WELCOME *To the*

2026 SYMPOSIUM

Vein mapping: Ultrasound vs Venogram

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Disclosures

None

Background

KDOQI Guidelines

KDOQI considers it reasonable to have an AV access (AVF or AVG) in a patient requiring HD, when consistent with their ESKD Life-Plan

(Expert Opinion)

Lok et al. KDOQI. Am J Kidney Dis. 2020;75(4 Suppl 2):S1-S164

KDIGO: Site Selection Principles

If suitable with ESKD Life-Plan:

- Distal-to-proximal approach to AVF creation is suggested
- Vessel preservation for future access options

Prefer non-dominant arm?
Avoid prior catheter sites ?

Lok et al. KDOQI. Am J Kidney Dis. 2020;75(4 Suppl 2):S1-S164

Site Selection Principles - Reality

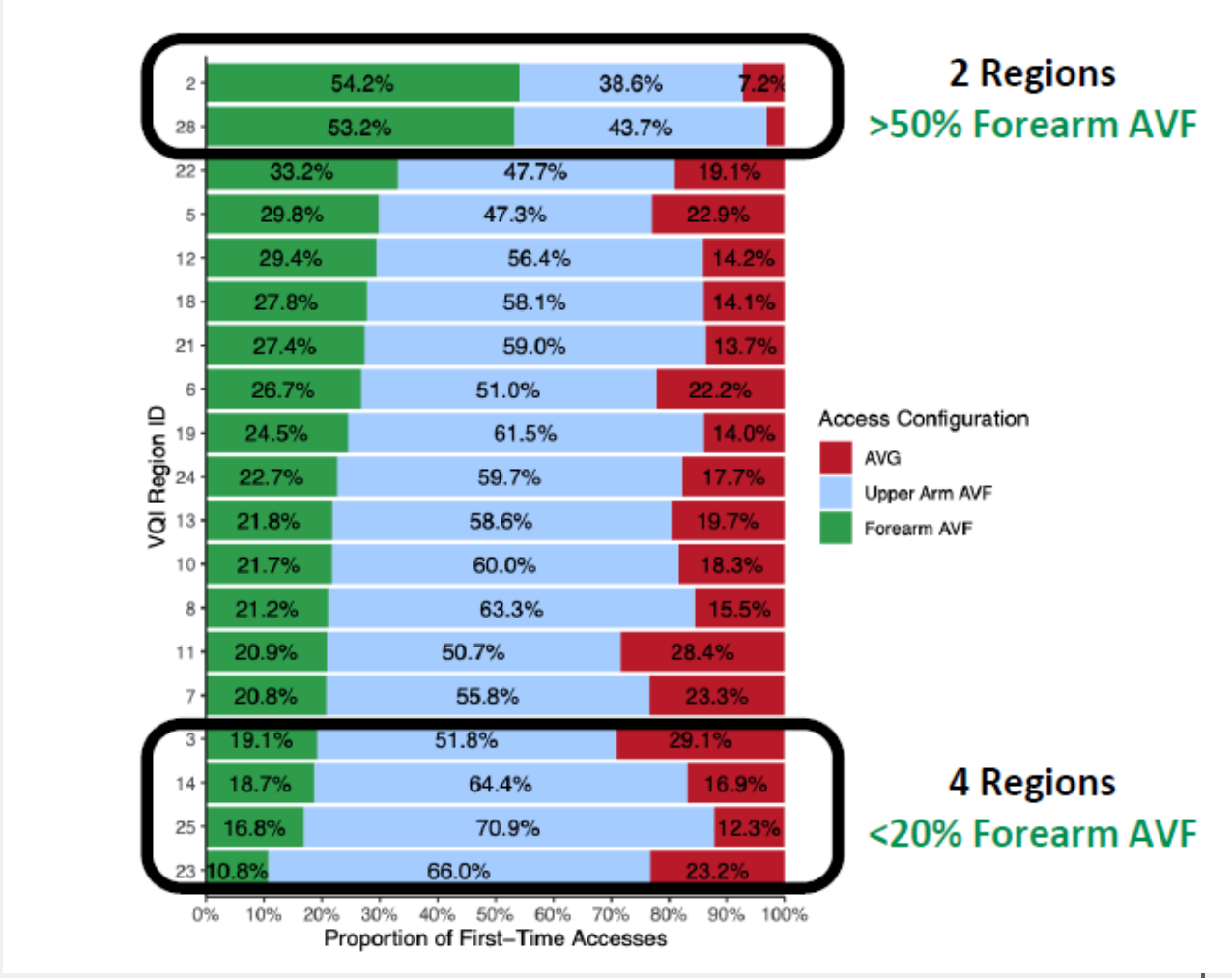
Vascular Access Creations in USA

(2012-2022)

Subgroup Analyses

Upper Arm AVGs:

- Women
- Older (> 80 years)
- Black
- Disadvantaged



Fitzgibbon et al. J Vasc Surg. 2024.

Why is it not happening

Why upper arm AVF or AVG?

Quick and easy surgery



No time or space to fix if not working

Will give me no trouble with maturation

Nephrologist push for graft: Penalty for catheter >90days

Why not plan on upper arm AVF or AVG



Why not plan on upper arm AVF or AVG

Forearm radial cephalic fistula

Flow volume
400-700 ml/min





Upper arm brachial basilic transposed fistula

Flow volume 2400 ml/min

Outcomes of forearm AVFs

Pooled analysis of prospective, multicenter clinical studies

- **forearm and upper arm AVFs demonstrated comparable long-term patency and usability**
- **forearm AVFs were associated with fewer steal interventions, reinforcing their hemodynamic advantage in select patients**
- **forearm AVFs were associated with significantly poorer outcomes at low-volume centers**

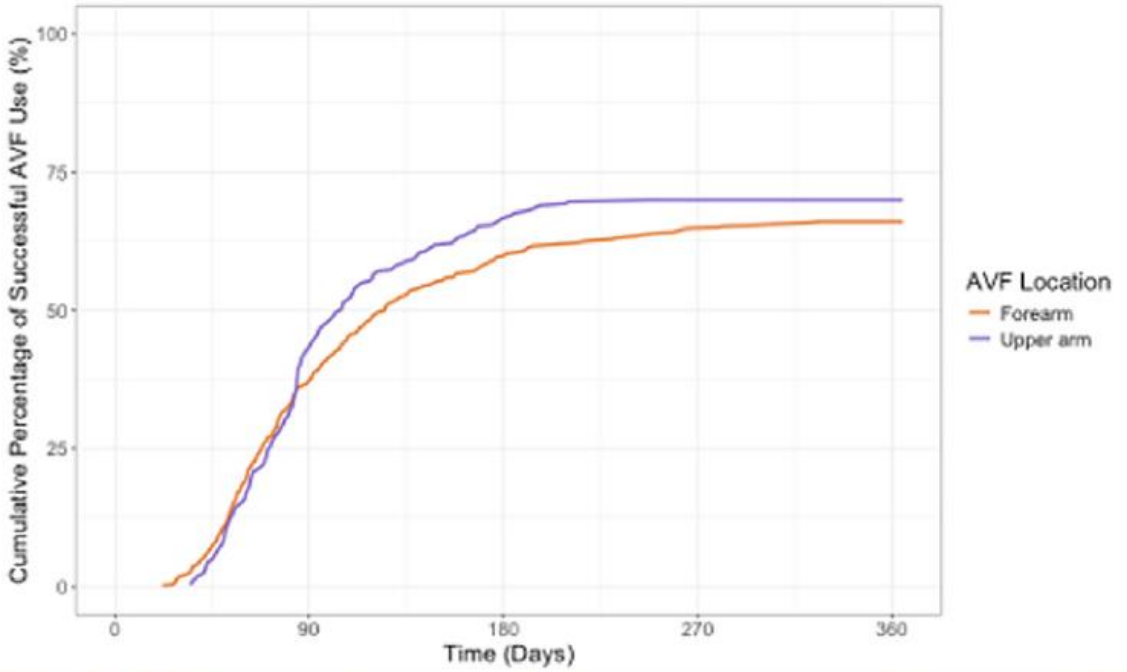


Fig 2. Difference in cumulative percentage of successful arteriovenous fistula (*AVF*) use over 1-year time course between forearm and upper arm AVFs.

