Optimal pharmacology:
My preferred cocktail for radial cases / protocol for spasm

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Aspects of spasm

1. Prevention of spasm

2. Treatment of established spasm

How to prevent or reduce radial artery spasm?

- The Radial artery is a very sensitive artery.
- With no preventive treatment - radial spasm is very frequent.
- The spasm can be due to hardware, technical or anatomical factors.
- Apart from above three factors, the most important is anxiety related.
- The key principle is , *“sedating”: the radial artery is as important as sedating the patient .*

How to prevent or reduce radial artery spasm?

the patient

Patient should be relaxed:

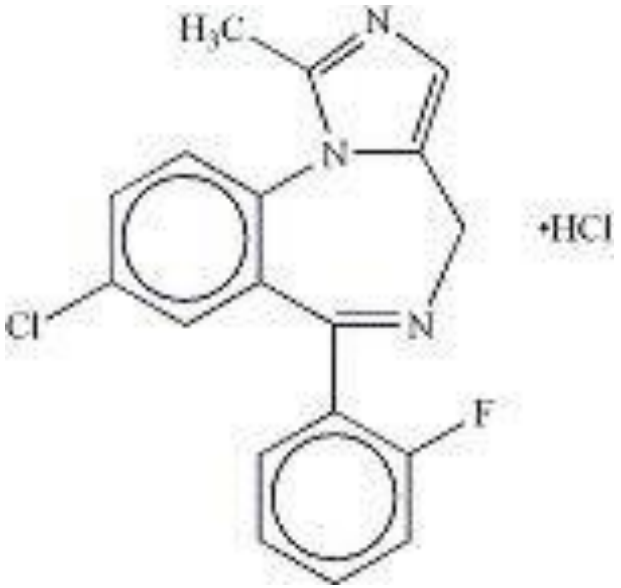
- Reduce patient's anxiety – good pre-procedure explanations
- Pre-intervention sedation with systemic medications [Diazepam]
- Very supportive nurses and techs
- Quite and calm cath lab
- Not too cold [air condition]
- Relaxing Music

How to prevent or reduce radial artery spasm?

PROTOCOL

- **IV MIDAZOLAM 2mg**

Chemically, midazolam HCl is 8-chloro-6-(2-fluorophenyl)-1-methyl-4 *H* -imidazo[1,5-a][1,4] benzodiazepine hydrochloride. Midazolam hydrochloride has the molecular formula $C_{18}H_{13}ClFN_3$, a calculated molecular weight of 362.25 and the following structural formula:



MIDAZOLAM

- Short-acting drug in the benzodiazepine class.
- Midazolam has a fast recovery time and is the most commonly used benzodiazepine as a premedication for sedation.
- The anterograde amnesia property of midazolam is useful for premedication before surgery to inhibit unpleasant memories.
- Midazolam, like many other benzodiazepines, has a rapid onset of action, high effectiveness and low toxicity level.
- Intravenous midazolam is indicated for procedural sedation (often in combination with an opioid, such as fentanyl), for preoperative sedation.

Mechanism of action

- The therapeutic as well as adverse effects of midazolam are due to its effects on the $GABA_A$ receptors;
- Midazolam does not activate $GABA_A$ receptors directly but, as with other benzodiazepines,
- it enhances the effect of the neurotransmitter GABA on the $GABA_A$ receptors (↑ frequency of Cl^- channel opening) resulting in neural inhibition.

Half-life

- Midazolam is a short-acting benzodiazepine in adults with an elimination half-life of one to four hours; however, in the elderly, as well as young children and adolescents, the elimination half-life is longer.

Antagonist

- Benzodiazepines require special precaution if used in the elderly, during pregnancy, in children, in alcohol or drug-dependent individuals or individuals with comorbid psychiatric disorders.

Flumazenil [Anexate]

Benzodiazepine antagonist drug that can be used to treat an overdose of midazolam as well as to reverse sedation.

- $GABA_A$ receptor antagonist
- Amp: 0.5mg/5ml IV

- Start 0.2 mg in 15 sec
- Repeat 0.1 mg per 1 minute

- Repeat after 20 min [due to shorter half life]

How to prevent or reduce radial artery spasm?

PROTOCOL

- **IV MIDAZOLAM 2mg**
- **First radial artery puncture is key**
- **Still pains or spasm**
- Consider adding Fentanyl 0.05mg

How to prevent or reduce radial artery spasm?

PROTOCOL <u>after puncture</u>:

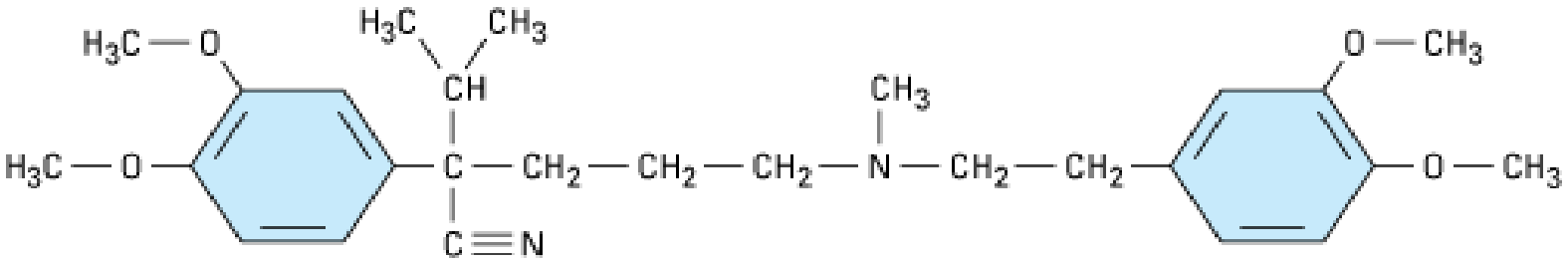
- **IA VERAPAMIL 2.5mg [diluted]**

Explain to the patient to expect a warm sensation

Verapamil

- Therapeutic group : calcium channel blockers; Class IV antiarrhythmic drugs

- The chemical name is benzeneacetonitrile, α-[3-[{2-(3,4-dimethoxyphenyl)ethyl} methylamino] propyl]-3,4-dimethoxy-α-(1-methylethyl) hydrochloride. Molecular formula: $C_{27}H_{38}N_2O_4$



