

Non-invasive study for arrhythmia patients

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Symptom

“두근거린다”

“목 혹은 가슴이 짹 메인다”

“맥이 건너 뛴다”

“호흡곤란”

“어지럽다”

Non-invasive study

12 Channel ECG(파형분석, 부정맥 감별)

심전도 파형 생성의 원리와 정상 심전도

Holter ECG(일과성 부정맥 진단)

홀터 분석시 주의 할점

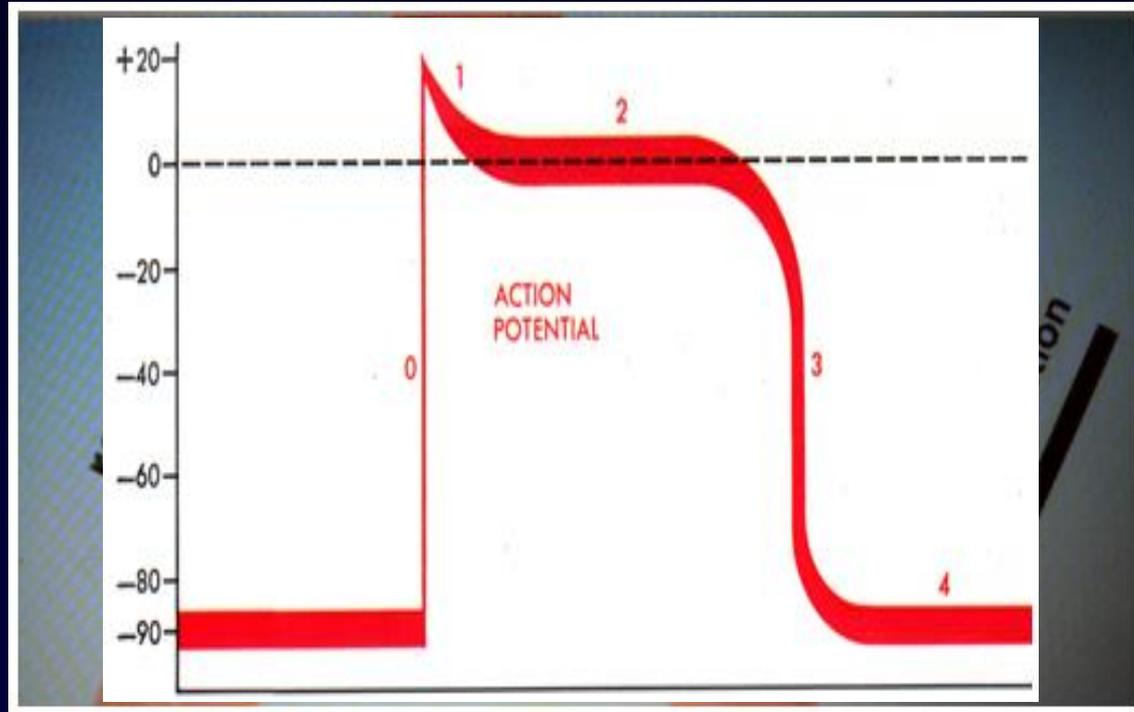
Exercise ECG(운동 유발성 부정맥 진단)

운동부하 검사시 부정맥이 유발된 case

12 Channel ECG

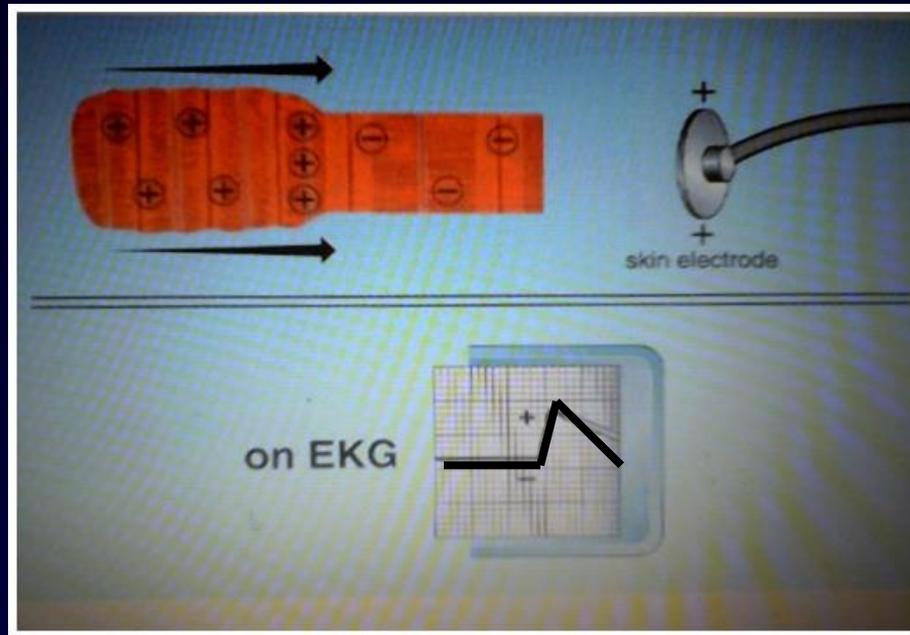


Depolarization



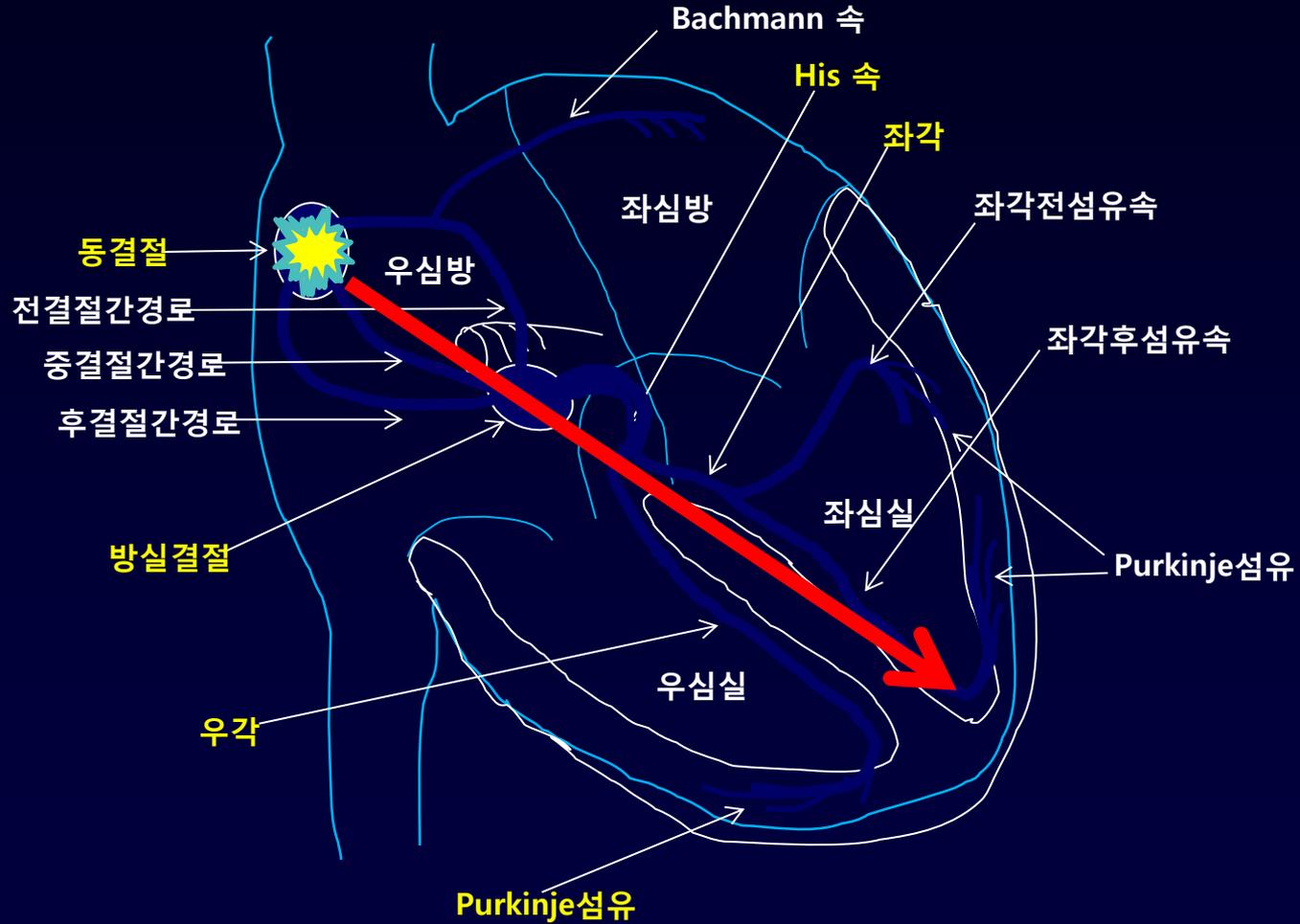
세포가 자극을 받으면 양이온이 세포안으로 들어가면서 수축을 하게된다.

심전도의 원리

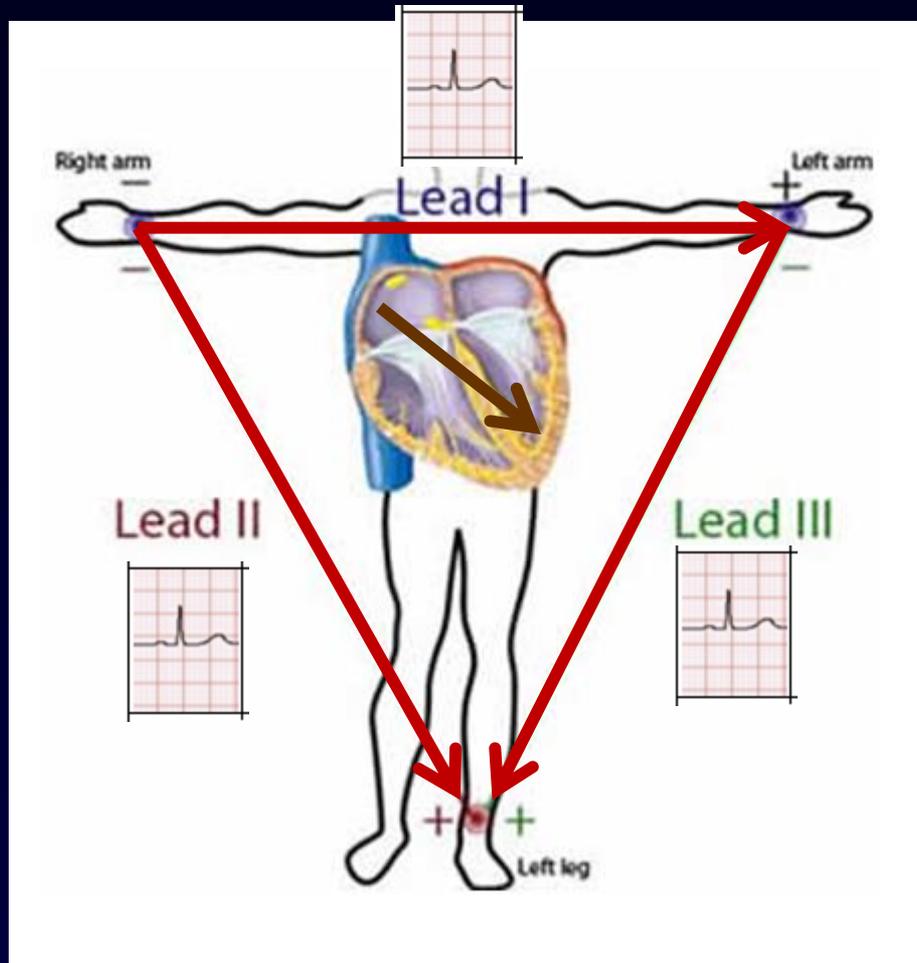


전기가(탈분극이) + 전극을 향해 올때 심전도에는 상향 파가 그려진다.

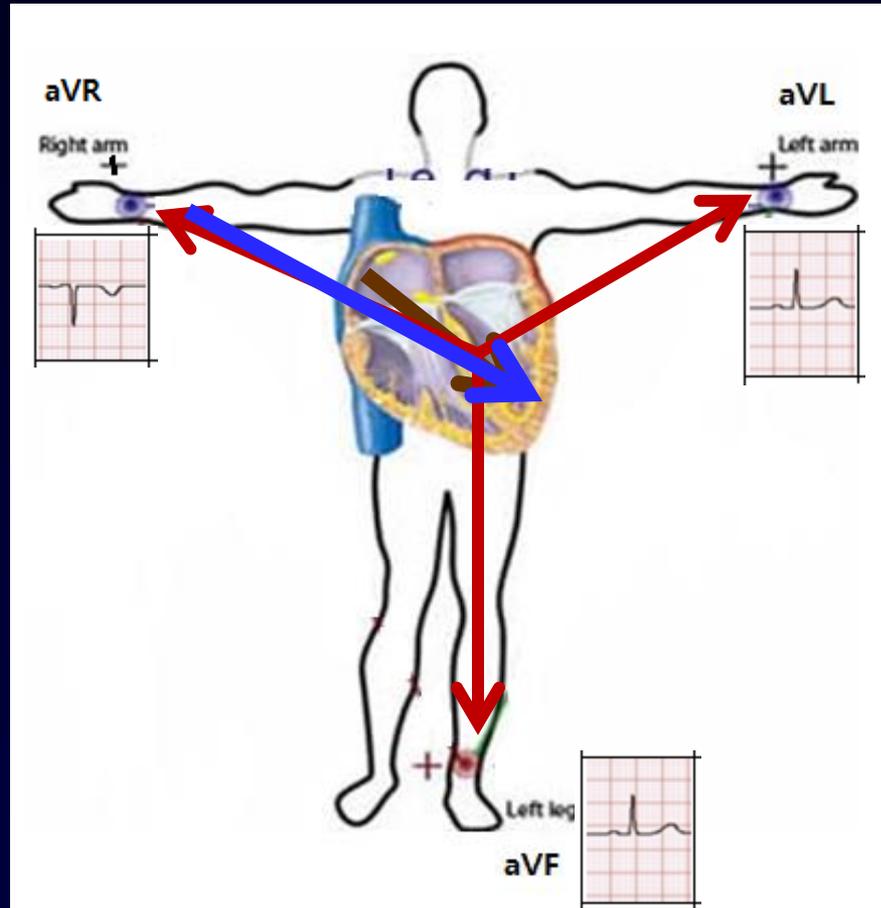
Conduction system



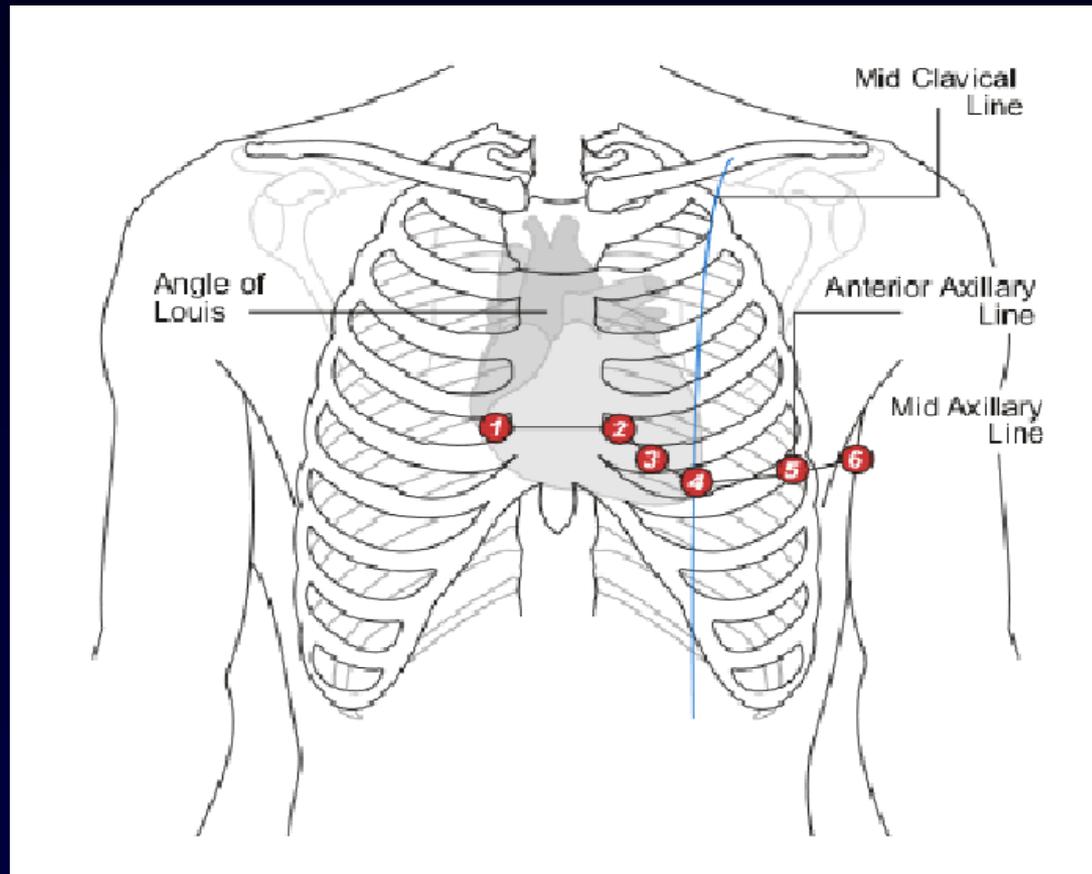
Standard lead



Extremity lead

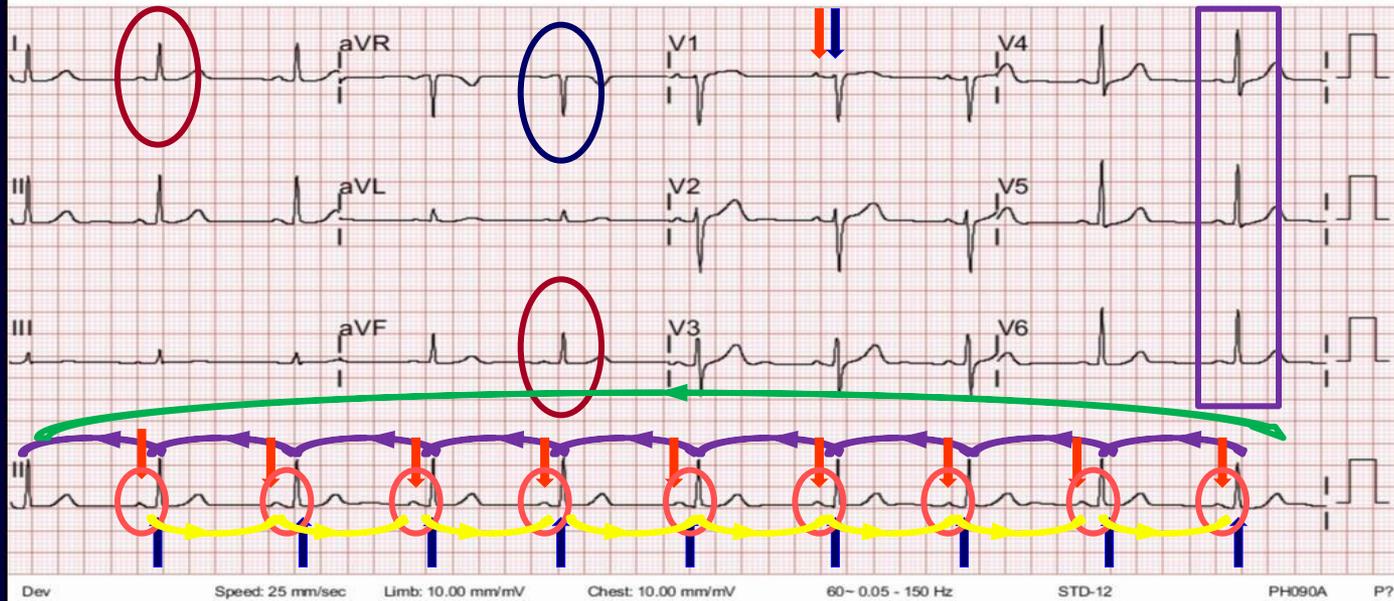


Chest lead



Normal sinus rhythm

- | | | |
|---------|-----------------------------------|---|
| Rate 58 | 1) HR 60~100회(II의 QRS갯수x6=1분간 HR) | 5) PR interval 0.12~0.20 sec |
| PR 168 | 2) Regular Rhythm(R-R, P-P) | 6) Axis 는I, aVF 가 둘다 상향 aVR 은 하향, V4~V6 상향 |
| QRSd 86 | 3) 동일한 P wave (2.5mm, 0.12 sec) | 7) PR relation 은 1:1 관계 |
| QT 428 | 4) Narrow QRS 0.06~0.10 sec | |
| QTc 421 | | |
| Axes | | |
| P 35 | | |
| QRS 38 | | |
| T 35 | | |



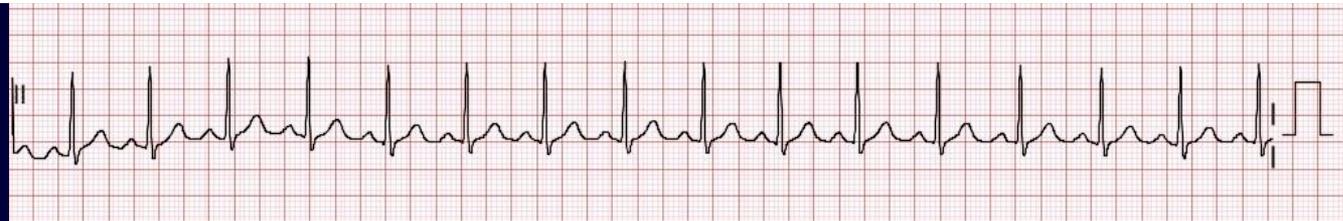
Rate 95
PR 188
QRSd 98
QT 380
QTc 478

Axes
P 69
QRS 57
T 60

“가슴이 덜컹 내려앉는다”

Unconfirmed Diagnosis

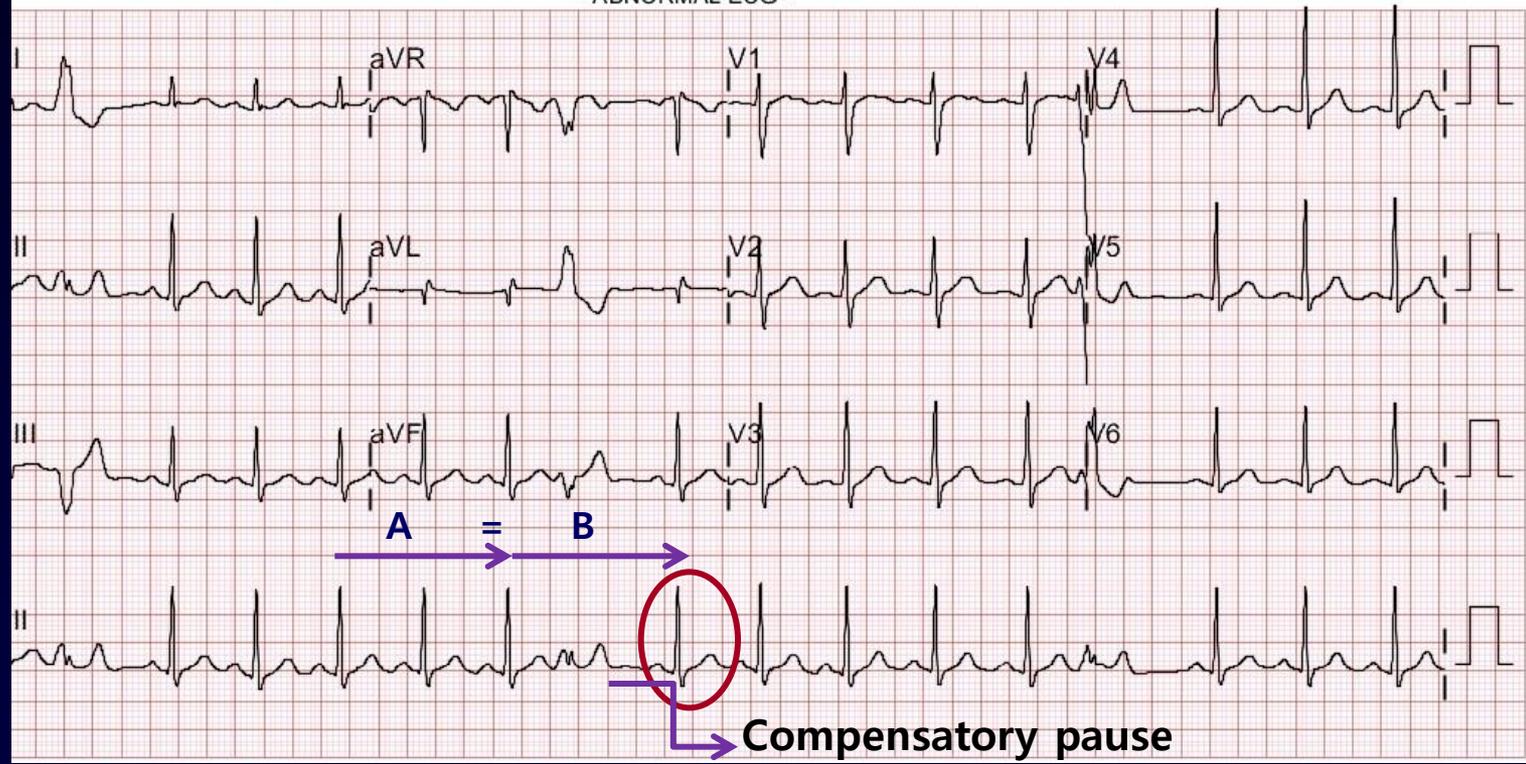
- BORDERLINE ECG -



| | |
|------|-----|
| Rate | 100 |
| PR | 180 |
| QRSd | 96 |
| QT | 368 |
| QTc | 475 |
| Axes | |
| P | 66 |
| QRS | 57 |
| T | 62 |

“가슴이 덜컹 내려앉는다”

- ABNORMAL ECG -

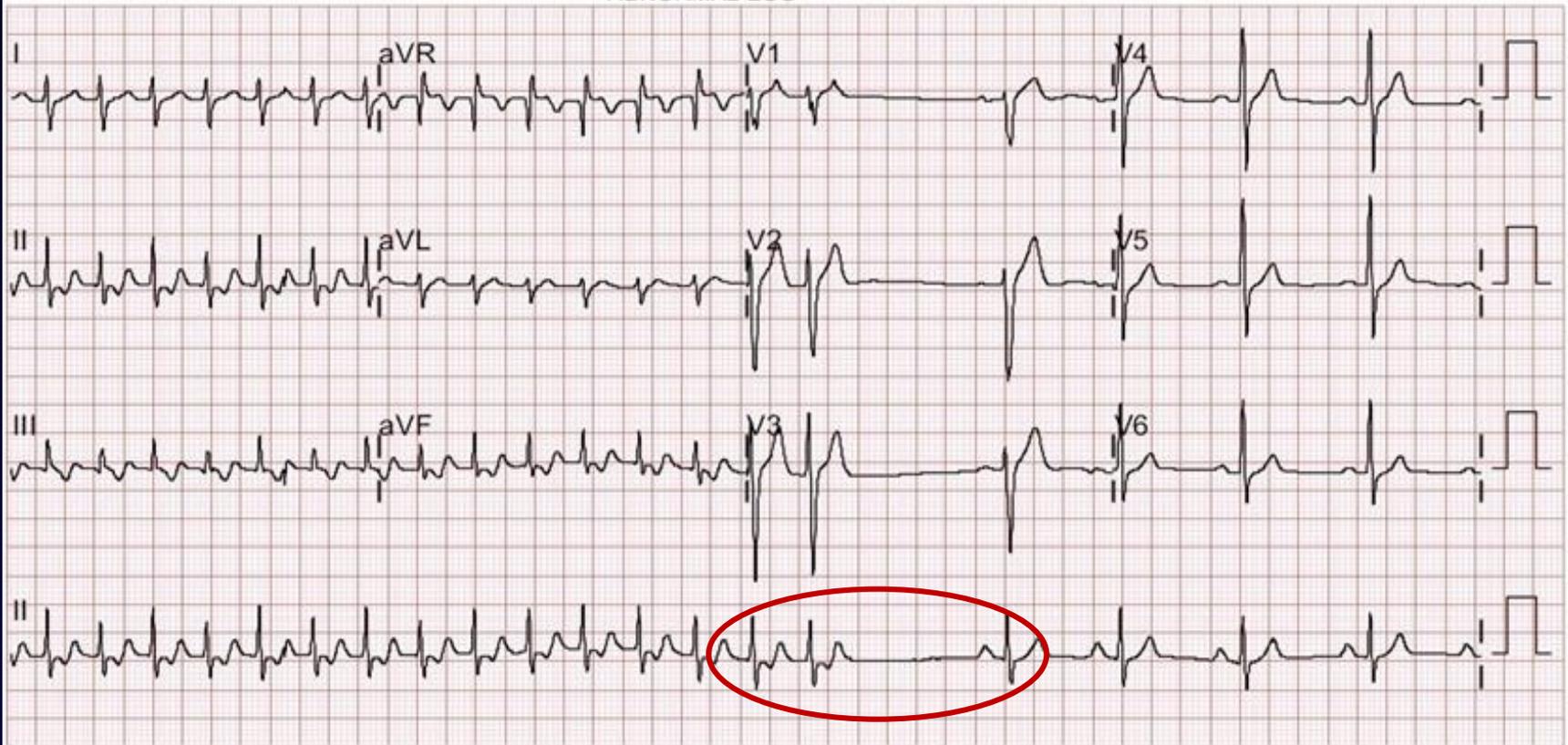


Data 434
Rate 140
PR 177
QRSd 100
QT 328
QTc 501

Axes
P 71
QRS 102
T 63

Unconfirmed Diagnosis

- ABNORMAL ECG -



Dev Speed: 25 mm/sec Limb: 10.00 mm/mV Chest: 10.00 mm/mV 60~0.05 - 150 Hz STD-12 PH090A P?

12 Channel ECG

증상이 있을때 심전도 검사는 부정맥 진단에 결정적
역할을 하므로 아직도 매우 중요한 비관혈적 검사이므로
검사자는 이상소견을 인지하면서 검사하여야 합니다.

Holter ECG





•In 1964, he became a full professor at the University of California in San Diego, coordinating activities at the Institute of Geophysics and Planetary Physics. In 1979, the Association for the Advancement of Medical Instrumentation (AAMI) awarded Holter with the AAMI Foundation Laufman-Greatbatch Prize for his contributions to medical technology.

•Starting in radio telemetry and research towards EEG, he later switched to the ECG recording, working together with Joseph A Gengerelli

**NORMAN JEFFERIS "JEFF" HOLTER
(FEBRUARY 1, 1914 – JULY 21, 1983)**

APC



Non-conducted APC



VPC



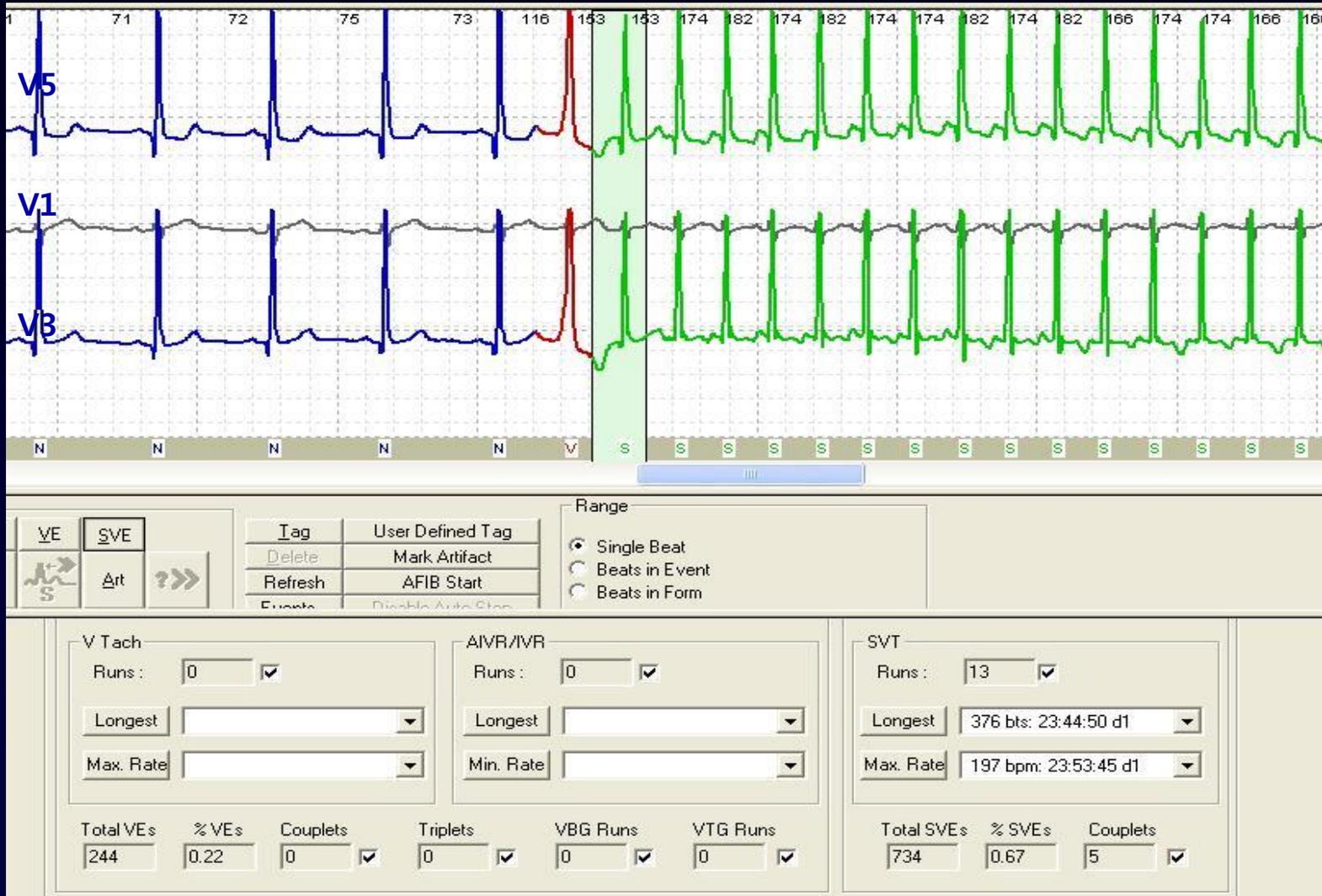
Premature beats(APC, VPC)

홀터 검사는 Premature beat 을 정량화 할 수 있다.

빈도나 양상이 심정지 위험을 높이지 않는다.

일시적인 경우가 많아 증상과의 관계를 연관지어 보는
것이 중요하다.

