Large Bore Access: Tips, Tricks, and Closure Devices

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Disclosure of Relevant Financial Relationships

Within the prior 24 months, I have had a relevant financial relationship(s) with an ineligible company(ies) listed below.

Nature of Financial Relationship	Ineligible Company
Grant/Research Support	
Consultant Fees/Honoraria	Abbott, Abiomed, Edwards, Medtronic, OpSens, Shockwave
Individual Stock(s)/Stock Options	4C Medical
Royalties/Patent Beneficiary	
Executive Role/Ownership Interest	Major Medical
Other Financial Benefit	

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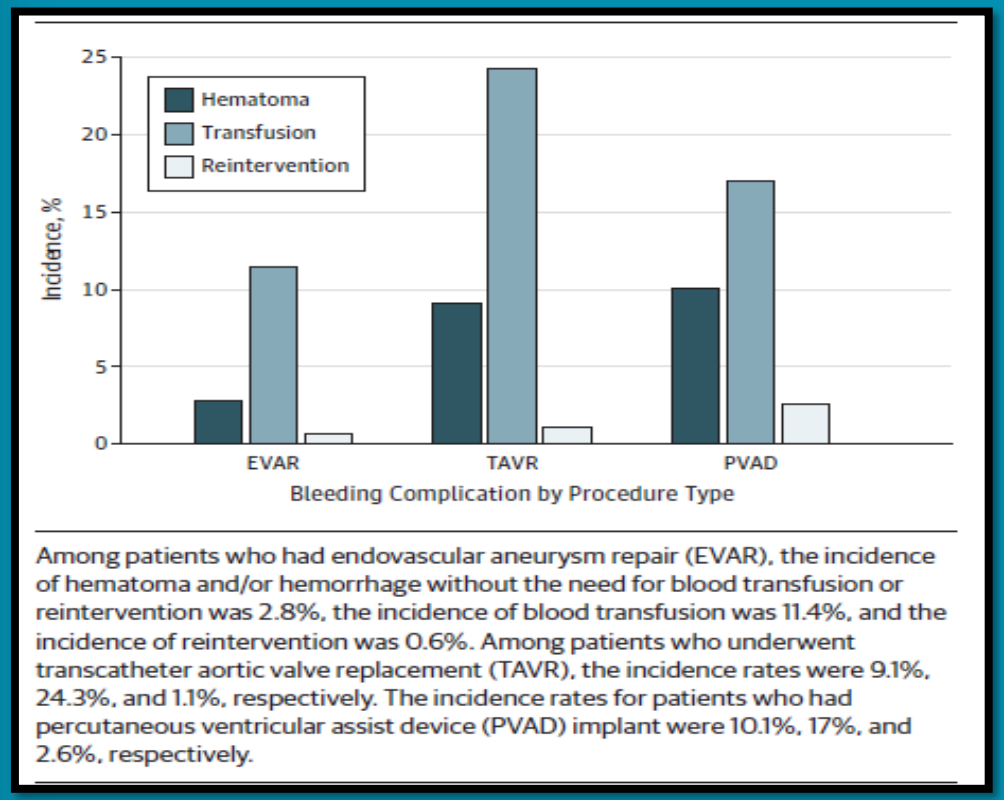
All Relevant Financial Relationships have been mitigated.
Faculty disclosure information can be found on the app

Incidence of Bleeding in Large Bore Access



Among patients who had endovascular aneurysm repair (EVAR), the incidence of hematoma and/or hemorrhage without the need for blood transfusion or reintervention was 2.8%, the incidence of blood transfusion was 11.4%, and the incidence of reintervention was 0.6%. Among patients who underwent transcatheter aortic valve replacement (TAVR), the incidence rates were 9.1%, 24.3%, and 1.1%, respectively. The incidence rates for patients who had percutaneous ventricular assist device (PVAD) implant were 10.1%, 17%, and 2.6%, respectively.

- 17,672 patients from national inpatient sample.
- Overall bleeding complications occurred in *17.7%* of patients
- Bleeding had *higher:*
  - Mortality
  - Cost
  - Longer Hospital Stay

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Redfors, B et al. MMortality, Length of Stay, and Cost Implications of Procedural Bleeding After Percutaneous Interventions Using Large-Bore Catheters. JAMA Cardiol. 2017 Mar 18

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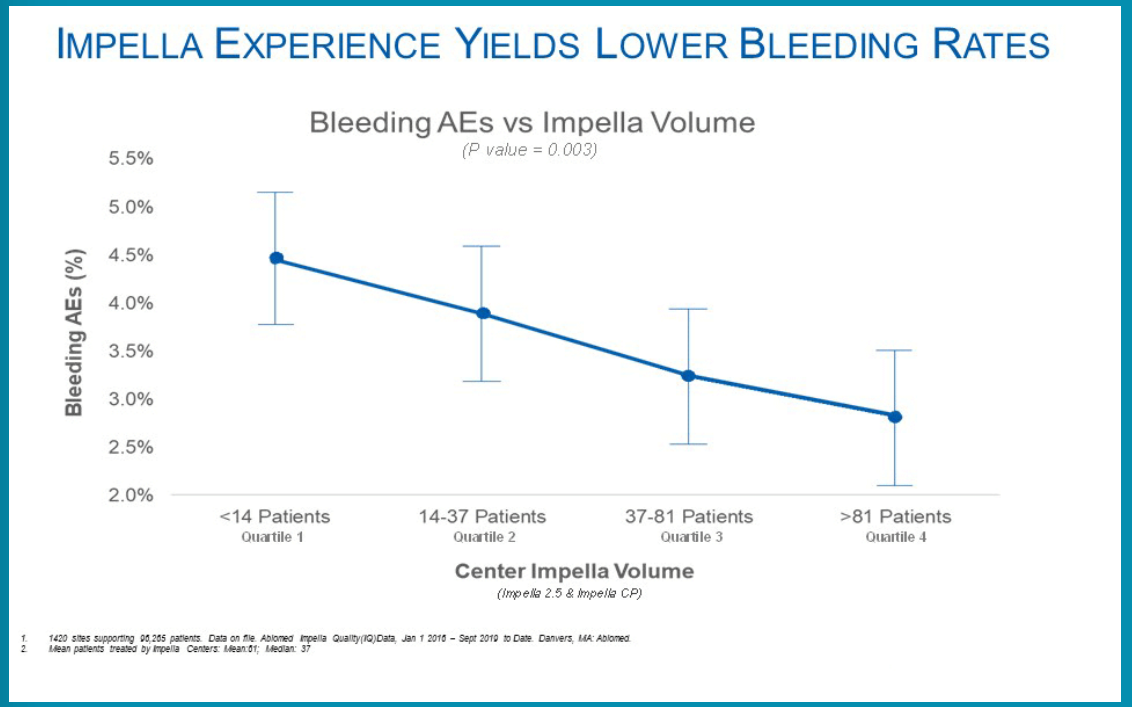
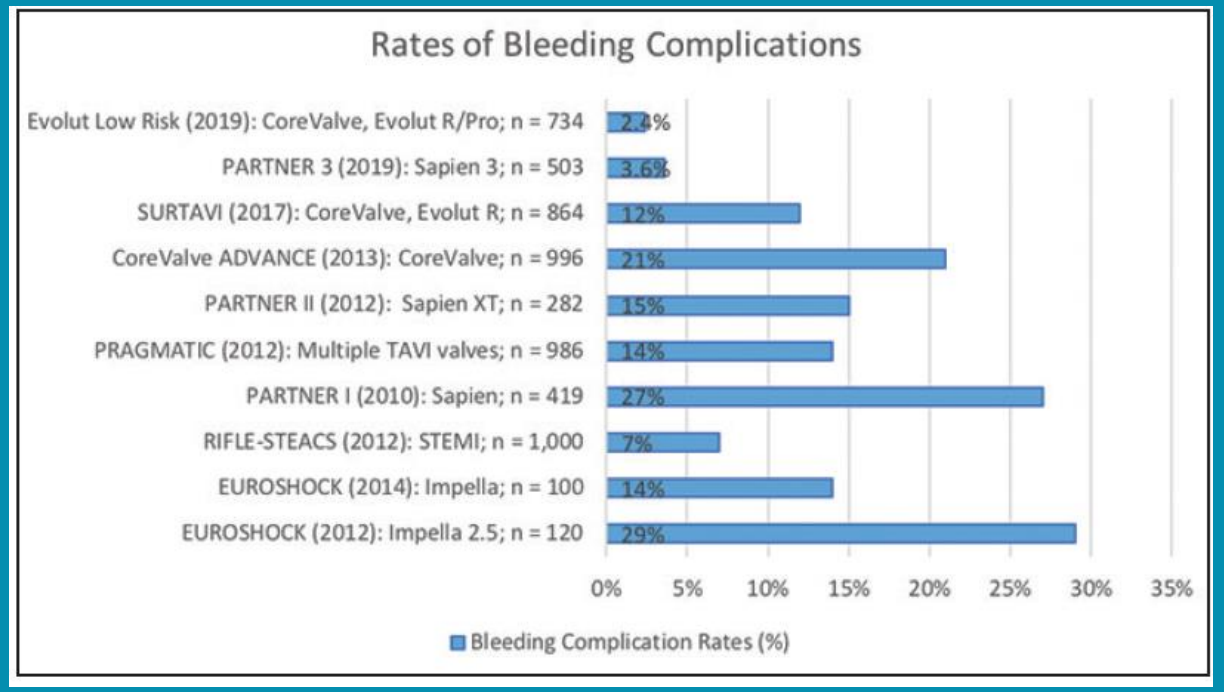
Decrease in bleeding with time and experience