Manchella M.K , et al:. Journal of Vascular Surgery, 82, 3, 2025

Vein assessment

KDOQI: Patient and Vessel Examinations

KDOQI recommends that a **physical examination** for the initial assessment. (Conditional Recommendation, Very Low Quality of Evidence)

Statements: Vessel Mapping for Vascular Access

KDOQI suggests selective preoperative **ultrasound** in patients at high risk of AV access failure rather than routine vascular mapping. (Conditional Recommendation, Low Quality of Evidence)

KDOQI considers it reasonable to use various imaging studies to evaluate the suitability of vessels for AV access creation, such as ultrasonography for peripheral vessels (including intraoperative ultrasound) and **venography** for select patient. (Expert Opinion)

Lok et al. KDOQI. Am J Kidney Dis. 2020;75(4 Suppl 2):S1-S164

Pre operative vein evaluation

Physical Exam



Imaging options

- Duplex Ultrasound Vein Mapping



- Venogram



Ultrasound Vein Mapping

Pro

- Quick
- Easy
- Vein and arteries
- Noninvasive
- Reimbursable

Contra

- Who is truly an expert?
- Who is checking on the circumstances?
- How easy is it to measure at 0.2 mm precision
- Intra-observer variability?
- Inter-observer variability?
- Central vein stenosis only indirect evidence
- Difficult to picture the whole trajectory if not done by same person who will perform surgery

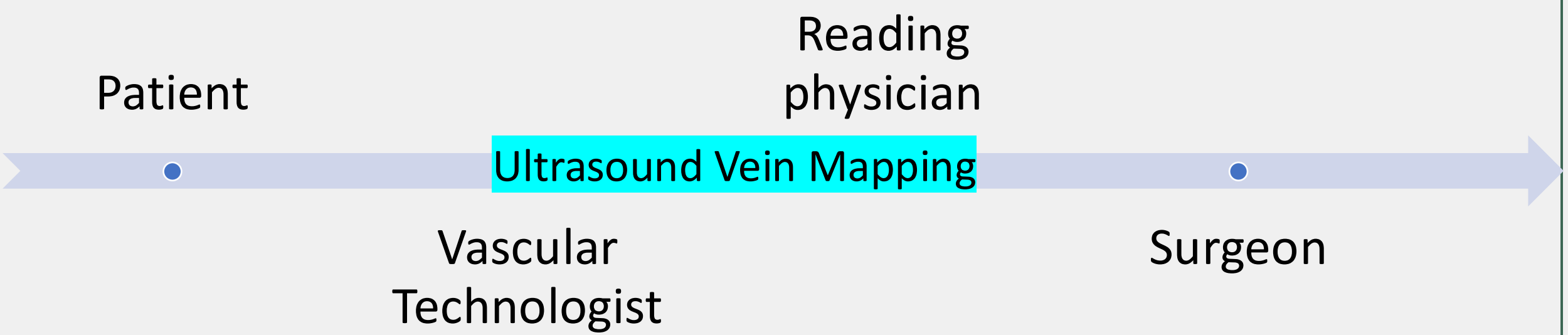
Ultrasound Vein Mapping

Venous Examination
- Venous luminal diameter ≥2.5 mm for AF
- Venous luminal diameter ≥4.0 mm for BG
- Absence of segmental stenoses or occluded segments
- Continuity with the deep venous system in the upper arm
- Absence of ipsilateral central venous stenosis or occlusion

Arterial Examination
- Absence of pressure differential ≥20 mm Hg between arms
- Arterial lumen diameter ≥2.0 mm
- Patent palmar arch

Silva M J Vasc Surg 1998

Ultrasound Vein Mapping



Experience?
Dedication?
Variation?
Room Temperature?
Tourniquet?

How exact is a measurement?
Compression of vein?
Inter observer variation?

Ultrasound Vein Mapping

Vein Mapping Ultrasound

INDICATIONS: End Stage renal disease. Dialysis fistula planning

TECHNIQUE: Duplex US of the arteries and superficial veins of bilateral upper extremity were examined. Selected sagittal and axial images were obtained.

FINDINGS: The veins are patent throughout.

SIDE: RIGHT

Arterial:

The brach elbow, measures 4.6 mm. There are tripha
The radia rist, measures 2.1 mm and presents w
The ulnar st, measures 1.6 mm and presents w

Venous:
Cephalic v

Lower Fore
Antecubita
Mid Upper

Basilic Ve....

	Diameter (mm
Lower Forearm	0.8/ 2.3
Antecubital fossa	1.8/ 8.4
Mid Upper Arm	3.5/ 11.3

Brachial veins:
There is a Type A (66% of the cases) brachial ve
veins and basilic vein draining into the brachia
arm/axilla.

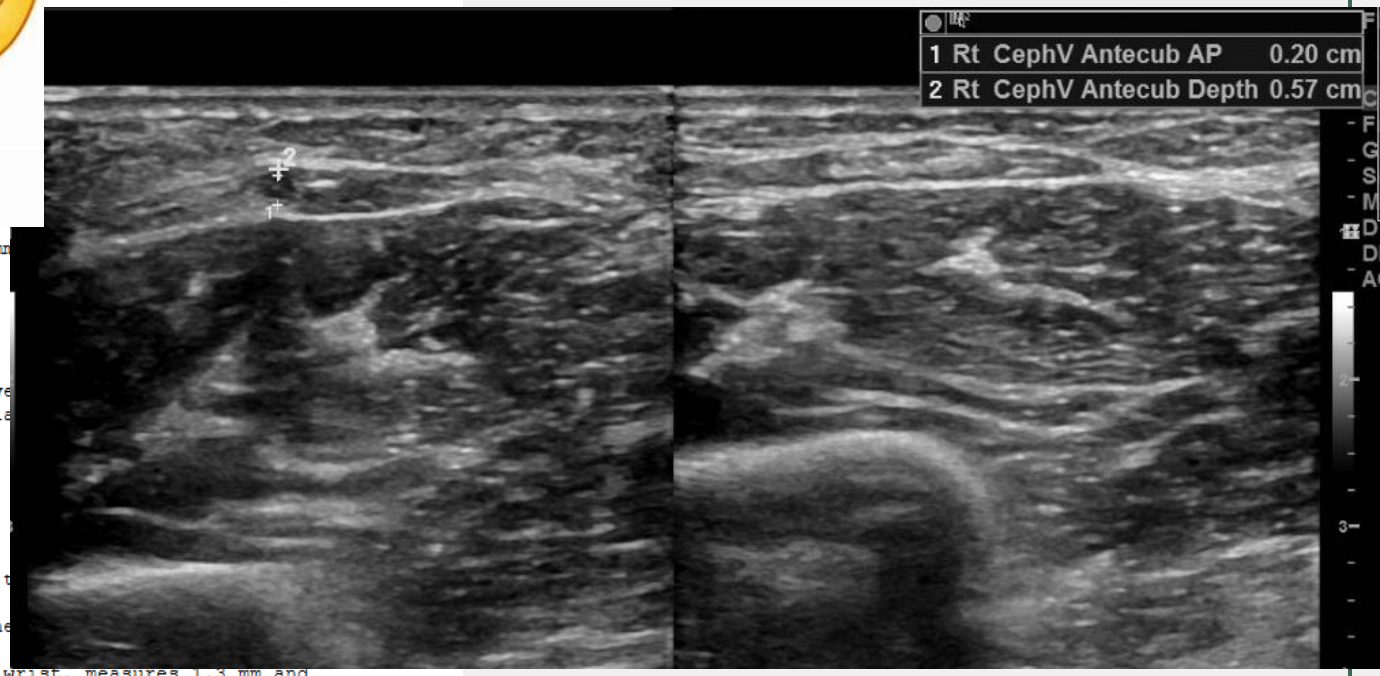
SIDE: LEFT

Arterial:

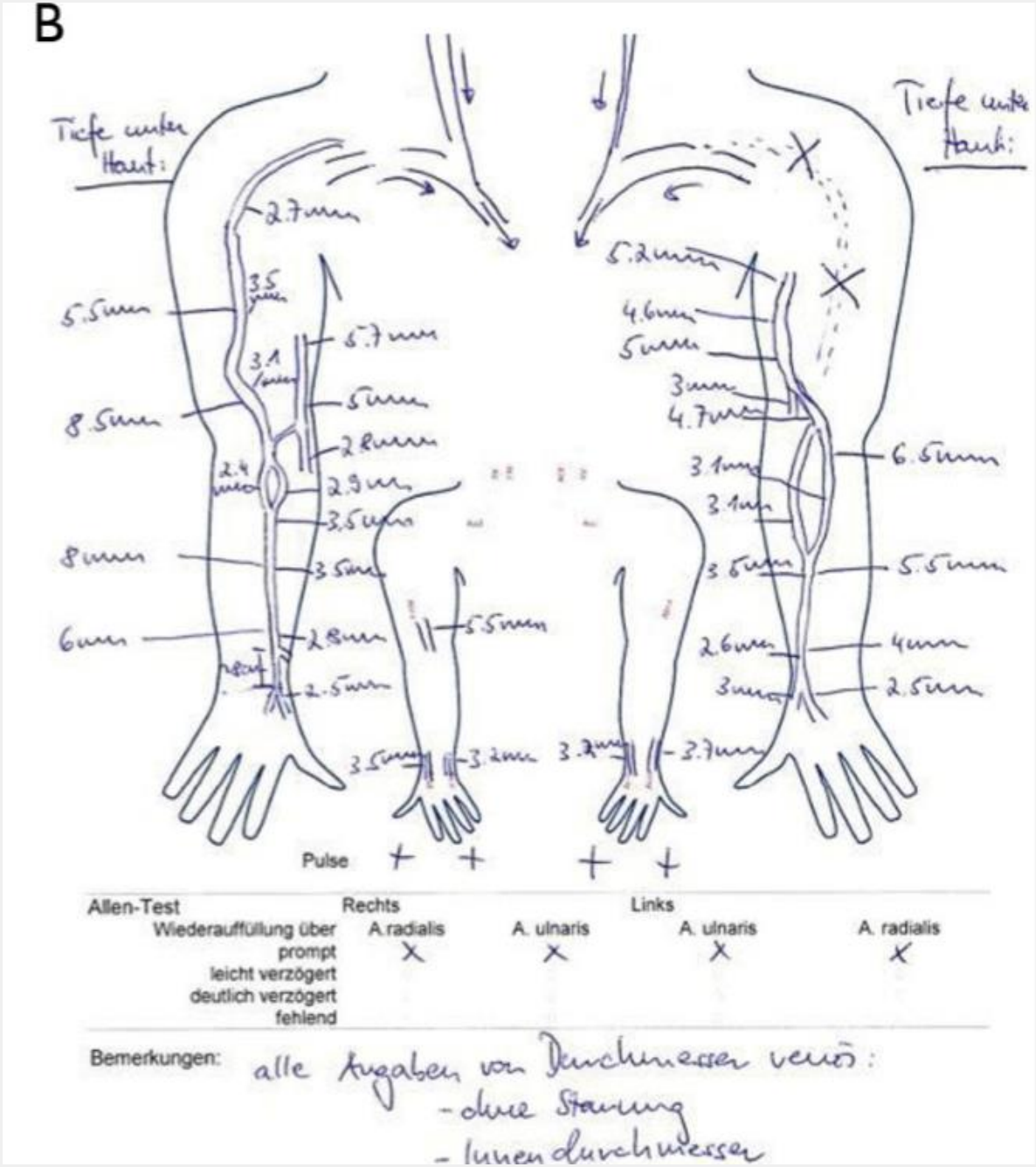
The brachial artery is patent at the level of t
are triphasic waveforms.
The radial artery is patent at the level of the
presents with biphasic waveforms.
The ulnar artery is patent at the level of the wrist, measures 1.3 mm and

Not sufficient for central veins

How warm was the room?
Were tourniquets used?



Richarz S
Cardiovasc Diagn Ther 2023;13(1):122



Vein mapping

Table 2.

Hemodialysis Access Type and Location for Patients, Stratified by Use

Characteristic, n (%)	Total	Preoperative Vein Mapping		P-value
		No	Yes	
	46,010 (100)	**6,614 (14.4)**	**39,396 (85.6)**	
Access Type				<0.001
AVF	35,022 (76.1)	4,452 (67.3)	30,570 (77.6)	
AVG	10,988 (23.9)	2,162 (32.7)	8,826 (22.4)	
Access Location				<0.001
Forearm	24,622 (53.5)	3,131 (47.3)	21,491 (54.6)	
Upper arm	19,384 (42.1)	2,975 (45.0)	16,409 (41.7)	
Lower extremity	858 (1.9)	295 (4.5)	563 (1.4)	
Other	1,146 (2.5)	213 (3.2)	933 (2.4)	

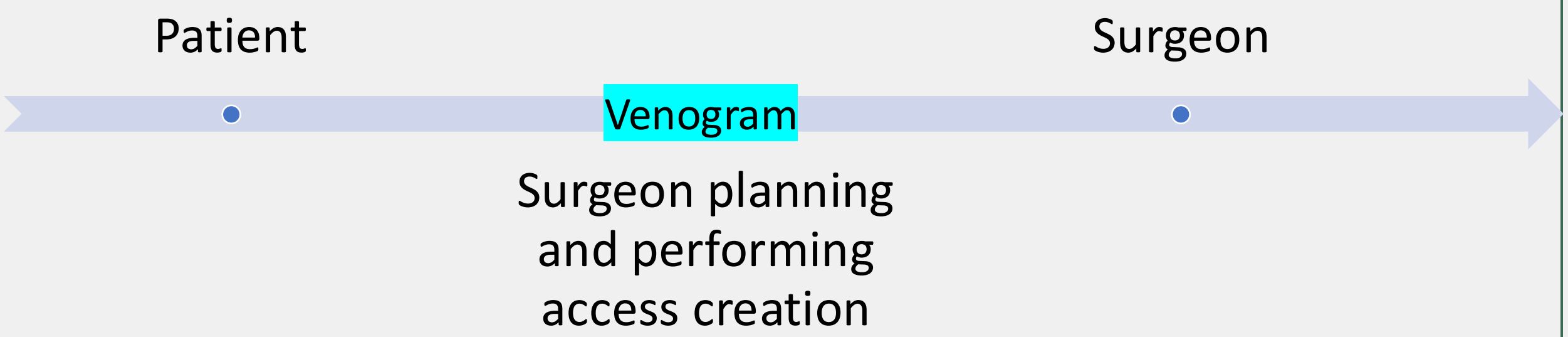
Abbreviations: AVF, Arteriovenous fistula; AVG, Arteriovenous graft.

