Case trouble shooting for CRM

단국대병원

CEPS, 강 나윤

Case 1

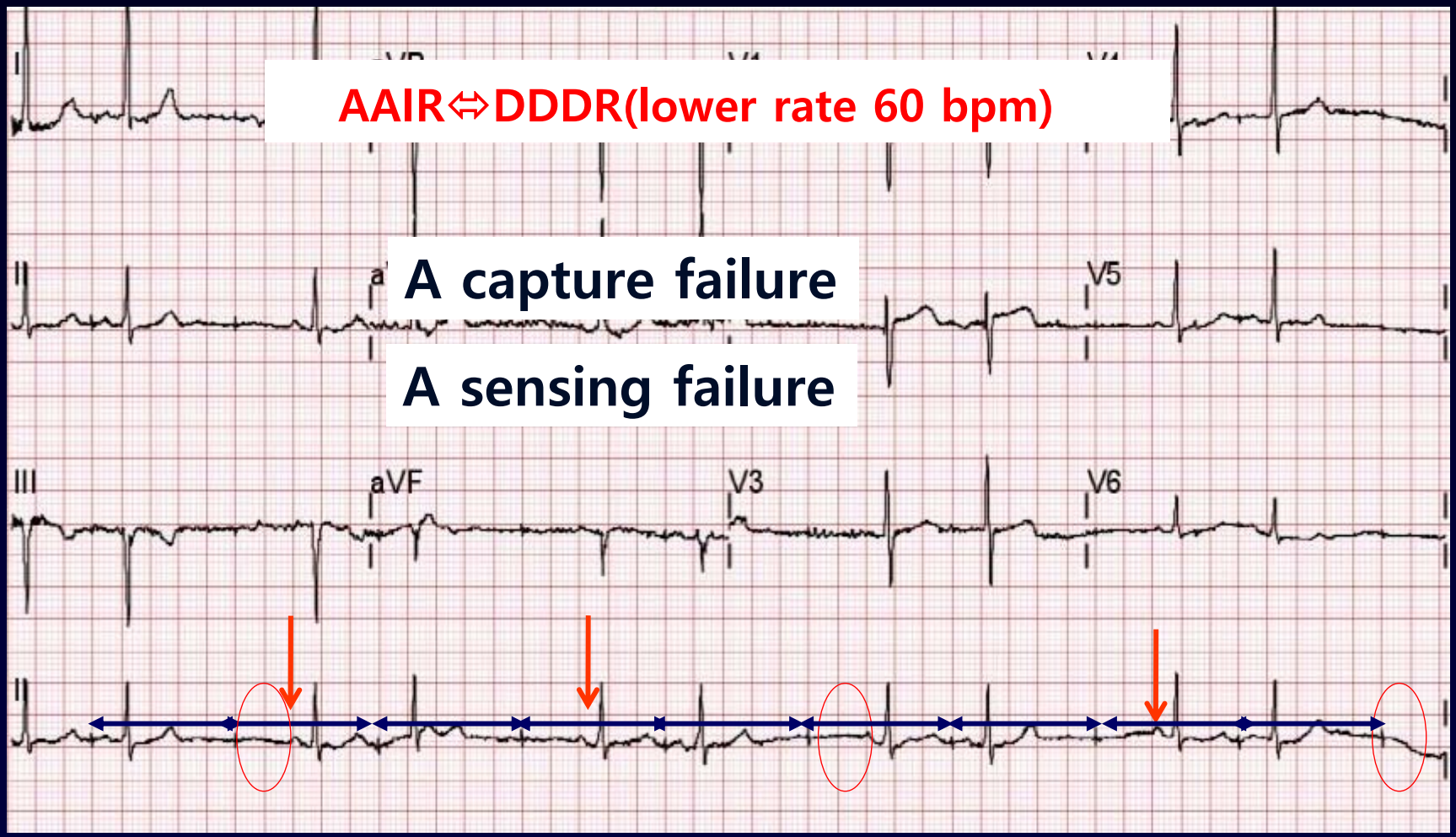
F / 86

1-May-2017 Pacemaker insertion d/t Sick sinus syndrome

18-Jan-2021 palpitation, ECG abnormality

일 자	구분	내 용	작성자	서 명
2021-01-18	특수환자해당없음			
	CC	Palpitation		
	PI	86세 여환 2017.5 SSS으로 본원에서 Pacemaker insertion 시행 받은 분. 이후 1년마다 pacemaker 검사 받아야 되나 작년 코로나로 병원 내원 어려워 검사 받지 못함. 파킨슨병, 치매로 현재 요양병원에서 지내며 휠체어 거동까지만 가능, 경구식이로 죽 드셨다고 함. 내원 당일 tachycardia, palpitation으로 응급실 내원. junctional tachycardia, adenosine 1A 투여 후 HR 100미만으로 감소 했으나 다시 HR 140회, junctional tachycardia 보여 verapamil 1A IV 투약 후 rate control 및 ECHO, pacemaker 검사 등 시행위해 입원함.		

Current ECG(Jan-2021)



Sensing & Impedance test

Battery and Lead Measurements Report Page 1

Last Interrogation: 18-Jan-2021 15:27:55

Battery Voltage

(RRT=2.83V)
18-Jan-2021
Voltage 3.01 V

Remaining Longevity

Estimated at: 6 years
Minimum: 4.5 years
Maximum: 7.5 years
(based on initial interrogation)

Sensing Integrity Counter

(if >300 counts, check for sensing issues)
Since 20-Mar-2019
Short V-V Intervals 0

Atrial Lead Position Check

No measurement since reset

Battery and Lead Measurements Report

Lead Impedance

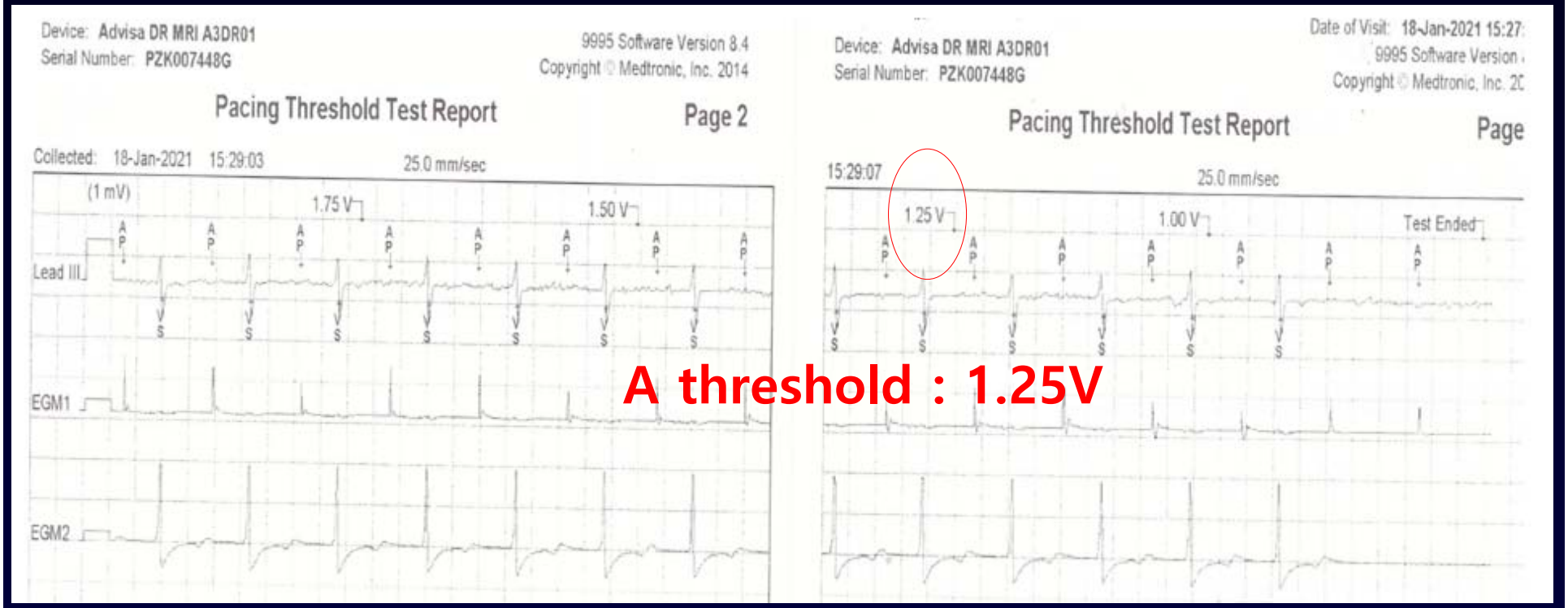
A. Pacing	(Bipolar)	475 ohms	18-Jan-2021
RV Pacing	(Bipolar)	684 ohms	18-Jan-2021

Sensing

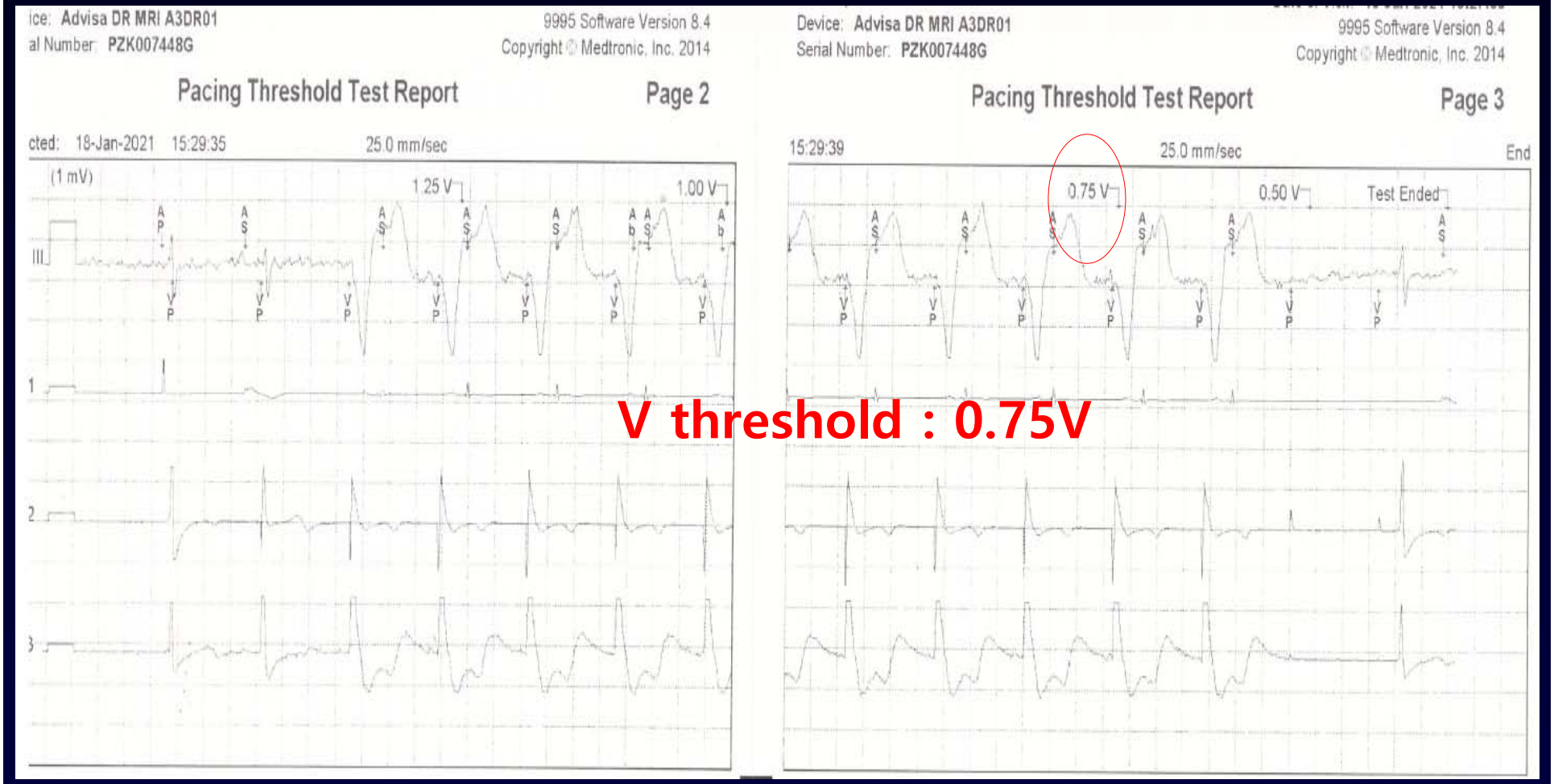
P-Wave Amplitude	3.9 mV	18-Jan-2021
R-Wave Amplitude	>20 mV	18-Jan-2021

Sensing A: 3.9mV V: >20mV
Impedance A: 475ohms V: 684ohms

A Threshold test



V Threshold test



등록번호 :	
성 명 :	
성별/나이:	F/86
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

시술일(Implant date): 05/01/2017 Current F/U date: 01/18/2021 Last F/U date:

1. Device Information

	Model	S/N
Generator	Medtronic Advisa DR MRI A3DR01	PZK007448G
A-Lead	Medtronic 5076 CapsureFix No...	PJN622519G
V-Lead	Medtronic 5076 CapsureFix No...	PJN704636G

2. Battery status

Battery Voltage	3.01	V	Current Impedance	Ω
Remaining Longevity	6	year		

3. Lead property

	Sensing		Threshold	Impedance	
A-Lead	3.9	mV	1.250 V at 0.40 ms	475	Ω
V-Lead	>20	mV	0.750 V at 0.40 ms	684	Ω

4. Setting value

Mode	AAIR<=>DDDR		Lower Rate	60	bpm
Mode swich	171	bpm	Upper Track Rate	130	bpm
AV delay(Paced/Sensed)	180 ms / 150 ms		Upper Sensor Rate	130	bpm
A-Sensitivity	0.30 → 4.00	mV	A Amplitude(Output)	2.25 → 3.00	V
V-Sensitivity	2.80	mV	V Amplitude(Output)	2.00	V

