

Peripheral Arterial Studies-Lower

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- No disclosures

Peripheral Arterial Studies-Lower

- Physiologic testing
- Duplex ultrasonography
- Physiologic testing includes:
 - 1) Segmental pressure measurements
 - 2) Pulse volume recordings (PVRs)
 - 3) Continuous wave (CW) Doppler
 - 4) Plethysmography
- Duplex ultrasonography includes:
 - 1) Gray-scale and doppler imaging
 - 2) Spectral and color flow Doppler



Peripheral Arterial Studies-Lower

- An ultrasound machine should be equipped with vascular software and two transducers/probes, at least 5- to 12- MHz transducers for the neck and extremities and 2.25- to 3.5-MHz transducers for the abdomen



Indirect Tests

- Ankle-Brachial Index
 - Segmental Pressure Measurements
 - Pulse Volume recordings
 - Doppler Waveforms
 - Treadmill Exercise Testing
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- Useful in screening and demonstrating the level of disease



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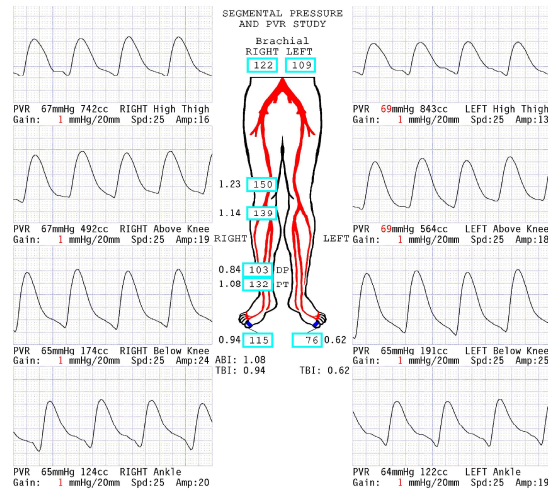
Segmental Pressure Measurements and Pulse Volume Recordings

- Sphygmomanometric cuffs are applied that are appropriately sized to the diameter of the limb segment under study.



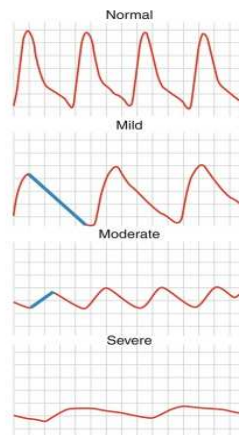
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Pulse Volume Recordings



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Pulse Volume Recordings



Vascular Medicine: A Companion to Braunwald's Heart Disease 3rd edition

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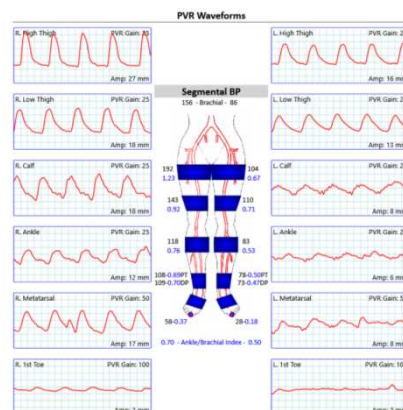
Ankle/Brachial Index	Classification of Atherosclerotic Disease
> 0.91	Normal
0.81 - 0.90	Mild disease
0.41 - 0.80	Moderate disease
< 0.40	Severe disease



