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2026 SYMPOSIUM

The Immature AVF: Methods to Induce Maturation

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Autogenous AV Fistulas



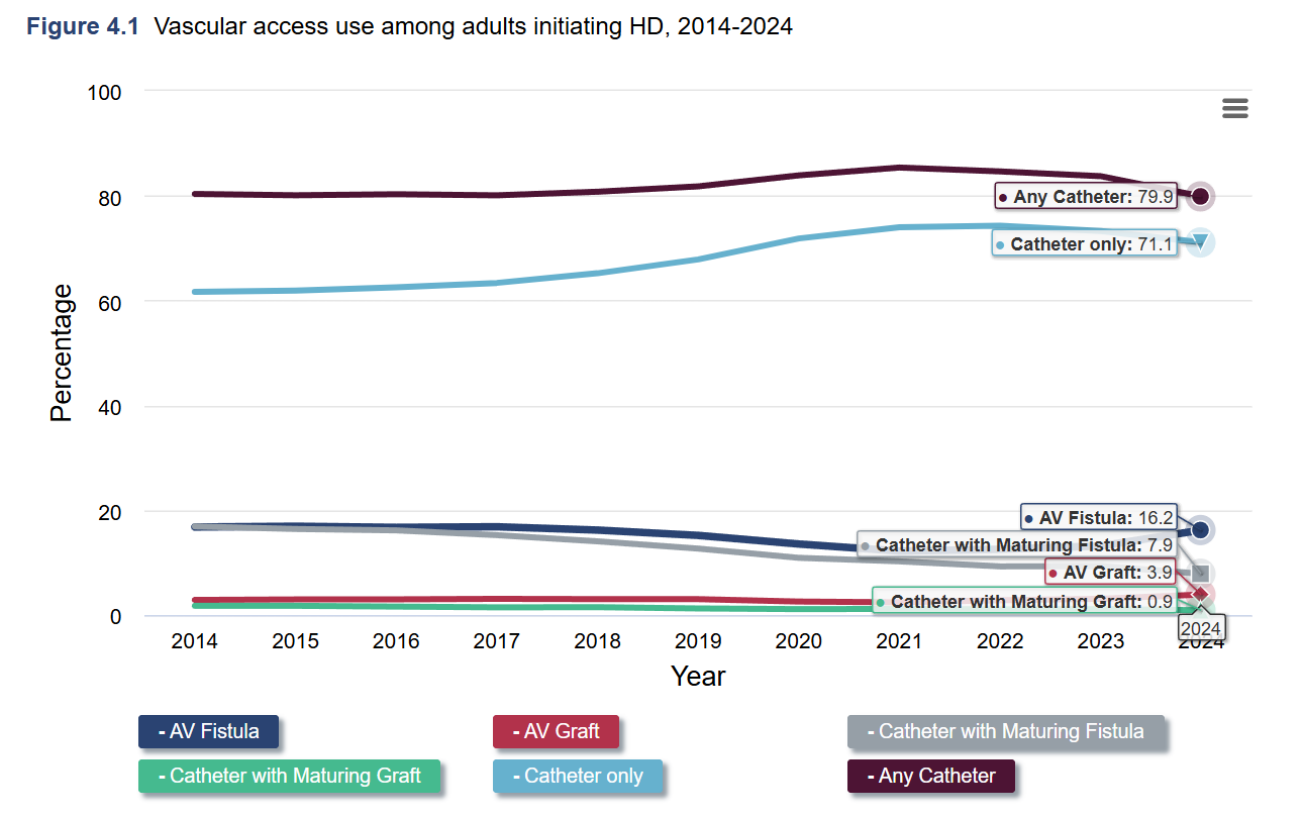
Disclosures

Speakers Bureau:

- ✓Gore
- ✓Venture Med
- ✓Cagent Vascular

Background

- High rate of AVF nonmaturation (20%-60%)
- High rate of interventions
- Risk factors for poor maturation:
  - small vein size
  - radiocephalic avf
  - women
  - advanced age
  - obesity