Verapamil

Verapamil - Indications

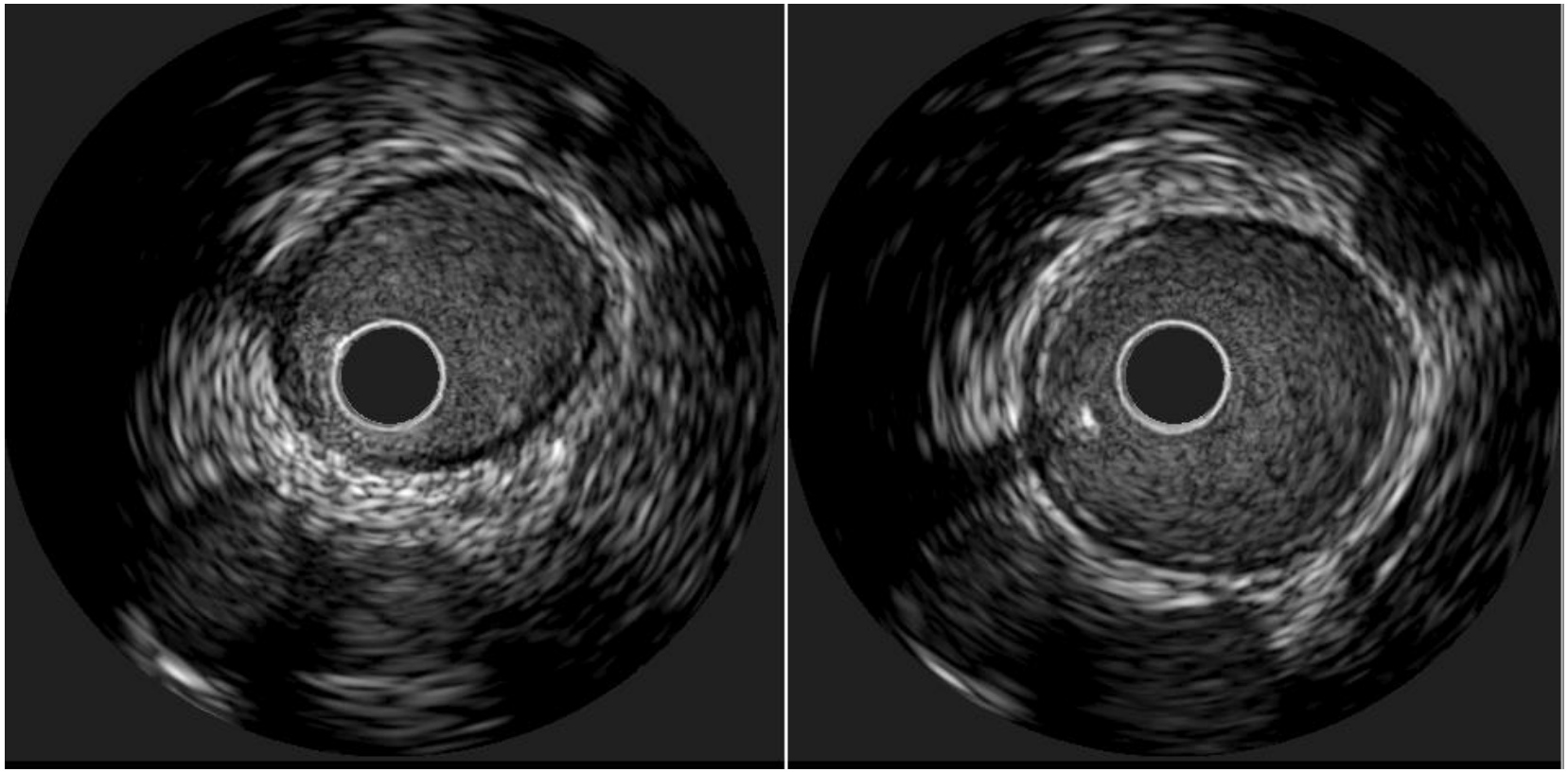
- Spasmolytic effect during TRI.
- Paroxysmal supraventricular tachycardia (PSVT):
- effective in the treatment of angina pectoris.
- alternative treatment for mild or moderate hypertension.

How to prevent or reduce radial artery spasm?

PROTOCOL after puncture:

- **IA VERAPAMIL 2.5mg [diluted]**
- **Optional – IA NTG (SL)**
- **We do not administer Heparin after puncture, only after first catheter in aorta [in case we need to switch to femoral approach].**
- **IV Heparin (IA)**

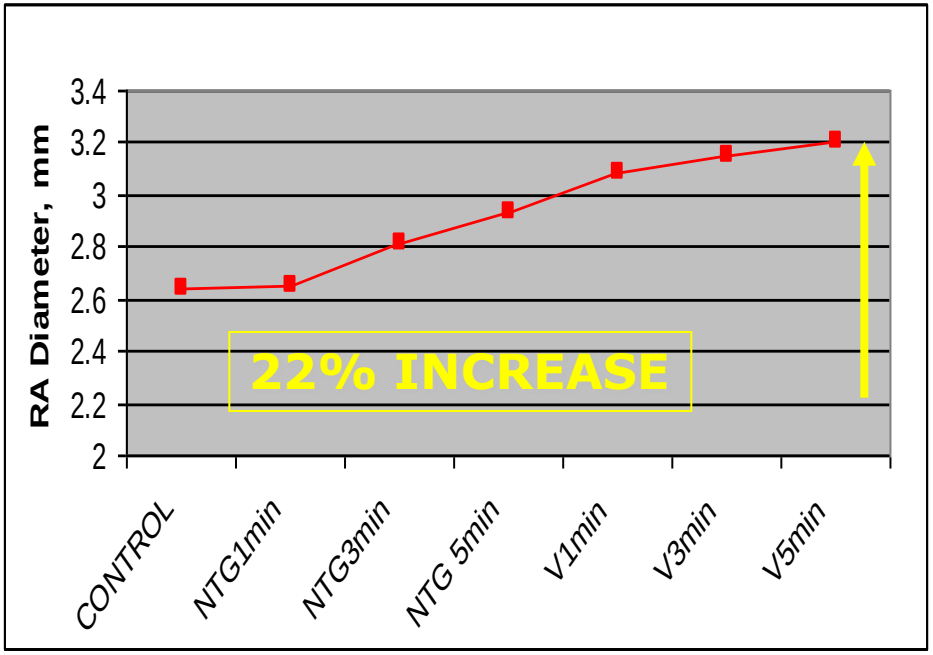
Radial Artery IVUS:
Effect of intra-arterial Verapamil