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Example 1

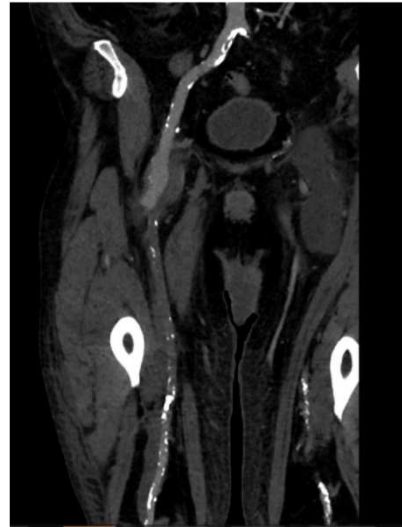
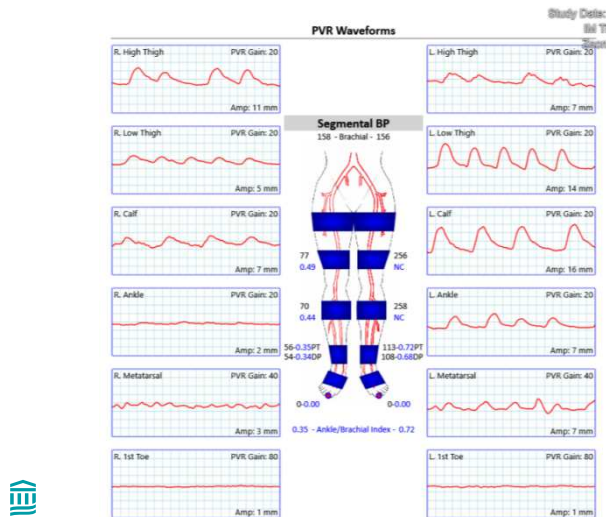
- 62 yo M with h/o smoking, CAD and LLE claudication



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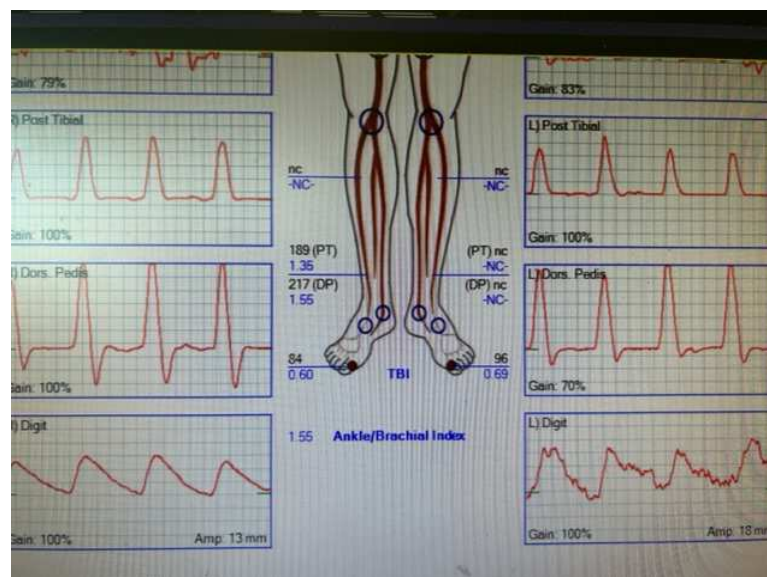
Example 2

- 52 yo M smoker, diabetic with right foot ulceration



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Lower extremity arterial calcification



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Exercise Testing for Peripheral Artery Disease

- The patient is instructed that they will be walking on a motorized treadmill at 12% grade and 2 mph for a period of 5 minutes or until they develop disabling claudication.
- If the ankle pressure demonstrates a drop of >20mmHg then the exercise stress test is considered positive.



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Lower extremity arterial duplex evaluation

- To assess patency of the lower extremity arterial system
- Identify hemodynamic and anatomic abnormalities that may impair lower extremity circulation
- Localize correctable abnormalities



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Lower extremity arterial duplex evaluation

Clinical Indications:

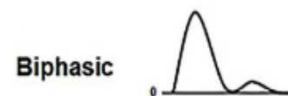
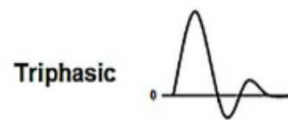
- 1) Abnormal physiologic testing
- 2) Presence of bruit on auscultation or thrill
- 3) New onset claudication, recurrent claudication, rest pain or ulcerations in the lower extremities



