Arrhythmia Review Course 1

Basic Interpretation of Arrhythmia

프로그램 디렉터: 이명용
패널: 박예민, 이대인, 유희태, 차명진
환자 정보 확인

환자번호: 17591293
환자명: chang eun yeong
나이: 38
성별: Female

Rate: 75
RR: 800
PR interval: 75
QRS: 66
QT: 378
QTc: 407

[ PID: 17591293 / Date: 2017-12-22 ]
M/45 심전도 이상소견

- Atrial rhythm
- Moderate ST depression
- Possible arm leads reversed, check lead requested
정상 lead 위치
Arm reversal (LA/RA)

정상 lead 위치

Arm lead reversal

I inverted

aVL

aVR

aVF
LA/LL reversal  RA/LL reversal
F/ 64 exertional dyspnea

Speed; 50mm/s

Sinus rhythm
HR; 74 bpm
Sinus bradycardia

Sinus rhythm
HR; 37 bpm
심전도 판독시 주의 사항; artifact
심전도 판독시 주의 사항; amplitude
심전도 판독시 주의 사항; amplitude
Abnormal ECG at ER

Tachycardia; HR 128bpm
T wave inversion V1-3
RVH
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Rate</td>
<td>128</td>
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<tr>
<td>RR</td>
<td>460</td>
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<tr>
<td>PR interval</td>
<td>140</td>
</tr>
<tr>
<td>QRS</td>
<td>74</td>
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<tr>
<td>QT</td>
<td>290</td>
</tr>
<tr>
<td>QTc</td>
<td>366</td>
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</tbody>
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**ECG Observations:**

- Significant ECG abnormality
- Non- Specific T wave abnormality

**Axis:**

- P: 55
- QRS: 74
- T: 22

[PID: 35939883 / Date: 2018-06-01]
Pediatric ECG findings that may be normal

- HR > 100 beats/min
- QRS axis > 90°
- Rt precordial T wave inversion
- Dominant right precordial R waves
- Short PR and QT intervals
- Short P wave and short duration of QRS complexes
- Inferior and lateral Q waves
39세 남자, 심전도 이상

- Telemetry monitoring -

Intermittent pause with nonconducted APC
Nonconducted APC

RP 280ms
61세 남자

* : APC with aberrant conduction
** : Nonconducted APC
APC with aberrant conduction

RP: 280 ms
A. Incomplete Compensatory Pause due to PAC

(2x PP interval)  (≤2x PP interval)

P  P  P  PAC  P
A  A  A  A
AV  AV  AV  AV
V  V  V  V
QRS  QRS  QRS  QRS

B. Complete Compensatory Pause due to PVC

(2x PP interval)  (2x PP interval)

P  P  P  (P)  P
A  A  A  A
AV  AV  AV  AV
V  V  V  V
QRS  QRS  QRS  QRS
PVC  PVC
Three Fates of APC
40 여자, 가정주부

1. PVC with full compensatory pause
2. Ventricular bigeminy with full compensatory pause
VPC with full compensatory pause
Ventricular Premature Contraction (VPC)

1. Premature QRS without preceding P wave
2. Bizarre QRS morphology
3. Full compensatory pause
4. Fixed coupling interval
A. Incomplete Compensatory Pause due to PAC

(2x PP interval)   (<2x PP interval)

P   P   P   PAC   P
A   A   A   A   A
AV   AV   AV   AV   AV
V   V   V   V   V
QRS  QRS  QRS  QRS  QRS

B. Complete Compensatory Pause due to PVC

(2x PP interval)   (2x PP interval)

P   P   P   PVC   P
A   A   A   A   A
AV   AV   AV   AV   AV
V   V   V   V   V
QRS  QRS  QRS  PVC  QRS
62세 남자

TMT (baseline)

1. Interpolated VPC
2. VPC with retrograde P
Interpolated VPC
VPC with retrograde P and sinus rest

![Diagram showing VPC with retrograde P and sinus rest with labeled intervals.]

