SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr. M.G.R Medical University, Chennai

DEPARTMENT OF CARDIAC TECHNOLOGY

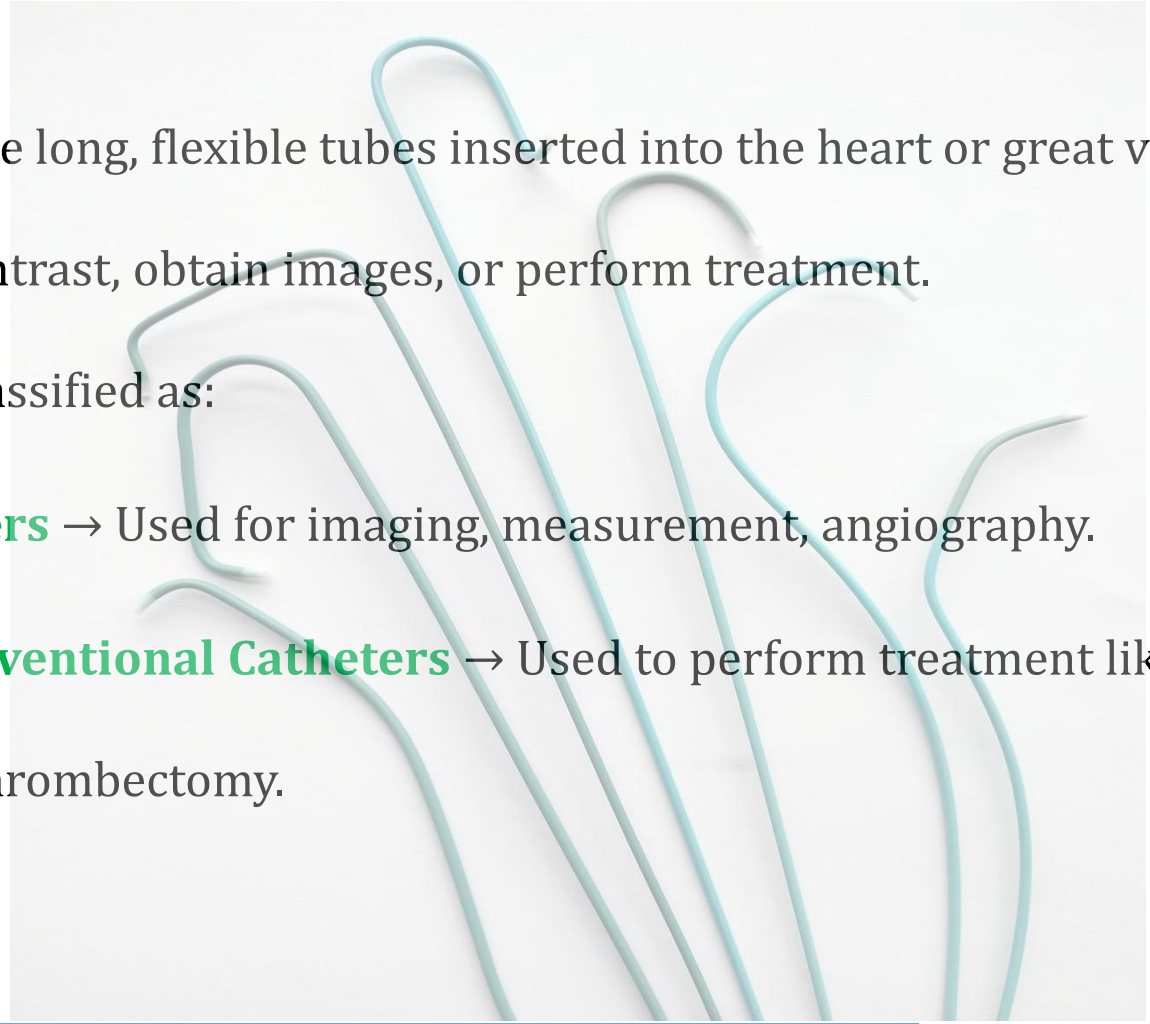
COURSE NAME : CARDIAC CATHERTERIZTION LABORATORY BASICS

UNIT : INTRODUCTION TO CATHETERS

TOPIC : BASIC CLASSIFICATION OF CARDIAC CATHETERS

FACULTY NAME : KAVIPRIYA S

Introduction



- Cardiac catheters are long, flexible tubes inserted into the heart or great vessels to measure pressures, inject contrast, obtain images, or perform treatment.

  They are broadly classified as:

- **Diagnostic Catheters** → Used for imaging, measurement, angiography.
- **Therapeutic/Interventional Catheters** → Used to perform treatment like angioplasty, stent delivery, ablation, thrombectomy.

Differences Between Diagnostic and Therapeutic Catheters

Type	Purpose	Examples
Diagnostic Catheters	For pressure measurement, contrast injection, hemodynamic data, angiography, EPS	Judkins L/R, Pigtail, Multipurpose, Swan-Ganz
Interventional (Procedure) Catheters	For stent delivery, balloon dilation, ablation, thrombectomy, structural heart interventions	Balloon catheters, Guiding catheters, Ablation catheters, Aspiration catheters
Feature	**Diagnostic Catheters**	**Therapeutic (Interventional) Catheters**
Function	Imaging, pressure recording, contrast injection, sampling	Treatment: ballooning, stenting, ablation, closure devices
Flow	High-flow lumen for contrast	Multiple lumens for wires, balloons, devices

DIFFERENTIATION BASED ON HOLES

Diagnostic Catheters

- Usually **multiple side holes** and **one end hole** (varying by function).
- Designed for **uniform contrast delivery**, **pressure recording**, and **safe ventricular injection**.

