

Vascular Ultrasound Vocabulary Reference

Part 3: Peripheral Arterial | Chapters 8–13

Kupinski, *Diagnostic Medical Sonography: The Vascular System*, 3rd Ed.

An In-Depth Review by Dr. Alice Matthews

amatthews@concorde.edu

Chapter 8: Indirect Assessment of Arterial Disease

Term	Definition	Analogy / Example
Allen Test	A clinical test evaluating hand perfusion by compressing the radial and ulnar arteries, having the patient make a fist, then releasing one artery at a time to assess palmar arch patency.	Like testing backup routes--block both supply lines, drain the system, then see if opening one route fills the hand quickly.
Ankle-Brachial Index (ABI)	The ratio of ankle systolic pressure to brachial (arm) systolic pressure. Normal ABI is 0.9-1.3; values <0.9 indicate arterial disease; <0.4 indicates critical ischemia.	Like comparing water pressure downstairs versus upstairs--if the ankle pressure is much lower than the arm, there's a blockage somewhere in between.
Critical Limb Ischemia (CLI)	Severe arterial insufficiency causing rest pain, nonhealing ulcers, or gangrene. ABI typically <0.4. Requires urgent intervention to prevent limb loss.	Like a plant about to die from drought--tissues are so starved of blood that they're dying.
Dependent Rubor	Redness of the foot when in a dependent (hanging down) position, indicating severe arterial disease with dilated arterioles.	Like blood pooling when gravity finally helps--if the foot turns red when dangling, the vessels are maximally dilated trying to get any blood they can.
Dicrotic Notch	A small notch on the downslope of an arterial waveform, representing aortic valve closure and reflected waves. Loss of the dicrotic notch suggests arterial disease.	Like a little bump in the road on the way down--the notch is normal; if it's missing, something is wrong with the arterial tree.
Elevation Pallor	Blanching (whitening) of the foot when elevated above heart level, indicating severe arterial insufficiency.	Like a fountain running dry when you raise it too high--if the foot goes white when lifted, blood can't fight gravity.
Exercise Testing	Measuring ankle pressures before and after treadmill walking to detect arterial disease that may not be apparent at rest. A drop in ABI >0.15-0.20 after exercise is abnormal.	Like stress-testing the plumbing--make the system work hard, then see if it can keep up. If pressure drops after walking, there's hidden disease.
Intermittent Claudication	Pain, cramping, fatigue, or tiredness in muscle groups (typically calf, thigh, or buttock) brought on by exercise and relieved by rest within 10 minutes. It indicates arterial insufficiency distal to the site of disease.	Like a muscle running out of fuel--the legs hurt during activity because blood can't keep up with demand, but pain goes away when you stop moving.
Photoplethysmograph (PPG)	An indirect test using infrared light to detect skin blood flow changes. Commonly used for digit waveforms and venous reflux testing.	Like a heart rate monitor on a smartwatch--infrared light detects blood pulsing through the skin.
Plethysmography	An indirect physiologic test that measures volume changes in a limb with each heartbeat. Pulse volume recordings (PVR) show waveform changes that indicate arterial disease.	Like watching a balloon inflate and deflate with each heartbeat--the waveform shows how well blood is filling and emptying the limb.

Term	Definition	Analogy / Example
Pulse Volume Recording (PVR)	A plethysmographic waveform showing the volume change in a limb segment with each cardiac cycle. Normal waveforms have sharp upstrokes and dicrotic notches; abnormal waves are dampened.	Like the shape of a heartbeat on a monitor--normal has a quick rise and notch; diseased looks rounded and weak.
Raynaud's Disease (Primary Raynaud's)	Idiopathic bilateral vasospasm affecting most digits (thumbs often spared), without underlying disease.	Like sensitive pipes that overreact to cold--no underlying cause, just twitchy vessels.
Raynaud's Phenomenon	Episodic vasospasm of the digital arteries in response to cold or emotional stress, causing color changes (white → blue → red) in the fingers or toes.	Like pipes freezing and thawing--fingers turn white (no flow), blue (stagnant blood), then red (flow returns with flushing).
Raynaud's Syndrome (Secondary Raynaud's)	Vasospasm associated with underlying conditions such as scleroderma, lupus, or trauma. May be unilateral or affect fewer digits.	Like pipes that spasm because something else is wrong--the vasospasm is a symptom of another disease.
Rest Pain	Severe pain in the toes, foot, or ankle that occurs at rest (without exercise), typically worse at night when lying flat. It indicates critical limb ischemia.	Like a constant toothache in the foot--even without walking, the pain persists because blood flow is so poor the tissues are starving.
Segmental Pressures	Systolic blood pressure measurements taken at multiple levels of the leg (thigh, calf, ankle) to localize arterial disease. A gradient >20-30 mmHg between segments suggests significant stenosis.	Like checking water pressure at different floors--a big pressure drop between two points tells you where the clog is.
Thoracic Outlet Syndrome (TOS)	Compression of the brachial plexus, subclavian artery, or subclavian vein at the thoracic outlet (between the neck and shoulder). Symptoms include arm pain, numbness, and weakness.	Like a hose getting pinched where it passes through a tight space--the structures get compressed between the neck and shoulder.
Toe-Brachial Index (TBI)	The ratio of toe systolic pressure to brachial systolic pressure. Used when calf arteries are calcified and incompressible. Normal TBI is >0.7.	Like measuring pressure at the very end of the pipe--when you can't trust the ankle measurement due to calcification, the toe gives a reliable reading.

