# Basic Knowledge for Catheter-based Intervention

### 인천세종병원 공준혁

### Introduction





#### **Vascular Specialists**



### Where

Motorized C-orm reduces stoff dependence and improve patient throughp



# **X-ray protection**

X-ray badge

Thyoid X-ray collar lead apron X-ray goggle



Mobile X-ray barrier







#### X-ray barrier



# Angiogram

• Routine Flurography

• DSA(digial subtraction angiography

• Roadmap







# Positioning the patient (for a right-handed operator)





### Access-site strategies for femoropopliteal artery intervention



# Unit



• Inch

- Wire

• French

mm

- Sheath (inner), Catheter
- Balloon, Stent

- 1 mm = 0.039 inch = 3F
- 25.2mm = 1 inch



### **Classification of Catheter**



### **Sheath(French): Inner wall**



### The Difference....

#### Avanti+

#### **Brite Tip Sheath**





### **Shuttle Sheath**

- 90 cm long
- Kink resistant
- Soft SL tip design
- Hydrophilic coating
- 6 Fr sheath compatible with most carotid stent platforms

4 F sheath compatible With BTK intervention



### **Balkin Sheath**

#### **Cordis contralateral guding sheath**

### **CFA Access**

- Optimal access-
  - Above bifurcation
  - Below inferior epigastric artery



#### **GUIDELINES AND STANDARDS**

#### Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists

 Christopher A. Troianos, MD, Gregg S. Hartman, MD, Kathryn E. Glas, MD, MBA, FASE, Nikolaos J. Skubas, MD, FASE, Robert T. Eberhardt, MD, Jennifer D. Walker, MD, and
Scott T. Reeves, MD, MBA, FASE, for the Councils on Intraoperative Echocardiography and Vascular Ultrasound of the American Society of Echocardiography, *Pittsburgh, Pennsylvania; Lebanon, New Hampshire; Atlanta, Georgia; New York, New York; Boston, Massachusetts; and Charleston, South Carolina*

(J Am Soc Echocardiogr 2011;24:1291-318.)

Keywords: Anatomy, Artery, Cannulation, Femoral, Guidelines, Internal jugular, Pediatric, Peripheral, Subclavian, Ultrasound, Vascular, Venous



Figure 15 The guide wire (arrow) is demonstrated entering the ight IJ vein, in SAX (A) and LAX (B) views.





#### **Operation Schema**



### Micropuncture





### Micropuncture Introducer Set, Silhouette™ Transitionless: Cook

- For placement of .035" or .038" inch diameter wire guides into the vascular system when a small 21 gage needle stick is desired.
- Transitionless Stiffened Cannula
- Smooth shaft to tip transition to eliminate hang-up on skin

Antegrade puncture Popliteal aretry, tibial artery puncture





# **Optimizing Image Quality**

• Depth

• Gain

• Focus





# **Optimizing Image Quality**

• Depth

• Gain





• Focus





### **Image Orientation**





Figure 1. A 15-MHz i7 hockey stick probe.

### In-plane view(longitudinal) vs Out-of-plane(transverse)



### Sono-Guidance Puncture Animation



# **Retrograde CFA puncture**





### **Antegrade SFA puncture**



# **Simple PTA & Stent**





## **Classification of Catheter**



### **Catheter(French):Outer wall**

• Diagnostic catheter:

flushing/selective



• Guiding catheter:

### All Information on the Hub..



# **Top 5 Selective Catheters**

- COBRA
- SIDEWINDER
- BERENSTEIN
- RENAL DOUBLE CURVE
- HEADHUNTER



# **Guiding Catheters**

- From 6F to 10F
- For safe balloon and stent delivery
- Designed to be introduced in vessel ostium
- For back up support
- Mainly in renal arteries



### **Peripheral Guiding Catheters**











Cordis a gefinier - gefinier company ENDOVASCULAR

**Renal Double Curve** 

Vista britetip Peripheral Guiding Catheter



Vista britetip Peripheral Guiding Catheter





**Hockey Stick** 




# **Guidewire Functions**

- First device IN, last device OUT !!!
- Insert sheath introducers.
- Straighten the vessel to help advance the catheter or interventional device.
- Facilitate the exchange of catheters.
- Guide and help place a catheter or interventional device.
- Access and cross the lesion site.



