

삽입형 심실제세동기 치료 : 6예 경험에 대한 보고

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Implantable Cardioverter-Defibrillator (ICD) Therapy : Initial Clinical Experience in 6 Patients

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ABSTRACT

Sudden cardiac death accounts for approximately half of all cardiovascular mortality in the industrialized countries and ventricular tachyarrhythmia is the most common mechanism for this event. Implantable cardioverter-defibrillator (ICD) has been effectively used for prevention of sudden cardiac death in patients with life-threatening ventricular tachyarrhythmias since 1980. Clinical experience with ICD device now exceeds 100,000 implants worldwide and the number of implantation is increasing. In Korea, there is also increasing trend of ICD implantation. The authors report the initial experience of of ICD implantation in 6 patients who had high risk of sudden cardiac death. (**Korean Circulation J 1999;29(2):999-1015**)

KEY WORDS : Implantable cardioverter-defibrillator(ICD) · Sudden cardiac death.

서론

가 (automatic implantable defibrillator) (antitachycardia pacing) 가 implantable cardioverter - defibrillator (ICD) (lead) (generator)

Mirowski¹⁾ 1980²⁾

가 (automatic implantable defibrillator) (antitachycardia pacing) 가 ICD 가

³⁾⁴⁾ ICD 1980 10

⁵⁾ Long QT 1996 Choi ICD 1997 8

: 1999 6 14
: 1999 9 1
: , 120 - 752 134

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ICD 1999 1 6 ICD

, ICD

가 . propranolol 1
120 mg verapamil 1 120 mg

대 상 환 자

1997 8 1999 1

amiodarone
Amiodarone 1 600 mg 2

ICD 6

amiodarone

ICD
47 (22 60

) , 가 5

4

, ,
amiodarone

가

가

가

darone

. Amiodarone

, , , isoproterenol

가 . 2

telemetry

(double ventricular extrastimuli)

180 msec 가

. Flecainide 1

증례 1 : 실신을 동반한 비후성 심근질환(Hypertrophic
cardiomyopathy with recurrent syncope)

300 mg 11

320 msec
(vertical axis) 가

60

340 msec 가

. 5

25

가

. Fle-

가

cainide

sotalol

가

amiodarone

(vertical axis)

320

가

msec

(cycle length) 가

(14 beats)

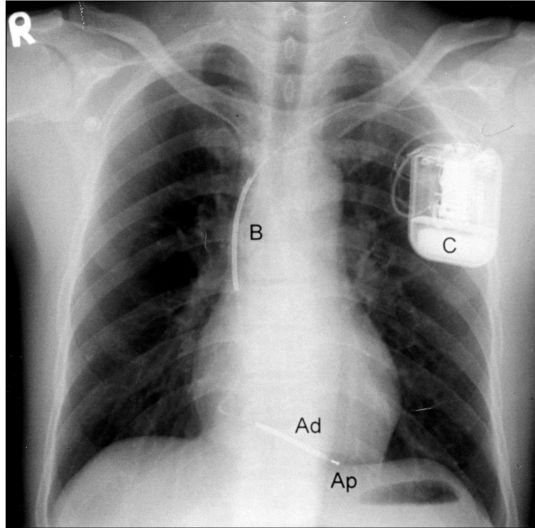
ICD

ICD

(Fig. 1), ICD

cycle

320 msec(1 가 187) nolo 1 120 mg verapamil 1 120 mg
 가 가 120
 propra- 가 가
 propranolol verapamil



ICD가
 ICD shock 1 11
 (Fig. 2) 가 ICD

종례 2 : 특발성 심실세동(Idiopathic ventricular fibrillation)

44
 가
 가
 가

Fig. 1. Implantation of ICD (case 1). ICD lead has defibrillating coil (Ad)contacted with RV septum, SVC coil (B) and pacing portion (Ad-Ap). The defibrillation can be performed by the current between defibrillating coil (Ad or Ad + B)and hot can(C).