Chapter 9: Duplex Ultrasound of Lower Extremity Arteries

Term	Definition	Analogy / Example
Arterial Calcification	Calcium deposits in the arterial wall that appear as bright echoes with acoustic shadowing on ultrasound. May be intimal (related to atherosclerosis) or medial (Monckeberg's, common in diabetes).	Like concrete hardening inside pipes--the calcium makes vessels stiff and hard to evaluate.
Duplex Arteriography (DA)	Comprehensive duplex ultrasound mapping of the lower extremity arteries from the aorta to the pedal vessels, used as a preoperative planning tool.	Like drawing a complete road map of all the arteries--surgeons use this instead of invasive angiograms for many procedures.
Hunter's Canal (Adductor Canal)	The anatomical region in the mid-thigh where the superficial femoral artery passes deep to the sartorius muscle. A common site for SFA disease.	Like a tunnel the artery passes through--a tight spot where plaque often builds up.
Incompressible Vessels	Arteries (typically tibial arteries in diabetics) that cannot be compressed by a blood pressure cuff due to heavy calcification, making pressure measurements unreliable.	Like trying to squeeze a rock-hard pipe--you can't compress it, so pressure readings are falsely elevated.

Term	Definition	Analogy / Example
Monckeberg's Medial Calcific Sclerosis	Calcification of the arterial media (muscular layer) that creates "pipestem" arteries. Common in diabetics and chronic kidney disease. Does not typically cause stenosis but makes vessels incompressible.	Like pipes that have hardened but aren't clogged--the walls are calcified but the channel remains open.
Monophasic Waveform	A simplified arterial waveform with only forward flow throughout the cardiac cycle. Abnormal in resting limbs; indicates disease distal to the sampling site or low-resistance outflow.	Like a one-way stream instead of waves--if there's no flow reversal, something has changed the normal resistance pattern.
Multiphasic Waveform	An arterial waveform with multiple phases including flow reversal. Normal in resting extremity arteries; indicates intact vessel compliance and high peripheral resistance.	Like a wave that sloshes back and forth--healthy peripheral arteries have this characteristic back-and-forth pattern.
Popliteal Aneurysm	Dilation of the popliteal artery to >1.5 times normal diameter. The most common peripheral aneurysm; often bilateral. May contain thrombus and cause distal embolization.	Like a bulging weak spot behind the knee--can throw clots downstream to the foot.
Runoff Vessels	The distal arteries (tibial and peroneal arteries) that receive blood flow from the proximal arteries. The number and quality of runoff vessels affect treatment options.	Like drainage pipes leaving a reservoir--the more open outlets you have, the better the flow.
Tibioperoneal Trunk	The short segment of the popliteal artery after the anterior tibial artery branches off, which then divides into the posterior tibial and peroneal arteries.	Like a highway interchange--the main road splits into three different routes to the lower leg and foot.
Triphasic Waveform	A normal peripheral arterial waveform with three phases: systolic forward flow, brief diastolic flow reversal, and late diastolic forward flow. Indicates high-resistance flow in a compliant vessel.	Like a heartbeat that goes forward, bounces back briefly, then moves forward again--the classic healthy peripheral artery pattern.
Velocity Ratio (Vr)	The ratio of peak systolic velocity at a stenosis to the velocity in a normal adjacent proximal segment. Vr >2 suggests >50% stenosis; Vr >3 suggests >70% stenosis.	Like comparing highway speeds before and after a construction zone--if traffic suddenly speeds up 3x through a narrow spot, the narrowing is severe.

