VASCULAR ACCESS COORDINATOR'S HANDBOOK

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Table of Contents

Vascular Access Coordinator Handbook

I. Introduction

What is a Vascular Access Coordinator? What are their responsibilities? Why hire a Vascular Access Coordinator? The intent of this handbook is to answer these questions and provide tools and information for a Vascular Access Coordinator to use to fulfill their responsibilities.

A. Responsibilities of a Vascular Access Coordinator

The responsibilities of the Vascular Access Coordinator (VAC) are multifaceted. They begin in the pre-dialysis and outpatient service with communication with the vascular access surgeon, coordination of the surgery, and patient and staff education. It takes place primarily in the dialysis clinic making sure that everything runs smoothly and the needs of the dialysis patients are met every time they come to the clinic for dialysis. A Vascular Access Coordinator's role also includes being a patient advocate, a teacher of patients and colleagues, and the liaison for all access issues.

Although a Vascular Access Coordinator's primary focus is on the vascular access needs of patients, they do much more than simply tend to patients. A VAC's responsibilities also entail:

- Collecting, tracking, and trending accurate and complete vascular access data;
- Educating patients in the care and management of vascular accesses;
- Monitoring vascular accesses with a focus on identifying access dysfunction prior to stenosis and clotting;
- Monitoring central venous catheter (CVC) use with a goal to reduce catheters;
- Facilitating the referral process for diagnosis of accesses with dysfunction or other pathology;
- Facilitating referrals for interventional or surgical treatment appropriate for diagnosed vascular access dysfunction;
- Monitoring documentation of vascular access care, intervention and outcomes;
- Participating in Vascular Access QAPI improvements and outcomes.

B. Access Coordinator Qualifications

A Vascular Access Coordinator's background would include:

- Experience in hemodialysis healthcare work (nurse, nurse practitioner, or dialysis technician.) This can be a current employee who takes on additional duties, or one hired to fulfill the role;
- Necessary certifications in hemodialysis or nephrology;
- Proficiency in vascular access care and management and committment to quality assessment and performance improvement.

A Vascular Access Coordinator's areas of competence would include:

- Developing and implementing protocols for staff support and patient education;
- Vascular access monitoring program implementation;
- Vascular access data collection;
- Audit infection and adverse outcomes;
- Quality control of vascular access care.

The professional and personal qualities that would serve a person well in the VAC role would include: the ability to be flexible, mobile, assertive and accountable; be able to manage the Continuous Quality Improvement (CQI) process; be a collaborator and communicator extraordinaire with others on their Dialysis Care Team.

I. Introduction cont.

C. Benefits of Having a Vascular Access Coordinator

A skilled and effective Vascular Access Coordinator is an invaluable asset to a dialysis team because they:

- Provide support in difficult circumstances, especially cannulation or helping to field central venous catheter management queries;
- Save nephrologists and staff time by ensuring the access is healthy and functioning;
- Improve clinic retention rates by proactively identifying problems with a patient's access;
- Improve communication among the dialysis staff and the vascular access care team;
- Improve patient outcomes through consistent vascular access monitoring and trending.

The typical day's daily schedule for a for a Vascular Access Coordinator might resemble the one shown below.

8:00am – 8:30am	**URGENT ISSUES** (Patients with a clotted access, a catheter not working, showing signs of infection, unable to get a needle in, or someone who needs to go to the hospital)	Nursing Station
8:30am – 8:40am	**TEAM HUDDLE**	Nursing Station
8:40am – 9:40am	**PATIENT ROUNDS**	Patient Care Floor
9:40am – 10:30am	Action Item Follow-up from Rounds, Care Plan Meetings, Quality Improvement Data Collections and Tasks	Nursing Station
10:30am – 10:45am	**BREAK**	Break Room
10:45am – 12:00pm	**ASSIST WITH SHIFT TURNOVER** Patient Assessments, Cannulation Assistance, Patient Education	Patient Care Floor
12:00pm – 12:30pm	**URGENT ISSUES**	Nursing Station
12:30pm – 1:00pm	**LUNCH**	Break Room
1:00pm – 1:10pm	**TEAM HUDDLE IF NEEDED**	Nursing Station
1:10pm – 2:10pm	**PATIENT ROUNDS**	Patient Care Floor
2:10pm – 3:00pm	Action Item Follow-up from Rounds, Care Plan Meetings, Quality Improvement Data Collections and Tasks	Nursing Station
3:00pm – 4:30pm	**ASSIST WITH SHIFT TURNOVER** Patient Assessments, Cannulation Assistance, Patient Education	Patient Care Floor
4:30pm – 5:30pm	**3RD SHIFT PATIENT ROUNDS** Action Item Follow-up from Rounds, Care Plan Meetings, Quality Improvement Data Collections and Tasks	Nursing Station & Patient Care Floor

III. Urgent Issues

Clearly, urgent issues must take precedence over a Vascular Access Coordinator's planned schedule. The issues that must be addressed immediately might change on a daily basis, but might include patients with:

1. A clotted access: the vascular access coordinator should alert the charge/team leader, nurse manager or nephrologist immediately for referral to an interventionalist or surgeon.

2. A catheter not supporting prescribed blood flow rate: the vascular access coordinator should troubleshoot. If the issue cannot be resolved, the charge/team leader, nurse manager or nephrologist should be alerted.

3. Failed (STOP) One Minute Check finding: the vascular access coordinator should use the expert level One Minute Check prior to cannulation (once the needles are inserted, the expert examination cannot be performed). Alert the charge/team leader, nurse manager or nephrologist with abnormal findings to determine if the vascular access can safely be utilized for the dialysis session as the findings are addressed.

4. Unable to get a needle in: the vascular access coordinator might assist in attempting to get the patient cannulated. If unsuccessful, alert the charge/team leader, nurse manager or nephrologist to seek and facilitate alternative avenues for dialysis.

5. Someone who needs to go to the hospital: the vascular access coordinator might arrange or have someone arrange for transportation to the hospital; alert the hospital to the patient's coming and their condition and support the patient through the transition to another medical facility.

On any given day at the clinic, unexpected or urgent issues might interrupt the daily routine or plan. This calls for a Vascular Access Coordinator to be constantly resourceful, flexible and a problem solver.

IV. Communication

A. Huddles

One effective way to get a Dialysis Care Team on the same page each day is to institute a daily huddle with your dialysis care team. They serve as a quick meeting where your team members can share important information about patient care. Huddles can take place:

- When there is a shift change;
- When a new employee or patient arrives;
- Before employees take breaks;
- If an issue occurs that needs the resources of the entire team.

Huddles can last between 5-15 minutes. They should start at the same time and in the same place each day.

Communication Breakdown Example

Jane comes to your clinic for dialysis on Mondays, Wednesdays and Fridays. When she arrives for her Wednesday treatment, her access is failing. What happened? The Monday nurses noticed swelling in Jane's arm, but due to a breakdown in communication, the Wednesday nurses weren't notified. Because of this, Jane has to miss her treatments to fix her access. Now your clinic is taking a financial hit from the loss of her treatments, and the quality of care for Jane wasn't where it should have been. If the staff caring for Jane would have used huddles, it's likely her issue would have been resolved in a timely manner without her having to miss treatments.

V. Patient Education

A. Introduction

A primary responsibility of a Vascular Access Coordinator is to encourage the Dialysis Care Team to talk to, get to know, and listen to each patient that enters the clinic. Their job is not only to administer dialysis, but also to support and advocate for their patients as they undergo treatment. They should also encourage patients to advocate for themselves with their health care team.

Not only are the Vascular Access Coordinator and the Dialysis Care Team the first lines of support for the patient, they also are there to educate patients about their dialysis delivery options (see box below), how or manage their accesses, and to help shepherd them through their decisions and treatments. This should also include information about caring for their catheters, fistulas and grafts, the benefits of an arteriovenous fistulas, and how to protect their veins.

B. ESKD Life-Plan

The 2019 KDOQI Vascular Access Guidelines details the utilization of an ESKD Life-Plan to guide the overall care of a patient with CKD Stage 4-5. The ESKD Life-Plan is defined as follows:

> "The individualized set of kidney replacement modalities (hemodialysis, peritoneal dialysis, transplantation) required to sustain the life of a patient with ESKD that considers the patient's current and anticipated medical and life cicrumstances and preferences. The Life-Plan should be regularly re-evaluated given expected changes in patient's life circumstances."