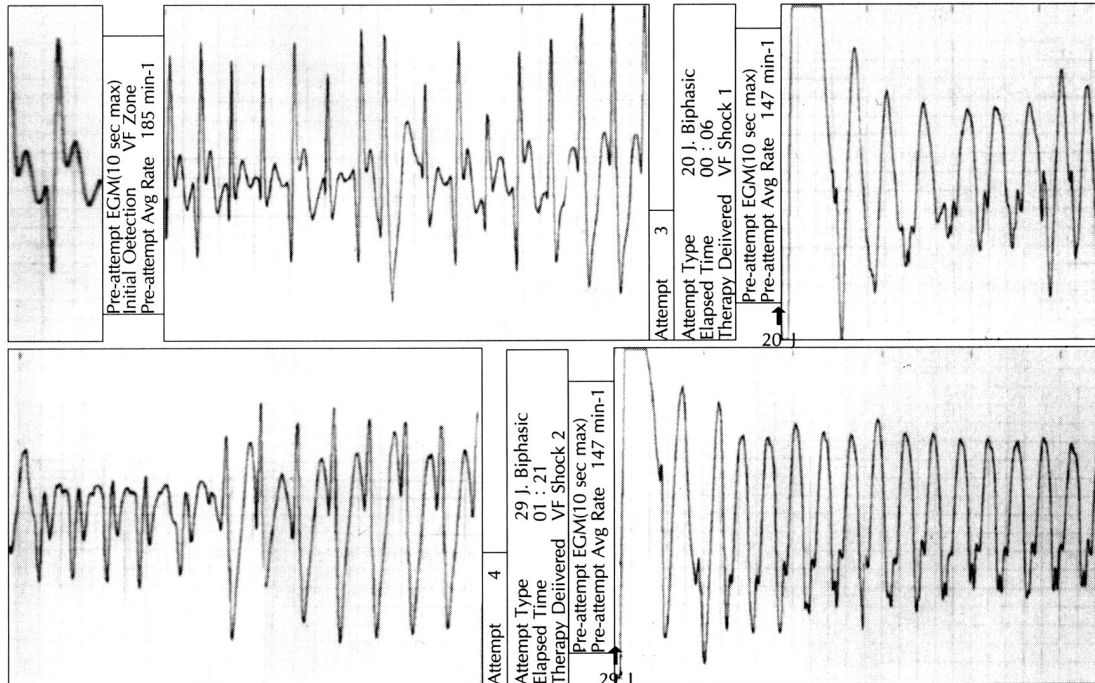


Fig. 2. Inappropriate shock delivery due to atrial fibrillation with rapid ventricular responses (Case 1). Atrial fibrillation was regarded as ventricular fibrillation by ICD.