KHRS 2018
35세 남자, 가슴 답답함
ECG morphology of outflow tract VPC

**Precordial Transition**

- **Anterior**
  - V1
  - V2
  - V3
  - V4
  - V5
  - V6

- **Posterior**
  - RCC
  - LCC
  - NCC

- **RVOT FW**
  - RVOT septum
  - RCC/AIV
  - LCC
  - GCV/MVA

- **LBBB**
  - Later transition

- **RBBB**
  - Earlier transition

*Hutchinson al. JCE 2013*
ECG morphology of outflow tract VPC

Frontal Plane QRS Axis

Lead I (+) Leftward axis

Lead I (-) Rightward axis
ECG morphology of outflow tract VPB

As the pacing site shifts posteriorly and leftward from the RVOT to the MA,

Progressive transition
(1) from an LBBB to an RBBB morphology
(2) Rightward frontal plane axis
35세 남자, 가슴 답답함
-33 msec earliest activation
Ablation site
Case. 63/F, Palpitation & Chest discomfort

Medication: Flecainide 75mg BID / Torsemide 5mg QD / Warfarin 2mg QD
Treadmill test

Stage 2, 114 bpm, 169/67 mmHg

Stage 2, 118 bpm, 149/66 mmHg

Stage 3, 171 bpm

Stage 3, 171 bpm
Class Ic antiarrhythmic drugs

- Primarily block Na\(^+\) channels
- Inhibits phase 0 depolarization
- Minimal effect on repolarization
- Slow binding and dissociation from the receptor
Use-dependence

• Class IC drugs dissociate slowly from the sodium channels during diastole
  – During faster HR, less time exists for the drug to dissociate from the receptor
  – Resulting in increased effect at more rapid rate

• A progressive decrease in impulse conduction velocity and a widening of the QRS complex

• It may also contribute to the proarrhythmic activity of these drugs, especially in diseased myocardium
Case 1-1. 79/M, Chest discomfort: Treadmill test
Case 1-1. 79/M, Chest discomfort: Treadmill test

Stage 2, 166/85 mmHg
Case 1-1. 79/M, Chest discomfort: Treadmill test

Stage 4, 177/89 mmHg
Case 1-1. 79/M, Chest discomfort: Treadmill test

Recovery 3min, 141/87 mmHg
Case 1-2. 67/M, Palpitation & Faintness: Treadmill test

Resting, 145/95 mmHg
Case 1-2. 67/M, Palpitation & Faintness: Treadmill test

Stage 3, peak exercise, 197/89 mmHg
Case 1-2. 67/M, Palpitation & Faintness: Treadmill test
Case 1-2. 67/M, Palpitation & Faintness: Treadmill test

Recovery 5min, 159/98 mmHg
Case 1-2. 67/M, Palpitation & Faintness: Treadmill test

Recovery 11min, 135/80 mmHg
Exercise induced ventricular arrhythmia

“The occurrence of frequent PVCs during exercise in asymptomatic middle-aged men is associated with a long-term increase in the risk of death from cardiovascular causes.”

Exercise induced ventricular arrhythmia

Ventricular Arrhythmias During Clinical Treadmill Testing and Prognosis

“Recovery PVCs, but not exercise PVCs, were associated with 71% to 96% greater propensity-adjusted mortality rates (HR 1.96, 95% CI 1.31-2.91 for infrequent PVCs; HR 1.71, 95% CI 1.07-2.73 for frequent PVCs compared with subjects without PVCs).”

“In heart failure-free population, recovery PVCs were associated with increased mortality and augmented established risk markers.”

Case 2. 40/F, Palpitation
Case 2. 40/F, Palpitation
What is the mechanism?

1. APC with aberrant conduction
2. PVC with concealed conduction
3. 1st degree AV block with PVCs
Interpolated PVC with concealed Wenckebach conduction
Case 3. 52/M, Palpitation & Chest discomfort
Case 3. 52/M, Palpitation & Chest discomfort
Case 3. 52/M, After Flecainide administration

Q> Possible diagnosis?

1. Complete AV block
2. Paroxysmal AV block
3. High degree AV block
4. Pseudo AV block
Case 3. 52/M, His electrogram
Pseudo AV block with JPC
다양한 임상상황에서의 심전도: Ventricular parasystole

간헐적인 두근거림과 어지러움으로 내원한 52세 남자 환자
r/o Ventricular parasystole
Ventricular parasystole

• Secondary pacemaker in the heart
• Protected from depolarization by the SA node

• ECG features
  ▪ Presence of variable coupling intervals of the manifest ectopic beats
  ▪ Inter-ectopic intervals that are simple multiples of a common denominator
  ▪ Fusion beats

• Prognosis: usually benign
다양한 임상적 상황에서 심전도: Drug Induced LQTS

우울증으로 약제 복용 중이던 56세 여자 환자
최근 우울감 악화되어 약제 증량
새벽에 집에서 쓰러진채 발견되어 응급실 내원
Long QT syndrome

• Congenital / Acquired

• Corrected QT interval of greater than 440 to 500 milliseconds together with clinical findings.

