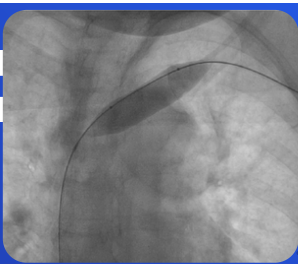
January 2026 | 3rd Edition

VESSOMAG's Inside the VESSEL ...

Official Quarterly Newsletter of the Vascular & Endovascular Surgeons of Maharashtra and Goa

THEME
AV ACCESS



Must Reads ....

- Dialysis Vascular Access : A Nephrologist's Perspective
- Cannulation Chaos : Tips to avoid complications
- How to DEAL with the STEAL ...
- Central Venous Stenosis : Hidden Burden of Permcaths
- FAQs on Arteriovenous Grafts ..
- Whats New in AV ACCESS
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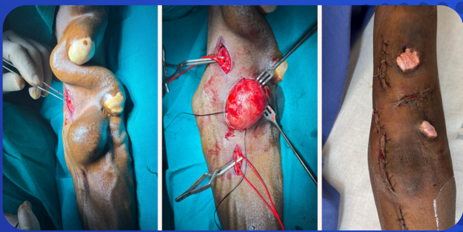

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From the Editor's Desk .....

Dr. Aniruddha Bhuiyan
Vascular & Endovascular Surgeon
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As we welcome 2026 with the third edition of INSIDE THE VESSEL, it feels timely to reflect on a procedure with which almost every vascular surgeon begins their practice: AV access for dialysis. Despite all the advances in endovascular technology, AV access remains a discipline where small decisions carry enormous clinical weight—especially in the lives of dialysis patients.

This edition focuses on the subtle yet decisive elements of AV access care: from the art of creating a good AV fistula to the challenges of access salvage. A well-matured fistula is not merely the product of surgical skill; it is a partnership between the nephrologist and the vascular surgeon to ensure that the patient receives adequate dialysis.

In this endovascular-first era, where minimally invasive techniques dominate, this newsletter highlights the importance of a patient-specific approach. Our hope is that this edition encourages each of us to revisit the fundamentals and reaffirm the principle that good access is the foundation of good dialysis.

I would like to thank all the authors for their contribution and BD for sponsoring this edition of the newsletter.

In the words of my teacher, "A good thrill in an AV fistula is comparable to a bounding distal pulse after a peripheral bypass surgery."

Warm regards....

Dialysis Vascular Access : A Nephrologist's Perspective

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INTRODUCTION

India had the second-highest number of people with chronic kidney disease in 2023, at 138 million, following China at 152 million. Approximately 220,000 patients annually develop kidney failure requiring dialysis, presenting a major burden of non-communicable disease. While kidney transplantation is the ideal form of kidney replacement therapy, the vast majority of kidney failure patients remain on dialysis due to the lack of suitable donors. The survival of patients on dialysis is highly dependent on good vascular access. The characteristics of optimum vascular access are:

- **It should provide uninterrupted, adequate blood flow for dialysis, typically above 300 mL per minute for an average-sized adult.**
- **It should require minimal interventions to maintain its patency.**
- **It should be associated with minimal complications.**

Currently, multiple surgical specialties can create AV fistulas; however, it is high time we recognize that <u>dialysis vascular access surgery is a specialty in itself.</u> Many hands can join arteries and veins, yet successful surgery requires not only skill in surgical technique but also an understanding of the intended use of the access. This may sound unusual, but I recall a humorous instance when a patient referred for AV fistula creation was sent back by a cardiac surgery registrar, with instructions to wait until dialysis was initiated. **Planning for AV fistula should typically begin at least six months before the anticipated need for dialysis**—this is one of the 'rules of 6' for AV fistula. Early creation provides adequate time for thorough preoperative assessment, necessary revisions, and sufficient fistula maturation. The increasing use of clinical and radiological assessments prior to surgery is a welcome advancement, helping in patient and family counseling on possible surgical outcomes.

There is another important practical reason to create the AV fistula before dialysis initiation. **Dialysis initiation can be turbulent; patients often 'crash land' in the emergency department with advanced uremia,** where blood pressure fluctuations during initial sessions put a newly created AV fistula at high risk of thrombosis. Hypotension due to catheter-related sepsis also poses significant threats to the patency of a new AV fistula.

It is not uncommon to encounter high-flow AV fistulas at the elbow without a visible cannulable vein segment. These patients shuttle between the dialysis room and the surgeon's office, as technicians request revisions and surgeons insist the fistula provides sufficient flow. This situation is avoidable if the surgeon appreciates the intended use of the access and basic dialysis principles. Adequate upfront counseling about a two-stage procedure can greatly reassure both the patient and dialysis team.

In the past five years, there has been a surge in tunneled catheter use for dialysis, with associated complications including bloodstream infections and venous thrombosis. Several factors contribute to this trend. Some patients survive longer on dialysis and have used multiple AV fistulas, leaving catheters as their only viable option. Others, **following dialysis initiation, are discharged with tunneled catheters and mistakenly believe these are 'permanent' solutions, creating misconceptions about AV fistula necessity.** This highlights a major gap in patient education at initiation, and counseling should be an integral part of the dialysis initiation standard operating procedure. **The term 'permanent' should be specifically discouraged regarding tunneled catheters.** Moreover, reimbursement schemes supporting tunneled catheter use have led to their increased adoption as the default vascular access at discharge. While this aligns with major international guidelines, it must be coupled with counseling about timely AV fistula creation post-discharge to reduce long-term complications from prolonged catheter use.

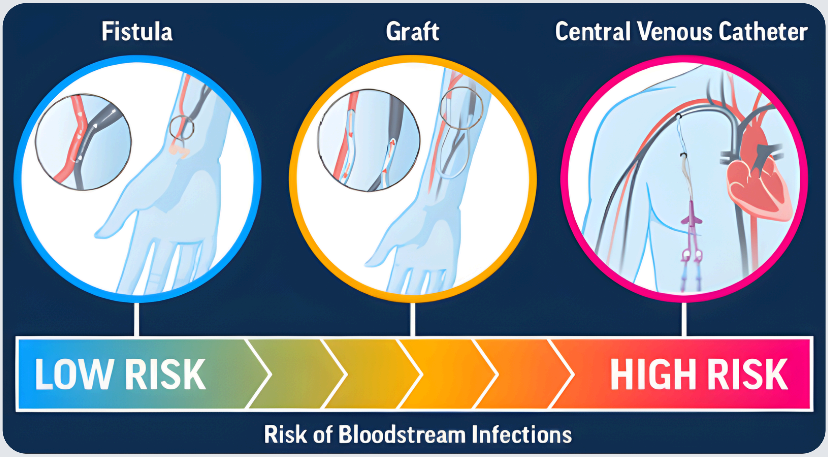
Dialysis Vascular Access : A Nephrologist's Perspective

The rising use of catheters has led to unprecedented increases in serious bloodstream infections, endocarditis, lung abscesses, and other metastatic infections. **During my residency, rheumatic valvular heart disease was the leading risk factor for infective endocarditis; now, dialysis catheters hold this distinction.**

Thrombosis of major veins is a risk factor for symptomatic central venous obstruction, venous edema, and increased secondary AV fistula failure risk. A recent case highlights these dangers: a young boy on dialysis for two years at a remote center had all veins exhausted by repeated cannulation with temporary and tunneled catheters. After one distal AV fistula failed, neither another AV fistula nor kidney transplant counseling was attempted. He presented with severe sepsis necessitating the removal of his femoral catheter. Eventually, dialysis access was established using the external jugular vein, and transplant evaluation proceeded with his mother as a donor. Preoperative Doppler and CT venogram revealed **complete bilateral common iliac vein thrombosis and partial IVC thrombosis**. Exploration confirmed total IVC thrombosis, leaving no suitable venous anastomosis options. A senior cardiac surgeon innovatively **used the inferior mesenteric vein for anastomosis, resulting in a successful transplant.** His hospital course was notable for subacute intestinal obstruction and delayed graft function, yet he was discharged with a functioning graft after a two-month stay. This case highlights the havoc that a catheter can potentially land our patients in. Encouragingly, more surgical specialties are developing interest in dialysis vascular access, and this is a very welcome change. A well-functioning access is the lifeline for patients with kidney failure, avoiding significant morbidity and mortality. Secondary AV fistula failure is as consequential for a dialysis patient as coronary thrombosis for someone without CKD. Prospective clinical and Doppler monitoring can identify impending acute thrombosis and secondary AV fistula failure. While endovascular salvage is possible for many, given the low secondary patency rates at one year and the expense of repeated interventions, creating another new AV fistula may often be the best course of action.

Dialysis Vascular Access : A Nephrologist’s Perspective

Dialysis vascular access is the ‘Achilles’ heel’ in the management of patients with kidney failure. **Despite significant advances in dialysis technology, AV fistula remains the oldest and the best possible access for dialysis.** Historically, vascular access surgery for dialysis was a "no man’s land," and this situation persists in many Indian cities. The growing interest of surgical colleagues in this specialty is promising. Dedicated training, fellowships, or certificate courses in vascular access surgery would help bridge this important gap in kidney failure care.



