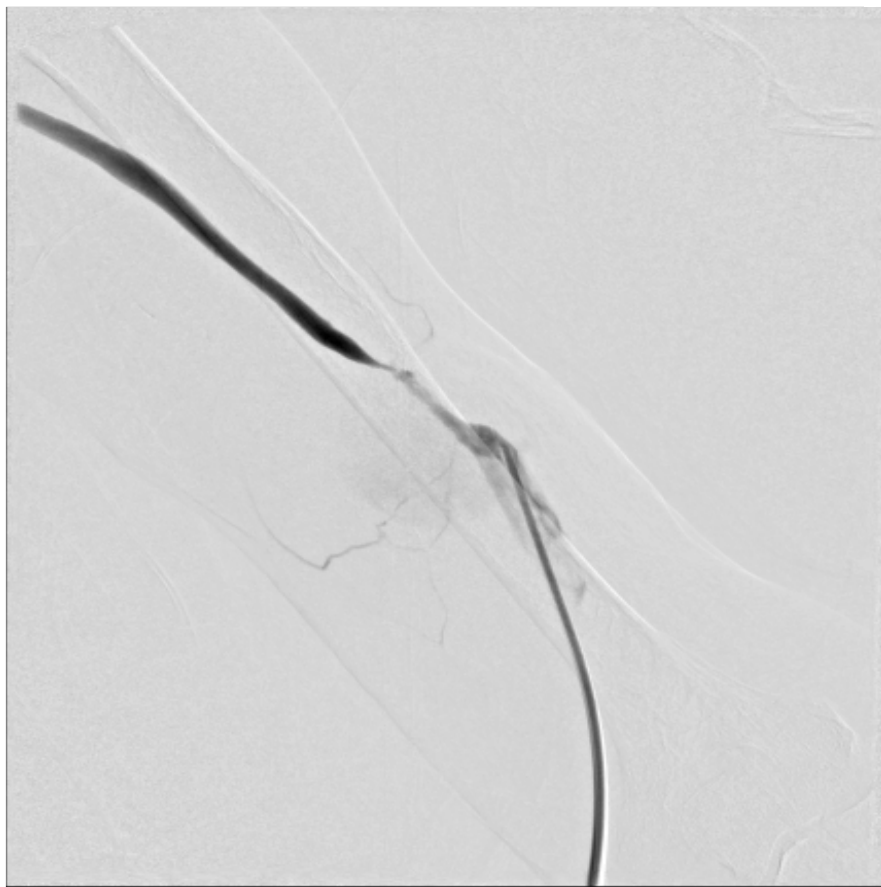


# 32/F with painful swelling at Cannulation site of Left Brachiocephalic AV Fistula

## DOPPLER EVALUATION

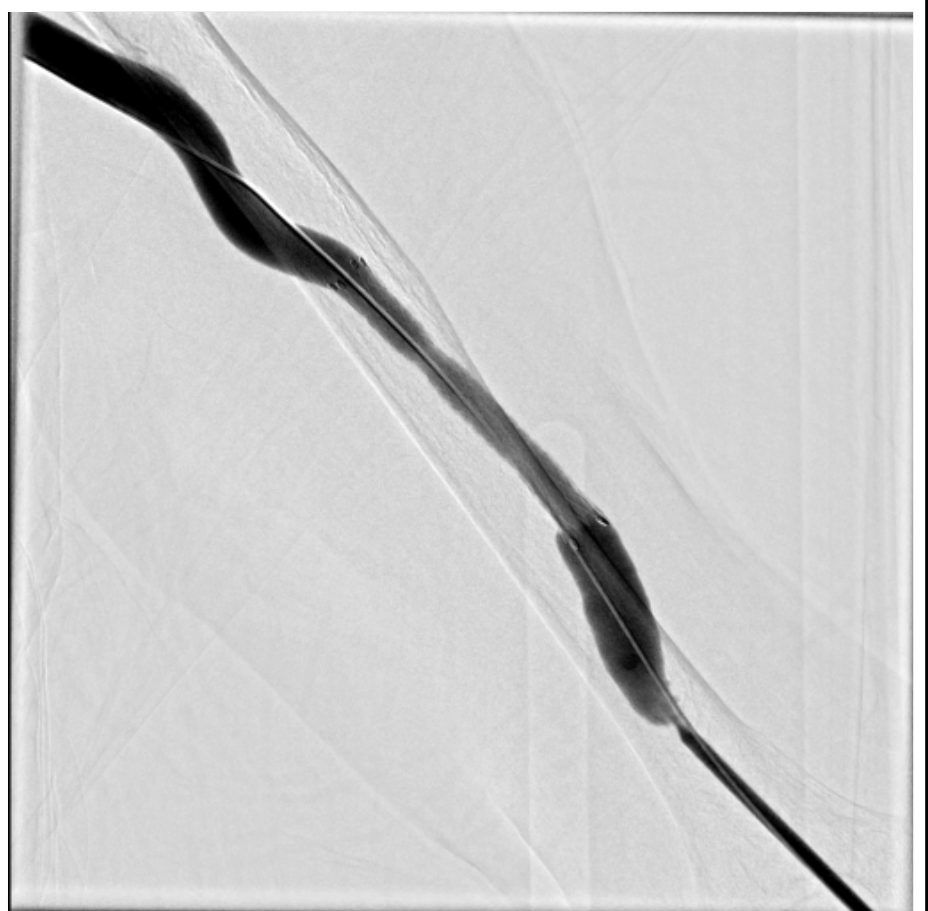
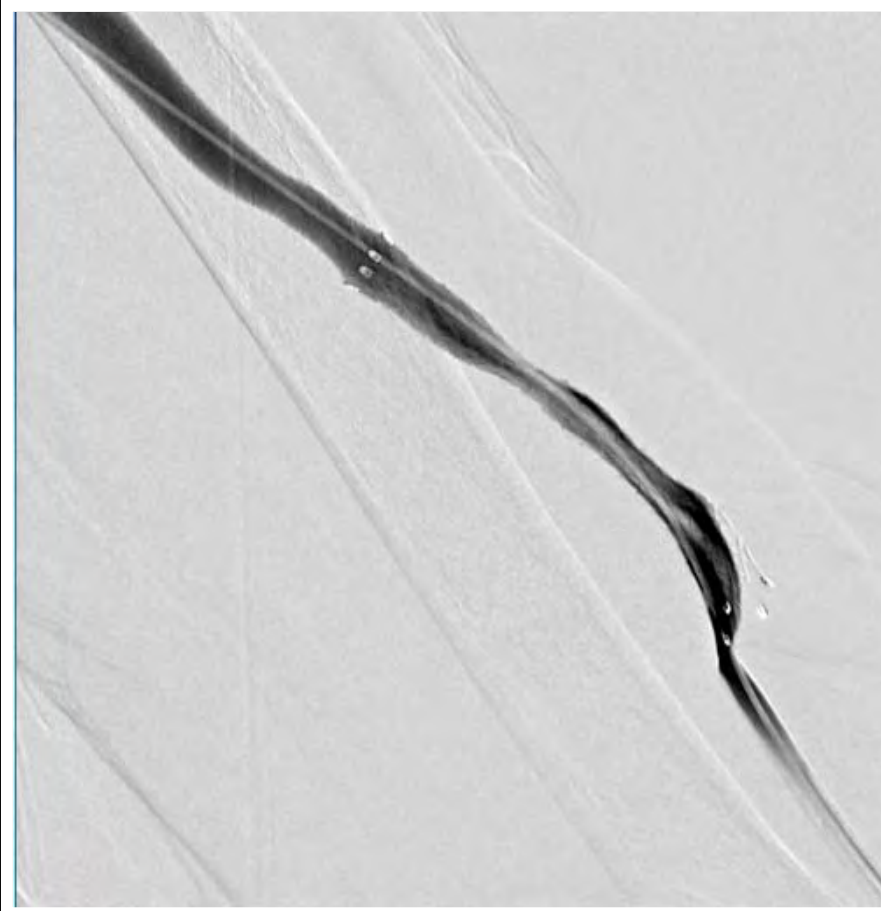


# INITIAL FISTULOGRAM





## POST STENT GRAFT EXCLUSION AND BALLOON MOULDING

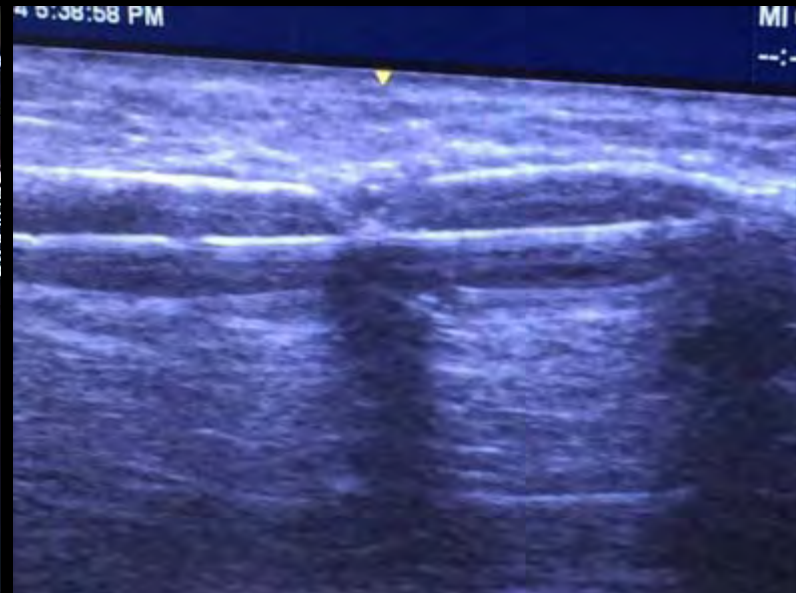




# Surgical Mess vs Percut



# US Guided Fistuloplasty





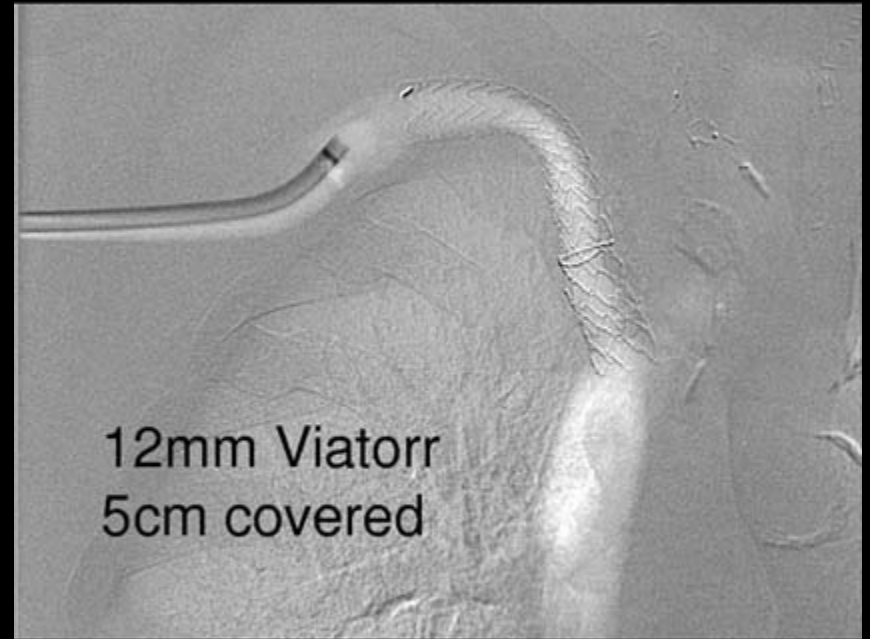
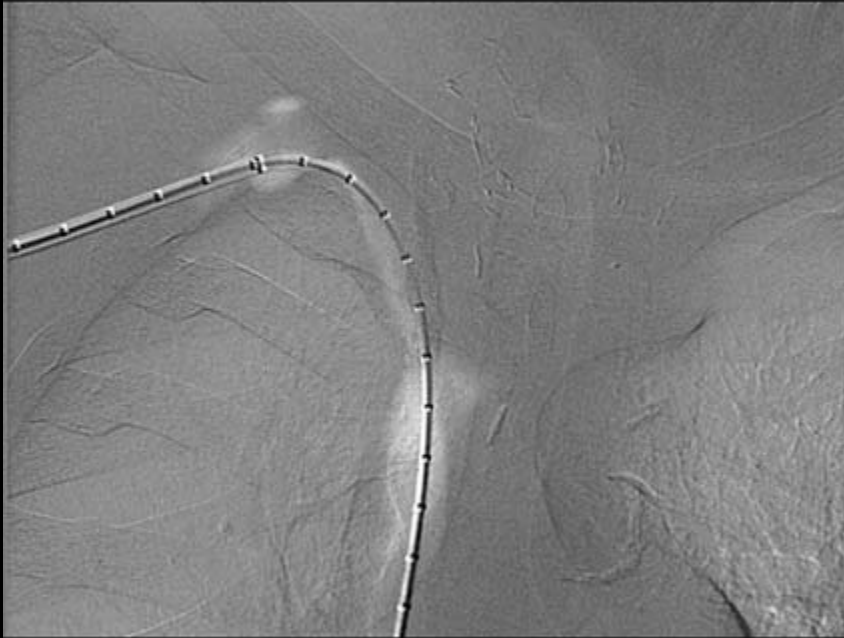
What's New

## US Guided Interventions

- Not for central obstruction
- Can be easily performed with basic knowledge of US/Doppler.
- No Radiation to both Patient & Staff.
- No fluid overload
- Can be performed without Cathlab



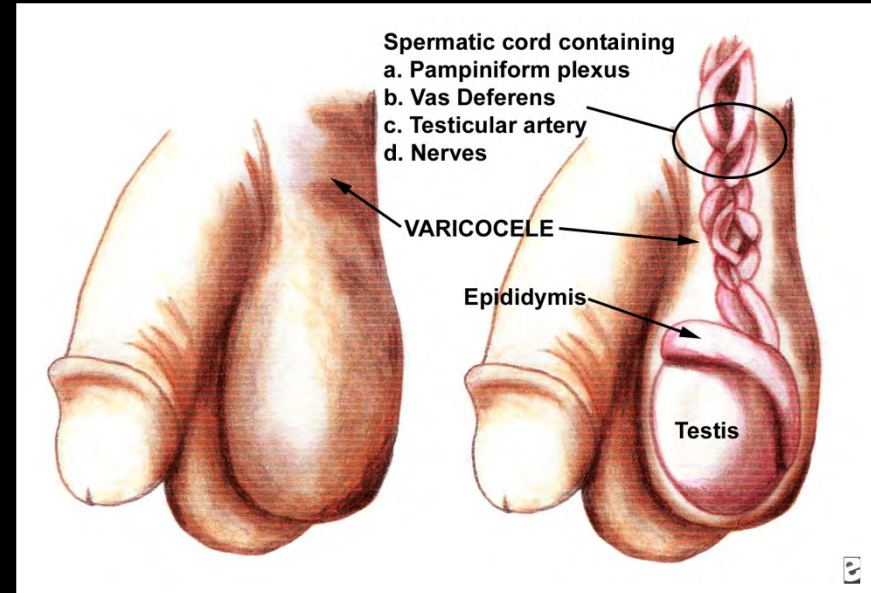
# Alternate Contrast Medium: Co2



# VARICOCELE

**Definition:** Dilatation of the Pampiniform venous plexus and the Internal spermatic vein.

- It is a well-known clinical entity that may result in mass-effect, pain, testicular atrophy, and infertility.
  - 15-20% of all males
  - 40% of infertile males
1. Amelar RD, Dubin L. Therapeutic implications of left, right, and bilateral varicocelectomy. *Urology*. 1987;30:53-59.
  2. Skoog S, Roberts K, Goldstein M, Pryor J. The adolescent varicocele: what's new with an old problem in young patients? *Pediatrics*. 1997;100:112.

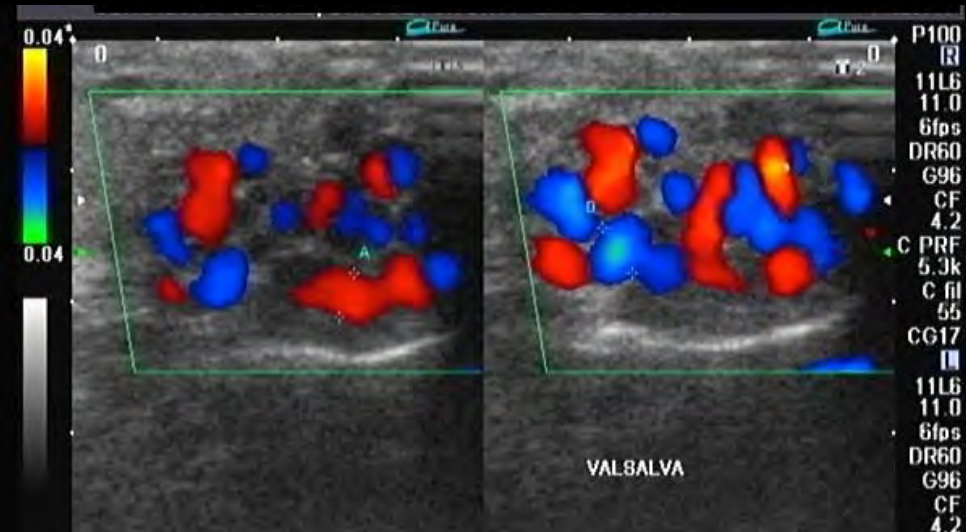
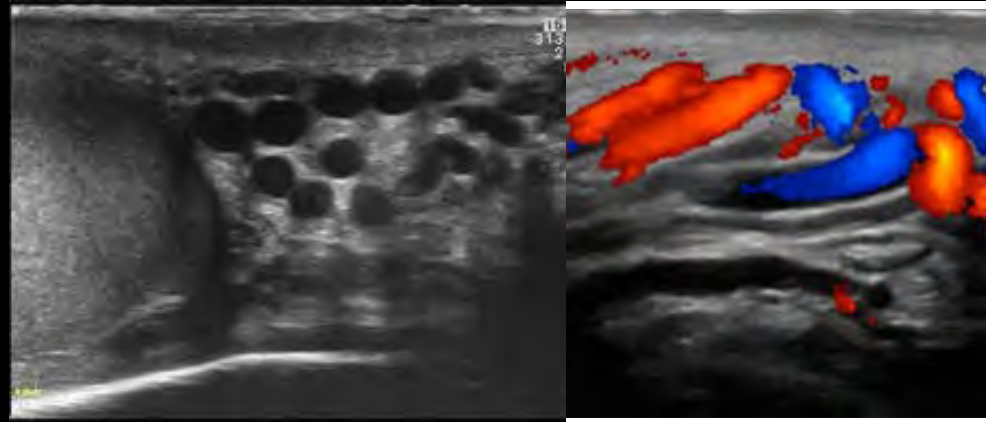


# Scrotal Ultrasound & Color Doppler

- Ultrasound with color allows accurate diagnosis in nearly all cases of varicoceles, even subclinical varicoceles and is the imaging technique of choice.