Catheter Type	Hole Design	Purpose
Pigtail catheter	8–12 side holes + 1 end hole	LV angiography; prevents jet effect
Judkins (JL/JR)	Single end hole	Selective coronary angiography
Multipurpose (MP)	1 end hole + 2–4 side holes	Versatile diagnostic injections
Swan-Ganz (PA Cath)	Multiple side holes near tip + balloon port	Hemodynamic pressure measurement

DIFFERENTIATION BASED ON HOLES

Interventional Catheters

- Usually **fewer holes**, often only **one end-hole**.
- Holes may weaken structural integrity, hence avoided.
- Designed to **maintain high pushability and torque response**.

Interventional Catheter	Hole Design	Function
Balloon angioplasty catheter	Single end-hole (if any)	Balloon inflation through lumen
Guiding catheters	No side holes	High-pressure stability for device delivery
Ablation catheters	Irrigation holes (many microholes)	Cools electrode during RF
Thrombectomy catheters	Large end opening	Thrombus aspiration

DIFFERENTIATION BASED ON MATERIALS

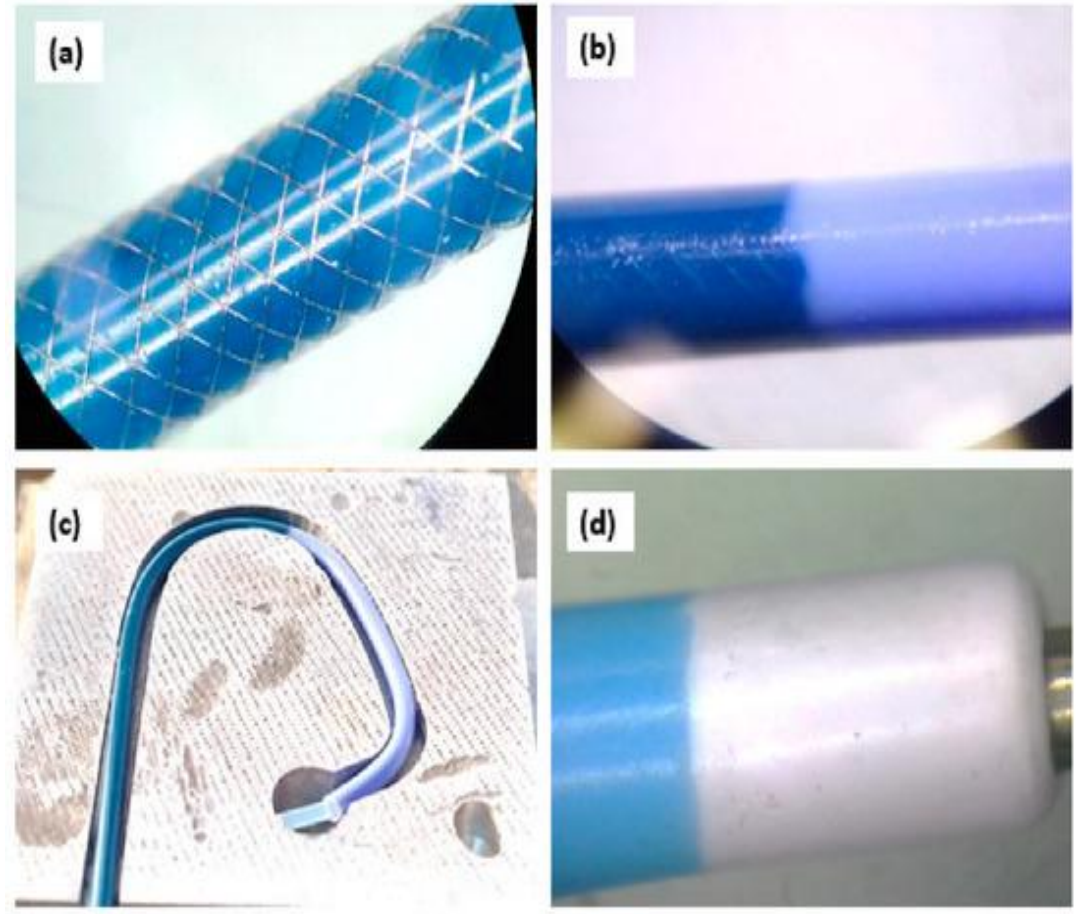
Diagnostic Catheters Materials

- **Softer, more flexible materials:**
  - **Nylon**
  - **Polyurethane**
  - **Pebax (softer grades)**
  - **Polyethylene**

Properties

•High flexibility
•Minimal vessel trauma
•Low friction
•Easy torque control

Reason → Designed for **navigation and imaging**, not to exert force.