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Normal peripheral arterial waveform

- Triphasic waveform (initial forward flow, early diastolic reverse flow and late diastolic forward flow components)
- Narrow systolic window
- Normal velocity range



Rutherford RB (ed)
Vascular Surgery 7th edition

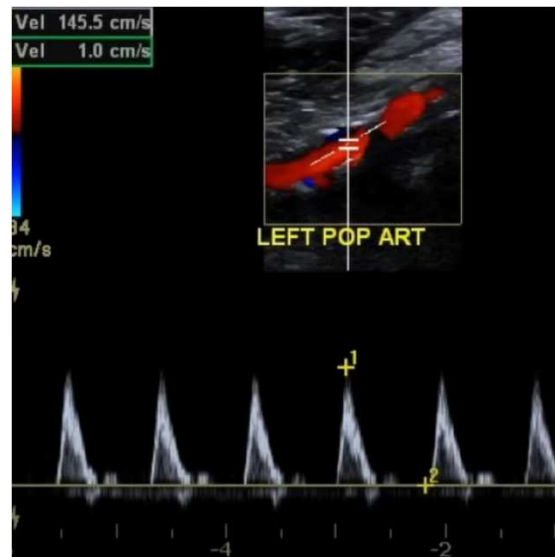
Ziegler et al SVM 2020

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Mild Disease: 1-19% diameter reduction

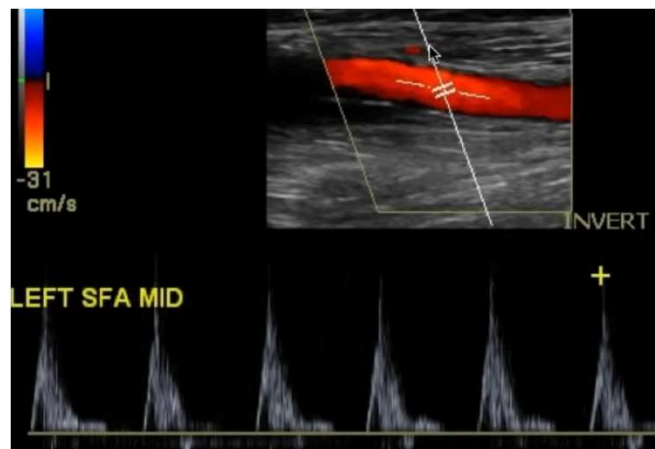
- Mild spectral broadening
- Mild increase in PSV up to 30%
- Normal waveform



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Moderate disease: 20-49% diameter reduction

- Spectral Broadening
- 30-99% increase in PSV
- Ratio <2:1



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Severe disease: 50-99% diameter stenosis

- A. A peak systolic velocity ratio of 2:1 between the site of stenosis and the closest normal segment preceding it represents $\geq 50\%$ stenosis.

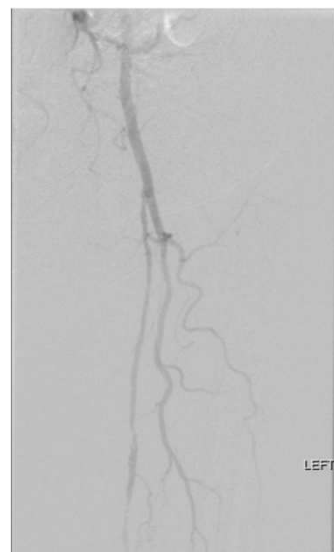
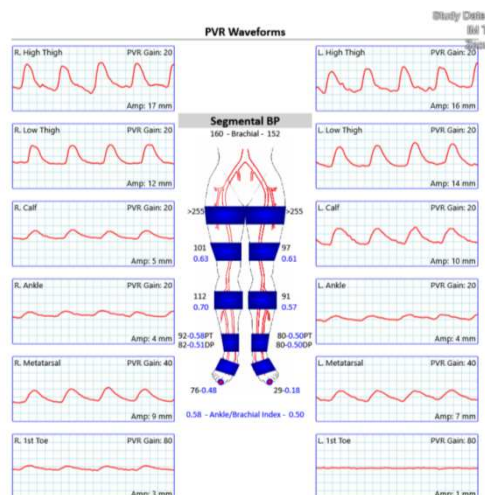


