Remote follow up for all CIEDs: Is it worth the extra physiologist resources?

Matthew Swift
Lead Cardiac Physiologist CRM
Overview

• Remote Monitoring
  – Principals
  – History
• Research
• DGH Experience
• Case Study
• Tips for running remote service
Fundamental Principals of Remote Monitoring

- Data Collection
- Data Analysis
- Clinical Decision Making
History of Remote Monitoring - Early Years
History of Remote Monitoring - The recent past
History of Remote Monitoring - Modern Day
Research

• Safety
  – Trust ICDs
  – COMPASS ppms
  – REFORM

• Reduces time to clinical decisions
  – CONNECT/TRUST
  – Continuous RM increase survival (IN TIME/ALTITUDE/MERLIN)

• Cost neutral in ICD over 10 years (Burri et al. 2013)
  – Reduced inappropriate therapy
  – Reduced in clinic FU
REMOTE MONITORING ALONE AS A PROMISING METHOD FOR FOLLOW UP OF PATIENTS WITH CARDIAC ELECTRONIC DEVICES. RESULTS OF THE RM-ALONE TRIAL

RM-Alone investigators:
F. Javier García-Fernández MD PhD (Hospital Universitario de Burgos-Burgos); Joaquín Osca Asensi MD PhD (Hospital Universitario La Fe-Valencia); Rafael Romero MD (H. Nuestra Señora de la Candelaria-Sta.Cruz de Tenerife); Ignacio Fernández Lozano MD FESC (H. U Puerta de Hierro-Madrid); José María Larrazabal (Hospital San Pedro de Alcántara-Cáceres); José Martínez Ferrer MD (H. Universitario Araba-Vitoria); Raquel Ortiz MD (H. General de la Palma-Las Palmas de Gran Canaria); Marta Pombo MD (H. Costa del Sol-Marbella(Malaga); Francisco José Tornés MD (Hospital Torrecárdenas -Almería); M. Moradi MD (Hospital Vall de Hebrón-Barcelona); Francisco García Urra MD(Hospital de Donostia); María José Sancho-Tello MD(Hospital Universitario La Fe-Valencia); Dr Enrique García MD (Complejo Hospitalario Universitario de Vigo ); S. Nicolás Franco (H. Rafael Méndez, Lorca); M. Rodríguez (H. Clínico U. San Cecilio, Granada); JM. Montes (H. U. Virgen de las Nieves, Granada)
RM ALONE TRIAL

OBJECTIVES:

• SAFETY:
  Demonstrate non inferiority of Home Monitoring only with respect to HM+IO in a long Follow up trial (24 months) using the same RM based protocol for both PM and ICDs.
  MACE: Death /stroke/ Hospitalization due to Cardiac cause/
  Device related surgery.

OBJECTIVES

• EFFICIENCY:
  1. Reduction of in office visits in the HMo group with respect to HM+IO
  2. Reduction of the workload of the staff.
RM Alone Trial

• Safety

MACE OVERALL POPULATION

<table>
<thead>
<tr>
<th>≥1 MACE</th>
<th>HMo (n:220)</th>
<th>HM+ IO (n:225)</th>
<th>p (non-inferior)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (n:445)</td>
<td>45 (20.5%)</td>
<td>42 (19%)</td>
<td>0.0152</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXITUS (n:30)</th>
<th>HMo (6.86%; n:15)</th>
<th>HM+ IO (6.6%; n:15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>4 (26.6%)</td>
<td>7 (46.6%)</td>
</tr>
<tr>
<td>Stroke</td>
<td>3 (20%)</td>
<td>1 (6.6%)</td>
</tr>
<tr>
<td>Non cardiac/Unknown</td>
<td>8 (53.3%)</td>
<td>6/1 (46.6%)</td>
</tr>
</tbody>
</table>

LOG RANK TEST: 0.573
HR(CI 95%): 1.12 (0.74-1.71)
RM Alone Trail

- Efficiency

![Graph A](image1)

![Graph B](image2)
RM ALONE TRIAL

RM+ RI every 6 months (common scheduling program for PM and ICD) vs. RM+IO evaluations/6 months

