Catheters and Wires

Dr. Vaibhav Jain MD,DNB,MNAMS

Senior Consultant, IR

Medanta, the Medicity, Gurgaon

Guidewires:

- Guidewires (solid wires navigated within the vascular system / extra-vascular tract) act as a lead point for catheters, allowing operators to traverse along a given vessel / track.

- **General Types of Guidewires:**
  - Starting guidewires - used for catheter introduction and some procedures.
  - Selective guidewires - used to cannulate side branches or cross critical lesions.
  - Exchange guidewires - are stiffer and used to secure position as devices are passed over the wire.

Guidewires:

Length

•Must be long enough to cover the distance both inside and outside the patient.

•Must also account for access well beyond the lesion, so that access across the lesion will not be lost intraoperatively.

•Usually varies from 145 to 300 cm.

Diameter

•Vascular catheters are designed with a guidewire port of specific diameter.

•Most procedures are performed with O35 guidewires (0.035 in.).

•Small-vessel angiography requires 0.018–0.014 in. guidewires.

Stiffness and Coating

•Most guidewires have a tightly wound steel core that contributes to body stiffness.

•A surrounding layer of flexible material prevents fracture during use.

•Teflon or silicone coatings are often used to reduce friction coefficient & allow smooth advancement within a vessel.

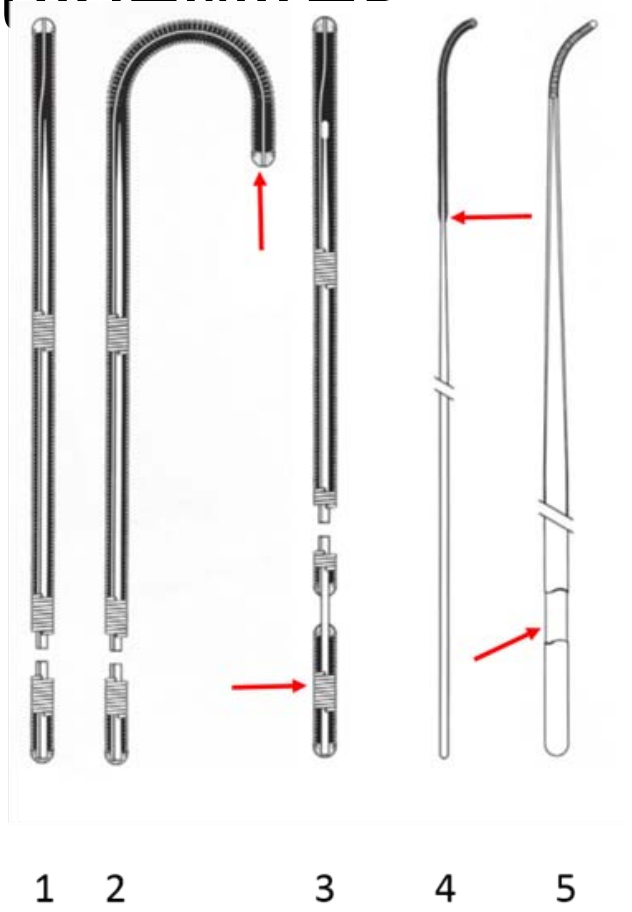
Tip Shape

•The shape of the guidewire tip often reveals the function of the guidewire.

•Floppy tip wires reduce the potential for vessel injury during access.

•Selective cannulation wires may be employed to traverse bends and curves and may be curved or angled to help the operator steer in a certain direction.