Remember the **Rule of 6**

- **Blood Flow:** The fistula should support at least 600 mL/min.
- **Vein Diameter:** The vein diameter should be greater than 6 mm.
- **Vein Depth:** The vein should be less than 6 mm from the skin surface for easy cannulation.

Monitoring and Surveillance for Vascular Access

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INTRODUCTION

Vascular access remains the lifeline of patients on maintenance hemodialysis (HD). Despite advances in access creation and endovascular salvage techniques, access dysfunction continues to be a major cause of morbidity, hospitalization, and loss of adequate dialysis. Regular monitoring and surveillance are key to maintaining patency, ensuring timely intervention, and prolonging the functional life of arteriovenous fistulas (AVFs) and grafts (AVGs).

Why Monitoring and Surveillance Matter

A well-functioning access ensures adequate blood flow rates for effective dialysis while minimizing complications such as thrombosis, stenosis or infection. Unfortunately, **up to 40% of AVFs and over 50% of AVGs develop significant stenosis within the first year**. Many of these events are preventable with structured monitoring and surveillance programs.

The goals of vascular access surveillance are to:

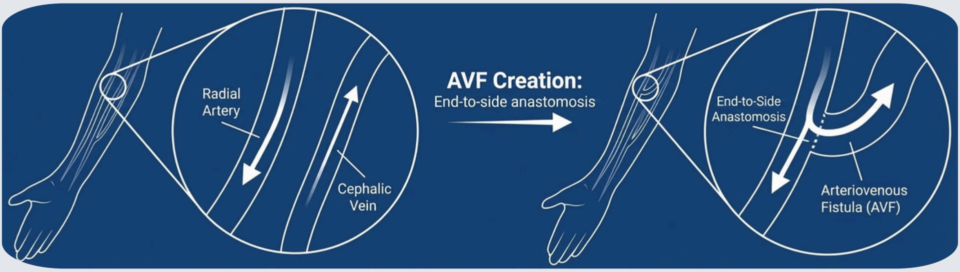
- Detect dysfunction early
- Prevent thrombosis
- Reduce the need for catheter use
- Optimize adequate dialysis (Kt/V $\geqslant$ 1.2)
- Improve long-term access survival

Definitions: Monitoring vs. Surveillance

These terms, though often used interchangeably, have distinct meanings:

- Monitoring refers to routine clinical assessment by the dialysis team with inspection, palpation and auscultation of the access during every dialysis

Monitoring and Surveillance for Vascular Access



session. It is a subjective, low-cost, clinical process.

- **Surveillance** involves objective testing that is done on a monthly / quarterly basis using devices or measurements to detect access dysfunction before clinical signs appear. Examples include flow measurements, pressure monitoring, or duplex ultrasonography. Trends rather than absolute values are important and no single abnormal reading should automatically trigger a referral. **Prospective surveillance for significant stenosis + early correction = improves patency and reduces thrombosis.** Both are complementary; monitoring identifies overt dysfunction, while surveillance detects subclinical stenosis. Maintaining a surgeon-based audit can also help improve results and reference patterns.

Clinical Monitoring Techniques (During every dialysis session):

- **Inspection:** Examine the entire limb including shoulder area to look for dilated veins, swelling, redness, bruising, hematoma, aneurysmal dilatation, infection. Flattening of veins or prolonged bleeding post-dialysis may suggest inflow or outflow stenosis respectively. Arm elevation test looking for flattening of distended vein on elevation rules out venous outlet obstruction.

Monitoring and Surveillance for Vascular Access

- **Palpation:** Palpate the entire limb- finger tips to axilla to look for temperature, pulsation, thrill in different areas. A normal AVF should have a continuous thrill. A "pulsatile" access with diminished thrill suggests a downstream obstruction. Comparing the character of the pulse over time is a sensitive indicator of dysfunction.
- **Auscultation:** A normal bruit has a low-pitched continuous tone. A high-pitched systolic bruit indicates a stenosis, usually within 5 cm of the anastomosis.
- **Maintain a record of the Dialysis Parameters:**
  - Difficulty in cannulation
  - Decreased achieved blood flow rate (<300 mL/min)
  - Increased venous pressure (>150 mmHg)
  - Elevated recirculation (>10%)

All warrant further evaluation. Routine documentation of these findings by dialysis staff and communication with the vascular team are essential.

Surveillance Techniques (Every 1-3 months):

- **Access Flow Measurement:** Access blood flow (Qa) can be measured by ultrasound dilution or thermodilution techniques.
  - AVF: Qa < 600 mL/min
  - AVG: Qa < 1000 mL/min
  - These values—or a 25% decline from baseline—suggest significant stenosis and require further evaluation.
- **Dynamic Venous Pressure Monitoring:** Measured during dialysis; a rising venous pressure trend (normalized for blood flow) is a surrogate for outflow obstruction.
- **Recirculation Measurement:** Increased recirculation (>10%) implies inflow or outflow problems. This is easily assessed with the saline bolus or urea-based method.

Monitoring and Surveillance for Vascular Access

- **Duplex Ultrasonography:** Considered as the gold standard is a non invasive and highly informative tool that provides both anatomical and hemodynamic information for mapping stenotic segments, assessing anastomotic flow, and planning interventions. Peak systolic velocity (PSV) ratio >2:1 compared to adjacent segments indicates ⩾50% stenosis.

Testing	Details	AVF	AVG
Physical findings	Venous = edema, prolonged bleeding Arterial = low flow (no thrill = flow is <450ml/min), intensified bruit (high pitch) = stenosis	✓	×
Intra-access flow	Ultrasound / conductance / thermal dilution measured within 1st 1.5 hrs Mean value of 3 diff determinants in a single treatment is considered Flow < 600 ml/min → fistulogram Flow < 1L/min ↓25% in 4 mth → fistulogram	✓	✓
Static Venous Dialysis Pressure	More sensitive than Dynamic venous pressure Criteria should be met on each of 2 consecutive weeks	✓	×
Dynamic Venous Pressure	Pressure must exceed threshold 3x in succession to be significant Access at same level with dialysis machine Trend is more important than static value	✓	×
Access recirculation using Urea content	Requires specialised equipment Recirculation > 5% → fistulogram	✓	✓
Access recirculation using dilution (non-urea)	Requires specialised equipment Recirculation > 5% → fistulogram	✓	✓
Kt/V, URR	Unexplained drop in hemodialysis delivered Not very sensitive	✓	✓
Negative Arterial pre-pump pressure	With normal needle position = arterial inflow stenosis	✓	✓
Doppler USG	Expensive, operator dependent Difficult to perform during dialysis	✓	✓

Monitoring and Surveillance for Vascular Access

Integrating Clinical and Surveillance Findings

An integrated protocol combining periodic monthly clinical monitoring and quarterly surveillance (or sooner if abnormalities arise) has been shown to reduce access loss rates. **The KDOQI 2019 guidelines** recommend proactive imaging or intervention when there is clinical or surveillance evidence of dysfunction plus decreased dialysis adequacy—not solely based on test thresholds.

Decision to intervene should therefore be multi-factorial, incorporating clinical judgment, objective findings, and dialysis efficiency.

Role of the Vascular Surgeon

The vascular surgeon plays a central role not just in access creation but in its long-term maintenance. Responsibilities include:

- Educating dialysis staff on clinical signs of dysfunction
- Establishing structured monitoring protocols
- Performing timely fistulograms or duplex evaluations
- Undertaking endovascular or surgical interventions when indicated

Emerging Technologies

Recent advances are bringing continuous, wearable flow sensors and smart dialysis machines that integrate real-time flow and pressure analytics. Artificial intelligence–based algorithms can predict impending stenosis based on trends in pressure-flow relationships. These innovations may transform surveillance into a more automated, predictive process.

Conclusion

Effective monitoring and surveillance transform vascular access management from a reactive to a proactive discipline. By integrating meticulous clinical observation with objective testing, we can detect stenosis before thrombosis, intervene before failure, and preserve the patient's lifeline for years. For the hemodialysis population, vigilance is truly vascular protection.

Cannulation CHAOS : Tips to AVOID COMPLICATIONS

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TIPS & TRICKS

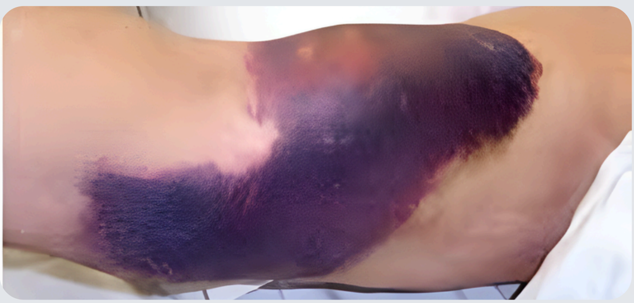
The AV fistula (AVF) is the most common and most preferred access for haemodialysis in CKD patients because it has the longest patency and fewest complications. Cannulation of AVF is a fundamental process, but the repeatedly required cannulation of the fistula remains a high-risk zone for complications. Despite best surgical creation, missteps in cannulation technique and access maintenance can lead to serious issues. This article summarises core practical points aimed at avoiding "cannulation chaos" and extending the lifespan of the access.