Sex Disparities in Arteriovenous Fistula Maturation Outcomes

Tabea Hoffstaetter,[1] Jeffrey Silpe,[2] David Delijani,[1] Gregg S. Landis,[2] and Yana Etkin,[2]
Hempstead, NY

Background: The end-stage kidney disease life-plan
access selection in patients requiring renal replac
for poor arteriovenous fistula (AVF) outcome
tients on this decision. This is especially t
AVF outcomes when compared to male
tors associated with poor AVF matura
vidualized access selection.
Methods: A retrospective review of
2021 at an academic medical center
tween 596 male and 481 female patie
created for the male and female cohort
tion. AVF was considered mature if it was
need for further interventions. Unassisted fist
any interventions.
Results: The male patients were more likely to receive
versus 244 (51%) female patients had radiocephalic AVF, $P < 0.$
significantly worse in female patients; 387 (80%) AVFs matured
male patients, $P < 0.001$. Similarly, the rate of unassisted maturat
patients versus 39% (233) in male patients, $P < 0.001$. Mean preoperative vein diameters were similar in both groups; 2.8 ± 1.1 mm in male versus 2.7 ± 0.97 mm in female patients, $P = 0.17$. Multivariate logistic regression analysis of the female patients revealed that Black race (odds ratio [OR]: 0.6, 95% confidence interval [CI]: 0.4–0.9, $P = 0.045$), radiocephalic AVF (OR: 0.6, 95% CI: 0.4–0.9, $P = 0.045$), and preoperative vein diameter <2.5 mm (OR: 1.4, 95% CI: 10.33–0.901.1–1.7, $P = 0.014$) were independent predictors of poor unassisted maturation in this cohort. In male patients, preoperative vein diameter <2.5 mm (OR: 1.4, 95% CI: 1.2–1.7, $P < 0.001$) and need for HD prior to AVF creation (OR: 0.6, 95% CI: 0.3–0.9, $P = 0.018$) were independent predictors of poor unassisted maturation.
Conclusions: Black women with marginal forearm veins may have worse maturation outcomes, and upper arm HD access should be considered when advising patients on their end-stage kidney disease life-plan.