A sensitivity 0.3mV =>4.0mV

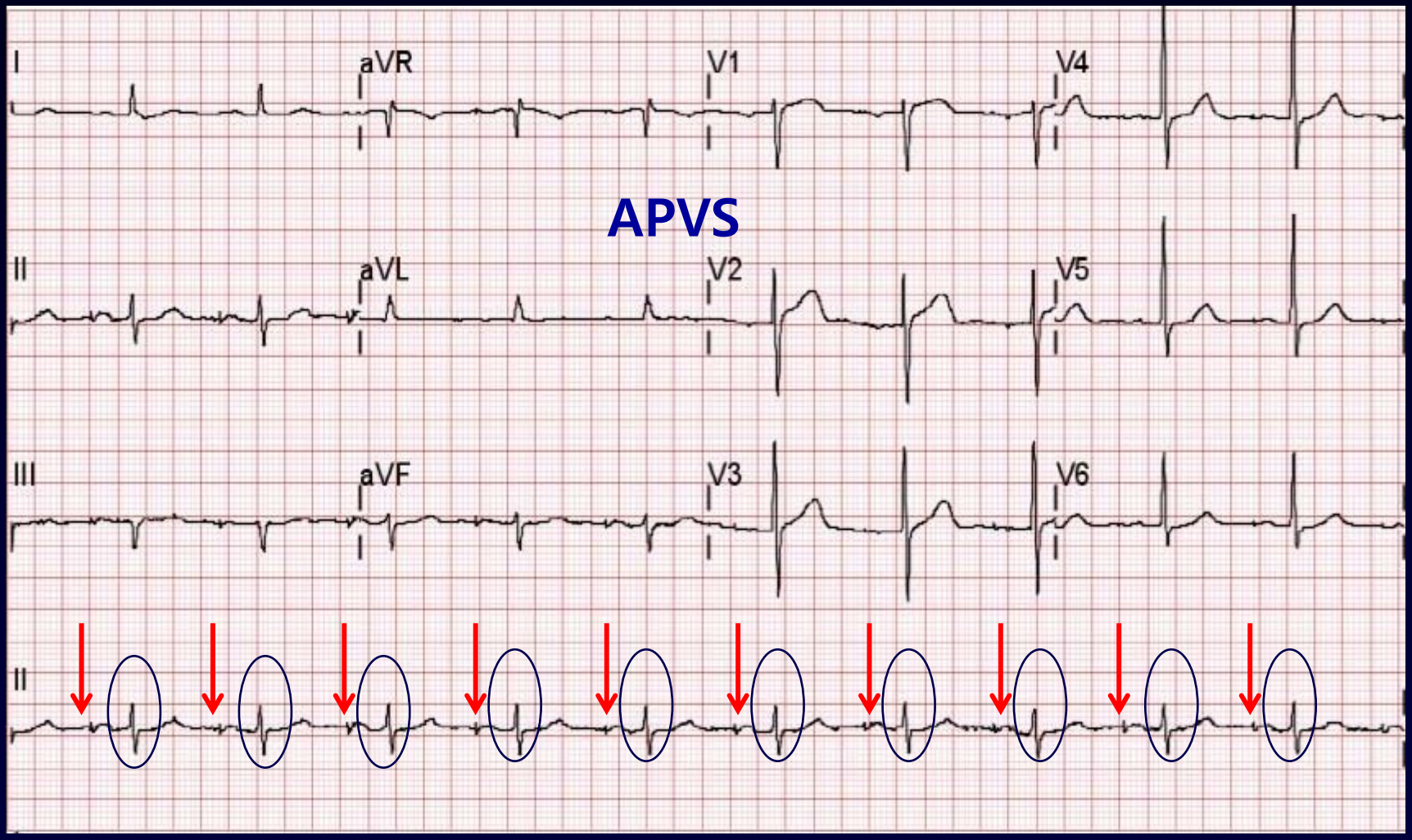
5. Episode

AS-VS	0.9	%	AS-VP	<0.1	%
AP-AS	98.7	%	AP-VP	0.3	%
AP		%	VP		%
Total VP		%	AHR episode	Fast A&V 38건	
Time in AT/AF	<0.1 hr / day(<0.1%)		VT (>4 beatS)	0	

A pacing 98.7%

6. Comment:
A sensing failure로 인해 A sensitivity 0.30mV→4.00mV, A output 2.25V→3.00V로 변경함.
Regular Pacemaker follow up.

AAIR⇔DDDR(lower rate 60 bpm)



Case 2

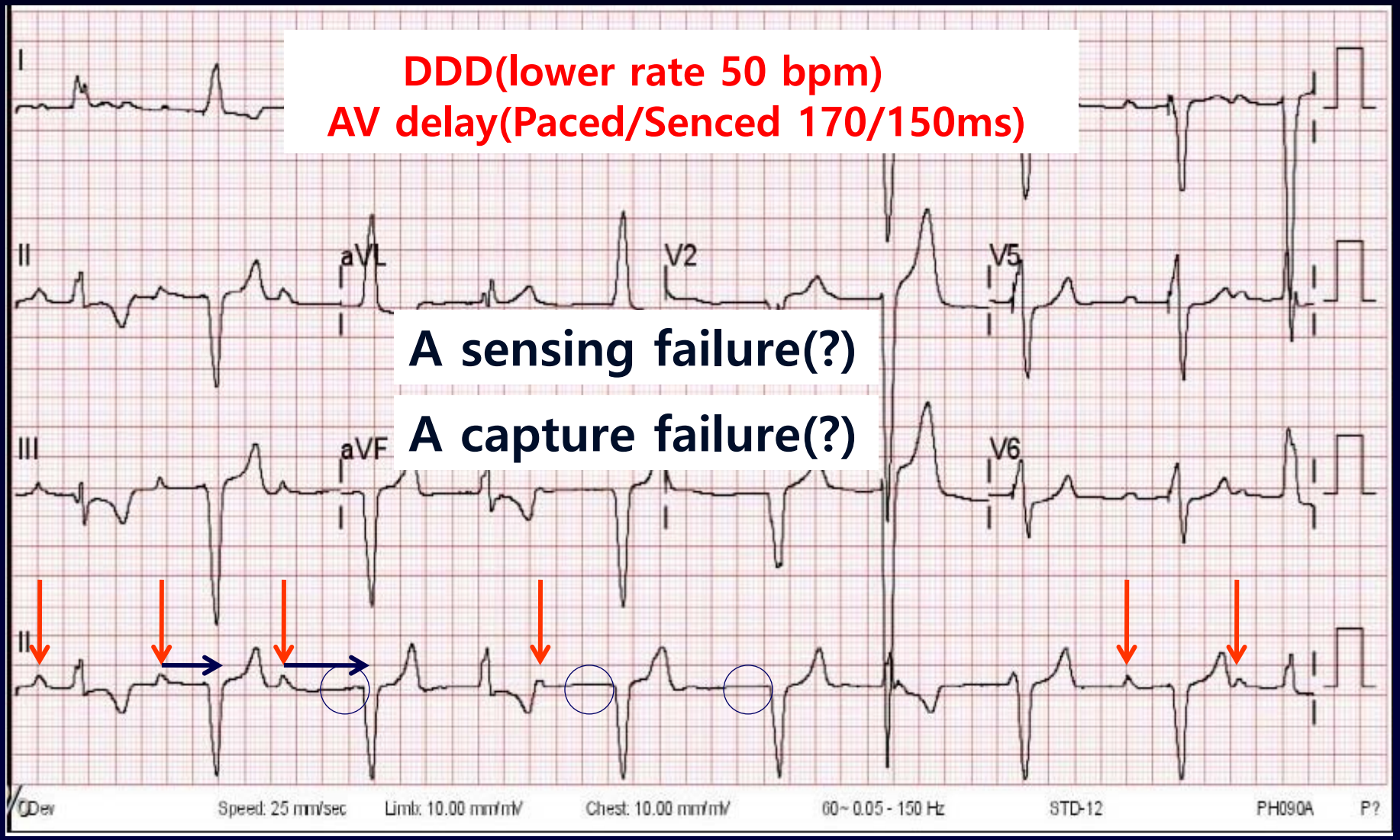
F / 78

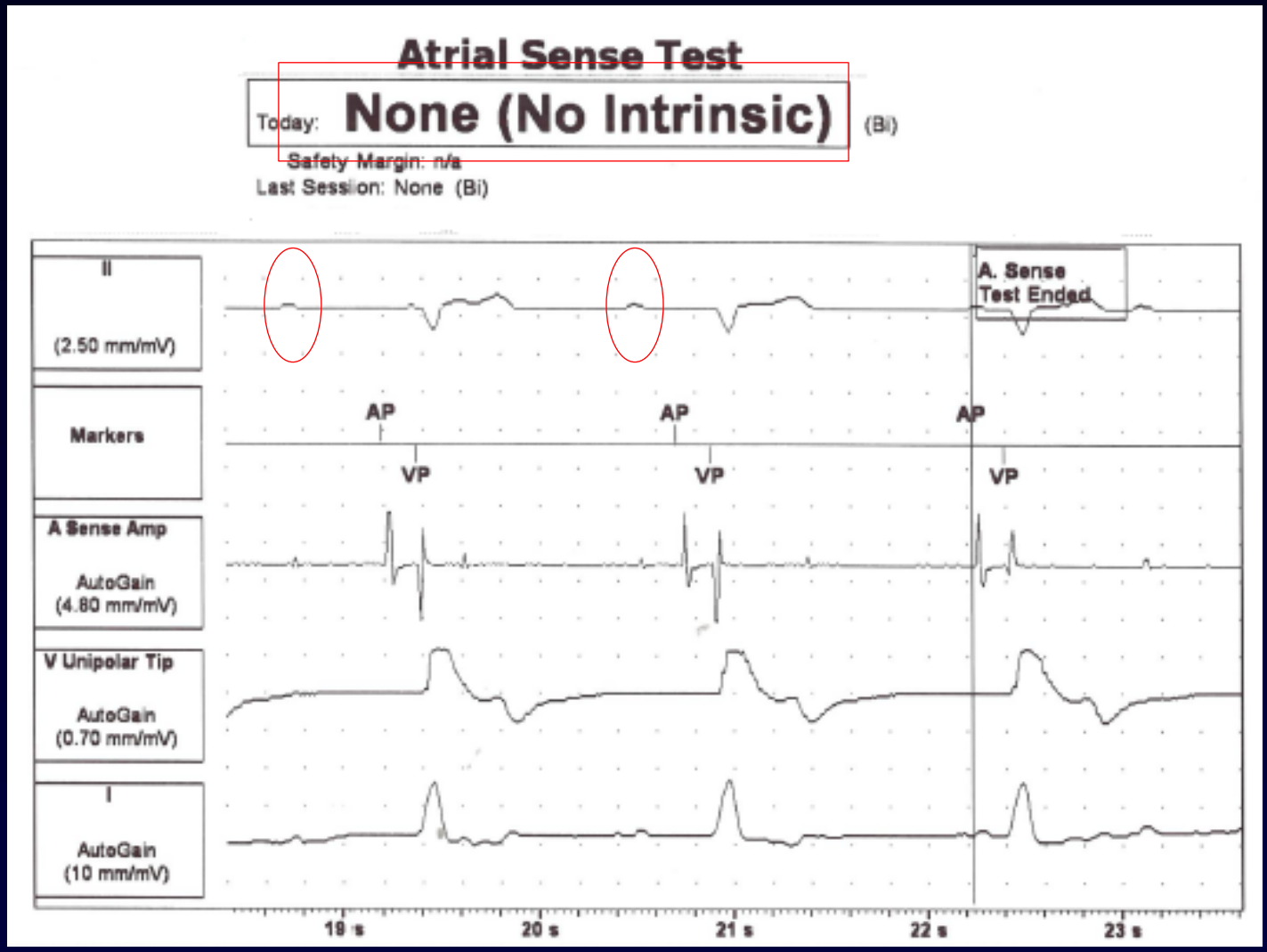
15-June-1999 Pacemaker insertion d/t AV dissociation, High degree AV block, Syncope(Teletronic)

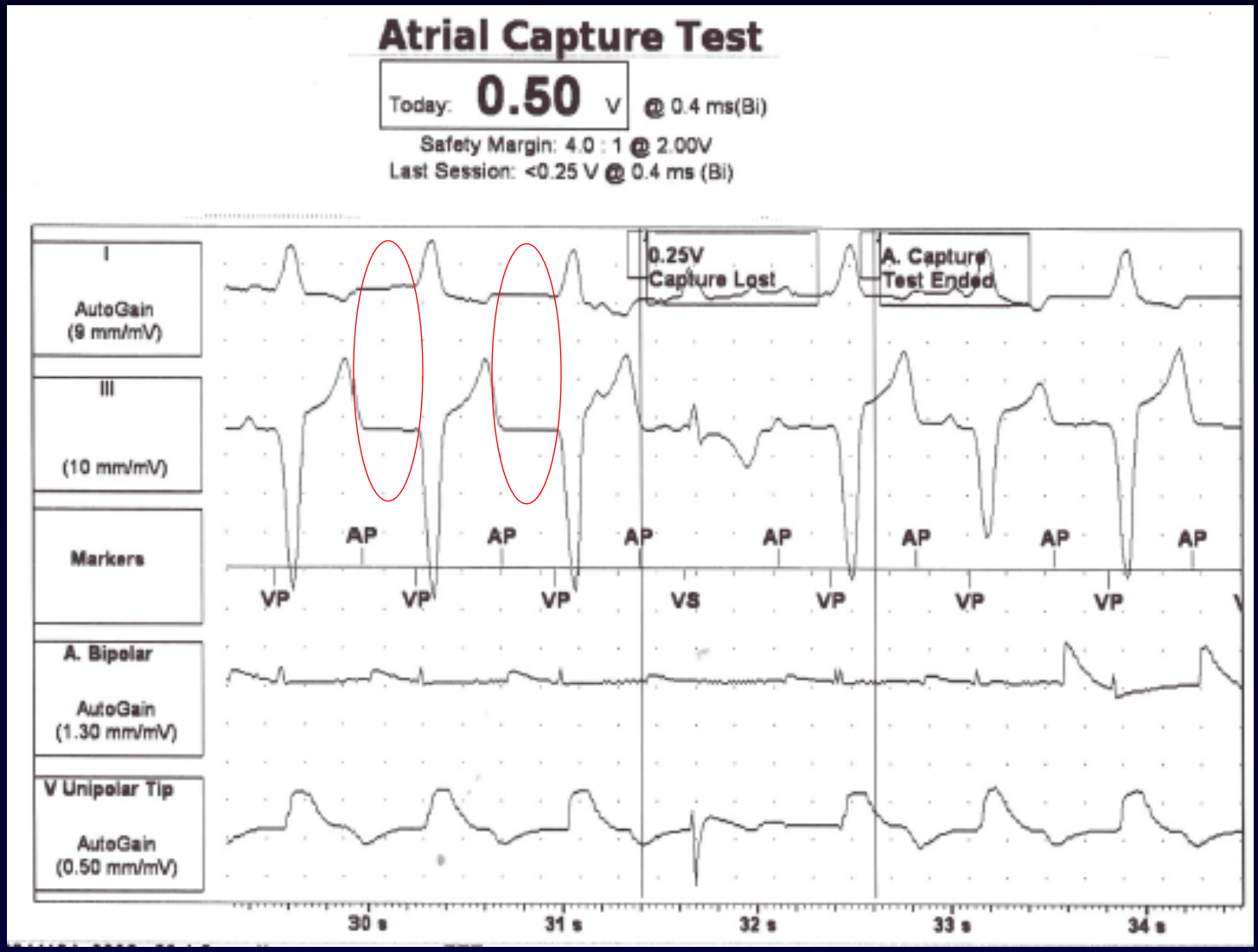
13-Dec-2011 Generator change, Battery depletion of previous pacemaker generator(St.Jude)

31-Jan-2018
Dyspnea, dizziness

ECG (Jan-2018)


DDD(lower rate 50 bpm)
AV delay(Paced/Senced 170/150ms)
A sensing failure(?)
A capture failure(?)
I
II
III
aVL
aVF
V2
V5
V6
Speed: 25 mm/sec
Limb: 10.00 mm/mV
Chest: 10.00 mm/mV
60~ 0.05 - 150 Hz
STD-12
PH090A


Atrial Sense Test
Today: None (No Intrinsic) (Bi)
Safety Margin: n/a
Last Session: None (Bi)
II
(2.50 mm/mV)
A. Sense Test Ended
Markers
AP
AP
AP
VP
VP
VP
A Sense Amp
AutoGain
(4.80 mm/mV)
V Unipolar Tip
AutoGain
(0.70 mm/mV)
I
AutoGain
(10 mm/mV)
19 s
20 s
21 s
22 s
23 s


