

# Echocardiography and Nuclear Scintigraphy in the Diagnosis of Transthyretin Cardiac Amyloidosis

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**A** 94-year-old man presented with worsening dyspnea and orthopnea of 4 days' duration. Physical examination revealed jugular venous distention, diminished breath sounds, and pitting edema of the lower extremities. An electrocardiogram (Fig. 1) revealed conduction abnormalities, low QRS voltage, and an old myocardial infarction; a chest radiograph (Fig. 2) revealed cardiomegaly. These findings prompted us to obtain speckle-tracking echocardiograms (Figs. 3A–B), which



**Fig. 1** Electrocardiogram shows sinus rhythm, first-degree atrioventricular block, right bundle branch block, evidence of an old inferior myocardial infarction, and low precordial QRS voltage.



**Fig. 2** Chest radiograph shows a markedly enlarged cardiac silhouette with bulging left and right atrial contours.

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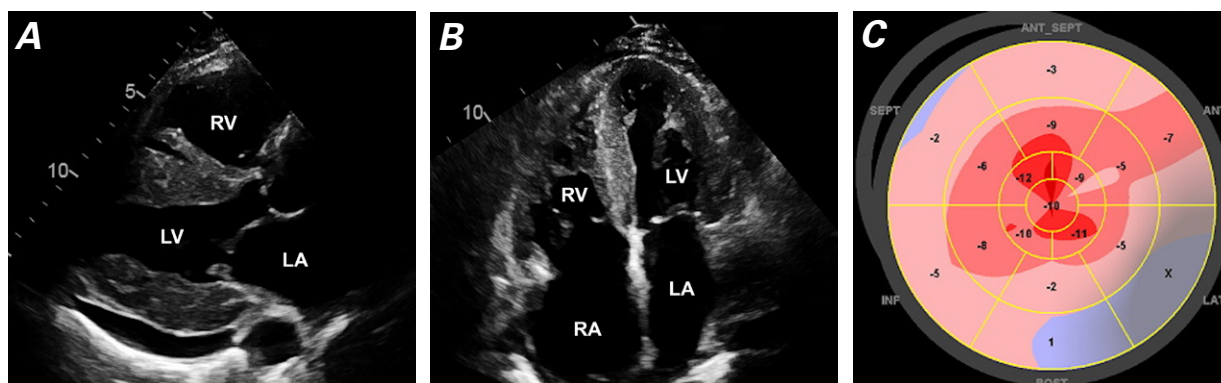
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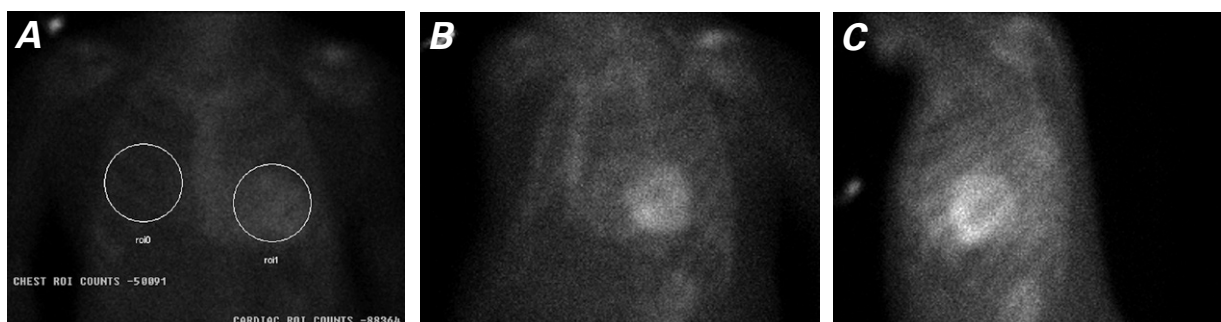
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**Fig. 3** Speckle-tracking echocardiograms obtained in the **A**) parasternal long-axis and **B**) apical 4-chamber views show speckling of severely thickened myocardium, normal left ventricular (LV) size, biatrial enlargement, and posterior pericardial effusion. **C**) A strain imaging map reveals the classic “cherry on top” pattern of apical sparing, which is typical of cardiac amyloidosis.

ANT = anterior; ANT\_SEPT = anterosseptal; INF = inferior; LA = left atrium; LAT = lateral; POST = posterior; RA = right atrium; RV = right ventricle; SEPT = septal



**Fig. 4** Nuclear scintigrams obtained in the **A**) anteroposterior, **B**) left anterior oblique, and **C**) left lateral views, 4 hours after injection of 21.4 mCi of technetium-99m pyrophosphate, show greater uptake of the radiotracer in the heart (roi1) than in the contralateral lung (roi0) (ratio, 1.76). The 4-hour delay in imaging was due to renal insufficiency.

ROI = region of interest

revealed speckling of thickened myocardium, normal left ventricular (LV) size, biatrial enlargement, and a plethoric inferior vena cava. A strain imaging map (Fig. 3C) revealed relative apical sparing of LV function. Together, these findings raised suspicion of a restrictive cardiomyopathy, specifically amyloidosis. To confirm this diagnosis, we performed technetium-99m pyrophosphate (PYP) nuclear scintigraphy and serum immunoassays. The PYP nuclear scintigram was strongly positive for cardiac uptake of the radiotracer (Fig. 4), thus establishing the diagnosis of transthyretin cardiac amyloidosis. Serum protein electrophoresis (SPEP) revealed no monoclonal protein, and the serum free light chain (SFLC) ratio was normal.

### Comment

Identifying a specific cause of heart failure is important for both prognosis and treatment.<sup>1</sup> An astute clinician recognizes the clinical, electrocardiographic, and echocardiographic signs of amyloidosis and performs

other tests to confirm the diagnosis. Echocardiographic findings suggestive of amyloidosis include an LV wall thickness greater than 1.5 cm (also seen in hypertrophic cardiomyopathy but otherwise unusual, even in the presence of hypertension and aortic stenosis) and a characteristic “cherry on top” strain pattern (readily confirmed with current technology and more diagnostically sensitive and specific than wall thickness and speckling).<sup>2</sup> Advanced testing can include cardiac magnetic resonance (CMR) imaging, nuclear scintigraphy, serum immunoassays, and endomyocardial biopsy. Although CMR is both sensitive and specific for cardiac amyloidosis, it cannot reliably distinguish between the light-chain and transthyretin subtypes.<sup>3</sup> On the other hand, the combination of PYP nuclear scintigraphy,<sup>4</sup> SPEP, and SFLC<sup>5</sup> testing can distinguish between them, which is especially important in guiding treatment. Endomyocardial biopsy is reserved for cases in which noninvasive test results are inconclusive.

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