## Findings:

1. On gray scale ultrasound there is
2. Color Doppler demonstrate Retrograde flow/ reflux in these veins with standing position or with Valsalva maneuver.
3. On spectral analysis, venous flow is directed to the testis which augments on increasing the abdominal pressure.





# Open Surgical Management

- Ligate all of the internal and external spermatic veins with preservation of spermatic arteries and lymphatics.

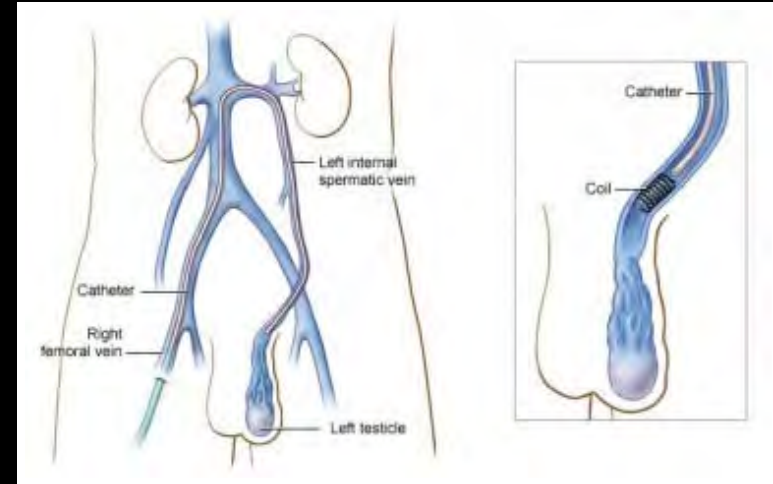
## Downside:

- Scar
- Recurrence
- Post operative recovery time



# Percutaneous Embolization

- Least invasive & safe means of Varicocele repair.
- Internal spermatic vein accessed via cannulation of femoral/Internal Jugular vein.
- Technical success 95-100% in experienced hands.



# Coil embolization of Left ISV



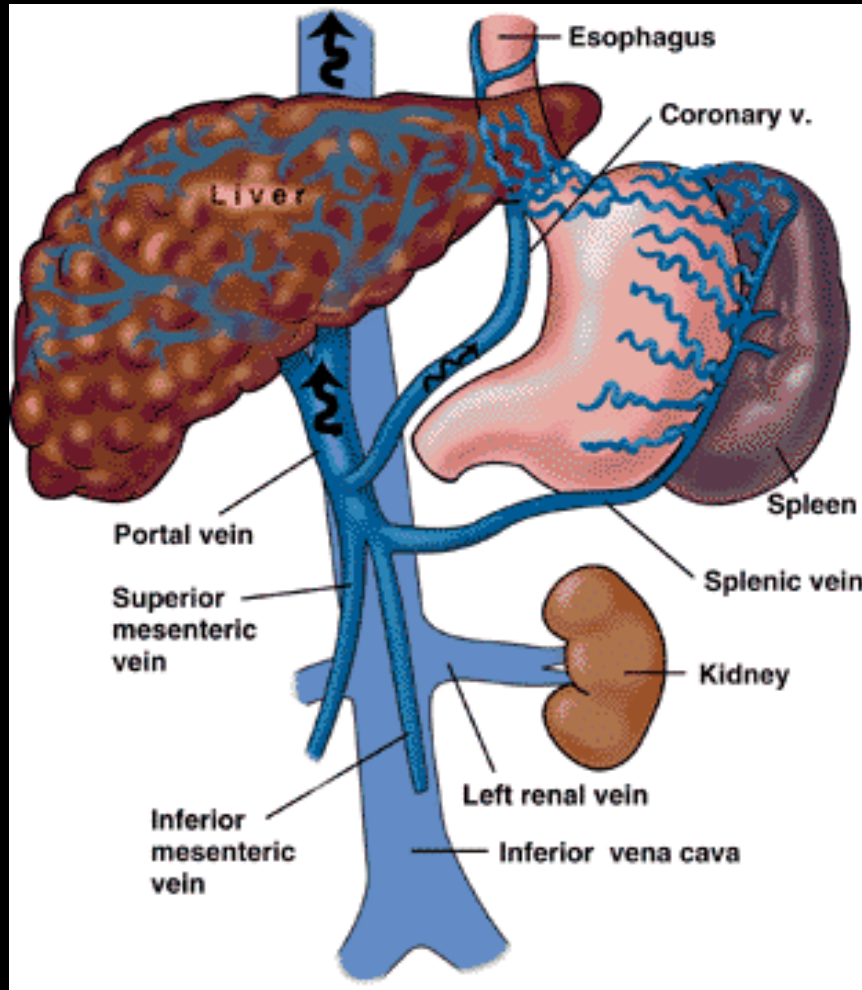


# Pelvic Congestion Syndrome (CPP, PVI, Female varicocele)

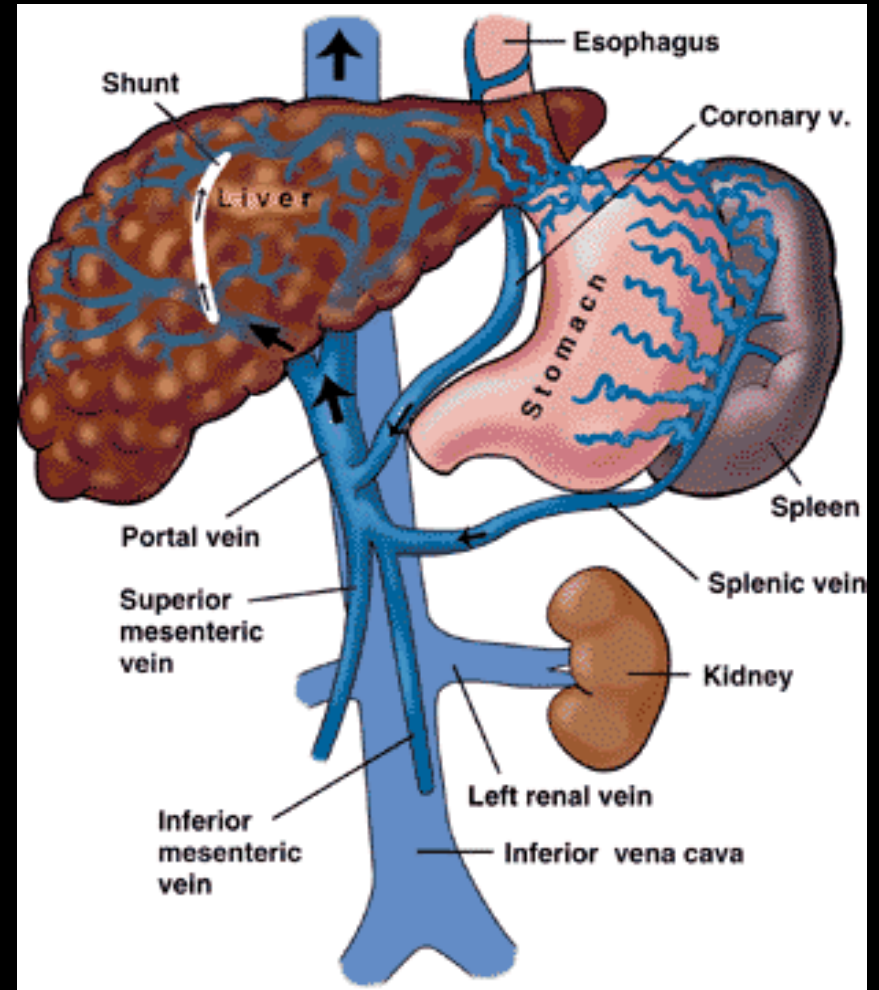
- Young Female G5, P5 with history of left lower quadrant pelvic pain for the past few years, which has worsened in the past 6 months. She describes the pain as worse after standing for a prolonged period.



**TIPS procedure:** involves guided creation of a connection between the hepatic vein and the portal vein that allows blood to flow from the portal vein to the inferior vena cava and back to systemic circulation with little resistance.



PRE-TIPS



POST-TIPS



# Common INDICATIONS OF TIPS

## PORTAL HYPERTENSION:

- Multiple episodes of variceal bleeding
- Refractory variceal hemorrhage despite adequate endoscopic treatment
- Refractory ascites
- Refractory hepatic hydrothorax

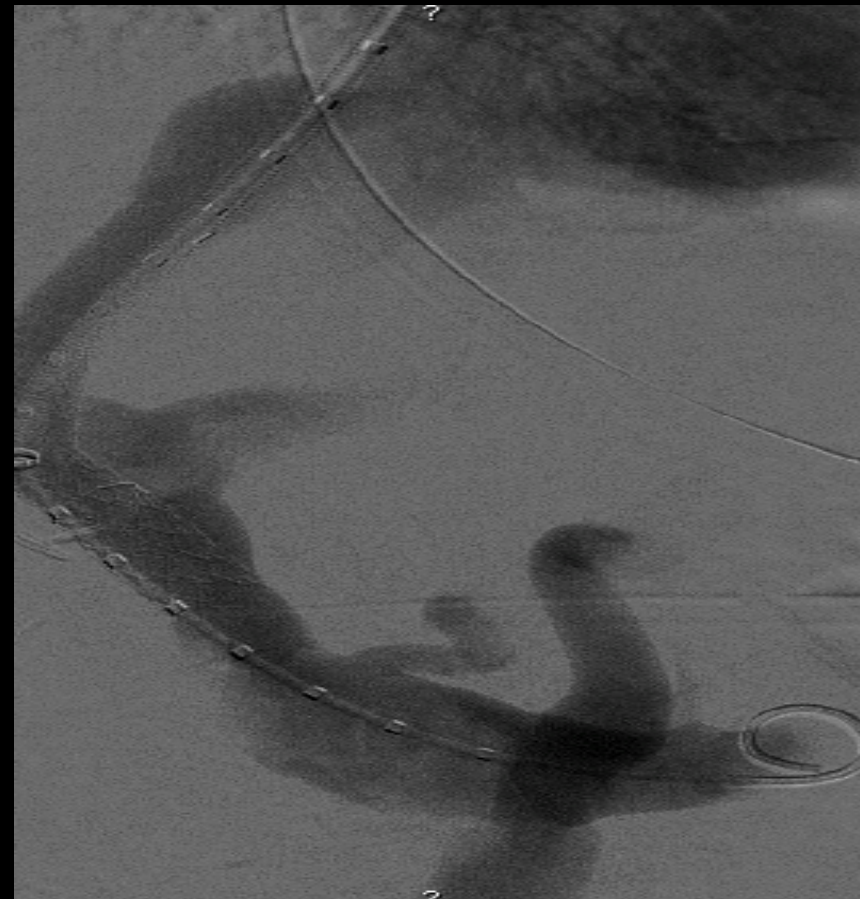
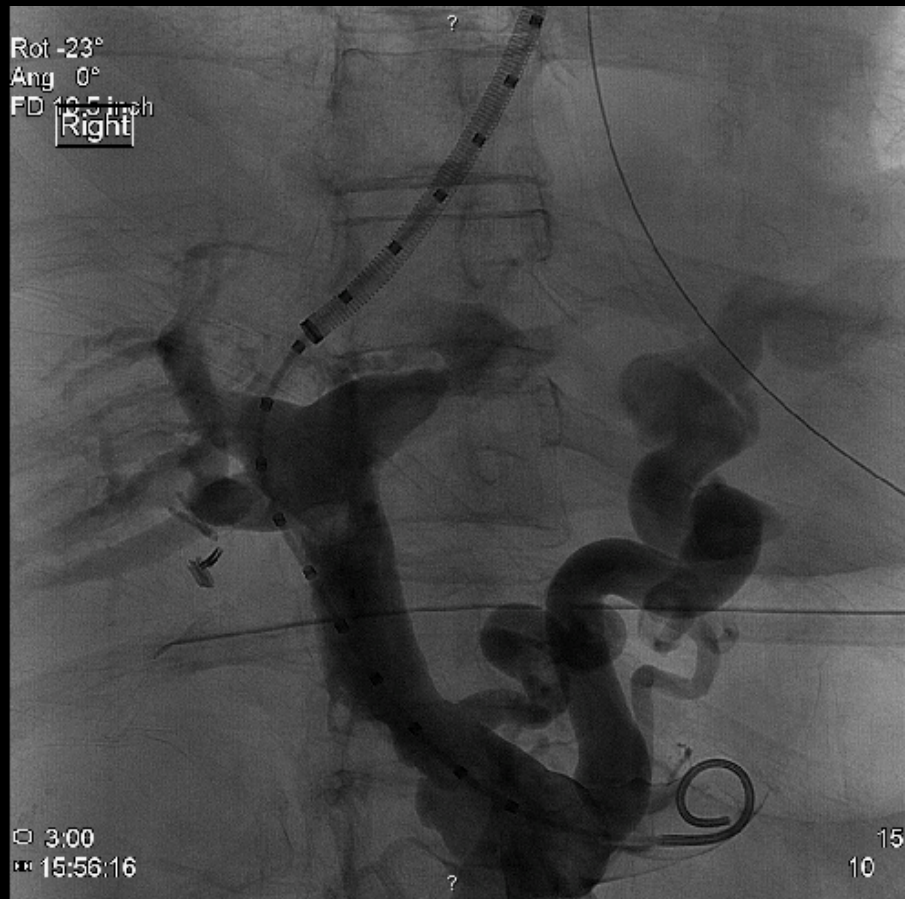
Budd-Chiari syndrome

# TIPS

- Cirrhosis of liver with recurrent variceal bleed and ascites, status post band ligation and unresponsive to medical management.
- On waiting list for liver transplant.

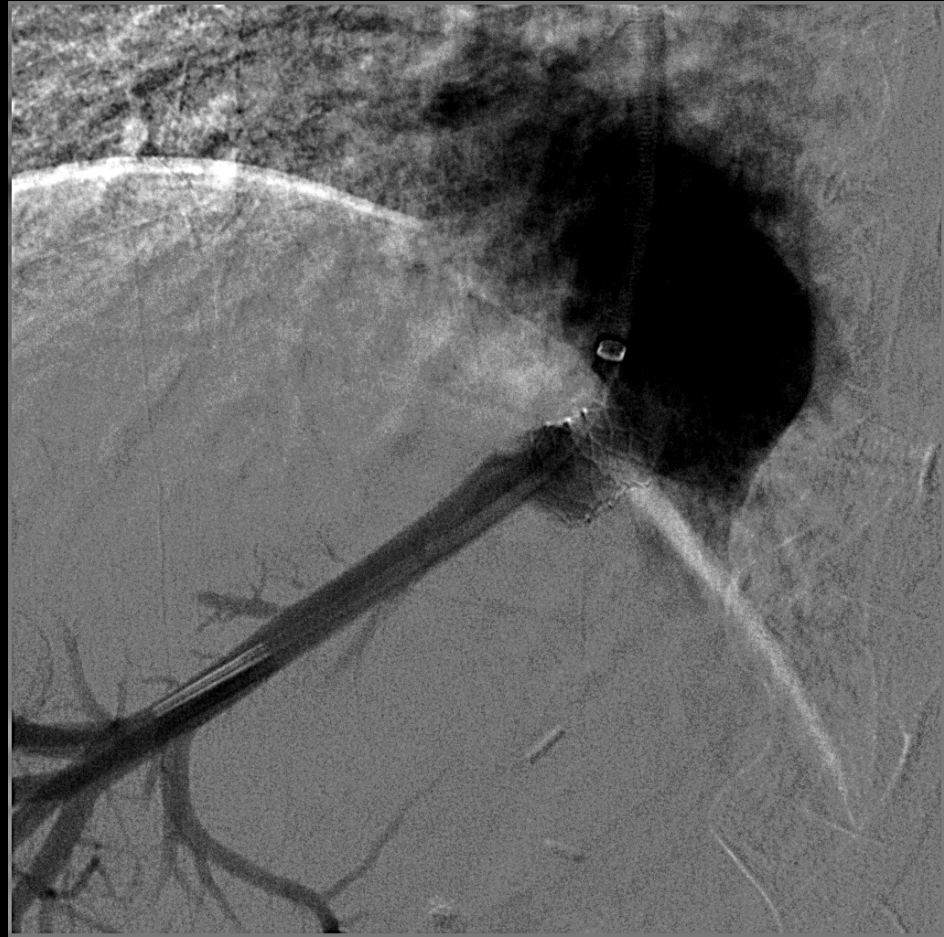
IR plays an Important role : TIPSS placement.