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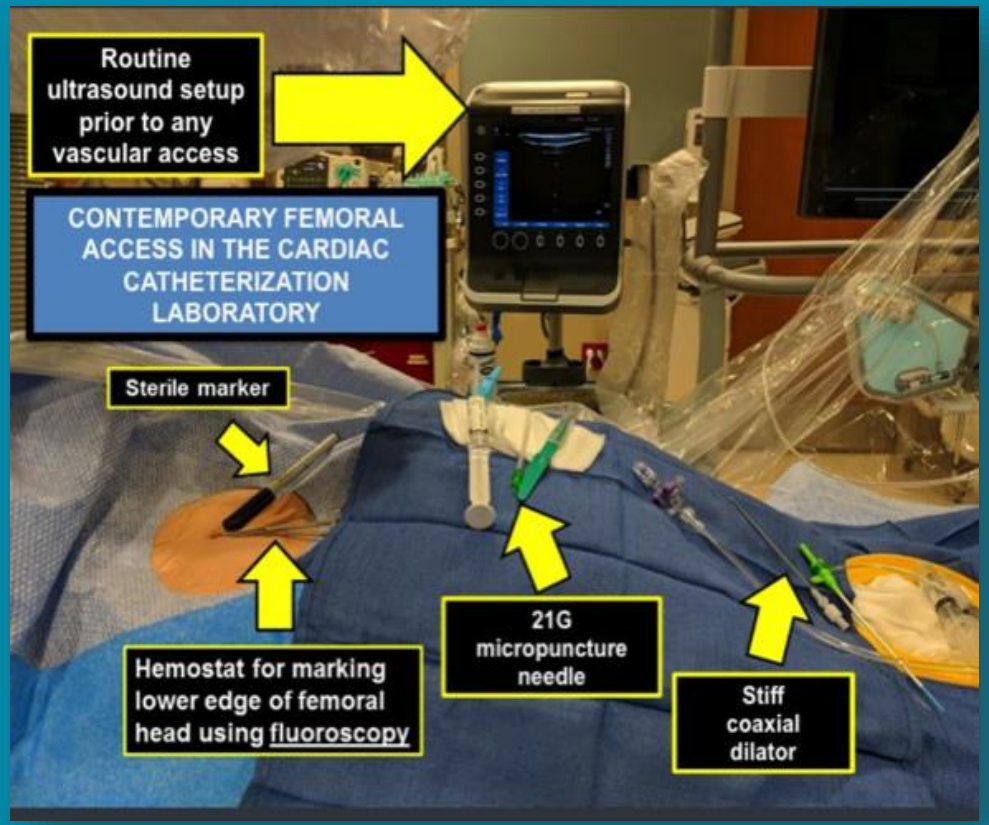
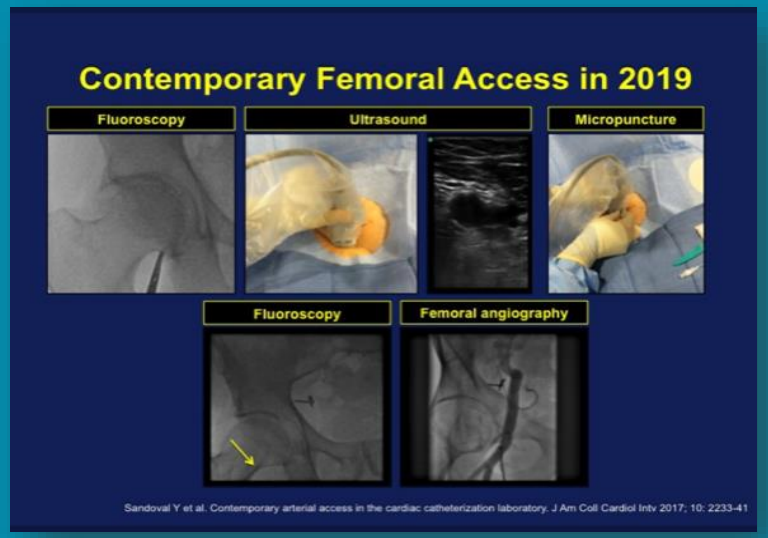
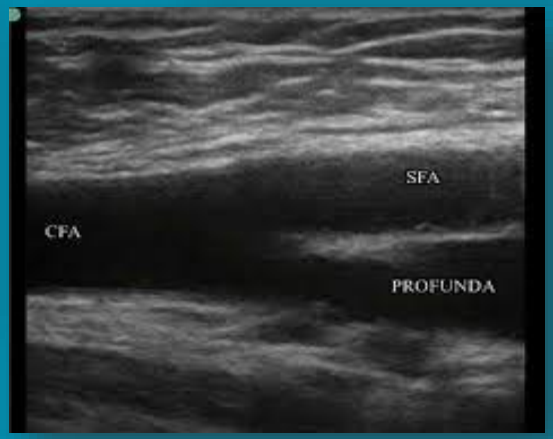
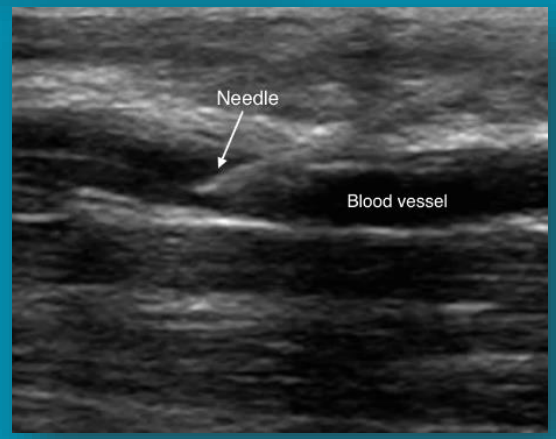
Best Practice for *ALL* Access









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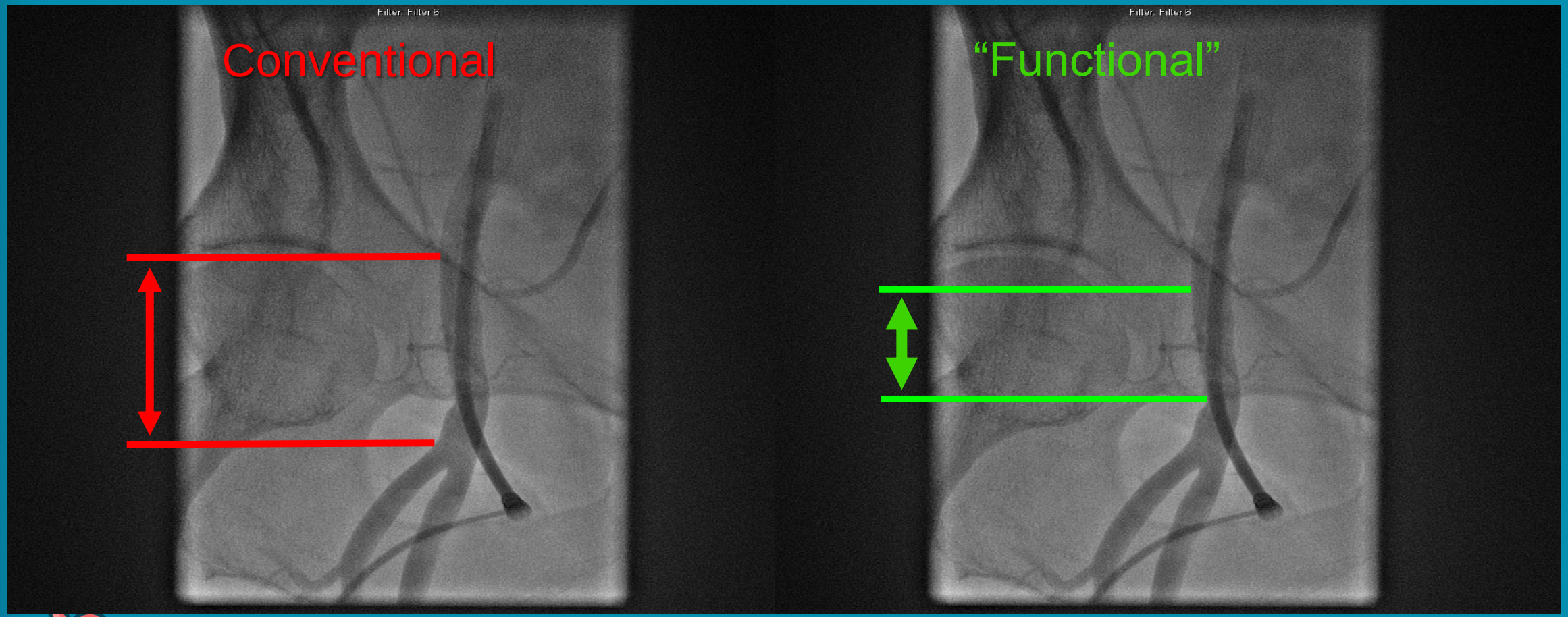
Focus on the Region of the Common Femoral that is Compressible



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Access: Step by Step

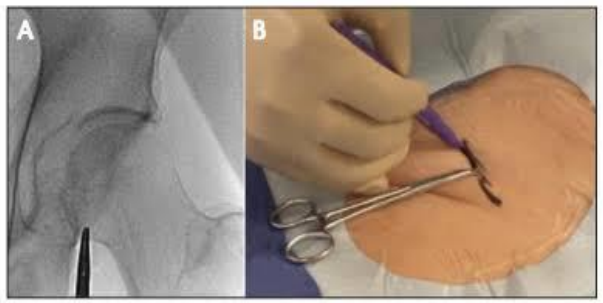
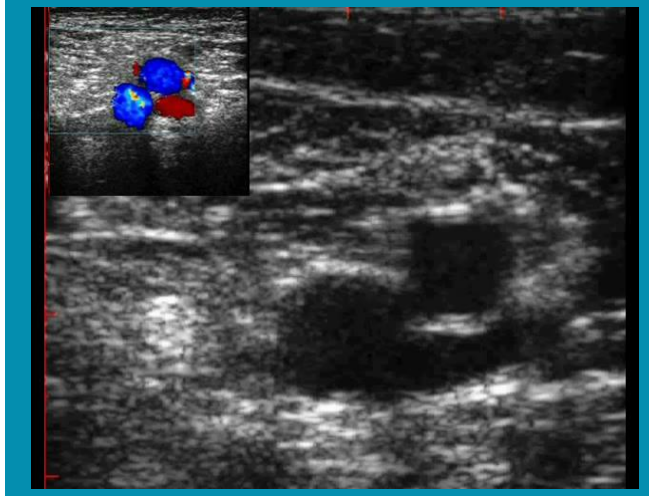
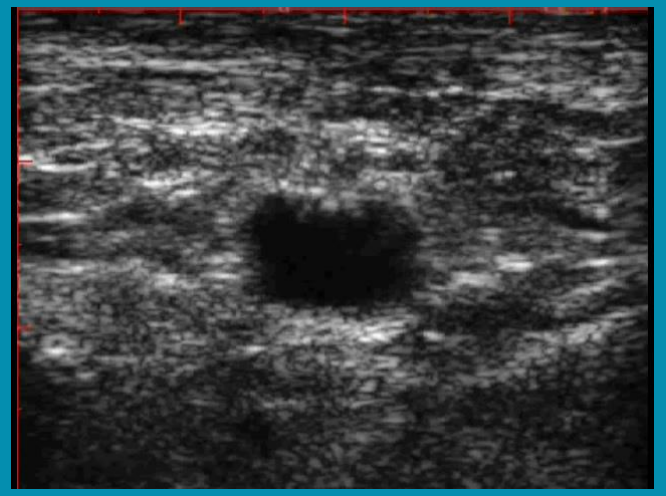
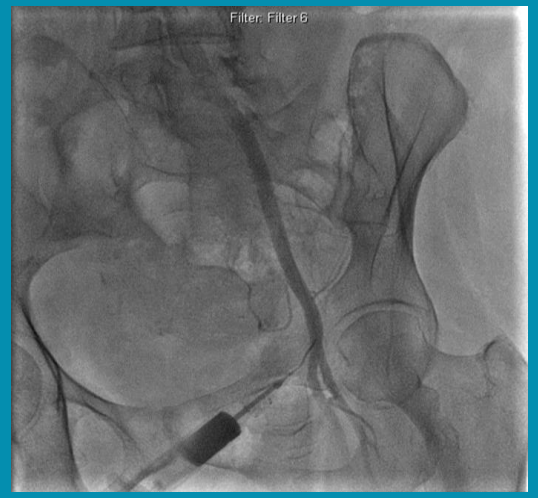


Figure 1. With the use of fluoroscopic guidance, the mid-lower femoral head is identified using a radiopaque object, such as curved Kelly hemostatic forceps (A). Once the site is identified, we then use a surgical marker to create a skin mark that is transverse to the direction of the femoral artery (B).