Atrial Capture Test
Today: 0.50 V @ 0.4 ms(Bi)
Safety Margin: 4.0 : 1 @ 2.00V
Last Session: <0.25 V @ 0.4 ms (Bi)
I
AutoGain
(9 mm/mV)
III
(10 mm/mV)
Markers
A. Bipolar
AutoGain
(1.30 mm/mV)
V Unipolar Tip
AutoGain
(0.50 mm/mV)
0.25V
Capture Lost
A. Capture
Test Ended
AP
VP
VS
30 s
31 s
32 s
33 s
34 s

등록번호 :	
성 명 :	
성별/나이:	F/78
생년월일 :	

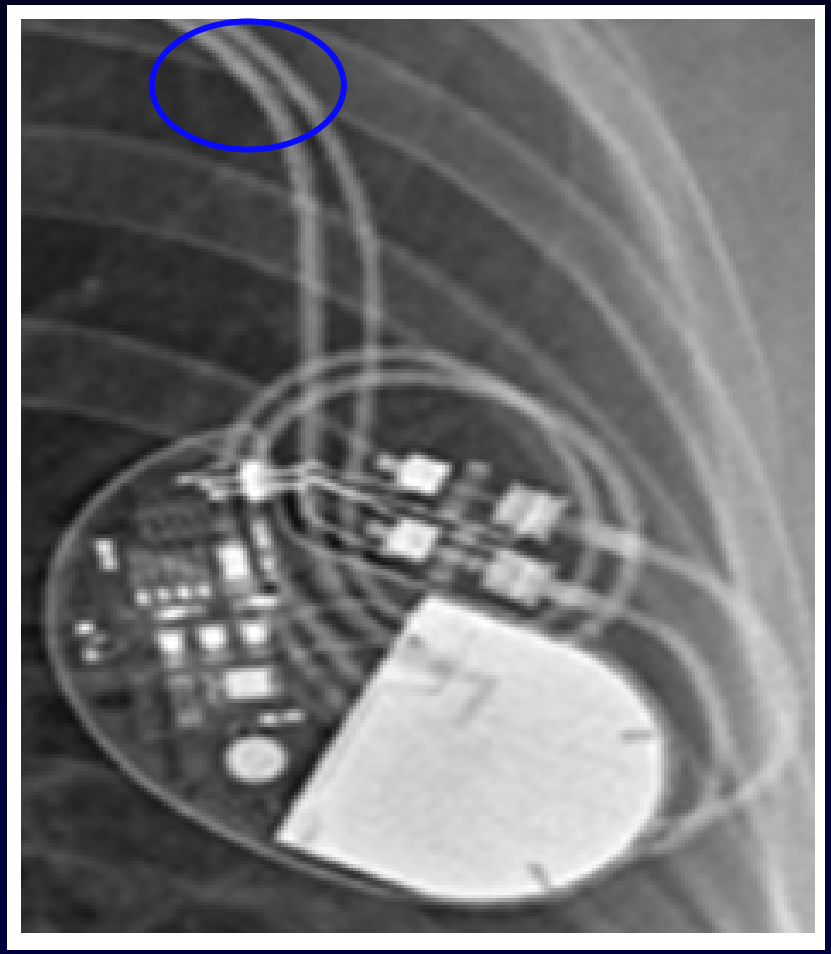
심장박동기 검사 결과지
Electronic analysis of pacemaker system

Lead property

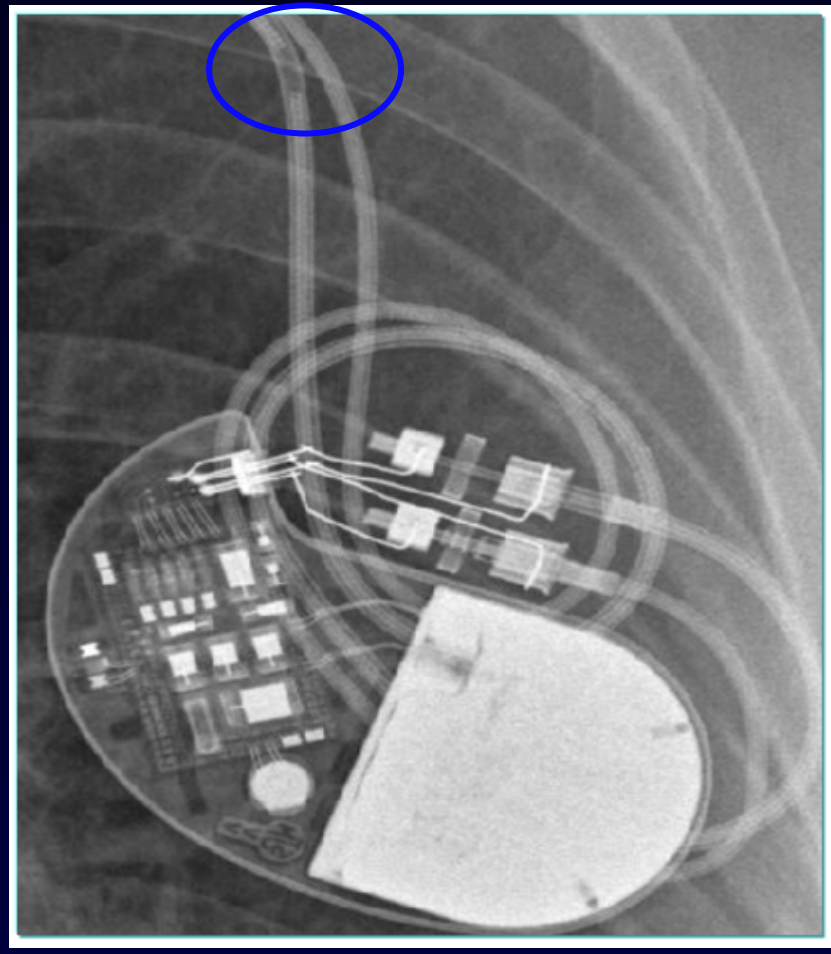
	Sensing		Threshold	Impedance	
A-Lead	uncheckable	mV	none V at ms	>2500	Ω
V-Lead	no intrinsic	mV	0.75 V at 0.4 ms	583	Ω

A lead sensing : N/A
A lead threshold : N/A
A lead impedance : >2500Ω

Pre X-ray



Current X-ray



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성 명 :	
성별/나이:	
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

Pre F/U(Jan-2017)

. Lead property

	Sensing		Threshold	Impedance	
A-Lead	1.3~1.9	mV	<0.25 V at 0.4 ms	395	Ω
V-Lead	none	mV	1.00 V at 0.4 ms	587	Ω

V sensing : none

. Setting value

Mode	DDD		Lower Rate	50	bpm
Mode swich	180	bpm	Upper Track Rate	120	bpm
AV delay(Paced/Sensed)	170 ms / 150 ms		Upper Sensor Rate	120	bpm
A-Sensitivity	1.0	mV	A-Amplitude(Output)	2.00	V
V-Sensitivity	2.0	mV	V-Amplitude(Output)	2.50	V

. Episode

AS-VS	<1	%	AS-VP	94	%
AP-VS	<1	%	AP-VP	5.7	%
Total VP	<1	%	AHR episode	0	
Time in AT/AF	hr / day(%)		VT (>4 beatS)	0	

V pacing > 99%

. Comment:
F/U for 1 year or OPD.

등록번호 :	
성 명 :	
성별/나이:	F/78
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

Lead property

	Sensing		Threshold	Impedance	
A-Lead	uncheckable	mV	none V at ms	>2500	Ω
V-Lead	no intrinsic	mV	0.75 V at 0.4 ms	583	Ω

Setting value

Mode		bpm
Mode swich		bpm
AV delay(Paced/S		bpm
A-Sensitivity		V
V-Sensitivity		V

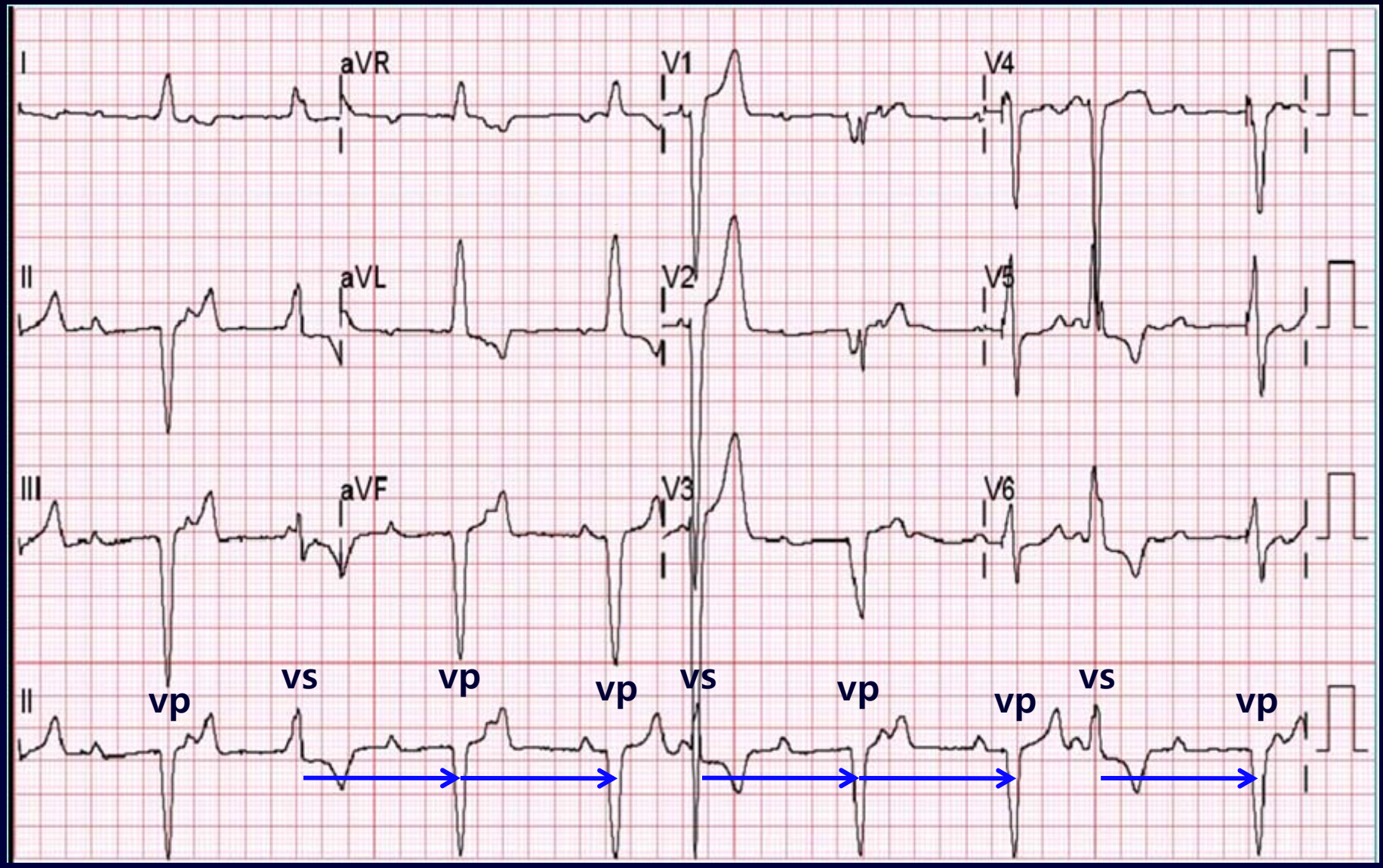
A lead sensing : N/A
A lead threshold : N/A
A lead impedance : >2500Ω
mode change on VVI mode

Episode

AS-VS	<1	%	AS-VP	65	%
AP-VS	<1	%	AP-VP	29	%
Total VP		%	AHR episode		
Time in AT/AF	hr / day(%)		VT (>4 beatS)		

Comment:
Atrial Lead failure 로 DDD→VVI 로 mode change
Routine follow up.

VVI(lower rate 50 bpm)



Case 3

M/70

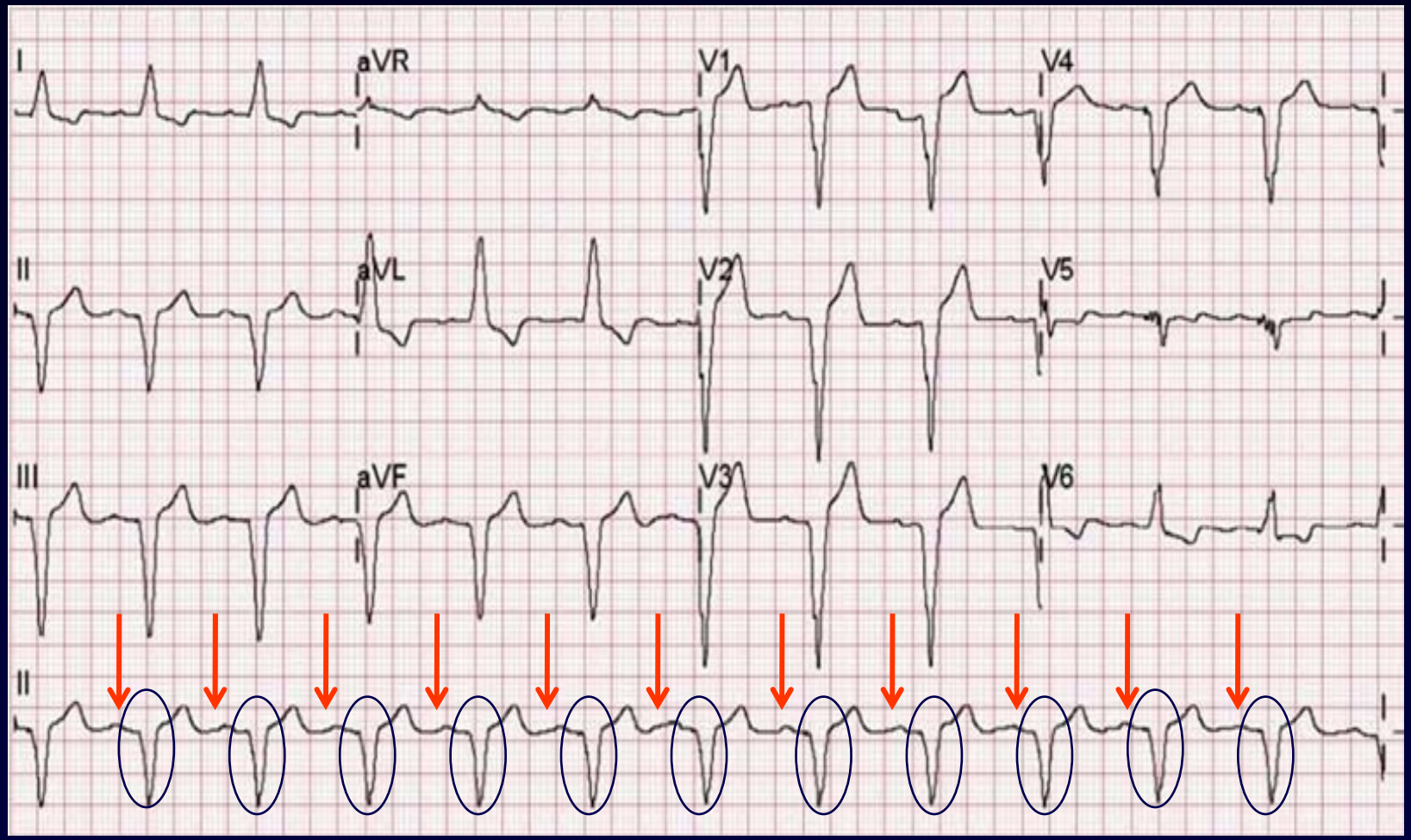
25-Jul-2016 Pacemaker insertion d/t Complete AV block

