

Apical hypertrophic cardiomyopathy, are low-risk patients really at low risk? A case report

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Background

Hypertrophic cardiomyopathy (HCM) is a genetically determined myocardial disease that constitutes the main cause of sudden cardiac death (SCD) in young athletes. Apical HCM (ApHCM) represents a complex subset of patients, whose risk of SCD seems not negligible. Most applied scores likely underestimate the risk of heart events in this subset of patients.

Case summary

We report the case of a 55-year-old man who was admitted in the emergency department after an episode of aborted sudden death due to ventricular fibrillation. The electrocardiogram made at admission was noted for atrial fibrillation and a new-onset left bundle branch block. Emergency coronary angiography was normal. The electrocardiogram was repeated and showed symmetrical and profound inversion of T waves in the lateral leads. Transthoracic echocardiogram and cardiac magnetic resonance revealed left ventricular apical hypertrophy suggestive of apical variant of HCM. A cardiac defibrillator was implanted for secondary prevention of SCD. After 6 months of follow-up no further rhythmic events were noted.

Discussion

Although low, the risk of SCD of ApHCM patients is not negligible. This case illustrates the need for searching of new predictors of rhythmic risk in patients with ApHCM.

Keywords

Hypertrophic cardiomyopathy • Apical hypertrophic cardiomyopathy • Sudden cardiac death • Implanted cardiac defibrillator • Secondary prevention • Case report

Learning points

- Risk scores for sudden cardiac death (SCD) show that apical hypertrophic cardiomyopathy (ApHCM) patients have an overall low probability of rhythmic events.
- Patients with ApHCM are still at higher risk for cardiac events and attention should be taken to determine the need for a cardiac device.
- Large-scale registries are needed to define variables to segregate patients with ApHCM in risk groups for SCD.

Introduction

Hypertrophic cardiomyopathy (HCM) is a genetically determined myocardial disease that constitutes the main cause of sudden cardiac death (SCD) in young athletes.¹ Its most frequent form derives from heterogenic mutations of sarcomeric proteins.^{1,2} HCM is associated with a variable degree of penetrance and clinical expression.^{1,3} Left ventricular hypertrophy (LVH) with diastolic dysfunction and no other known cause, such as essential hypertension or severe aortic

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stenosis, is the main feature of the disease.^{3,4} Wall thickness of 15 mm or more in any segment of the left ventricle is diagnostic for HCM.^{1,3} Hypertrophic cardiomyopathy is associated with heart failure and increased risk of SCD.^{1,3,4} Hypertrophied myocytes displayed in a core of interstitial fibrosis may justify a substrate for an increased arrhythmic risk, therefore indicating the need for an implantable cardiac defibrillator in some cases.⁵ Left ventricular hypertrophy is not usually present at birth, but instead develops gradually in adolescence and has a progressive behaviour.¹ Several factors establish a higher risk for SCD, namely older age, higher left ventricular maximum thickness, larger left atria, higher left ventricular outflow tract gradient, family history of SCD, and prior history of complex arrhythmic events or cardiac arrest.^{2,6} Apical HCM (ApHCM) represents a complex subset of patients with a non-obstructive variant of HCM, whose risk of SCD seems not negligible.⁷ All patients must undergo risk stratification for SCD, albeit most applied scores likely underestimate the risk of heart events.^{8,9} It is not yet fully established if this lower score represents a lower arrhythmic risk of the variant itself or if it shows a lower capability on predicting the risk of events in these patients.

Timeline

Index cardiac event	Hospital admission after cardiac arrest in ventricular fibrillation. Emergency coronary angiography documents normal epicardial coronary arteries. Intensive care unit admission. Initiates 24-h hypothermia protocol and invasive ventilation.
1 day later	Transthoracic echocardiogram reveals left ventricular apical hypertrophy suggestive of an apical variant of hypertrophic cardiomyopathy.
1 week later	Total suspension of sedation and weaning from invasive ventilation. Cerebral magnetic resonance imaging shows multiple areas of hypoxic lesions and electroencephalogram reveals severe encephalopathy but no patterns consistent with poor prognosis.
1.5 weeks later	Implantable cardioverter-defibrillator implanted for secondary prevention of sudden cardiac death.
6 months later	Follow-up device interrogation shows no further rhythmic events.