Ref: Lok CE, Huber TS, Lee T, et al; KDOQI Vascular Access Guideline Workgroup. KDOQI clinical practice guideline for vascular access: 2019 update. Am J Kidney Dis. 2020; 75(4)(suppl 2):S1-S164.

The 2019 KDOQI Guidelines Number 2 addresses the Vascular Access Types and the need to select the access type based on the patient's individual Life-Plan.

KDOQI considers it reasonable to have an AV access (AVF or AVG) in a patient requiring HD when consistent with their ESKD lifeplan and overall goals of care. KDOQI considers it reasonable in valid clinical circumstances to use tunneled CVC's for short-term or long-term durations when consistent with their ESKD Life-Plan and overall goals of care.

In accordance with the ESKD Life Plan, catheters can be used in short-term and long-term applications. Therefore, catheters must be carefully monitored and maintained to prevent infection and dysfunction.

V. Patient Education cont.

A sample ESKD Life-Plan is included in the KDOQI Guidelines- see example below:

ESKD Life-Plan

Date Completed:_____

Patient Name:

Addressograph

Primary Nephrologist: _____ Phone: _____

Primary Interventionalist: _____ Phone: _____

Primary Surgeon: _____ Phone: _____

Primary Care Practitioner: _____ Phone: _____

Emergency Contact: _____ Phone: _____

Key Notes: _____

Language(s) Spoken: _____ Translator required: _____

Modality 1	→	Modality 2	→	Modality 3
HD		Transplant		HD

Access Strategy	Access Strategy	Access Strategy

I gave input into my ESKD Life-Plan, understand it and agree to it.

I have discussed the RRT options and associated dialysis access strategies with the patient and answered their questions to their satisfaction and understanding

_____ Patient signature

_____ Health care professional signature

This is an annual update: ☐ Yes ☐ No

Has the ESKD Life-Plan changed since the last review: ☐ Yes ☐ No

If YES, the ESKD Life-Plan has changed, fill out a new ESKD Life-Plan document

V. Patient Education cont.

The Access Strategy can include both HD and PD options. Over the lifetime of the patient, the modality and access needs will change. The acronym P-L-A-N (Patient Life-Plan Access Needs) helps account for these changes.

Creation Plan: Includes all the steps required for the evaluation and creation of the dialysis access (PD or HD). The plan should also include all steps required for the vascular access to functionally support dialysis (such as any interventions required to achieve fistula maturation and successful cannulations with the catheter removed).

Contingency Plan: Includes the cannulation, access monitor (One Minute Check), and access surveillance to identify any early indication of access dysfunction. The KDOQI defines the contingency plan to include remedial measures for the vascular access's anticipated problems.

Succession Plan: KDOQI defines the succession plan as thoughtful planning for the next dialysis access before the current access is even created, and revisited before it fails, which considers the patient's ESKD Life-Plan.

C. Central Venous Catheter

To help avert problems with catheters, patients must learn about catheter safety, and plan for a more permanent arteriovenous access to achieve catheter freedom.

CVC Safety — The One Minute Catheter Check

A Vascular Access Coordinator should ensure that each and every catheter patient knows how to check their catheter daily, first by looking at the catheters insertion site and secondly, by feeling the catheter (see next page). If they do not notice any change, they should keep checking daily and report to their Dialysis Care Team on the next visit that there was no change. If, on the other hand, the patient sees or feels a change in their catheter, they should notify their Dialysis Care Team immediately to get instructions on what to do next.

V. Patient Education cont.

CVC Safety — The One Minute Catheter Check

It only takes a minute to check your catheter.

A Bridge to Your Lifeline

Look

Look at your catheter dressing in the mirror.

It is clean and dry, and it covers the exit site (the place where the catheter comes out of your skin)

GO

The dressing does not cover the exit site, it is wet or dirty, there is blood or pus on the dressing.

STOP

Feel

Feel over the catheter dressing. *Do not remove the dressing!*

The dressing is dry and there is no pain in the area under the dressing.

GO

The dressing is wet, you have pain in the area under the dressing, something feels different, or you think you may have a fever.

STOP

If you notice any of the red "stop" signs during your daily catheter check, follow these instructions IMMEDIATELY:

Contact: _____

During regular facility hours _____

After hours _____

Reference: www.esrdncc.org Lifeline for a Lifetime: Planning for Your Access developed by ESRD National Coordinating Center and Fistula First

V. Patient Education cont.

D. AV Access (Including AV Fistula or AV Graft)

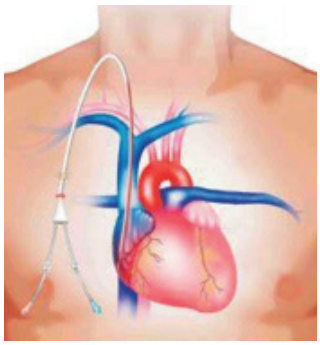
Planning for a Vascular Access: A Lifeline for a Lifetime[1]

For either new and established patients, the patient and Dialysis Care Team should work together to develop and carry out a patient-focused access plan that is followed at all sites of care: the dialysis clinic; access center; hospital, outpatient facility, or other location.

A Vascular Access Plan should include the following:

1. Generating an access plan and reviewing its steps;
2. Explaining how the surgeon will find the best site for the access;
3. Having a scheduled appointment with a vascular surgeon or interventionalist;
4. Undergoing surgery to create the vascular access;
5. Waiting for the access to mature or heal;
6. Using the access for hemodialysis;
7. Having the catheter removed once the vascular access is being used routinely;
8. Caring of the access for a lifetime with a daily one-minute check.

[1]Reference: www.esrdncc.org Lifeline for a Lifetime: Planning for Your Access developed by ESRD National Coordinating Center and Fistula First



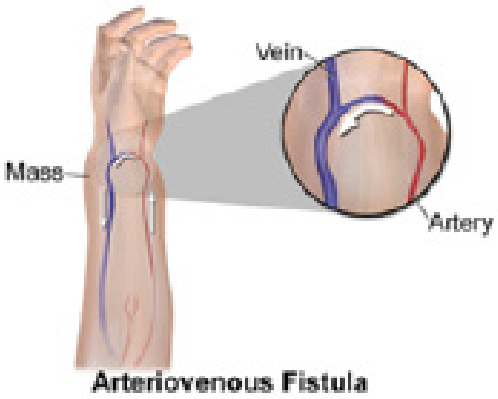
CVC inserted via the jugular vein into the right atrium of the heart to serve as a vascular access for hemodialysis.

Vascular Access Options

Arteriovenous Fistulas (AVF) — Preferred Access

Surgical or endovascular connection between an artery and vein

- A continuous circuit;
- Lowest complication rate;
- 6-8 week maturation time;
- Best long-term primary patency;
- Requires the fewest interventions.

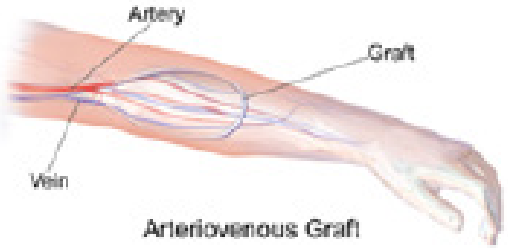


Arteriovenous Fistula

Arteriovenous Grafts (AVG)

AVG (synthetic or biologic materials) standard graft material or early cannulation material

- Ready for use in 2-3 weeks (if standard graft material);
- Useful if veins prohibit AVF development;
- More infections than an AVF, but less than an catheter;
- Tends to clot more often than AVFs.



Arteriovenous Graft

V. Patient Education cont.

Caring For Your AV Fistula: Look • Listen • Feel

V. Patient Education cont.

The One Minute Access Check: Look • Listen • Feel cont.

Summary

An important role for a Vascular Access Coordinator and their Dialysis Care Team is to work with each patient, preparing them and helping them to adapt to their dialysis treatments.

If the patient has a catheter, a vascular access coordinator can teach them to perform a routine catheter safety check and plan for a more permanent access, if possible.

- Catheters can be considered a **Bridge to a Lifeline**.
- Access Planning is preparing for a **Lifeline for a Lifetime** and
- Access Monitoring is caring for that **Lifeline for a Lifetime**.

Reference: www.esrdncc.org developed by ESRD National Coordinating Center and Fistula First under contract Number HHSM-500-2013-NW002C sponsored by the Centers for Medicare and Medicaid Services (CMS).