가 3 가

Isoproterenol 가 7

ergonovine 가 가

3 (double 가

ventricular extrastimuli) 180 msec 가

가 (Fig. 3), troponin T

(idiopathic ventricular fibrillation) ICD 가

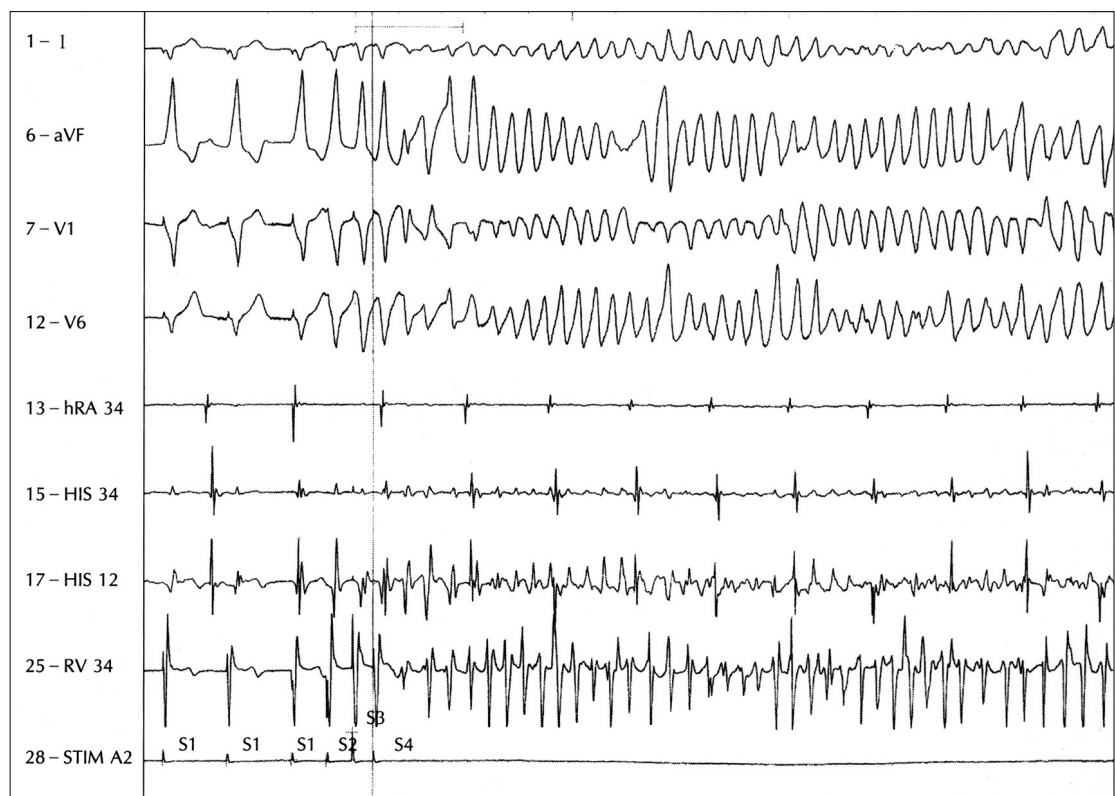


Fig. 3. Polymorphic ventricular tachycardia induced by TVEST in a patient with aborted sudden cardiac death(case 2). Tachycardia was sustained and terminated by DC cardioversion. Clinically documented cardiac rhythm during cardiopulmonary resuscitation was ventricular fibrillation.

ergonovine
 3 (triple ventricular
 extrastimuli) 220 msec 가
 12
 V1 - V3 ST (Fig.
 4A) V1 - V3 QRS (Fig. 4B).
 ST 가
 , isoproterenol ST V1