- VQI Data (Vascular Quality Intiative
- USA and Canada
- Retrospective analysis
- >46000 Patients
- 85% had pre op vein mapping either by vasc. tech or by surgeon

Patients with preoperative vein mapping
- AVF >AVG, forearm >upper arm
- better secondary patency

Fedorova A, J Vasc Surg. 2022 April ; 75(4): 1395–1402

Venogram – real time by operator



Post GA and post block point of care ultrasound – repeat ultrasound by surgeon

Post-General Anesthesia Ultrasound-Guided Venous Mapping Increases Autogenous Access Placement Rates

C. Y. Maximilian Png, Adam Korayem, and David J. Finlay, New York, New York

Postanesthesia ultrasound facilitates creation of more preferred accesses without affecting access survival

Check for updates

Patrick K. McGlynn, MD,[a,b] Konstaninos D. Arnaoutakis, MD,[c] Elize P. Deroo, BS,[d] C. Keith Ozaki, MD,[c] John P. Forman, MD, MSc,[b] *and* Dirk M. Hentschel, MD,[a,b] *Boston, Mass*

Pre OP–Ultrasound
– only 66% found suitable veins

Post GA – Ultrasound
– 100% found suitable veins

Ann Vasc Surgery 2018

Post block Ultrasound
– doubled chances of more distal access (radial cephalic)

- **distal access had equal or better secondary patency**

Journal Vasc Surgery 2019

Venogram

Venogram

Pro

- Quick
- Easy
- Reimbursable
- Central vein imaging
- Visualization of entire vein system

Contra

- IV needed
- IV dye
- Radiation
- Arterial system needs separate test
- Technique standardization?

Open Evidence

There is no single universally standardized institutional protocol for preoperative venography prior to dialysis access creation

1. **IV access**: An intravenous catheter is placed in the **dorsum of the hand**

2. **Contrast agent**: **Low iso-osmolar contrast (10–30 mL)** diluted **1:1 with normal saline**

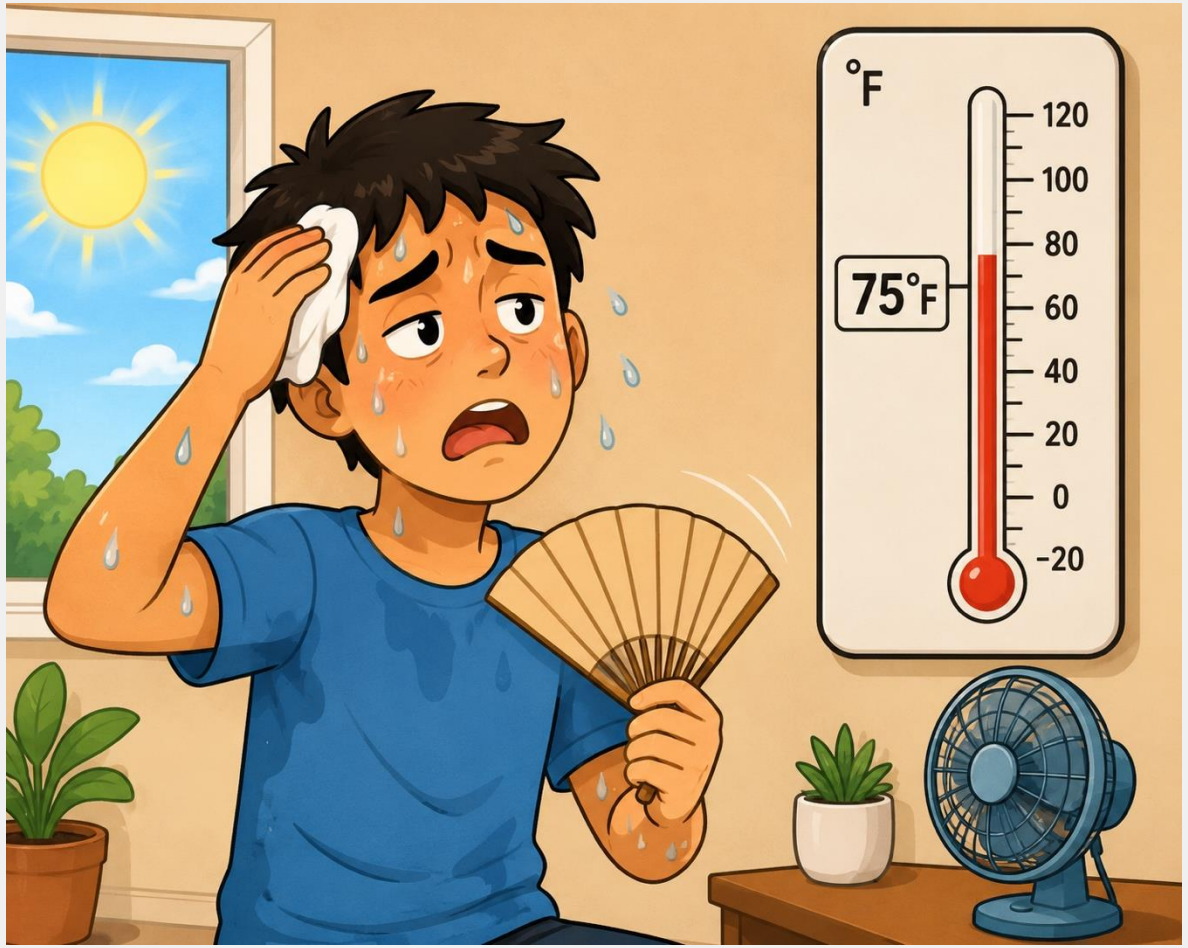
3. **Tourniquet placement**: **Sequential tourniquets** are applied —below elbow+ axilla

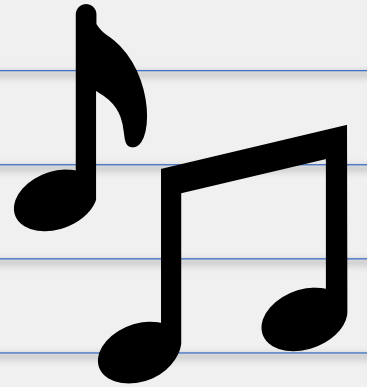
4. **Image acquisition**: **calibrated pulse fluoroscopy** at **15 frames/sec**

5. **Evaluation sequence**: **distally to proximally**, start with nondominant arm.

