

: MRI¹
 .² .² .² .²

: (arrhythmogenic right ventricular dysplasia, ARVD)
 : 1996² 1999¹
 ARVD MRI 15
 37.7 (2 - 60) , 가 13 가 2 .
 MRI T1 2
 cine gradient - echo image ARVD 가
 4 Wilcoxon signed rank test
 : ARVD가 MRI 15 MRI
 ARVD 가 3 4 3 . 15 11
 가 (p > 0.05).
 : MRI ARVD가 ARVD

. ARVD (1,
 2, 5, 7, 10, 11).
 (arrhythmogenic right ventricular dysplasia, ARVD) (1).
 가 (2, 5, 12).
 (1 - 9). , (2, 3).
 (1, , ARVD
 6, 9, 10). 0.8%
 35 (3, 4, 6)
 (2 - 4, 6 - 8, 11). (left bundle branch block, LBBB) (5, 7, 11 - 13). 가 (MRI)
 ARVD (5, 7, 8, 12). MRI

¹
²
 2000 3 17 2000 10 5 . 가 25 - 50%
 695

(7, 8) MRI (ARVD 가), 3 (ARVD 가), 4 (ARVD 가) MRI 1.5 Tesla (Magnetom Vision, Siemens, Erlangen, Germany) CP body array coil (EKG - gated turbo spin - echo sequence)

가 (diagnostic grading) (3, 7). MRI (transverse axial image) (short axis image) (long axis image) (single slice breath hold image) T1 2 T1 ; TR: R - R interval, TE: 32 ms, : 7 mm, interslice gap: , FOV: 30 - 40 cm, matrix: 198 × 256.

1996 2 1999 1 ARVD MRI cine gradient - echo image ; T - R: R - R interval, TE: 4.8 ms, : 20 , : 8 mm, interslice gap: , FOV: 30 - 40 cm, matrix: 128 × 256, 2 excitation.

15 37.7 (2 - 60) , 가 13 가 2 ARVD MRI (5, 7, 8) , 1) T1 , 2) (right ventricular outflow tract) , 3) , 4) (1 - 3, 8, 14, 15), 4 ; 1 (ARVD 가) , 2 , 3

ARVD MRI (ventricular tachycardia with LBBB configuration), 2) sinus rhythm (repolarization abnormalities (T - wave inversion) in the right precordial lead during sinus rhythm), 3) , 4) (ARVD 가) , 2 (ARVD 가)