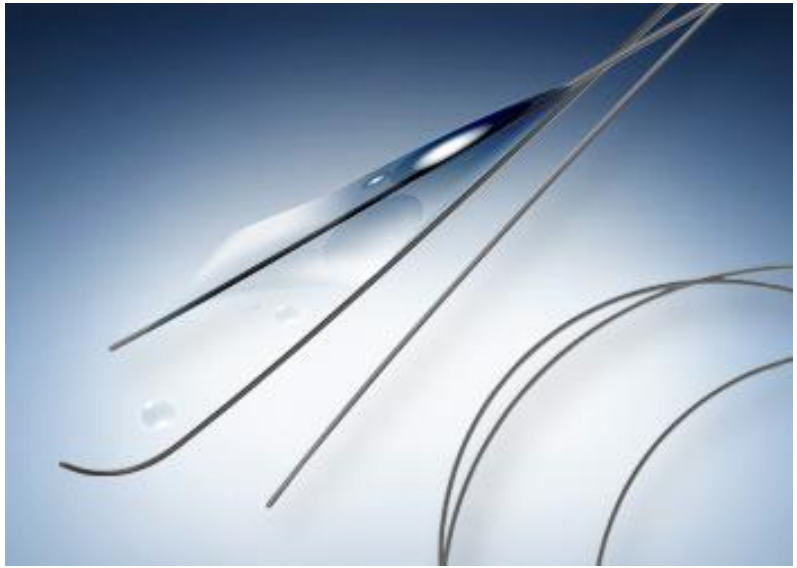
Basic construction of common guidewires:



- Curved (2) and straight (1) safety guidewires with outer coiled spring wrap, central stiffening mandril welded at back end only, and small safety wire (arrow) welded on inside at both ends.
- (3) Movable-core guidewire in which mandril can be slid back and forth and even removed completely to change wire stiffness, using handle incorporated into guidewire (arrow).
- (4) Mandril guidewire in which soft spring wrap is limited to one end of guidewire (arrow). Remainder of guidewire is a plain mandril.
- (5) Mandril guidewire coated with hydrophilic substance

- The hydrophilic-coated guidewire is the most commonly used vascular specialty guidewire; its central core is coated with an outer layer of hydrophilic material

- The stiff, metallic guidewire is the most commonly used non-vascular guidewire for drainage catheter placements



Catheters:

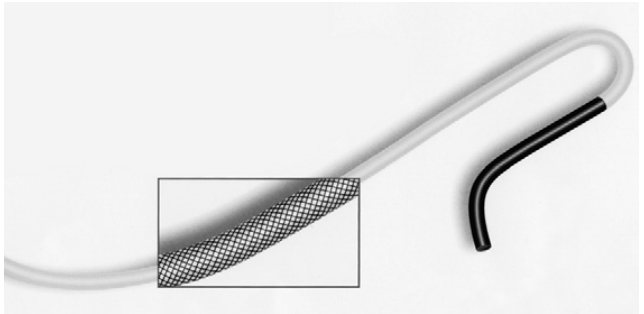
Angiographic catheters:

- Used for diagnostic and therapeutic invasive intra-vascular procedures.
- Are of various shapes and tip configurations
- Usually have one end-hole for selective injections
- Usual size: 2Fr – 8Fr

Drainage catheters:

- Used for percutaneous drainage of fluid/collections
- Usual shape is straight tip or “pigtail” or a mushroom (Malecot).
- Usually have multiple holes in the “pig” for optimal drainage
- Usual size: 6Fr to 32Fr