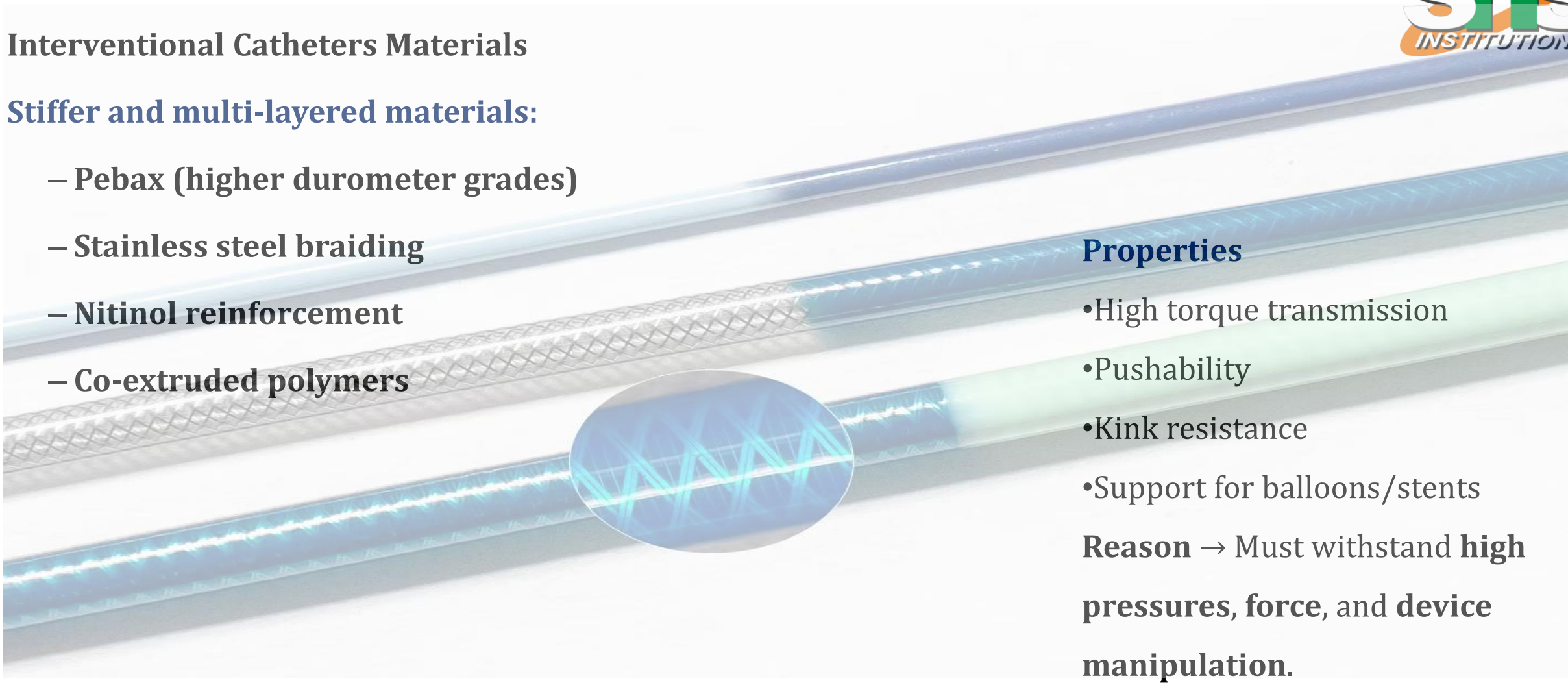


DIFFERENTIATION BASED ON MATERIALS

Interventional Catheters Materials

Stiffer and multi-layered materials:

- Pebax (higher durometer grades)
- Stainless steel braiding
- Nitinol reinforcement
- Co-extruded polymers



Properties

- High torque transmission
- Pushability
- Kink resistance
- Support for balloons/stents

Reason → Must withstand **high pressures**, **force**, and **device manipulation**.