Case presentation

A 55-year-old man with past medical history of erectile dysfunction was admitted in the emergency department after an aborted sudden death due to ventricular fibrillation. His wife reported that she woke in the middle of the night and found the patient in gasping breathing with anomalous movements of the limbs. Current medication included irregular intake of avanafil; no previous allergies were described. There was no family history of SCD. The patient was assisted at home and

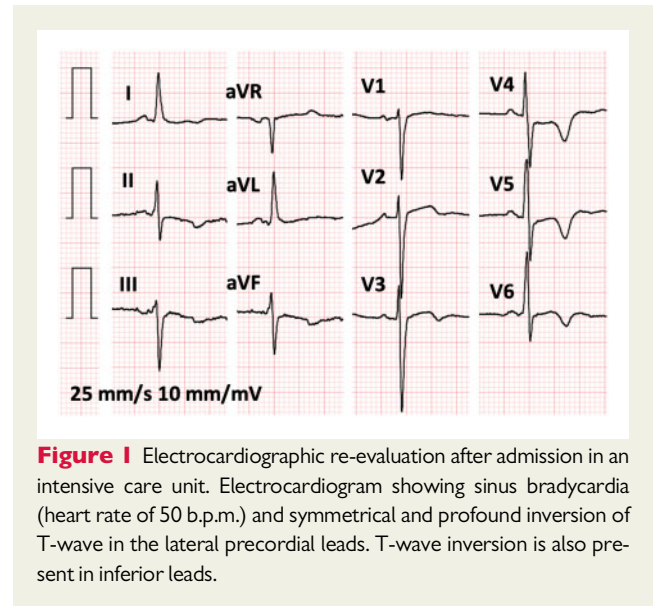


Figure 1 Electrocardiographic re-evaluation after admission in an intensive care unit. Electrocardiogram showing sinus bradycardia (heart rate of 50 b.p.m.) and symmetrical and profound inversion of T-wave in the lateral precordial leads. T-wave inversion is also present in inferior leads.

spontaneous circulation was obtained after six cycles of conventional cardiopulmonary resuscitation. The patient was haemodynamically stable at admission and cardiac and pulmonary auscultation showed no significant changes. Immediate electrocardiogram after recovery showed atrial fibrillation with left bundle branch blockage and apparent concordant ST-segment elevation in the inferior precordial leads. Emergency coronary angiography excluded significant epicardial coronary disease. Cerebral magnetic resonance imaging (MRI) showed multiple areas of encephalomalacia corresponding to hypoxic lesions. Electroencephalogram (EEG) showed severe encephalopathy but excluded any EEG patterns consistent with poor prognosis.

During the stay in the intensive care unit, the patient remained invasively ventilated for 1 week and was submitted to the hypothermia protocol during the first 24 h. Electrocardiographic re-evaluation showed sinus bradycardia (heart rate of 50 b.p.m.) and symmetrical and profound inversion of T wave in the lateral precordial leads (Figure 1). Corrected QT-interval was normal. No other high-risk rhythmic patterns were found. A 24-h Holter monitoring was normal. Transthoracic echocardiogram revealed left ventricular apical hypertrophy (maximum thickness of 17 mm in the distal interventricular septum and apex), suggesting an apical variant of HCM. Cardiac MRI corroborated the apical LVH. Left ventricular mass was normal (71.43 g/m², normal range, NR: 42–78 g/m²) (Figure 2). The global and regional systolic function of both ventricles was normal. No foci of fibrosis or necrosis were found (Table 1).

