Case Report

Arrhythmogenic right ventricular dysplasia: a rare case report from tribal zone of Central India

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ABSTRACT

Arrhythmogenic Right Ventricular Dysplasia (ARVD) is under diagnosed cardiomyopathy which commonly presents in young adults with ventricular tachycardia or sudden death. It is characterized pathologically by progressive fibrofatty replacement of the myocardium, primarily of the right ventricular free wall. Clinically, it presents with life-threatening malignant ventricular arrhythmias which may lead to sudden death, most often in young people and athletes. ARVD/C is difficult to diagnose, although standardized diagnostic criteria have been proposed, based on the presence of major and minor criteria encompassing electrocardiographic, arrhythmic, morphofunctional, histopathologic, and genetic factors.

Keywords: ARVD arrhythmogenic right ventricular dysplasia, VT ventricular tachycardia, PSVT paroxysmal supra ventricular tachycardia

INTRODUCTION

Arrhythmogenic Right Ventricular (RV) Cardiomyopathy (ARVC) is a cardiomyopathy characterized pathologically by fibrofatty replacement primarily of the RV and clinically by life-threatening ventricular arrhythmias in apparently healthy young people.¹ Arrhythmogenic RV cardiomyopathy is recognized as a cause of sudden death during athletic activity because of its association with ventricular arrhythmias that are provoked by exercise-induced catecholamine discharge.

The clinical presentation varies widely because ARVD/C includes a spectrum of different conditions rather than a single identity. Different pathologic processes may manifest a diversity of symptoms, such as fatigue,

atypical chest pain, syncope, or acute coronary syndrome.²

CASE REPORT

A 30 year male young patient was admitted in department of medicine, intensive cardiac coronary unit at Pt. J. N. M. medical college & Dr B.R.A.M. hospital Raipur with the complain of palpitation, dizziness, dyspnoea on exertion and left sided chest pain, cough with expectorant & distension of abdomen since 8 days. Patient having severe palpitation and dizziness in recent hours.

Patients having similar complain and admitted two time in hospital in last two year and patient had episode of PSVT and had given DC shock and patient on aspirin 75 mg HS, amiodarone 200 mg BD, metoprolol 50 Mg OD.

There is no family history of sudden cardiac death and any heart disease. Patient was formed by occupation and having addiction to tobacco and occasionally alcoholic.

On general examination pulse - 100/min regular, blood pressure was 100/70 mmHg, height - 161 cm, weight 58 kg, BMI - 22.39, Icteric, oedema was present. On systemic examination bilateral crepitation present in infrascapular area, apex beat present on 5th intercostar space on midclavicular lines, S1 soft. S2 present, S3, S4 absent. No thrill, murmur, parasternal heave were absent.

On investigation E.C.G. ST segment elevation seen in lead II, III, aVF, ST segment depression in lead I, aVL, T-wave inversion in V1-V6, epsilon wave in V1-V3. Troponin card test was positive and patient diagnosed as acute inferior wall myocardial infraction with congestive cardiac failure.

Other investigation were random blood sugar was 120 mg/dl, urea 90 mg/dl, creatinine 2 mg/dl, S. bilirubin 3.7 mg/dl, direct bilirubin 2.3 mg/dl, S.G.O.T & S.G.P.T were high, alkaline phosphatase 12877 mg/dl, sodium 130 mg/dl, potassium 4.9 mg/dl. S. protein 7 g/dl, serum albumin 4 gm/dl, S. cholesterol 114 mg/dl, triglyceride 64 mg/dl, LDL 84 mg/dl, VLDL 13 mg/dl, HDL - 17 mg/dl. TLC count was 34000/cumm, Hb 14.5 gm/dl, platelet 222000/cumm.

X-ray chest cardiomegaly was present. On echocardiography Right ventricle dilated, RV wall thickness 4 mm. Right Atrium dilated, severe non hypertensive TR, Right ventricle thinned out, normal LV systolic function suggestive of arrhythmogenic right ventricular dysplasia. Patient was advised to continue amiodarone 200 mg BD, aspirin 75 mg HS, ramipril 2.5 mg OD and has been asymptomatic ever since.