Chapter 10: Upper Extremity Arterial Duplex Scanning

Term	Definition	Analogy / Example
Adson's Maneuver	A provocative test for thoracic outlet syndrome where the patient extends the neck, turns the head toward the symptomatic side, and holds a deep breath while the examiner checks the radial pulse.	Like twisting yourself into a pretzel to see if symptoms appear--if the pulse disappears or symptoms worsen, compression is likely.
Costoclavicular Compression	Compression of neurovascular structures between the clavicle and first rib, a type of thoracic outlet syndrome.	Like getting pinched between a rock and a hard place--the clavicle and first rib squeeze the vessels.
Hyperabduction Syndrome	Compression of the subclavian or axillary vessels when the arm is raised overhead, often due to the pectoralis minor tendon.	Like kinking a hose by lifting it too high--raising the arm pinches the vessels under the pectoral muscle.
Hypothenar Hammer Syndrome	Occlusion or aneurysm of the ulnar artery at the hypothenar eminence caused by repetitive trauma (palm pounding). May cause digital emboli.	Like damaging a pipe by hitting it repeatedly--chronic palm trauma can injure the ulnar artery.

Term	Definition	Analogy / Example
Subclavian Steal Syndrome	Reversal of flow in the vertebral artery due to proximal subclavian artery stenosis, causing blood to be "stolen" from the brain to supply the arm during exercise.	Like siphoning fuel from a neighbor's tank--when the subclavian is blocked, blood flows backward from the brain to feed the arm.
Ulnar Artery Dominance	The normal anatomical variant where the ulnar artery is the primary blood supply to the hand via the superficial palmar arch (present in ~85% of people).	Like having a main highway and a side road--the ulnar artery is usually the bigger supplier to the hand.

Chapter 11: Ultrasound Assessment of Arterial Bypass Grafts

Term	Definition	Analogy / Example
Anastomosis	The surgical connection between a graft and a native artery. The proximal anastomosis connects to the inflow artery; the distal anastomosis connects to the outflow artery.	Like welding two pipes together--the connection points where the graft joins the native arteries.
Autogenous Vein Graft	A bypass conduit made from the patient's own vein (usually great saphenous vein). Preferred over synthetic grafts due to better long-term patency.	Like using your own hose from the garage--your natural vein works better than artificial materials.
Bypass Graft	A surgical conduit (vein or synthetic) that diverts blood flow around an occluded or severely stenotic artery.	Like a detour around a blocked highway--the graft creates an alternate route for blood to reach the tissues.
Distal Anastomosis	The connection between the bypass graft and the outflow (downstream) artery, typically the popliteal or tibial artery.	Like where the detour rejoins the main road--the downstream connection point.
Failing Graft	A bypass graft with hemodynamically significant stenosis that hasn't yet thrombosed. The goal of surveillance is to detect and repair these before failure.	Like a dam about to break--stenosis is severe but flow still exists; fix it before it clots.
Graft Aneurysm	Abnormal dilation of a vein graft, typically occurring years after surgery. May contain thrombus and require revision.	Like the detour road developing a bulge--the graft wall weakens and expands over time.
Graft Stenosis	Narrowing within a bypass graft, typically due to myointimal hyperplasia at valve sites or anastomoses. PSV >300 cm/s or Vr >3.5 suggests significant stenosis.	Like a kink developing in the detour--narrowing threatens the entire bypass.
Graft Surveillance	Routine duplex ultrasound monitoring of bypass grafts to detect problems before graft failure. Typically performed at 3, 6, and 12 months, then annually.	Like regular inspections of a bridge--catch problems early before catastrophic failure.
Graft Thrombosis	Complete occlusion of a bypass graft by blood clot. Usually occurs due to progression of stenosis that wasn't detected and treated.	Like the detour getting completely blocked--if narrowing isn't fixed, the graft clots off.
In Situ Bypass	A bypass using the great saphenous vein left in its natural position, with valves destroyed (lysed) and branches tied off.	Like repurposing a road that's already there--the vein stays where it is, just modified to carry arterial flow.
Inflow Artery	The artery supplying blood to the proximal end of a bypass graft, typically the common femoral or superficial femoral artery.	Like the water source feeding the detour--the upstream artery providing blood to the graft.