Dua et al. The Massachusetts General Hospital Clinical Approach to Vascular Ultrasound

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Example 4

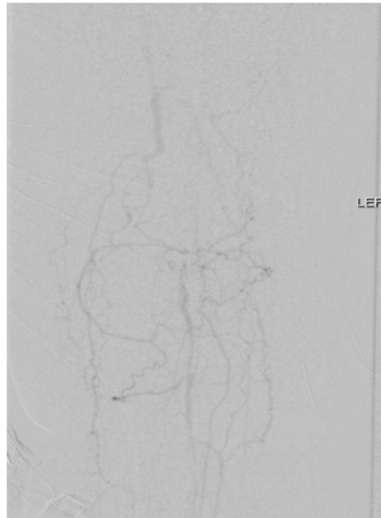
- 92 yo F with DM, hypertension and a left foot wound that is not healing



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Example 4

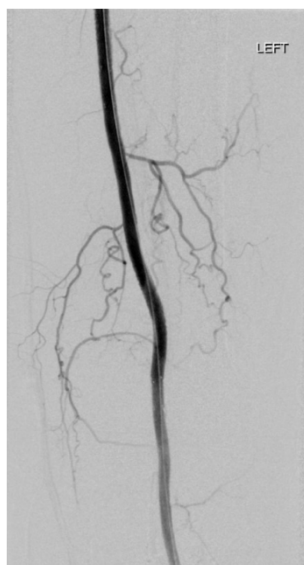
- 92 yo F with DM, hypertension and a left foot wound that is not healing



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Example 4

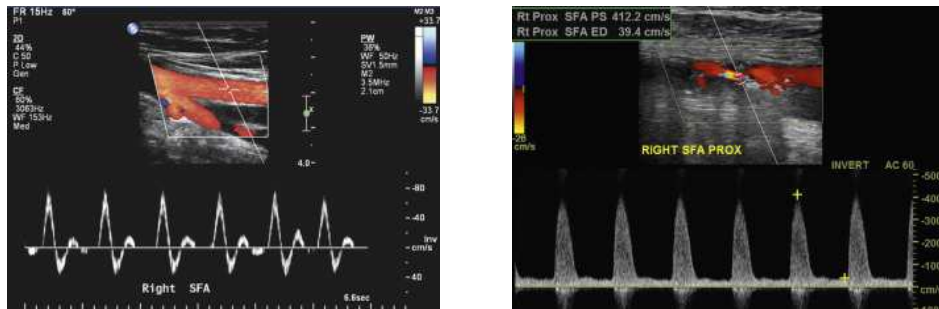
- Status post left superficial femoral/popliteal stenting and anterior tibial artery balloon angioplasty



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Lower extremity arterial duplex evaluation

B. Peak systolic velocity ratio of 3:1 between the site of stenosis and the closest normal segment preceding it represents $\geq 75\%$ stenosis.

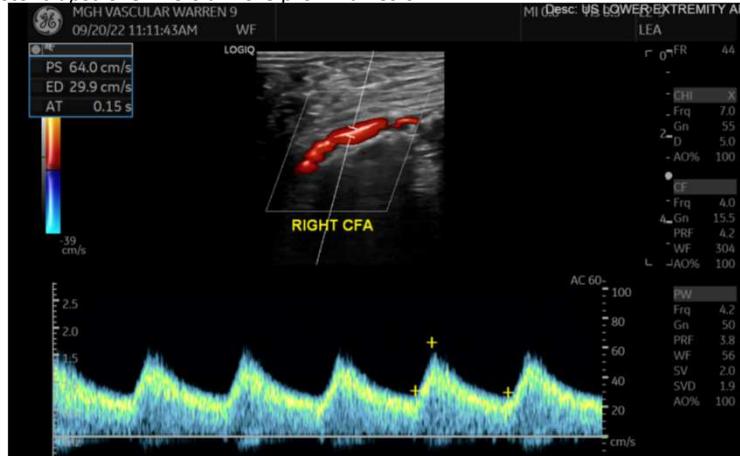


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Lower extremity arterial duplex evaluation

- D. A delay in systolic upstroke infers a more proximal lesion.