Common AVF Cannulation Mishaps and Their Mechanisms

Reports show that complications such as stenosis, thrombosis, pseudo-aneurysm and access failure are strongly linked to cannulation technique. Stenosis is being the most common across all.

1. **Infiltration / extravasation:** When the needle tip passes through the posterior (back) wall of the fistula, blood flow may leak into perivascular tissues, causing bruising or even hematoma formation. (Fig 1)

Fig 1. Extravasation Post Cannulation



Cannulation CHAOS : Tips to AVOID COMPLICATIONS

2. **Aneurysm formation**: Repeated cannulation at the same point weakens the wall, leads to outpouching (aneurysm) and increases risk of rupture or bleeding.
3. **Infection**: Poor aseptic technique, especially with buttonhole or repeated punctures at same site, raises the risk of local or systemic infection.
4. **Inadequate flow / recirculation**: Improper spacing of arterial and venous needle tips (too close) or puncture in immature fistula segments may lead to thrombosis or poor dialysis adequacy.
5. **Needle dislodgement / haemorrhage**: Poor fixation or inadvertent movement can cause bleeding at high fistula pressures.
6. **Prolonged bleeding from cannulation site**- Suggest venous hypertension due to distal outflow stenosis or central venous stenosis.

Key Tips to Avoid Complications

1. **Pre-cannulation assessment :**

- Assess and prepare the access thoroughly
- "Look, feel, listen" to the fistula: check for thrill, palpable vein, proper arterialised flow. Ultrasound guidance may improve cannulation accuracy in difficult accesses.
- Confirm the fistula is ready (Rule of 6's - 6week old, 6mm size, skin depth<6mm, minimum 6 cm matured segment, flow > 600 ml/min), cannulating too early increases risks of haematoma, vessel damage, early failure.
- Avoid cannulating aneurysmal or scabbed segments of the fistula
- Use an appropriately sized needle and gauge matched to vein diameter and pump settings.

2. **Strict aseptic technique :**

- Clean and prepare the skin with strict aseptic technique. Though full maximal sterile technique may be impractical, proper glove use, hand hygiene and skin prep are mandatory.

3. **Cannulation technique and site rotation :**
- Avoid repeated puncture of the same spot - this causes wall weakening, aneurysm formation and pseudo-aneurysm risk.
- Enter at a shallow angle (approximately 20–35° for superficial fistulas) to avoid back-wall penetration.
- Ensure the arterial and venous needle tips are well separated (e.g., 3–5 cm downstream for venous tip from arterial) to reduce recirculation.
- Secure the needle well with tape (e.g., “chevron” tape technique) to prevent dislodgment and haemorrhage

4. **Rotate cannulation sites**
- Avoid repeatedly cannulating the same spot; evenly distribute punctures along the fistula to prevent local wall damage.
- Monitor for prolonged bleeding, which may signal outflow stenosis.
- Guideline recommend Rope Ladder technique of cannulation.

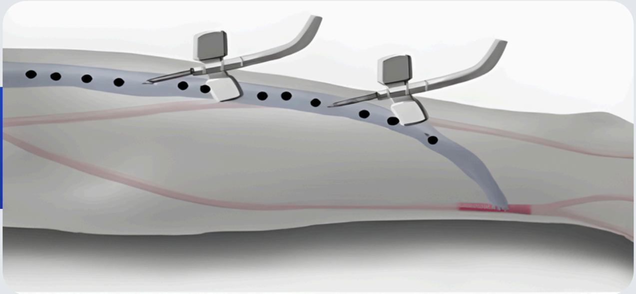
5. **Monitoring during dialysis**
- Continuously monitor pressures, flow rates and needle conditions. Unexpected high venous pressures, bleeding, infiltration signs or haemodynamic instability warrant prompt investigation.
- Keep the needle entry sites visible and undisturbed. If bleeding occurs after needle removal, apply firm pressure; prolonged bleeding signifies vessel wall fragility or stenosis downstream.

6. **Early recognition of problems**
- Monitor for signs of infiltration (swelling/bruising), aneurysm, infection, poor flow or abnormal pressures. When in doubt, stop and escalate.
- If cannulation is difficult (no flashback, or repeated failures), investigate for underlying stenosis or anatomical issues via imaging.

Step Ladder (Rope-Ladder) Technique:

The step ladder technique, is a site-rotation method in which use a site-rotation plan is generally safer for structural integrity. The buttonhole technique has some benefits but higher infection risk in certain settings.

Fig 2. Rope Ladder Cannulation Technique



Advantages of rope-ladder:

- Distributes damage along the vessel wall rather than concentrating it, reducing risk of aneurysm and venous wall weakening.
- Recommended in many guidelines as the preferred method for AVF cannulation.

Limitations and considerations:

- Requires a sufficiently long and mature fistula to have multiple usable sites. Proper staff training and mapping of cannulation sites are critical.

Conclusion

Cannulation chaos in AV fistulas remain a preventable source of morbidity and access failure. By combining rigorous assessment, aseptic preparation, correct insertion technique, secure fixation, and rotation of puncture sites (preferably by the rope-ladder method), dialysis teams can significantly reduce complications such as infiltration, aneurysm, infection, and premature access loss. Continued vigilance, protocol adherence and staff education are key to preserving the vascular lifeline of haemodialysis patients.

How to DEAL with the STEAL ....

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TIPS & TRICKS

Dialysis-associated steal syndrome (DASS) remains a relatively infrequent but clinically important complication in patients undergoing hemodialysis via arteriovenous fistula (AVF). As nephrologists and vascular specialists continue to prioritise autogenous fistulas for long-term access, recognising, diagnosing, and effectively managing this complication becomes essential to patient outcomes.

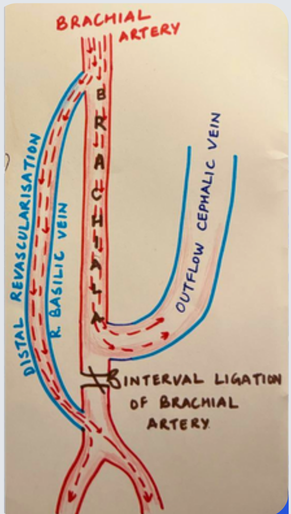


Fig 1. DRIL Procedure Diagram

Understanding the Pathophysiology

Steal syndrome occurs when the AVF—being a low-resistance conduit—*diverts arterial blood preferentially into the fistula, reducing perfusion to the distal limb.* While the majority of patients compensate well, a subset develops significant arterial insufficiency. This is particularly common with proximal fistulas such as brachiocephalic or brachiobasilic AVFs, which channel substantial flow away from the forearm and hand.

Patients may present with a spectrum of symptoms, ranging from hand claudication, tingling, and numbness, to more severe findings such as rest pain, ulcerations, or digital gangrene. Advanced stages of DASS can threaten both limb viability and the dialysis access itself, making timely intervention critical.

How to DEAL with the STEAL ....

Treatment Approaches

Several surgical strategies have been described to restore distal perfusion while protecting the access. These include:

- Banding or access flow reduction procedures
- Revascularisation techniques
- Complete ligation of the AVF, followed by creation of a new access on the contralateral limb

While ligation may resolve ischemic symptoms, it inevitably sacrifices a functioning fistula—an undesirable outcome in a dialysis-dependent patient with limited access options.

This has led to greater adoption of more sophisticated reconstructive procedures, the most effective and durable among them being the DRIL procedure — Distal Revascularisation and Interval Ligation.

DRIL: Concept and Advantages

The DRIL technique is designed to restore hand perfusion without compromising the dialysis fistula. It involves two key steps:

1. **Creating a bypass from the proximal brachial artery to a distal artery** (typically distal brachial or proximal radial/ulnar) using a conduit, thereby ensuring adequate antegrade blood flow to the hand.
2. **Ligation of the native artery just distal to the AVF anastomosis**, preventing retrograde flow into the fistula and eliminating the steal.

This results in two physiologically independent outflow pathways—one dedicated to the fistula and the other exclusively supplying the distal circulation. Numerous studies have confirmed that DRIL offers high success rates, durable symptom relief, and excellent fistula salvage rates.

How to DEAL with the STEAL ....

DRIL: Distal Revascularisation and Interval Ligation Procedure

Exposure of Basilic Vein 15 cm Graft harvested

Reversed Graft used to bypass flow from Proximal Brachial to Distal Brachial (Distal to the Fistula)

Interval Ligation of Brachial Artery (Segment between the fistula and distal bypass anastomosis)

Fig 2. DRIL Procedure

Case Highlight

We recently managed a 55-year-old dialysis-dependent patient with CKD, who developed frank ischemic changes in the hand following the creation of a well-functioning brachiocephalic AVF. The patient presented with severe burning pain and early digital ischemia—classic indicators of advanced steal physiology.

How to DEAL with the STEAL ....