DIFFERENTIATION BASED ON FRENCH SIZE

French (Fr) = external diameter measurement

1 Fr = 0.33 mm

A. Diagnostic Catheter French Sizes

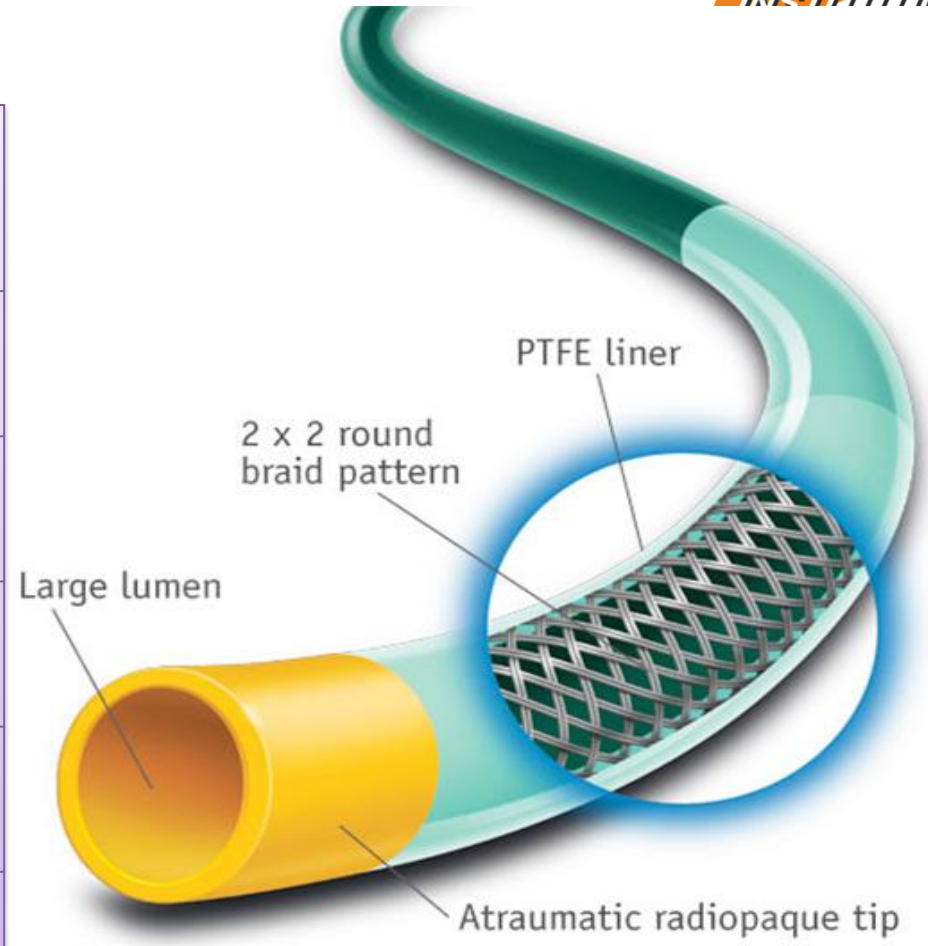
4F to 6F most common

Smaller profile reduces bleeding risk

Type	Common French Size
Judkins	5F or 6F
Pigtail	5F–6F
Multipurpose	5F–6F
Swan-Ganz	7F–8F (specialized)

Interventional Catheter French Sizes

Device	French Size
Guiding catheter	6F – 7F
Balloon catheter	2F–4F balloon profile / delivered via 6F
Stent catheter	5F – 6F
Ablation catheter	7F – 8F
TAVR delivery	12F – 20F

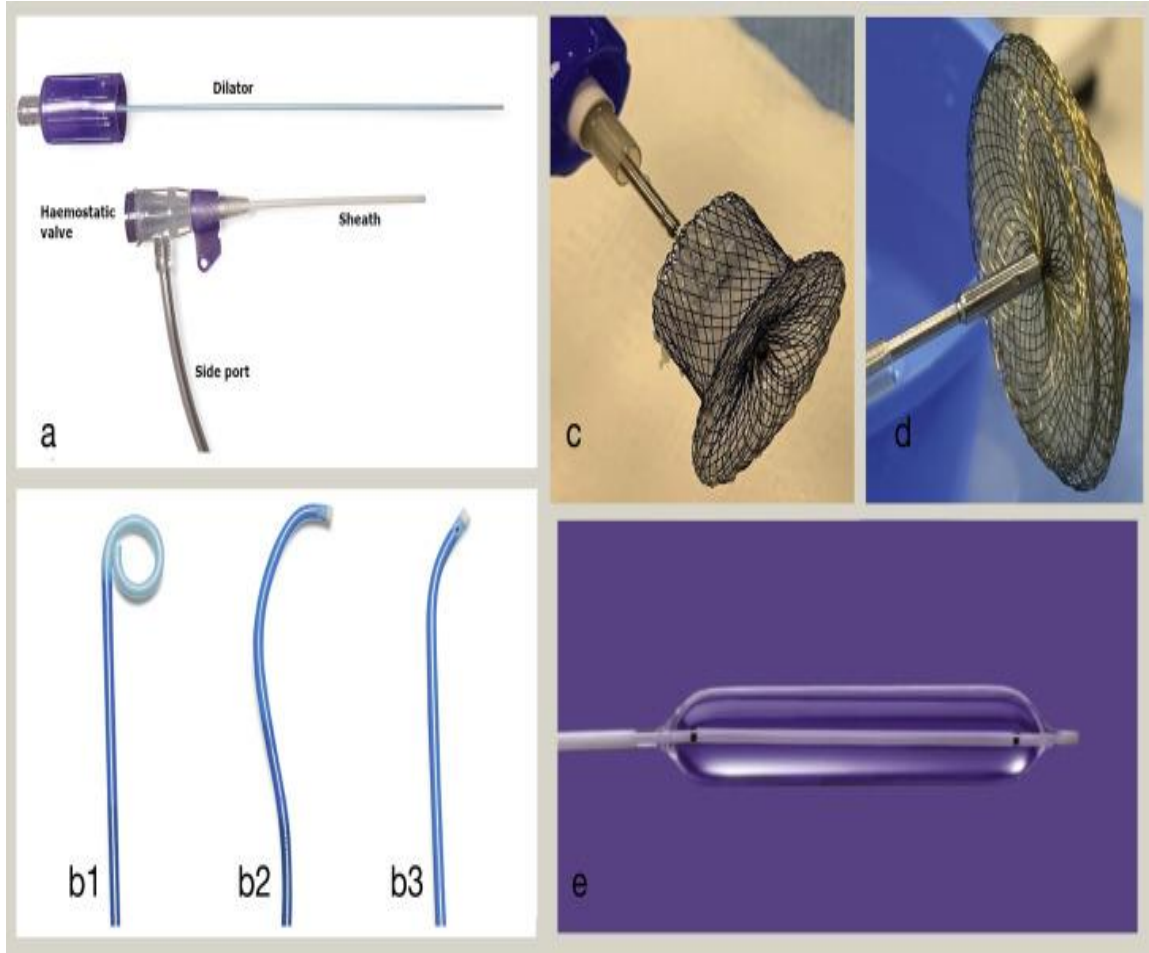


FRENCH SIZE SELECTION FOR DIFFERENT TYPES OF PATIENTS

Different patient groups require specific catheter sizes depending on vessel diameter, access-site safety, and procedural requirement.