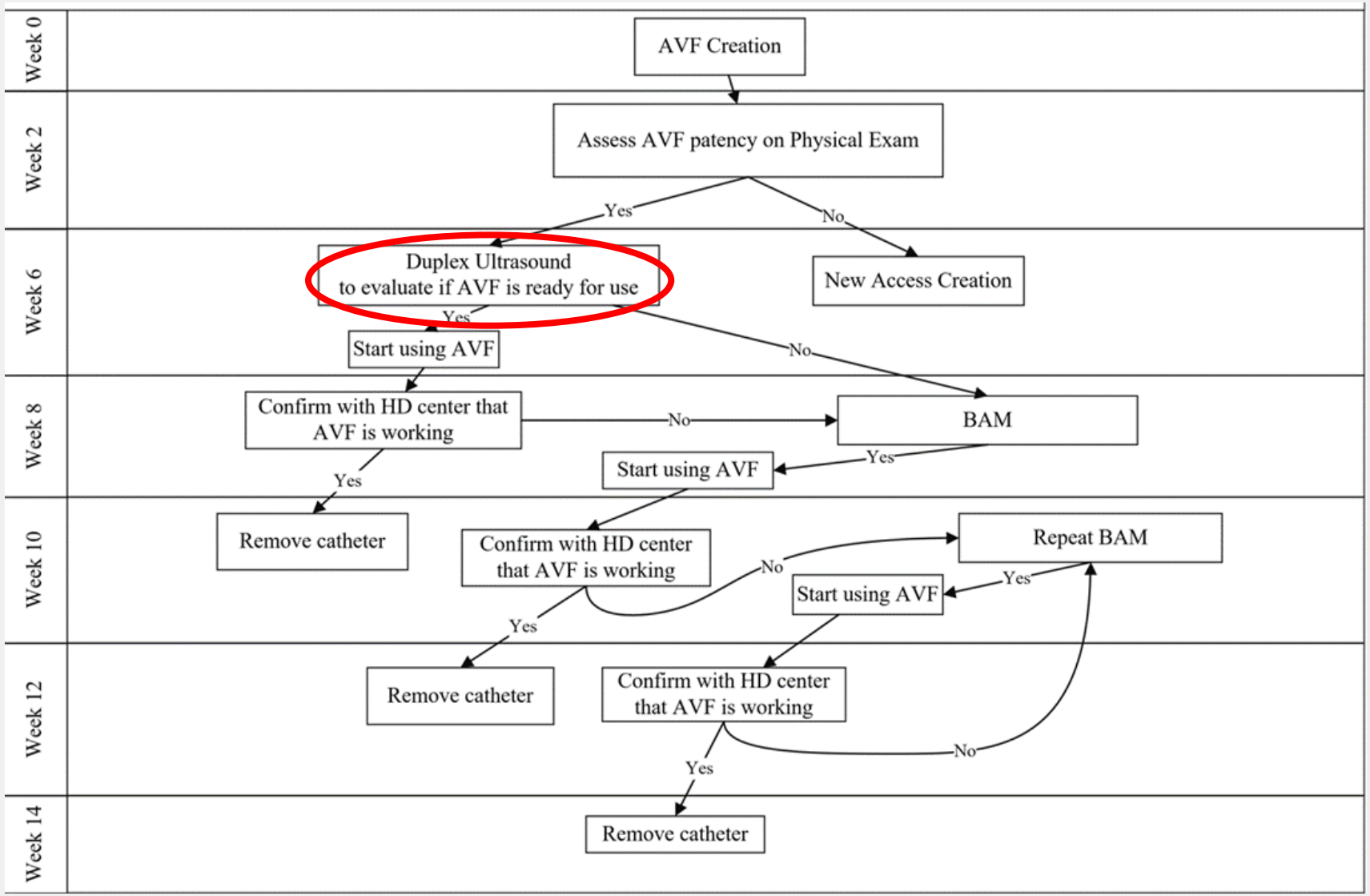
1,077 AVFs
65% radiocephalic
Overall maturation: 84%
Primary Maturation: 39%
> 1BAM: 15%

Timely follow-up

10.1 **KDOQI considers it reasonable for AV access (AVF and AVG) to be evaluated by a surgeon/operator for postoperative complications within 2 weeks and for an appropriate member of the vascular access team to evaluate for AVF maturation by 4-6 weeks after AV access creation and refer for further investigation if not maturing as expected. (Expert Opinion)**

Note: Ideally, the surgeon/operator evaluating for complications would be the same individual who created the AV access.

Early recognition: do not wait 3 months without a plan



The Role of Duplex Ultrasound in Assessing AVF Maturation

Yana Etkin,[1] Sonia Talathi,[1] Amit Rao,[1] Meredith Akerman,[2] Martin Lesser,[2] Firas F. Mussa,[1] and Gregg S. Landis,[1] New Hyde Park and Hempstead, New York

Background: Arteriovenous fistulas (AVFs) are favored for hemodialysis (HD) access. However, in many instances, AVFs fail to mature. We examined the utility of postoperative color duplex ultrasound (CDU) in assessing AVF maturation and determining the need for balloon-assisted maturation (BAM).

Methods: A total of 633 patients underwent AVF creation at a single institution from 2015 to 2018. A total of 339 patients (54%) underwent CDU at a median of 8 weeks postoperatively. We collected the following parameters: vein diameter, volume flow (VF), peak systolic velocities in arterial inflow and venous outflow, and presence of stealing branches. A peak systolic velocity ratio (SVR) of ≥2 correlated with ≥50% stenosis in venous outflow, and SVR ≥3 correlated with ≥50% stenosis at the anastomosis. AVFs were considered mature when they were successfully cannulated on dialysis. A generalized linear mixed model (GLMM) was created to compare duplex criteria associated with successful use of AVF (maturation) to those AVFs that required further intervention or failed to mature. Fistulography images, the current gold standard, were compared with findings from CDU studies to determine validity of the duplex ultrasound.