A DRIL procedure was performed with the following steps:

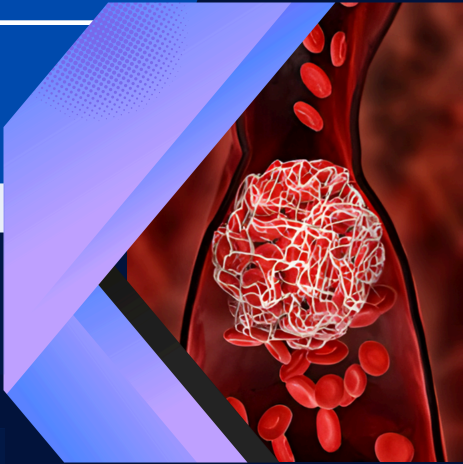
- A vein graft was harvested and used to construct a bypass from the proximal brachial artery to supply the radial and ulnar arteries, effectively restoring direct inflow to the hand.
- The brachial artery was ligated distal to the fistula, interrupting the steal pathway.

Postoperatively, the patient demonstrated immediate clinical improvement. The radial pulse became palpable, hand warmth improved, and the burning dysesthesia resolved promptly—signaling successful restoration of distal perfusion. Importantly, the AVF remained fully functional, ensuring uninterrupted dialysis access.

Conclusion

DASS, though uncommon, poses a dual threat of limb ischemia and loss of vascular access. The DRIL procedure represents a powerful solution—one that restores distal circulation while preserving a functioning fistula. As dialysis populations grow and access sites become increasingly precious, techniques such as DRIL will continue to be indispensable tools in the vascular surgeon's repertoire. Early recognition, careful patient selection, and meticulous surgical execution remain essential to achieving optimal outcomes.

Stenosis & Thrombosis in AV Access



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CLINICAL CORNER

Introduction

An arteriovenous (AV) fistula is the preferred vascular access for hemodialysis owing to its superior long-term patency and lower infection risk compared to grafts and central venous catheters. Created surgically by anastomosing an artery to a vein—commonly the radiocephalic, brachiocephalic, or brachiobasilic configuration—it allows arterial blood flow to arterialize the vein, increasing its diameter and wall thickness for repeated cannulation. Despite its advantages, AV fistulas are prone to stenosis and thrombosis, which remain leading causes of access failure and hospitalization among dialysis patients.

Pathophysiology

1. **Stenosis** : Stenosis develops due to intimal hyperplasia—a proliferative response of vascular smooth muscle cells and fibroblasts to shear stress, turbulent flow, and repeated endothelial injury. The juxta-anastomotic segment is most commonly affected, though venous outflow and central veins can also develop narrowing. Factors such as uremia, inflammation, oxidative stress, and repeated needle trauma contribute to endothelial dysfunction and neointimal proliferation, leading to progressive luminal narrowing.

2. **Thrombosis:** Thrombosis usually occurs secondary to an underlying stenosis that compromises flow. Reduced blood velocity promotes platelet aggregation and fibrin deposition. Acute thrombosis can also result from hypotension, hypercoagulable states, or excessive compression post-dialysis. Once thrombosis occurs, the fistula often becomes unusable unless rapid intervention restores patency.

Routine clinical monitoring remains the cornerstone of early detection in vascular access dysfunction. Stenosis is suggested by difficult cannulation, needling pain, prolonged bleeding after needle withdrawal, elevated venous pressures during dialysis, and a reduction in thrill intensity or a discontinuous bruit. Thrombosis, on the other hand, presents with a sudden loss of thrill and bruit, inability to achieve adequate blood flow during dialysis, and a firm, tender, non-compressible cord-like vein. Color Doppler ultrasonography serves as the noninvasive gold standard for surveillance, where a peak systolic velocity ratio greater than 2:1 compared with adjacent segments indicates at least 50% stenosis, and flow volumes below 500 mL/min in upper-arm fistulas or below 300 mL/min in forearm fistulas suggest dysfunction. In cases of thrombosis, Doppler reveals absent color flow or spectral signal along with intraluminal echogenic material. Ultrasonography also plays a crucial role in guiding interventions such as thrombolysis and angioplasty.

Management

1. **Conservative Measures :** In cases of partial stenosis or sluggish flow, early conservative approaches can help: Optimize hydration and blood pressure to maintain adequate flow. Treat underlying causes such as hypotension, hypercoagulability, or infection. Avoid repeated puncture of the same site; rotate cannulation areas (“rope ladder” technique). Antiplatelet agents (e.g., aspirin) may reduce early thrombosis risk, though evidence is mixed.

Stenosis & Thrombosis in AV Access

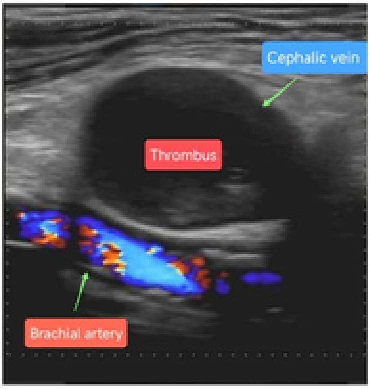

Fig 1. Thrombosis in Cephalic Vein (USG)

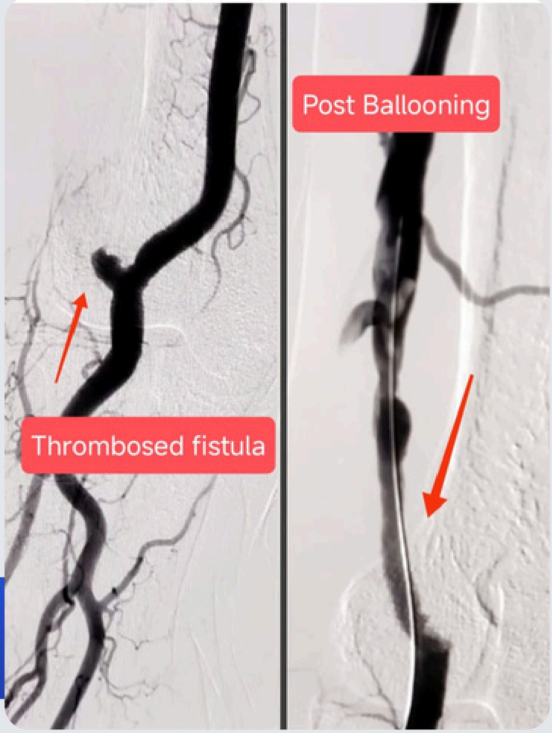

Fig 2. Thrombosed AVF on DSA

2. Endovascular Intervention

Percutaneous transluminal angioplasty (PTA) is the first-line treatment for most stenotic lesions. Technique: Balloon dilatation under fluoroscopic or ultrasound guidance. Success rate: 80–90% technical success with immediate flow restoration. Limitations: Restenosis within 6–12 months due to recurrent intimal hyperplasia.

In thrombosed fistulas, pharmacomechanical thrombectomy or catheter-directed thrombolysis (e.g., tPA or urokinase) can rapidly restore patency, followed by PTA to treat the underlying stenosis. Stent placement is reserved for recurrent or elastic lesions resistant to balloon angioplasty.

3. Surgical Management

When endovascular therapy fails or the lesion is extensive, surgical revision or open thrombectomy is indicated. Surgical thrombectomy involves removal of thrombus using a Fogarty catheter or direct venotomy. Revision may include creating a new anastomosis proximal to the stenosis or interposition grafting. Success depends on prompt intervention—ideally within 24 hours of thrombosis onset—to prevent irreversible venous damage.

Prevention :

- Preventing AV fistula failure relies on routine surveillance, patient education, and timely intervention.
- Regular physical examination by dialysis staff for changes in thrill, bruit, or access pressures.
- Surveillance with doppler ultrasound in high-risk patients or when dysfunction is suspected.
- Optimal cannulation technique: Use of rope-ladder or buttonhole methods to minimize trauma.
- Blood pressure control—avoid hypotension during dialysis.
- Medication management: Low-dose aspirin may modestly reduce thrombosis risk. Prompt treatment of early stenosis before thrombosis develops.

Conclusion : Stenosis and thrombosis are the most frequent complications jeopardizing AV fistula patency. Early recognition through clinical assessment and Doppler surveillance enables timely intervention, preserving access longevity. Endovascular therapy remains the mainstay of management, while surgical revision provides durable outcomes when minimally invasive approaches fail. Preventive strategies—anchored in vigilant monitoring, patient education, and meticulous cannulation—are essential to sustaining functional vascular access and improving dialysis outcomes.

Central Venous Stenosis : Hidden Burden of Permcaths

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CLINICAL CORNER

The use of a cuffed tunneled central venous catheter remains common in haemodialysis initiation, bridging to arteriovenous fistula (AVF) or graft creation, or in patients unsuitable for permanent access. However, catheter dependence is associated with complications including infection, thrombosis, malfunction—and importantly for access longevity, central venous stenosis (CVS). The presence of prior central venous stenosis may compromise future AVF/graft creation, limit options, increase access failure, and raise morbidity (e.g., ipsilateral arm/neck/face swelling, venous hypertension, loss of access patency). It is well reported that catheter sites matter: subclavian vein–placed catheters have a much higher risk of CVS compared to internal jugular placement.

Pathophysiology & Risk Factors

The mechanism of CVS in catheter-dependent haemodialysis patients is multifactorial:

Mechanical injury: A catheter in a central vein (e.g., brachiocephalic, superior vena cava) causes endothelial trauma, turbulent flow, and repeated micro-injury leading to intimal hyperplasia, smooth muscle proliferation, wall thickening, and stenosis.