- Is not inferior in terms of safety
- Reduces in office evaluations (79%) without a significant increase of unscheduled visits.
- Reduces the workload of the staff.
3. TRANSMITTED / REMOTE DEVICE FOLLOW UP

Remote follow-up of cardiac devices can be an extremely useful tool in the management of device patients and can give access to data and diagnostics that normally can be accessed only at a face to face visit. Remote follow-up can be useful in reducing the number of visits that all patients have to make to a device clinic and is recommended for monitoring patients where possible and appropriate.
The GWH Experience
Departmental Workload
GWH Pacing clinic

• Increasing demand for diagnostic testing
  – Echo
• Lack of space for device patients in clinic
  – 1 pacing room
• >6000 patients actively FU
  – 19 patients per day/each day
  – If seen once per year
  • Increased advanced devices
Device Implants 2014-2018

Total Device Implants

2014 2015 2016 2017 2018

0 100 200 300 400 500 600 700

Implants
Implants by Type

![Graph showing implants by type from 2014 to 2018, with lines for Brady Devices and Advanced Devices.]

- Brady Devices
- Advanced Devices
Implant/Clinic Effect
Brady Devices

- Brady Devices
- Clinic FU
- Remote FU

Heart Rhythm Congress
www.heartrhythmcongress.org
Implant/Clinic Effect
Advanced Devices

<table>
<thead>
<tr>
<th>Year</th>
<th>Clinic FU</th>
<th>Remote FU</th>
<th>Advanced Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

Legend:
- Clinic FU
- Remote FU
- Advanced Devices
Physiologist Hours/FU

- Advanced Clinic: 1.0
- Advanced Remote: 0.5
- Brady Clinic: 0.6
- Brady Remote: 0.4
Detailed guidance for device follow up is given in the Appendix; however, the general principles are detailed below:

1. PHYSIOLOGISTS

Device follow up clinics should be undertaken with a minimum of two physiologists immediately available, of which the senior physiologist must have evidence of postgraduate training in cardiac rhythm management e.g. current BHRS, EHRA or IBHRE certification, current ILS or ALS certification and evidence of continued professional development in CRM, with knowledge and skills equivalent to Agenda for Change band 7.

BHRS Standards - Implantation and Follow-Up of CRM Devices in Adults (January 2018)

- RM follow up, interpretation of data
- No altering of patients prescription/programming
- Performed by 1 suitably qualified physiologist
  - Virtual MDT
    - Email
    - WhatsApp
Alerts

- Alerts can be labour intensive
  - see a lot of “normal”
- Managing alerts
  - Implant programming
  - Proactive disabling
- Dynamic Monitoring
Individually Tailored Alerts

- Lead Measurements
  - Threshold
  - Sensing
  - Impedance
- Arrhythmias
  - AF
  - HVR
  - % Paced Burden
- Episodes
- Home Monitoring
  - HM no signal
  - PIEGM arrived
RM vs Clinic

• 100% remote FU does not allow for patient interaction

• Assessment of pt symptoms
  – Ankle swelling
  – No. pillows slept with
  – “how have you been?”
  – Wound checks

• Pt and GP letters
  – Wounds and symptoms
4.1 Symptoms and signs

Symptoms are often non-specific and do not, therefore, help discriminate between HF and other problems (Table 4.1). Symptoms and signs of HF due to fluid retention may resolve quickly with diuretic therapy. Signs, such as elevated jugular venous pressure and displacement of the apical impulse, may be more specific, but are harder to detect and have poor reproducibility. Symptoms and signs may be particularly difficult to identify and interpret in obese individuals, in the elderly and in patients with chronic lung disease. Younger patients with HF often have a different aetiology, clinical presentation and outcome compared with older patients.
Heart Failure Diagnostics

Remote detection and management of Heart Failure

Today, the management of HF is largely reactive in nature with the patient developing symptoms and presenting to the clinic or emergency department for care. Early access to physiologic data may allow for a shift in the treatment paradigm.
Remote HF Diagnostic tools

- Thoracic Impedance monitoring
  - Optivol
  - Corvue
  - Thoracic Impedance
- Pt activity
- AF burden
  - V rate during AF
- HR variability
- % pacing
  - A,RV&CRT
- PVC/h
RM in detection of HF

