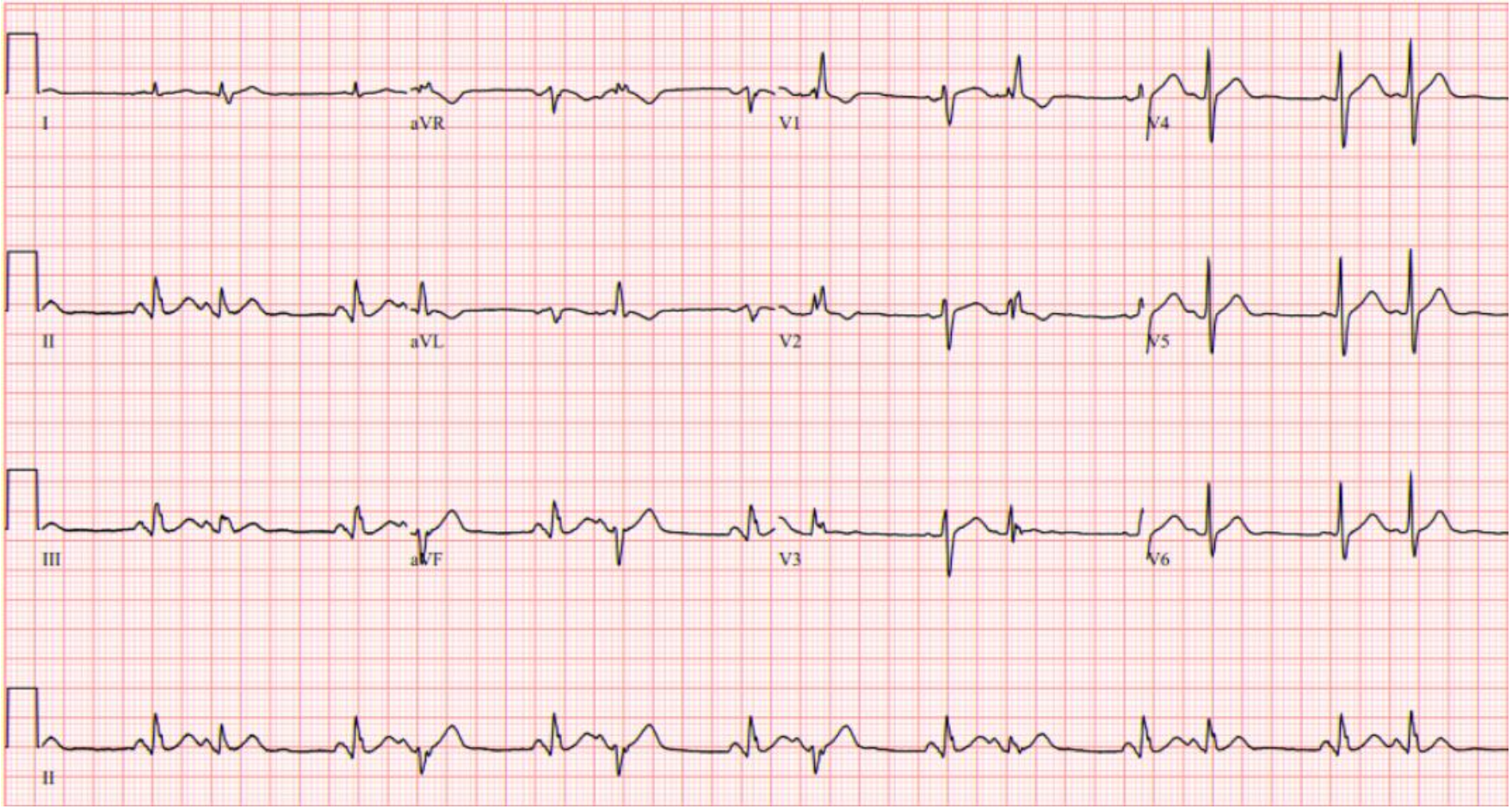
Interesting ECG

2018년 추계심장학회

M/73, 두근거림

증례 1

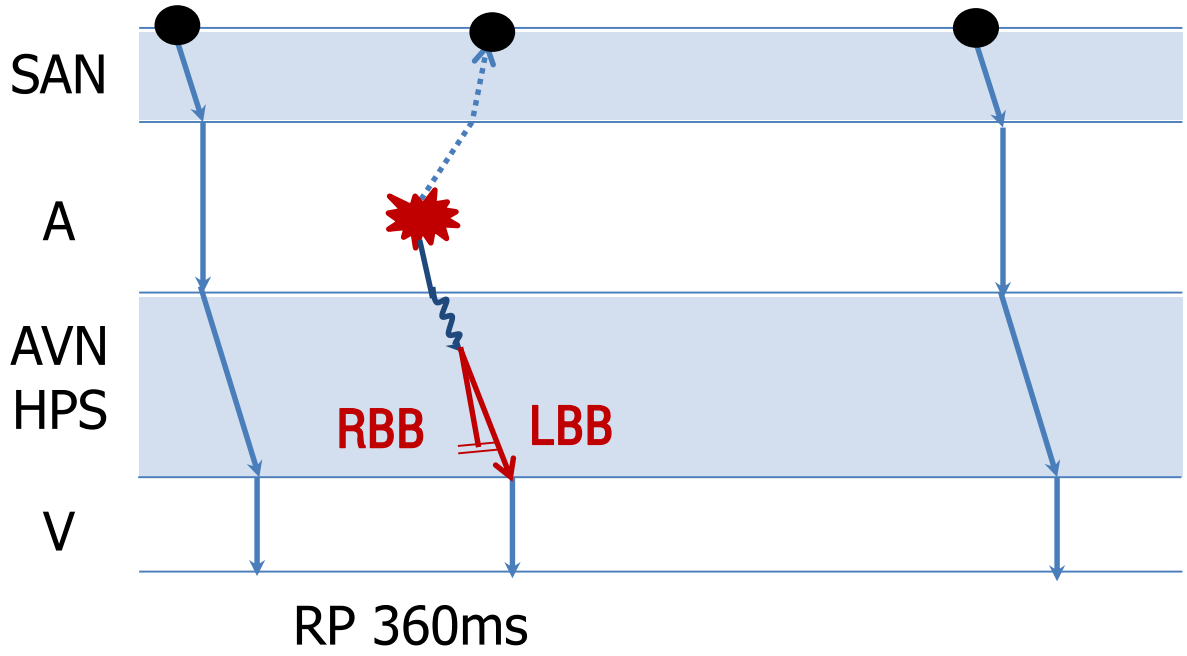


이 심전도에서 관찰되는 소견은?

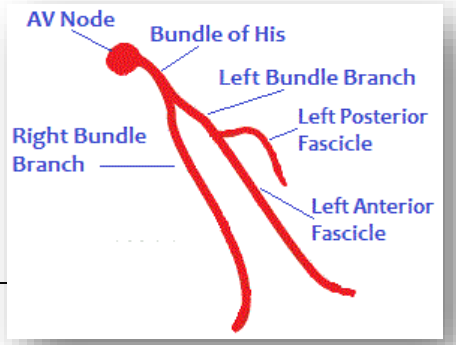
1) APC 2) VPC 3) Both 4) None of them

APC with aberrant conduction

증례 1



"Physiologic delay in the His-Purkinje system"



P

A

AVN

AVN

HPS

RBB

LPF

LAF

AVN

RBB

LPF

LAF

V

QRS

c b a

a : Normal

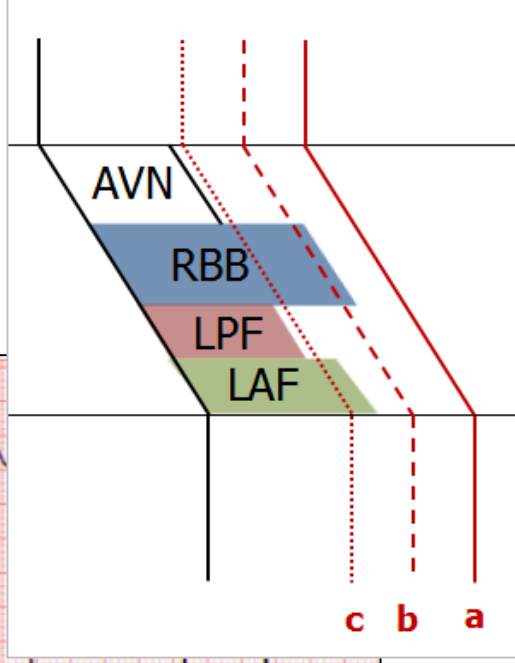
b : RBBB

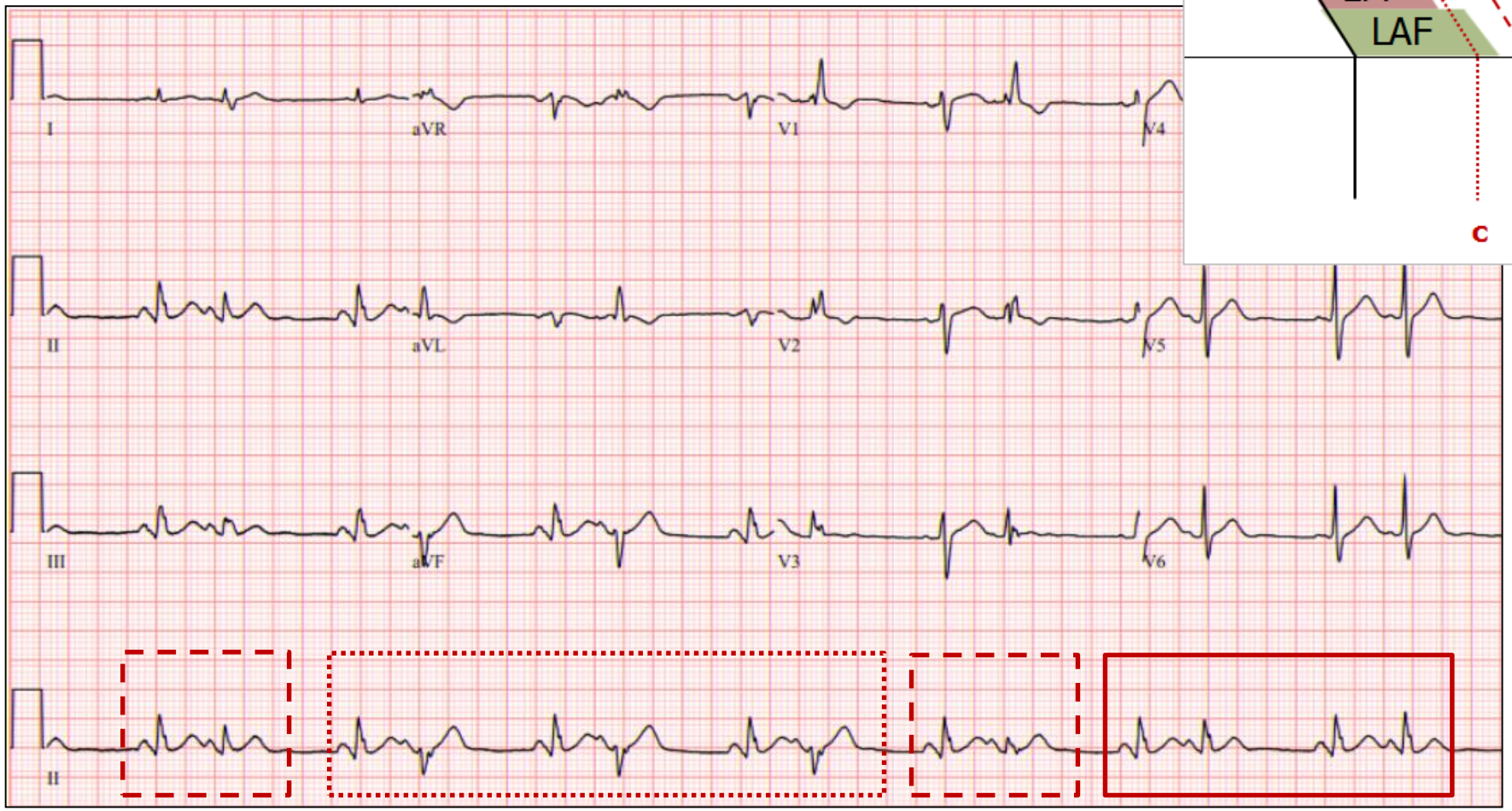
c : Bifascicular block (RBBB+LAFB)

a : Normal

b : RBBB

c : Bifascicular block (RBBB+LAFB)

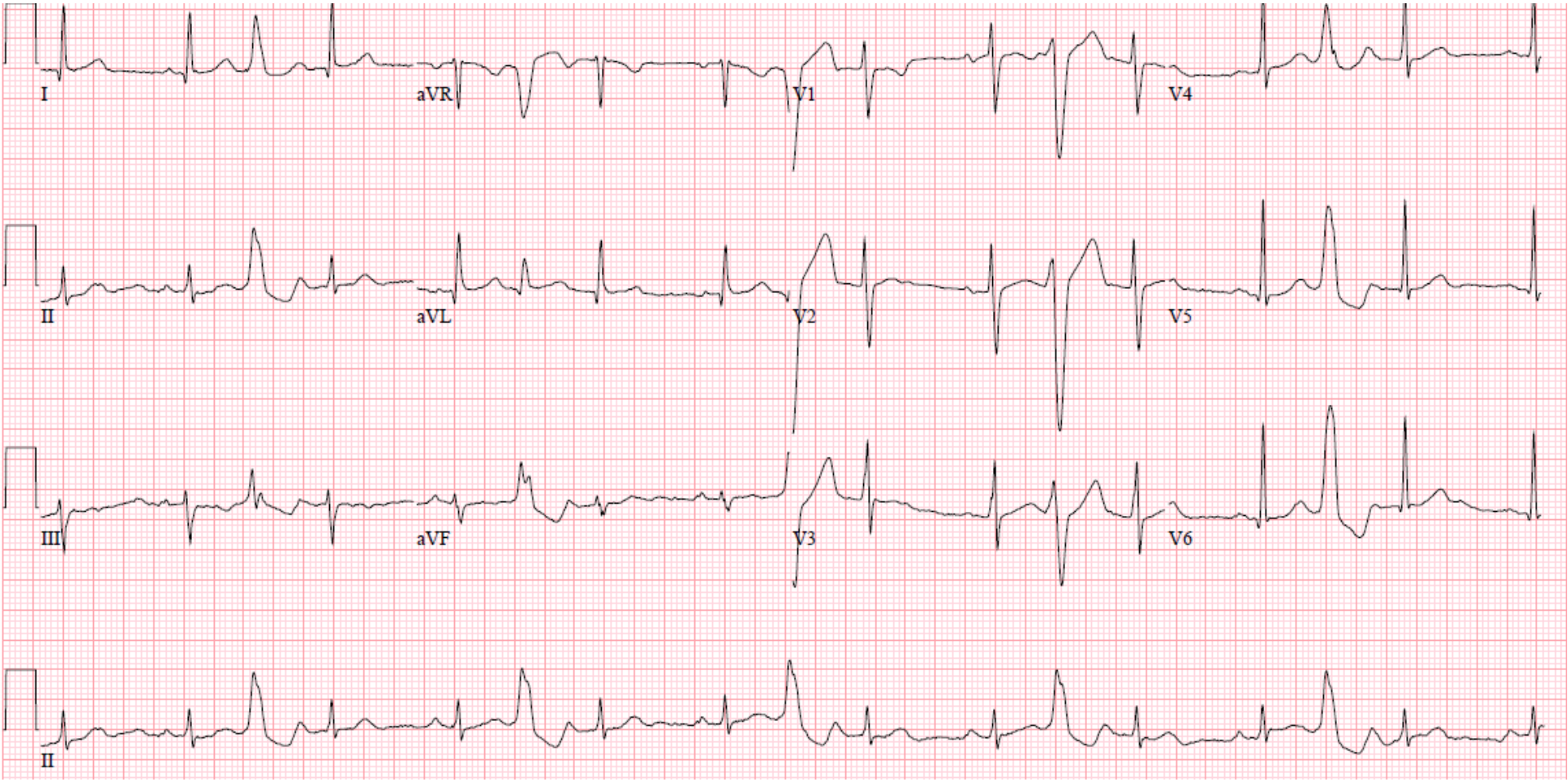




b **c (RP 320ms)** **b (RP 360ms)** **a (RP 380ms)**

증례 2

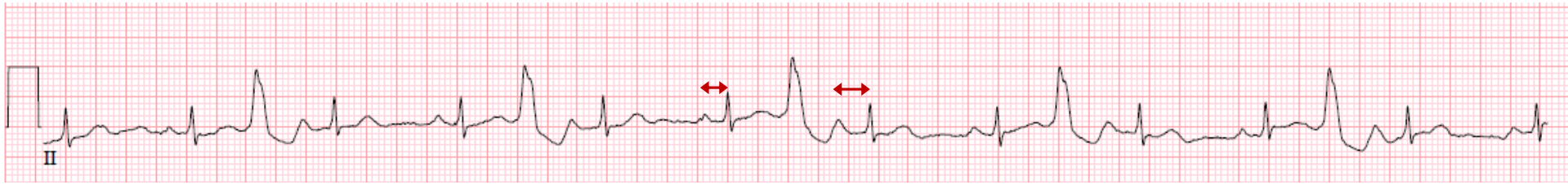
F/65, No Sx.

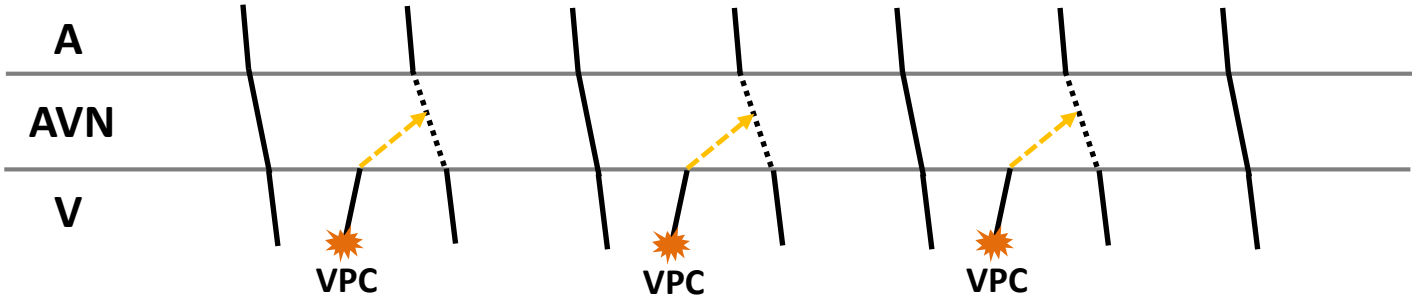


심전도에서 보이는 소견은?

1) Aberrant conduction 2) Concealed conduction 3) Non-conduction

증례 2





Concealed reterograde conduction of a ventricular premature beats
delayed AV conduction (prolong PR interval)

증례 3

53세 여자

- 53세 여자
- 5개월전부터 하루 2회 어지럼증, 3일전 악화, 마트 점원으로 일하다 실신
- 가족력: 어머니가 심장마비

- 심초음파: 정상

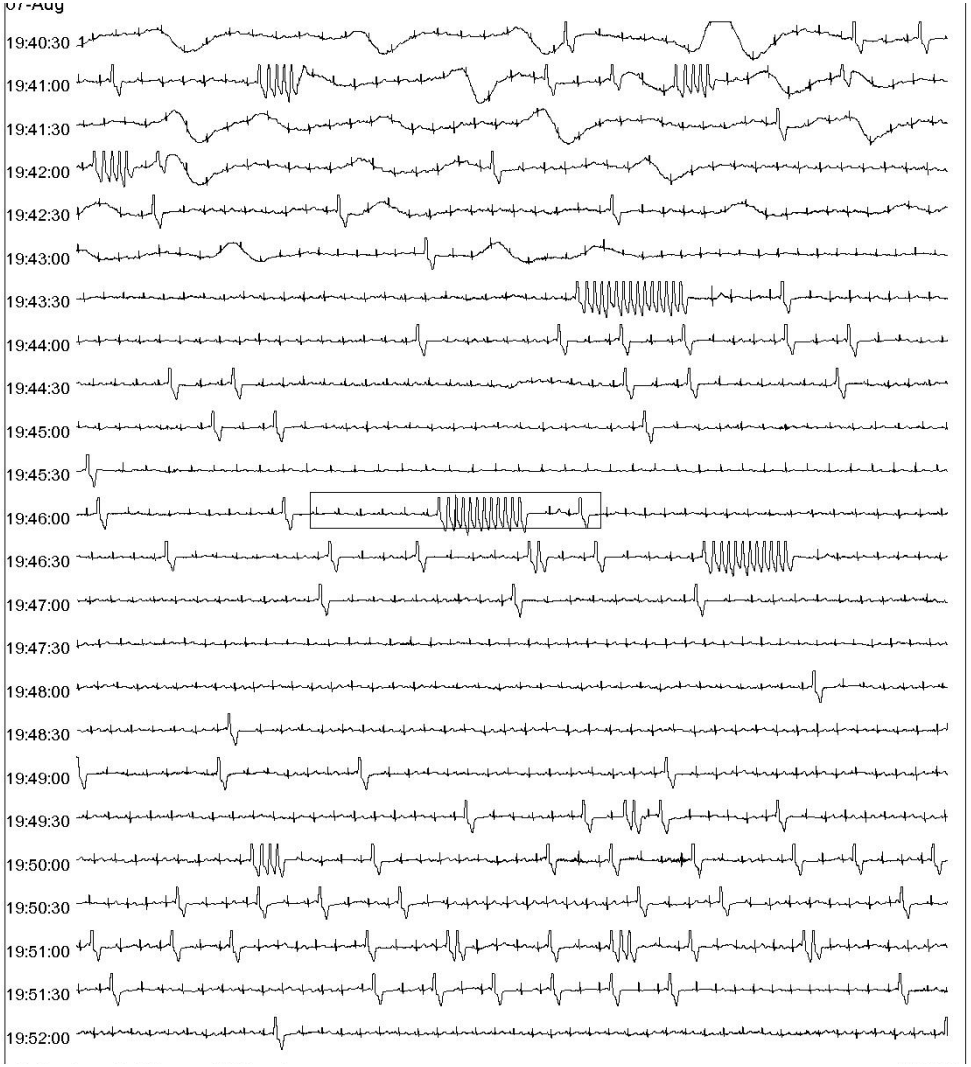
증례 3

GE MAC55 V009B.1 (1)
25mm/s 10mm/mV 16 - 150Hz 60Hz

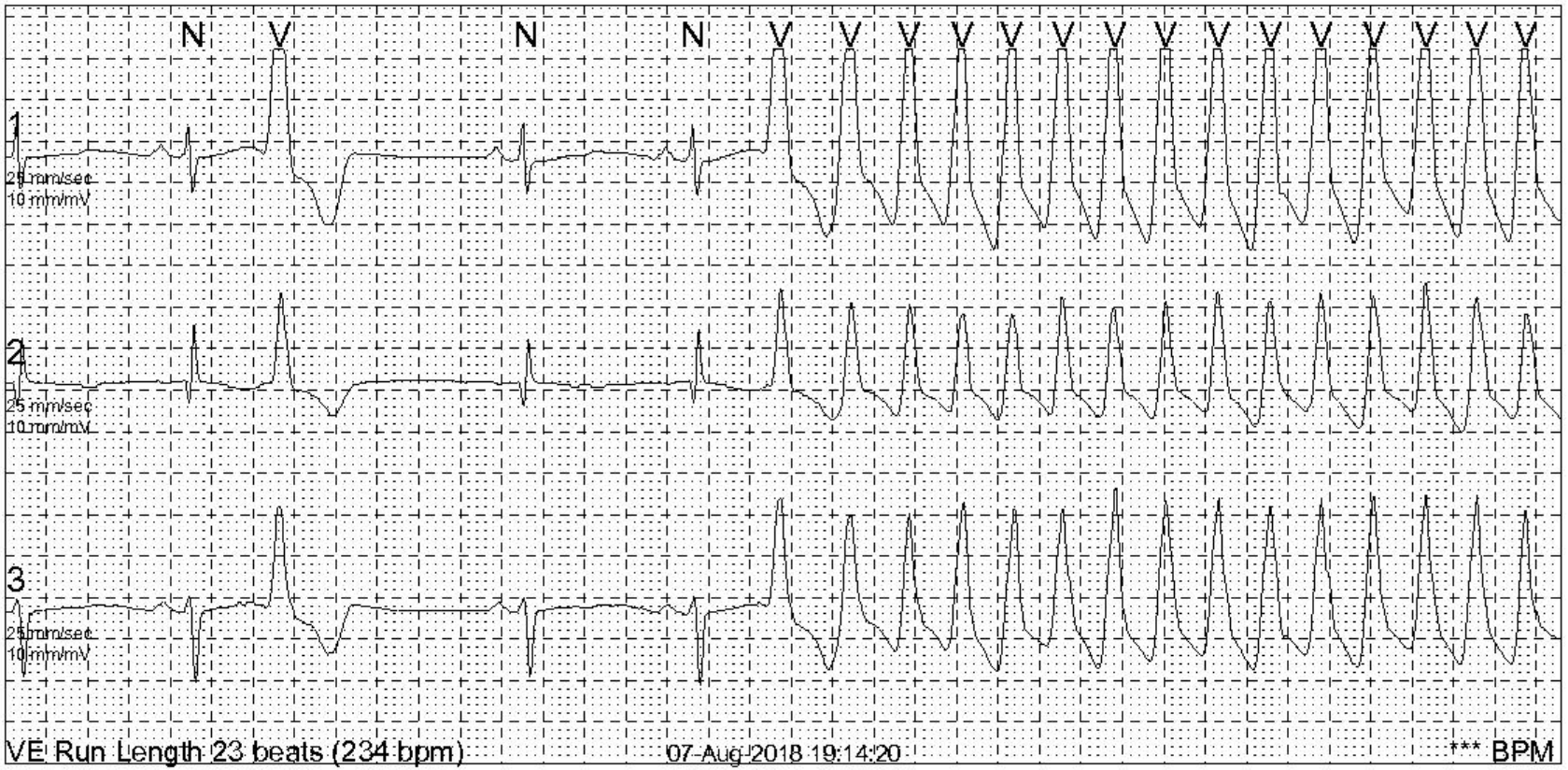
Attending MD:

증례 3

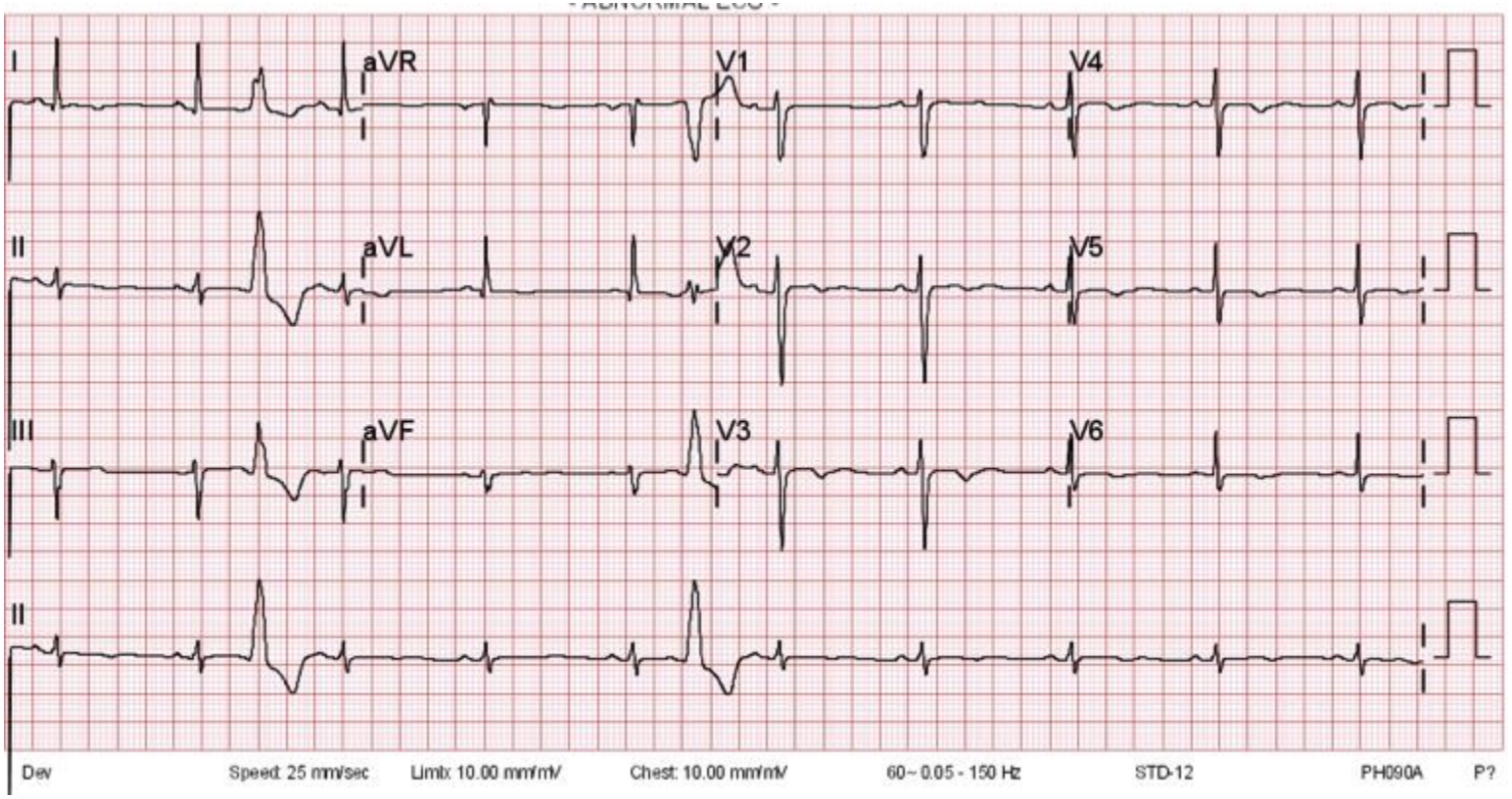
외부병원 Holter



증례 3


N V N N V V V V V V V V V V V V V V
1
25 mm/sec
10 mm/mV
2
25 mm/sec
10 mm/mV
3
25 mm/sec
10 mm/mV
VE Run Length 23 beats (234 bpm)
07-Aug-2018 19:14:20
*** BPM

증례 3

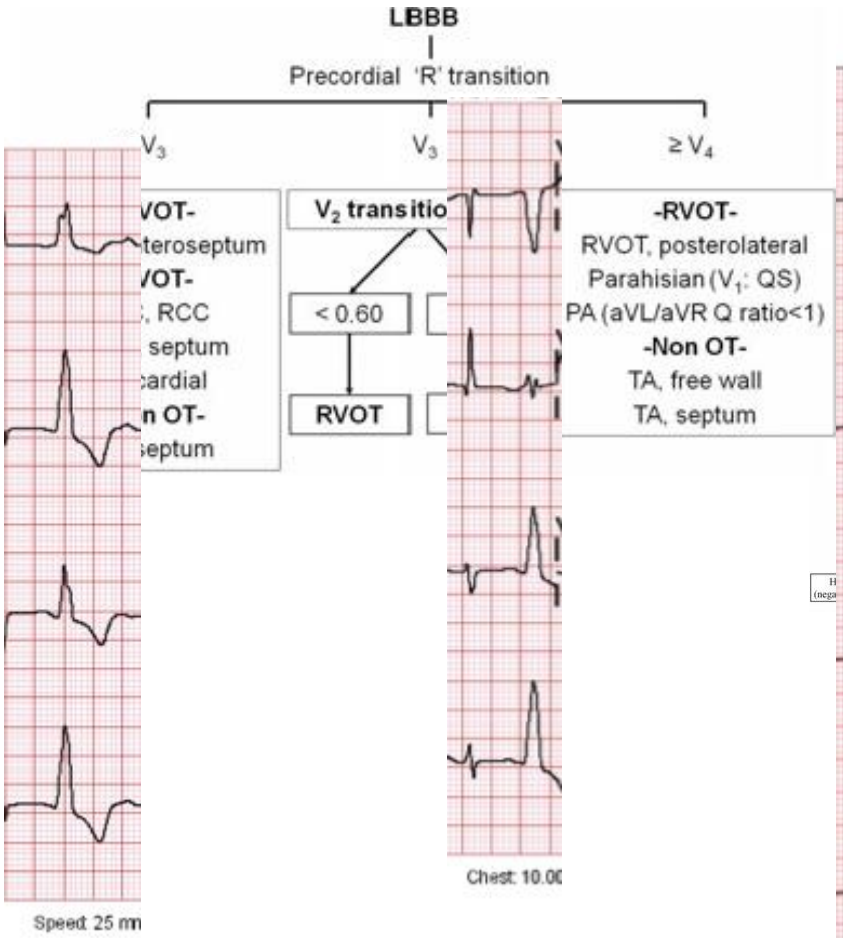

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Dev
Speed: 25 mm/sec
Limb: 10.00 mm/mV
Chest: 10.00 mm/mV
60~ 0.05 - 150 Hz
STD-12
PH090A
P?

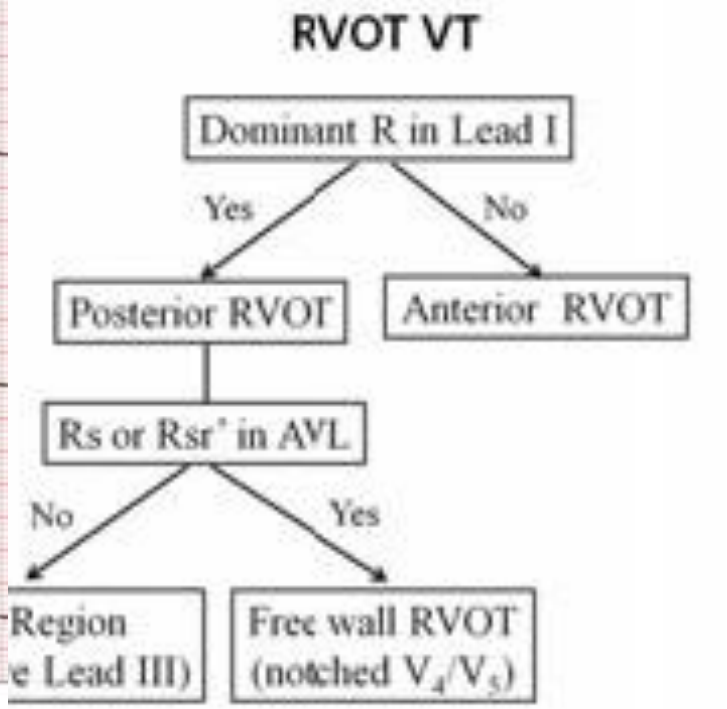
증례 3

부정맥 발생 위치는?

1. LVOT – Right coronary cusp
2. LVOT – Non-coronary cusp
3. RVOT – septum
4. RVOT – free wall

증례 3


LBBB
Precordial 'R' transition
V3
V3
≥ V4
V2 transitio
< 0.60
RVOT
-RVOT-
RVOT, posterolateral
Parahisian (V1: QS)
PA (aVL/aVR Q ratio<1)
-Non OT-
TA, free wall
TA, septum
Speed 25 mm
Chest: 10.00


RVOT VT
Dominant R in Lead I
Yes
No
Posterior RVOT
Anterior RVOT
Rs or Rsr' in AVL
No
Yes
Region
e Lead III)
Free wall RVOT
(notched V4/V5)

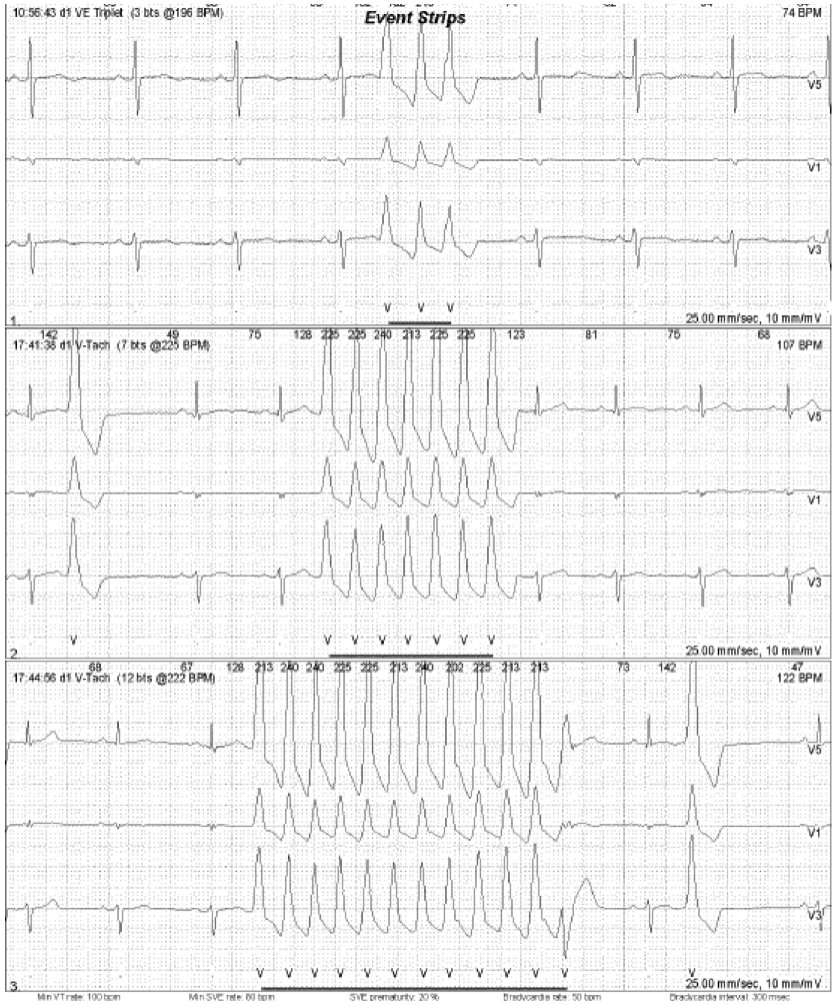
증례 3

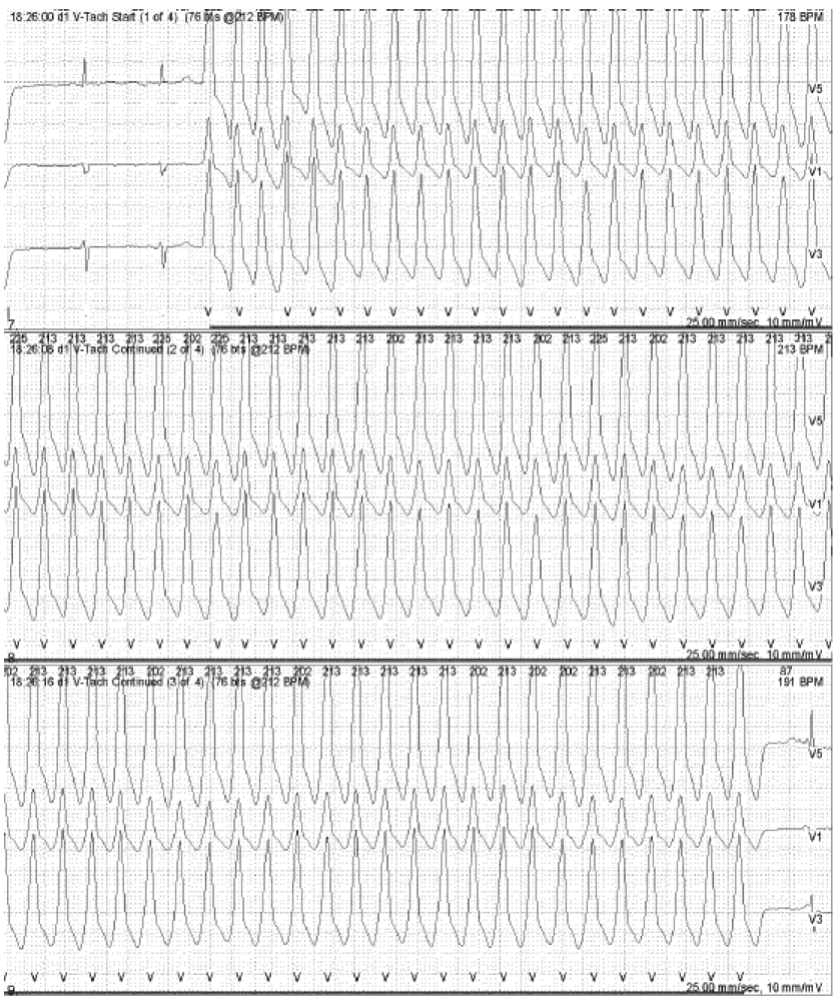
TABLE 23-1 Estimation Indexes of Right Ventricular Outflow Tract Ventricular Tachycardia Origins by 12-Lead ECG*

Anterior Versus Posterior: QRS Duration, Leads II and III R Wave Pattern				
QRS duration	>140 msec	≤140 msec	Rr′ or rr′ in II and III	R in II and III
Free wall side	7	1	0	8
"Septal"	6	21	5	22
Left Versus Right: Leads aVR and aVL QS Wave Amplitude, Lead I Polarity				
QS amplitude	aVR < aVL	aVR ≥ aVL	Lead I negative	Lead I positive
Left side	18	5	20	3
Right side	2	10	3	9
Superior Versus Inferior: Leads V_1 and V_2 Initial r Wave Amplitude				
V_1 and V_2	High r*	Low r†		
Proximal side below pulmonic valve	14	8		
Distal side below pulmonic valve		4	9	
LVOT Versus RVOT: Lead V_3 R/S Ratio				
V_3	R/S ≥ 1	R/S < 1		
LVOT side	4	1		
RVOT side	6	29		

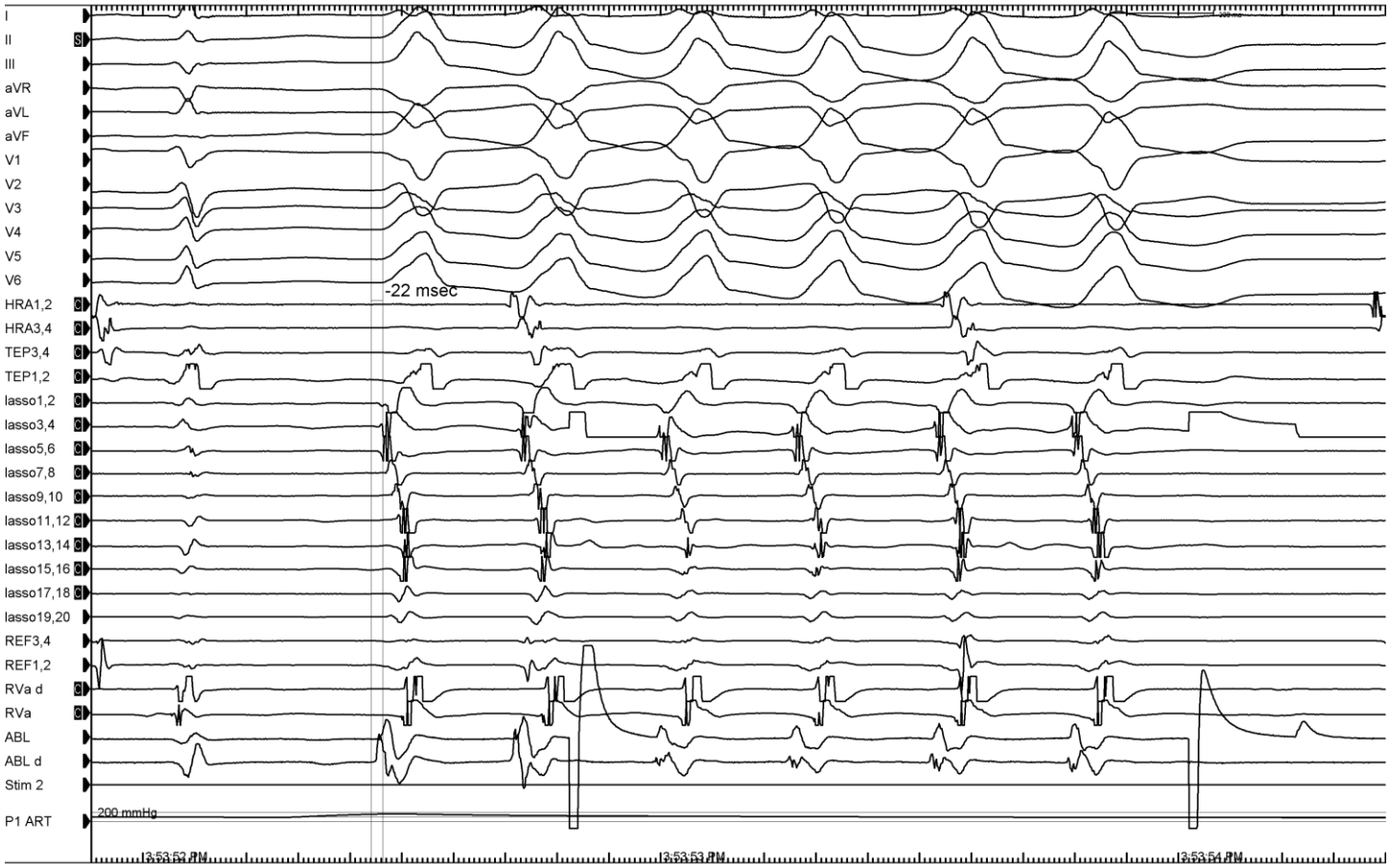
*High r means initial r wave amplitude greater than 0.2 mV in both leads.
†Low r means r wave amplitude less than 0.2 mV in one or both leads.
LVOT = left ventricular outflow region; RVOT = right ventricular outflow tract.
From Kottkamp H, Chen X, Hindricks G, et al: Idiopathic left ventricular tachycardia: new insights into electrophysiological characteristics and radiofrequency catheter ablation, *Pacing Clin Electrophysiol* 18:1285, 1995.

