New real-time loop recorder for diagnosis of symptomatic arrhythmia via telemedicine

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Declaration of Interest for Arie Roth MD

Medical Consultant for ‘SHL-Telemedicine’
**Background**

- Loop recorders are often used to detect ECG signals which may explain various symptomatic events that could potentially result in untoward clinical and/or hemodynamic sequelae.
- One inherent disadvantage of current loop recorders is the waste of time between recording an ECG to establishing diagnosis to taking appropriate measures.
- The Cardio R is a loop recorder which uses digital technology to transmit cardiac recordings via cellular communication at the press of a button. Users can also choose from a list to describe their symptoms.
Objective

To assess the utility of the Cardio R device for early detection of electrical events which may account for the selected symptoms.
The Cardio-R

Uses digital technology to record and transmit cardiac recordings by cellular communication at the press of a button.

It has a 90-minute storage of the 3 leads.
The Cardio-R

Advantages

- Instant transmission enables rapid response (vital in life-threatening arrhythmias)
- Does not require dialing the monitor center’s number
- Enables rapid delivery of the patient’s selections of symptoms from the list
- Enables transmission of a complete ECG tracing (via the Internet)
Methods

Every recording arrives to the 'SHL'-Telemedicine's call center* where it is instantly displayed on a screen for immediate diagnosis by the on-duty medical team.

* SHL - Medical Call Center
24- hours/ 7 days a week  service
Staffed by specially trained nurses and physicians
Pt. is wired to the continuously recording device.

Start button results in a 2-min recording before & a 1-min recording after symptom occurrence.

Pt. chooses & transmits symptoms from the list.

The transmission arrives to the call center & the team immediately inspects the recording to rule out an emergency. The Pt. is contacted for instructions & reassurance, & an MICU is dispatched when indicated.

Detailed interpretation of ECG with approval of a physician or cardiologist follows.

Can follow patient’s ECG ‘diary’ or detailed data on the Internet.

Receives a CD containing full management details, statistical data, etc. upon completion of follow-up.
## Results

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Period</strong></td>
<td>Jan 2009 - June. 2011</td>
</tr>
<tr>
<td><strong>Patients</strong></td>
<td>935</td>
</tr>
<tr>
<td><strong>Mean age, y</strong></td>
<td>56 ± 19 (range 10-95)</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td>60%</td>
</tr>
<tr>
<td><strong>ECG transmissions</strong></td>
<td>24,636</td>
</tr>
<tr>
<td><strong>Transmissions/patient</strong></td>
<td>26 ± 49</td>
</tr>
</tbody>
</table>
Symptoms

Palpitations - 634
Pre-syncope - 263
Chest pain - 38
Results (cont.)

(24,636 transmissions, 27,899 episodes)

Notifications to physicians, n (%) - 107 (0.43)

MICU dispatches, n (%) - 26 (0.11)

Instructions to callers, n (%) - 289 (1.17)

Median time to ‘first glance’ ECG - 7 minutes

Median time to ECG interpretation by center staff - 5 hours

Median time to confirmation of ECG interpretation by physician - 16 hours

Delay until transmission of 1st symptomatic episode, days - 2 ± 7
<table>
<thead>
<tr>
<th>Parameter/reason for referral</th>
<th>Palpitations 634 pts Transmissions 16,812</th>
<th>Pre-syncope 263 pts Transmissions 6,626</th>
<th>Chest pain 38 pts Transmissions 1,198</th>
<th>n 935 pts Transmissions 24,636</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± 1 SD), y</td>
<td>56 ± 18</td>
<td>59 ± 21</td>
<td>55 ± 22</td>
<td>56 ± 12</td>
</tr>
<tr>
<td>Male, %</td>
<td>38</td>
<td>45</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Average transmissions/patient</td>
<td>27 ± 48</td>
<td>25 ± 50</td>
<td>32 ± 55</td>
<td>26 ± 49</td>
</tr>
<tr>
<td>Notifications to physicians, n (%)</td>
<td>59 (0.35)</td>
<td>46 (0.69)</td>
<td>2 cases</td>
<td>107 (0.43)</td>
</tr>
<tr>
<td>MICU dispatches, n (%)</td>
<td>15 (0.09)</td>
<td>11 (0.17)</td>
<td>0</td>
<td>26 (0.11)</td>
</tr>
<tr>
<td>Advice to caller, n (%)</td>
<td>192 (1.11)</td>
<td>88 (1.33)</td>
<td>9</td>
<td>289 (1.17)</td>
</tr>
<tr>
<td>Relevant events</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number/total (%)</td>
<td>11,432/16,812 (68)</td>
<td>693/6,626 (10)</td>
<td>519/1,198 (43)</td>
<td>12,644/24,636 (51)</td>
</tr>
<tr>
<td>Diagnostic real-time ECG, n (%)</td>
<td>8,574/11,432 (75)</td>
<td>617/693 (89)</td>
<td>301/519 (58)</td>
<td>9,492/12,644 (75)</td>
</tr>
<tr>
<td>Delay (days) until transmission of 1st symptomatic episode</td>
<td>2 ± 5</td>
<td>2 ± 4</td>
<td>3±4</td>
<td>3 ± 4</td>
</tr>
</tbody>
</table>
Case 1

- 73-year-old, female
- Reason for referral – palpitations & chest pain
Findings: sinus rhythm, episode(s) of ventricular tachycardia, rate 226 bpm, ventricular pacing 55 ppm. During NSR there were ST elevations at II, III, than there was sinus with V pacing followed by NSVT.
• MICU dispatched
• Patient admitted to hospital
• Underwent PCI
Case 2

- 76-year-old, male
- 2 years of recurrent pre-syncope symptoms
- No neurological findings
- Holter: 3-second pause 2 weeks before Cardio R placement
Diagnosis: 999.9 UNKNOWN

<table>
<thead>
<tr>
<th>Event</th>
<th>Symptoms</th>
<th>GVX Tracer</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>???????</td>
<td></td>
<td>SVE[s], sinus bradycardia, sinus arrest. Pause[s] of 6 sec[s].</td>
</tr>
<tr>
<td>10</td>
<td>???????</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Event Data:
- **Type**: Manual
- **Status**: Complete
- **Type**: Manual
- **Status**: Complete

Clinical Measurements:
- **BPM**: 12 - 53
- **PR**: 0.17
- **QRS**: 0.14
- **QT**: 0.38
• MICU dispatched
• Admitted to Hospital
• Pacemaker implanted
Conclusions

The Cardio R device enabled prompt ECG interpretations and timely interventions for cardiac-relevant complaints.

An improved version capable of detecting asymptomatic arrhythmic events will further enhance our capabilities to detect potentially life-threatening arrhythmic events in time to implement appropriate therapeutic measures.
Many thanks for your attention!

QUESTIONS?