Figure 1: The ECG in patients with ARVD/C usually shows sinus rhythm, QRS duration 110 ms in lead V1, a terminal deflection within or at the end of the QRS complex (called epsilon wave) in leads V1-V3 (30% of patients), and inversion of T waves in the right pr.

DISCUSSION

The name Arrhythmogenic Right Ventricular Dysplasia (ARVD) was coined for the first time in 1978 by Frank and Fontaine. The prevalence of the disease has

been estimated at 1 in 5000 individuals, although this estimate will likely increase as awareness of the condition increases among physicians. A familial predilection of the disease has been recognized since 1982 when Marcus et al. described 24 cases of ARVC, two in the same family.

Genetics

The disease is typically inherited as an autosomal dominant trait with variable penetrance and incomplete expression. The genes responsible for ARVC have not been identified, but seven loci have been mapped to chromosomes 14 (14q23 to q24 and 14q12 to q22), 1 (1q42 to q43), 2 (2q32.1 to q32.2), 3 (3p23) and 10 (10p12 to p14).³

Recently, plakoglobin has been identified as the first gene responsible for autosomal recessive ARVC. Plakoglobin participates in forming cell-to-cell junctions. It is postulated that inadequate cell adherence damages the cardiac cell membranes leading to cell death and fibrofatty replacement.

The cardiac ryanodine receptor gene (RyR2) has also recently been implicated in ARVC and offers potential insight into the association of adrenergically mediated ventricular arrhythmias with this disease. The ryanodine receptor induces calcium release from the sarcoplasmic reticulum into the cytosol. The cardiac ryanodine receptor has also been identified as being responsible for catecholamine-induced ventricular tachycardia.⁴

Histopathology

Characteristically, the RV in ARVC is replaced with a fibrofatty tissue. Morphologic alterations of ARVC usually begin in the subepicardium or mediomural layers of the RV and progress to the endocardium with fibrofatty replacement of myocytes and thinning of the wall. The regions of RV most frequently involved are the RV inflow area, the apex and the infundibulum. These three areas form "the triangle of dysplasia". However, small amounts of fat are present in the epicardial layer and within the RV myocardium in normal subjects.⁵

Etiology

In addition to a genetic cause of ARVC, disontogenetic, degenerative, infectious or inflammatory (apoptotic and myocyte transdifferentiation theories have been proposed either as the cause of or as environmental factors facilitating gene expression.

The disontogenetic theory is largely historical but suggests that ARVC is a milder form of "parchment RV" or Uhl's anomaly a congenital hypoplasia of the RV myocardium, which presents in infancy as Congestive Heart Failure (CHF).

The degenerative theory suggests that ARVC is a consequence of myocyte death due to an inherited metabolic or ultrastructural defect.

The infectious or inflammatory theory maintains that the disease results from previous myocarditis.⁶

ECG

The ECG in patients with ARVD/C usually shows sinus rhythm, QRS duration 110 ms in lead V1, a terminal deflection within or at the end of the QRS complex (called epsilon wave) in leads V1-V3 (30% of patients), and inversion of T waves in the right precordial leads (50%-70% of patients). Complete right bundle branch block is found in approximately 15% of patients and incomplete right bundle branch block in 18% of patients with ARVD/C. In the presence of right bundle branch block pattern, selective prolongation of the QRS duration in leads V1-V3 compared with lead V6 (25 ms, parietal block) is an important hallmark of ARVD/C.⁶

Echocardiography

Mild to Severe dilatation and reduction of right ventricular ejection fraction with no (or only mild) left ventricular impairment localised right ventricular aneurysms (akinetic or dyskinetic areas with diastolic bulging) severe segmental dilatation of the right ventricle.⁷

Cardiovascular magnetic resonance imaging

This modality allows visualization of the right ventricle, not only anatomically and morphologically but also in functional and flow dynamic terms. Functional abnormalities consist of right ventricular aneurysms, regional thinning, right ventricular dilation, failure of systolic thickening, and impaired global and diastolic right ventricular function.