Thrombosis/fibrin sheath formation:
Risk factors include multiple prior CVC placements, longer catheter dwell time, use of the subclavian rather than internal jugular vein, left-sided catheters, concomitant pacemakers or other intravascular devices, and younger age in some studies.

From the KDOQI guideline:
"Use of CVCs is associated with central venous stenosis; previous placement of venous catheters, pacemakers, etc., may have damaged target vasculature necessary for vascular access."

KDOQI Remarks

- Do not place catheters in subclavian veins unless absolutely necessary because of the high risk of CVS, which may permanently exclude ipsilateral upper-extremity permanent vascular access options.
- Use the side opposite anticipated AVF/graft creation when placing a catheter to preserve future access options.
- Establish a multidisciplinary vascular access team and emphasise a "save the vein" philosophy.

Case

Patient: 53-year-old gentleman
Known case: Chronic Kidney Disease (CKD) Stage V on regular hemodialysis

Clinical course:

- Initially, a right internal jugular (IJ) hemodialysis (HD) catheter was inserted for dialysis initiation.
- Subsequently, the access was switched to a left IJ permacath for long-term use.
- An arteriovenous (AV) access was created at the left brachiocephalic site, which unfortunately failed.
- A left basilic vein transposition was then performed, as it was the only suitable vein available.

Central Venous Stenosis : Hidden Burden of Permcaths

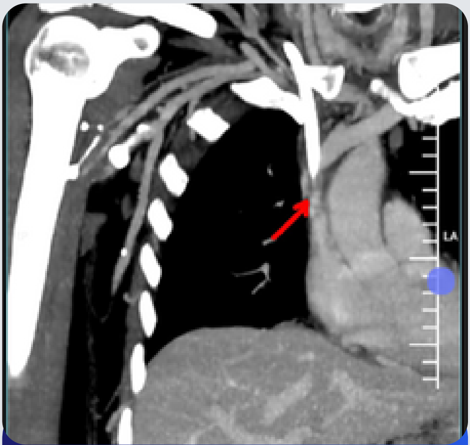

Fig 1. CT showing Stenosis of Central Vein

Fig 2. DSA Image showing venoplasty of segment

Postoperative course:

- The patient developed left upper limb edema following the basilic vein transposition.
- Contrast-enhanced CT of the chest and upper limb veins revealed central venous stenosis involving the left brachiocephalic vein segment.
- The patient subsequently underwent endovascular balloon angioplasty for treatment of the central venous stenosis.

Current status:

Improvement in limb edema post-procedure.

Practical Recommendations

1. Minimise catheter dependence

- Prioritise early AVF/graft referral, planning, and creation so that catheter dwell time is as short as possible. The longer the catheter remains, the higher the risk of CVS.

- Avoid placing catheters in the subclavian vein. Choose the right internal jugular vein (RIJV) as the preferred site when feasible (straight anatomy, lower CVS risk).
- Use ultrasound + fluoroscopy guidance for catheter insertion. Confirm tip position optimally (mid-atrium or upper right atrium) to reduce mechanical trauma.
- Align catheter side and future AVF/graft side: avoid ipsilateral placement that may jeopardise future access.

2. Surveillance & pre-access mapping

- In patients with a previous catheter history (especially multiple or long-duration CVCs), consider preoperative venographic assessment of central veins (venography/CT/contrast MR) before AVF/graft creation to detect occult central stenosis. Studies suggest hidden stenosis among such patients.
- Clinically monitor for signs indicative of CVS: ipsilateral arm/neck/face swelling, venous collaterals, high venous pressure on dialysis, and access dysfunction. KDOQI emphasises clinical monitoring for catheter complications (Guideline 20), including CVS.

3. Management of CVS

- Asymptomatic central venous stenosis incidentally detected: per KDOQI Statement 26.1, it is reasonable to observe rather than intervene.
- Symptomatic CVS (e.g., access dysfunction, venous hypertension, limb swelling): evaluate with imaging (venography) and consider endovascular intervention (angioplasty ± stenting).
- Access flow reduction (e.g., banding) may be considered adjunctively when high-flow fistula/graft contributes to outflow vein stress in the setting of central stenosis.

4. “Save the vein” philosophy

- In incident CKD/ESKD patients, avoid unnecessary central venous catheterisations, PICC lines, or non-dialysis central lines in upper-extremity central veins to preserve veins/central venous anatomy for future dialysis access. The KDOQI guideline emphasises this vein-preservation concept.

- When catheters are unavoidable, use the smallest diameter and shortest duration feasible, optimise tip location, and avoid left-sided and subclavian routes if possible.

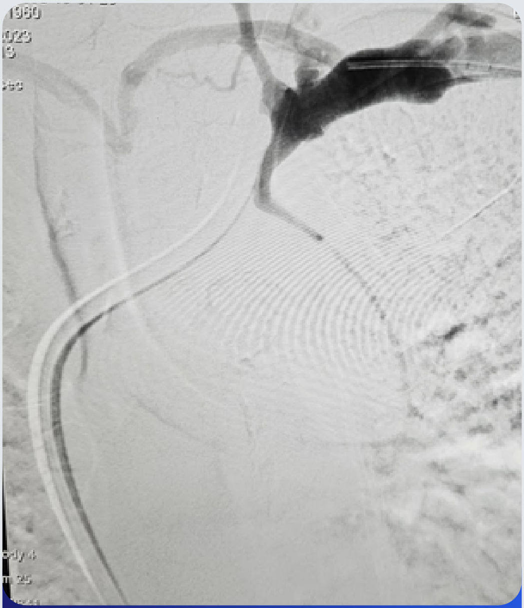

Fig 3. Fibrin sheath formation in central veins due to permcath causing AVF dysfunction

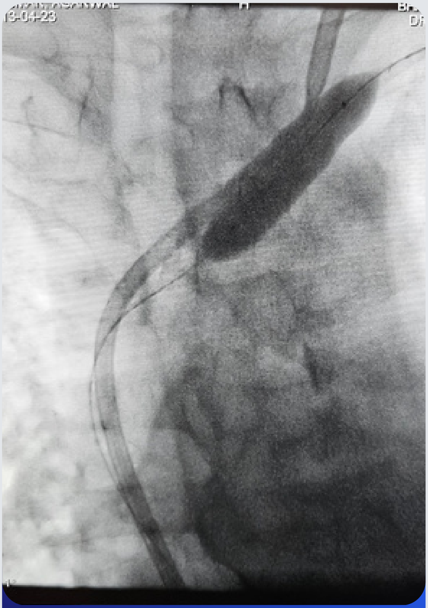

Fig 4. Post Venoplasty followed by removal of permcath

FAQs on Arteriovenous Grafts ...

Dr. Amish Mhatre
Vascular & Endovascular Surgeon
MUMBAI

CLINICAL CORNER

Why Graft?
During the course of chronic kidney disease, haemodialysis will be needed. Although an arteriovenous fistula with native veins provides the best long-term patency and the least complications, there comes a time in most patients when they will exhaust their veins for a good haemodialysis access. With a high incidence of catheter-related (especially cuffed tunneled catheter) central venous stenosis, a graft as a conduit for haemodialysis is a good alternative.

Why not a Great Saphenous Vein Graft?
Yes, a GSV is a good alternative, but it is a poor conduit for haemodialysis due to its anatomical variability, delayed maturation, poor dilatation, high complication rates and poor long-term patency.

Interesting! Then why are more patients not on AV Graft?
A graft is a synthetic material, and these are prone to complications and have poor long-term patency. Also, cannulation and post-dialysis care require specialised training and a learning curve.

Tell me, what exactly is a graft?
A graft for haemodialysis is a conduit between an artery and a vein. This tube acts as a vein for haemodialysis cannulation during dialysis.
PTFE (Polytetrafluoroethylene): The most commonly used synthetic material; it is durable and has a long shelf life, making it suitable for early use after placement.
Dacron (Polyester): An alternative synthetic option to PTFE.

Biologic Materials
Materials derived from bovine carotid arteries; these integrate better with the body and reduce the risk of complications compared to synthetic options. However, they are not easily available.

Do you have them in various sizes and lengths?
Yes. As you are aware, these grafts are primarily used for arterial bypass (e.g., femoral-popliteal artery bypass), so they come in various sizes and lengths. But for our A-V fistula access, a 6 mm diameter graft is used, and the length depends on the site and placement. A minimum of 15 cm of usable length should be available for dialysis cannulation.

Looking at the complications, how is graft better than a central catheter?
There is a high incidence of catheter-related (especially cuffed tunneled catheter) central venous stenosis, which can result in central venous obstructive symptoms and unavailable sites for AV fistula creation. A graft as a conduit for haemodialysis is a good alternative.

What is the life of an A-V graft?
The average life is one year, but with better cannulation technique and care, it has been usable for up to two years.

You have been talking about cannulation—how is it different from a native vein A-V fistula?
For a native vein, two cannulation techniques are used: the buttonhole and the stepladder.
For an A-V graft, ONLY the STEPLADDER technique is used.

Fig 1. Tunnelling an AV Graft

FAQs on Arteriovenous Grafts ...

Why?

Remember, a graft is a synthetic material, and the needle hole, unlike in a vein, will never heal. Cannulating the same site repeatedly will damage the graft and shorten its usable life.