Clinical and imaging findings were compatible with the diagnosis of ApHCM. Estimated risk of SCD was 2.8% at a 5-year analysis according to the European Society of Cardiology risk score. Due to paroxysmal atrial fibrillation, anticoagulation was initiated. A cardiac defibrillator was implanted for secondary prevention of SCD. Single-chamber implantable cardioverter-defibrillator (ICD) was implanted during hospitalization and the procedure was uneventful. The patient had a favourable neurologic recovery despite maintaining reduced limb strength. After 6 months of follow-up, the patient did not display new rhythmic events or needed further treatment. Genetic testing showed a heterozygous mutation in the MYBPC3 gene.

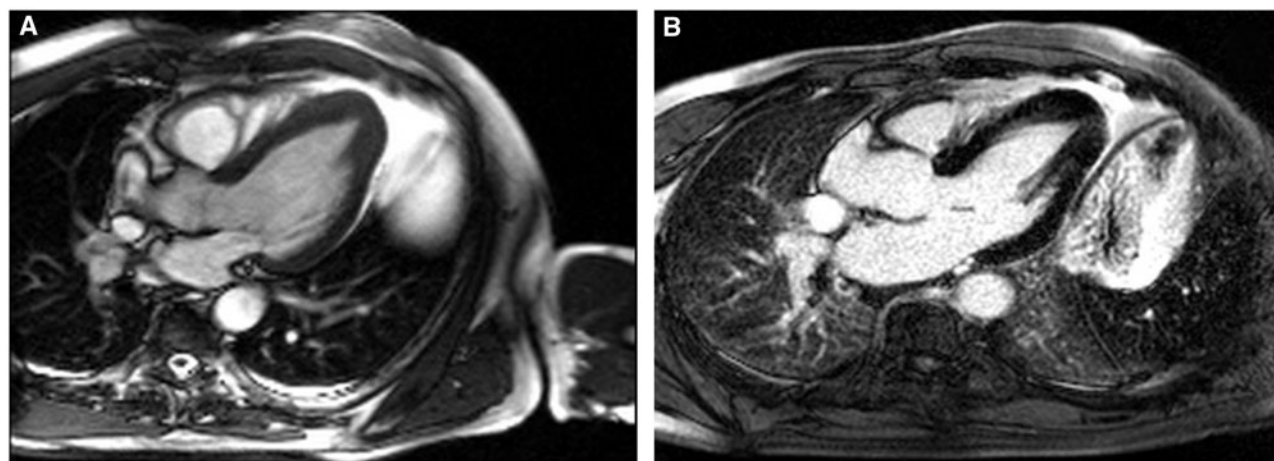


Figure 2 Cardiac magnetic resonance images. (A) Three-chamber cine SSFP showing apical hypertrophy. (B) Three-chamber late gadolinium enhancement showing no fibrosis on the hypertrophied segments.

Table 1 Most relevant findings in imaging studies

Most relevant findings	
Electrocardiogram	Sinus bradycardia (heart rate of 50 b.p.m.) and symmetrical and profound inversion of T wave in the lateral precordial leads.
Transthoracic echocardiogram	Left ventricular apical hypertrophy (maximum thickness of 17 mm in the distal interventricular septum and apex).
Cardiac resonance imaging	Apical left ventricular hypertrophy but normal left ventricular mass. The global and regional systolic function of both ventricles was normal. No foci of fibrosis or necrosis were found.

This case highlights the importance of medical history in predicting SCD, even in patients with HCM with a low estimated SCD risk. New variables must be found to segregate patients with ApHCM in low and high-risk groups for SCD.