Clinical presentation

The clinical presentation varies widely because ARVD/C includes a spectrum of different conditions rather than a single identity. Different pathologic processes may manifest a diversity of symptoms, such as fatigue, atypical chest pain, syncope, acute coronary syndrome.⁸

ARVD/C is a disease that may have a temporal progression, and the disease may present differently according to the time of presentation. There may be (1) a symptomatic form with transient or sustained ventricular tachycardia of left bundle branch block configuration, although right bundle branch block configuration also can be observed; (2) an asymptomatic form consisting of ventricular ectopic beats (1000/24 hours); (3) right ventricular failure with or without arrhythmias; and (4) a masked form in which sudden death, usually during exercise, is the first clinical presentation. Overall, judging

the accurate position of the patient on the time scale of the spectrum is difficult, and some patients may remain stable for several decades.⁹

Diagnosis

A definite diagnosis of ARVD/C is based on histologic demonstration of transmural fibrofatty replacement of right ventricular myocardium at either autopsy or surgery.

In 1994, McKenna et al. established the criteria for diagnosing ARVD/C in a Task Force report on ARVD/C. The new criteria for ARVD diagnosis was proposed in 2010 by Dr. Frank Marcus and colleagues. This new criteria divided the possibility for being diagnosed an ARVD into three stages; Definite ARVD: 2 Major or 1 major and two minor or 4 minor criteria from different categories, Borderline ARVD: 1 major and 1 minor, 3 minor criteria from different categories, Possible ARVD: 1 major or 2 minor criteria from different categories.¹⁰⁻¹³

Therapy

Because clinical findings that predict long-term outcome of patients with ARVD/C are incompletely known, no precise guidelines exist to select patients who should be treated with β -blockers, antiarrhythmic drugs, or an implantable cardioverter-defibrillator. Management of patients with ARVD/C is individualized, and strategies are based on local experience of the different centers. The first objective of management therapy in patients with ARVC is to prevent sudden death. Therapeutic options include β -blockers, antiarrhythmic drugs, catheter ablation, and ICD therapy.

The asymptomatic ARVC patients do not require any prophylactic treatment. They should be followed up on non-invasive cardiac evaluations for early identification of warning symptoms and demonstration of disease progression or ventricular arrhythmias. Asymptomatic and healthy gene carriers avoid physical exercise and sport activity, which is associated with an increased risk of ventricular arrhythmias and disease worsening. Whether prophylactic β -blockers may reduce the rate of ARVC progression and arrhythmic complications in asymptomatic patients and gene carriers remains to be proven. Antiarrhythmic drug therapy is the first choice treatment for patients with well tolerated and not life threatening ventricular arrhythmias. The available evidence suggests that either sotalol or amiodarone (alone or in combination with β -blockers) are the most effective drugs with a relatively low proarrhythmic risk although sudden death may occur.¹³⁻¹⁶

Long term therapy - ICD therapy is the most logical therapeutic strategy for patients with ARVC, whose natural history is primarily characterised by the risk of sudden arrhythmic death and, only secondarily, by contractile dysfunction leading to progressive heart failure.

Table 1: Criteria for diagnosis of ARVD/C.