Results: Of the 339 AVFs with postoperative CDU, 31.3% matured without interventions, 38.3% required BAM, 9.7% thrombosed, and the remaining patients were not yet on HD. Based on GLMM analysis, the probability of AVF maturation increases if CDU demonstrated one of the following: the vein diameter is ≥ 6 (odds ratio [OR] = 38.7), no evidence of stenosis in the venous outflow tract (OR = 35.6), no stealing branches (OR = 21.6) and VF ≥ 675 (OR = 5.0). Fistulography was performed in 195 patents. Sensitivity and specificity for each are as follows: vein diameter (84.3%, 28.6%), stenosis (59.3%, 78.8%), and stealing branches (20.7%, 92.7%).

Conclusions: Postoperative CDU should be considered routine to correct anatomical findings that might limit AVF maturation and identify the need for further interventions.

Table I. CDU findings in matured AVFs versus AVFs requiring BAM/failed AVFs

CDU parameters	Matured AVFs (n = 174)	AVFs requiring BAM/ failed AVFs (n = 234)	P-value
Mean vein diameter ±SD, mm	7.1 ± 1.2	4.9 ± 1.2	<0.0001
Mean VF ±SD, mL/min	1094.7 ± 511.2	625.2 ± 411.2	<0.0001
≥50% stenosis at the anastomosis, n (%)	8 (4.6)	11 (4.7)	0.43
≥50% stenosis in the venous outflow tract, n (%)	8 (4.6)	90 (39.1)	0.0001
Presence of stealing branches, n (%)	3 (1.7)	28 (12.3)	0.0001

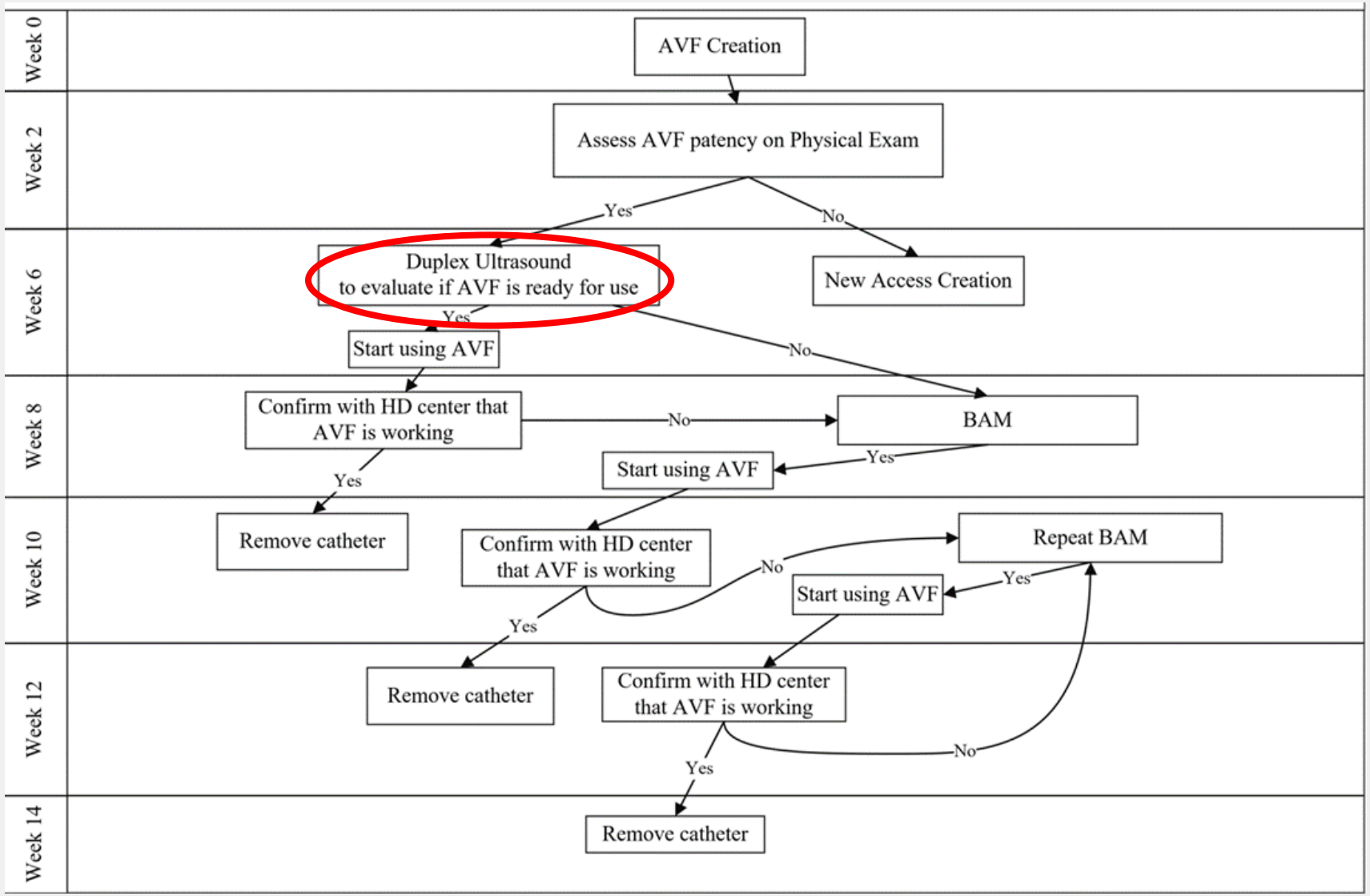
SD, standard deviation.