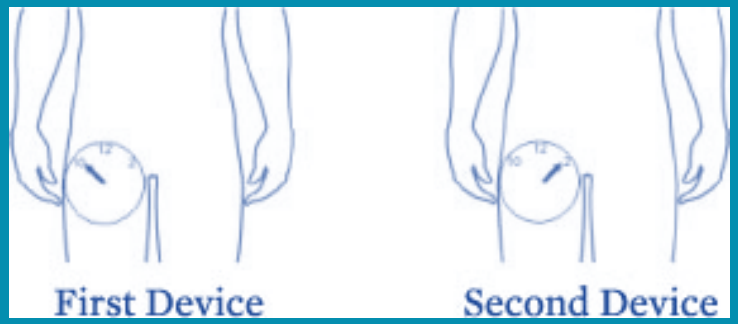


1. Palpate for pulses, identify bony landmarks
2. Verify with Fluoroscopy (vascular markers are helpful and usually on the table!)
3. Identify bifurcation of SFA/Profunda with Ultrasound
4. Move U/S Probe to identify ‘healthiest’ segment of CFA
5. Stick anterior wall of the vessel while visualizing under U/S
6. Perform Iliofemoral angiogram through 4Fr micropuncture sheath

Upsize to 6-8Fr Sheath and Pre-Close Arteriotomy

Deploy the needles of the first ProGlide device at least 30º medially or laterally from the midline.

The second ProGlide needles are then deployed at
≥ 60º angle from the first device, and the pretied knot and sutures of both devices are then secured with hemostats



- Typically 2 devices are used for access up to 20/22 Fr
- Typically 3 devices are used for ≥22 Fr or if the stability/adequacy of 1 stich is in question

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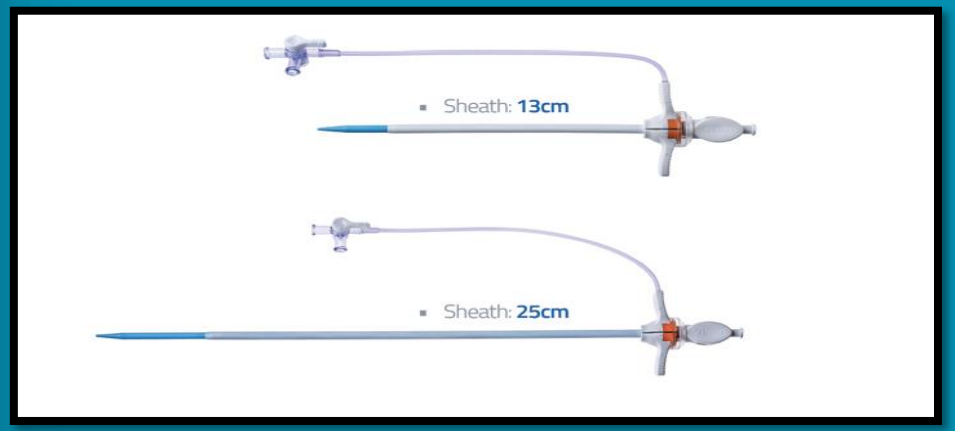
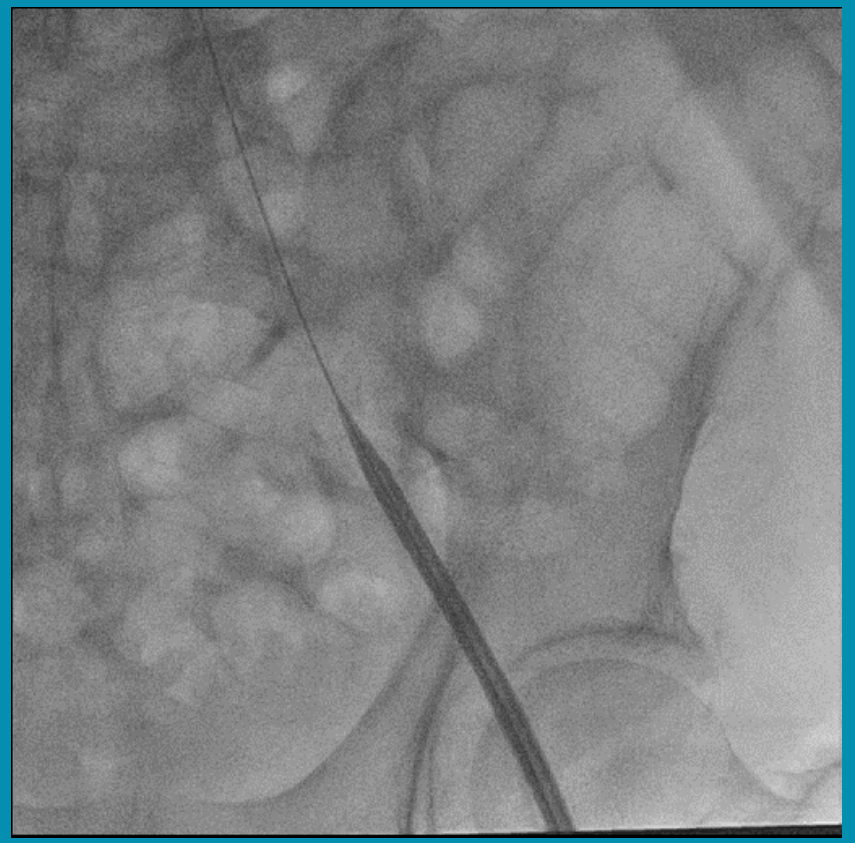
Access Site Dilation

- **Dilators and Sheath** Should be **Advanced Over a stiff wire:**
  - *Lunderquist*
  - *Amplatz Super Stiff*
  - *SupraCore*





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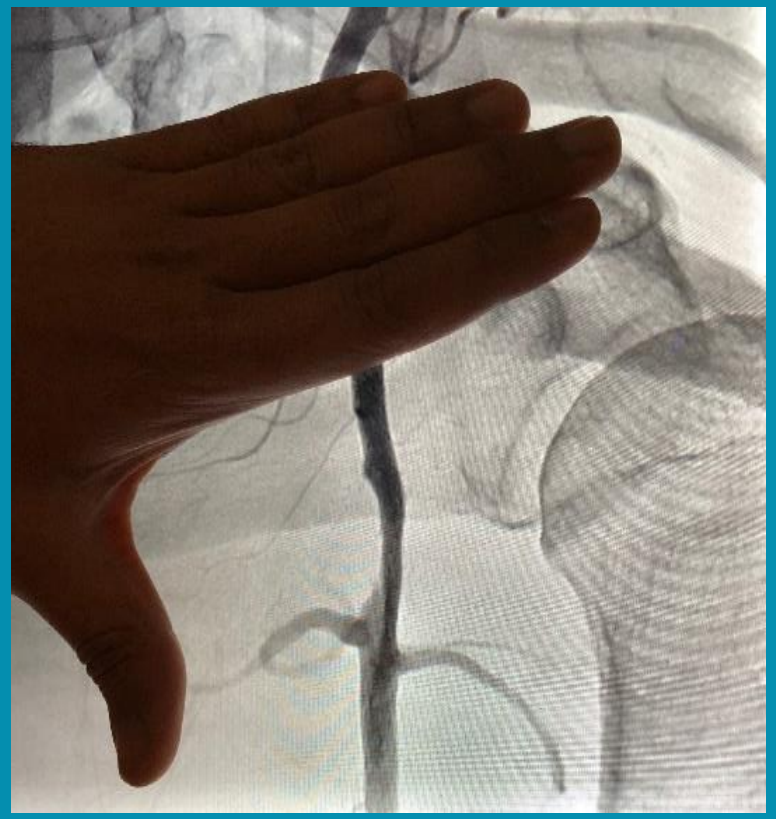
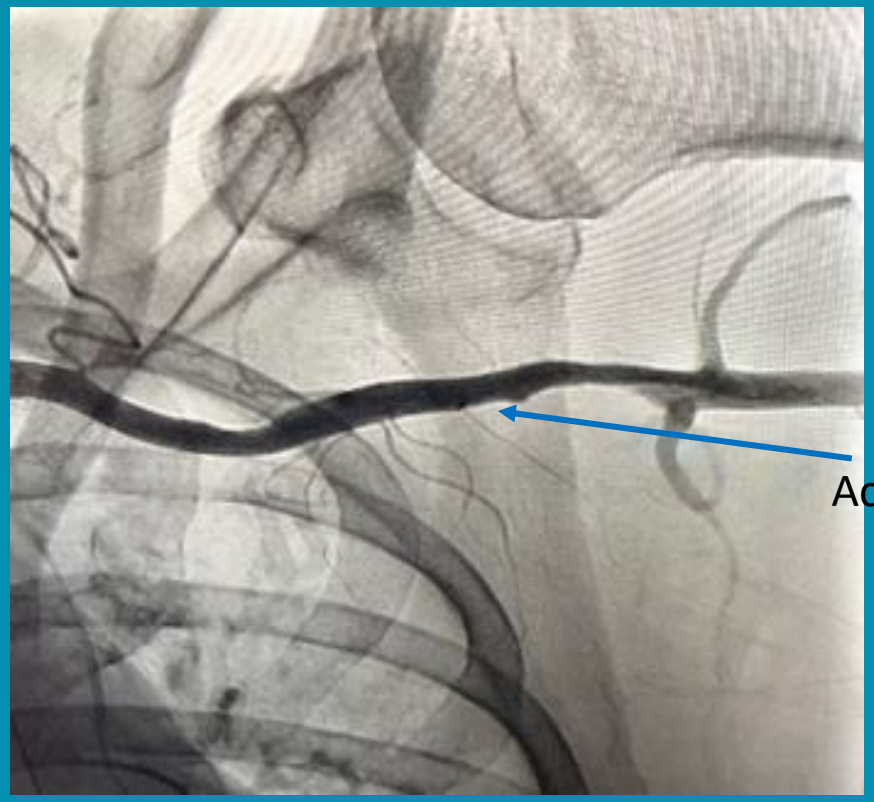
Large Bore Femoral Access is a Translatable Skill Set





