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Preprocedure Evaluation of a Dysfunctional Dialysis Access

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Given the many different types of hemodialysis access and the various problems that can occur in each, a structured approach should be taken in the preprocedure evaluation of patients referred for hemodialysis access intervention. Abnormalities detected on surveillance or monitoring trigger referrals for evaluation and intervention in hopes of preventing thrombosis or underdialysis. Familiarity with surveillance and monitoring findings not only facilitates better communication with nephrologists but also helps the interventionalist surmise where the site of stenosis might be and which stenoses are clinically relevant. Additionally, knowing where stenoses are prone to occur (eg, the cephalic arch in brachiocephalic fistulas) and facility with performing and interpreting an on-table ultrasound are important in preprocedure planning.
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Introduction

Before performing an access intervention, there is a wealth of information that an interventionalist should review to aide in planning the procedure. This includes evaluating the problems detected during monitoring or surveillance that triggered the referral, performing a preprocedure physical examination of the access and performing a brief preprocedure ultrasound. Additionally, each access type has a certain characteristic site where stenoses are prone to occur and familiarity with these sites also aids with planning. Predicting the site of stenosis within the access dictates the direction one should puncture. Even more important, interpretation of these monitoring and surveillance findings is essential for the interventionist to decide whether or not to treat a stensosis, as one should only proceed with treatment if there is a >50% luminal reduction and an associated functional or clinical abnormality.[1] Without familiarity of the context for which a patient was referred, one may indiscriminately dilate narrowings that are not clinically relevant, a practice that does not improve access patency and could be detrimental.

Hemodialysis (HD) patients with mature accesses are referred for endovascular intervention for 3 main reasons: problems detected with clinical monitoring, problems detected during periodic surveillance, and because of access thrombosis. The latter is discussed in a subsequent article in this issue. Monitoring and surveillance are performed to detect a problematic access so that intervention can be performed to correct stenoses, improving access flow thereby avoiding access thrombosis and underdialysis (Table 1).

Monitoring consists of 3 basic components: physical examination, noting problems with needling of the access (eg, difficulty with cannulation or prolonged bleeding) and review of information collected in the normal course of dialysis, such as dialysis adequacy (quantified as *Kt/V*) or serum potassium. Surveillance involves specialized, periodic, instrument-based measurements. These include access flow rates (Qa), static pressures and measurement of recirculation. Monitoring and surveillance programs are mandated by the Centers for Medicare and Medicaid services (CMS) and are part of the National Kidney Foundation–Dialysis Outcomes Quality Initiative (KDOQI) guidelines.[1]

Monitoring

Weekly physical examination of the access is the bedrock of monitoring. It is very useful, detecting about 70%-90%

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Table 1 Monitoring and Surveillance to Localize Area of Stenosis

	Inflow*	Peripheral Outflow	Central Outflow†
Monitoring			
Visual inspection	Flat, non-visible fistula	Aneurysmal enlargement of fistula Visible pulsations	Arm swelling Chest wall collaterals Breast/face swelling
Palpation	Easily collapsible	Tense	Moderately difficult to collapse‡
	Weak thrill	Thrill present in systole only§ Marked pulsatility Lack of collapse with arm elevation Focal thrill at stenosis	Moderate pulsatility‡
Auscultation	Weak bruit near anastomosis	Bruit present in systole only Focal high-pitched bruit at site of stenosis	+/-discontinuous bruit
Needling problems	Difficulty with cannulation	Prolonged bleeding	Prolonged bleeding
Dialysis adequacy	↓ *Kt/V*	↓ *Kt/V*	± ↓*Kt/V*
Surveillance			
Access flow (*Q*a)	↓	↓	± ↓
Static venous pressures	Normal	↑↑	↑‡
Recirculation	Present	Present	± Present

* Inflow is any portion of the access upstream from arterial needle (LV to cannulation segment).
† Central veins: subclavian veins, innominate veins and the superior vena cava.
‡ Collaterals veins, in the setting of central venous stenosis become capacious and dissipate pressure.
§ Arm elevation test is only relevant for AVFs. Diameter of AVG is constant.

of accesses with significant (>50%) stenoses.[2-4] One study found it to be the most predictive test of subsequent access thrombosis.[5] It is also an essential part of the preprocedure evaluation, helping to determine the likely location of stenosis and serving as a baseline to which a postintervention examination can be compared. Note, however, that the physical exam may be less reliable in forearm fistulas,[6] possibly related to a higher proportion of inflow stenosis in these accesses. The turbulence caused by these inflow stenoses causes a thrill that can be falsely interpreted as normal (Fig. 1). Examination of a dialysis access is easy to learn,[4,6-8] especially for interventionalists who have the advantage of instant angiographic feedback.

The first step of access examination is visual inspection. This offers a clue to what type of access the patient has. For example, a long scar on the medial side of the upper arm is consistent with a brachial artery to transposed basilic vein fistula. A normal fistula should be readily visible. Aneurysmal dilation or visible pulsations under the skin surface are abnormal and are signs of outflow stenosis. Multiple chest wall collaterals,[9] arm swelling,[10] unilateral breast swelling,[11,12] and facial swelling[13,14] are all visual signs of central vein stenosis or occlusion (Figs. 2 and 3). An ipsilateral pacemaker[15,16] or scar from prior central venous catheter[10,17] should alert one of the possibility of central venous stenosis (Fig. 4). Isolated hand or forearm swelling points to an outflow stenosis or occlusion just central to

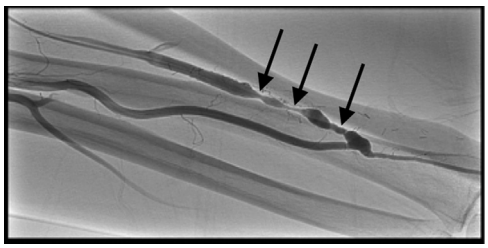

Figure 1 A 52-year-old man referred for access evaluation because of difficulty with cannulation of his radiocephalic fistula. Initial physical examination revealed a thrill throughout the body of the fistula, incorrectly interpreted as normal. A thrill near the anastomosis is a normal finding, created by turbulence across the anastomosis. However, a thrill, can also be created by stenoses (arrows) downstream from the anastomosis.

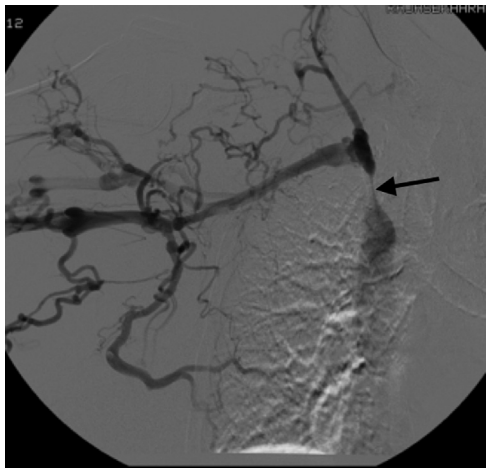

Figure 2 An 85-year-old woman with a long-standing right upper extremity fistula who had right arm swelling. Physical examination also showed multiple chest wall collaterals. Initial venogram showed severe stenosis of the right brachiocephalic vein (black arrow) and multiple collateral veins.

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