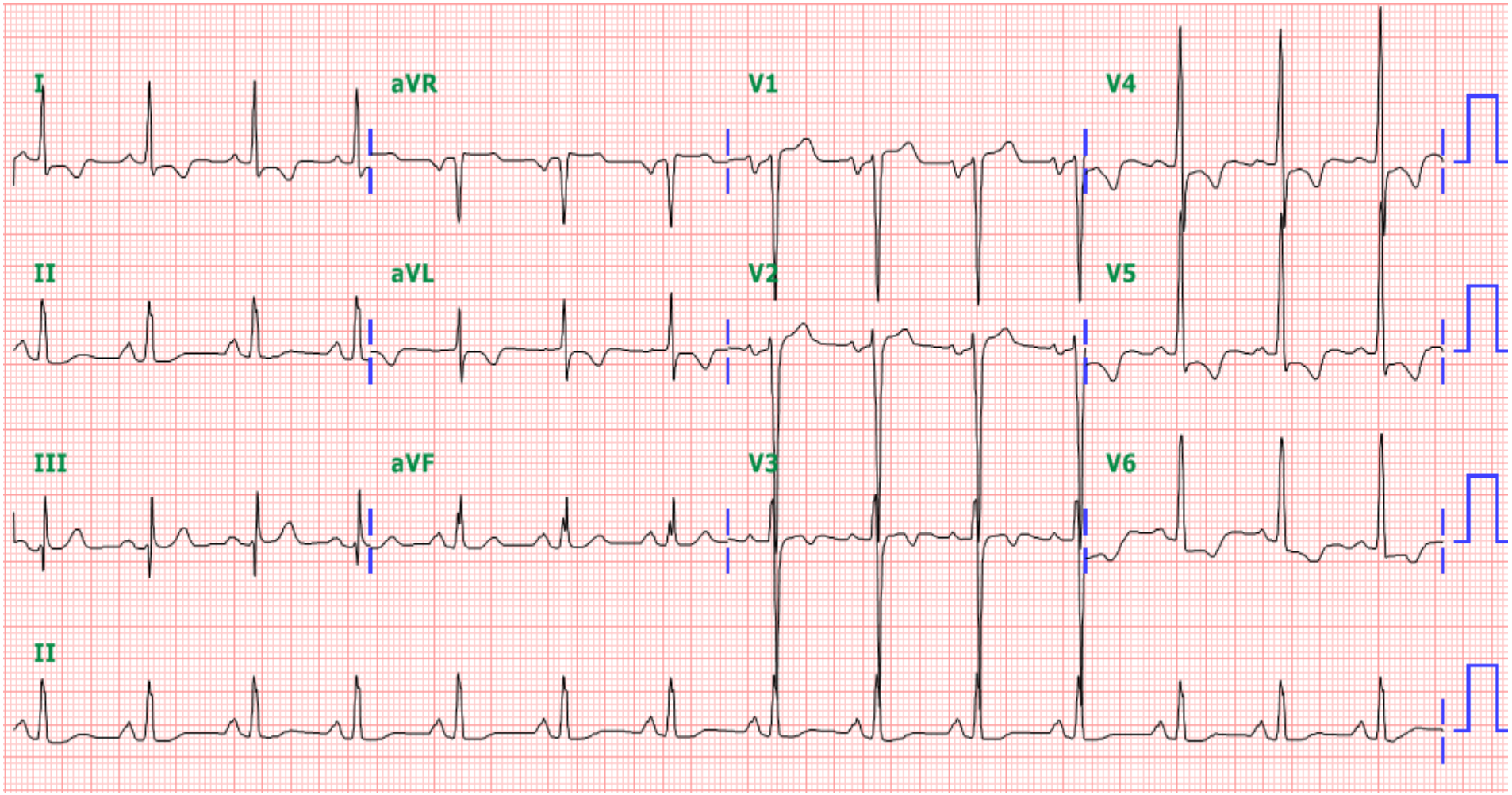
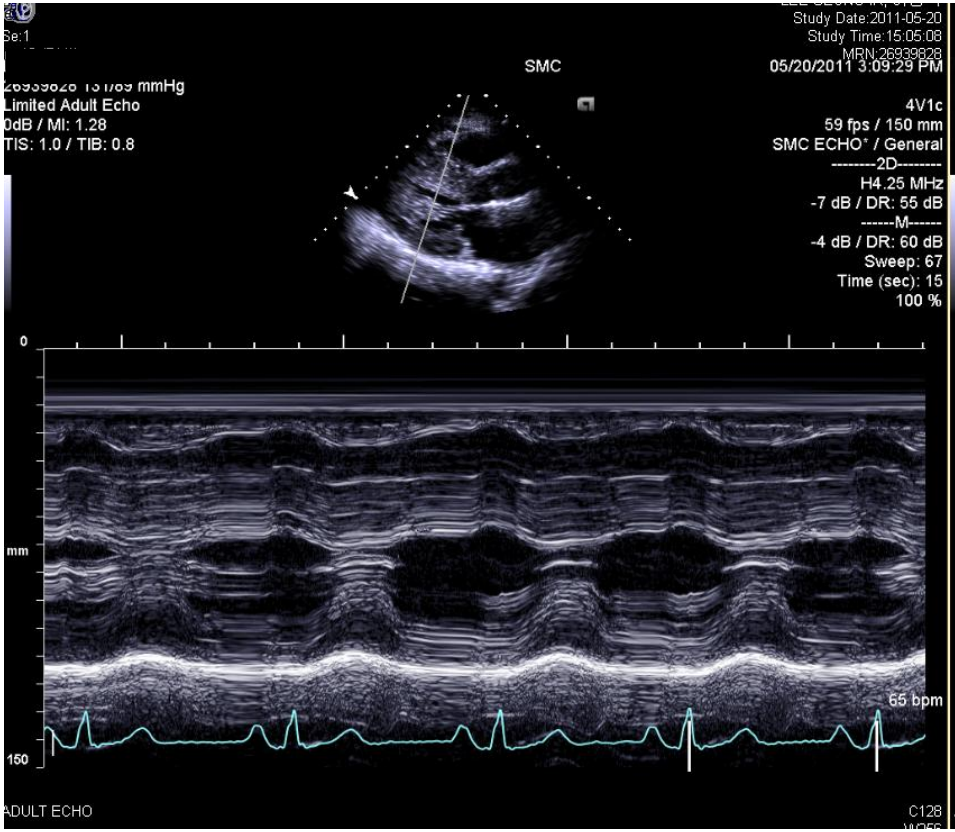
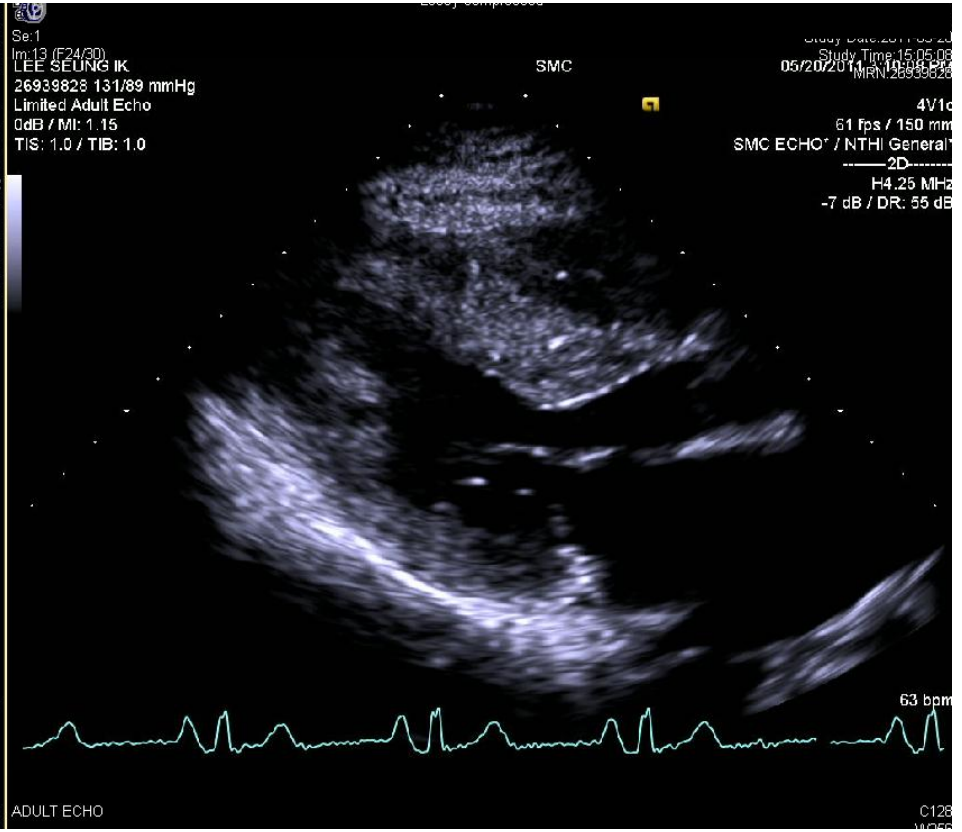
ICD in HCMP patient

