Indonesian Journal of Cardiology
Indonesian J Cardiol • Vol. 47 • 2026
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2076

Case Report

Unveiling Cardiac Amyloidosis: A Case Report Exploring The Role of Multimodal Imaging

Yosua Cristo Reynaldo Napitupulu[1], Hilfan Ade Putra Lubis[1], Cut Aryfa Andra[1], Anggia Chairuddin Lubis[1]

Abstract

Background: Cardiac Amyloidosis (CA) is a condition caused by the deposition of amyloid fibrils in the heart. The diagnosis of CA can be challenging and requires a high index of suspicion. Multimodality imaging, including echocardiography and Cardiac Magnetic Resonance (CMR), plays a crucial role in the diagnosis, evaluation, and management of CA. This case report presents a patient with suspected CA and highlights the role of multimodality imaging in diagnosis.

Case Illustration: A 49-year-old male with previously diagnosed hypertension came with progressive dyspnea, fatigue, and lower extremity edema. Initial clinical suspicion for Heart Failure with preserved Ejection Fraction (HFpEF) with increased thickness in the Interventricular Septum (IVS) was raised. Electrocardiography showed Left Ventricular Hypertrophy (LVH). Further diagnostic work-up revealed evidence of CA. Both multimodal imaging, including echocardiography and cardiac Magnetic Resonance Imaging (MRI), were used to confirm the diagnosis.

The patient underwent comprehensive multimodal imaging, which included: 1) Echocardiography showed LVH with diastolic dysfunction (E' <5), myocardial sparkling, and cherry on top appearance in Global Longitudinal Strain (GLS) analysis with reduced GLS, suggestive of amyloid infiltration; 2) Cardiac MRI demonstrated diffuse subendocardial Late Gadolinium Enhancement (LGE) patterns typical of amyloid deposition.

The combination of imaging findings led to the diagnosis of CA. There was no Endomyocardial Biopsy (EMB) needed to reveal amyloid deposits. The patient was started on symptomatic management for heart failure.

Conclusions: This case highlights the importance of multimodality imaging in the diagnosis of CA. Echocardiography, CMR, and nuclear imaging are complementary tools that enhance diagnostic accuracy and guide treatment decisions. Early recognition of CA is crucial for appropriate management and better prognosis.

Keywords: Amyloidosis, Heart Failure, Infiltrative Disease, CMR

[1]Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia.

Correspondence:
Hilfan Ade Putra Lubis,

Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia.

Email: hilfan27@gmail.com

Introduction

Cardiac Amyloidosis (CA) is recognized as a cause of restrictive cardiomyopathy and heart failure due to abundant deposits of amyloid fibrils in cardiac tissue. There are many proteins known to cause amyloidosis, such as AL Amyloidosis, Transthyretin Amyloidosis (ATTR)wt (senile systemic amyloidosis), ATTRm (familial amyloidosis), and secondary amyloidosis. Once considered rare, advances in imaging techniques have revealed a significantly higher prevalence, particularly among older adults and patients previously labeled as having hypertensive, hypertrophic, or "diastolic" cardiomyopathy. With the emergence of disease-modifying therapies—especially for ATTR—timely and accurate diagnosis is critical to improving outcomes and preventing irreversible cardiac dysfunction.[1-2]

Historically, Endomyocardial Biopsy (EMB) was the gold standard for diagnosis; however, its invasive nature, limited availability, and potential procedural risks limit routine use, especially in older populations. In addition, focal sampling may lead to false-negative results in cases of patchy myocardial involvement. Over the last decade, multimodality cardiac imaging has revolutionized diagnostic pathways, allowing earlier recognition and precise characterization of the disease without invasive tissue sampling. Echocardiography provides initial structural and functional insights, whereas Cardiac Magnetic Resonance (CMR) with Late Gadolinium Enhancement (LGE) and T1 mapping offers unparalleled capabilities for tissue characterization and quantification of amyloid burden. Moreover, the advent of technetium-labeled bone scintigraphy (e.g., technetium-99m pyrophosphate [99mTc-PYP]) now enables non-biopsy diagnosis of ATTR amyloidosis in the absence of monoclonal protein disorders, representing a major paradigm shift in the diagnostic algorithm.[1,3]

This case report highlights the important role of a multimodal imaging strategy in identifying CA and illustrates how integrated assessment with echocardiography and CMR can guide clinical management. Through this case, we emphasize the superiority of non-invasive imaging pathways in diagnostic accuracy, patient safety, and early disease detection, underscoring their growing importance in the modern evaluation of suspected CA.