증례 3

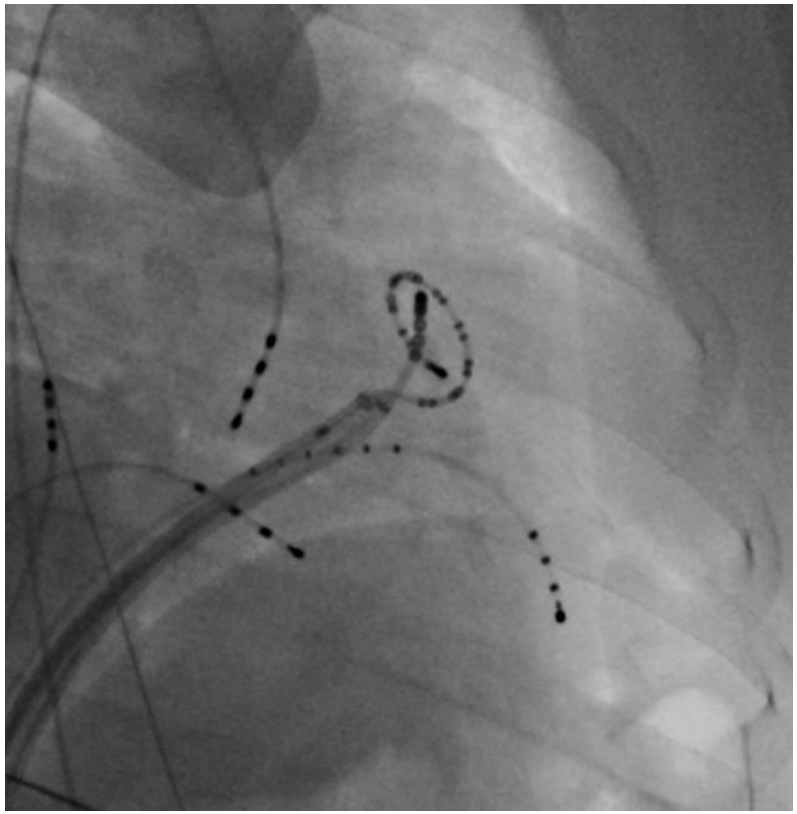

Event Strips
10:56:43 d1 VE Triplet (3 bts @196 BPM)
74 BPM
17:41:36 d1 V-Tach (7 bts @225 BPM)
107 BPM
17:44:56 d1 V-Tach (12 bts @222 BPM)
122 BPM
V5
V1
V3
25.00 mm/sec, 10 mm/mV

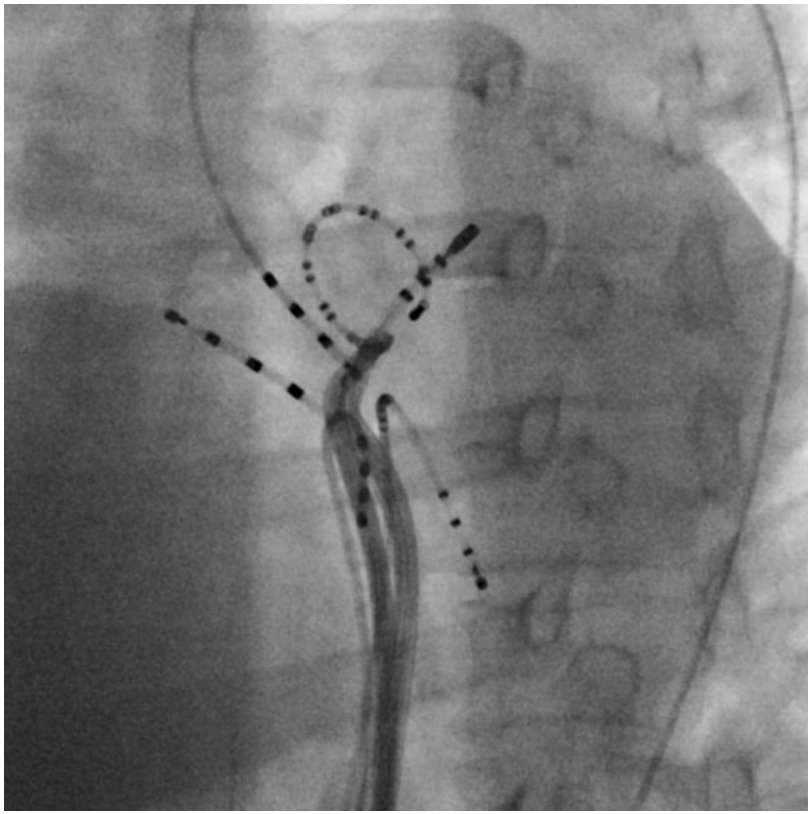

18:26:00 d1 V-Tach Start (1 of 4) (76 bts @212 BPM)
178 BPM
18:26:08 d1 V-Tach Continued (2 of 4) (76 bts @212 BPM)
213 BPM
18:26:16 d1 V-Tach Continued (3 of 4) (76 bts @212 BPM)
191 BPM
V5
V1
V3
25.00 mm/sec, 10 mm/mV

증례 3


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
HRA1,2
HRA3,4
TEP3,4
TEP1,2
lasso1,2
lasso3,4
lasso5,6
lasso7,8
lasso9,10
lasso11,12
lasso13,14
lasso15,16
lasso17,18
lasso19,20
REF3,4
REF1,2
RVa d
RVa
ABL
ABL d
Stim 2
P1 ART
-22 msec
200 mmHg

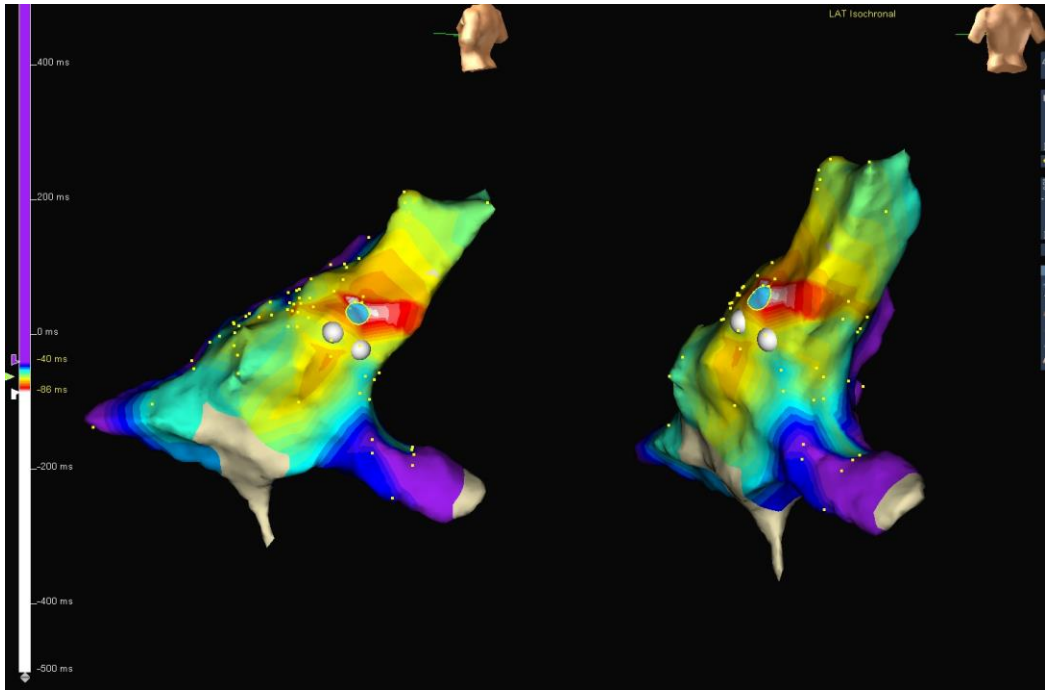
증례 3



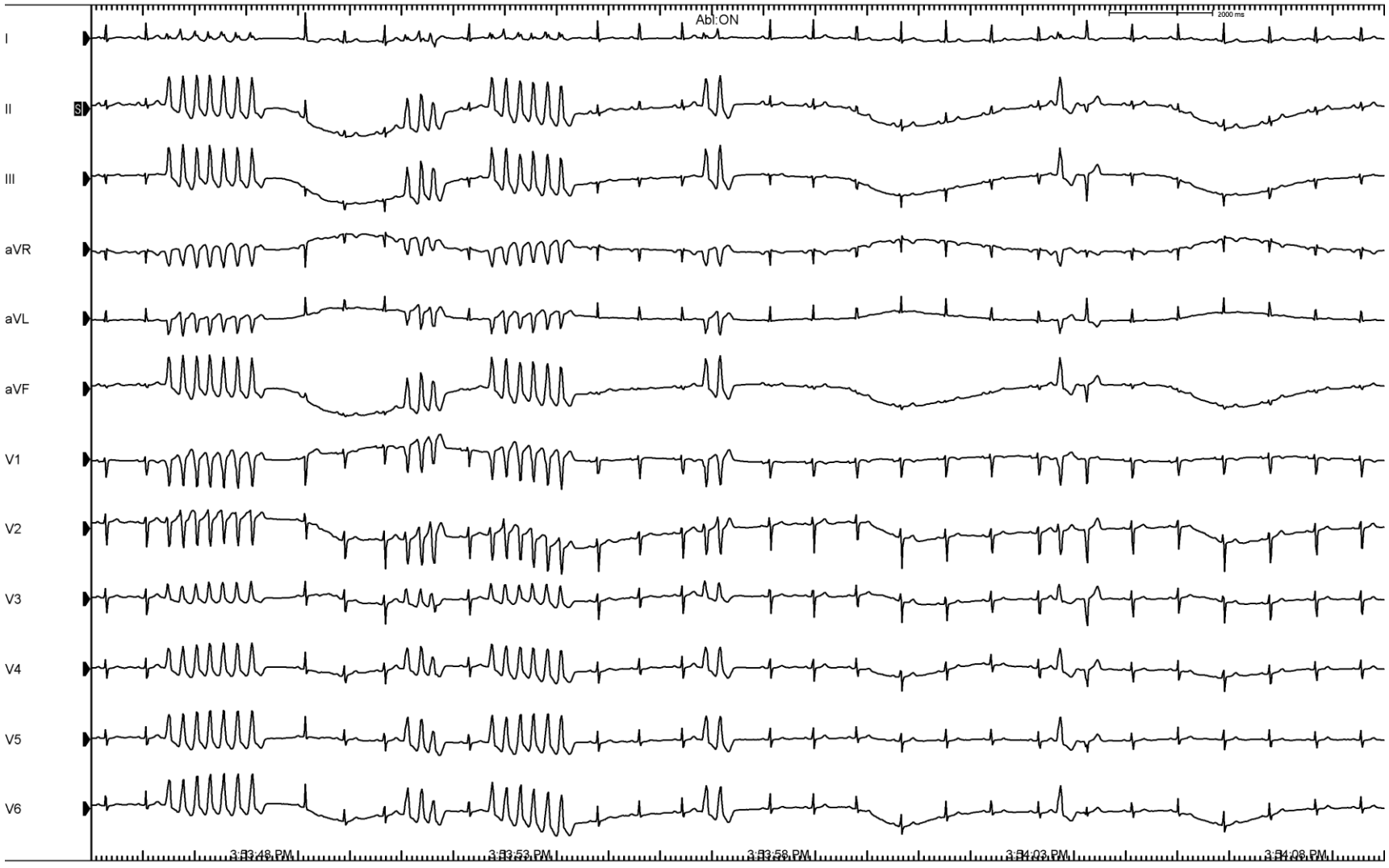


증례 3

RVOT, mid septum

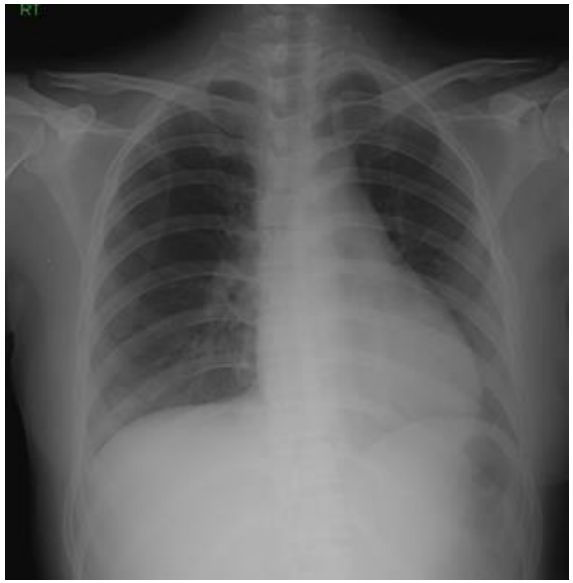


증례 3


Abl:ON
2000 ms
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
3:53:48 PM
3:53:53 PM
3:53:58 PM
3:54:03 PM
3:54:08 PM

증례 4-1

- F/44, previously healthy
- C/C; chest discomfort
- F/Hx : 모친50대에 MI로 사망
- P/I : Urosepsis로 타병원 입원치료 중 BP 저하로 전원
- V/S : 87/65-88bpm-37.8℃

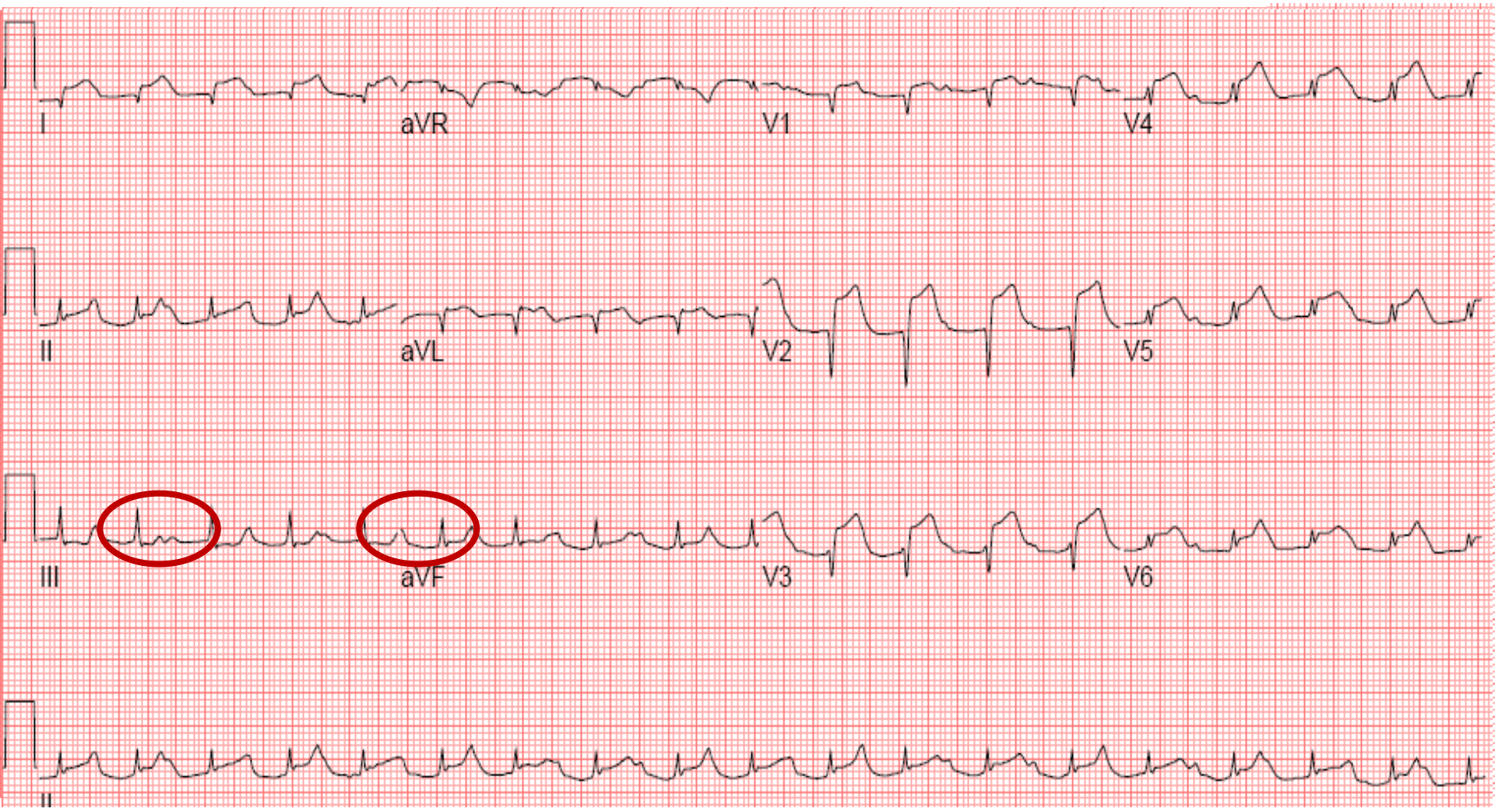


WBC : 14160(83%)

AST / ALT : 54/59

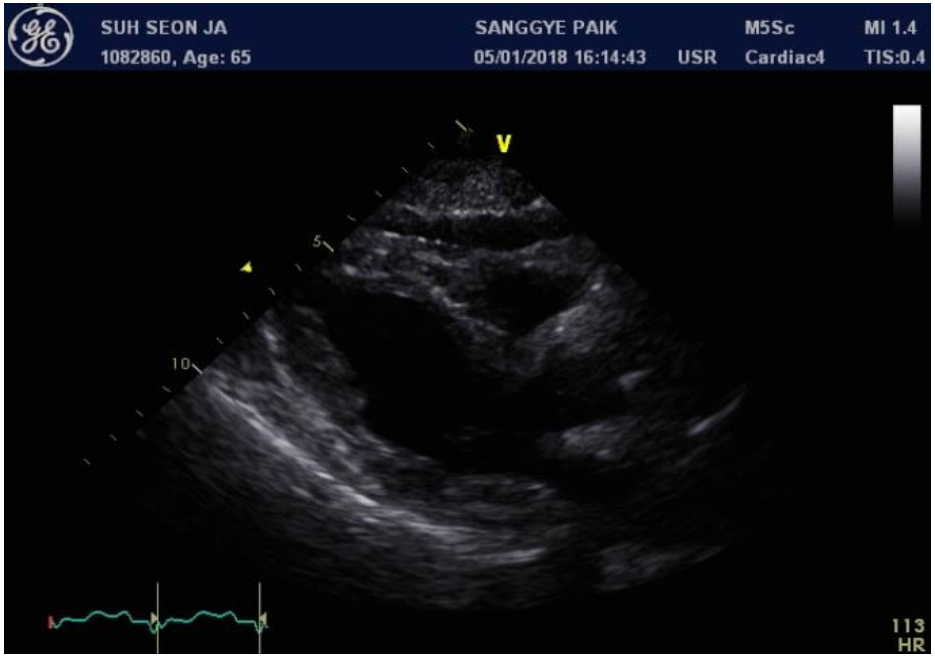
CK/CK-MB/TnT : 280/31/0.781

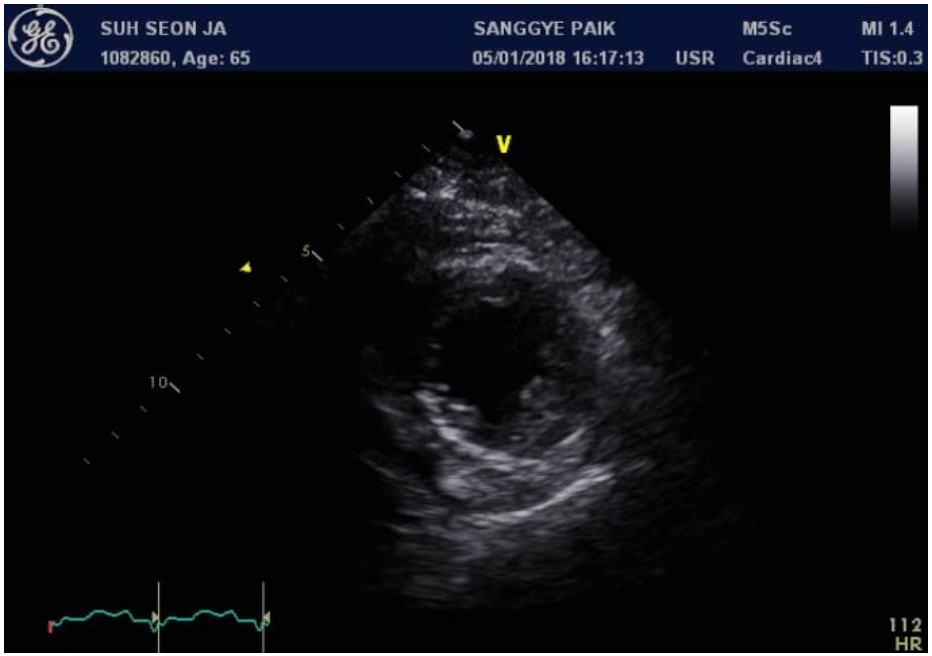
After 1hour, with chest discomfort 증례 4-1



① STEMI
② Myopericarditis
③ Stress CMP
④ I don't know

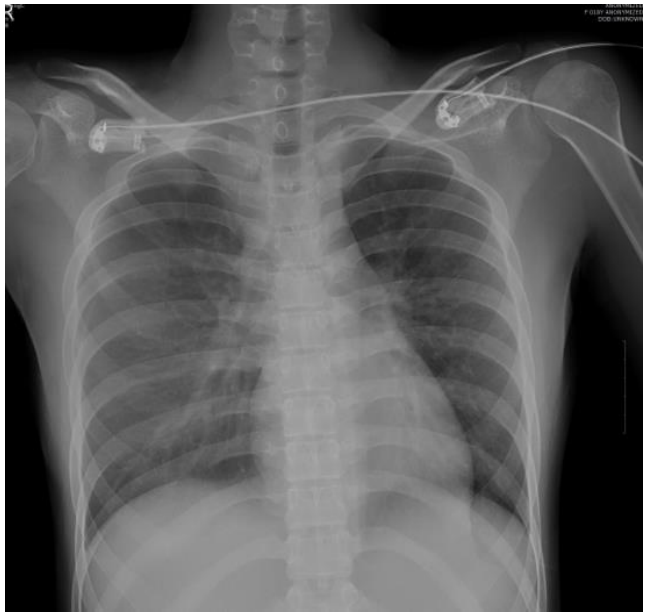
증례 4-1


SUH SEON JA
1082860, Age: 65
SANGGYE PAIK
05/01/2018 16:14:43
USR
M5Sc
Cardiac4
MI 1.4
TIS:0.4
V
5
10
113
HR


SUH SEON JA
1082860, Age: 65
SANGGYE PAIK
05/01/2018 16:17:13
USR
M5Sc
Cardiac4
MI 1.4
TIS:0.3
V
5
10
112
HR

증례 4-2

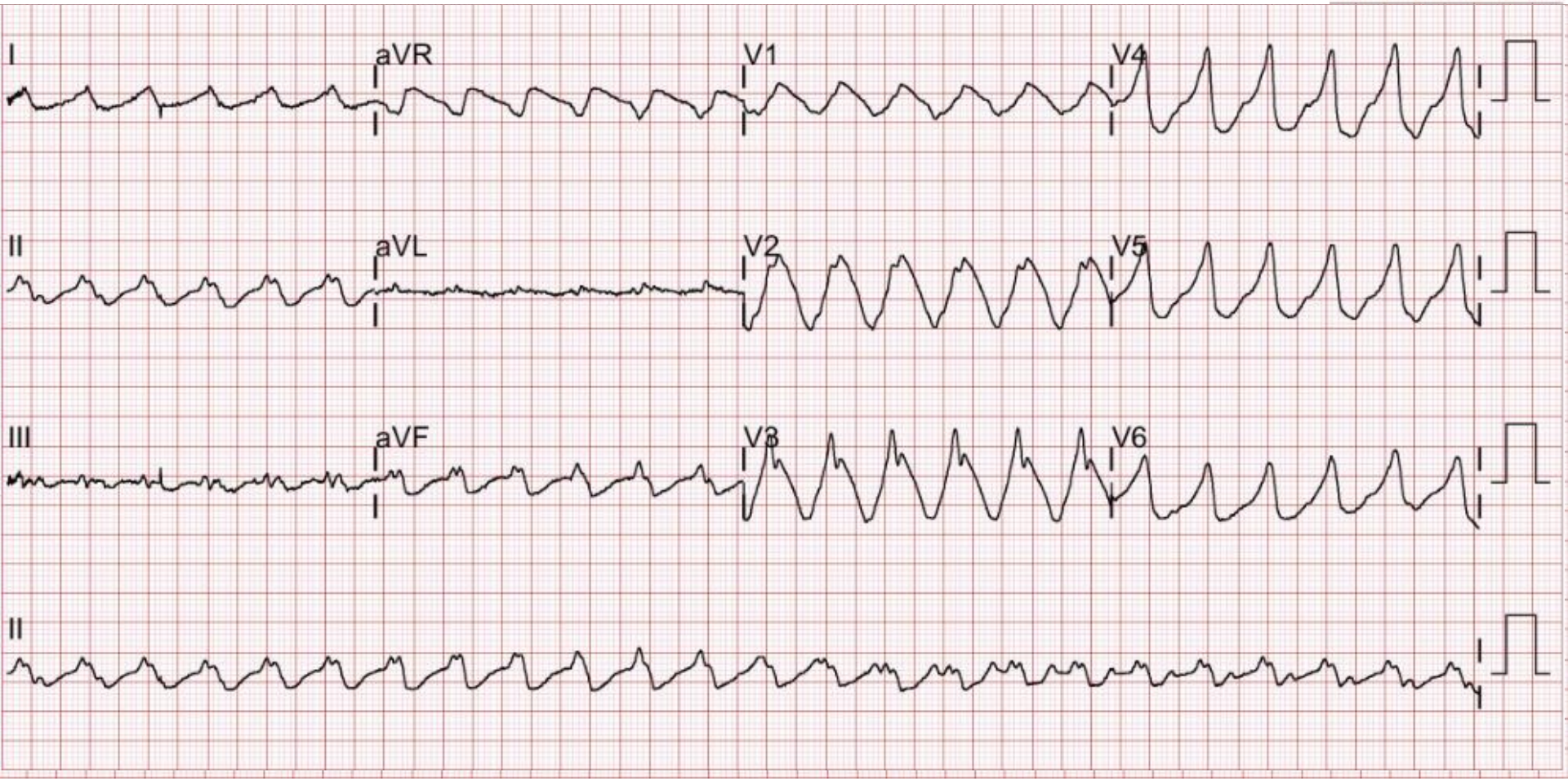
- F/18, previously healthy
- C/C; abdominal pain, vomiting
- GI OPD 내원 이후 R/O AGE로 ER refer
- V/S : 75/41-83bpm-36℃



WBC : 6,540 (61%)
AST/ALT : 258/102
Bun/Cr : 54.7/1.22
CK/CK-MB/TnI : 1069/21.32/46.52
BNP : 780

증례 4-2

14:16

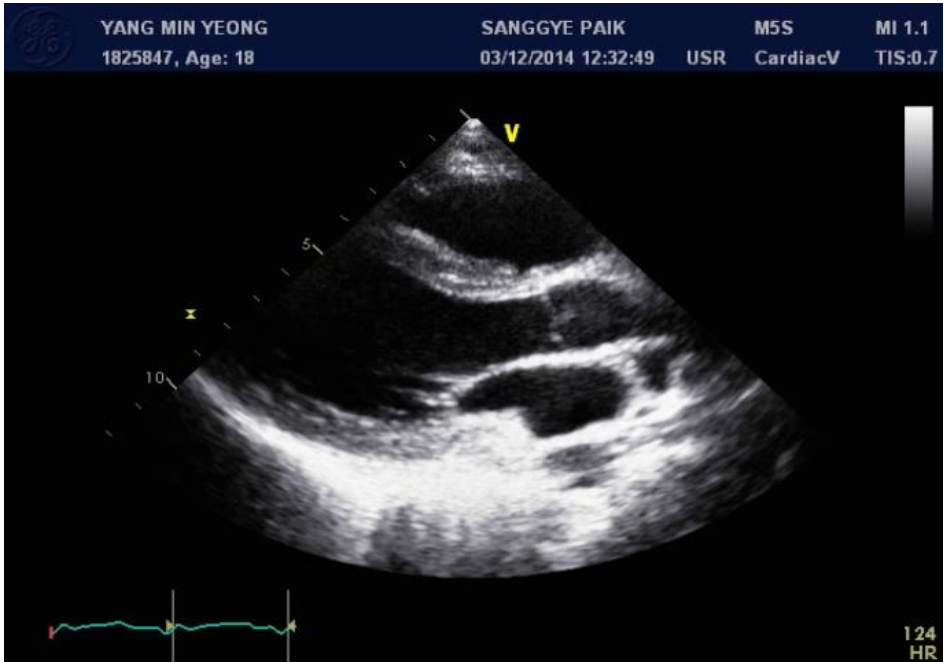


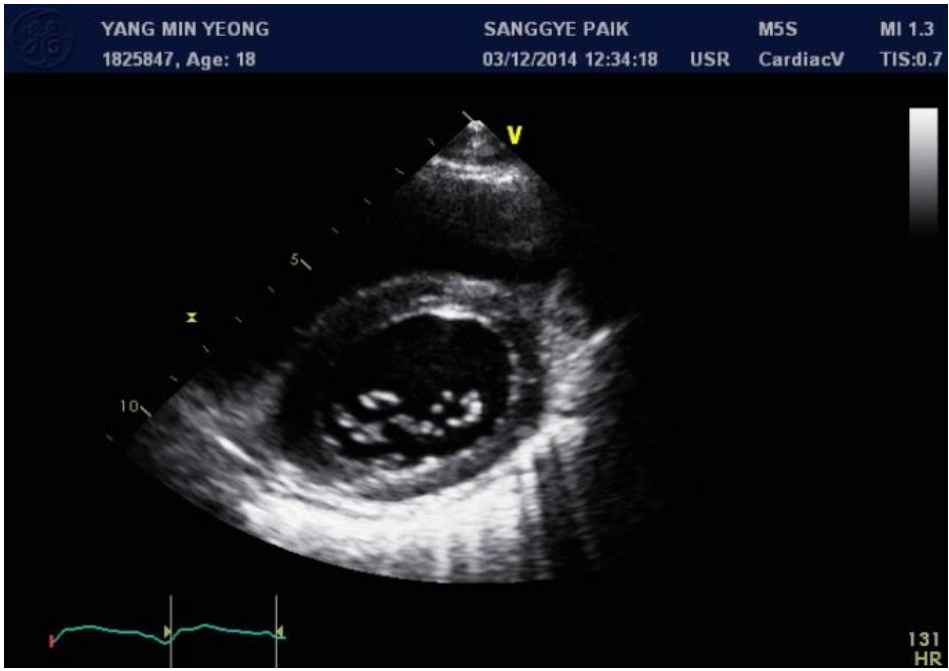
Next step ?

① DC cardioversion **② Defibrillation**

③ IV amiodarone **④ I don't know**

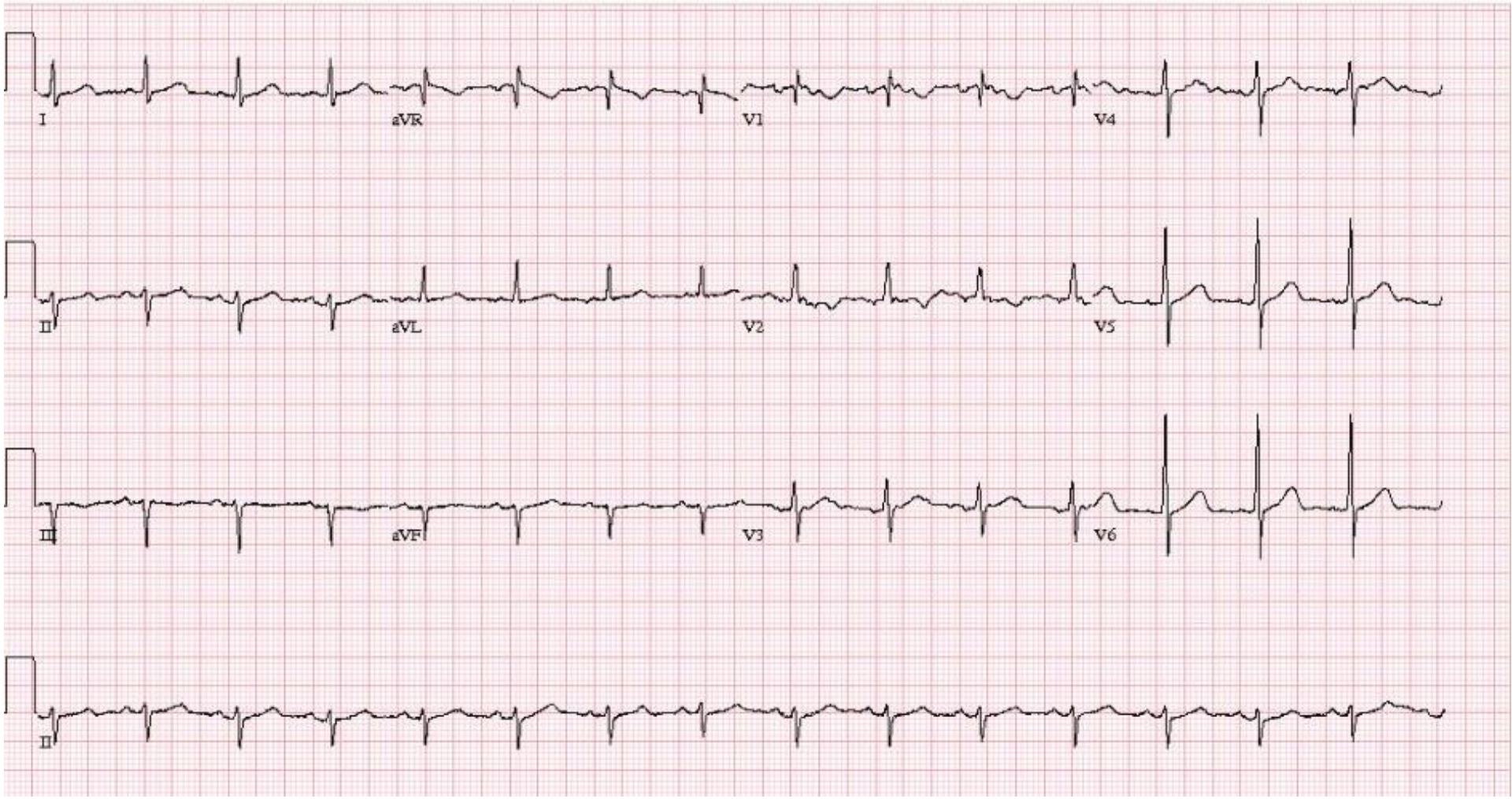
증례 4-2


YANG MIN YEONG
1825847, Age: 18
SANGGYE PAIK
03/12/2014 12:32:49
M5S
USR
CardiacV
MI 1.1
TIS:0.7
V
5
10
124
HR


YANG MIN YEONG
1825847, Age: 18
SANGGYE PAIK
03/12/2014 12:34:18
M5S
USR
CardiacV
MI 1.3
TIS:0.7
V
5
10
131
HR

증례 4-2

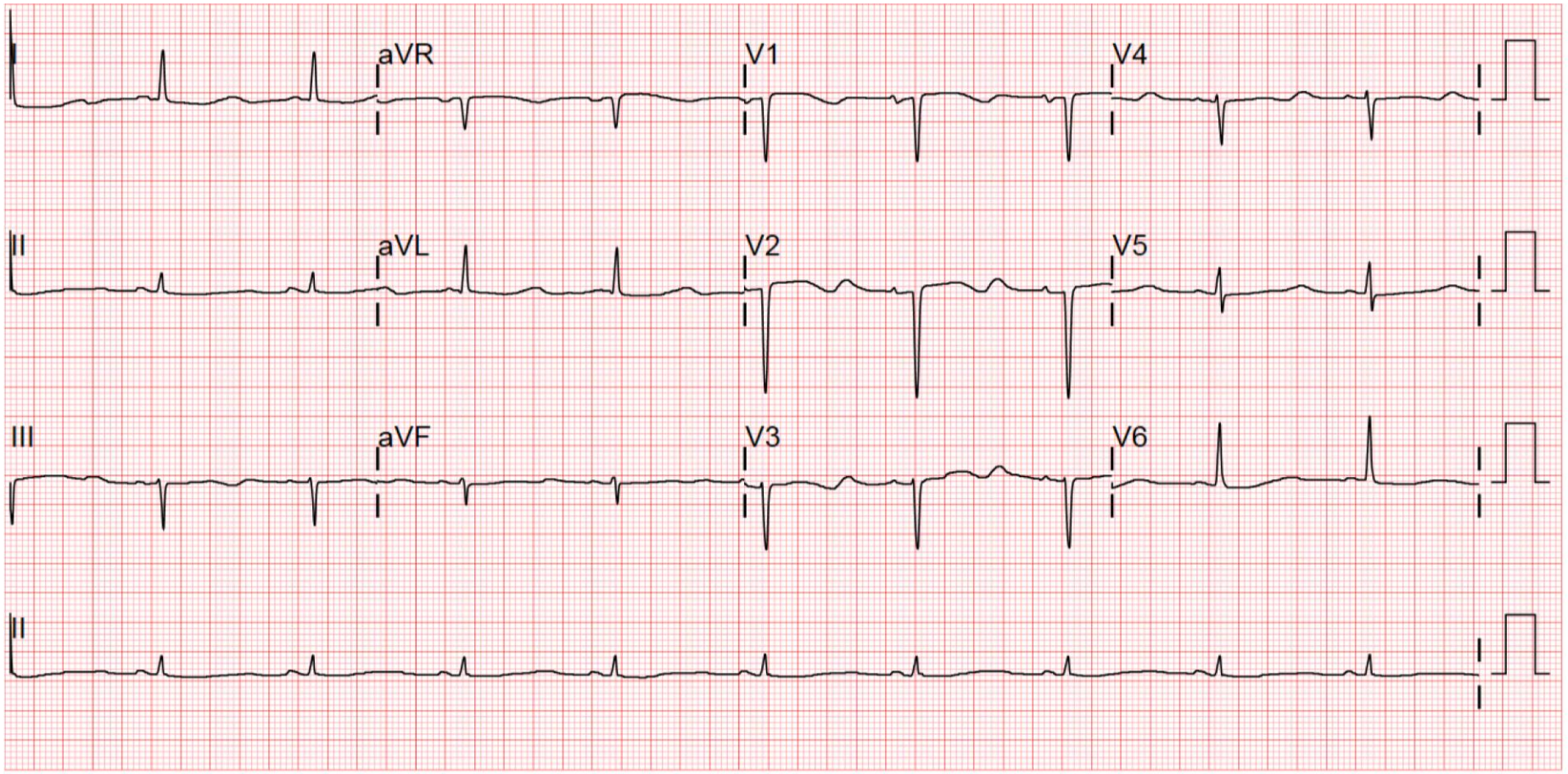
After cardiac transplantation



72/F, syncope

증례 5

- h/o NSTEMI, s/p PCI to LAD and RCA (6MA) with normal LV function (EF 55%)
- PAF on sotalol
- Underlying CKD, recent worsening (Cr 2.6 -> 3.99)



Holter

증례 5

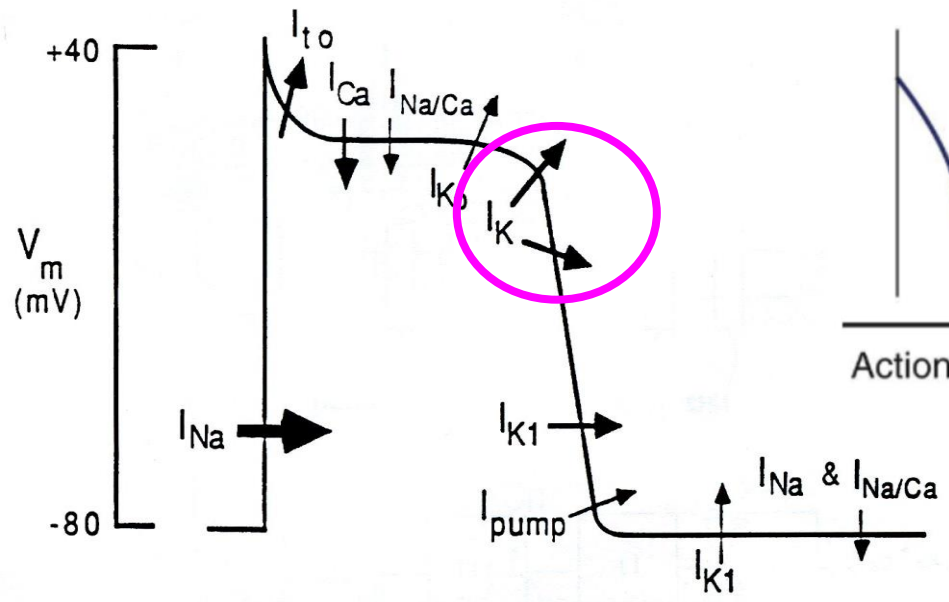
다음으로 적절한 처치는?