온 영 근
삼성서울병원 성균관의대

A 47-year-old men has experienced syncope for three times. The patient has family history of sudden cardiac death, father and brother.

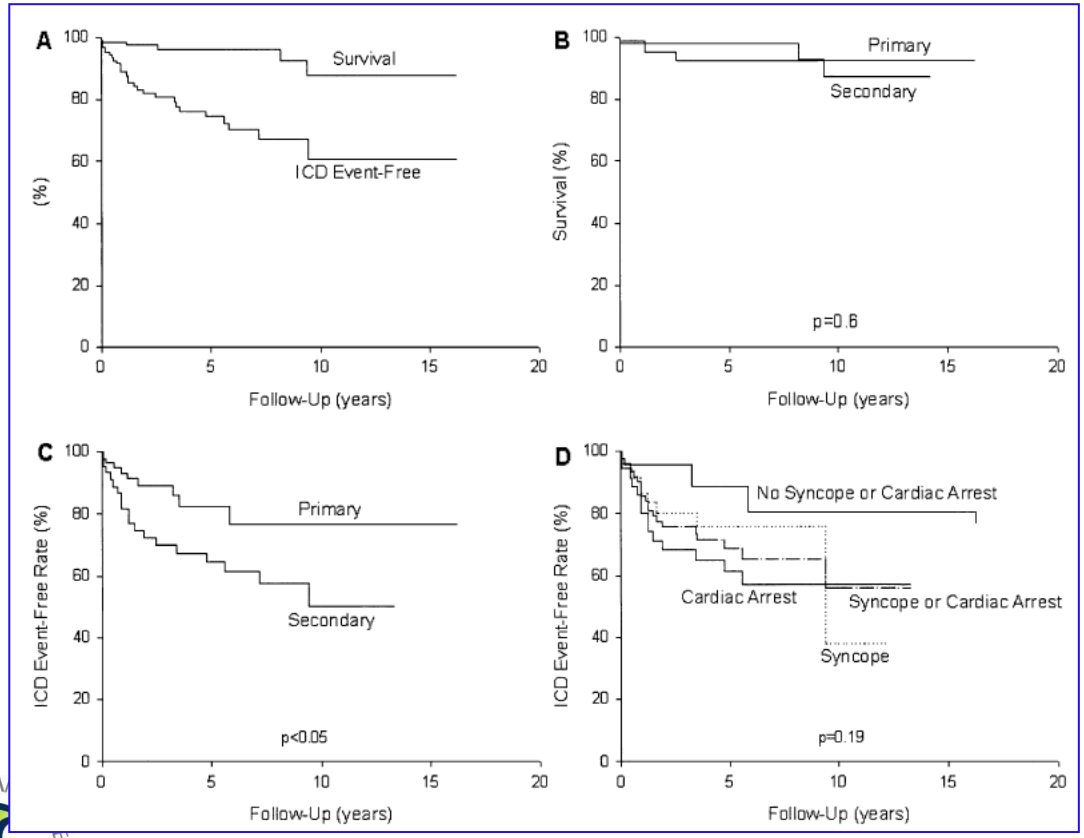

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II


Study Date:2011-05-20
Study Time:15:05:08
MRN:26939828
SMC
05/20/2011 3:09:29 PM
Limited Adult Echo
0dB / MI: 1.28
TIS: 1.0 / TIB: 0.8
4V1c
59 fps / 150 mm
SMC ECHO° / General
--------2D--------
H4.25 MHz
-7 dB / DR: 55 dB
------M------
-4 dB / DR: 60 dB
Sweep: 67
Time (sec): 15
100 %
0
mm
150
65 bpm
ADULT ECHO
C128