Case Illustration

A 49-year-old male with a history of dyspnoea on effort and hypertension presented to our hospital with progressive shortness of breath, lower leg edema, and fatigue for 6 months, with progressively aggravated over 1 month, with a history of acute heart failure. Patient denied symptoms of chest pain. There were no extra-cardiac symptoms. The patient has been working in a water purification factory with positive chemical exposure and has been an active smoker. Patient's Electrocardiography (ECG) shows sinus rhythm with low voltage and q waves in anterior leads. Chest X-ray showed cardiomegaly. scing elit.

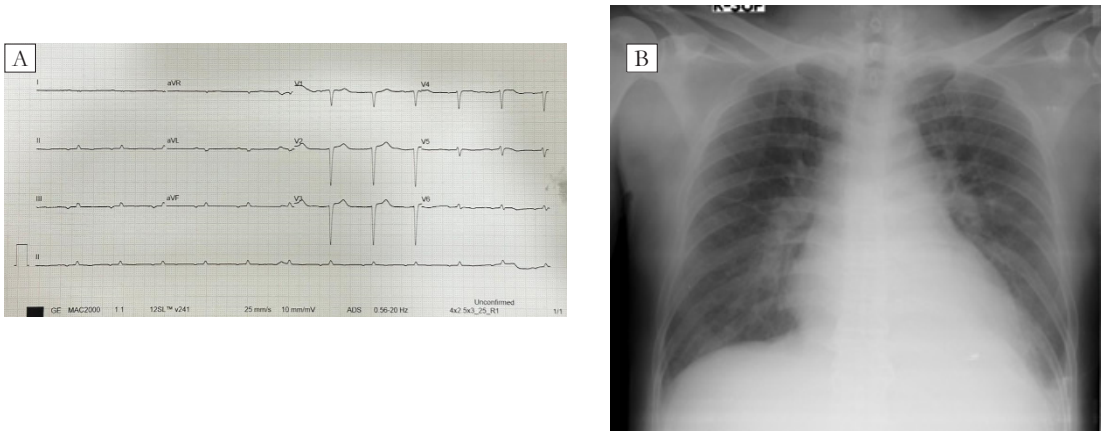

Figure 1. (a) ECG showed a low-voltage QRS complex. (b) Chest X-ray showed cardiomegaly.

From echocardiography (Figure 2), concentric Left Ventricular Hypertrophy (LVH) (IVS Diameter 25mm, Posterior Wall Diameter diastolic (PWDd) 1.5, IVS/PWd ratio 1.67), normal ejection fraction, and normal wall kinetics were found. Due to discordance between ECG voltage and myocardial wall thickness, tissue doppler showed decreased values of e' lateral and septal (at 4.5 cm/s and 5.5cm/s respectively) with E/a 1.3 showing a restrictive pattern. CA was suspected, with a cherry-on-top appearance in the global strain analysis. The patient was scheduled to undergo EMB and gadolinium CMR, but refused EMB.

From Native T1 (pre-contrast) CMR, Cine function view of Four Chamber and Three chamber showed concentric hypertrophy with preserved ejection fraction without segmental abnormalities (see Figure 3). From the LGE Short-Axis view (see Figure 4a), some sequences revealed diffuse, circumferential subendocardial enhancement involving nearly all Left Ventricular (LV) segments, with areas of patchy extension toward the mid-myocardial and transmural regions. Additionally, the study shows difficulty achieving myocardial nulling, in which the myocardium appears brighter than the blood pool—an imaging hallmark attributable to markedly shortened T1 relaxation times due to amyloid infiltration. Global myocardial thickening is also apparent, consistent with an infiltrative cardiomyopathy rather than pressure-overload hypertrophy. Collectively, these CMR characteristics—diffuse subendocardial LGE, abnormal gadolinium kinetics, impaired myocardial nulling, and concentric myocardial thickening—are highly specific for CA.