# TIPSS

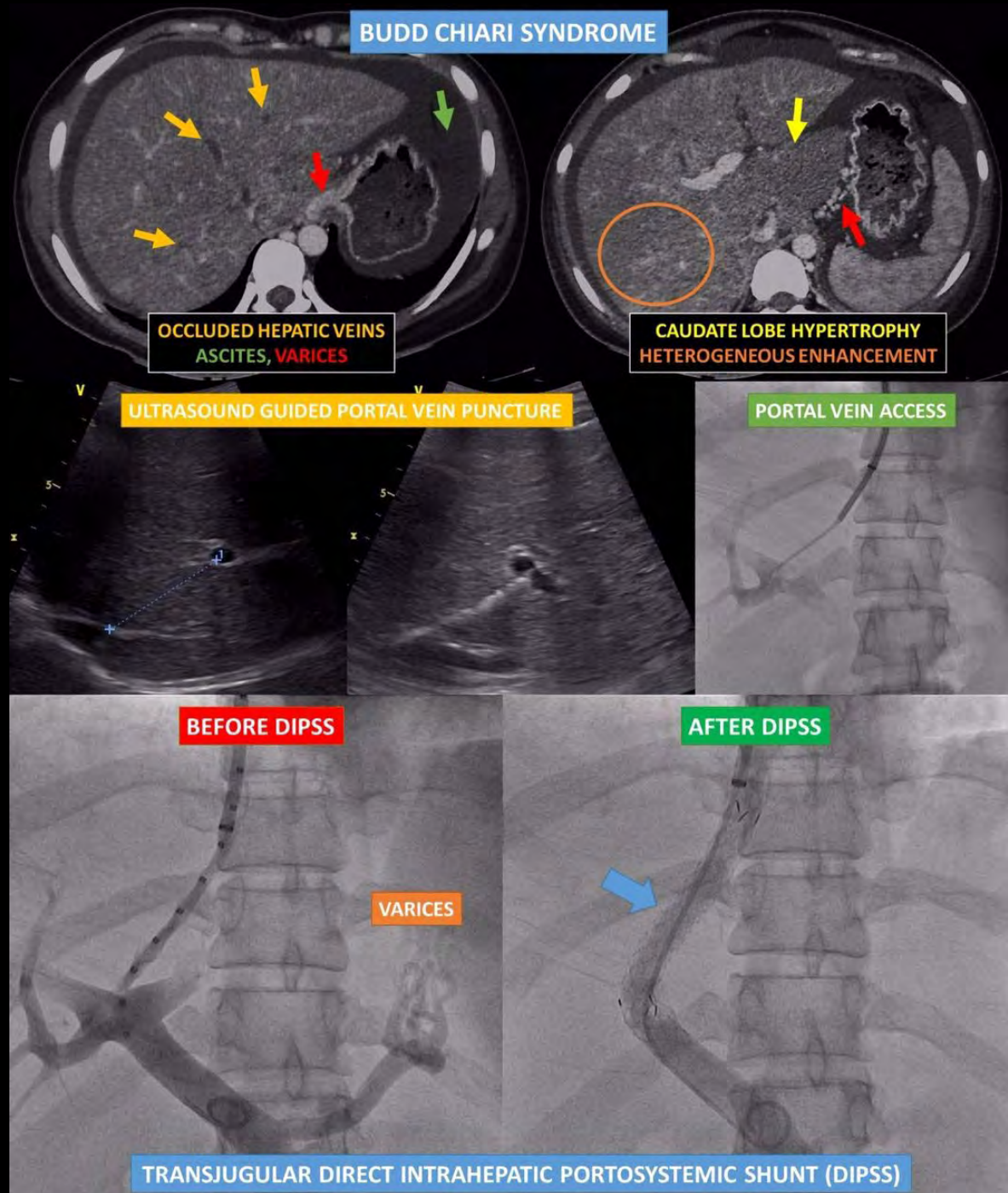




# HVOTO

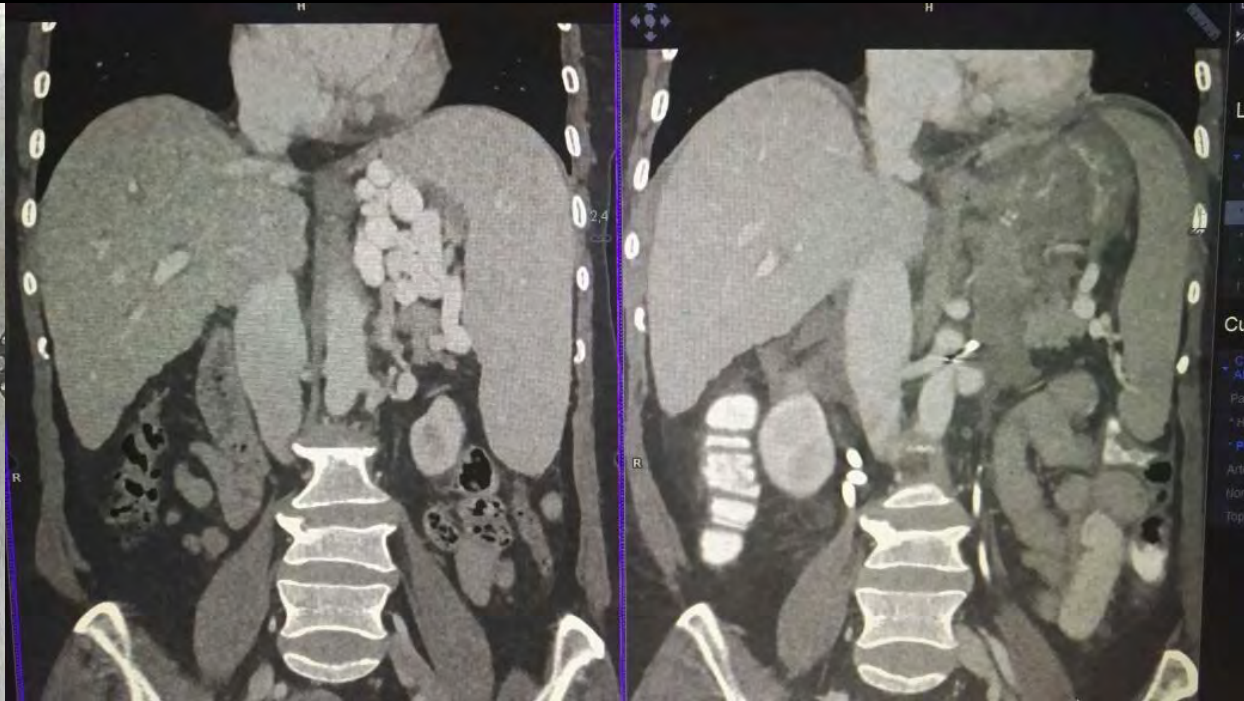
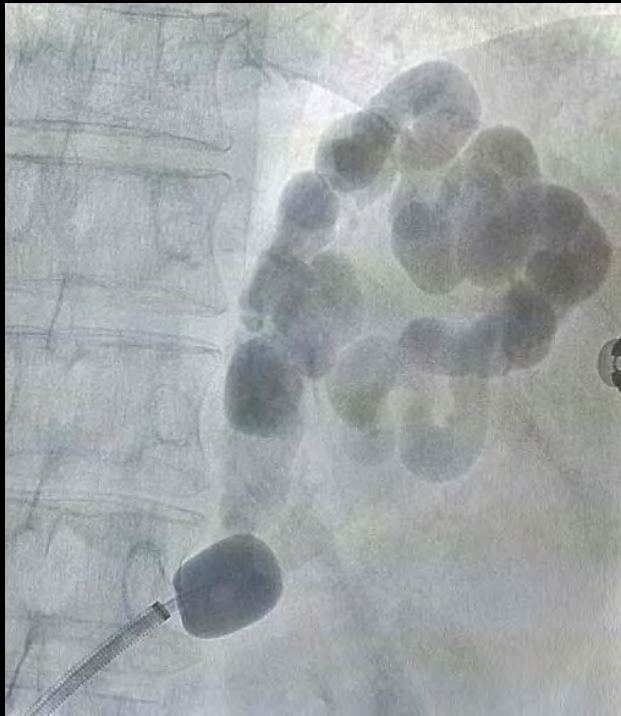


# BUDD CHIARI SYNDROME





# Variceal Bleed: BRTO





# For DNB/MD

- Causes/Pathophysio/SS/CEAP classification & IR treatment options of Varicose veins
- DVT & PE: Role of IR
- HD access route & role of IR
- TIPSS/BRTO: Indications/ Procedure steps
- Varicocele & PCS

# Take Home Message

- “Interventional Radiology or IR” is a well established entity in 2017.
- We all Radiologists who have special interest to poke Needle shall apply his/her clinical & radiological knowledge & aggressively use technical skills as the community surely needs a super hero.

**THANK YOU FOR PATIENT LISTENING**

# Puncture/Access needle

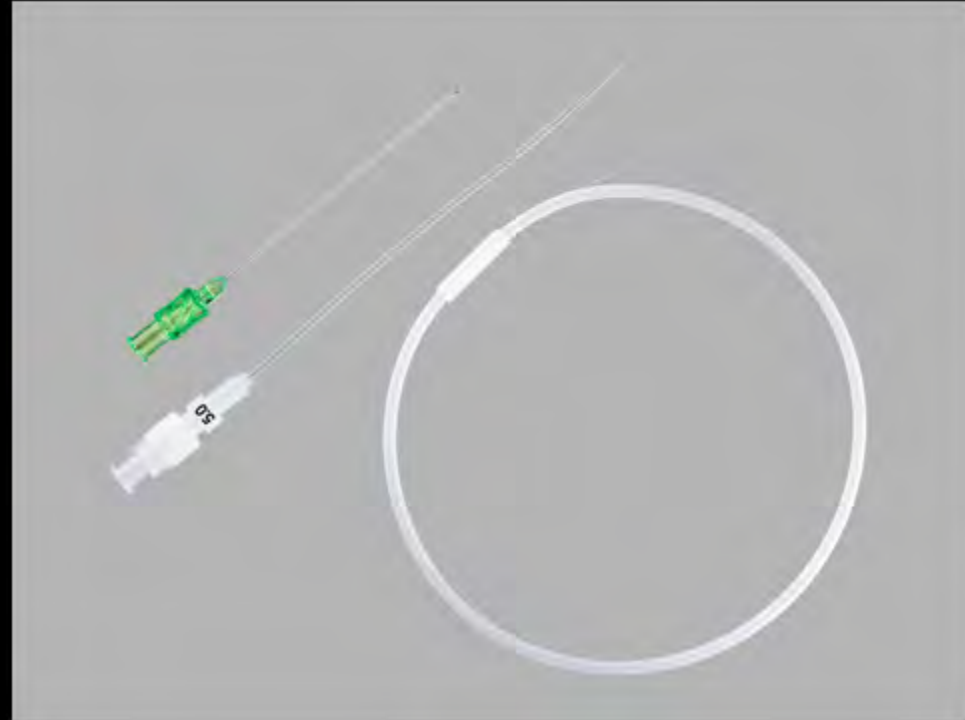
- Typical single wall access needles: 18 or 19 G
- Sharp beveled distal edge



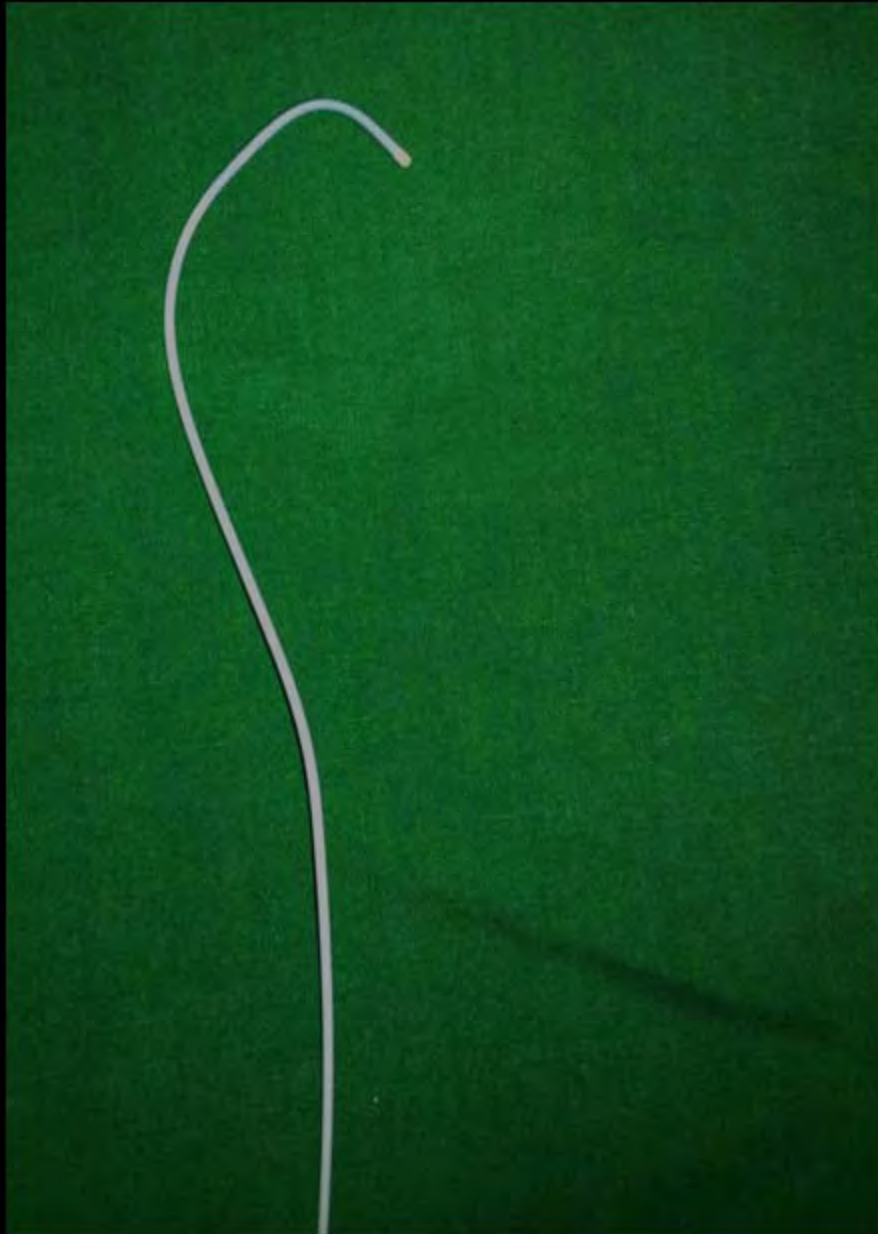


# Micropuncture Access set

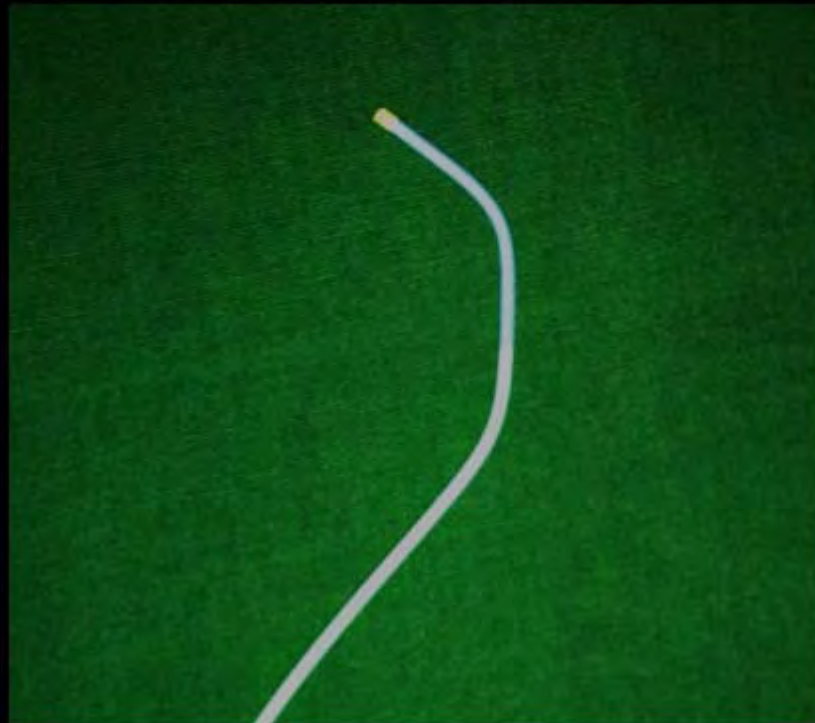
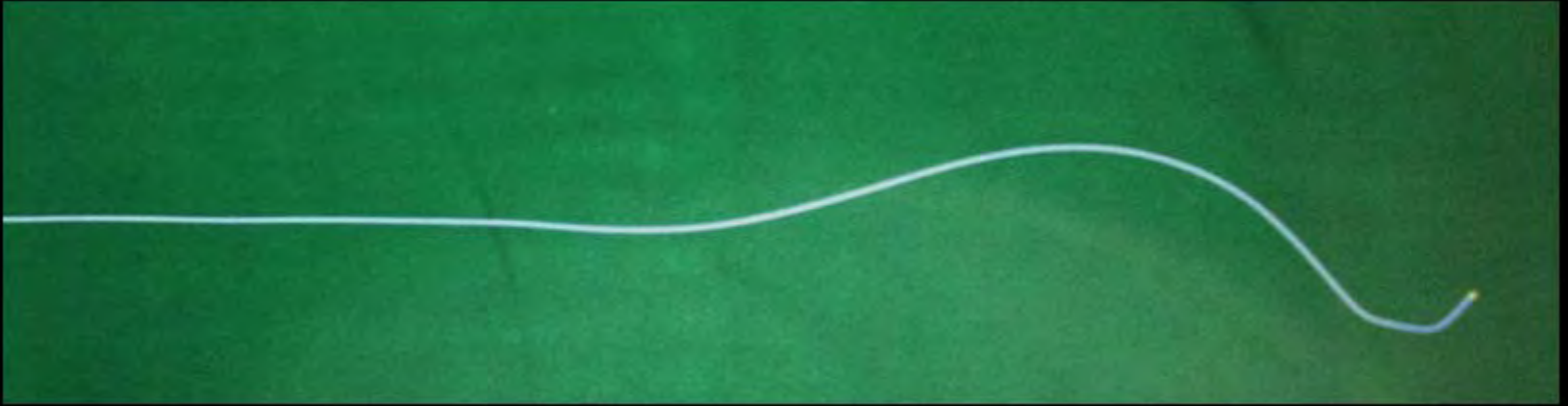
- 3 parts
- Beveled tip needle 21 G
- Dilator
- 0.018 inch guide wire