Se:1
Im:13 (F24/30)
LEE SEUNG IK
26939828 131/89 mmHg
Limited Adult Echo
0dB / MI: 1.15
TIS: 1.0 / TIB: 1.0
SMC
4V1c
61 fps / 150 mm
SMC ECHO° / NTHI General
-------2D--------
H4.25 MHz
-7 dB / DR: 55 dB
63 bpm
ADULT ECHO
C128

Hypertrophic CardioMyopathy (HCM)

- Prevalence of 1~2 of 1,000 general population
- Prone to atrial and ventricular arrhythmias and sudden death
- Annual incidence of sudden death in HCM : 1~2 %



Begley DA, et al. *PACE 2003;26:1887*

Implantable Cardioverter Defibrillator (ICD)

보험급여기준

비후성 심근병증 환자로서 아래의 ①~⑤ 중 두 가지 이상에 해당되는 경우

(1) 실신의 증상

(2) 급사의 가족력

(3) 좌심실중격의 과도한 비후(**>30mm**)

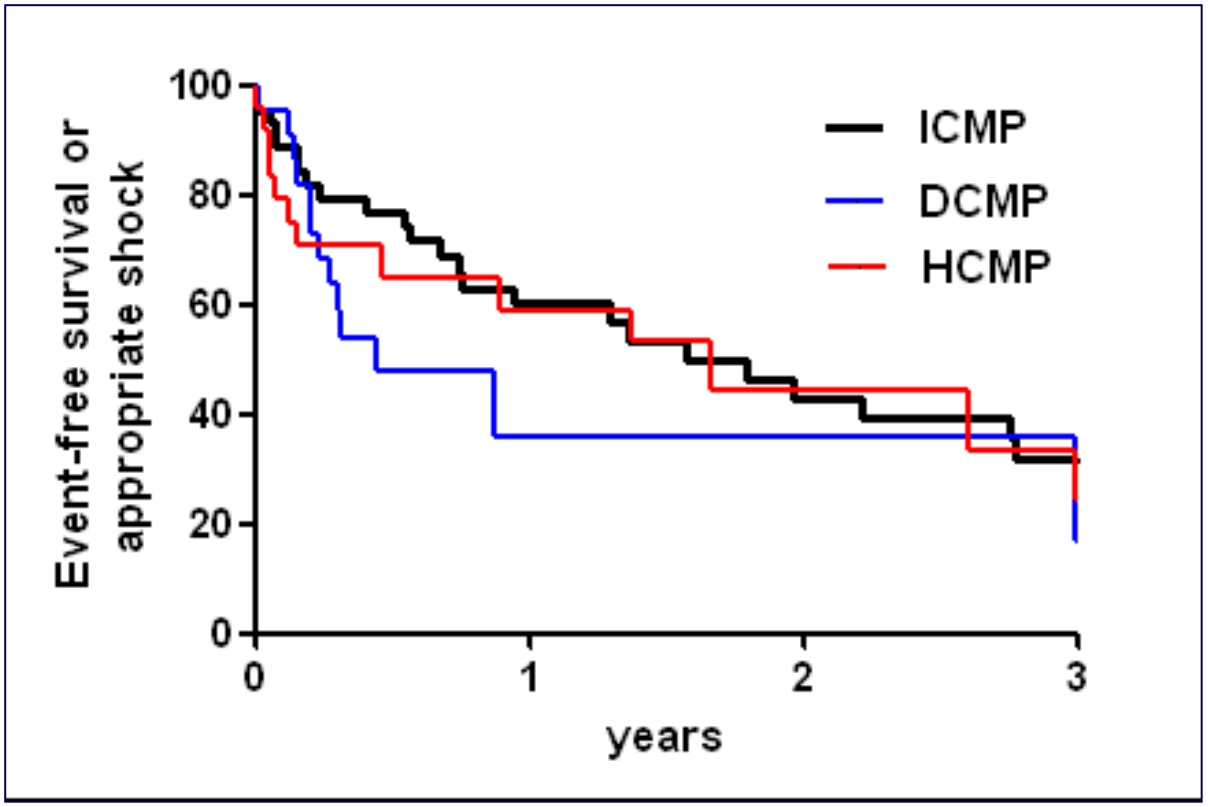
(4) **24**시간 활동 중 심전도에서 나타난 비지속성 심실빈맥

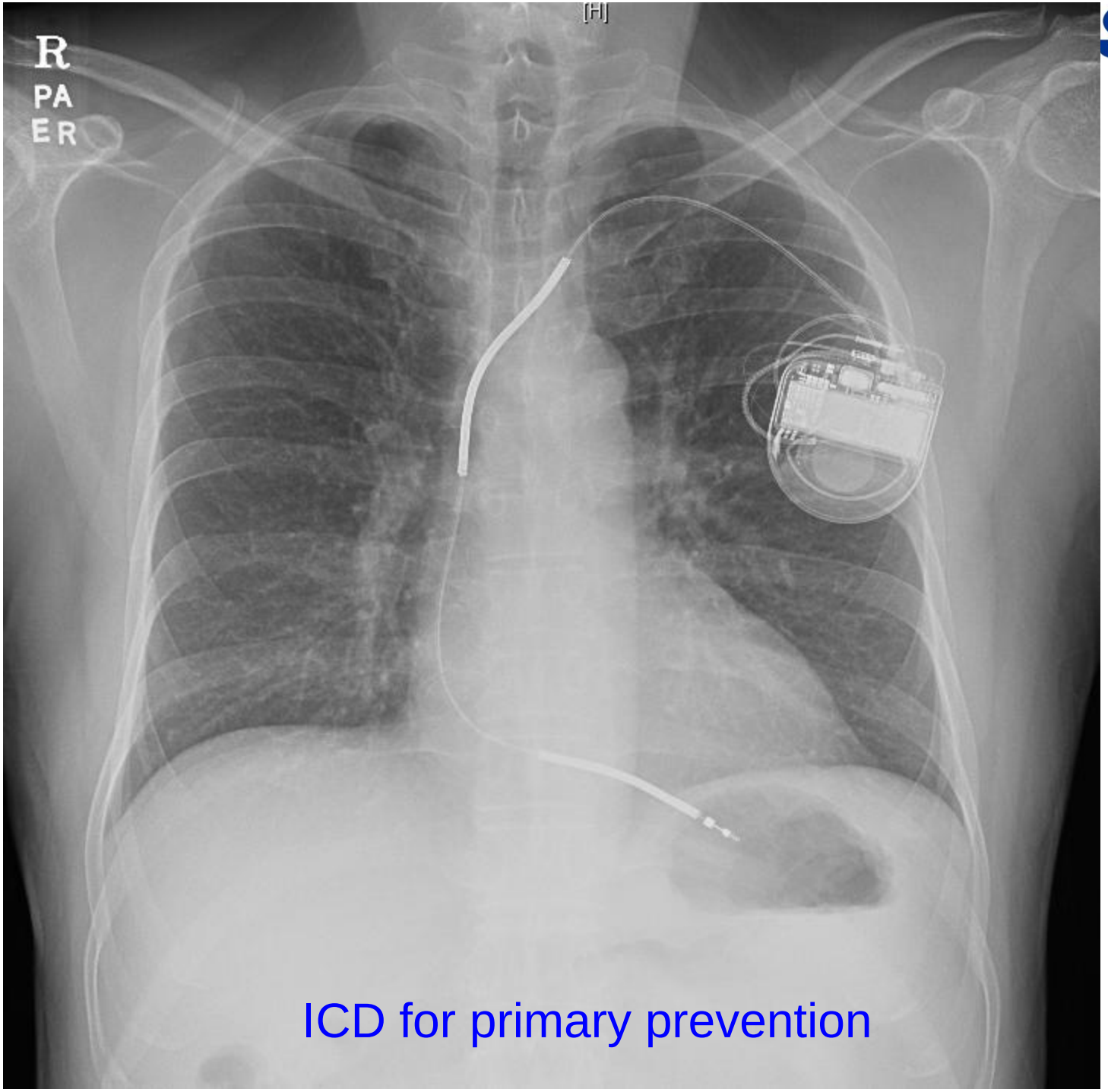
(5) 운동부하검사 상 이상 혈압증가 반응이 없는 경우

(충분한 운동부하에도 혈압상승이 < **20mmHg** 인 경우)

Death or appropriate shock in Korean ICD patients