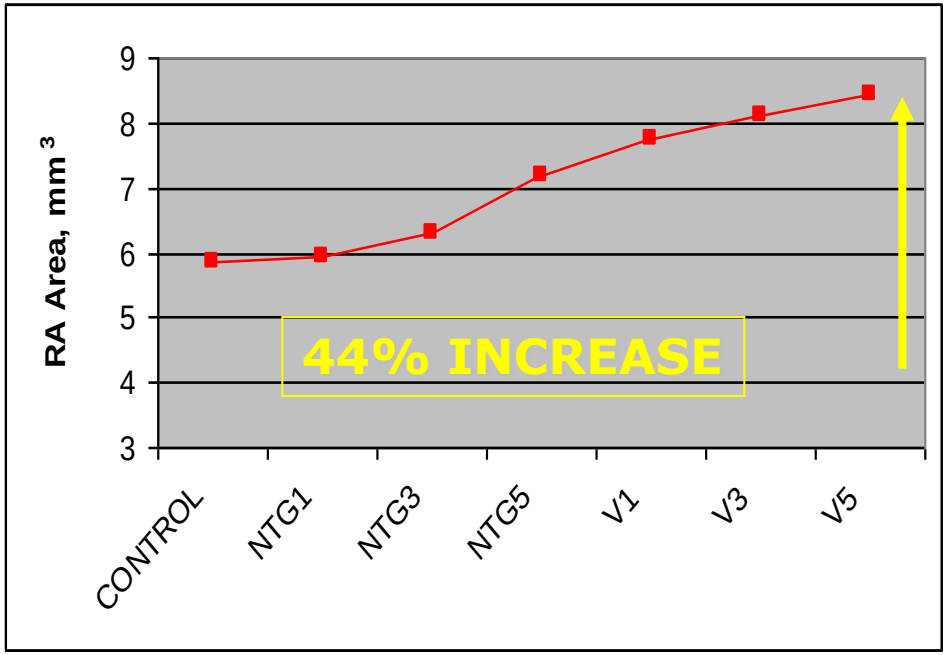


Baseline

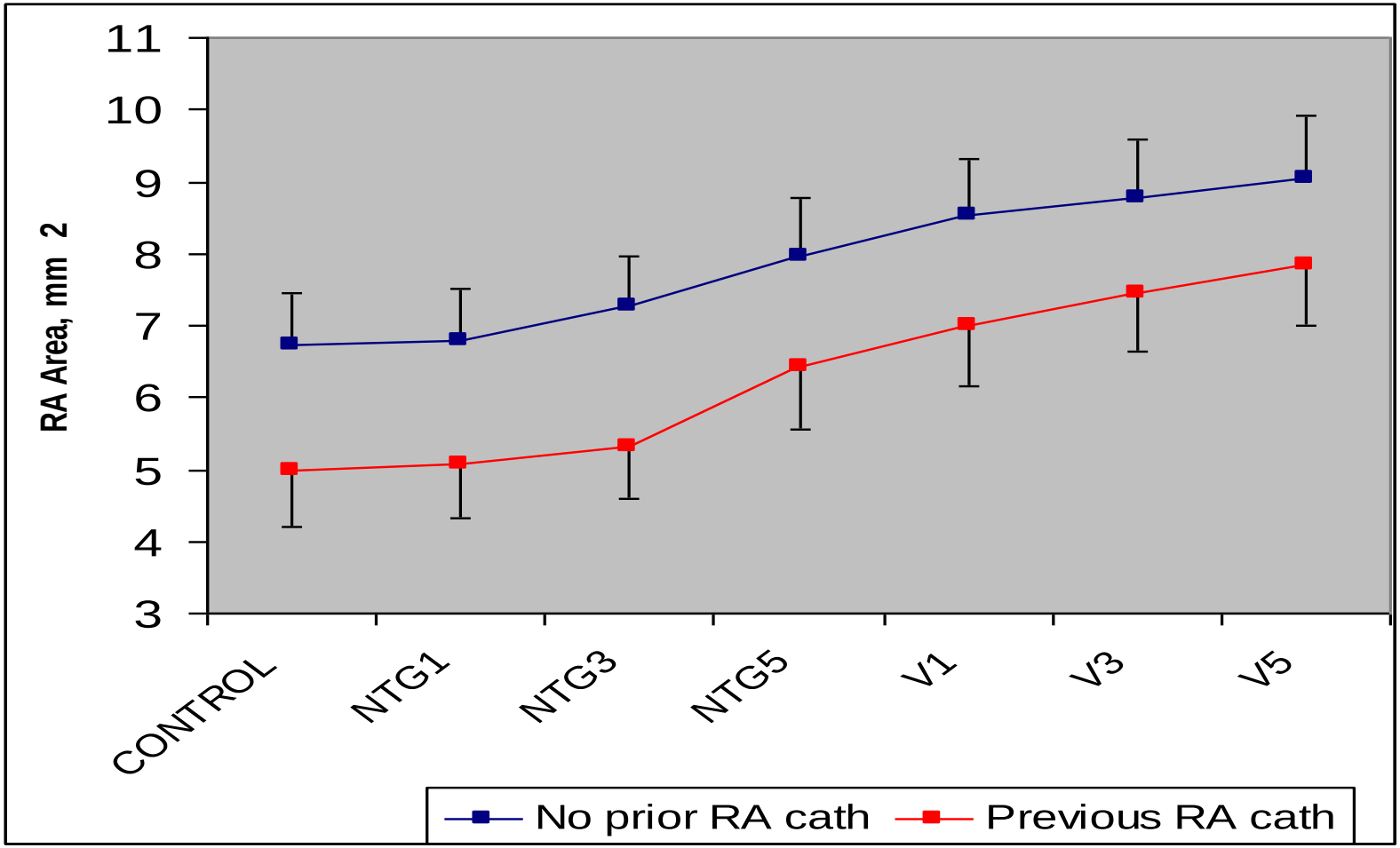
Post 3mg Verapamil

Effect of SL NTG & IA Verapamil on RA IVUS DIAMETER and AREA





Previous RA cath decreases RA size:
but not responsiveness to NTG and VERAPAMIL



How to treat radial artery spasm?
Your guiding catheter is not moving!

How to treat radial artery spasm?
Your guiding catheter is not moving!

- **Ask the patient to concentrate on breathing or simply talk with him/her [ie concentrate not on the procedure]**
- **Sedate patient, midazolam**
- **Fentanyl for pain**
- **Patience, do not apply force**

How to treat radial artery spasm?

If spasm continues:

- **Repeat Verapamil and/or NTG**
- **Sedate patient, midazolam**
- **Fentanyl for pain**

- **FEMORAL APPROACH**

Optimal pharmacology:
My preferred cocktail for radial cases / protocol for spasm

IV Midazolam

After puncture: IA Verapamil 2.5mg

After catheter in aorta - Heparin

Minimizing radial artery injury

A randomized study 5F vs 6F

Endpoints	**5F TRI** (n=87)	**6F TRI** (n=84)	*P*
Procedural success	95.4%	92.9%	0.097
Radial spasm	1.1%	4.8%	0.080
Clinical success	93.1%	90.5%	0.097
Minor hematoma	1.1%	4.8%	0.07
Radial occlusion	1.1%	5.9%	0.050

Dahm JB et al Cathet Cardiovasc Intervent 2002

TRI

Dedicated Puncture Device

Radial Introducer Kit
Including metal needle and spring mini guide wire

- Dilators are tapered to the guide wire minimizing risk of vessel trauma
- Smooth sheath-to-dilator transition to reduce penetration resistance
- Dedicated radial needle

Diameter:	4, 5 & 6Fr
Length:	7 and 10cm
Wire:	0.018”, 0.021” & 0.025”
Needle:	20G or 22G
Code:	RT-R….