# COBRA

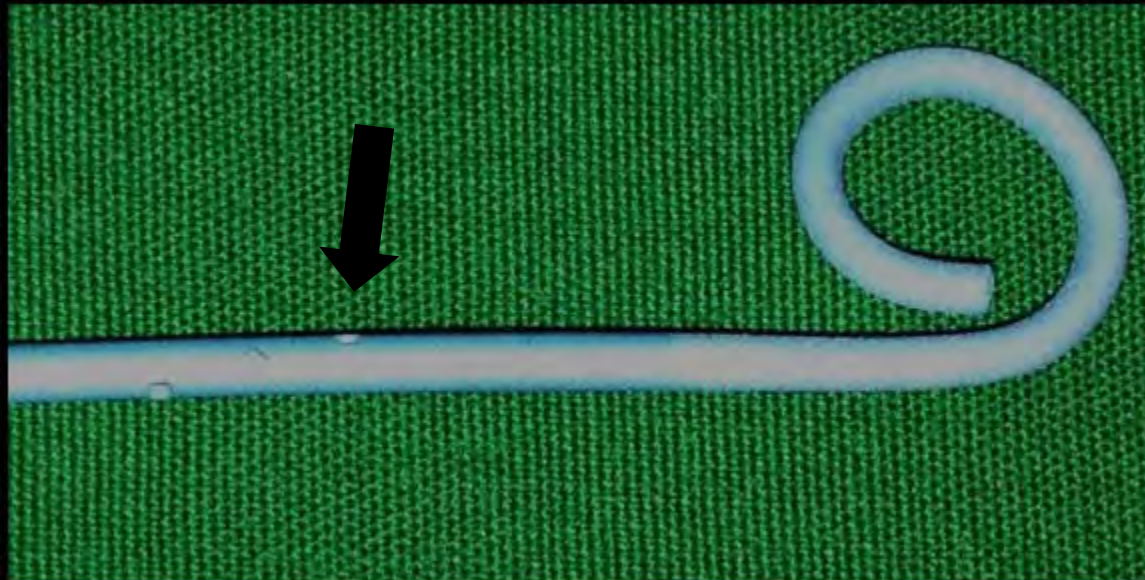
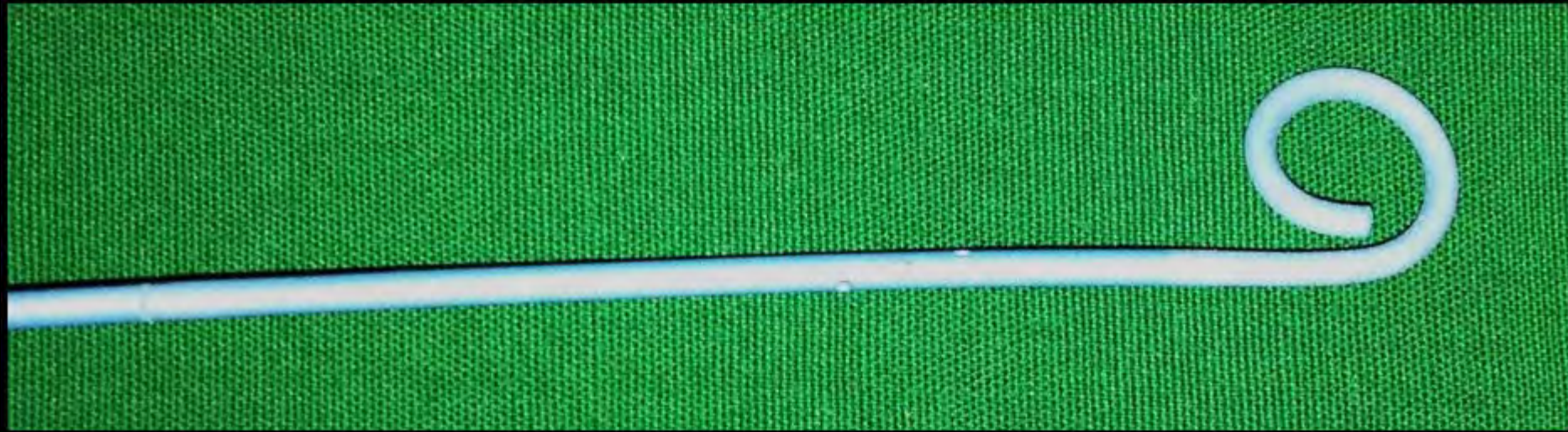


# HEAD HUNTER

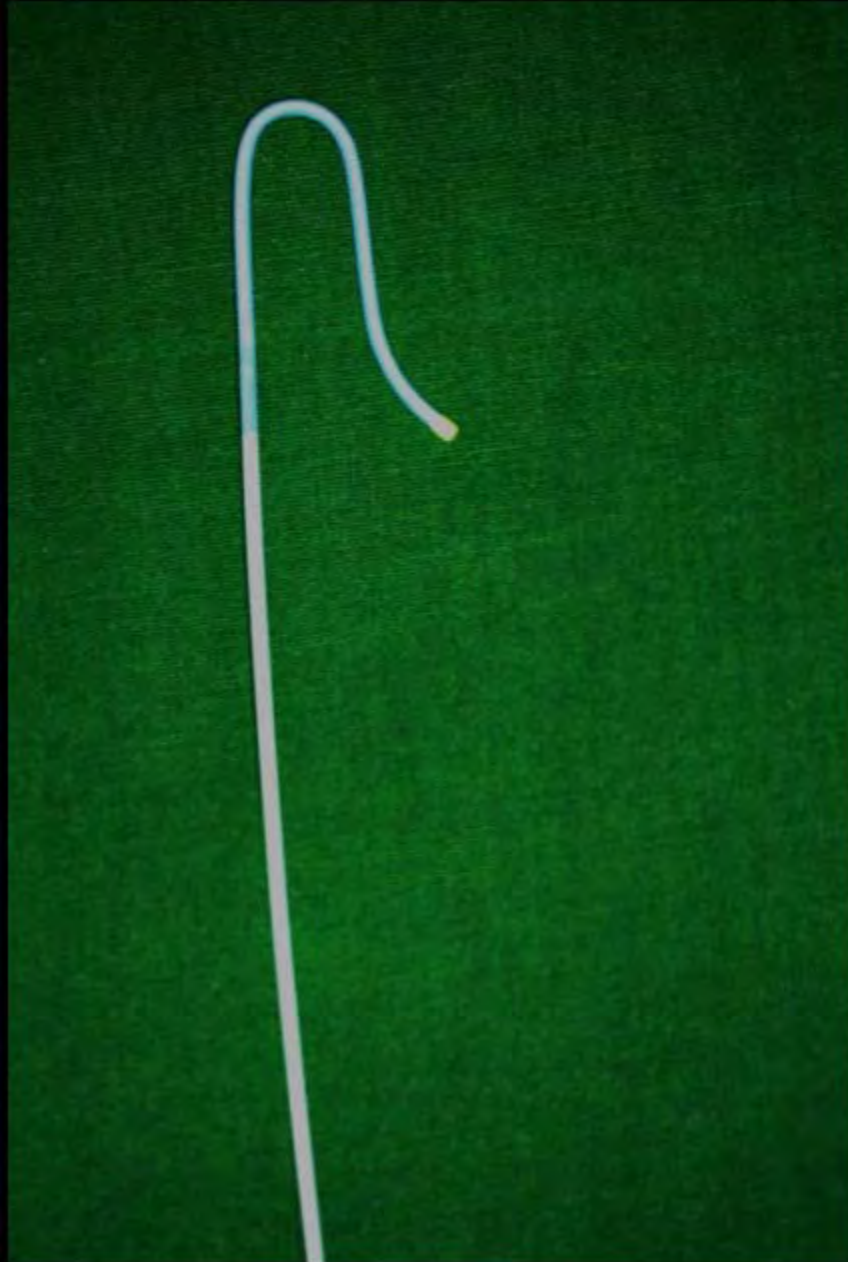




# PIG TAIL

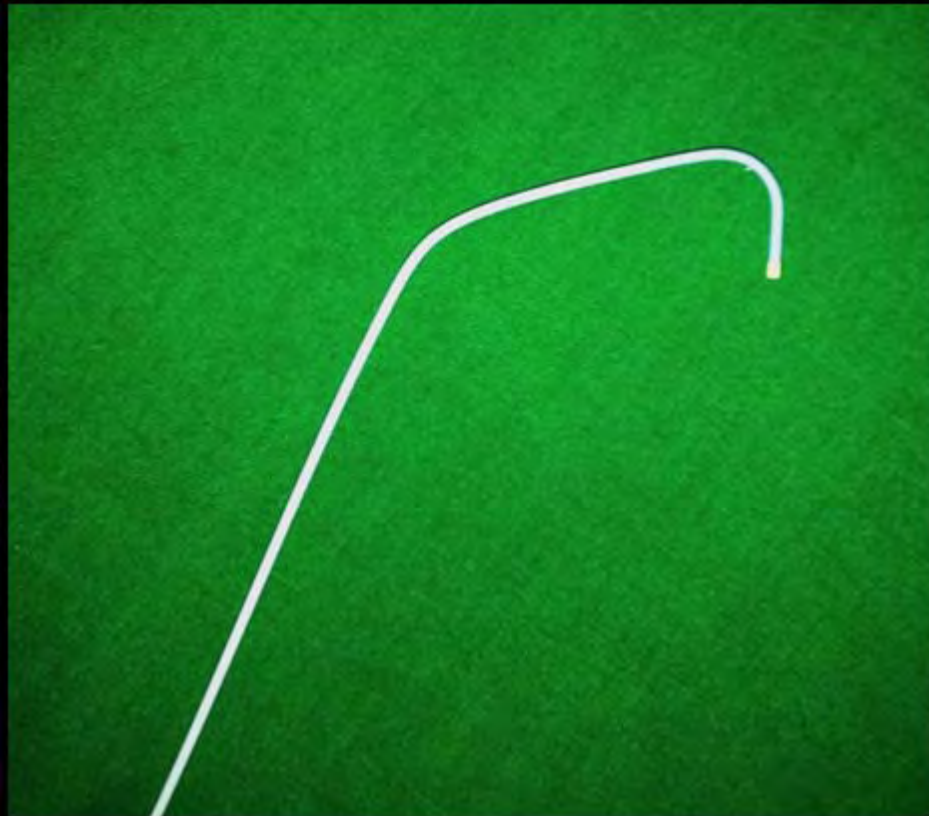
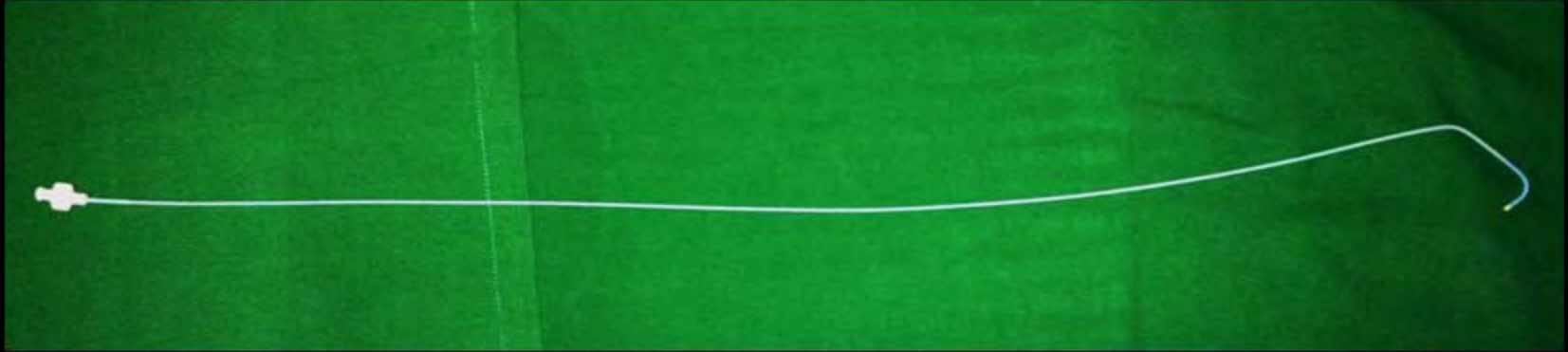


# SIM

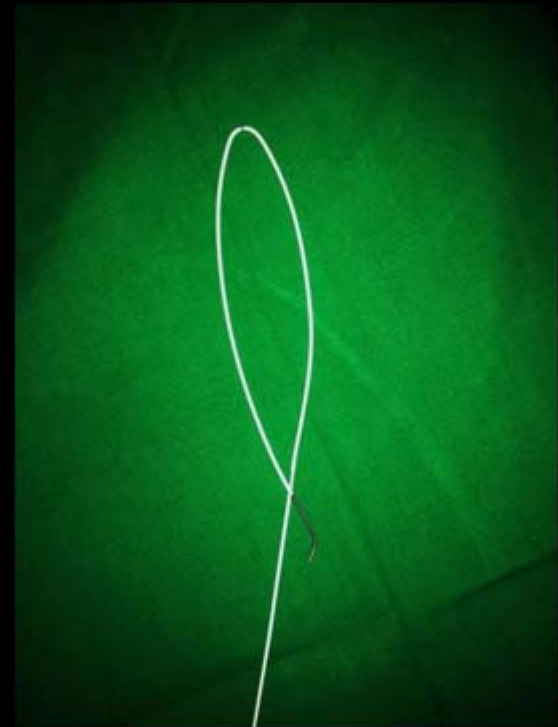
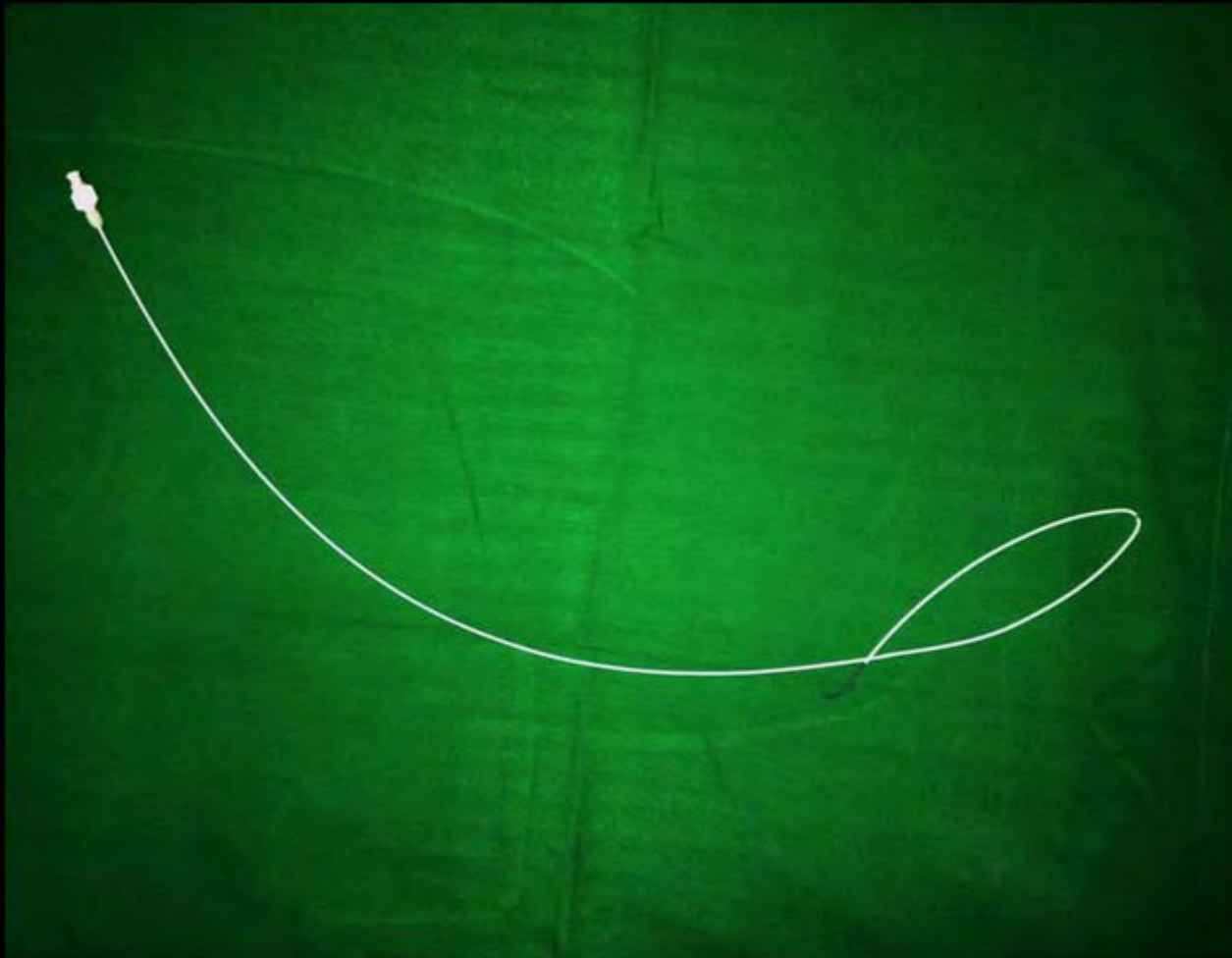




