Atrial standstill phenomenon in a non-dilated cardiomyopathy phenotype of a genetically confirmed laminopathy

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Laminopathies as hereditary diseases may present different phenotypes. We described a case history of a patient with LMNA laminopathy, without signs of left ventricular (LV) dilatation but with unusual atrial cardiomyopathy and severe right ventricular dilatation.

A 57-year-old man diagnosed with LMNA cardiomyopathy was hospitalized for signs and symptoms of heart failure (HF) progression. His medical history started in 2013 (Figure 1A), when, at age 44, he was diagnosed with atrial fibrillation (AF) and sick sinus syndrome, underwent pulmonary vein isolation connected with left atrial appendage closure, followed by dual chambers pacemaker implantation. Regardless of atrial appendage closure, anticoagulation treatment was maintained. Because of his relatively young age and unexplained conduction disorders, he was referred to genetic counseling, and his genetic test was positive for LMNA laminopathy — variant NM_001282625.1:p.Gln6*/c.16C>T. This mutation was observed in Emery–Dreifuss dystrophy.

In the following years, the conduction disturbances progressed and finally led to a third-degree atrioventricular block. Regardless of the lack of HF symptoms, taking into account the baseline diagnosis and the need for persistent stimulation, the pacemaker was upgraded into a cardiac resynchronization therapy defibrillator (CRT-D).

For the next 6 years, the patient did not experience any deterioration. After that time, during hospitalization for CRT-D battery depletion, the following abnormalities were observed: HF decompensation, AF, increased N-terminal pro-B-type natriuretic peptide concentration (442 pg/ml), worsening of LV ejection fraction (LVEF: 40%, normal LV dimensions, E/e' = 15, left atrium 44 mm) were found. However, detailed ECG re-analysis (Figure 1B) did not confirm AF, but the atrial stimulus with no atrial response was present. The CRT-D control (Figure 1D) showed that there was no atrial electrical activity or conduction, even after increasing the threshold to maximum.

Because of the significant right ventricular enlargement and signs of pulmonary hypertension (PH) (Figure 1C), we performed right heart catheterization and diagnosed post-capillary PH (mean pulmonary pressure: 27 mm Hg, PAWP: 20 mm Hg, pulmonary vascular resistance: 1.9 Wood units). The patient was discharged with typical HF treatment (bisoprolol 5 mg/d) and anticoagulation (dabigatran 2 × 150 mg/d) and directed to strict ambulatory control.

In conclusion, the presented case is an example of a "non-dilated" cardiomyopathy phenotype related to LMNA laminopathy. We should be aware that both AF and conduction disturbances in young patients may be the first presentation of a genetic disorder. Thus, the detailed diagnostic process including genetic tests is necessary and may improve prognosis for these patients. When the non-dilated LV cardiomyopathy phenotype is recognized, it is recommended to test the same gene panel as in dilated cardiomyopathy [1].

Special interest should be paid to the lack of atrial electrical activity — this is a rare phenomenon, called atrial standstill, often connected with laminopathy diagnosis. Furthermore, some authors described this phenomenon with accompanying multiple arterial embolisms [2]. The reason for an elevated risk of arterial embolism is lack of atrial conduction and almost no contractility function. In the case of our patient, when AF