PSVT





Ventricular Events

V Tach

Runs : 0

Longest

Max. Rate

AIVR/IVR

Runs : 0

Longest

Min. Rate

Total VEs

245

% VEs

0.22

Couplets

0

Triplets

0

VBG Runs

0

VTG Runs

0

Supra Ventricular Events

SVT

Runs : 13

Longest 376 bts: 23:44:50 d1

Max. Rate 197 bpm: 23:53:45 d1

Total SVEs

735

% SVEs

0.67

Couplets

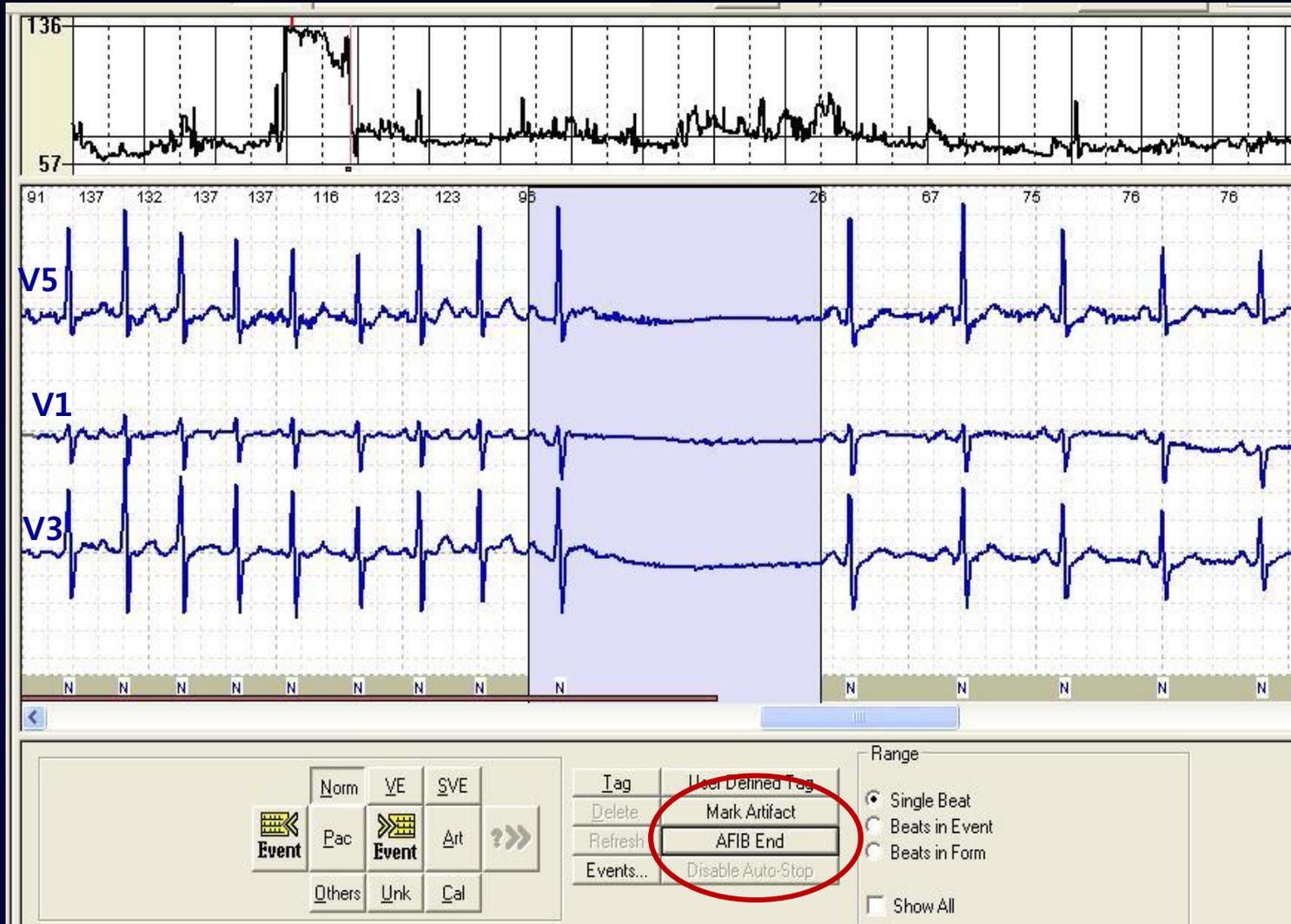
5

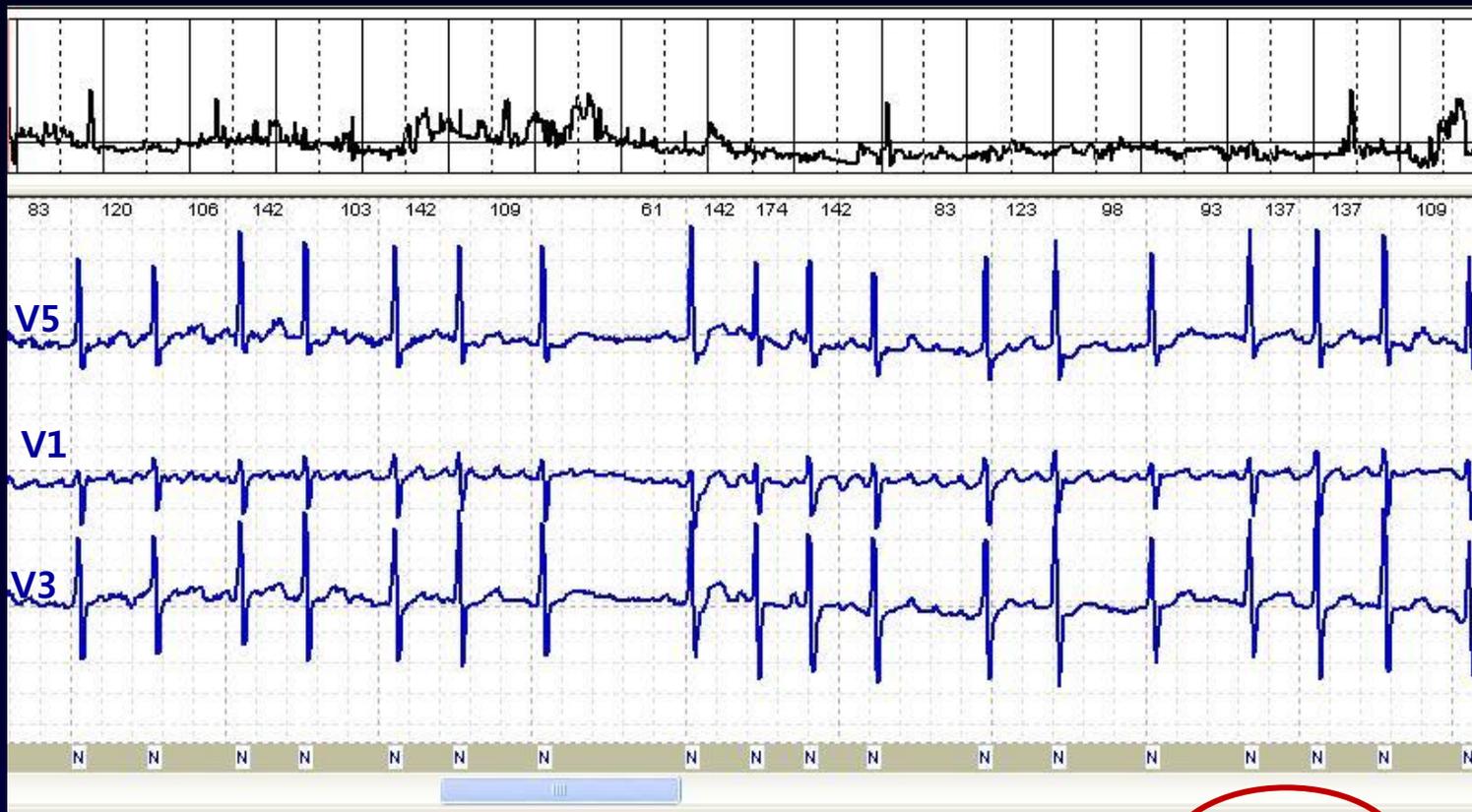
Atrial tachycardia



Paroxysmal A fib







The first maximum heart rate

Percent AFIB

Summary

| | | | | | | | | | | |
|------------|---------------|-----------------|-----------|----------------|--------|--------------|---|---------------|-----------------------|-----------------------|
| Patient: | HONG JONG SIK | Hours Analyzed: | 23:49:49 | Total Beats: | 105782 | Other Beats: | 0 | RR Intervals: | Max | 2.00 sec: 10:39:03 d1 |
| Report ID: | 8A931C7DE0F31 | Record Date: | 3/27/2014 | Unknown Beats: | 12 | | | Min | 0.31 sec: 18:21:53 d1 | |

Summary Report

| | | |
|---------------------------------|-------------------------------|----------------------|
| Report Number : 8A931C7DE0F312E | Start Time : 8:58:00 AM | Total Beats : 105782 |
| Test Date : 3/27/2014 | Hours Analyzed : 23 : 49 : 49 | Unknown Beats : 12 |
| Report Date : 3/28/2014 | Artifact : 0 : 01 : 08 | Other Beats : 0 |
| | | Percent AFIB : 4 |

| | |
|-----------------------------|----------------------------------|
| Heart Rates | Rate Dependent Events |
| Min : 52 BPM at 09:24:30-1 | Bradycardia Runs : 0 |
| Max : 137 BPM at 11:55:50-1 | Longest : 0 beats at |
| Avg : 74 BPM | Min rate : 0 BPM at |
| | Pauses : 1 |
| | Longest : 2.3 secs at 12:52:35-1 |

| | | | | | | | |
|---------------------------|-------------------------|---------------|-----|--------------------------------|-------------------------|----------|-----|
| Ventricular Events | | | | Supraventricular Events | | | |
| Total Beats | : 1 | Couplets | : 0 | Total Beats | : 9 | Couplets | : 0 |
| % Beats | : 0.00 | Triplets | : 0 | % Beats | : 0.01 | | |
| Forms | : 1 | Bigeminy Runs | : 0 | | | | |
| AIVR/IVR Runs | : 0 | | | | | | |
| Longest | : 0 beats at | | | SVTach Runs | : 0 | | |
| Min Rate | : 0 BPM | | | Longest | : 0 beats at | | |
| V Tach Runs | : 0 | | | Max Rate | : 0 BPM at | | |
| Longest | : 0 beats at | | | Max SVE/Minute | : 3 beats at 18:02:00-1 | | |
| Max VE/Minute | : 1 beats at 11:48:00-1 | | | Max SVE/Hour | : 3 beats 18:00:00-1 | | |
| Max VE/Hour | : 1 beats 11:00:00-1 | | | Mean SVE/Hour | : 0.4 | | |
| Mean VE/Hour | : 0.0 | | | SVE/1000 | : 0.1 | | |
| VE/1000 | : 0.0 | | | | | | |

Impressions and Findings

1. Rhythm analysis revealed paroxysmal atrial fibrillation. (percent A fib 4%).
2. There were 2 episode of patient's markers (palpitation) correlated with Paroxysmal A fib.

Atrial fibrillation



Summary Report

| | | | | | |
|---------------|-------------------|----------------|----------------|---------------|----------|
| Report Number | : 8A94157DC0F211D | Start Time | : 5:17:00 PM | Total Beats | : 102108 |
| Test Date | : 4/19/2012 | Hours Analyzed | : 23 : 50 : 51 | Unknown Beats | : 0 |
| Report Date | : 4/23/2012 | Artifact | : 0 : 02 : 44 | Other Beats | : 0 |
| | | | | Percent AFIB | : 100 |

Heart Rates

| | | | | | |
|-----|------------------------|------------------|------|--------|------|
| Min | : 46 BPM at 01:21:40-2 | Bradycardia Runs | : 81 | Pauses | : 0 |
| Max | | | | | secs |
| Avg | | | | | |

Rate Dependent Events

증상이 있는 환자에서 Rate control

- Resting : HR 70~90 BPM

- Mild exertion : less than 110BPM

Most of the rhythm was atrial fibrillation with **controlled** ventricular response. (average HR 71 BPM).

Most of the rhythm was atrial fibrillation with **slow** ventricular response. (average HR less than 60 BPM).

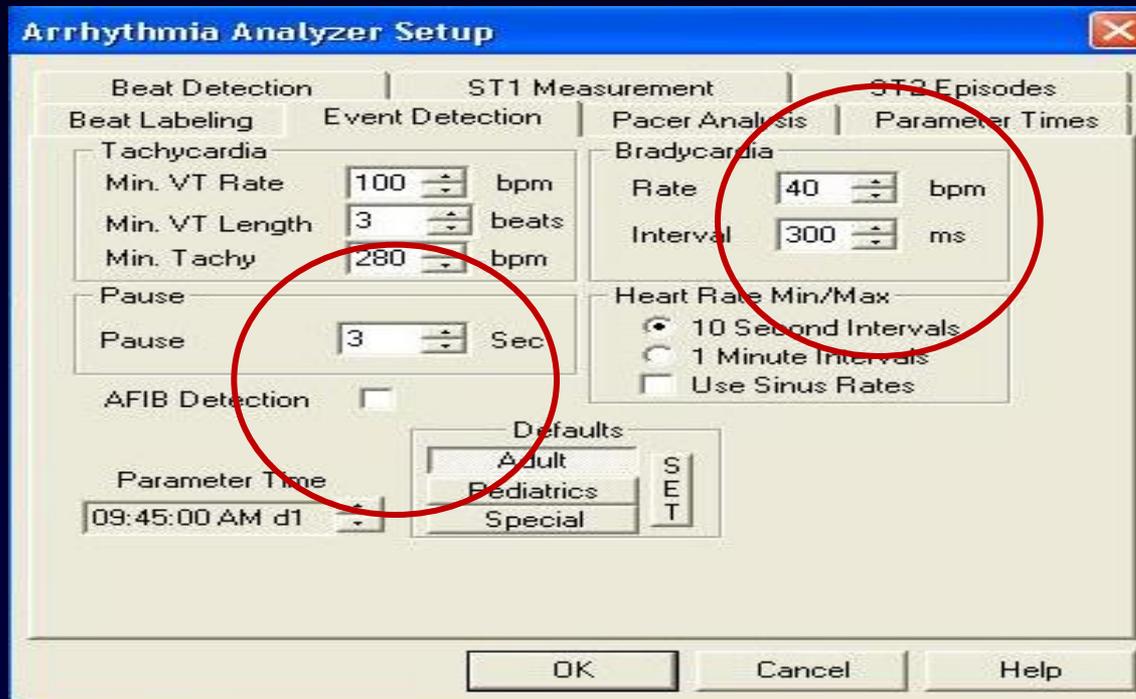
Most of the rhythm was atrial fibrillation with **rapid** ventricular response. (average HR more than 100 BPM).

Tachycardia(PSVT, AT, A fib)

Atrial fibrillation , Atrial tachycardia 같은 빈맥의 특성 분석에
홀터의 중요성이 커지고 있다.

영구적 심방세동 환자에서 약물 치료로 rate control 하는 환자들
의 HR 분석에 도움을 줄 수 있다.

Bradycardia(sss, block)



Indication(C-AV block):

Class I : 무증상의 각성상태에서 심정지기간이 3초이상, 이탈박동이 40회 미만인경우

Sinus bradycardia



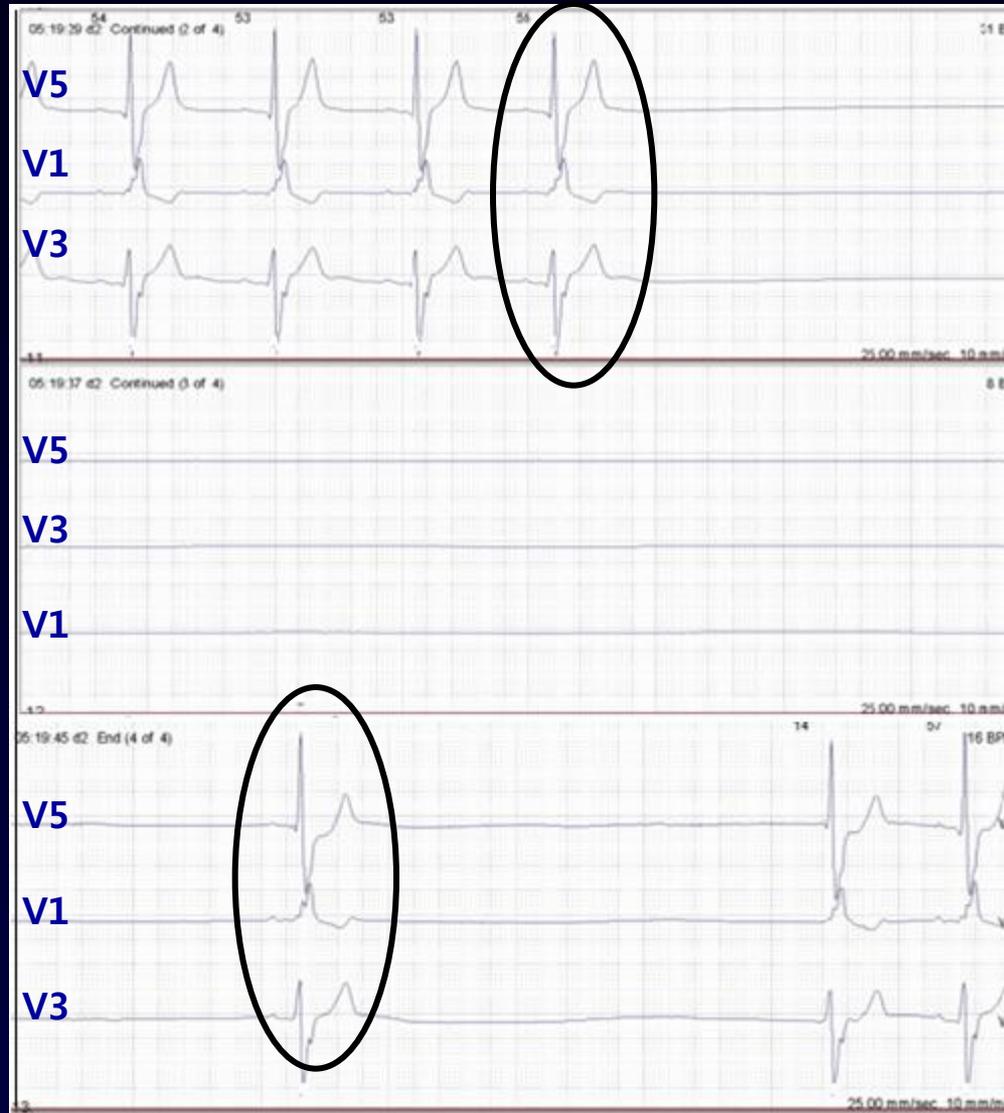
| Summary Report | | | | | |
|--------------------|-------------------------|-----------------------|---------------------------|----------------|--------------------------|
| Report Number | : 8A91127DC110637 | Start Time | : 11:35:00 AM | Total Beats | : 77344 |
| Test Date | : 1/17/2012 | Hours Analyzed | : 21 : 28 : 55 | Unknown Beats | : 0 |
| Report Date | : 1/18/2012 | Artifact | : 0 : 02 : 00 | Other Beats | : 0 |
| | | | | Percent AFIB | : 0 |
| Heart Rates | | Rate Dependent Events | | | |
| Min | : 35 BPM at 13:04:20-1 | Bradycardia Runs | : 323 | Pauses | : 39 |
| Max | : 92 BPM at 17:53:20-1 | Longest | : 730 beats at 07:03:17-2 | Longest | : 2.5 secs |
| Avg | : 60 BPM | Min rate | : 27 BPM at 13:04:35-1 | | at 11:54:51-1 |
| Ventricular Events | | | Supraventricular Events | | |
| Total Beats | : 10 | Couplets | : 0 | Total Beats | : 345 |
| % Beats | : 0.01 | Triplets | : 0 | % Beats | : 0.45 |
| Forms | : 2 | Bigeminy Runs | : 0 | | |
| AJVR/IVR Runs | : 0 | | | | |
| Longest | : 0 beats at | | | | |
| Min Rate | : 0 BPM | | | | |
| V Tach Runs | : 0 | | | SVTach Runs | : 6 |
| Longest | : 0 beats at | | | Longest | : 11 beats at 08:59:10-2 |
| Max Rate | : 0 BPM | | | Max Rate | : 122 BPM at 16:57:26-1 |
| Max VE/Minute | : 1 beats at 11:58:00-1 | | | Max SVE/Minute | : 14 beats at 17:52:00-1 |

1. Symptomatic bradycardia with min HR was 35BPM while awake.
2. The patient's markers (dizziness) were correlated with sinus bradycardia.

Conc> Symptomatic sick sinus syndrome.

Sinus pause





| Summary Report | | | |
|---------------------------------------|-----------------------------------|--|---------------|
| Report Number : 8A9C067DB161A1D | Start Time : 2:28:00 PM | Total Beats : 101576 | |
| Test Date : 12/5/2011 | Hours Analyzed : 23 : 55 : 24 | Unknown Beats : 0 | |
| Report Date : 12/6/2011 | Artifact : 0 : 00 : 31 | Other Beats : 0 | |
| | | Percent AFIB : 0 | |
| Heart Rates | | Rate Dependent Events | |
| Min : 23 BPM at 06:12:20-2 | Bradycardia Runs : 121 | Pauses : 14 | |
| Max : 111 BPM at 16:56:40-1 | Longest : 266 beats at 16:50:10-1 | Longest : 21.9 secs | |
| Avg : 70 BPM | Min rate : 6 BPM at 02:38:38-2 | | |
| Ventricular Events | | Supraventricular Events | |
| Total Beats : 16 | Couplets : 0 | Total Beats : 4550 | Couplets : 92 |
| % Beats : 0.02 | Triplets : 0 | % Beats : 4.48 | |
| Forms : 2 | Bigeminy Runs : 0 | | |
| A/VR/IVR Runs : 0 | | | |
| Longest : 0 beats at | | | |
| Min Rate : 0 BPM | | | |
| V Tach Runs : 0 | | SVTach Runs : 163 | |
| Longest : 0 beats at | | Longest : 1345 beats at 23:06:51-1 | |
| Max Rate : 0 BPM | | Max Rate : 111 BPM at 16:56:01-1 | |
| Max VE/Minute : 3 beats at 13:17:00-2 | | Max SVE/Minute : 110 beats at 16:59:00-1 | |
| Max VE/Hour : 9 beats 13:00:00-2 | | Max SVE/Hour : 1112 beats 17:00:00-1 | |
| Mean VE/Hour : 0.7 | | Mean SVE/Hour : 197.8 | |
| VE/1000 : 0.2 | | SVE/1000 : 44.8 | |

1. There were 14 episode of pause more than 3.0 sec, longest pause 21.9 sec.
2. The patient's markers(dizziness, chest tightness) were correlated with sinus pause.

Conc> Symptomatic sick sinus syndrome.

Sick sinus syndrome

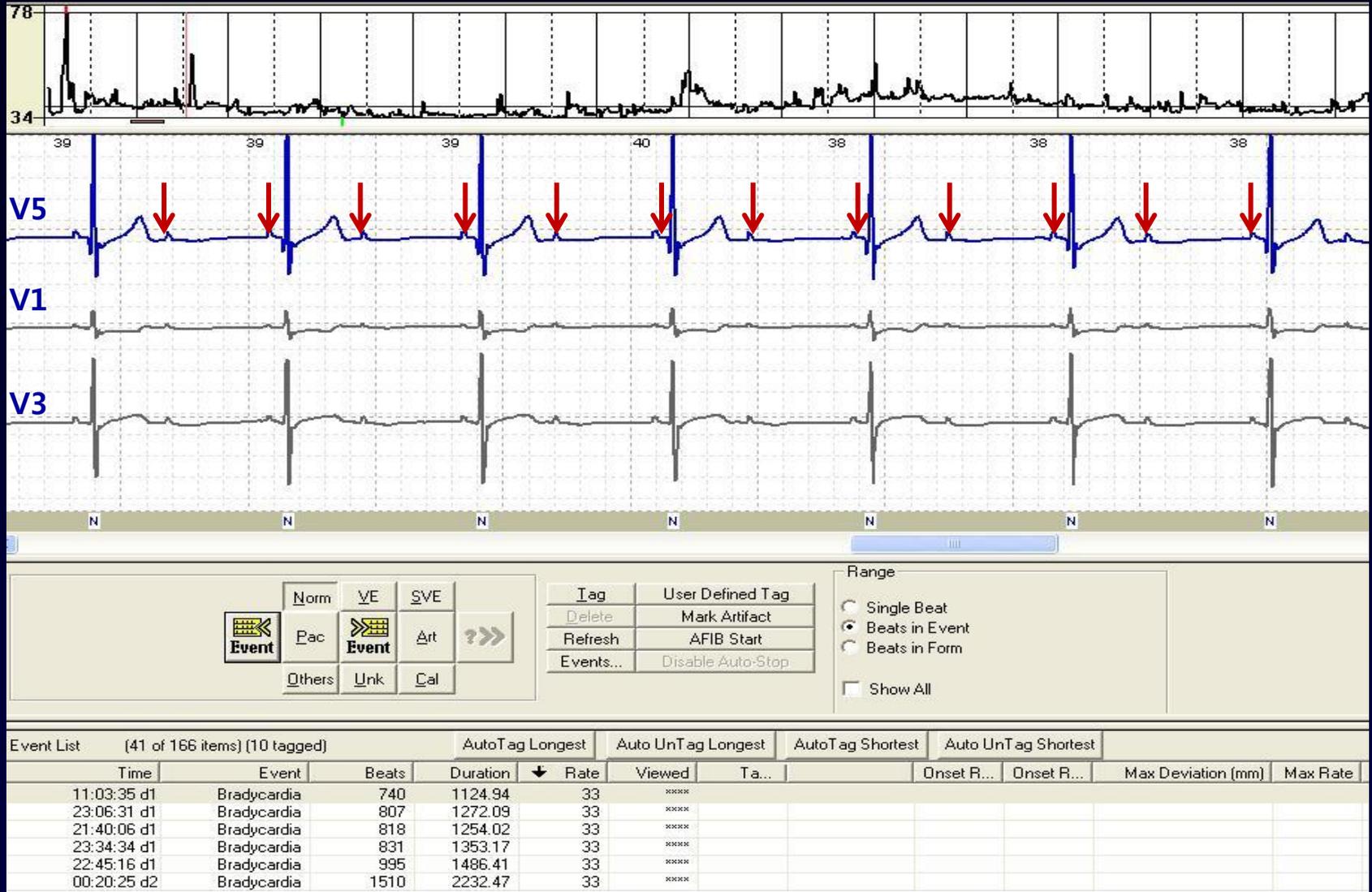
수면 중 분당 35~40회의 sinus bradycardia, 3초 전 후의 pause
등이 있는 경우 반드시 이상을 의미하지는 않는다.

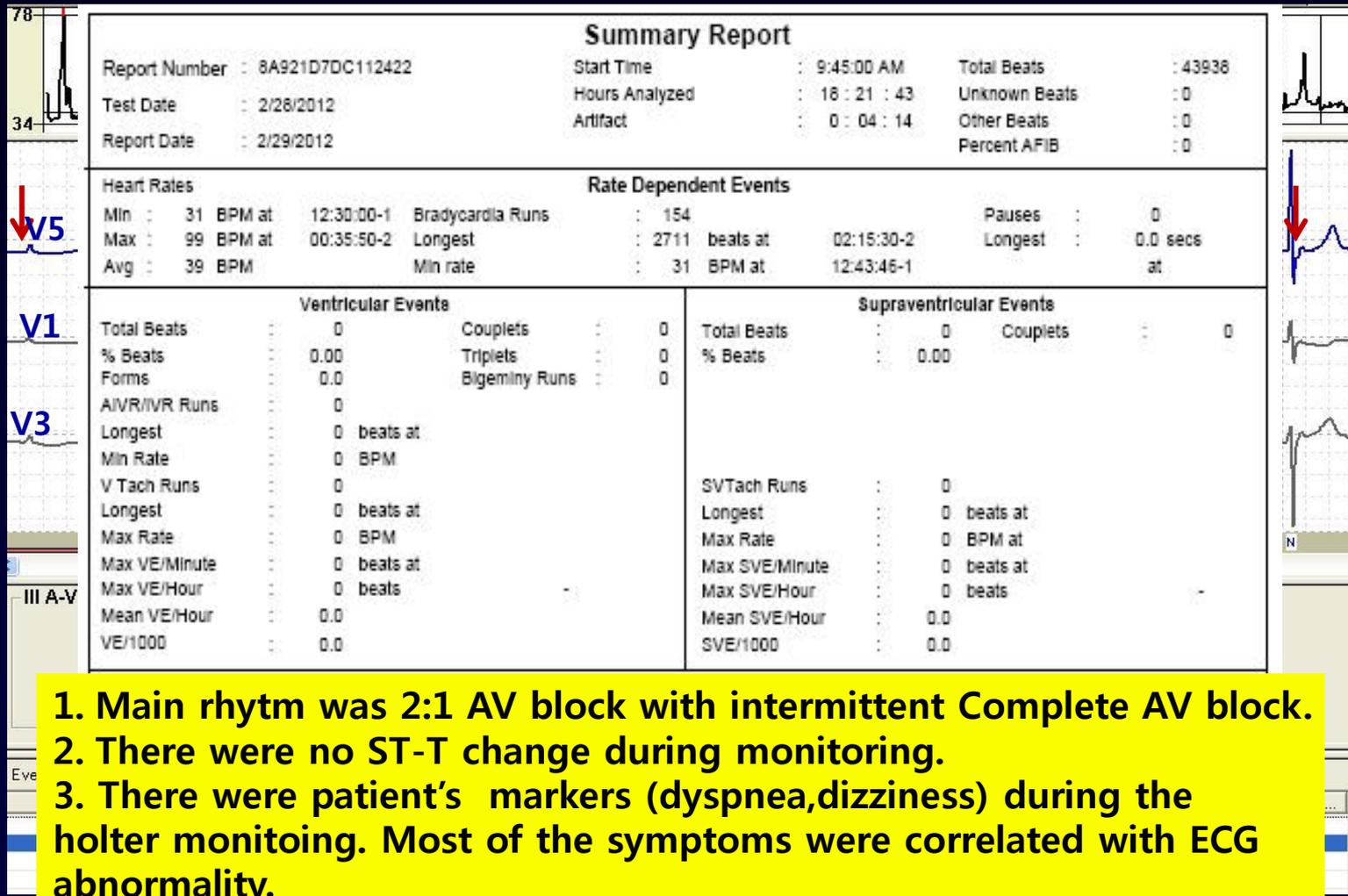
증상과 연관이 있을 경우만이 심박동기 치료술의 대상이 된다.

Second degree AV block



2:1 AV block





Summary Report

| | | |
|---------------------------------|-------------------------------|---------------------|
| Report Number : 8A921D7DC112422 | Start Time : 9:45:00 AM | Total Beats : 43936 |
| Test Date : 2/26/2012 | Hours Analyzed : 18 : 21 : 43 | Unknown Beats : 0 |
| Report Date : 2/29/2012 | Artifact : 0 : 04 : 14 | Other Beats : 0 |
| | | Percent AFIB : 0 |

| Heart Rates | | Rate Dependent Events | |
|----------------------------|------------------------------------|-----------------------|--|
| Min : 31 BPM at 12:30:00-1 | Bradycardia Runs : 154 | Pauses : 0 | |
| Max : 99 BPM at 00:35:50-2 | Longest : 2711 beats at 02:15:30-2 | Longest : 0.0 secs | |
| Avg : 39 BPM | Min rate : 12:43:46-1 | | |

| Ventricular Events | | | | Supraventricular Events | | | |
|----------------------------|-------------------|-----------------------------|--------------|-------------------------|--|--|--|
| Total Beats : 0 | Couplets : 0 | Total Beats : 0 | Couplets : 0 | | | | |
| % Beats : 0.00 | Triplets : 0 | % Beats : 0.00 | | | | | |
| Forms : 0.0 | Bigeminy Runs : 0 | | | | | | |
| AIVR/IVR Runs : 0 | | SVTach Runs : 0 | | | | | |
| Longest : 0 beats at | | Longest : 0 beats at | | | | | |
| Min Rate : 0 BPM | | Max Rate : 0 BPM at | | | | | |
| V Tach Runs : 0 | | Max SVE/Minute : 0 beats at | | | | | |
| Longest : 0 beats at | | Max SVE/Hour : 0 beats | | | | | |
| Max Rate : 0 BPM | | Mean SVE/Hour : 0.0 | | | | | |
| Max VE/Minute : 0 beats at | | SVE/1000 : 0.0 | | | | | |
| Max VE/Hour : 0 beats | | | | | | | |
| Mean VE/Hour : 0.0 | | | | | | | |
| VE/1000 : 0.0 | | | | | | | |

1. Main rhythm was 2:1 AV block with intermittent Complete AV block.
2. There were no ST-T change during monitoring.
3. There were patient's markers (dyspnea,dizziness) during the holter monitoring. Most of the symptoms were correlated with ECG abnormality.

C-AV block with wide QRS



Block site

-Narrow QRS-

Supra His block

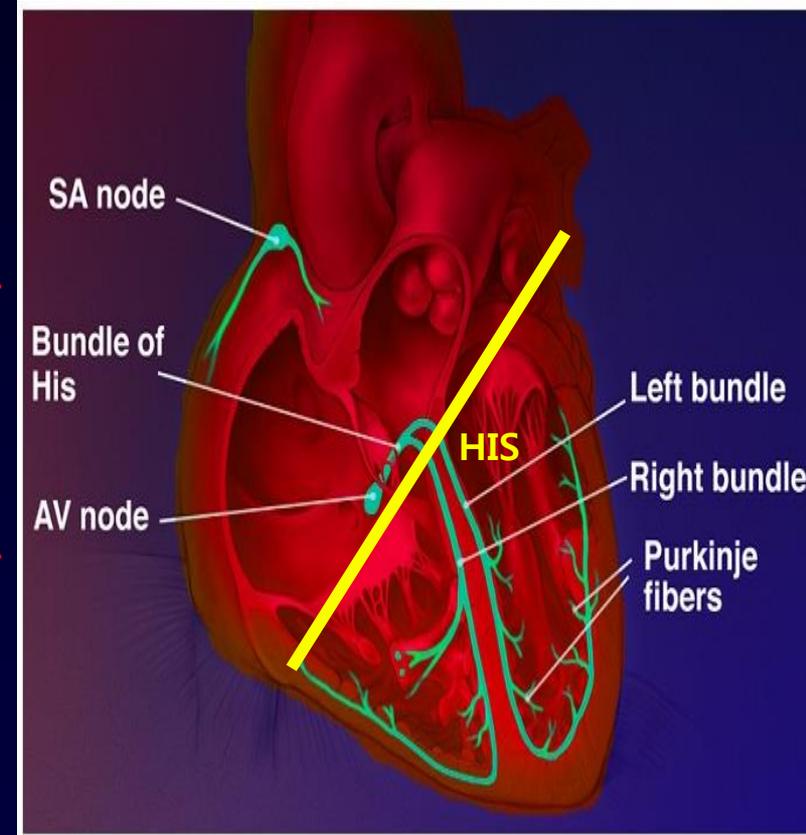
잠재적 pacemaker 는 AV node(40~60bpm/min)

-Wide QRS-

Infra His block

잠재적 pacemaker는 ventricle(20~40bpm/min)

90% 이상에서 pacemaker 시술



Summary Report

| | | |
|---------------------------------|-------------------------------|---------------------|
| Report Number : 8A95167DD102805 | Start Time : 9:38:00 AM | Total Beats : 48418 |
| Test Date : 5/21/2013 | Hours Analyzed : 23 : 53 : 35 | Unknown Beats : 0 |
| Report Date : 5/22/2013 | Artifact : 1 : 18 : 37 | Other Beats : 0 |
| | | Percent AFIB : 0 |

| | | | | | |
|-------------|----------------------|-----------------------|--------------------------|-----------|----------|
| Heart Rates | | Rate Dependent Events | | Pauses : | 0 |
| Min : | 25 BPM at 07:37:40-2 | Bradycardia Runs : | 2100 | Longest : | 0.0 secs |
| Max : | 55 BPM at 05:32:20-2 | Longest : | 1370 beats at 07:27:34-2 | | |
| Avg : | 34 BPM | Min rate : | 25 BPM at 07:38:10-2 | | |

| | | | | | | | |
|--------------------|------------|-----------------|---|-------------------------|------------|------------|---|
| Ventricular Events | | | | Supraventricular Events | | | |
| Total Beats : | 0 | Couplets : | 0 | Total Beats : | 0 | Couplets : | 0 |
| % Beats : | 0.00 | Triplets : | 0 | % Beats : | 0.00 | | |
| Forms : | 0.0 | Bigeminy Runs : | 0 | | | | |
| AJVR/IVR Runs : | 0 | | | | | | |
| Longest : | 0 beats at | | | SVTach Runs : | 0 | | |
| Min Rate : | 0 BPM | | | Longest : | 0 beats at | | |
| V Tach Runs : | 0 | | | Max Rate : | 0 BPM at | | |
| Longest : | 0 beats at | | | Max SVE/Minute : | 0 beats at | | |
| Max Rate : | 0 BPM | | | Max SVE/Hour : | 0 beats | | |
| Max VE/Minute : | 0 beats at | | | Mean SVE/Hour : | 0.0 | | |
| Max VE/Hour : | 0 beats | | | SVE/1000 : | 0.0 | | |
| Mean VE/Hour : | 0.0 | | | | | | |
| VE/1000 : | 0.0 | | | | | | |

1. Complete AV block with wide QRS morphology(infra-his block).
2. Symptomatic bradycardia (Avg HR 34 BPM)
3. The patient's markers (dizziness, chest tightness, dyspnea) were correlated 24 hours ECG.

Conc> Complete AV block with ventricular escape rhythm (Infra His block).