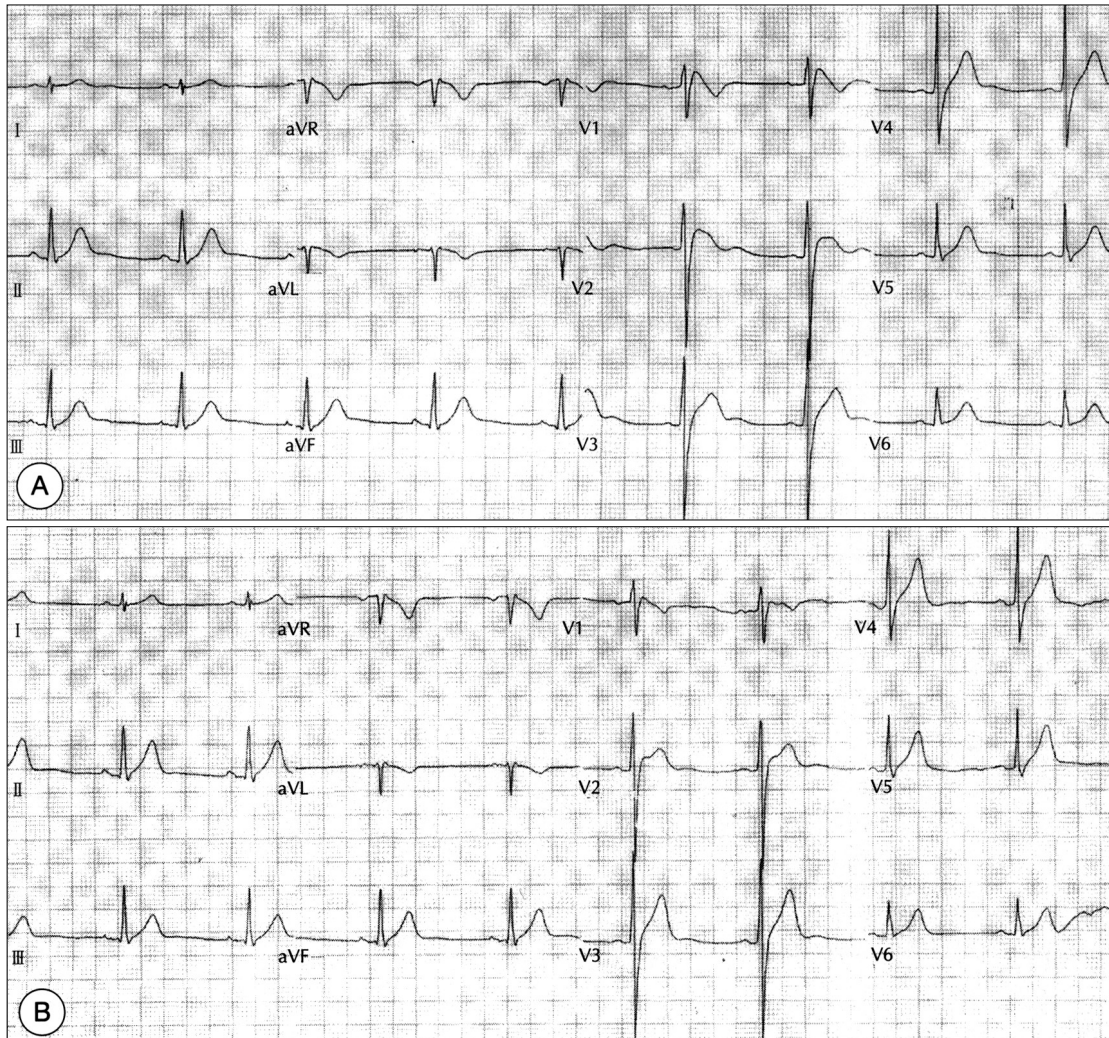


Fig. 4. Changes of ECG findings of a patient with Brugada syndrome (case 3). QRS complex showed incomplete RBBB pattern and ST segments in V1-V3 were elevated(A). ST segment elevation disappeared and QRS complex was normalized in follow-up ECG(b).

Brugada (Fig. 6). shock
 가 가 ICD
 가 가 ICD
 (Fig. 5A). Brugada 가 ICD
 가 ICD
 ICD 7
 가 ICD
 (data) 증례 4 : 심근질환과 동반된 심실빈맥(Recurrent ven-
 ICD tricular fibrillation associated with cardiomy-
 ICD 60 pathy)

