

ACCF 2013 Appropriate Use Criteria for Peripheral Vascular Ultrasound and Physiological Testing Part II: Testing for Venous Disease and Evaluation of Hemodialysis Access

Appropriate Use Criteria (By Rating)

Section 1: Upper Extremity Venous Evaluation

Table 1. Venous Duplex of the Upper Extremities for Patency and Thrombosis

Indication		Appropriate Use Rating
Limb Swelling		
1.	• Unilateral – acute	A (9)
2.	• Unilateral – chronic, persistent	A (7)
3.	• Bilateral – acute • Suspected central venous obstruction	A (8)
4.	• Bilateral – chronic, persistent • No alternative diagnosis identified (e.g., no CHF or anasarca from hypoalbuminemia) • Suspected central venous obstruction	A (7)
Limb Pain (Without Swelling)		
6.	• Non-articular pain in the upper extremity with indwelling upper extremity venous catheter	A (7)
7.	• Tender, palpable cord in the upper extremity	A (8)
Known Upper Extremity Venous Thrombosis		
14.	• New upper extremity pain or swelling while on anticoagulation	A (7)
15.	• New upper extremity pain or swelling, not on anticoagulation (i.e., contraindication to anticoagulation)	A (7)
Vein Mapping Prior to Bypass Surgery (Coronary or Peripheral)		
20.	• In the absence of adequate leg vein for harvest	A (8)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 2: Lower Extremity Venous Evaluation

Table 2. Venous Duplex of the Lower Extremities for Patency and Thrombosis

Indication		Appropriate Use Rating
Limb Swelling		
28.	• Unilateral – acute	A (9)
29.	• Unilateral – chronic, persistent	A (7)
30.	• Bilateral – acute	A (8)
Limb Pain (Without Swelling)		
32.	• Non-articular pain in the lower extremity (e.g., calf or thigh)	A (7)

34.	<ul style="list-style-type: none"> Tender, palpable cord in the lower extremity 	A (8)
Shortness of Breath		
35.	<ul style="list-style-type: none"> Suspected pulmonary embolus 	A (8)
36.	<ul style="list-style-type: none"> Diagnosed pulmonary embolus 	A (7)
Known Lower Extremity Venous Thrombosis		
39.	<ul style="list-style-type: none"> Surveillance of calf vein thrombosis for proximal propagation in patient with contraindication to anticoagulation (within 2 weeks of diagnosis) 	A (7)
40.	<ul style="list-style-type: none"> New lower extremity pain or swelling while on anticoagulation 	A (7)
41.	<ul style="list-style-type: none"> New lower extremity pain or swelling, not on anticoagulation (i.e., contraindication to anticoagulation) 	A (8)
44.	<ul style="list-style-type: none"> Surveillance after diagnosis of lower extremity superficial phlebitis Not on anticoagulation, phlebitis location < 5 cms from deep vein junction 	A (7)
Vein Mapping Prior to Bypass Surgery (Coronary or Peripheral)		
46.	<ul style="list-style-type: none"> In the absence of prior lower extremity vein harvest or ablation procedure 	A (8)
47.	<ul style="list-style-type: none"> In the presence of prior lower extremity vein harvest or ablation procedure 	A (8)
Post Endovenous (Great or Small) Saphenous Ablation		
52.	<ul style="list-style-type: none"> Lower extremity swelling or pain 	A (8)
53.	<ul style="list-style-type: none"> Routine post procedural follow-up, no lower extremity pain or swelling <p>Within 10 days post procedure</p>	A (7)
Other Symptoms or Signs of Vascular Disease		
54.	<ul style="list-style-type: none"> Physiologic testing positive for venous obstruction 	A (7)
55.	<ul style="list-style-type: none"> Patent foramen ovale with suspected paradoxical embolism for patient without lower extremity pain or swelling obstruction 	A (7)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Screening examination performed in the absence of lower extremity pain or swelling

Table 3. Duplex Evaluation for Venous Incompetency

Indication		Appropriate Use Rating
Venous Insufficiency (Venous Duplex with Provocative Maneuvers for Incompetency)		
56.	<ul style="list-style-type: none"> Active venous ulcer 	A (9)
57.	<ul style="list-style-type: none"> Healed venous ulcer 	A (7)
60.	<ul style="list-style-type: none"> Varicose veins with lower extremity pain or heaviness 	A (7)
61.	<ul style="list-style-type: none"> Visible varicose veins with chronic lower extremity swelling or skin changes of chronic venous insufficiency (e.g., hyperpigmentation, lipodermatosclerosis) 	A (7)
62.	<ul style="list-style-type: none"> Skin changes of chronic venous insufficiency without visible varicose veins (e.g., hyperpigmentation, lipodermatosclerosis) 	A (7)
64.	<ul style="list-style-type: none"> Mapping prior to venous ablation procedure 	A (8)
65.	<ul style="list-style-type: none"> Prior endovenous (great or small) saphenous ablation procedure with new or worsening varicose veins in the ipsilateral limb 	A (8)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Table 4. Venous Physiological Testing (Plethysmography) With Provocative Maneuvers to Assess for Patency and/or Incompetency