A fib with C-AV block



S-T Pacer The first maximum heart rate Percent AFIB 100

Summary

| | | | | |
|--------------------------|--------------------------|--------------------|----------------|---|
| Patient: BAEG LANG JA, I | Hours Analyzed: 24:02:08 | Total Beats: 56443 | Other Beats: 0 | RR Intervals Max: 1.83 sec: 01:55:34 d2 |
| Report ID: 8A9B057DB1226 | Record Date: 11/4/2011 | Unknown Beats: 0 | 0 | RR Intervals Min: 0.53 sec: 08:02:03 d2 |

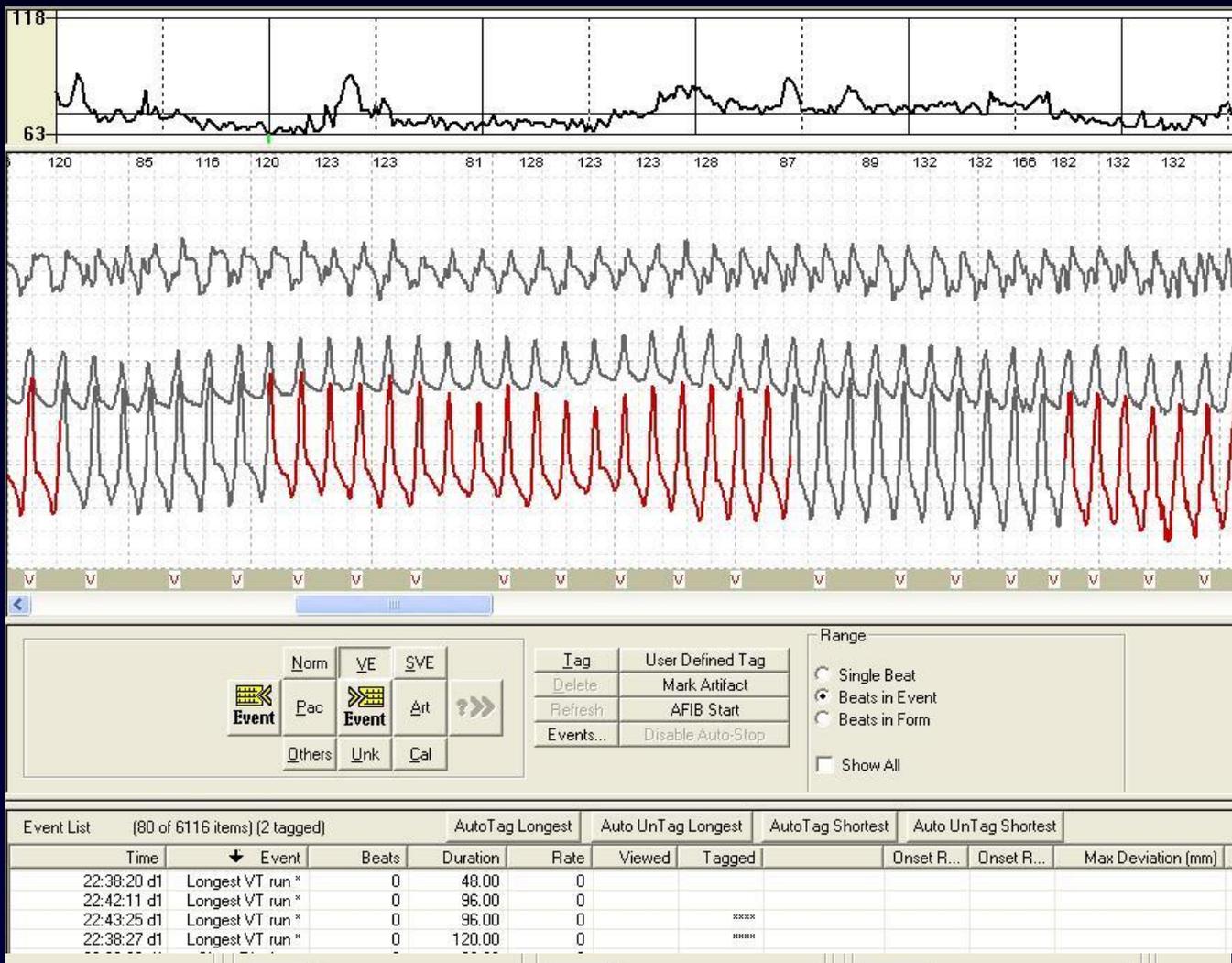
| | | |
|------------------------------|--|--|
| Heart Rate Average: 39 | Bradycardia Runs: 26 <input checked="" type="checkbox"/> | Pauses Occurrences: 0 <input type="checkbox"/> |
| Maximum: 58 bpm: 14:00:10 d1 | Longest: 18182 bts: 02:29:07 d2 | Longest: [] |
| Minimum: 33 bpm: 00:22:40 d2 | Min. Rate: 33 bpm: 02:29:07 d2 | 2 R-R: 0 <input checked="" type="checkbox"/> |

| Summary Report | | | | | |
|--------------------|-------------------------|-------------------------|----------------------------|----------------|-------------------------|
| Report Number | : 8A9B057DB12263B | Start Time | : 11:02:00 AM | Total Beats | : 56443 |
| Test Date | : 11/4/2011 | Hours Analyzed | : 24 : 02 : 05 | Unknown Beats | : 0 |
| Report Date | : 11/5/2011 | Artifact | : 0 : 00 : 05 | Other Beats | : 0 |
| | | | | Percent AFIB | : 0 |
| Heart Rates | | Rate Dependent Events | | | |
| Min | : 33 BPM at 00:22:30-2 | Bradycardia Runs | : 26 | Pauses | : 0 |
| Max | : 55 BPM at 14:01:00-1 | Longest | : 1515 beats at 02:29:05-2 | Longest | : 0.0 secs at |
| Avg | : 39 BPM | Min rate | : 33 BPM at 02:29:05-2 | | |
| Ventricular Events | | Supraventricular Events | | | |
| Total Beats | : 30 | Couplets | : 2 | Total Beats | : 14 |
| % Beats | : 0.05 | Triplets | : 0 | % Beats | : 0.02 |
| Forms | : 4 | Bigeminy Runs | : 0 | | |
| AVR/VR Runs | : 0 | | | | |
| Longest | : 0 beats at | | | | |
| Min Rate | : 0 BPM | | | | |
| V Tach Runs | : 0 | | | SVTach Runs | : 0 |
| Longest | : 0 beats at | | | Longest | : 0 beats at |
| Max Rate | : 0 BPM | | | Max Rate | : 0 BPM at |
| Max VE/Minute | : 2 beats at 21:36:00-1 | | | Max SVE/Minute | : 2 beats at 06:02:00-2 |
| Max VE/Hour | : 7 beats 10:00:00-2 | | | Max SVE/Hour | : 11 beats 06:00:00-2 |
| Mean VE/Hour | : 1.3 | | | Mean SVE/Hour | : 0.6 |
| VE/1000 | : 0.5 | | | SVE/1000 | : 0.2 |

1. Most of the rhythm was atrial fibrillation with slow ventricular response (avg HR 39 BPM) & complete AV block.
2. The patient's markers (dizziness) were associated 24 hours ECG

Conc> Symptomatic atrial fibrillation with complete AV block.

MI with VT



Low grade 분류(MI후 돌연사 위험성 판정)

0도 VPC가 없음

1도 1A - VPC가 30개/시간 미만, 1개/분 이하
1B - VPC가 30개/시간 미만, 가끔 2개/분 이상

2도 VPC 30개/시간 이상

3도 Multifrom VPC

4도 4A - pair 혹은 couple
4B - VT(연속적인 3개이상의 VPC)

5도 R-on-T 현상

| Summary Report | | | |
|---------------------------|---------------------------|--------------------------------|---------------|
| Report Number | : 8A931C7DE100A08 | Start Time | : 3:03:00 PM |
| Test Date | : 3/27/2014 | Hours Analyzed | : 7 : 40 : 20 |
| Report Date | : 3/28/2014 | Artifact | : 0 : 00 : 50 |
| Total Beats | : 33804 | Unknown Beats | : 94 |
| Other Beats | : 0 | Percent AFIB | : 0 |
| Heart Rates | | Rate Dependent Events | |
| Min | : 58 BPM at 16:04:10-1 | Bradycardia Runs | : 0 |
| Max | : 133 BPM at 22:39:10-1 | Longest | : 0 beats at |
| Avg | : 73 BPM | Min rate | : 0 BPM at |
| Ventricular Events | | Supraventricular Events | |
| Total Beats | : 10888 | Couplets | : 708 |
| % Beats | : 32.21 | Triplets | : 137 |
| Forms | : 113 | Bigeminy Runs | : 228 |
| AVR/VR Runs | : 880 | | |
| Longest | : 8 beats at 15:09:02-1 | | |
| Min Rate | : 65 BPM 22:22:56-1 | | |
| V Tach Runs | : 228 | | |
| Longest | : 10 beats at 18:35:00-1 | | |
| Max Rate | : 156 BPM 15:21:47-1 | | |
| Max VE/Minute | : 115 beats at 22:40:00-1 | | |
| Max VE/Hour | : 1526 beats 16:00:00-4 | | |
| Mean VE/Hour | : 1555.4 | | |
| VE/1000 | : 322.1 | | |
| Total Beats | : 81 | Couplets | : 5 |
| % Beats | : 0.24 | | |
| | | | |
| SVTach Runs | : 2 | | |
| Longest | : 4 beats at 15:28:18-1 | | |
| Max Rate | : 142 BPM at 16:28:30-1 | | |
| Max SVE/Minute | : 9 beats at 15:28:00-1 | | |
| Max SVE/Hour | : 19 beats 16:00:00-1 | | |
| Mean SVE/Hour | : 11.6 | | |
| SVE/1000 | : 2.4 | | |

1. Rhythm was revealed frequent VPCs (low grade 5)
2. Polymorphic VT was induced with R-on-T phenome none.
3. The patient's symptom not analysis due to CPR state.

MI with VT

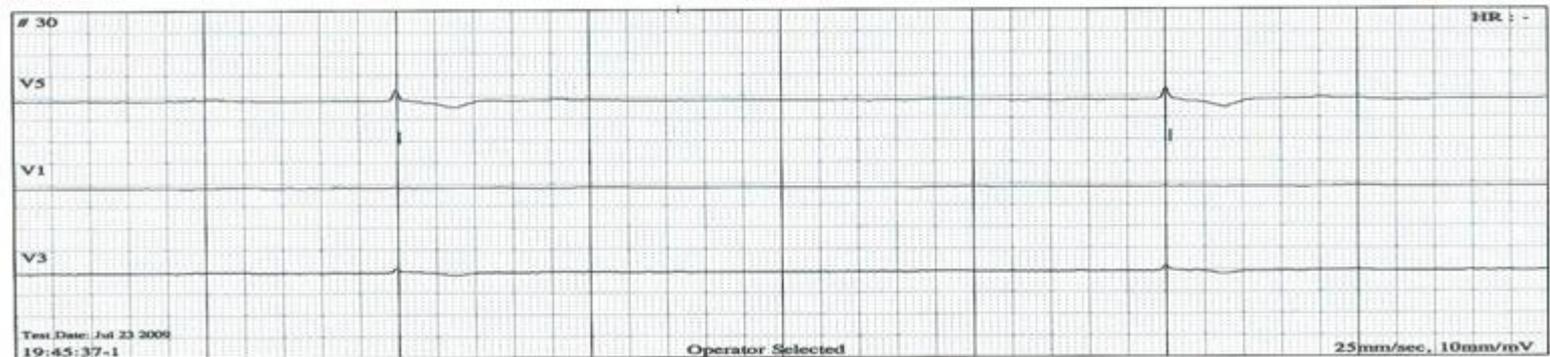
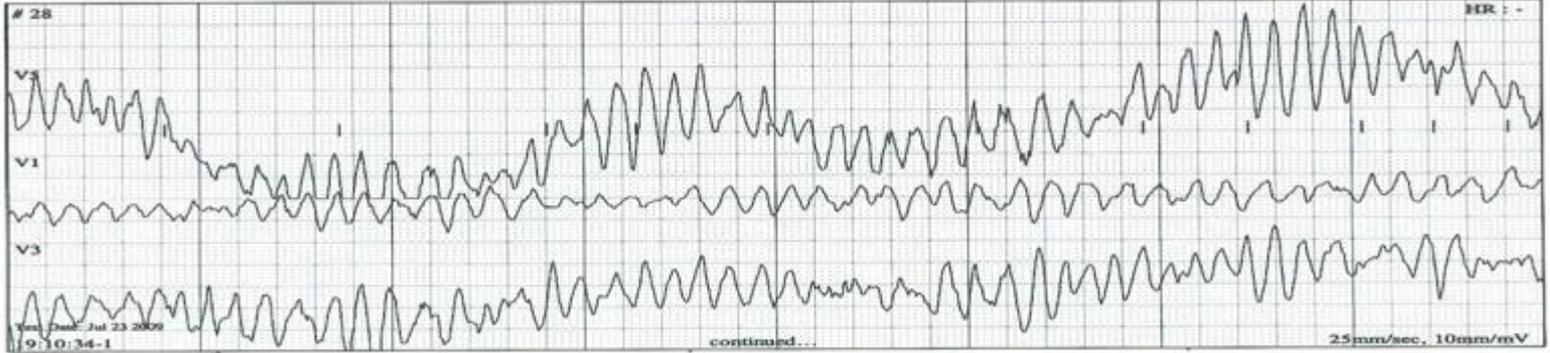
MI후 심실빈맥과 심실세동으로 인한 급성 심장사의 위험율 (1년내의 위험율 5%).

홀터에서 시간당 10회 이상의 VPC나 high grade 의 ventricular ectopy beat는 높은 사망률과 관련이 있다.

Patient :

Event Strip - Ch : 1 & 2 & 3

Report Date :



Printed Jul 31 2009 08:31:08

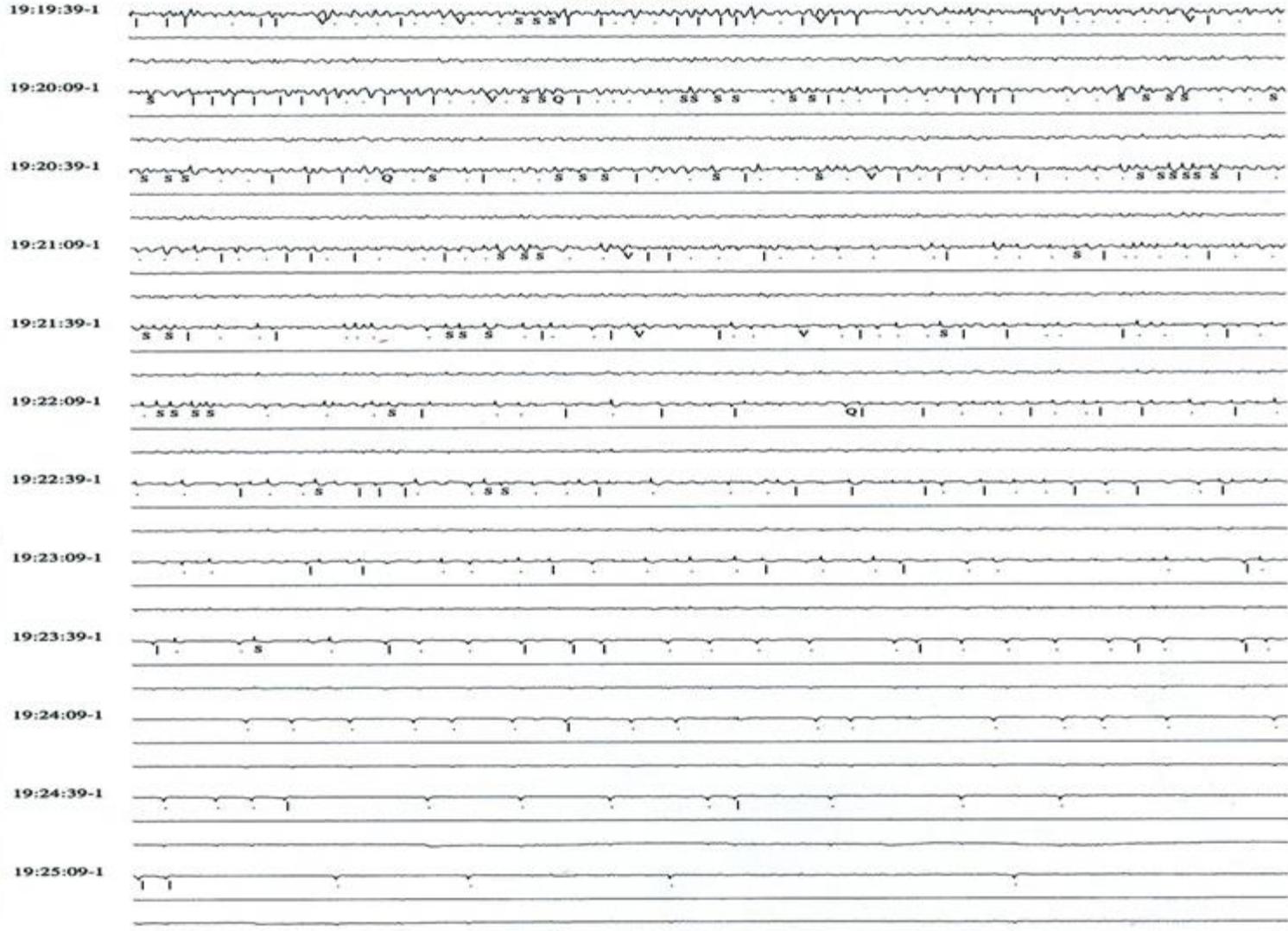
Min VT rate: 100 bpm
 Min SVT rate: 80 bpm
 SVE prematurity: 0.20 %
 Bradycardia rate: 30 bpm
 Bradycardia interval: 300 msec

atient :

Event Page - Ch: 1 & 2 & 3

Report Date :

Operator Selected



Test Date: Jul 23 2009

Holter ECG

홀터 검사는 조기수축을 정량화 할 수 있고,

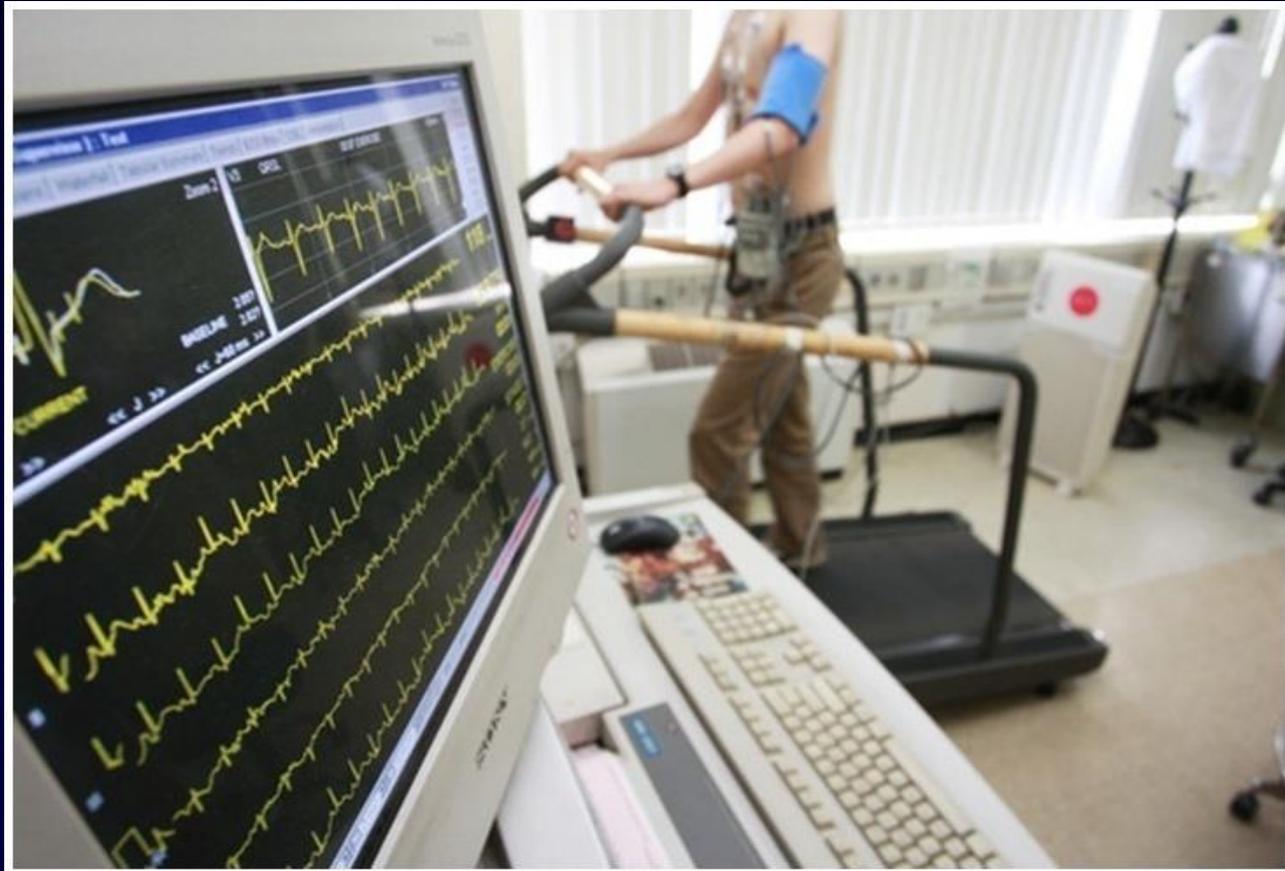
빠른 혹은 느린 부정맥의 시작과 끝에 대한 정보를 얻을 수 있다.

특히 심박동기 시술 예정인 환자는 심박동기 Indication에 해당되는

비정상 소견을 꼭 출력해주어야 하며 환자의 증상 관련 여부를

반드시 확인하여야 한다.

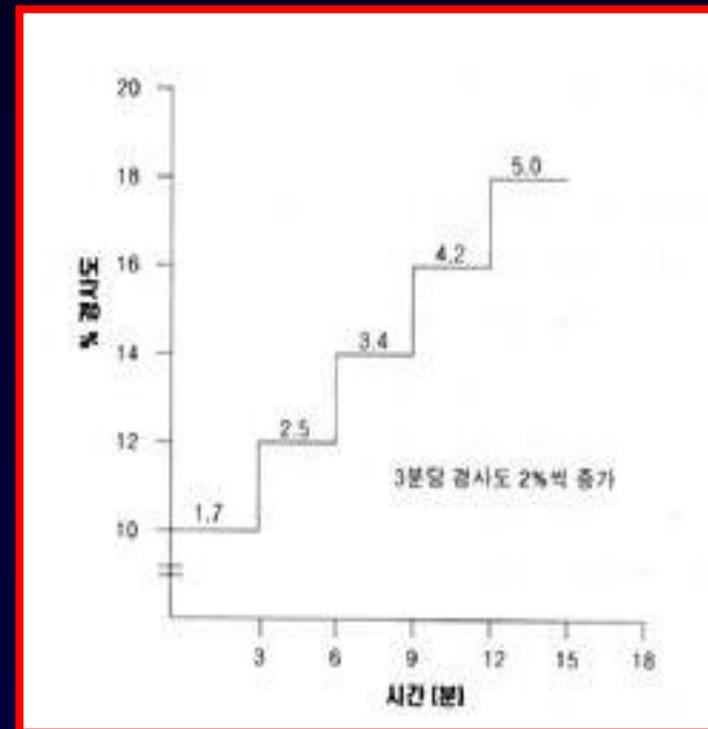
EXERCISE ECG



최초 운동시작의 부하를 경사도 10%에서 1.7mph로 3분 동안 실시하며

이후 매 3분마다 경사도 2%, 속도는 0.8~0.9mph씩 증가시킨다

단계별로 약 2~3 mets 씩 증가해서 피검자가 최대에 도달할때 까지 수행





답차→발로 밟아서 강물을 땅위로 퍼올리는기구, 19세기 영국 죄인 처벌하는 용도로 쓰임, 에드워드 스미스가 운동부하 검사에 처음 이용함

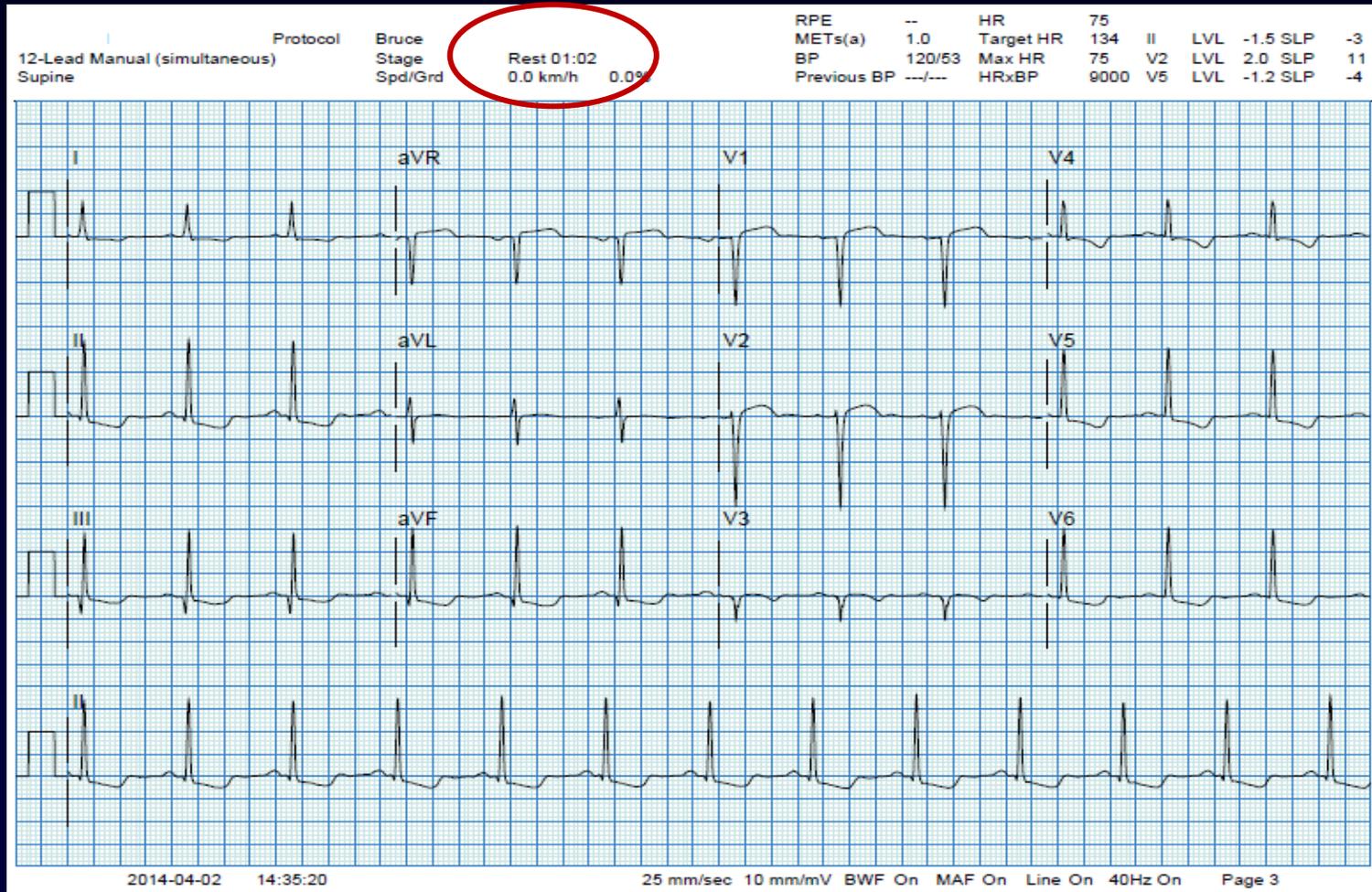
Indication

운동은 교감신경(카테콜아민상승)을 흥분시키고, 심근허혈을 발생시키며, 심박동수를 증강시켜 이들 기전에 의해 발생하는 부정맥을 진단할 수 있다.

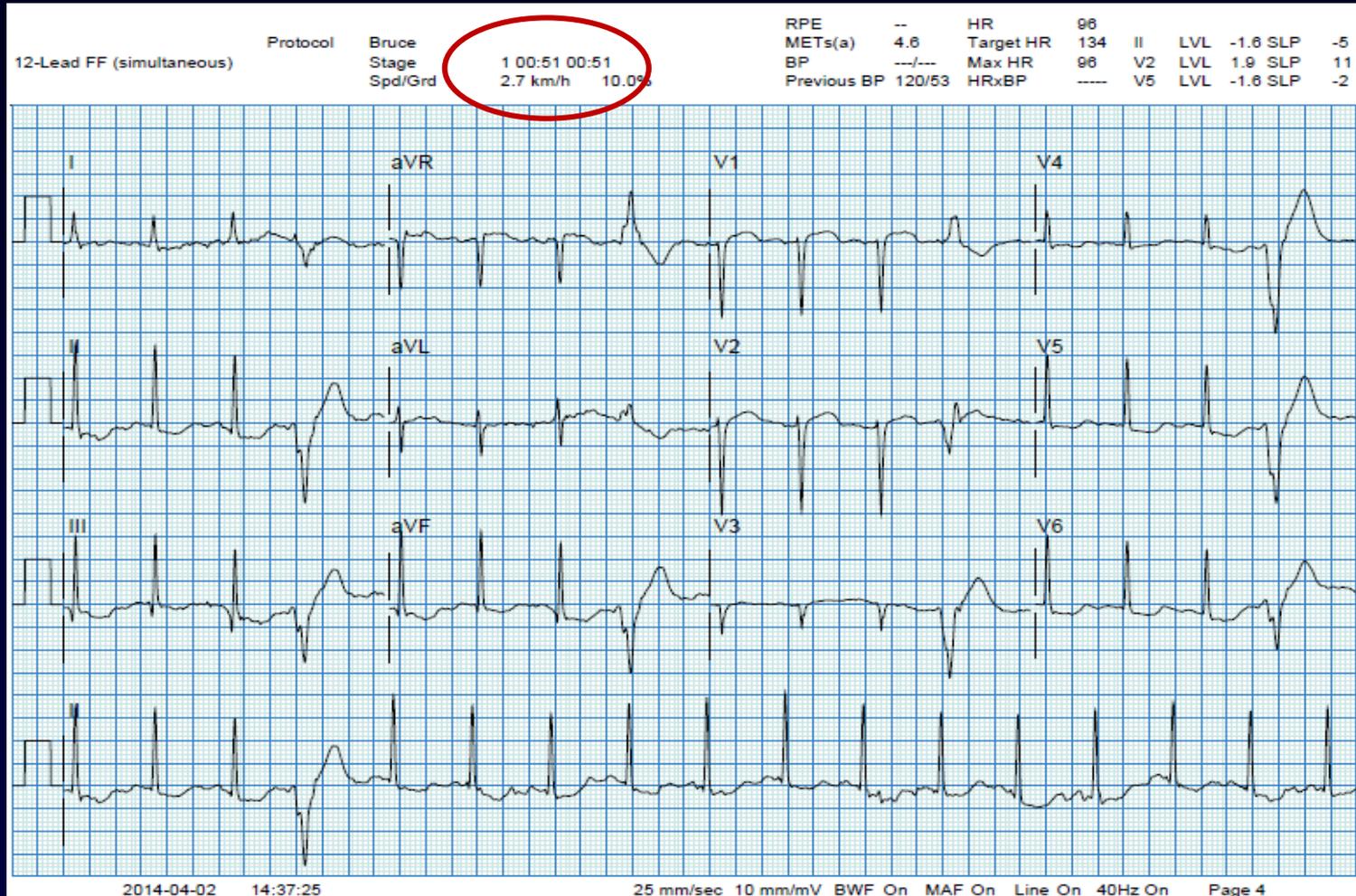
1. 관상동맥 질환 진단의 확인
2. 흉통의 감별진단
3. 잠복기 관상동맥질환의 조기 발견
4. 심장 부정맥의 운동과의 관련성 평가
5. 운동과 관련된 증상(의식혼절, 심계항진, 흉통 등)의 평가
6. 불안정성 고혈압(labile hypertension)의 조기 발견

유발될 수 있는 부정맥-VPC, VT, PSVT, Atrial fibrillation, Pause

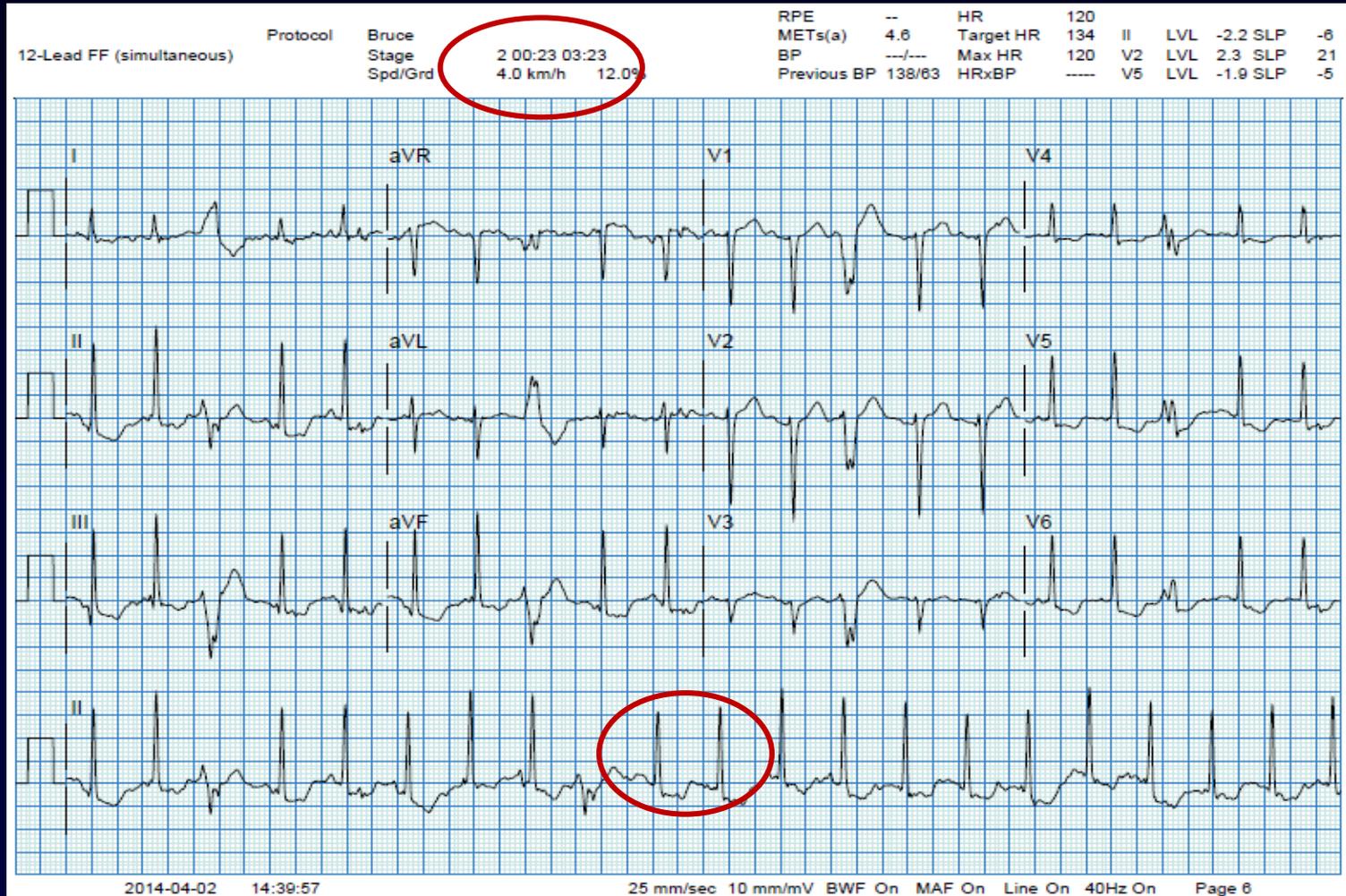
62/M 걸을때 dyspnea, OMI



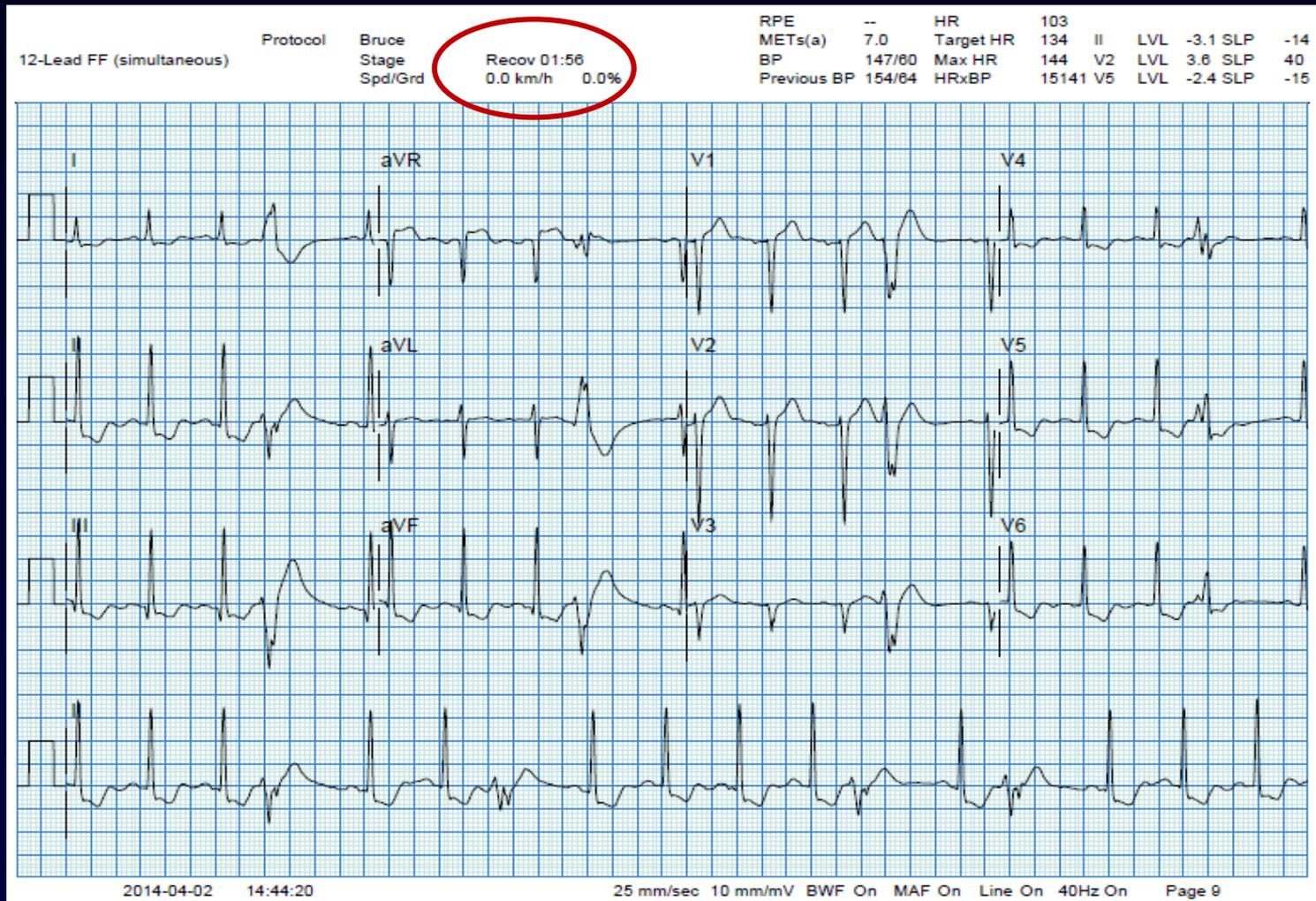
VPC



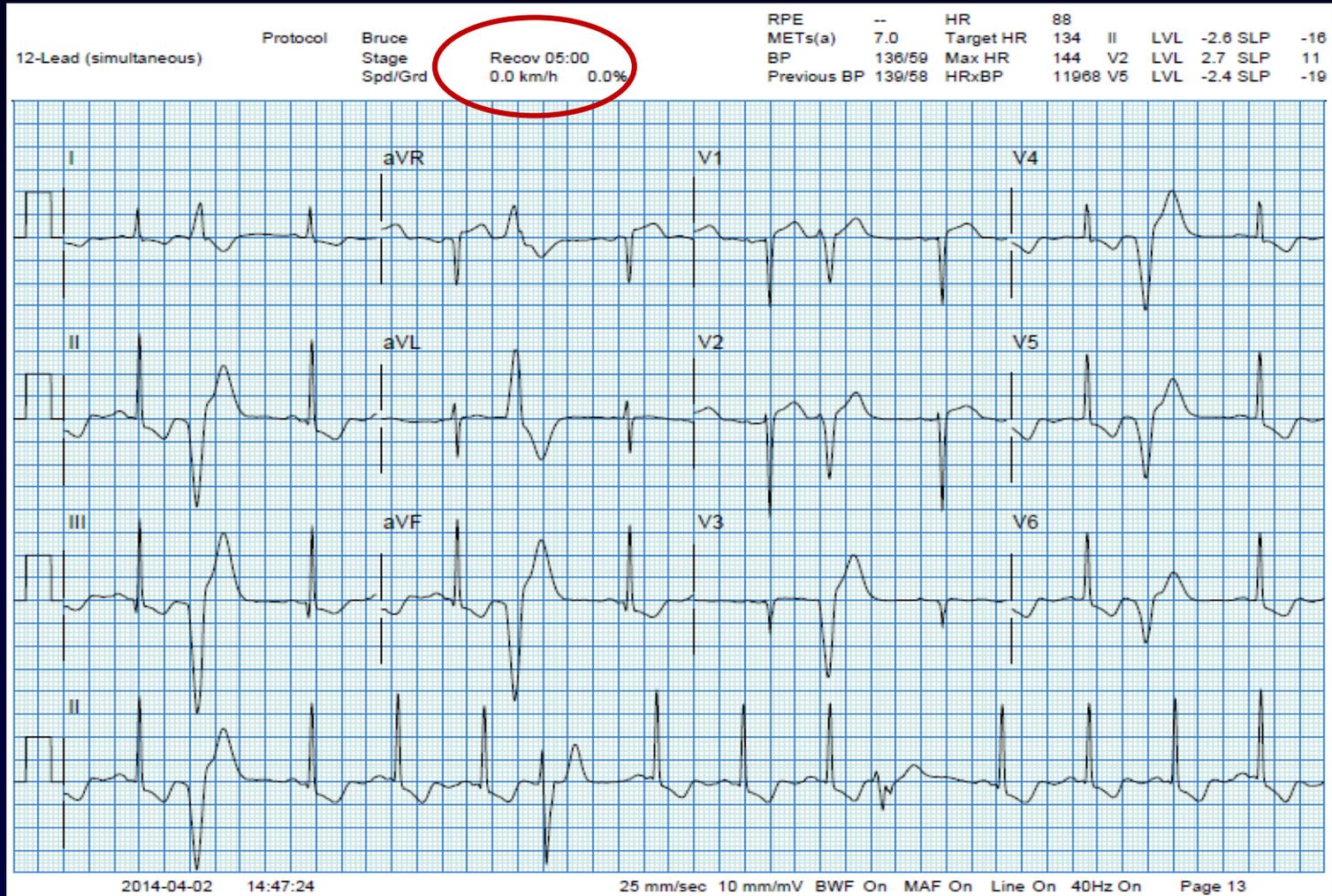
VPC



VPC



VPC



12-Lead (simultaneous)