# RDC

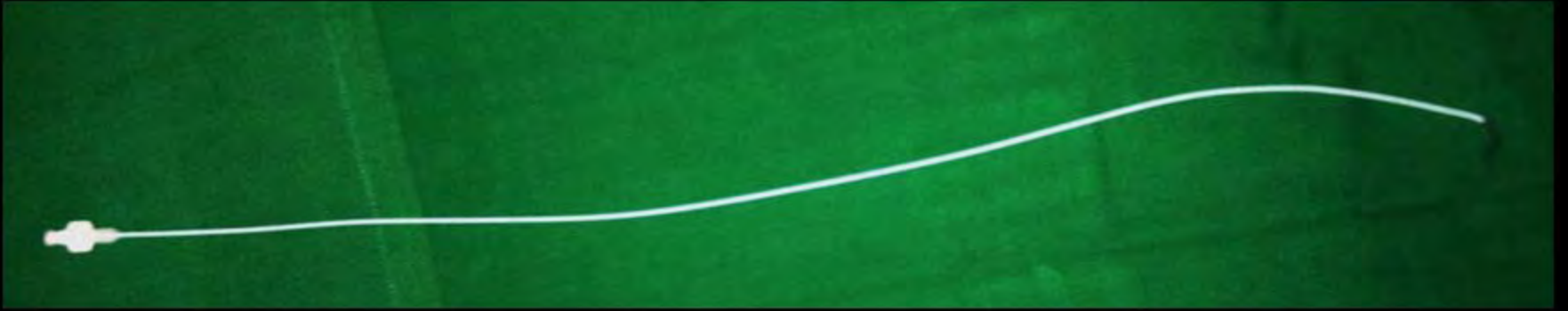


# RUC

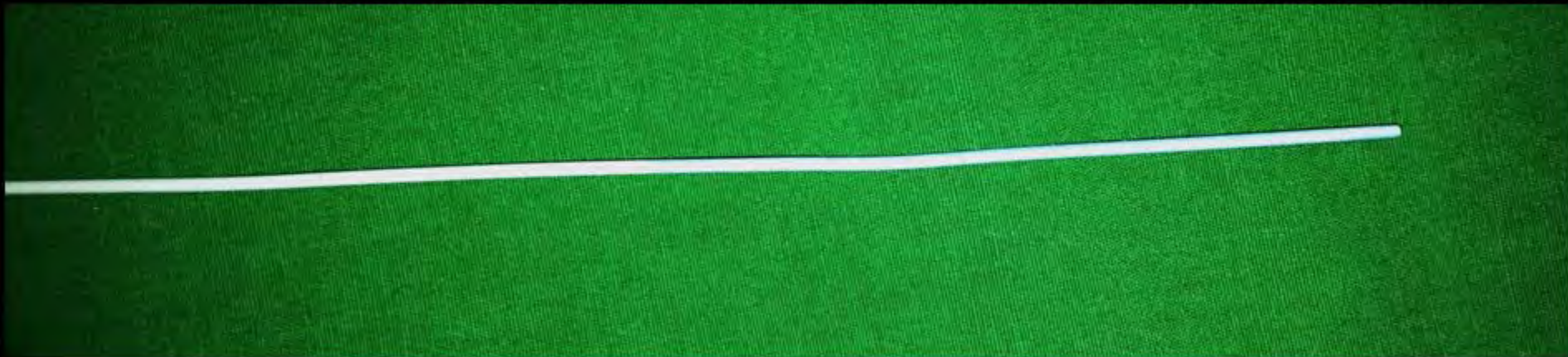




# SHEPHERD'S HOOK



# STRAIGHT FLUSH

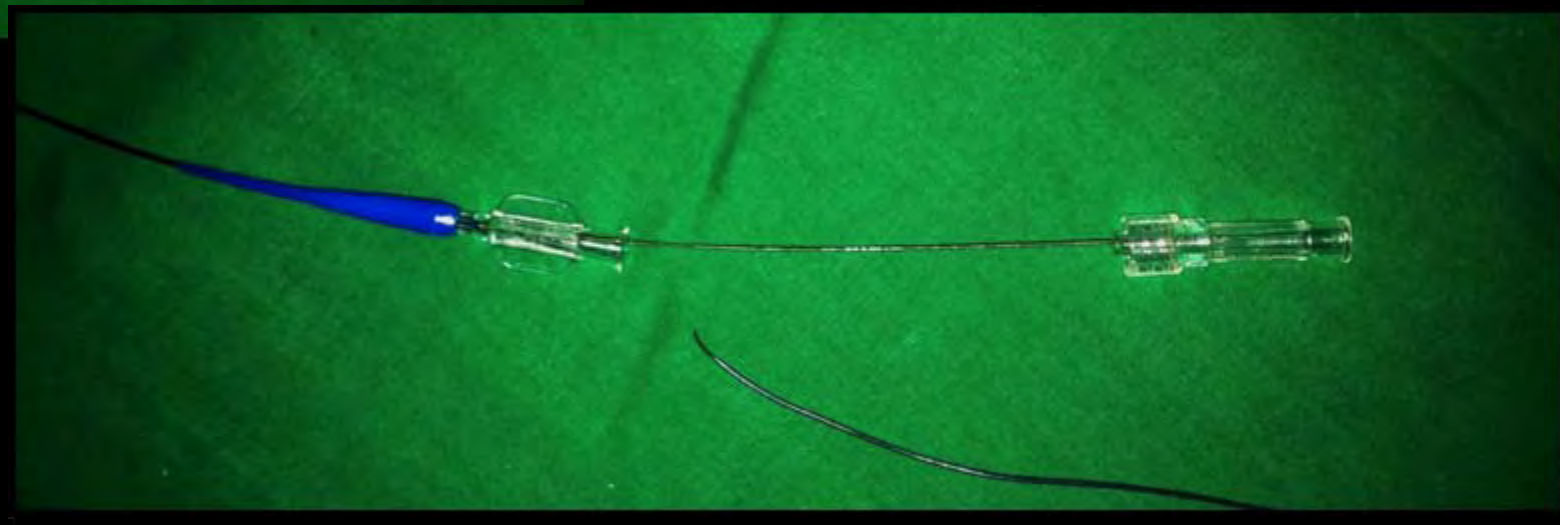
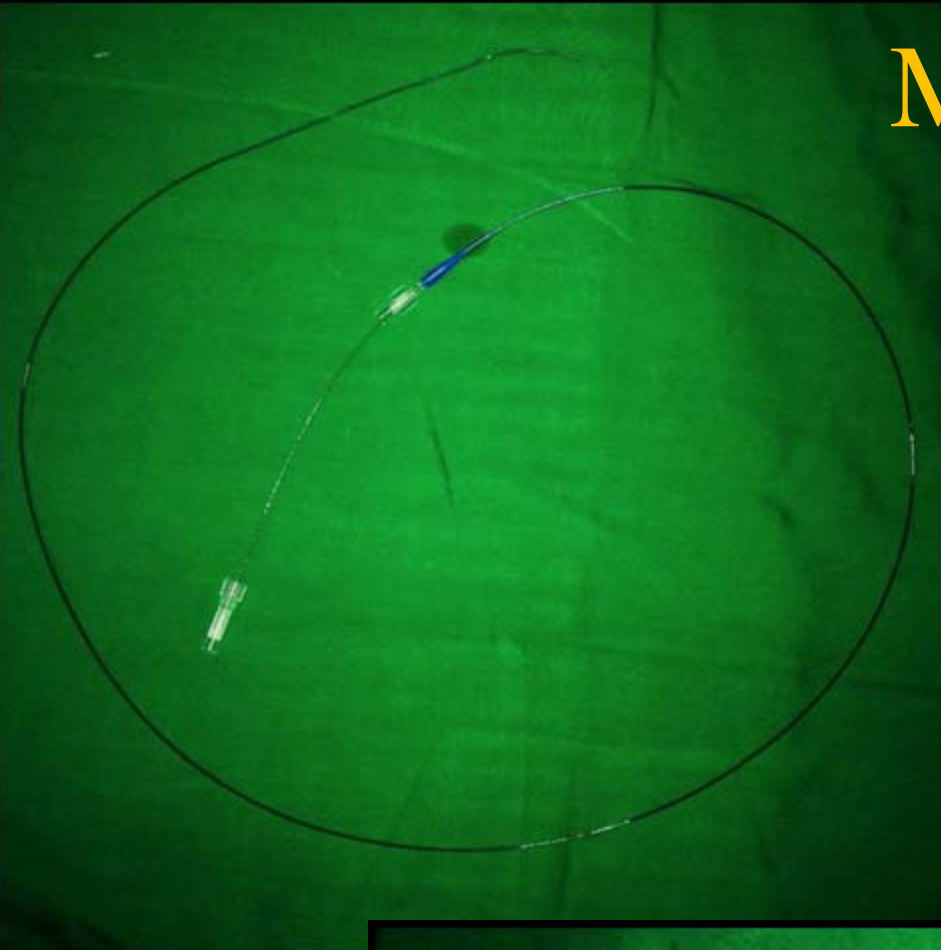


# MULTIPURPOSE

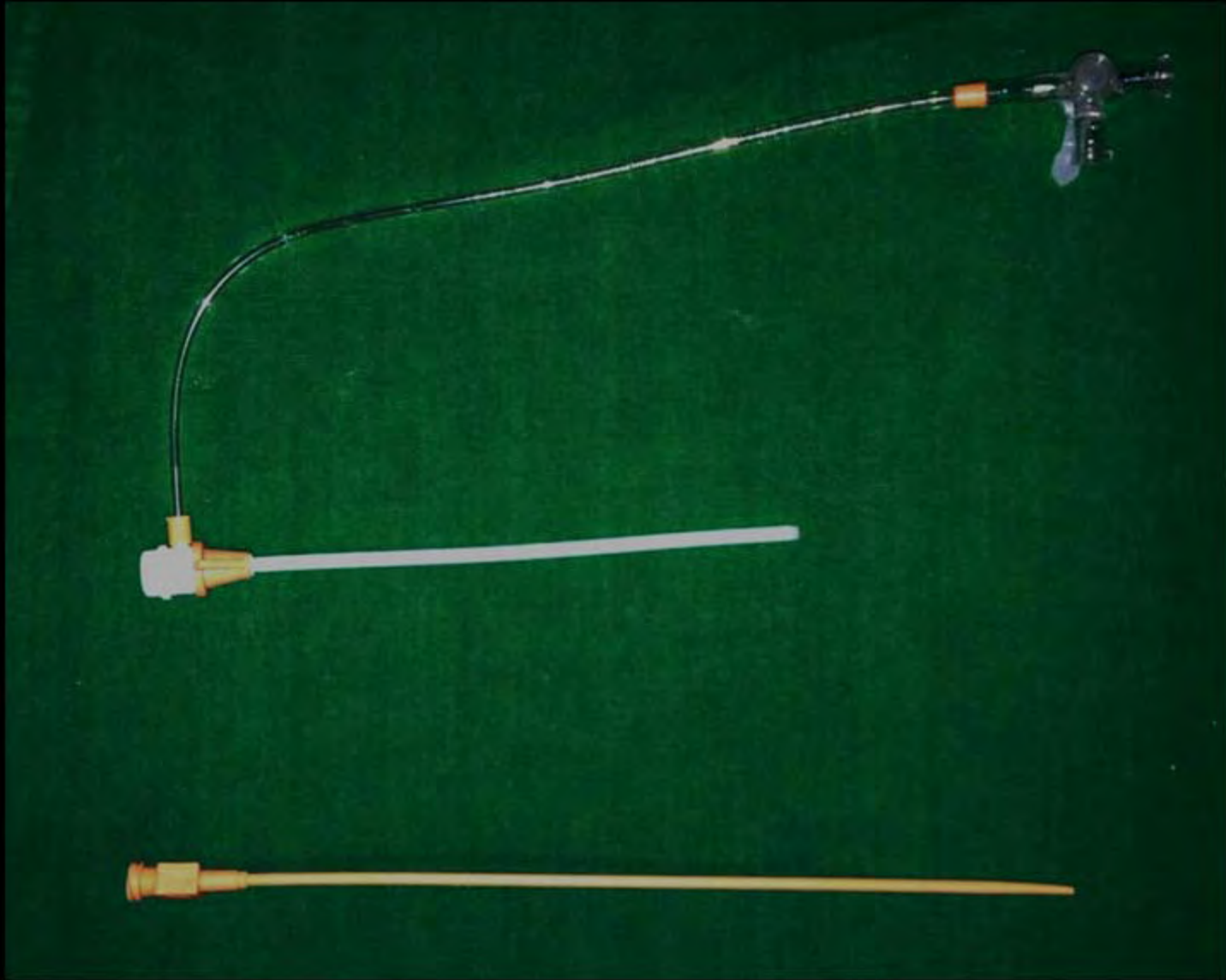




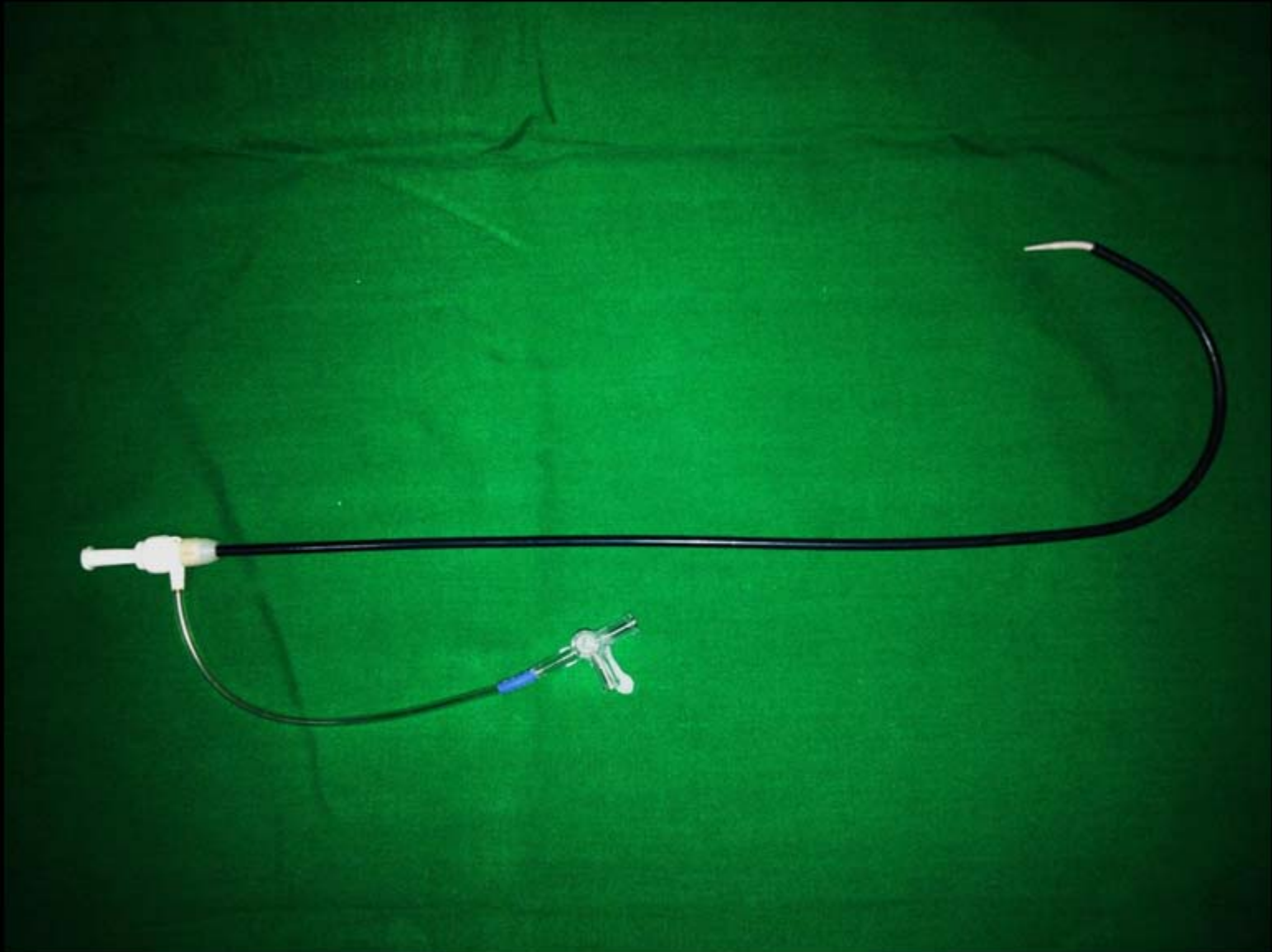
# MICRO-CATHETER



# INTRODUCER SHEATH



# BALKIN SHEATH

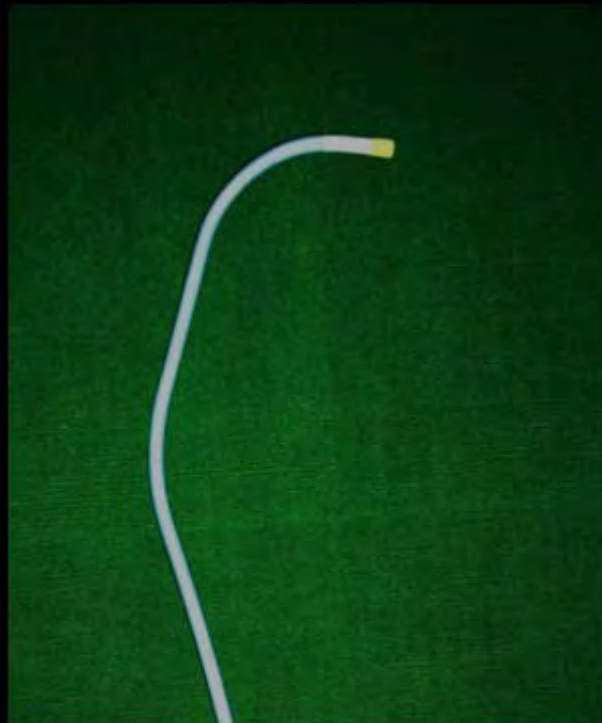
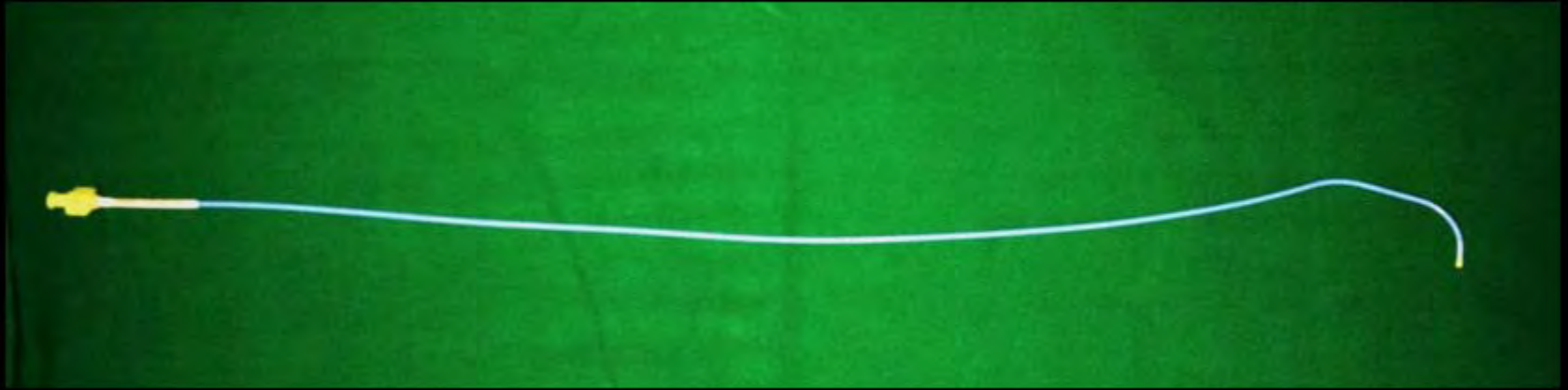




