Triplane imaging

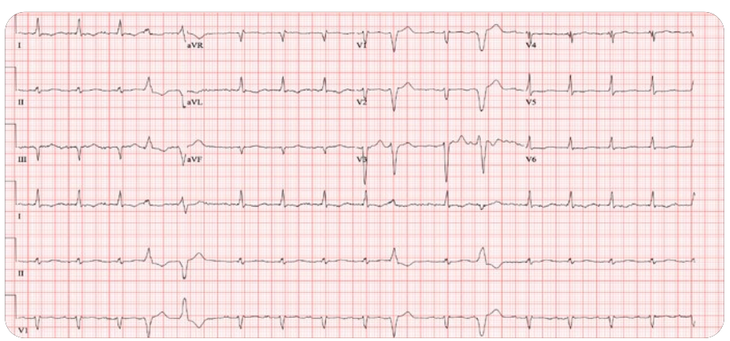
Courtesy of Dr. Jordan Strom, Beth Israel Deaconess Medical Center, U.S.

Patient history/ pathology

The patient is a 65-year old male with Type 2 diabetes mellitus, hypertension, prior cerebrovascular accident with residual right facial droop and mild dysarthria, longstanding persistent atrial fibrillation, chronic kidney disease, and prior seizure who presents with right upper quadrant abdominal pain. Cardiac biomarkers were mildly positive (troponin T 0.8 x 2). The patient's electrocardiogram sinus rhythm with inferior Q-waves suggestive of a prior myocardial infarction. In this setting, an echocardiogram was performed to evaluate for wall motion abnormalities.

Challenges

Challenges in this case included need for full endocardial border visualization, accurate quantification of left ventricular ejection fraction, as well as the need for speckle-tracking strain analysis to fully evaluate for subclinical systolic dysfunction. All was done in a busy clinical echocardiography laboratory with < 1 hour for examination due to the patient showing up 15 minutes late to his scheduled appointment.



ECG demonstrating inferior Q-waves.

System, probe & device used

Using a Vivid E95 echocardiograph with cSound™ and a 6Vc-D probe, we obtained diagnostic quality images. Offline post-processing of raw images was performed using the EchoPAC v206 plug-in through Viewpoint 2.0. The Automated Functional Imaging (AFI) package was used to determine global longitudinal strain as well as biplane left ventricular ejection fraction.

Step-by-step procedure

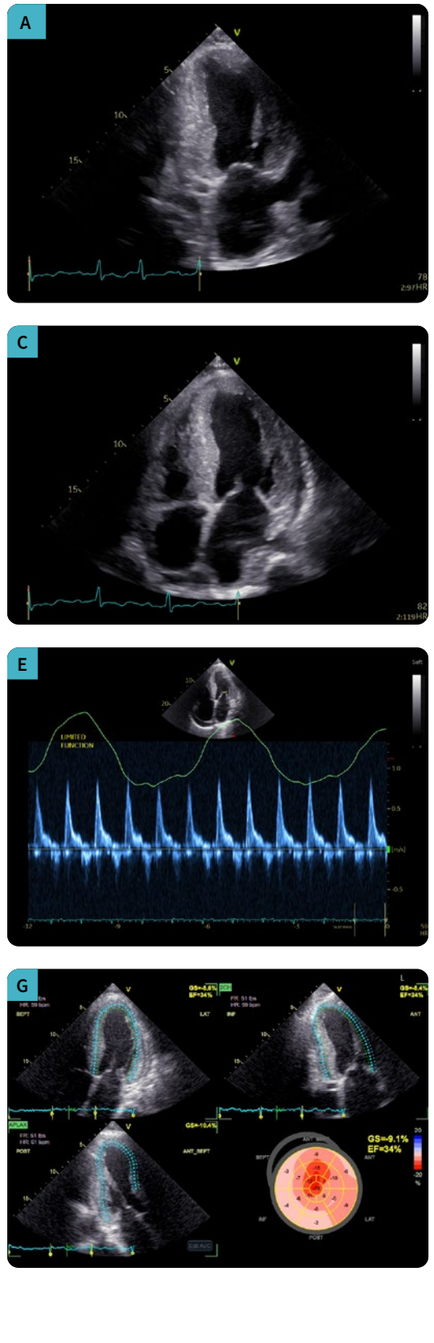
The procedure began with a triplane acquisition from the apical window. Easy AFI LV, auto-detected all relevant views, contoured the regions of interest, and calculated a reduced global longitudinal strain of -9.1% with relative sparing of the apex ("cherry-on-top" sign) and a moderately reduced biplane left ventricular ejection fraction (34%) all in the matter of seconds. Further imaging demonstrated a small pericardial effusion, left ventricular wall thickening, biatrial dilation, and restrictive left ventricular filling with a mitral L-wave and reduced TDI septal e' velocities.

Conclusion

Starting an examination with an apical triplane view can be useful to assess image quality, visualize all cardinal wall segments, a global assessment of left ventricular ejection fraction, and determine global longitudinal strain, all from a single heartbeat (thus reducing variability in strain values due to differences in the heart rate across apical views). The AFI package facilitated rapid assessment of global longitudinal strain and an apical sparing pattern (apical/basal strain ratio = 1.7; normal < 1.0) which was highly suggestive of cardiac amyloidosis, allowing rapid diagnosis and treatment. ECG findings were felt to be due to a pseudo-infarct pattern.

Imaging follow-up

Based on the echocardiogram, there was suspicion for cardiac amyloidosis. The patient was referred for PYP-imaging which was highly suggestive for TTR cardiac amyloidosis. The patient was ultimately started on tafamidis with improvement in symptoms.



A) Apical 2-Chamber View.

B) Apical 3-Chamber View.

C) Apical 4-Chamber View.

D) Parasternal long-axis view demonstrating thickening of the left ventricular walls, valves, left atrial dilation, and a small pericardial effusion.

E) Pulsed wave Doppler sweep at the mitral valve tips demonstrating restrictive filling with a mitral L-wave.

F) TDI of the septal annulus demonstrates a reduced e' velocity of 4 cm/s.

G) Speckle-tracking strain in the AFI package demonstrating a reduced global longitudinal strain with apical sparing, and a reduced biplane left ventricular ejection fraction.

H) A follow-up PYP SPECT scan demonstrating a heart to contralateral ratio of > 1.5, highly suggestive for TTR cardiac amyloidosis.

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