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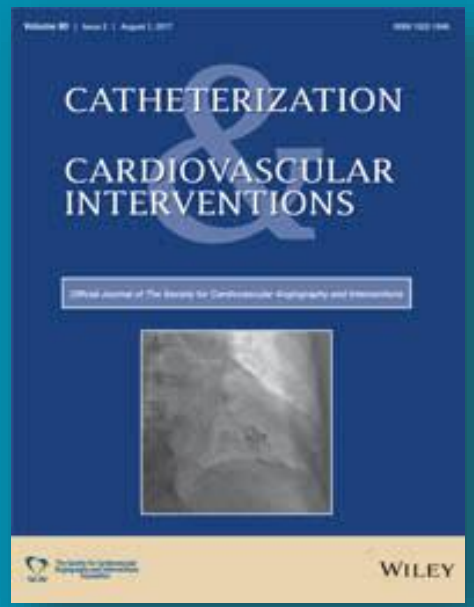
Femoral vs Axillary Artery Size

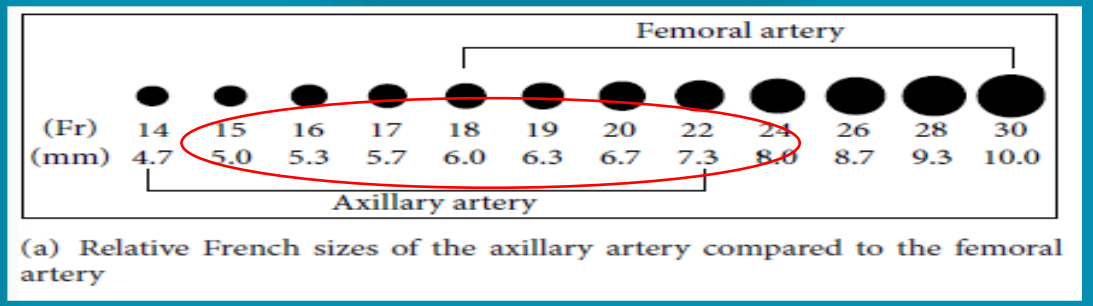
Caliber and Fitness of the Axillary Artery as a Conduit for Cardiovascular Procedures

Daniel M Arnett MD[1], James C Lee MD[2], Michael A Harms MD[1], Kathleen E Kearney MD[2], Mario Ramos, Bryn M Smith BSc, Rajiv Tayal MD[3], James M McCabe MD[2]

[1]Department of Medicine, University of Washington, Seattle, WA
[2]Department of Medicine, Division of Cardiology, University of Washington, Seattle, WA
[3]Department of Medicine, Division of Cardiology, Newark Beth Israel Medical Center, Newark, NJ

n = 208	Minimal Luminal Diameter, mm		Moderate to Severe Calcification, n		>50% Stenosis, N	
	Right	Left	Right	Left	Right	Left
Proximal Axillary Artery	6.0 ± 1.1	5.9 ± 1.0	18 (9%)	17 (8%)	4 (2%)	5 (2%)
Distal Axillary Artery	5.6 ± 1.0	5.6 ± 0.9				
Subclavian Artery	6.0 ± 1.1	5.8 ± 1.1	36 (18%)	45 (21%)	16 (8%)	17 (8%)
Innominate Artery	8.9 ± 1.8	n/a	40 (19%)	n/a	10 (5%)	n/a
Iliofemoral Arteries	6.6 ± 1.8	6.5 ± 1.8	137 (66%)	129 (62%)	25 (12%)	29 (14%)





(a) Relative French sizes of the axillary artery compared to the femoral artery

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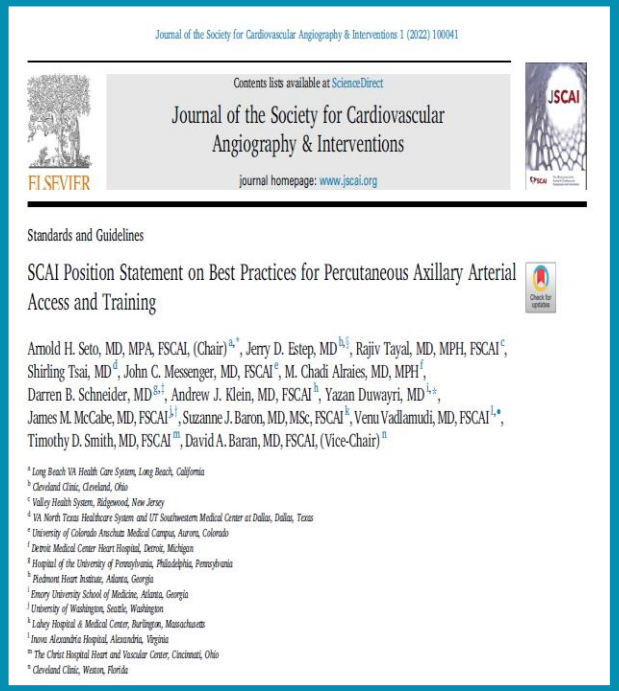
SCAI Position Statement on Best Practices for Percutaneous Axillary Artery Access



Journal of the Society for Cardiovascular Angiography & Interventions 1 (2022) 100041

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Journal of the Society for Cardiovascular Angiography & Interventions

journal homepage: www.jscai.org

Standards and Guidelines

SCAI Position Statement on Best Practices for Percutaneous Axillary Arterial Access and Training

Arnold H. Seto, MD, MPA, FSCAI, (Chair)[a,*], Jerry D. Estep, MD[b,§], Rajiv Tayal, MD, MPH, FSCAI[c], Shirling Tsai, MD[d], John C. Messenger, MD, FSCAI[e], M. Chadi Alraies, MD, MPH[f], Darren B. Schneider, MD[g,†], Andrew J. Klein, MD, FSCAI[h], Yazan Duwayri, MD[i,‡], James M. McCabe, MD, FSCAI[j,‖], Suzanne J. Baron, MD, MSc, FSCAI[k], Venu Vadlamudi, MD, FSCAI[l,*], Timothy D. Smith, MD, FSCAI[m], David A. Baran, MD, FSCAI, (Vice-Chair)[n]

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[b] Cleveland Clinic, Cleveland, Ohio
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[d] VA North Texas Healthcare System and UT Southwestern Medical Center at Dallas, Dallas, Texas
[e] University of Colorado Anschutz Medical Campus, Aurora, Colorado
[f] Detroit Medical Center Heart Hospital, Detroit, Michigan
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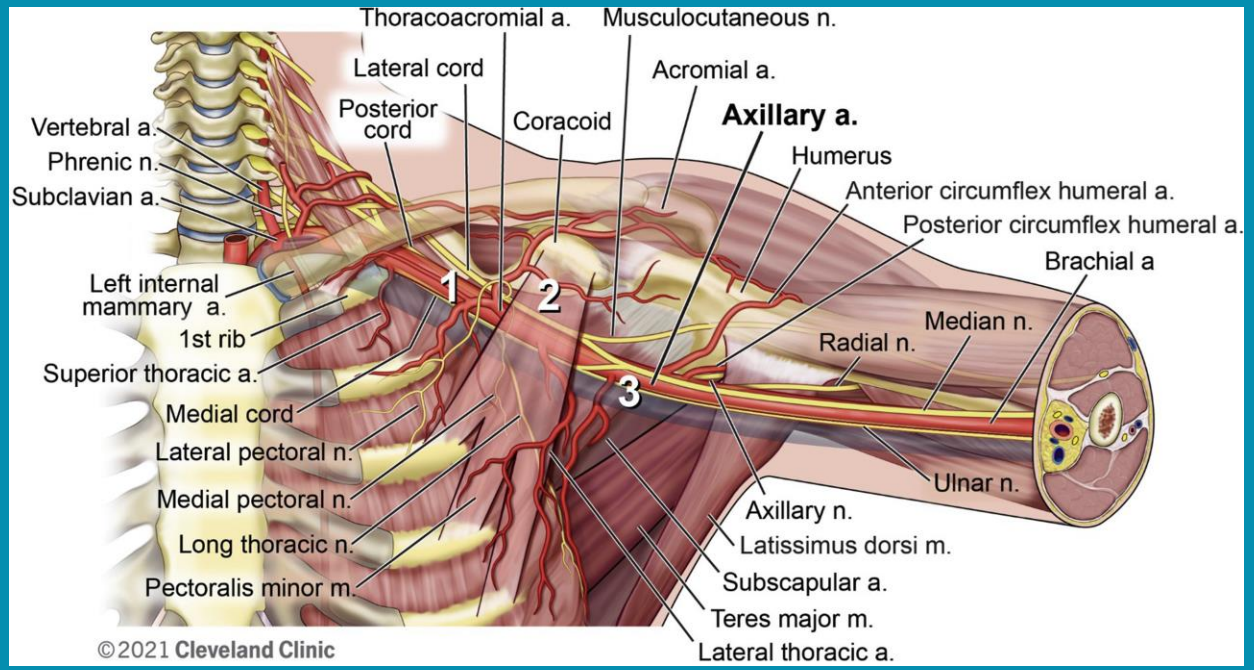
[i] Emory University School of Medicine, Atlanta, Georgia
[j] University of Washington, Seattle, Washington
[k] Lahey Hospital & Medical Center, Burlington, Massachusetts
[l] Inova Alexandria Hospital, Alexandria, Virginia
[m] The Christ Hospital Heart and Vascular Center, Cincinnati, Ohio
[n] Cleveland Clinic, Weston, Florida



- The artery is divided into three segments defined by the pectoralis minor muscle with the first segement being medial to the PM.
- The *posterior, medial, and lateral cords of the brachial plexus* are intimately related to the axillary artery
- **The absence of a cord *anterior* to the second segment results in a safer window for percutaneous puncture and closure techniques.**