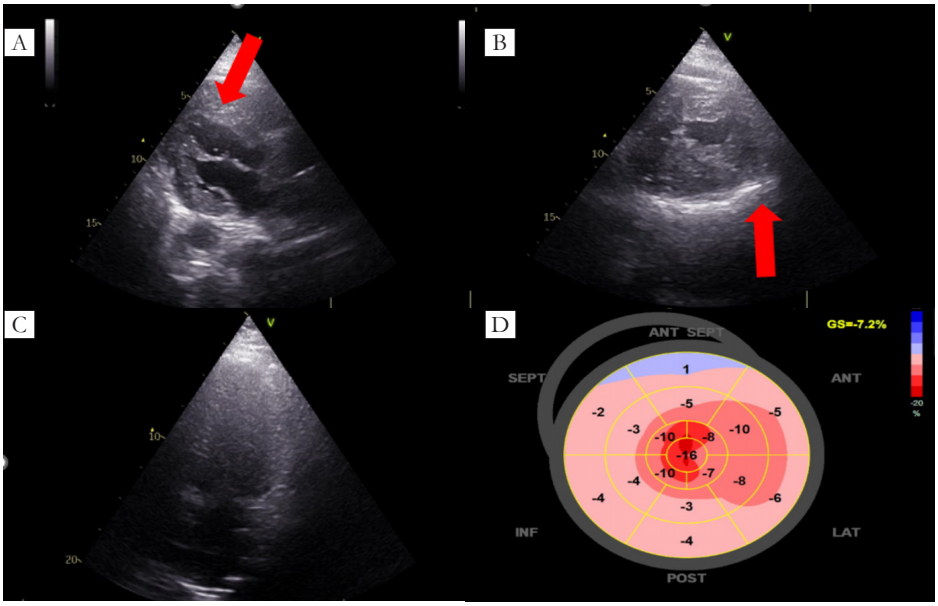

Figure 2. (a) PLAX echocardiography view shows increased myocardial thickness. (b) SAX view shows increased myocardial thickness. (c) A four-chamber view shows increased myocardial thickness. (d) Strain analysis showed an apical-sparring pattern.

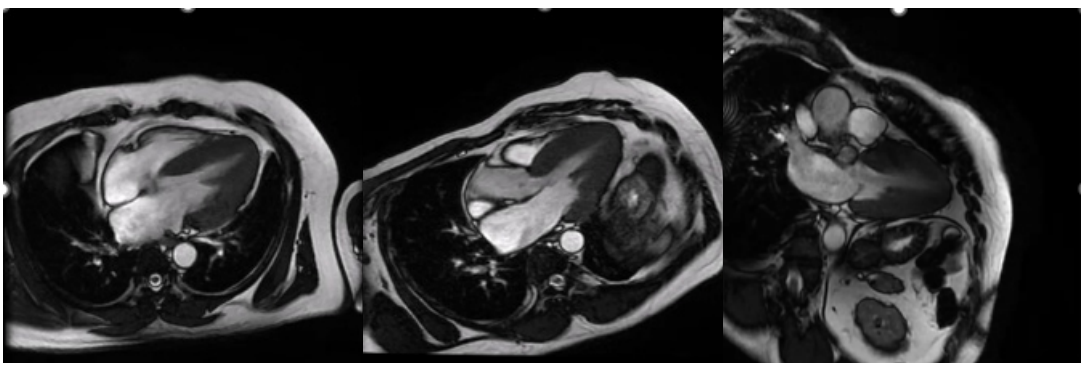

Figure 3. From Native T1 (pre-contrast) CMR, Cine function view of Four Chamber and Three chamber showed concentric hypertrophy with preserved ejection fraction without segmental abnormalities.