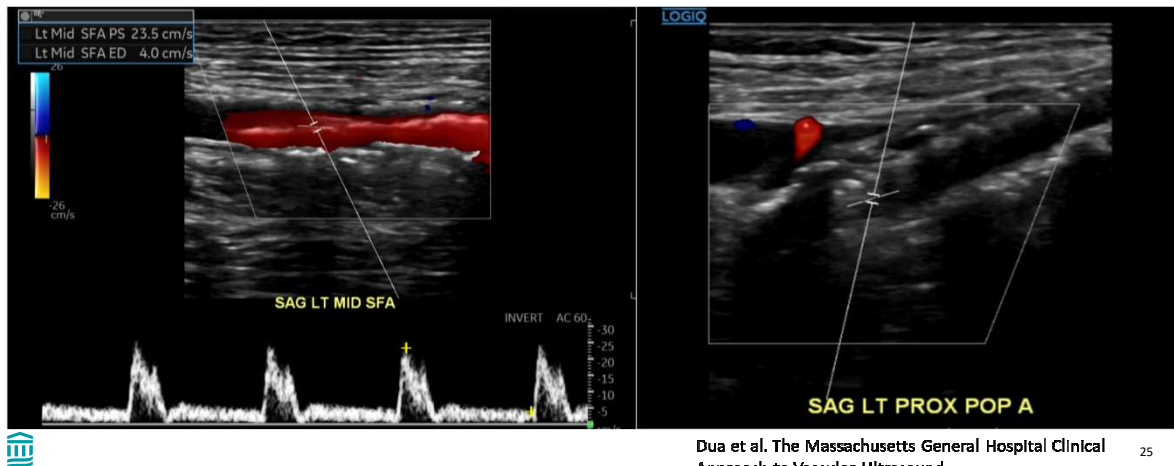


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Lower extremity arterial duplex evaluation

E. A decrease in diastolic flow indicates peripheral resistance and implies a distal lesion.



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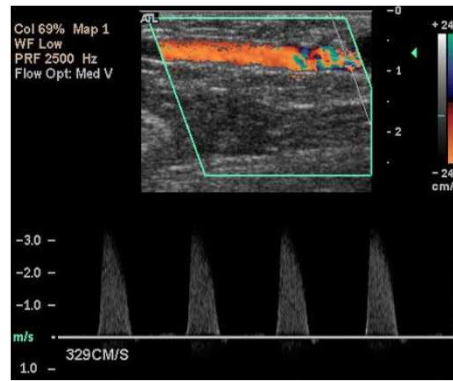
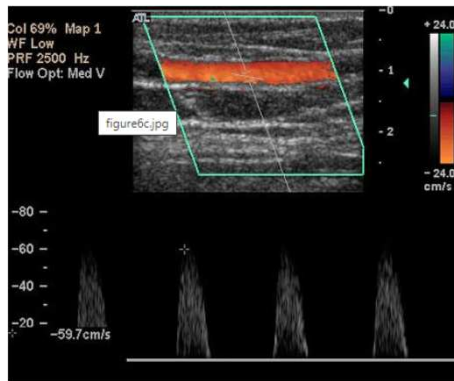
Lower extremity arterial duplex evaluation (bypass graft)

Risk Category	Stenosis	PSV (cm/s)	Velocity Ratio	Graft flow velocity (cm/s)
Highest	>70% stenosis with low graft flow	>300	>3.5	<45
High	>70% stenosis	>300	>3.5	>45
Moderate	50-70% stenosis	180-300	>2.0	>45
Low	<50% stenosis	<180	<2.0	>45

