Imaging and Doppler of Veins: IVC, Hepatic Veins, SVC

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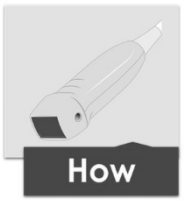
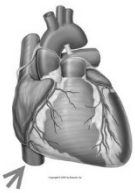
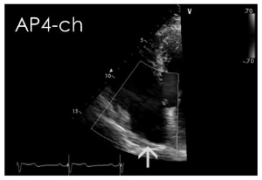
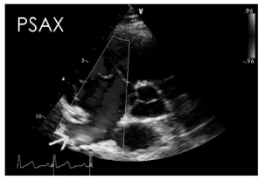

How


What


When

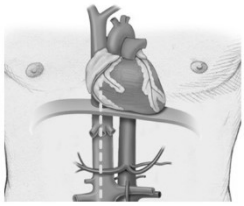

IVC



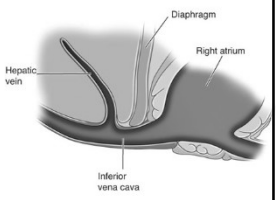


Subcostal View

- Subxiphoid region
- Rotate to 12 o'clock
- Angle towards right
- Long axis of IVC



IVC & Hepatic Vein



Adapted from
https://accessemergencymedicine.mhmedical.com
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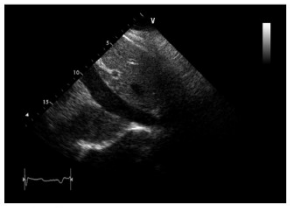
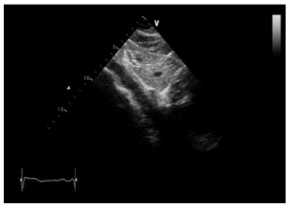
Imaging tip IVC vs. Abdominal Aorta

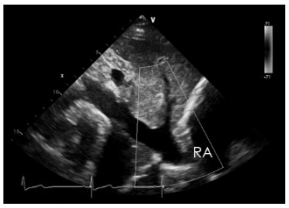


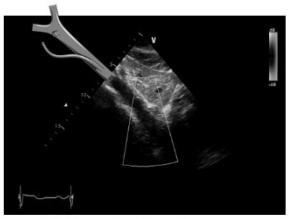


IVC:
- Size varies with breathing
- Courses horizontally

Abdominal aorta:
- Systolic contractions
- Courses vertically

Imaging tip IVC vs. Abdominal Aorta





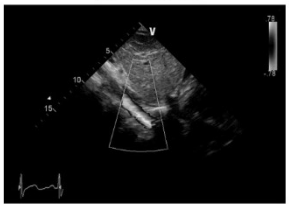
IVC:
- Size varies with breathing
- Courses horizontally
- Blue continuous flow towards RA

Abdominal aorta:
- Systolic contractions
- Courses vertically
- Red systolic flow towards lower limbs

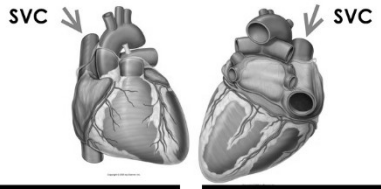
Exceptions

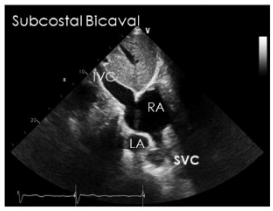
Systolic pulsations of IVC (severe TR)

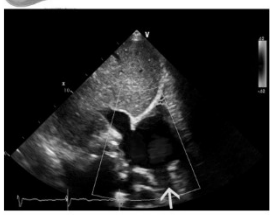
Blue flow in Abdo Ao (severe AR)



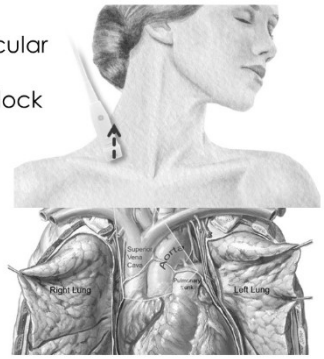
Patel KD, et al. CASE (Phila). 2017 Jun 26;1(3):119-121