The 1994 Task Force Report on ARVD diagnosis	The Revised criteria for ARVD diagnosis
Minor criteria	Minor criteria
RV dysfunction and structure Severe dilatation and reduction of RV ejection fraction with little or no LV impairment Localized RV aneurysms Severe segmental dilatation of the RV	RV systolic function and structure- By 2D echo: Regional RV akinesia, dyskinesia or aneurysm and one of the following (end diastole): PLAX RVOT >32 mm, PSAX RVOT >36 mm, Or fractional area change <33% By MRI: Regional RV akinesia, dyskinesia or aneurysm or dyssynchronous RV contraction and one of the following: Ratio of RV end-diastolic volume to BSA >110 mL/m ² (male) or >100mL/m ² (female) or RV <40% By RV angiography: Regional RV akinesia, dyskinesia or aneurysm
Conduction abnormalities- Fibrofatty replacement of myocardium on endomyocardial biopsy	Tissue characterization- Residual myocytes <60% by morphometric analysis (or 1 sample, with or without fatty replacement of tissue on endocardial biopsy)
Arrhythmia epsilon waves in V1-V3. Localized prolongation (>110 ms) of QRS in V1-V3	Repolarization abnormality : Inverted T waves in right precordial leads (V1, V2, and V3) or beyond in individuals >14 years of age (in the absence of complete right bundle - branch block QRS >120 ms)
Family history - Familial disease confirmed on autopsy or surgery	Depolarization abnormality : (reproducible low-amplitude signals between end of QRS complex to onset of the T wave in the right precordial leads (V1-V3) or
	Arrhythmia : Non-sustained or sustained ventricular tachycardia of left bundle branch morphology with superior axis (negative or indeterminate QRS in leads II, III, and a VF and positive in lead aVL)
	Family history : ARVD/C confirmed in the first degree relative who meets current Task Force criteria or ARVD/C confirmed pathologically at autopsy or surgery in the first degree relative or identification of a pathogenic mutation categorized as associated or probably associated with ARVD/C in the patient under evaluation
Minor Criteria	Minor criteria
RV dysfunction and structure Mild global RV dilatation and/or reduced ejection fraction with normal LV Mild segmental dilatation of the RV Regional RV hypokinesia	RV systolic function and structure- By 2D echo : Regional RV akinesia, dyskinesia or aneurysm and one of the following (end diastole): PLAX RVOT >29 to <32 mm, PSAX RVOT >32 to <36 mm, Or fractional area change >33% to <40% By MRI: Regional RV akinesia, dyskinesia or aneurysm or dyssynchronous RV contraction and one of the following; Ratio of RV end-diastolic volume to BSA >100 to <110 mL/m ² (male) or >90 to 40 to By RV angiography: Regional RV akinesia, dyskinesia or aneurysm
Conduction abnormalities- Inverted T waves in V2 and V3 in an individual over 12 years old, in the absence of a right bundle branch block (RBBB) Late potentials on signal averaged ECG.	Tissue characterization - Residual myocytes 60% to 75% by morphometric analysis (or 50% to 65% if estimated), with fibrous replacement of the RV free wall myocardium in >1 sample, with or without fatty replacement of tissue on endocardial biopsy.
Arrhythmia : Ventricular tachycardia with a left bundle branch block (LBBB) morphology Frequent PVCs (>1000 PVCs/24 hours)	Repolarization abnormality : Inverted T waves in leads V1 and V2 in individuals >14 years of age (in the absence of complete right bundle - branch block) or in V4, V5, or V6 or inverted T waves in leads V1-V4 individuals >14 years of age in the presence of complete right bundle branch block
Family history- Family history of sudden cardiac death before age 35 Family history of ARVD	Depolarization abnormality : late potential by SAECG (signal average ECG in >1 of 3 parameters in the absence of a QRS duration of >110 ms on the standard ECG, Filtered QRS duration (fQRS) >114 ms, Duration of terminal QRS <40 micro V (low amplitude signal duration) >38 ms, Root - mean-square voltage of terminal 40 ms <20 micro V, terminal activation duration of QRS >55 ms <20 micro V or Terminal activation duration of QRS >55 ms measured from the nadir of the S wave to the end of the QRS, including R' in V1, V2, or V3, in the absence of complete right bundle-branch block
	Arrhythmia : Nonsustained or sustained ventricular tachycardia of RV outflow configuration, left bundle branch morphology with inferior axis (positive QRS in leads II, III, and aVF and negative in lead aVL) or of unknown axis or >500 ventricular extrasystoles per 24 hours (holter)
	Family history : History of ARVD/C in a first degree relative in whom it is not possible or practical to determine whether the family member meets current Task Force criteria or premature sudden death

The candidates for ICD therapy are patients with prior cardiac arrest, VT with haemodynamic compromise, and extensive RV/LV involvement. Unexplained syncope is also considered a predictor of sudden death and appears to be an indication for ICD implantation. In this subgroup of patients, antiarrhythmic drug therapy (including β -blockers, amiodarone) and/or catheter ablation seem to be a reasonable first line therapy.

It is noteworthy that VT relapses are frequently observed after catheter ablation (up and have been attributed to development of new arrhythmogenic zones because of the progressive nature of the underlying heart muscle disease. Therefore, catheter ablation is usually reserved for ARVC patients with drug refractory incessant VT or frequent recurrences of VT after ICD implantation, in whom it is the only option available.

In asymptomatic patients and gene carriers there is no general indication for prophylactic ICD implantation, because of their overall favourable prognosis and device and electrode related complications observed during follow-up.