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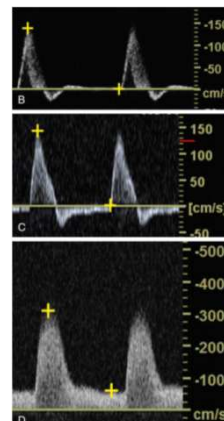
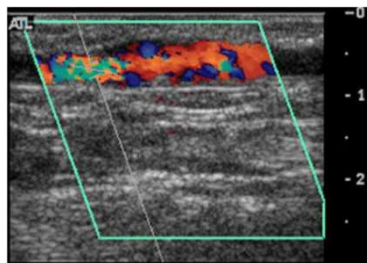
Lower extremity arterial duplex evaluation (bypass graft)



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Other ultrasound indicators of arterial stenosis

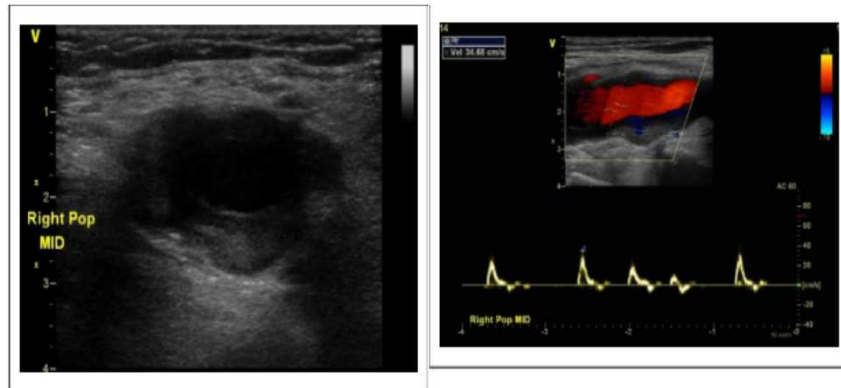
- Mosaic flow pattern
- Spectral broadening
- Irregular and calcified atherosclerotic plaque causing acoustic shadowing



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Lower extremity arterial aneurysm evaluation

- 65 M with h/o AAA and prominent right popliteal pulses
- Right popliteal artery aneurysm 2.8 x 2.0 cm



Bearse et al J Diag Med Son 2014



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Example 5

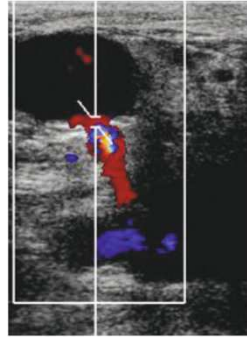
- 73 yo M with h/o severe aortic stenosis undergoes a TAVR in the cardiac catheterization lab, patient is on dual antiplatelet treatment
- 3 hours post procedure the patient has right groin pain, swelling and ecchymosis
- He has palpable distal pulses and his extremity is well perfused
- Physical examination demonstrates a pulsatile right femoral mass
- A right lower extremity arterial duplex is performed



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Right Femoral Pseudoaneurysm

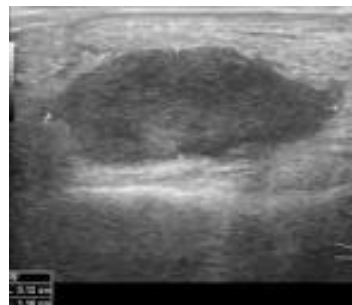
- <1.8 cm observe, repeat ultrasound in 2 weeks
- >3 cm intervention is warranted
- Diameter of neck > 1 cm
- Leak of neck < 0.5 cm



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Hematoma

- Common after trauma, fall or motor vehicle accident
- Mixed-echogenicity mass devoid of color
- Confirmed absence of flow by Doppler spectral sampling



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Thank you