VI. Cannulation Education & Assistance

A healthy arteriovenous fistula or graft depends on the quality of the blood vessels and the surgical technique used to create the access. It also depends on an essential part of hemodialysis treatment: the repeated cannulation of the access. Nurses and nephrology clinical technicians (NCT) play a pivotal role in the cannulation and care of a patient's vascular access, for they are the ones to cannulate the access and assess vascular access function during every hemodialysis session up to 312 times each year. Successful cannulation requires a high level of awareness and skills of the dialysis nurse, frequent monitoring, and a continued evaluation and education of the technique.

Consequently, an essential role of a Vascular Access Coordinator is to ensure that the dialysis staff has competent cannulation skills. While poor cannulation may result in VA complications leading to suboptimal hemodialysis, the need for extra needle insertions, patient discomfort, interventions and even loss of the vascular access, correct cannulation technique can positively influence the lifespan of a vascular access.

Pre Cannulation Care

Arteriovenous Fistula (AVF)

Staff should examine the fistula before cannulation during each hemodialysis session. Patients in pre-dialysis therapy should be taught how to perform self examination.

Arteriovenous Grafts (AVG)

In AVGs, healing is based on the time needed for tissue to graft incorporation and for tissue swelling to decrease after graft implantation, rather than a flow increase over time because flow is high from the day of surgery and changes little over time. Some polyurethane grafts, multilayer ePTFE self-sealing grafts or biologic grafts can be cannulated within 24-72 hours without major complications, avoiding catheters in patients that need early hemodialysis and that do not have suitable veins for a fistula.

After creation of an AVG most patients experience significant tissue swelling as a result of tunneling so palpation of the graft is difficult for the cannulating nurse and painful for the patient. Therefore, grafts should generally not be cannulated for at least 2 weeks after placement and only after the swelling has subsided and palpation along the course of the graft can be performed. Early cannulation grafts should, if possible, be left for at least 24 hours after placement and until after the swelling has subsided so that palpation of the course of the AVG can be performed.

Skin Prep

Because hemodialysis patients are more frequent carriers of Staphylococcus aureus than the general population, meticulous skin preparation prior to any cannulation is critical. To minimize infections, facilities should have a procedural policy for patient VA preparation. Proper preparation of the access sites using strict aseptic technique should be used for all cannulation procedures. Circular cleansing is generally preferred over the east-west technique. Reference: (www.cdc.gov/dialysis/coalition/index.html)

Anesthesia

Pain related to cannulation is a significant concern for some patients. Anesthetics available for needle insertions include: topical creams such as those containing both lidocaine 2.5% and prilocaine 2.5%, intradermal lidocaine injection, and coolant sprays which cause reduced pain sensation by rapid skin cooling on evaporation.

Pre-cannulation Exam

Vascular access stenosis is the most common cause of access dysfunction. Monitoring by physical examination to detect the physical signs of dysfunction before any cannulation is of utmost importance. Monitoring should consist of a full physical examination of the vascular access prior to every hemodialysis session including inspection, auscultation and palpation (Look, Listen, Feel, see page 18). Inspection may reveal swelling, signs of infection (redness, discharge, edema), aneurysms, hematoma of the hand and

VI. Cannulation Education & Assistance cont.

stenosis. Palpation should reveal a characteristic thrill. A change in the strength of the pulse over a short segment may indicate a stenosis, while a pulsatile AVF indicates the presence of a downstream or distal stenosis. Post-stenotic collapse of the vein on elevation of the arm can demonstrate the hemodynamic relevance of a stenosis. The vascular access should have a bruit. Over a stenosis a bruit will be high pitched.

Monitoring should also include a review of regular routine laboratory tests, including hemodialysis adequacy (urea reduction ratio or Kt/V), and difficulties in cannulation or achieving hemostasis after needle withdrawal, documented recirculation, and other clinical clues.

Cannulation

Needle Selection

It is important to choose the appropriate needle according to the desired blood pump speed and the available vascular access flow rate in order to optimize HD efficiency. Needle selection is especially critical for the initial cannulation. One method used to select the appropriate needle size is a visual and tactile examination. This examination allows the person performing the cannulation to determine which needle gauge would be most appropriate, based on the size of the vessels of the fistula. The needle size should be equal to or smaller than that of the vein without a tourniquet applied. If the needle is larger than the diameter of the vein, it can cause damage with cannulation. It is also important to match needle gauge to the blood flow rate. For initial cannulation attempts the smallest needle available, usually a 17 G, is typically used. If the arterial pressure falls below 200-250 mmHg, and the venous pressure is higher than 250 mmHg, the needle size should be increased. The arterial needle should always have a back eye (an oval hole/opening at the back site of the needle) to maximize the flow from the VA and reduce the need for rotation and flipping of the needle.

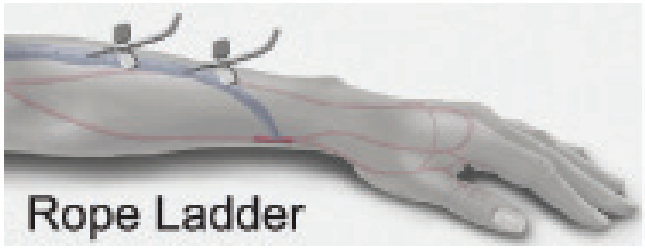
Ultrasound-Assisted Cannulation

Cannulation related complications are especially common in patients with a new vascular accesses especially in autogenous AVFs. POCUS (Point of Care Ultrasound) can be used to map the access for vessel size and depth, and for ultrasound-guided cannulation. Duplex Ultrasound (DUS) guided cannulation of AVFs might improve the cannulation rate of more difficult AVFs, potentially reducing the time required to commence HD and the number of local cannulation complications.

Techniques

Rope Ladder Technique (Preferred Method)

The rope ladder technique is used for the cannulation of AV fistuas and AV grafts to avoid their disintegration and the formation of aneurysms or pseudoaneurysms. It uses the entire

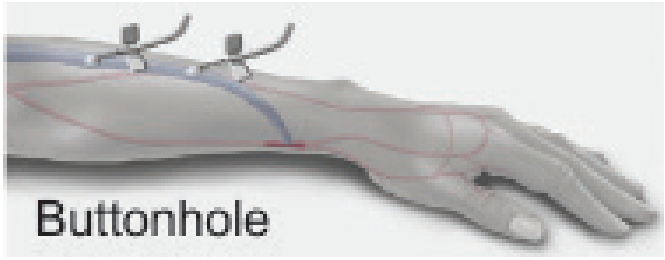


length of the cannulation segment for cannulation. Two new puncture sites are created with approximately 5 cm between the tips of the arterial and venous needles, and at least 3 cm from the anastomosis, avoiding the previous sites. The venous needle is placed in the direction of the blood flow (antegrade). Arterial needle placement can be in or against the direction of the blood flow (antegrade or retrograde). The direction of the arterial needle will not influence the risk of recirculation as long as the VA blood flow is greater than the blood pump flow.

Based on assessment of the vascular access, the care team member chooses the unique angle of insertion for the needle, based on the depth

VI. Cannulation Education & Assistance cont.

of the vessel beneath the skin. POCUS can help measure the vessel depth at various locations in the cannulation segments. The needle angle insertion increases the steepness as the depth of the vessel increases. Generally, the angle of insertion for a fistula is 25 degrees, and for an graft 45 degrees. Grafts are tougher than autogenous vessels. Cannulation-related complications are more often seen in autogenous fistulas than in grafts.



Buttonhole Technique

(Acceptable in Special Circumstances)

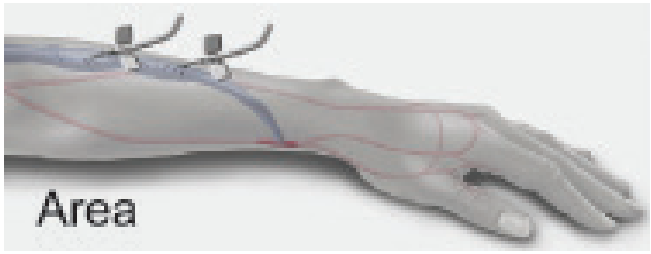
The buttonhole technique is used for fistulas. The buttonhole technique requires that the fistula must be repeatedly cannulated at exactly the same site, using the same insertion angle and the same depth of penetration every time. After approximately 6-10 sessions a tissue tunnel track is formed with sharp needles, enabling the subsequent use of blunt needles for cannulation.