입 원 기 록 지

등록번호 :
환 자 명 :
성별/나이: M / 70 입원과: IC

일 자	구분	내 용	작성자	서 명
2016-07-21	특수환자	해당없음		
	CC	Bradycardia		
	PI	상기 70세 남환, HTN (10yrs),전립선 비대 수술, h/o Chronic SDH과거력 있으신 분으로 이전부터 맥박 느리다는 이야기 들었으나 특이 증상 없어 경과관찰 하던 분으로, 내원 당일 보건소에 혈압체크시 맥박 30~40으로 느린 소견 보여, 이에 대해 큰 병원 권유받고, Local 내원하여 EKG상 Complete AV block소견 보여 큰 병원 권유받고 본원 내원하였습니다. 내원하여 Dobutamine 사용후 Sinus Rhythm으로 돌아오는 소견 관찰됨		

May-2017 A sensing V pacing



등록번호 :	
성 명 :	
성별/나이:	M/71
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

시술일(Implant date): 2016-07-25 Current F/U date: 2017-05-25 Last F/U date:

1. Device Information

	Model	S/N
Generator	Medtronic Advisa DR MRI A3DR01	PZK815169S
A-Lead	Medtronic 5076 CapsureFix No..	PJN520495G
V-Lead	Medtronic 5076 CapsureFix No..	PJN502224G

2. Battery status

Battery Voltage	3.01	V	Current Impedance	Ω
Remaining Longevity	8	year		

3. Lead property

	Sensing		Threshold	Impedance	
A-Lead	4.8	mV	0.625 V at 0.40 ms	551	Ω
V-Lead	16.8	mV	0.50 V at 0.40 ms	722	Ω

4. Setting value

Mode : DDDR

Mode	DDDR		Lower Rate	60	bpm
Mode swich	171	bpm	Upper Track Rate	130	bpm
AV delay(Paced/Sensed)	180 ms / 150 ms		Upper Sensor Rate	130	bpm
A-Sensitivity	0.30	mV	A-Amplitude(Output)	1.50	V
V-Sensitivity	2.80	mV	V-Amplitude(Output)	2.00	V

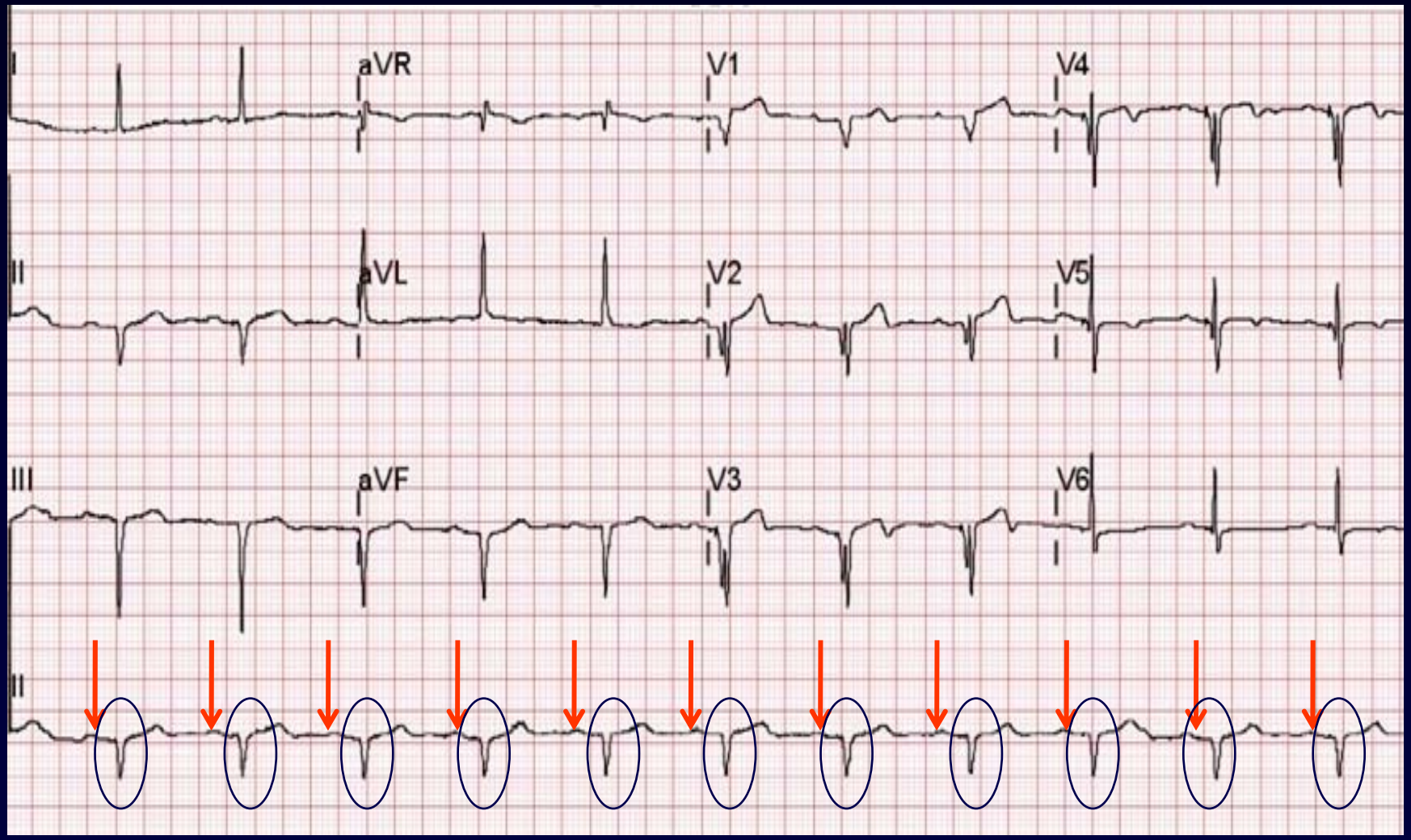
5. Episode

V pacing 100%

AS-VS	<0.1	%	AS-VP	77.2	%
AP-VS	<0.1	%	AP-VP	22.8	%
Total VP	100	%	AHR episode		
Time in AT/AF	<0.1 hr / day(<0.1%)		VT (>4 beatS)	0	

6. Comment:
Routine F/U.

Nov-2017 A sensing V pacing fusion



등록번호 :	
성 명 :	
성별/나이:	M/72
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

시술일(Implant date): 07/25/2016 Current F/U date: 11/02/2017 Last F/U date:

1. Device Information

	Model	S/N
Generator	Medtronic Advisa DR MRI A3DR01	PZK815169S
A-Lead	Medtronic 5076 CapsureFix No...	PJN520495G
V-Lead	Medtronic 5076 CapsureFix No...	PJN502224G

2. Battery status

Battery Voltage	3.01	V	Current Impedance	Ω
Remaining Longevity	8	year		

3. Lead property

	Sensing		Threshold	Impedance	
A-Lead	4.5	mV	0.625 V at 0.40 ms	551	Ω
V-Lead	12.1	mV	0.500 V at 0.40 ms	703	Ω

4. Setting value

Mode	AAIR<=>DDDR		Lower Rate	60	bpm
Mode swich	171	bpm	Upper Track Rate	130	bpm
AV delay (Paced)	150 ms		Upper Sensor Rate	130	bpm
A-Sensitivity	0.30	mV	A-Amplitude(Output)	1.50	V
V-Sensitivity	2.80	mV	V-Amplitude(Output)	2.00	V

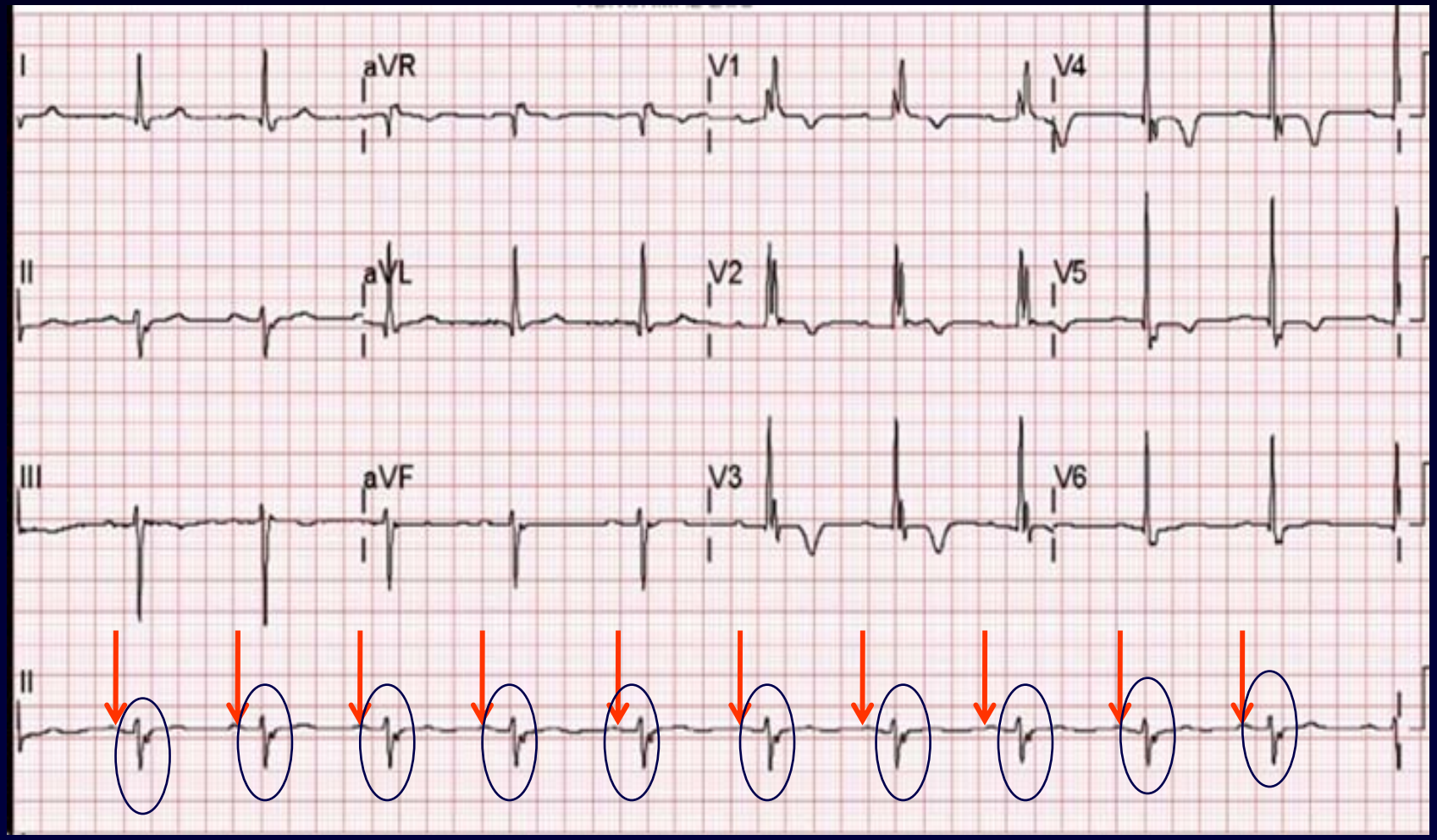
5. Episode

AS-VS	<0.1	%	AS-VP	68.9	%
AP-VS	<0.1	%	AP-VP	31.1	%
Total VP	100.0	%	AHR episode	0	
Time in AT/AF	<0.1 hr / day(<0.1%)		VT (>4 beatS)	0	

6. Comment:
MVP Off->ON,

MVP "on"
Mode : AAIR⇔DDDR

A sensing V sensing



등록번호 :	
성 명 :	
성별/나이:	M/72
생년월일 :	

심장박동기 검사 결과지
Electronic analysis of pacemaker system

시술일(Implant date): 07/25/2016 Current F/U date: 05/10/2018 Last F/U date:

1. Device Information

	Model	S/N
Generator	Medtronic Advisa DR MRI A3DR01	PZK815169S
A-Lead	Medtronic 5076 CapsureFix No...	PJN520495G
V-Lead	Medtronic 5076 CapsureFix No...	PJN502224G

2. Battery status

Battery Voltage	3.01	V	Current Impedance	Ω
Remaining Longevity	7	year		

3. Lead property

	Sensing		Threshold	Impedance	
A-Lead	4.1	mV	0.625 V at 0.40 ms	532	Ω
V-Lead	4.3	mV	0.500 V at 0.40 ms	684	Ω

4. Setting value

Mode	DDIR = [illegible]DDR		Lower Rate	60	bpm
Mode swich	171	bpm	Upper Track Rate	130	bpm
AV delay(Paced/Sensed)	180 ms / 150 ms		Upper Sensor Rate	130	bpm
A-Sensitivity	0.30	mV	A-Amplitude(Output)	1.50	V
V-Sensitivity	2.80	mV	V-Amplitude(Output)	2.00	V

5. Episode

AS-VS	25.3	%	AS-VP	58.2	%
AP-VS	7.8	%	AP-VP	8.7	%
Total VP	66.9	%	AHR episode	0	
Time in AT/AF	0.0 hr / day(0.0%)		VT (>4 beatS)	0	

6. Comment:
Routine follow up.

Prevent Pacing Induced CMP

V pacing 66.9%

Case 4

F / 67

11-Apr-2017 Pacemaker insertion d/t Sick sinus syndrome

A DDDR pulse generator (Advisa MRI A3DR01, Medtronic®, SN; PZK003603G)

Lowest HR	60
Highest HR	130
Rate-responsive	On
A-tachy	On
MVP	On (AAIR↔DDDR)

Permanent Pacemaker

Name:
Hospital Number:
Date of Birth:
Date of Operation: 11/Apr/2017
Operator:

Preoperative diagnosis

Sick sinus syndrome
Persistent atrial fibrillation with LAA thrombus
PFO
Hypertension
DM
Dyslipidemia