Niyyar and Wasse Semin Dial 2017, Marques and Ponce Semin Dial 2017

Venogram Technique – Interv. Nephrology Boston





- Warm room 75 F / blanket/ music
- 3 Tourniquets upper arm
- 21G IV back of hand
- contrast injected slowly
- continuous flouro as C-Arm moves proximal
- tourniquets released sequentially
- Arm lifted for central images
- 12-14 cc of contrast per arm
- Bilateral if on dialysis
- Staged unilateral venogram – for pre ESRD

Venogram







Venogram

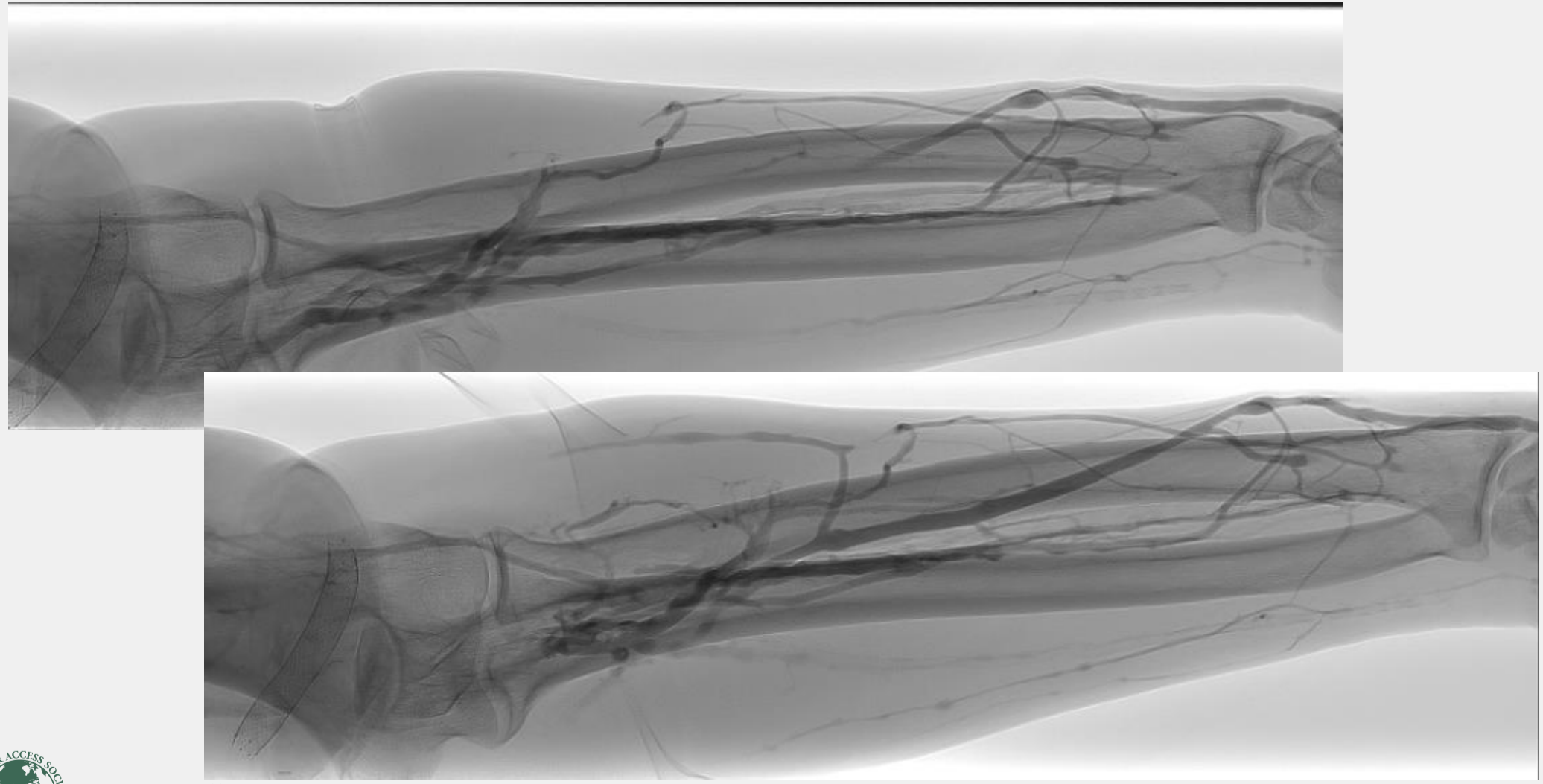


“TV – dump”

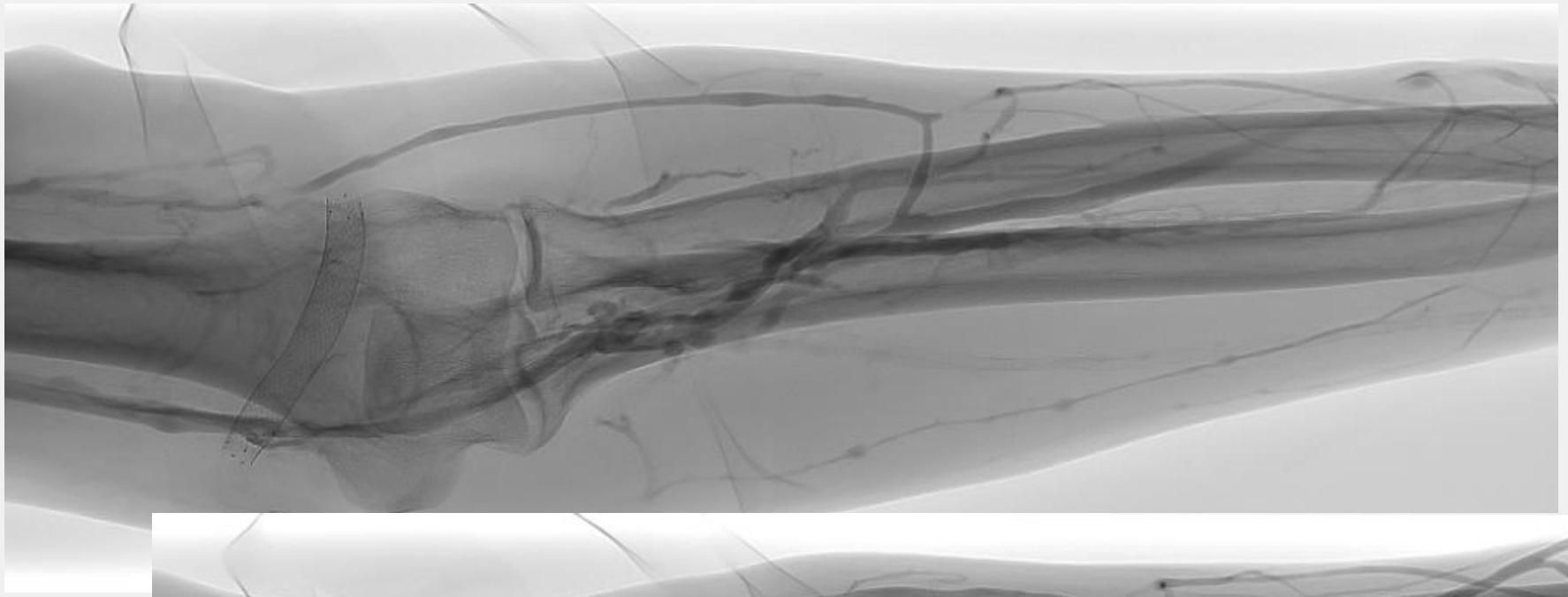
- 5 cc contrast + 5 cc NS injected
- Followed by 20 cc syringe with NS
- Arm lift once contrast reaches central veins



45 y o M with left upper arm AVG created 2 years ago elsewhere and now failing – needing new access