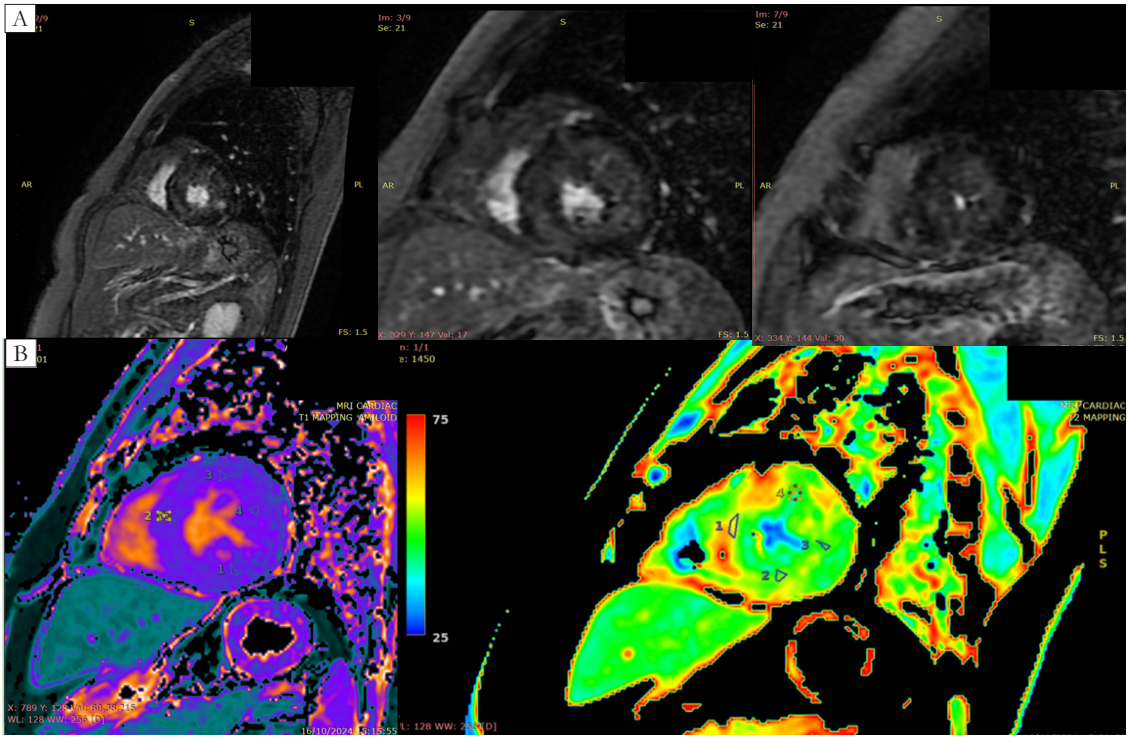

Figure 4. (a) The short-axis MOLLI T1 mapping image demonstrates markedly increased native T1 values across all sampled myocardial segments. (b) The T2 mapping image shows globally increased T2 relaxation times.

CMR with T1 and T2 mapping was performed using parametric mapping sequences with modified Look-Locker Inversion Recovery (MOLLI) for T1 and T2 mapping (Figure 4b). The short-axis MOLLI T1 mapping image demonstrates markedly increased native T1 values across all sampled myocardial segments. The T1 relaxation time increased in the mid-inferior segment (1037ms), mid anteroseptal segments (1030ms), mid anterior (1059ms), and mid anterolateral (1051ms). This diffuse elevation is a hallmark of interstitial expansion, most commonly caused by amyloid fibril deposition. The T2 mapping image shows a globally increased T2 relaxation time (60.8 ms), indicating myocardial edema or inflammation.

When considered together, the pattern of diffuse elevation of both native T1 and T2, especially when combined with LGE and difficulty nulling the myocardium (from your earlier images), is highly characteristic of CA—most commonly AL (light-chain) amyloidosis or ATTR amyloidosis. We performed QALE score quantification by summing the Basal LGE (Score 4), Mid Ventricle LGE (Score 4), Apex LGE (Score 4), and RV LGE (Score 6). The total QALE score was 18, thus suggesting ATTR type rather than AL type CA. After commencing echocardiography and CMR Imaging, a CA diagnosis was made, and the patient was given anti-failure medication. Still, the patient refused scintigraphy, serum electrophoresis, and amyloidosis-specific treatment.