It is recommended to map different cannulation sites and rotate to old sites only once all sites have been used.

Tell me again, what are the complications of an A-V graft?

- Hypersensitivity reaction to the synthetic material (graft rejection)
- Infection
- Bleeding
- Cannulation site infection and bleeding
- Thrombosis
- Venous swelling due to graft anastomosis with deep vein causing venous congestion
- Pseudoaneurysm

What are the sites for an A-V graft?

- Upper limb: Forearm or arm — either a straight or loop graft
- Lower limb: Loop graft in thigh between femoral artery and GSV
- Subclavian vein to opposite side subclavian artery: Rarely done; considered a last resort
- Even grafting to the right atrium has been described in textbooks, though we do not have experience with this technique.

What care needs to be taken?

The most important aspect is post-dialysis care: cannulation site bleeding should be controlled manually. Under no circumstances should a tourniquet be used. The rest of the care is similar to that for an A-V fistula.

FAQs on Arteriovenous Grafts ...

Once the graft has run through its usable life, can the same site be used for a new A-V graft?

Because the skin over the graft is scarred from multiple cannulations, it is difficult to use the same site for a new graft.

Do we have to remove a thrombosed graft, and how do we repair the blood vessels?

Yes. As there is a risk of infection in a thrombosed graft, it is advisable to remove the graft from its anastomosis.
Arterial continuity needs to be maintained, either by a vein patch or a bypass.
Infected anastomosis sites need to be ligated, and a bypass must be performed.
The venous end can be safely ligated.

What is HeRO?

The HeRO (Haemodialysis Reliable Outflow) Graft is designed for patients who have exhausted traditional vascular access options due to central vein stenosis.
It consists of two components:

- Arterial Component: Anastomosed to an artery, made of PTFE
- Venous Outflow Component: Inserted through the stenosed central vein, with its end placed in the right atrium

The PTFE graft component is then used as the access for haemodialysis.
Limitations: High cost and the need for multiple procedures to maintain patency.

When can you use a graft for haemodialysis after surgery?

Unlike a vein, a graft does not need time to mature. Grafts have been used within 2 days, but ideally one should allow the graft tunnel to heal. The ideal time for cannulation is two weeks.

Infection Prevention in AV Access

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CLINICAL CORNER

For patients undergoing hemodialysis, the arteriovenous (AV) access whether a native fistula (AVF), central venous catheter, or a synthetic graft (AVG) is literally a lifeline. However, any breach in the integrity of this access can lead to infection, a complication that is not only associated with significant morbidity, loss of access, and increased healthcare costs but is also a leading cause of mortality among end-stage renal disease (ESRD) patients.

<u>Understanding the Threat:</u> The hierarchy of risk is well-established: temporary catheters pose the highest threat, followed by tunneled cuffed catheters, then arteriovenous grafts (AVGs), with the native arteriovenous fistula (AVF) having the lowest risk of infection. This evidence strongly supports the clinical maxim of "fistula first, lines last."

The primary culprits in AV access infections are bacterial, most commonly Staphylococcus aureus and Staphylococcus epidermidis.
It is crucial for patients and staff to recognize the signs of infection early. These include:

- **Redness (Erythema)**
- **Swelling and Warmth**
- **Pain:**
- **Drainage: Pus or unusual discharge from the needle sites.**
- **Fever and Chills: Systemic signs that can indicate a bloodstream infection (bacteremia).**

Infection Prevention in AV Access

Several factors further heighten the risk of AV access infection:

- Type of Access: Grafts and catheters introduce foreign material, which bacteria readily colonize.
- Poor Hygiene: Inadequate patient hygiene, particularly around the access site, is a significant contributor.
- Cannulation Technique: Repeated or improper needling of the access site, especially in a non-sterile field, creates entry points for bacteria.
- Comorbidities: Conditions like diabetes and older age are associated with Increased vulnerability to infection.

1. The Power of Patient Education and Hygiene

- Empowering patients is the first line of defense. The patient must understand their role in protecting their access 24/7.
- Daily Personal Hygiene: Patients must be instructed to maintain excellent personal hygiene. This includes washing the entire access arm with antibacterial soap and warm water daily.
- Pre-Dialysis Scrub: Before every dialysis session, the patient should thoroughly wash the access site with soap and water before entering the unit.
- Site Inspection: Patients must be taught to inspect their access site daily for signs of infection (redness, swelling, drainage, pain) and to immediately report any concerns to their care team.
- Protecting the Access: They must be cautioned against wearing tight clothing over the access, sleeping on the access arm, or allowing anyone to take blood pressure or draw blood from that limb.

2. Clinical Asepsis:

- Hand Hygiene and Gloving: Proper hand washing and the use of clean or sterile gloves are mandatory before touching the access site.
- Skin Disinfection: The skin over the access site must be prepared with a suitable antiseptic solution, such as chlorhexidine with 70% alcohol,
- Proper Cannulation: Needles must be inserted using an appropriate technique, avoiding repeated probing.

Rope Ladder Technique

The Rope Ladder technique is the standard and preferred method for AVF and AVG cannulation. This method involves rotating the arterial and venous puncture sites at every dialysis session, utilizing the entire length of the cannulation segment of the access. The new sites are chosen a minimum distance (e.g., 1–2 cm) away from the previous puncture sites, avoiding the same general area for repeated punctures.

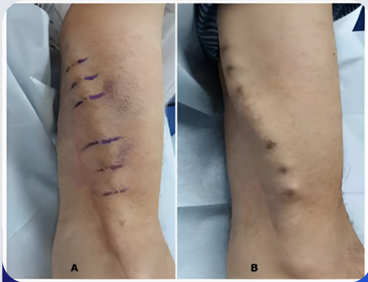


Fig 1. Rope Ladder Technique

Buttonhole Technique

The Buttonhole (or constant-site) technique involves puncturing the access at the exact same location and angle during every session. This creates a permanent, epithelialized subcutaneous tunnel or "track."

Track Creation: Initial cannulations (typically 8–12 sessions) are performed with sharp needles to establish the tunnel.

* Maintenance: Once the track is mature, a blunt needle is used for all subsequent cannulations.

Buttonhole cannulation has been associated with a significantly higher risk of localized and systemic Staphylococcus aureus infections compared to the Rope Ladder technique. This is primarily because the repeated use of the same site, which requires scab (eschar) removal before cannulation, introduces a potential pathway for bacteria to enter the tunnel and bloodstream.

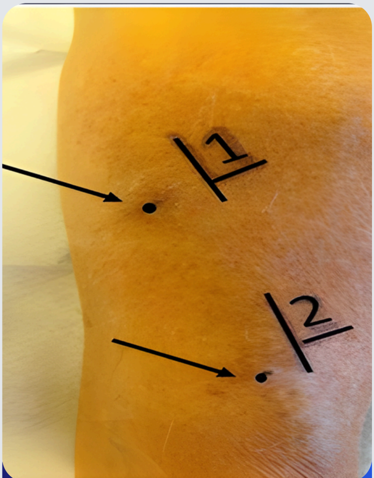


Fig 2. Button Hole Technique

* Post-Dialysis Care: After needle removal, pressure should be applied with sterile gauze, and the site should be covered with a clean, dry dressing until bleeding stops, minimizing environmental contamination.

3. Early Recognition and Management

Early intervention can prevent a localized infection from progressing to systemic sepsis.

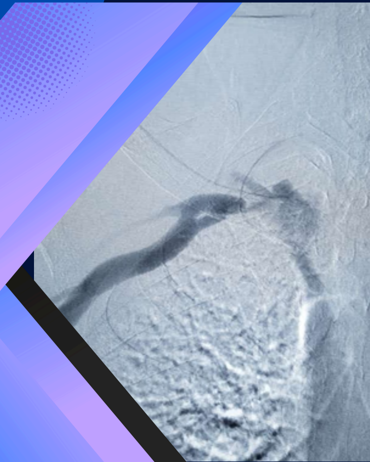
- Vigilant Assessment: Dialysis staff must perform a meticulous physical examination of the access at every session, checking for pain, warmth, swelling, erythema (redness), and purulent discharge.
- Prompt Diagnosis: If infection is suspected, the immediate steps include obtaining blood cultures and cultures from the access site (or from any drainage) before initiating antibiotic therapy.
- Empiric Antibiotics: Broad-spectrum antibiotics are typically started immediately, then adjusted based on the culture and sensitivity results to target the specific pathogen.
- Surgical Intervention: The ultimate treatment for an established graft infection is often surgical source control, which may involve partial or total graft excision to remove the infected foreign material. For a fistula, drainage and culture with targeted IV antibiotics may be attempted first, but persistent or severe infection may also necessitate ligation and excision.

Conclusion

The prevention of infection in AV access is an ongoing, shared responsibility. By prioritizing the creation of a native arteriovenous fistula (where clinically possible), enforcing strict adherence to aseptic cannulation protocols, and ensuring robust patient education on personal hygiene and surveillance, the dialysis community can significantly reduce the devastating burden of access-related infections. The goal is clear: to safeguard this essential lifeline, ensuring the patient's continuity of care and improving their long-term health and quality of life.

