Multi-Day ECG Recording System

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Monitoring of Arrhythmia
Monitoring of Arrhythmia

Get the complete picture

Best-in-class reporting driven by complete data and full statistical analysis, allows you to see more and do more for patients

Stop Guessing

[Image of medical equipment and graphical elements]
Ambulatory ECG

✓ Ambulatory ECG (AECG) is used to evaluate symptoms such as syncope, dizziness, chest pain, palpitations, or shortness of breath, which may correlate with intermittent cardiac arrhythmias.

✓ AECG is used to evaluate patient’s response to anti-arrhythmic therapy and to assess prognosis in specific clinical contexts.

✓ Noninvasive, easy to use, relatively inexpensive
Holter monitoring

- Ability to record and document continuous 3- to 12-lead ECG signal simultaneously with a variety of other biological signals during normal daily activities.

**Disadvantage**

- Frequent noncompliance with symptom logs and event markers
- Frequent electrode detachments
- Signal quality issues due to skin adherence artifacts, wire entanglements, and occasional skin dermatitis caused by electrode gels
- Absence of real-time data analysis
## Duration of Recording

<table>
<thead>
<tr>
<th>Duration of recording</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 min</td>
<td>External event recorder</td>
</tr>
<tr>
<td></td>
<td>Smartphone-based recorder</td>
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<tr>
<td>24–48 hr</td>
<td>Standard Holter recorder</td>
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<tr>
<td></td>
<td>Mobile cardiac telemetry</td>
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<tr>
<td>3–7 days</td>
<td>Patch/Vest/Belt recorder</td>
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<tr>
<td></td>
<td>Mobile cardiac telemetry</td>
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<tr>
<td></td>
<td>Event loop recorder</td>
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<tr>
<td>1–4 weeks</td>
<td>Patch/Vest/Belt recorder</td>
</tr>
<tr>
<td></td>
<td>Mobile cardiac telemetry</td>
</tr>
<tr>
<td></td>
<td>External loop recorder</td>
</tr>
<tr>
<td>&lt;36 months</td>
<td>Implantable loop recorder</td>
</tr>
</tbody>
</table>
Multi-day Monitoring

Recording period

Detection rate

Inconvenience
First generation
External Ambulatory Monitoring

a Holter monitoring
Patient wears monitor
(Typically 24–48 h)

b Event monitoring
Patient carries monitor
(typically 30 days)

c Loop monitoring
Patient wears monitor
(typically 30 days)

J Am Coll Cardiol 2011;58:1741–9
Second generation External Ambulatory Monitoring

a Holter monitoring
Patient wears monitor patch (up to 7–14 days)

b Ambulatory telemetry monitoring - (Non-real time)
Patient wears monitor (up to 30 days)

c Ambulatory telemetry monitoring - (Real time)
Patient wears monitor (up to 30 days)

J Am Coll Cardiol 2011;58:1741–9
Patch ECG monitor
Patch ECG monitor

✓ Long-term recording of 14 days or longer
✓ Excellent patient acceptance

Disadvantage

✓ Records a limited ECG from closely spaced electrodes with lower voltage amplitudes
✓ Lacking localization ability of arrhythmia origin
✓ Inconsistent optimal ECG signal quality due to varying body types
Event recorders

From youtube, Dr. Ruan Louw
Event recorders

- Records only selected ECG segments of fixed duration after an event is detected by the patient
- Immediate alarm generation upon the event detection
- Well-tolerated by the patient

Disadvantage

- Single-lead devices → Unknown origin of arrhythmias
- No capability to continuously document cardiac rhythm
- Diagnostic yield of event recorders is highly dependent on patient’s ability to recognize correct symptom
Mobile Cardiac Telemetry (MCT)

✓ Outpatient

Patient indicates symptoms on PDA. Abnormal ECG transmitted automatically.

PDA stores ECG data and symptom status. Wireless transmission capability provided.

Physician receives and acts upon data as medically appropriate.

Monitor center receives, reviews and transmits data to physician. Pre-determined “urgency” criteria determine timing of physician alerts.

✓ Hospital-Based
Clinical Indication of AECG

Diagnosis of arrhythmia

- Unexplained syncope and dizziness
- Cardiac palpitation
- Chest pain or dyspnea thought to be associated with arrhythmias
- Cryptogenic stroke evaluation
- Pediatric monitoring
Clinical Indication of AECG

Prognosis and risk stratification

- Ischemic heart disease and postinfarction
- Non-ischemic DCM
- HCM
- Arrhythmogenic RV Cardiomyopathy
- WPW syndrome
- Inherited arrhythmic diseases
- Athletes and pre-competition screening
Clinical Indication of AECG

- ST segment analysis
- Heart rate variability
- Signal-averaged ECG
- Obstructive sleep apnea
- The effect and safety of treatment (medication or catheter ablation)
Selection of Appropriate Technologies

Consideration about…

✔ Symptom frequency
✔ Patient acceptance
✔ Degree of automaticity
✔ Cost-effectiveness
✔ The overall patient clinical condition
✔ The probability of life-threatening arrhythmia
Diagnostic yield of AECG

From youtube, Dr. Ruan Louw.

Heart Rhythm 2017;14:e55–e96
Modern AECG Device

- Microelectronic circuits
- Networking technology
- Smart Bluetooth
- Light and inconspicuous
- Automatic arrhythmia detection
- Wireless transmission of data in real time

Multiple biological signal sensors

Artificial intelligence

References:

Future needs

✓ Data burden
Take Home Message

✓ AECG is commonly used in a variety of clinical contexts, for a variety of clinical purposes, and involves a variety of clinical personnel.

✓ There needs to be an understanding of the strengths and limitations of the AECG, and also of the specifically implemented technique, in order to optimize the impact that these results have on patient care.
Thank you for Listening