Discussion

Several studies conclude that the distribution and mass of LVH may correlate with overall cardiovascular prognosis of HCM patients.^{10,11} Our patient's ventricular mass was normal, which raises questions concerning other determinants of the risk of events. The prognosis of ApHCM, a rare and localized variant of HCM, is relatively good and the risk of cardiovascular mortality is low.⁹ This conclusion may not be entirely true regarding all patients.^{7,10} We currently know that some histopathological features of HCM are also present in ApHCM and may increase the risk of arrhythmic events.⁵ International scoring systems to determine the need for ICD implantation may not

accurately predict the overall prognosis in this variant, leading to a significant underestimation of SCD. Clinical features, such as previous history of syncope and family history, should be carefully collected to estimate the individual risk of SCD and to determine the importance of implanting a cardiac device.^{7,12} Nonetheless, we know that patients with ApHCM are at higher risk for other atrial arrhythmias, such as atrial fibrillation.¹ Loop recorders may help create the correlation between clinical manifestations and rhythm or conduction disturbances.¹

Conclusion

There is a lack of data referring to ApHCM. Most of the patients are asymptomatic and do not require specific therapy.⁹ This case highlights the importance of patient history to adequately evaluate the need for invasive device implantation. Despite being a variant associated with good prognosis, patients are still at higher risk for cardiac events.¹² Scoring systems may be useful to balance overall prognosis but are not flawless and should only serve as a mere initial guidance for implanting a device. New observational studies regarding patients with ApHCM are needed to establish adequate risk stratification.

Lead author biography



Rui Files Flores was born in Amarante, Portugal in 1991. He graduated in Medicine from the Faculty of Medicine, University of Porto in 2015 (MD), completed 1 year of general residency training in 2016 and is currently attending the Cardiology Internship in Hospital of Braga, Braga, Portugal. He is keen in lecturing, research and school teaching. He practices whitewater slalom in his spare time.

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

References

1. Maron BJ. Clinical course and management of hypertrophic cardiomyopathy. *N Engl J Med* 2018;**379**:655–668.
2. Sabater-Molina M, Pérez-Sánchez I, Hernández del Rincón JP, Gimeno JR. Genetics of Hypertrophic cardiomyopathy: a review of current state. *Clin Genet* 2018;**93**:3–14.
3. Maron BJ, Maron MS. Hypertrophic cardiomyopathy. *Lancet* 2013;**381**:242–255.
4. Medical Masterclass contributors JF. Cardiology: hypertrophic cardiomyopathy. *Clin Med (Lond)* 2019;**19**:61–63.
5. Becker RC, Owens AP, Sadayappan S. Tissue-level inflammation and ventricular remodeling in hypertrophic cardiomyopathy. *J Thromb Thrombolysis* 2020;**49**:177–183.
6. Shah M. Hypertrophic cardiomyopathy. *Cardiol Young* 2017;**27**:S25–S30.
7. Gupta T, Paul N, Palaniswamy C, Balasubramaniyam N, Aronow WS, Kolte D et al. Sudden cardiac arrest in a patient with apical hypertrophic cardiomyopathy: case report and a brief review of literature. *Am J Ther* 2016;**23**:e276–e282.
8. Jan MF, Todaro MC, Oreto L, Tajik AJ. Apical hypertrophic cardiomyopathy: present status. *Int J Cardiol* 2016;**222**:745–759.
9. Zimmerman DD, Bransted T, Geiger J. Apical hypertrophic cardiomyopathy: a benign condition? *J Insur Med* 2014;**44**:118–121.
10. Ripoll-Vera T, Alvarez-Rubio J. Hypertrophic cardiomyopathy with little hypertrophy and severe arrhythmia. *Glob Cardiol Sci Pract* 2018;**2018**:26.
11. Khan H, Somarakis K, Thain A, Al-Atta A, Mathew T. 131 Left ventricular indexed mass associated with ventricular arrhythmias in patients with hypertrophic cardiomyopathy—a tertiary centre mri registry. *Heart* 2017;**103**:A98.2–A99.
12. Moore B, Semsarian C, Chan KH, Sy RW. Sudden cardiac death and ventricular arrhythmias in hypertrophic cardiomyopathy. *Heart Lung Circ* 2019;**28**:146–154.