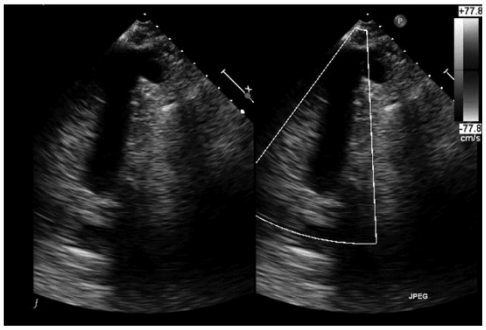




- Right supraclavicular fossa
- Rotate to 12 o'clock
- Steep inferior tilt

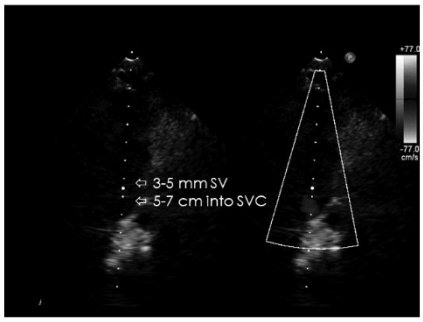


SVC from RSC



PWD Examination IVC/HV

PWD Examination SVC

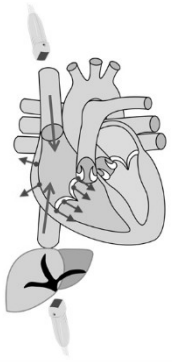


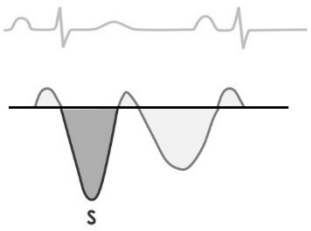
PWD of HV & SVC

Normally:

- **Venous flow:** continuous throughout the cardiac cycle
- **Inspiration:** flow "sucked" into the RA
- **Flow direction:** from subcostal & RSC fossa for HV and SVC into RA is directed away from the transducer
- **Profiles are similar:** 3-4 waveforms

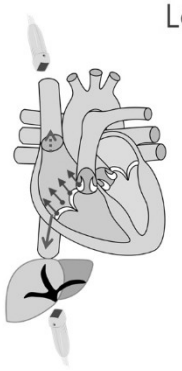
Systole

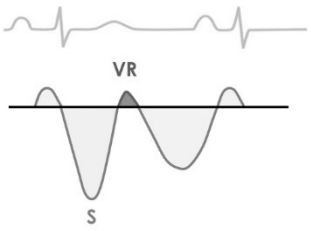




Systolic (S) forward flow due to:
- RA relaxation
- Descent tricuspid annulus
- Slight increase with inspiration

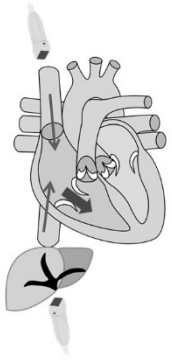
Late Systole

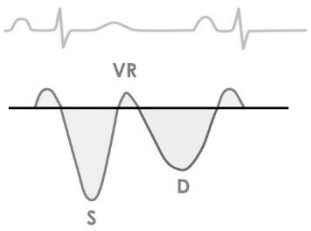




Ventricular reversal (VR) due to:
- Atrial V wave on RA pressure trace
- TV annulus returning to position
- **Absent on SVC trace**

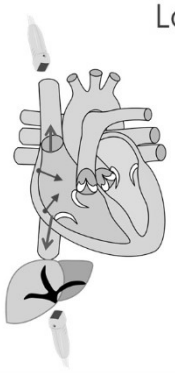
Diastole

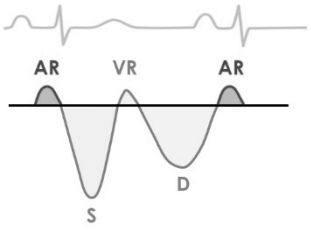




Diastolic (D) forward flow due to:
- Passive RV filling through open TV
- Normally lower than S velocity
- Slight increase with inspiration