Neonates

- **Arteries are very small** → minimal trauma required
- Use **3F – 4F**
- **Used for:** congenital cath, PDA, ASD evaluation

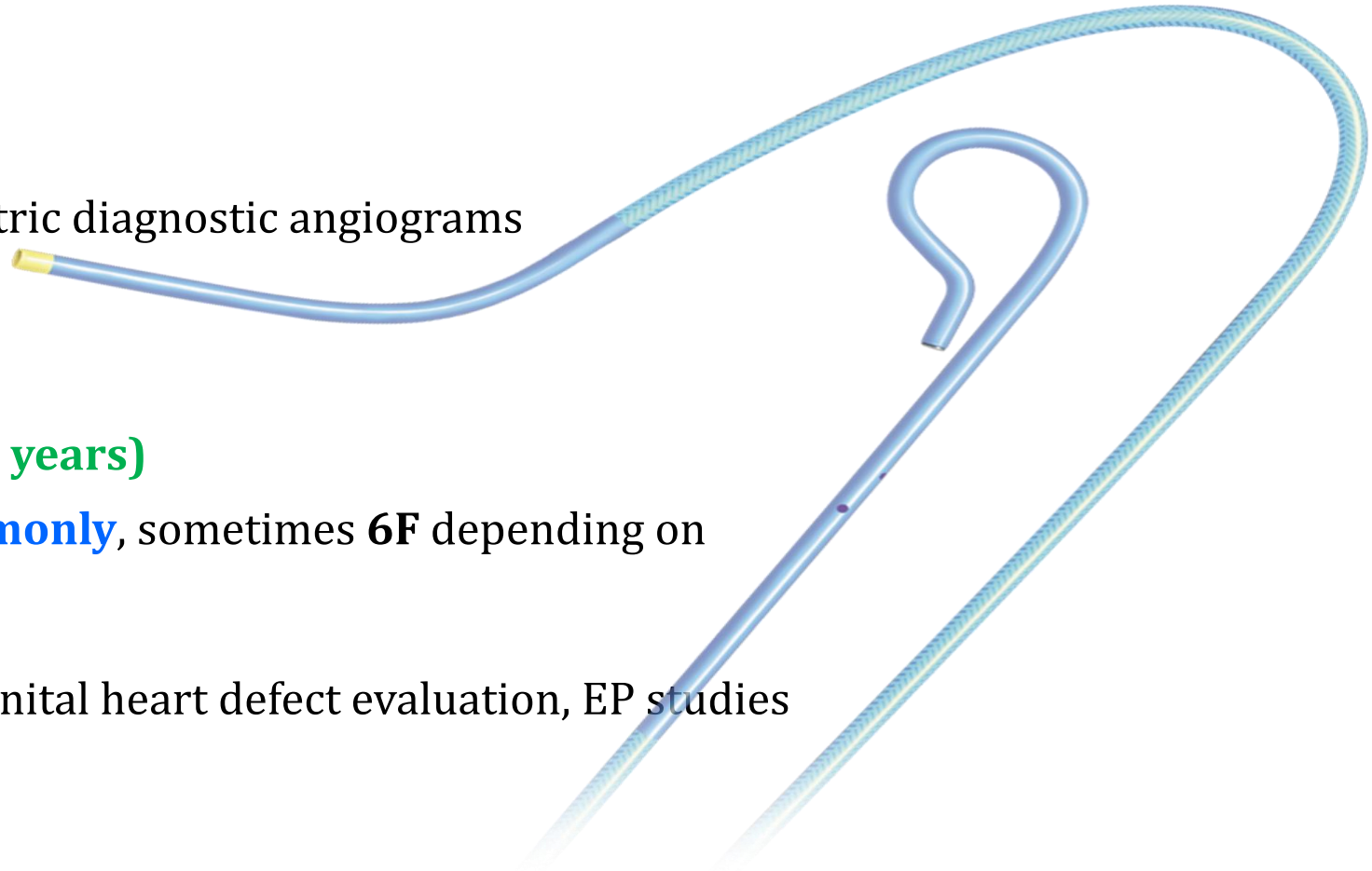


FRENCH SIZE SELECTION FOR DIFFERENT TYPES OF PATIENTS

Infants

- Use **4F – 5F**

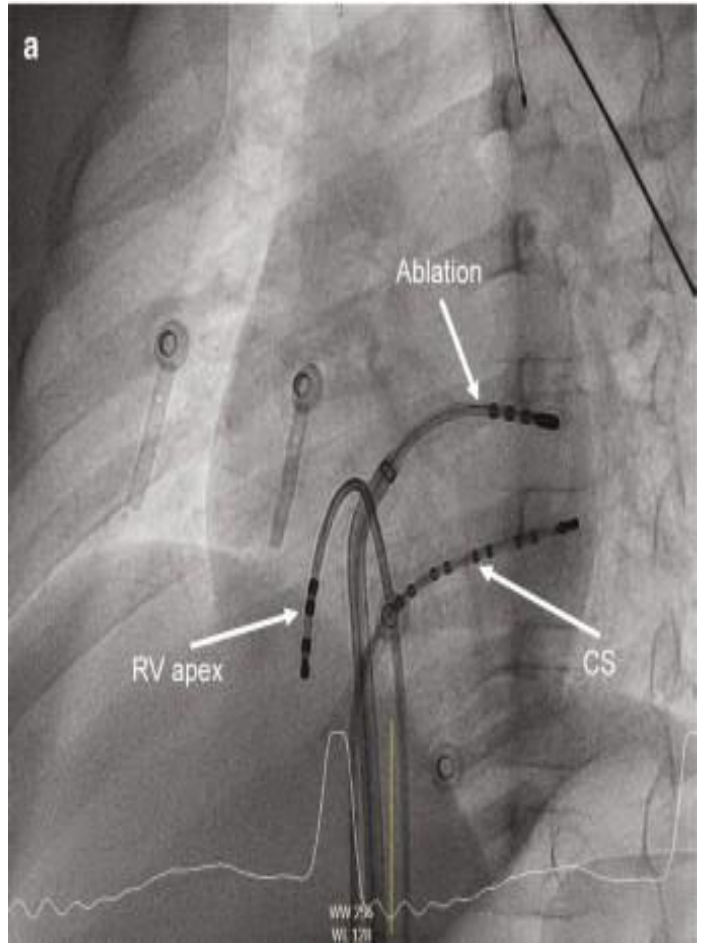
Used for: pediatric diagnostic angiograms