# LONG SHEATH



# GUIDING CATHETER

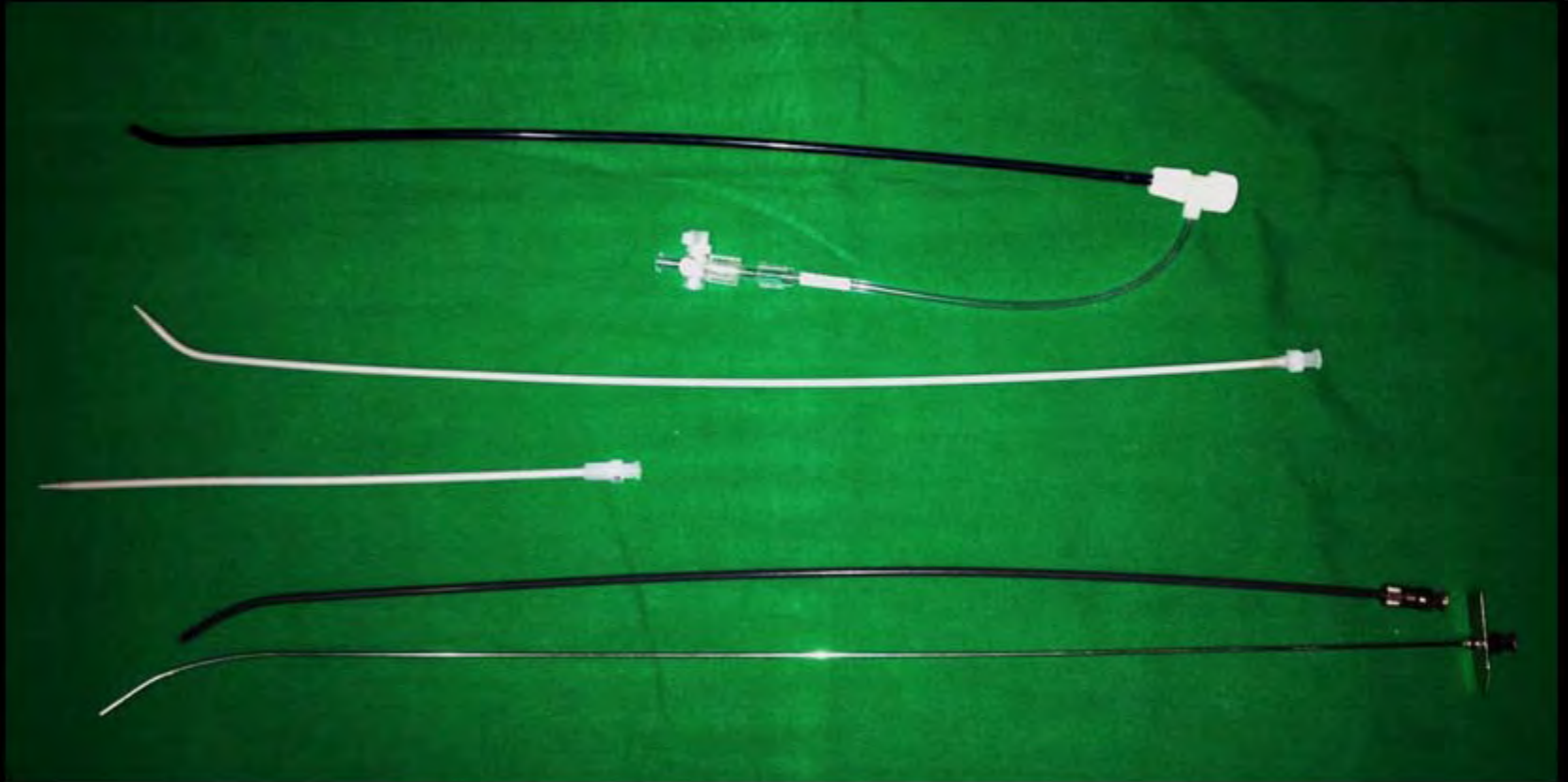


# LONG SHEATH

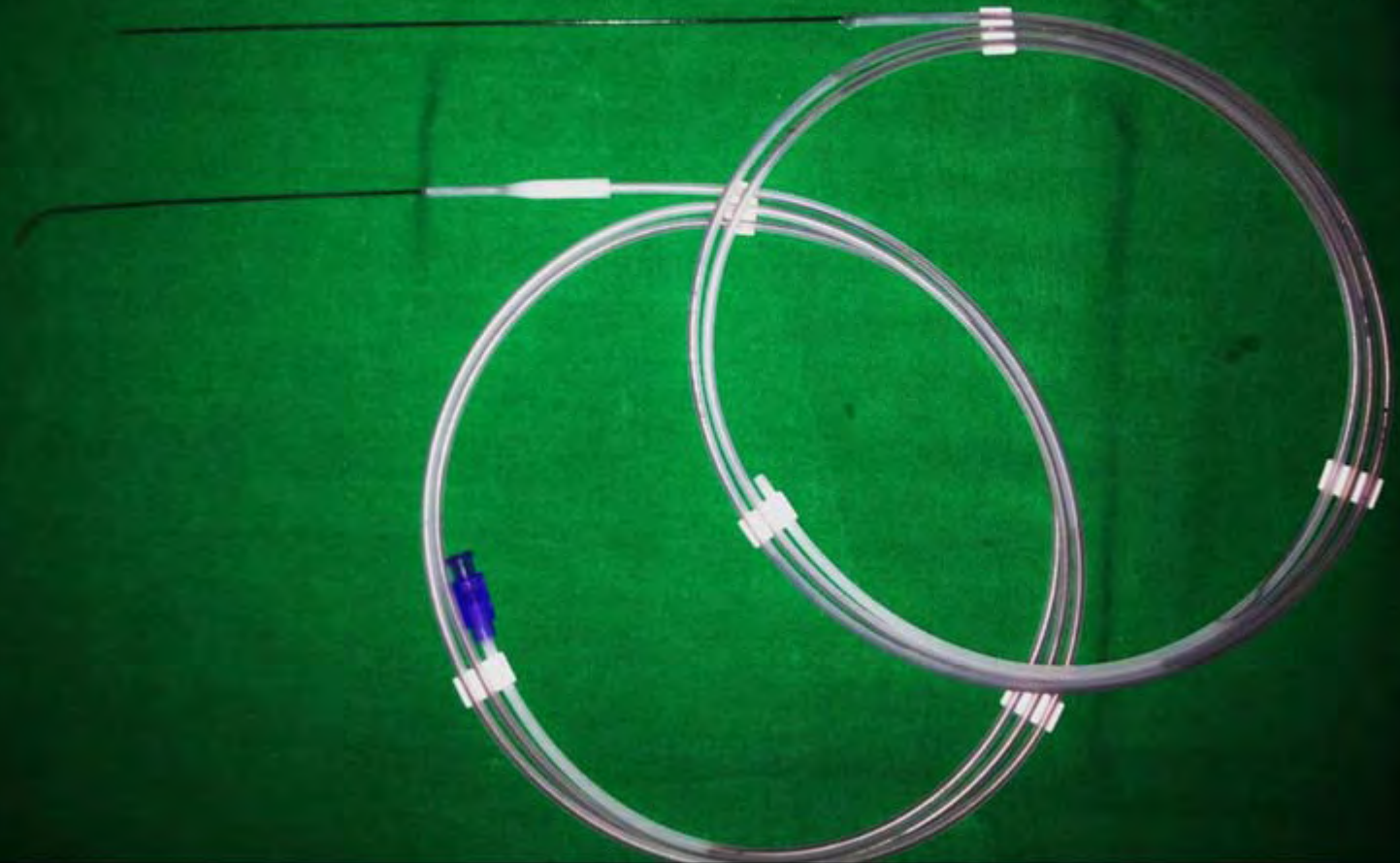
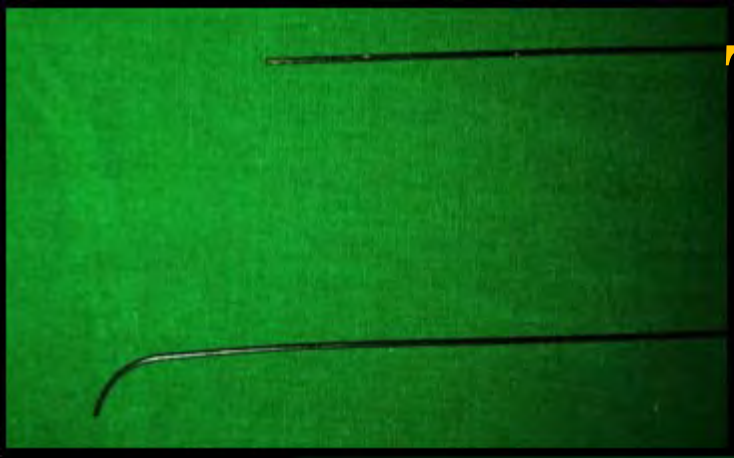