- 삼성서울병원
- 148명 ICD implanted patients (Oct 1999 ~ Jun 2011)
- Mean fu 29 개월





ICD for primary prevention

ICD setting

Type	Status	Detect CL	NIDini	NIDredect	Rx
VF	On	300 ms (200bpm)	18/24	12/16	On
VT	OFF				
Monitor	On	400ms(150bpm)			

VF Therapies	Rx1	Rx 2	Rx3	Rx4	Rx5	Rx6
Stauts	On	On	On	On	On	On
Pathway	B>AX	B>AX	B>AX	AX>B	B>AX	AX>B
Energy(J)	20	35	35	35	35	35

Single Chamber SVT Criteria

Wavelet: On

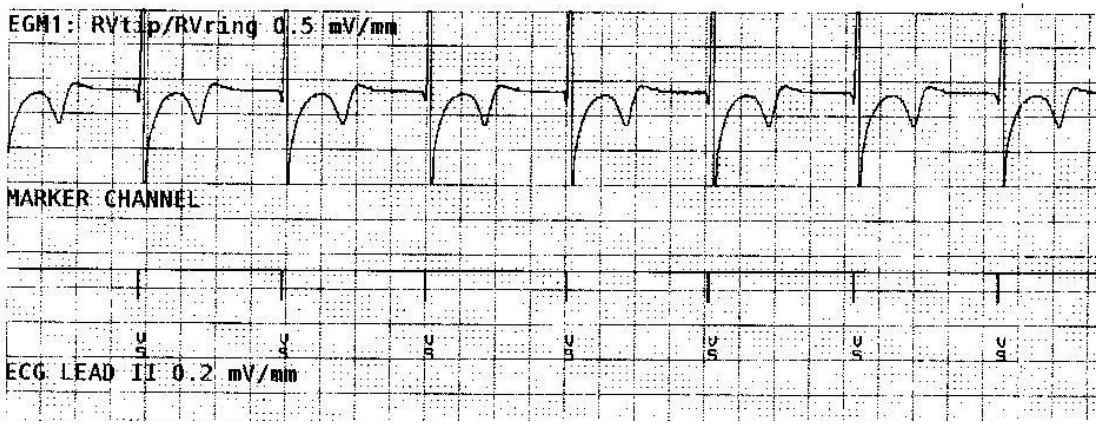
Stability: On(40ms)

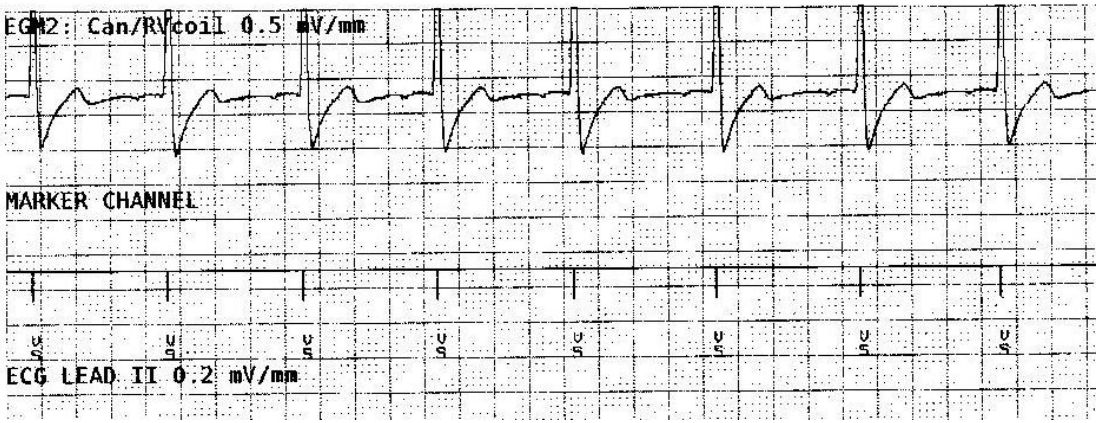
Onset: OFF

SVT Limit: 300msec **(200 bpm)**

ATP (burst 8 beats) during charging up to 240ms **(250 bpm)**

Virtuoso VR D164VWC 19-Jul-2011 12:16:26
CHART SPEED 25.0 mm/s





Device: **Virtuoso VR D164VWC**
Serial Number: **PUP615678S**

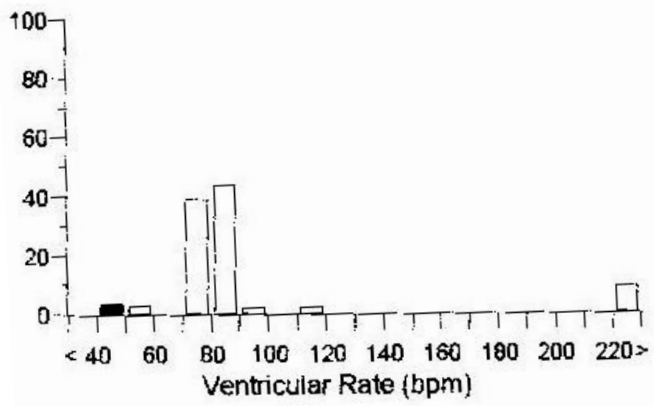
Date of Visit: **19-Jul-2011 12:08:09**
SW002 Software Version 7.0