Ideally, the same nurse or nephrology clinical technician should cannulate the fistula until an established track is created to reduce the risk of track malformation. Cannulation sites should be selected in an aneurysm-free area with at least 5 cm between the tips of the needles. After a good puncture route is established, subsequent cannulators should only use blunt needles and must follow the direction and angle of the developed track. The benefits of buttonhole cannulation include reduced complication rates: lower infiltration rates resulting in a reduced incidence of hematoma formation, fewer aneurysms, improved hemostasis times and less pain during cannulation. It is also reported that the buttonhole technique is easier for patients who self-cannulating their accesses. However, an increased risk of infection has been reported with the buttonhole technique so staff re-education regarding correct cannulation techniques, cleansing techniques and scab removal is critical.

Area Technique

(Not an Acceptable Method)

A widely used technique is one that it no longer recommended. It is the area technique that calls for repeated cannulations in the same area of the vascular access. This leads to aneurysmal dilatation of the puncture areas with subsequent stenoses in adjacent regions. Also, the overlying



skin becomes thinner, which leads to longer bleeding times after the needles are removed.

Post Cannulation Access Care

Needle Withdrawal

To protect the vascular access from damage and to facilitate proper hemostasis, needle removal is also important. The needle should be removed at approximately the same angle as it was inserted. After the needle is removed, gentle direct pressure should be applied to the needle exit sites of both the skin and graft or vessel wall, using a two-digit technique over a hemostatic dressing. Pressure to the puncture site should not be applied until the needle has been completely removed, to prevent damage of the vascular access.

In general, grafts require a longer time to achieve hemostasis than fistulas. While compressing the area, it is important to ensure a

VI. Cannulation Education & Assistance cont.

flow can be felt in the vascular access. A dressing should be applied to the sites, but should not encircle the limb to avoid constriction of blood flow to the vascular access. Prior to the patient leaving the unit, the quality of the bruit and thrill should be assessed and documented.

Difficulties in cannulation or achieving hemostasis after needle withdrawal can be a sign of a venous outflow stenosis in a patient with normal bleeding times. If prolonged hemostasis is ongoing, anticoagulation should be reassessed, dynamic venous pressure readings should be reviewed, and vascular access flow studies performed to rule out a stenosis as the cause.

2018 ESVS Clinical Practice Guideline Recommendations

#35	Arteriovenous fistulas should be considered for cannulation 4-6 weeks after creation, and standard arteriovenous grafts after 2-4 weeks.
#36	Arteriovenous fistulas cannulation should generally not be performed before 2 weeks.
#37	Arteriovenous fistula cannulation between 2 and 4 weeks after creation may be considered in selected patients under close supervision.
#40	Strict aseptic technique is recommended for all vascular access cannulations.
#41	Physical examination of the vascular access prior to any cannulation is recommended.
#42	In patients with a short cannulation segment the use of the buttonhole technique should be considered over other techniques.
#43	The rope ladder technique should be used for cannulation of arteriovenous grafts.

Schmidli J *et al*, Vascular Access: 2018 Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS), Eur J of Vasc & Endovasc Surg May 2018.

VI. Cannulation Education & Assistance cont.

2019 KDOQI Guidelines

Cannulation Methods and Recommendations

Cannulation Method	Vascular Access Type	Description of Arterial/Venous Needle Locations	Recommendations KDOQI 2019 VA Guidelines
Rope Ladder	• AV fistula – surgical or endovascular • AV graft (synthetic or biological)	Cannulation site is moved up and down the cannulation zone to allow full site rotation	11.2 Considered the Best Practice for routine AV fistula of AV graft cannulation method
Area Puncture	• AV fistula – surgical or endovascular • AV graft (synthetic or biological)	Limited segment of the cannulation zone is used for repeated cannulation	**Not Recommended** as a cannulation method
Buttonhole	• AV fistula – surgical or endovascular	Exact same cannulation site and angle is utilized to create a tissue tunnel track with a sharp needle then converted to a dull needle	11.3-11.5 Only **special circumstances** given the associated increased risks of infection and related adverse consequences (self-cannulation, very short segment cannulation zones)

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Cannulation Skills and Recommendations

Cannulator & Skill Set	Recommendations KDOQI 2019 VA Guidelines
Skilled cannulators with established high rates of success to perform initial cannulations	11.6
Utilization of a structured training and supervision of dialysis techicians and nurses before and during initial cannulation attempts and regular training updates to maintain cannulation competency	11.7
Support & educate eligible patients on self-cannulation of their AV fistula or AV graft	11.8 (also CMS Conditions of Coverage V-tag 456)

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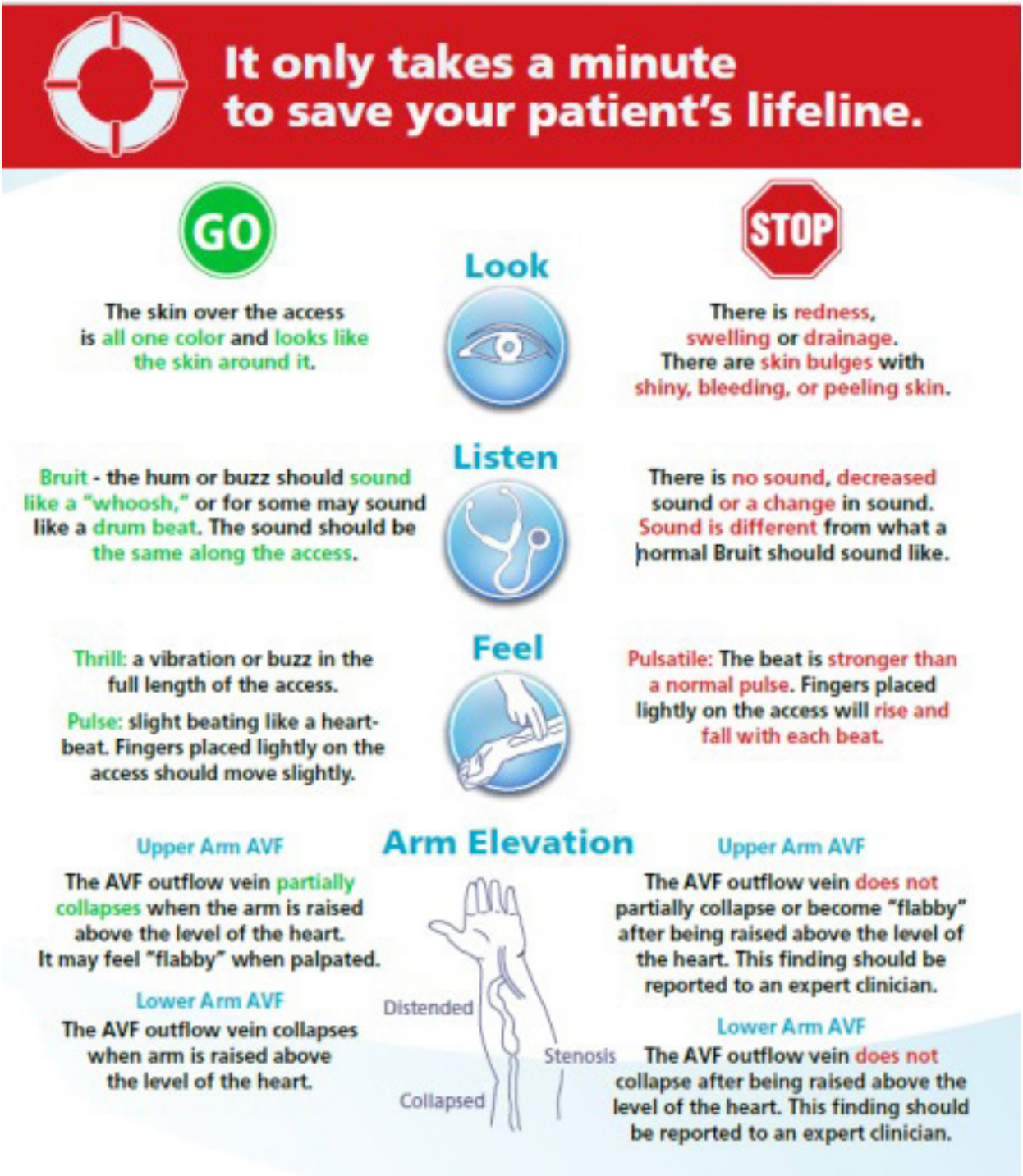
VIIa. Access Monitoring

A. Access Monitoring

KDOQI defines monitoring, as "applying physical examination techniques to detect access dysfunction." When performed correctly, monitoring can identify most access dysfunction.