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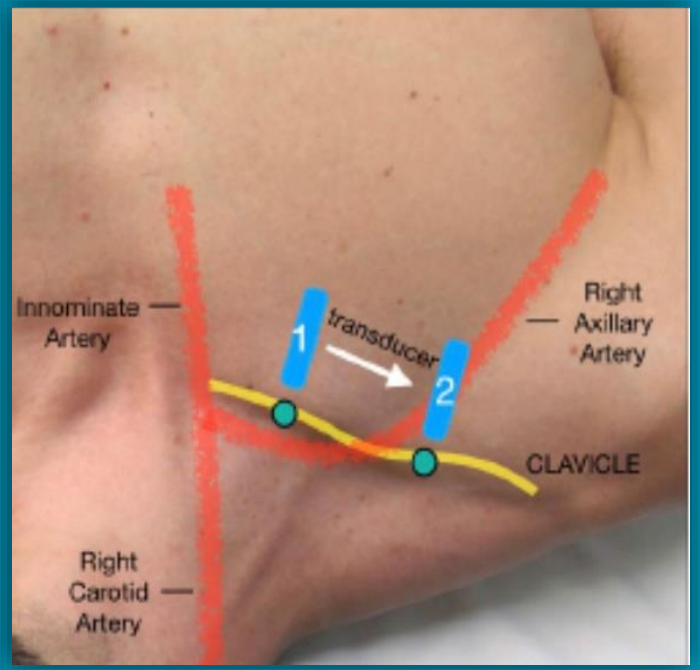
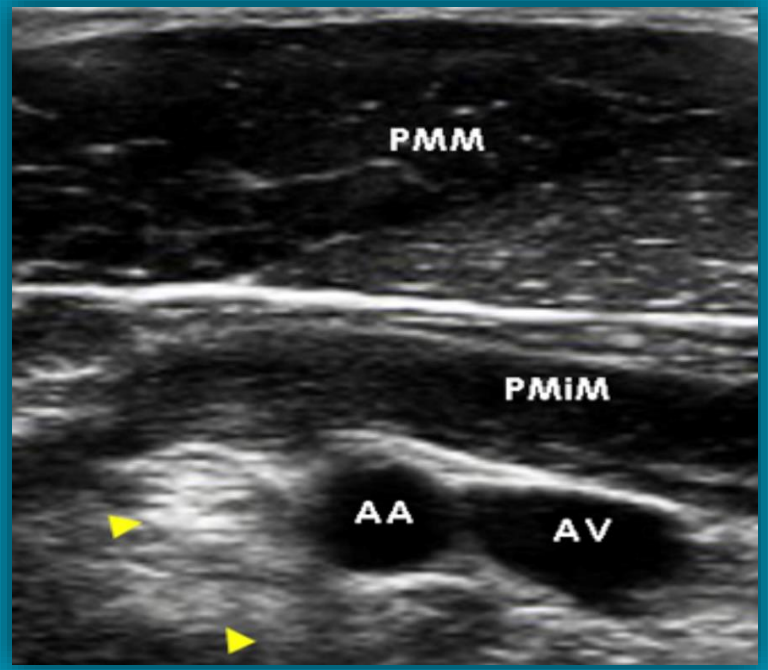
Ultrasound Guided Access

Wire Facilitates Identification of Artery





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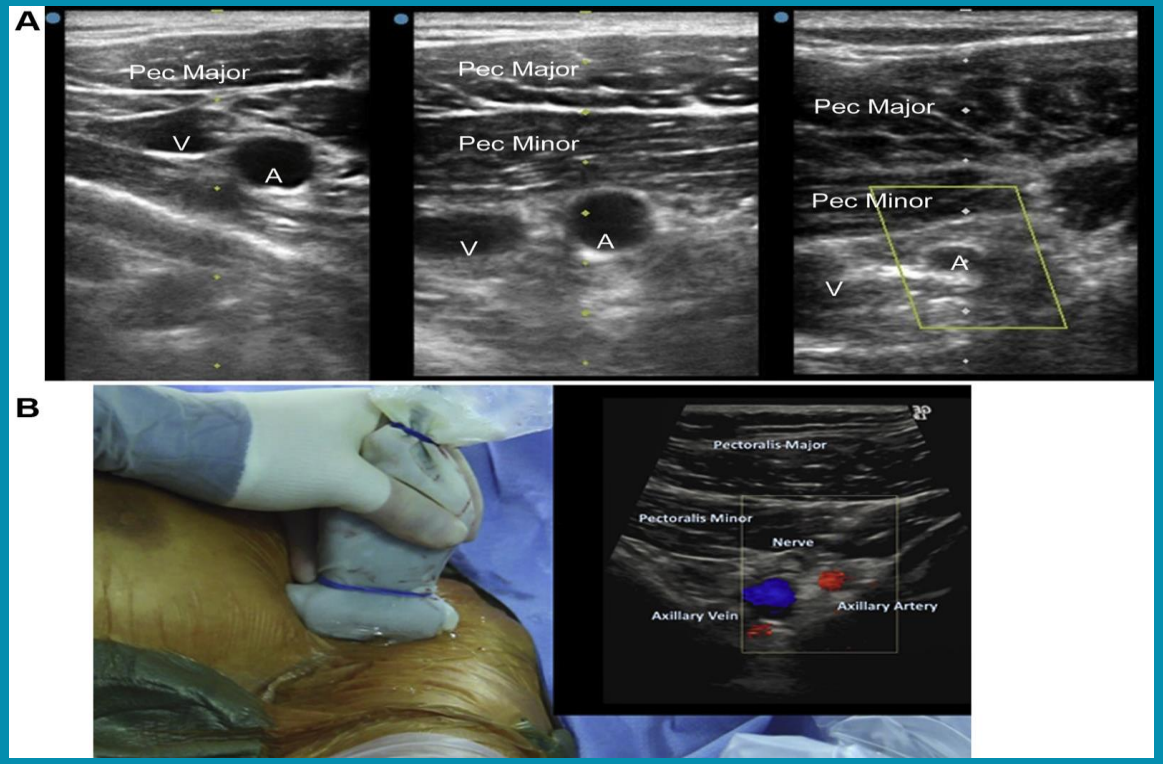
Ultrasound Guidance



Upper row: Representative cross-sectional left axillary ultrasound images at the first segment (left), second segment (center) and third segment (right) demonstrating the relationship between the pectoralis muscles (Pec), axillary vein (V), and axillary artery (A).
Lower panel: Ultrasound probe with (inset) color Doppler ultrasound image showing a nerve anterior to third axillary artery segment.

Landmarks to Reliably Obtain Safe Percutaneous Axillary Access

ORIGINAL CONTRIBUTION

Suggested Bony Landmarks for Safe Axillary Artery Access

Mohammad Thawabi, MD; Rajiv Tayal, MD, MPH; Zain Khakwani, MD; Michael Sinclair; Marc Cohen, MD; Najam Wasty, MD

ABSTRACT: Objective. To identify a fluoroscopic bony landmark for safe percutaneous axillary artery cannulation. **Background.** No bony landmarks exist to guide safe percutaneous axillary artery cannulation, which is an important alternate access site for catheter-based procedures in selected patients. **Methods.** We retrospectively analyzed 51 consecutive percutaneous axillary artery sheath angiograms and attempted to correlate a fixed bony landmark to the proximal end of the third part of the artery. Proximal to this site, no cords of the brachial plexus traverse the anterior aspect of the vessel. Moreover, this site is proximal to the subscapular branch of the axillary artery, the first branch of its third part, and a sentinel component of the scapular anastomosis responsible for collateral blood flow to the arm. **Results.** With the arm abducted at 135°, the subscapular artery originated at or distal to the inferior border of the glenoid cavity, as seen on fluoroscopy in the anterior-posterior projection, in all patients. The origin was within 5 mm distal to the inferior border of the glenoid cavity in 17 patients (46%), 5-10 mm in 13 patients (35%), and between 10 mm and 20 mm in 7 patients (19%). **Conclusions.** With the arm abducted, the origin of the subscapular artery correlates well with the inferior-most aspect of the glenoid cavity of the scapula under fluoroscopy. Axillary artery cannulation medial to this bony landmark typically lands the sheath in the second part or proximal end of the third part of the artery, thereby theoretically sparing injury to the brachial plexus and the subscapular artery.

J INVASIVE CARDIOL 2018;30(3):xxx-xxx
KEY WORDS: axillary artery cannulation, large-bore catheters, high-risk PCI, subscapular artery

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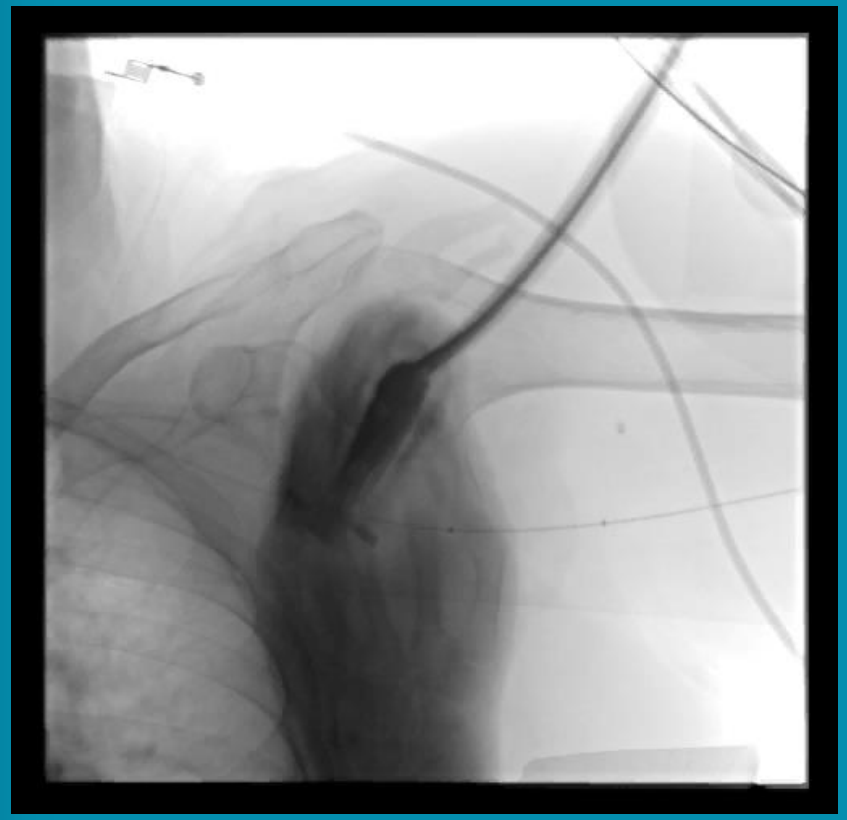
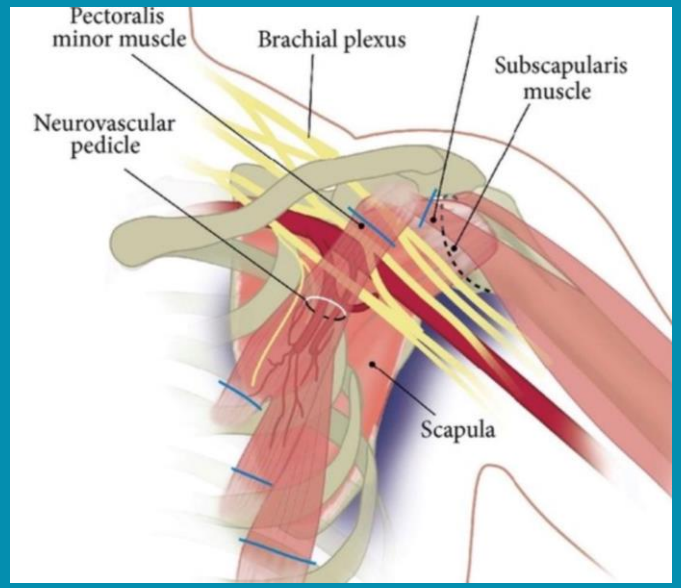
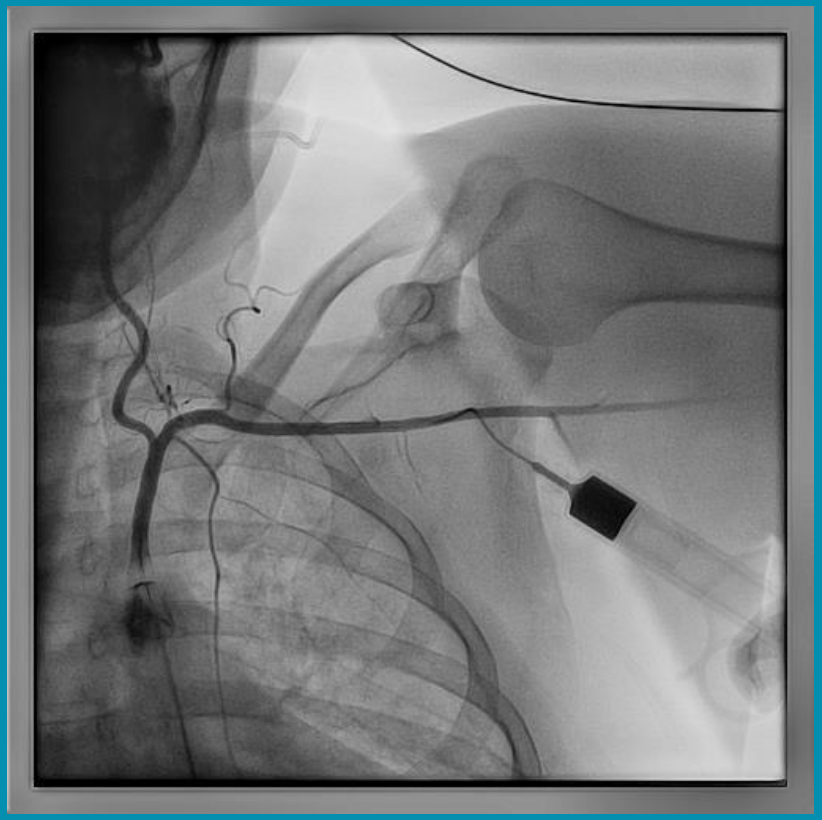
Inject Via Micropuncture Prior to 6-8Fr Sheath