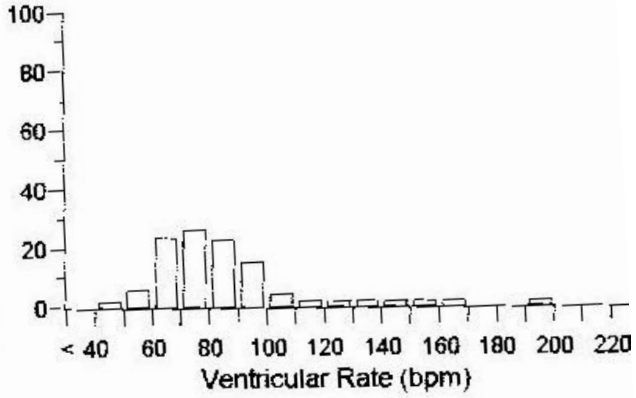
Rate Histograms

Prior to Last Session
26-May-2011 to 26-May-2011
47 seconds

Since Last Session
26-May-2011 to 19-Jul-2011
54 days

Ventricular
% of Time
□ VS
■ VP





The patient complained of two ICD shocks after ICD implantation

Device: **Virtuoso VR D164VWC**
Serial Number: **PUP615678S**

SW002 Software Version 7.0

Arrhythmia Episode List

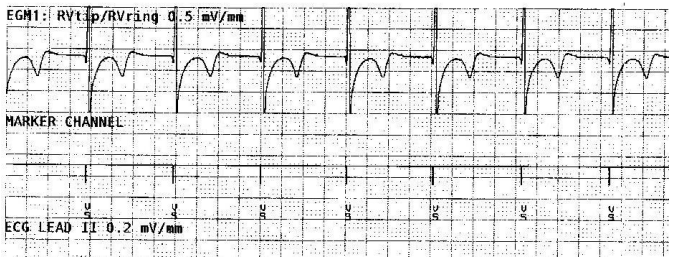
Arrhythmia Episode List: 26-May-2011 09:33:43 to 19-Jul-2011 12:08:09
All collected episodes.

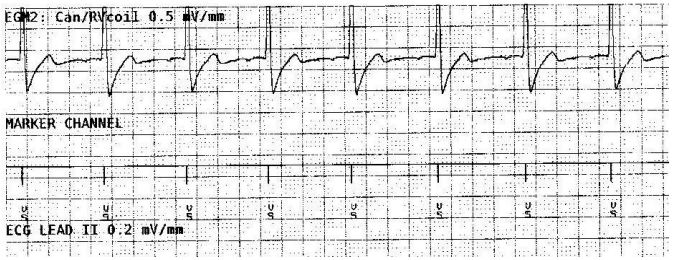
Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm V
VF	1	20J	Yes	7	19-Jul-2011	09:40	:10	207
VT-Mon				6	19-Jul-2011	09:35	:04:40	195
VF	1	20J	Yes	5	19-Jul-2011	09:35	:13	207
VT-Mon				4	19-Jul-2011	09:35	:01	207
SVT-Wavelet				3	19-Jul-2011	09:22	:13:38	176
SVT-Wavelet				2	22-Jun-2011	01:46	:20	158

Last Programmer Session 26-May-2011

(Data prior to last session has not been interrogated.)