Children (5–12 years)

- Use **5F commonly**, sometimes **6F** depending on vessel size

Used for: congenital heart defect evaluation, EP studies



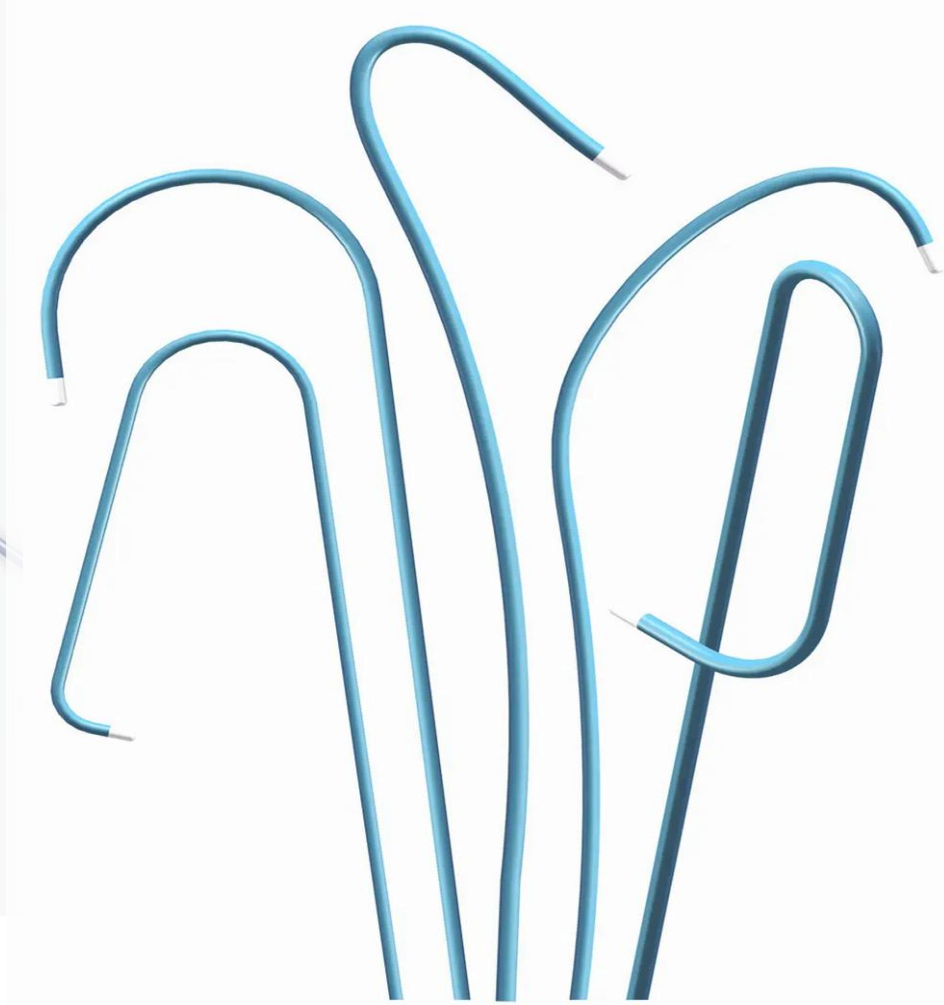
FRENCH SIZE SELECTION FOR DIFFERENT TYPES OF PATIENTS

Adults

- ✓ **Diagnostic:** 5F – 6F
- ✓ **Interventional (PCI):** 6F – 7F majority
- ✓ **Complex PCI:** 7F – 8F
- ✓ **Used for:** coronary angiography, angioplasty, stenting

Elderly Patients

- ✓ Elderly patients have **calcified, fragile, and tortuous arteries**
- ✓ Prefer **smaller sizes**: 5F for diagnostics
- ✓ Interventions typically **6F**, avoid >7F unless necessary



FRENCH SIZE SELECTION FOR DIFFERENT TYPES OF PATIENTS

Obese Patients

Obese patients often have:

•Deep arteries

•Need for strong support and larger guide

→ PCI may require **7F** guiding catheters

Diagnostics: 6F is common.