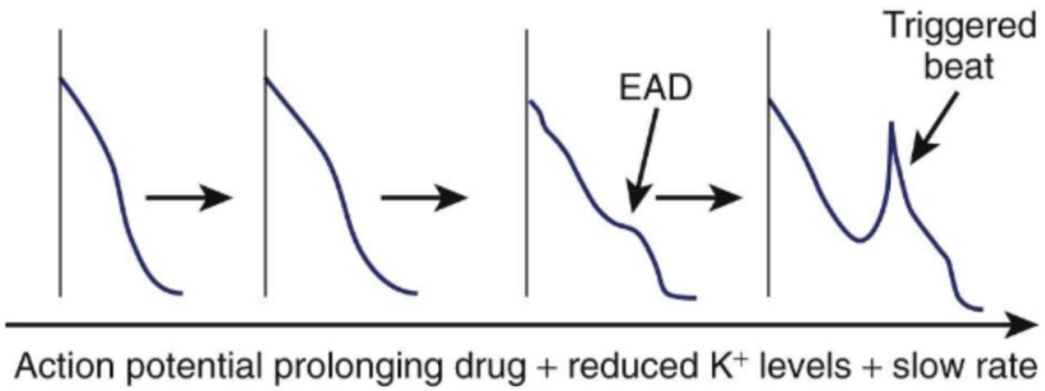
1) RFCA
2) Add bisoprolol
3) Sotalol → Amiodarone
4) d/c Sotalol
5) ICD implantation

Long QT, Torsade de Pointes

Sotalol

- Class III anti-arrhythmic agent (K channel blocker)
- Beta-blocker action
- Excreted mainly by the kidney, may require renal dosing





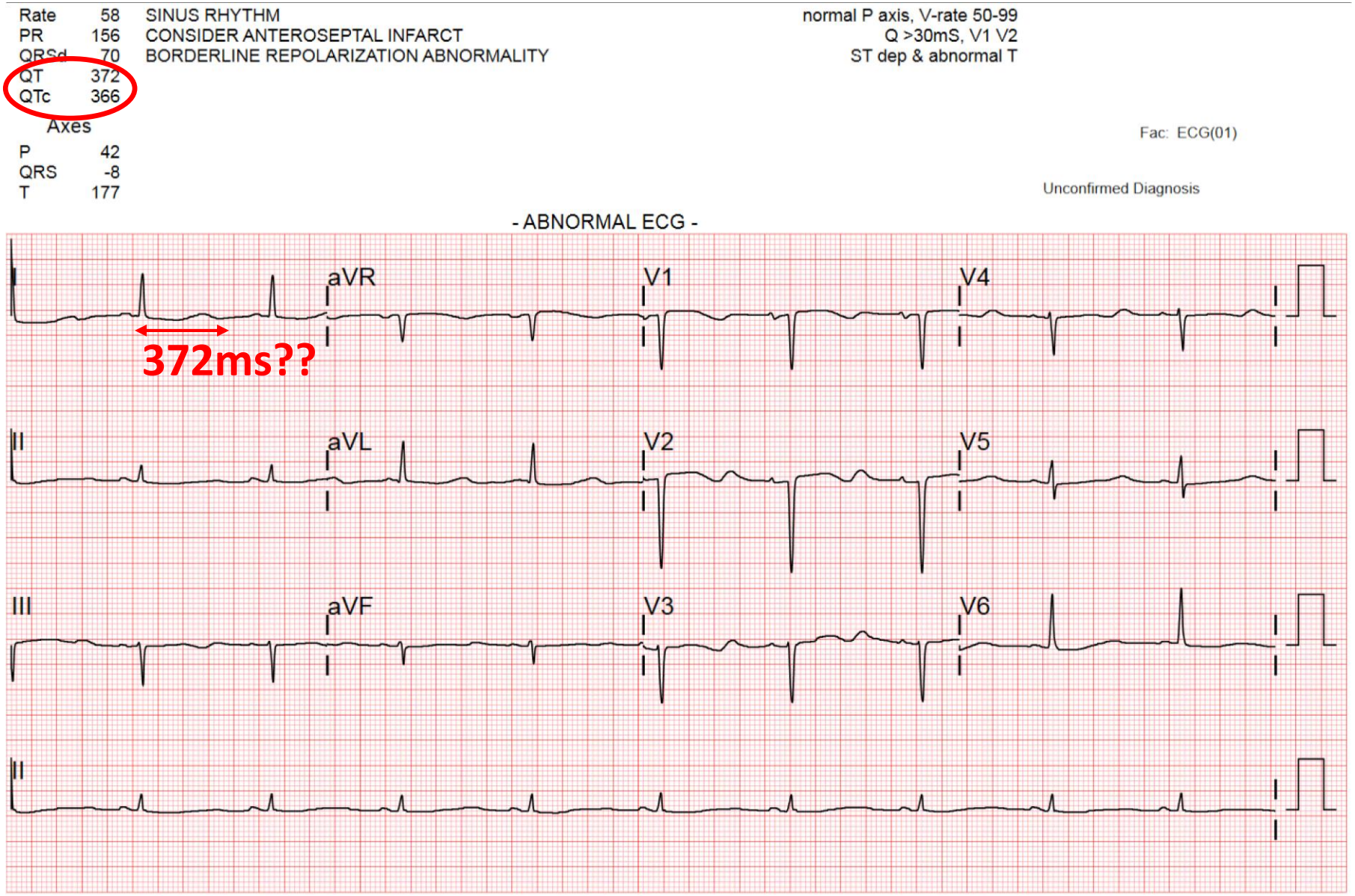
Drug-induced Long QT Syndrome

- K channel blocker (sotalol, amiodarone), erythromycin, antihistamine agents, etc.

- Treatment
  - Magnesium sulfate (1 to 2 g IV bolus)
  - Discontinue the implicated drug
  - Overdrive pacing
  - Isoproterenol, Atropine
  - Serum K^+ - the high normal range (4.5 to 5 mEq/L)

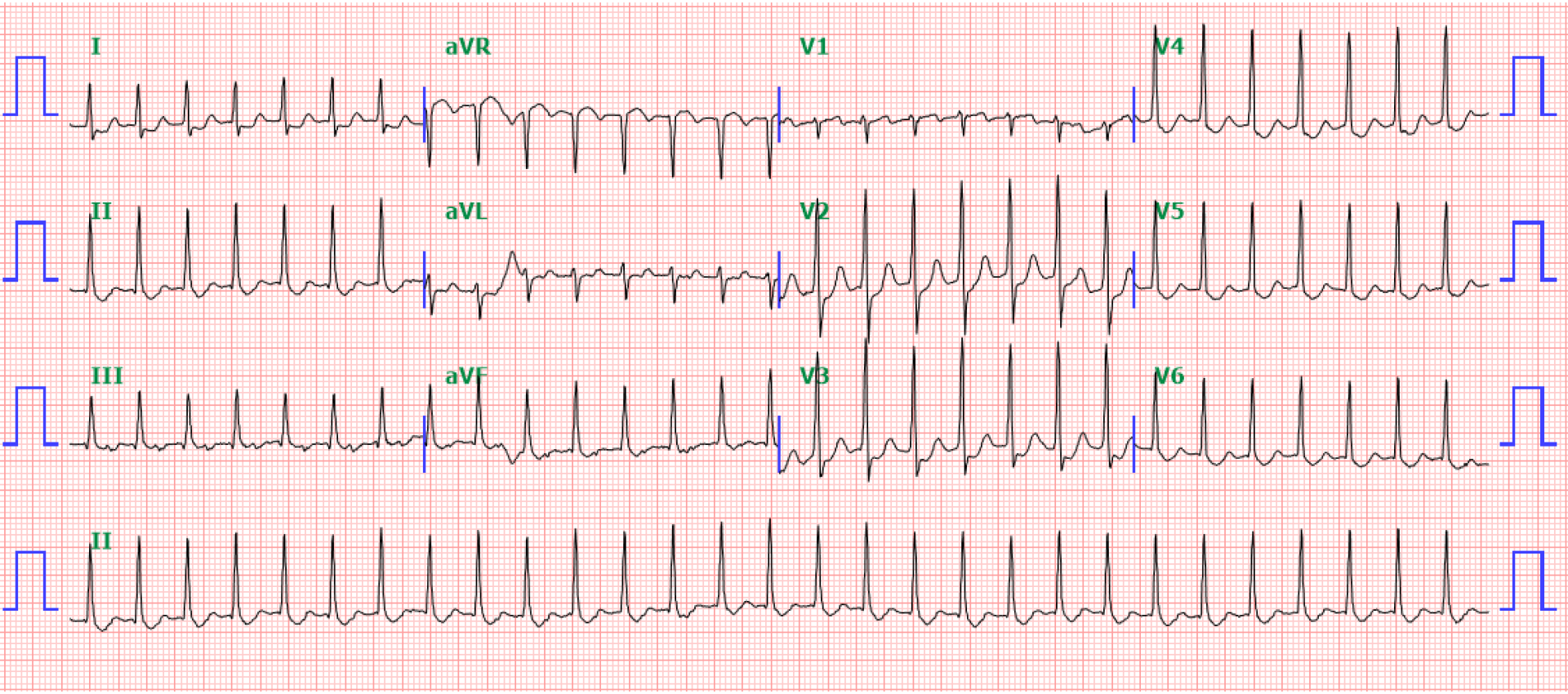
Miscalculated QTc interval

증례 5



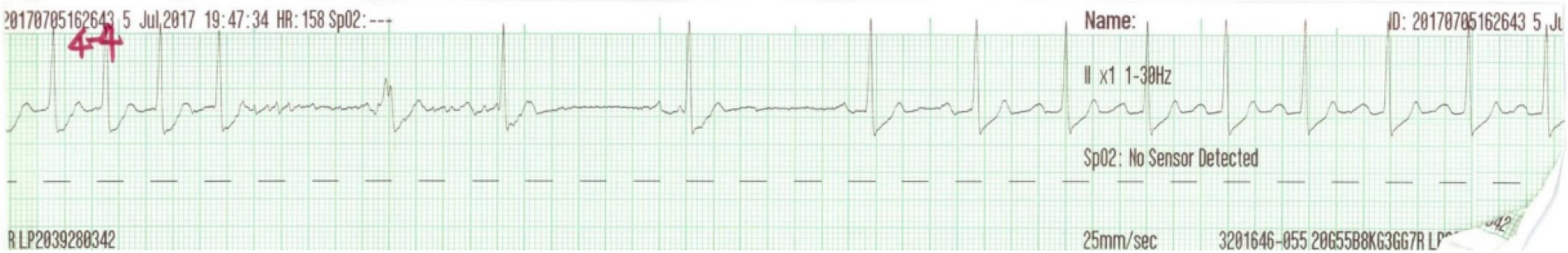
M/47 1시간 이상 지속되는 두근거림 증례 6

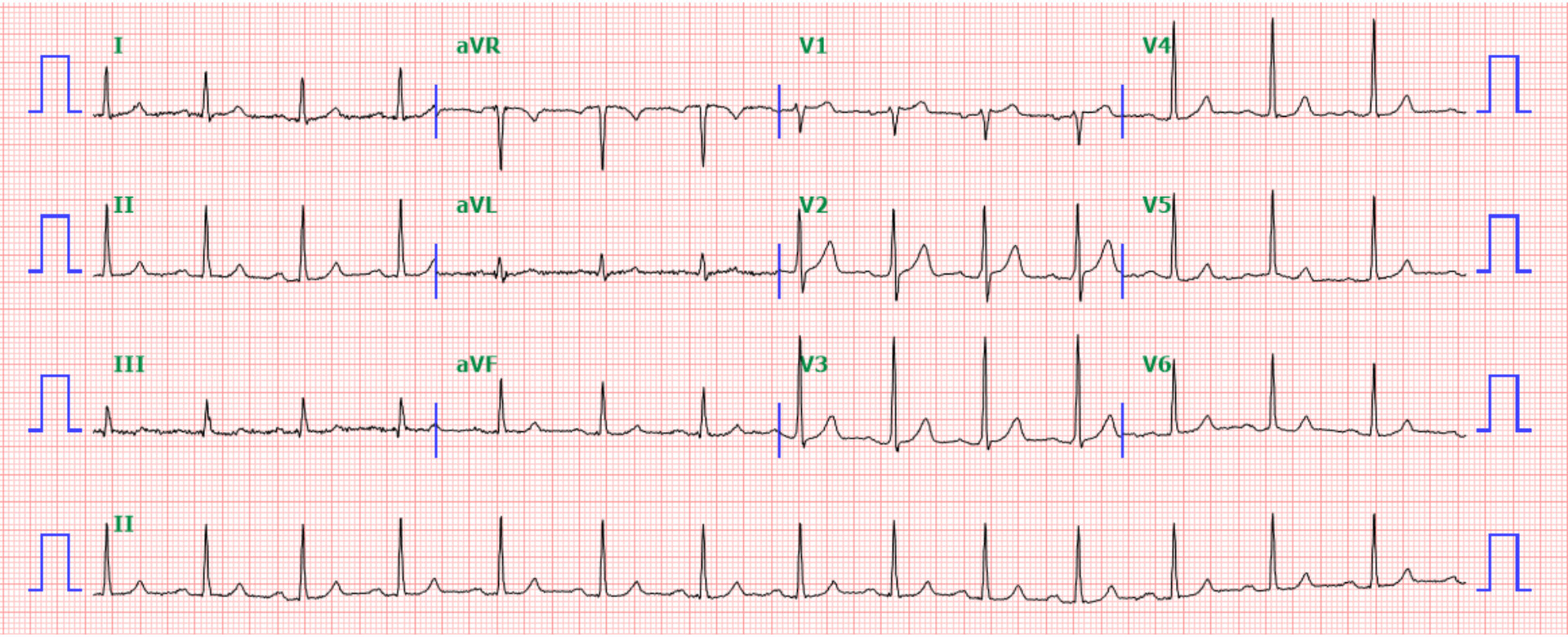
BP 110/75, HR 177bpm



IV adenosine 6mg injection

증례 6

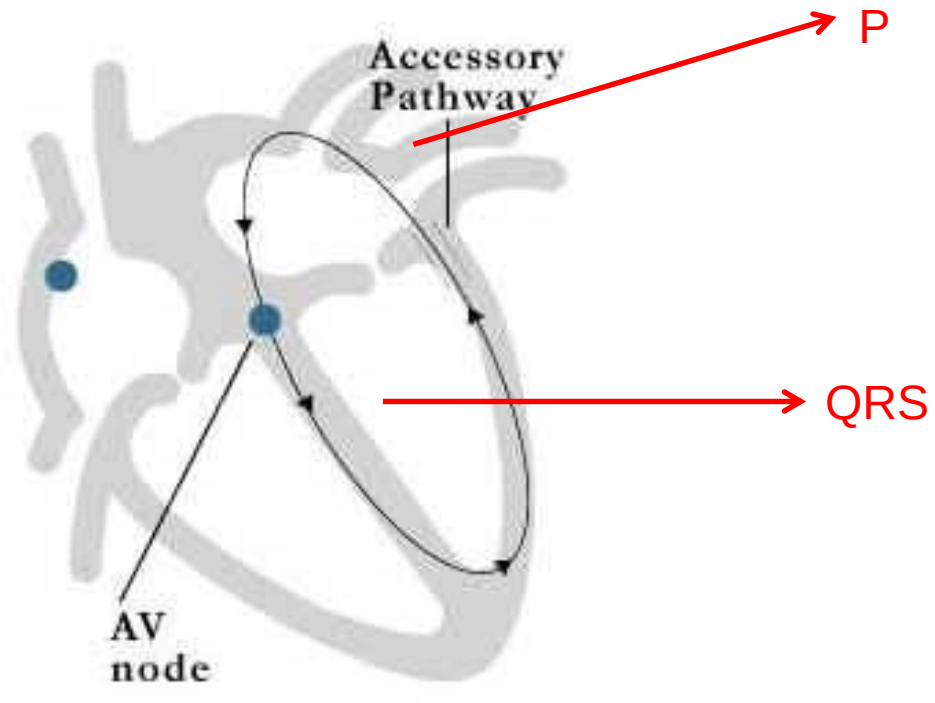


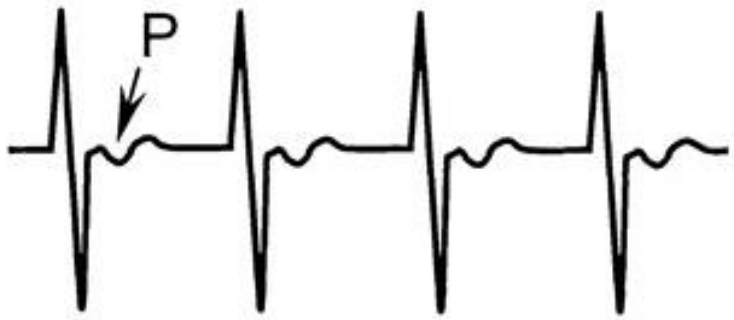


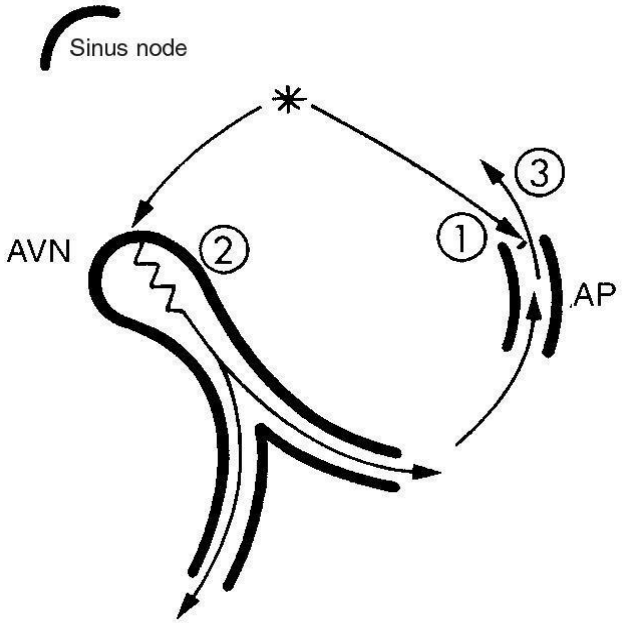
문제) 가장 가능성 있는 진단은?

1) AVNRT
2) AVRT
3) Atrial flutter
4) Atrial fibrillation
5) Ventricular tachycardia

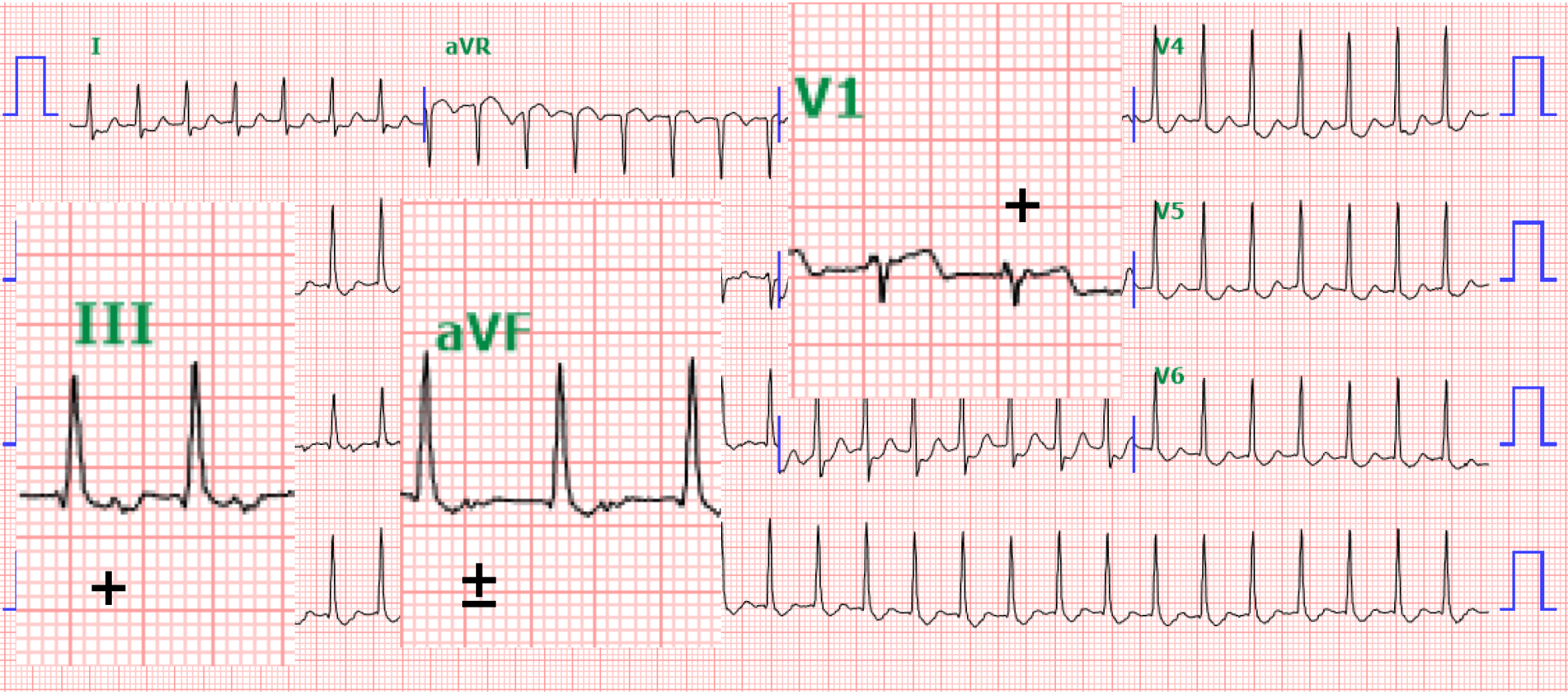
AVRT (방실 회귀성 빈맥)



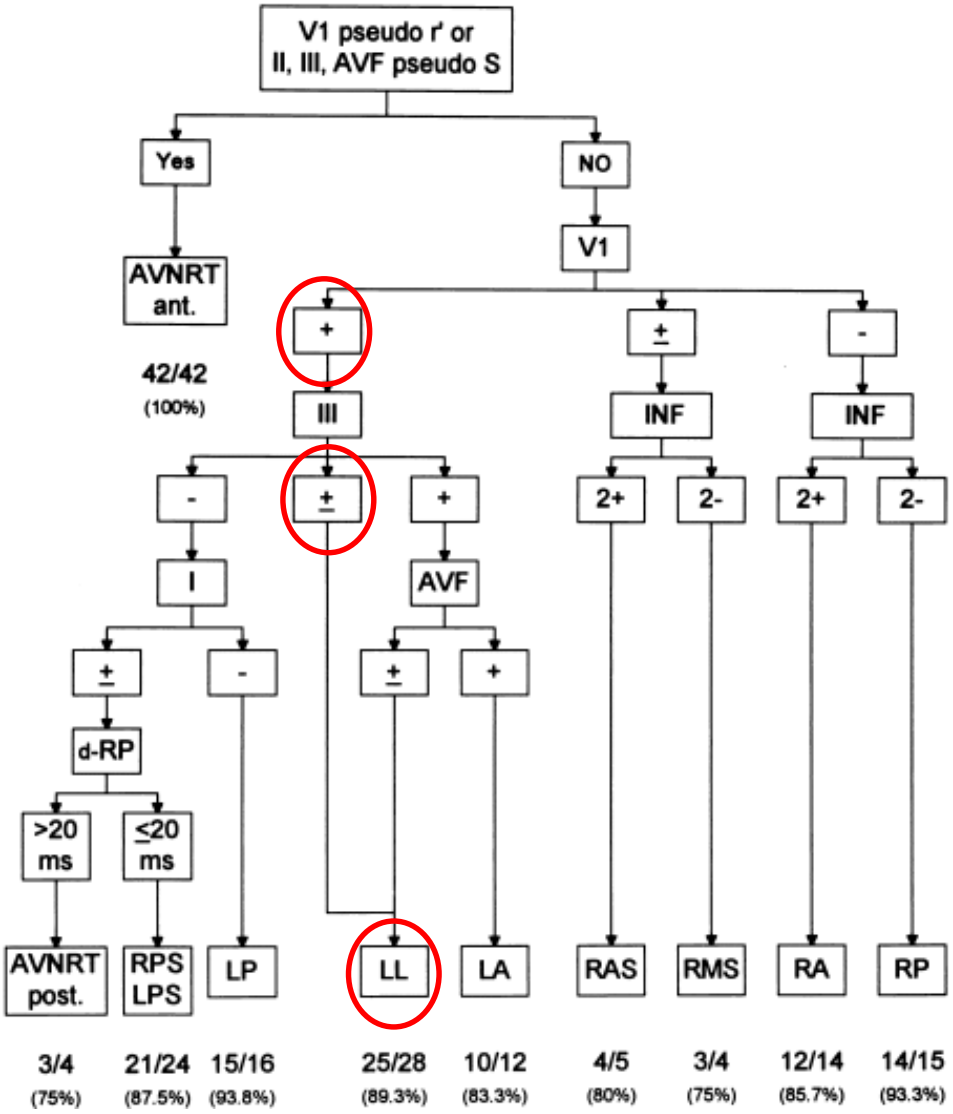


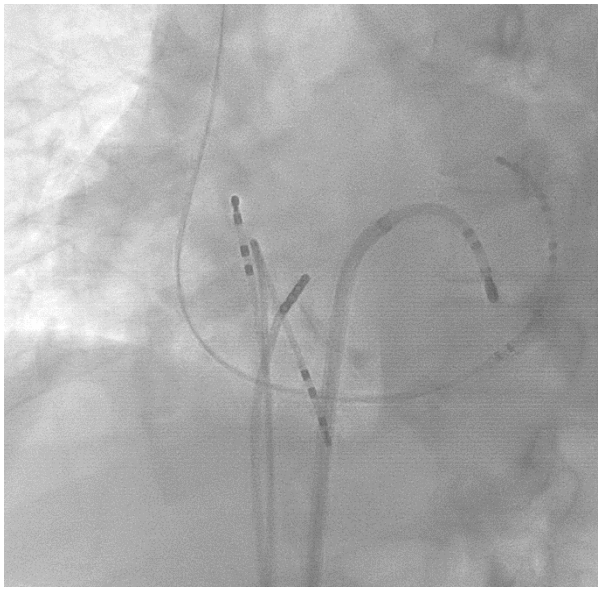


AP localization from p wave



AP localization from p wave



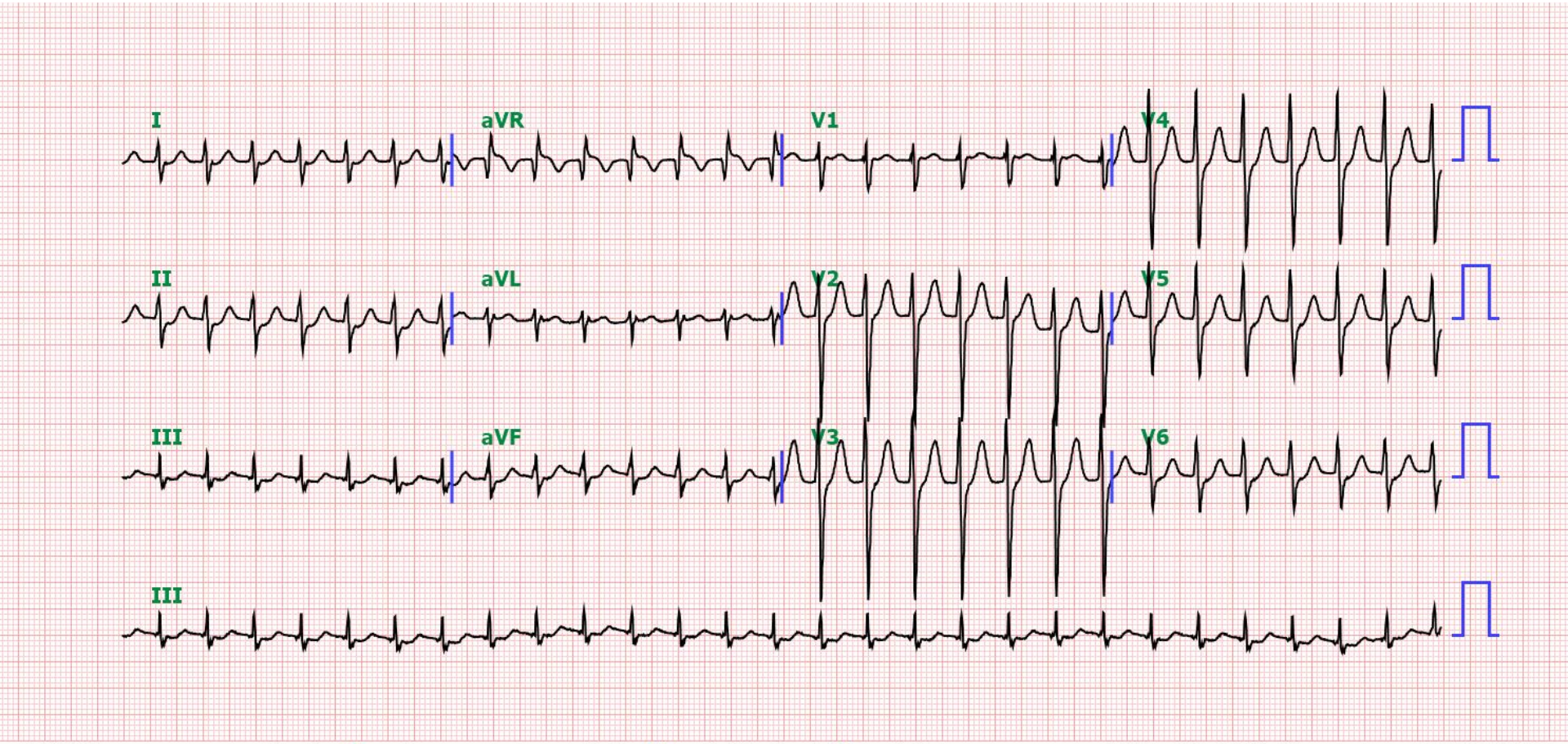


Ablation of AP

J Am Coll Cardiol 1997;29:394-402

증례 7

- 남자, 63세, 두근거림
- 2013.10.30 응급실에 내원
- 2년 전부터 3차례 증상, 30분-3시간 지속, 갑자기 증상 발생/호전

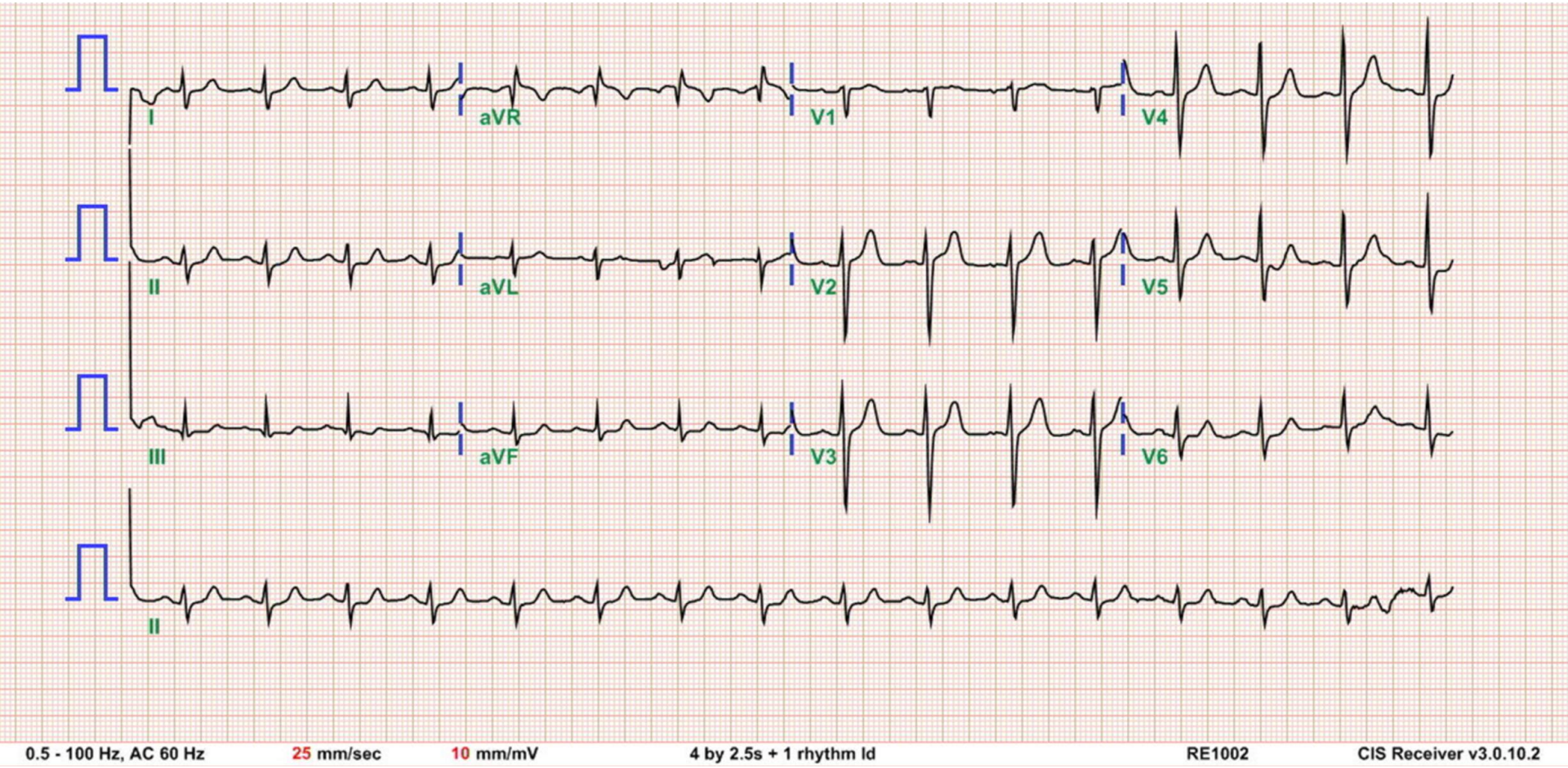


의심되는 진단은?

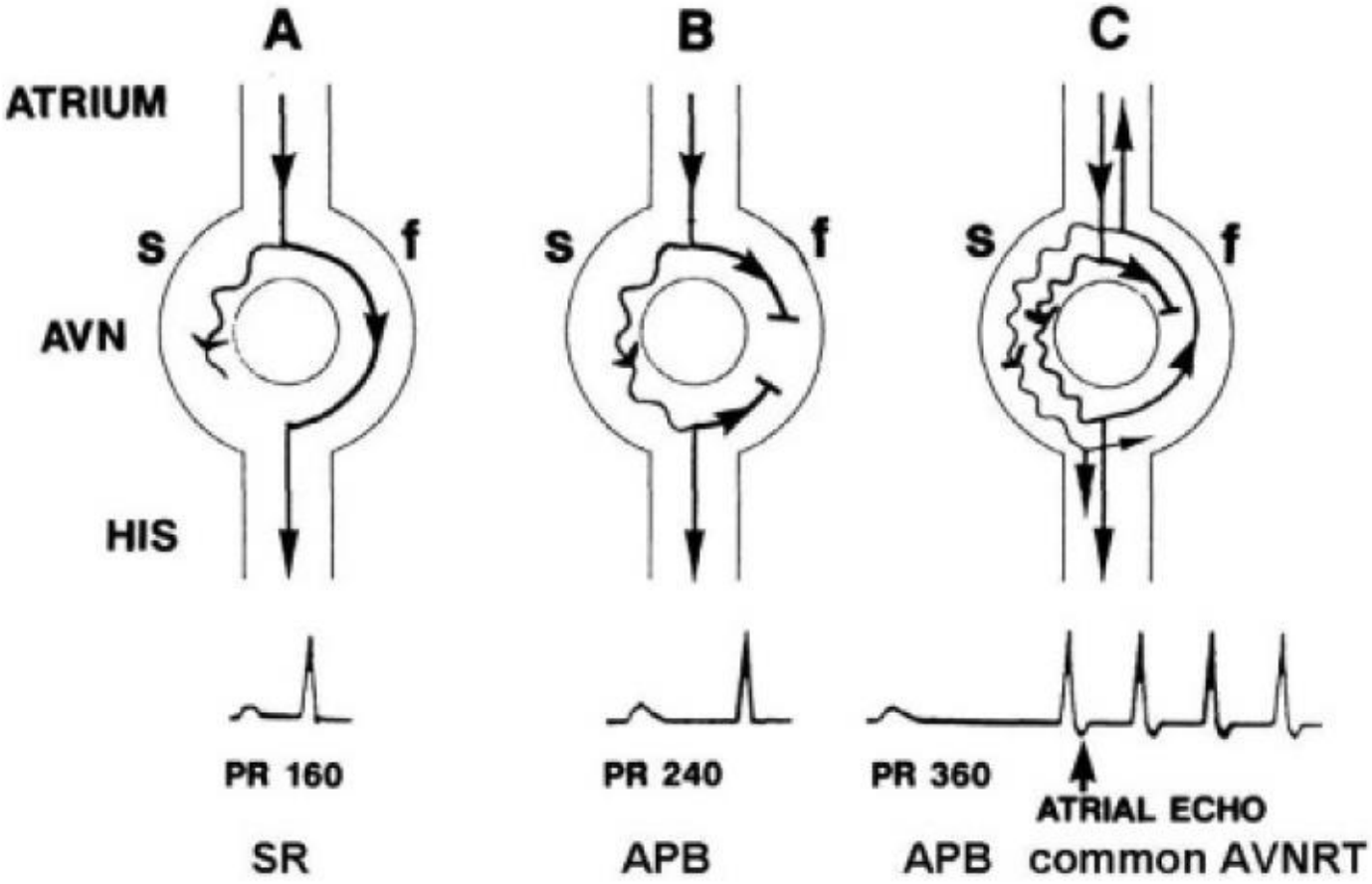
1. Typical atrioventricular nodal reentrant tachycardia
2. Atypical atrioventricular nodal reentrant tachycardia
3. Atrioventricular reentrant tachycardia
4. Sinus tachycardia
5. Atrial tachycardia

증례 7

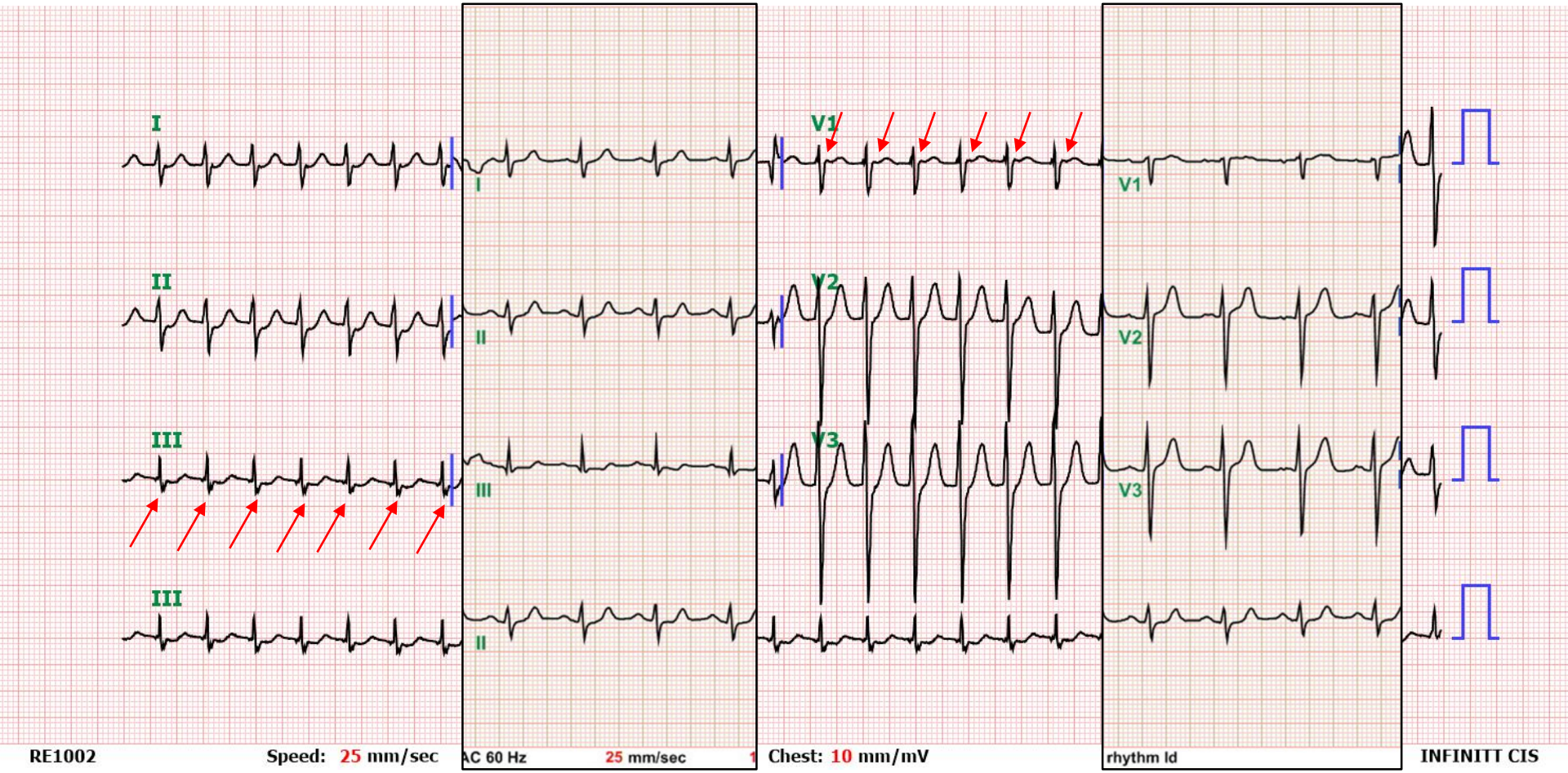
- IV adenosine 12mg 투여 후 호전
- 5일 후 전기생리학적 검사 상 typical AVNRT (slow-fast) 진단 후 전극도자절제술을 시행