Expert Interview: Central Venous Stenosis

Dr. R. Sekhar
Vascular & Endovascular Surgeon
MUMBAI



SPOTLIGHT

Central venous stenosis (CVS) remains one of the most challenging complications encountered in patients on long-term hemodialysis. Although endovascular therapy continues to evolve, prevention and early detection remain cornerstones of management. In this interview, Dr. R. Sekhar, Vascular & Endovascular Surgeon, discusses the nuances of diagnosing, monitoring, and managing CVS in clinical practice.

Q1. Dr. Sekhar, how do you define central venous stenosis in the context of dialysis access?

Dr. Sekhar: Central venous stenosis refers to narrowing of the major outflow veins—typically the subclavian, brachiocephalic, or superior vena cava—in patients undergoing hemodialysis. These lesions compromise venous return from the access limb and result in venous hypertension, impaired dialysis efficiency, and significant morbidity. Although prevention remains the best strategy, symptomatic cases often require endovascular intervention guided by surveillance and clinical findings. Drug-eluting balloons (DEBs) offer a promising new direction, but long-term data for central veins is still evolving.

Q2. What clinical signs and symptoms should raise suspicion for early or evolving CVS?

Dr. Sekhar: Early recognition is critical. Clinicians should evaluate for:

- Ipsilateral arm, hand, breast, facial, or neck swelling, often with discomfort or heaviness.
- Prominent dilated collateral veins along the arm, neck, or chest—these tortuous channels are often the earliest visible clue.

- Skin discoloration, ranging from dusky to violaceous, and in severe cases lymphatic blistering or even stasis ulceration.
- Failure of the AV fistula or graft to collapse on arm elevation, reflecting impaired venous outflow.
- Abnormal access findings, such as a weak thrill or altered bruit quality.

Dialysis-related indicators are equally important: difficulty with cannulation, inability to reach target pump speeds, persistently high venous pressures, prolonged bleeding after needle removal, and unexplained increases in recirculation. Any of these should prompt further evaluation.

Q3. What surveillance strategies do you recommend for timely diagnosis of CVS?
Dr. Sekhar: Surveillance exists to prevent thrombosis and detect dysfunction early. My approach is multilayered:

1. Clinical Monitoring: A structured monthly physical examination—inspection, palpation, and auscultation—performed by trained personnel remains indispensable. Patient and family education is equally important; they must recognize swelling, color changes, or prolonged bleeding.
2. Physiological Surveillance: KDOQI-based assessments, such as:
    - Access flow measurements, where a $\geqslant$25% reduction from baseline or flows <600 mL/min for grafts and <400–500 mL/min for fistulas warrants further study.
    - Static venous pressure ratios, which can flag developing stenosis.
3. Diagnostic Imaging: If clinical or physiological parameters are abnormal, we proceed to imaging.
    - Conventional venography remains the gold standard for diagnosis and procedural planning.
    - Duplex ultrasound or MR venography are helpful non-invasive screening tools, particularly when differentiating between local versus central lesions.
4. Indications for Intervention: I reserve treatment for symptomatic lesions—typically >50% stenosis with correlating clinical or dialysis abnormalities.

Q4. What is the current standard of care in managing symptomatic central venous stenosis?

Dr. Sekhar: Endovascular therapy is the primary treatment modality.

- Percutaneous Transluminal Angioplasty (PTA) remains the first-line intervention. While it is effective, it carries high recurrence rates due to elastic recoil and neointimal hyperplasia. Fortunately, PTA is repeatable, though each recurrence adds cost and burden for already strained patients.
- Stents, are indicated for:
  - Immediate elastic recoil with >50% residual stenosis after PTA.
  - Rapid restenosis—typically within 3 months.
- Drug-Eluting Balloons (DEBs) are an exciting evolution. By delivering antiproliferative agents—usually paclitaxel—DEBs target the biological drivers of restenosis. Early randomized trials show improved primary patency and longer intervention-free intervals at 6–12 months compared to plain balloon angioplasty.

Q5. From a preventive standpoint, what can clinicians do to reduce the incidence of CVS?

Dr. Sekhar: The most impactful step is judicious use of central venous catheters, especially subclavian lines, which dramatically increase CVS risk. Early fistula planning, minimization of catheter dwell time, and right-sided access when catheters are unavoidable all help reduce stenosis rates.

Equally important is robust patient education and meticulous follow-up—both are essential in detecting early dysfunction before complications escalate.

Closing Remarks : Central venous stenosis poses a significant financial, physical, and emotional burden for dialysis patients and their families. Our greatest contribution as clinicians lies in prevention, early recognition, and smart access planning.

Whats NEW in AV ACCESS

Dr. Piyush Jain
Vascular & Endovascular Surgeon
NAVI MUMBAI

SPOTLIGHT

INTRODUCTION

The landscape of dialysis vascular access is undergoing one of its most significant periods of innovation. Newer technologies are improving how we create, monitor, and maintain AV access—reducing catheter dependence, minimizing failure rates, and enabling more durable vascular circuits. This SPOTLIGHT update highlights four major advancements shaping the future.

ENDOVASCULAR AVF (ENDOAVF):

EndoAVF has evolved from an emerging concept to a practical, widely adoptable option. The latest-generation systems have expanded anatomical eligibility, improved maturation, and reduced procedural burden. Two systems dominate current clinical practice abroad:

1. **Ellipsys Vascular Access System**

Technology: Single-catheter, thermal fusion
Guidance: Ultrasound only
Strengths:

- No incision, no sutures
- Quick procedure with rapid recovery
- Predictable anastomosis formation
- Excellent for proximal radial artery–perforator vein anatomy

Ideal Patient:
Those with good perforator vein anatomy and suitable superficial outflow.
Considerations:
Operator-dependent; assisted maturation may be needed.

2. **WavelinQ EndoAVF System**

Technology: Dual-catheter, magnetic alignment + RF energy

Guidance: Fluoroscopy + ultrasound

Strengths:

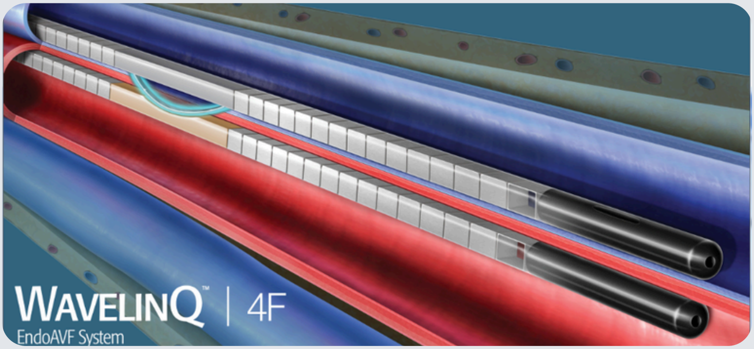
- Greater anatomical flexibility
- Works well in deeper targets and obese patients
- Multiple arterial–venous combinations possible

Ideal Patient:

Those with adjacent artery–vein pairs within 1.5 mm and multiple outflow options.

Considerations:

Dual access and imaging requirements; slightly longer learning curve.



DRUG-COATED BALLOONS :

Recurrent stenosis remains a major cause of AVF dysfunction. Drug-coated balloons (DCBs) continue to show meaningful advantages over conventional PTA.

Where DCBs shine :

- Cephalic arch stenosis
- Basilic outflow lesions
- Recurrent venous stenosis after multiple PTAs

Benefits:

- Longer intervention-free intervals
- Reduced recurrence at 6–12 months

Limitations:

- Not ideal for elastic recoil
- Limited role in central venous stenosis

AI-POWERED SURVEILLANCE

Dialysis machines collect thousands of real-time data points. AI platforms introduced can interpret these patterns to predict stenosis before symptoms appear.

AI Capabilities :

- Detect micro-variations in venous pressure & flow
- Predict stenosis weeks ahead of clinical findings
- Identify high-risk cannulation habits
- Trigger automated alerts to nephrologists/surgeons
- Support early duplex or intervention scheduling

This represents a shift from reactive to predictive access care.

AUTOMATED FLOW MONITORING

The role of automated flow sensors has become more refined. Instead of implantables, the trend is toward wearable or session-based flow trend devices.

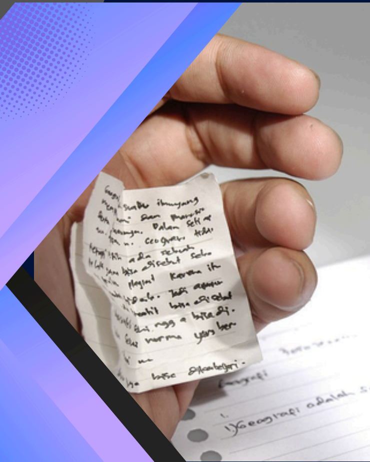
Current Practical Use Cases:

- Track flow changes across successive sessions
- Detect subtle drops indicating impending thrombosis
- Confirm post-angioplasty improvement

These technologies collectively push us closer to the universal goal: durable, dependable & catheter-free dialysis access.

CHEAT SHEET for DIALYSIS ACCESS

Dr. Aniruddha Bhuiyan
Vascular & Endovascular Surgeon
MUMBAI



GUIDE

1. ACCESS SELECTION

- Fistula first (Radio-Cephalic → Brachio-Cephalic → Brachio-Basilic).
- Grafts when veins inadequate / early use needed.
- Avoid central venous catheters due to infection & thrombosis risk.
- Perform Duplex mapping before access creation.