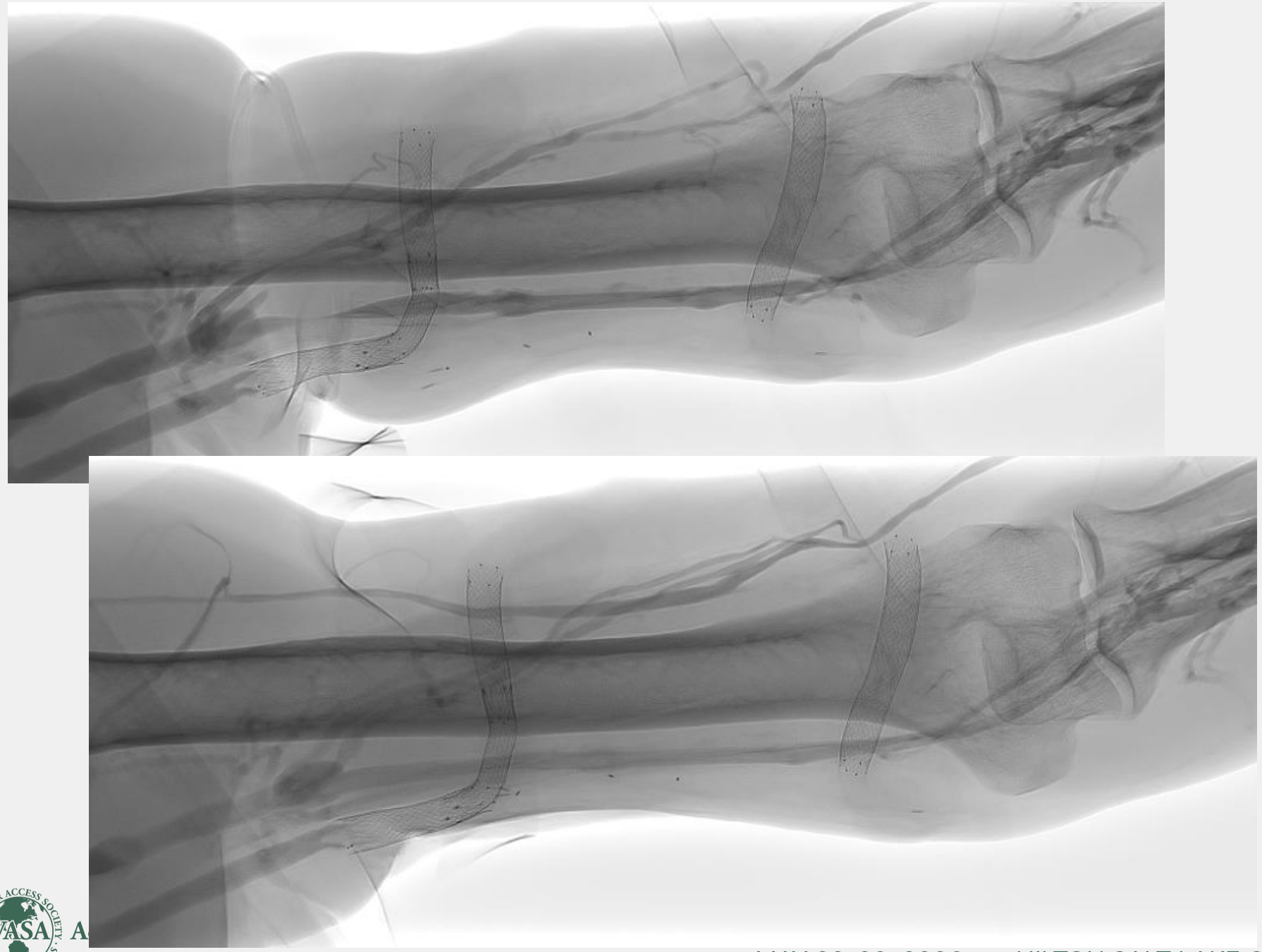


First tourniquet released



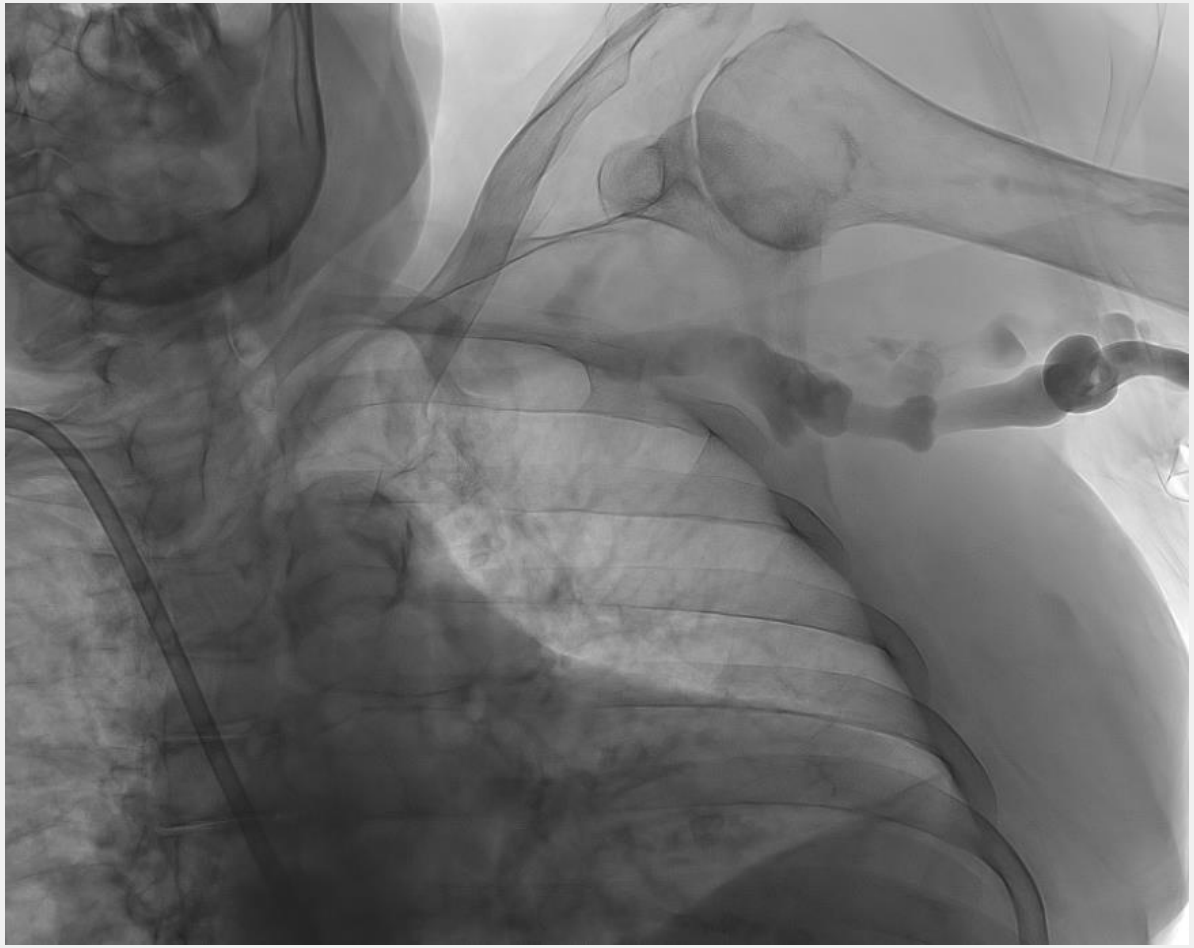


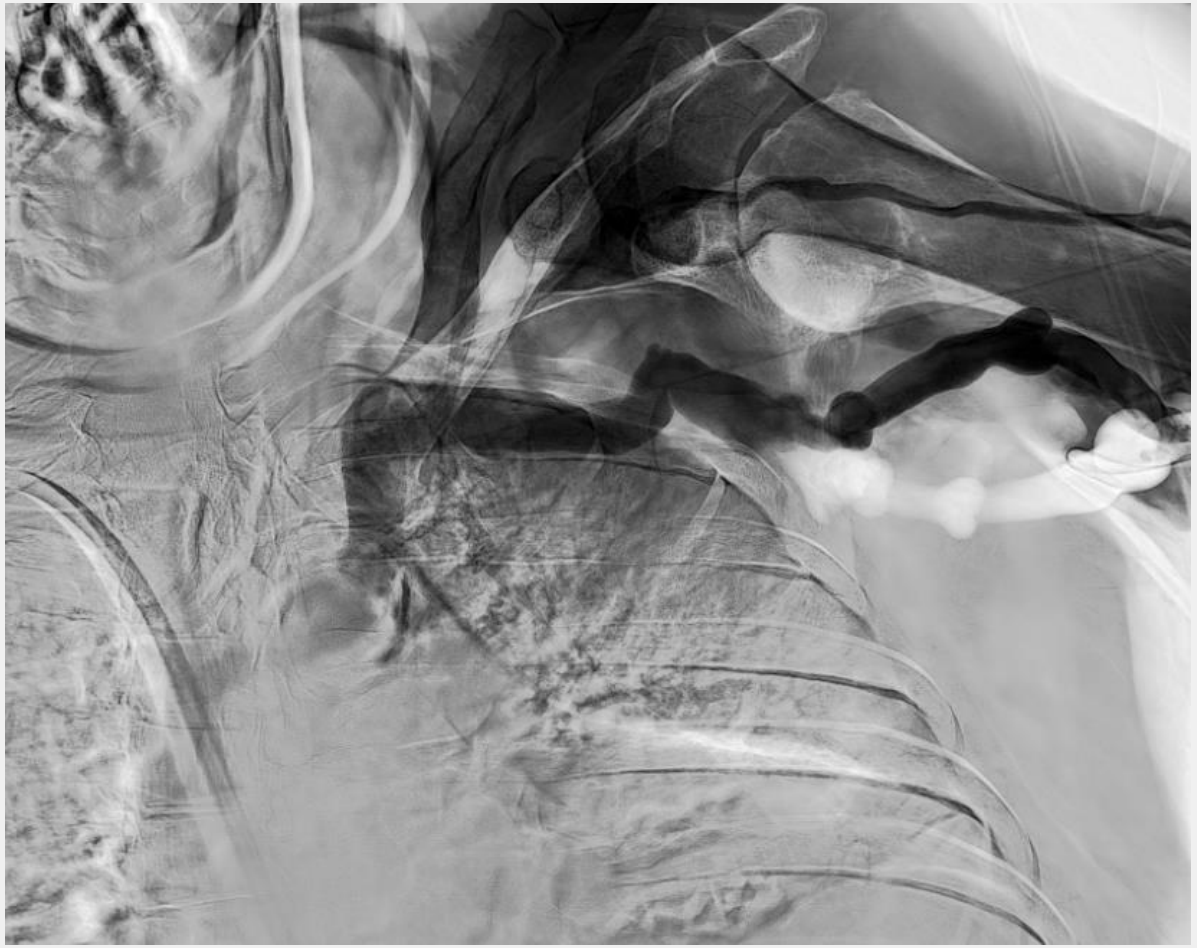
Second tourniquet released



Third tourniquet released

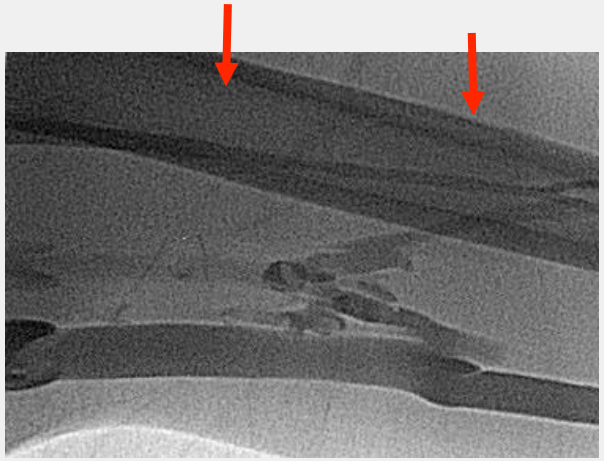
Pre and post arm elevation

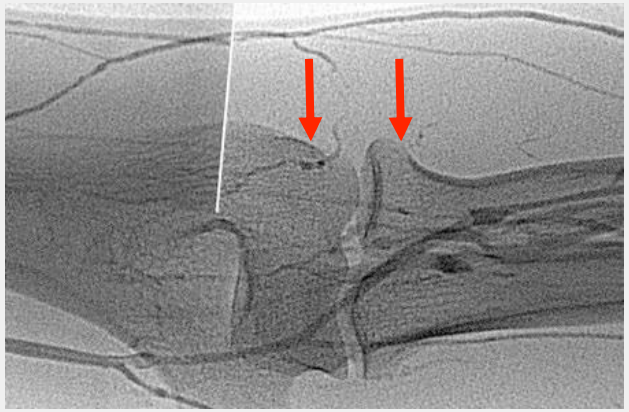


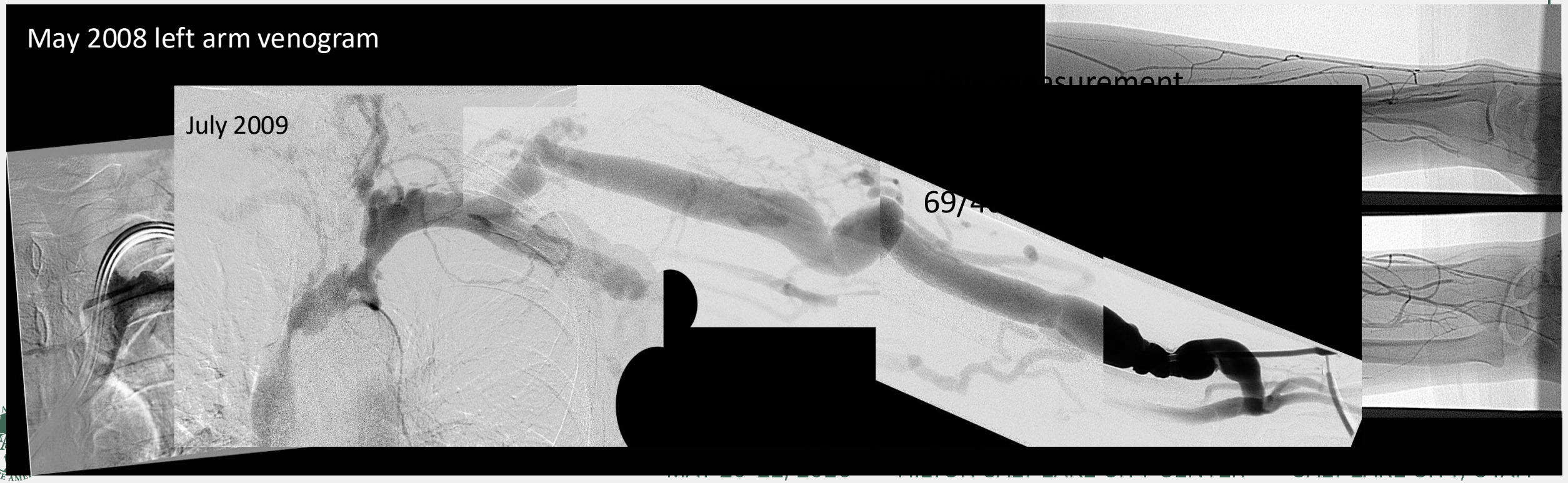


Venogram

Age of patient has an influence on
size of vessel acceptable for access creation







Unilateral venogram

Retrospective analysis 3 years
142 patients/284 venograms
pre dialysis/ckd 4 and 5
120 access created
95% autogenous
69 % in forearm

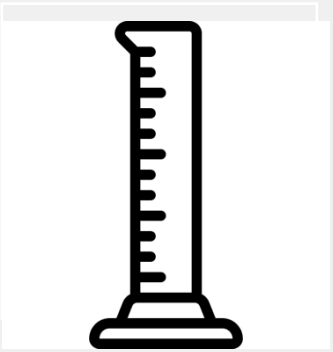
2.5% CIN- reversible



Length of Venography:
Seconds (SD): 30.4 (14.6)