Protocol

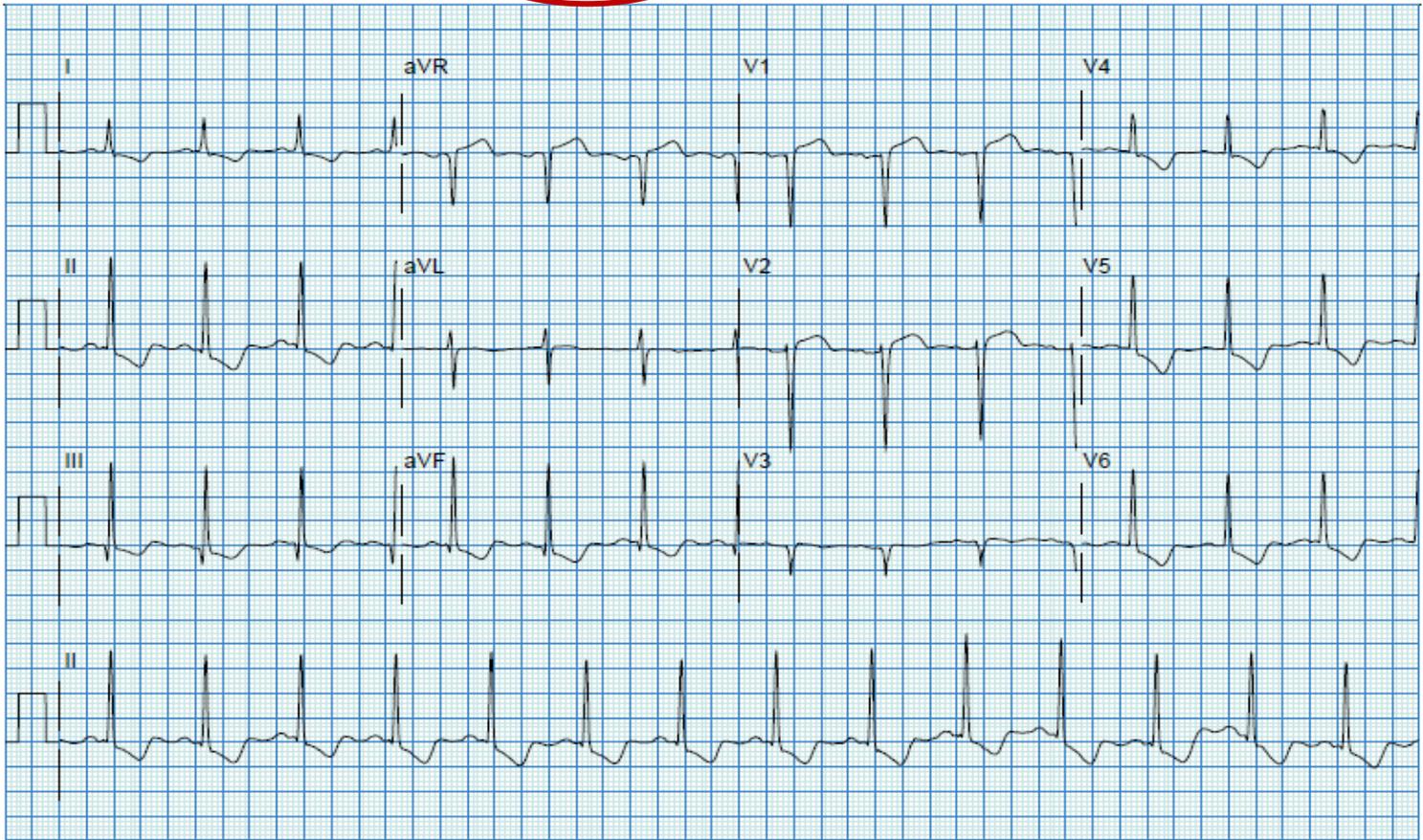
Bruce

Stage

Spd/Grd

Recov 07:00
0.0 km/h 0.0%

| | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|---------|
| RPE | -- | HR | 87 | | | | |
| METs(a) | 7.0 | Target HR | 134 | II | LVL | -2.3 | SLP -15 |
| BP | 129/60 | Max HR | 144 | V2 | LVL | 2.5 | SLP 10 |
| Previous BP | 136/59 | HRxBP | 11223 | V5 | LVL | -2.0 | SLP -15 |



2014-04-02 14:49:24

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 15

VPC

관상동맥 질환 환자의 50% 에서 운동시 발생하며,
정상인 보다 낮은 맥박수(<130회/분)에서 잘 유발되며
recovery때 발생하는 VPC는 예후가 나쁘다.

56/M 계단 오를때 chest tightness

12-Lead Manual(simultaneous)
Supine

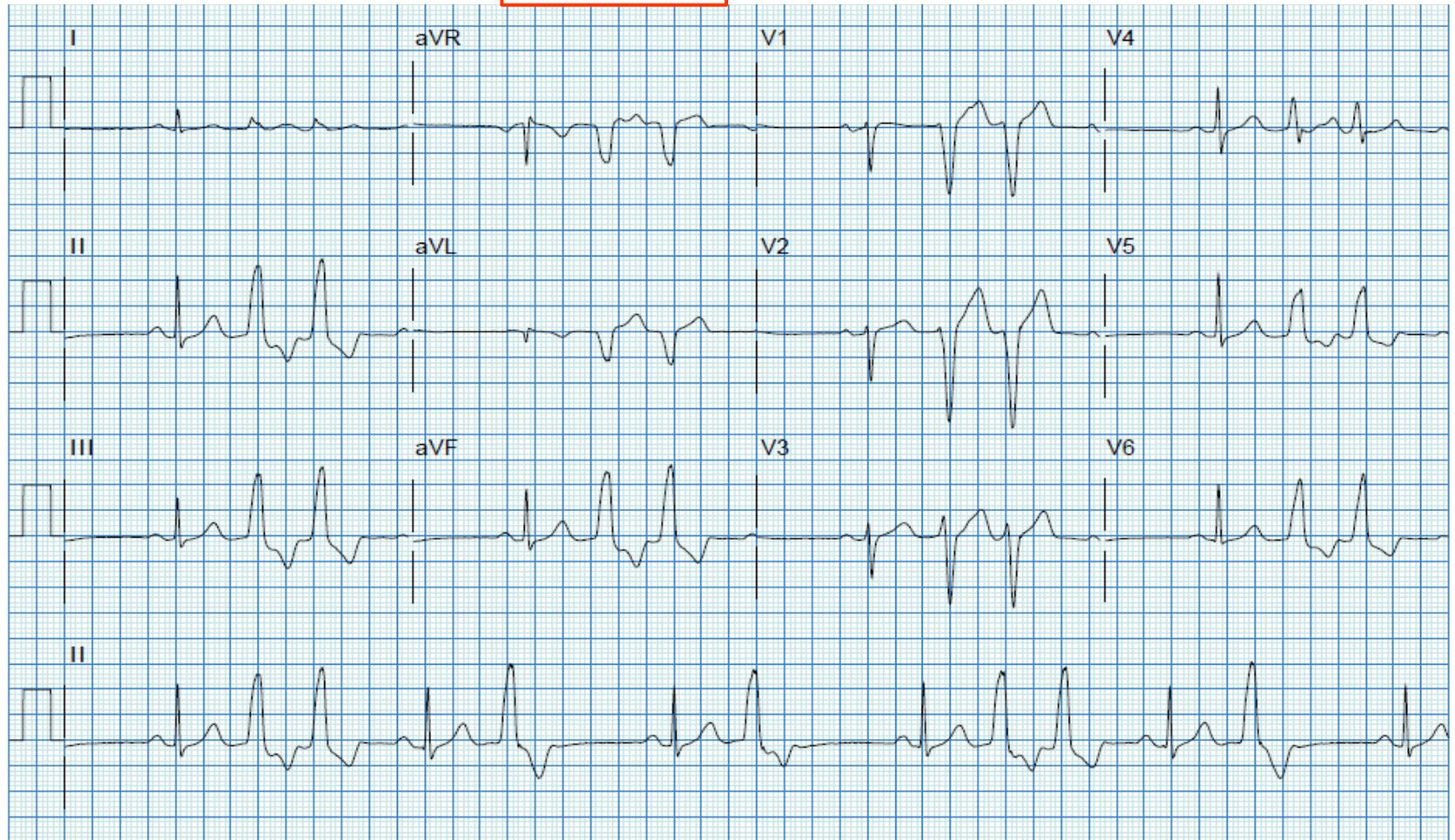
Protocol

Bruce
Stage
Spd/Grd

Rest 05:11
0.0 km/h 0.0%

| | | | |
|-------------|--------|-----------|------|
| RPE | -- | HR | 76 |
| METs(a) | 1.0 | Target HR | 139 |
| BP | 116/70 | Max HR | 76 |
| Previous BP | --/-- | HRxBP | 8816 |

| | | | | |
|----|-----|-----|-----|----|
| II | LVL | 0.4 | SLP | 11 |
| V2 | LVL | 1.3 | SLP | 6 |
| V5 | LVL | 0.3 | SLP | 8 |



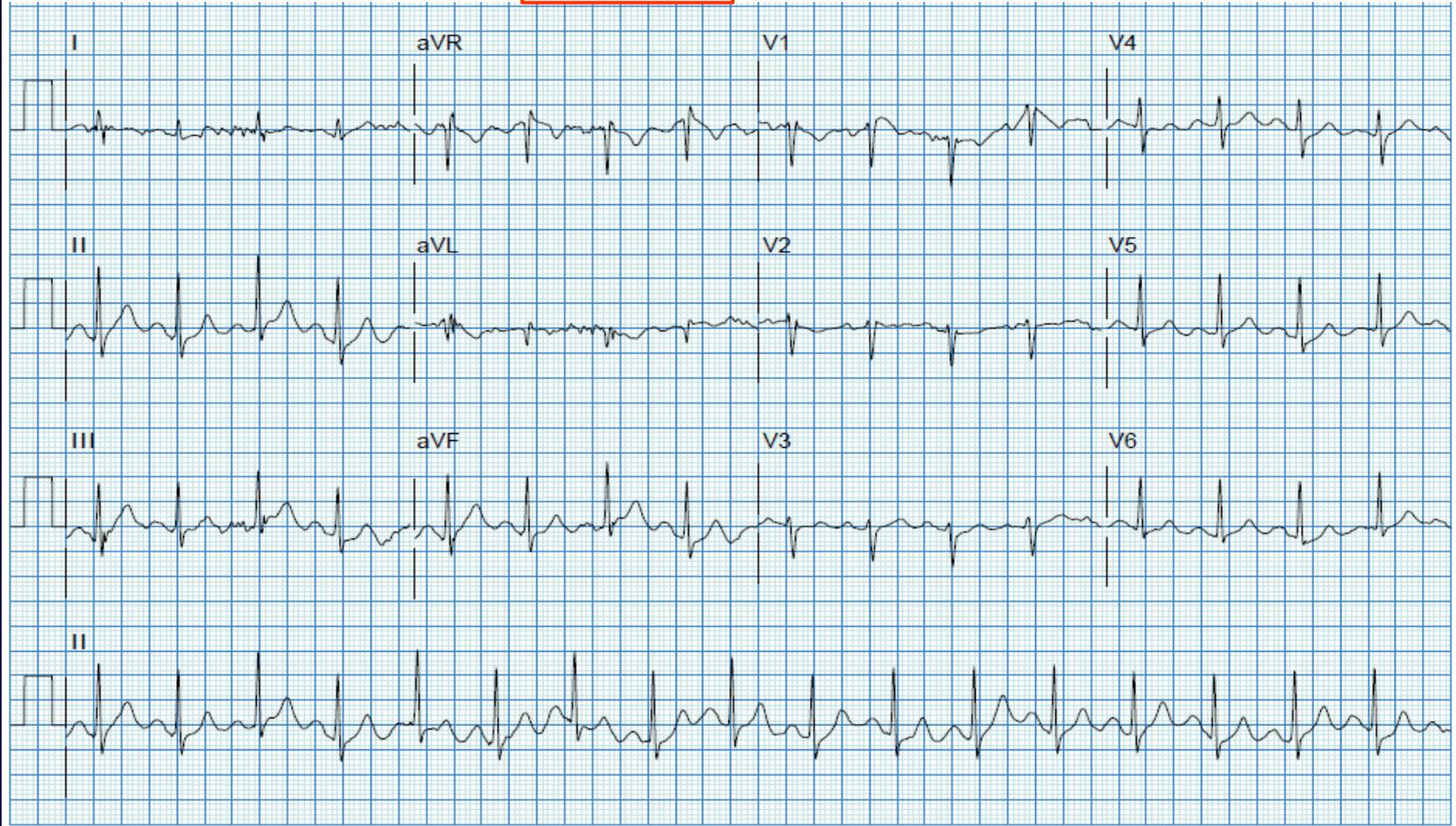
12-Lead Manual(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

2 00:59 03:59
4.0 km/h 12.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|-----|-----|----|
| RPE | - | HR | 105 | II | LVL | 0.6 | SLP | 17 |
| METs(a) | 7.0 | Target HR | 139 | V2 | LVL | 0.0 | SLP | -3 |
| BP | --/-- | Max HR | 110 | V5 | LVL | 0.3 | SLP | 10 |
| Previous BP | 150/72 | HRxBP | ---- | | | | | |



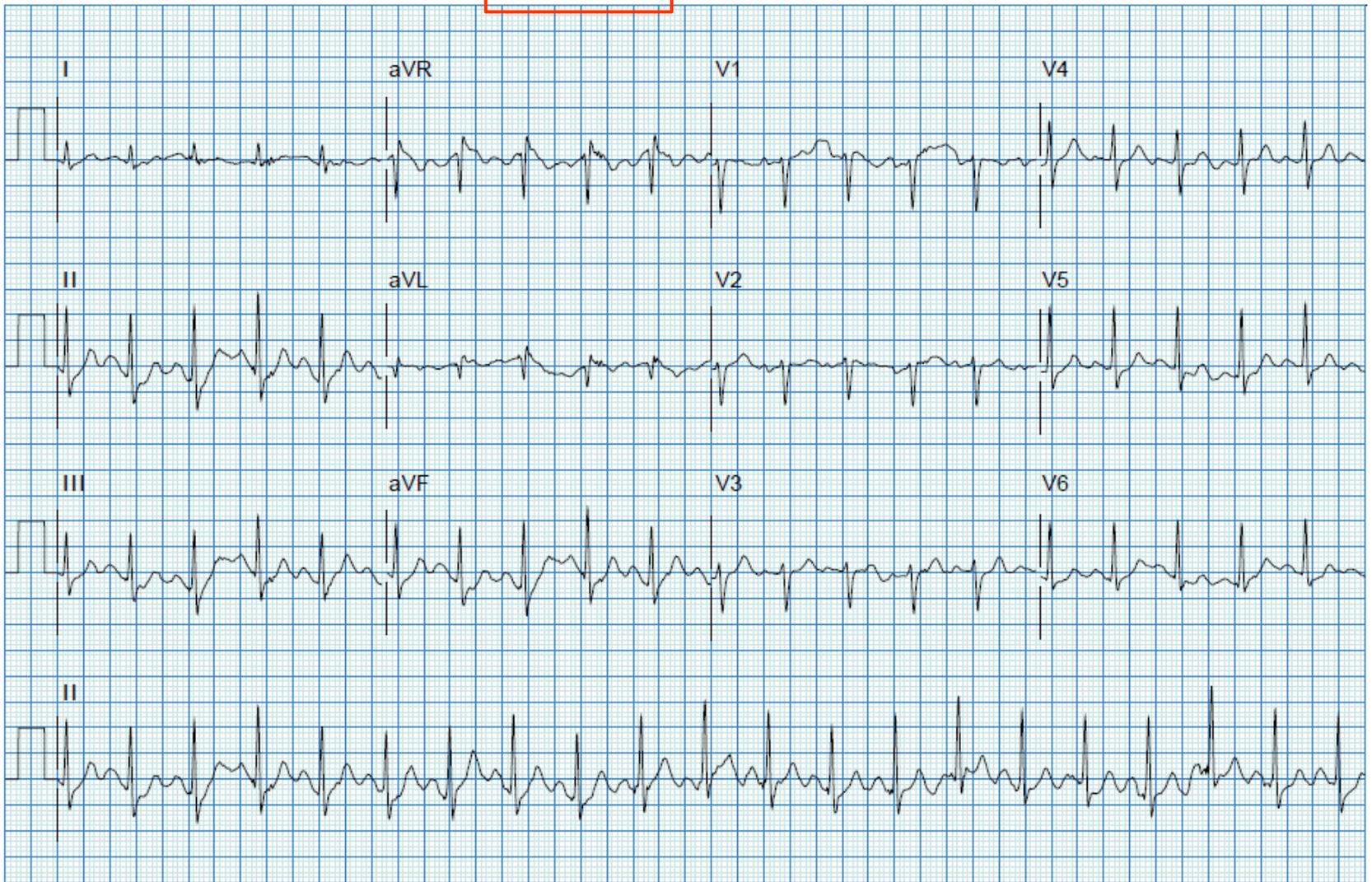
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

3 02:50 08:50
5.4 km/h 14.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|
| METs(a) | 10.1 | Target HR | 139 | II | LVL | 0.0 | SLP | 26 |
| BP | 174/82 | Max HR | 124 | V2 | LVL | 0.5 | SLP | 5 |
| Previous BP | 161/73 | HRxBP | 21576 | V5 | LVL | 0.1 | SLP | 18 |



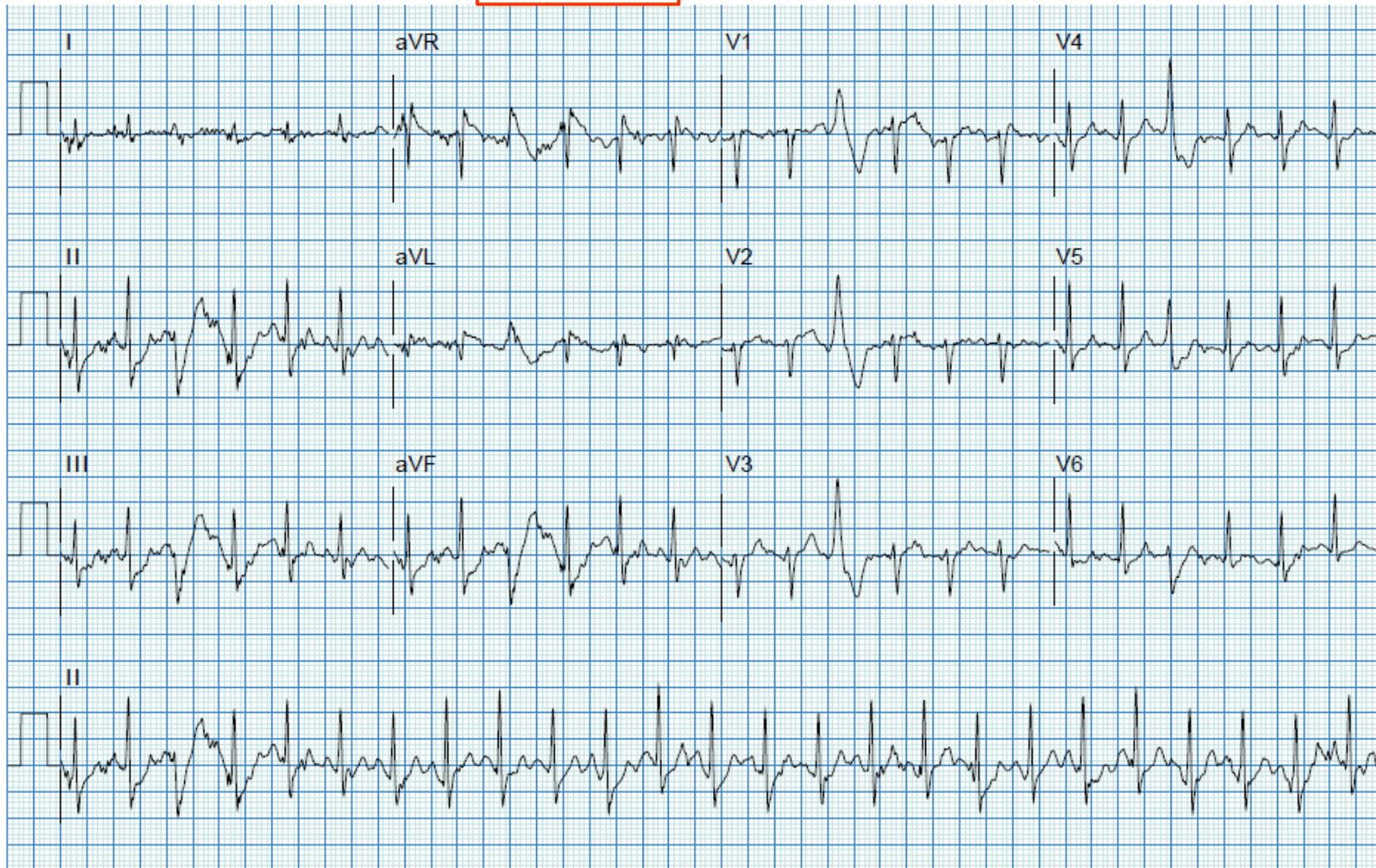
12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

4 01:36 10:36
6.7 km/h 16.0%

| | | | | | | | |
|-------------|--------|-----------|------|--------|-----|-----|----|
| RPE | -- | HR | 148 | II LVL | 0.0 | SLP | 32 |
| METs(a) | 12.8 | Target HR | 139 | V2 LVL | 0.7 | SLP | 11 |
| BP | --/-- | Max HR | 148 | V5 LVL | 0.1 | SLP | 22 |
| Previous BP | 174/82 | HRxBP | ---- | | | | |



12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 02:06
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|
| RPE | - | HR | 83 | II | LVL | 1.0 | SLP | 30 |
| METs(a) | 12.8 | Target HR | 139 | V2 | LVL | 0.8 | SLP | 11 |
| BP | 178/84 | Max HR | 150 | V5 | LVL | 0.5 | SLP | 21 |
| Previous BP | 174/82 | HRxBP | 14774 | | | | | |

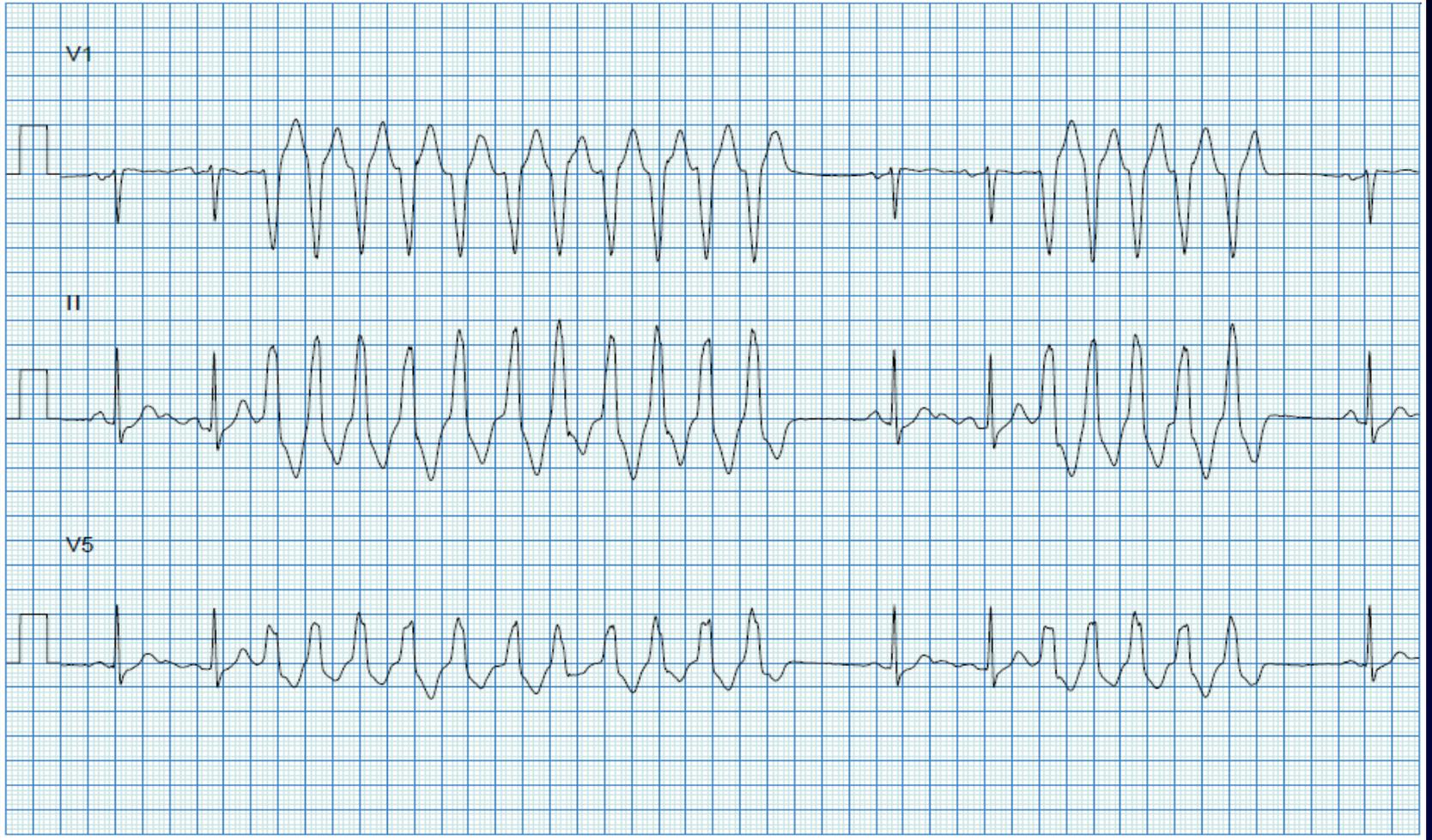


10-second Rhythm FF

Protocol Bruce
Stage
Spd/Grd

Recov 02:31
0.0 km/h 0.0%

| | | | |
|-------------|---------|-----------|-------|
| RPE | -- | HR | 134 |
| METs(a) | 12.8 | Target HR | 139 |
| BP | 178/84 | Max HR | 150 |
| Previous BP | 174/82 | HRxBP | 23852 |
| II | LVL 0.4 | SLP | 24 |
| V2 | LVL 0.8 | SLP | 6 |
| V5 | LVL 0.2 | SLP | 17 |



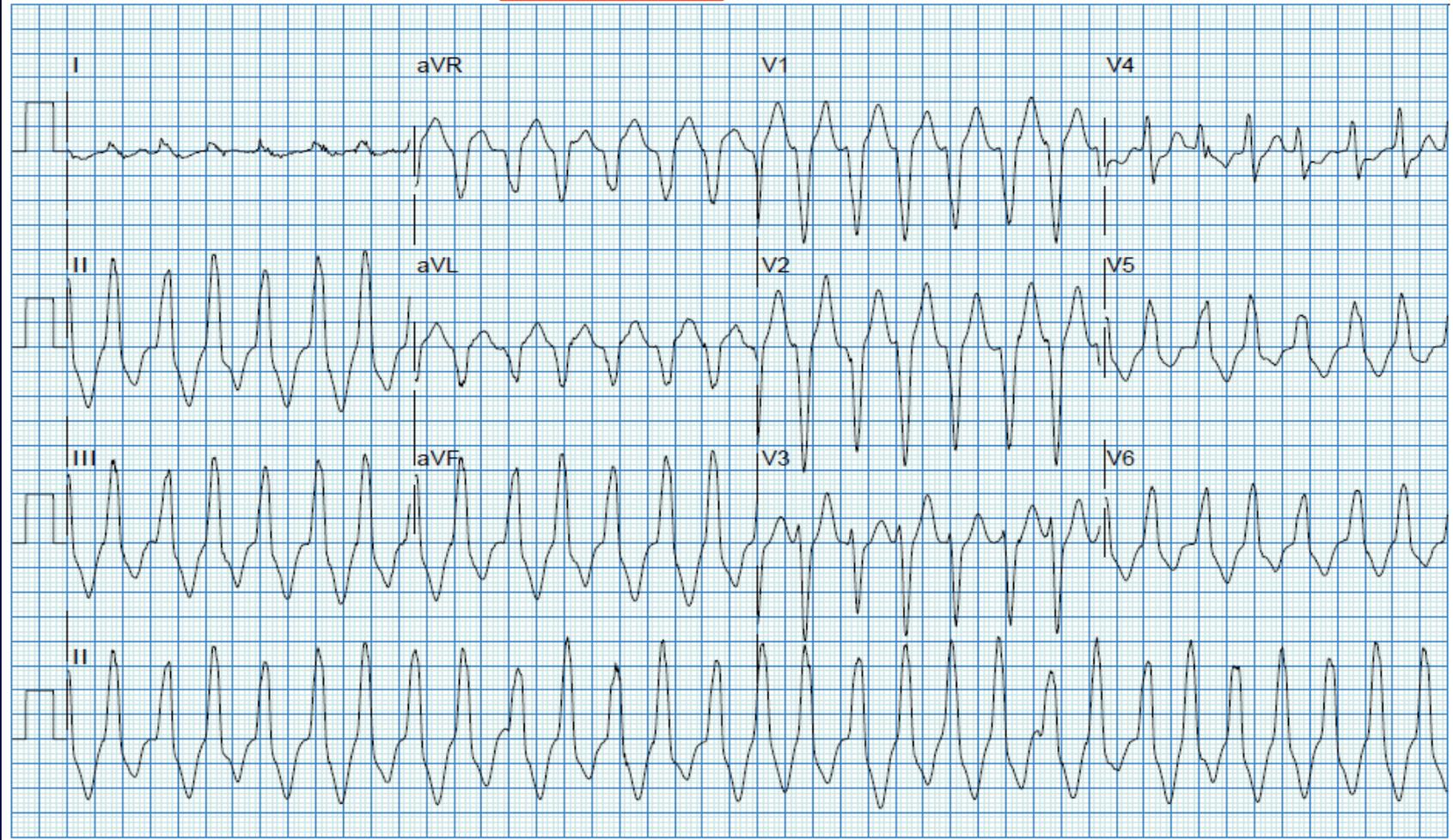
12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 02:36
0.0 km/h 0.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|--|
| RPE | -- | HR | 146 | | | | | | |
| METs(a) | 12.8 | Target HR | 139 | II | LVL | 0.4 | SLP | 21 | |
| BP | 178/84 | Max HR | 150 | V2 | LVL | 0.6 | SLP | 3 | |
| Previous BP | 174/82 | HRxBP | 25988 | V5 | LVL | 0.1 | SLP | 15 | |



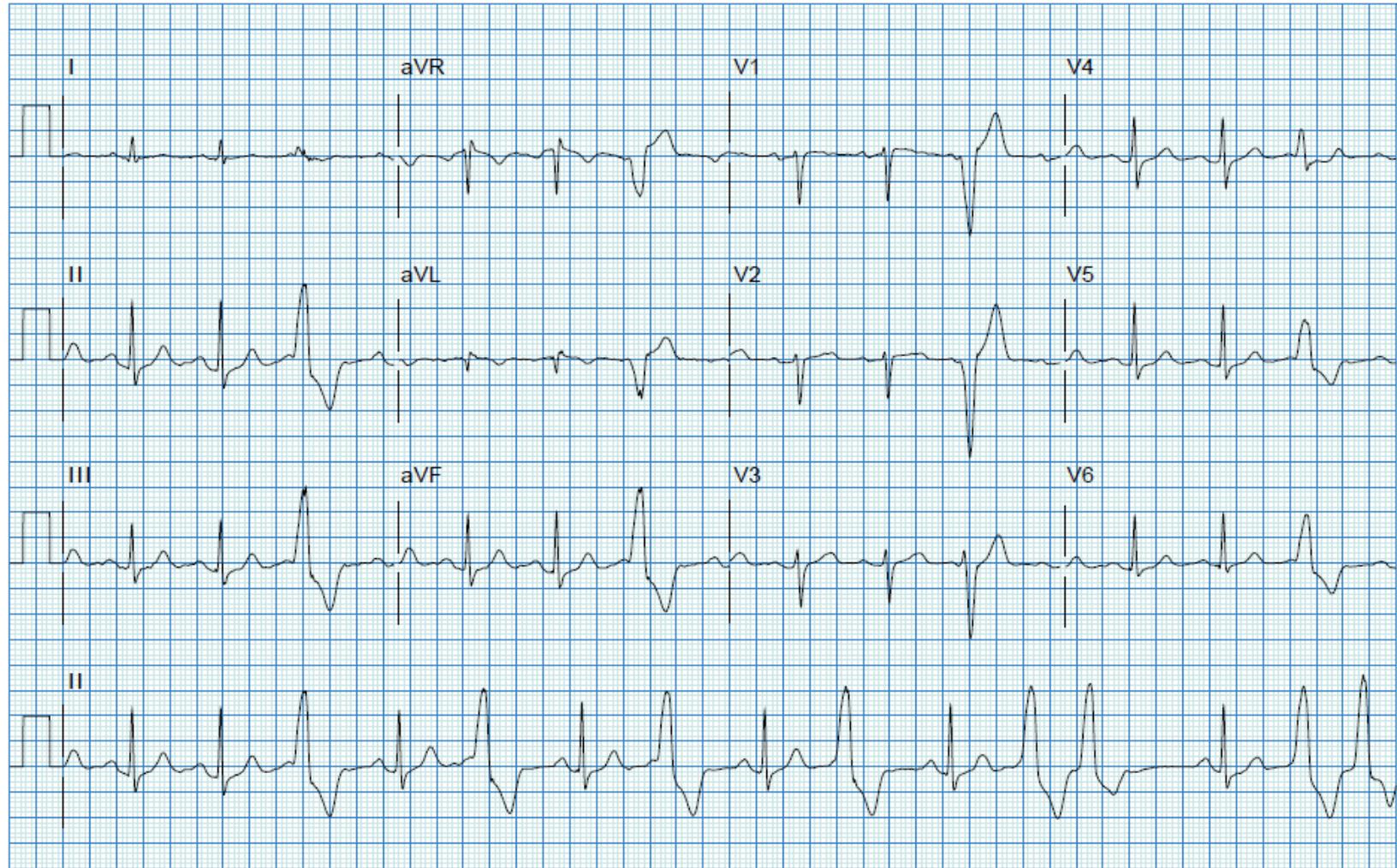
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 07:00
0.0 km/h 0.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|-----|-----|--|
| RPE | -- | HR | 94 | | | | | | |
| METs(a) | 12.8 | Target HR | 139 | II | LVL | -7.0 | SLP | -50 | |
| BP | 123/70 | Max HR | 181 | V2 | LVL | 5.3 | SLP | 50 | |
| Previous BP | 115/69 | HRxBP | 11562 | V5 | LVL | -3.5 | SLP | -26 | |



Idiopathic RVOT VT

RVOT VT는 운동과 연관이 많으며, 운동검사로 비교적 잘 유발되어 대부분이 운동부하 심전도 검사로 심실빈맥을 증명할 수 있다.