Atrial echo in typical AVNRT



증례 7


I
II
III
III
V1
V2
V3
RE1002
Speed: 25 mm/sec
AC 60 Hz
25 mm/sec
Chest: 10 mm/mV
rhythm Id
INFINITT CIS

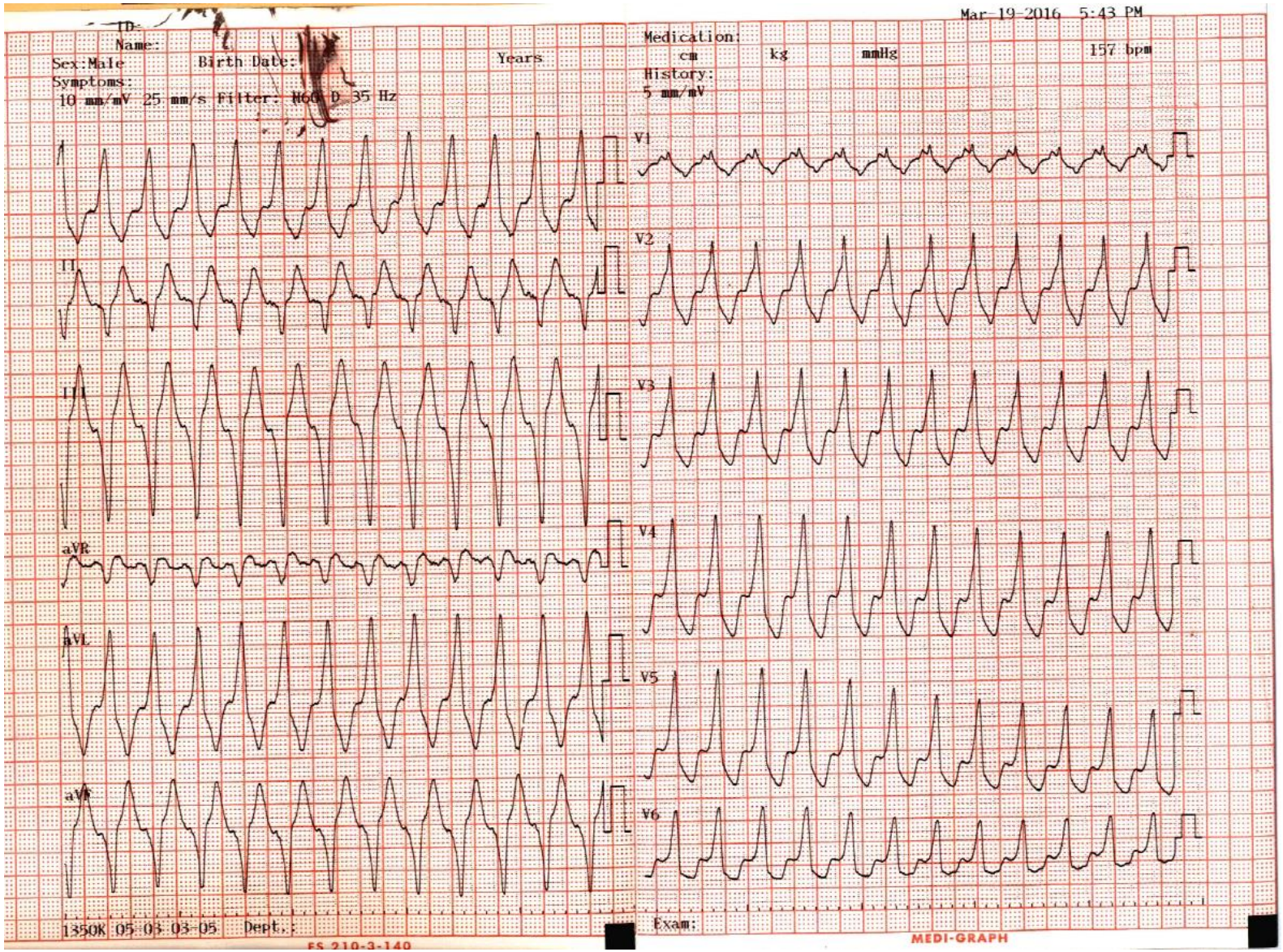
증례 8

남/59 palpitation, visit ER

- Palpitation, chest pain for 3 hrs
- Phx; HTN, DM for 7 yrs
- V/S; 112/68-160-18-36.5°C

증례 8

Initial ECG at ER



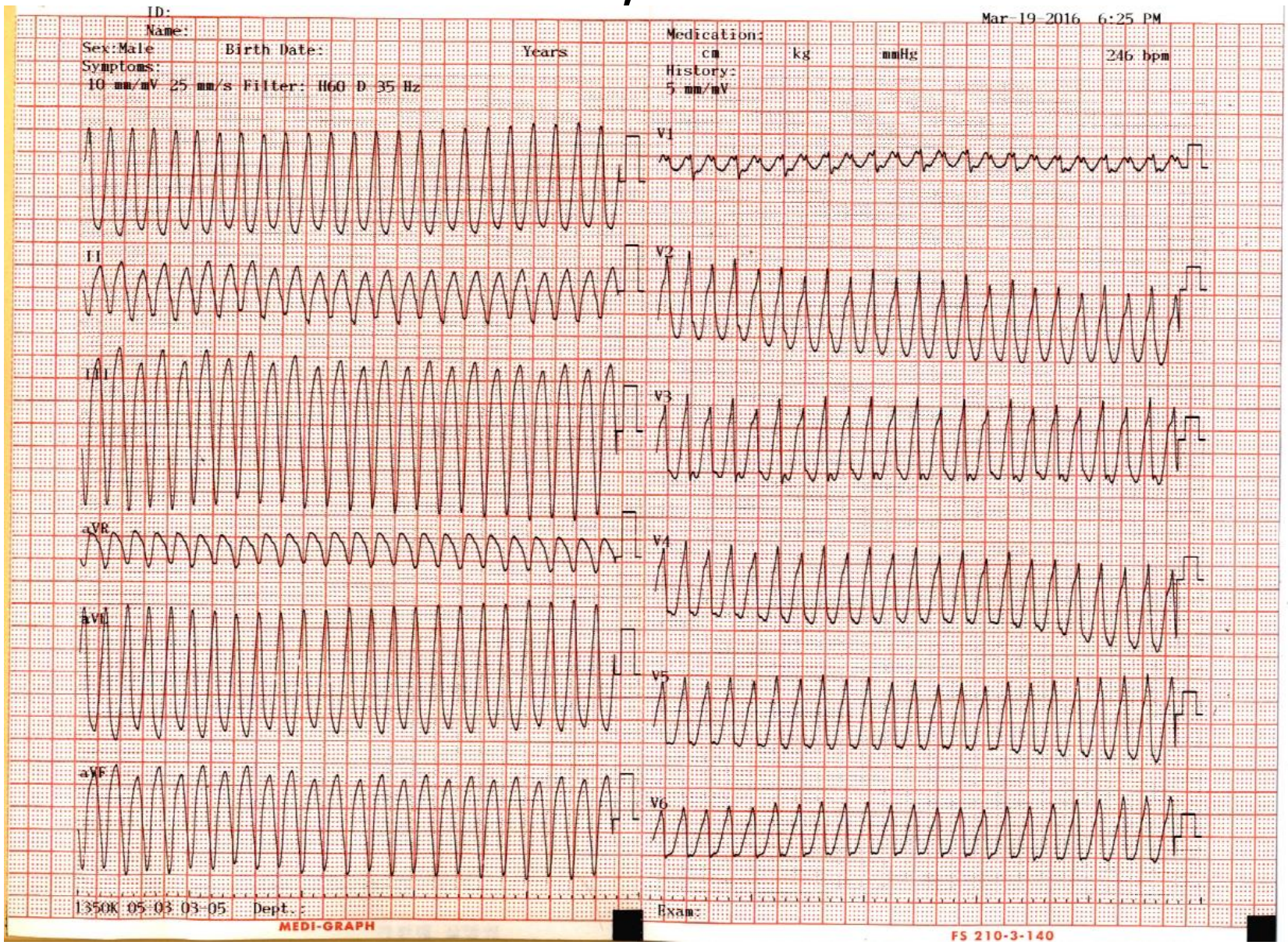
증례 8

진단은?

1. Ventricular tachycardia
2. AT with aberration
3. Antidromic tachycardia in WPW syndrome
4. SVT with underlying bundle branch block

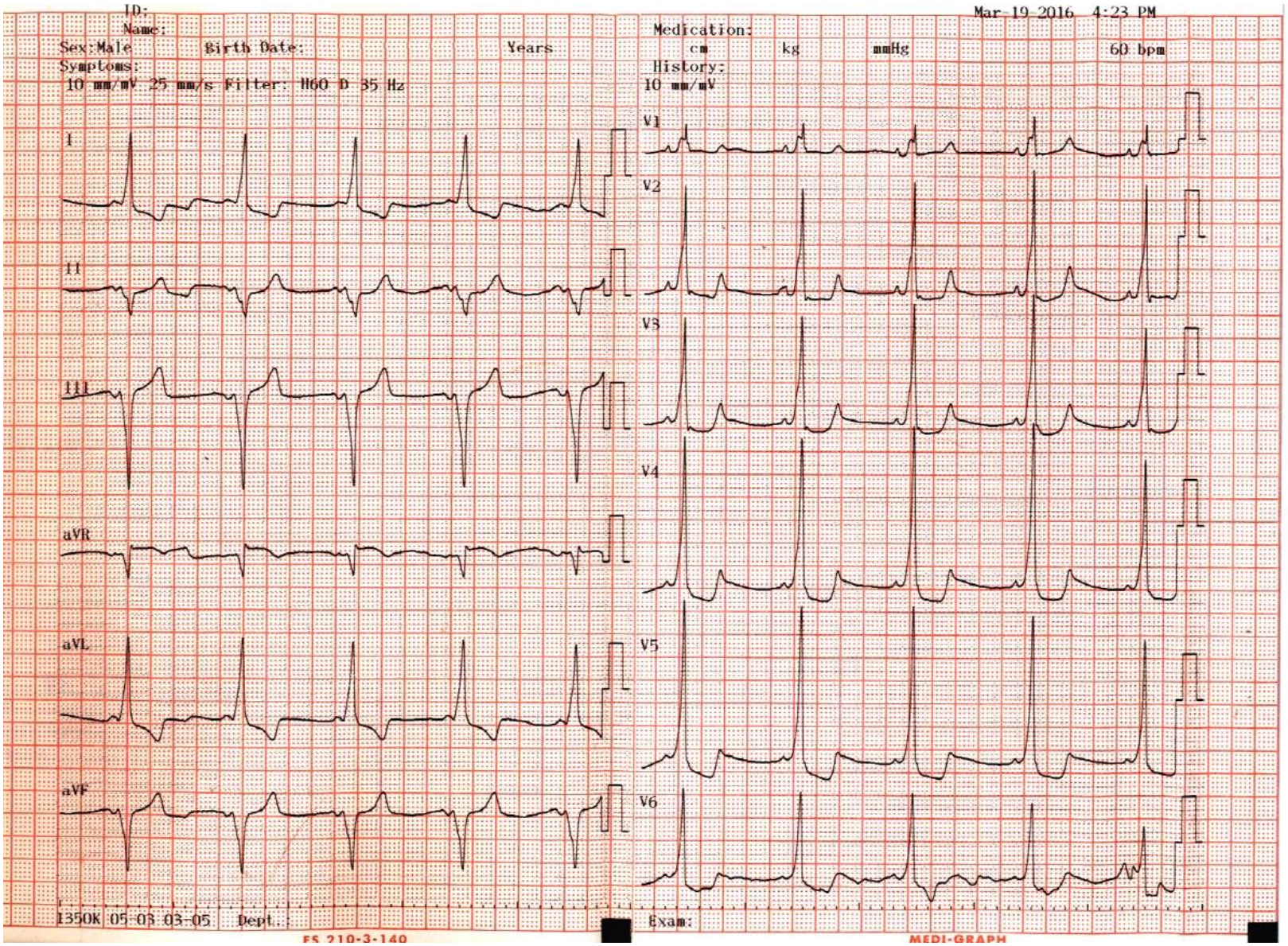
Adenosine, diltiazem iv

증례 8

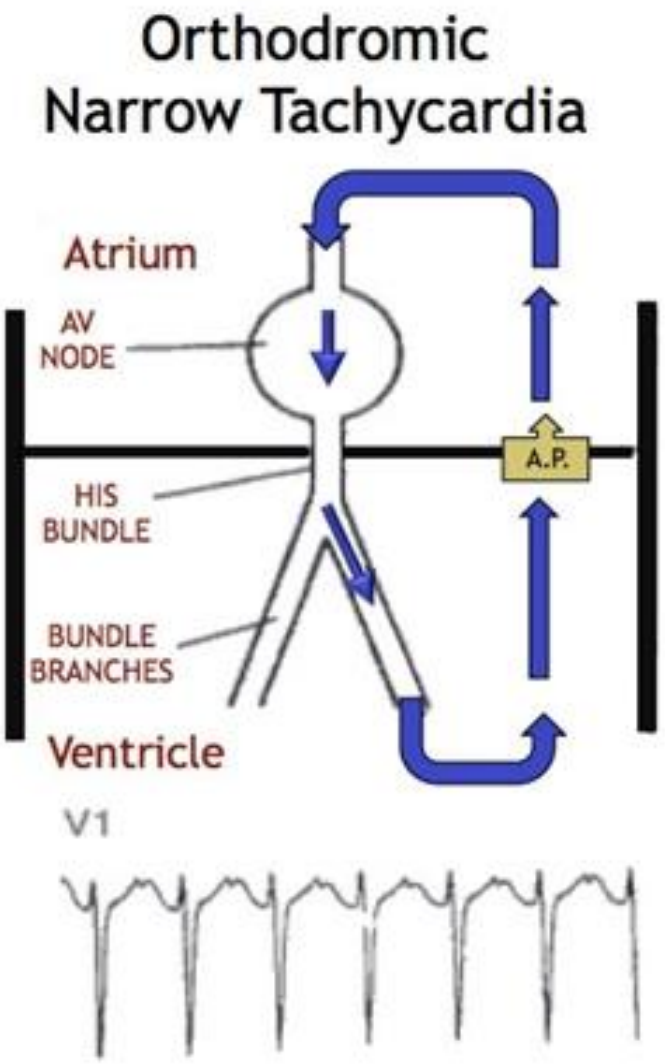


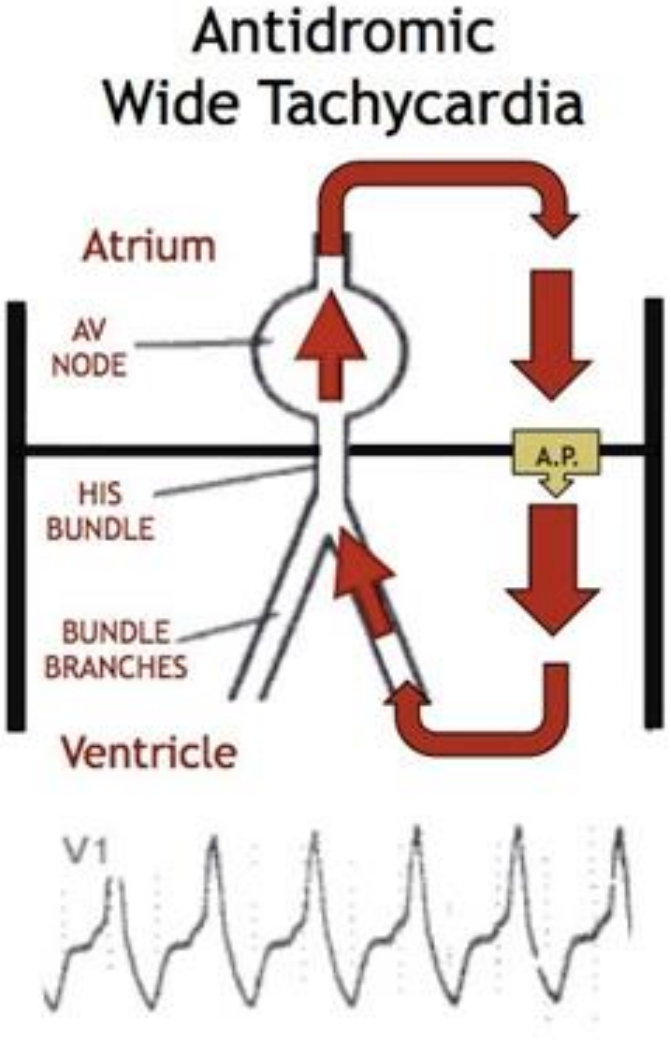
증례 8

CV 50J


ID:
Name:
Sex:Male
Birth Date:
Years
Symptoms:
10 mm/mV 25 mm/s Filter: H60 D 35 Hz
I
II
III
aVR
aVL
aVF
1350K 05-03 03-05
Dept.
FS 210-3-140
Mar-19-2016 4:23 PM
Medication:
cm
kg
mmHg
60 bpm
History:
10 mm/mV
V1
V2
V3
V4
V5
V6
Exam:
MEDI-GRAPH

Orthodrmic VS. antidromic tachycardia





치료

- AVRT: similar fashion as those with PSVT
  - Beta-blocker, diltiazem, verapamil
  - Procainamide, flecainide

- **Treatment of antidromic AVRT, AF**
  - **Class IC AAD: flecainide, propafenone, class IA: procainamide, class III: dofetilide, amiodarone, ibutilide**
  - **Contraindication: AV nodal blocker (b-blocker, digoxin, verapamil)**

- Catheter ablation should be considered as first line therapy (Class I)

증례 9

56세 여자

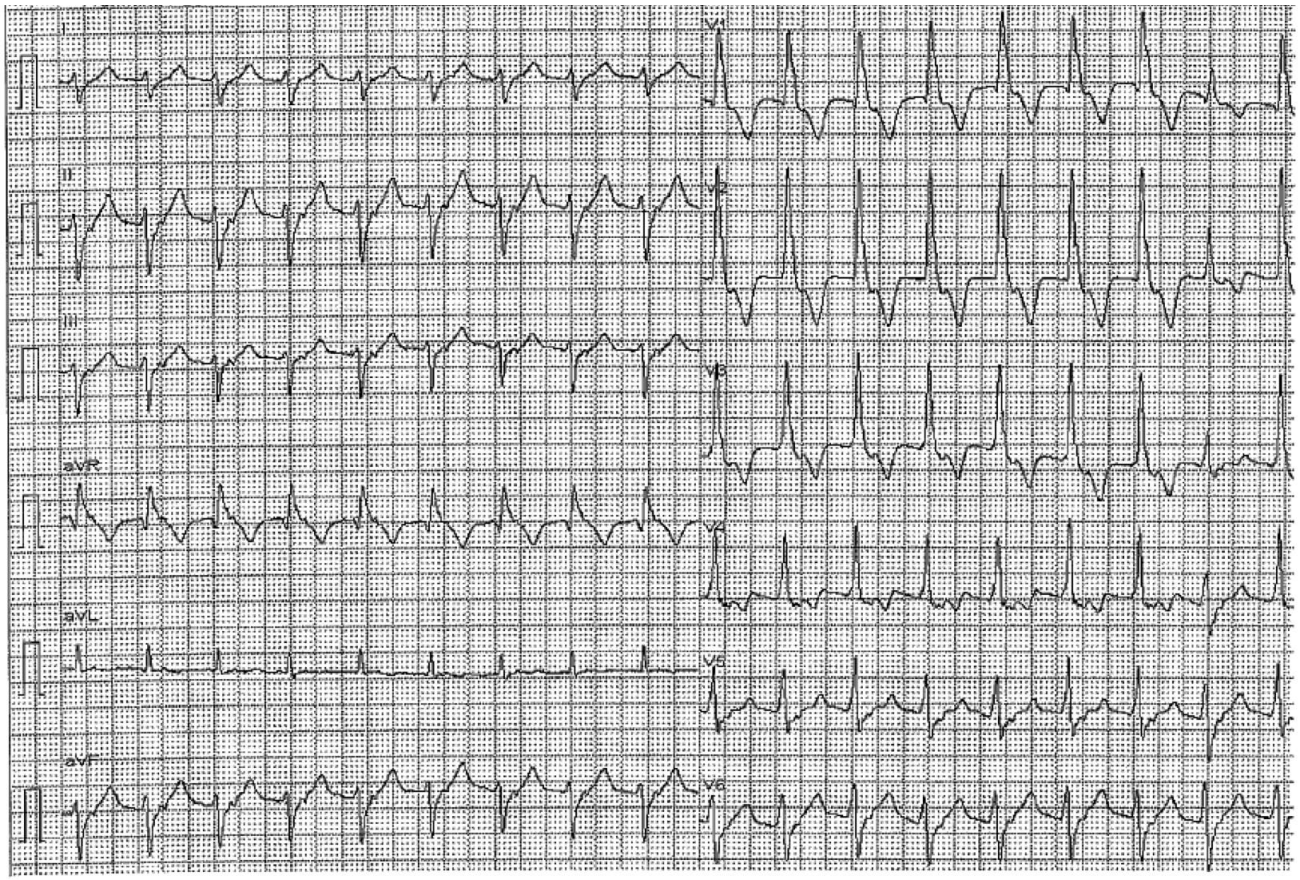
- 1년 전부터 두근거림
- 당뇨로 투약 중임.

- TMT: negative TMT
- TTE:

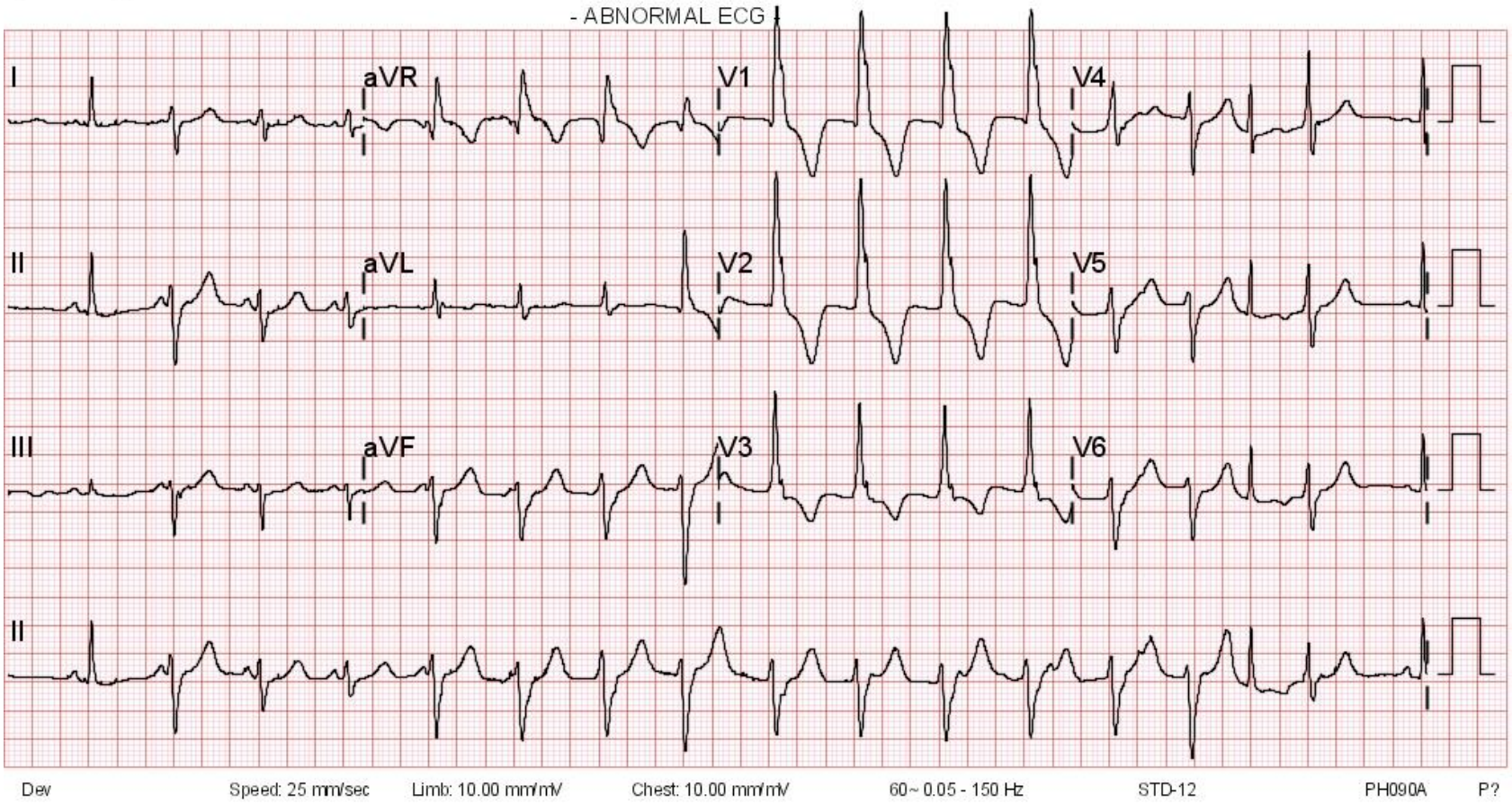
1. Normal size of cardiac chambers with good global LV systolic function.
2. Impaired LV relaxation.
3. No RWMAs.
4. Trivial TR(PG=23mmHg).

증례 9

외부 심전도



증례 9

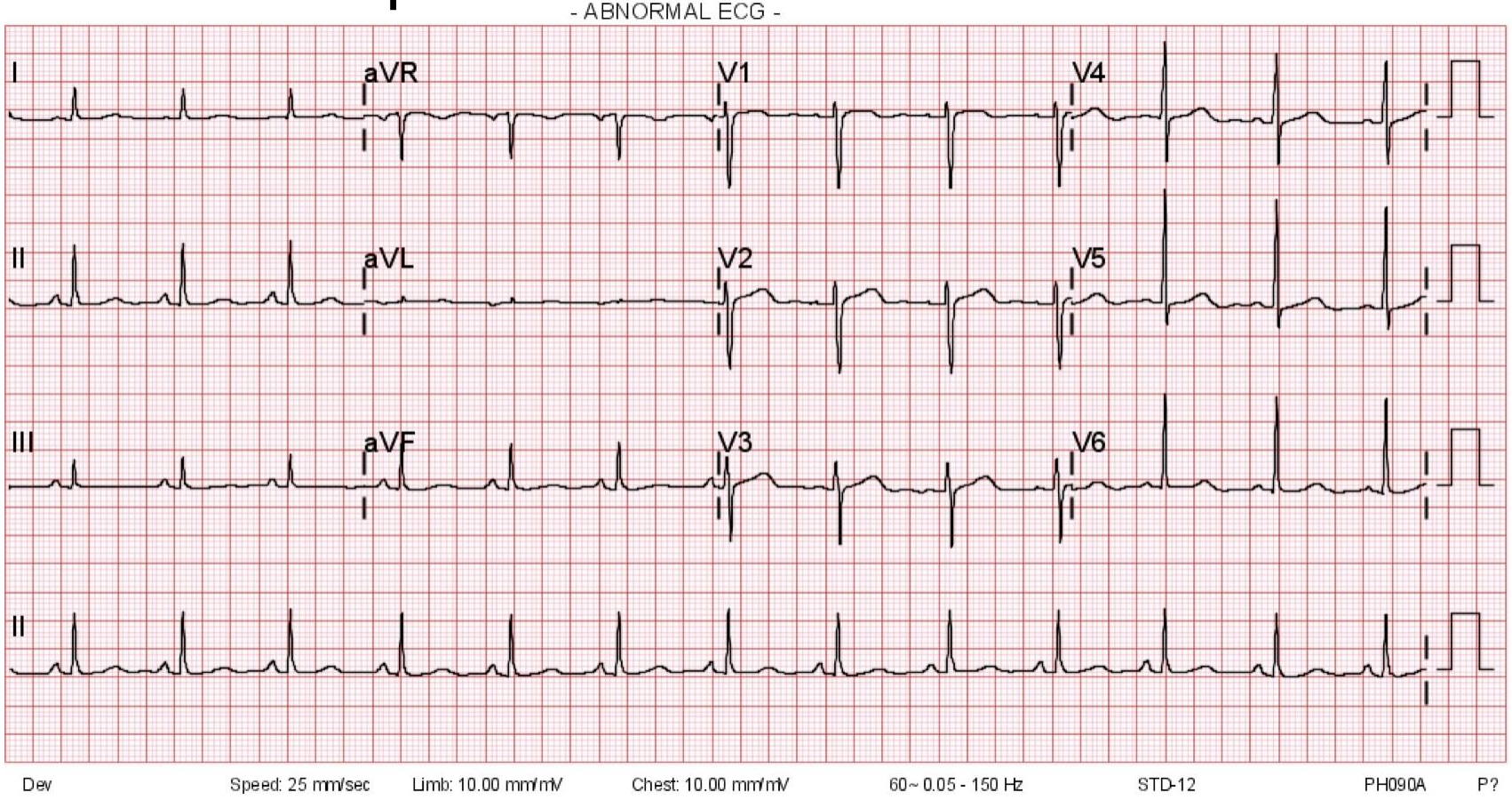

- ABNORMAL ECG -
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Dev
Speed: 25 mm/sec
Limb: 10.00 mm/mV
Chest: 10.00 mm/mV
60~ 0.05 - 150 Hz
STD-12
PH090A
P?

관찰되지 않는 소견은?

1. Fusion beat
2. Capture beat
3. AV dissociation
4. Left anterior fascicular block
5. Aberrant conduction

증례 9

After verapamil



증례 10

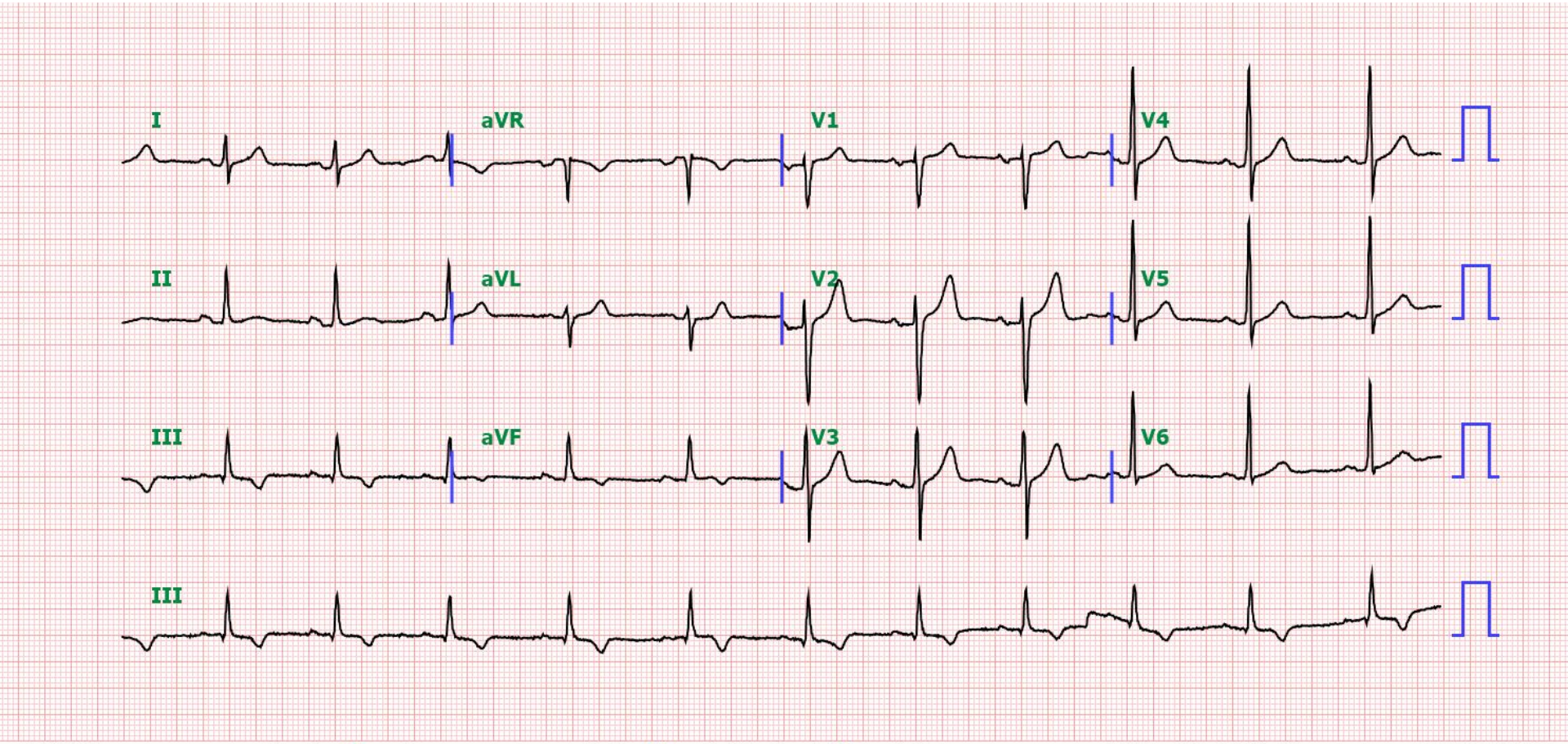
- 남자, 39세, 두근거림
- 2018.07.06 순환기내과 외래 내원
- 1개월 전부터 증상, 20분간 지속, 어지러움 동반

의심되는 진단은?

1. Premature ventricular conduction
2. Premature atrial conduction
3. Non-sustained atrial tachycardia
4. Ventricular tachycardia
5. Sinus rhythm with aberrancy (RBBB)

증례 10

- IV Adenosine과 IV verapamil에 반응 (-)
- 다음날 전기생리학적검사 상 fascicular ventricular tachycardia 진단 하에 전극도자절제술 시행



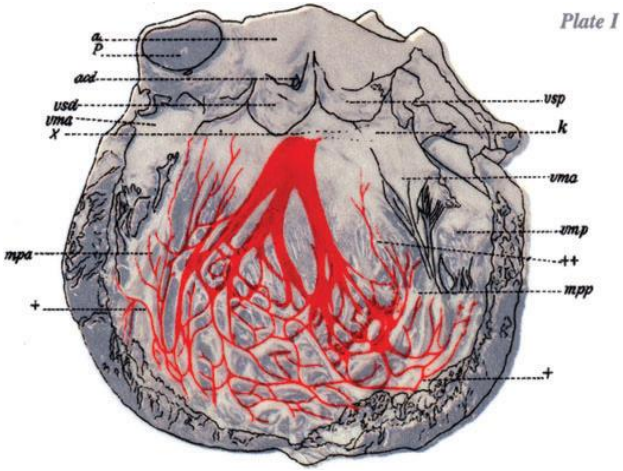
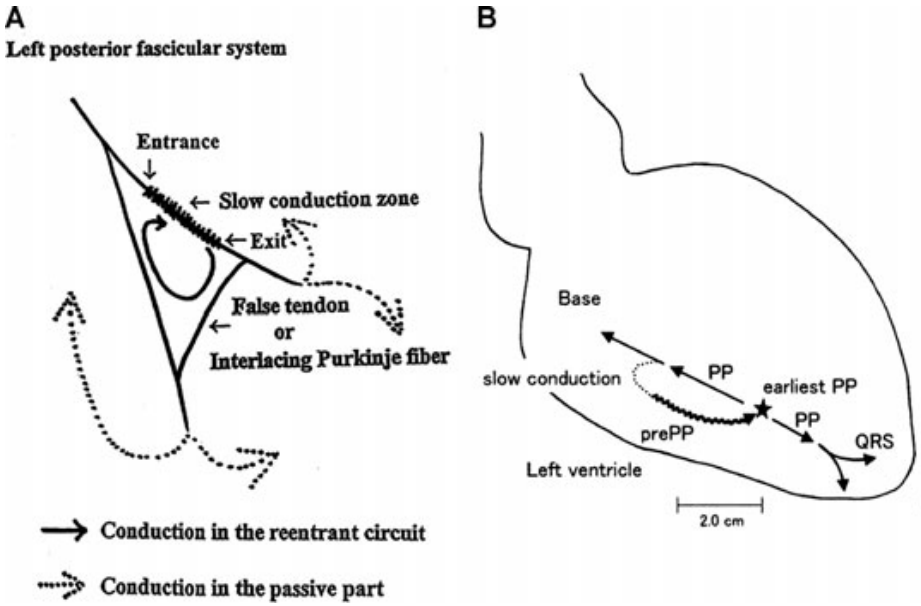
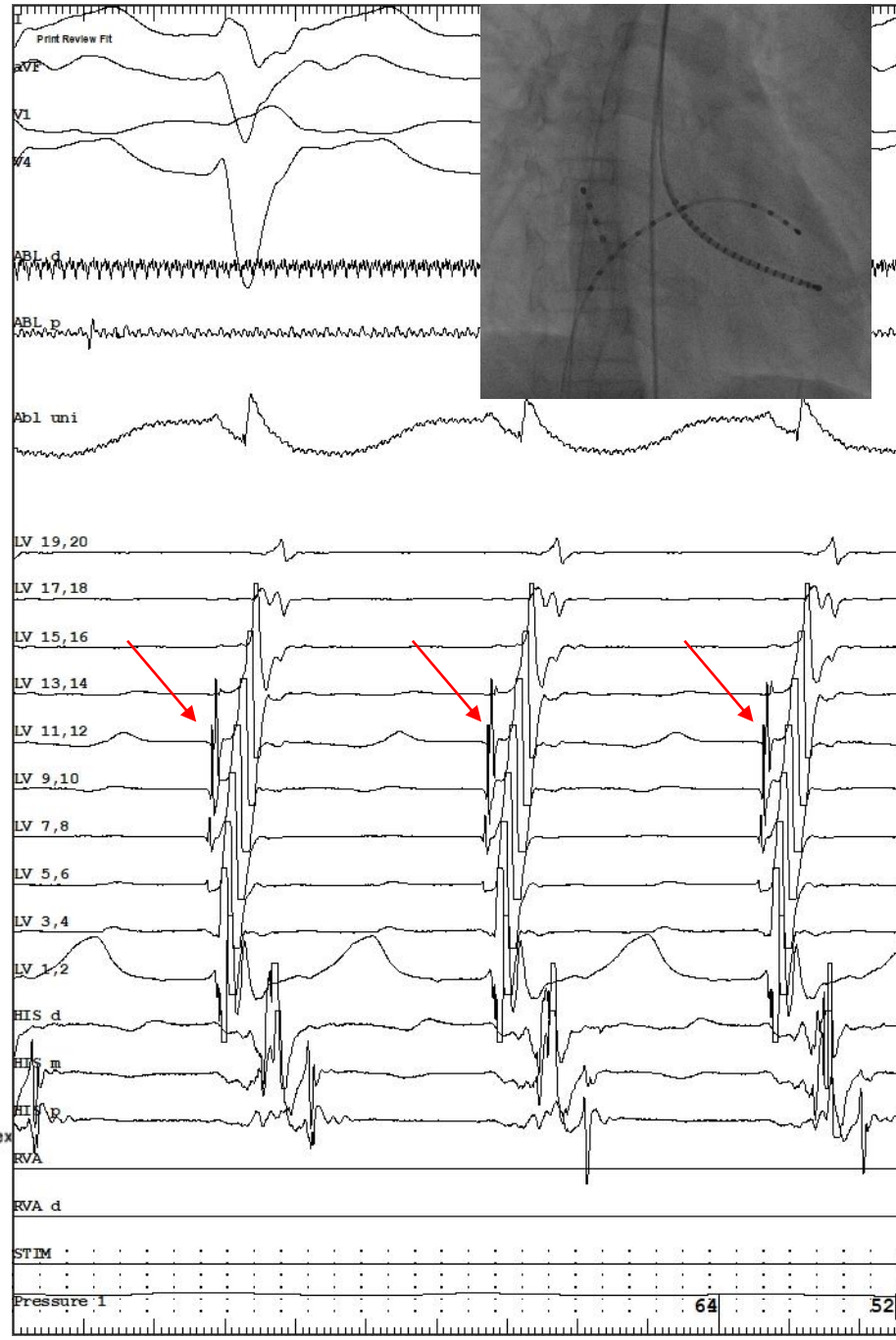
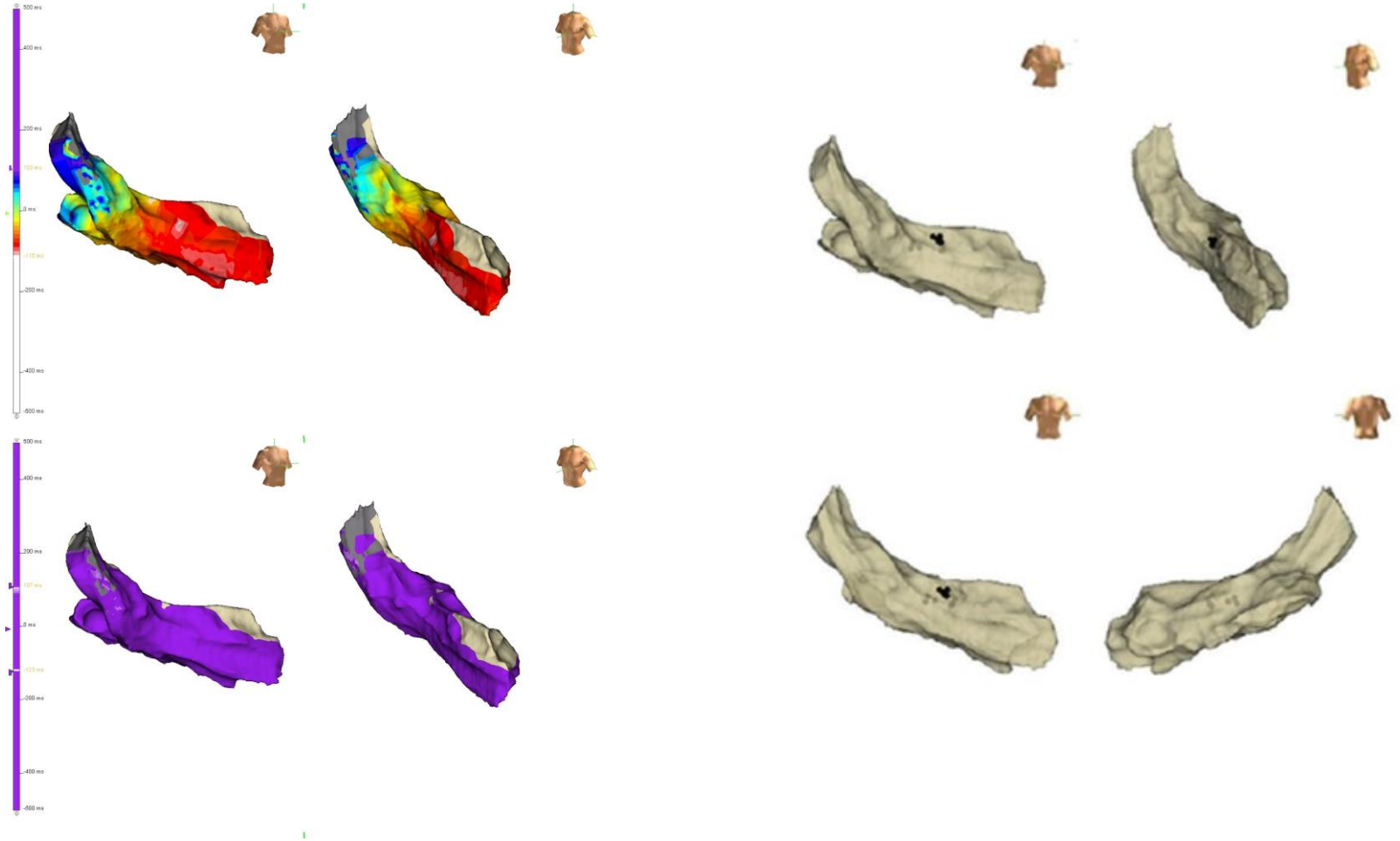