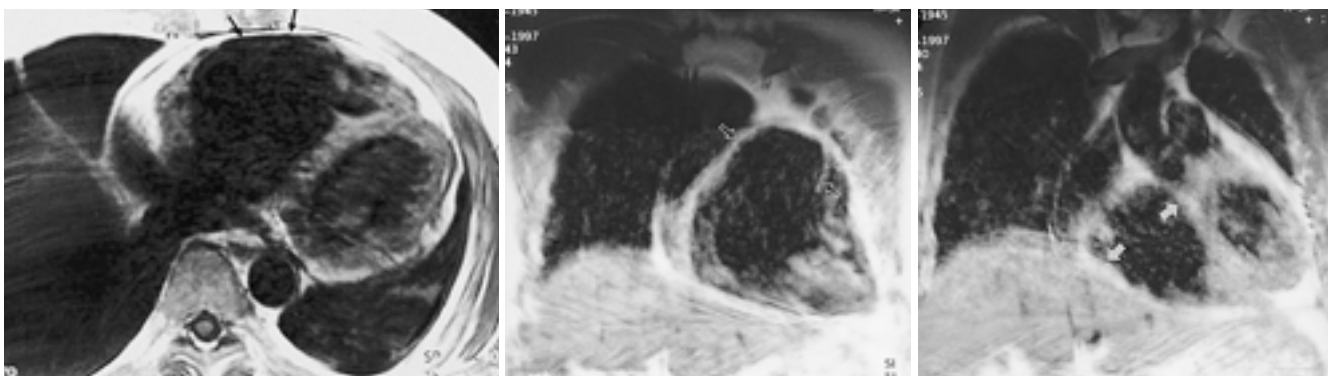


Fig. 1. T1-weighted MR imaging of a 53-year-old man who presented with a sudden cardiac arrest (case 13). **A.** Axial MR image obtained at the midventricular level shows myocardial wall thinning at the right ventricular free wall (arrows) and also there is global right ventricular dilatation. The interventricular septum shows convexity to the left ventricular side. **B, C.** Coronal MR images show aneurysmal dilatation of the right ventricular outflow tract (open arrows in B). Right ventricle is dilated globally (arrows in C).

(ARVD 가), 4 9 6 가 .
 (ARVD 가 ARVD 가
) . 1 10 , 2 2 , 3 2 , 4
 T1 1 (Table 1). MRI T1 2 4
 가 가 가 3 . 4
 가 (5), 가 .
 3 ,
 (phase encoding) (artifact) 3
 . MRI 1 . MRI ARVD
 1 11 , 2 1 , 3 3 4
 (16). (Table 2).
 가 1 10
 (8). Webber (17) 5
 cine MRI (LBBB .
)가 42 mm 10 MRI 9 가 1
 , (T1
)가 41 mm (MRI 2) .
 . MRI 1 1
 ARVD 가 (MRI 1) .
 MRI ARVD MRI 3 3
 MRI Wilcoxon signed rank 2
 test 가 . 1 T1
 4
 1 MRI 3
 ,
 9 가 LBBB MRI 11

Table 1. Clinical and Laboratory Data of 15 Patients with Suspected Diagnosis of Arrhythmogenic Right Ventricular Dysplasia

Case No.	Age	Sex	Clinical Presentation	FHx of sudden CD	Clinical Diagnostic Criteria				
					VT with LBBB	Repolar Abn	VKA	Heart Failure	Dx Grade
1	36	M	Sudden LOC	Father	+	+	Focal, RV apex	-	3
2	28	M	Recurrent LOC	Father, Brother	+	+	Focal, RV free wall	-	3
3	31	M	Sudden LOC	No	+	-	-	-	1
4	41	M	Palpitation	No	+	-	-	-	1
5	54	M	Sudden chest pain	No	+	-	-	-	1
6	49	M	Recurrent LOC	Sister, Brother	-	-	-	-	1
7	50	M	Sudden LOC	No	-	-	-	-	1
8	48	M	Recurrent syncope	No	-	-	Focal, RV apex & free wall	-	1
9	2	F	Irritability	No	-	-	-	-	1
10	47	M	Palpitation	No	-	-	-	-	1
11	39	M	Sudden LOC	No	+	+	-	-	2
12	20	F	Syncope	No	-	+	-	-	1
13	53	M	Sudden cardiac arrest	Father, Brother	+	+	Global hypokinesia	+	4
14	7	M	VT	No	+	+	-	-	2
15	60	M	Exercise induced VT	Father, Sister	+	-	-	-	1

FHx of sudden CD: family history of sudden cardiac death, VT with LBBB: ventricular tachycardia with left bundle branch block, Repolar Abn: Repolarization abnormality, VKA: Ventricular kinetic alteration on echocardiography or cardiac angiography, Dx Grade: diagnostic grade, LOC: loss of consciousness, RV: right ventricle, VT: ventricular tachycardia

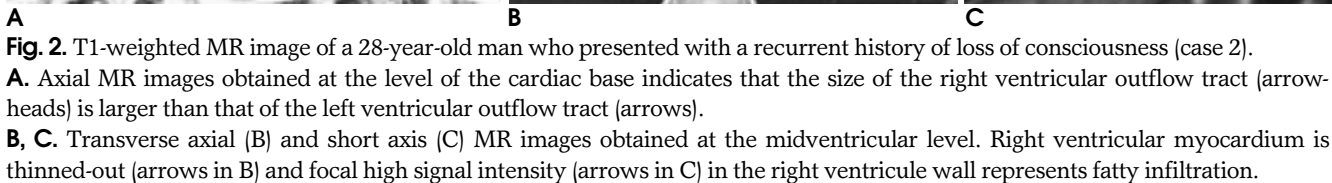


Table 2. Findings and Diagnostic Grade of MRI in 15 Patients with Suspected Diagnosis of Arrhythmogenic Right Ventricular Dysplasia