52/M 산에 오를때, 목욕탕에서 더우면 palpitation

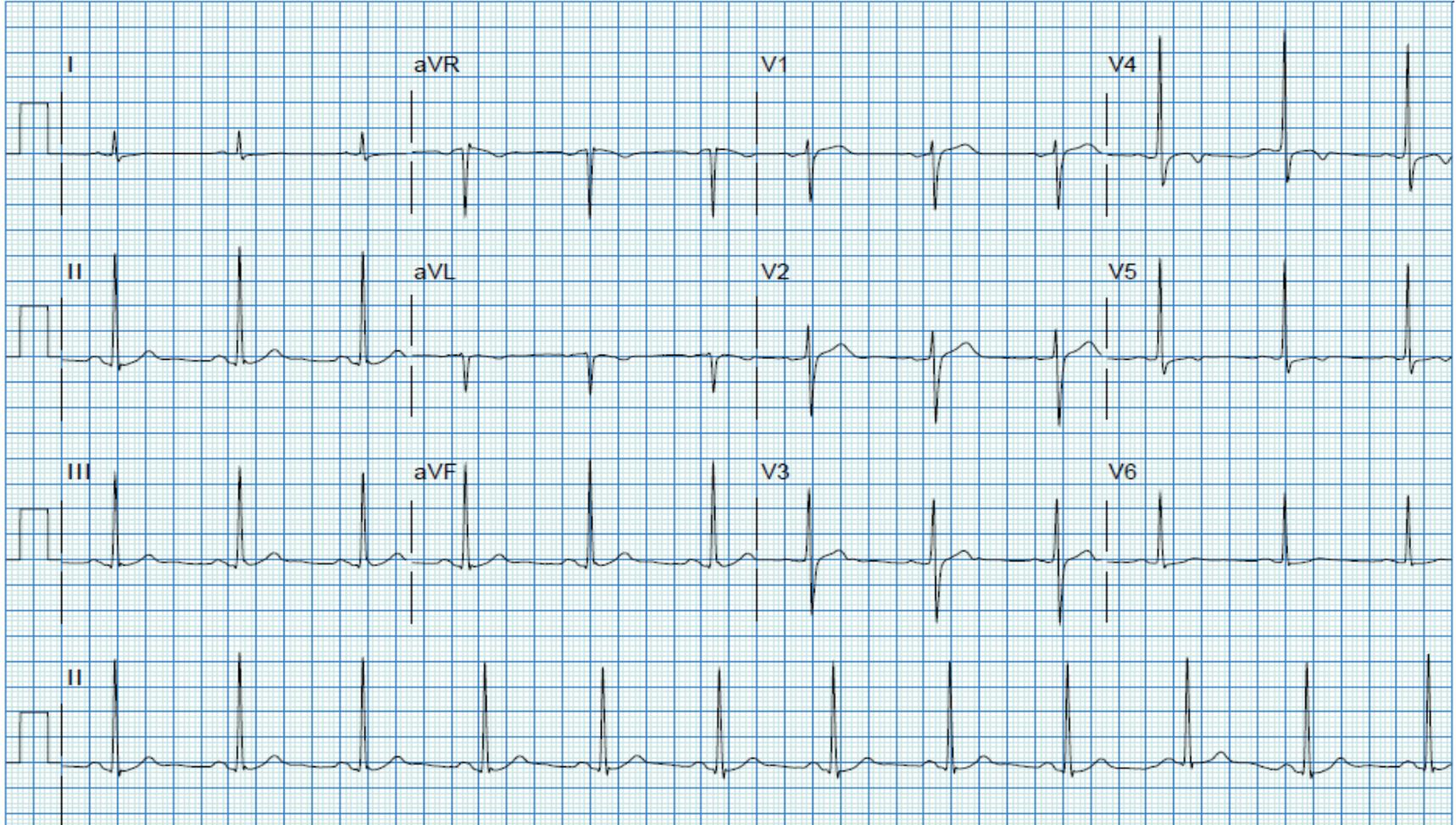
12-Lead Manual(simultaneous)
Supine

Protocol

Bruce
Stage
Spd/Grd

Rest 00:55
0.0 km/h 0.0%

| | | | | | | | |
|-------------|---------|-----------|------|--------|-----|-----|----|
| RPE | -- | HR | 67 | II LVL | 0.2 | SLP | 8 |
| METs(a) | 1.0 | Target HR | 127 | V2 LVL | 1.5 | SLP | 13 |
| BP | 119/71 | Max HR | 67 | V5 LVL | 0.0 | SLP | 5 |
| Previous BP | ---/--- | HRxBP | 7973 | | | | |



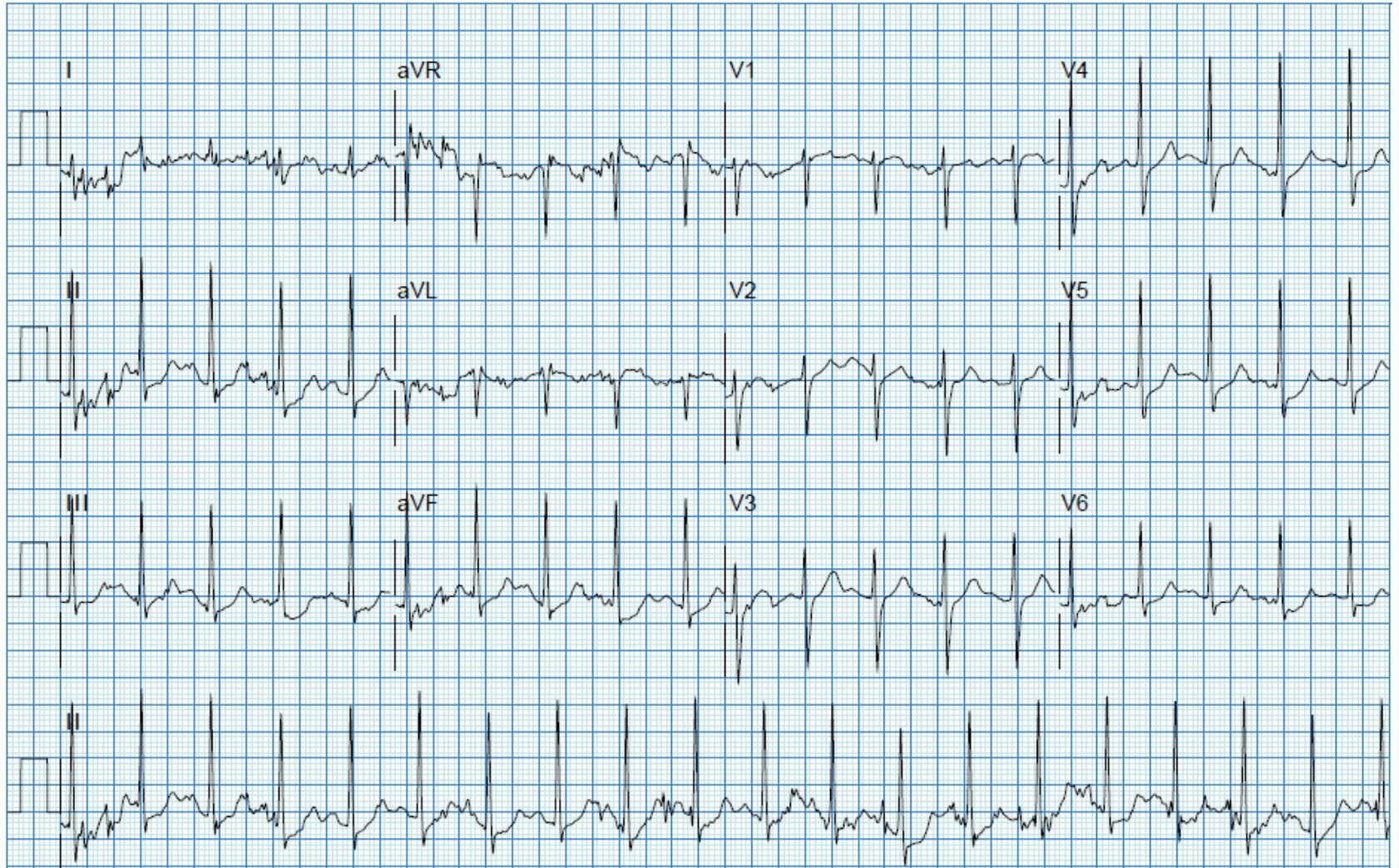
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

1 02:50 02:50
2.7 km/h 10.0%

| | | | | | | |
|-------------|--------|-----------|-------|--------|----------|----|
| RPE | -- | HR | 113 | II LVL | -0.8 SLP | 15 |
| METs(a) | 4.6 | Target HR | 127 | V2 LVL | 1.1 SLP | 12 |
| BP | 142/59 | Max HR | 114 | V5 LVL | -0.5 SLP | 11 |
| Previous BP | 119/71 | HRxBP | 16046 | | | |



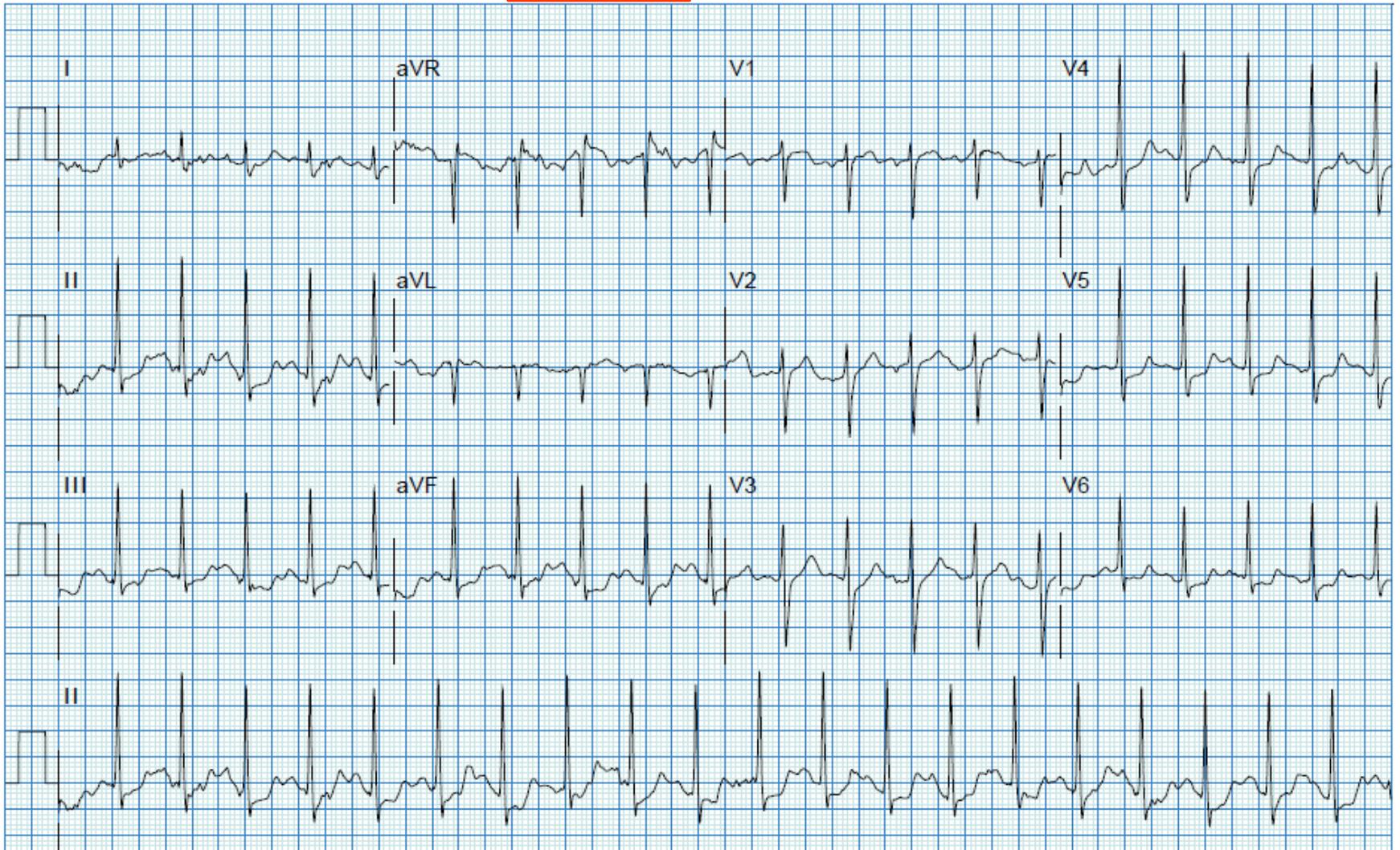
12-Lead Manual(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

2 00:32 03:32
4.0 km/h 12.0%

| | | | | | | | | |
|-------------|---------|-----------|-----|----|-----|------|-----|----|
| RPE | - | HR | 126 | II | LVL | -1.6 | SLP | 14 |
| METs(a) | 4.6 | Target HR | 127 | V2 | LVL | 1.1 | SLP | 15 |
| BP | ---/--- | Max HR | 126 | V5 | LVL | -1.2 | SLP | 8 |
| Previous BP | 142/59 | HRxBP | --- | | | | | |

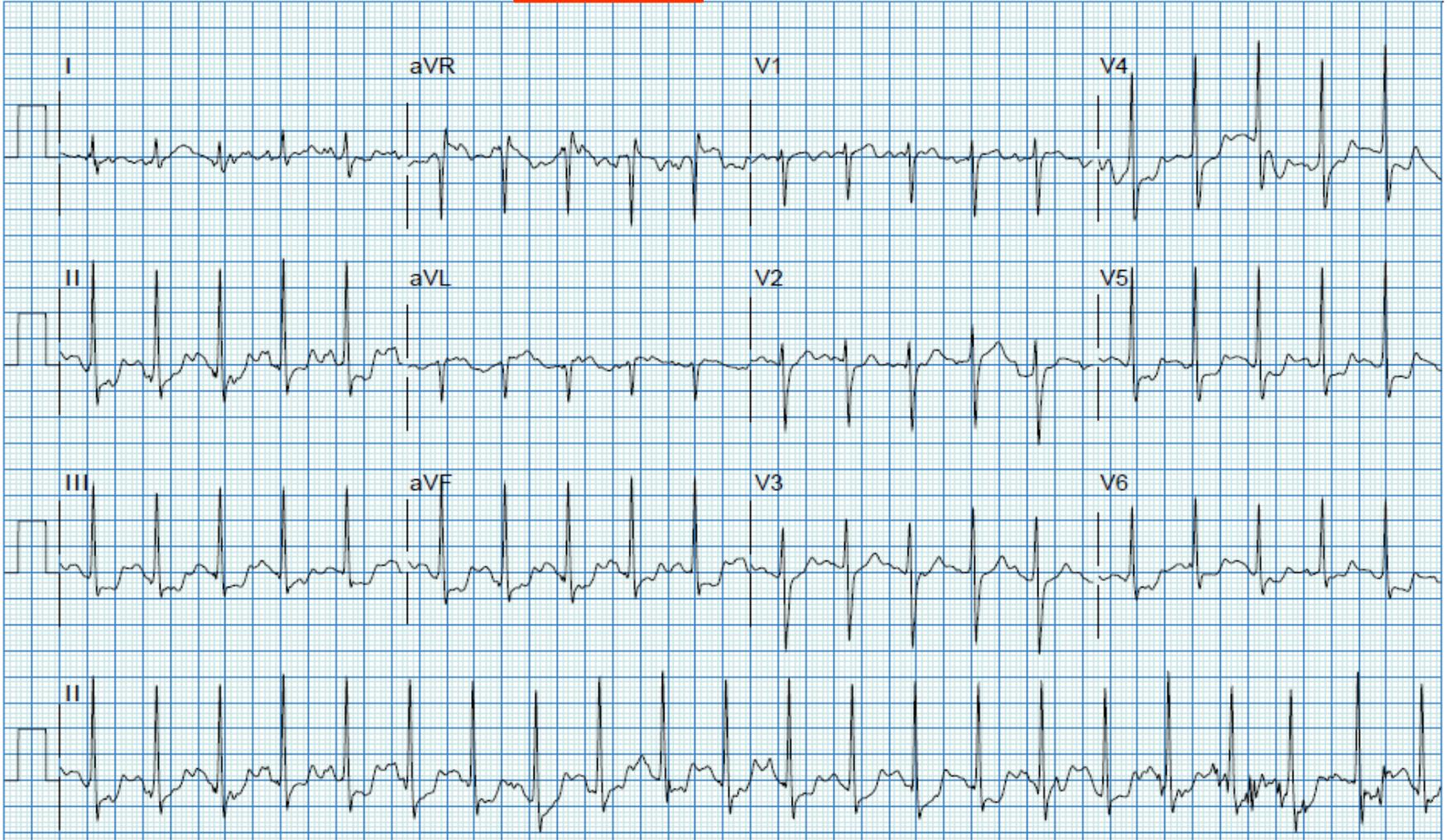


12-Lead Manual(simultaneous)

Protocol
Bruce
Stage
Spd/ Grd

2 01:26 04:26
4.0 km/h 12.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|------|-----|----|
| RPE | -- | HR | 130 | II | LVL | -1.6 | SLP | 9 |
| METs(a) | 7.0 | Target HR | 127 | V2 | LVL | 0.9 | SLP | 17 |
| BP | --/-- | Max HR | 130 | V5 | LVL | -1.4 | SLP | 4 |
| Previous BP | 142/59 | HRxBP | ---- | | | | | |



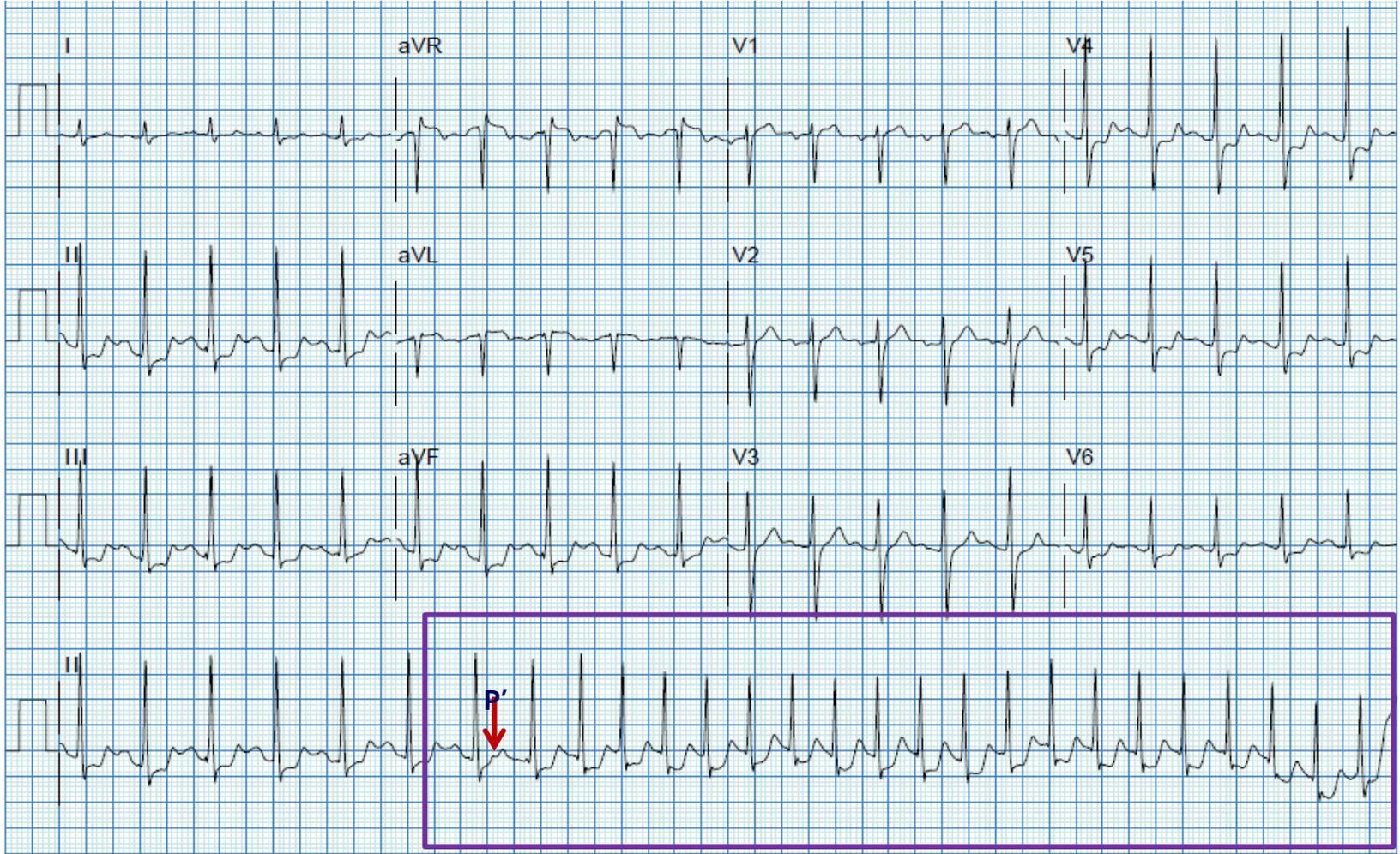
12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 00:50
0.0 km/h 0.0%

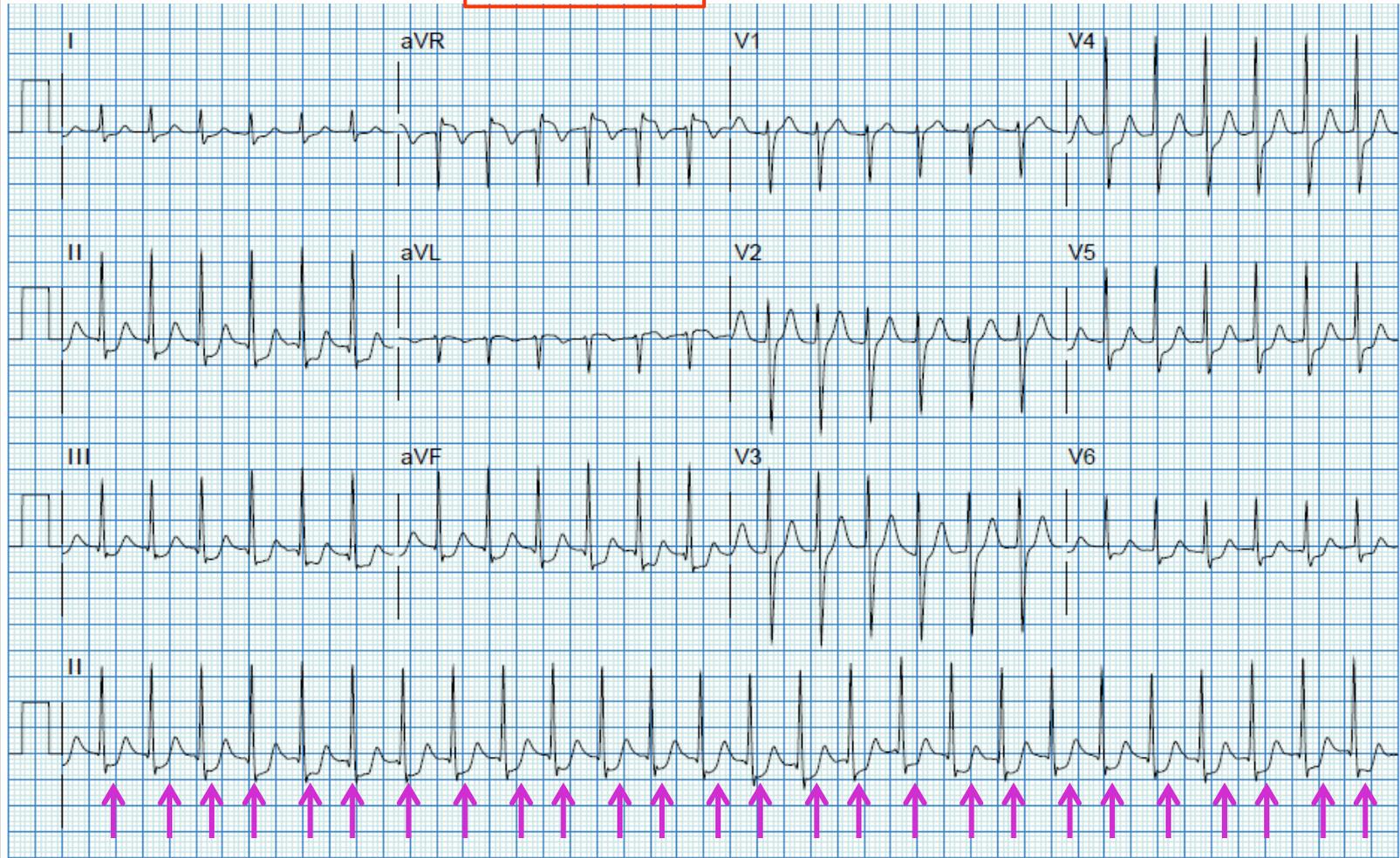
| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|-----|----|--|
| RPE | -- | HR | 125 | | | | | | |
| METs(a) | 10.1 | Target HR | 127 | II | LVL | -1.3 | SLP | 1 | |
| BP | 166/62 | Max HR | 145 | V2 | LVL | 1.8 | SLP | 32 | |
| Previous BP | 155/60 | HRxBP | 20750 | V5 | LVL | -1.2 | SLP | -4 | |



PSVT

| | | | | | | | | | | | |
|--------------------------|----------|-------|-------------|--------|-----------|-------|----|-----|------|-----|----|
| 12-Lead FF(simultaneous) | Protocol | Bruce | RPE | -- | HR | 162 | | | | | |
| | Stage | | METs(a) | 10.1 | Target HR | 127 | II | LVL | -2.6 | SLP | 29 |
| | Spd/Grd | | BP | 166/62 | Max HR | 185 | V2 | LVL | 2.6 | SLP | 50 |
| | | | Previous BP | 155/60 | HRxBP | 26892 | V5 | LVL | -1.6 | SLP | 30 |
| | | | | | | | | | | | |

Recov 02:10
0.0 km/h 0.0%

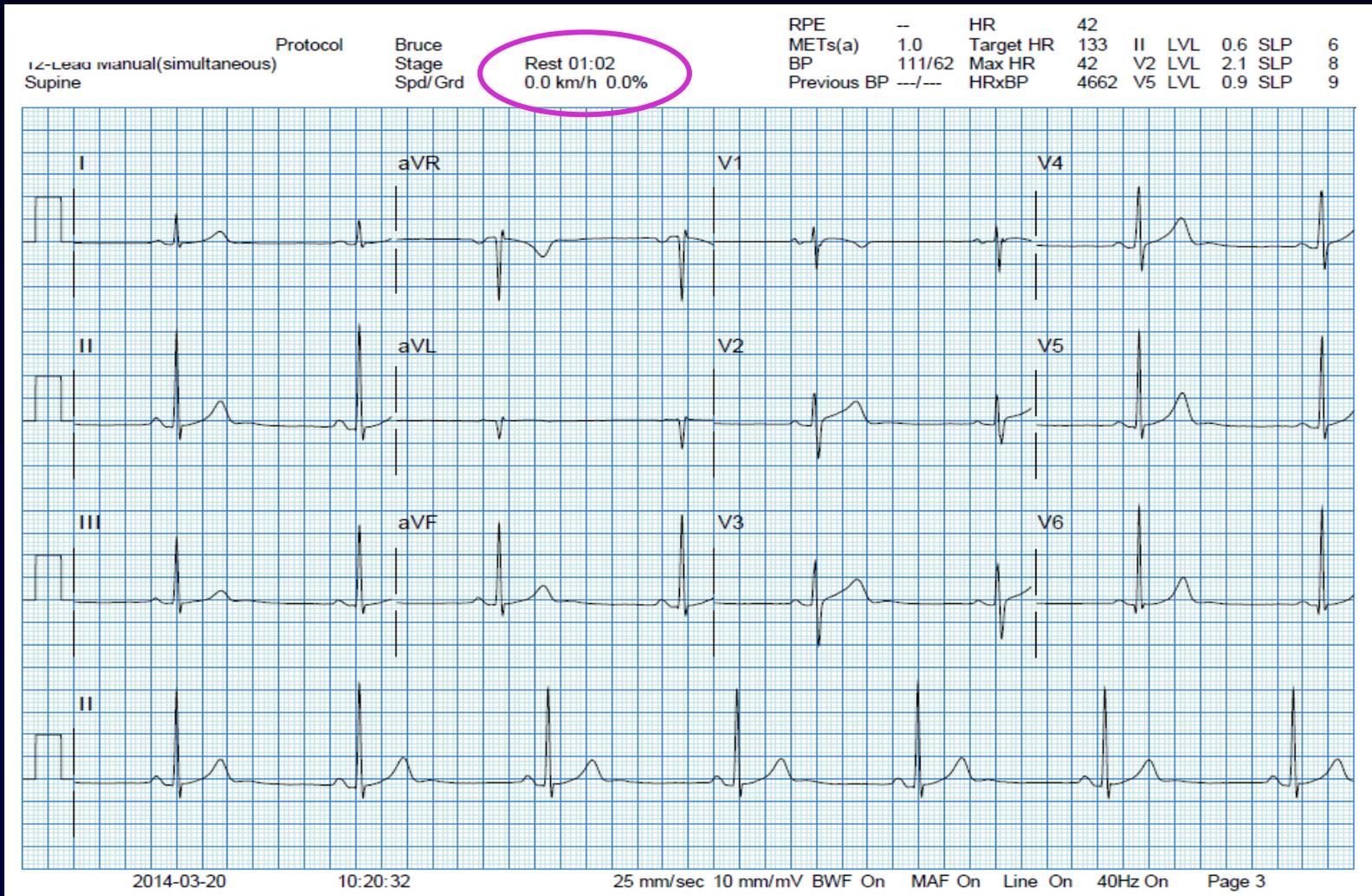


PSVT

Sustained supraventricular premature beat는 운동시

1~2%의 환자에서 유발이 가능하다고 한다.