• **Drug-induced QT prolongation**
  • **Antiarrhythmics**: Amiodarone, Disopyramide, Dofetilide, Ibutilide, Procainamide, Quinidine, Sotalol
  • **Antibiotics**: Chloroquine, Clarithromycin, Erythromycin, Halofantrine, Pentamidine, Sparfloxacin
  • **Antipsychotics**: Chlorpromazine, Haloperidol, Mesoridazine, Pimozide, Thioridazine
  • **Antinauseants**: Domperidone, Droperidol
  • **Antineoplastic**: Arsenic trioxide
  • **Gastric promotility**: Cisapride
  • **Antihistamines**: Terfenadine, Astemizole
이전 특이병력 없는 52세 남자. 운동시 발생하는 심한 홍통으로 내원

Baseline ECG
Treadmill test: stage 2
Treadmill test: stage 2

2017/09/12 10:33:58am 172/83 mmHg 05:50 4.0 km/h

I II III aVR aVL aVF V1 V2 V3 V4 V5 V6
EPS / RFCA
Exercise-induced ventricular tachycardia

• Exercise may be a trigger of the condition

• Prognosis: dependent on whether or not there is an underlying structural heart condition → For idiopathic patients, ventricular tachycardia induced by exercise may be recurrent but ultimately has a good prognosis

• Treatment:
  • Discontinuing smoking, avoidance of excessive drug and alcohol use as well as dietary modification
  • RFCA: 90% of cure rate
  • ICD implantation
Brugada syndrome

이전 특이병력 없는 52세 남자.
새벽에 자던 중 발생한 arrest로 응급실 내원
Baseline ECG
Flecainide provocation test
ICD implantation
Brugada syndrome

- Inherited autosomal dominant disease
- Incidence: 1~30/10,000 persons
- Diagnosed by identifying characteristic patterns on an ECG
- Diagnostic test: Provocation testing / Genetic testing
DGX toxicity

심부전 및 발작성 심방세동으로 약물치료를 받고 있던 67세 여자 환자
3개월 전 Digoxin 투약을 시작하였고, 최근 소변량이 감소하였다.
수 일전부터 악화된 흉부 불편감으로 내원

6개월 전 심전도
2개월 전 심전도
내원시 심전도
Digoxin toxicity

• **Symptoms:** typically vague (nausea, vomiting, abdominal pain, headache, dizziness, confusion, delirium, vision disturbance (blurred or yellow vision)).

• **ECG findings**
  - Therapeutic dose: Downsloping ST depression
  - Overdose: frequent premature ventricular beats (PVCs), depressed conduction, Sinus bradycardia, other cardiac disturbances including irregular heartbeat, ventricular tachycardia, ventricular fibrillation, sinoatrial block and AV block
SAH and ECG change #1

46세 남자 환자. 두통으로 응급실 내원하여 Subarachnoid hemorrhage 진단받고 aneurysm clipping 시행 후 입원한 직후 간헐적인 흉통 호소하여 시행한 심전도가 다음과 같음.

CK-MB/Proponin : 6.0/0.2 → 9.1/0.32 → 3.6/0.08
Coronary CT angiography: Mild intermediate lesions
SAH and ECG change #2

75세 여자 환자. 실신으로 응급실 내원하여 Subarachnoid hemorrhage 진단받고 Embolization of Aneurysm 시행 하였고 의식 없는 상태에서 심전도 이상으로 의뢰됨

CK-MB/Proponin: 9.0/1.75 → 15.3/3.1 → 3.3/0.34 → 2.9/0.24
Coronary CT angiography: Mild intermediate lesions
Subarachnoid haemorrhage (SAH) and ECG changes

• SAH: Neurological emergency with high mortality rates

• ECG change: ST-segment deviations, T-wave inversion, and QTc prolongation; cardiac enzyme elevation etc

• Possible mechanism
  • autonomic neural stimulation from the hypothalamus or elevated levels of circulating catecholamine.
  • Hypothalamic stimulation may cause ECG changes without associated myocardial damage whereas elevated catecholamine levels have been correlated with QT-interval prolongation and myocardial damage.