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Objective

Development of less invasive device for

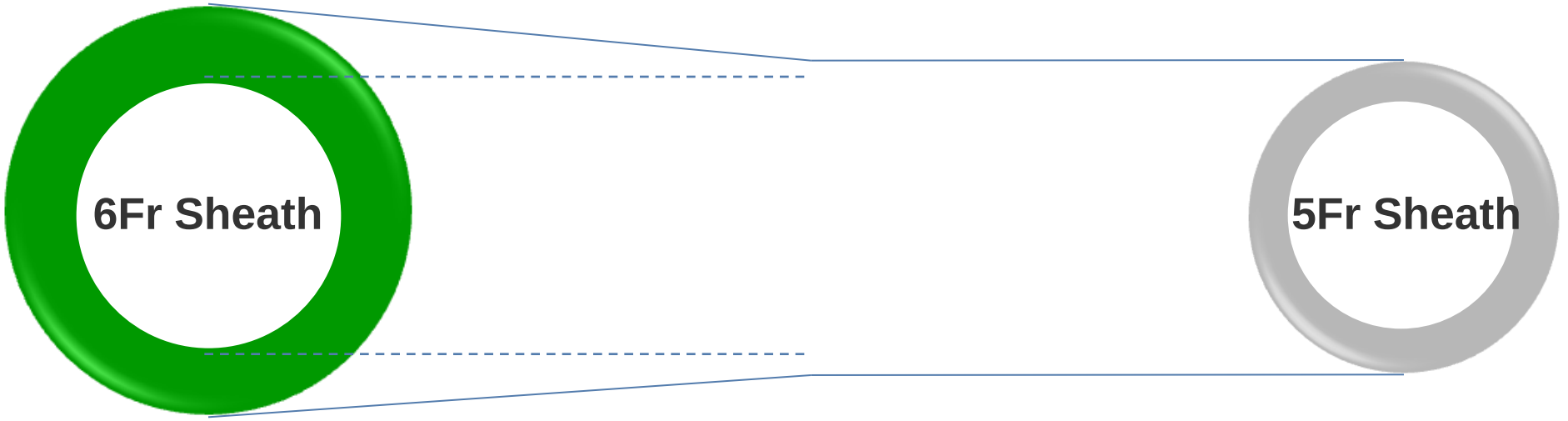
Transradial approach

TRI

TERUMO RADIAL INTERVENTION

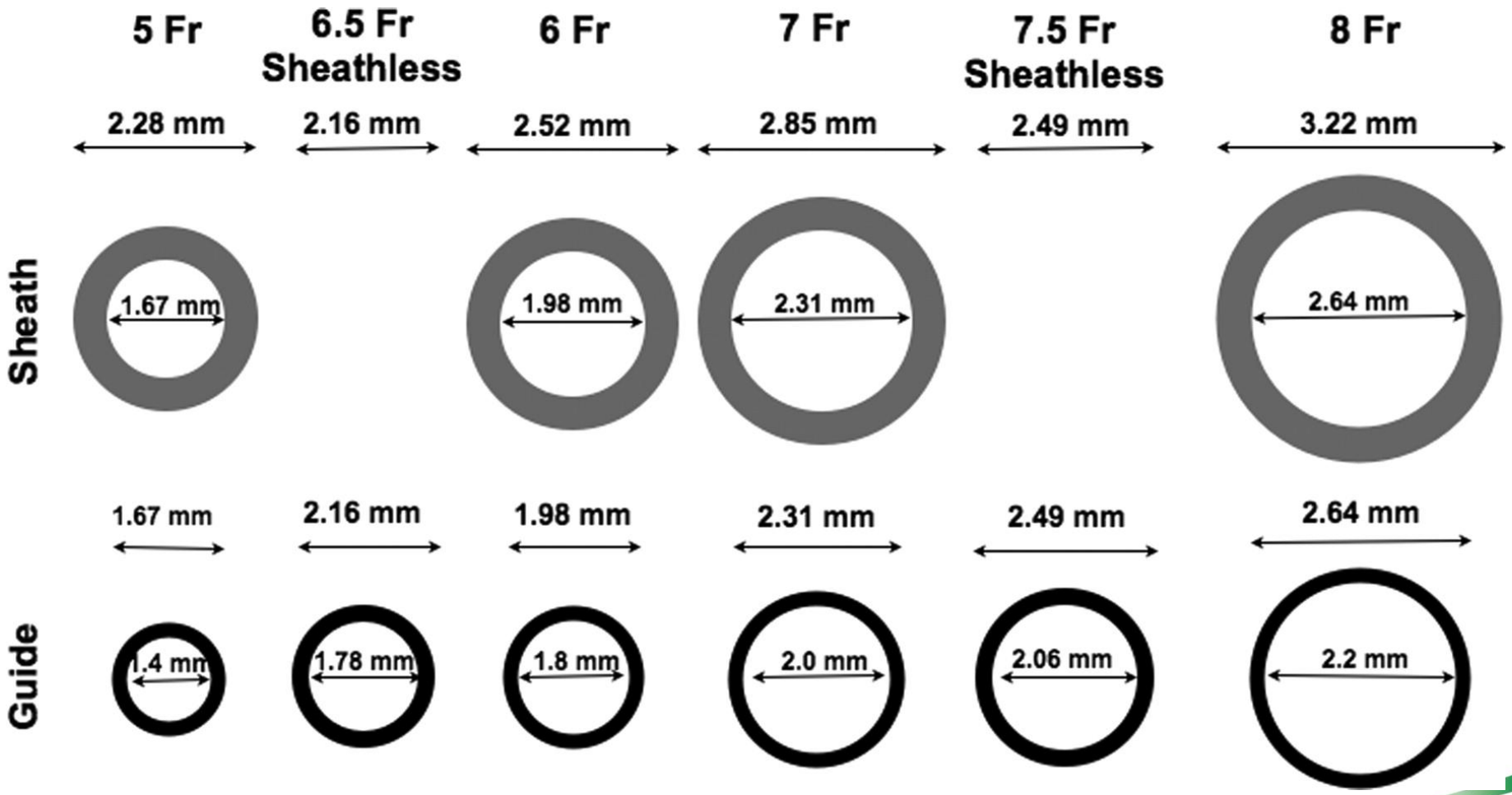
Concept

Glidesheath Slender®

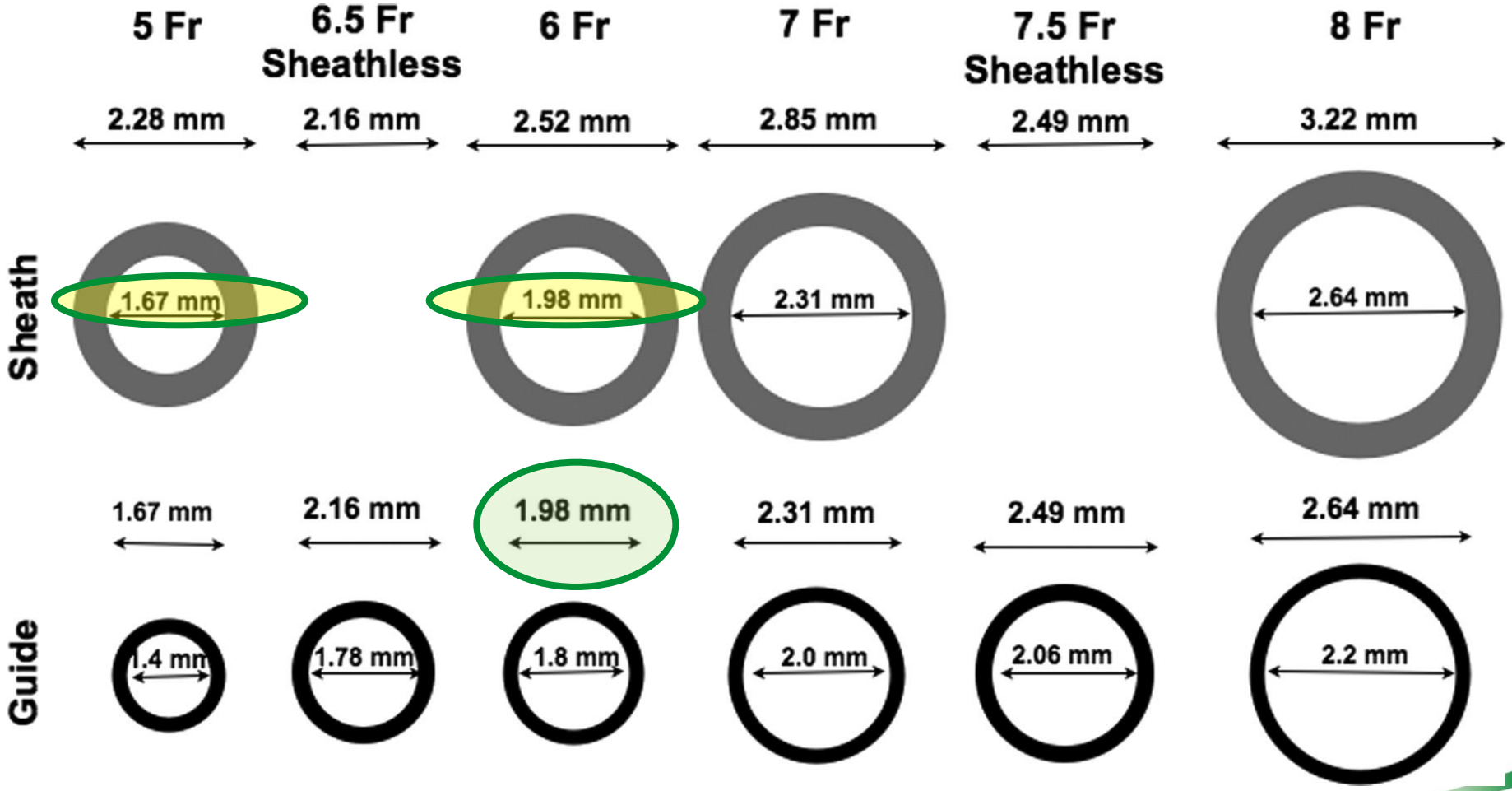