64/M Chest pain을 동반하지 않은 palpitation



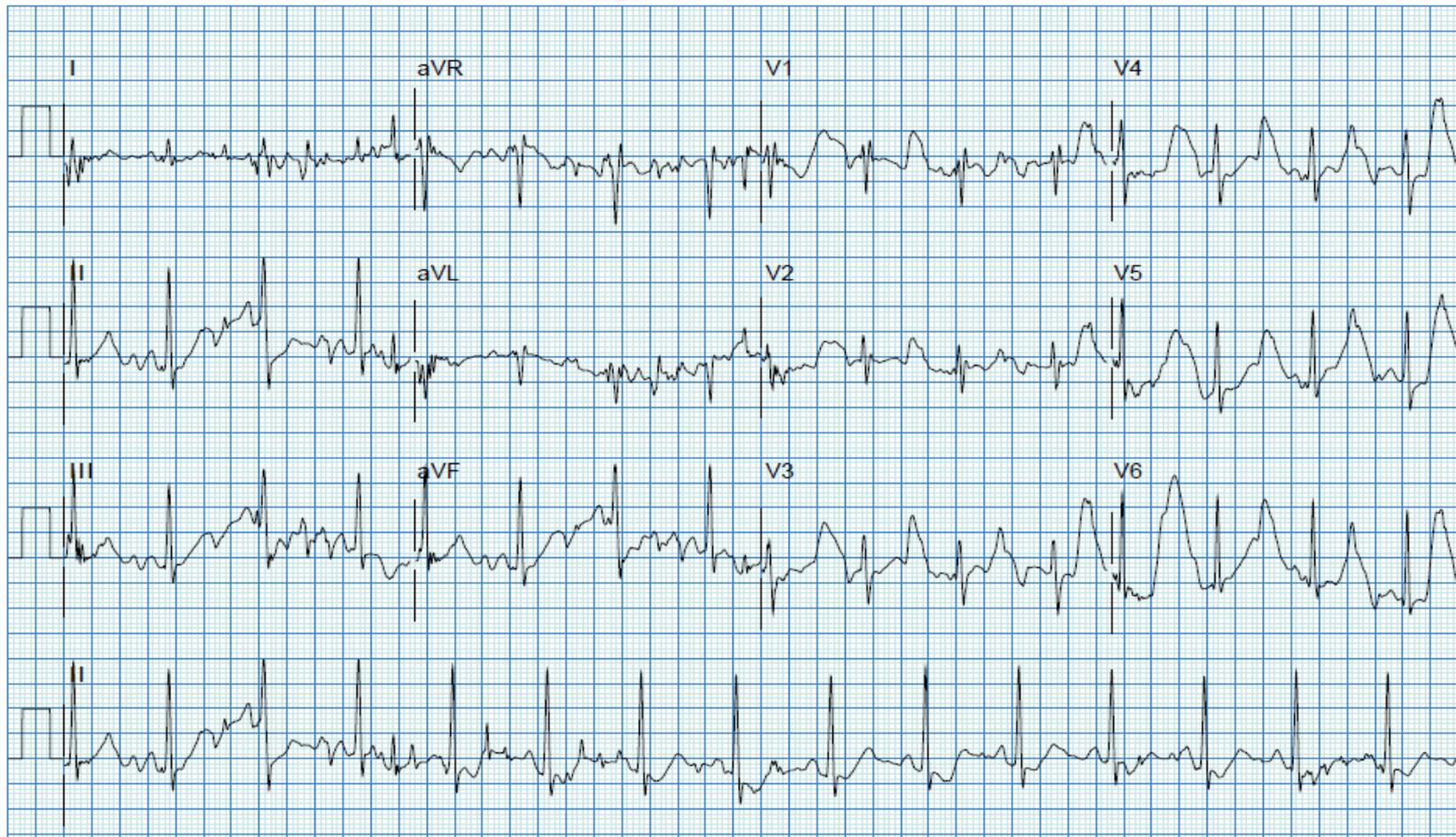
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

1 02:50 02:50
2.7 km/h 10.0%

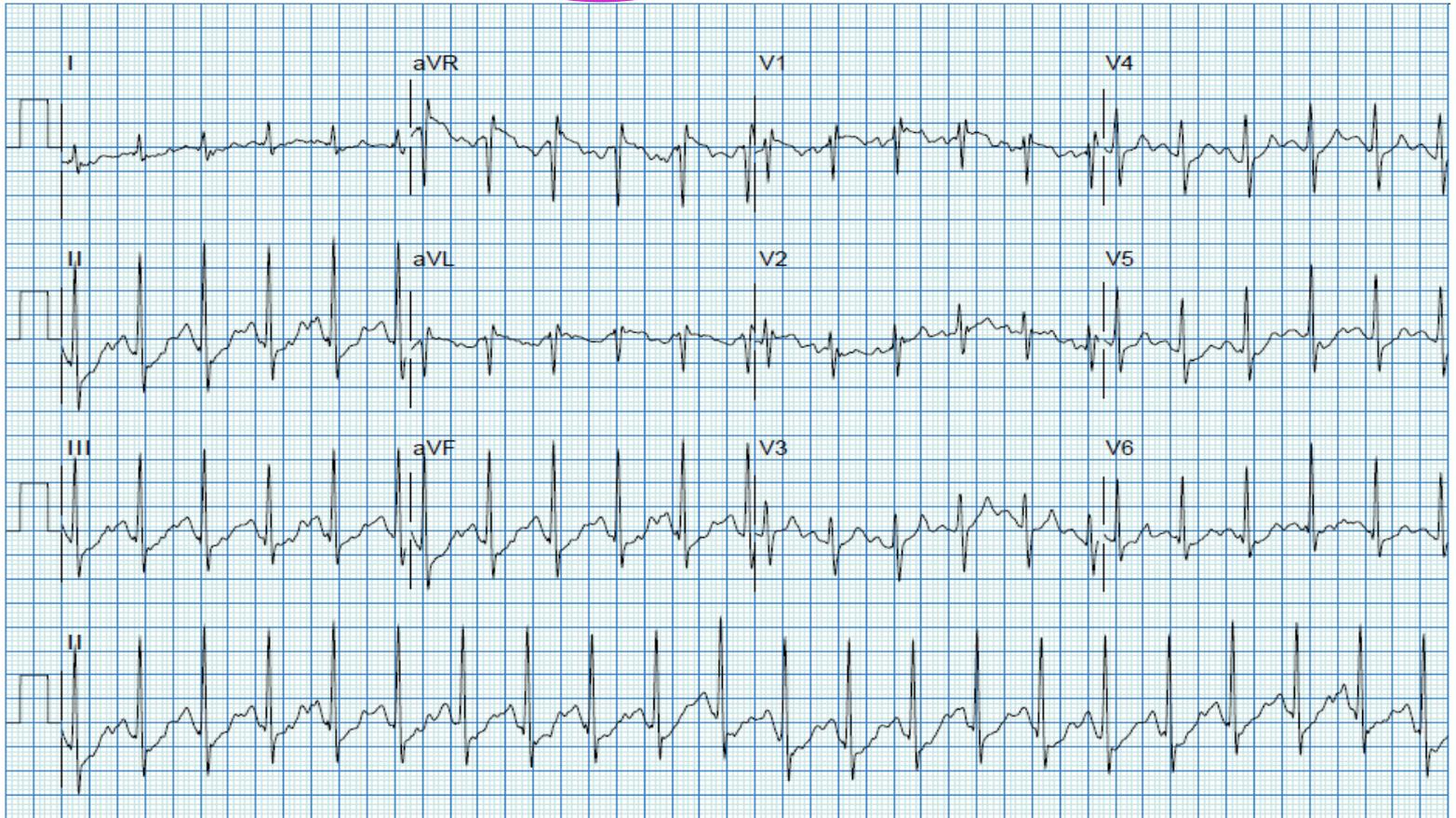
| | | | | | | | |
|-------------|--------|-----------|-------|--------|-----|-----|----|
| RPE | - | HR | 86 | II LVL | 0.0 | SLP | 14 |
| METs(a) | 4.6 | Target HR | 133 | V2 LVL | 1.1 | SLP | 7 |
| BP | 121/58 | Max HR | 91 | V5 LVL | 0.6 | SLP | 22 |
| Previous BP | 111/62 | HRxBP | 10406 | | | | |



12-Lead(simultaneous)

Protocol Bruce
Stage 3 02:50 08:50
Spd/Grd 5.4 km/h 14.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|-----|----|
| RPE | - | HR | 127 | II | LVL | -1.3 | SLP | 24 |
| METs(a) | 10.1 | Target HR | 133 | V2 | LVL | 0.6 | SLP | 6 |
| BP | 162/63 | Max HR | 128 | V5 | LVL | -0.4 | SLP | 20 |
| Previous BP | 132/58 | HRxBP | 20574 | | | | | |



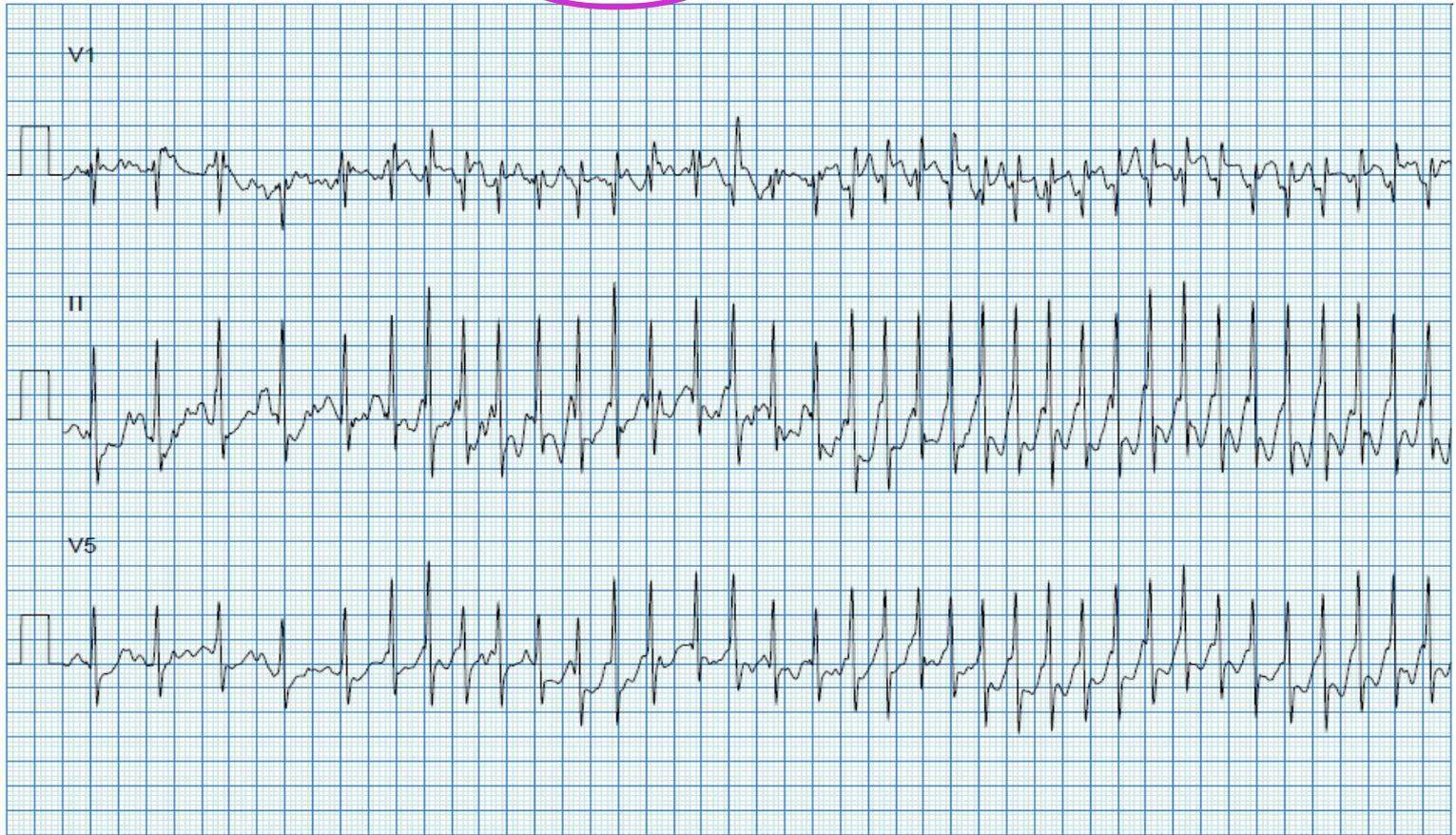
2014-03-20 10:30:19 25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 6

10-second Rhythm FF

Protocol Bruce
Stage
Spd/Grd

4 00: 16 09: 16
6.7 km/h 16.0%

| | | | | | | | |
|-------------|---------|-----------|-----|--------|------|-----|----|
| RPE | -- | HR | 135 | II LVL | -1.8 | SLP | 29 |
| METs(a) | 10.1 | Target HR | 133 | V2 LVL | 1.1 | SLP | 8 |
| BP | ---/--- | Max HR | 135 | V5 LVL | -0.6 | SLP | 20 |
| Previous BP | 162/63 | HRxBP | --- | | | | |



2014-03-20

10:30:45

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 7

Atrial fibrillation

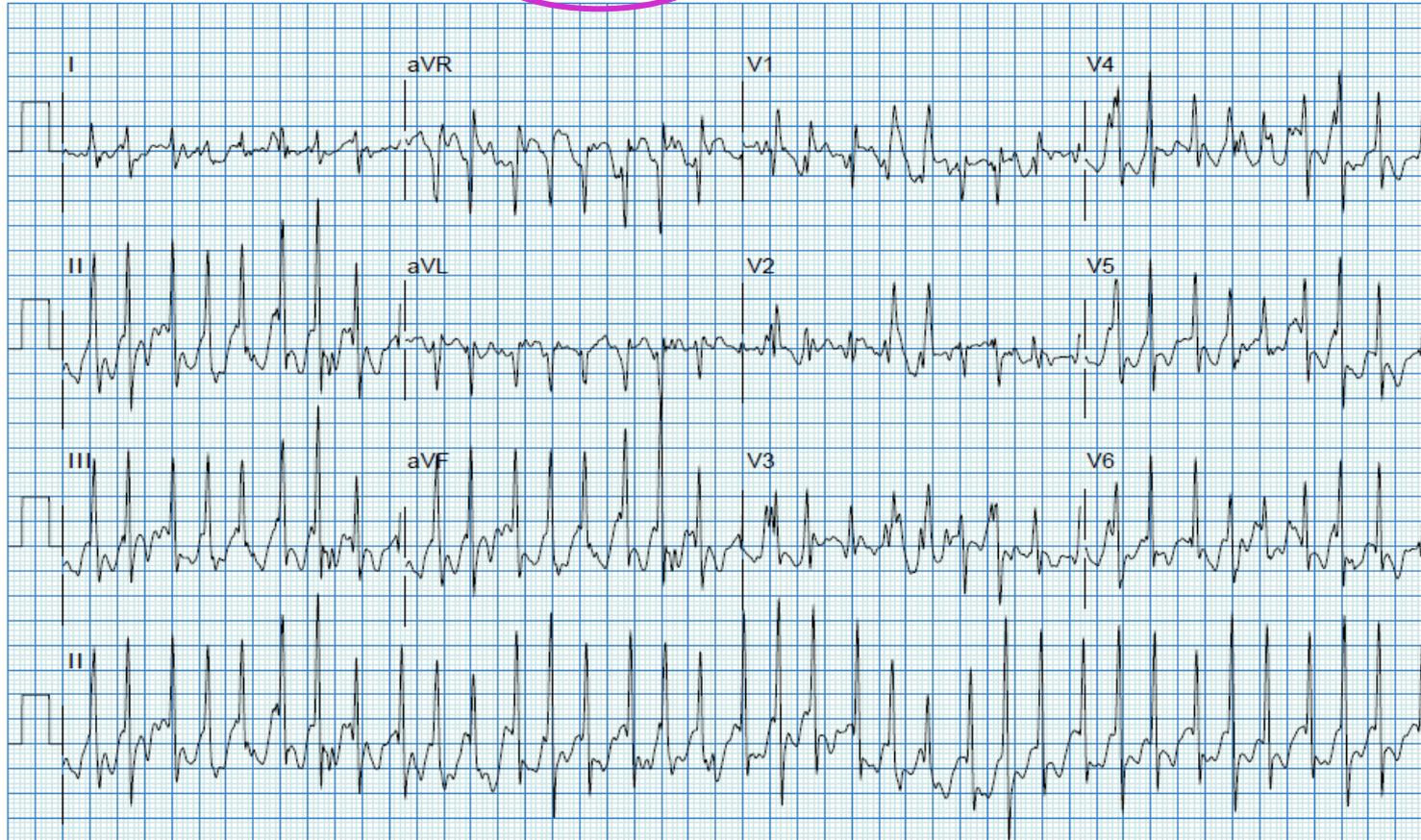
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 00:00
1.9 km/h 0.0%

| | | | | | | |
|-------------|---------|-----------|------|--------|----------|-----|
| RPE | - | HR | 261 | II LVL | -0.7 SLP | -23 |
| METs(a) | 10.1 | Target HR | 133 | V2 LVL | -0.4 SLP | 13 |
| BP | ---/--- | Max HR | 263 | V5 LVL | -0.1 SLP | -19 |
| Previous BP | 162/63 | HRxBP | ---- | | | |



2014-03-20

10:31:05

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 10

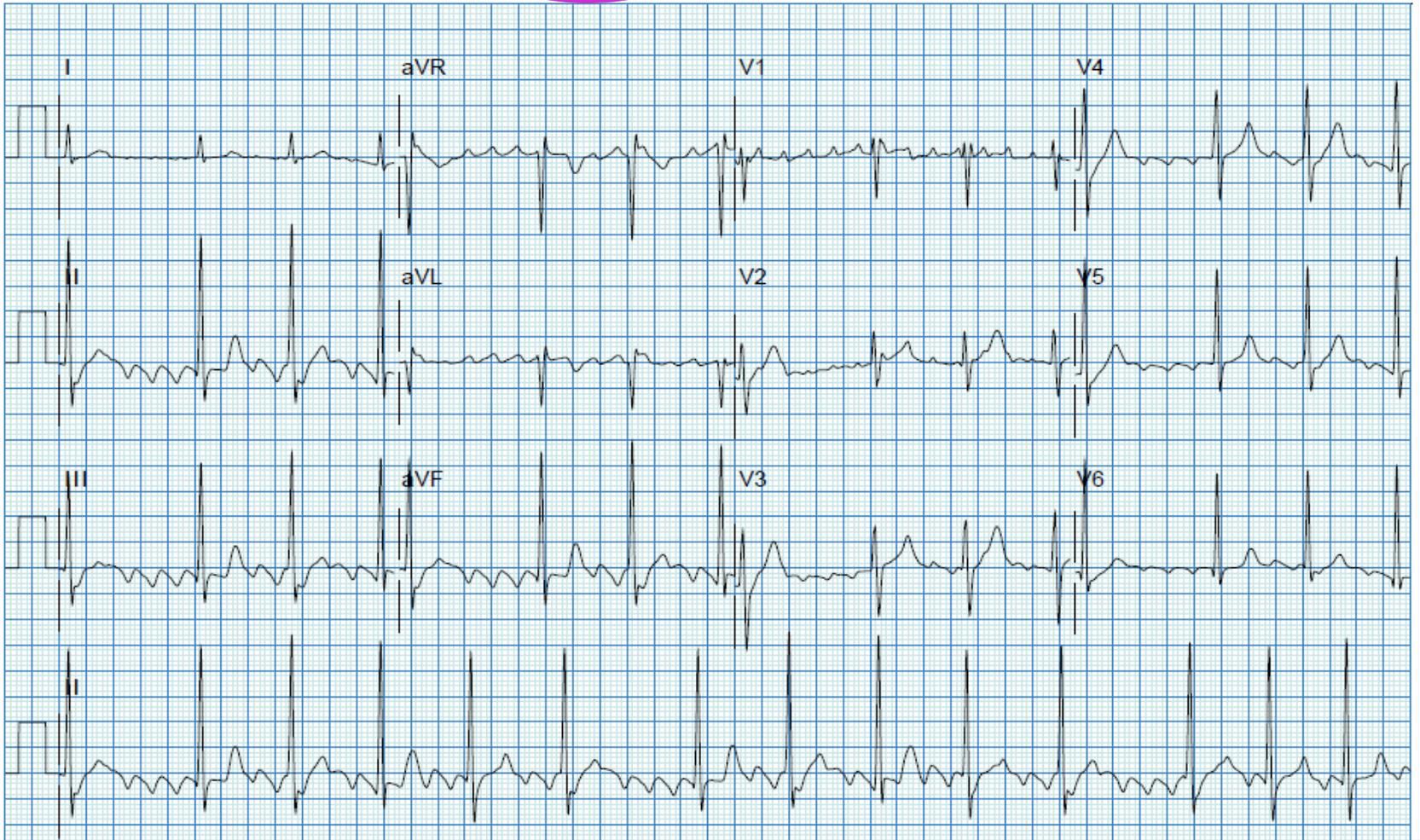
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 03:00
0.0 km/h 0.0%

| | | | | | | |
|-------------|---------|-----------|-----|--------|----------|----|
| RPE | - | HR | 82 | II LVL | -0.1 SLP | 16 |
| METs(a) | 10.1 | Target HR | 133 | V2 LVL | 1.4 SLP | 21 |
| BP | ---/--- | Max HR | 263 | V5 LVL | 0.3 SLP | 17 |
| Previous BP | 121/64 | HRxBP | --- | | | |



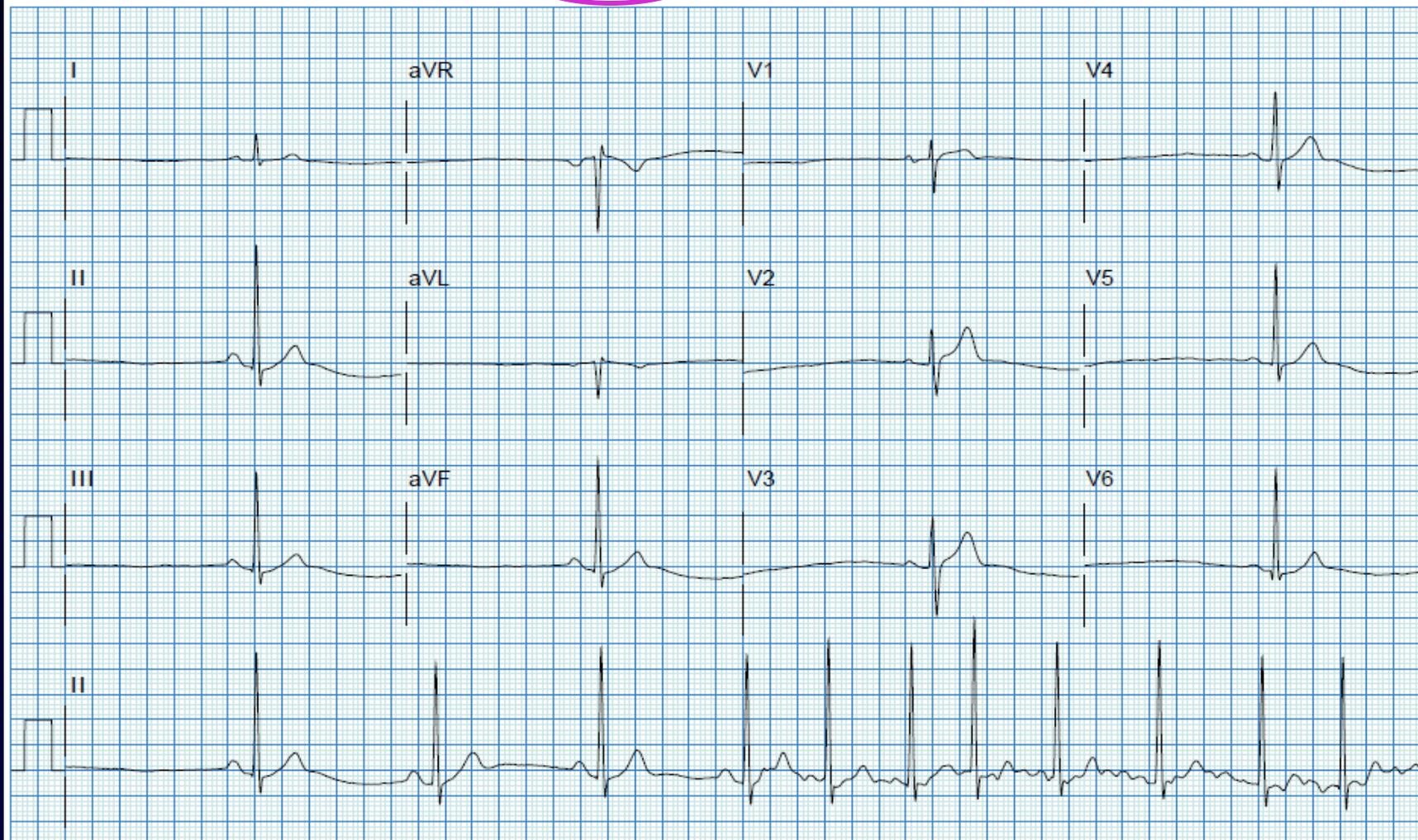
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 05:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|-----|----|
| RPE | -- | HR | 88 | II | LVL | -0.1 | SLP | 3 |
| METs(a) | 10.1 | Target HR | 133 | V2 | LVL | 1.6 | SLP | 13 |
| BP | 148/84 | Max HR | 263 | V5 | LVL | 0.3 | SLP | 6 |
| Previous BP | 157/89 | HRxBP | 13024 | | | | | |



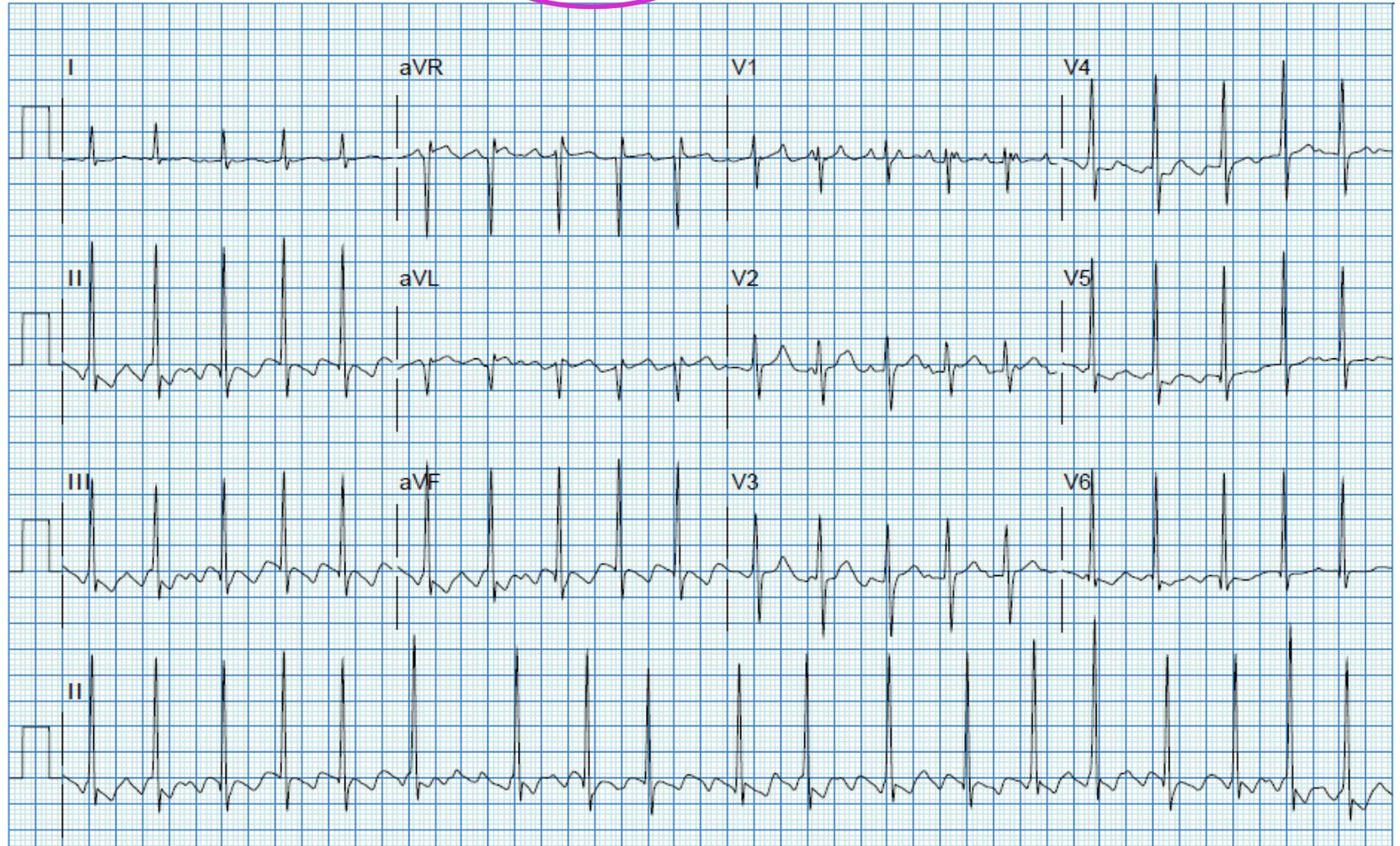
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 11:00
0.0 km/h 0.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|------|-----|----|--|
| RPE | -- | HR | 117 | | | | | | |
| METs(a) | 10.1 | Target HR | 133 | II | LVL | -0.9 | SLP | -4 | |
| BP | 107/79 | Max HR | 263 | V2 | LVL | 1.4 | SLP | 10 | |
| Previous BP | 106/78 | HRxBP | 12519 | V5 | LVL | -0.2 | SLP | 1 | |



Atrial fibrillation

운동시에 유발가능하고, 운동이 끝나는시점에 체내 카테콜아민은 감소하고 미주신경활성도가 상승하면서 발생할 수 있으며 1%에서 유발될 수 있다.

42/F 종합검진에서 정밀검사 의뢰

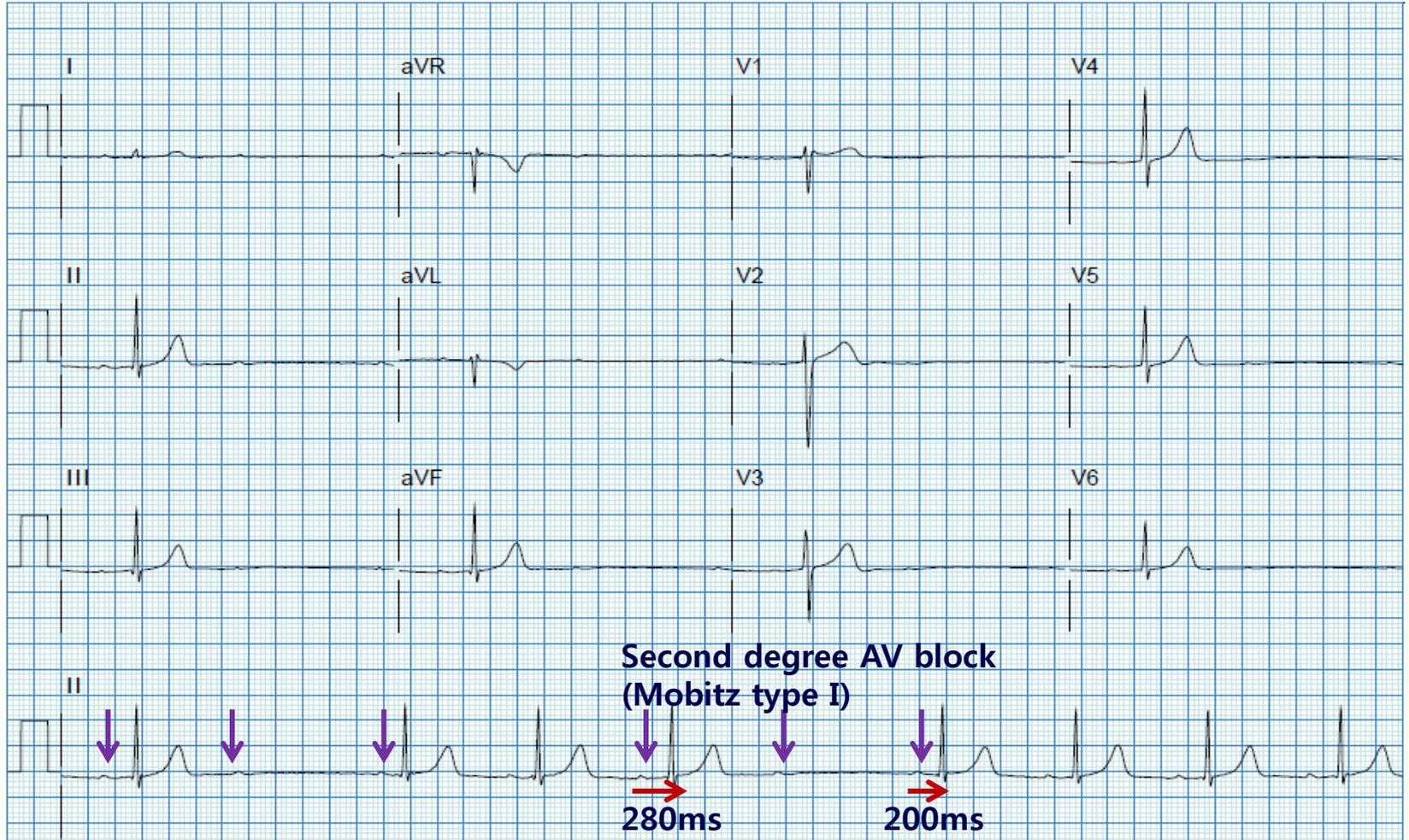
12-Lead Manual(simultaneous)
Supine

Protocol

Bruce
Stage
Spd/Grd

Rest 01:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|-----|-----|---|
| RPE | -- | HR | 40 | II | LVL | 0.3 | SLP | 3 |
| METs(a) | 1.0 | Target HR | 152 | V2 | LVL | 1.3 | SLP | 8 |
| BP | 100/67 | Max HR | 40 | V5 | LVL | 0.3 | SLP | 4 |
| Previous BP | --/-- | HRxBP | 4000 | | | | | |



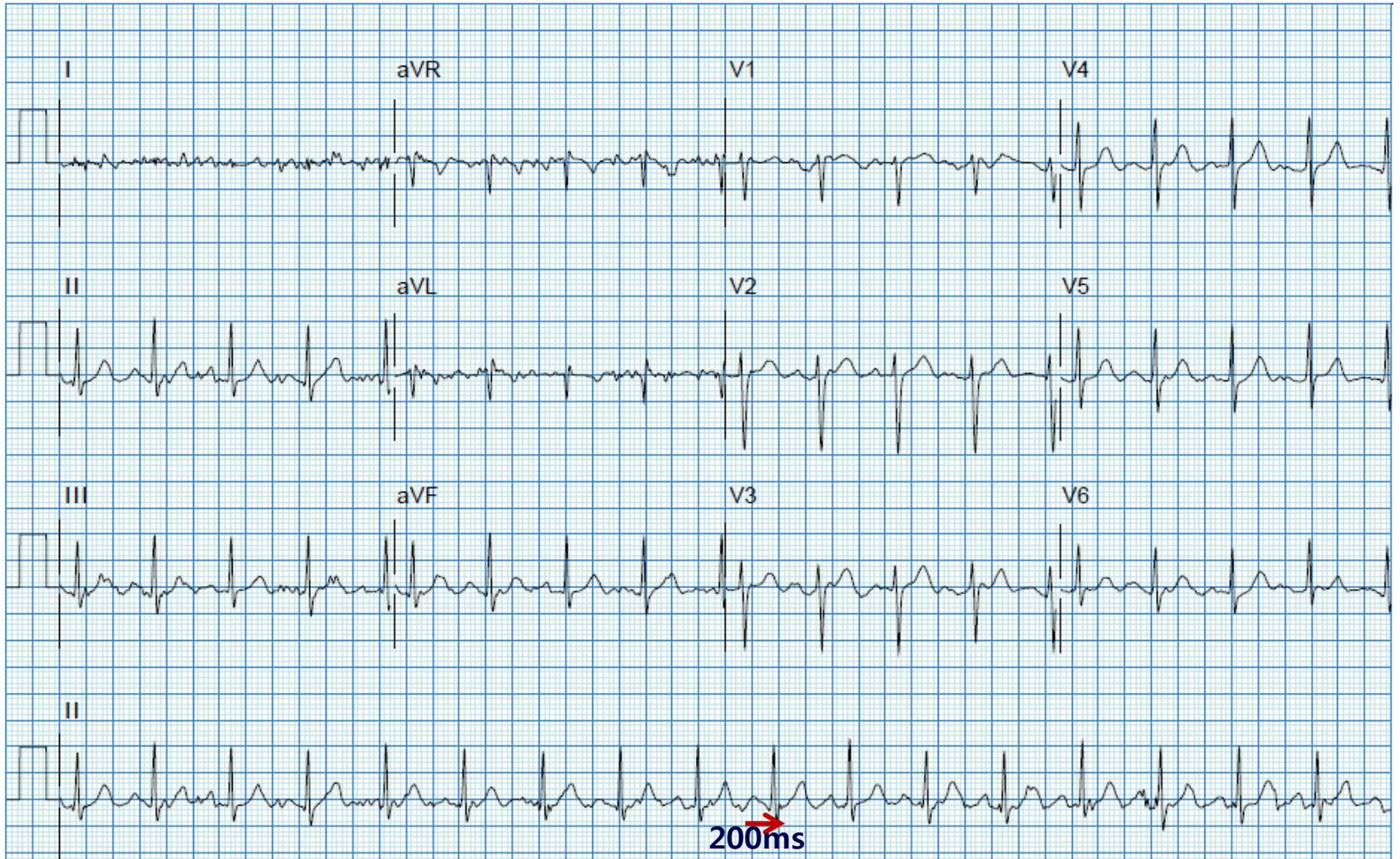
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

1 02:50 02:50
2.7 km/h 10.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|--|
| RPE | -- | HR | 111 | | | | | | |
| METs(a) | 4.6 | Target HR | 152 | II | LVL | 0.5 | SLP | 16 | |
| BP | 133/76 | Max HR | 115 | V2 | LVL | 1.2 | SLP | 13 | |
| Previous BP | 100/67 | HRxBP | 14763 | V5 | LVL | 0.9 | SLP | 14 | |



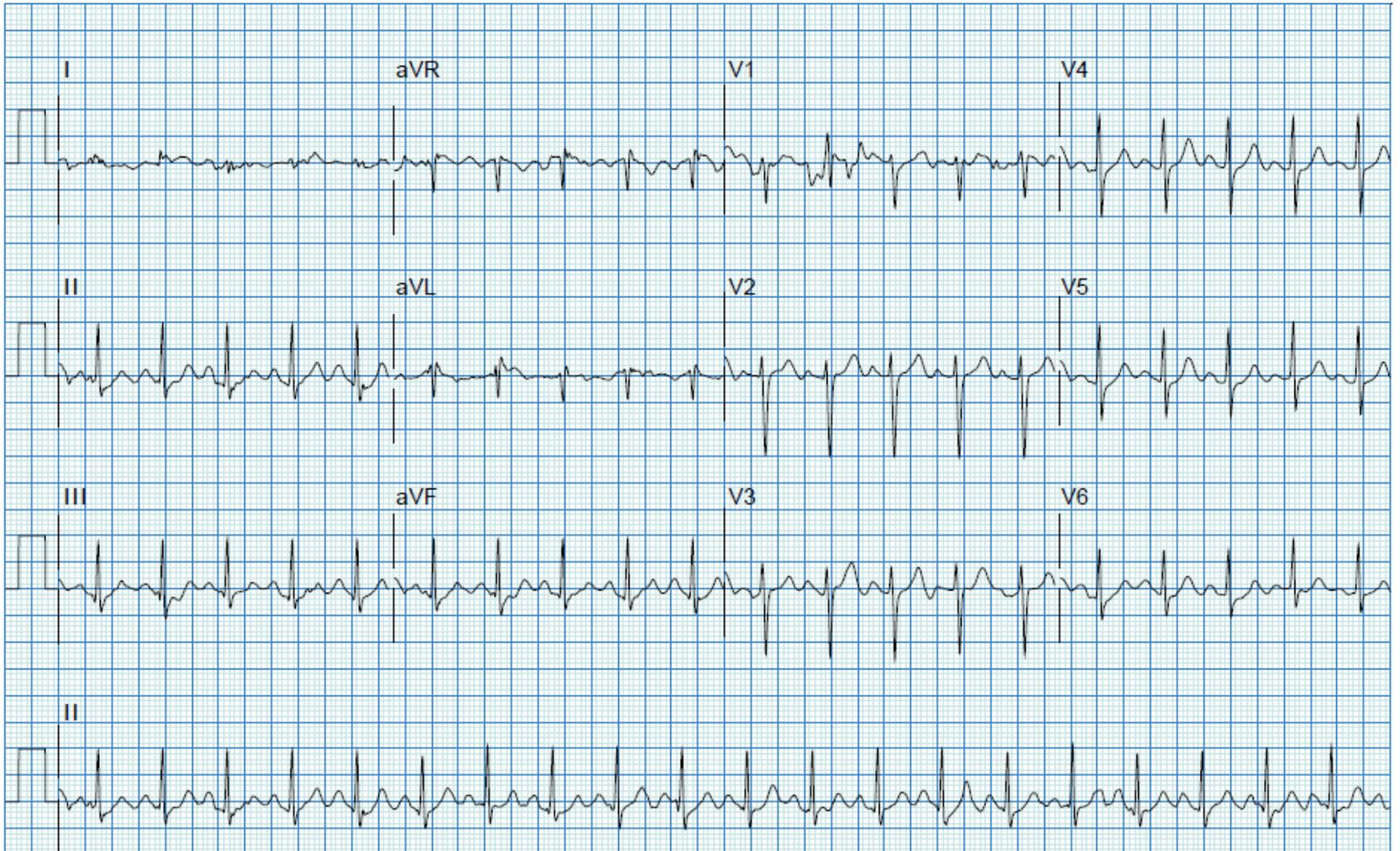
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