High SI: high signal intensity, RVOT: right ventricular outflow tract, Dx Grade: diagnostic grade, RV: right ventricle, RA: right atrium, RVFW: right ventricular free wall

Table 3. Comparison of the Clinical and MRI Diagnostic Grading in 15 Patients with Suspected Diagnosis of Arrhythmogenic Right Ventricular Dysplasia

Nava(2) ARVD 24
1
LBBB
ARVD MRI
20 - 50%
T1
가 (5, 7, 8, 14).
ARVD 가 MRI ARVD
ARVD 가 ,
ARVD 가
ARVD 가
MRI 15 1 ,
MRI 2 ARVD 가 .
MRI

(5, 7, 14). T1

ARVD (10, 18-20) MRI (19, 20), MRI T1 ARVD 가 (5, 7, 14). ARVD가 MRI T1 ARVD 가 MRI T1 (phase encoding) (artifact) (anteroapical portion) 가 (transverse axial) MRI ARVD 가 (10, 18, 19). MRI ARVD (pulmonary infundibulum) (free wall of subtricuspid area) ARVD MRI가 ARVD LBBB MRI가 ARVD MRI T1 ARVD MRI ARVD가 MRI MRI

(4). 4 T1 2 T1 2 Thiene (4) ARVD (lipomatous pattern) (fibrous or fibrolipomatous pattern) 가 가 가 13 2

T1 ARVD가

1. Marcus FI, Fontaine GH, Guiraudon G, et al. Right ventricular dysplasia : a report of 24 adult cases. *Circulation* 1982;65:384-398
2. Nava A, Thiene G, Canciani B, et al. Clinical profile of concealed form of arrhythmogenic right ventricular cardiomyopathy presenting with apparently idiopathic ventricular arrhythmias. *Int J Cardiol* 1992;35:195-206