6Fr in 5Fr???

Sheath VS Guide-catheter sizing

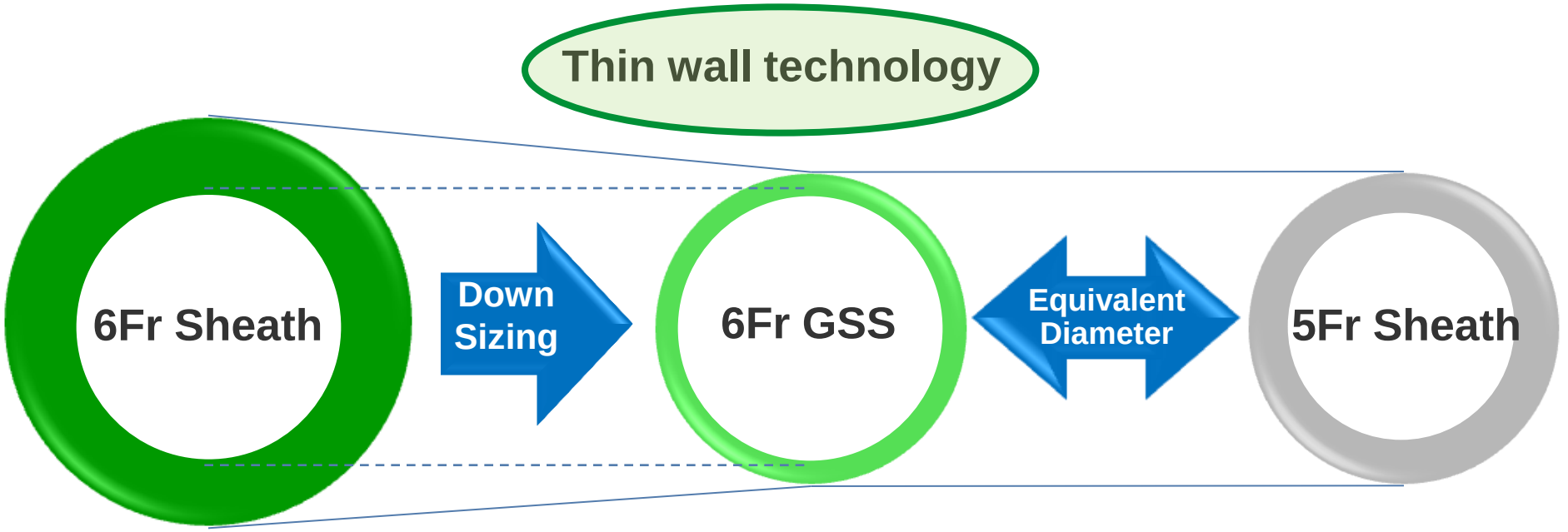


Sheath VS Guide-catheter sizing: Inner Vs Outer Diameter



Concept

Glidesheath Slender®



6Fr GSS is compatible with 6Fr guiding catheter while outer diameter is very close to current 5Fr sheath

