

The pulsed-wave Doppler hepatic venous waves are as follows: A-wave, S-wave, V-wave, D-wave.

Note: A = atrial contraction, S = systole, D = diastole the **V**-wave is between the S and D waves. The **V**-wave is a negative deflection (negative velocity) resulting from an increase in right atrial pressure during **V**enous return. When comparing the pulsed wave Doppler hepatic venous flow profile to the corresponding right atrial pressure (RAP) tracing, you will notice that anything that increases RA pressure will decrease flow through the hepatic veins towards the RA. Conversely, anything that decreases RAP will increase flow towards the RA. Below is a list of the RA pressure tracing components along with its corresponding hepatic venous flow (HV) wave:

RAP A-wave → HV A-wave

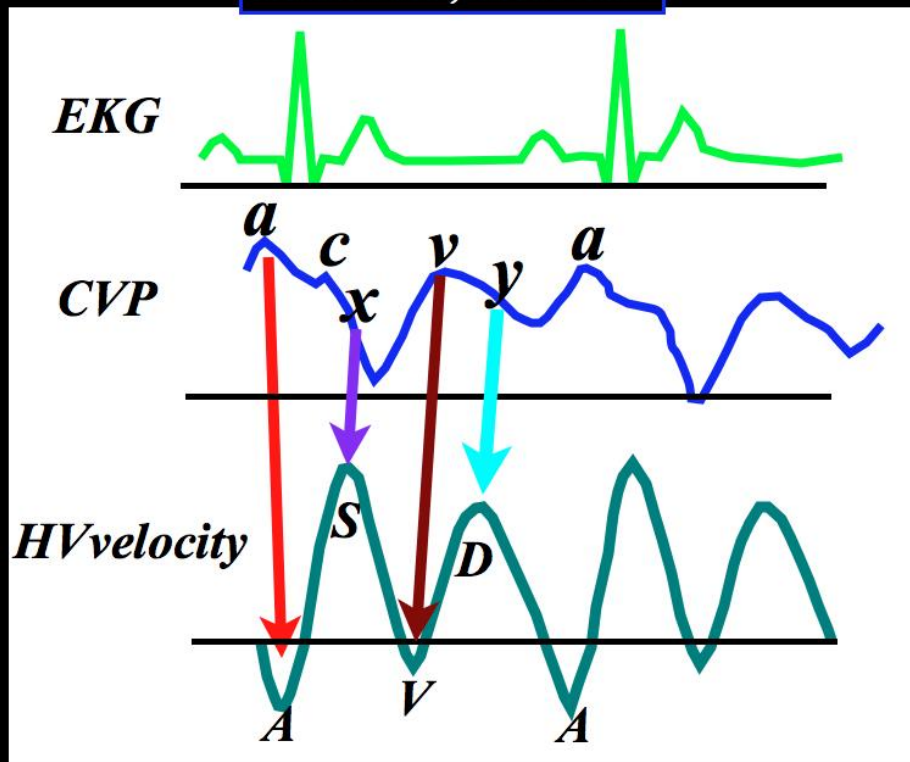
RAP x-descent → HV S-wave

RAP V-wave → HV V-wave

RAP Y-descent → HV D-wave

Notice as RAP increases, flow into the RA decreases, and in some cases flow reverses (A wave and V-Wave). Below is a figure illustrating this relationship:

**Guidelines for Assessment of
the Right Heart
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The following cardiac disorders result in changes to the hepatic venous flow pulsed-wave Doppler spectral profile:

- Elevated RAP from decreased RV compliance: Hepatic venous $S < D$. This may be seen with pseudonormal or restrictive diastolic dysfunction.
- TR → blunting or reversal of S wave (reversal → severe TR)
- Large HV A-wave is seen with: TS and/or complete heart block (CHB).

The explanation for the large A-wave with TS and CHB is as follows: There are no valves in the hepatic veins, so when the right atrium contracts there will be forward flow into the right ventricle and retrograde flow into the hepatic veins creating the hepatic venous A-wave (HV A-wave = Atrial Reversal wave = AR wave). With TS there is obstruction to forward flow through the stenotic tricuspid valve and therefore a predominance of retrograde hepatic venous flow with atrial contraction. CHB can be thought of as the worst TS ever, as the valve is closed when atrial contraction occurs resulting in a large HV A-wave from retrograde pulmonary venous flow.

Abbreviations: RA = right atrium, RAP = right atrial pressure, TS = tricuspid stenosis, TR = tricuspid regurgitation = tricuspid insufficiency, CHB = complete heart block, HV = hepatic venous, AR = atrial reversal.

References:

1. Rudski LG, Lai WW, Afilalo J, Hua L, Handschumacher MD, Chandrasekaran K, Solomon SD, Louie EK, Schiller NB: Guidelines for the echocardiographic assessment of the right heart in adults: a report from the American Society of Echocardiography endorsed by the European Association of Echocardiography, a registered branch of the European Society of Cardiology, and the Canadian Society of Echocardiography. J Am Soc Echocardiogr; 23: 685-713; quiz 786-8
2. Mathew, JP et. al. Clinical Manual and Review of TEE, 2nd ed. McGraw-Hill 2010:289