2 02:50 05:50
4.0 km/h 12.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|--|
| RPE | -- | HR | 126 | | | | | | |
| METs(a) | 7.0 | Target HR | 152 | II | LVL | 0.3 | SLP | 21 | |
| BP | 137/72 | Max HR | 127 | V2 | LVL | 1.1 | SLP | 18 | |
| Previous BP | 133/76 | HRxBP | 17262 | V5 | LVL | 0.6 | SLP | 20 | |



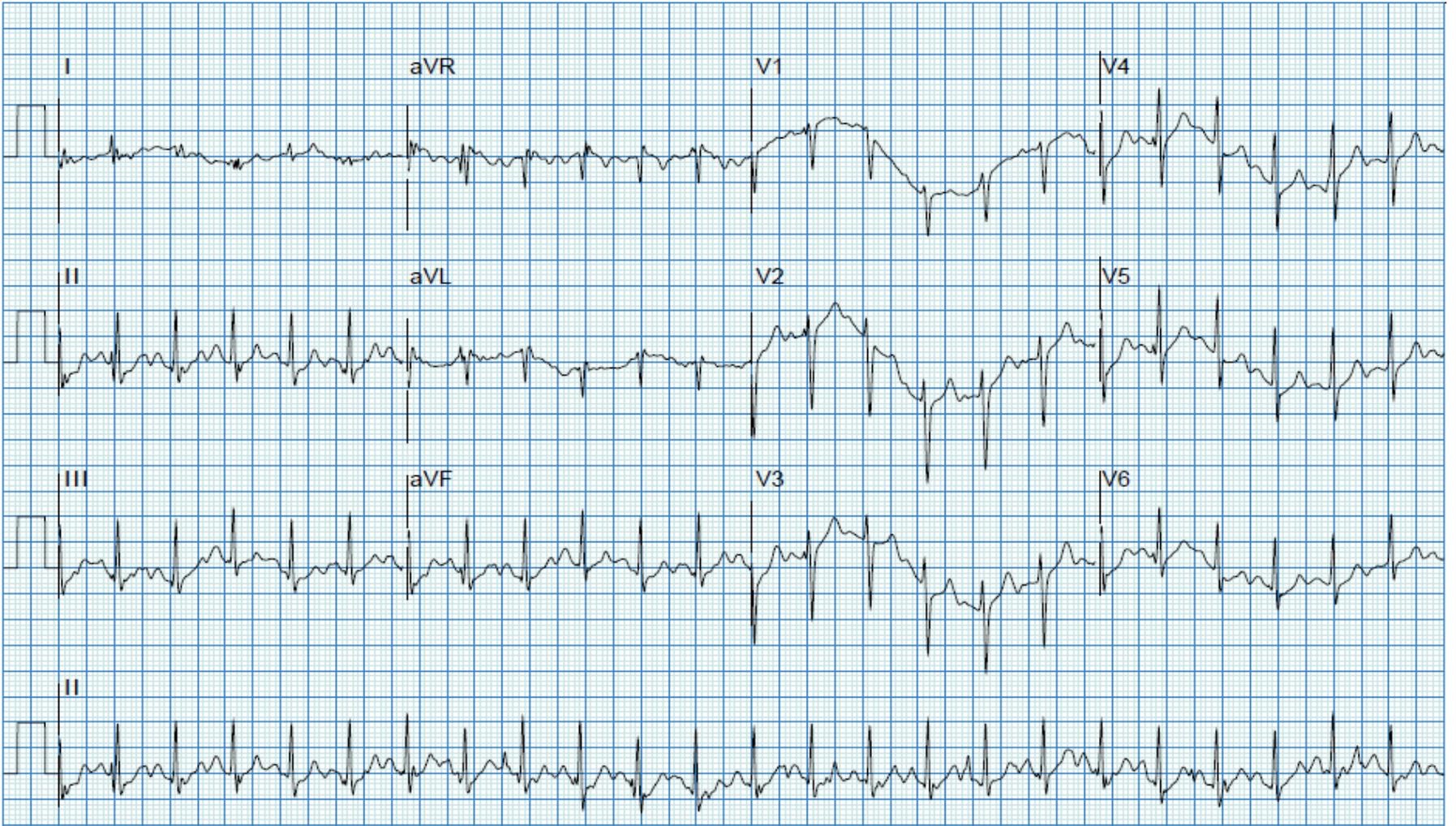
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

3 02:50 08:50
5.4 km/h 14.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|
| RPE | - | HR | 145 | II | LVL | 0.1 | SLP | 25 |
| METs(a) | 10.1 | Target HR | 152 | V2 | LVL | 1.7 | SLP | 29 |
| BP | 141/66 | Max HR | 145 | V5 | LVL | 0.6 | SLP | 31 |
| Previous BP | 137/72 | HRxBP | 20445 | | | | | |



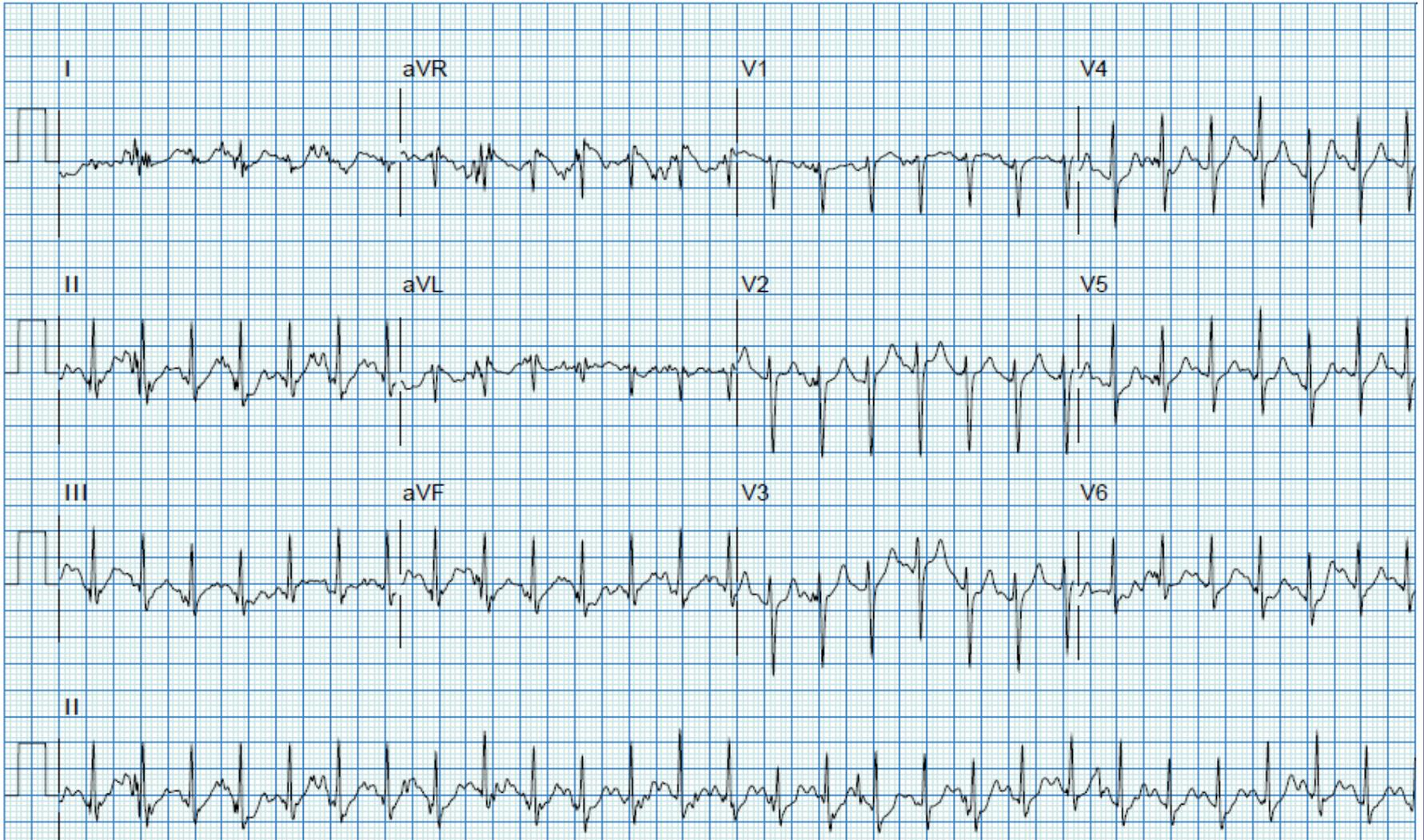
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 00:00
1.9 km/h 0.0%

| | | | | | | | |
|-------------|---------|-----------|------|--------|-----|-----|----|
| RPE | -- | HR | 167 | II LVL | 0.5 | SLP | 31 |
| METs(a) | 12.8 | Target HR | 152 | V2 LVL | 2.1 | SLP | 39 |
| BP | ---/--- | Max HR | 167 | V5 LVL | 0.8 | SLP | 36 |
| Previous BP | 141/66 | HRxBP | ---- | | | | |



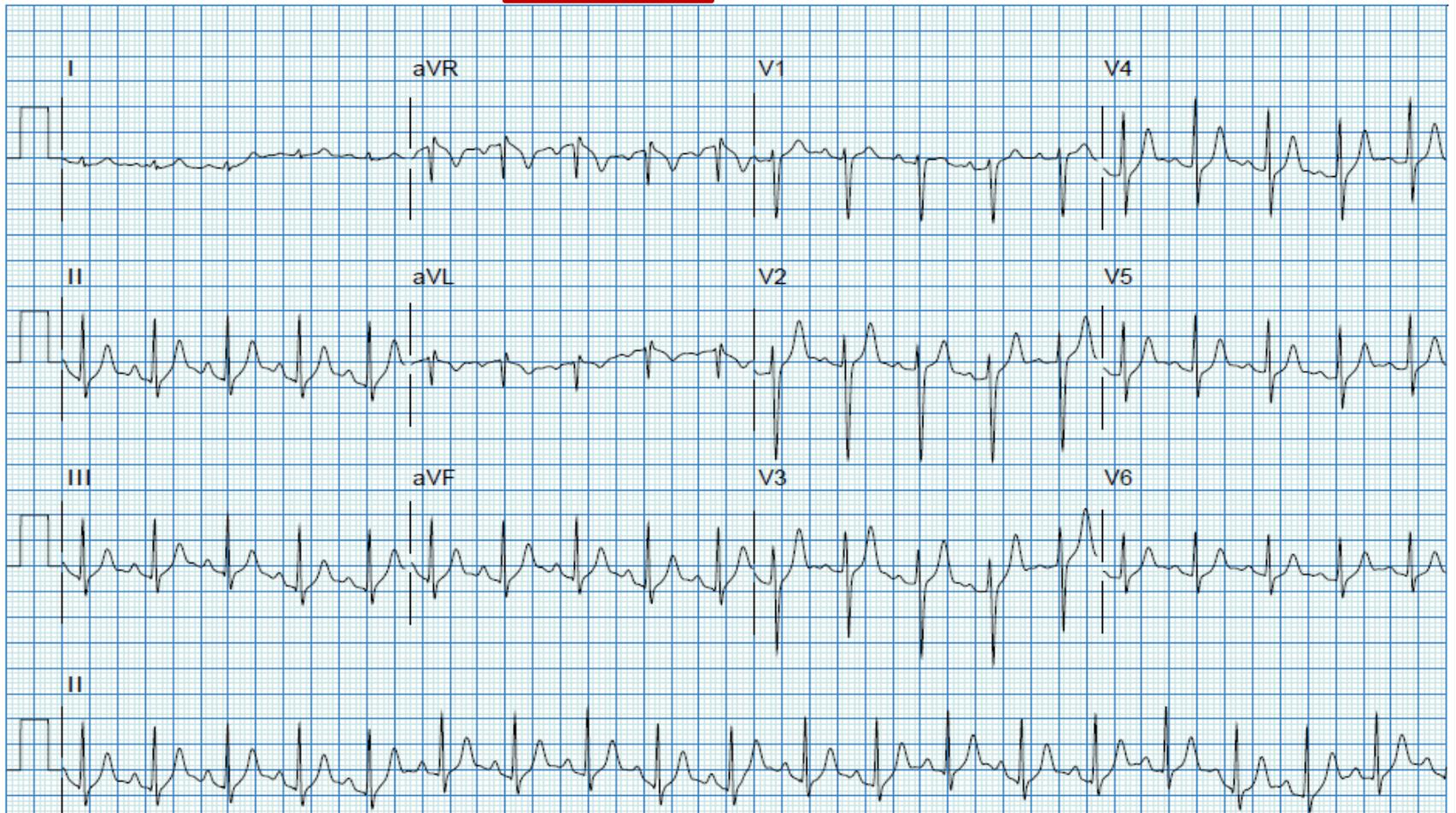
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 01:00
0.0 km/h 0.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|--|
| RPE | - | HR | 120 | | | | | | |
| METs(a) | 12.8 | Target HR | 152 | II | LVL | 1.8 | SLP | 50 | |
| BP | 137/63 | Max HR | 167 | V2 | LVL | 2.6 | SLP | 50 | |
| Previous BP | 141/66 | HRxBP | 16440 | V5 | LVL | 1.6 | SLP | 50 | |



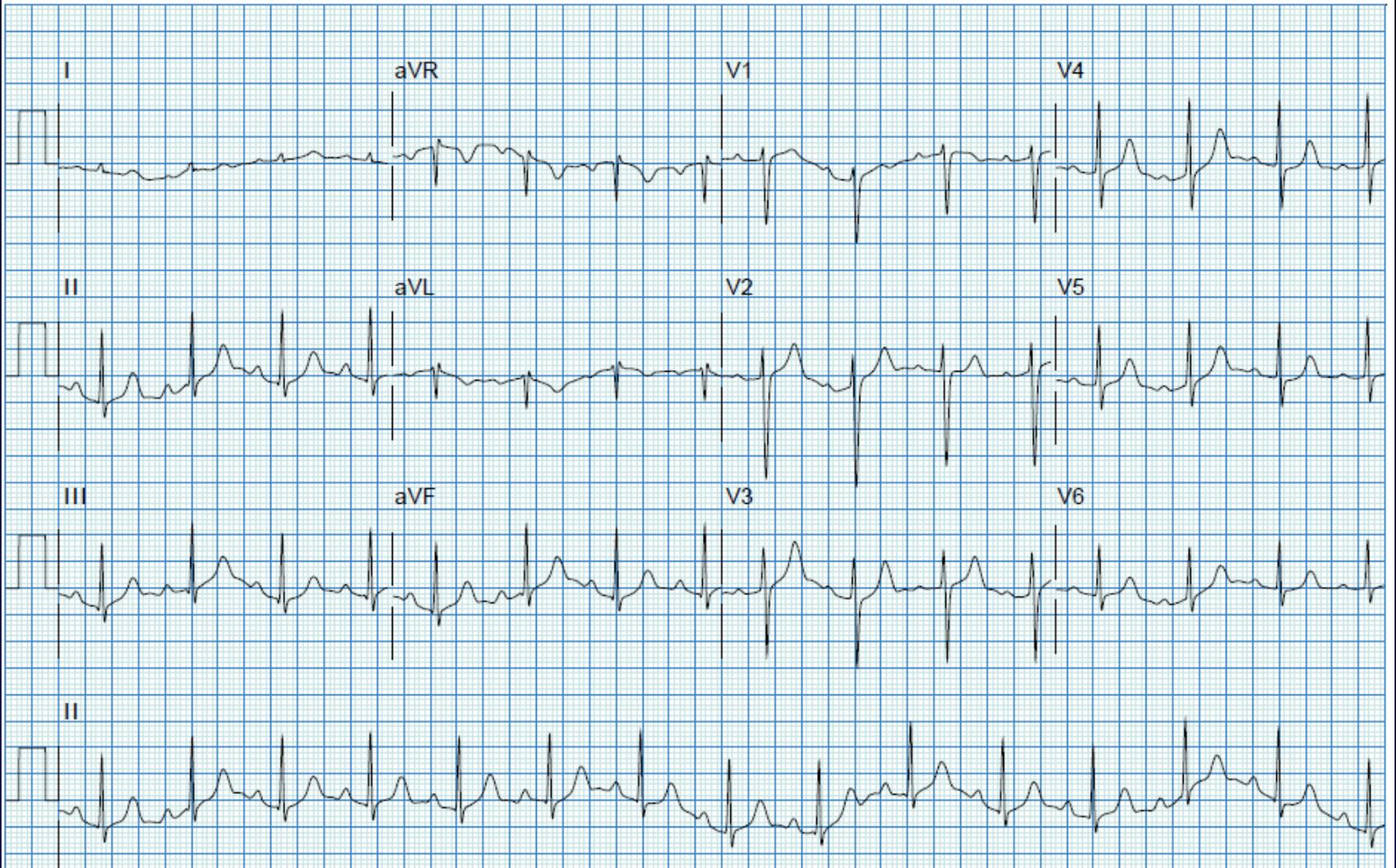
12-Lead(simultaneous)

Protocol

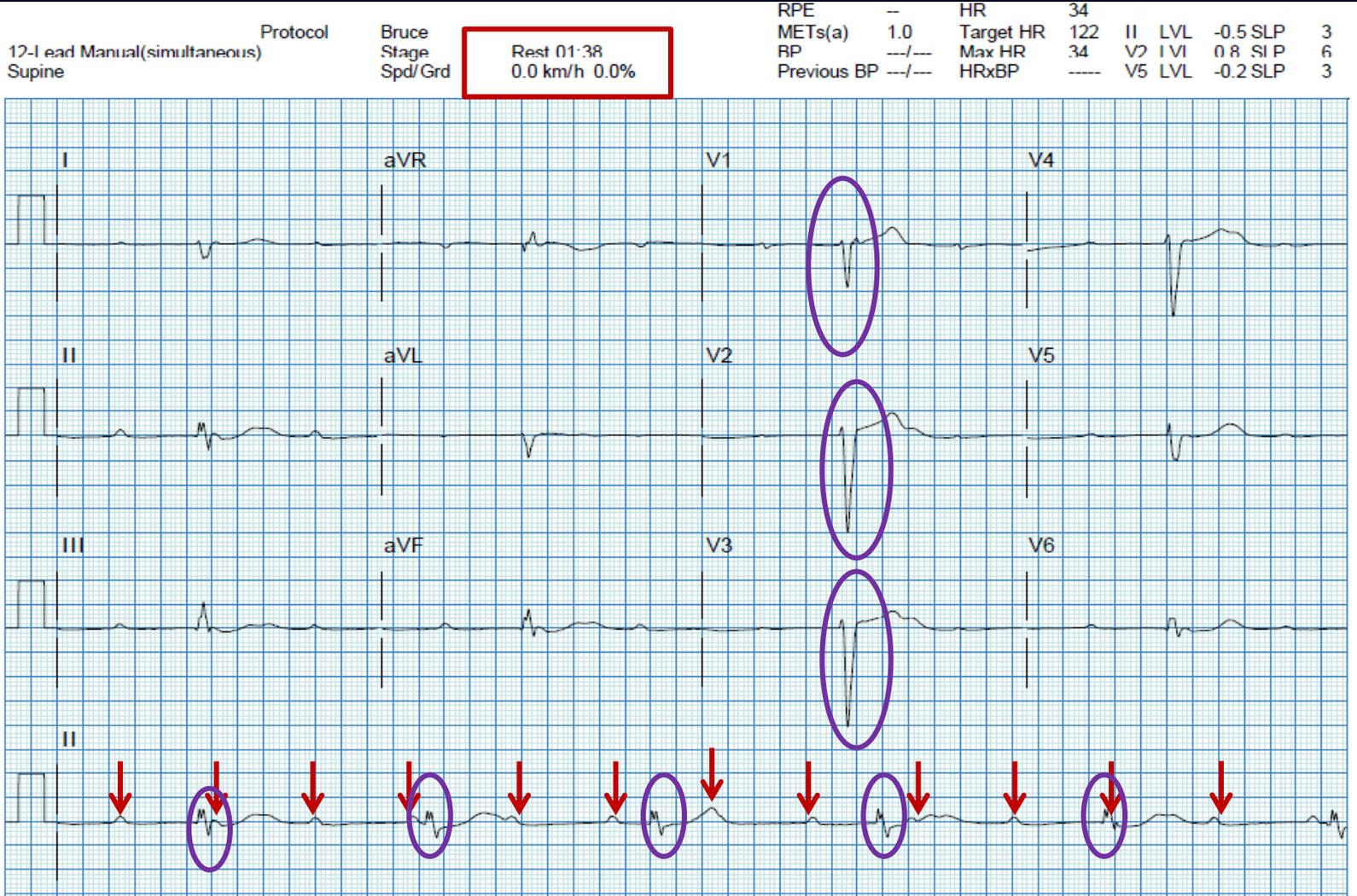
Bruce
Stage
Spd/Grd

Recov 03:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|
| RPE | -- | HR | 93 | II | LVL | 1.0 | SLP | 15 |
| METs(a) | 12.8 | Target HR | 152 | V2 | LVL | 1.6 | SLP | 15 |
| BP | 142/68 | Max HR | 167 | V5 | LVL | 0.8 | SLP | 12 |
| Previous BP | 137/63 | HRxBP | 13206 | | | | | |



77/M 대화중 syncope



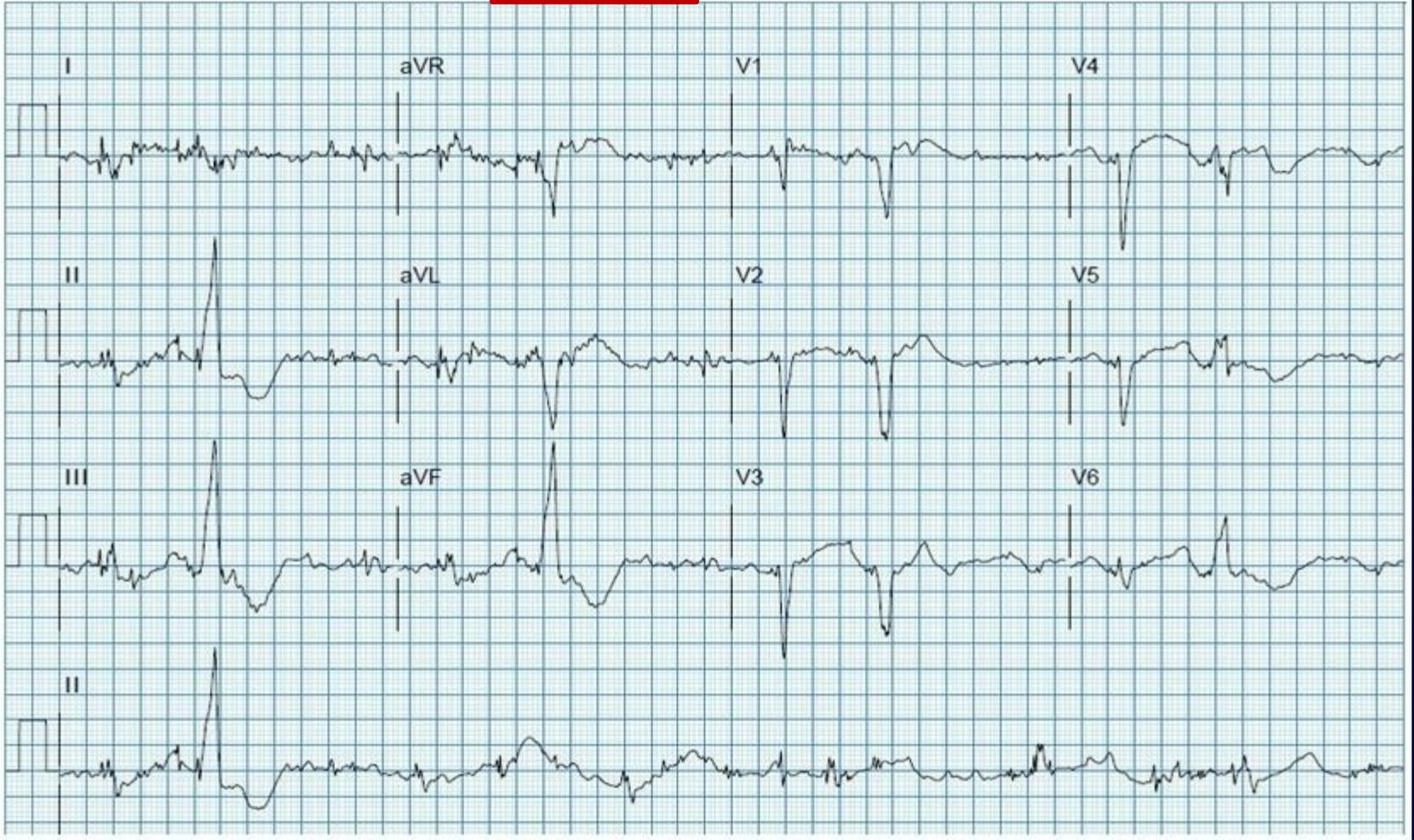
12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

1 01:12 01:12
2.7 km/h 10.0%

| | | | | | | |
|-------------|---------|-----------|------|--------|----------|----|
| RPE | -- | HR | 39 | II LVL | -0.9 SLP | 6 |
| METs(a) | 4.6 | Target HR | 122 | V2 LVL | 0.1 SLP | 10 |
| BP | ---/--- | Max HR | 47 | V5 LVL | -0.4 SLP | 8 |
| Previous BP | ---/--- | HRxBP | ---- | | | |



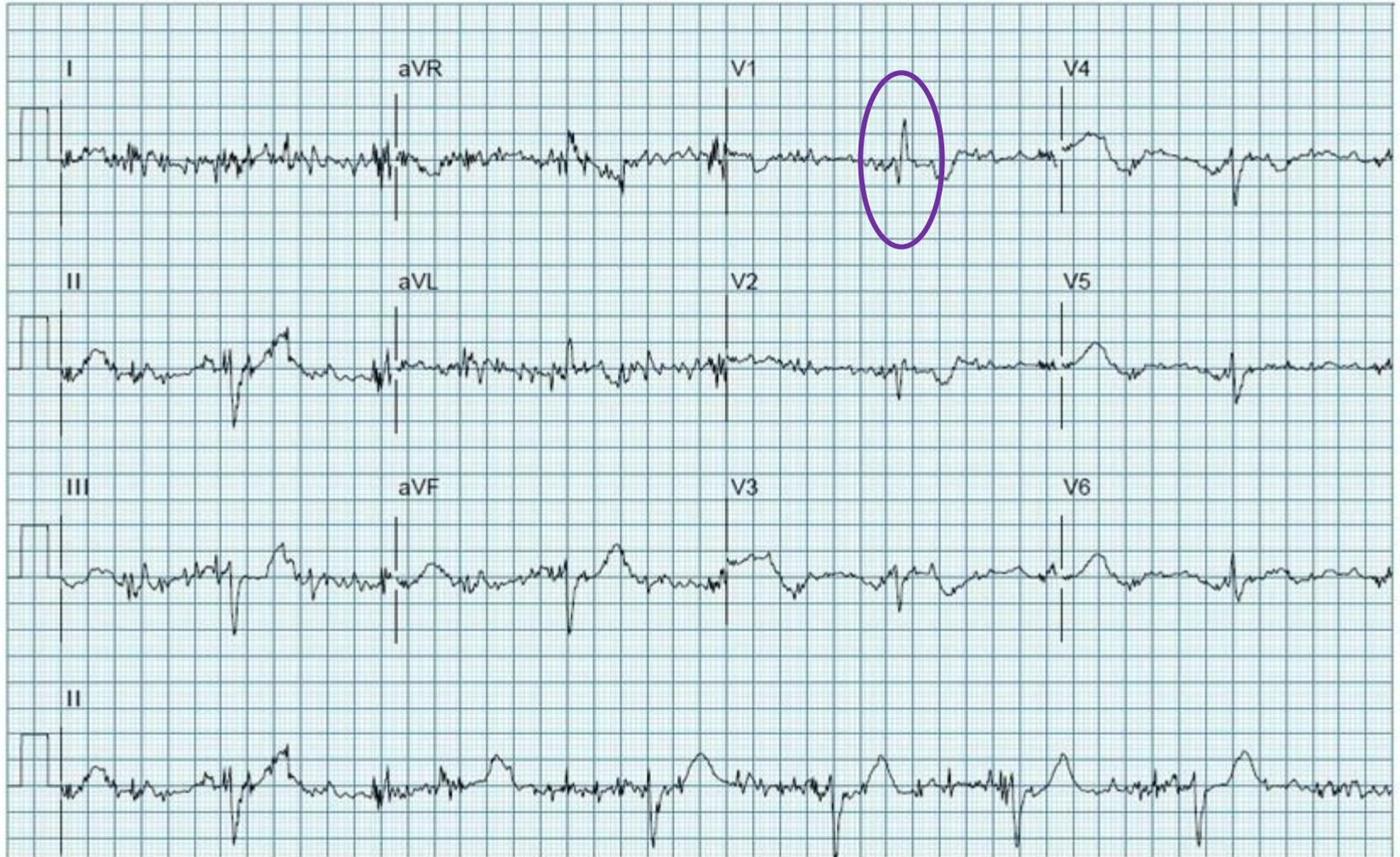
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 00:00
1.9 km/h 0.0%

| | | | | | | | |
|-------------|--------|-----------|------|--------|------|-----|----|
| RPE | -- | HR | 36 | II LVL | -1.4 | SLP | 16 |
| METs(a) | 4.6 | Target HR | 122 | V2 LVL | 1.2 | SLP | -6 |
| BP | --/-- | Max HR | 73 | V5 LVL | 0.3 | SLP | 0 |
| Previous BP | 138/62 | HRxBP | ---- | | | | |



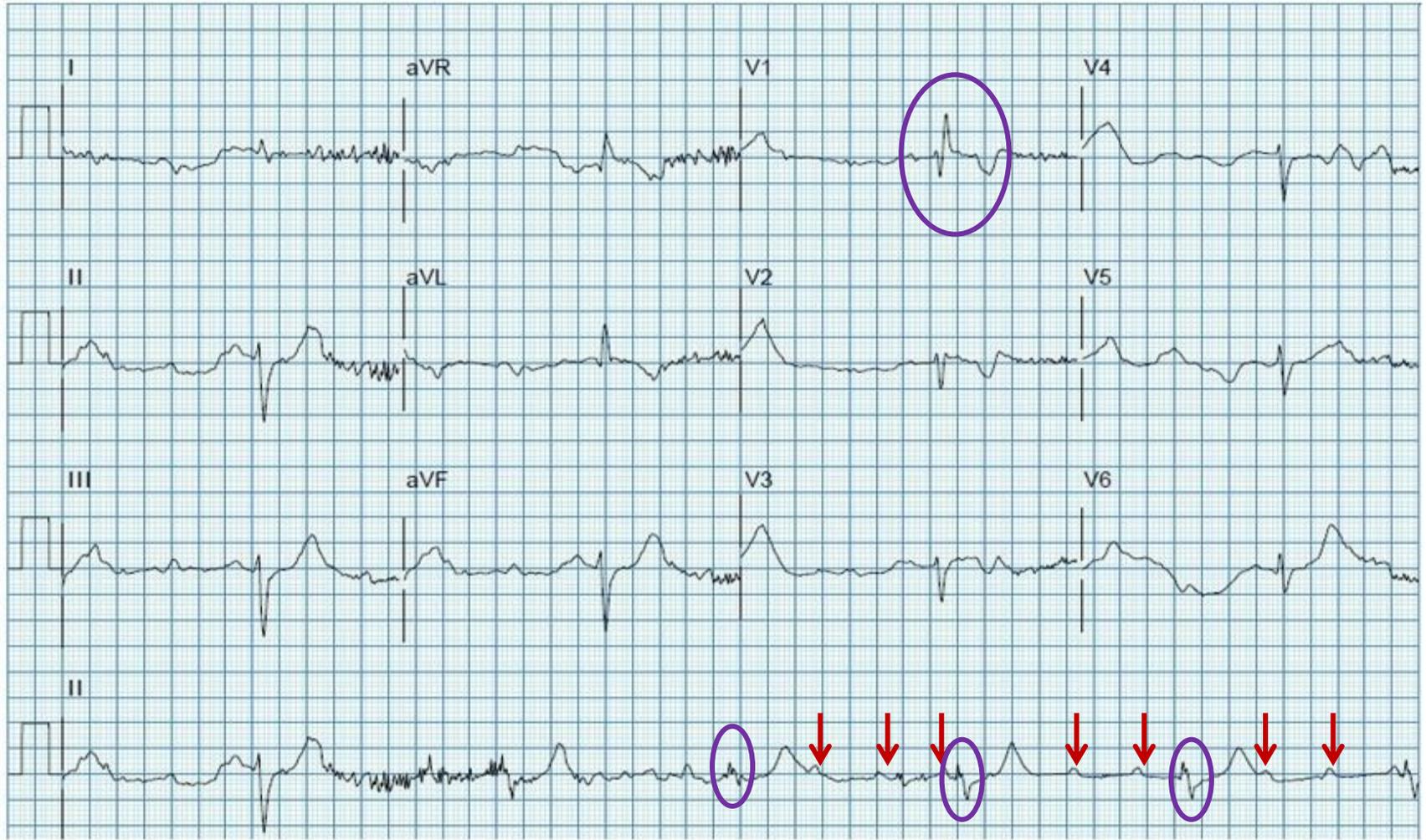
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 01:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|------|-----|----|
| RPE | -- | HR | 41 | II | LVL | -1.7 | SLP | 50 |
| METs(a) | 4.6 | Target HR | 122 | V2 | LVL | 1.9 | SLP | 50 |
| BP | 134/57 | Max HR | 73 | V5 | LVL | -1.6 | SLP | 50 |
| Previous BP | 138/62 | HRxBP | 5494 | | | | | |

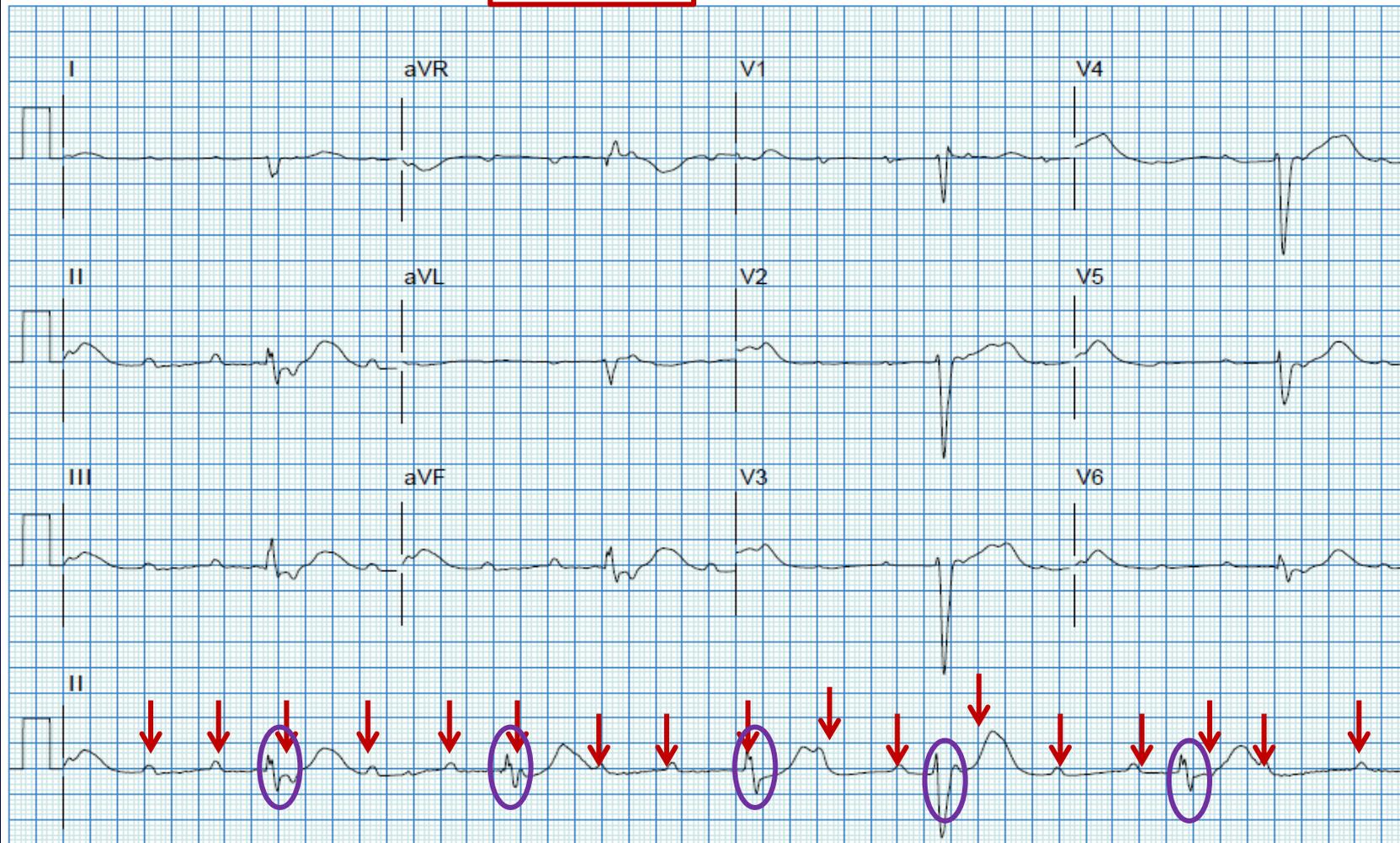


12-Lead(simultaneous)