Indication		Appropriate Use Rating
Limb Pain, Swelling or Other Signs of Venous Disease		
67.	<ul style="list-style-type: none"> Active venous ulcer 	A (7)
69.	<ul style="list-style-type: none"> Varicose veins with lower extremity pain or heaviness 	A (7)
70.	<ul style="list-style-type: none"> Varicose veins with chronic lower extremity swelling or skin changes of chronic venous insufficiency (e.g., hyperpigmentation or lipodermatosclerosis) 	A (7)
71.	<ul style="list-style-type: none"> Skin changes of chronic venous insufficiency without visible varicose veins (e.g., hyperpigmentation or lipodermatosclerosis) 	A (7)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 3: Duplex Evaluation of the Inferior Vena Cava (IVC) and Iliac Veins

Table 5. Duplex of the IVC and Iliac Veins for Patency and Thrombosis

Indication		Appropriate Use Rating
Prior to IVC Filter Placement		
Evaluation for Suspected Deep Vein Thrombosis		
79.	<ul style="list-style-type: none"> Lower extremity swelling – unilateral or bilateral –performed selectively – when the lower extremity venous duplex is positive for acute proximal DVT 	A (7)
80.	<ul style="list-style-type: none"> Selectively - When the flow pattern in one or both common femoral veins is abnormal 	A (8)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 4: Hepatoportal and Renal Venous Evaluation

Table 6. Duplex of the Hepatoportal System (portal vein, hepatic veins, splenic vein, superior mesenteric vein, inferior vena cava) for patency, thrombosis, and flow direction †

Indication		Appropriate Use Rating
Evaluation of Hepatic Dysfunction or Portal Hypertension		
87.	<ul style="list-style-type: none"> Cirrhosis with or without ascites 	A (7)
90.	<ul style="list-style-type: none"> Hepatomegaly and/or splenomegaly 	A (7)
91.	<ul style="list-style-type: none"> Portal hypertension 	A (7)
Surveillance following Portal Decompression Procedure		
92.	<ul style="list-style-type: none"> Follow-up of a TIPS 	A (8)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Testing indications refer to evaluation of native hepatoportal venous system only (i.e. hepatic transplant sites and arterial system excluded).

Section 5: Hemodialysis Vascular Access Duplex Ultrasound

Table 8. Preoperative Planning and Postoperative Assessment of a Vascular Access Site*

Indication		Appropriate Use Rating
Assessment Prior to Access Site Placement*		
106.	<ul style="list-style-type: none"> Preoperative Mapping Study (Upper extremity arterial and venous duplex) <3 months prior to access placement 	A (8)
“Failure to Mature”		
108.	<ul style="list-style-type: none"> “Failure to Mature” on basis of physical examination > 6 weeks after placement 	A (8)
Symptoms and Signs of Disease†		
109.	<ul style="list-style-type: none"> Signs of access site malfunction during dialysis (e.g., low blood flows, kt/V, recirculation times or increased venous pressure) 	A (8)
110.	<ul style="list-style-type: none"> Mass associated with an AVF/AVG 	A (8)
111.	<ul style="list-style-type: none"> Loss of palpable thrill of AVF/AVG 	A (8)
112.	<ul style="list-style-type: none"> Arm swelling 	A (8)
113.	<ul style="list-style-type: none"> Hand pain, pallor, and/or digital ulceration (i.e., evaluation for suspected arterial steal syndrome) 	A (8)
115.	<ul style="list-style-type: none"> Difficult cannulation by multiple personnel on multiple attempts 	A (8)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

*Ultrasound assessment prior to creation of dialysis access (AVF or AVG) typically includes a combined arterial and venous duplex examination that is performed to determine the adequacy of superficial veins (patency, size, and length of conduit), patency of central venous outflow, and adequacy of adequate arterial inflow. Determination of central venous patency is particularly important for patients with a history of prior central venous catheter(s).