Table III. CDU versus fistulography findings

	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy (%)
Vein diameter	84.3	28.6	81.1	33.3	72.3
Stealing branches	59.3	78.8	73.1	66.7	69.2
Stenosis in the venous outflow tract	20.7	92.7	54.5	73.4	71.3

PPV, positive predictive value; NPV, negative predictive value.

Early recognition: do not wait 3 months without a plan



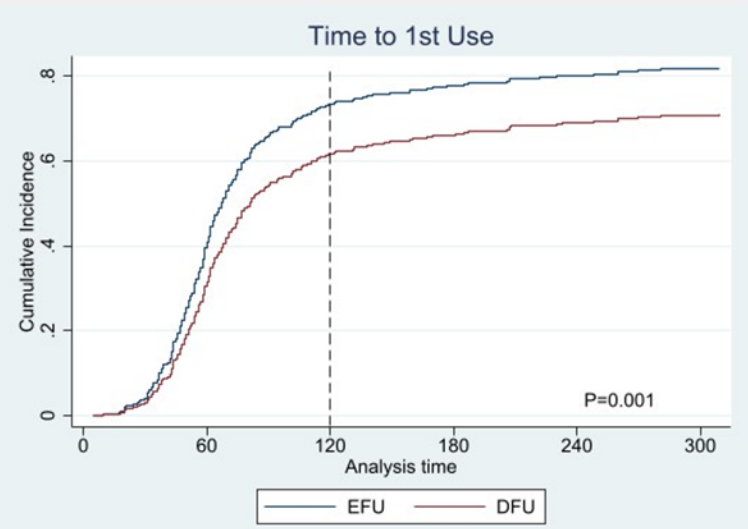
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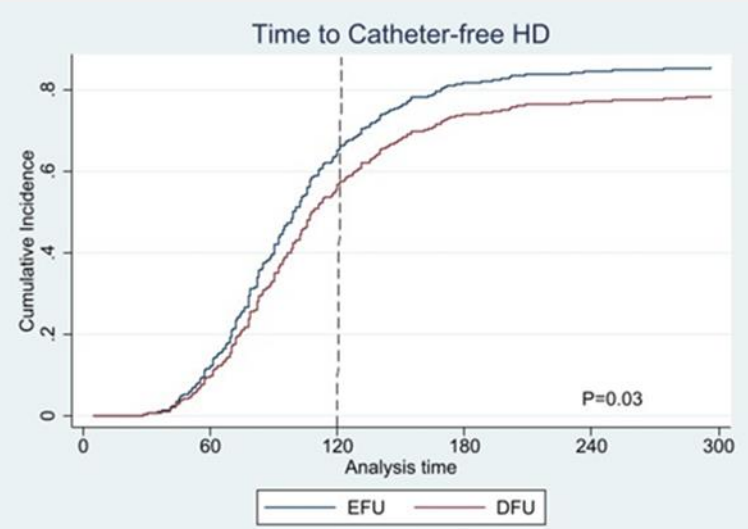
Early Follow-Up after Arteriovenous Fistula Creation is Associated with Improved Access-Related Outcomes