Postoperative diagnosis

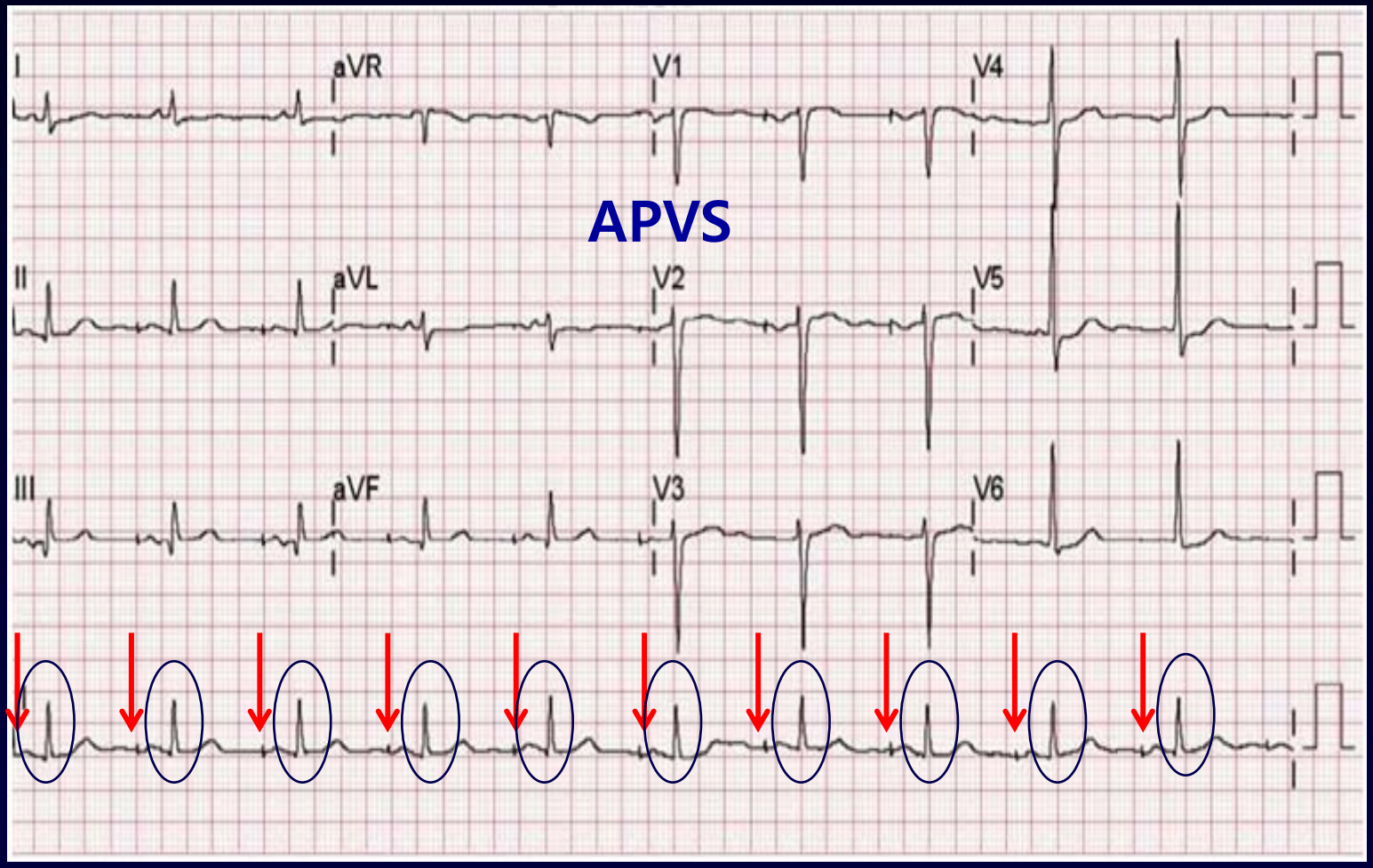
Sick sinus syndrome

Operative Procedure

1. 12 lead ECG and electrocautery was placed.
2. Draping was done.
3. Temporary pacemaker was inserted through right femoral vein puncture. Back-up pacing rate was set to 50/min.
4. Pulse generator pocket was made at the left upper chest area after local anesthesia with lidocaine, and meticulous bleeding control was done.
5. An atrial (Capsure Fix MRI 5076-52, Medtronic®, SN; PJN663162G) and a ventricular (Capsure Fix MRI 5076-58, Medtronic®, SN; PJN667964G) electrodes were inserted through separate axillary vein punctures.

	Threshold (Volt)	Impedance (Ω)	P/R wave (mV)
A-Lead	1.3	531	2.8
V-Lead	0.5	665	8.2

ECG (13-Apr-2017)



OPD (22-Aug-2018)

■ 진료정보
2018-08-22 IC(CC07)

■ 활력징후
혈당 : 식후 시간 2hrs30` BST 173mg/dl 비고사항 : 설탕커피드심
138/70 mmHg, 66/min, regular rhythm

■ 통증
구분:환자, 통증:없음

■ 주관적소견
입장에서 당검사 하면 조금 높다고 함.
Palpitation (-)
Husband 가 bone tumor (?) 로 본인이 모든 일을 해야 함.
육체적으로 무리한 일을 계속하시고 있음.

■ 객관적소견
S1: OK
S2: OK
S3 (-)
S4 (-)
No definitive murmur

QRS duration: 104 msec QTc: 442 msec
Well-functioning pacemaker, Sinus

Pacemaker follow-up
Battery 2.96Volt (1.5years)
Atrial lead High Volt - 1.1 mV - 380 ohm
Ventricular lead 1.25 Volt - 10.1 mV - 380 ohm
AsVs 0.8%, AsVp 0.1%, ApVs 98.7%, ApVp 0.3%
Atrial high rate episode (+) 188회, 최대 10시간
Ventricular high rate (-)
Atrial lead test 상에서는 threshold가 1.50 Volt 임.

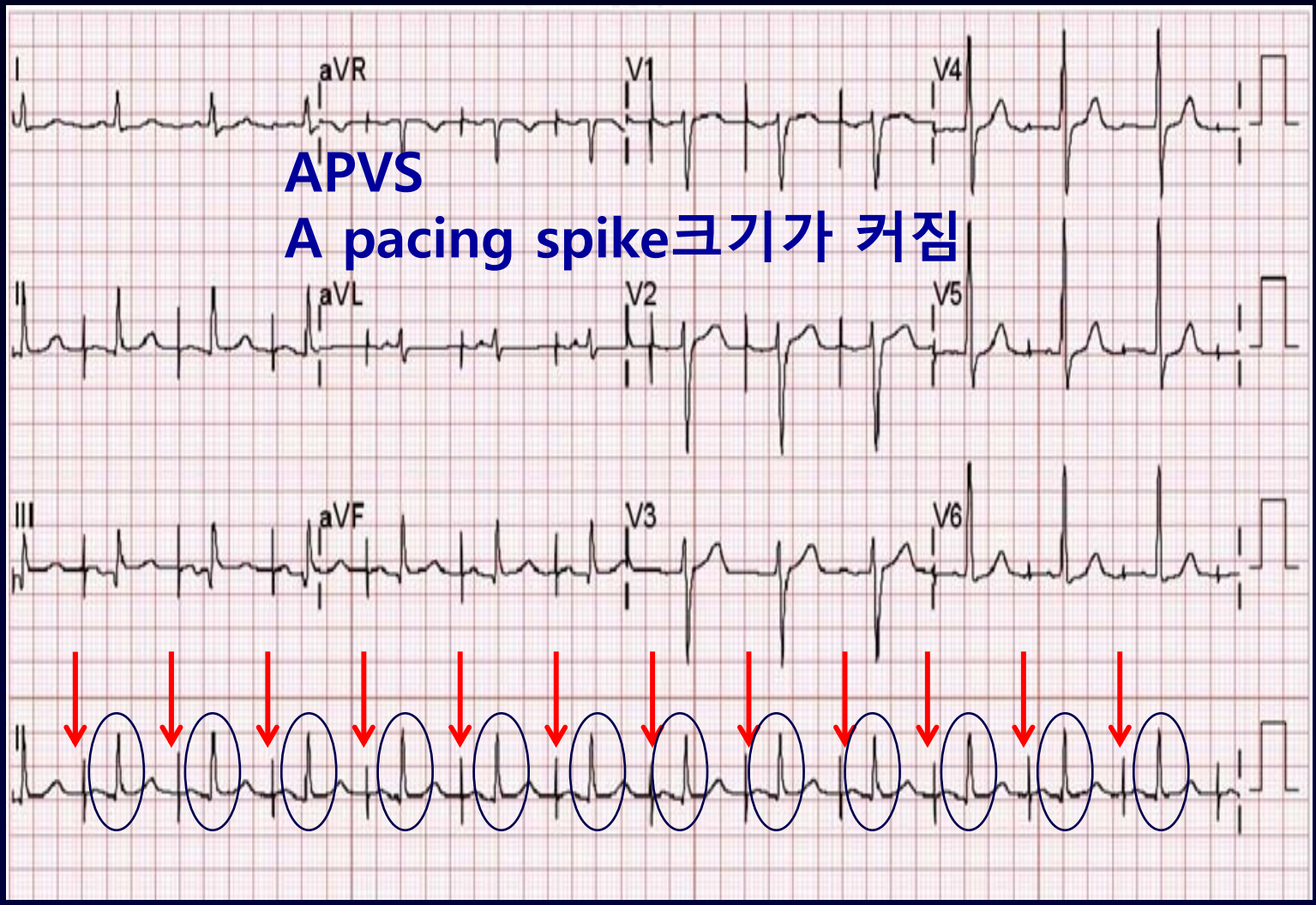
■ 진단적평가
I480.Atrial fibrillation
CHA2DS2-VASc 4, HAS-BLED 2
I495.Sick sinus syndrome(SSS), symptomatic
AF --> sinus converiosn시 symptomatic pause (+)
DDD [2017/04/11]
I109.Hypertension(arterial, essential, primary, systemic)
since 2007 [허윤내과]
E119.Non-insulin-dependent diabetes mellitus, without complications
E782.Mixed hyperlipidemia

4 months --> 2 months follow-up

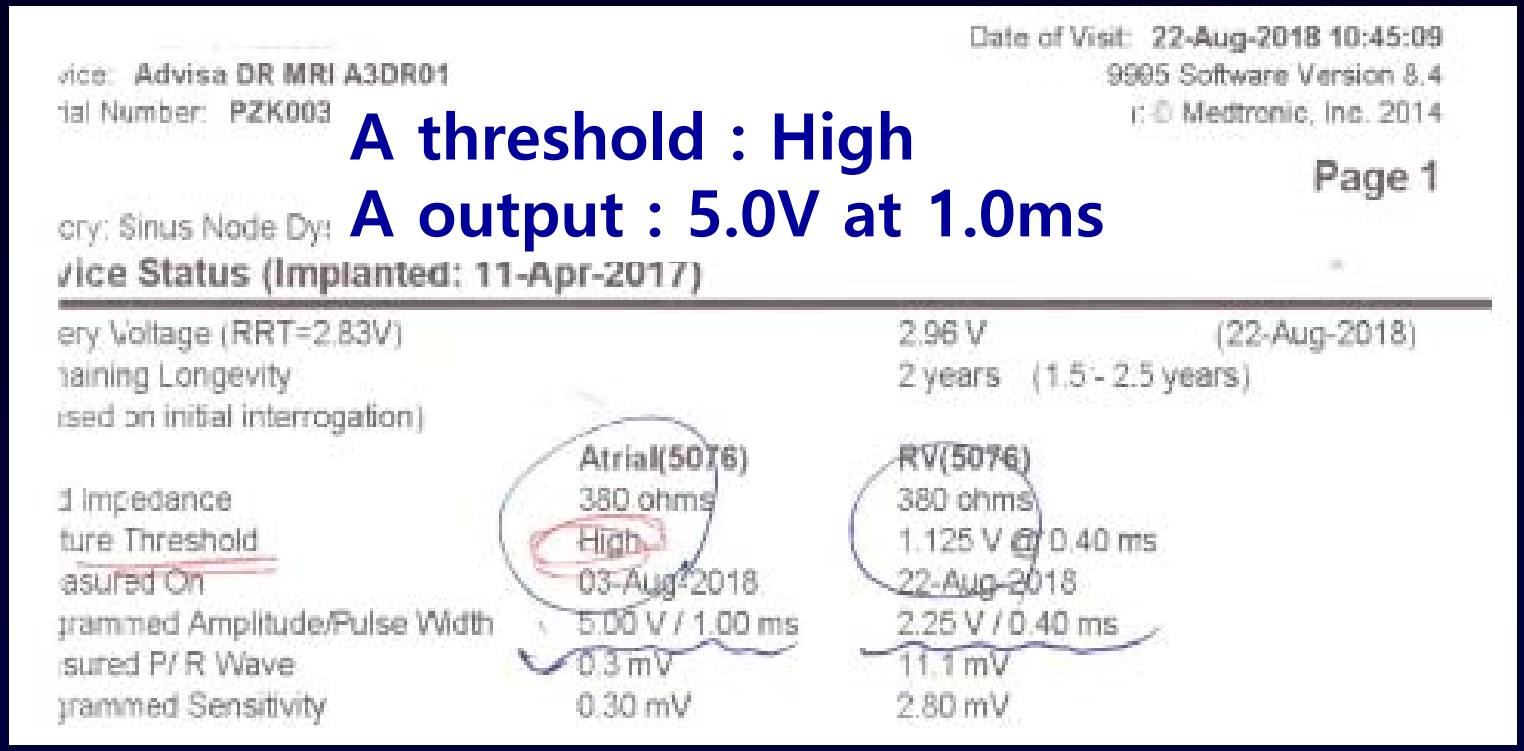
Apixaban 5mg	(1X2X56:B)
Bisoprolol 5mg/t	(1X2X56:B)
Glimepiride 2mg	(1X1X56:DA)
Losartan 50mg (Cozaar 50mg)	(1X1X56:D)
Propafenone HCl 425mg/cap	(1X2X56:B)
Rosuvastatin 10mg/tab	(1X1X56:D)

Transvenous Implantation of Cardiovertor
E.C.G
CHEST P-A R/O pacemaker lead fracture

ECG (22-Aug-2018)



Battery test



Date of Visit: 22-Aug-2018 10:45:09
vice: Advisa DR MRI A3DR01 9985 Software Version 8.4
ial Number: PZK003 r: © Medtronic, Inc. 2014
Page 1

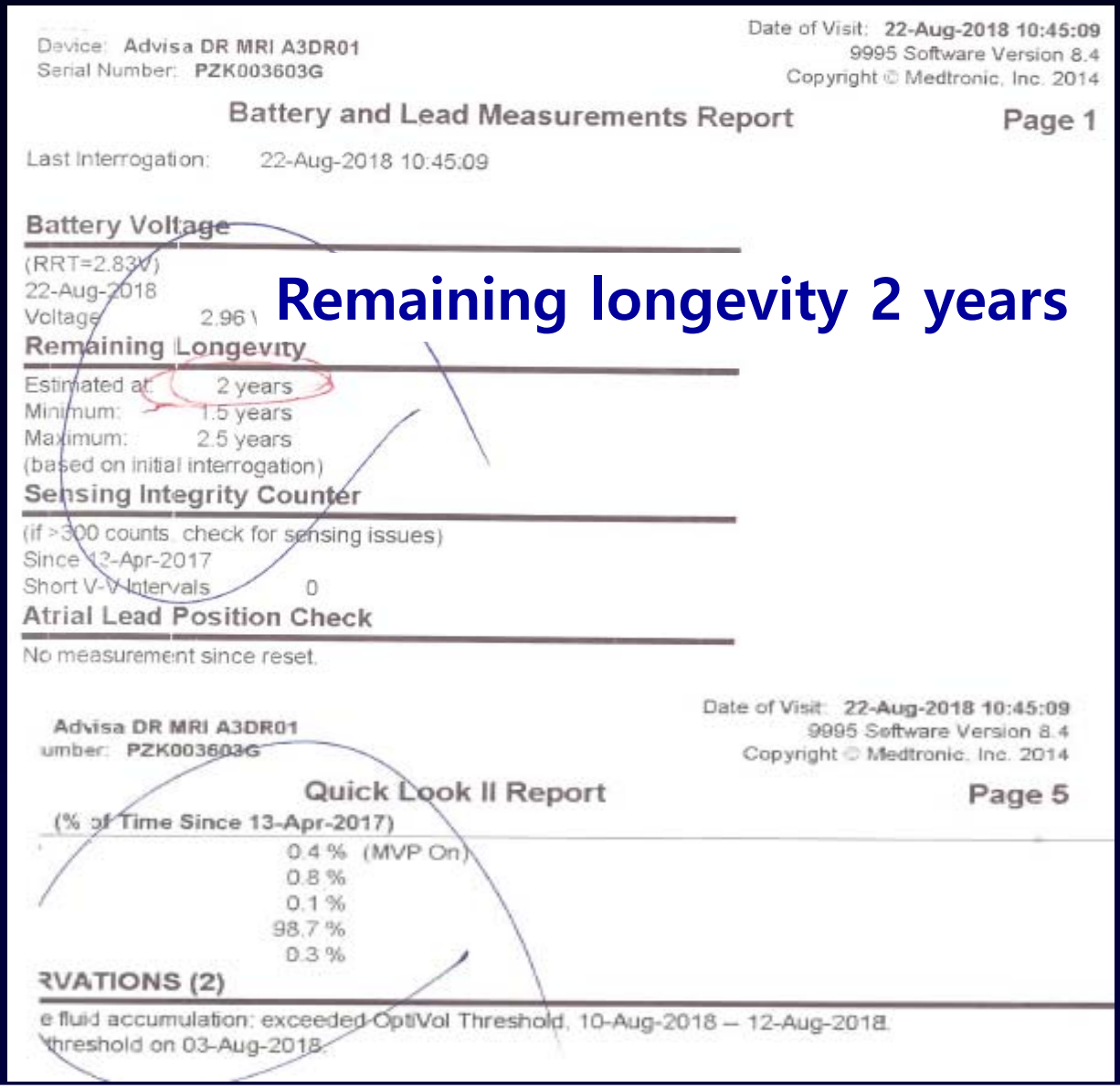
A threshold : High
A output : 5.0V at 1.0ms

cry: Sinus Node Dy:

vice Status (Implanted: 11-Apr-2017)

ery Voltage (RRT=2.83V)	2.96 V	(22-Aug-2018)
aining Longevity	2 years	(1.5 - 2.5 years)
sed on initial interrogation)		
	Atrial(5076)	RV(5076)
d Impedance	380 ohms	380 ohms
ture Threshold	High	1.125 V @ 0.40 ms
asured On	03-Aug-2018	22-Aug-2018
grammed Amplitude/Pulse Width	5.00 V / 1.00 ms	2.25 V / 0.40 ms
sured P/ R Wave	0.3 mV	11.1 mV
grammed Sensitivity	0.30 mV	2.80 mV