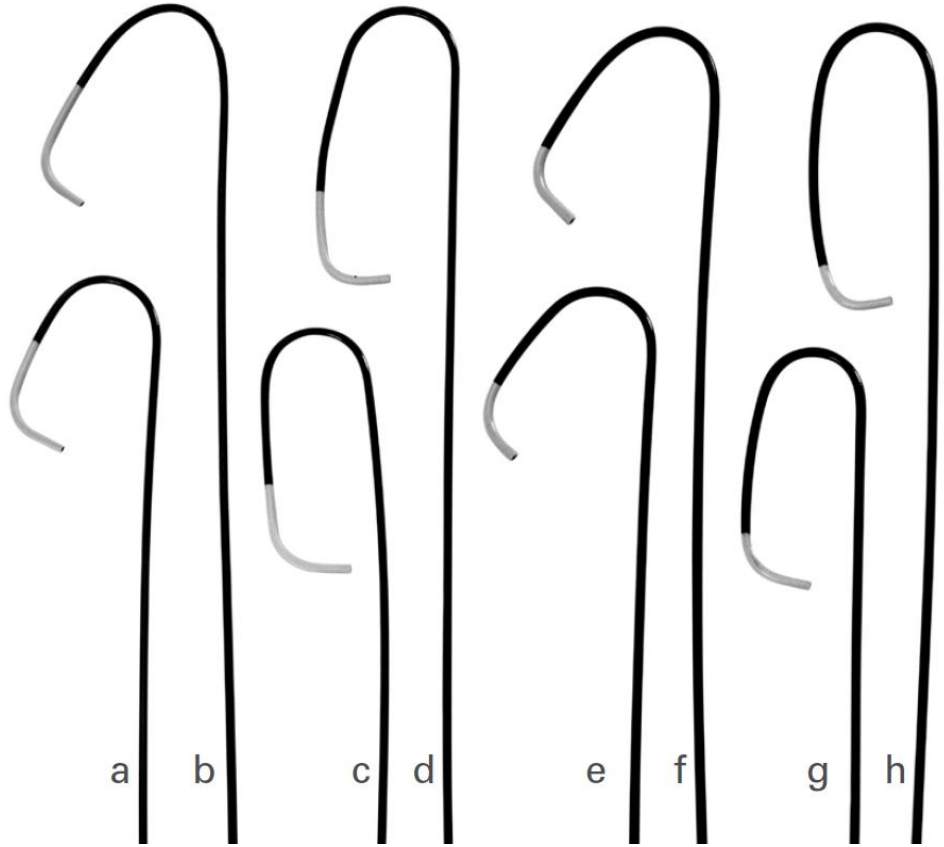
Patients with Radial Access

Radial artery is smaller than femoral:

•**4F – 5F** for diagnostic

•**5F – 6F** for PCI

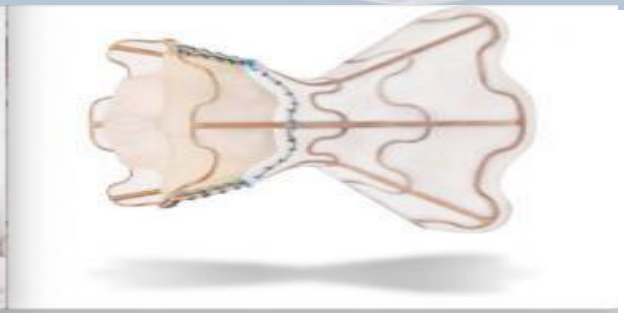
•Large French sizes avoided due to radial spasm

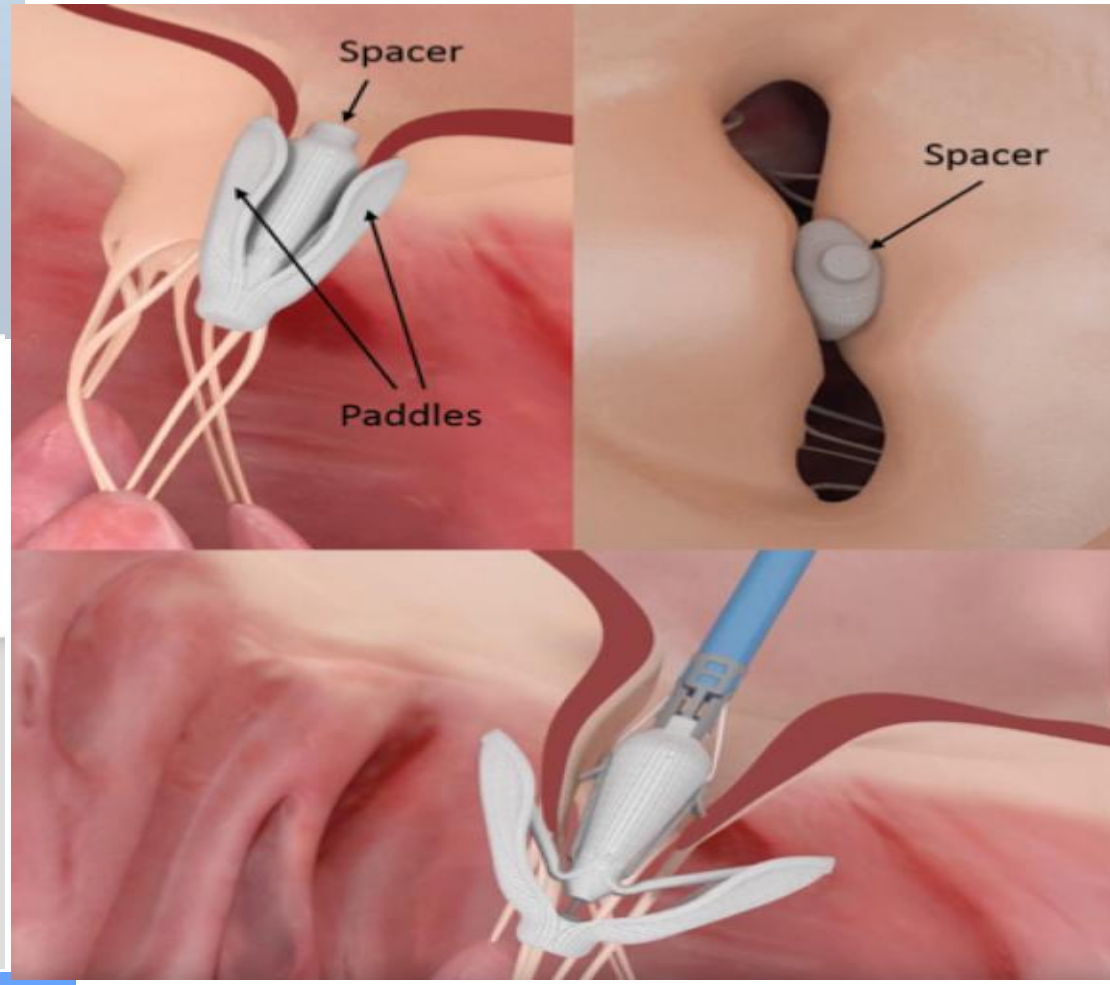


FRENCH SIZE SELECTION FOR DIFFERENT TYPES OF PATIENTS

Structural Heart Disease Patients

- Require **large bore** devices:
- **10F–20F**
  (for TAVR, MitraClip, PFO/ASD closure delivery systems)