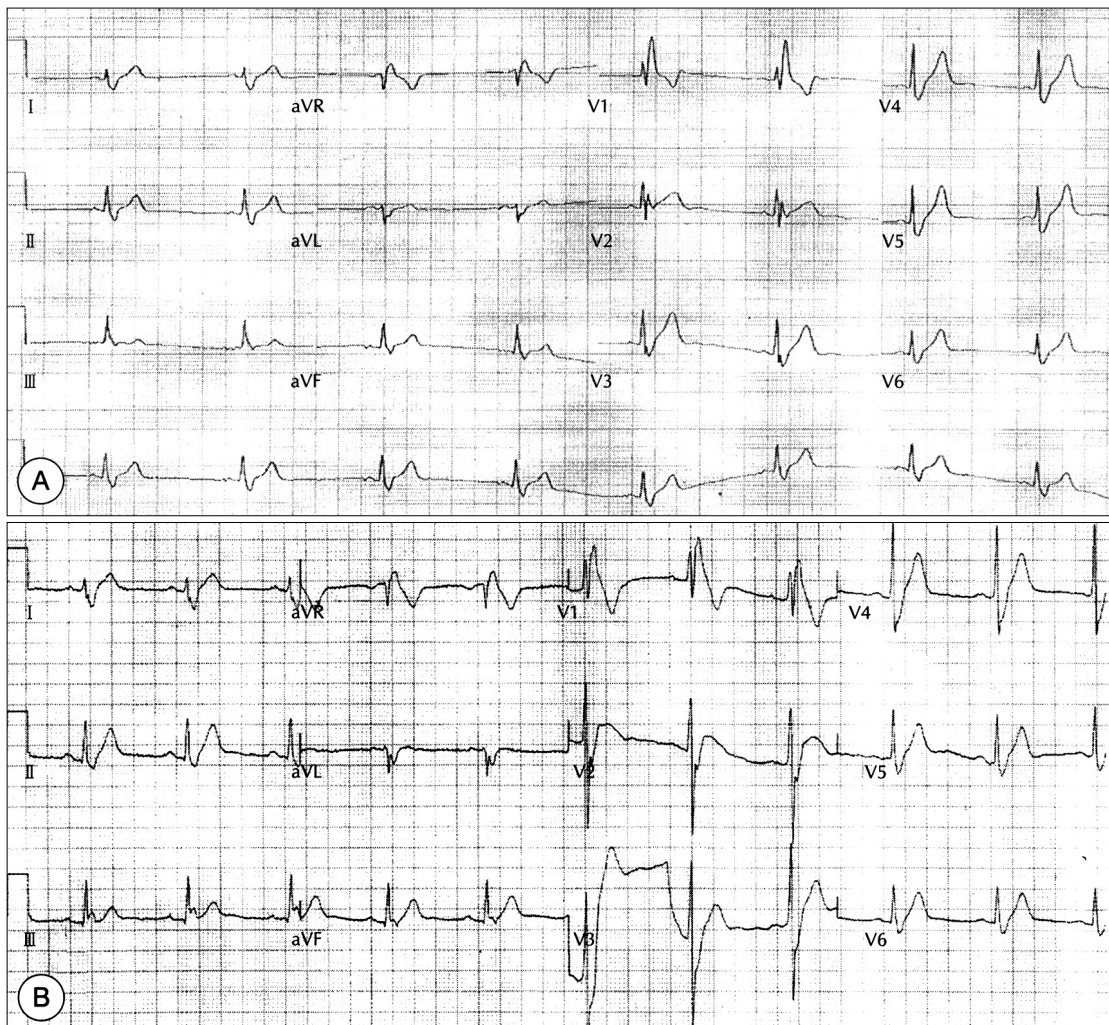


Fig. 5. ECG finding of an asymptomatic elderly brother of a patient with Brugada syndrome(case 3). RBBB-patterned QRS complex and ST segment of V2, V3 were found in asymptomatic brother(A) and the patient(B).

3
5
가 (ve-
5 ntricular fibrillation)
6
10 가 2 3 amiodarone 1 400 mg 15
20
3

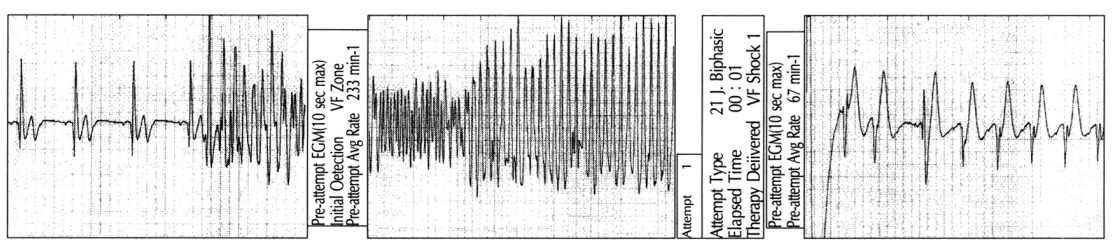


Fig. 6. Termination of ventricular fibrillation by ICD in a patient with Brugada syndrome (case 3). Charging time was 6.4 seconds, ventricular fibrillation was termination 10 seconds after onset.

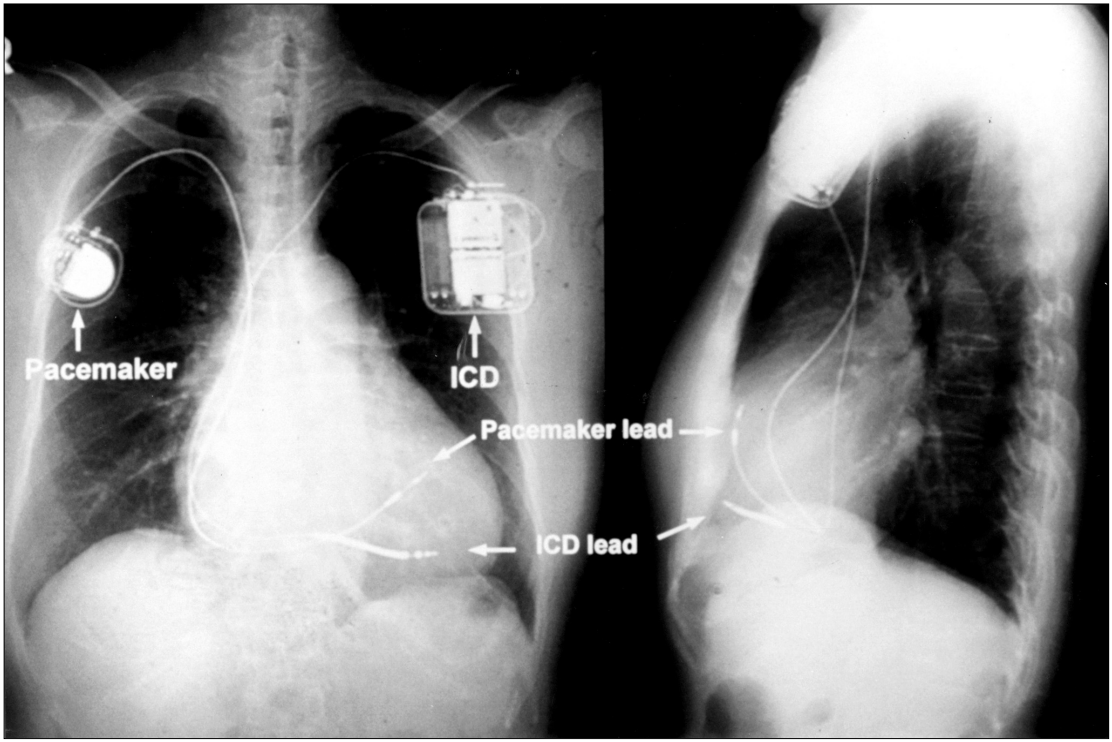


Fig. 7. Implantation of ICD and pacemaker of VVIR type in a patient presented as aborted sudden cardiac death(case 4). Pacemaker lead was directed and anchored to RV septum to avoid an interaction between ICD lead and pacemaker lead.