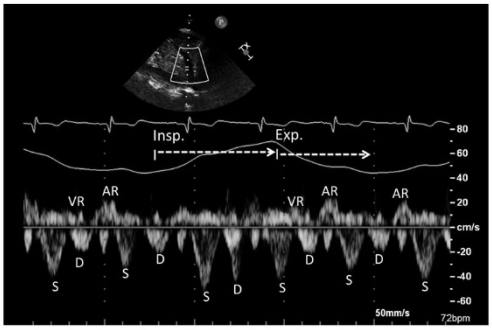
Late Diastole



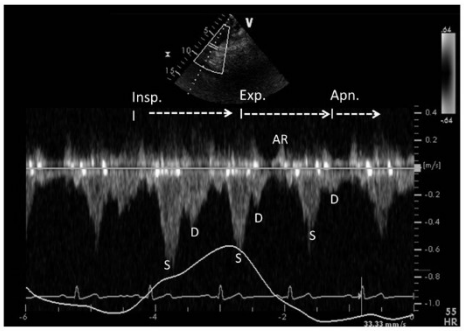


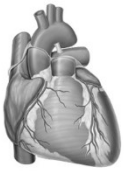
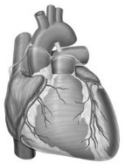
Atrial reversal (AR) due to:
- Atrial contraction
- Very low velocity
- Slight increase with expiration

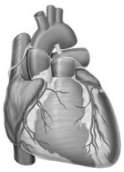
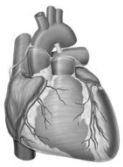
Normal HV Profile



Normal SVC Profile



		
• RAP • Tamponade • Hypovolemia • CHD	• RAP • Tamponade • CP (vs RCM) • TR severity	• RAP • Tamponade • CP (vs COAD) • Persistent LSVC

		
• **RAP** • Tamponade • Hypovolemia • CHD	• RAP • Tamponade • **CP (vs RCM)** • **TR severity**	• RAP • **Tamponade** • CP (vs COAD) • **Persistent LSVC**

IVC & RAP
(spontaneously breathing)

Normal size, > 50% collapse:
- normal RAP (3 mmHg)

Normal size, < 50% collapse:
- intermediate RAP (8 mmHg)

Dilated, > 50% collapse:
- intermediate RAP (8 mmHg)

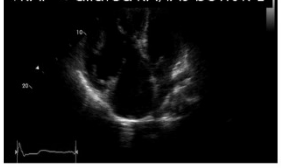
Dilated, no collapse:
- high RAP (>15 mmHg)

Dilated IVC in absence of Elevated RAP

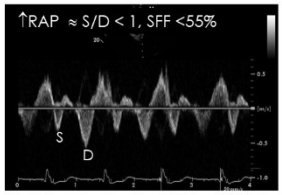
Imaging tip

- Eustachian valve
- Young athlete
- Large BSA
- Mechanical ventilation

↑RAP ≈ dilated RA, IAS bows R-L



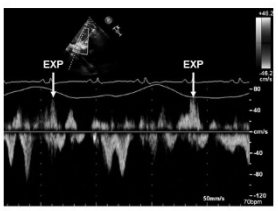
↑RAP ≈ S/D < 1, SFF <55%



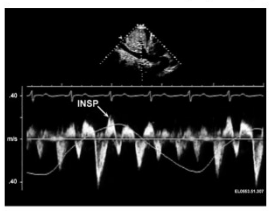
Systolic filling fraction [SFF] = (S/S+D)

HV: CP vs RCM

Constrictive Pericarditis

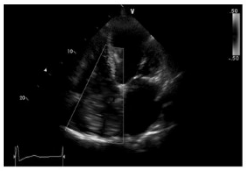


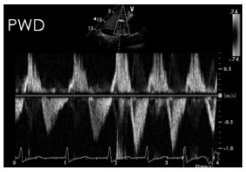
Restrictive Cardiomyopathy

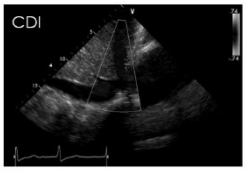


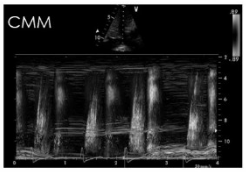
Trace courtesy Jae K. Oh, Mayo Clinic

TR Severity & HV SFR





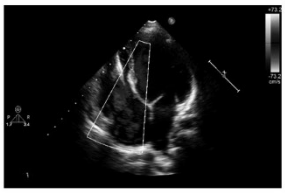


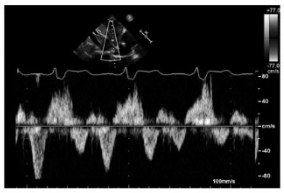


Other Causes of SFR

Imaging tip

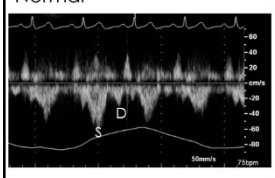
- Abnormal RA compliance
- Junctional rhythm
- AV dissociation
- CHB
- Atrial arrhythmias
- **Ventricular pacing**