Virtuoso VR D164VWC 19-Jul-2011 12:16:26
CHART SPEED 25.0 mm/s

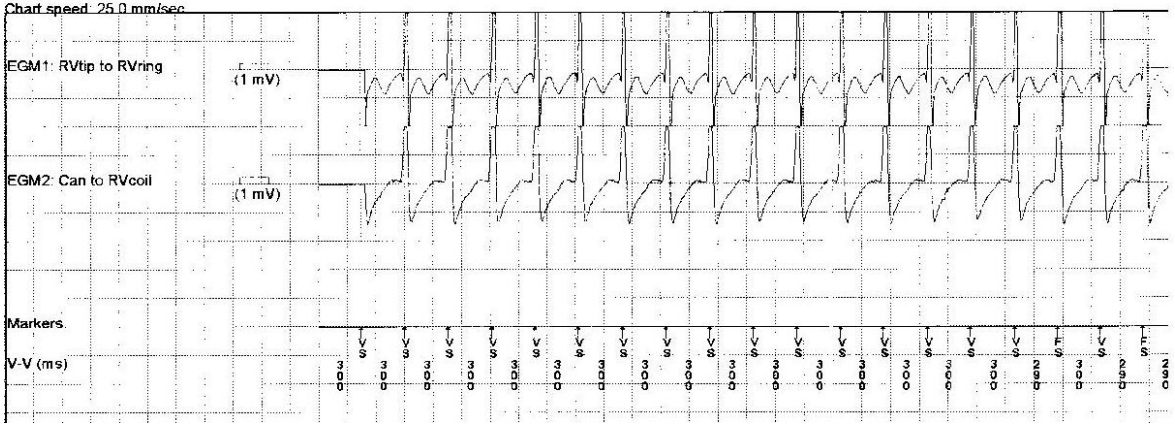


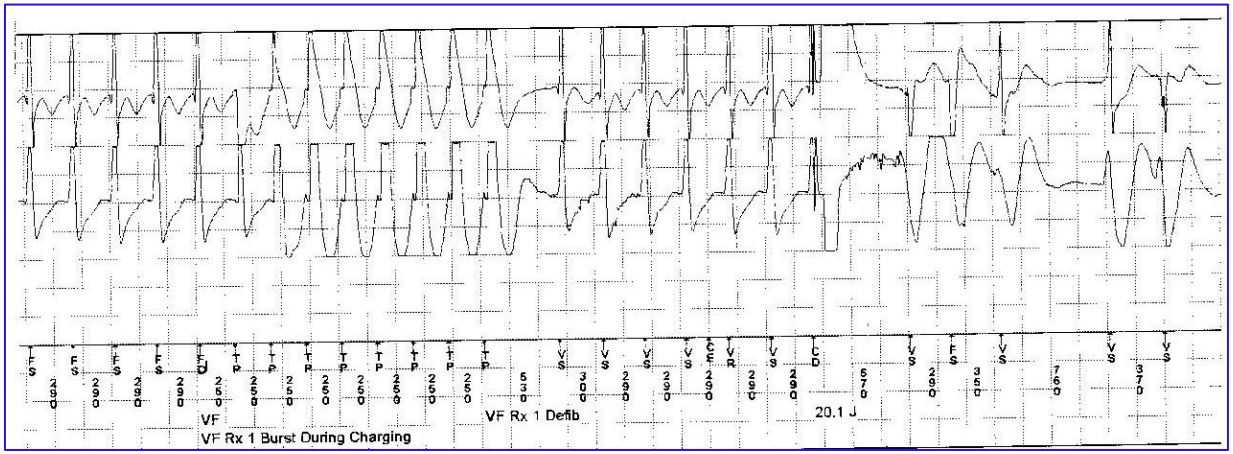


Device: Virtuoso VR D164VWC
Serial Number: **PUP615678S**

Treated VT/VF Episode #7

Episode #7 - VF
Chart speed: 25.0 mm/sec



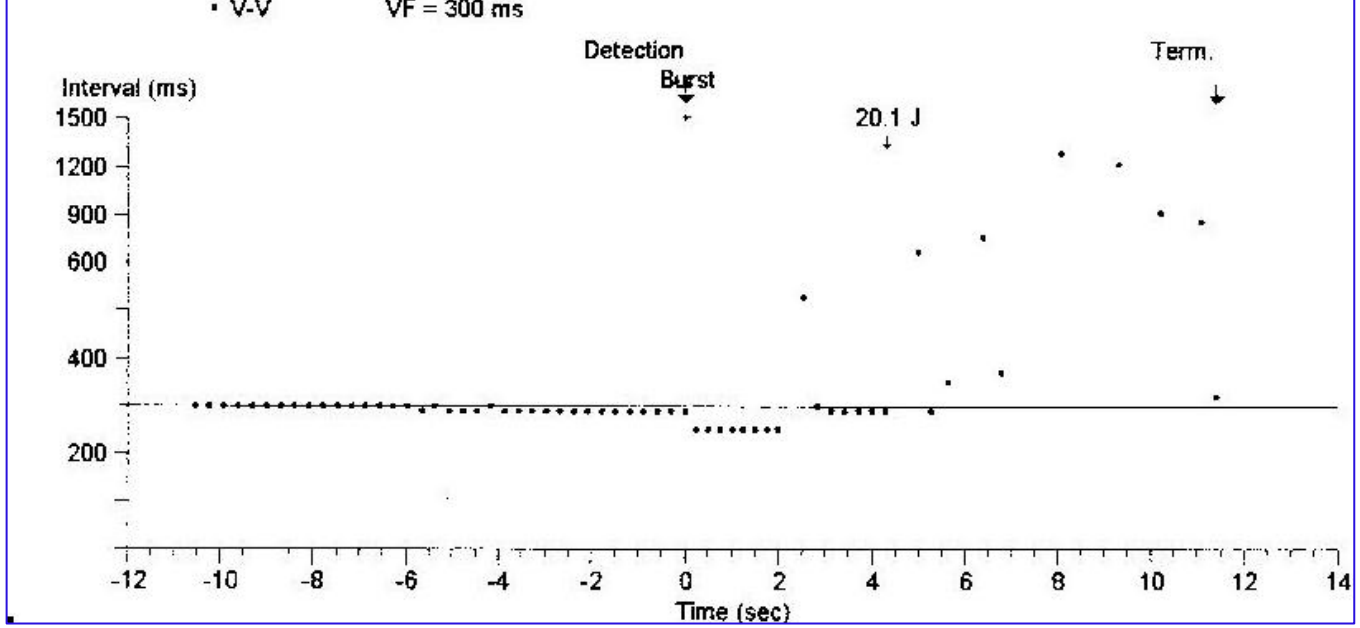


Device: Virtuoso VR D164VWC
Serial Number: PUP615678S

SW002 Software Version 7.0

Treated VT/VF Episode #7

Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm V
VF	1	20J	Yes	7	19-Jul-2011	09:40	:10	207