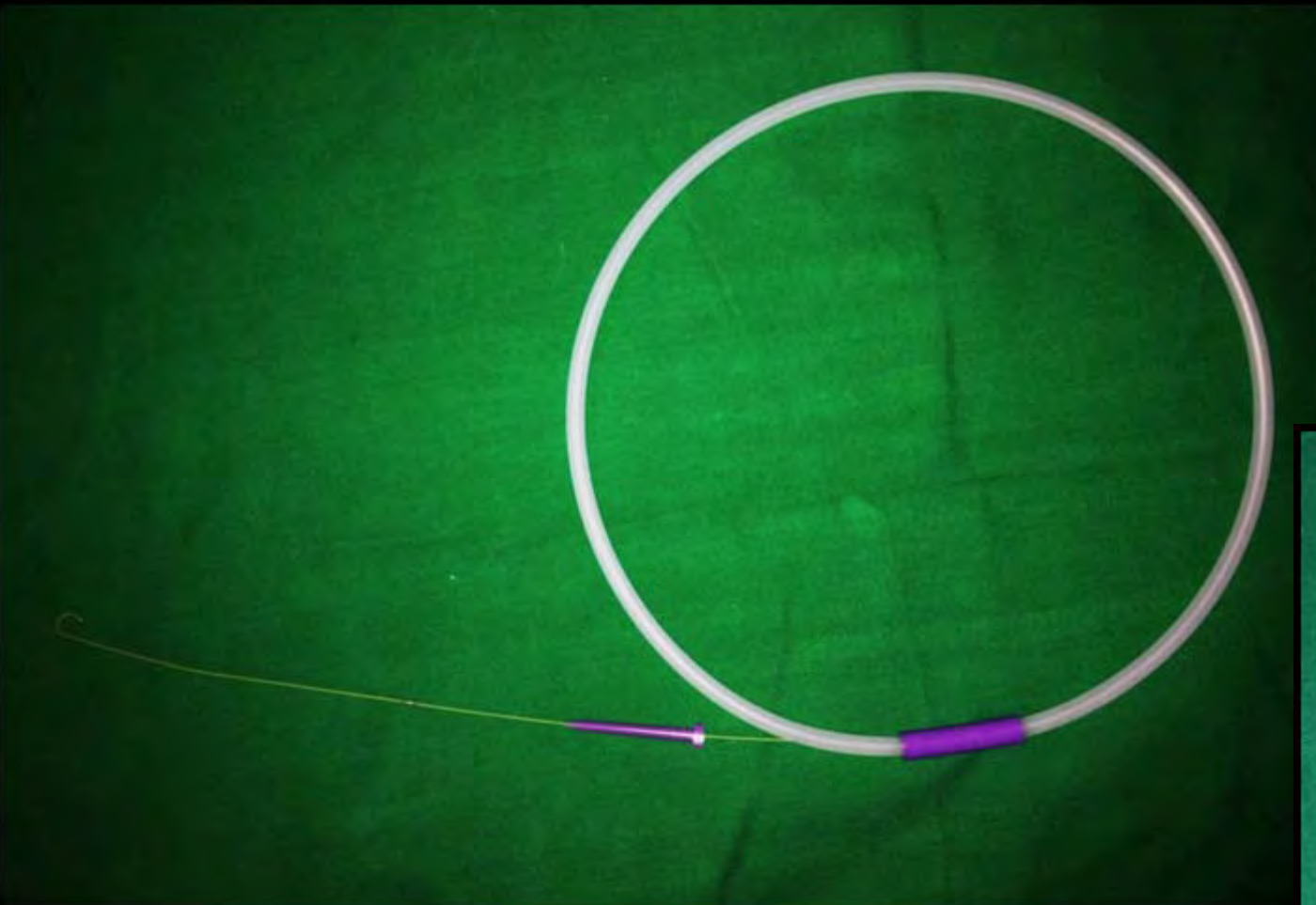
# TIPSS SET



# TERUMO GLIDEWIRE

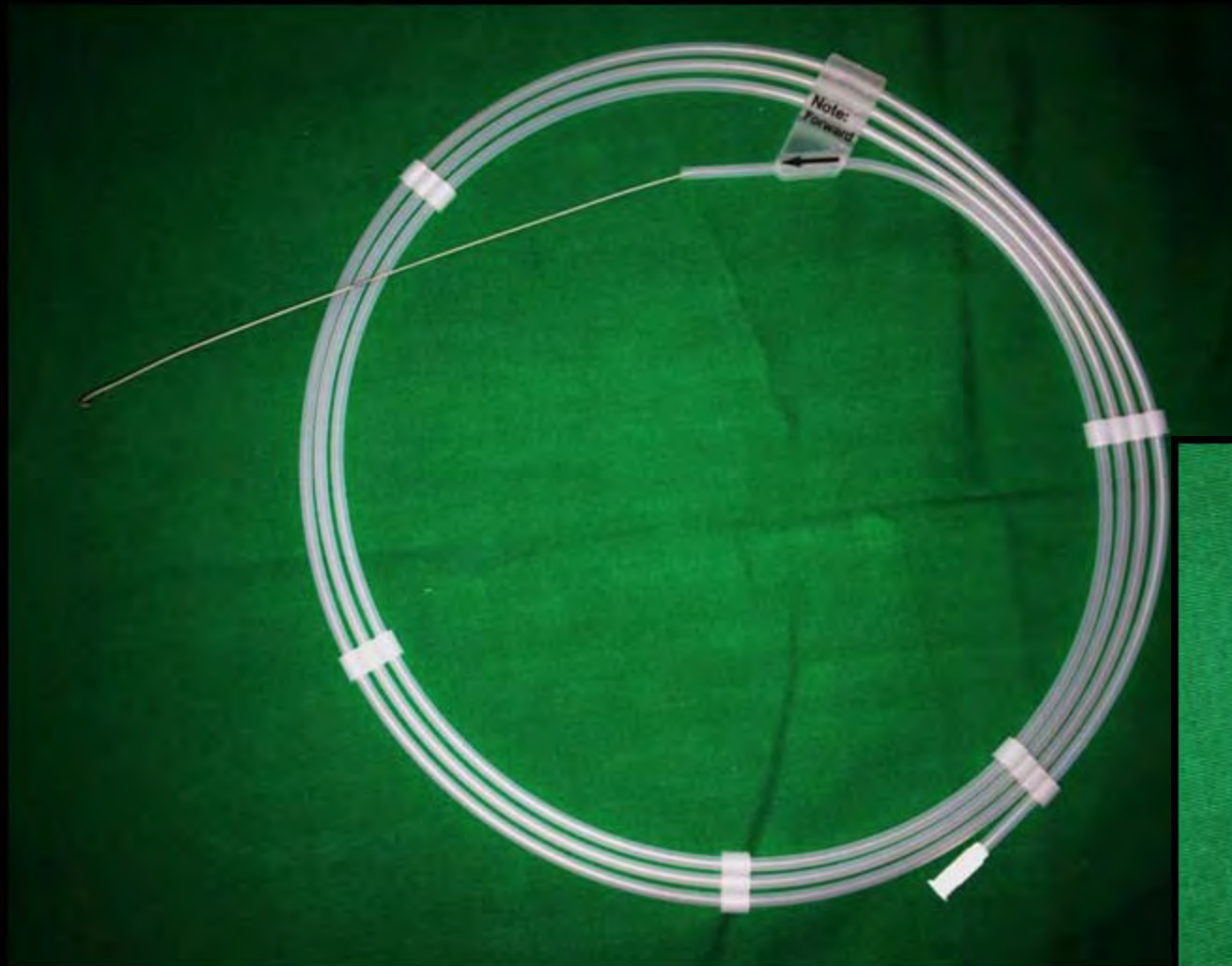


# AES GUIDEWIRE



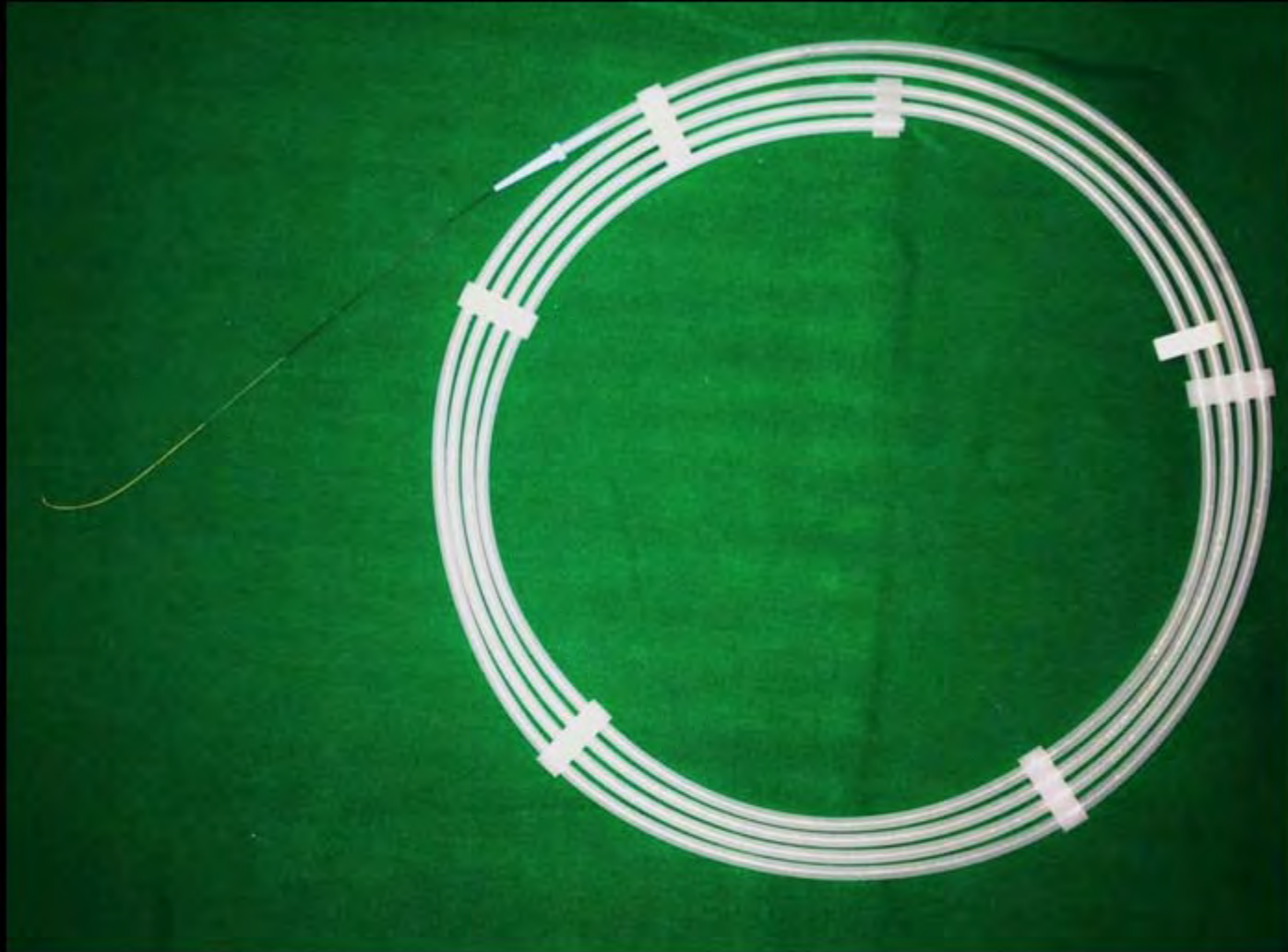


# AUS GUIDEWIRE

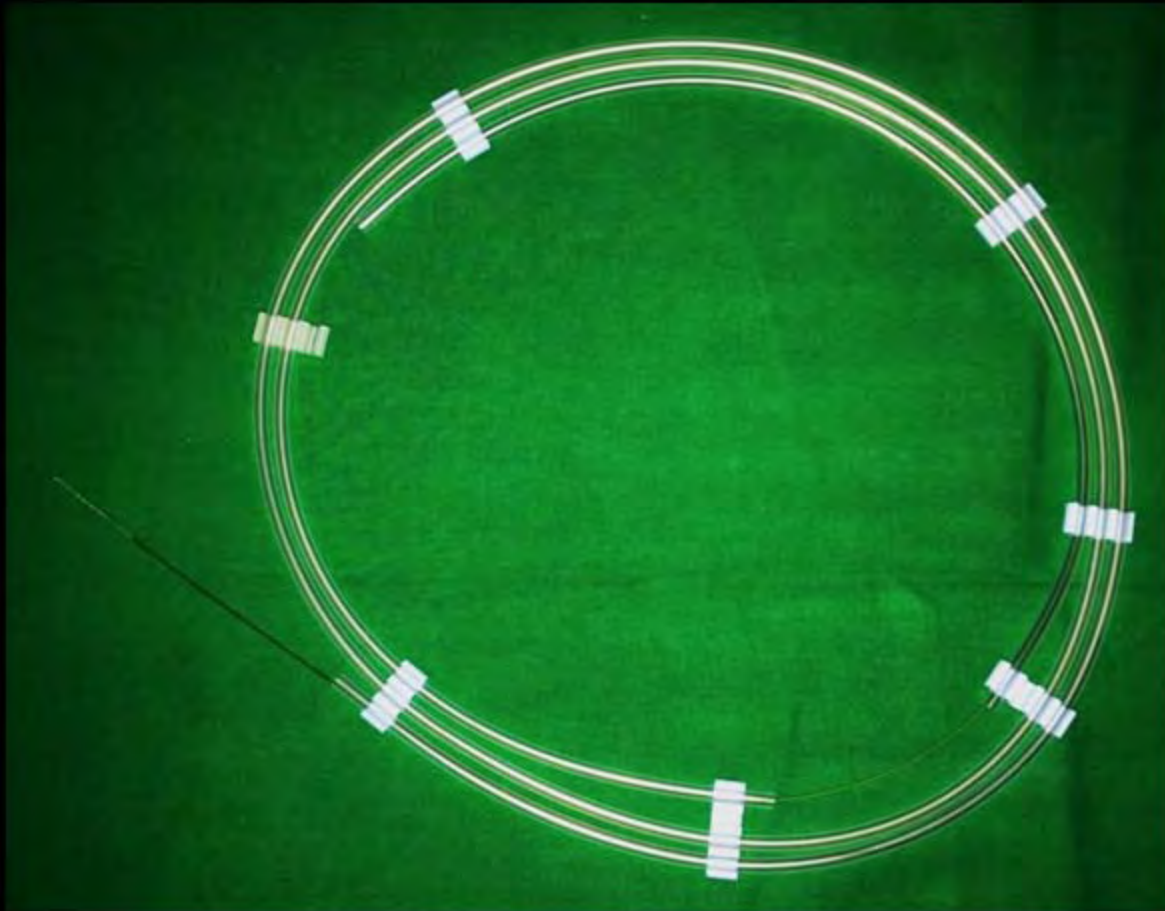




# 0.018'' NITREX GUIDEWIRE



# 0.014'' STABILIZER GUIDEWIRE



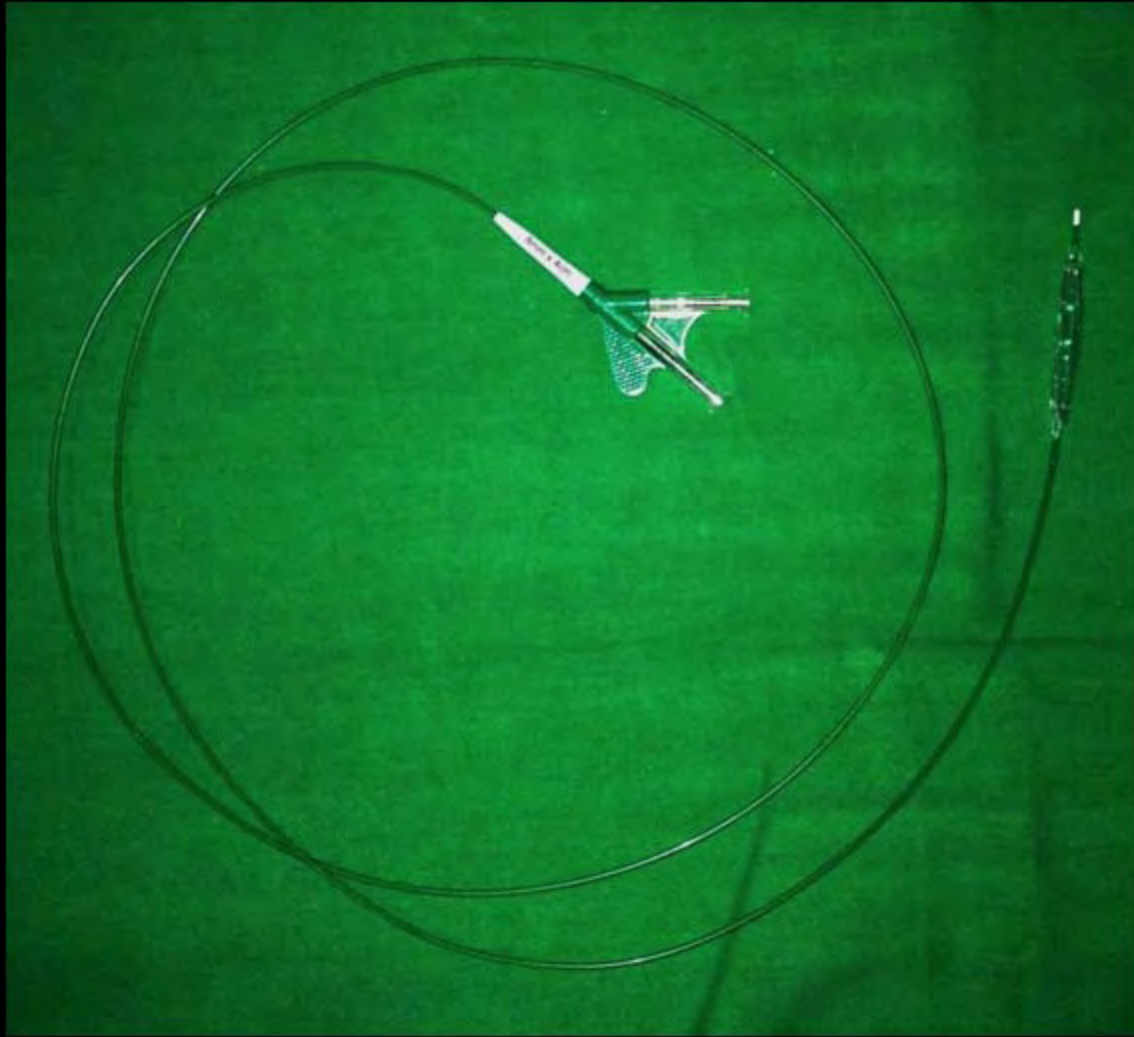


# SNARE





# BALLOON





# BALLOON

COOK MEDICAL

## Advance® 35LP

Low Profile PTA Balloon Dilatation Catheter

REF PTA5-35-135-8-4.0

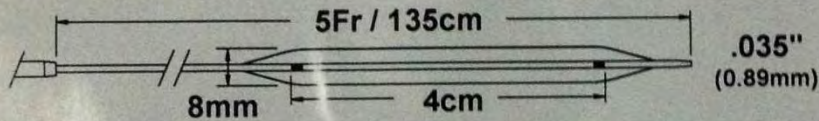
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8 Atm/Bar



8mm x 4cm



STERILE EO

2014-04



Rx only

LOT F2644363

2011-04



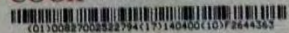
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750 Daniels Way  
Bloomington, IN 47404 USA  
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EC REP William Cook Europe ApS  
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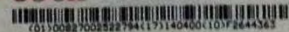
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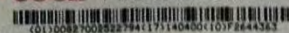
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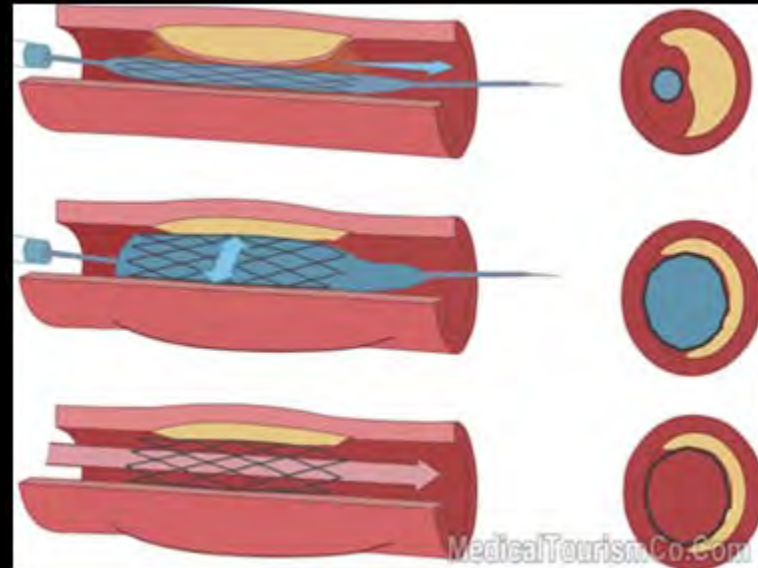
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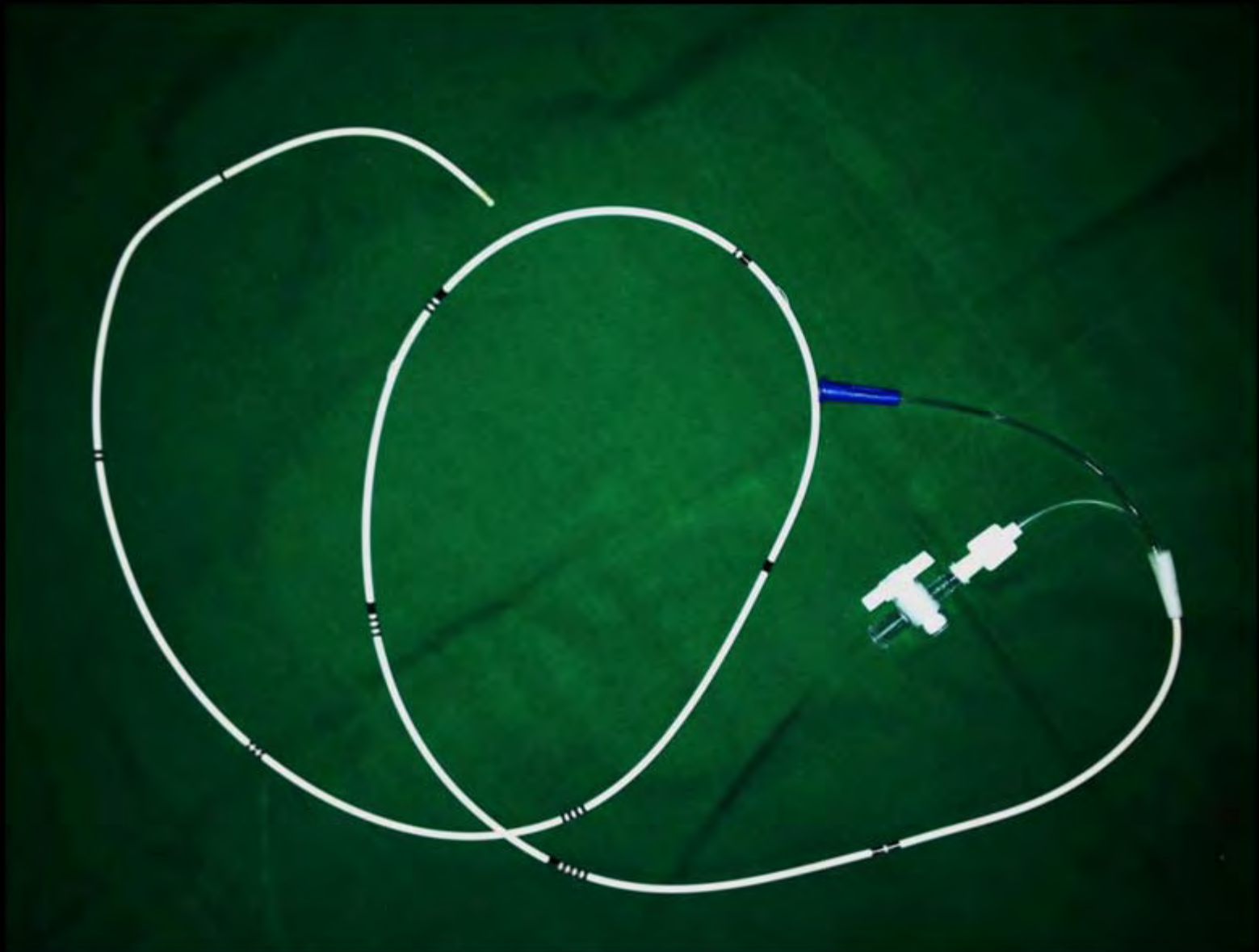
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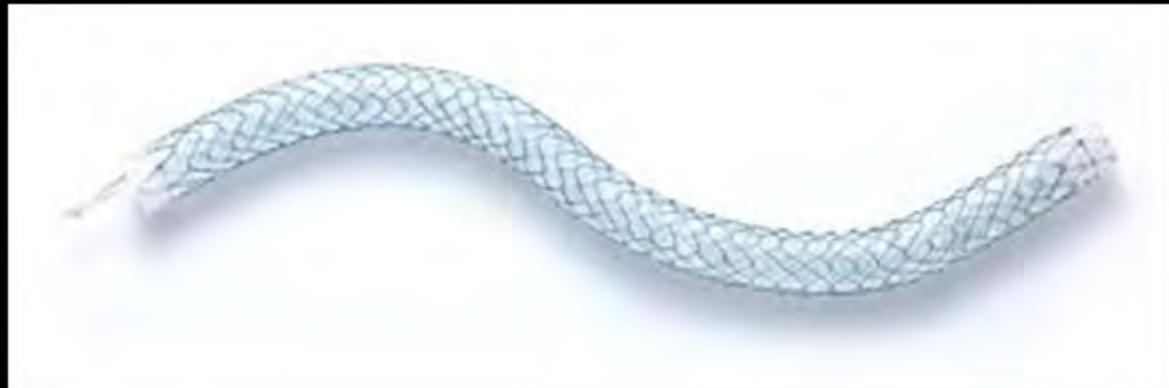