40 /)
 ICD
 (rate -
 adaptive VVIR) ICD
 (Fig. 7).
 ICD 6 ICD
 가
 56%
 Isoproterenol
 ICD (data)
 (interstitial fibrosis) 290 msec ICD
 (vascular sclerosis) 11 (Fig. 8).
 증례 5 : 특발성 심실세동(Idiopathic ventricular fi-
 brillation)
 가
 22
 3
 (triple ventricular extrastimuli) 220 msec 2
 가
 ICD 가
 (30

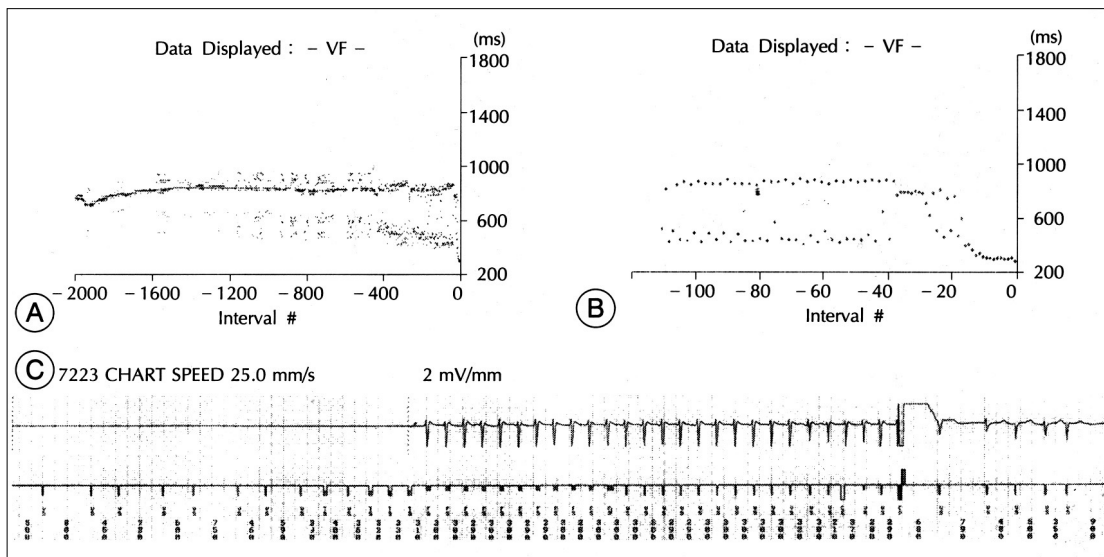


Fig. 8. Appropriate ICD shock in the patient with VVIR and ICD (case 4). Panel(A) showed RR intervals of 2000 beats prior to VF detection. Panel (B) is a detail presentation of last 100 beats, which showed two distinctive RR intervals associated with frequent PVCs. Rate-setting of VVIR pacemaker was 70 bpm (low rate) and 120 bpm (upper rate), respectively. Panel (C) showed fast ventricular tachycardia (TCL 290 - 300), which was successfully terminated by ICD treatment and was not prevented by VVIR pacemaker.

가 65 mm,

58 mm 가

20%

가

3 , isoproterenol , 가

ergonivine ,

telemetry

60 mmHg

가 , 2 (double

가 가 ventricular extrastimuli) 240 msec

(triple ventricular extrastimuli) 230 가 (mono-

msec 가 morphic VT)

(overdrive pacing)

ICD ICD ,

propranolol digoxin, , ACE

1 120 mg

propranolol 1 60 mg

증례 6 : 실신을 동반한 확장성 심근질환(Idiopathic dilated cardiomyopathy with syncope)

50

2 대상환자의 임상상

2 ICD 6 4 (2, 3, 4, 5)

가

digoxin 2 (2, 5)

3 가 6

가 2

(1) (6)

2 6

4 ,

. 10 2

(2, 5)

2 (3, 4)

1) (6) (5) 3
 2 (isoproterenol
 4) 5 1 (
 (1)
 3
 1 , 1
 1 3 가 . 6 4 (2, 3,
 (Table 1). 4, 5) 1
 가 (1)
 1 (6)
 4 1 (Table 2).