Battery test



Device: Advisa DR MRI A3DR01
Serial Number: PZK003603G

Date of Visit: 22-Aug-2018 10:45:09
9995 Software Version 8.4
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Battery and Lead Measurements Report — Page 1

Last Interrogation: 22-Aug-2018 10:45:09

Battery Voltage

(RRT=2.830)
22-Aug-2018
Voltage 2.96 V

Remaining Longevity

Estimated at: 2 years
Minimum: 1.5 years
Maximum: 2.5 years
(based on initial interrogation)

Sensing Integrity Counter

(if >300 counts, check for sensing issues)
Since 13-Apr-2017
Short V-V Intervals 0

Atrial Lead Position Check

No measurement since reset.

Remaining longevity 2 years

Advisa DR MRI A3DR01
umber: PZK003603G

Date of Visit: 22-Aug-2018 10:45:09
9995 Software Version 8.4
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Quick Look II Report — Page 5

(% of Time Since 13-Apr-2017)

0.4 % (MVP On)
0.8 %
0.1 %
98.7 %
0.3 %

RVATIONS (2)

e fluid accumulation: exceeded OptiVol Threshold, 10-Aug-2018 – 12-Aug-2018.
threshold on 03-Aug-2018.

Sensing test

Device: **Advisa DR MRI A3DR01**
Serial Number: **PZK003603G**

Date of Visit: **22-Aug-2018 10:45:09**
9995 Software Version 8.4
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Sensing Test Report

Page 1

Sensing Test

	Test Value	Permanent
Mode	DDD	AAIR<=>DDDR
AV Delay	250 ms	180 ms
Lower Rate	40 bpm	60 bpm

Last Sensing Measurement

22-Aug-2018

P-Wave Amplitude	1.1 mV
R-Wave Amplitude	10.0 mV

Sense Polarity

P-wave	Bipolar
R-wave	Bipolar

Threshold test

Device: Advisa DR MRI A3DR01
Serial Number: PZK003603G

Date of Visit: 22-Aug-2018 10:45:09
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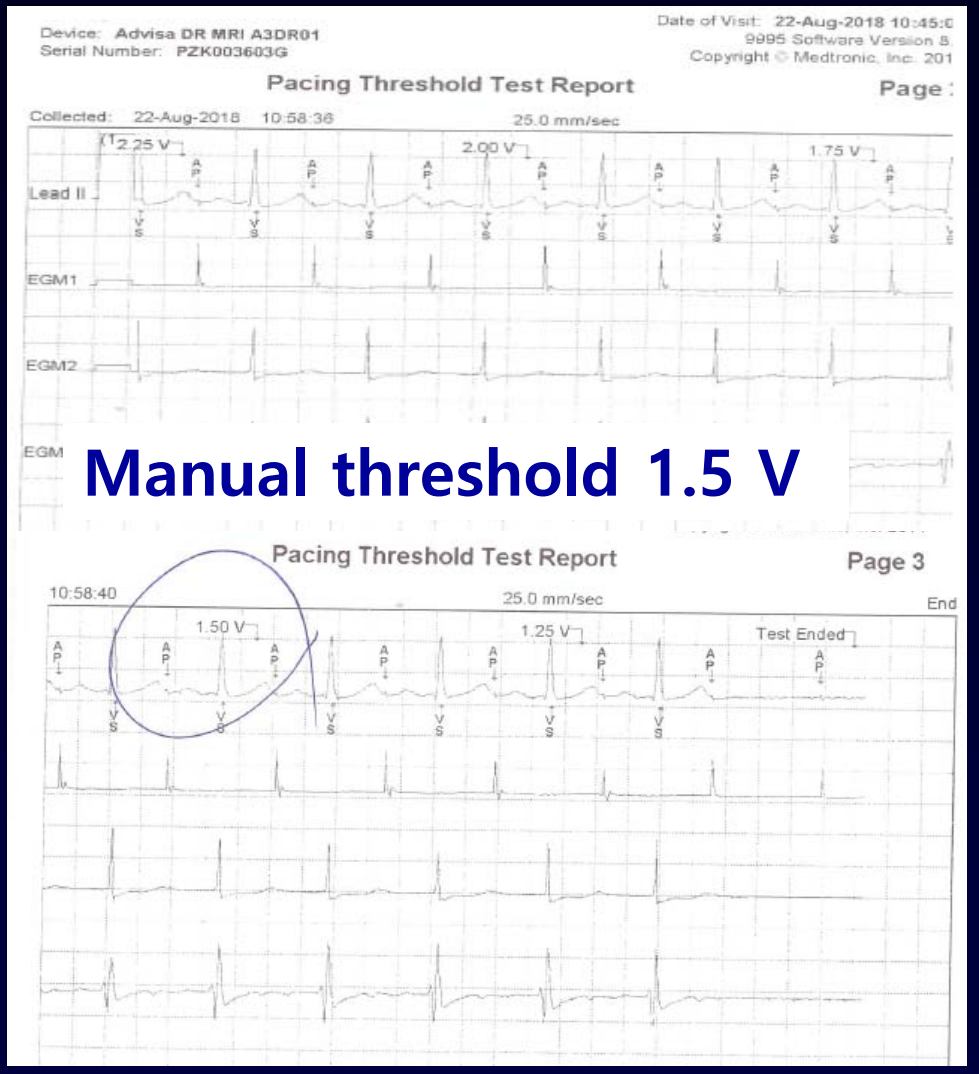
Pacing Threshold Test Report

Page 1

Atrial Amplitude Threshold Test

	Ending Value	Threshold	Permanent
Mode	AAI		AAIR<=>DDDR
Lower Rate	90 bpm		60 bpm
AV Delay			180 ms
A. Amplitude	1.25 V	1.50 V	5.00 V
A. Pulse Width	1.00 ms	1.00 ms	1.00 ms
A. Capture Management			Adaptive
Amplitude Margin			2.0 X
Min. Adapted Amplitude			1.50 V
Acute Phase Remaining			Off
Acute Phase Completed			09-Aug-2017
V. Pace Blanking			200 ms
A. Pace Blanking	200 ms		200 ms
PVARP			Auto
Pace Polarity	Bipolar		Bipolar



Lead test

Device: **Advisa DR MRI A3DR01**
Serial Number: **PZK003603G**

Date of Visit: **22-Aug-2018 10:45:09**
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Battery and Lead Measurements Report Page 2

Lead Impedance

A. Pacing	(Bipolar)	380 ohms	22-Aug-2018
RV Pacing	(Bipolar)	380 ohms	22-Aug-2018

Device: **Advisa DR MRI A3DR01** (1)
Serial Number: **PZK003603G**

Date of Visit: **17-Oct-2018 10:47:45**
9995 Software Version 8.4
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Lead Impedance Test Report Page 1

Last Lead Impedance Measurement
17-Oct-2018

	Programmed		Others	
A. Pacing	437 ohms	(Bipolar)	399 ohms	(Unipolar)
RV Pacing	399 ohms	(Bipolar)	361 ohms	(Unipolar)

Device: **Advisa DR MRI A3DR01** (2)
Serial Number: **PZK003603G**

Date of Visit: **17-Oct-2018 10:47:**
9995 Software Version 8
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Lead Impedance Test Report Page

Last Lead Impedance Measurement
17-Oct-2018

	Programmed		Others	
A. Pacing	437 ohms	(Bipolar)	399 ohms	(Unipolar)
RV Pacing	399 ohms	(Bipolar)	361 ohms	(Unipolar)

Impedance does not change when arm is moved

evice: **Advisa DR MRI A3DR01** (3)
erial Number: **PZK003603G**

Date of Visit: **17-Oct-2018 10:47:45**
9995 Software Version 8.4
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Lead Impedance Test Report Page 1

st Lead Impedance Measurement
-Oct-2018

	Programmed		Others	
Pacing	418 ohms	(Bipolar)	399 ohms	(Unipolar)
/ Pacing	399 ohms	(Bipolar)	361 ohms	(Unipolar)

Device: **Advisa DR MRI A3DR01** (4)
Serial Number: **PZK003603G**

Date of Visit: **17-Oct-2018 10:47:45**
9995 Software Version 8.4
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Lead Impedance Test Report Page 1

Last Lead Impedance Measurement
17-Oct-2018

	Programmed		Others	
A. Pacing	418 ohms	(Bipolar)	399 ohms	(Unipolar)
RV Pacing	399 ohms	(Bipolar)	361 ohms	(Unipolar)

Capture threshold OFF, Output 3.5V

Device: **Advisa DR MRI A3DR01**
Serial Number: **PZK003603G**

Date of Visit: **22-Aug-2018 12:37:55**
9995 Software Version 8.4
Copyright © Medtronic, Inc. 2014

Final: Session Summary

Page 1

Device Information

Device	Medtronic	Advisa DR MRI A3D...	PZK003603G	Implanted: 11-Apr-2017
Atrial	Medtronic	5076 CapsureFix No...	PJN663162G	Implanted: 11-Apr-2017
RV	Medtronic	5076 CapsureFix No...	PJN667964G	Implanted: 11-Apr-2017

Device Status (Implanted: 11-Apr-2017)

Battery Voltage (RRT=2.83V)	2.96 V	(22-Aug-2018)
Remaining Longevity (based on initial interrogation)	2 years	(1.5 - 2.5 years)

	Atrial(5076)	RV(5076)
Lead Impedance	399 ohms	380 ohms
Capture Threshold	Off	1.125 V @ 0.40 ms
Measured On		22-Aug-2018
In-Office Threshold	3.00 V @ 0.40 ms	
Programmed Amplitude/Pulse Width	3.50 V / 0.40 ms	2.00 V / 0.40 ms
Measured P/R Wave	0.3 mV	11.1 mV
Programmed Sensitivity	0.30 mV	2.80 mV

Follow up (17-Oct-2018)

Increased longevity

Date of Visit: **17-Oct-2018 10:34:58**
Device: **Advisa DR MRI A3DR01**
Serial Number: **PZK003603G**
9995 Software Version 8.4

Battery and Lead Measurements Report

Last Interrogation: 17-Oct-2018 10:34:58

Battery Voltage

(RRT=2.83V)
17-Oct-2018
Voltage 2.99 V

Remaining Longevity

Estimated at: 4.5 years
Minimum: 3.5 years
Maximum: 5.5 years
(based on initial interrogation)

Longevity increased 2 years → 4 years

Sensing Integrity Counter

(if >300 counts, check for sensing issues)
Since 22-Aug-2018
Short V-V Intervals 0

Atrial Lead Position Check

No measurement since reset.

Capture Management

자동적으로 pacing threshold thresholds를 일정한 기간마다 측정해서,
safety margin과 프로그램 가능한 최소 amplitude에 맞춰 값을 설정

환자의 Rhythm 평가 → Threshold check 후 결정 → Safety margin에 맞게 Pacing Output 조절

Why?

-Patient Safety: Threshold는 환자의 condition or 약물복용 여부에 따라 매우 변동적임
-Device Longevity: 적절한 Pacing output을 제공
-Troubleshooting Info: Recording → 문제발생 시 정보제공

How?

-병원에서 직접 하면 F/U을 Device가 Automatically check

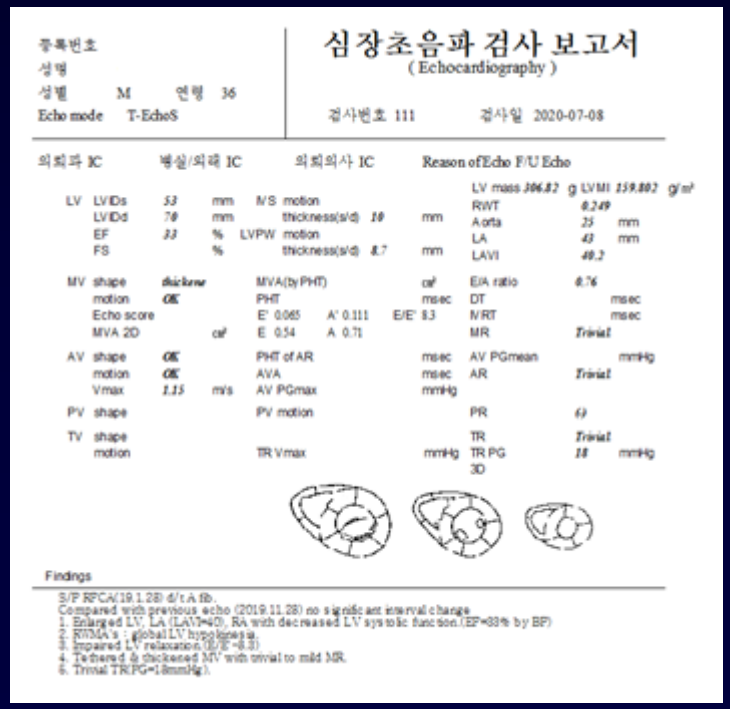
5.0V at 1.0ms 이면 Test는 진행하지만 Amplitude는 줄어들지 않으므로 close follow up 하면서 조정해야한다

Case 5

M / 47

Sx: DCMP (EF 33%)

23-Jul-2020 ICD insertion



등록번호
성명
성별 M 연령 36
Echo mode T-EchoS

심장초음파 검사 보고서
(Echocardiography)

검사번호 111 검사일 2020-07-08

의뢰과 IC 병실/외래 IC 의뢰의사 IC Reason of Echo F/U Echo

								LV mass 306.82 g		LVMI 159.802 g/m²	
LV	LVIDs	53	mm	M/S motion			RWT	0.249			
	LVIDd	70	mm		thickness(s/d)	10	mm	Aorta	25	mm	
	EF	33	%	LVPW motion				LA	43	mm	
	FS		%		thickness(s/d)	8.7	mm	LAVI	40.2		
MV	shape	thickene		MVA(by PHT)			㎠	E/A ratio	0.76		
	motion	OK		PHT			msec	DT		msec	
	Echo score			E' 0.065	A' 0.111	E/E' 8.3		IVRT		msec	
	MVA 2D		㎠	E 0.54	A 0.71			MR	Trivial		
AV	shape	OK		PHT of AR			msec	AV PGmean		mmHg	
	motion	OK		AVA			msec	AR	Trivial		
	Vmax	1.15	m/s	AV PGmax			mmHg				
PV	shape			PV motion				PR	0		
TV	shape							TR	Trivial		
	motion			TR Vmax			mmHg	TR PG	18	mmHg	
								3D			

Findings

S/P RFCA(19.1.28) d/t A fib.
Compared with previous echo (2019.11.28) no significant interval change
1. Enlarged LV, LA (LAVI=40), RA with decreased LV systolic function.(EF=33% by BP)
2. RWMA's : global LV hypokinesia.
3. Impaired LV relaxation.(E/E'=8.3)
4. Tethered & thickened MV with trivial to mild MR.
5. Trivial TR(PG=18mmHg).