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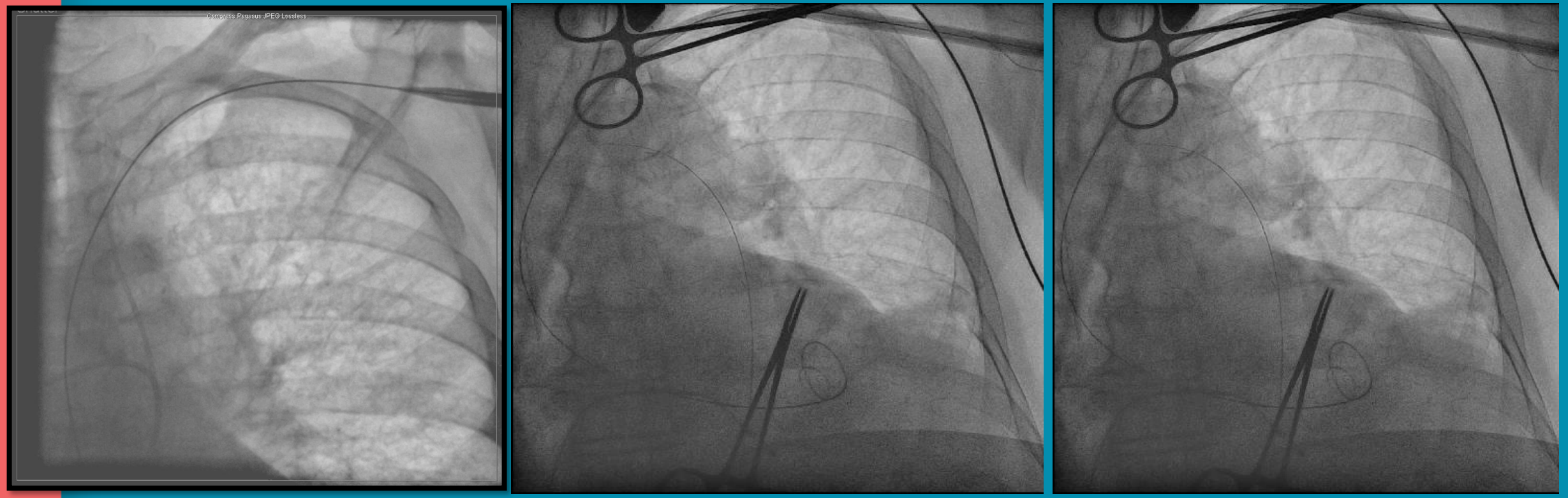
Double Pre-Close and Advance Sheath Over Stiff Wire



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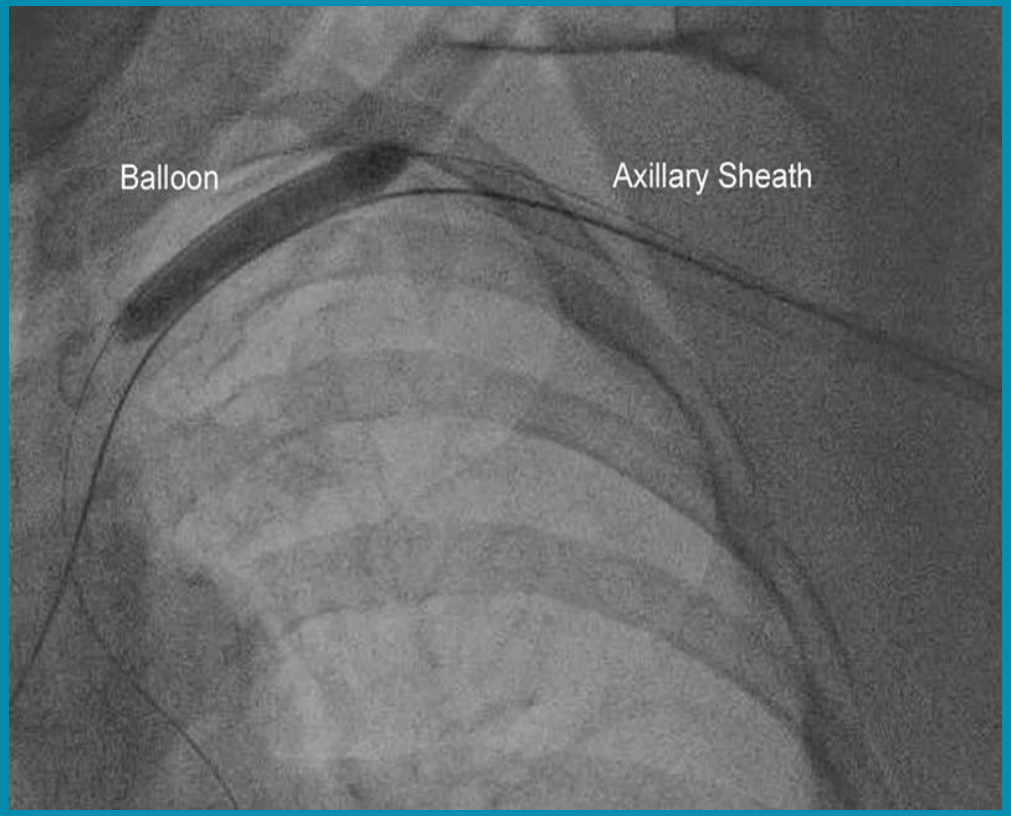
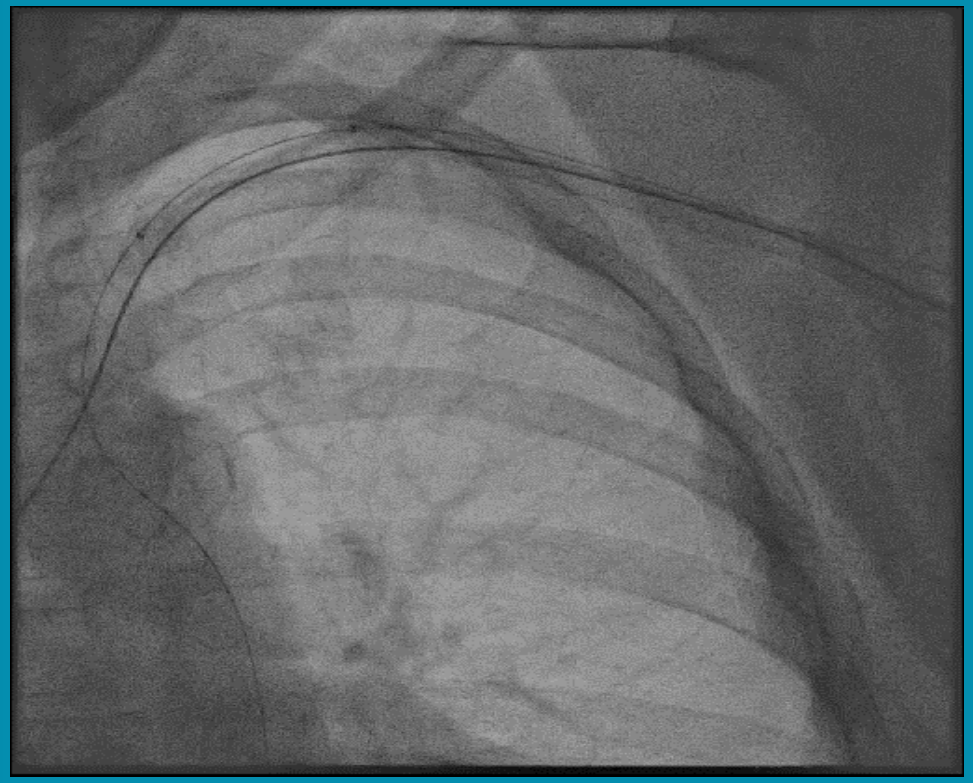
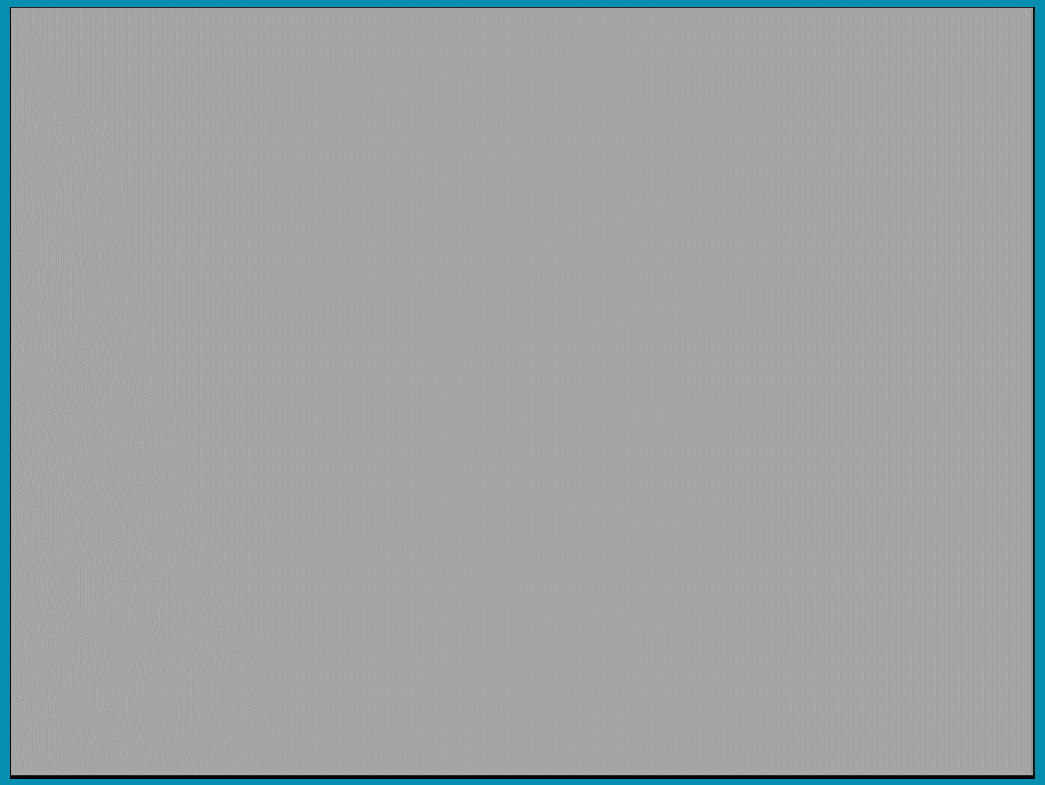
Hemostasis, Removal and Closure Techniques