Plate I
a
p
acd
usd
vma
x
vsp
k
vma
vmp
mpa
++
mpp
+
+


A
Left posterior fascicular system
Entrance
Slow conduction zone
Exit
False tendon
or
Interlacing Purkinje fiber
Conduction in the reentrant circuit
Conduction in the passive part
B
Base
slow conduction
PP
earliest PP
prePP
PP
QRS
Left ventricle
2.0 cm
Apex

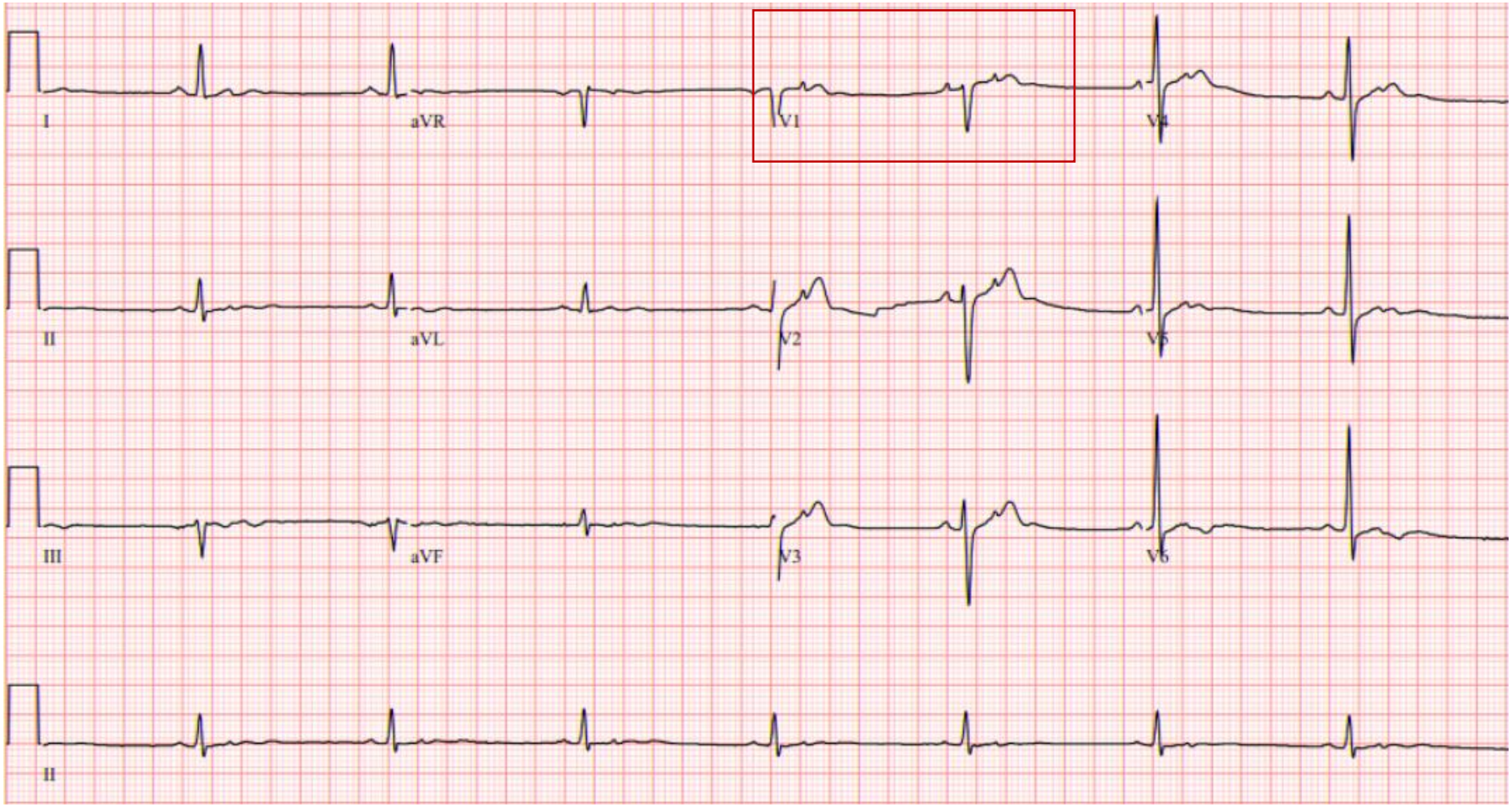

Print Review Fit
aVF
V1
V4
ABL d
ABL p
Abl uni
LV 19,20
LV 17,18
LV 15,16
LV 13,14
LV 11,12
LV 9,10
LV 7,8
LV 5,6
LV 3,4
LV 1,2
HIS d
HIS m
HIS p
RVA
RVA d
STIM
Pressure 1
64
52

EPS and RFCA



M/70, no symptom, during CTx

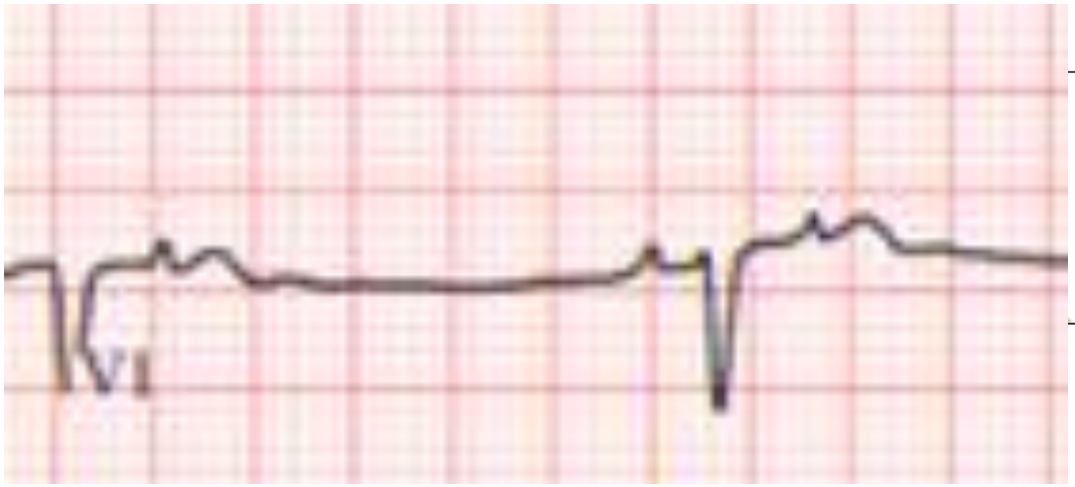
증례 11

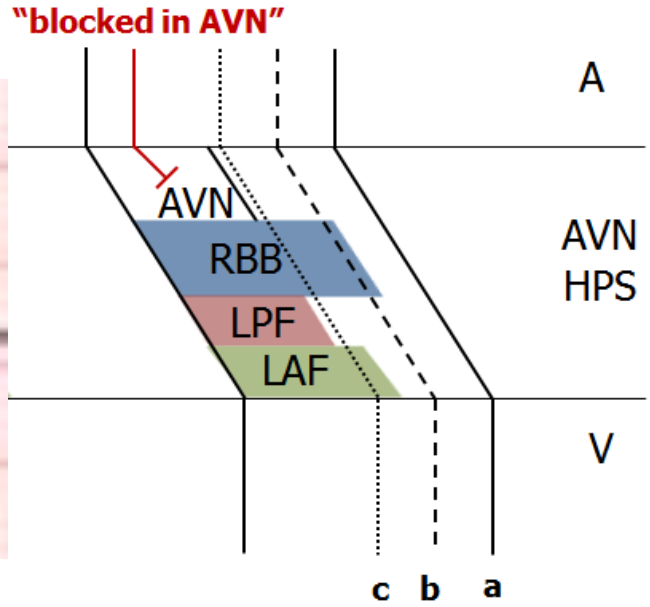


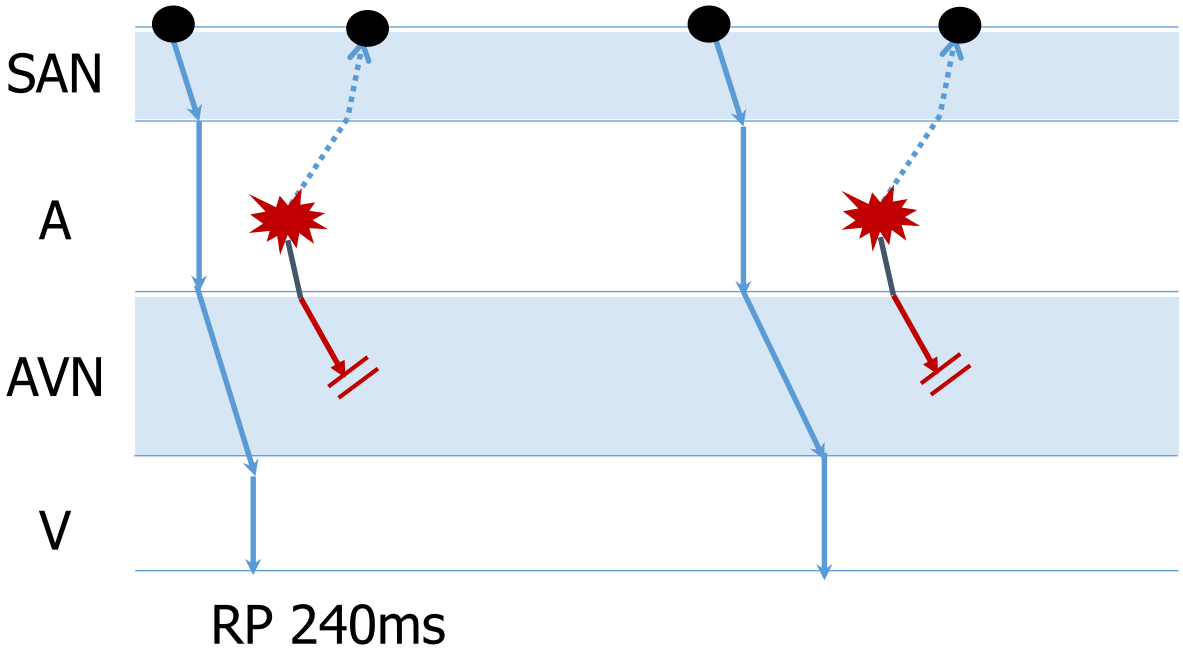
이 심전도의 진단은?

1) Sinus bradycardia
2) APC, bigeminy
3) 2:1 AV block
4) Junctional rhythm

Non-conducted APC

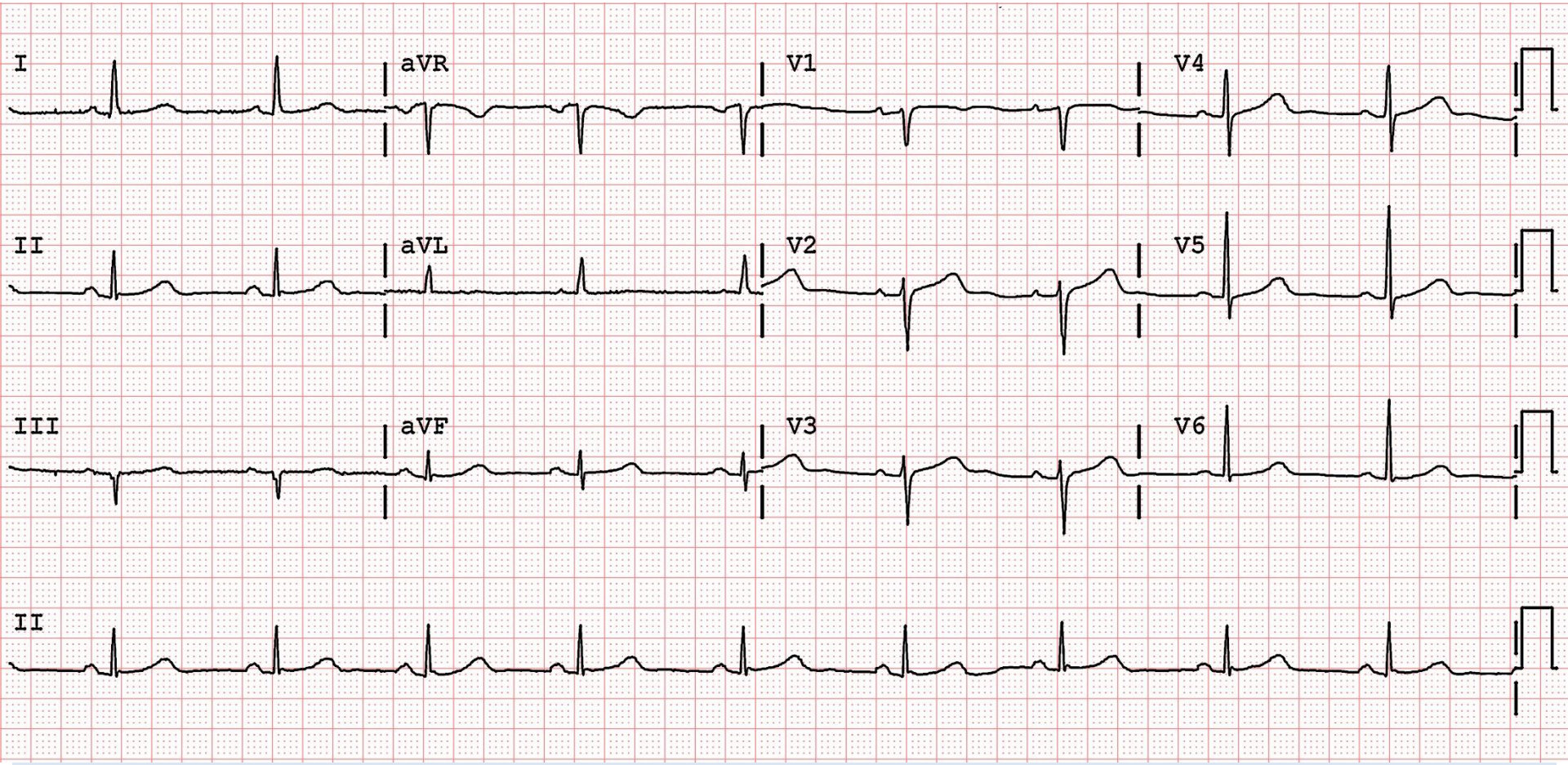






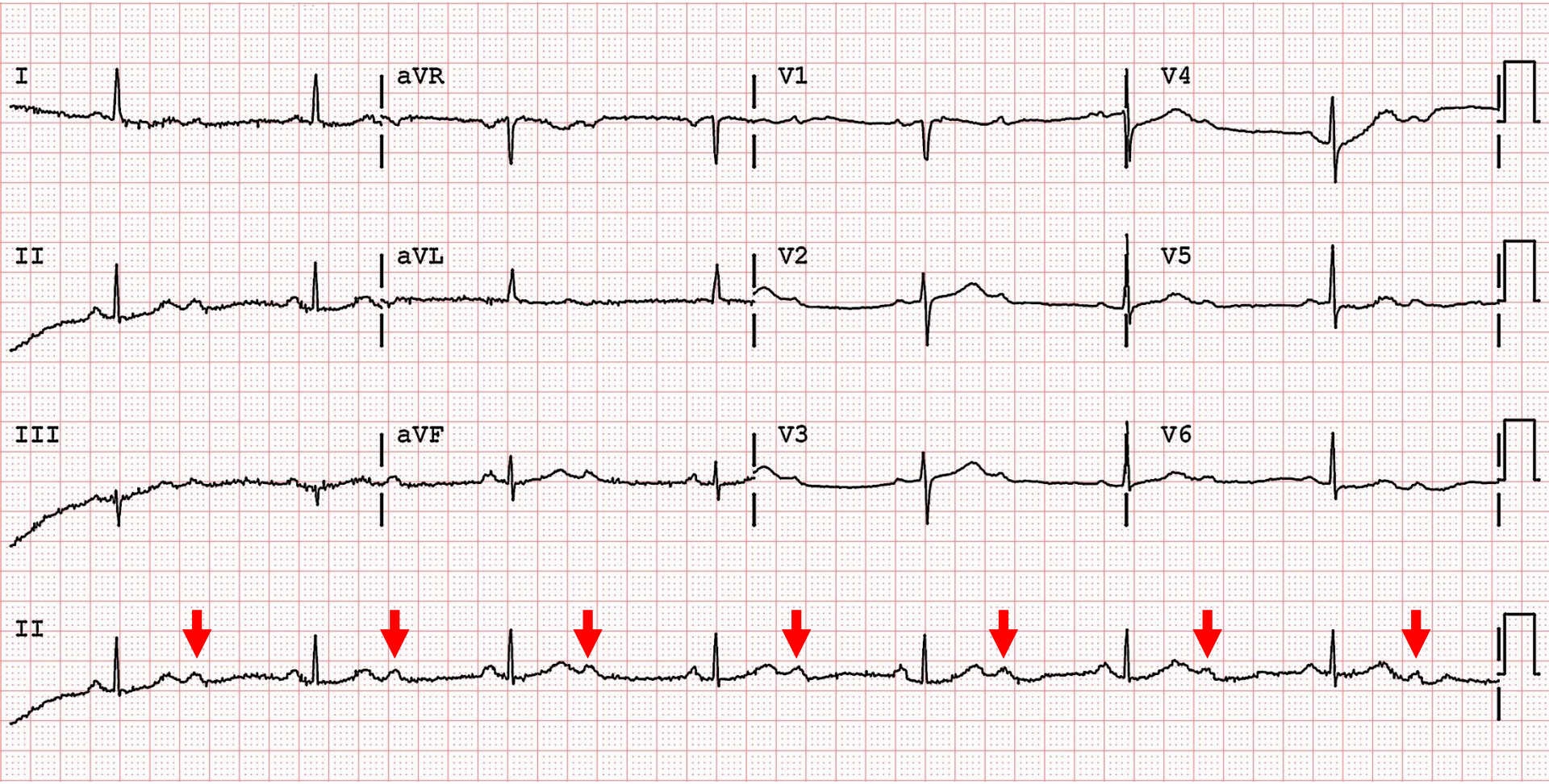
53세/여자, 어지럼증으로 입원

증례 12

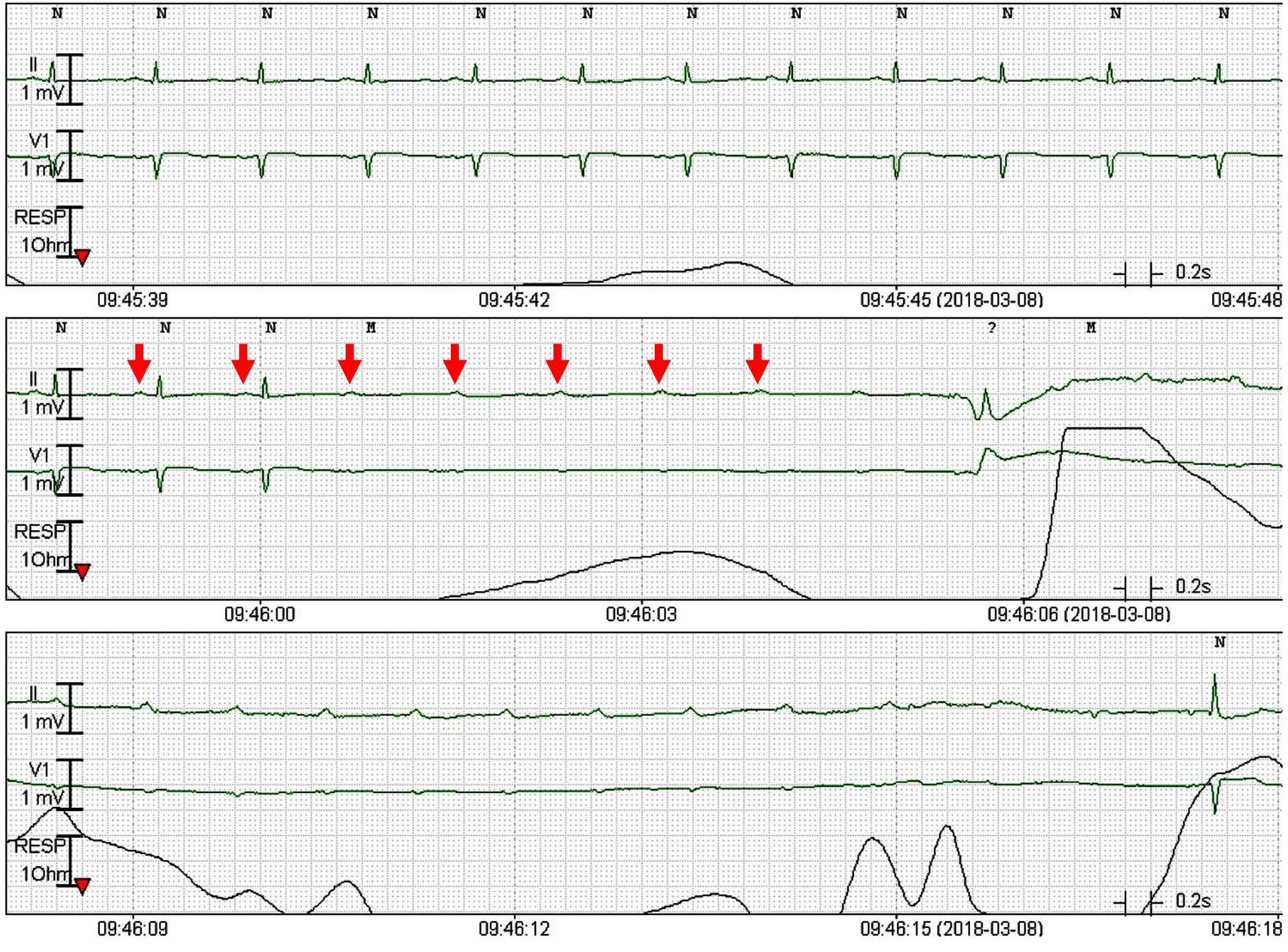


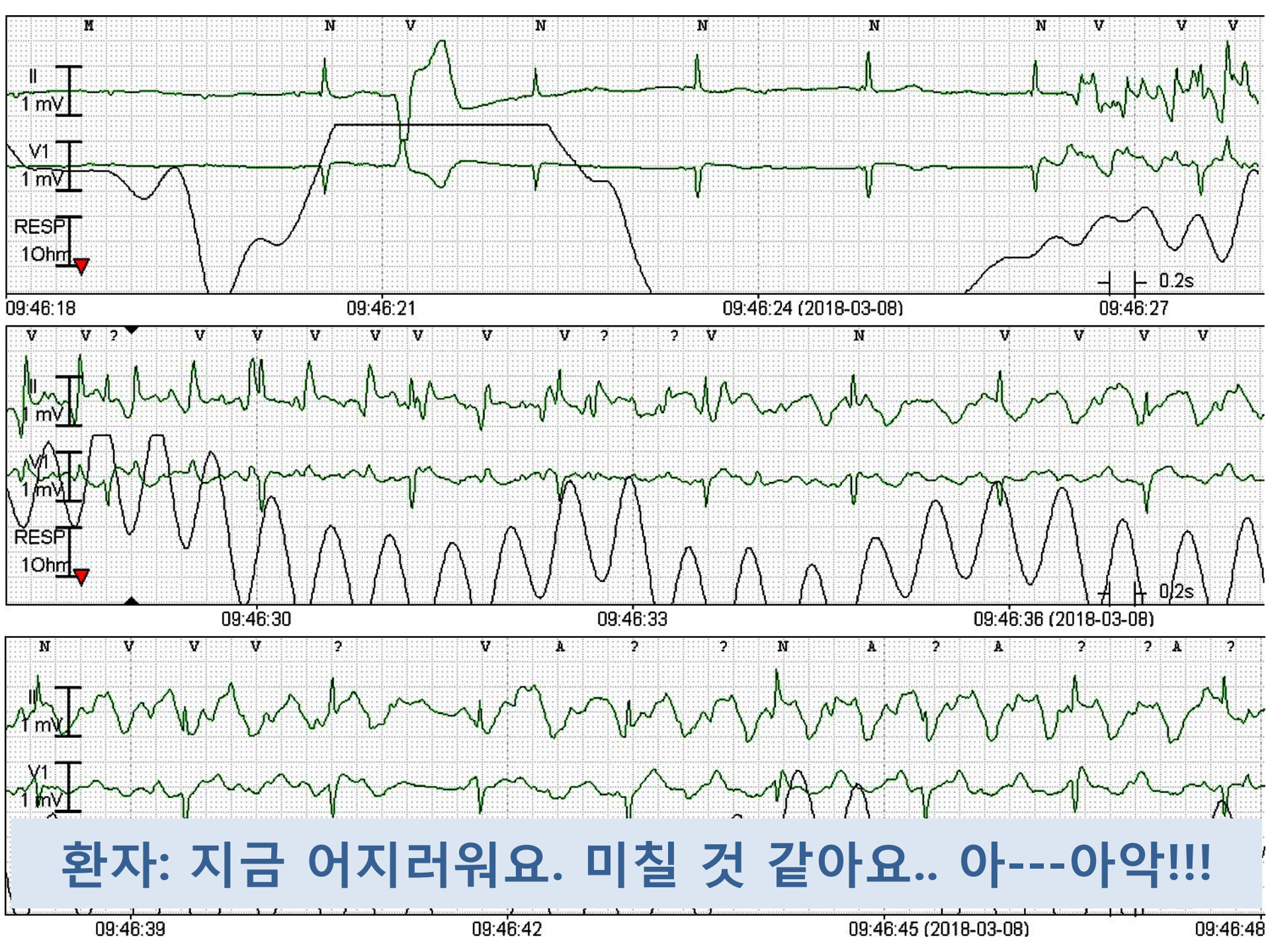
환자: 지금 어지러워요. 미칠 것 같아요. 아---아악!!!

응급실 방문했을 때의 심전도

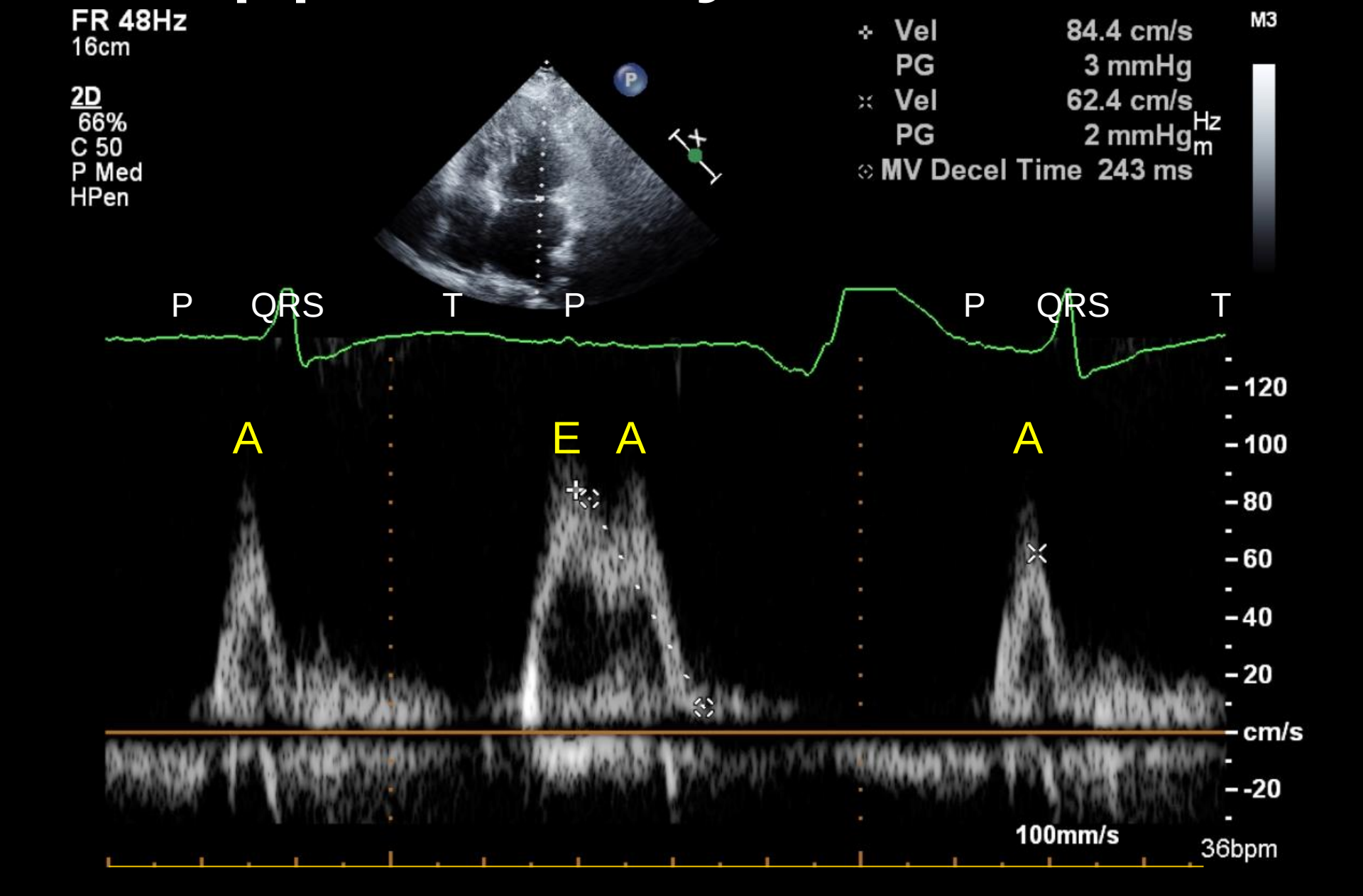


정신과 협진 후 불안장애, 공황장애로 치료만 함.


N N N N N N N N N N N N N
II
1 mV
V1
1 mV
RESP
1Ohm
0.2s
09:45:39
09:45:42
09:45:45 (2018-03-08)
09:45:48
N N N M ? M
II
1 mV
V1
1 mV
RESP
1Ohm
0.2s
09:46:00
09:46:03
09:46:06 (2018-03-08)
N
II
1 mV
V1
1 mV
RESP
1Ohm
0.2s
09:46:09
09:46:12
09:46:15 (2018-03-08)
09:46:18

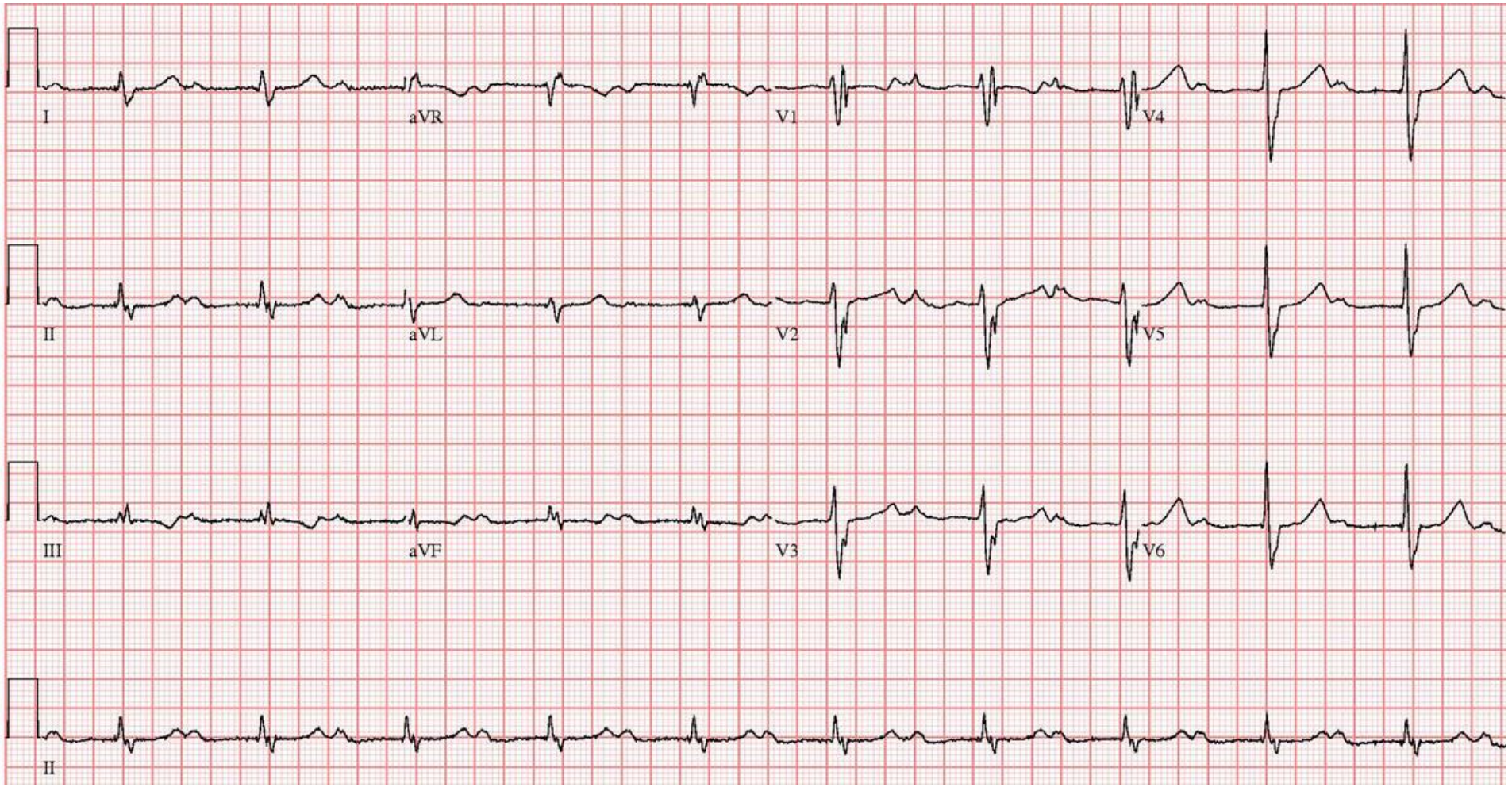

II
1 mV
V1
1 mV
RESP
1Ohm
0.2s
09:46:18
09:46:21
09:46:24 (2018-03-08)
09:46:27
09:46:30
09:46:33
09:46:36 (2018-03-08)
09:46:39
09:46:42
09:46:45 (2018-03-08)
09:46:48
환자: 지금 어지러워요. 미칠 것 같아요.. 아---아악!!!

Doppler study: Mitral E/A



증례 13

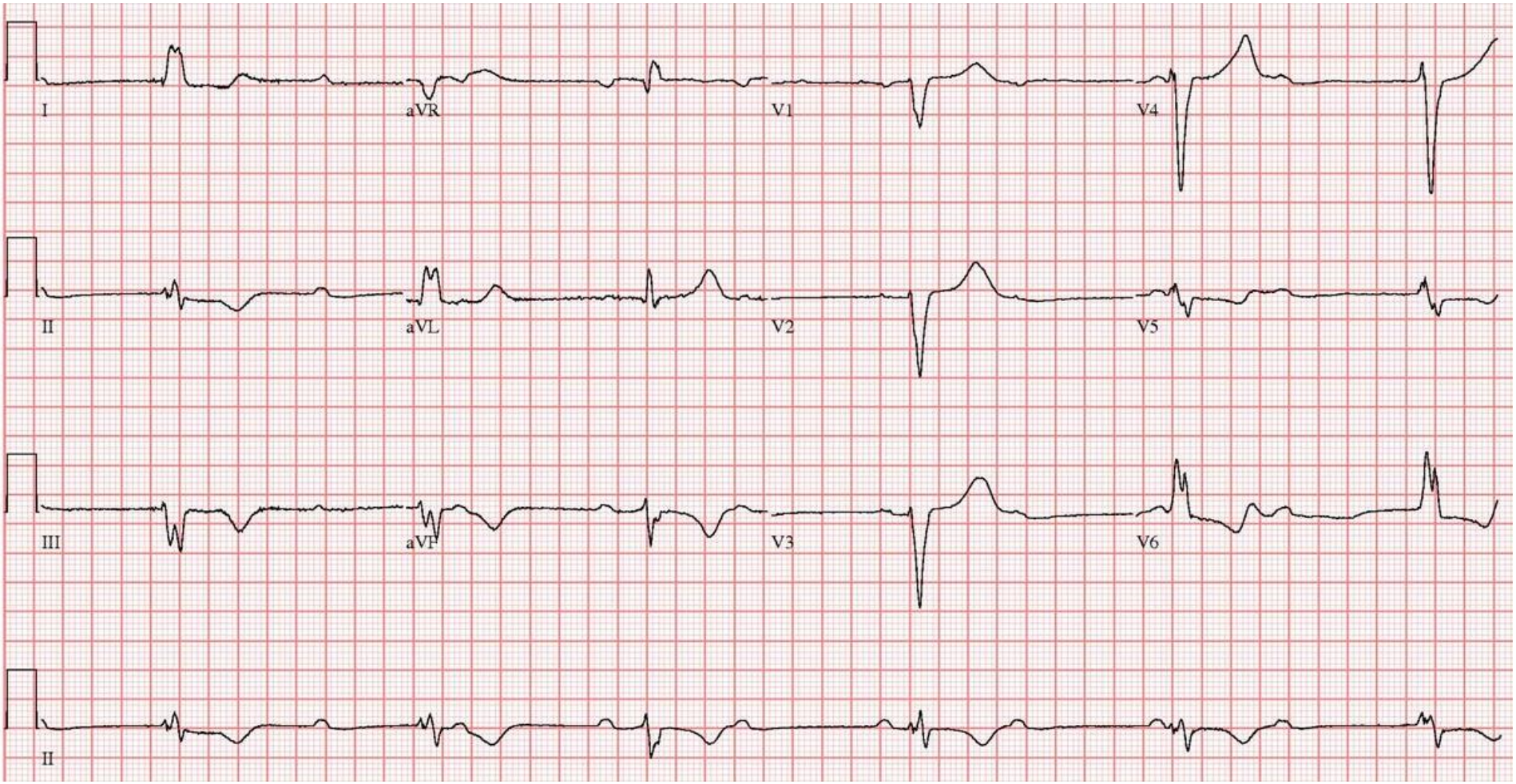
71세 여자. 1주 전부터 숨이 차서 왔다. 2년 전부터 심부전과 협심증으로 치료 중이었다. 왔을 때 심전도 (1)이다. 이상은?



1) 1도 방실차단 2) 1도 방실차단+완전 우각차단
3) 1도 방실차단+완전 좌각차단 4) 2섬유속차단 5) 3섬유속차단

증례 13

경과 관찰 중 아래 심전도(2)를 보였다.
종합적인 진단은?



1) 1도 방실차단 2) 1도 방실차단+완전 우각차단
3) 1도 방실차단+완전 좌각차단 4) 2섬유속차단 5) 3섬유속차단

3섬유속차단 (trifascicular block)

- 심실 내 전도로 3가닥 (right bundle branch, left anterior fascicle, left posterior fascicle) 모두 완전 혹은 불완전하게 전도장애를 일으킨 상태

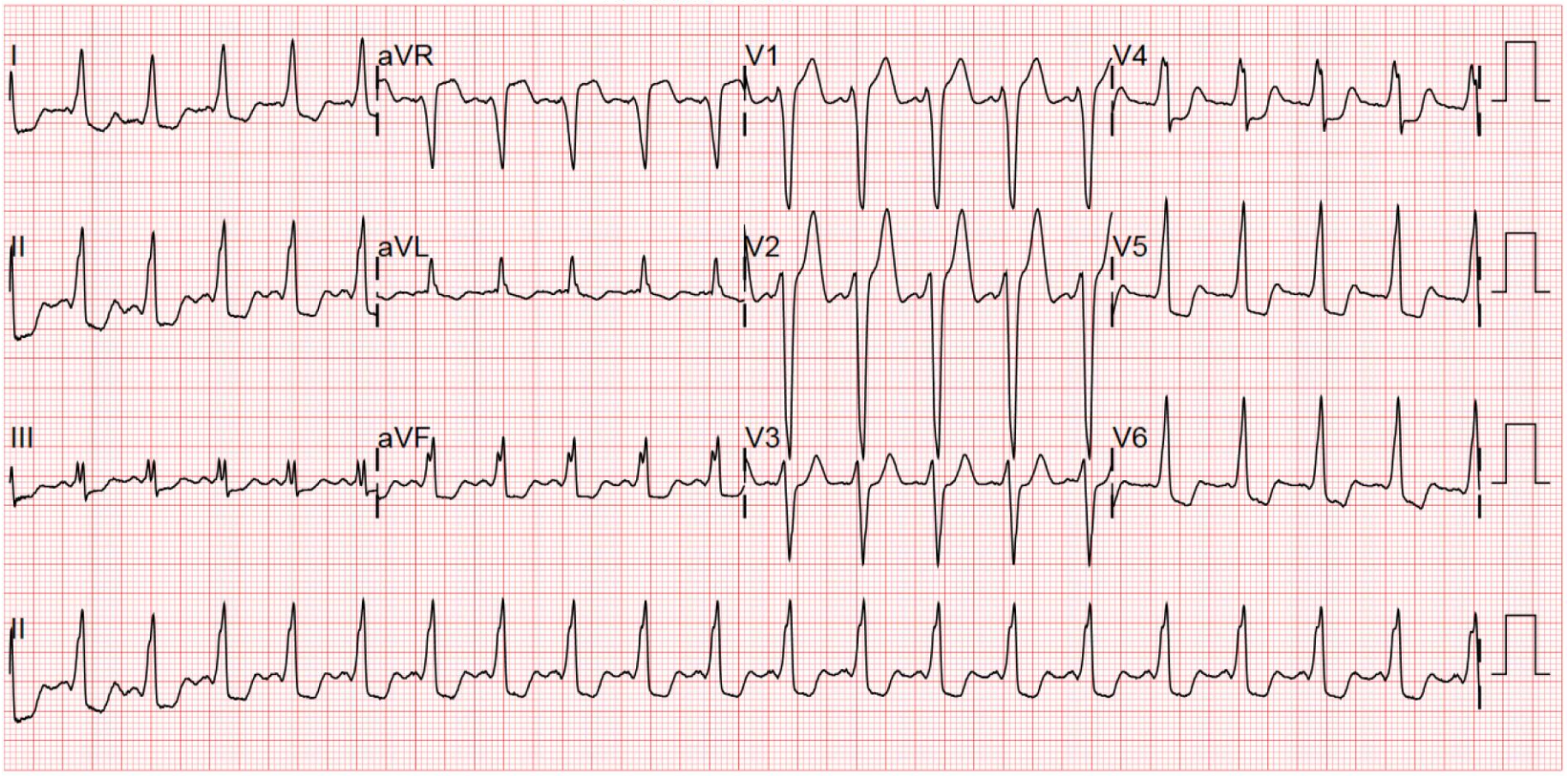
  - 완전 차단: complete AV block
  - 불완전 차단:
    - Bifascicular block + 1st AVB (most common)
    - Bifascicular block + 2nd AVB
    - RBBB + alternating LAFB/LPFB
    - Alternating RBBB and LBBB

    - Cf) 만성 2섬유속차단: 전기생리검사 등으로 실신, 현기증의 원인이 방실차단으로 판단되는 경우 혹은 HV간격이 100ms 이상이거나, pacing에 의해 His속 아래 방실차단이 유도되는 경우 영구 심박동기 적응증.