### **Wire Diameters**

• Always measured in thousandths of an inch.

- <u>.014" for Rx systems (Originally Cardiology)</u>
- <u>.018</u>" for crossing tight stenose
- <u>.035" for support for delivering devices</u>
- .038" for support for delivering devices

# Wire(inch): Outer wall

- Diameter:
- Coating:
- Stiffness:
- Tip shape:
- 0.014/0.018/0.035/0.038 hydrophilic/teflon/steel standard/stiff/superstiff

### **Hydrophilic Coating**



### **BENEFITS:**

Facilitate device trackability

Cross tight lesions

# **Hydrophilic Wires**

- Angiodynamics: AquaLiner
- Angiotech: CanaliZer
- Asahi: Regalia 1.0XS
- Boston Scientific: Transend Steerable, Fathom-14,16 Steerable, Zipwire
- Cook: HiWire, Roadrunner
- Cordis: Aquatrack
- Medtronic: Cougar, Zinger, Thunder, Persuader 3/6/9

- Merit: H2O
- Microvention: Headliner, Traxcess
- Micrus: Watusi
- St Jude: Hydrosteer
- Terumo: Glidewire,
  <u>Glidewire Gold</u> J, straight
- Vascular solutions: VSI

### **Coiled Stainless Steel Wires**

- Abbott: Hi-Torque Supra Core/ Steelcore/ Spartacore
- Angiodynamics: PTFEcoated
- B.Braun: Guidewires
- Boston Scientific: Amplatz Super Stiff, Meier, Starter, Schneider
- Cardiovascular Systems: Viperwire
- Cordis: Emerald
- ev3/Invatec: Nitrex, Babywire

- Cook: Safe-T-J, Bentson, Newton, Rosen, Amplatz Extra Stiff/Ultra Stiff/
  - Tapered, Lunderquist, Double flexible tip, Tefcor
- Merit: InQwire
  - Covidien (Tyco/Mallinckrodt): Wholey Hi-Torque, TAD, Flex Hi-Torque
- St Jude: GuideRight
- Vascular Solutions: VSI, Jiffy, VSI

### **SHAFT STIFFNESS**



### SHAFT STIFFNESS

Function of core size

Larger core => stiffer shaft

Create "room" for larger core with flat-wire coil

Stiff shaft provides support for device delivery



![](_page_44_Picture_6.jpeg)

![](_page_45_Picture_0.jpeg)

# **Balloon(mm): Outer wall**

![](_page_46_Figure_1.jpeg)

### Semi-compliant vs Non-Compliant

### **Radial Force : Balloon Compliance**

#### Compliance is the ability of a balloon to grow with pressure.

- <u>Semi-compliant</u> balloons grow and conform to the areas of least resistance as pressure is increased
  - Semi-compliant balloon actually grows more where it is not constricted, thus having a higher potential for causing edge dissections.
  - $\uparrow$  pressure =  $\uparrow$  size
- <u>Non-compliant</u> balloons grow and conform less as pressure is increased
  - Little change in volume with incremental
  - increases in pressure. More force is exerted against a lesion at a given inflation pressure than SC balloons, including stent delivery balloons.
  - $\uparrow$  pressure =  $\uparrow$  rigidity

Semi-Compliant

![](_page_47_Picture_11.jpeg)

"Dog bone" effect

Non-Compliant

![](_page_47_Picture_14.jpeg)

![](_page_47_Picture_15.jpeg)

Romagnoli et al JACC 2008

### **Compliant vs Non-Compliant**

![](_page_48_Picture_1.jpeg)

(a) A compliant balloon tends to be oversized at the edges, with less dilatati on at the obstructive segment of the lesion ('dog-boning')(b) A noncompliant balloon gives a predictable amount of pressure at the les ion without uncontrolled radial and longitudinal growth

### **IN.PACT DCB** with FreePac Coating

![](_page_49_Figure_1.jpeg)