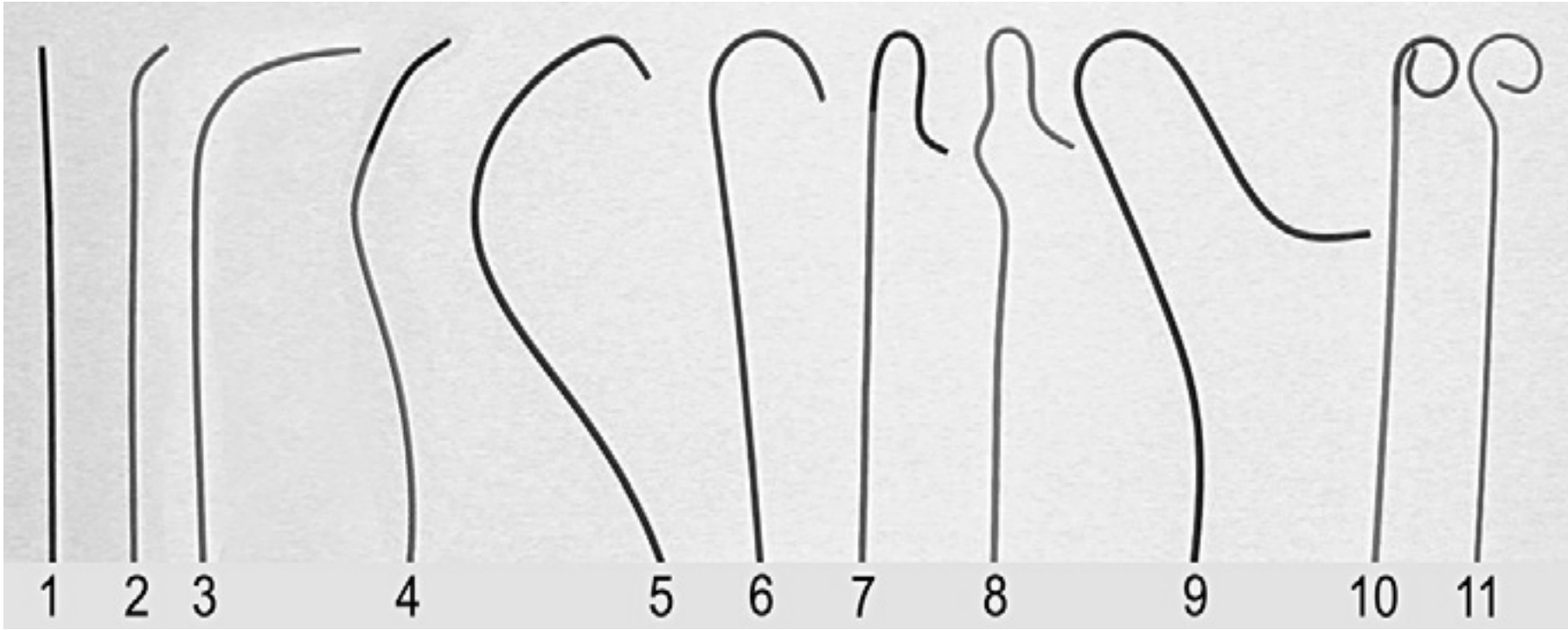
Angiographic catheters:



- usually made of plastic (polyurethane, polyethylene, Teflon, or nylon)
- exact catheter material, construction, coatings, inner diameter, outer diameter, length, tip shape, side-hole pattern, and end-hole dimensions are determined by the intended use
- Diameter is outer size described in French gauge (3F = 1 mm) and inner lumen is in hundredth of an inch
- Length described in centimeters (usually between 65 and 100 cm)
- usually have fine metal or plastic strands incorporated into the wall (“braid”) which enables the catheter tip to be responsive to gentle rotation of the shaft

Common vascular catheter shapes:

What the tip looks like
Name of person who designed it
Intended use

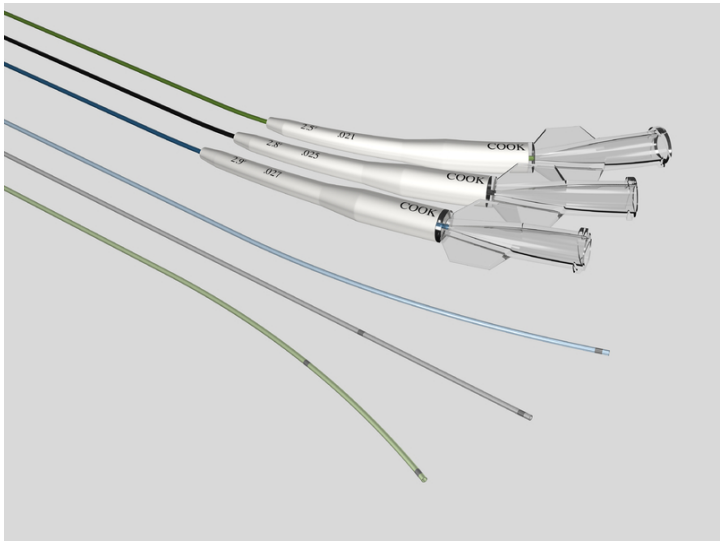


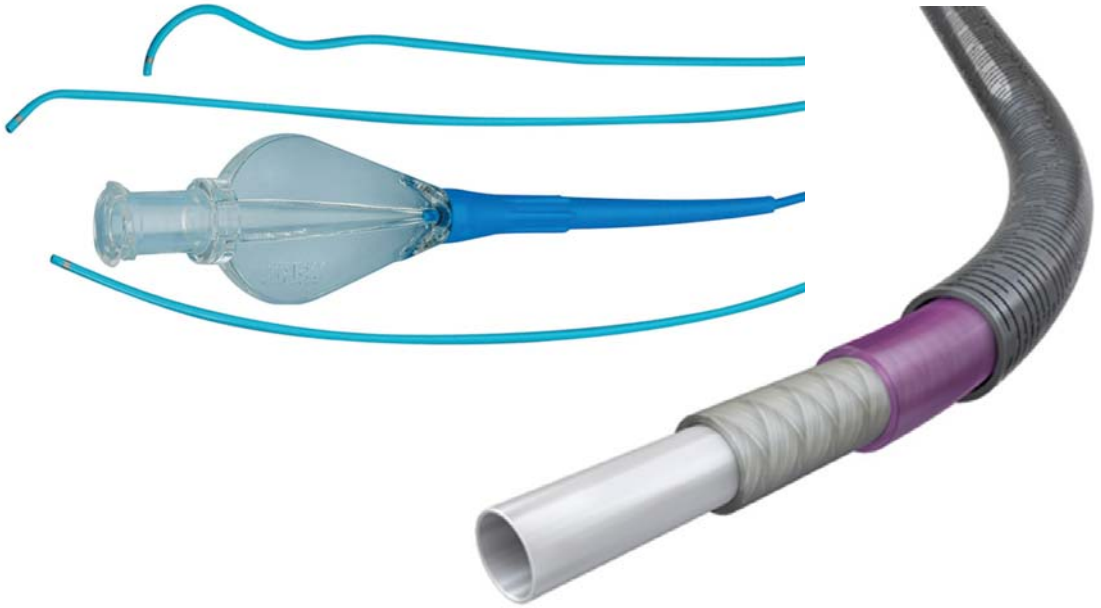
1: Straight; 2: Davis (short angled tip); 3: multipurpose (“hockey-stick”); 4: headhunter (H1); 5: cobra-2 (cobra-1 has tighter curve, cobra-3 has larger and longer curve); 6: Rosch celiac; 7: visceral (very similar to Simmons 1); 8: Mickelson; 9: Simmons-2; 10: pigtail; 11: tennis racket.

Microcatheters:

- Small catheters (3F or smaller outer diameter) that are specially designed to fit coaxially within the lumen of a standard angiographic catheter
- Soft and flexible; typically 2F to 3F in diameter, with 0.010- to 0.027-inch inner lumens
- Advanced over specially designed 0.010- to 0.025-inch guidewires
- Designed to reach far beyond standard catheters in small or tortuous vessels (super-selective position & procedures)
- Technologically advanced with wide range of characteristics, such as stiffness, braiding, flow rates, and hydrophilic coatings
- The small inner lumen and long length result in a high resistance to flow → not used for routine angiography.
- Contrast and flush solutions most easily injected through these catheters with 3-mL or smaller Luer-Lok syringes.