Section 1: Upper Extremity Venous Evaluation

Table 1. Venous Duplex of the Upper Extremities for Patency and Thrombosis

Indication		Appropriate Use Rating
Limb Swelling		
Limb Pain (Without Swelling)		
5.	<ul style="list-style-type: none"> Non-articular pain in the upper extremity (no indwelling upper extremity venous catheter) 	M (5)
Shortness of Breath		
8.	<ul style="list-style-type: none"> Suspected pulmonary embolus (no indwelling upper extremity venous catheter) 	M (4)
9.	<ul style="list-style-type: none"> Suspected pulmonary embolus with indwelling upper extremity venous catheter. 	M (6)

10.	<ul style="list-style-type: none"> Diagnosed pulmonary embolus (no indwelling upper extremity venous catheter) 	M (4)
11.	<ul style="list-style-type: none"> Diagnosed pulmonary embolus with indwelling upper extremity venous catheter. 	M (6)
Fever		
13.	<ul style="list-style-type: none"> Fever with indwelling upper extremity venous catheter 	M (4)
Known Upper Extremity Venous Thrombosis		
16.	<ul style="list-style-type: none"> Before anticipated discontinuation of anticoagulation treatment 	M (5)
18.	<ul style="list-style-type: none"> Surveillance after diagnosis of upper extremity superficial phlebitis Not on anticoagulation, phlebitis location < 5 cms from deep vein junction 	M (6)
19.	<ul style="list-style-type: none"> Surveillance after diagnosis of upper extremity superficial phlebitis Not on anticoagulation, phlebitis location > 5 cms from deep vein junction 	M (4)
Vein Mapping Prior to Bypass Surgery (Coronary or Peripheral)		
21.	<ul style="list-style-type: none"> In the presence of adequate leg vein for harvest 	M (4)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 2: Lower Extremity Venous Evaluation

Table 2. Venous Duplex of the Lower Extremities for Patency and Thrombosis

Indication		Appropriate Use Rating
Limb Swelling		
31.	<ul style="list-style-type: none"> Bilateral – chronic, persistent No alternative diagnosis identified (e.g., no CHF or anasarca from hypoalbuminemia) 	M (6)
Limb Pain (Without Swelling)		
33.	<ul style="list-style-type: none"> Knee pain 	M (4)
Fever		
37.	<ul style="list-style-type: none"> Fever of unknown origin (no indwelling lower extremity venous catheter) 	M (5)
38.	<ul style="list-style-type: none"> Fever with indwelling lower extremity venous catheter 	M (5)
Known Lower Extremity Venous Thrombosis		
42.	<ul style="list-style-type: none"> Before anticipated discontinuation of anticoagulation treatment 	M (5)
43.	<ul style="list-style-type: none"> Shortness of breath in a patient with known lower extremity DVT 	M (5)
45.	<ul style="list-style-type: none"> Surveillance after diagnosis of lower extremity superficial phlebitis Not on anticoagulation, phlebitis location > 5 cms from deep vein junction 	M (5)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Table 3. Duplex Evaluation for Venous Incompetency

Indication		Appropriate Use Rating
Venous Insufficiency (Venous Duplex with Provocative Maneuvers for Incompetency)		
59.	• Varicose veins, entirely asymptomatic	M (5)
63.	• Lower extremity pain or heaviness without signs of venous disease	M (5)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Table 4. Venous Physiological Testing (Plethysmography) With Provocative Maneuvers to Assess for Patency and/or Incompetency

Indication		Appropriate Use Rating
Limb Pain, Swelling or Other Signs of Venous Disease		
68.	• Varicose veins, entirely asymptomatic	M (5)
72.	• Lower extremity pain or heaviness without signs of venous disease	M (6)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 3: Duplex Evaluation of the Inferior Vena Cava (IVC) and Iliac Veins

Table 5. Duplex of the IVC and Iliac Veins for Patency and Thrombosis

Indication		Appropriate Use Rating
Prior to IVC Filter Placement		
75.	• Prior to IVC filter placement • For procedural access planning	M (6)
Evaluation for Suspected Deep Vein Thrombosis		
77.	• Lower extremity swelling – unilateral or bilateral – combined routinely with a venous duplex of the lower extremities	M (4)
78.	• Lower extremity swelling – unilateral or bilateral –performed selectively – when the lower extremity venous duplex is normal	M (6)
Evaluation for Suspected Pulmonary Embolus		
82.	• Pulmonary symptoms (suspected pulmonary embolus) – combined routinely with a venous duplex of the lower extremities	M (4)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 4: Hepatoportal and Renal Venous Evaluation