Discussion

CA remains diagnostically challenging due to its heterogeneous presentation and its overlap with other cardiovascular disorders. The patient presented with progressive dyspnoea, fatigue, lower-extremity edema, and a history of hypertension. The first major diagnostic red flag was the discordance between markedly increased LV wall thickness on echocardiography (IVS 25 mm) and low-voltage QRS complexes on ECG, a classical hallmark of infiltrative cardiomyopathy rather than true hypertrophy. Additional findings—restrictive filling pattern, reduced tissue Doppler velocities (e'), and apical sparing on GLS—further strengthened clinical suspicion. These features align with guideline-recognized "red flags," including discordant ECG-echo findings, unexplained HFpEF, increased LV thickness without hypertension severity, and strain patterns with apical sparing, all of which have been strongly associated with amyloid infiltration. CA must be suspected when there is an increase in LV wall thickness ≥ 12mm with one or more red-flag findings. Red flags of CA can be seen in Table 1.[1,4]

Table 1. Red flags of cardiac amyloidosis from clinical and echocardiographic findings.

Clinical Features	Echocardiographic Features
Heart Failure in ≥ 65 years	Bilateral carpal tunnel syndrome
Aortic Stenosis in ≥ 65 years	Subendocardial/ Transmural LGE
Hypotension or normotensive if previously hypertensive	Reduced longitudinal strain with apical sparing
Sensory involvement, autonomic dysfunction	Decreased QRS voltage-to-mass ratio
Peripheral polyneuropathy	Pseudo Q Waves
Proteinuria	AV conduction disease
Skin Bruising	Family history of ATTR
Ruptured Biceps Tendon	Known Multiple Myeloma
Interpretation of the echo findings is classified of: Strongly suggestive: increased LV Wall thickness, increased LV Mass, typical LV longitudinal strain pattern, Mitral Annular TDI <5cm/s, biatrial enlargement, small A wave in sinus rhythm, small pericardial effusion.	

LGE: Late Gadolinium Enhancement; ATTR: Transthyretin Amyloidosis; LV: Left Ventricular; TDI: Tissue Doppler Imaging.

Traditionally, definitive diagnosis was histological confirmation of amyloid deposition through cardiac or extracardiac tissue sampling. This approach, although accurate, is limited by its invasive nature, procedural risks, and sampling error, especially in older populations. The diagnostic algorithm presented in the figure highlights this shift by delineating two diagnostic pathways: invasive biopsy-based confirmation applicable to all amyloid types, and a non-invasive pathway specifically validated for ATTR.[5]

Among the available non-invasive tools, CMR has emerged as a pivotal modality owing to its ability to characterize myocardial tissue composition. CMR provides high-resolution assessment of diffuse interstitial expansion, global subendocardial or transmural LGE, abnormal gadolinium kinetics, and quantitative T1 mapping—patterns that correlate strongly with amyloid infiltration. T2 elevation was not a red-flag finding of CA because it indicates inflammatory and oedematous changes. These characteristic findings yield both high sensitivity and specificity for CA, often surpassing conventional echocardiographic markers. Importantly, CMR detects disease earlier than routine structural imaging and exhibits strong concordance with histopathological burden, making it a powerful surrogate for tissue diagnosis. Recommendation of standardized interpretation for CMR analysis for CA can be seen in Table 2.[6]

Table 2. Recommendation of standardized interpretation for CMR analysis for Cardiac Amyloidosis.