Device: **Virtuoso VR D164VWC**
Serial Number: **PUP615678S**

SW002 Software Version 7.0

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Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm V
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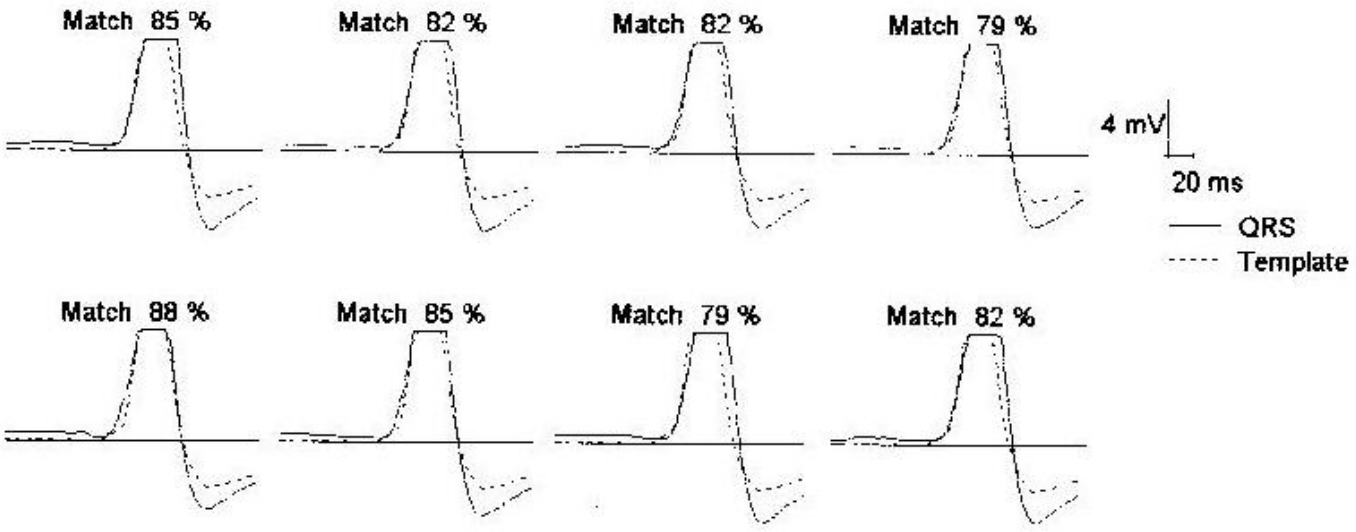
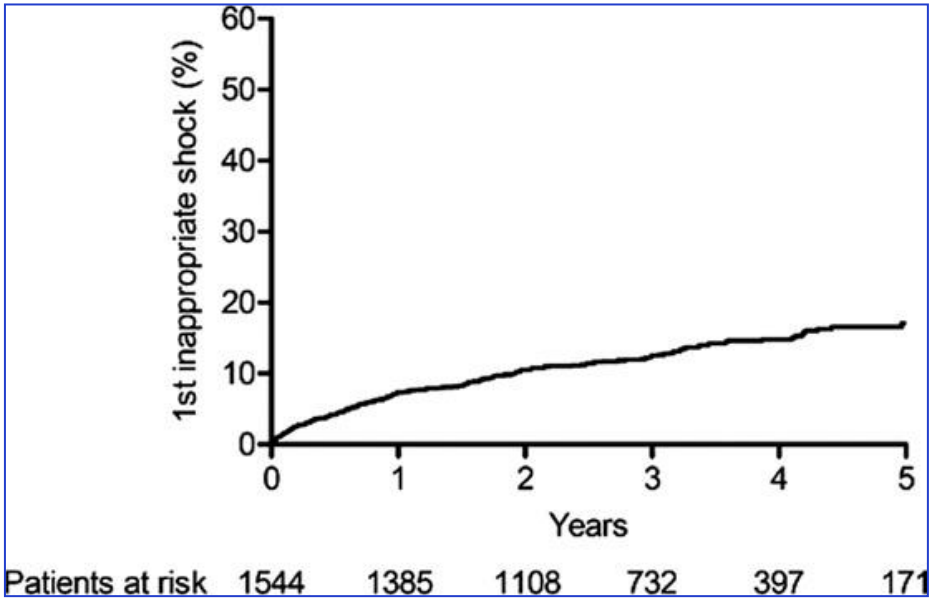


Inappropriate ICD Shocks

- Decreased compliance to the therapy
- Anxiety to receive the next inappropriate ICD Rx

  : bad quality of life or depression

First Inappropriate Device Shock



n =1,544
Mean age 61 yr old
Male 79%
Primary prevention 56%
Ischemic heart disease 64%

The average time from implantation to first inappropriate shock was 17 ± 16 months.
The cumulative incidence : **7%** at 1 year, **13%** at 3 years, **18%** at 5-year follow-up.

van Rees JB, et al. *J Am Coll Cardiol*. 2011;57:556

Predictors of Inappropriate Shock

	Univariate			Multivariate		
	HR	95% CI	p Value	HR	95% CI	p Value
Female	0.8	0.6–1.2	0.34			
Age <70 yrs	1.7	1.1–2.3	<0.01*	1.8	1.3–2.5	0.01
History of AF	2.0	1.5–2.7	<0.01*	2.0	1.5–2.7	<0.01
History of smoking	1.2	0.9–1.6	0.32			
Secondary indication for ICD	1.1	0.8–1.5	0.48			
Nonischemic heart disease	1.3	1.0–1.8	0.04*			
No statins at baseline	1.4	1.0–1.8	0.03*	1.3	1.0–1.7	0.09
Beta-blocker	0.8	0.6–1.1	0.22*			
NYHA functional class III to IV	1.0	0.7–1.3	0.96			
Interim appropriate shocks	1.6	1.0–2.7	0.04*	1.6	1.0–2.6	0.06

Independent predictors of the occurrence of inappropriate shocks included a history of atrial fibrillation (hazard ratio [HR]: 2.0, p <0.01) and age younger than 70 years (HR: 1.8, p <0.01).

van Rees JB, et al. *J Am Coll Cardiol*. 2011;57:556

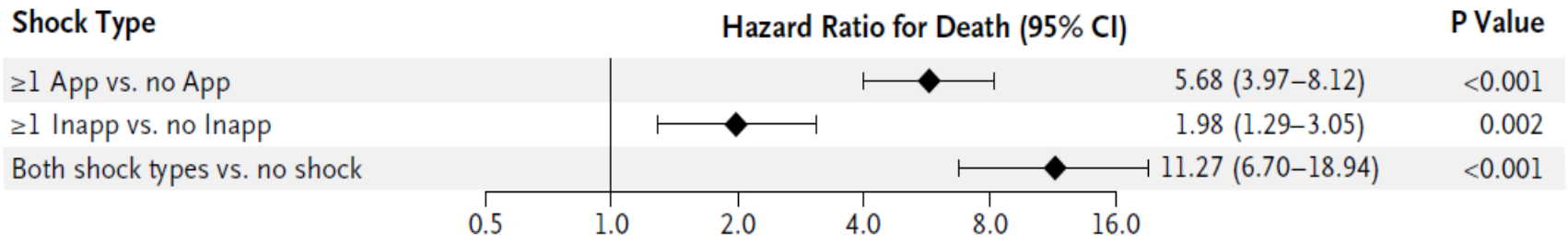
Causes of Inappropriate Shock

	Total (n = 1,544)	Single-Chamber ICD (n = 188)	Dual-Chamber ICD (n = 819)	CRT-D (n = 537)
Patients with ≥1 inappropriate shock	204 (13)	29 (15)	122 (15)	53 (10)
Rhythm misdiagnosis				
Supraventricular tachycardia	155 (76)	19 (65)	96 (79)	40 (75)
AF	92 (45)	14 (48)	55 (45)	23 (43)
Other than AF	63 (31)	5 (17)	41 (34)	17 (32)
Abnormal sensing	25 (12)	2 (8)	15 (12)	8 (15)
Sinus tachycardia	22 (11)	7 (24)	10 (8)	5 (10)
Unclassified	2 (1)	1 (3)	1 (1)	0 (0)

Misdiagnosis of supraventricular tachycardia was the leading cause (76%) of inappropriate shocks.

van Rees JB, et al. *J Am Coll Cardiol*. 2011;57:556

- 811 ICD implanted patients with heart failure for primary prevention
- median fu 45.5 months
- 33.2% ICD shocks: 15.8% appropriate shocks, 10.7% inappropriate shocks
- Appropriate and inappropriate shocks associated with a five-fold and two-fold increased risk of death, respectively.