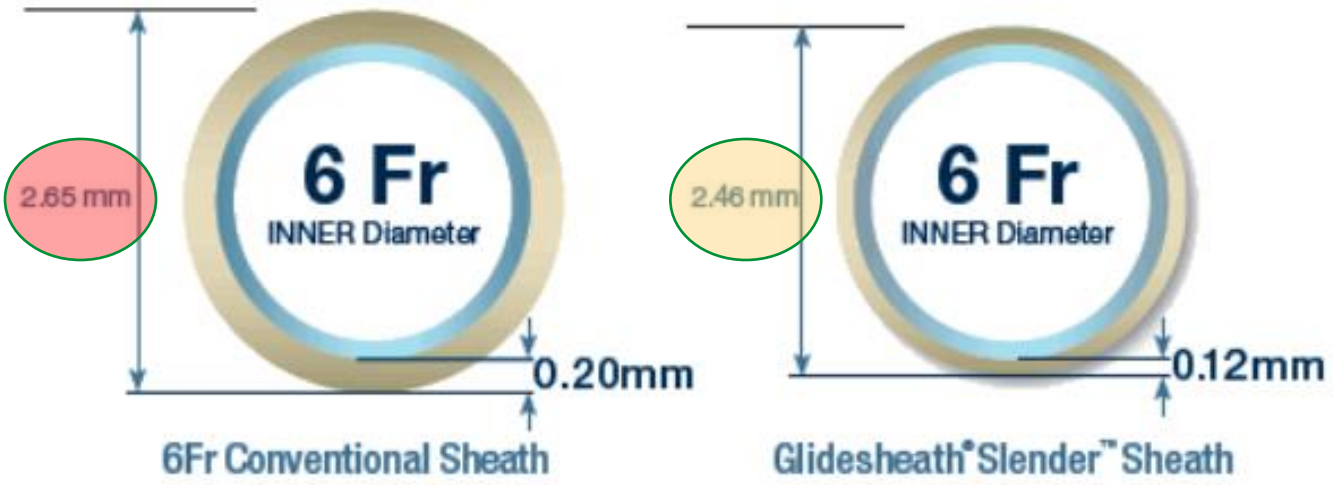
TERUMO®

Glidesheath® Slender™

HYDROPHILIC COATED INTRODUCER SHEATH

Revolutionary thin-wall technology makes it possible

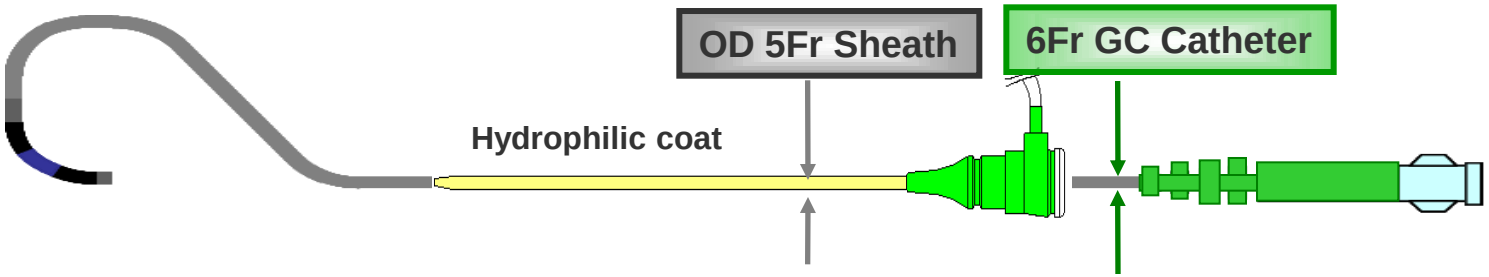
Unique thin-wall structure reduces the outside diameter by 1Fr while maintaining an inner-diameter equivalent, for devices up to 6Fr.



- Take advantage of compatibility with 6Fr devices
- Perform diagnostic and interventional procedures without upsizing to a larger sheath
- Incorporates Terumo Glide Technology™ for ease of insertion and removal

Specification

The world's thinnest wall sheath with hydrophilic coating.
One size up guiding catheter is compatible.



Sheath O.D.	Max. GC Size	O.D.	I.D.	Thickness
5Fr OD Sheath	6Fr GC	2.46	2.22	0.12

7 in 6Fr is under consideration

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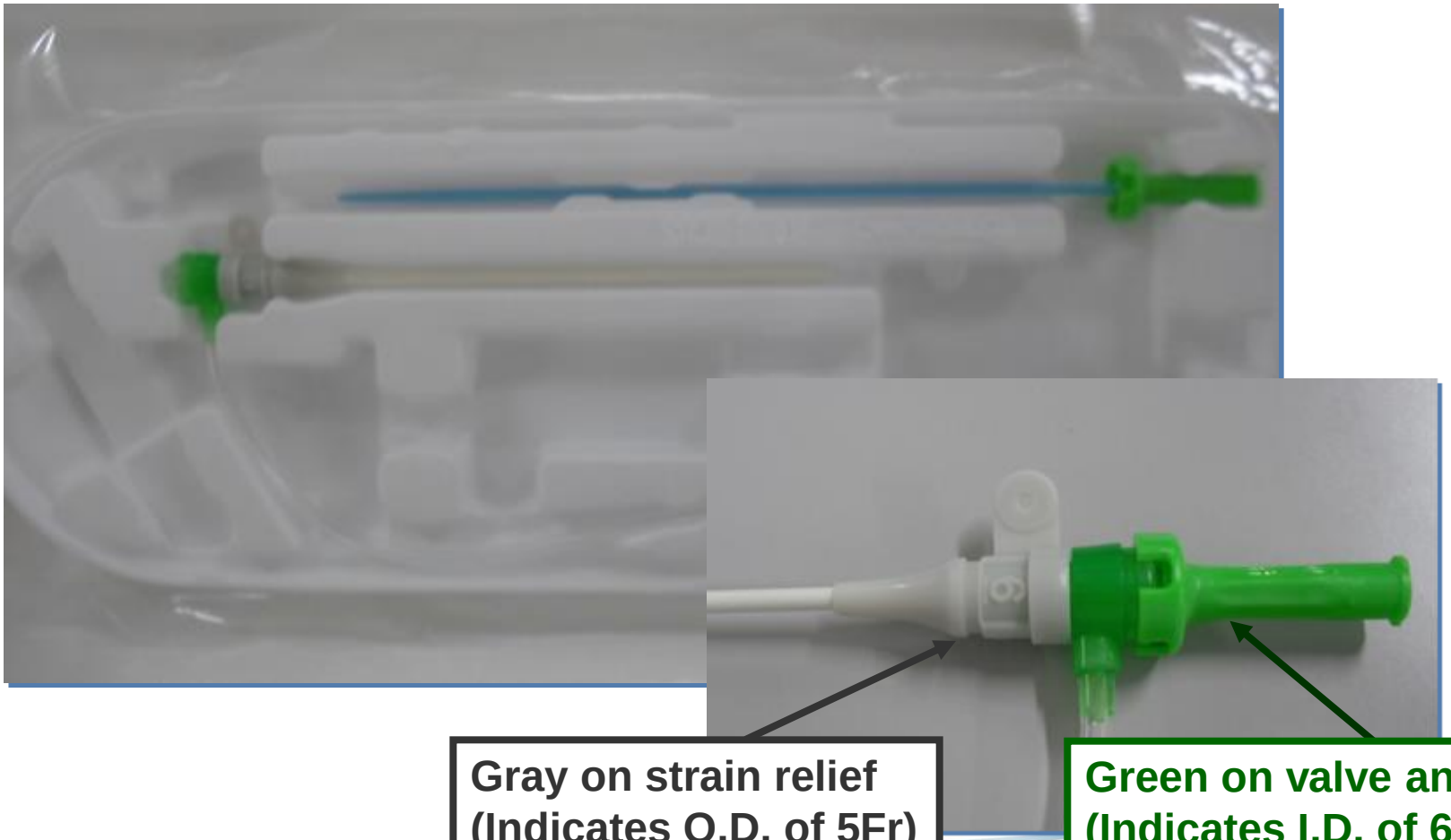
Sheath color image