Term	Definition	Analogy / Example
Myointimal Hyperplasia	Proliferation of smooth muscle cells in the intimal layer of a vein graft, causing stenosis. The most common cause of vein graft failure, typically occurring within 2 years of surgery.	Like scar tissue growing inside the pipe--the vein reacts to arterial pressure by thickening its walls.
Orthograde Bypass	A free vein graft placed in the same orientation as the original vein (proximal vein end to proximal artery), requiring valve lysis.	Like keeping the vein's natural direction--valves must be destroyed to allow forward flow.
Outflow Artery	The artery receiving blood from the distal end of a bypass graft, typically the popliteal or tibial artery.	Like the destination where the detour ends--the downstream artery receiving graft flow.
Prosthetic Graft	A synthetic bypass conduit made of materials such as PTFE (Teflon) or Dacron. Used when adequate vein is unavailable.	Like using a plastic pipe instead of organic material--works but doesn't last as long as your own vein.
Proximal Anastomosis	The connection between the bypass graft and the inflow (upstream) artery, typically the common femoral artery.	Like where the detour begins--the upstream connection point.
PTFE (Polytetrafluoroethylene)	A synthetic material (Teflon) commonly used for prosthetic bypass grafts. Less thrombogenic than Dacron but still inferior to vein grafts.	Like using non-stick pan coating for a pipe--Teflon is relatively smooth and resists clotting.
Retained Valve	A venous valve that was incompletely destroyed during bypass surgery, potentially causing stenosis or graft failure.	Like a gate left partially closed--an undestroyed valve can block flow and cause problems.
Reversed Vein Bypass	A bypass using a free segment of vein that is removed and reversed (flipped) so valves don't obstruct flow.	Like taking a one-way street and turning it around--the vein is flipped so the valves don't block arterial flow.
Valve Lysis	Surgical destruction of venous valves in an in situ or orthograde vein bypass to allow forward arterial flow.	Like removing one-way gates--the valves must be destroyed so blood can flow forward through the vein.

Chapter 12: Ultrasound Following Interventional Procedures

Term	Definition	Analogy / Example
Angioplasty	A minimally invasive procedure using a balloon catheter to dilate a stenotic artery. Also called percutaneous transluminal angioplasty (PTA).	Like using a balloon to push open a narrowed pipe--inflate a balloon inside the artery to widen it.
Atherectomy	A procedure to remove plaque from an artery using a cutting, rotating, or laser device. An alternative to angioplasty for heavily calcified lesions.	Like using a Roto-Rooter on pipes--physically cuts or grinds away the blockage.
Bare Metal Stent	A basic metal stent without drug coating. Simpler than drug-eluting stents but has higher restenosis rates.	Like a plain metal scaffold--does the job but the body may overgrow tissue inside it.
Completion Study	An ultrasound examination performed immediately after a surgical or endovascular procedure to verify technical success.	Like inspecting your work before signing off--verify the repair is good before leaving the OR.
Covered Stent (Stent-Graft)	A stent lined with synthetic material (PTFE or Dacron), used to exclude aneurysms or treat vessel injuries.	Like a pipe with a liner--the covering seals off the damaged area from blood flow.

Term	Definition	Analogy / Example
Drug-Eluting Stent	A stent coated with medication that slowly releases to prevent tissue overgrowth (restenosis).	Like a scaffold that releases medicine--the coating prevents scar tissue from clogging the stent.
Postangioplasty Criteria	Modified velocity criteria for evaluating arteries after angioplasty or stenting, as normal criteria may overestimate stenosis in treated vessels.	Like using different speed limits for repaved roads--treated arteries need adjusted standards.
Restenosis	Re-narrowing of an artery after intervention, caused by neointimal hyperplasia (tissue growth inside the vessel).	Like the clog coming back--the body's healing response can cause new narrowing.
Stent	A metal mesh tube placed in an artery to keep it open after angioplasty. May be balloon-expandable or self-expanding.	Like a scaffold holding a tunnel open--the metal framework props the artery open from inside.