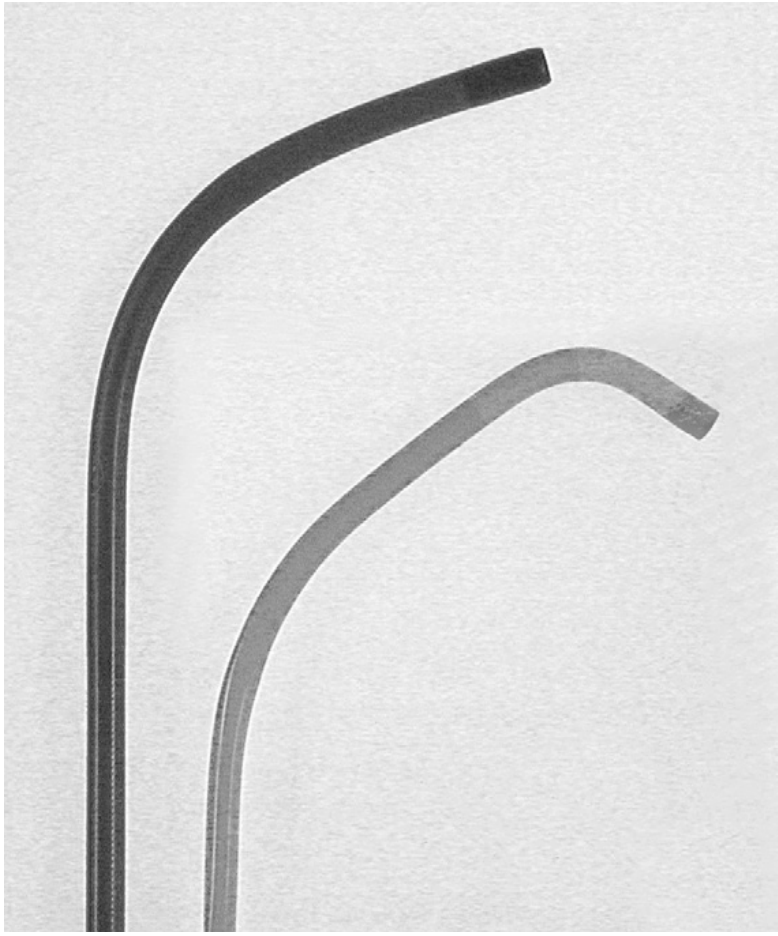
Microcatheters:





Guide catheters:

- Class of catheters designed to make selective catheterization and interventions easier
- Used in some situations to help position and stabilize standard catheters
- They are non-tapered catheters with extra-large lumens and a simple shape that accepts standard-sized catheters and devices



Drainage catheters:

Direct trocar puncture:

- Can be used in large superficial lesions
- Require blunt dissection and direct placement by “push”
- Trocar may advance farther than intended
- Difficult in deep seated collections

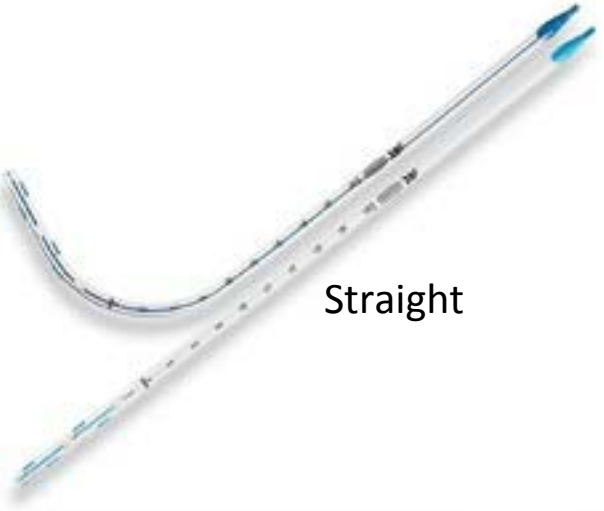
Drainage catheters:

Seldinger technique: universal

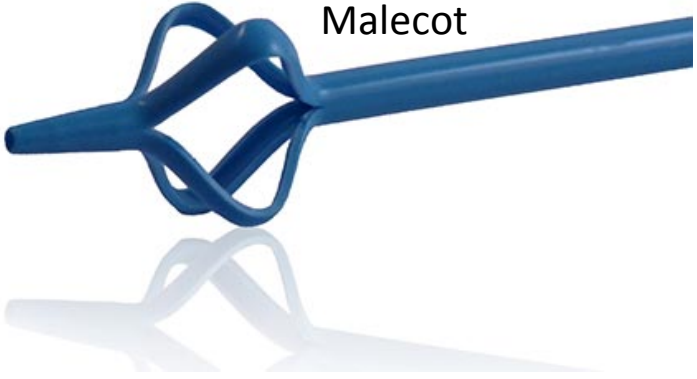
- 18G needle puncture
- An 0.035-in. wire placed in collection
- Track dilated over the stiff wire (dilate equal to or 1 Fr size larger than the intended drain)
- Catheter placed “over the wire”

Pigtail

Straight



Malecot



While there are many right ways to create or perform a procedure, the skill of an IR lies in their ability to discern when not to use a particular tool, keeping in mind the safety of the patient and the limitations of the hardware