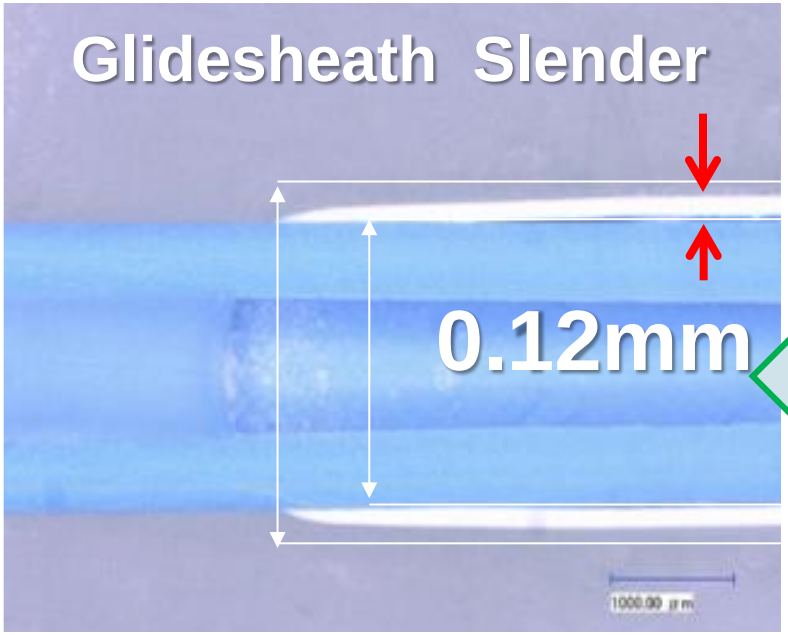
Sheath of 5Fr O.D. and 6Fr O.D. (6in5Fr)

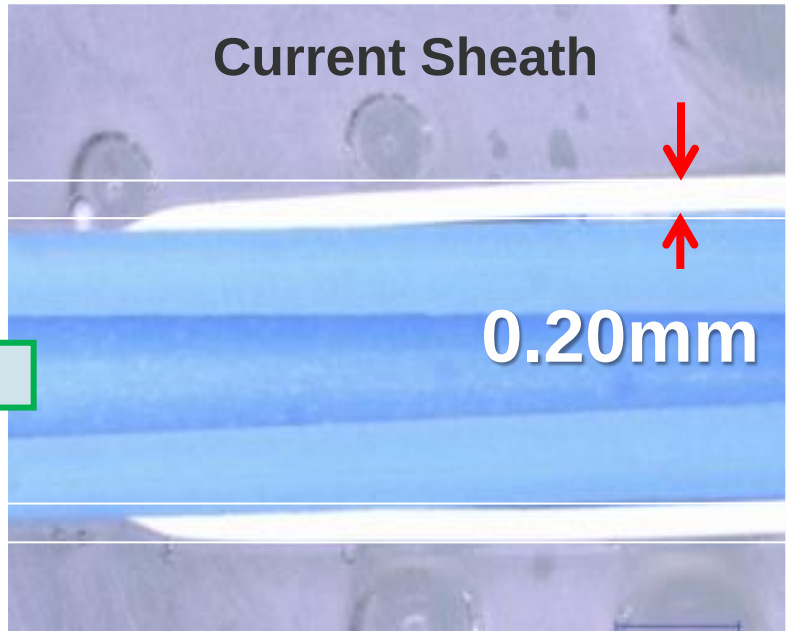


Gray on strain relief
(Indicates O.D. of 5Fr)

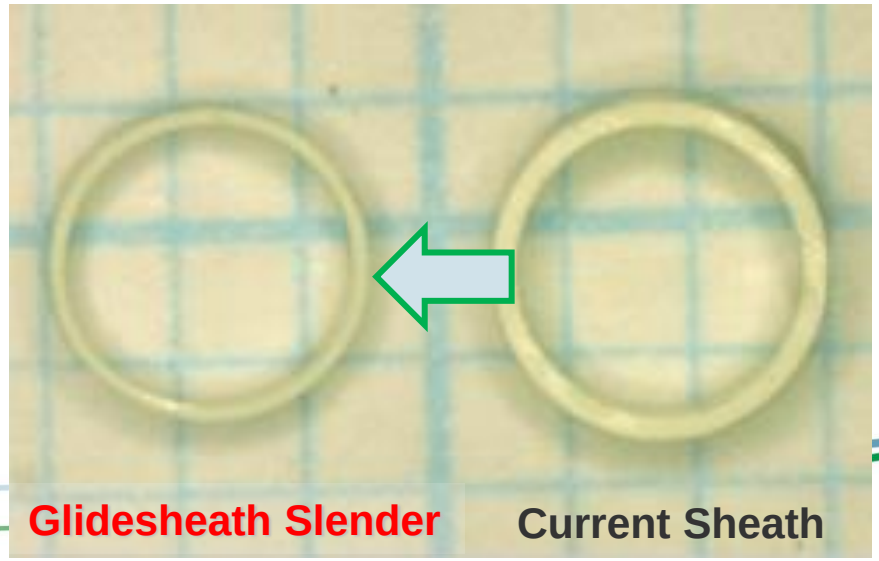
Green on valve and dilator
(Indicates I.D. of 6Fr)