Table 6. Duplex of the Hepatoportal System (portal vein, hepatic veins, splenic vein, superior mesenteric vein, inferior vena cava) for patency, thrombosis, and flow direction †

Indication		Appropriate Use Rating
Evaluation of Hepatic Dysfunction or Portal Hypertension		
86.	• Abnormal liver function tests • No alternative diagnosis identified (e.g., medication related or infectious hepatitis)	M (6)

89.	<ul style="list-style-type: none"> • Jaundice • No alternative diagnosis identified after initial evaluation (e.g., no biliary obstruction) 	M (6)
Evaluation of Other Symptoms or Signs of Abdominal Vascular Disease		
93.	<ul style="list-style-type: none"> • Abdominal pain 	M (4)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Testing indications refer to evaluation of native hepatportal venous system only (i.e. hepatic transplant sites and arterial system excluded).

Table 7. Duplex of the Renal Veins for Patency and Thrombosis †

Indication		Appropriate Use Rating
Evaluation for Suspected Renal Vein Thrombosis – Potential Signs and/or Symptoms		
98.	<ul style="list-style-type: none"> • Acute renal failure 	M (5)
99.	<ul style="list-style-type: none"> • Acute flank pain 	M (5)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Testing indications refer to evaluation of native renal veins only for patency (i.e. renal transplant sites and renal arteries excluded).

Section 5: Hemodialysis Vascular Access Duplex Ultrasound

Table 8. Preoperative Planning and Postoperative Assessment of a Vascular Access Site*

Indication		Appropriate Use Rating
“Failure to Mature”		
107.	<ul style="list-style-type: none"> • “Failure to Mature” on basis of physical examination 0-6 weeks after placement 	M (6)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

*Ultrasound assessment prior to creation of dialysis access (AVF or AVG) typically includes a combined arterial and venous duplex examination that is performed to determine the adequacy of superficial veins (patency, size, and length of conduit), patency of central venous outflow, and adequacy of adequate arterial inflow. Determination of central venous patency is particularly important for patients with a history of prior central venous catheter(s).

†In a mature AVF or AVG that is being accessed for hemodialysis

Section 1: Upper Extremity Venous Evaluation

Table 1. Venous Duplex of the Upper Extremities for Patency and Thrombosis

Indication	Appropriate Use Rating
Fever	

12.	<ul style="list-style-type: none"> Fever of unknown origin (no indwelling upper extremity venous catheter) 	R (2)
Known Upper Extremity Venous Thrombosis		
17.	<ul style="list-style-type: none"> Shortness of breath in a patient with known upper extremity DVT 	R (3)
Screening Examination for Upper Extremity DVT†		
22.	<ul style="list-style-type: none"> Prior to pacemaker or implantable cardiac defibrillator placement 	R (3)
23.	<ul style="list-style-type: none"> Prolonged ICU stay (e.g., > 4 days) No indwelling upper extremity venous catheter 	R (2)
24.	<ul style="list-style-type: none"> Prolonged ICU stay (e.g., > 4 days) with indwelling upper extremity venous catheter 	R (3)
25.	<ul style="list-style-type: none"> Monitoring indwelling upper extremity venous catheter that is functional 	R (2)
26.	<ul style="list-style-type: none"> In those with high-risk: acquired, inherited or hypercoagulable state 	R (2)
27.	<ul style="list-style-type: none"> Positive D-dimer test in a hospital inpatient 	R (1)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Screening examination performed in the absence of upper extremity pain or swelling

Section 2: Lower Extremity Venous Evaluation

Table 2. Venous Duplex of the Lower Extremities for Patency and Thrombosis

Indication		Appropriate Use Rating
Screening Examination for Lower Extremity DVT†		
48.	<ul style="list-style-type: none"> After orthopedic surgery 	R (3)
49.	<ul style="list-style-type: none"> Prolonged ICU stay (e.g., > 4 days) 	R (3)
50.	<ul style="list-style-type: none"> In those with high-risk: acquired, inherited or hypercoagulable state 	R (3)
51.	<ul style="list-style-type: none"> Positive D-dimer test in a hospital inpatient 	R (2)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Screening examination performed in the absence of lower extremity pain or swelling

Table 3. Duplex Evaluation for Venous Incompetency

Indication		Appropriate Use Rating
Venous Insufficiency (Venous Duplex with Provocative Maneuvers for Incompetency)		
58.	<ul style="list-style-type: none"> Spider veins (telangiectasias) 	R (3)
66.	<ul style="list-style-type: none"> Prior endovenous (great or small) saphenous ablation procedure with no residual symptoms. 	R (3)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Table 4. Venous Physiological Testing (Plethysmography) With Provocative Maneuvers to Assess for Patency and/or Incompetency