Radiation Exposure: mGy
(SD) 8.8

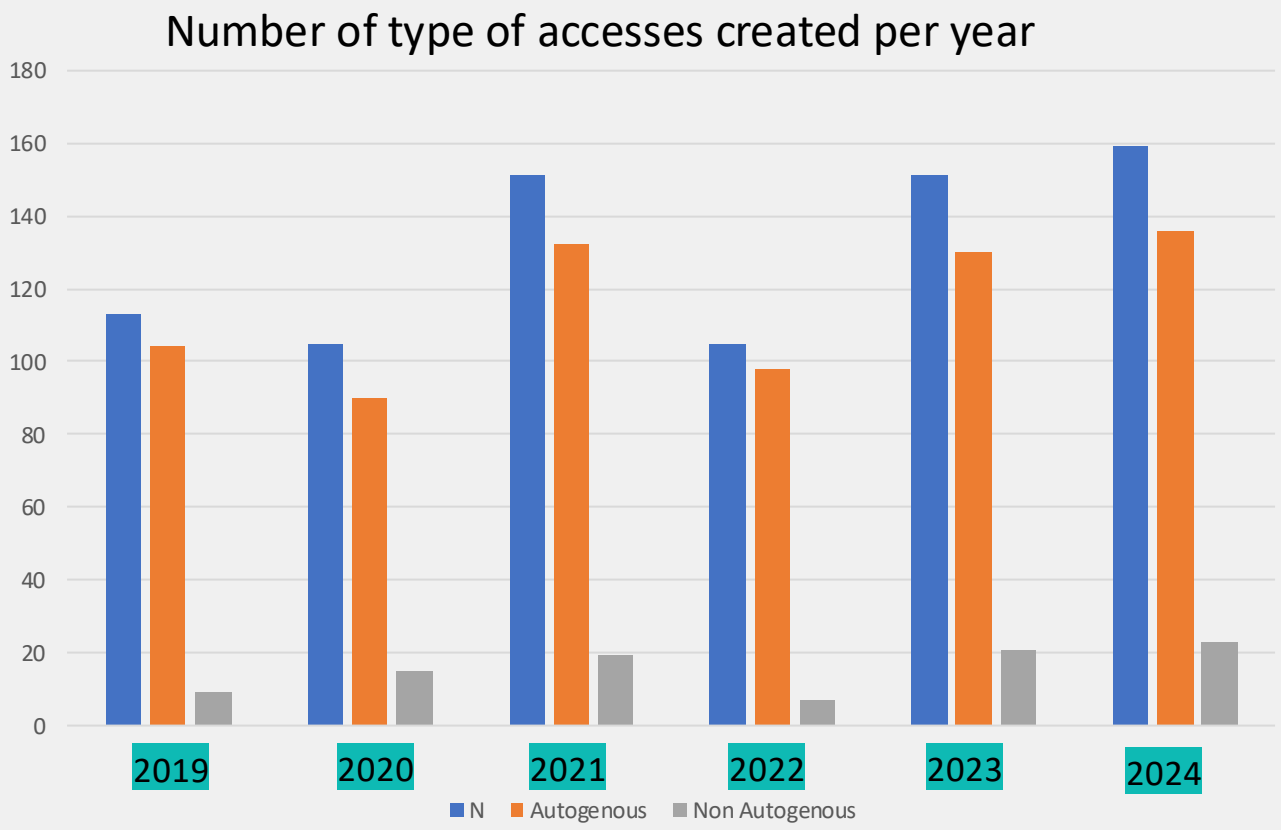


Contrast: 12.3 ml/min

Holden-Wingate L et al. JVA. 2022

Center with high volume access creation





130-140 Access creations/year

88% autogenous accesses
67-70% forearm AVF
27% snuff box fistulas
25% wrist fistula
17% other forearm fistula

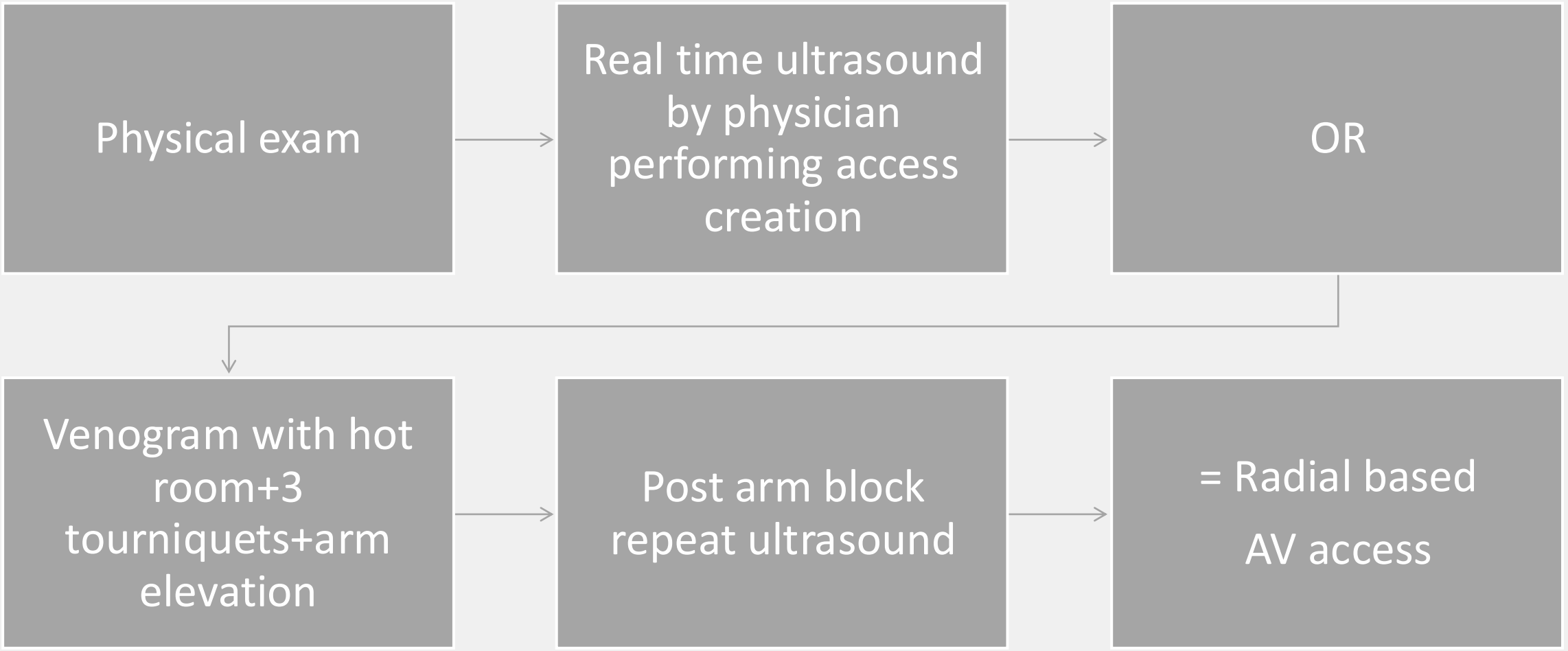
12% non autogenous access
20% of these forearm AVG

All patients had venograms done in IN

Joint access clinic: IN+Vasc.Surgery and patient discuss options

Data courtesy of Dr Keith Ozaki

Summary


Physical exam
Real time ultrasound by physician performing access creation
OR
Venogram with hot room+3 tourniquets+arm elevation
Post arm block repeat ultrasound
= Radial based AV access









THANK YOU