Comparison with current sheath





OD:5Fr
ID :6Fr



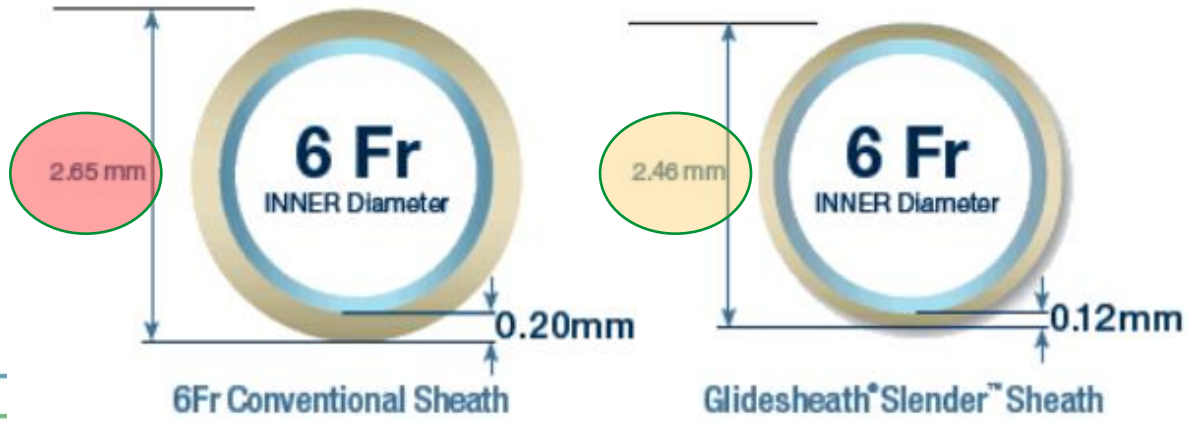
OD:6Fr
ID :6Fr

TERUMO

Glidesheath Slender®

TransRadial Introducer Kit

Glidesheath Slender features an outer diameter equivalent to a 5Fr while maintaining an inner diameter large enough for a 6Fr. It is designed for ideal TransRadial procedure. This unique concept of a 6-in-5Fr is patient-friendly and makes daily TRI procedures more comfortable.



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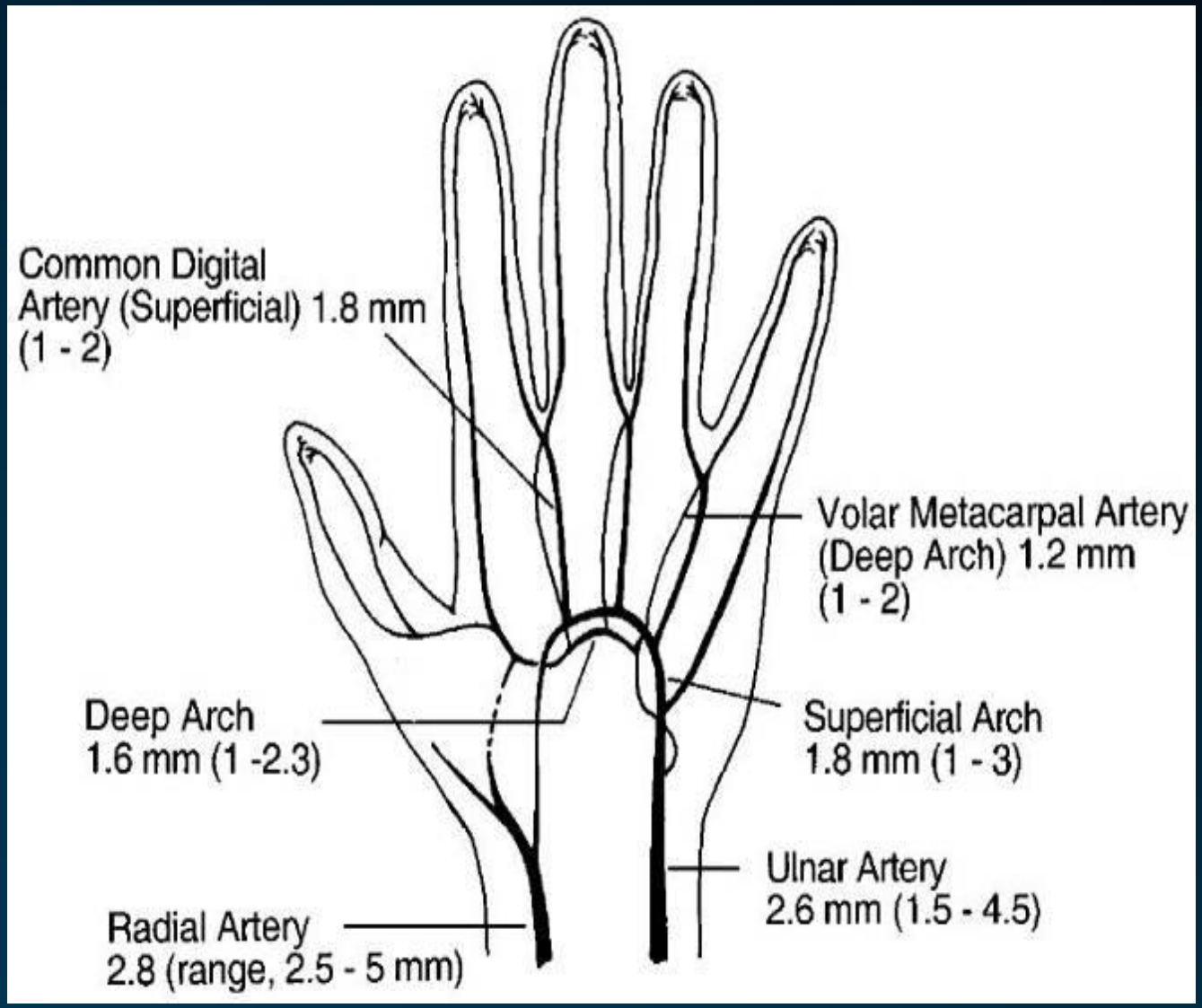
Glidesheath Slender 6Fr			
Sheath length	**Entry needle**		**Mini guide wire[1]**
10cm Hydrophilic	Plastic IV catheter	20G(0.9mm)x51mm	Plastic 0.025”(0.64mm)x45cm
		20G(0.9mm)x51mm	Spring 0.025”(0.64mm)x45cm
		22G(0.7mm)x32mm	Plastic 0.021”(0.53mm)x45cm
	Metallic entry needle	20G(0.9mm)x35mm	Spring 0.025”(0.64mm)x45cm
		21G(0.8mm)x35mm	Spring 0.021”(0.53mm)x45cm
16cm	Plastic IV catheter	20G(0.9mm)x51mm	Plastic 0.025”(0.64mm)x80cm
		20G(0.9mm)x51mm	Spring 0.025”(0.64mm)x80cm
		22G(0.7mm)x32mm	Plastic 0.021”(0.53mm)x80cm
	Metallic entry needle	20G(0.9mm)x35mm	Spring 0.025”(0.64mm)x80cm
		21G(0.8mm)x35mm	Spring 0.021”(0.53mm)x80cm

Radial approach is expected to continue to increase



Optimal pharmacology:
My preferred cocktail for radial cases / protocol for spasm

Sedate artery and patient

IV Midazolam

Try to puncture in the first attempt

After puncture: IA Verapamil 2.5mg

After catheter in aorta - Heparin