Indication		Appropriate Use Rating
Limb Pain, Swelling or Other Signs of Venous Disease		
73.	<ul style="list-style-type: none"> Limb swelling: unilateral – acute Suspected acute venous thrombosis 	R (3)
Shortness of Breath		

74.	<ul style="list-style-type: none"> • Suspected pulmonary embolus 	R (2)
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A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 3: Duplex Evaluation of the Inferior Vena Cava (IVC) and Iliac Veins

Table 5. Duplex of the IVC and Iliac Veins for Patency and Thrombosis

Indication		Appropriate Use Rating
Evaluation for Suspected Deep Vein Thrombosis		
76.	<ul style="list-style-type: none"> • Lower extremity swelling - unilateral or bilateral – as a “stand alone test” without a venous duplex of the lower extremities 	R (3)
Evaluation of Other Symptoms or Signs of Abdominal Vascular Disease		
83.	<ul style="list-style-type: none"> • Abdominal pain 	R (3)
84.	<ul style="list-style-type: none"> • Abdominal bruit 	R (3)
85.	<ul style="list-style-type: none"> • Fever of unknown origin 	R (3)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

Section 4: Hepatoportal and Renal Venous Evaluation

Table 6. Duplex of the Hepatoportal System (portal vein, hepatic veins, splenic vein, superior mesenteric vein, inferior vena cava) for patency, thrombosis, and flow direction †

Indication		Appropriate Use Rating
Evaluation of Hepatic Dysfunction or Portal Hypertension		
88.	<ul style="list-style-type: none"> • Jaundice • As an initial diagnostic test 	R (3)
Evaluation of Other Symptoms or Signs of Abdominal Vascular Disease		
94.	<ul style="list-style-type: none"> • Fever of unknown origin 	R (3)
Evaluation of Cardiac and/or Pulmonary Symptoms		
95.	<ul style="list-style-type: none"> • Pulmonary symptoms (suspected pulmonary embolus) 	R (3)
96.	<ul style="list-style-type: none"> • Cor pulmonale 	R (3)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Testing indications refer to evaluation of native hepatoportal venous system only (i.e. hepatic transplant sites and arterial system excluded).

Table 7. Duplex of the Renal Veins for Patency and Thrombosis †

Indication		Appropriate Use Rating
Evaluation for Suspected Renal Vein Thrombosis – Potential Signs and/or Symptoms		
97.	<ul style="list-style-type: none"> • Gross hematuria 	R (3)
Evaluation of Cardiac and/or Pulmonary Symptoms		
100.	<ul style="list-style-type: none"> • Pulmonary symptoms (suspected pulmonary embolus) 	R (3)
Evaluation of Other Symptoms or Signs of Abdominal Vascular Disease		

101.	<ul style="list-style-type: none"> • Drug-resistant hypertension (suspected renal artery stenosis) 	R (3)
102.	<ul style="list-style-type: none"> • Microscopic hematuria (prior to urological evaluation) 	R (2)
103.	<ul style="list-style-type: none"> • Fever of unknown origin 	R (2)
104.	<ul style="list-style-type: none"> • Epigastric bruit 	R (2)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

†Testing indications refer to evaluation of native renal veins only for patency (i.e. renal transplant sites and renal arteries excluded).

Section 5: Hemodialysis Vascular Access Duplex Ultrasound

Table 8. Preoperative Planning and Postoperative Assessment of a Vascular Access Site*

Indication		Appropriate Use Rating
Assessment Prior to Access Site Placement*		
105.	<ul style="list-style-type: none"> • Preoperative Mapping Study (Upper extremity arterial and venous duplex) ≥3 months prior to access placement 	R (3)
Symptoms and Signs of Disease†		
114.	<ul style="list-style-type: none"> • Cool extremity • Without pain, pallor, or ulceration 	R (3)

A indicates Appropriate; R, Rarely appropriate; and M, Maybe appropriate.

*Ultrasound assessment prior to creation of dialysis access (AVF or AVG) typically includes a combined arterial and venous duplex examination that is performed to determine the adequacy of superficial veins (patency, size, and length of conduit), patency of central venous outflow, and adequacy of adequate arterial inflow. Determination of central venous patency is particularly important for patients with a history of prior central venous catheter(s).

†In a mature AVF or AVG that is being accessed for hemodialysis