Reference: www.esrdncc.org developed by ESRD National Coordinating Center and Fistula First under contract Number HHSM-500-2013-NW002C sponsored by the Centers for Medicare and Medicaid Services (CMS).

VIIa. Access Monitoring

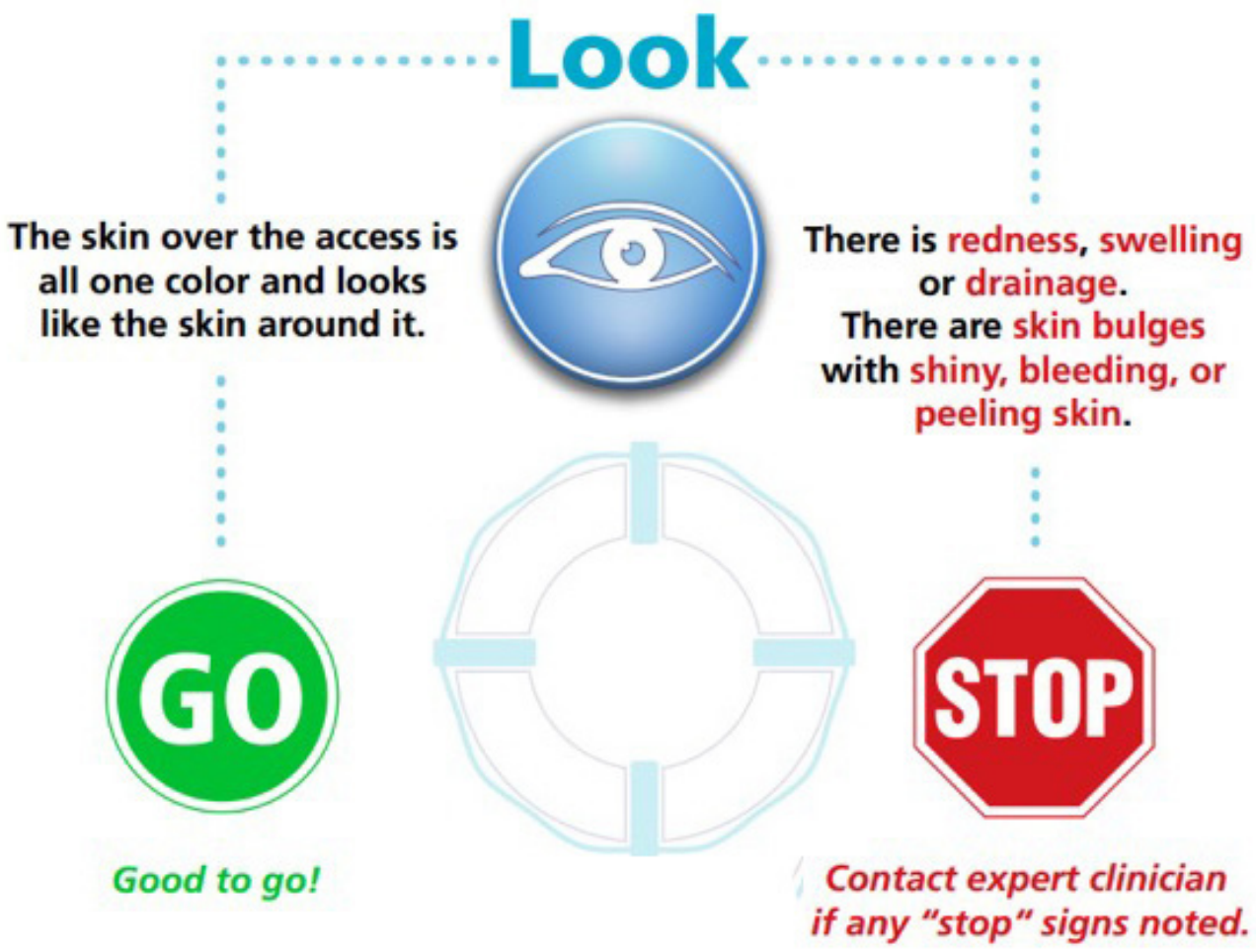
Adequacy of AVF for Size & Flow[1]

If fistula diameter is 0.4 cm or greater, the chance that it would be adequate for dialysis is 89% versus 44% if the fistula size was less than 0.4 cm.

If fistula blood flow is 500 mL/min or greater, the chance that it would be adequate is 84% versus 43% if it is less than 500 mL/min. Combining the two variables, the chance that it would be adequate is 95% versus 33% if neither criteria were met. Experienced dialysis nurses have an 80% accuracy in predicting the ultimate utility of a fistula for dialysis. [1]Schmidli J *et al*, Vascular Access: 2018 Clinical Practice Guidelines of ESVS, page 23.

Perform a quick one-minute check of an access at each visit to the dialysis clinic.

One Minute Check: Look • Listen • Feel



One Minute Check: Look • Listen • Feel

Listen (Stethoscope Bruit)

The hum or buzz should sound like a "whoosh," or for some may sound like a drum beat. The sound should be the same along the access.

GO

Sounding good!

No sound or decreased sound. Change noted.
Sound is different from what a normal BRUIT should sound like.

STOP

Contact expert clinician if any "stop" signs noted.

Feel

Thrill: a vibration or buzz in the full length of the access.

Pulse: slight beating like a heart-beat. Fingers placed lightly on the access should move slightly.

GO

Good to go!

Pulsatile: The beat is stronger than a normal pulse. Fingers placed lightly on the access will rise and fall with each beat.

STOP

Contact expert clinician if any "stop" signs noted.

Reference: www.esrdncc.org developed by ESRD National Coordinating Center and Fistula First under contract Number HHSM-500-2013-NW002C sponsored by the Centers for Medicare and Medicaid Services (CMS).

VIIa. Access Monitoring

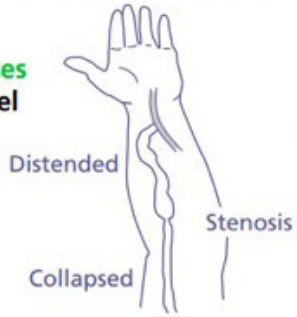
Arm Elevation Test

Upper Arm AVF

The AVF outflow vein partially collapses when the arm is raised above the level of the heart. It may feel "flabby" when palpated.

Lower Arm AVF

The AVF outflow vein collapses when the arm is raised above the level of the heart.



Upper Arm AVF

The AVF outflow vein does not partially collapse or become "flabby" after being raised above the level of the heart.

Lower Arm AVF

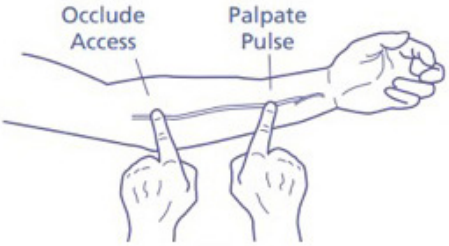
The AVF outflow vein does not collapse after being raised above the level of the heart.

Good to go!

Contact expert clinician if any "stop" signs noted.

Augmentation Test

Place your fingers on the out-going vein, feel the pulse, press down until no blood is flowing through the access. Keep your finger on the vein and feel for the pulse on the lower part of the access.



Pulse should be "strong and bounding" and may cause your finger to rise and fall with each beat.

Good to go!

Pulse does not become more forceful or "strong and bounding".

Contact expert clinician if any "stop" signs noted.

VIIb. HD03 Measurements

Hemodialysis Vascular Access Trending

On-the-spot vascular access assessment with the HD03 helps you safeguard the health of your patients by ensuring dialysis adequacy through measurements of pump flow and vascular access recirculation in AVFs, AVGs and catheters. Vascular access flow can also be trended in AVFs and AVGs. This ultrasound dilution technology works by having paired flow/dilution sensors clip onto dialysis tubing and to measure flow within the tubing. Measurements take less than 10 minutes per patient.

HD03 Hemodialysis Monitor

Using the HD03 during Hemodialysis?

Transonic HD03 Hemodialysis Monitor measures vascular access flow directly in AVFs and AVGs for an immediate snapshot of access function and detection of any flow limiting problems within the vascular access circuit.