- Some small studies have suggested RM may reduce HF morbidity and mortality
- Thoracic Impedance alone has been shown in studies to have poor sensitivity and specificity. Leading to an increase in unnecessary hospitalisations (DOT-HF, 2011; SENSE-HF, 2009)
- Studies using multi-parameter diagnostic algorithms showed patients at risk of HF could be identified (PARTNERS, 2010)
- IN TIME (2014) Multi-parameter assessment of diagnostic data from daily alerts >50% mortality benefit in RM arm
- REM HF (2017) Large trial 1650 patients, not alert driven, weekly download review. Neutral for HF hospitalisations and mortality
RM HF Diagnostics Case Study

- 63yo lady
- DR ICD Implanted 17/10/17
- 2° Prevention
- Tertiary population – 1hr 25mins drive to GWH

FastPath™ Summary

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode DDD</td>
<td>60 min⁻¹</td>
</tr>
<tr>
<td>Max Track Rate</td>
<td>110 min⁻¹</td>
</tr>
<tr>
<td>Paced AV Delay</td>
<td>250 ms</td>
</tr>
<tr>
<td>Sensored AV Delay</td>
<td>225 ms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VT-1</th>
<th>VT-2</th>
<th>VF</th>
</tr>
</thead>
<tbody>
<tr>
<td>166 min⁻¹</td>
<td>187 min⁻¹</td>
<td>230 min⁻¹</td>
</tr>
<tr>
<td>ATP x3</td>
<td>ATP x2</td>
<td>ATP x1</td>
</tr>
<tr>
<td>800 V</td>
<td>800 V</td>
<td>800 V</td>
</tr>
<tr>
<td>875 V</td>
<td>875 V</td>
<td>875 V</td>
</tr>
<tr>
<td>875 V x2</td>
<td>875 V x2</td>
<td>875 V x4</td>
</tr>
</tbody>
</table>

Capture & Sense
- ACap™ Confirm/V. AutoCapture
- Pulse Amplitude: 1.75 V
- Pulse Width: 0.5 ms
- AutoSense: On
- Sensitivity: Auto

Diagnostics Summary
- Since 11 May 2018
  - AP: 48%
  - VP: <1%
  - AMS Episodes: 0
  - Mode Switch: 0%
  - AT/AF Burden: 0%

VT/VF Episodes: 1
- Since 8 Jun 2018
  - VT-1: 0
  - VT-2: 0
  - VF: 0
  - ATP Delivered: 0
  - Shocks Delivered: 0
  - SVT Episodes: 0
  - Non-sustained Episodes: 1
Episode 17/8/18

- AP VS with PVCs ++
- Short FVT in VF zone
- Trigger for HF diagnostic assessment
Diagnostics

**Daily Exercise Training**  (Activity >1 minute)
Max Heart Rate  157 min⁻¹

- □ >80% Max HR
- □ 60-80% Max HR (Target HR)
- □ 40-60% Max HR

**Total Daily Activity**

- □ Activity
Further Diagnostics

- Discussed within virtual MDT
- Electronically forwarded to consultant sister centre
- Referred to community HF team
3 days later

Daily Percent Pacing
- Atrial
- Ventricular

Daily Heart Rate
- Day
- Night

Daily Activity
Data not collected during AT/AF
Departmental Changes

- Core team of 7 physiologists
  - Bands 6/7/8
- All hold current post-graduate qualification in devices
  - BHRS
  - IBHRE
  - EHRA
- Flexible working patterns/Work from home
  - Retention
  - Recruitment
- Change in culture
  - Remote working
  - Task oriented
Paperless Department

• 2010 moved to a fully paperless system
• Scanned all previous pacing documentation into CVIS data base
• Now use USB sticks to save in clinic PDF files to CVIS
• Attach remote monitoring PDFs in a similar fashion
• Create virtual MDT
Summary

- A tool which can ease the burden of in-clinic FU
- Follow up our patients 7 days a week
- Greater flexibility for staff around working patterns
- Long and laborious process to set up
- The remote follow up of devices can be tricky
  - Requiring highly adept staff
Thank you for listening

matthew.swift2@nhs.net