20/F, palpitation

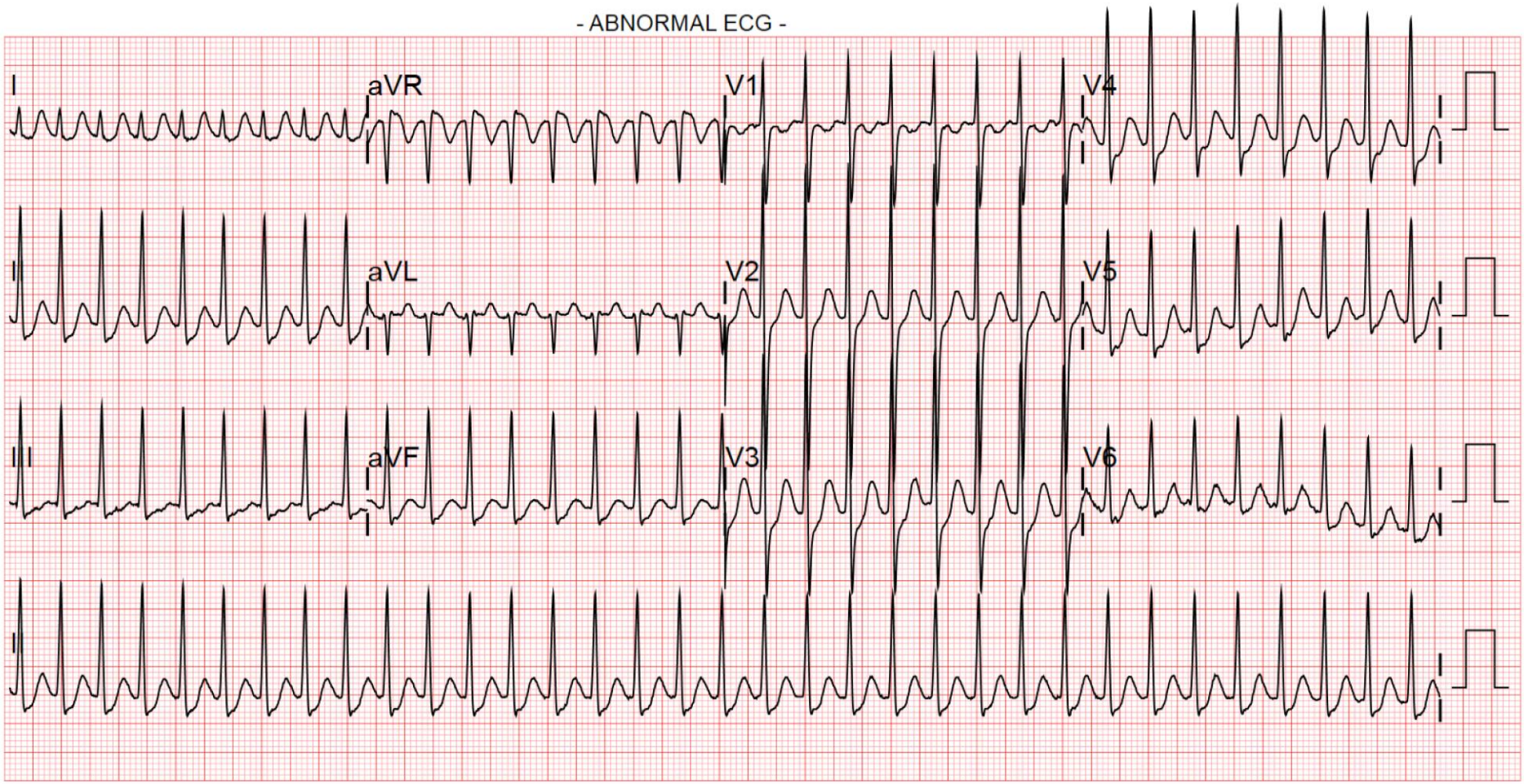
증례 14

Baseline ECG



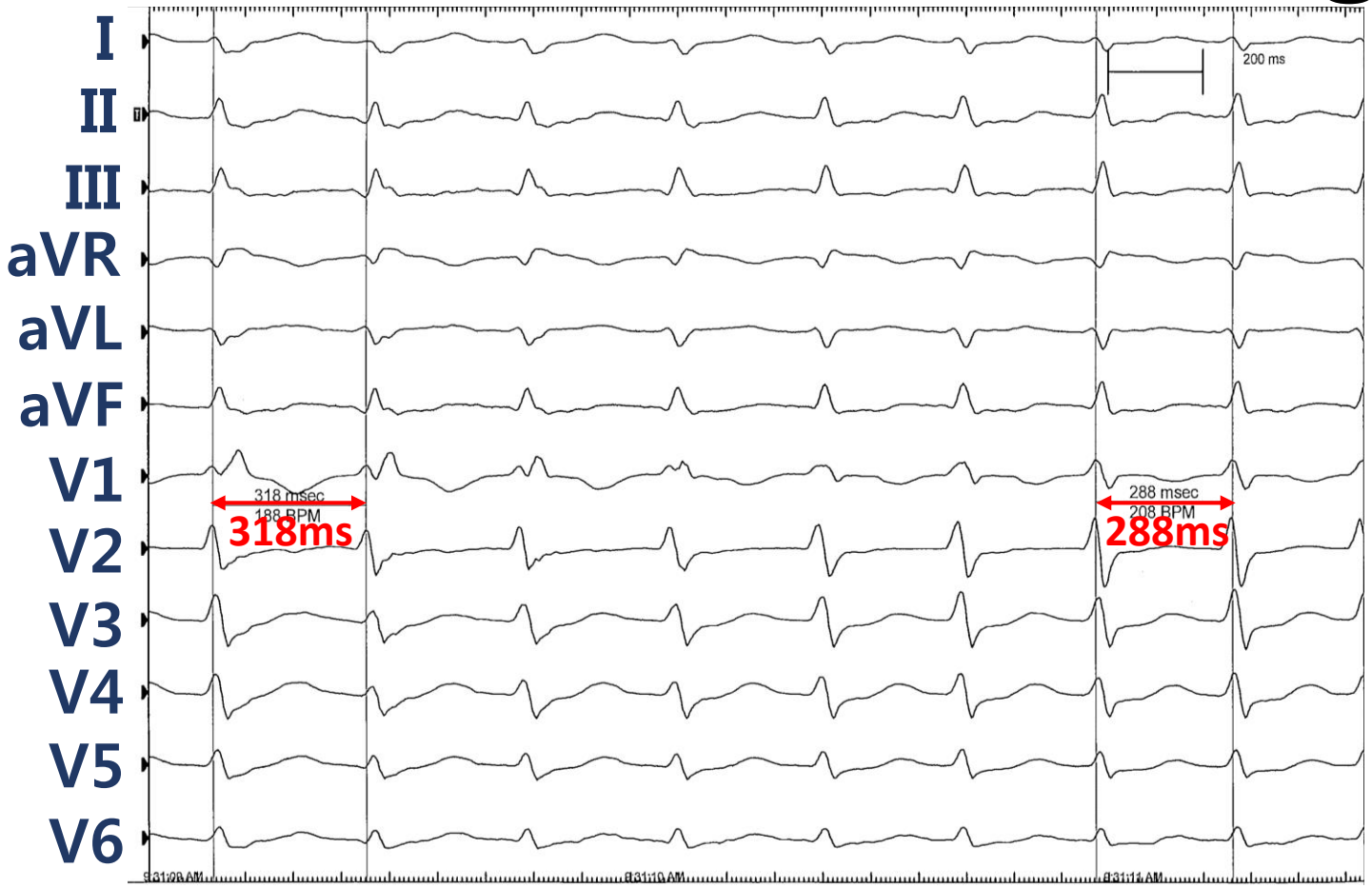
Tachycardia @ER

증례 14



@EP lab

증례 14



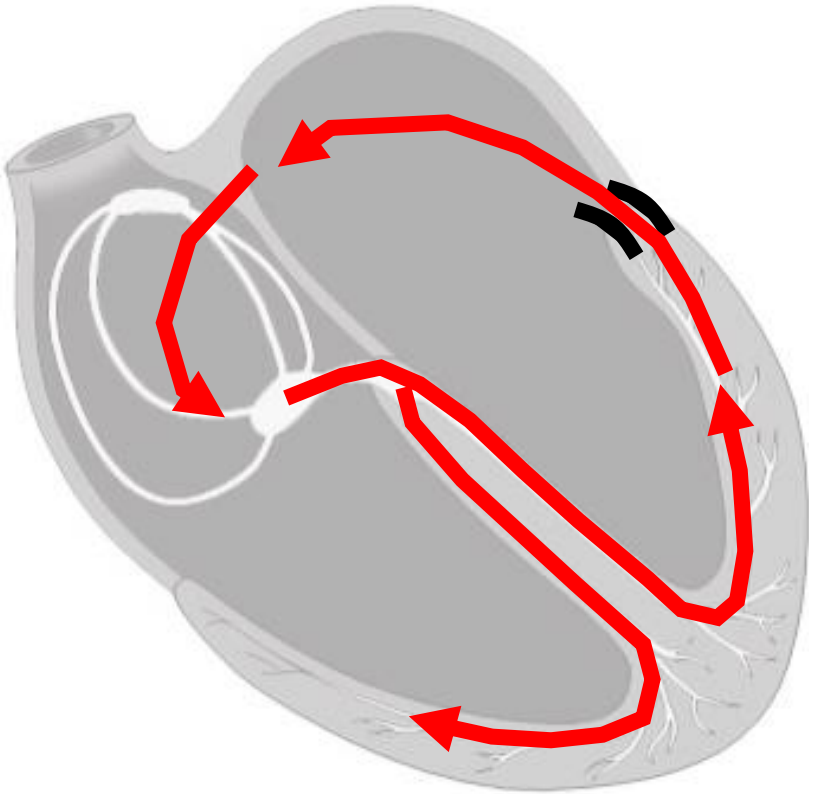
가장 가능성이 높은 진단은?

(AVRT = atrioventricular reentrant tachycardia, AP = accessory pathway)

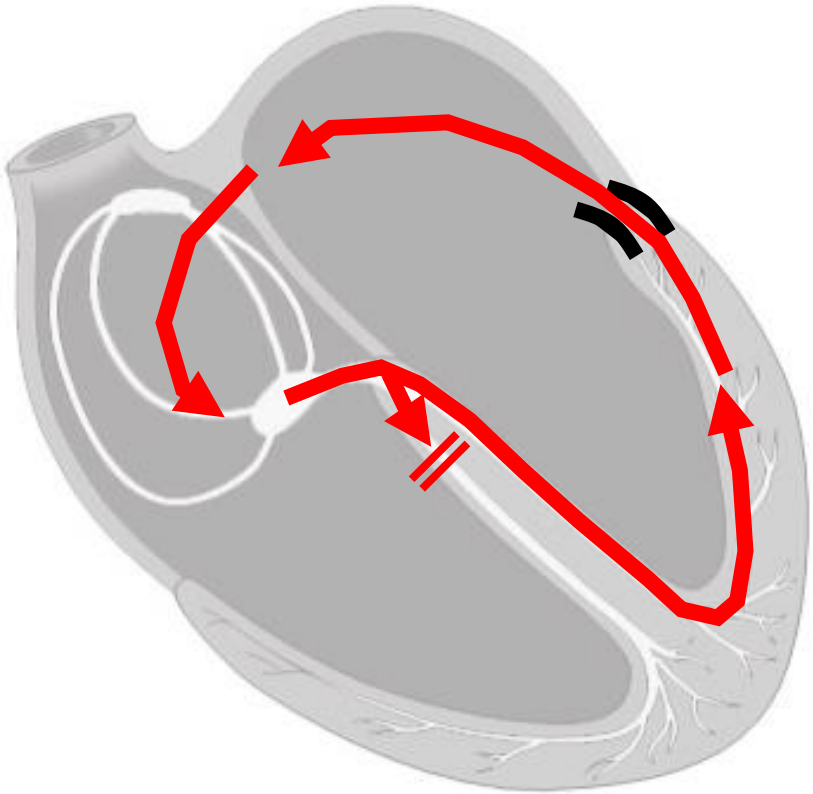
1) Antidromic AVRT using Rt AP
2) Antidromic AVRT using Lt AP
3) Orthodromic AVRT using Rt AP
4) Orthodromic AVRT using Lt AP
5) AVNRT w/ innocent Rt AP

Coumel's Law

AVRT without BBB

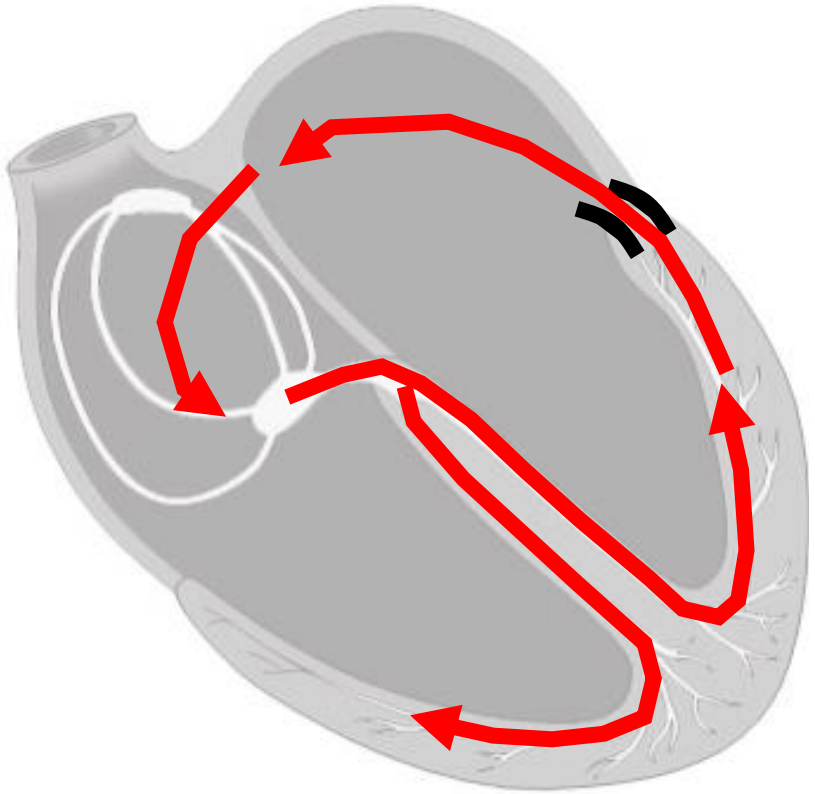


AVRT with contralateral BBB

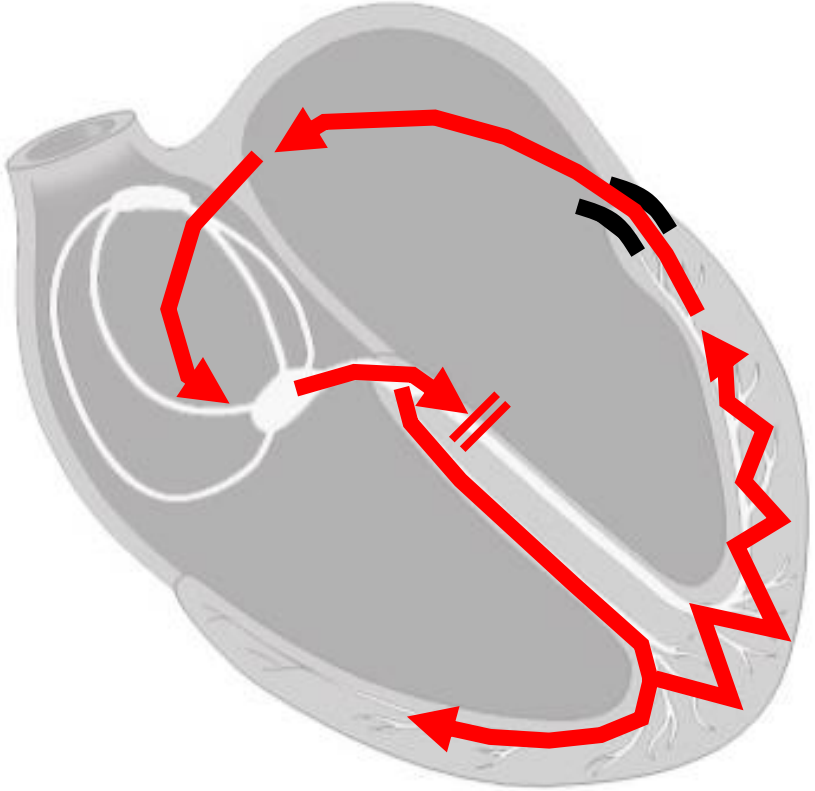


Coumel's Law

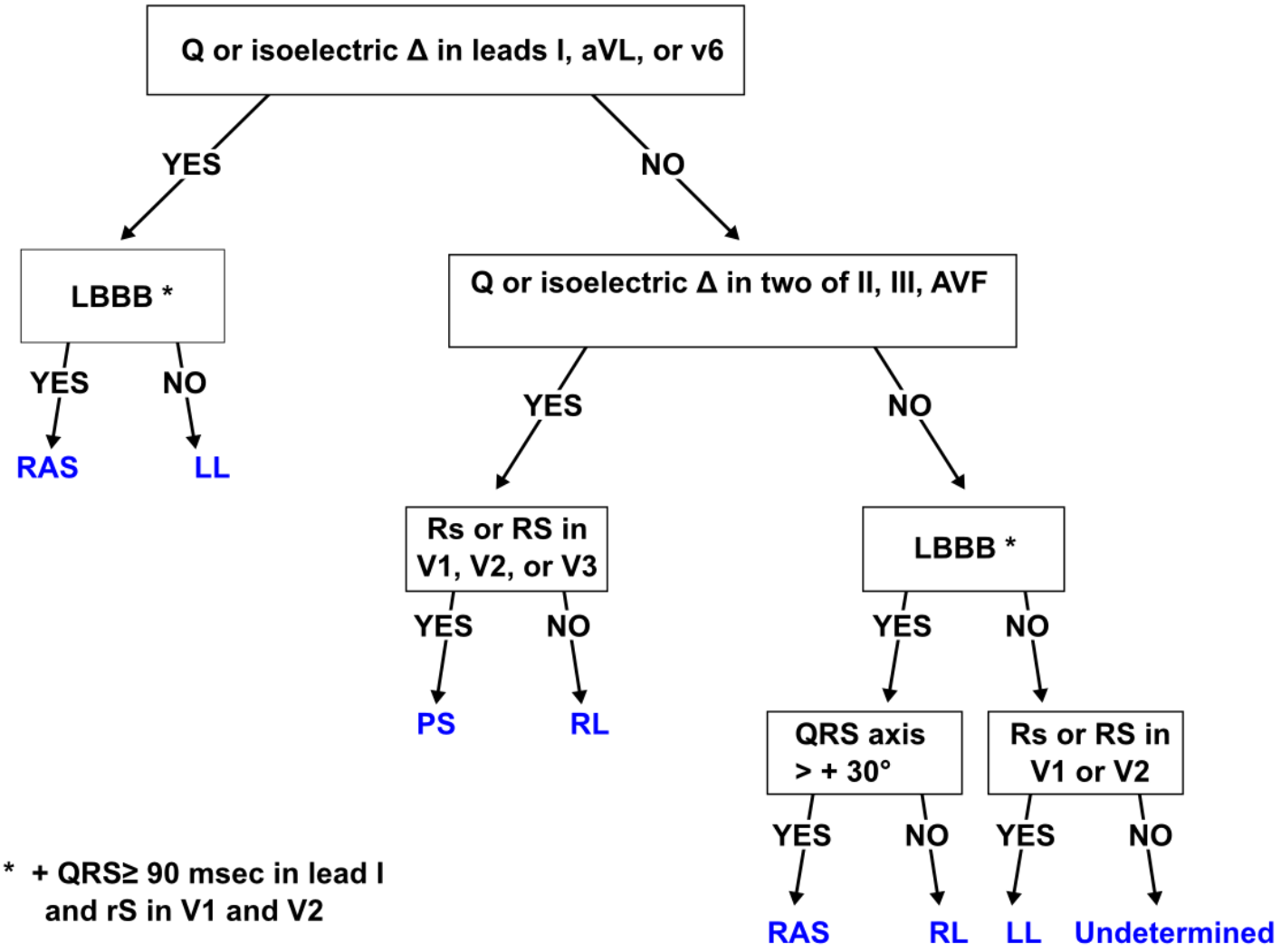
AVRT without BBB



AVRT with ipsilateral BBB

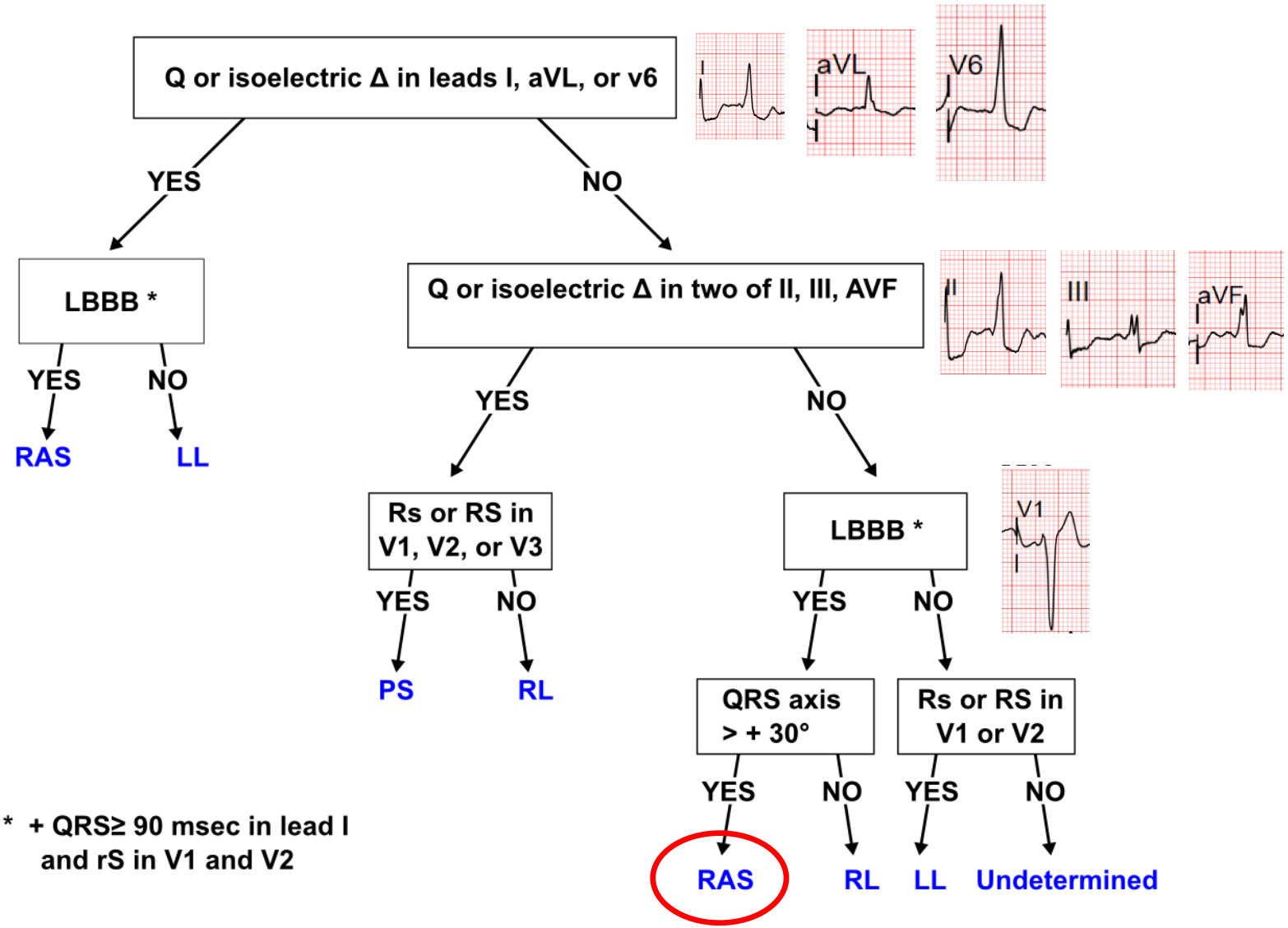


Localization of Accessory pathway
Milstein's algorithm

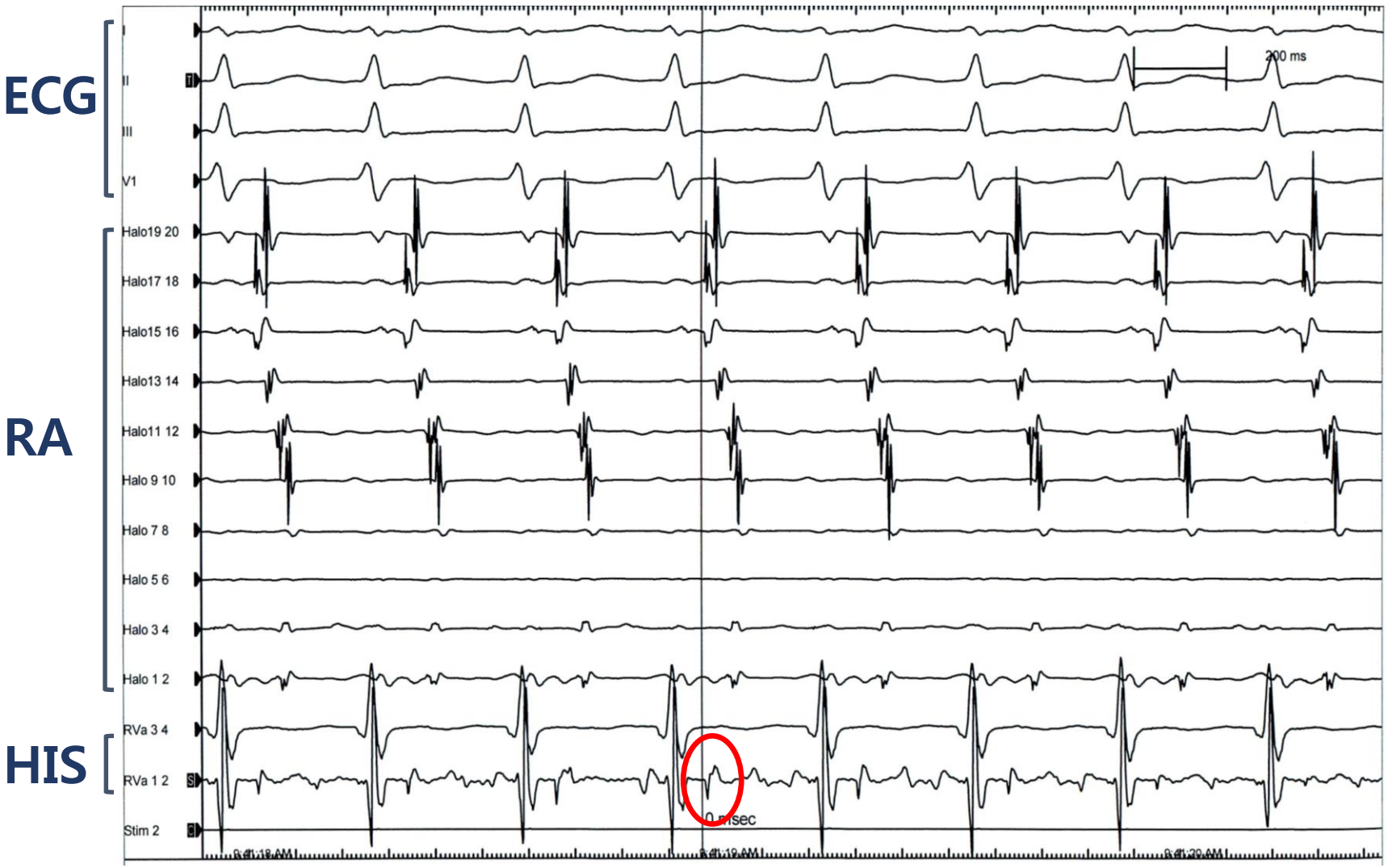


* + QRS≥ 90 msec in lead I and rS in V1 and V2

Localization of Accessory pathway
Milstein's algorithm

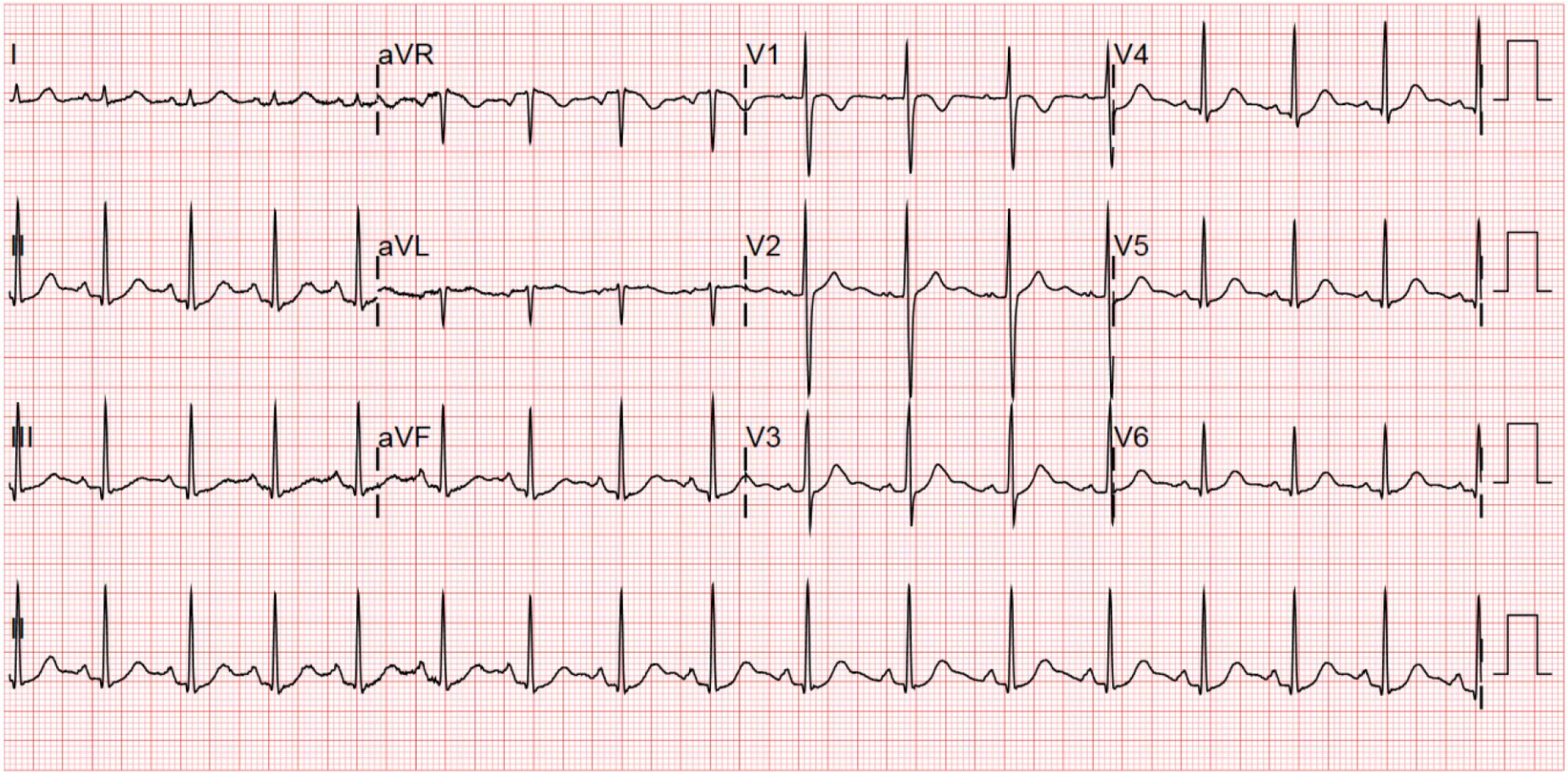


During tachy; earliest A @His (RAS)



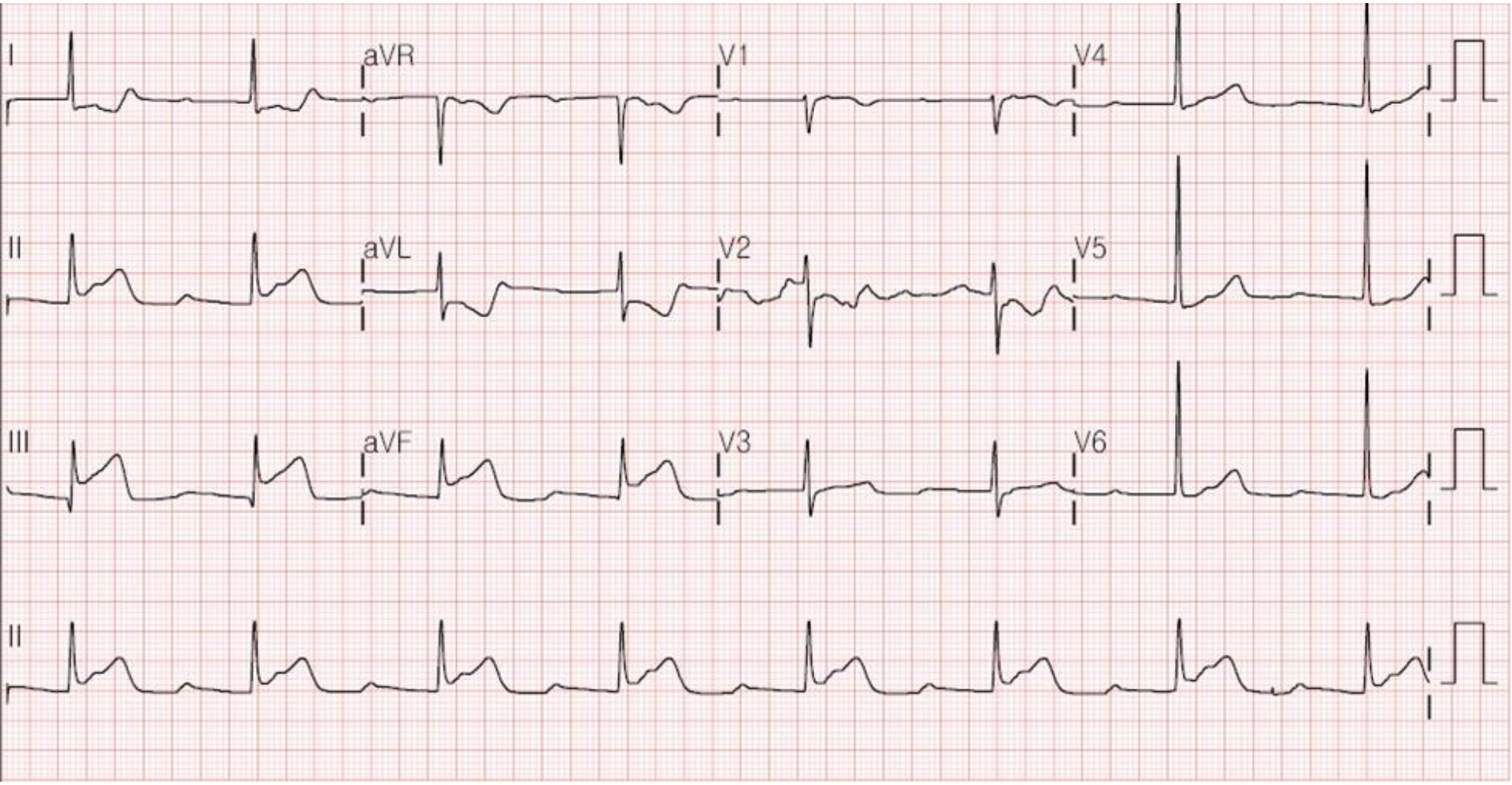
After RFCA @RAS

증례 14



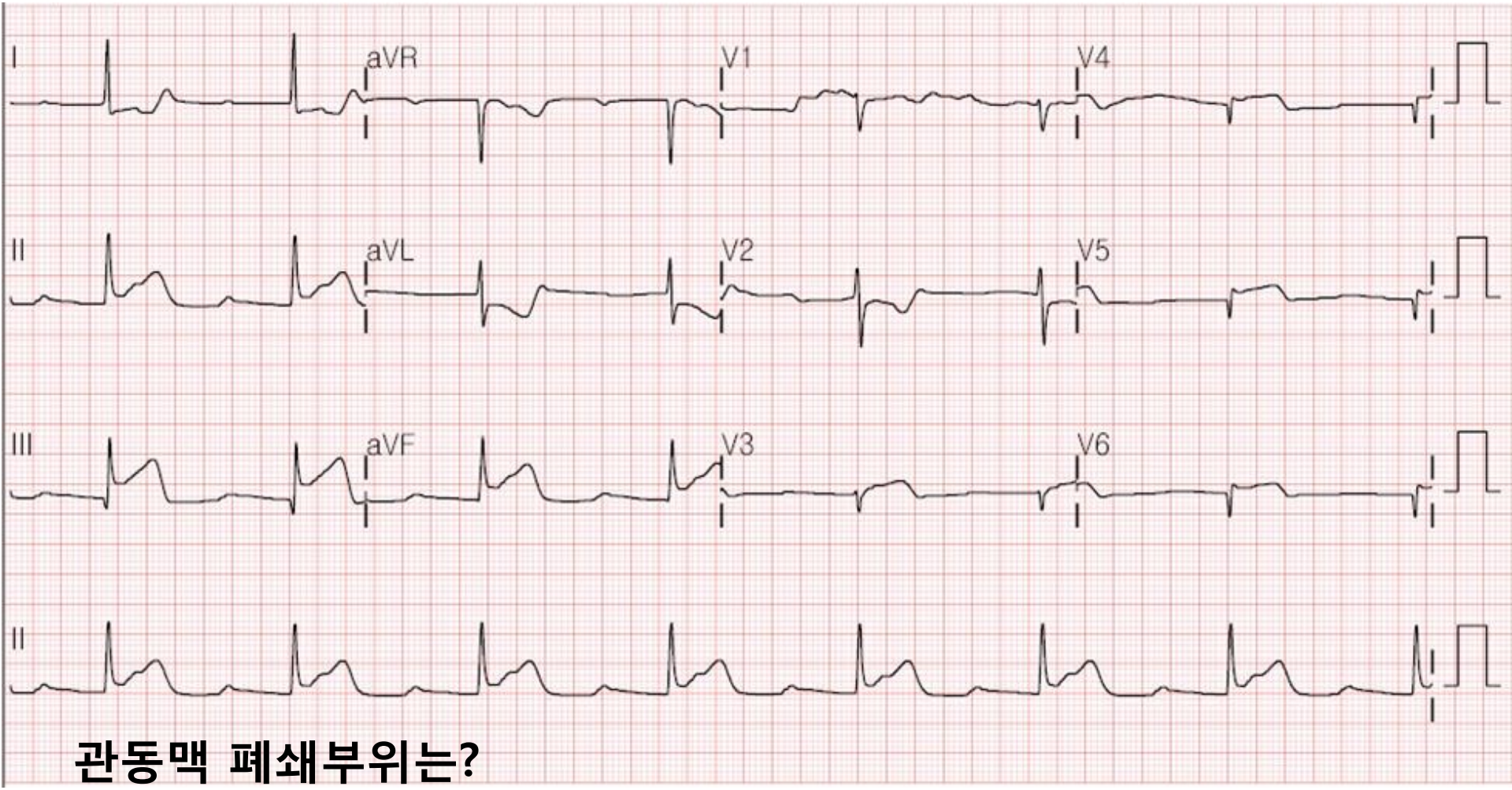
증례 15-1

F/63, Chest pain



증례 15-1

F/63, Chest pain, reverse

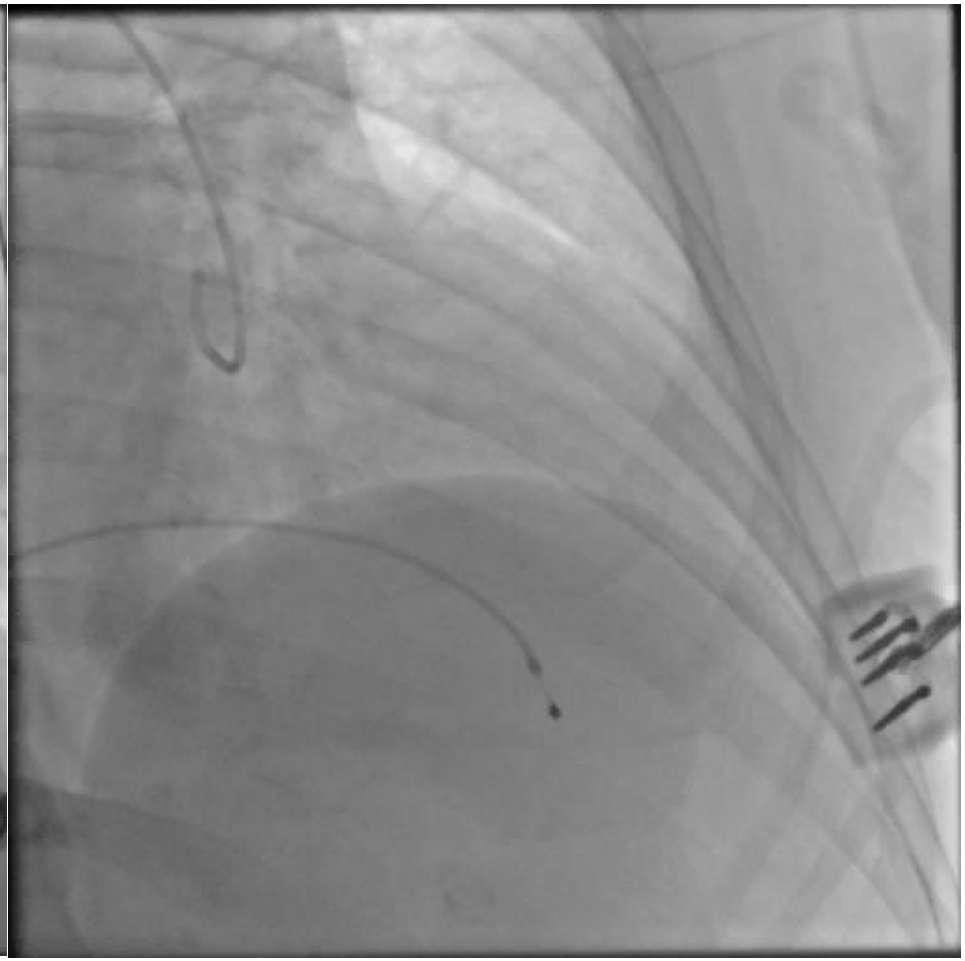


관동맥 폐쇄부위는?