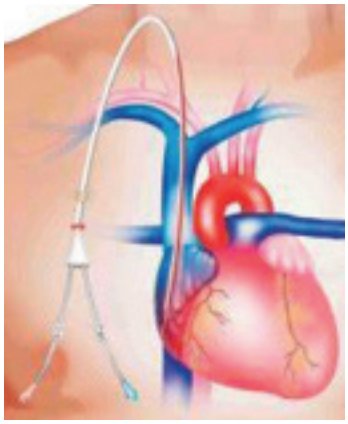
The HD03 Hemodialysis Monitor is also used to optimize dialysis delivery by measuring delivered pump blood flow and recirculation in AVFs and AVGs. Delivered pump flow and recirculation can also be measured in central venous catheters to optimize dialysis by helping to establish a maximum dialysis pump setting before recirculation occurs.

PATIENTS WITH AVF (LEFT) OR AVG (RIGHT)
Vascular Access Flow
Dialysis Adequacy Tests
- Delivered Blood Flow
- Recirculation

Cardiac Function Test

How Does the HD03 Help the Dialysis Care Team?

With the best interests of their patients always at heart, the staff can quantify access recirculation in AVFs, AVGs and catheters; avoid inadvertent reversal of dialysis lines to prevent recirculation and/or underdialysis, and readily identify a discrepancy between pump setting & delivered blood flow. They can ensure correct needle placement during cannulation; confirm that there is 0% recirculation and readily detect inflow, outflow or between needle stenoses.



CATHETER PATIENTS:
Dialysis Adequacy Tests
- Delivered Blood Flow
- Recirculation

How Does the HD03 Help the Nephrologist?

The staff can alert the nephrologist to possible onset of access dysfunction and referral for early intervention. From HD03 measurement results, a nephrologist gleans myriad information that helps in the selection of an ideal treatment plan tailored to each patient. By knowing the actual function in arteriovenous grafts and fistulas, a nephrologist can identify a failing access and avert underdialysis and/or thrombosis. HD03 Trending will also exclude access dysfunction as a cause of underdialysis. It identifies a mid-access obstruction and in patients with access problems, it identifies whether the problem is from too much or too little flow which guides the choice

VIIb. HD03 Measurements

for correction.

1. Hemodialysis Adequacy in AVFs, AVGs and Catheters[1]

- Tests calibration of the blood pump;
- Verifies true delivered blood flow; compares delivered blood flow to pump setting to identify flow disparity and avoid underdialysis. If disparity is significant, Flow-QC® assists in determining cause (blood pump calibration versus inflow restriction/excessive pre-pump negative arterial pressure);
- Detects and quantifies access recirculation in AVFs, AVGs, catheters;
- Identifies inadvertent reversal of dialysis lines to prevent recirculation and/or underdialysis;
- Determines proper needle placement;
- Identifies sources of large negative arterial blood line pressure (and its resulting underdialysis);
- Determines the most appropriate blood pump setting for a low flow access when it is not feasible to increase access flow;
- Provides delivered flow and recirculation measurements to maximize catheter function.

2. Vascular Access Measurements in AVFs, AVGs[1]

- Measures actual function in AVFs and AVGs in order to identify failing accesses and avert underdialysis and/or thrombosis;
- Indicates effectiveness of interventions (post-intervention Trending) or limb ischemia;
- Excludes access dysfunction quickly as cause of underdialysis;
- Identifies a mid-access obstruction;
- Identifies high-flow versus low-flow accesses to select ideal treatment plan for correction (flow-restricting versus re-vascularization procedure);
- Permits access Trending to be performed by the clinic's staff who then can alert nephrologist to possible onset of access dysfunction;
- Implements KDOQI Guidelines;
- Implements Best Practices for patient care with gold standard reference method.

[1]Spergel LM, "Transonic Flow Trending — The Cornerstone of My Vascular Access Management Program (VAMP©)" or Clinical Applications of the Transonic Flow Monitor in the Hemodialysis Facility. (Transonic Focus Note # HD58)

How Does HD03 Trending Help the Clinic?

By proactively being able to address vascular access or treatment problems of patients, a clinic is able to retain patients and keep their chairs filled. Appointments are not missed because emergencies are averted before a patient needs to go to a hospital. This translates into significant cost savings for a clinic.

Secondly, a clinic benefits because its best practices comply with Medicaid ESRD Conditions for Coverage requirement for access monitoring and surveillance to detect access dysfunction.

VIIb. HD03 Measurements

How Does HD03 Trending Help the Patient?

A hemodialysis patient's link to life is his or her vascular access. It is also the Achilles heel of hemodialysis, for the consequences of a thrombosed or failing access are dire. HD03 Trending ensures the maintenance of a healthy access. With HD03 Trending the formation of a stenosis is readily identified so that a problem can be proactively addressed, rather than having the patient rushed to a hospital for emergency treatment or a thrombectomy. Patients experience less morbidity. Ultimately, HD03 Trending can help extend a patient's life.

2018 ESVS Clinical Practice Guideline Recommendations

#45	Vascular access Trending is performed by flow measurement in AVGs monthly and AVFs every 3 months.
#46	When AVF blood flow measurements during dialysis indicate the presence of a vascular access stenosis based on a Qa < 500 mL/min, angiographic assessment of the access should be considered.
#47	Venous pressure adjusted for the mean arterial pressure >.50 (or derived static venous pressure adjusted for the mean arterial pressure .>55) is not a reliable indicator of stenosis and intervention based on this finding is not recommended.
#48	When hemodialysis efficiency is impaired, investigation and correction of an underlying vascular access stenosis should be considered.

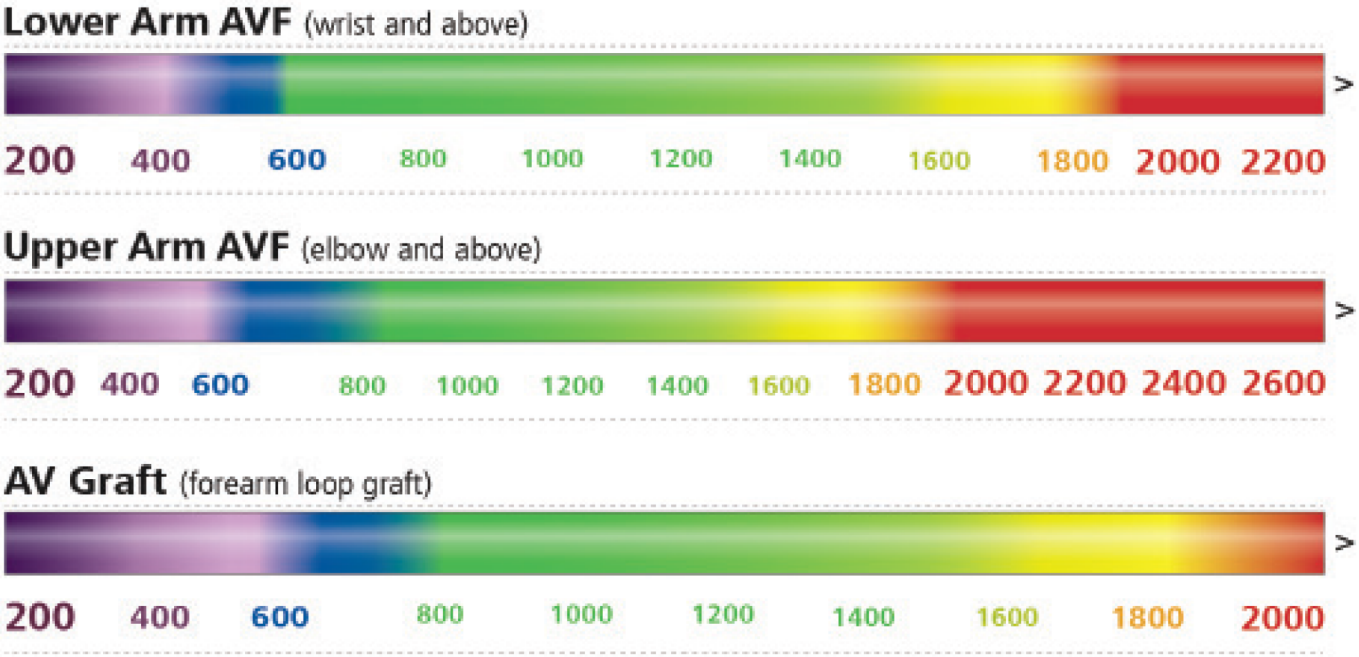
Schmidli J *et al*, Vascular Access: 2018 Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS), Eur J of Vasc & Endovasc Surg May 2018., page 33.