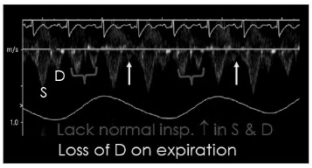


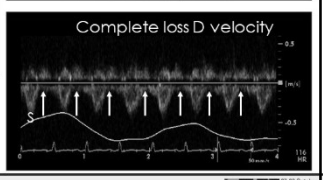


SVC in Tamponade

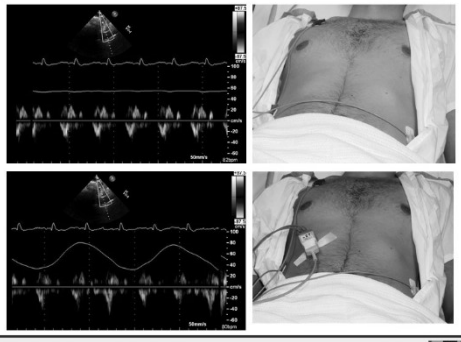
Normal





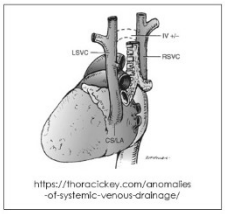


For good respiratory traces

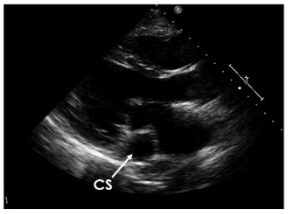


Persistent Left SVC (PLSVC)

- 80-90% cases: PLSVC drains into RA via CS*
- Echo clue to PLSVC is a dilated CS

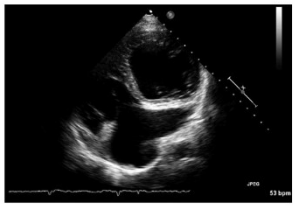


https://thoracickey.com/anomalies-of-systemic-venous-drainage/

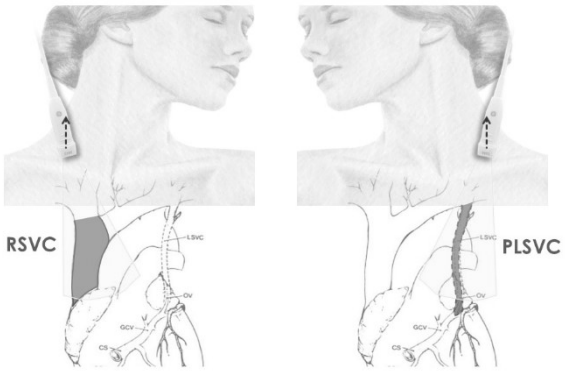


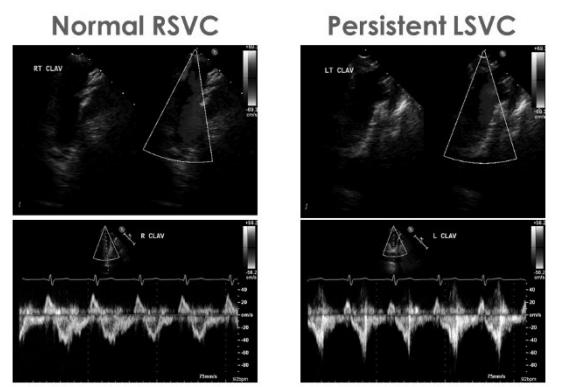
* Goyal SK, et al. Cardiovasc Ultrasound. 2008; 6: 50.

Persistent Left SVC (PLSVC)



- Agitated saline into left antecubital vein
- PLSVC confirmed when CS fills with bubbles prior to RA





References and Further Reading

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