Table 1. Clinical characteristics of 6 patients

Patient	Age/Sex	Clinical manifestation	Underlying heart disease	Documented Arrhythmia
1	60/M	Recurrent Syncope	Hypertrophic CMP	Nonsustained VT
2	44/M	Aborted SCD	None	VF
3	43/M	Aborted SCD	Brugada syndrome	PMVT/VF
4	60/F	Aborted SCD	Cardiomyopathy, unspecified	PMVT/VF
5	22/M	Aborted SCD	None	VF
6	50/M	Syncope	Dilated CMP	Frequent VPC

CMP, cardiomyopathy ; PMVT, polymorphic ventricular tachycardia ; SCD indicates sudden cardiac death ; VF, ventricular fibrillation ; VPC, ventricular premature contraction

Table 2. Results of diagnostic tests

Patient	EF (%)	HUT	TMT	Isoproterenol provocation	Coronary angiography/ Ergonovine provocation	EPS Induced arrhythmia/Hemodynamics/Mode of induction
1	55	Negative	Nonsustained VT(LBBB + Vertical axis, 320 msec)	Negative	Normal/Not done	1st EPS ; Polymorphic VT (180 msec)/Unstable/DVEST 2nd EPS ; Monomorphic VT(LBBB + Vertical axis,340 msec)VT/Stable/RVP(320 ms)
2	65	Negative	Negative	Negative	Normal/Negative	Polymorphic VT(180 mec)/Unstable/TVEST
3	74	Not done	Negative	Negative	Normal/Negative	Polymorphic VT(220 msec)/Unstable/TVEST
4	56	Not don	Not done	Negative	Normal/Not done	Polymorphic VT(220 msec)/Unstable/TVEST
5	70	Positive	Negative	Negative	Normal/Negative	Polymorphic VT(230 msec)/Unstable/TVEST
6	20	Negative	Negative	Negative	Not done*	MonomorphicVT(240 msec)/Unstable/DVEST

*No evidence of ischemia on dipyridamole-stress myocardial perfusion imaging with Tc99m-MIBI
 DVEST, double ventricular extrastimuli ; EF, ejection fraction of left ventricle evaluated by echocardiography ; EPS, electro-physiologic study ; HUT,head-up tilt table test ; RVP, rapid ventricular pacing ; TMT, treadmill test ; TVEST, triple ventricular extrastimuli ; VT, ventricular tachycardia

ICD의 시술 (lead) (defibrillation threshold, DFT) (generator) (subcutaneous) (subpectoral) (pocket) ICD 50 msec (1). DFT 2.6 shock ICD generator ICD dummy (low energy coil) (high energy coil) 2) shock 20 joules 15J, DFT가 15 tip (subclavian vein) 10J (11.5 joules). (subclavian vein) (vascular sheath) ICD (fluoroscopy) DFT ICD coil 가 (Fig. 1). X ICD (fluoroscopy) 가 (external defibrillator) (R wave amplitude) DFT 4 가 (subpectoral pocket) . 6 (pacing threshold) 0.6 2 (su - V(0.5 ms pulse width) (electro - bcutaneous approach) 가 .

Table 3. ICD implantation data

Patient	Implant date	Pacing threshold	R wave Amplitude(mV)	Lead impedance(W)	DFT(J)	ICD type	Anesthesia/ Procedure site	Pocket site
1	97-08-08	0.5 V × 0.5 ms	12.3	470	8	Ventak Mini 1741 (CPI)	General/OR	SP
2	98-10-17	0.5 V × 0.5 ms	12.0	680	<15	Micro Jewel (Medtronic)	General/OR	SP
3	98-09-15	0.4 V × 0.5 ms	8.0	480	<10	Ventak mini 1763(CPI)	General/OR	SP
4	98-09-04	0.7 V × 0.5 ms	8.0	940	<12	Micro Jewel (Medtronic)	General/OR	SP
5	98-12-13	0.6 V × 0.5 ms	14.0	550	<12	Micro Jewel (Medtronic)	Local/EP lab	SQ
6	99-01-06	0.6 V × 0.5 ms	12.0	570	<12	Micro Jewel (Medtronic)	Local/EP lab	SQ

DFT, defibrillation threshold ; EP lab, electrophysiology laboratory ; OR, operating room ; SP, subpectoral ; SQ, subcutaneous