Chapter 13: Nonatherosclerotic Arterial Pathology

Term	Definition	Analogy / Example
Acute Limb Ischemia	Sudden decrease in limb perfusion, typically due to embolism or thrombosis. A surgical emergency requiring urgent intervention.	Like a pipe bursting or clogging suddenly--immediate threat to the limb requiring emergency treatment.
Arterial Embolism	Sudden blockage of an artery by material (usually clot) traveling from elsewhere, often from the heart or an aneurysm.	Like debris floating downstream and getting stuck--a traveling clot suddenly blocks the vessel.
Blue Toe Syndrome	Blue discoloration of the toes caused by microembolization, often from a proximal aneurysm or ulcerated plaque.	Like tiny clots showering the toes--small emboli block the tiny vessels, turning toes blue.
Buerger's Disease (Thromboangiitis Obliterans)	An inflammatory disease of small and medium arteries, typically affecting young male smokers. Causes segmental thrombosis and may lead to gangrene.	Like arteries getting angry at cigarettes--the vessels become inflamed and clot off in young smokers.
Chronic Exertional Compartment Syndrome	Recurrent compartment pressure elevation during exercise, causing pain that resolves with rest. Common in athletes.	Like muscles getting too big for their container during exercise--pressure builds up with activity.
Compartment Syndrome	Increased pressure within a muscle compartment that compromises blood flow. May be acute (emergency) or chronic (exertional).	Like a balloon being squeezed too tight--pressure builds up and crushes the vessels and nerves.
Cystic Adventitial Disease	A rare condition where mucin-filled cysts form in the arterial wall, typically in the popliteal artery, causing stenosis.	Like a water balloon forming inside the artery wall--cysts push into the lumen and narrow it.
Ergotism	Vasoconstriction and ischemia caused by ergot alkaloids (medications or fungal contamination), leading to arterial spasm and potential gangrene.	Like arteries clamping down from poisoning--certain drugs or mold can cause severe vasospasm.
Fibromuscular Dysplasia (FMD)	A non-atherosclerotic disease causing abnormal cellular growth in artery walls, creating a "string of beads" appearance. Most common in young to middle-aged women.	Like arteries growing in lumps and bumps--not plaque, just abnormal wall development creating bulges and narrow spots.
Giant Cell Arteritis (Temporal Arteritis)	An inflammatory disease of large arteries, typically affecting the temporal artery in older adults. Causes headache, jaw claudication, and risk of blindness.	Like the immune system attacking artery walls--common in elderly, can cause sudden blindness if untreated.

Term	Definition	Analogy / Example
Hypothenar Hammer Syndrome	Damage to the ulnar artery from repetitive trauma to the palm, causing aneurysm or occlusion with potential digital emboli.	Like constantly hitting a pipe until it breaks--repetitive palm trauma damages the ulnar artery.
Popliteal Entrapment Syndrome	Compression of the popliteal artery by abnormal muscle or fibrous bands, typically in young athletes. May cause claudication or arterial damage.	Like muscles squeezing the artery too tight--anatomical abnormality compresses the vessel behind the knee.
Radiation-Induced Arteritis	Arterial damage caused by radiation therapy, leading to accelerated atherosclerosis, fibrosis, and stenosis.	Like pipes damaged by radiation--radiation therapy can scar and narrow arteries years later.
Takayasu's Arteritis	A rare inflammatory disease affecting the aorta and its major branches, primarily in young Asian women. Causes stenosis, occlusion, or aneurysm.	Like the aorta being attacked from within--an autoimmune disease that narrows or damages major arteries.
Vasculitis	Inflammation of blood vessels that can cause stenosis, occlusion, or aneurysm. Many types exist, including polyarteritis nodosa and Wegener's granulomatosis.	Like the immune system attacking the plumbing--inflammation damages vessel walls.

Quick Reference: ABI Interpretation

ABI Value	Interpretation
>1.3	Abnormal (calcification, incompressible)
1.0 - 1.3	Normal
0.9 - 1.0	Borderline
0.7 - 0.9	Mild disease
0.4 - 0.7	Moderate disease
<0.4	Severe disease / Critical ischemia

Quick Reference: Lower Extremity Stenosis Criteria

Stenosis	Velocity Ratio (Vr)
Normal / <50%	Vr < 2.0
50-69%	Vr > 2.0
70-99%	Vr > 3.0
Occlusion	No flow

Quick Reference: Bypass Graft Surveillance Schedule

Time Post-Op	Frequency
0-3 months	Once (first surveillance)
3-12 months	Every 3 months

Time Post-Op	Frequency
12-24 months	Every 6 months
>24 months	Annually

Quick Reference: Graft Stenosis Criteria

Finding	Suggests Significant Stenosis
PSV	>300 cm/s
Velocity Ratio	>3.5
ABI drop	>0.15

This vocabulary reference covers Part 3: Peripheral Arterial (Chapters 8-13) from “Diagnostic Medical Sonography: The Vascular System” by Ann Marie Kupinski, 3rd Edition.

Dr. Alice Matthews · amatthews@concorde.edu · alice@deepneuro.ai · Concorde Career College Portland