ICD

Name:

Hospital Number:

Date of Birth:

Date of Operation: 23/Jul/2020 /

Operator:

Preoperative diagnosis

DCMP

Atrial fibrillation

H/O hypertension

S/P right MCA infarction (Jan. 2019)

H/O TIA (Sep. 2018)

S/P renal infarction (Nov. 2018)

OPD 12-Oct-2020

■ 활력징후
120/78 mmHg, 66/min, regular rhythm

■ 통증
구분: 환자, 통증: 없음.

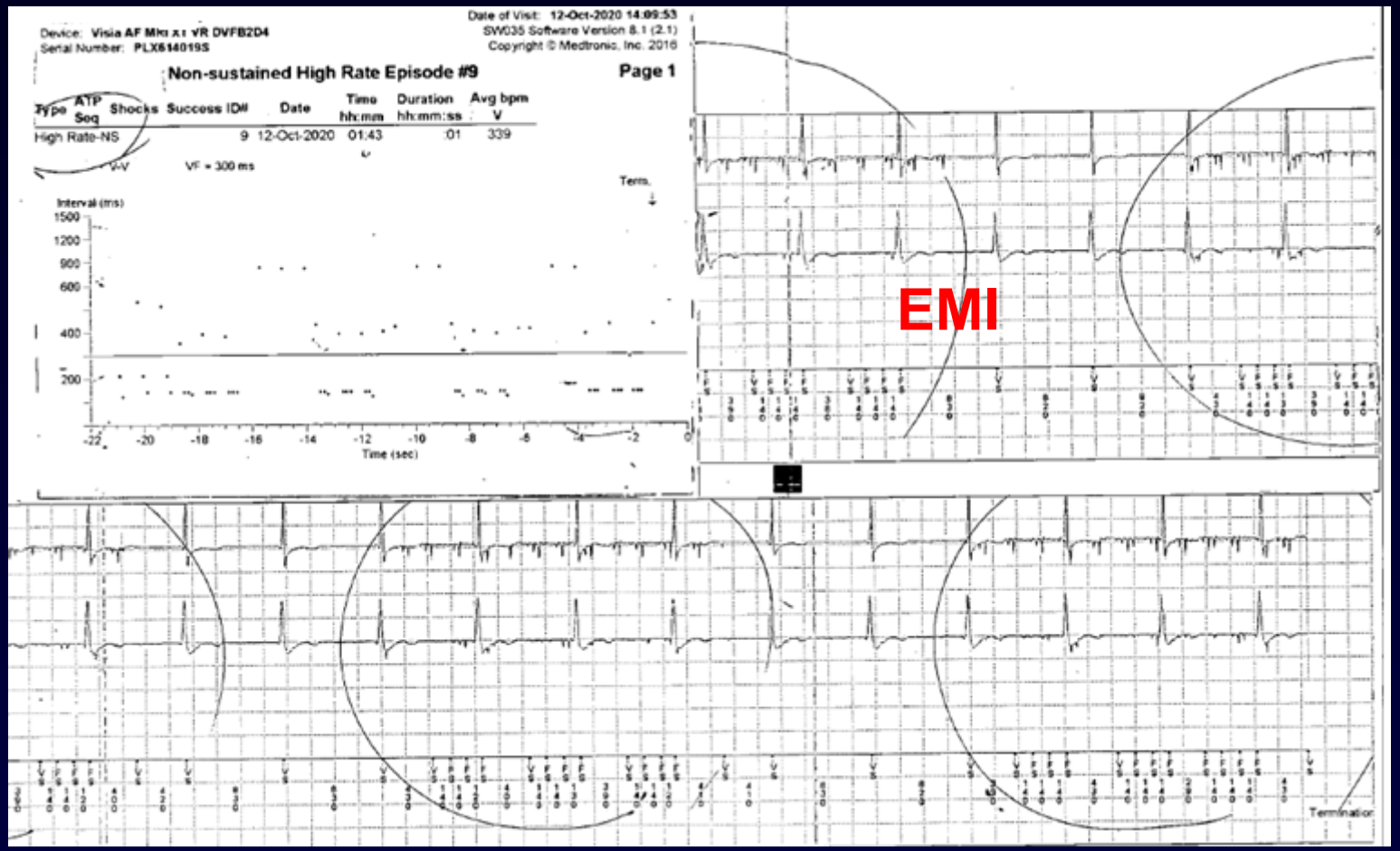
■ 주관적소견
ICD alarm 이 울린다.

■ 객관적소견
PMI: ?
Thrill (−) Heaving (−)
S1: OK
S2: OK
S3 (−)
S4 (−)
No definitive murmur

QRS duration: 104 msec QTc: 498 msec
Sinus

ICD follow−up
Battery 3.08 Volt (11.2 years) RRT 2.73 Volt
Last full charge 4.0
RV pacing 0.75 Volt − 19.8 mV − 494 ohm, RV coil 60 ohm
Vs 100%, Vp <0.1%
Shock (−)
VT episode (−)
Non−sustained VT (−)
High rate non−sustained 1회 −−> EGM은 모두 niose 임
Atrial tachycardia (−)

■ 진단적평가
I420.Dilated cardiomyopathy, EF 20~37%
I480.paroxysmal Atrial fibrillation, CHA2DS2−VASc 4, HAS−BLED 1
RFCA [2019/01/28] 4 PVI + CTI block + roof line
Late recurrnece −−> DC cardioversion [2020/06/27]
I109.Hypertension(arterial, essential, primary, systemic)
E782.Mixed hyperlipidemia
I6318.Cerebral infarction due to embolism of other precerebral artery
TIA [Sep. 2018]
Renal infarction [Nov. 2018]
Right MCA infarction [Jan. 2019]
G459.Transient cerebral ischemic attack, unspecified


Device: Visia AF MRI x1 VR DVFB2D4
Serial Number: PLX614019S
Date of Visit: 12-Oct-2020 14:09:53
SW035 Software Version 8.1 (2.1)
Copyright © Medtronic, Inc. 2016
Non-sustained High Rate Episode #9
Page 1
Type ATP Seq Shocks Success ID# Date Time hh:mm Duration hh:mm:ss Avg bpm V
High Rate-NS 9 12-Oct-2020 01:43 :01 339
VF = 300 ms
Term.
Interval (ms)
1500
1200
900
600
400
200
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0
Time (sec)
EMI
Termination

등록번호 :	
성 명 :	
성별/나이:	
생년월일 :	

심실제세동기 추적 검사 결과지

시술일(Implant date): 07/23/2020 Current F/U date: 10/12/2020 Last F/U date:

1. Device Information

	Model	S/N
Device	Medtronic Visia AF MRI XT VR DVFB2D4	PLX614019S
A-Lead		
RV-Lead	Medtronic 6935M Sprint Quattr...	TDL171081G
LV-Lead		

2. Battery voltage: 3.08 V **Last Full charge:** 4.0 sec

3. Defibillation impedance: RV coil 60Ω SVC coil noneΩ

	A	RV	LV

V sensitivity 0.3mV=>0.6mV incresed

9.Parameter summary			10.Detection	Rates	Therapies
9-1.Mode	VVI		**AT/AF** Monitor		
9-2.Mode switch	On Off		**VF** On	>200 bpm	ATP During Charging, 35J x 6
9-3.Lower/Upper/Sensor rate	40 PPM		**FVT** OFF		All Rx Off
9-4.AV delay	Paced ms	Paced ms	**VT** OFF		All Rx Off
9-5.Pacing(% of total)	AS-VS VS 100.0%	AP-VS %			
	AS-VP VP <0.1%	AP-VP %			

11. Episode: Alert: RV Lead Integrity warning on 12-Oct-2020.

12. Comment:
V sensitivity 0.30mV → 0.60mV로 변경함.
Regular ICD follow up.

Case 6

11-Jan-2013 ICD insercion d/t documented Ventricular fibrillation with cardiac arrest
No shock episode

상기환자 TA(2000년)로 Lt. leg amputation 한 것이외의 특이 MHx.없는 분으로, 금일 오전 5시경부터 1~2분정도 3회정도 seizure like motion을 보였다 하며, 7시 40분경에 local에 도착했을때 VF 소견 보였다 함. DC 3차례 했고, arrest 로 10여분간 CPR 를 ROSC 되어 보호자분 대학병원 치료 원하여 본원 er vist. (ROSC 된 후에 CAG 했다하며, 특이 소견 없었다 함. brain CT 촬영하고 옴)
(CPR시 epi 1*3mg , amiodarone 300mg)

형이 부정맥으로 3차례 시술을 받고 타병원에서 f/u 중이라 함.

ICD

Name:
Hospital Number:
Date of Birth:
Date of Operation: 11 Jan, 2013
Operator: Myung-Yong Lee, MD. PhD.

Preoperative diagnosis

Documented ventricular fibrillation with cardiac arrest
Successfully resuscitated cardiac arrest
Known HT on medication

Postoperative diagnosis

Documented ventricular fibrillation with cardiac arrest

OPD(27-Jul-2020)

■ 진료정보
2020-07-27 IC(CC07)

■ 활력징후
140/80 mmHg, 54/min, regular rhythm

■ 통증
구분: 환자, 통증: 없음.

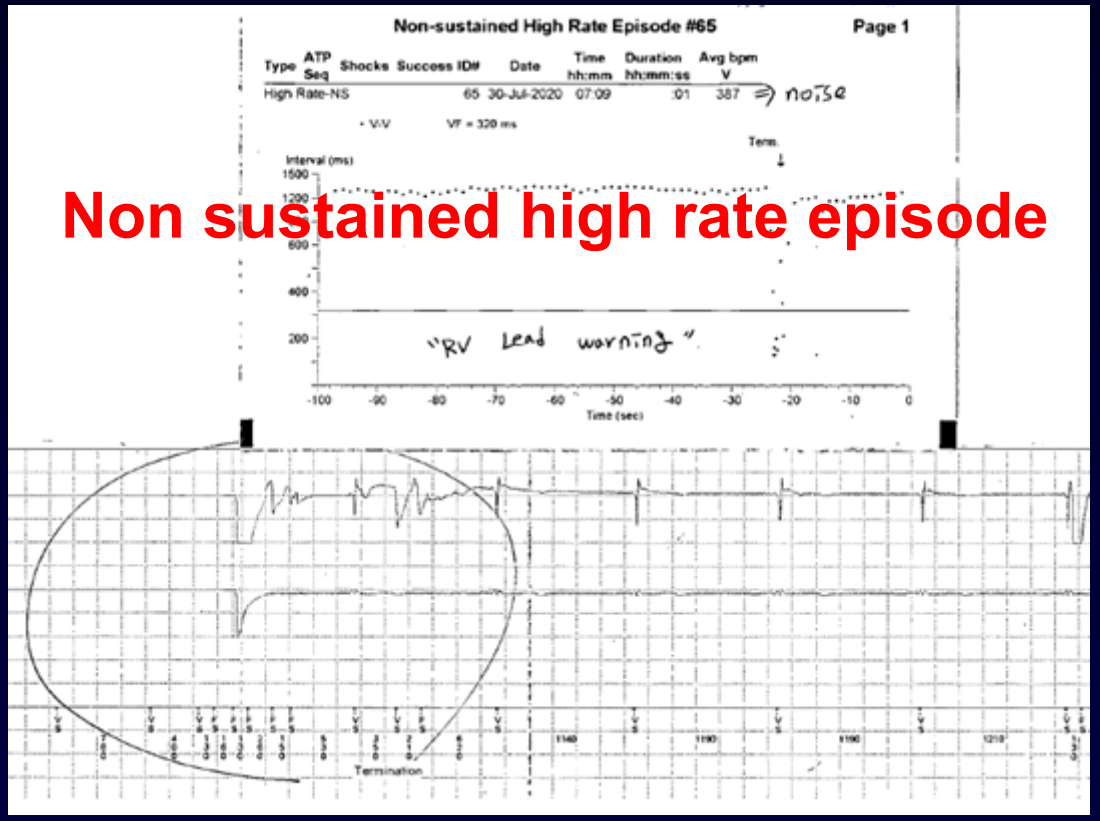
■ 주관적소견
ICD shock (-) 갑자기 ICD alarm 이 울렸다
RV lead impedence > 1,000 ohm

ICD alarm

■ 객관적소견
PMI: ?
Thrill (-) Heaving (-)
S1: OK
S2: OK
S3 (-)
S4 (-)
No definitive murmur

QRS duration: 120 msec QTc: 413 msec
ICD follow-up
Battery 2.81 Volt (years) RRT 2.63 Volt
Last full charge 11.2 sec
RV pacing 1.50 Volt - 9.1 mV - 475 --> 1,026 ohm, Recheck 532 ohm
SVC coil 66 ohm, RV coil 51 ohm
Vs 99.4%, Vp 0.6%
Shock (-)
VT episode (+) Non-sustained 3회, monitoring (+) 최대 1초

OPD(27-Jul-2020)



Non sustained high rate episode

Sensing polarity : Bipolar => tip to coil

Park, Seung-Ki 07108114
Device: Protecta XT VR D354VRM
Serial Number: PSH602960S

Date of Visit: 10-Aug-2020 15:13:51
SW009 Software Version 1.3 (4.1)
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Final: Session Summary Page 2

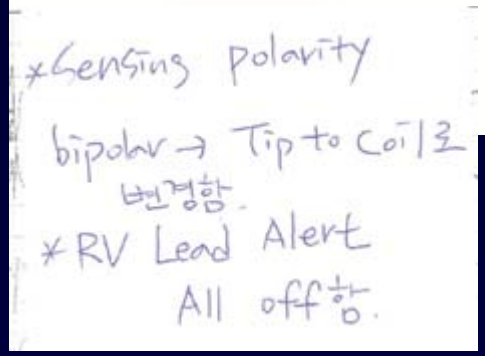
Parameter Summary

Mode	VVI	Lower Rate	40 bpm

Detection		Rates	Therapies
VF	On	>188 bpm	ATP During Charging, 20J, 35J x 5
FVT	OFF		All Rx Off
VT	OFF		All Rx Off

Enhancements On: VT Monitor, Wavelet, High Rate Timeout, TWave, Noise(Timeout)

Changes This Session	Session Start	Current Value
RV Sense Polarity	Bipolar	Tip to Coil



Park, Seung-Ki 07108114
Device: Protecta XT VR D354VRM
Serial Number: PSH602960S

Date of Visit: 10-Aug-2020 15:13
SW009 Software Version 1.3 (
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Final: Parameters Page

Pacing Summary

Mode		Rates	
Mode	VVI	Lower	40 bpm

Pacing Details	RV
Amplitude	3.00 V
Pulse Width	0.40 ms
Capture Management	Adaptive
Amplitude Margin	2.0 X
Min. Adapted Amplitude	2.00 V
Acute Phase Remaining	Off
Acute Phase Completed	11-May-2013
Sensitivity	[illegible]
Pace Polarity	Bipolar
Sense Polarity	Tip to Coil

Refractory/Blanking		Arrhythmia Interventions	
V. Blank Post VP	200 ms	V. Rate Stabilization	Off
V. Blank Post VS	120 ms		

OPD(10-Aug-2020)

■ 진료정보
2020－08－10　　IC(CC07)

■ 활력징후
123/80 mmHg 54/min, regular rhythm

1주일 만에 다시 ICD alarm

■ 통증
구분: 환자, 통증: 없음.