DFT shock ICD가
 pentothal sodium (spike artifact) (ve-
 ntricular electrogram) 가 2 가 가 0.3 mV
 Pocket ICD system 가 0.6 mV
 100 g (volume) 50cc ICD 0.6 mV
 ICD pocket 4 ICD
 2 ICD
 가 ICD pocket (tiered therapy) '가 가
 ICD (volume) 130% ICD (antitachycardia pacing) '가 가
 pocket X- ICD (battery)
 ICD 가 가
 ICD 가
 60 (4) shock
 ICD cardioversion shock R wave
 ICD (battery) VVIR R wave
 ICD
 DFT,
 가
 ICD 3 cm 가 고 안
 ICD가 (Fig. 7).⁶⁾
 (trabeculation) 5 10% 2 가 30 50%
 (screw) ICD 가⁷⁾⁸⁾ ICD
 VOO
 100
 ICD ICD가
 (total mortality)

가⁹⁾¹⁰⁾ (mo -
ICD nophasic wave form) (bipha -
가 (threshold energy)가
1997 AVID(The Antiarrhy -¹³⁾ (generator)
thmics Versus Defibrillator) 가 가 lead system
40% 1016 patch lead (endo -
ICD (507) amiodarone (13) (thra -
(496) sotalol (13) cotomy)
1 , 2 3 ICD 39%, 27% (epicardial patch) (sho -
31% ICD ck wave) (pectoral implanta -
coil
4) 1990 (shock wave) 가
MADIT(Multicenter Automatic Implantable Defi -
brillator)¹¹⁾ ICD (generator)
defibrillation electrode(active can)
coil active can (shock
wave) 가
35% (simple unipolar trans - venous defibr -
illation system)
procain -
amide
95 ICD 101 가 (tiered therapy)
(amiodarone) 가 가
2 가
38.6% ICD 15. (low - en -
8% ICD ergy antitachycardia pacing)
shock
ICD MADIT 가 가
ICD MADIT (dual - chamber)ICD가 가
ICD DC shock (genera -¹⁴⁾ ICD
tor) (lead) ICD
(DC shock energy)
(defibrillating lead)¹⁵⁾
(rate sensing - pacing le -
ad)가 (thracotomy) ICD
(patch electrode)
4 5% 가 ICD

16) 가 가 4 ,
 가 가
 가 , 가
 ICD 6 ICD
 (substrate) 가 1 11
 DFT 가 shock (inappropriate shock delivery)
 ICD (Fig. 2).
 DFT ICD
 17) 가 가
 6 ICD 가 (dual cham-
 ber)ICD가 가
 가 가 15)
 가 가 10%
 가 가 22)
 ICD 가 가 Class 1A
 23)
 18) (2, 5)가 2
 3/4 11% 22)23)
 가 ICD 가
 19) 가
 ICD
 1992 Brugada 24)
 2/3 8
 V1 V3
 20) ST
 가 amiodarone
 63
 , amiodarone
 21) ICD ICD
 25) 43
 V1, V2, V3 ST

ICD 가
 QRS ST
 (Fig. 4A and B).
 60 (4)
 Brugada 가 가 가 ICD
 가 가 가
 가
 ICD ICD (battery) ICD
 VVIR ICD
 (Fig. 5A)
 가
 2 ICD
 가 ICD 3cm
 amiodarone amio - 가 ICD
 darone ICD가 (Fig. 7). VOO
 amiodarone ICD 100
 ICD 4)
 ICD 가 shock
 (6) artifact) ICD가 (spike
 (ventricular electrogram)
 가 2 가
 27) (4) 0.3 mV
 가 0.6 mV
 ICD ICD 0.6 mV
 ICD
 ICD가 (4)
 가
 28) ICD
 가
 29)
 pause - dependent torsades

ICD
 VVIR pacing
 ICD 가
 ICD
 ICD
 3
 (shock therapy)가
 ICD
 (battery)
 가
 ICD (device activation)
 (parameter) 가
 ICD 가 가
 ICD 가
 ICD
 ICD
 ICD 가

요 약

연구배경 :
 가 ICD
 가 ICD 가
 ICD 6

대상 및 방법 :

1997 8 1999 1
 ICD 6
 ICD

결 과

1) ICD 47(22 60)
 가 5

2) 6 4 가
 , 2
 3) 6
 4 3 3
 4) 3
 ICD
 5) ICD 4
 가 subpectoral pocket
 , 2
 subcutaneous approach
 6) VVIR ICD
 7) 가 2
 ICD
 가
 ICD 가 가
 결 론
 ICD
 가 ICD

중심 단어 :

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