- Dry closure of the axillary artery using a 1:1 sized 7-10 x 40mm balloon inflated in the subclavian artery prior to removal of the axillary sheath is recommended
- Vascular closure devices (VCD) are frequently utilized ‘off-label’ for axillary artery closure
- Most commonly Perclose with double Pre-close prior to LBA
- Hybrid Closure helpful

Dry Closure and DSA Always





Balloon Occlusion Decreases Bleeding and Allows Visualization in Large Bore Femoral Procedures

CATHETERIZATION & CARDIOVASCULAR INTERVENTIONS

Valvular and Structural Heart Diseases

Impact of routine crossover balloon occlusion technique on access-related vascular complications following transfemoral transcatheter aortic valve replacement

Sarah Zaman MBBS, PhD, Robert Gooley MBBS, Victoria Cheng MBBS ... See all authors ›

First published: 23 April 2016
https://doi.org/10.1002/ccd.26371

RESULTS: CBOT was successfully performed in 96% with 2% occurrence of a minor CBOT-related complication. At 30-days access-site-related major vascular and/or bleeding occurred in 5.5% and 18.6% of the CBOT and control group, respectively (P = 0.042). This consisted of VARC-2 major vascular events in 3.6% and 16.3% (P = 0.036) and VARC-2 major/life-threatening bleeding events in 5.5% and 14.0% (P = 0.137) of the CBOT and control group,

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CFA Perforation after IVL of iliac to facilitate TAVR saved by COBT

8 x 40mm PTA + external pressure x 30 min

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Like the Femoral, the Axillary is Compressible

Research Article

Efficacy of Manual Hemostasis for Percutaneous Axillary Artery Intra-Aortic Balloon Pump Removal

Rajiv Tayal,[1,2] Michael DiVita,[1] Christoph W. Sossou,[3,4] Alexis K. Okoh,[3] Kelly Stelling,[5] James M. McCabe,[6] Amir Kaki,[7] Najam Wasty,[1] and David A. Baran[5]

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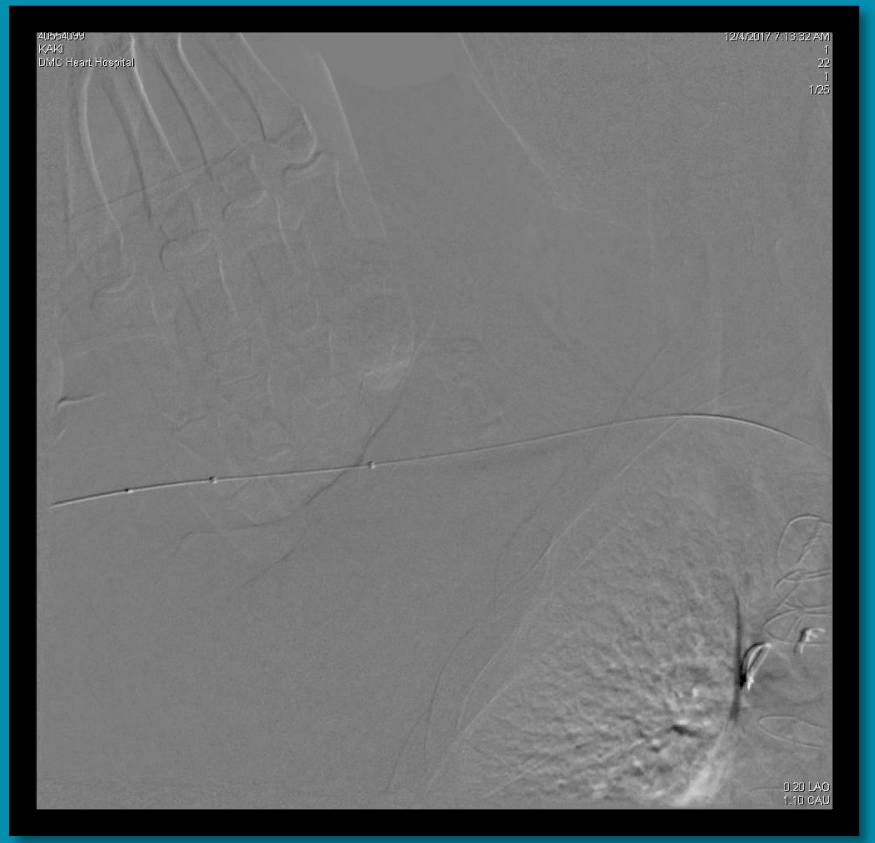

- If extravasation is noted to occur post procedure, threshold for covered stent placement is high
- Best imaged with cranial or caudal angulation
- Use balloon sized 1:1, low pressure inflation x 5 min WITH MANUAL PRESSURE
- Repeat x 2, then give protamine and repeat additional 5 minutes

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Alternative Techniques: Hybrid Closure

Safety and Efficacy of a Novel "Hybrid Closure" Technique in Large-Bore Arteriotomies

Michael K. Amponsah, MD[1] Rajiv Tayal, MD[1] Zain Khakwani, MD[1] Michael Sinclair, BSc[1] Najam Wasty, MD[1]

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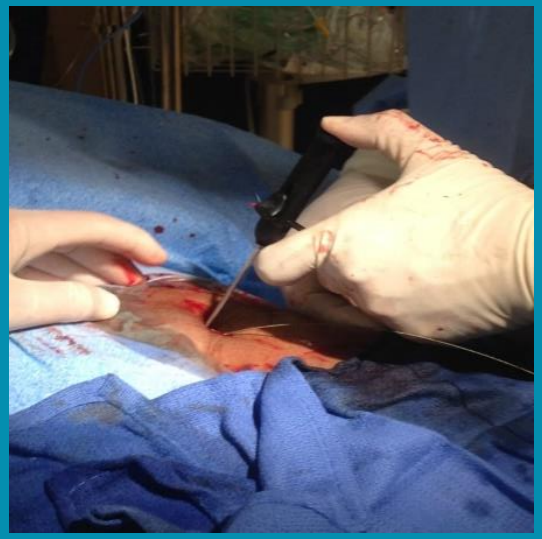
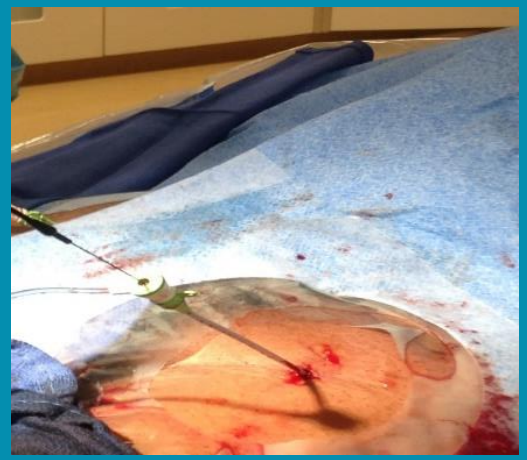
Int J Angiol 2017;26:116–120.





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Valley Health System

In affiliation with Cleveland Clinic Heart and Vascular Institute

Ipsilateral Balloon Occlusion in Single Access

Dry field closure of large bore access with simultaneous iliac artery angioplasty through the ipsilateral sheath:
The "Single access *Dry Closure Technique*".

Short Title*: *"Single access Dry Closure Technique".

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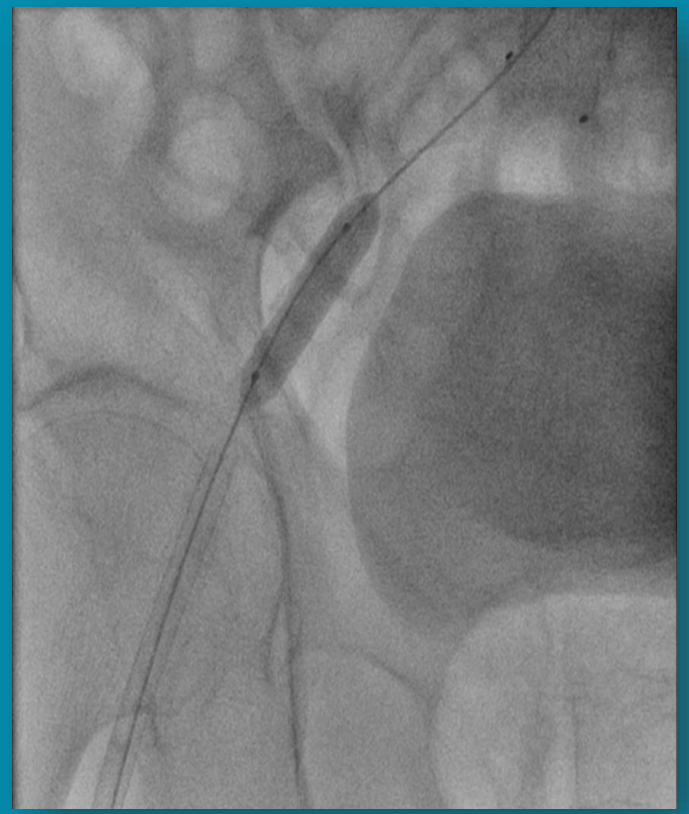

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Post Close Technique (No Pre-Close)

CLINICAL IMAGES

Post-Close Technique for Arteriotomy Hemostasis After Impella Removal

Mohammad Thawabi, MD; Marc Cohen, MD; Najam Wasty, MD

J INVASIVE CARDIOL 2019;31(6):E159.
KEY WORDS: hemostasis, new technique, Perclose device, post-close technique

Utilization of large-bore sheaths has increased dramatically with the advancement of hemodynamic support devices. The "pre-close" technique is widely used to achieve hemostasis after device removal. However, this technique might fail or be deferred in certain situations, such as planned extended hemodynamic support or in emergencies. Employment of the Perclose vascular closure system (Abbott Vascular) in arteriotomies larger than 8 Fr might not be successful, as the device foot does not catch the vessel's anterior wall. We describe a simple "post-close" technique for large arteriotomies (13-14 Fr), after removal of Impella 2.5 or CP systems (Abiomed) from the common femoral artery, using two Perclose devices.