#### **IN.PACT**<sup>™</sup>

Medtronic-Invatec DEB
 balloon line

#### **FreePac**™

- Proprietary hydrophilic coating formulation
  - Urea facilitates improved drug transfer efficiency from balloon
  - Urea facilitates
    Paclitaxel absorption
    into the vessel wall

### **DEB Coating Overview**

![](_page_50_Figure_1.jpeg)

#### **DEB Desired Coating Characteristics**

<b>Desired Characteristic</b>	Why Important
Durability	Ensure therapeutic dose of drug reaches lesion
Uniformity	Ensure uniform drug dose applied to vessel wall
Drug Transfer Efficiency	Fast release to vessel wall
Safety	<ul><li>Minimize embolic particulate</li><li>Minimize vessel wall inflammation</li></ul>

### Temporary Occlusion/Vascular Prostheses Post Dilatation Balloons

- Coda Balloon Catheter (Cook)
- RELIANT® Stent Graft Balloon Catheter (Medtronic)
- Berenstein Large Balloon Catheter
- Equalizer Balloon Scientific)

![](_page_51_Picture_5.jpeg)

![](_page_52_Picture_0.jpeg)

# Stent(mm):Outer wall

### Balloon expandable

#### Advantages :

- Radiopacity
- Radial force
- Precise delivery

#### Disadvantages:

- Flexibility
- Trackability

#### Indications:

 Short, calcified stenoses

![](_page_53_Picture_11.jpeg)

### Self expandable

#### Advantages :

- Flexibility
- Trackability

#### Disadvantages :

- Radiopacity (advantage of distal radio-opaque markers)
- Radial force

#### Indications :

- Long lesions, tortuous arteries.

![](_page_53_Picture_21.jpeg)

![](_page_53_Picture_22.jpeg)

### Open-Cell vs Closed-cell Stent

![](_page_54_Picture_1.jpeg)

### Open-Cell vs Closed-cell Stent

Stent Design and Prototype	No. 144
Closed-cell stents	
Wallstent (Boston Scientific, Natick, MA),	31
Niti-S stent (Taewoong Med, Seoul, Korea)	113
Open-cell stents	257
Luminexx (Bard Peripheral, Murray Hill, NJ)	27
SMART stent (Cordis, Miami lakes, FL)	125
Zilver (Cook, Bloomington, IN)	105

### **Closed-cell stent**

![](_page_56_Picture_1.jpeg)

### **Stent Complications**

![](_page_57_Picture_1.jpeg)

![](_page_57_Picture_2.jpeg)

![](_page_57_Picture_3.jpeg)

![](_page_57_Picture_4.jpeg)

![](_page_57_Picture_5.jpeg)

![](_page_57_Picture_6.jpeg)

### **Disease Based Devices**

### **Endo for PAOD**

![](_page_59_Picture_1.jpeg)

# New technologies for lower extremity revascularization

![](_page_60_Figure_1.jpeg)

- Drugs
- Subintimal Angioplasty
- Bare Stents
- Covered stents
- Drug eluting Stents
- Drug eluting balloon
- Bioabsorbable Stents
- Brachytherapy
- Cryoplasty
- Cutting balloon
- Photodynamic therapy
- Debulking -artherectomy

### **Directional Atherctomy catheter**

![](_page_61_Picture_1.jpeg)

A catheter equipped with a bladed tip is guided to the blockage. A balloon is inflated to push the blade toward the plaque to cut it away. Pieces of the plaque are stored within a chamber and removed when the catheter is withdrawn. © 2004 · Duplication not permitted

![](_page_61_Picture_3.jpeg)

![](_page_61_Picture_4.jpeg)

![](_page_61_Picture_5.jpeg)

![](_page_61_Picture_6.jpeg)

# Rotational Atherectomy catheter

![](_page_62_Picture_1.jpeg)

![](_page_62_Picture_2.jpeg)

![](_page_62_Picture_3.jpeg)

# TEVAR

Descending Thoracic Aortic Aneurysm Ruptured DTA Thoracic Aortic Dissection Aortic Ulcers/Mobile Atheroma Traumatic Aortic Transection Aorto Bronchial Fistulas Other Aortic Pathology

![](_page_63_Picture_2.jpeg)

![](_page_63_Picture_3.jpeg)

![](_page_64_Picture_0.jpeg)