Parameters for acquisition	Notes	Recommendation
LV Function	LV ejection fraction is typically preserved in cardiac amyloidosis.	Required
LV wall thickness	Increased LV wall thickness (increased relative wall thickness >0.42 cm) is a suggestive finding. Concomitant increased right ventricular wall thickness is also suggestive	Required
LV mass	LV mass ≥91 g/m2 for men and ≥78 g/m2 for women.	Required
Atrial Size and Function (Based on Simpson Method)	Increased left atrial volume >163 mL for men and >131 mL for women.	Required
Pericardial effusion	Combinations with other CMR signs are suggestive findings	Required
LGE imaging	Abnormal LGE Pattern • Diffuse LGE • Subendocardial LGE • Patchy LGE • myocardial nulling	Required
Myocardial signal suppression pattern	Myocardium nulls before blood pool on Look Locker, Cine IR, or TI scout sequences.	Required
Native T1 Mapping (pre-contrast)	Abnormal T1 mapping is highly suggestive	Required

LV: Left Ventricular; LGE: Late Gadolinium Enhancement; CMR: Cardiac Magnetic Resonance; IR: Inversion Recovery.

The echocardiographic and CMR findings in this case closely mirror established diagnostic patterns described in ATTR and AL amyloidosis, which are:

1. Diffused subendocardial LGE and abnormal myocardial nulling have been reported as classic CMR markers of amyloid infiltration.
2. Elevation of native T1 indicates expanded interstitial space due to amyloid fibril deposition.
3. Apical-sparing strain pattern is strongly associated with CA, which can raise diagnostic suspicion. However, its diagnostic performance varies across populations and disease stages; thus, it should be viewed as a red flag for clinical suspicion.

The QALE concept has been proposed as a supportive tool for raising clinical suspicion of CA. A QALE score >13 may help raise suspicion of ATTR instead of AL type (82% sensitivity, 76% specificity). However, QALE does not provide definitive amyloid subtyping and cannot discriminate transthyretin (ATTR) from light-chain (AL) amyloidosis without biochemical and scintigraphy correlation. In this case report, the QALE framework was utilized to illustrate the multimodal imaging phenotype rather than to establish a diagnostic classification.[6-7]

Compared with biopsy, CMR avoids complications such as bleeding, arrhythmias, pericardial effusion, or sampling error—issues that can limit diagnostic accuracy, especially given the patchy nature of amyloid infiltration. Furthermore, CMR is able to examine the entire myocardium, whereas biopsy evaluates only a minute sample of tissue. As a result, current consensus statements from both the European Society of Cardiology (ESC) and the American College of Cardiology (ACC) now advocate multimodal imaging as the first approach for suspecting CA.[7] However, definite subtyping of amyloid could not be established by only imaging According to next step diagnostic algorithms, a non-invasive diagnosis of transthyretin (ATTR) CA requires grade 2–3 myocardial uptake on bone scintigraphy in the absence of monoclonal proteins. In this patient, bone scintigraphy was not performed, and serological screening for monoclonal gammopathy (serum free light chains, serum/urine immunofixation) was unavailable due to the patient's refusal, and EMB was declined. Also, several conditions can mimic CA, such as Hypertrophic Cardiomyopathy (HCM), Hypertensive heart disease, Fabry disease, Sarcoidosis, End-stage renal disease, and LVH. The combination of ECG-echo discordance, classic strain pattern, and characteristic CMR findings effectively ruled out these alternatives.[8-9]

Conclusion

This case underscores the indispensable role of multimodal cardiac imaging in the diagnosis of CA. Clinical red flags—especially ECG-echo discordance, restrictive diastolic indices, and apical sparing—prompted further evaluation. The integration of echocardiography and advanced CMR mapping techniques revealed a highly specific pattern of myocardial infiltration. The use of the QALE scoring system further strengthened the phenotypic classification of ATTR type. This case illustrates an imaging-consistent CA phenotype, although a definitive amyloid subtype could not be confirmed due to incomplete diagnostic workup. Early and accurate finding of CA remains critical to guiding therapy and improving patient outcomes.