Mariah Buzzell • Adrian Chen • Tabea Hoffstaetter • ... Gregg Landis • Jeffrey Silpe • Yana Etkin
Show all authors

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Median time to 1st Use
50 vs. 88 days (p<0.0001)



Median Time to Catheter-Free HD
75 vs. 188 days (p<0.0001)

Diagnose the failure pattern

Failure pattern	Signs and Symptoms	Treatment
Inflow/anastomotic stenosis	Weak thrill, poor augmentation, low flow	Angioplasty or surgical revision
Juxta-anastomotic / outflow stenosis	Pulsatile fistula, high-pitched bruit, poor vein growth	PTA / BAM; selective surgery
Accessory veins	Flow diverted into branches, poor main-channel enlargement	Branch ligation or coil embolization
Too deep	Good flow/diameter but hard to palpate/cannulate	Superficialization, elevation, transposition, selective lipectomy
Central venous outflow issue	Arm swelling, collaterals, prior catheter	Central venous imaging/intervention

Algorithm: **Immature AVF at 4–6 weeks**

Is it patent?
No thrill/bruit → urgent duplex/fistulogram; consider thrombosis salvage if viable.

Is flow low?
Look for inflow, anastomotic, juxta-anastomotic, or outflow stenosis → angioplasty or surgical revision.

Is flow diverted?
Large accessory branches → ligation or coil embolization, usually after stenosis is addressed.

Is flow/diameter adequate but cannulation impossible?
Too deep, tortuous, short usable segment → superficialization, elevation, transposition, lipectomy, or cannulation plan.

Is the patient stuck in repeat interventions?
Reassess the access plan, catheter dependence, transplant candidacy, life expectancy, and alternatives.

Procedures for Maturation

- BAM vs. Surgery
- When to create new access

Endovascular and Surgical Intervention

10.9 There is inadequate evidence for KDOQI to make a recommendation on the preferred use of surgical or endovascular techniques for postoperative maturation. It is reasonable to consider a careful individualized approach to using either surgical techniques or endovascular techniques when needing to intervene on an AV access to enhance maturation postoperatively.



13 studies→ 1427pts

Clinical success rate 90%

Technical success rate 97%

Complications (venous rupture, hematoma) 1.7-4.1%

Techniques for BAM

- Flow rerouting
- Staged balloon angioplasty maturation
- Limited controlled extravasation
- Competing branch vein elimination

15.6 There is inadequate evidence for KDOQI to make a recommendation regarding the use of specialized balloons (drug-coated or cutting) versus standard high-pressure balloons in the primary treatment of AVF and AVG stenosis.

15.7 There is inadequate evidence for KDOQI to make a recommendation regarding the optimal duration of balloon inflation time during angioplasty to improve intervention primary patency in the treatment of AVF or AVG stenosis.