Poole JE, et al. N Engl J Med 2008;359:1009

Inappropriate Shock in Korea

- 삼성서울병원
- 148명 ICD implanted patients (Oct 1999 ~ Jun 2011)
- 남자 88명, 75%, mean **53 세**
- Mean fu 29 개월
- Primary prevention **23%**
- ICD shock :

  appropriate shock: **43%** of patients

  (15.6% or 50% of primary or secondary prevention, *p<0.001*)

  inappropriate shock: **23%** of patients

  (18.8% or 24.1% of primary or secondary prevention, *p = ns*)
- Causes of inappropriate shock

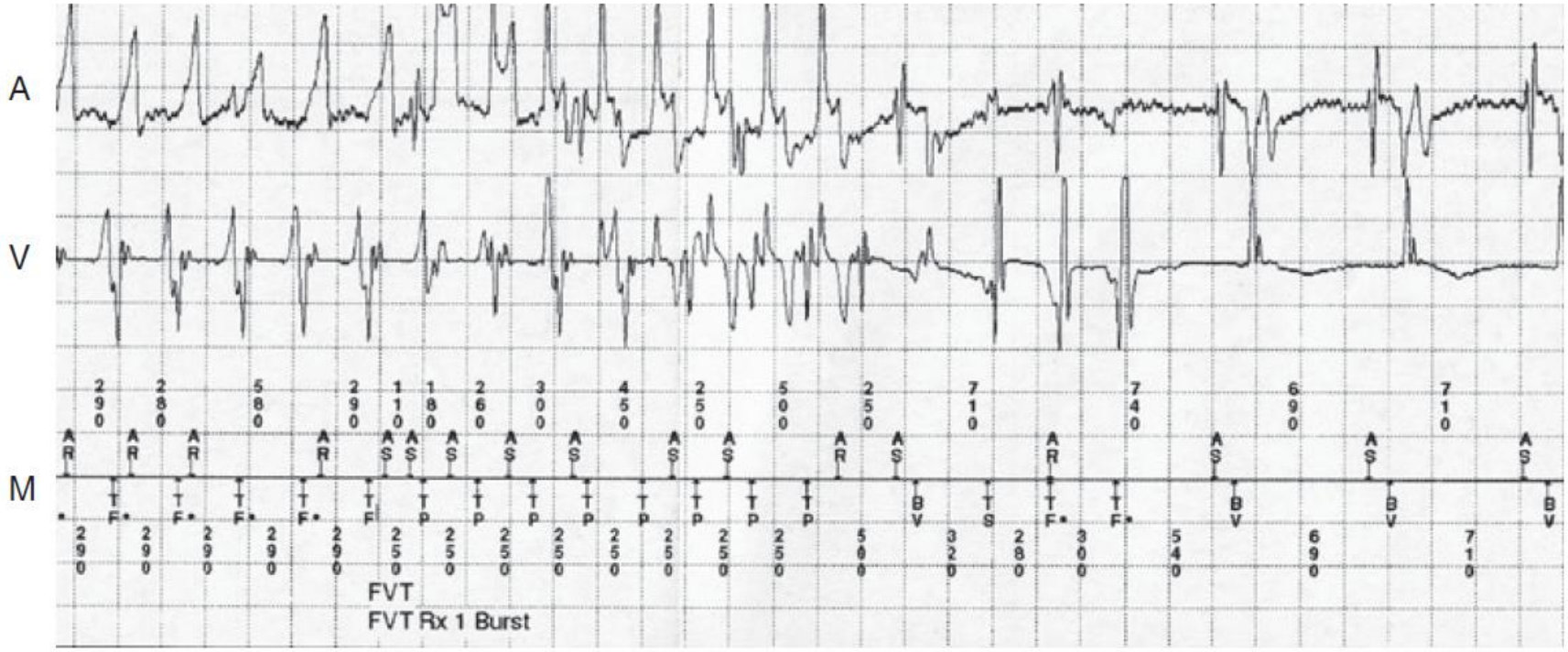
  AF 67.7%, SVT 23.5%, erroneous sensing 8.8%

To reduce unnecessary ICD Rx

- The programming of antitachycardia pacing (ATP)
- Prolongation in ventricular tachyarrhythmia (VT) detection

: to reduce unnecessary ICD Rx owing to supra- as well as nonsustained VT

Termination of a FVT with the ATP



Schwab JO. Fundamental & Clinical Pharmacology 2010;24:653

PREPARE study

(Programming of Detection and Therapy Parameters in ICDs Reduces Shock)

- Prospective, cohort-controlled study of 700 patients with primary prevention for ICD from 38 centers
- Control cohort of 689 primary prevention patients from the EMPIRIC and MIRACLE-ICD

- VT/VF : rates ≥182 beats/min that were maintained for at least 30 of 40 beats.
- Antitachycardia pacing : first therapy for regular rhythms with rates of 182 ~ 250 beats/min
- Supraventricular tachycardia discriminators for rhythms ≤ 200 beats/min

- Shock in the first year: **9% vs. 17%** ($p<0.01$).

- Shock reduction by combining use of ATP for fast VT (250 bpm), fast rate cutoffs, extended detection durations and use of SVT discriminators up to 200 bpm

Wilkoff BL, et al. J Am Coll Cardiol 2008;52:541

Final ICD setting of the patient

Type	Status	Detect CL	NIDini	NIDredetect	Rx
VF	on	272ms (220bpm)	18/24	12/16	on
VT	on (monitor)	400ms (150bpm)	16	12	off

Take Home Message

- Hypertrophic Cardiomyopathy patients are prone to atrial and ventricular arrhythmias and sudden death.

- Death or appropriate shock in Korean HCMP patients with ICD
  : 41% in 1 years, 56% in 2 years, 75% in 3 years.

- Inappropriate shock: **23%** of patients during mean fu of 29 months
- Causes of inappropriate shock : AF 67.7%, SVT 23.5%

- Programming of detection and therapy parameters in ICDs could reduces inappropriate shock.