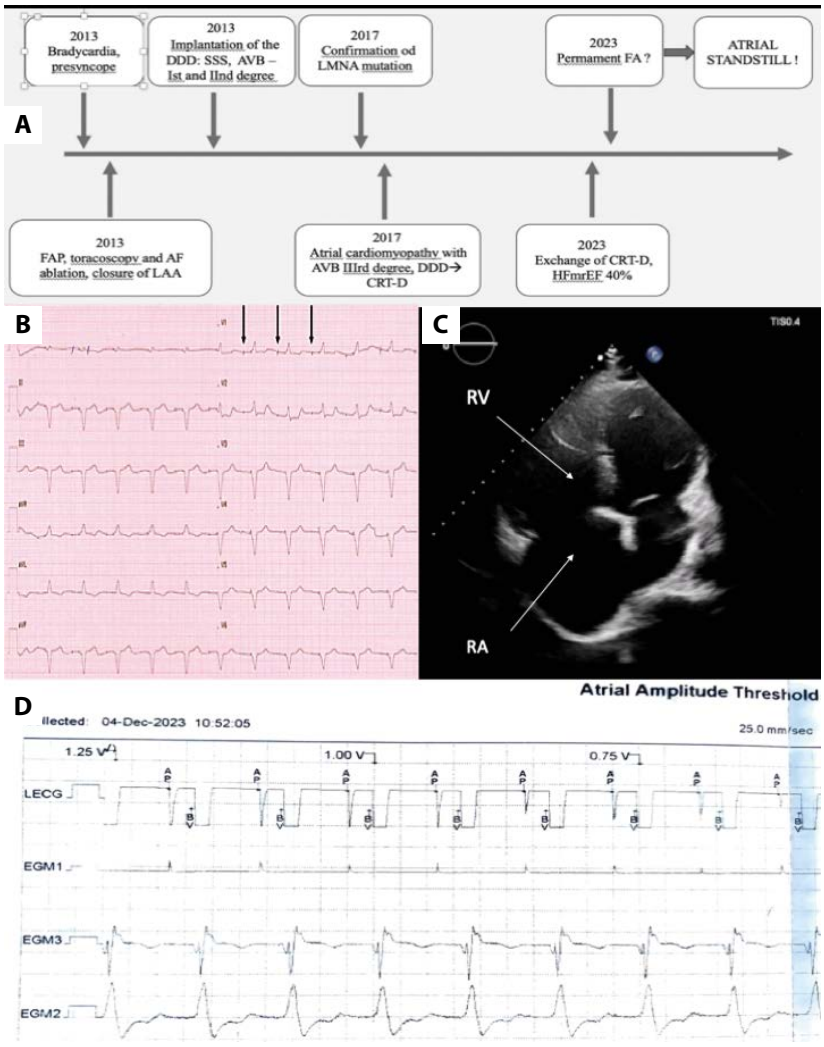

Figure 1. A. Flowchart. **B.** Electrocardiography — atrial stimulation without any response, biventricular stimulation. **C.** Transthoracic echocardiography — 4-chamber view. Enlargement of right ventricle and right atrium. **D.** CRT-D record – atrial stimulus with no response

Abbreviations: AF, atrial fibrillation; CRT-D, cardiac resynchronization therapy defibrillator; LAA, left atrial appendage; RA, right atrium; RV, right ventricle

turned into atrial standstill, an electrophysiology study should have been done.

It has been confirmed [3] that novel pathogenic variants of the *LMNA* gene could manifest as atrial cardiomyopathy. Moreover, it has been shown that LMNA mutations and elevated N-terminal pro B-type natriuretic peptide concentration are connected to increased mortality [4]. Such patients require strict observation and multidirectional therapy. Atrial standstill and postcapillary PH, as a result of HF, with mildly reduced EF, diastolic dysfunction, and atrial remodeling are indirect markers of disease advancement.

Article information

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REFERENCES

1. Biernacka EK, Osadnik T, Bilińska ZT, et al. Genetic testing for inherited cardiovascular diseases. A position statement of the Polish Cardiac Society endorsed by Polish Society of Human Genetics and Cardiovascular Patient Communities. Pol Heart J. 2024; 82(5): 569–593, doi: 10.33963/v.phj.100490, indexed in Pubmed: 38712785.
2. Zhang Y, Zhang Y, Ren M, et al. Atrial standstill associated with lamin A/C mutation: A case report. SAGE Open Med Case Rep. 2023; 11: 2050313X231179810, doi: 10.1177/2050313X231179810, indexed in Pubmed: 37425136.
3. Ning S, Han M, Qiu R, et al. Novel pathogenic variant in LMNA gene identified in a six-generation family causing atrial cardiomyopathy and associated right atrial conduction arrhythmias. Front Cardiovasc Med. 2023; 10: 1109008, doi: 10.3389/fcvm.2023.1109008, indexed in Pubmed: 37465451.
4. Marchel M, Madej-Pilarczyk A, Steckiewicz R, et al. Predictors of mortality and cardiovascular outcomes in Emery-Dreifuss muscular dystrophy in a long-term follow-up. Kardiol Pol. 2021; 79(12): 1335–1342, doi: 10.33963/KP.a2021.0159, indexed in Pubmed: 34783354.