1) RCA 근위부 2) RCA 원위부 3) LCX 근위부 4) LCX 원위부

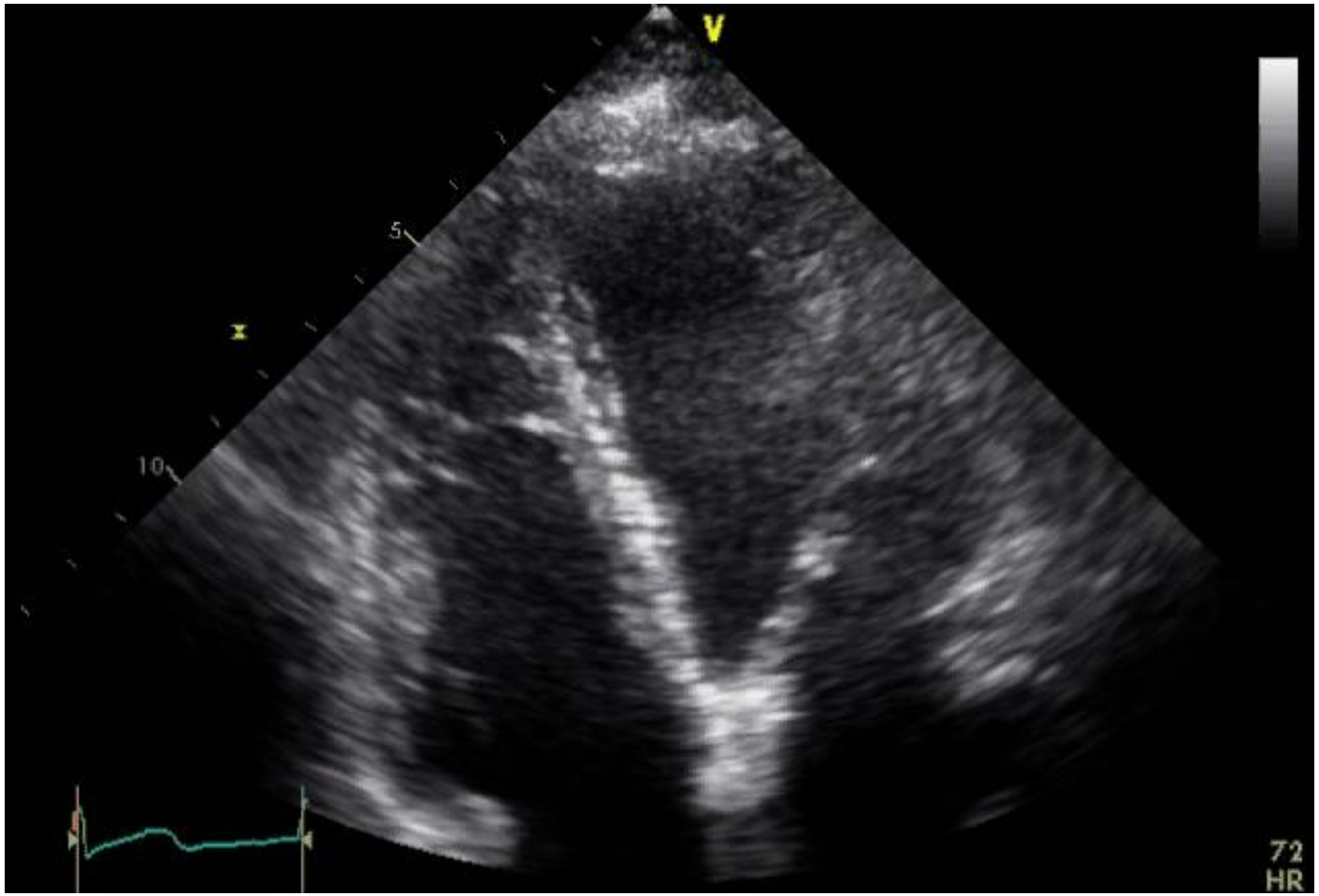
증례 15-1

Coronary angiography (CAG)



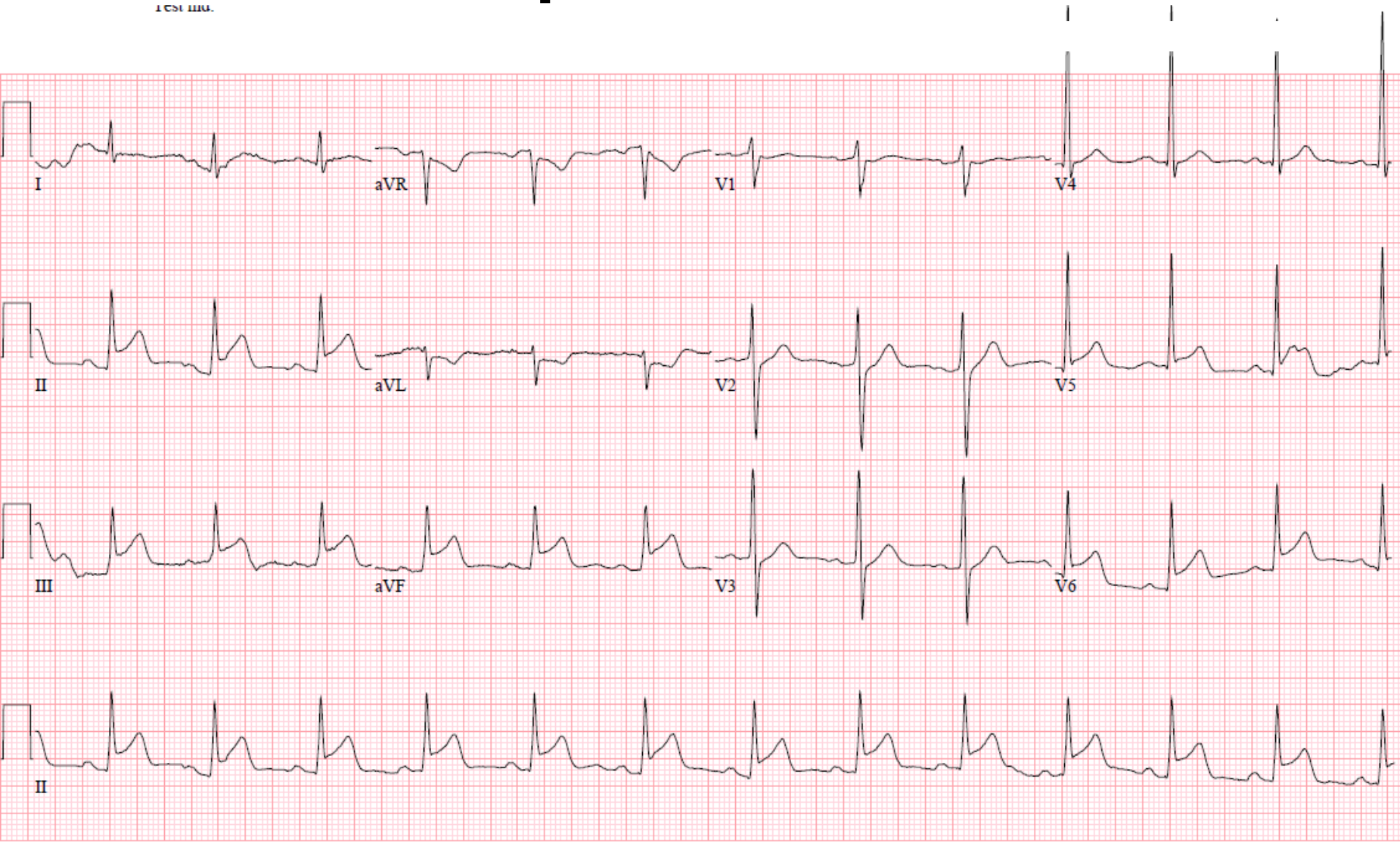
증례 15-1

Echocardiography



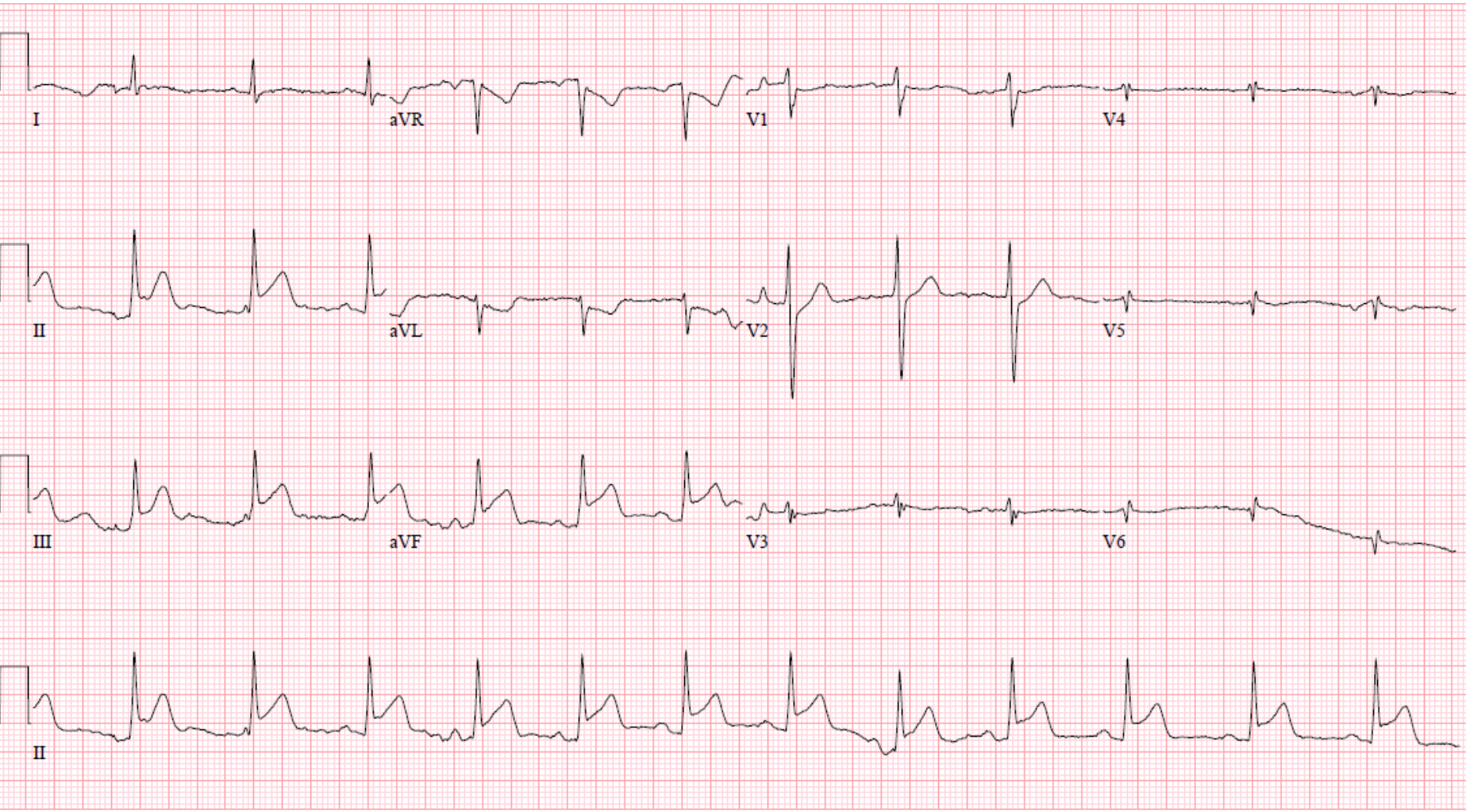
증례 15-2

M/46, Chest pain



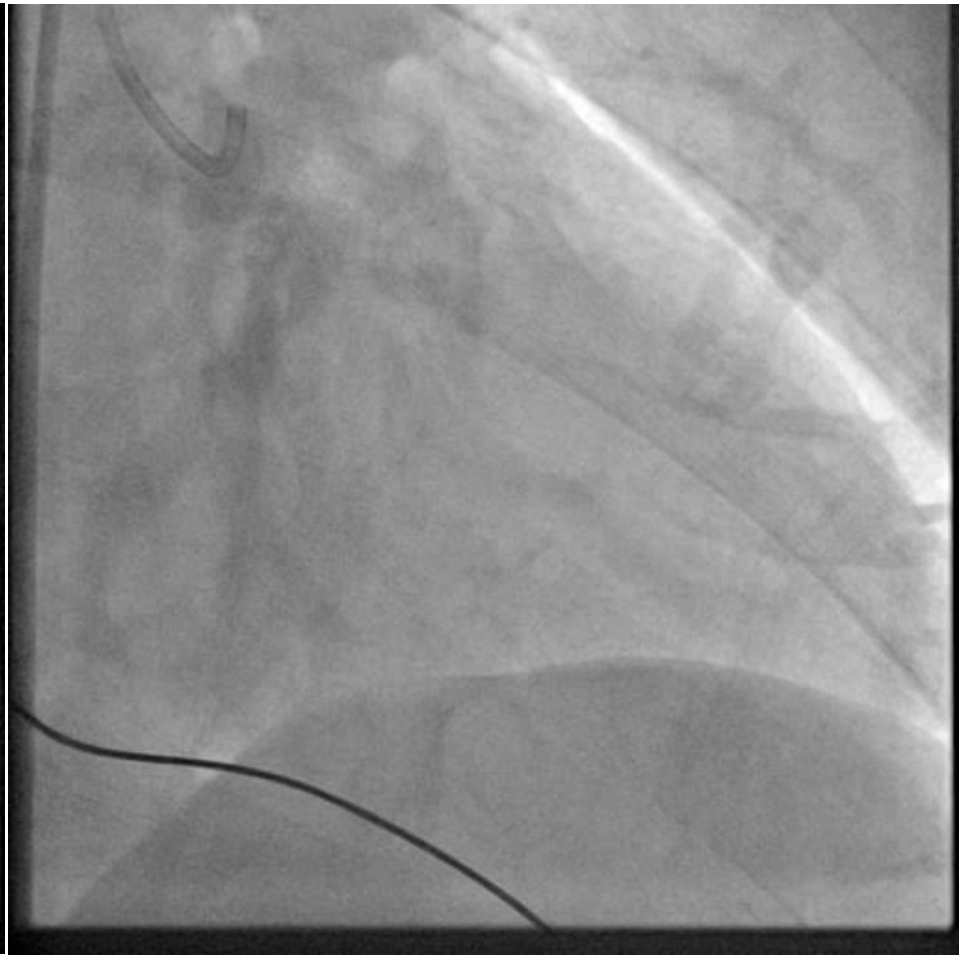
증례 15-2

M/46, Chest pain reverse

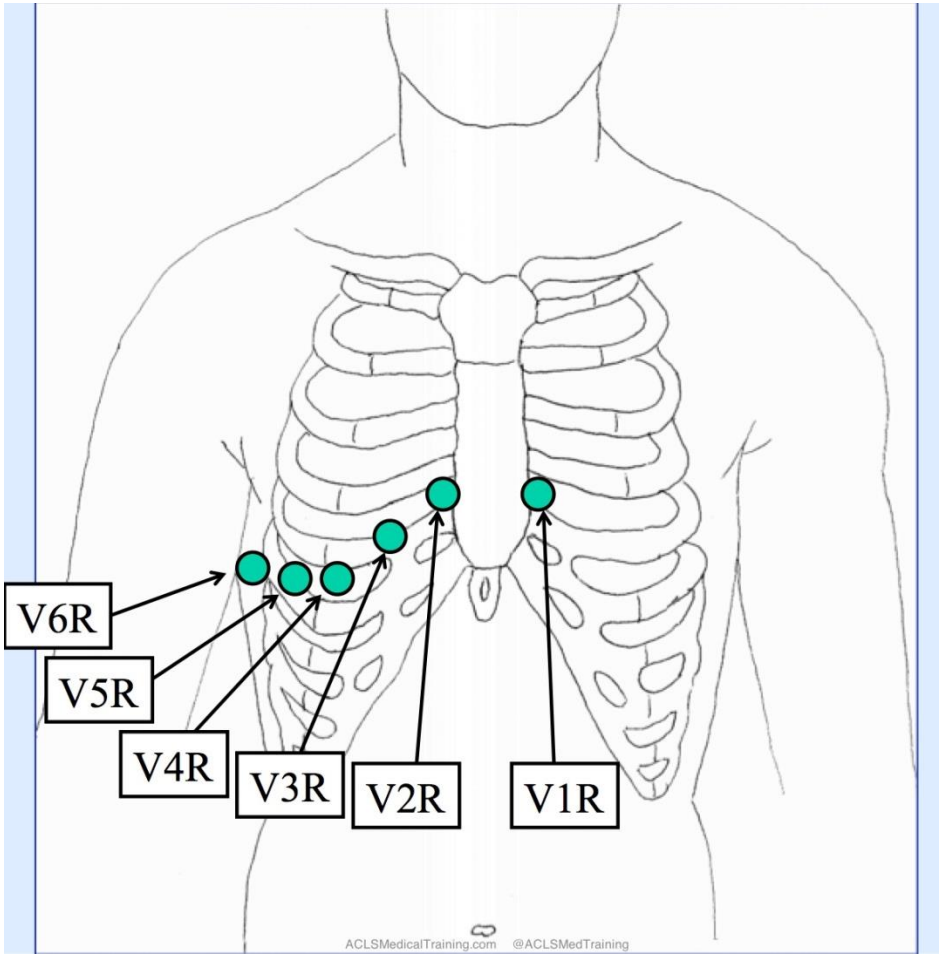


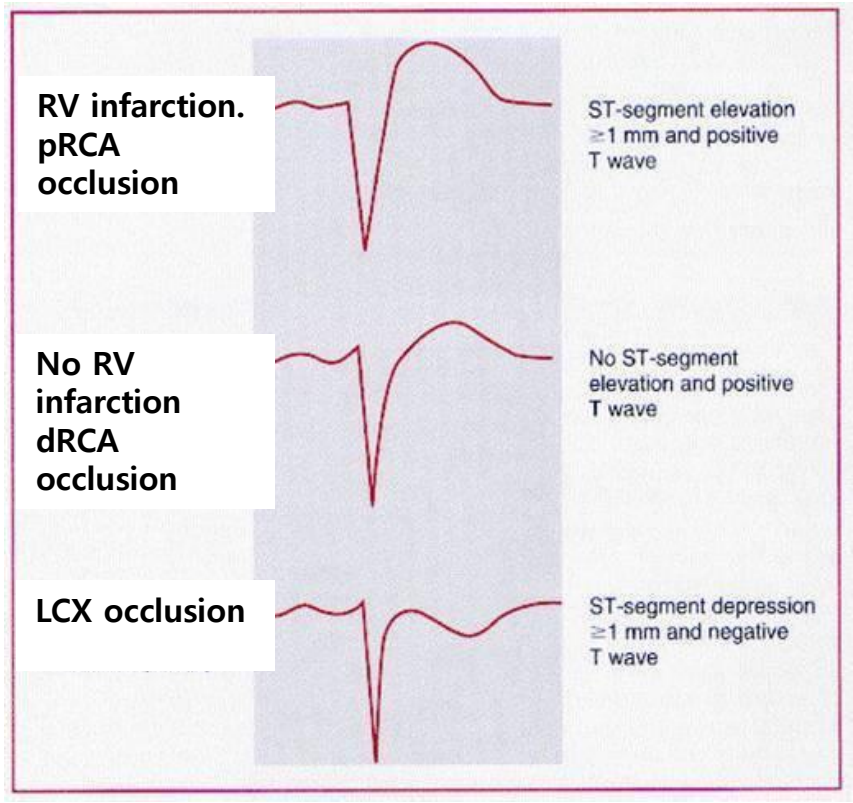
증례 15-2

Coronary angiography (CAG)



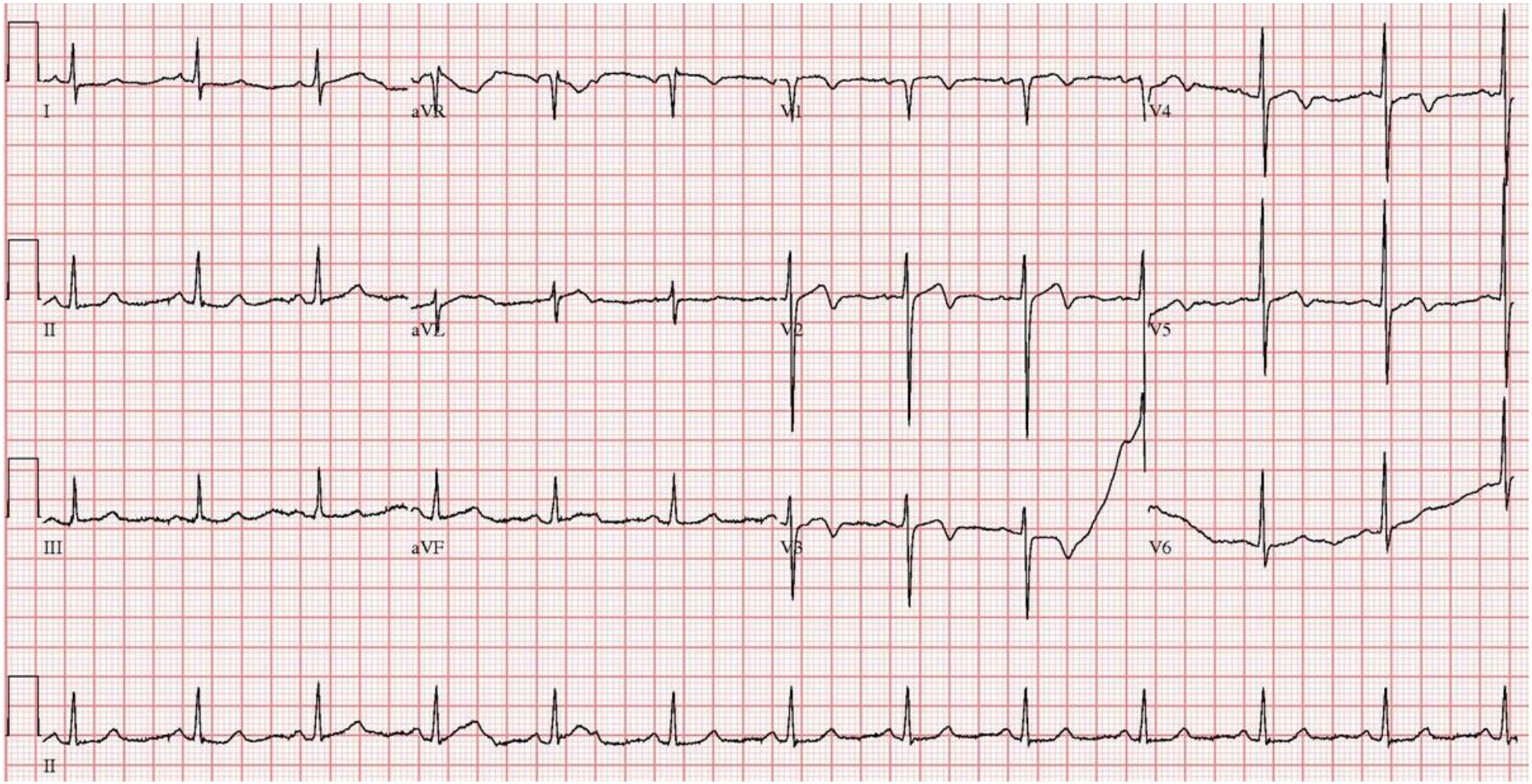
V4R leads


V6R
V5R
V4R
V3R
V2R
V1R
ACLSMedicalTraining.com @ACLSMedTraining


RV infarction. pRCA occlusion
ST-segment elevation ≥1 mm and positive T wave
No RV infarction dRCA occlusion
No ST-segment elevation and positive T wave
LCX occlusion
ST-segment depression ≥1 mm and negative T wave

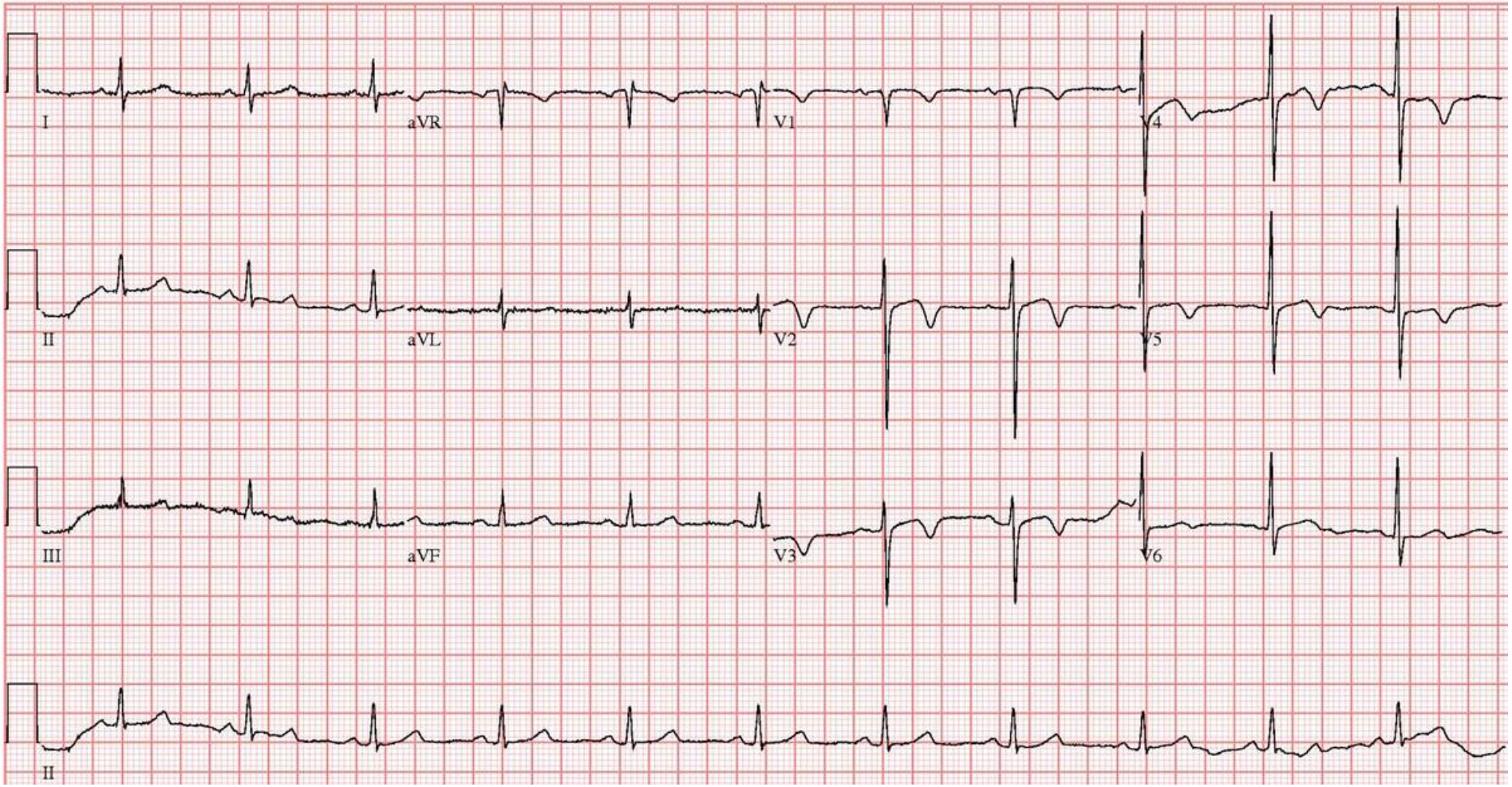
증례 16

55세 여자가 1시간 전부터 가슴이 아파서 응급실에 왔다. 왔을 때 심전도(1).



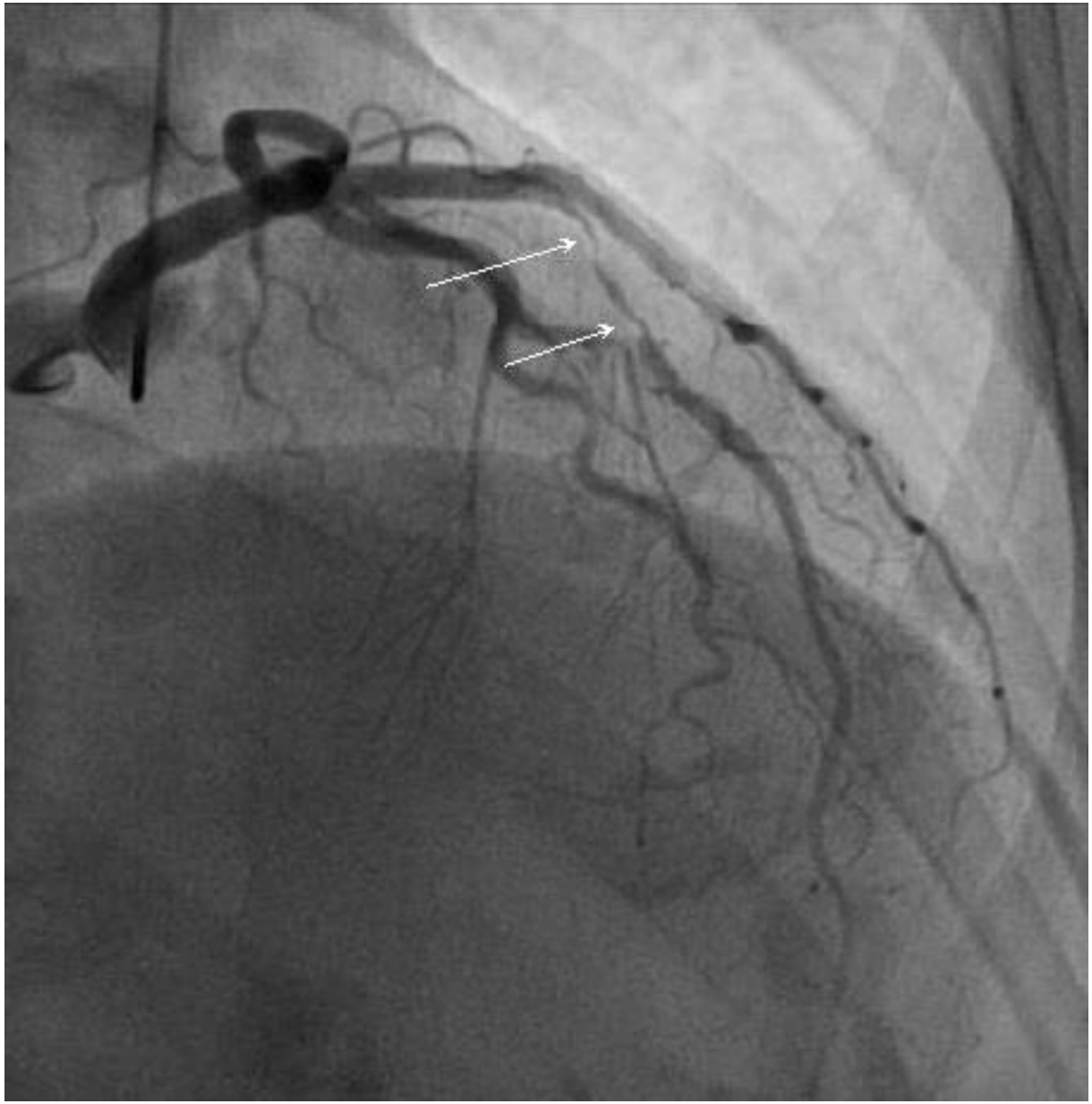
2시간 뒤 심전도(2)이다. 진단 및 치료는?

증례 16



1) 이상 없음, 외래 f/u
2) Proximal LAD 이상, routine CAG
3) Proximal LAD 이상, emergency CAG
4) Distal LAD 이상, routine CAD
5) Left main 이상, emergency CAG

증례 16



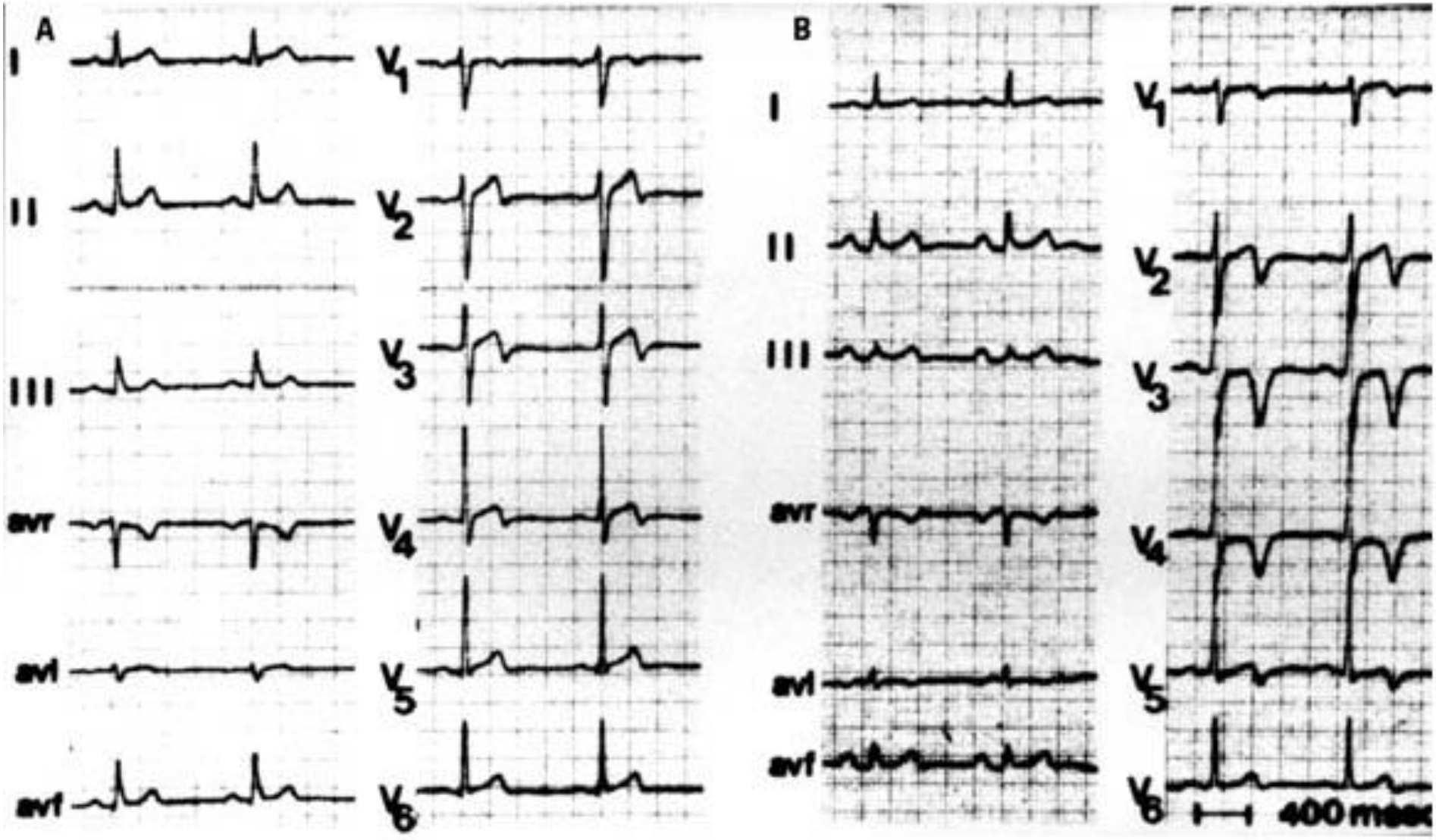
Wellens syndrome

- Represents critical stenosis of the LAD
- Not necessarily STEMI equivalent but will **require PCI in the next 24-48hr**

- 12-Lead ECG findings
  - **Deeply-inverted or biphasic T waves in V2-3**
  - Isoelectric or minimally-elevated ST segment (<1 mm)
  - Absent precordial Q waves with preserved R waves

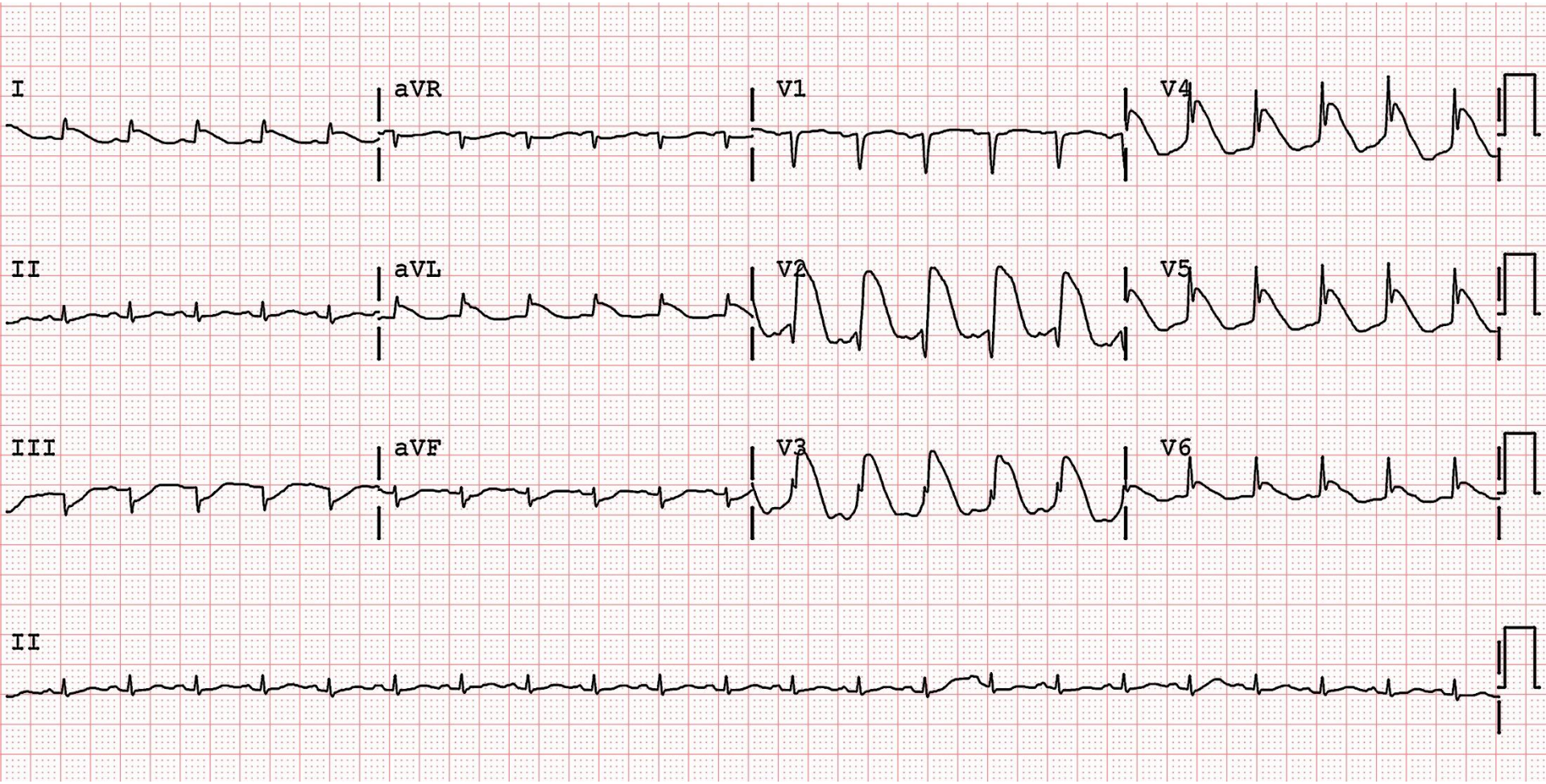
- Two T wave characteristics:
  - Type A: Biphasic pattern - 25% - Biphasic T-waves (initial + deflection and terminal - deflection)
  - Type B: Inversion pattern - 75% - Deeply inverted and symmetric T-waves