■ 주관적소견
1주일만에 다시 ICD에서 alarm이 울렸다.

■ 객관적소견
PMI: ?
Thrill (－) Heaving (－)
S1: OK
S2: OK
S3 (－)
S4 (－)
No definitive murmur

QRS duration: 116 msec QTc: 433 msec
Chest PA/lateral: Suspicious lead fracture (+)
ICD follow－up
Battery 2.79 Volt (years) RRT 2.63 Volt
Last full charge 11.2 sec
RV pacing 2.00 Volt － 8.1 mV － 535 －－> 1,045 ohm
SVC coil 67 ohm, RV coil 49 ohm
Vs 96.9%, Vp 3.1%
Shock (－)
VT episode (+) Non－sustained 71회, EGM은 모두 noise

Quick Look II Report　　Page 5

Pacing	(% of Time Since 27-Jul-2020)
VS	96.9 %
VP	3.1 %

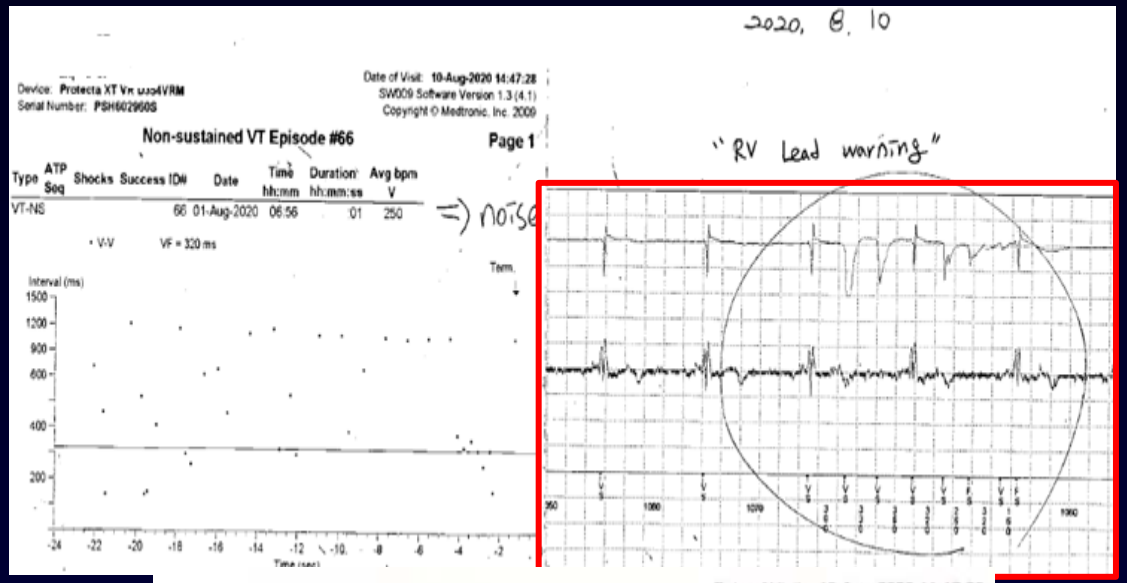
Alert RV lead integrity warning

OBSERVATIONS (2)

Alert: RV Lead Integrity warning on 04-Aug-2020 (2 or more criteria met). Review High Rate-NS episodes, Sensing Integrity Counter (Short V-V Intervals) and RV Lead Impedance. The oldest High Rate-NS episode associated with this observation is dated 30-Jul-2020.

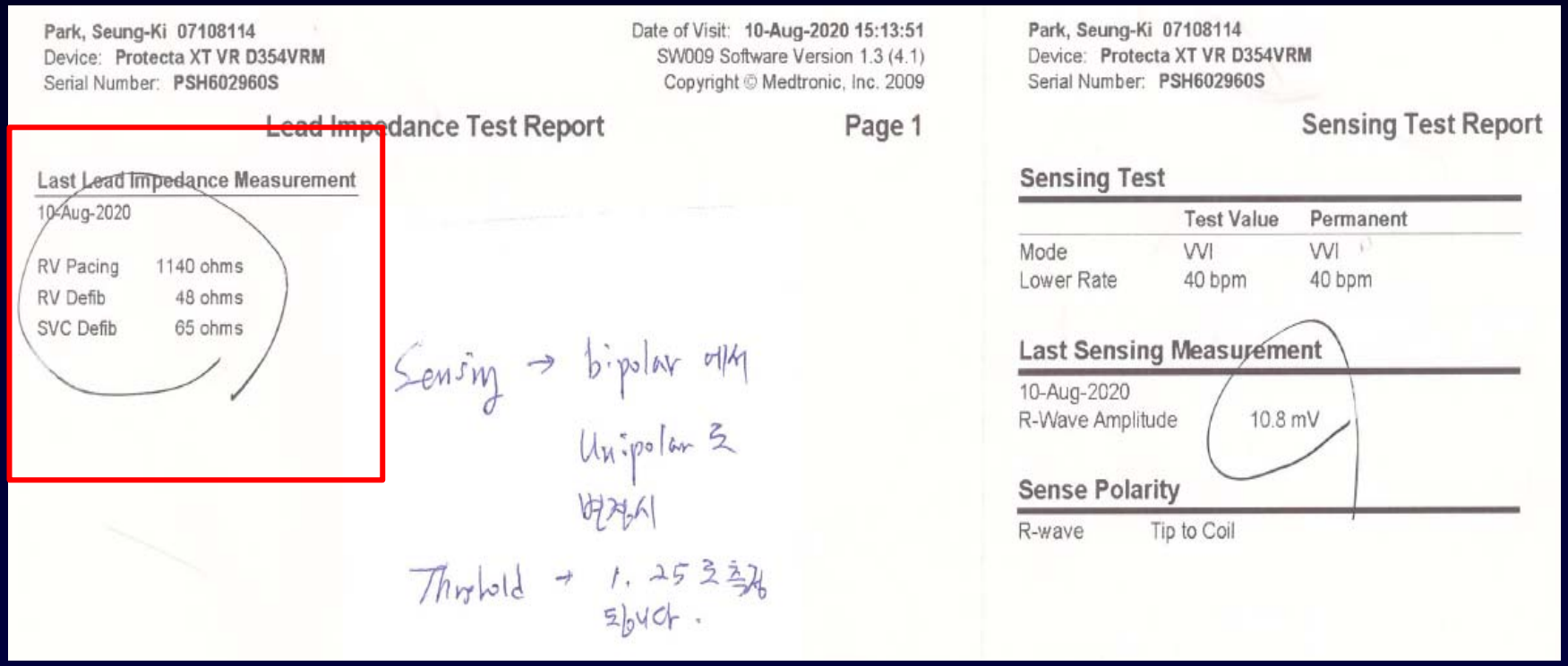
· RV Capture Management: Actual safety margin (2.4 X) > programmed margin (2.0 X).

10-Aug-2020, lead warning



High rate episode 71

lead impedance(10-aug-2020)



Park, Seung-Ki 07108114
Device: Protecta XT VR D354VRM
Serial Number: PSH602960S

Date of Visit: 10-Aug-2020 15:13:51
SW009 Software Version 1.3 (4.1)
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Lead Impedance Test Report

Page 1

Last Lead Impedance Measurement
10-Aug-2020

RV Pacing	1140 ohms
RV Defib	48 ohms
SVC Defib	65 ohms

Sensing → bipolar 에서
Unipolar 로
변경시
Threshold → 1.25 로측정
되었다.

Park, Seung-Ki 07108114
Device: Protecta XT VR D354VRM
Serial Number: PSH602960S

Sensing Test Report

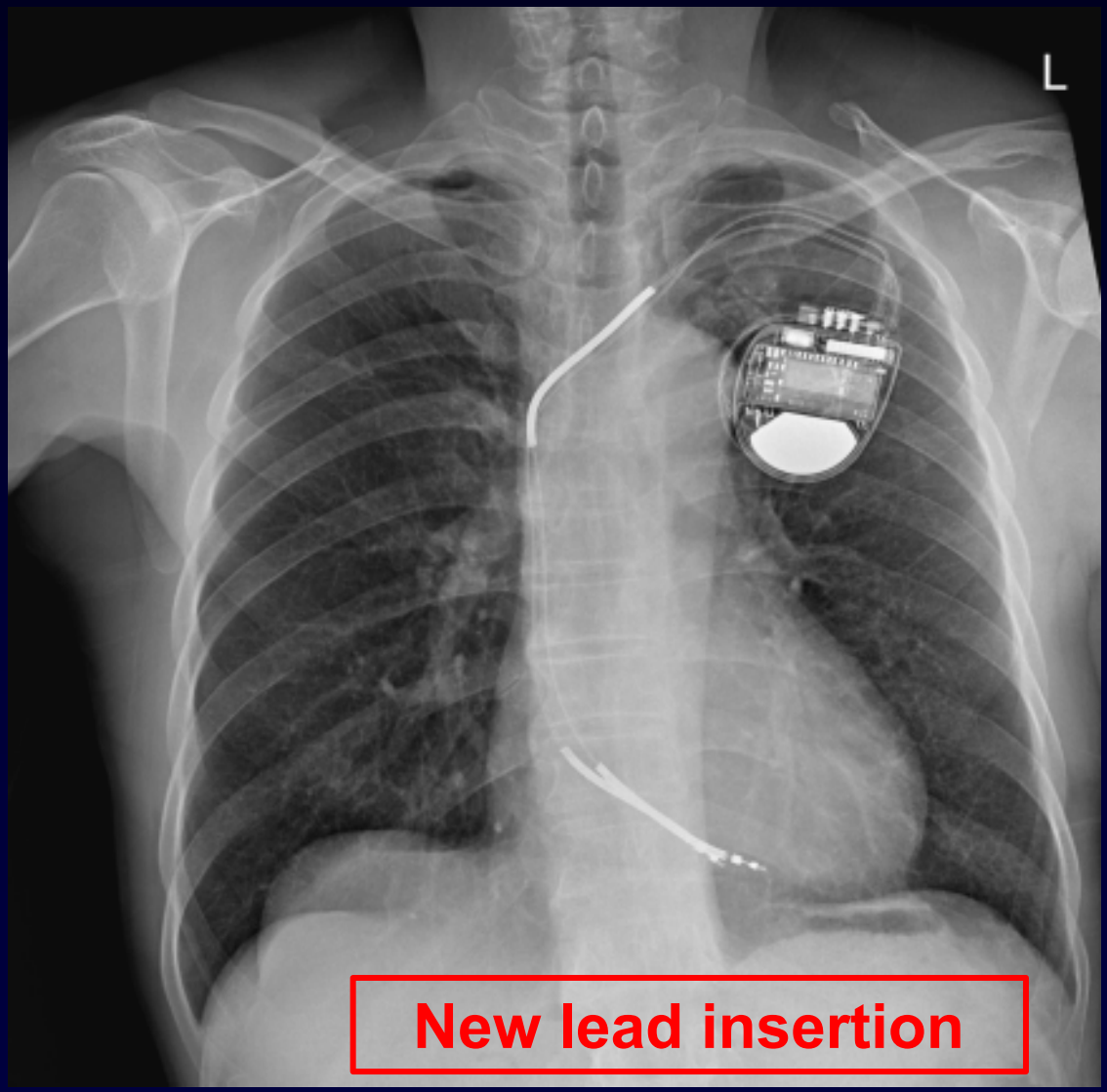
Sensing Test

	Test Value	Permanent
Mode	VVI	VVI
Lower Rate	40 bpm	40 bpm

Last Sensing Measurement
10-Aug-2020
R-Wave Amplitude 10.8 mV

Sense Polarity
R-wave Tip to Coil

04-Sep-2020



OPD (26-Oct-2020)

■ 진료정보
2021-04-20 IC(CC07)

■ 활력징후
혈압 124/71 mmHg 맥박57회/min

■ 통증
구분: 환자, 통증: 없음.

■ 주관적소견
ICD shock (-)

■ 객관적소견
PMI: ?
Thrill (-) Heaving (-)
S1: OK
S2: OK
S3 (-)
S4 (-)
No definitive murmur

QRS duration: 114 msec QTc: 432 msec
Sinus

ICD follow-up
Battery 3.08 Volt (11.1 years) RRT 2.73 Volt
Last full charge 3.9 sec
RV pacing 0.75 Volt - 18.5 mV - 399ohm, RV coil 55 ohm
Vs 99.6%, Vp 0.4%
Shock (-)
VT episode (+) VT 5회, Non-sustained 2회, EGM은 대부분 sinus tachycardia with PVCs. 간혹 T wave oversensing

등록번호 :	
성 명 :	
성별/나이:	
생년월일 :	

심실제세동기 추적 검사 결과지

시술일(Implant date): 09/03/2020 Current F/U date: 10/26/2020 Last F/U date:

1. Device Information

	Model	S/N
Device	Medtronic Visia AF MRI XT VR DVFB2D4	PLX614789S
A-Lead		
RV-Lead	Medtronic 6935M Sprint Quattr...	TDL172194G
LV-Lead		

2. Battery voltage: 3.15 V **Last Full charge:** 2.1 sec

3. Defibillation impedance: RV coil 49Ω SVC coil noneΩ

	A	RV	LV
4.Pacing impe	Ω	361Ω	Ω
5.Threshold/Pulse width	V at ms	0.625V at 0.40ms	V at ms
6.Amplitude/Pulse width	V at ms	3.50V at 0.40ms	V at ms
7.Measured P/R wave	mV	16.9mV	
8.Sensitivity	mV	0.30mV	

9.Parameter summary			**10.Detection**	**Rates**	**Therapies**
9-1.Mode	VVI		**AT/AF** Monitor		ATP
9-2.Mode switch	On Off		**VF** On	>200 bpm	
9-3.Lower/Upper/Sensor rate	40 PPM		**FVT** OFF		
9-4.AV delay	Paced ms	Paced ms	**VT** OFF		
9-5.Pacing(% of total)	AS-VS VS 99.0%	AP-VS %			
	AS-VP VP 1.0%	AP-VP %			

11. Episode:

12. Comment:
Regular ICD follow up.

No episode, No alert

Trouble shooting

TROUBLESHOOTING

* High threshold - Exit block
* Loss of ventricular capture by visible pacemaker stimuli
* Missing stimuli during VVI pacing
* Lead insulation defect
* Lead fracture
* Analysis of lead problems
* Lead fracture - Conversion from bipolar to unipolar
* Subclavian crush syndrome
* Twiddler's syndrome
* Diaphragmatic stimulation
* Muscle stimulation
* Runaway pacemaker

Trouble shooting

1. Define problem
2. Possible causes
3. Correct the problem
4. Verify solution

THANK YOU FOR YOUR ATTENTION