Duplex findings s/p BAM	≥ 7mm balloon (n=149)	<7mm balloon (n=90)	P Value
Vein Diameter, mm (median, IQR)	5.9 (5-6.4)	5.1 (4.2-5.9)	**0.03**
Volume Flow, mm (median, IQR)	732 (539-1169)	590 (472-802)	0.1
Vein stenosis, n (%)	2 (2%)	6 (7%)	**0.04**

Outcomes	≥ 7mm balloon (n=149)	<7mm balloon Group II (n=90)	P Value
Procedure duration, min (mean±SD)	38±17	38±13	0.8
Contrast extravasation	22 (15%)	18 (21%)	0.2
Re-intervention rate	24(16%)	30(33%)	**0.002**
Time to catheter-free HD, days (median, IQR)	29 (19-47)	42 (24-75)	**0.002**

From the Society for Clinical Vascular Surgery

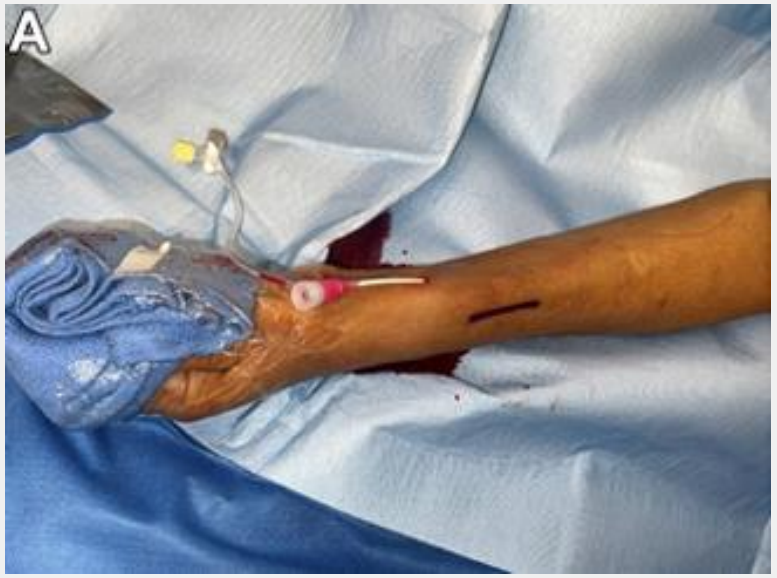
Transradial access for balloon-assisted maturation of arteriovenous fistulas

Mayumi Kohiyama, BS,[a] Tabea Hoffstaetter, BS,[a] Jeffrey Silpe, MD, MS-HPEd,[b] Avinash Garlapati, BS,[a] Gregg S. Landis, MD,[b] *and* Yana Etkin, MD,[b] *Hempstead, NY*

ABSTRACT

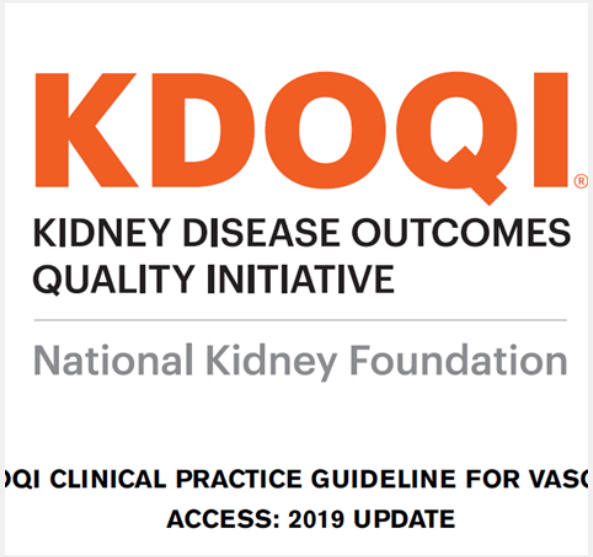
Balloon-assisted maturation (BAM) of arteriovenous fistulas has conventionally been performed via direct fistula access. The transradial approach has not been well described for BAM, although its use has been reported throughout the cardiology literature. The purpose of the present study was to assess the outcomes of transradial access for its use with BAM. A retrospective review of 205 patients with transradial access for BAM was performed. One sheath was inserted into the radial artery distal to the anastomosis. We have described the procedural details, complications, and outcomes. The procedure was considered technically successful if transradial access had been established and the AVF had been ballooned with at least one balloon without major complications. The procedure was considered clinically successful if no further interventions had been required for AVF maturation. The average time for BAM via transradial access was 35 ± 20 minutes, with 31 ± 17 mL of contrast used. No access-related perioperative complications, including access site hematoma, symptomatic radial artery occlusion, or fistula thrombosis, had occurred. The technical success rate was 100%, and the rate of clinical success was 78%, with 45 patients requiring additional procedures to achieve maturation. Transradial access is an efficient alternative to trans-fistula access for BAM. It is technically easier and allows for better visualization of the anastomosis. (J Vasc Surg Cases Innov Tech 2023;9:1-6.)