Wellens syndrome



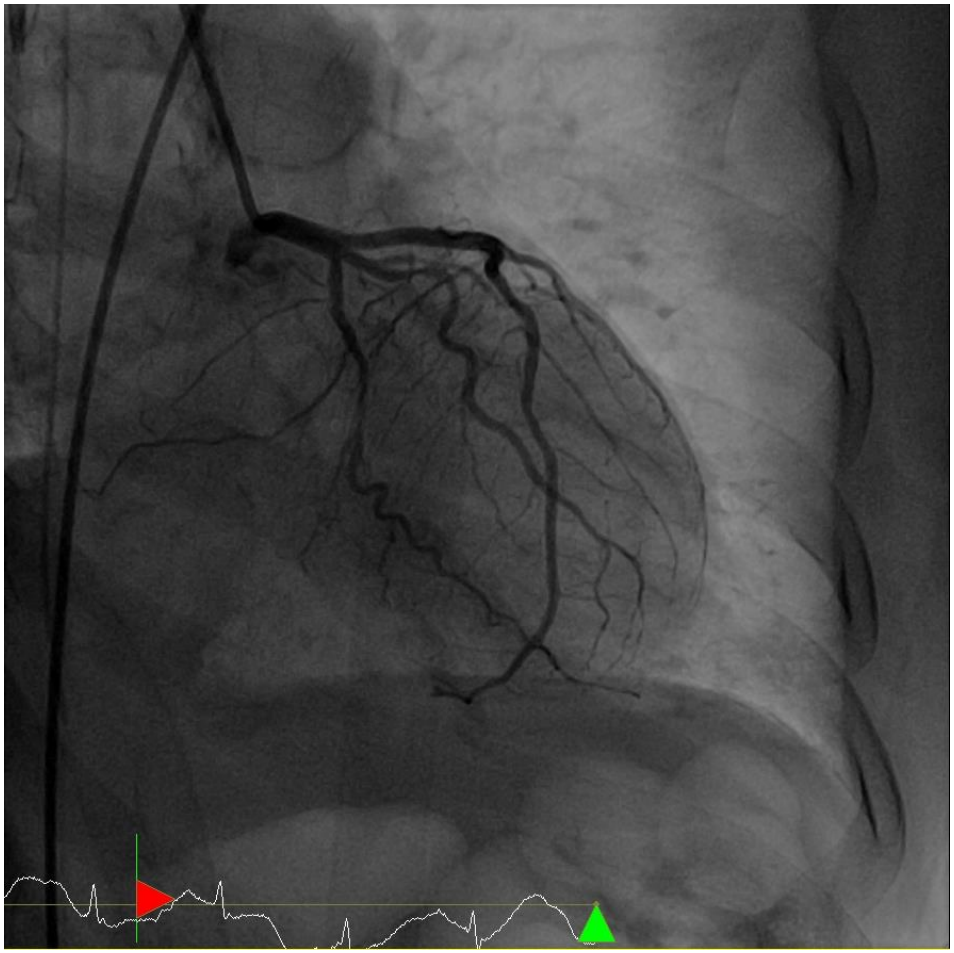
74세/여자, 의식저하

증례 17

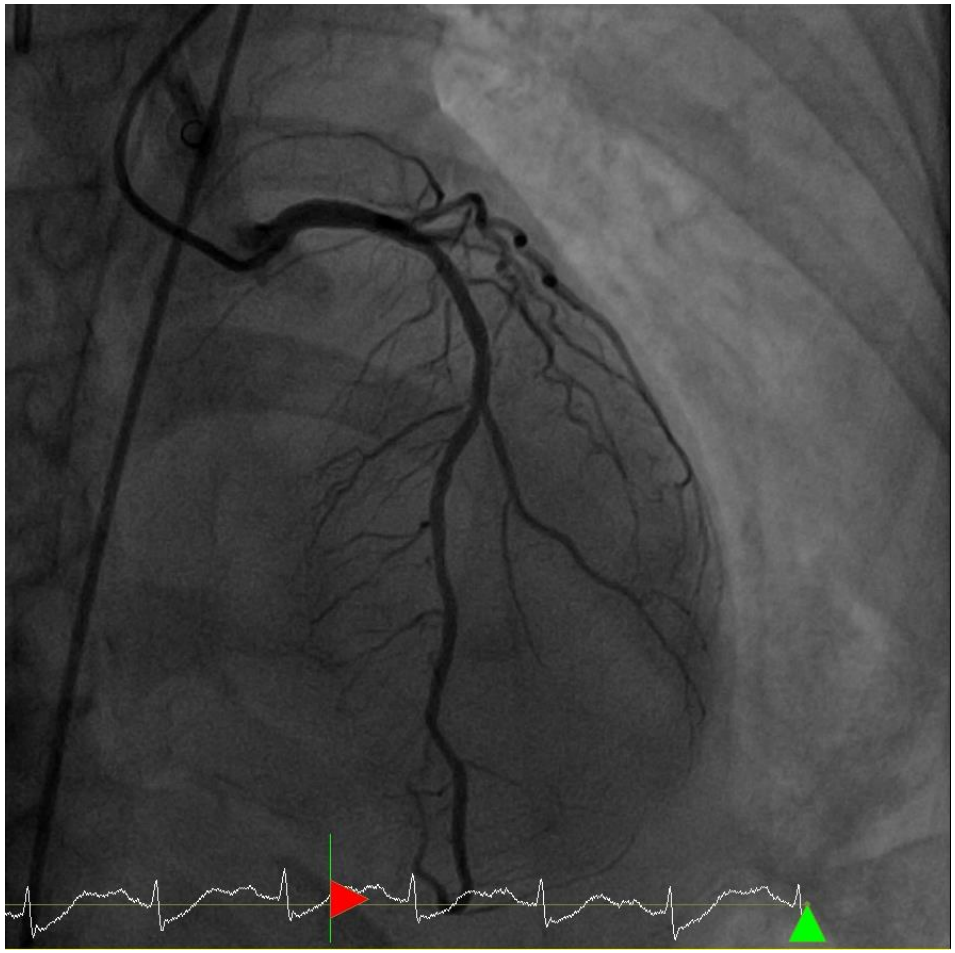


관상동맥 조영검사

증례 17

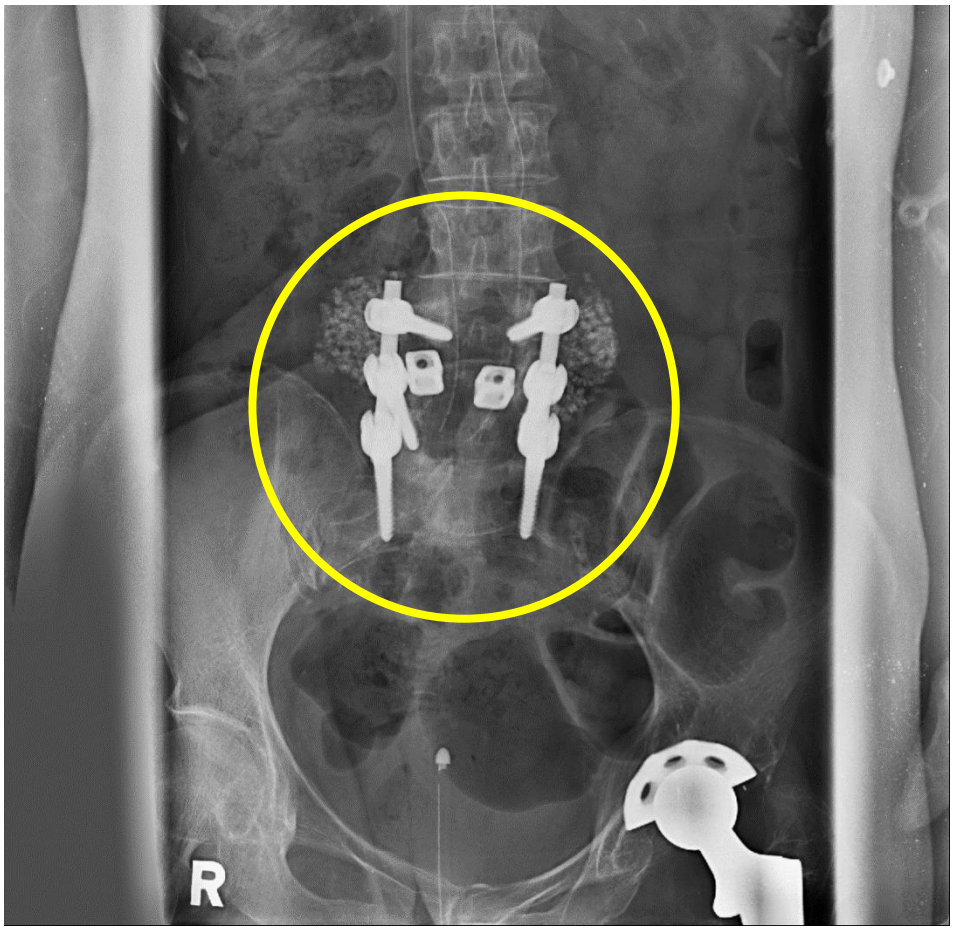


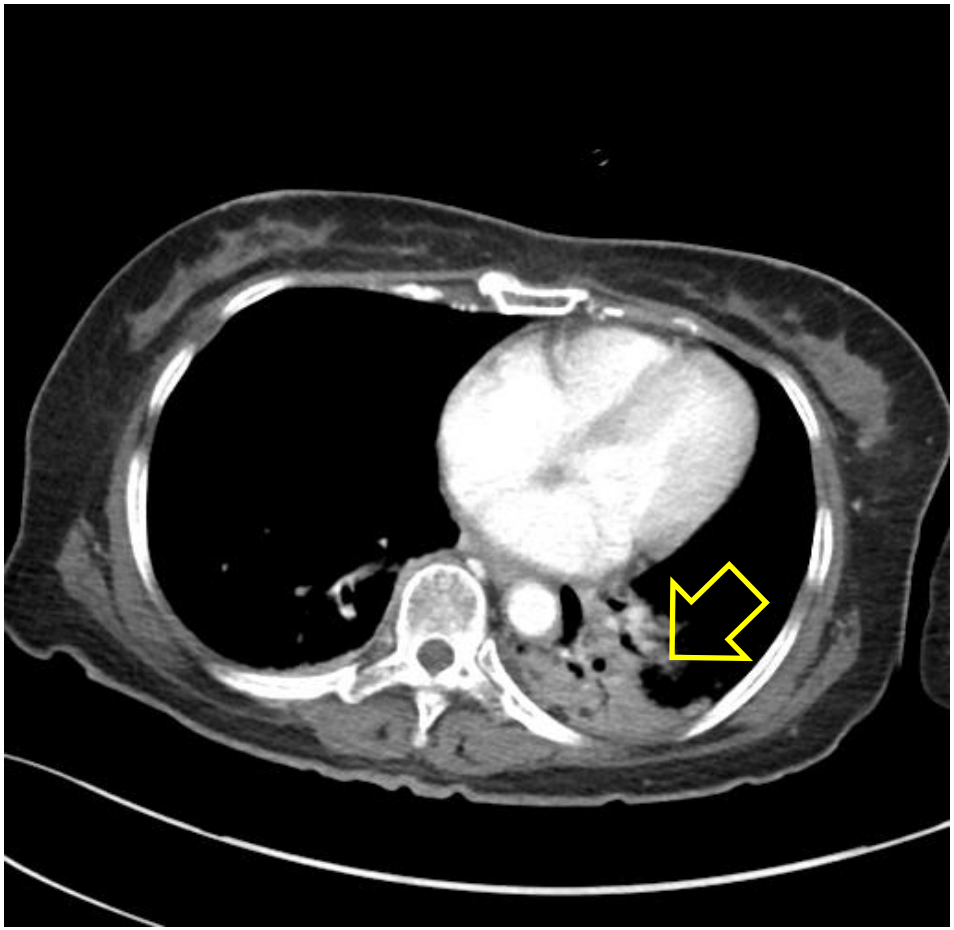
RAO 20°, Caudal 20°



Crania 40°

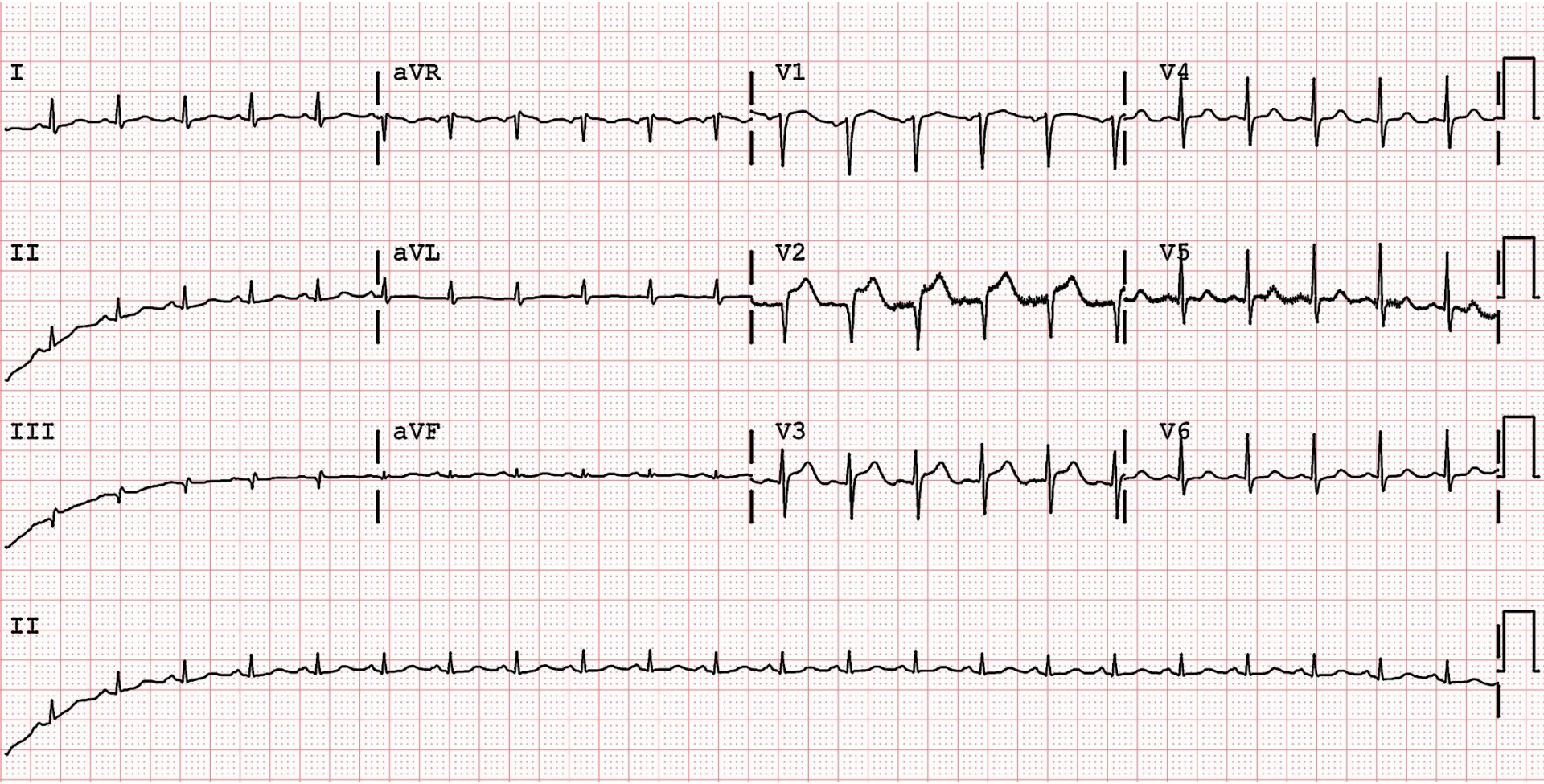
허리수술 후 7일째, 폐렴/패혈증



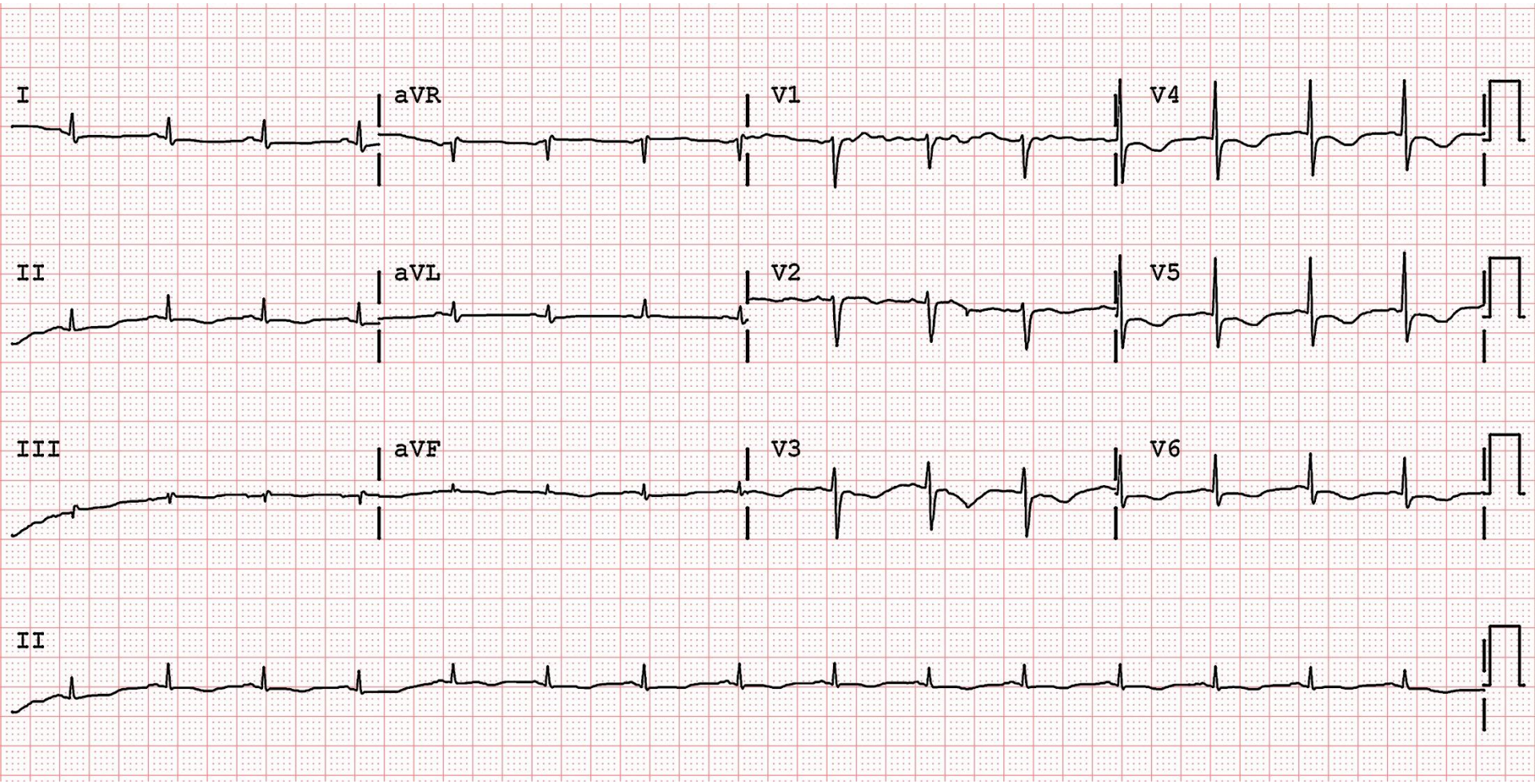


스트레스 유발성 심근병증

다음 날 추적 심전도

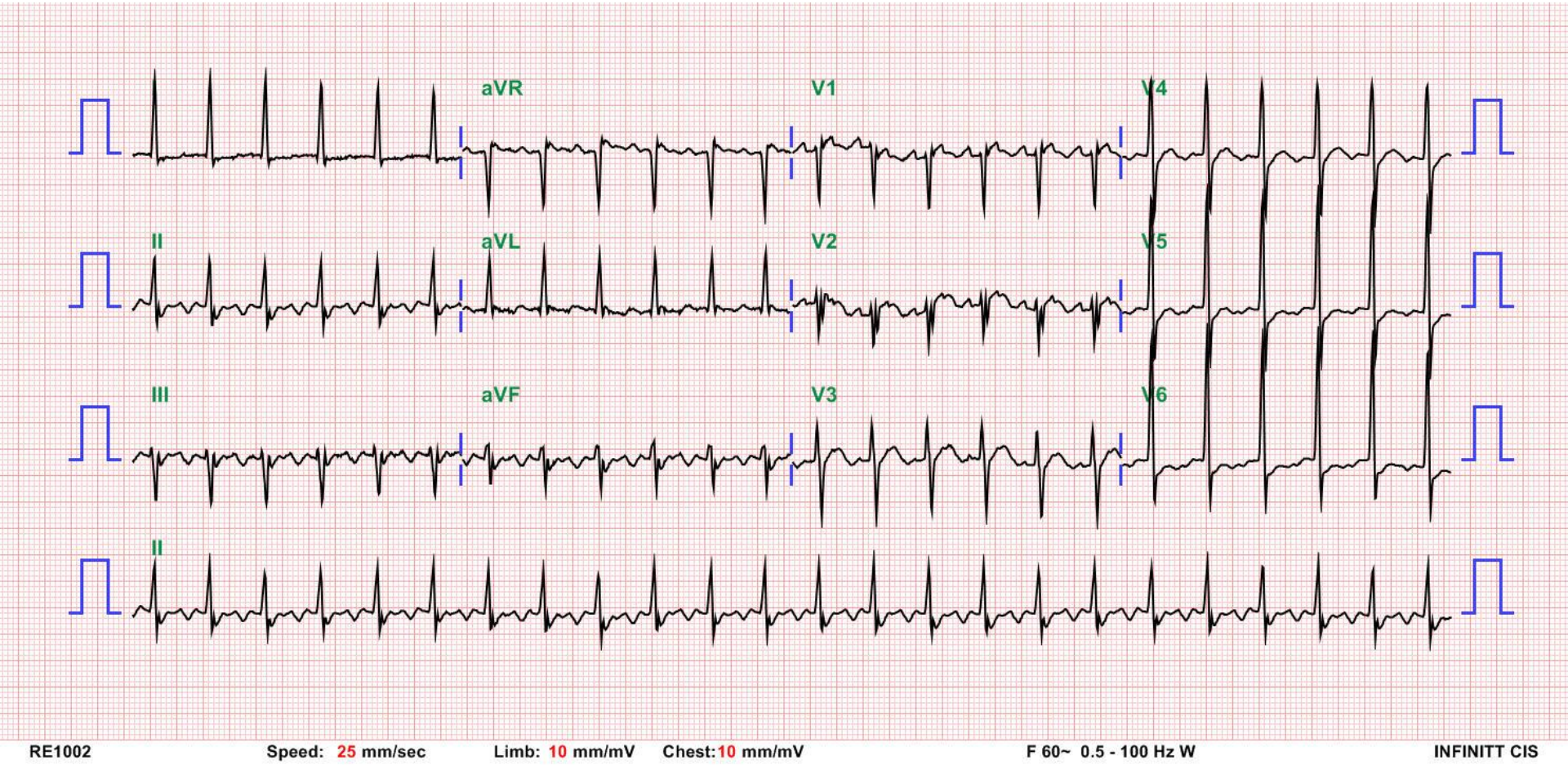


3일 후 추적 심전도



A 57-year-old lady with palpitation

증례 18



Next step ?

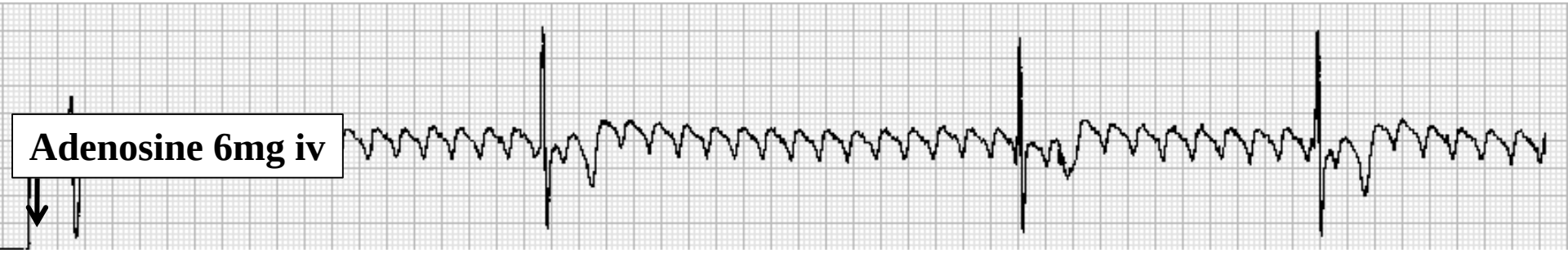
① Anxiolytics

② Adenosine IV

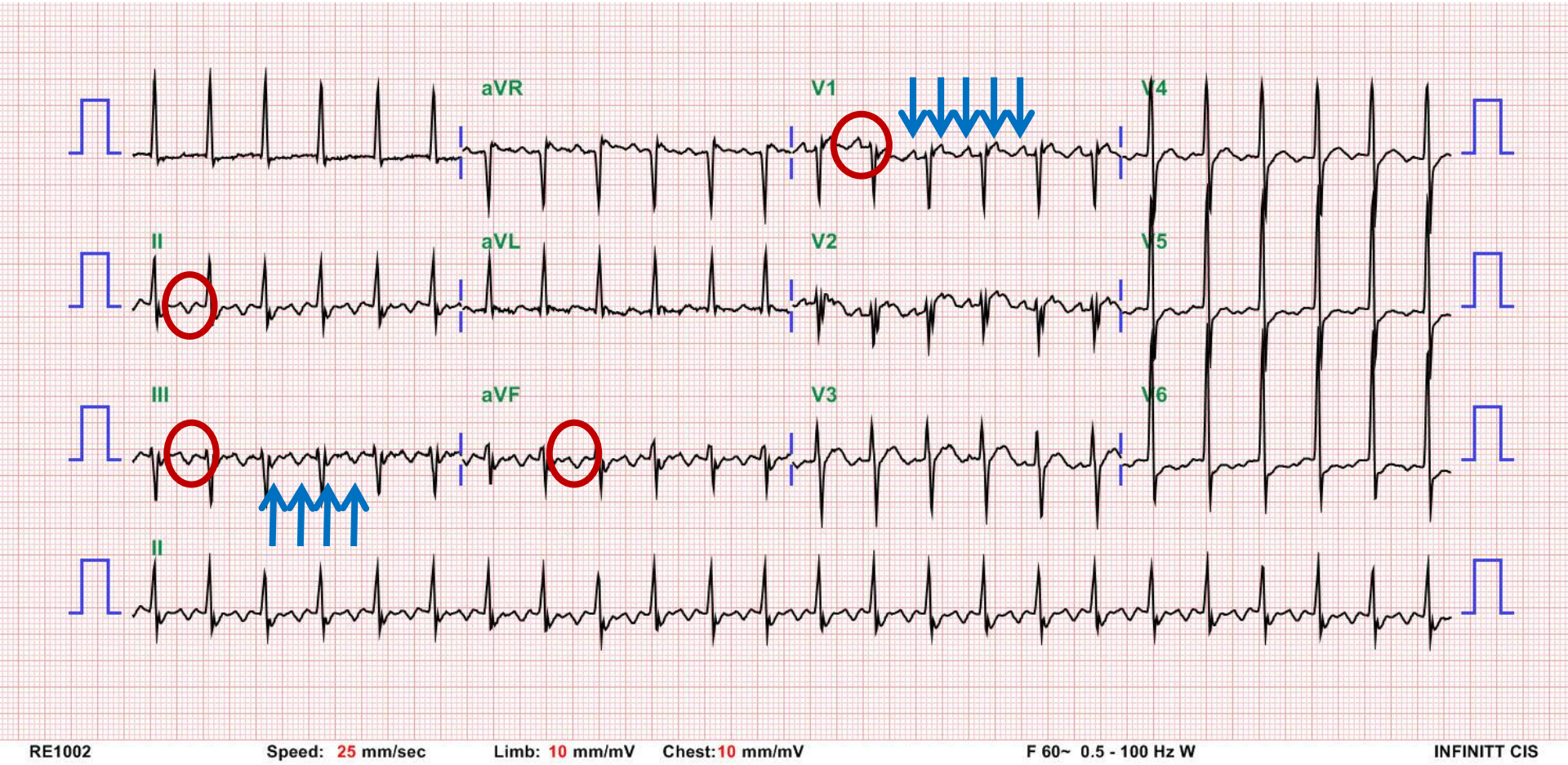
③ DC cardioversion

④ Short term OPD F/U

A 57-year-old lady with palpitations
During iv injection of adenosine



A 57-year-old lady with palpitations (2)

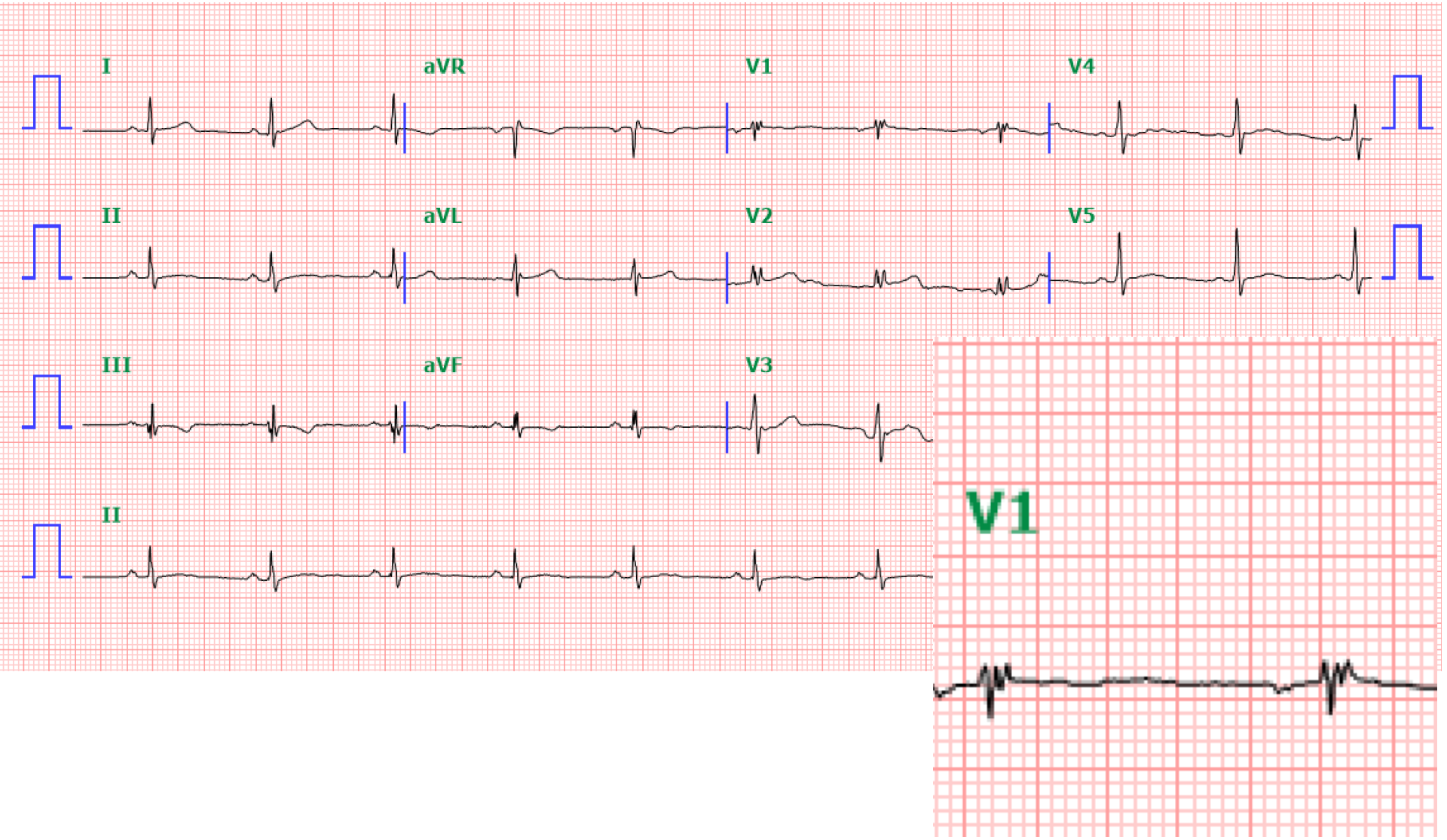


증례 19

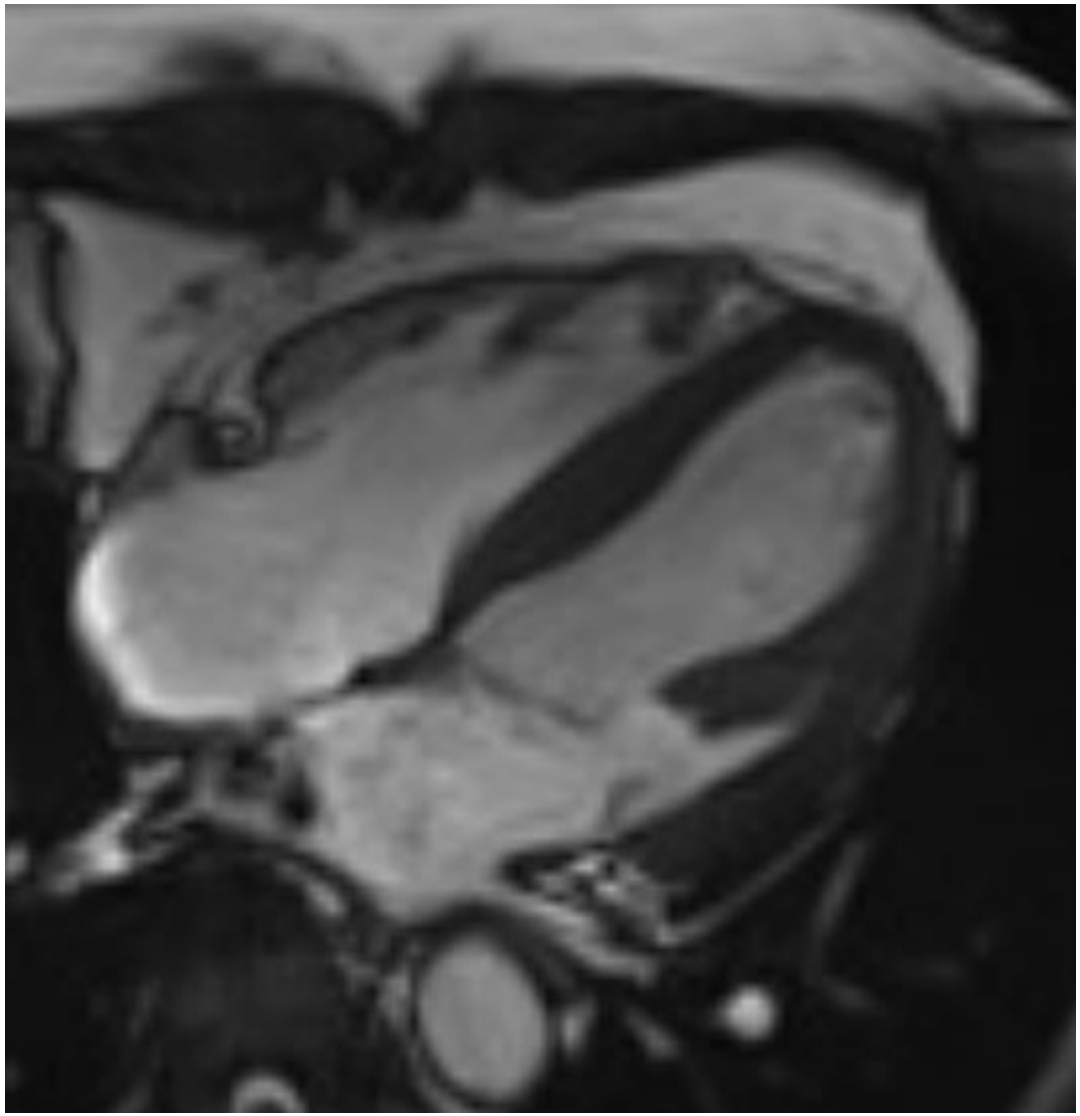
M/49 Aborted SCD due to VF

증례 19

활력징후 회복 후 심전도



Cardiac MRI

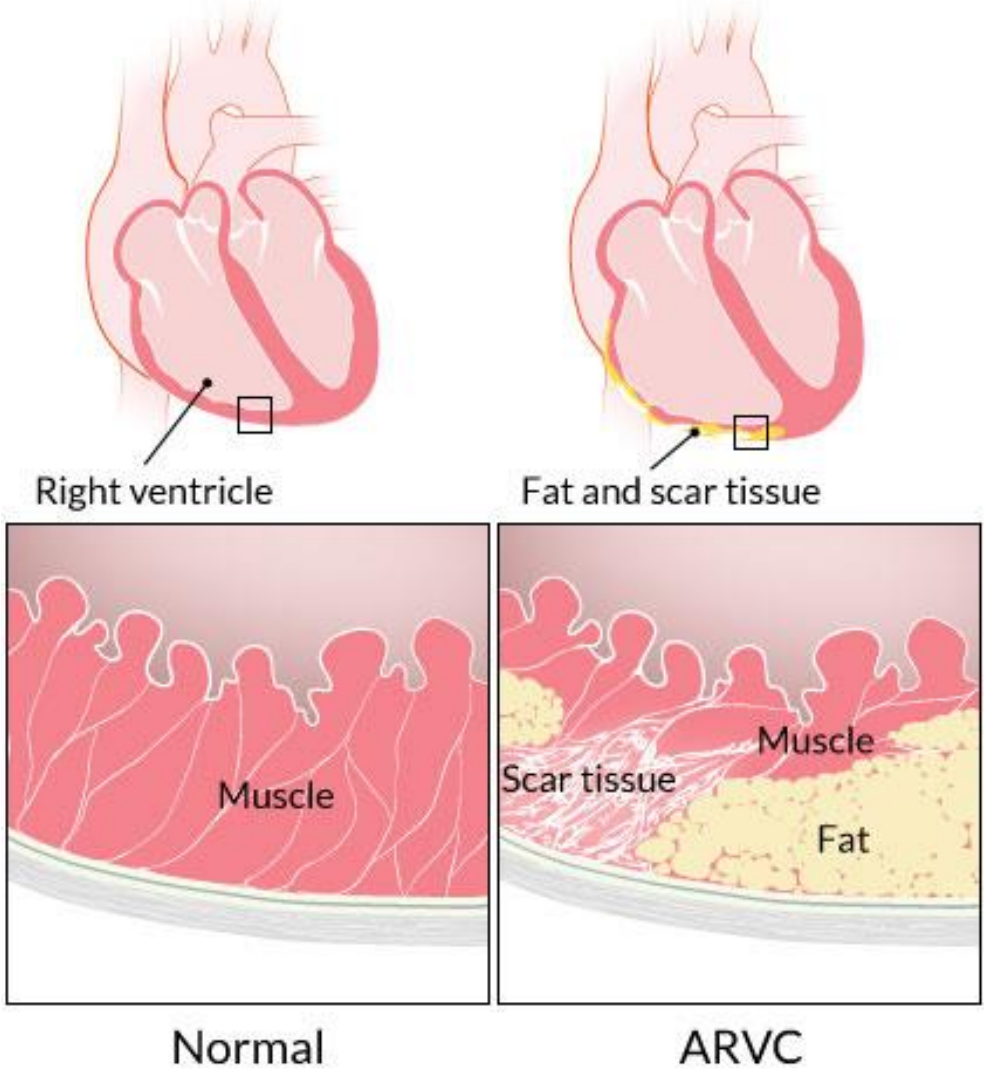


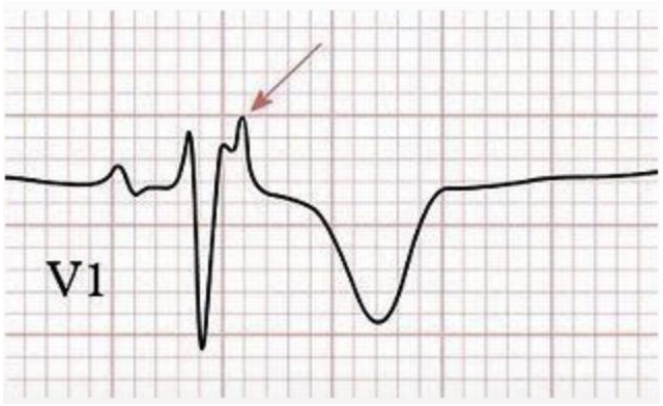
Reading: RV myocardium이 extensive transmural fatty replacement가 되어 있음

문제) 가장 가능성 있는 진단은?

1) **Brugada syndrome**
2) **Long QT syndrome**
3) **Arrhythmogenic RV dysplasia**
4) **Hypertrophic cardiomyopathy**

ARVD (Arrhythmogenic RV dysplasia)





Epsilon wave in V1

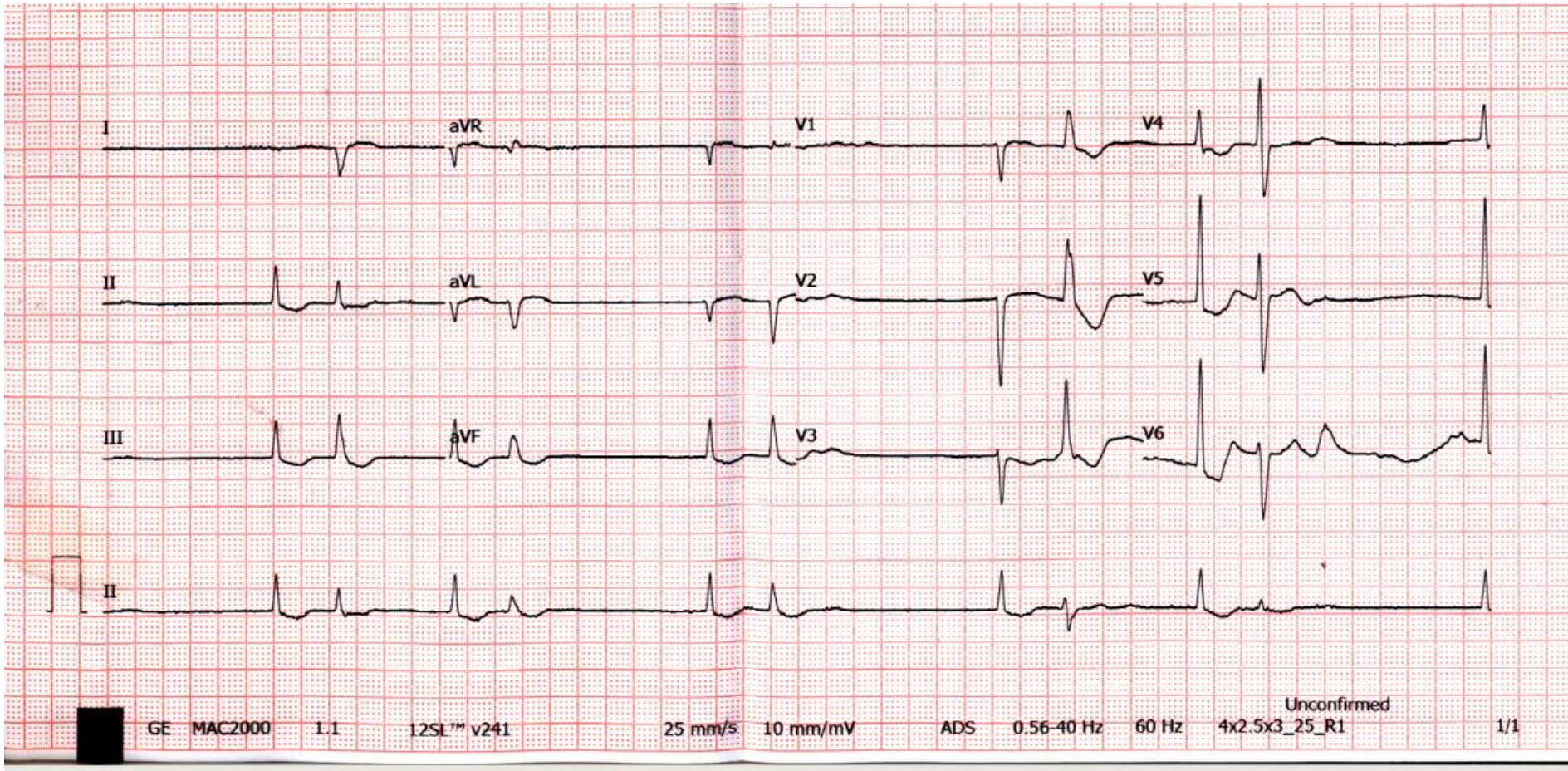
증례 20

여/71 nausea, visit ER

- 심부전으로 약물 치료
- 최근에 digoxin 0.25mg를 추가함.

Digoxin level 4.0ng/ml

증례 20



Digoxin toxicity

- GI; nausea, vomiting, anorexia, diarrhea
- Visual; blurred vision, yellow/green discolouration
- Chest; palpitation, syncope, dyspnea
- CNS; confusion, dizziness, delirium, fatigue

ECG finding

- Frequent PVCs, SVT
- Sinus bradycardia, slow AF
- AV block, prolonged PR interval
- Downsloping ST depression, J point depression
- Flattened, inverted, biphasic T wave (U wave)
- Shortened QT interval