2019 KDOQI Guidelines for Monitoring of AV Grafts and Fistulas

The 2019 KDOQI Vascular Access Guidelines call for an "End-Stage Kidney Disease Life-Plan" (an individualized and comprehensive map for dialysis modalities and vascular access for the lifetime of the patient).

- Primary in the Life Plan is to have a regular physical examination or check of an AVF or AVG in every patient by an experienced health practitioner in order to detect clinical indicators of flow dysfunction in the AVF or AVG.
- If clinical indicators of flow dysfunction present, they can be corroborated and quantified in true mL's/min to remove any reasonable doubt by Transonic HD03 flow monitoring and trending of vascular access flow data.

VIIb. HD03 Measurements



CLINICAL INTERPRETATION KEY:

Probable risk for Hemodynamically Significant Stenosis/Recirculation as flow decreases (indicated by color progression from blue to purple)	**Expected Access Flow Range** Expected flow range is ideal. However, a sudden drop of 25% in this range may signal a potential onset of stenosis.	**Probable risk for Cardiac Failure as flow increases** (indicated by color progression from yellow to red)
Action: Consider Clinical Examination & Imaging	**Action: If Flow Is Steady, Continue Monitoring. If 25% Decrease Occurs, Consider Clinical Exam & Imaging**	**Action: Evaluate the patient for signs and symptoms of high output cardiac failure.**

Notes:

- Actual flow levels for AV fistula and graft patients should be customized by the nephrologist.
- A clinical examination (look, listen, feel, arm elevation and augmentation) should be used routinely as part of the pre-cannulation process.
- Transonic access flow measurements are intended to be utilized in conjunction with a clinical examination to detect/confirm indications of access dysfunction.
- Snuffbox or endovascular fistulas may have a lower access flow range depending on the location of the anastomosis and the vessel's outflow configuration.
- Upper arm AV fistulas typically have a higher access flow range due to the larger artery size.
- A potential for cardiac overload exists at flow >1600-3000 mL/min. Evaluate patient for signs and symptoms of high-output cardiac failure.

VIIb. HD03 Measurements

References: Access Flow Interpretation in AV Fistulas & Grafts

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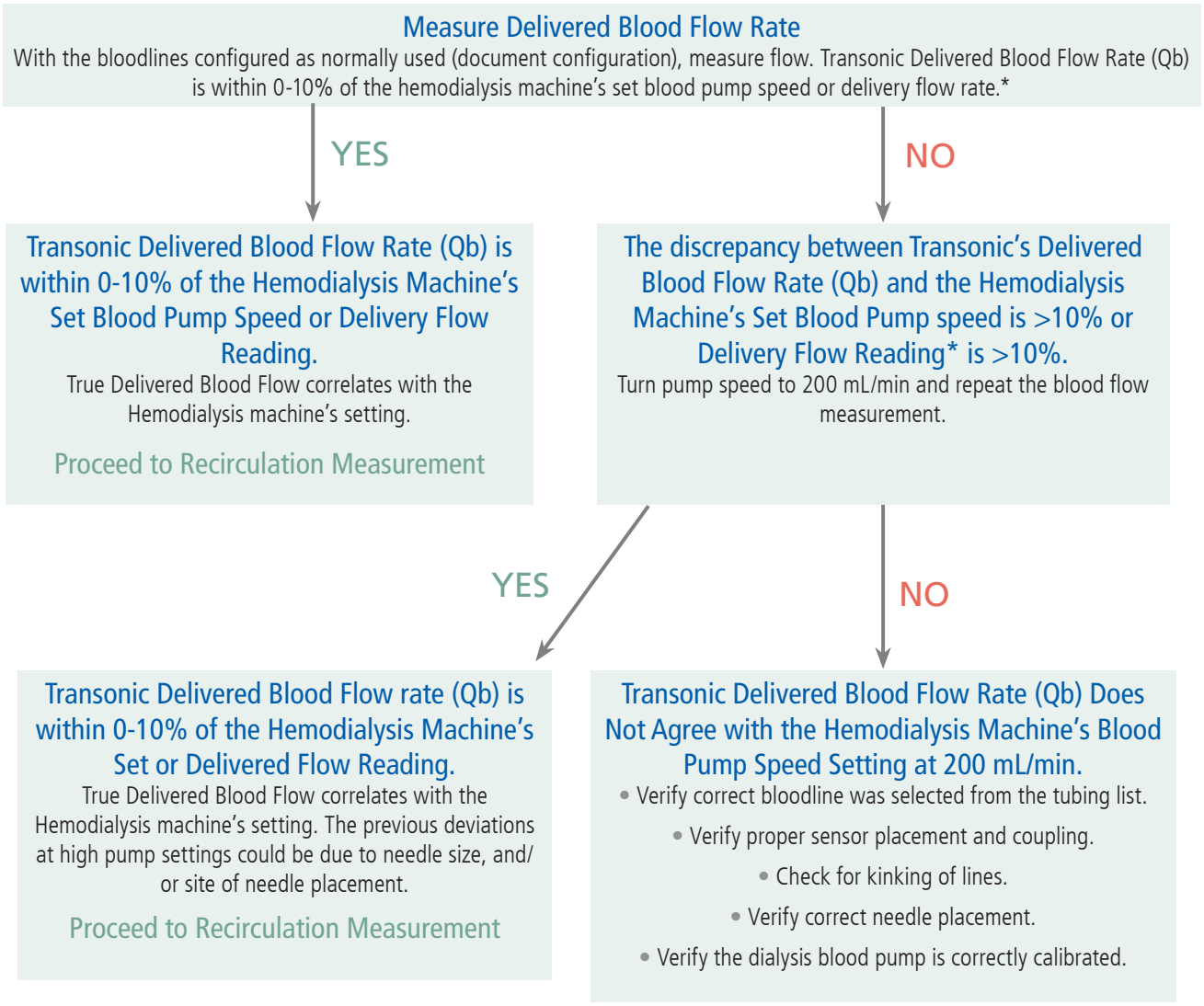
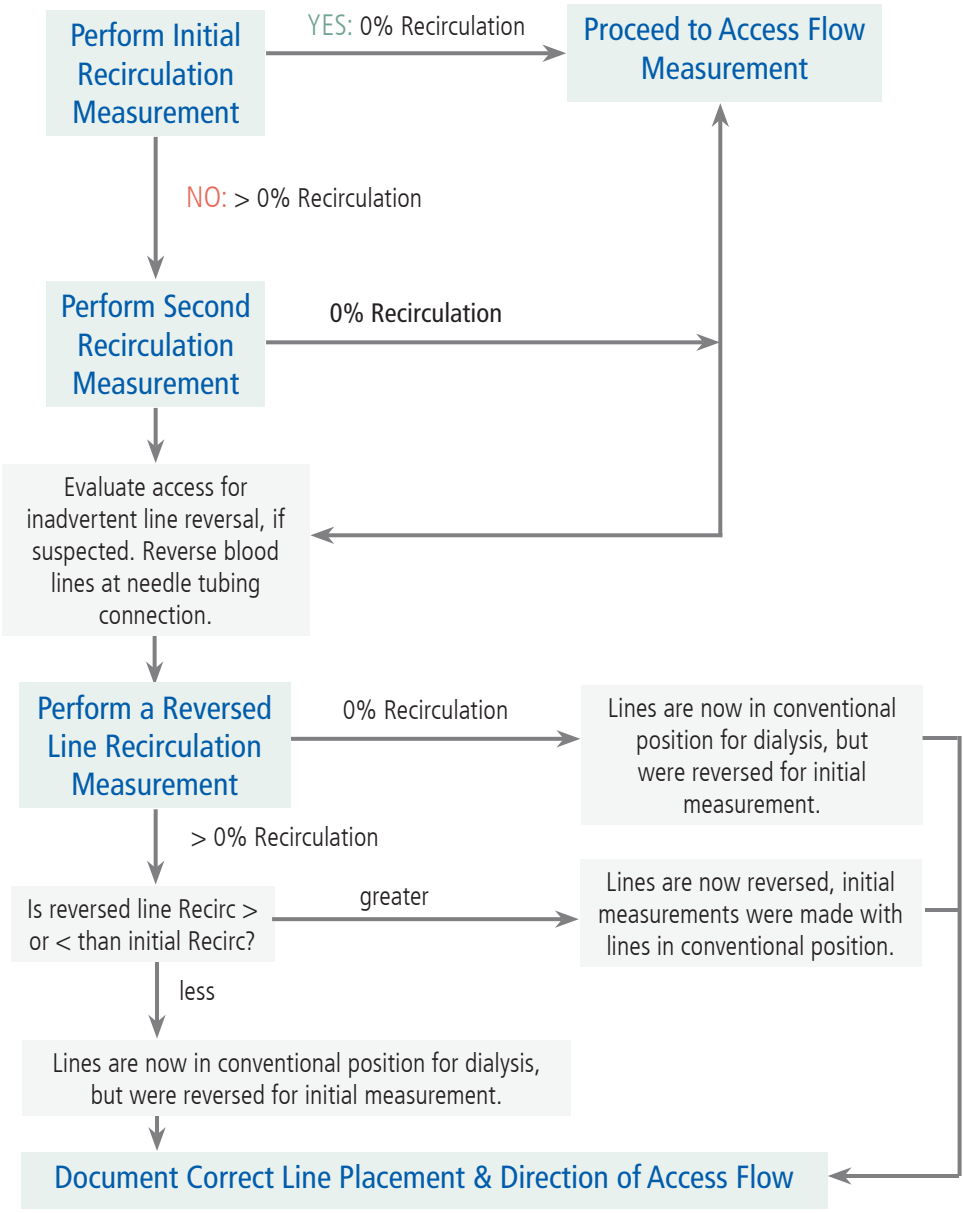
AV Fistula or AV Graft: Delivered Blood Flow Protocol