ICD therapy in patients with multiple risk factors, familial sudden death, or VT/VF inducibility at programmed ventricular stimulation is controversial and the decision to implant should be made on a case-by-case basis. Heart transplantation is the final therapeutic option in cases of refractory congestive heart failure and/or untreatable ventricular arrhythmias.¹³⁻¹⁶

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REFERENCES

1. Thomas Herren, Philipp A. Gerber, Firat Duru. Arrhythmogenic right ventricular cardiomyopathy / dysplasia: a not so rare "disease of the desmosome" with multiple clinical presentations. Clin Res Cardiol. 2009;98:141-58.
2. Dimitrios Avramides, Nikos Protonotarios, Angeliki Asimaki, Evangelos Matsakas. Arrhythmogenic right ventricular cardiomyopathy/dysplasia. Hellenic J Cardiol. 2011;52:452-61.
3. Bauce B, Rampazzo A, Basso C, Bagattin A, Daliento L, Tiso N, et al. Screening of ryanodine receptor type 2 mutations in families with effort induced polymorphic ventricular arrhythmias and sudden death: early diagnosis of asymptomatic carrier. J Am Coll Cardiol. 2002;40(2):341-9.
4. Cristina Basso, Domenico Corrado, Frank I. Marcus, Andrea Nava, Gaetano Thiene. Arrhythmogenic right ventricular cardiomyopathy. Lancet. 2009;373:1289-300.
5. Rampazzo A, Nova A, Malacrida S, Beffagua G, Bauce B, Rossi V, et al. Mutation in human desmoplakin domain binding to plakoglobin causes a dominant form of arrhythmogenic right ventricular dysplasia. Am J Hum Genet. 2002;71(5):1200-6.
6. Domenico Corrado, Guy Fontaine, Frank I. Marcus, William J. McKenna, Andrea Nava, Gaetano Thiene et al. Circulation. 2000;101:e101-6.
7. Carol Gemayel, Antonio Pelliccia, Paul D. Thompson. Arrhythmogenic right ventricular cardiomyopathy. J Am Coll Cardiol. 2001;38(7):1773-81.
8. Frank R, Fontaine G. Electrocardiologie de quatre cas de dysplasia ventriculaire droite arythmogene. Arch Mal Coeur Vaiss. 1978;71:963-72.
9. Philippine Kiès, Marianne Bootsma, Jeroen Bax, Martin J. Schalij, Ernst E. van der Wall. Arrhythmogenic right ventricular dysplasia / cardiomyopathy: screening, diagnosis, and treatment. Heart Rhythm. 2006;3:225-34.
10. Siddiq I. Khalil, Amjad Kamal, Shakeel Ahmad. Arrhythmogenic right ventricular dysplasia presenting as acute coronary syndrome: a case report. Eur J Echocardiogr. 2004;5:394-8.
11. McKenna WJ, Thiene G, Nava A, Fontaliran F, Blomstrom-Lundqvist C, Fontaine G, et al. Diagnosis of arrhythmogenic right ventricular dysplasia cardiomyopathy. Br Heart J. 1994;71:215-8.
12. Marcus FI, McKenna WJ, Sherrill D, Basso C, Bauce B, Bluemke DA, et al. Diagnosis of arrhythmogenic right ventricular cardiomyopathy/dysplasia: proposed modification of the task criteria. Circulation. 2010;121:1533-41.
13. Corrado D, Leoni L, Link MS, Della Bella P, Gaita F, Curnis A, et al. Implantable cardioverter-defibrillator therapy for prevention of sudden death in patients with arrhythmogenic right ventricular cardiomyopathy/dysplasia. Circulation. 2003;108:3084-91.
14. Wichter T, Paul M, Wollmann C, Acil T, Gerdes P, Ashraf O, et al. Implantable cardioverter / defibrillator therapy in arrhythmogenic right ventricular cardiomyopathy: single-center experience of long-term follow-up and complications in 60 patients. Circulation. 2004;109:1503-8.
15. Roguin A, Bomma CS, Nasir K, Tandri H, Tichnell C, James C, et al. Implantable cardioverter-defibrillators in patients with arrhythmogenic right ventricular dysplasia/cardiomyopathy. J Am Coll Cardiol. 2004;43:1843-52.
16. IDomenico Corrado, Cristina Basso, Gaetano Thiene. Arrhythmogenic right ventricular cardiomyopathy: an update. Heart. 2009;95:766-73.

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