Keywords: Arteriovenous fistula maturation; Balloon-assisted maturation; Transradial access





When enough is enough



AV Access (Fistula or Graft) Target	
2	All AV access (Fistula or Graft) Intervention goal = "1-2-3" interventions as follows: 1. For each 1 AV access creation 2. There should be ≤2 interventions to facilitate AV access use 3. There should be ≤3 interventions to maintain AV access use per year *Access use refers to successful use of AV access with 2-needle cannulation to achieve prescribed dialysis.*

When to consider open revision



- Anastomotic revision / patch angioplasty
- Proximalization or new anastomosis when inflow is limiting
- Superficialization or Transposition
- Abandonment and new access when the circuit is not worth repeated rescue

Adjunctive Techniques

Statements: Use of Operator-Assisted Maneuvers for AV Access Maturation

8.5 KDOQI does not suggest the use of allogenic endothelial implants to improve AVF maturation, patency, or clinical usability or to improve AVG graft patency or reduce thrombosis. (*Conditional Recommendation, Very Low Quality of Evidence*)

8.6 KDOQI does not suggest the use of pancreatic elastase to improve the patency and clinical use of AVF or AVG. (*Conditional Recommendation, Moderate Quality of Evidence*)

8.7 KDOQI considers it reasonable to have a careful individualized approach to operator-enhanced (surgical or endovascular) maneuvers during AV access creation to facilitate AV access maturation, based on the operator's best clinical judgment and expertise. (*Expert Opinion*)

Statements: Postoperative AV Access Maturation

Patient Enhanced

10.2 There is inadequate evidence for KDOQI to make a recommendation on the use of upper extremity exercise to facilitate postoperative AVF maturation.

10.3 KDOQI recommends the use of whole arm rather than finger exercise, if exercise is used to facilitate AVF maturation. (*Conditional Recommendation, Moderate-High Quality of Evidence*)

Pharmacologic Intervention

10.4 KDOQI does not suggest the use of heparin as an adjuvant therapy in the perioperative period to improve primary patency or initial use of AV access (AVF or AVG). (*Conditional Recommendation, Low Quality of Evidence*)

10.5 KDOQI does not suggest the use of adjuvant clopidogrel monotherapy initiation in the perioperative period to improve AVF maturation and reduce the likelihood of primary failure. (*Conditional Recommendation, Low Quality of Evidence*)

10.6 KDOQI does not suggest the use of glyceryltrinitrate to enhance AVF maturation. (*Conditional Recommendation, Low Quality of Evidence*)

10.7 KDOQI does not suggest the use of cholecalciferol to enhance AVF maturation. (*Conditional Recommendation, Moderate Quality of Evidence*)

10.8 There is inadequate evidence for KDOQI to make a recommendation on the use of clopidogrel-prostacyclin (iloprost) for AVF usability or patency.

Summary

The immature AVF should trigger a workflow, not a waiting period

- No level I data on how to improve maturation
- Standardized f/up protocol and early eval for maturation (4-6w)
- Image & identify the dominant lesion
- Intervene if AVF is not ready for use
- No proven advantages of specific BAM techniques (large balloons ???)
- Decide when to abandon the access (after 3 BAMs???)
- No benefits of intraop or postop adjunctive techniques



Thank you