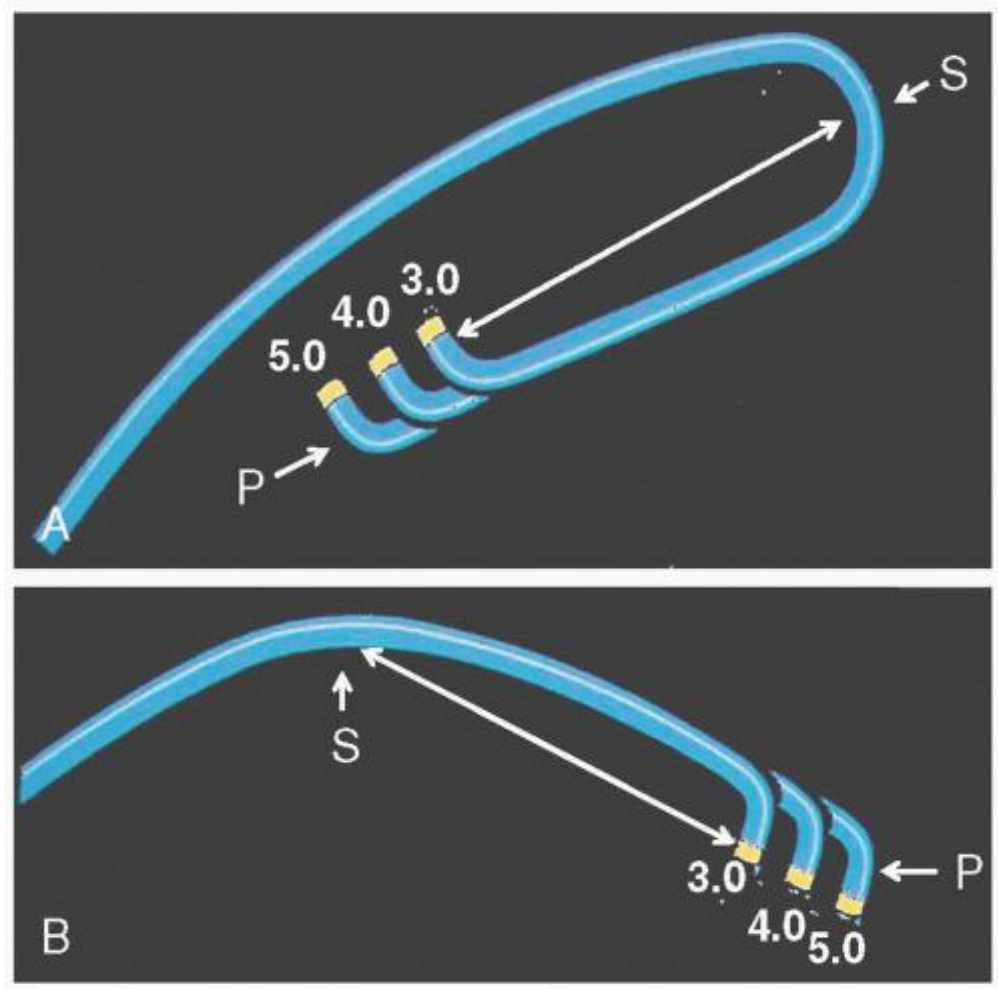




DESIGN FEATURES

Diagnostic Catheter Design

- Soft tip
- Specific curves (JL, JR, Amplatz)
- Smooth pressure transmission
- Flexible shaft



Interventional Catheter Design

- Reinforced steel-braided shaft
- Large internal lumen
- Device support capability
- High torque and pushability
- Dual lumen (balloon catheters)
- Irrigation ports (ablation)

SUMMARY TABLE

Feature	Diagnostic Catheters	Interventional Catheters
Purpose	Imaging, hemodynamics	Treatment (PCI, ablation, stenting)
French Sizes	4F–6F	6F–12F (PCI), up to 20F (TAVR)
Holes	Many side holes	End-hole / no side holes
Materials	Soft polyurethane, Nylon	Nitinol, braided steel
Design	Curve-specific soft tip	Reinforced, stiffer
Lumen	Single	Single/Dual (balloon)
Suitability	All patient types	Depends on device + access
Pediatric Use	3F–5F	Rare (unless structural)

References

Textbooks

- **Grossman & Baim's Cardiac Catheterization, Angiography, and Intervention** – 8th Edition
- **BraunWald's Heart Disease – A Textbook of Cardiovascular Medicine**
- **Topol: Textbook of Interventional Cardiology** – 7th Edition

Journals

- *Journal of the American College of Cardiology (JACC)* – Catheterization Standards
- *Circulation: Cardiovascular Interventions*
- *Catheterization and Cardiovascular Interventions (CCI)*

THANK YOU