IVI Y ()

Aortofix

Zenith

# **EVAR**

![](_page_64_Figure_2.jpeg)

![](_page_64_Picture_3.jpeg)

### **T-Branch**

![](_page_65_Picture_1.jpeg)

Fig 1. Cook Zenith t-Branch. A, Picture of the t-Branch. B, Intraoperative image of the t-Branch before deployment. Radiopaque markers: *CT*, Celiac trunk; *LR*, left renal artery; *RR*, right renal artery; *SMA*, superior mesenteric artery. C, Intraoperative image of the t-Branch after deployment. D, Postoperative computed tomography angiography of the t-Branch, volume rendering.

### Carotid Artery Stenting

![](_page_66_Figure_1.jpeg)

# Endo of DVT

![](_page_67_Figure_1.jpeg)

# **Endo for AVF**

![](_page_68_Picture_1.jpeg)

### **Catheter Management**

![](_page_69_Picture_1.jpeg)

Permcath

Long term cath

Chemoport

PICC

![](_page_69_Picture_6.jpeg)

![](_page_69_Picture_7.jpeg)

![](_page_69_Picture_8.jpeg)

![](_page_69_Picture_9.jpeg)

### Varicose vein

![](_page_70_Figure_1.jpeg)

![](_page_70_Figure_2.jpeg)

![](_page_70_Picture_3.jpeg)

![](_page_70_Picture_4.jpeg)

### Summary

![](_page_71_Picture_1.jpeg)

![](_page_71_Figure_2.jpeg)

#### **Vascular Specialists**

![](_page_71_Figure_4.jpeg)
# 수고하셨습니다.

joonhyukkong@empas.com Youtube: " joonhyukkong"

#### **Reentry Catheter**

# New technologies for lower extremity revascularization



- Drugs
- Subintimal Angioplasty
- Bare Stents
- Covered stents
- Drug eluting Stents
- Drug eluting balloon
- Bioabsorbable Stents
- Brachytherapy
- Cryoplasty
- Cutting balloon
- Photodynamic therapy
- Debulking -artherectomy



#### Torque Device

#### Frontrunner XP Peripheral CTO

- .039" distal tip size
- 2.3mm jaw opening
- 90 and 120cm lengths
- Responsive torque
- Shapeable distal tip
- Blunt micro-dissection technology





## Frontrunner XP Peripheral CTO



#### **Outback and Pioneer Catheter**

Enables rapid, safe, and reproducible re-entry of a guidewire from the subintimal space back into the true lumen of a peripheral vessel



#### Distal Housing & Nosecone Assembly - Detail A











#### Crossover





# **Pigtail & Outback**



## Atherectomy

# New technologies for lower extremity revascularization



- Drugs
- Subintimal Angioplasty
- Bare Stents
- Covered stents
- Drug eluting Stents
- Drug eluting balloon
- Bioabsorbable Stents
- Brachytherapy
- Cryoplasty
- Cutting balloon
- Photodynamic therapy
- Debulking -artherectomy

## **Types of Atherectomy**

- Directional Atherectomy
- Rotational Atherectomy
- Transluminal Extraction Atherectomy

#### **Directional Atherctomy catheter**



A catheter equipped with a bladed tip is guided to the blockage. A balloon is inflated to push the blade toward the plaque to cut it away. Pieces of the plaque are stored within a chamber and removed when the catheter is withdrawn. © 2004 · Duplication not permitted









# **Directional Athrectomy**



# Rotational Atherectomy catheter







#### Transluminal Extraction Atherectomy

- Usually used for bypass graft arteries
- Tiny rotating blade and a hollow tube
- Particles are sucked into a tube through a

#### vacuum



The bladed catheter is guided to the blockage. Spinning blades slice away the plaque, and the pieces are sucked out of the body through a vacuum tube.







# **Risk and Benefits**

- Risks
  - Heart attack
  - Emergency bypass surgery
  - Coronary artery perforation

- Benefits
  - Open blocked arteries
  - Improve blood flow to heart
  - Relieves symptoms
  - Improves exercise duration
  - Stops or prevent heart attacks

#### TurboHawak



#### **JetStream**







#### Jetstream