*Some Hemodialysis Machines display both a Set Blood Pump Speed and Delivery Flow Reading. If both readings are displayed on your Hemodialysis machine, use the Delivery Flow Reading.

Recirculation Protocol: AV Fistulas & Grafts



Optimizing HD Adequacy in Catheters

Step 1:

Measure Delivered Blood Flow Rate

With the bloodlines configured as normally used (document configuration), measure flow. Transonic Delivered Blood Flow Rate (Qb) is within 0-10% of the hemodialysis machine's set blood pump speed or delivery flow rate.*

YES

Transonic Delivered Blood Flow Rate (QB) is within 0-10% of the Hemodialysis Machine's Set or delivery flow reading*

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration

Proceed to Recirculation Measurement

NO

Transonic Delivered Blood Flow Rate (QB) is >10% Lower than the Hemodialysis Machine's Set Blood Pump Speed or Delivery Flow Reading*

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing the bloodlines to the opposite lumens of the catheter used for the initial measurement. Document configuration.

Repeat the blood flow measurement.

YES

Transonic Delivered Blood Flow Rate (QB) is within 0-10% of Hemodialysis Machine's Set, or Delivery Flow reading*

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration

Proceed to Recirculation Measurement

NO

Transonic Delivered Blood Flow Rate (QB) is 10% Lower than the Hemodialysis Machine's Set Blood Pump Speed

Carefully document measurement and catheter configurations.

Proceed to recirculation measurements with both catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

*Some Hemodialysis machines display both a Set Blood Pump Speed and Delivery Flow Reading. If both readings are displayed on your Hemodialysis machine, use the Delivery Flow Reading.

Catheter Configurations:

- Normal Configuration: Arterial Catheter Hub to Arterial Bloodline + Venous Catheter Hub to Venous Bloodline
- Reverse Configuration: Arterial Catheter Hub to Venous Bloodline + Venous Catheter Hub to Arterial Catheter Hub

Optimizing HD Adequacy in Catheters

Step 2:

Check Recirculation

With the bloodlines configured from Step One with maximized Delivered Blood Flow Rate,

Measure Recirculation

Recirculation is within 0 - 10%

NO

YES

Recirculation is Greater than 10%

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing blood-lines to the opposite lumens of the catheter used for the initial measurement.

Repeat Recirculation Measurement

YES

Recirculation is within 0-10%

Current blood pump setting is maximizing Delivered Blood Flow with the current catheter to bloodline configuration.

NO

Recirculation is Greater than 10%

Carefully document measurement and catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

Recirculation is within 0-10%

Current blood pump setting is maximizing Delivered Blood Flow with the current catheter to bloodline configuration.

Optimizing HD Adequacy in Catheters

For Use with Hemodialysis machines that have Compensated Blood Flow Rate Capabilities

Step 1:

Measure Delivered Blood Flow Rate

With the bloodlines configured as normally used (document configuration), measure flow.

Transonic Delivered Blood Flow Rate (Qb) is higher than the set blood pump speed or within 0-10% lower than the set blood pump speed.

NOTE: Both higher and lower differences are displayed in red on the Transonic screen.

YES

Transonic Delivered Blood Flow Rate (QB) is Higher than the Set Blood Pump Speed or is within 0-10% Lower than the Set Blood Pump Speed.

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration

Proceed to Recirculation Measurement

NO

Transonic Delivered Blood Flow Rate (QB) is >10% Lower than the Set Blood Pump Speed.

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing bloodlines to the opposite lumens of the catheter used for the initial measurement. Document configuration.

Repeat the blood flow measurement.

YES

Transonic Delivered Blood Flow Rate (QB) is Higher than the Set Blood Pump Speed or is within 0-10% Lower than the Set Blood Pump Speed.

Current blood pump setting is maximizing the Delivered Blood Flow with the current catheter to bloodline configuration

Proceed to Recirculation Measurement

NO

Transonic Delivered Blood Flow Rate (QB) is 10% Lower than the Set Blood Pump Speed

Carefully document measurement and catheter configurations.

Proceed to recirculation measurements with both catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

Catheter Configurations:

- Normal Configuration: Arterial Catheter Hub to Arterial Bloodline + Venous Catheter Hub to Venous Bloodline
- Reverse Configuration: Arterial Catheter Hub to Venous Bloodline + Venous Catheter Hub to Arterial Catheter Hub

Optimizing HD Adequacy in Catheters cont.

For Use with Hemodialysis machines that have Compensated Blood Flow Rate Capabilities

Step 2:

Check Recirculation

With the bloodlines configured from Step One with maximized Delivered Blood Flow Rate,

Measure Recirculation

Recirculation is within 0 - 10%

NO

Recirculation is Greater than 10%

Only proceed if both catheter lumens had blood return with treatment initiation.

Using aseptic technique, reverse the catheter configuration by reversing blood-lines to the opposite lumens of the catheter used for the initial measurement.

Repeat Recirculation Measurement

NO

Recirculation is Greater than 10%

Carefully document measurement and catheter configurations.

Escalate the results of the findings to the nephrologist for possible catheter evaluation or prescription adjustment to address catheter dysfunction.

YES

Recirculation is within 0-10%

Current blood pump setting is maximizing Delivered Blood Flow with the current catheter to bloodline configuration.

YES

Recirculation is within 0-10%

Current blood pump setting is maximizing Delivered Blood Flow with the current catheter to bloodline configuration.

VIII. Vascular Access Coordinator Resources

Professional Associations

- **Vascular Access Society of the Americas (VASA)** www.vasamd.org
  Devoted to the advancement of the field of dialysis access through research, education and advocacy for patients with end stage kidney disease.
- **American Society of Diagnostic and Interventional Nephrology (ASDIN)** https://www.asdin.org/default.aspx
- **American Nephrology Nurses Association (ANNA)** annanurse.org
  Improves members' lives through education, advocacy, networking, and science.
- **American Society of Nephrology (ASN)** www.asn-online.org
  Leads the fight against kidney disease by educating health professionals, sharing new knowledge, advancing research, and advocating the highest quality care for patients.
- **Renal Physicians Association (RPA)** www.renalmd.org
  A resource for practitioners who are committed to achieving and maintaining optimum levels of kidney patient safety.
- **National Association of Nephrology Technicians (NANT)** www.facebook.com/pages/: A professional Medical group designed for Nephrology Technicians
- **The European Dialysis and Transplant Nurses Association/European Renal Care Association (EDTNA/ERCA**) https://edtnaerca.org/ A leading multidisciplinary Renal Care Association with 1300 members from 70 countries.

Additional Resources/References

- **Renal Fellow Network** renalfellow.blogspot.com
- **Keeping Kidney Patients Safe** www.renalmd.org/mpage/KKPS_home
- **ESRD NCC Tools** https://esrdncc.org/en/fistula-first-catheter-last/
- **My Kidney Life Plan** - patient tool https://mykidneylifeplan.org/