List of Abbreviations

99mTc-PYP	Technetium-99m Pyrophosphate
ACC	American College of Cardiology
ATTR	Transthyretin Amyloidosis
CA	Cardiac Amyloidosis
CMR	Cardiac Magnetic Resonance
ECG	Electrocardiography
EMB	Endomyocardial Biopsy
ESC	European Society of Cardiology
GLS	Global Longitudinal Strain
HCM	Hypertrophic Cardiomyopathy
HFpEF	Heart Failure with preserved Ejection Fraction
IR	Inversion Recovery
IVS	Interventricular Septum
LGE	Late Gadolinium Enhancement
LV	Left Ventricular
LVH	Left Ventricular Hypertrophy
MOLLI	Modified Look-Locker Inversion Recovery
MRI	Magnetic Resonance Imaging
PWDd	Posterior Wall Diameter diastolic
TDI	Tissue Doppler imaging

Ethical Clearance

Not applicable.

Publication Approval

All authors consent to the publication of this manuscript.

Authors' Contributions

YCRN conceived the case report, collected and interpreted the clinical and imaging data, drafted the manuscript, and revised the manuscript critically for important intellectual content. HAPL contributed to the interpretation of multimodal imaging findings and critically reviewed the manuscript for important intellectual content. CAA contributed to the clinical management of the patient, assisted in data interpretation, and critically revised the manuscript. ACL supervised the study, contributed to the interpretation of clinical and imaging findings, critically revised the manuscript, and approved the final version for publication. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Acknowledgments

None.

Conflict of Interest

The authors declare that they have no competing interests.

Availability of Data and Materials

Not applicable.

Funding

None.

Copyright/Permissions for Figures

Not applicable.

Generative AI and AI-Assisted Technologies in the Writing Process

The authors confirm that no generative AI or AI-assisted technologies were used in the preparation, writing, editing, analysis, interpretation, or revision of this manuscript. All content was developed solely by the authors.

References

1. Arbelo, E. et al. (2023) '2023 ESC Guidelines for the management of cardiomyopathies: Developed by the task force on the management of cardiomyopathies of the European Society of Cardiology (ESC)', European Heart Journal, 44(37), pp. 3503–626.
2. Garcia-Pavia P, Rapezzi C, Adler Y, et al. Diagnosis and treatment of cardiac amyloidosis: a position statement of the ESC Working Group on Myocardial and Pericardial Diseases. Eur Heart J. 2021 Apr 21;42(16):1554-68. doi: 10.1093/eurheartj/ehab072. PMID: 33825853; PMCID: PMC8060056.
3. Dorbala S., Cuddy S., Falk,R., How to Image Cardiac Amyloidosis. JACC: CARDIOVASCULAR IMAGING, VOL. 13, NO. 6, 2020.1369. JUNE 2020:1368–83. doi: 10.1016/j.jcmg.2019.07.015.
4. Kittleson MM, Maurer MS, Ambardekar AV. Cardiac amyloidosis: evolving diagnosis. Circulation. 2020.
5. Phelan D, et al. Apical sparing of longitudinal strain in cardiac amyloidosis. JACC Imaging. 2012.
6. Dorbala S., Ando Y., Bokhasi S, et al. ASNC/AHA/ASE/EANM/HFSA/ISA/SCMR/SNMMI Expert Consensus Recommendations for Multimodality Imaging in Cardiac Amyloidosis. Circ Cardiovasc Imaging. 2021;14:e000029. DOI: 10.1161/HCI.0000000000000029.
7. Dungu JN., Valencia O., Pinney J.H., et al. CMR-Based Differentiation of AL and ATTR Cardiac Amyloidosis. JACC: CARDIOVASCULAR IMAGING, VOL. 7, NO. 2, 2014. http://dx.doi.org/10.1016/j.jcmg.2013.08.015
8. Gillmore, J.D., Maurer, MS., Falk, RH., et al. Nonbiopsy Diagnosis of Cardiac Transthyretin Amyloidosis.
9. Sanchez AC., Murphy R.m Rao S., et al. A Case Report of Cardiac Amyloidosis Highlighting the Importance of Strain Analysis. Hindawi Case Reports in Cardiology. Volume 2021, Article ID 5673364, 5 pages. https://doi.org/10.1155/2021/5673364