MedicalTourism.Co.Com

# COMPLIANT BALLOON



# STENTS





# COVERED STENT



PASMAN  
MALE

G10

INTERVEN  
RADIOLOG  
G.M.C. N

18387

DIXAS 11

MRIJANA RD DESMAYARD





# SCLEROTHERAPY



BLEOMYCIN



SODIUM TETRADECYL SULFATE



# LIQUID EMBOLICS



LIPIODOL



HISTOACRYL

# EMBOLIZATION AGENTS

POLY VINYL ALCOHOL



EMBOSPHERE



GELFOAM

# EMBOLIZATION AGENTS



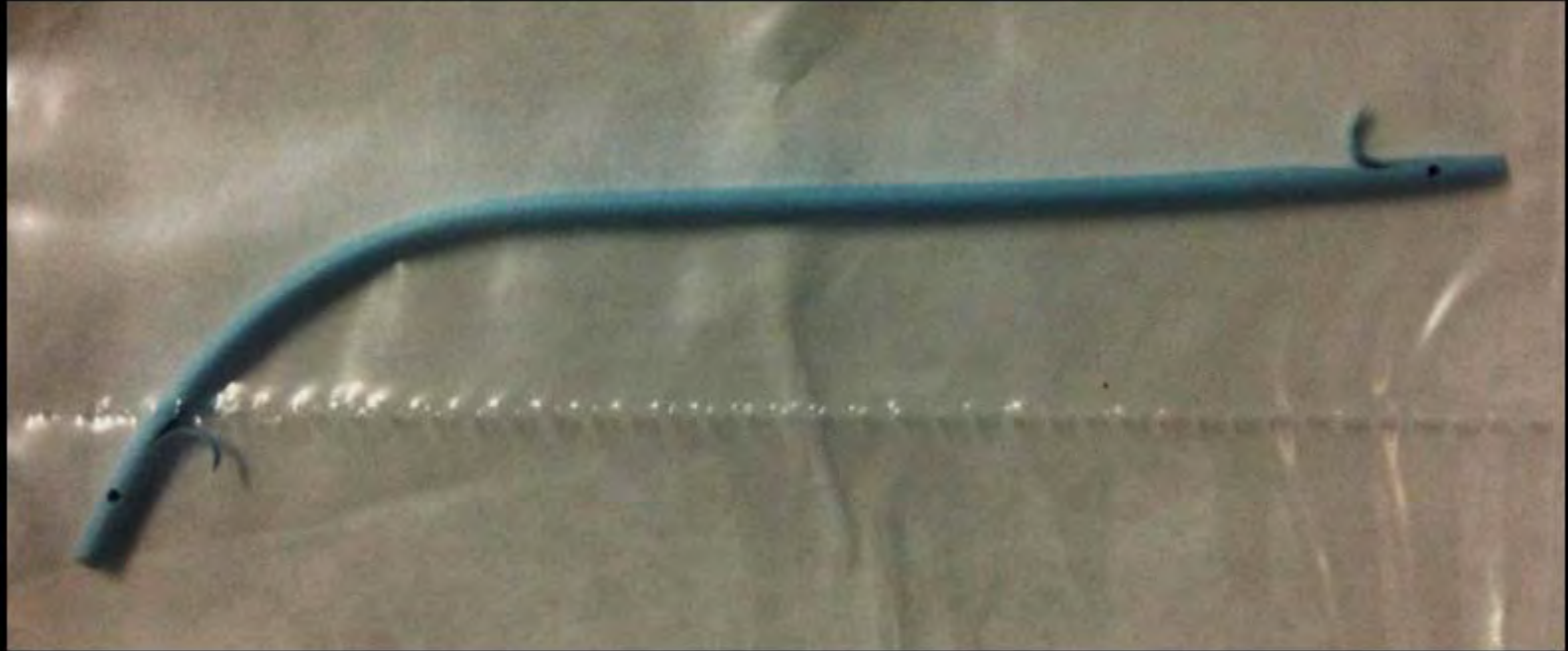
## COILS



# PIG TAIL CATHETER



# PLASTIC BILIARY STENT

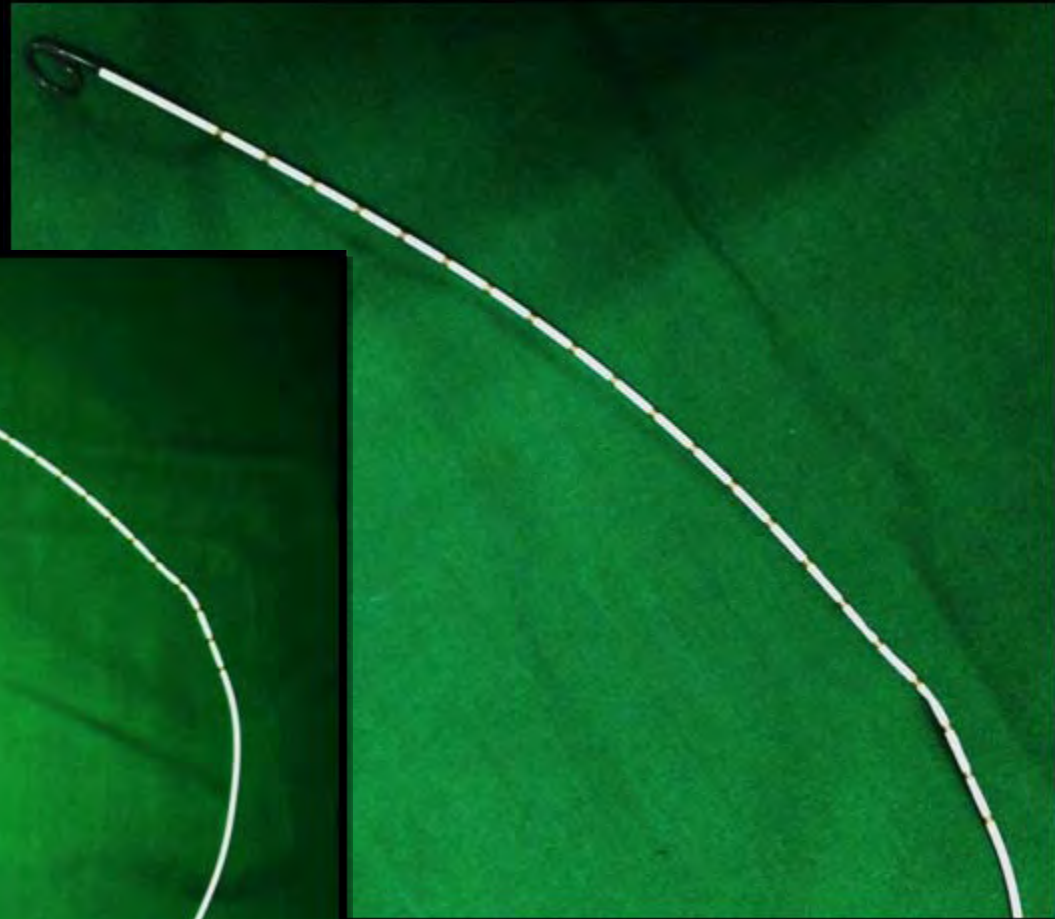
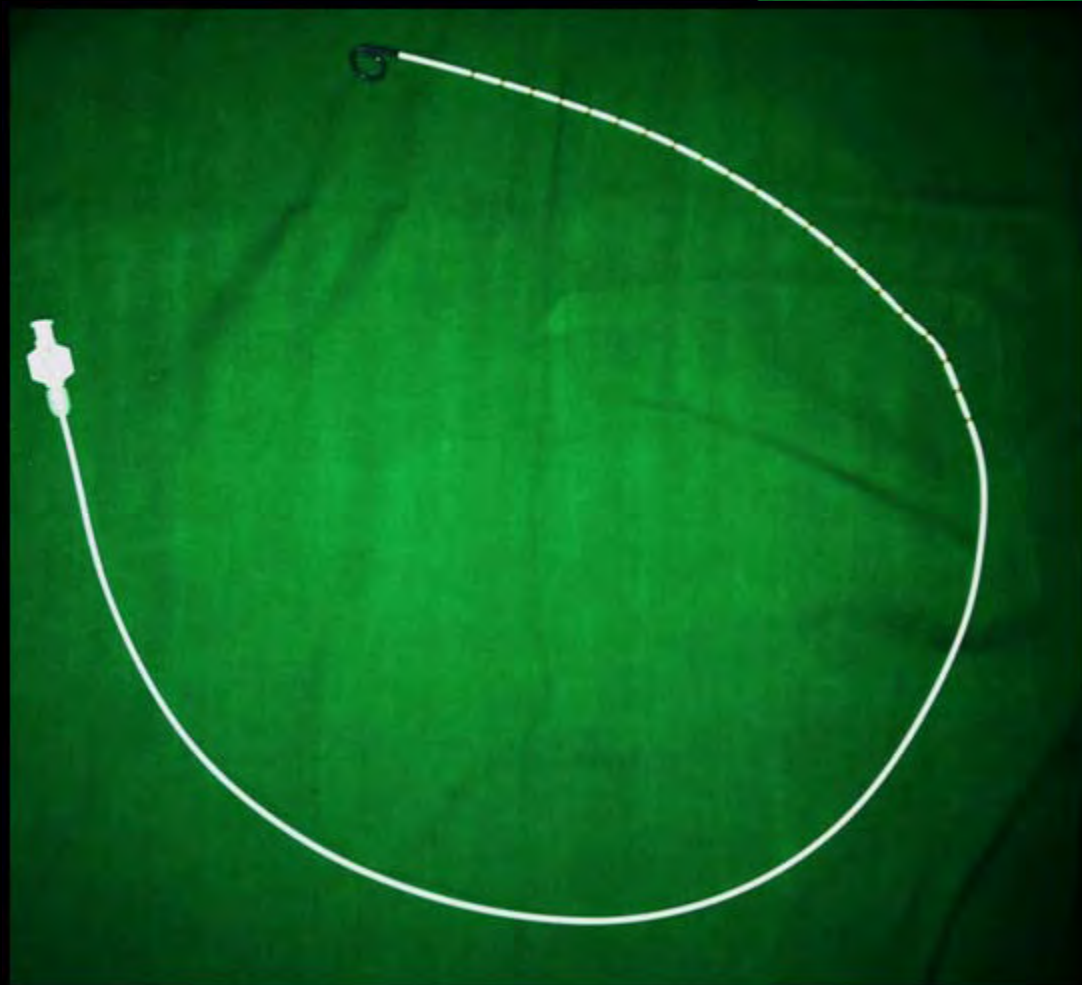


# DOUBLE J STENT





# MARKER PIG

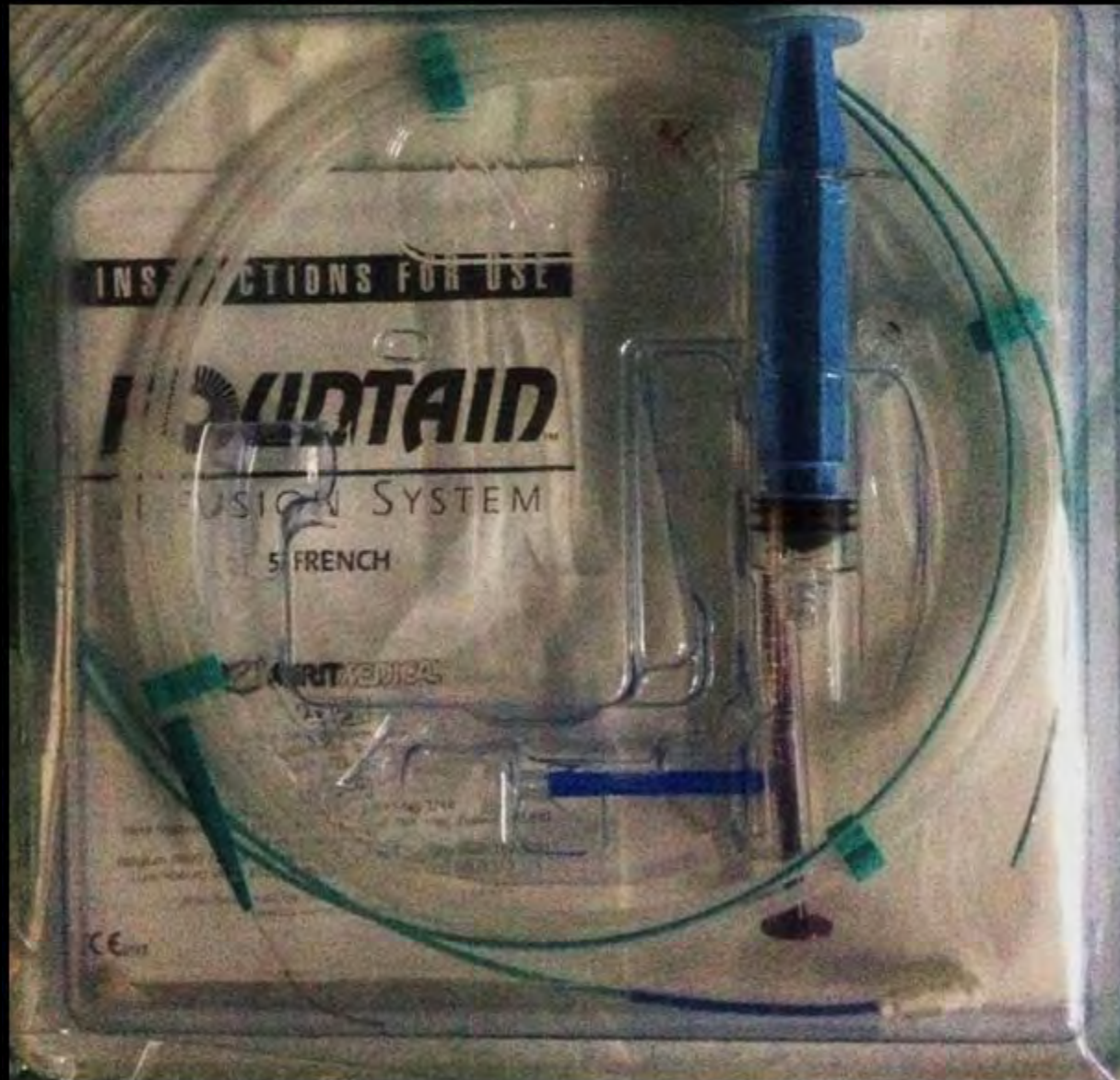


# TRANSJUGULAR BIOPSY NEEDLE

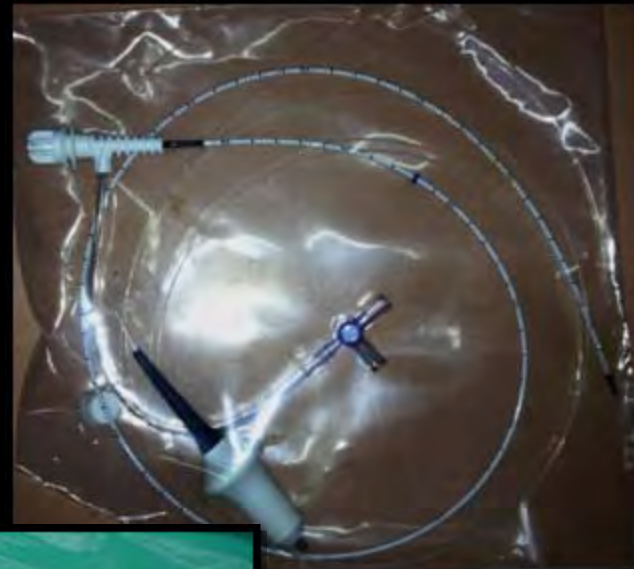




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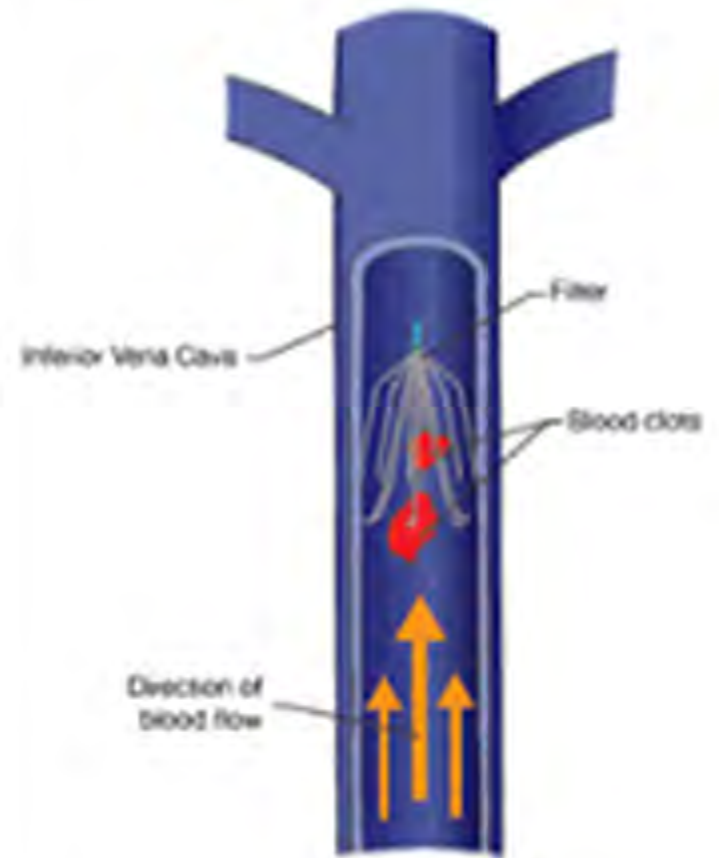
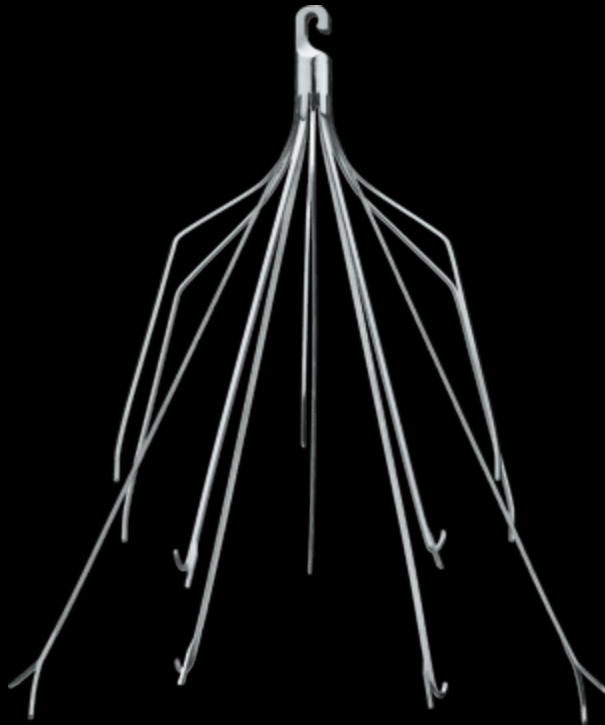


# EVLT KIT

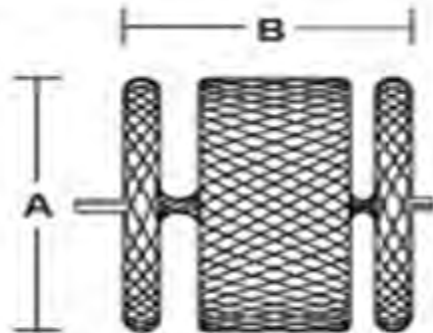
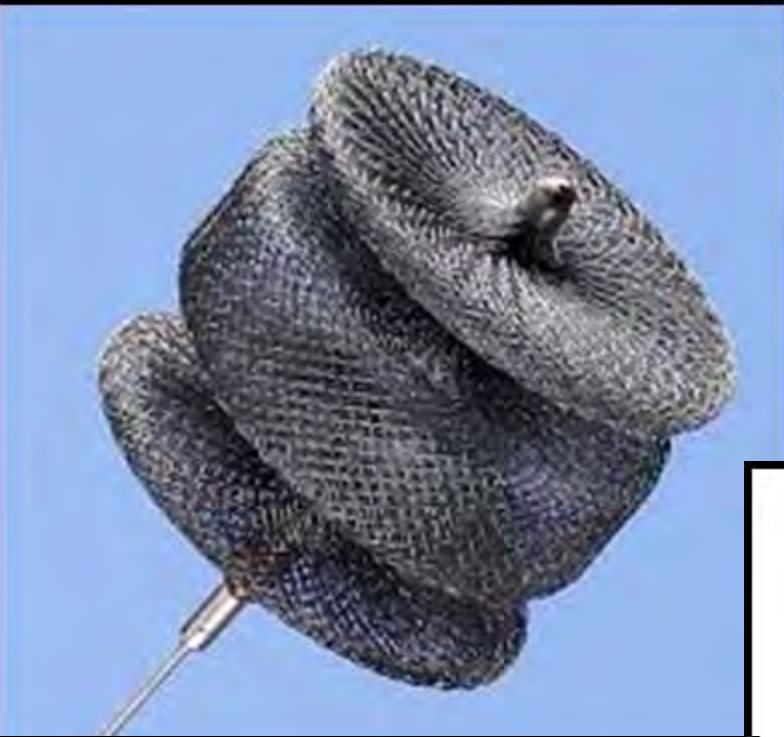




# IVC filter



# Vascular plug



A: Device Diameter (mm)  
B: Unconstrained Device Length (mm)