3. McKenna WJ, Thiene G, Nava A, et al. Diagnosis of arrhythmogenic right ventricular dysplasia/cardiomyopathy. *Br Heart J* 1994; 71:215-218
4. Thiene G, Nava A, Corrado D, Rossi L, Pennelli N. Right ventricular cardiomyopathy and sudden death in young people. *N Engl J Med* 1988;318:129-133
5. Ricci C, Longo R, Pagnan L, et al. Magnetic resonance imaging in right ventricular dysplasia. *Am J Cardiol* 1992;70:1589-1595
6. Basso C, Thiene G, Corrado D, Angelini A, Nava A, Valente M. Arrhythmogenic right ventricular cardiomyopathy: dysplasia, dystrophy, or myocarditis? *Circulation* 1996;94:983-991
7. White RD, Trohman RG, Flamm SD, et al. Right ventricular arrhythmia in the absence of arrhythmogenic dysplasia: MR imaging of myocardial abnormalities. *Radiology* 1998;207:743-751
8. Midiri M, Finazzo M, Brancato M, et al. Arrhythmogenic right ventricular dysplasia: MR features. *Eur Radiol* 1997;7:307-312
9. Manyari DE, Klein GJ, Gulamhusein S, et al. Arrhythmogenic right ventricular dysplasia: a generalized cardiomyopathy? *Circulation* 1983;68:251-257
10. Daubert C, Descaves C, Foulgoc JL, Bourdonnec C, Laurent M, Gouffault J. Critical analysis of cineangiographic criteria for diagnosis of arrhythmogenic right ventricular dysplasia. *Am Heart J* 1988;115:448-459
11. Strain J. Adipose dysplasia of the right ventricle: is endomyocardial biopsy useful? *Eur Heart J* 1989;10:84-88
12. Blake LM, Scheinman MM, Higgins CB. MR Features of arrhythmogenic right ventricular dysplasia. *AJR Am J Roentgenol* 1994;162: 809-812
13. Daliento L, Turrini P, Nava A, et al. Arrhythmogenic right ventricular cardiomyopathy in young versus adults patients: similarities and differences. *J Am Coll Cardiol* 1995;25:655-664
14. Auffermann W, Wichter T, Breithardt G, Joachimsen K, Peters PE. Arrhythmogenic right ventricular disease: MR imaging vs angiography. *AJR Am J Roentgenol* 1993;161:549-555
15. Rossi P, Massumi A, Gillette P, Hall RJ. Arrhythmogenic right ventricular dysplasia: clinical features, diagnostic techniques, and current management. *Am Heart J* 1982;103:415-420
16. Foale R, Nihoyannopoulos R, McKenna W, et al. Echocardiographic measurement of the normal adult right ventricle. *Br Heart J* 1986; 56:33-44
17. Weber CK, Gutierrez FR, Saffitz JE, Peterson RR. *Anatomy of the cardiovascular system*. In: Gutierrez FR, Brown JJ, Mirowitz SA eds. *Cardiovascular magnetic resonance imaging*. St Louis, Mosby Year Book, 1992;30-34
18. Caruso G, Frassanito F, Serio G, Pennella A. Is adipose tissue a normal component of the myocardium? *Eur Heart J* 1989; 10:89-91
19. Angelini A, Thiene G, Boffa GM, et al. Endomyocardial biopsy in right ventricular cardiomyopathy. *Int J Cardiol* 1993; 40:273-282
20. Dembinski AS, Dosbon JR, Wilson JE, et al. Frequency, extent, and distribution of endomyocardial adipose tissue: morphometric analysis of endomyocardial biopsy specimens from 241 patients. *Cardiovasc Pathol* 1994;3:33-41

Value of Cardiac MR Imaging for the Diagnosis of Arrhythmogenic Right Ventricular Dysplasia: Comparison of Clinical and MR Imaging Diagnostic Grades¹

In Sun Lee, M.D., Hyae Young Kim, M.D.², Sang Il Choi, M.D., Han Na Noh, M.D.,
Jung Hwa Hwang, M.D.², Tae-Hwan Lim, M.D.

¹Department of Radiology, Asan Medical Center, University of Ulsan College of Medicine

²Department of Radiology, Mokdong Hospital, Ehwa University, College of Medicine

Purpose: To evaluate the usefulness of cardiac MRI in the diagnosis of clinically suspected arrhythmogenic right ventricular dysplasia (ARVD).

Materials and Methods: Between February 1991 and January 1999, 15 patients [M:F = 13:2, aged 2 - 60 (mean, 37 - 7) years] with clinically suspected ventricular arrhythmia due to unknown causes underwent MR imaging. Using a CP body array coil and the single slice breath hold technique, ECG-gated T1-weighted images were obtained. In all patients, these were acquired transaxially from the diaphragm to the aortic arch and along the true short and long axis, and in two, coronal images were obtained. On the basis of clinical and MRI diagnostic criteria, ARVD was classified as one of four types. The significance of differences in diagnostic grades between clinical and MRI criteria was determined using Wilcoxon's signed rank test.

Results: According to both clinical and MRI criteria, it was highly probable that three of the 15 patients had ARVD. In eleven, both sets of criteria indicated the same diagnostic grade. Wilcoxon's signed rank test indicated no significant differences in diagnostic grades between clinical and MRI criteria ($p > 0.05$).

Conclusion: For the diagnosis or exclusion of ARVD, MR imaging is a useful modality.

Index words : Heart, ventricles
Heart, MR
Heart, arrhythmia

Address reprint requests to : Tae-Hwan Lim, M.D., Department of Radiology, Asan Medical Center, University of Ulsan College of Medicine
388-1 Poongnap-dong, Songpa-gu, Seoul 138-736, Korea.
Tel. 82-2-2224-4400 Fax. 82-2-476-4719