2. FISTULA MATURATION

- Targets: Diameter $\geq$6 mm, Depth $\leq$6 mm, Flow $\geq$600 mL/min.
- Start hand-grip exercises early.
- Assess maturation with ultrasonography at 4–6 weeks.
- Treat stenosis/branching early (angioplasty/ligation).

3. CLINICAL MONITORING

- Thrill continuous; systolic-only = stenosis.
- Bruit high-pitched/discontinuous = obstruction.
- Pulse weak = inflow stenosis; bounding = outflow stenosis.
- Red flags: difficult cannulation, prolonged bleeding, cold hand.

4. DIALYSIS UNIT SURVEILLANCE

- Rising venous pressures = outflow stenosis.
- Access flow >25% drop is significant.
- Recirculation >10% = inflow issue.
- Nurse training prevents failures.

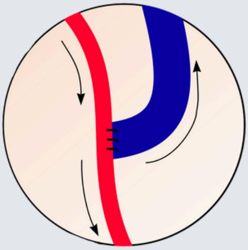
CHEAT SHEET for DIALYSIS ACCESS

5. CANNULATION BEST PRACTICES

·Fistulas: Rope-ladder preferred; buttonhole only when mature; avoid needling <5 cm from anastomosis.

·Grafts: Rope-ladder only; avoid bends/pseudoaneurysms.

6. PREVENT THROMBOSIS



·Avoid intradialytic hypotension.

·Treat stenosis early.

·Loss of thrill or swelling = emergency.

·Minimise catheter dependence.

7. COMPLICATIONS – QUICK GUIDE

·Stenosis → angioplasty.

·Thrombosis → thrombectomy/thrombolysis within 24 hrs.

·Steal syndrome → DRIL/RUDI/banding.

·Aneurysm → revise if enlarging/skin thinning.

·Infection → antibiotics ± graft excision.

PERMCATH CARE

A. DOs

·Use strict aseptic technique.

·Chlorhexidine skin prep each time.

·Keep exit site clean, dry, covered.

·Use antimicrobial locks when indicated.

·Check catheter flow each dialysis.

B. DON'Ts

·No scissors near catheter.

·Do not wet in water.

·Do not use for IV meds/blood draws unless essential.

·Avoid unnecessary manipulation.

C. RED FLAGS – URGENT

·Fever, chills.
·Exit-site redness/discharge.
·Tunnel tract tenderness.
·Inability to aspirate/flush.
·Sudden flow drop.
·Facial/neck swelling (possible central stenosis).

D. COMMON COMPLICATIONS

·CRBSI (catheter bloodstream infection).
·Exit-site infection.
·Central vein stenosis.
·Catheter lumen thrombosis.
·Mechanical kinking.
·Infective Endocarditis.

E. REDUCING LONG-TERM DEPENDENCE

·Plan early fistula creation.
·Salvage failing fistulas early.
·Avoid subclavian catheter placements.
·Use pre-op US to identify high-risk anatomy.
·Refer early to vascular surgeon.

KEY TAKEAWAYS

·Early detection = access salvage.
·Good cannulation prolongs access life.
·Strict asepsis prevents CRBSI.
·Fistulas first remains best practice.
·Patient education dramatically improves outcomes.

Vascular Access SPOTTERS

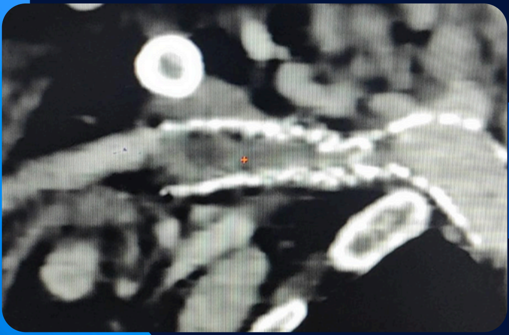
PEARLS

Courtesy : Dr. Aniruddha Bhuiyan

Brachiocephalic AV Fistula Anastomotic site Pseudoaneurysm
Treatment : Pseudoaneurysm Excision & Vessel Repair

Courtesy : Dr. R Sekhar

Left Index Finger tip Ischaemia due to Steal
Treatment : Proximalisation of AV Access / Closure of Current AVF



Courtesy : Dr. Aniruddha Bhuiyan

Right Axillary Vein Stent Thrombosis due to extrinsic compression
Treatment : Creation of New AV Access on opposite side

Vascular SPOTTERS

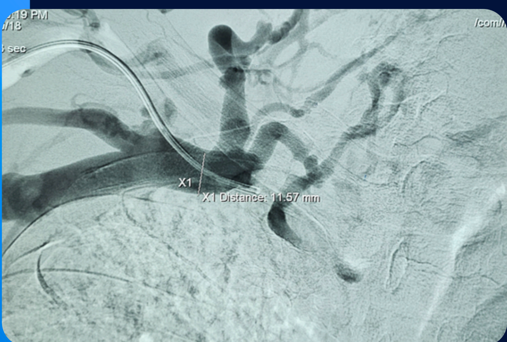
PEARLS

Courtesy : Dr. Amish Mhatre

Left upper limb AVF Aneurysm
Post Cephalic Arch Stenosis
Treatment : Decompression surgery of Clavipectoral Fascia with Venoplasty

Courtesy : Dr. Simit Vora

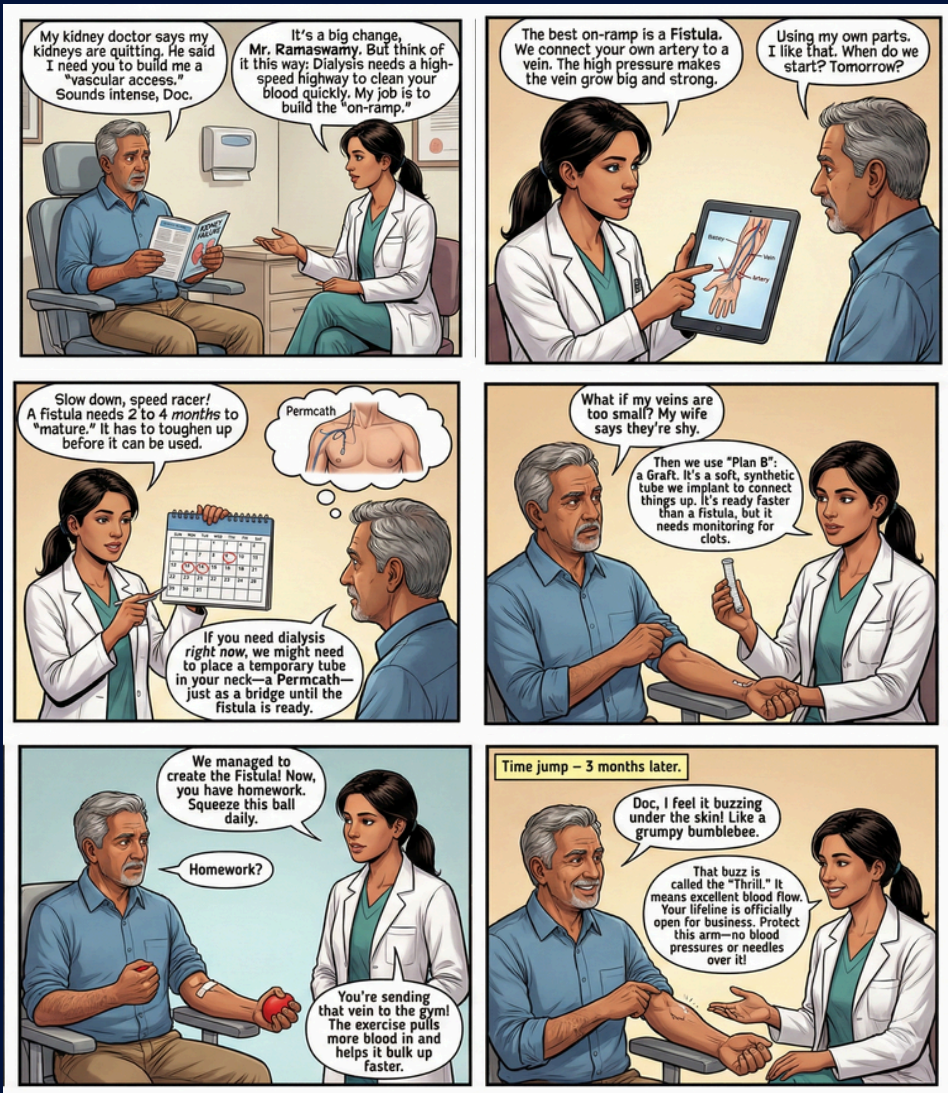
Right HD catheter in the Aorta
Treatment : Removal of the HD Catheter & Repair of the Right Subclavian Artery



Courtesy : Dr. Piyush Jain

Right central vein occlusion
Treatment : Right subclavian and BC trunk venoplasty and stenting

Lifeline Builders



The Threatened Access

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Dr. Thomas Fogarty

"Good vascular access is quiet work – when it functions, no one notices; when it fails, the entire system suffers."