Protocol
Bruce
Stage
Spd/Grd

Recov 05:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|-------|-----------|-----|----|-----|------|-----|---|
| RPE | -- | HR | 34 | II | LVL | -0.9 | SLP | 3 |
| METs(a) | 4.6 | Target HR | 122 | V2 | LVL | 0.2 | SLP | 0 |
| BP | --/-- | Max HR | 73 | V5 | LVL | -0.2 | SLP | 1 |
| Previous BP | --/-- | HRxBP | --- | | | | | |



Block site

-AV block이 호전되는 경우-

Supra His block

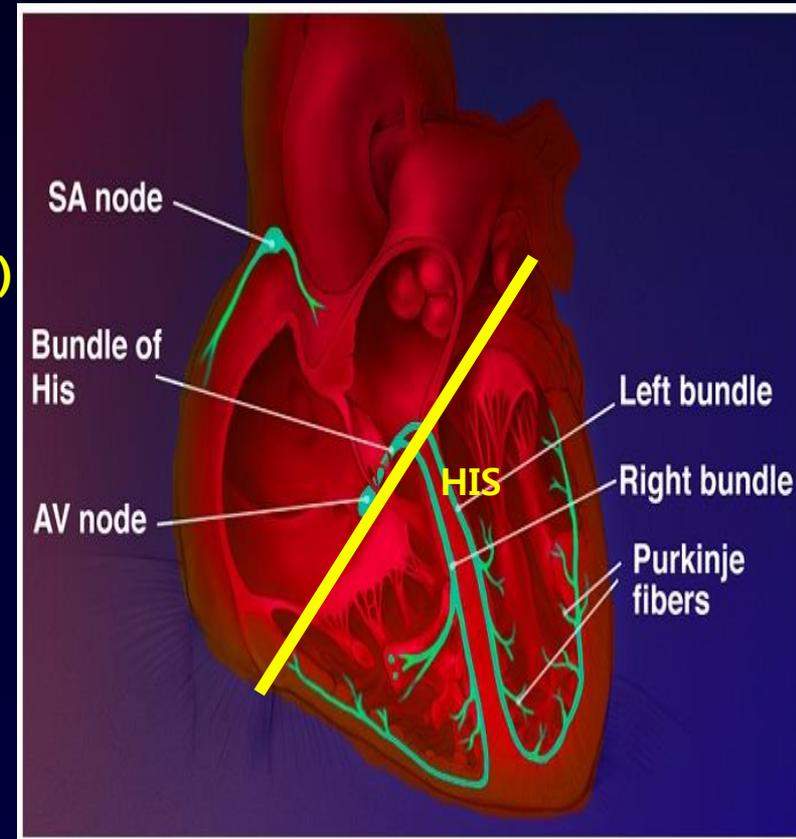
잠재적 pacemaker 는 AV node(40~60bpm/min)

-AV block이 변화가 없거나 악화되는 경우-

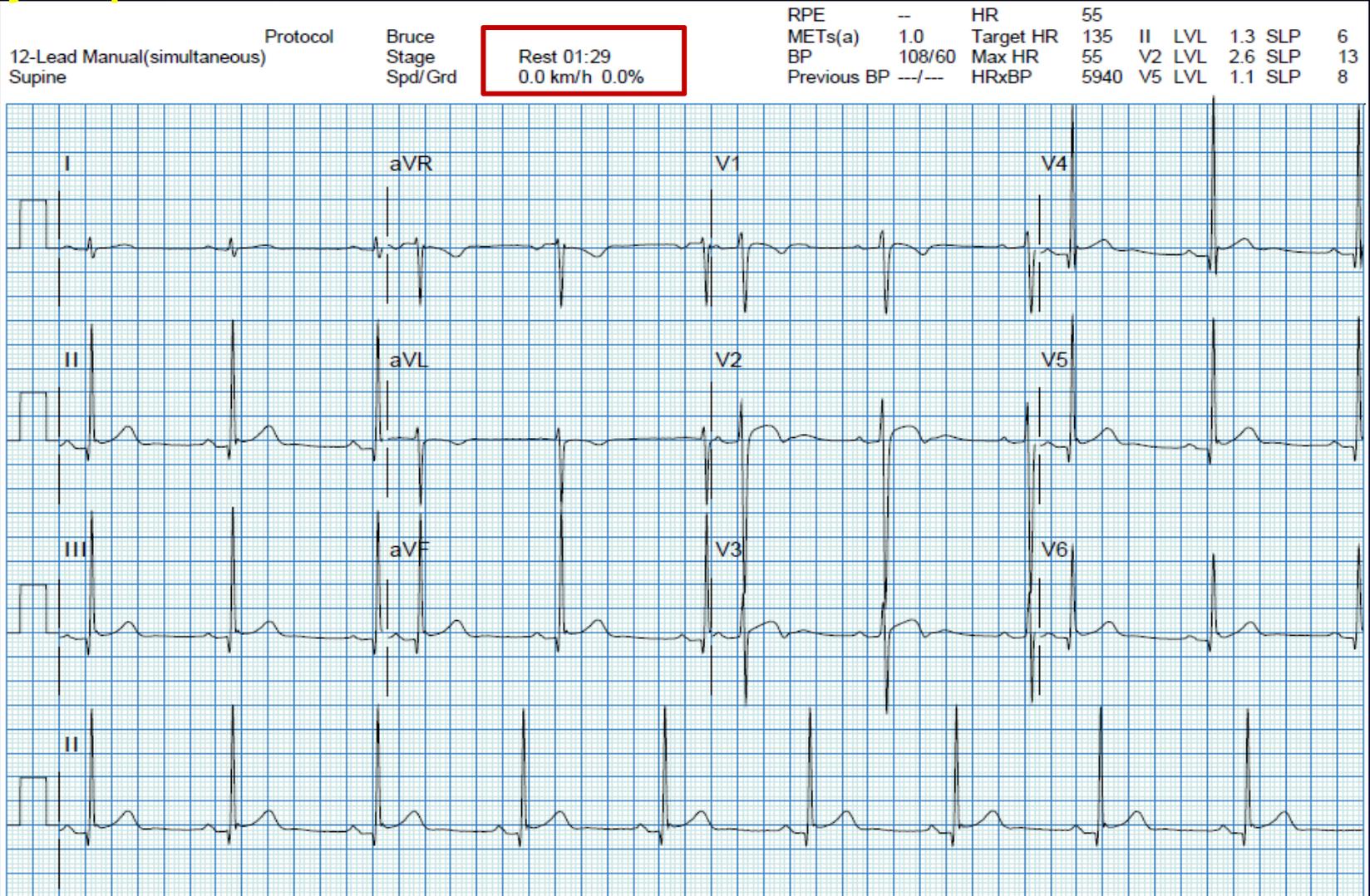
Infra His block

잠재적 pacemaker는 심실뿐(20~40bpm/min)

90% 이상에서 pacemaker 시술



62/M 수년전부터 1년에 한번꼴로 운동후 심한 dyspnea, dizziness, syncope(20분)



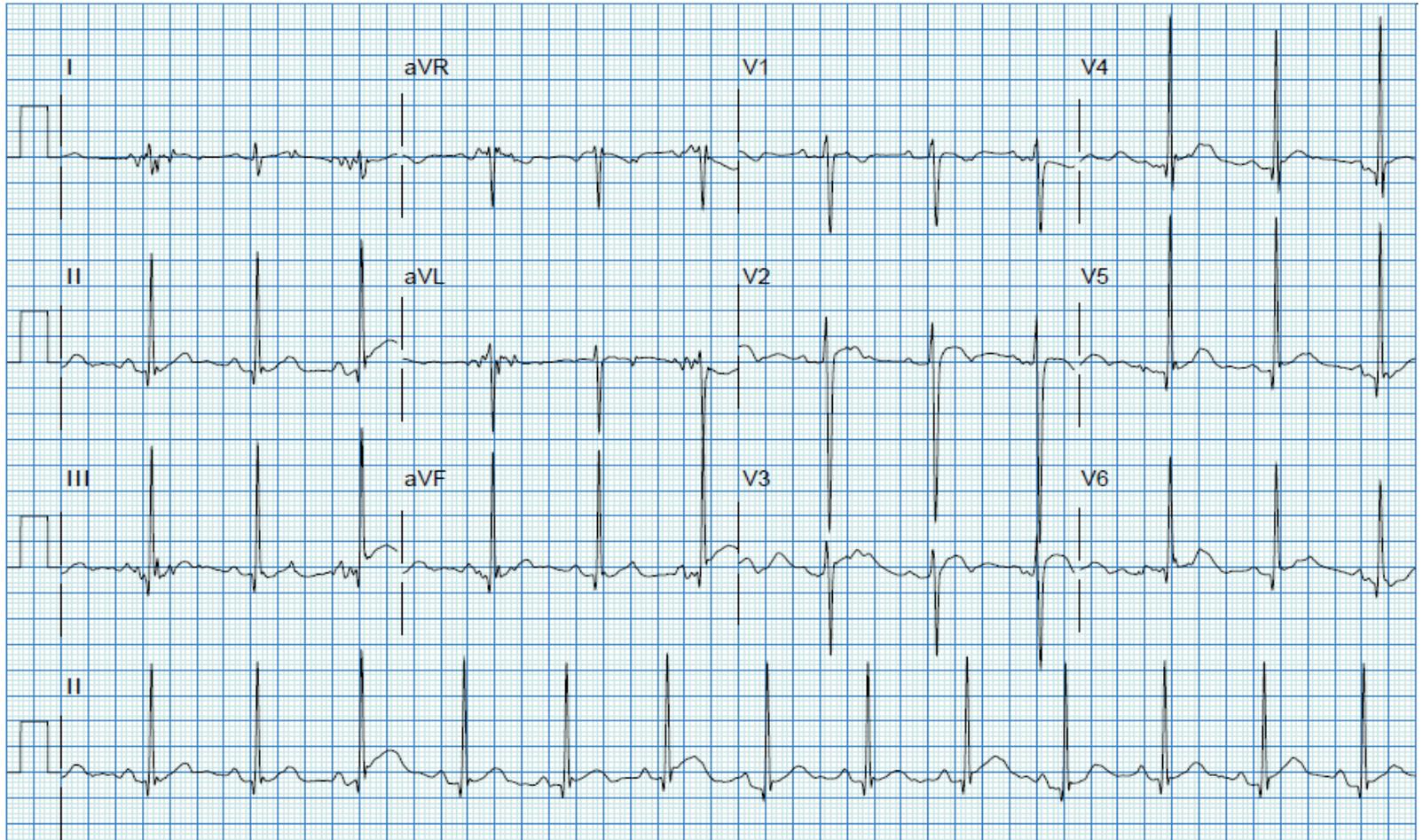
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

1 02:50 02:50
2.7 km/h 10.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|-----|-----|----|
| RPE | -- | HR | 80 | II | LVL | 1.0 | SLP | 15 |
| METs(a) | 4.6 | Target HR | 135 | V2 | LVL | 2.3 | SLP | 7 |
| BP | --/-- | Max HR | 88 | V5 | LVL | 0.9 | SLP | 13 |
| Previous BP | 108/60 | HRxBP | ---- | | | | | |



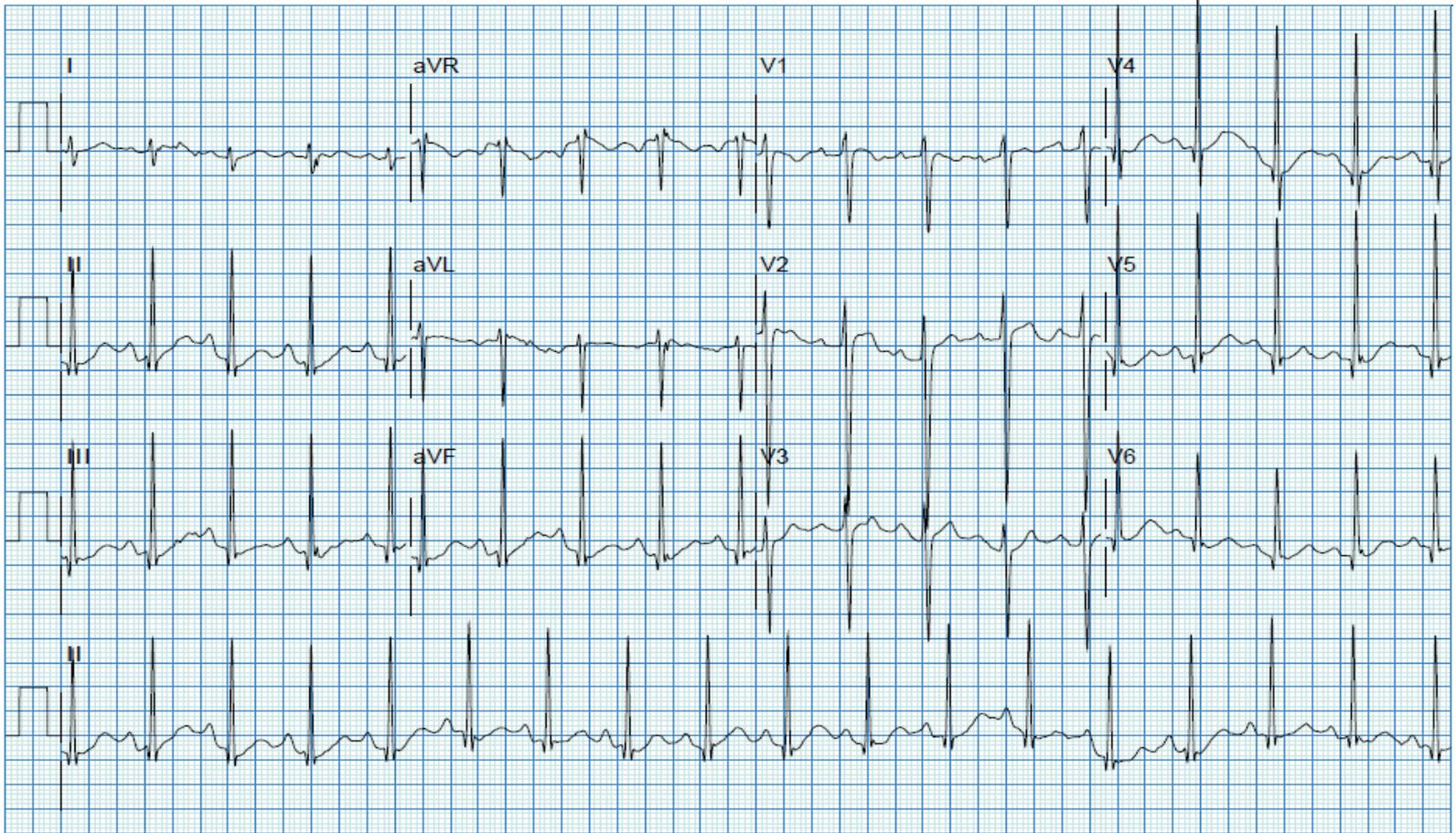
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

2 02:50 05:50
4.0 km/h 12.0%

| | | | | | | | | | |
|-------------|--------|-----------|-------|----|-----|-----|-----|----|--|
| RPE | -- | HR | 97 | | | | | | |
| METs(a) | 7.0 | Target HR | 135 | II | LVL | 0.5 | SLP | 19 | |
| BP | 133/60 | Max HR | 100 | V2 | LVL | 2.3 | SLP | 11 | |
| Previous BP | 141/61 | HRxBP | 12901 | V5 | LVL | 0.0 | SLP | 18 | |



2013-05-02

10:59:45

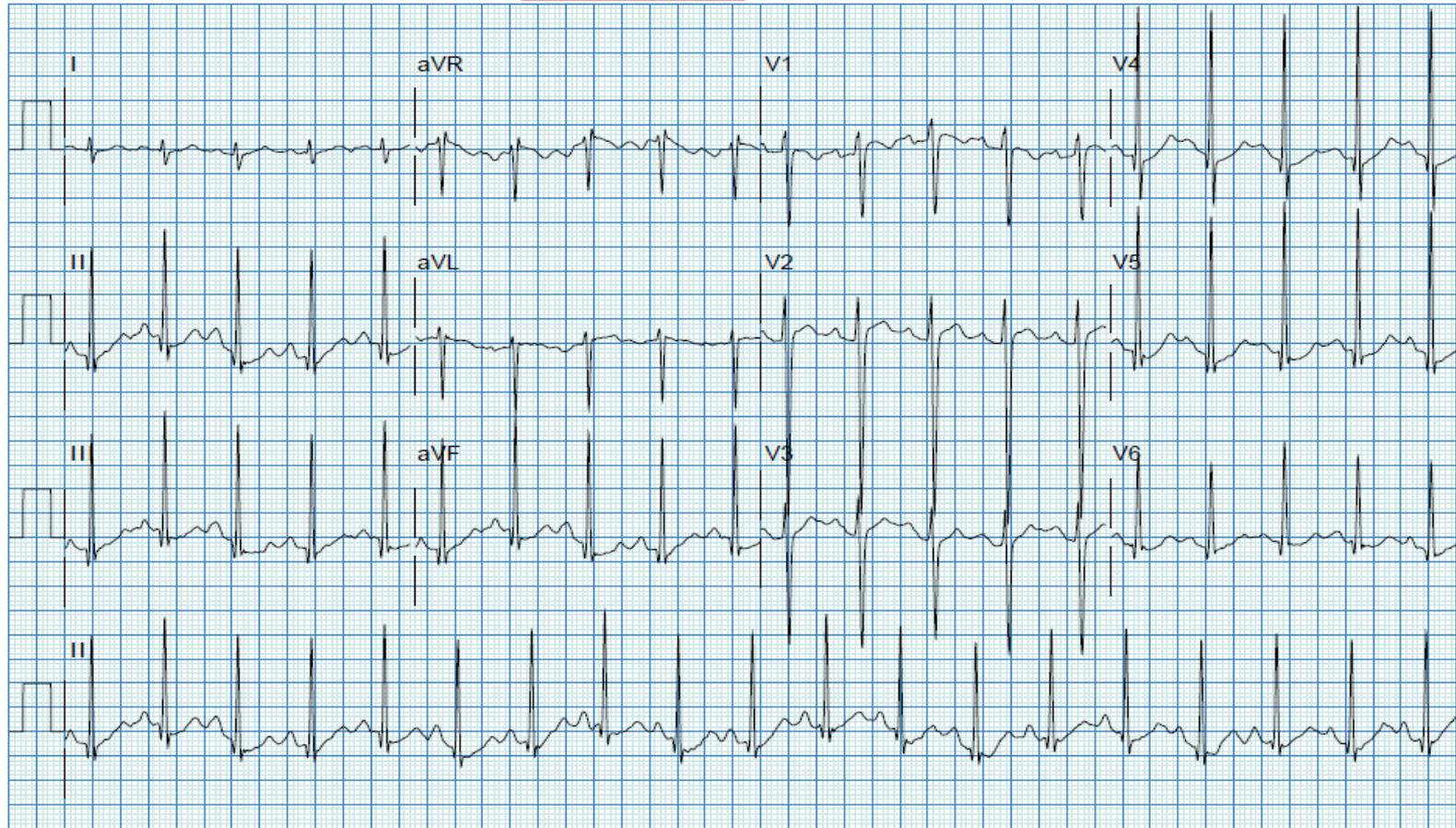
25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 5

12-Lead(simultaneous)

Protocol Bruce
Stage
Spd/Grd

3 02:50 08:50
5.4 km/h 14.0%

| | | | | | | | |
|-------------|--------|-----------|-------|--------|------|-----|----|
| RPE | - | HR | 114 | II LVL | 0.0 | SLP | 16 |
| METs(a) | 10.1 | Target HR | 135 | V2 LVL | 2.2 | SLP | 14 |
| BP | 154/65 | Max HR | 114 | V5 LVL | -1.0 | SLP | 16 |
| Previous BP | 133/60 | HRxBP | 17556 | | | | |



2013-05-02

11:02:45

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 6

12-Lead FF(simultaneous)

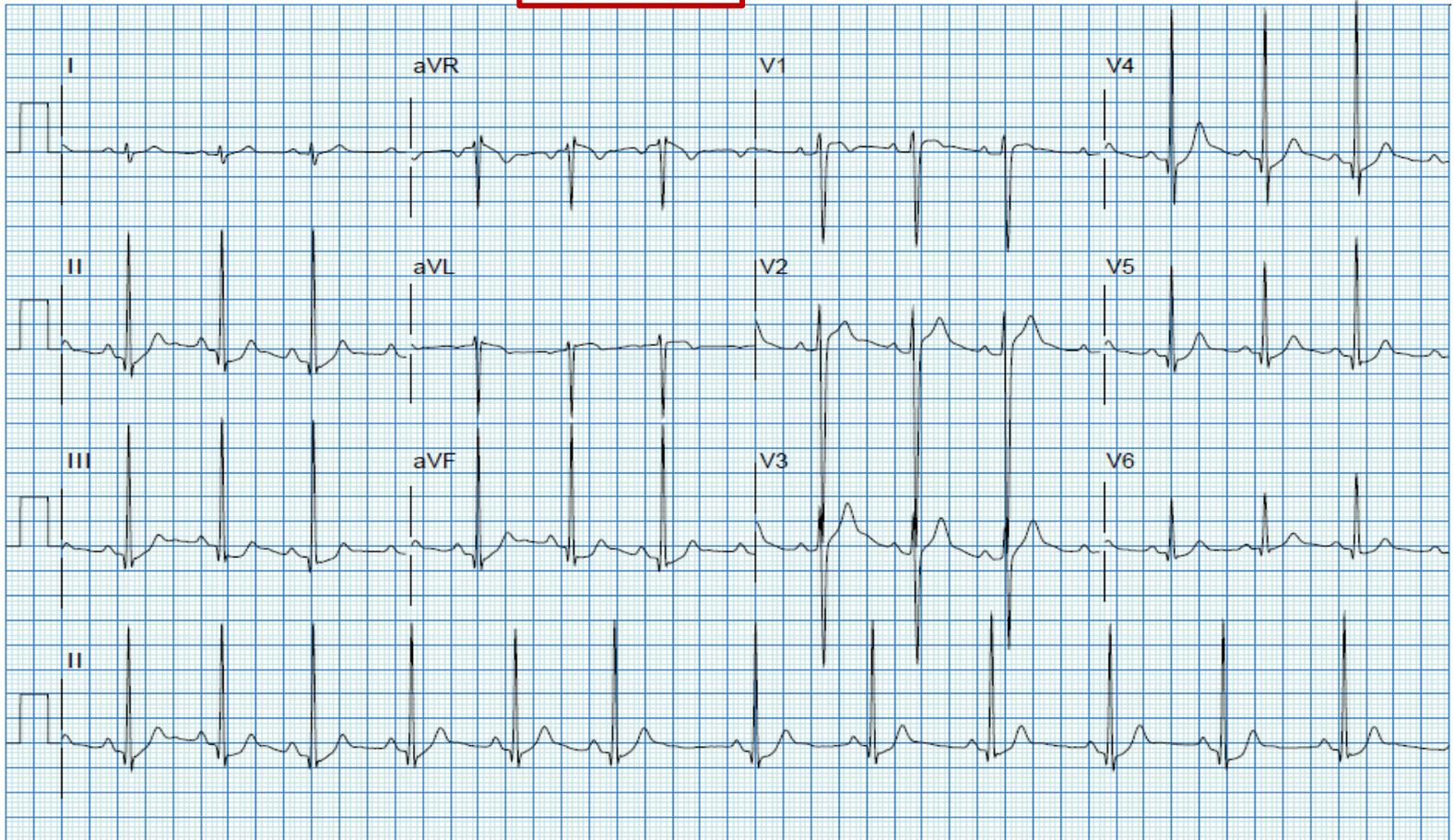
Protocol

Bruce
Stage
Spd/Grd

Recov 00:40
0.0 km/h 0.0%

| | | | |
|-------------|--------|-----------|-------|
| RPE | - | HR | 108 |
| METs(a) | 12.8 | Target HR | 135 |
| BP | 169/63 | Max HR | 140 |
| Previous BP | 154/65 | HRxBP | 18252 |

| | | | |
|--------|------|-----|----|
| II LVL | -0.2 | SLP | 16 |
| V2 LVL | 4.0 | SLP | 30 |
| V5 LVL | -0.5 | SLP | 21 |



2013-05-02

11:05:35

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 8

운동후 pause

12-Lead FF(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 01:17
0.0 km/h 0.0%

| | | | | | | |
|-------------|--------|-----------|------|--------|----------|----|
| RPE | -- | HR | 0 | II LVL | -0.4 SLP | 16 |
| METs(a) | 12.8 | Target HR | 135 | V2 LVL | 3.7 SLP | 10 |
| BP | 169/63 | Max HR | 140 | V5 LVL | -0.3 SLP | 14 |
| Previous BP | 154/65 | HRxBP | ---- | | | |



2013-05-02

11:06:12

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 12

12-Lead Manual(simultaneous)

Protocol Bruce
Stage
Spd/Grd

Recov 01:36
0.0 km/h 0.0%

| | | | | | | | |
|-------------|--------|-----------|------|--------|------|-----|----|
| RPE | -- | HR | -- | II LVL | -1.8 | SLP | -2 |
| METs(a) | 12.8 | Target HR | 135 | V2 LVL | 4.1 | SLP | -6 |
| BP | 169/63 | Max HR | 140 | V5 LVL | -0.6 | SLP | 8 |
| Previous BP | 154/65 | HRxBP | ---- | | | | |



2013-05-02

11:06:31

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 13

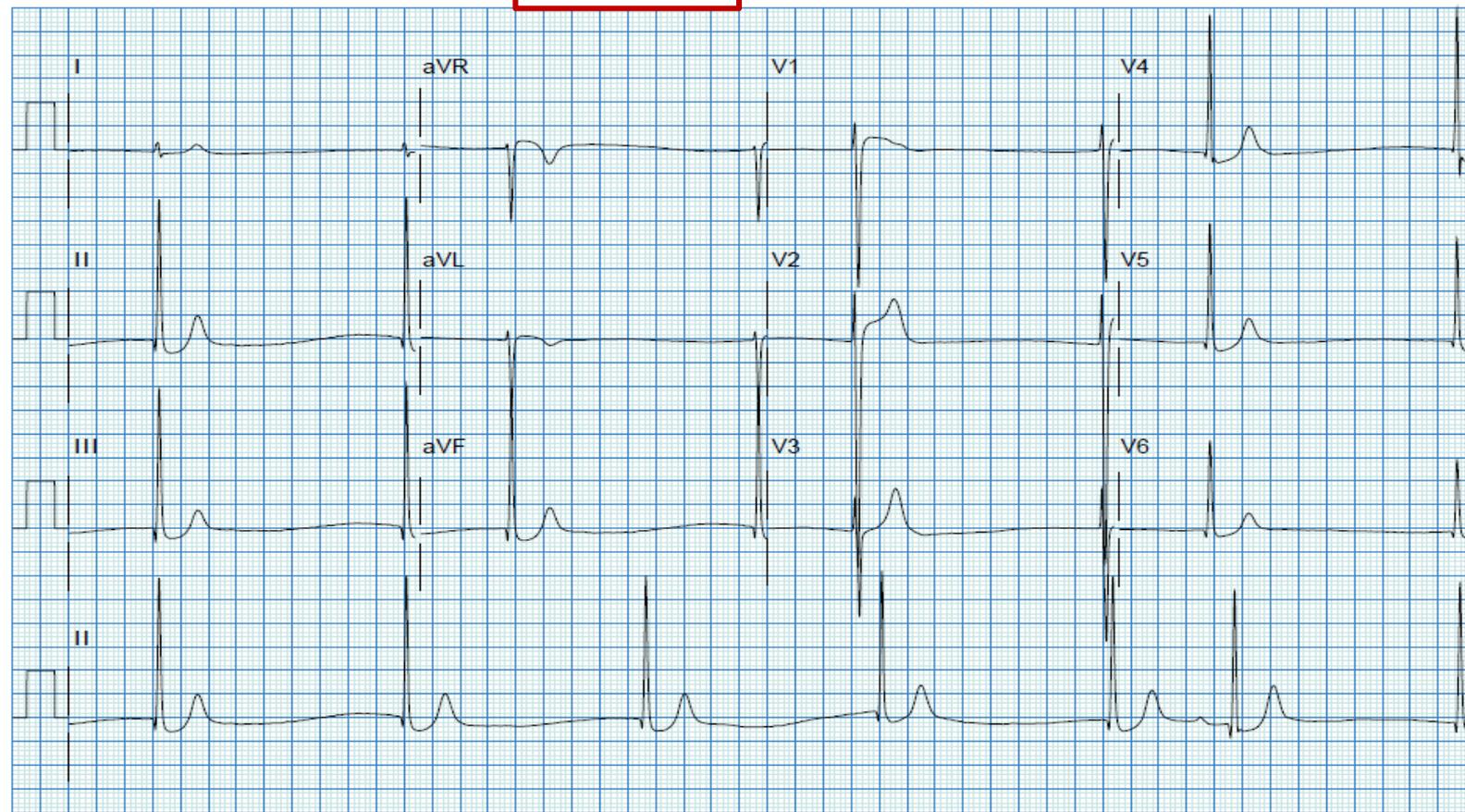
12-Lead Manual(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 01:49
0.0 km/h 0.0%

| | | | | | | | |
|-------------|--------|-----------|------|--------|------|-----|----|
| RPE | -- | HR | 44 | | | | |
| METs(a) | 12.8 | Target HR | 135 | II LVL | -2.7 | SLP | 2 |
| BP | 169/63 | Max HR | 140 | V2 LVL | 4.4 | SLP | 11 |
| Previous BP | 154/65 | HRxBP | 7436 | V5 LVL | -1.5 | SLP | 12 |



2013-05-02 11:06:44 25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 14

12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 03:00
0.0 km/h 0.0%

| | | | | | | | |
|-------------|--------|-----------|------|--------|------|-----|---|
| RPE | -- | HR | 49 | II LVL | -2.0 | SLP | 2 |
| METs(a) | 12.8 | Target HR | 135 | V2 LVL | 3.0 | SLP | 7 |
| BP | 98/43 | Max HR | 140 | V5 LVL | -2.1 | SLP | 0 |
| Previous BP | 169/63 | HRxBP | 4802 | | | | |



2013-05-02

11:07:55

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 15

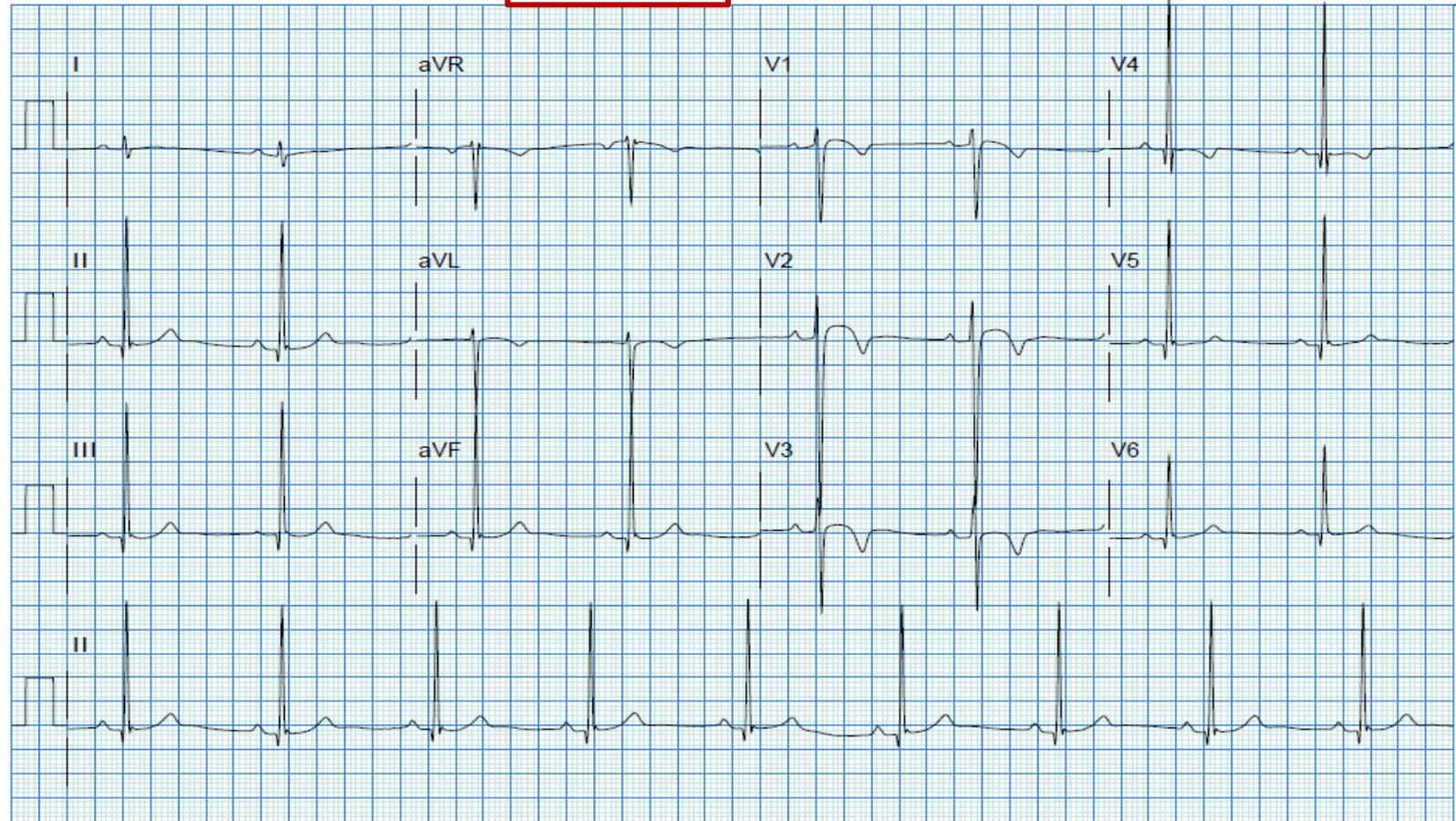
12-Lead(simultaneous)

Protocol

Bruce
Stage
Spd/Grd

Recov 05:00
0.0 km/h 0.0%

| | | | | | | | | |
|-------------|--------|-----------|------|----|-----|-----|-----|---|
| RPE | - | HR | 54 | II | LVL | 0.1 | SLP | 1 |
| METs(a) | 12.8 | Target HR | 135 | V2 | LVL | 2.4 | SLP | 7 |
| BP | 109/53 | Max HR | 140 | V5 | LVL | 0.0 | SLP | 2 |
| Previous BP | 98/43 | HRxBP | 5886 | | | | | |



2013-05-02

11:09:55

25 mm/sec 10 mm/mV BWF On MAF On Line On 40Hz On Page 16

운동후 pause

기질적 심질환이 없는 경우 운동후 회복기에 발생하는
실신은 과도한 미주신경 반응 때문이다.

따라서, 유발상황을 피할수 있는 교육과 함께 관찰하여 볼
수 있다.

Take home message

부정맥을 진단하기 위한 검사는 일반적으로 안전하고
입원이 필요없는 Non -invasive study 부터 시작하여,
복잡하고 위험성이 있고, 입원이 필요한 Invasive study
순서로 진행되고 있습니다.

경청해주셔서 감사합니다