If the Impella peel-away or another compatible sheath is in place, the Impella device is removed. However, if the repositioning sheath is in use, artery reaccess can be achieved utilizing the wire port inlet, if available, or an access-site salvage technique. After device removal, two 0.035″ guidewires are inserted together through the existing sheath or the newly inserted sheath after artery reaccess. The sheath is then removed and an 8 Fr sheath is inserted over each wire in a side-by-side fashion (Figure 1A). At this point, hemostasis should be adequate as the two 8 Fr sheaths, positioned side-by-side, have a perimeter similar to the 13-14 Fr arteriotomy (Figure 1B). The first sheath is then removed while maintaining the wire in place. With the second sheath in place, a Perclose device is advanced side-by-side to the sheath and deployed at the 12 o'clock position (Figures 1C and 1D). The second sheath is then removed and another Perclose is deployed. The wire is removed after hemostasis is confirmed (Figure 1E). A final angiogram can be done if contralateral access is available (Figure 1F).

In conclusion, the post-close technique, using two Perclose devices, is an option after Impella device removal.

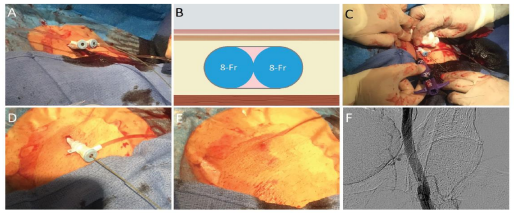

FIGURE 1. (A) Two 0.035″ guidewires are inserted together followed by two 8 Fr sheaths in a side-by-side fashion. (B) This configuration provides comparable perimeter coverage of the arteriotomy and allows for successful Perclose deployment. (C, D) The first Perclose device is deployed and the site is assessed for hemostasis. (E) After deployment of the second Perclose device, the wire is removed if adequate hemostasis is achieved. (F) Final angiogram showing complete seal of the arteriotomy.

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Disclosure: The authors have completed and returned the ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors report no conflicts of interest regarding the content herein.

The authors report that patient consent was provided for publication of the images used herein.

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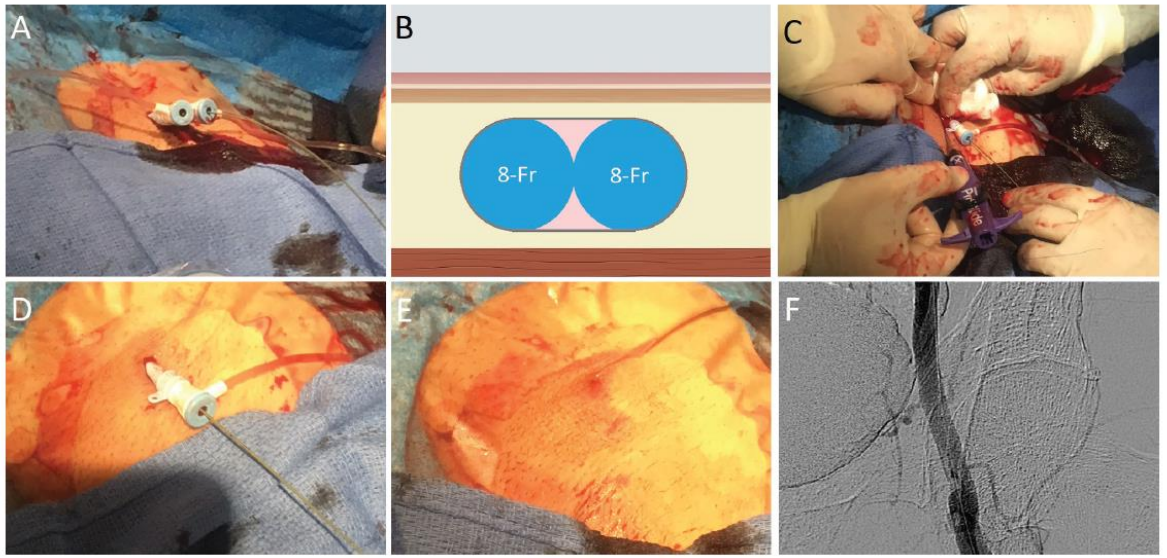

FIGURE 1. (A) Two 0.035″ guidewires are inserted together followed by two 8 Fr sheaths in a side-by-side fashion. (B) This configuration provides comparable perimeter coverage of the arteriotomy and allows for successful Perclose deployment. (C, D) The first Perclose device is deployed and the site is assessed for hemostasis. (E) After deployment of the second Perclose device, the wire is removed if adequate hemostasis is achieved. (F) Final angiogram showing complete seal of the arteriotomy.

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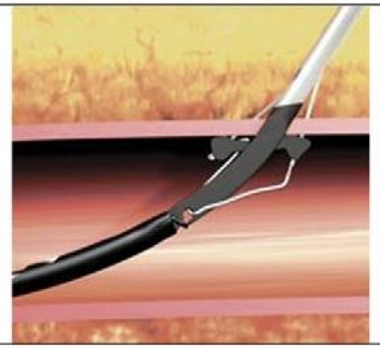
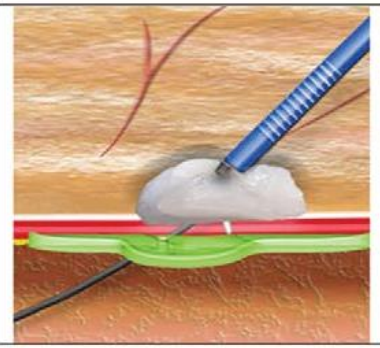
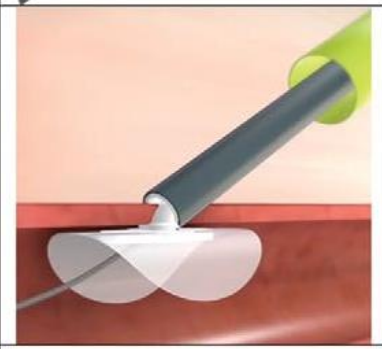
New and Novel Large Bore Closure Devices

ProGlide®	MANTA™	PerQseal®	InSeal
			
			
Suture-based	Collagen-based	Patch-based	Membrane-based
5–8 Fr (off-label use > 8 Fr)	10–14 Fr (14 Fr system) 14–22 Fr (18 Fr system)	< 24 Fr	14–21 Fr
CE mark	CE mark	CE mark	CE mark

ical, InSeal Medical and Vivasure Medical.

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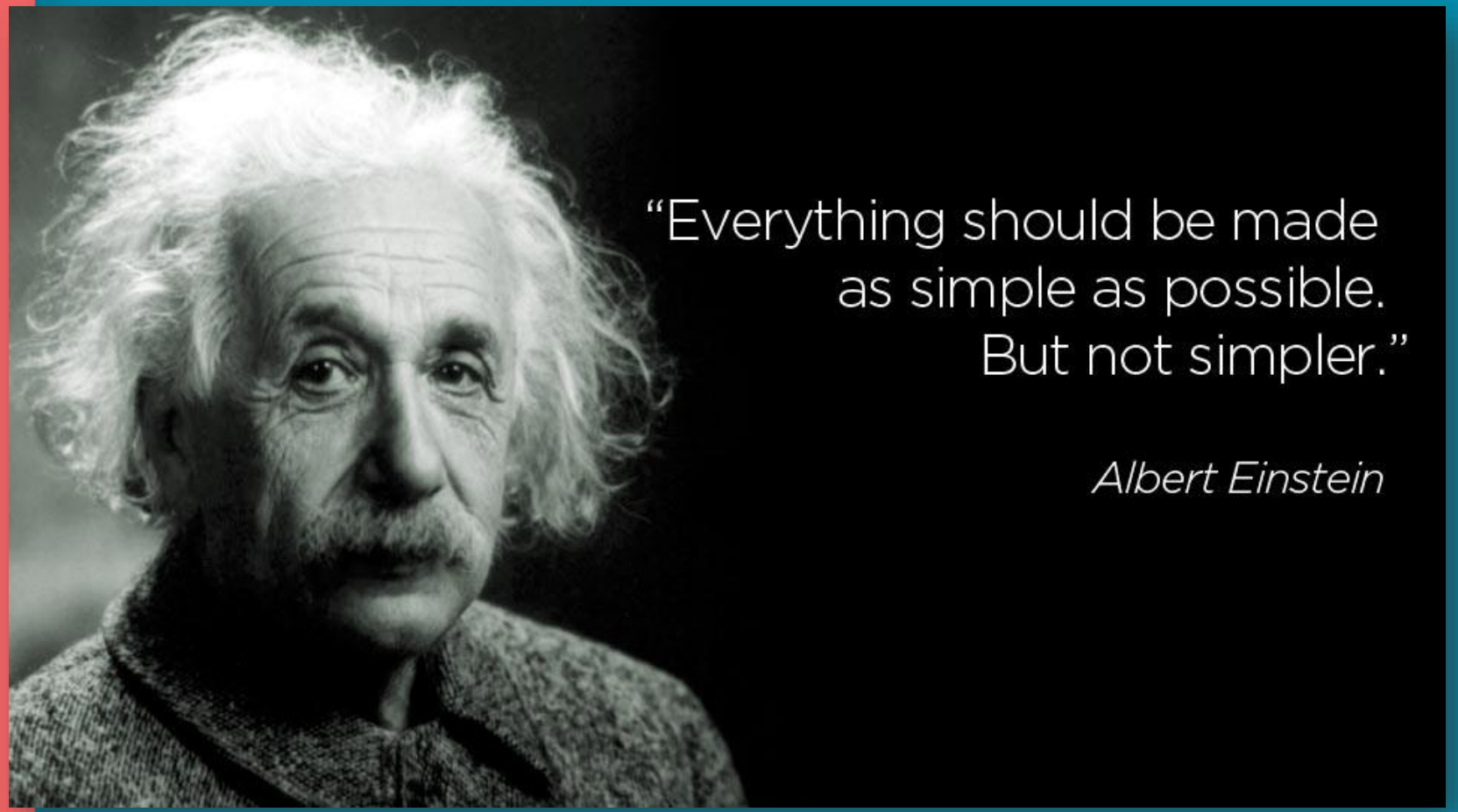

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