How to set up a device clinic for heart failure patients

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Consultant Cardiologist /Electro physiologist
CARE Hospitals, CARE Foundation
Need to set up a device clinic for heart failure patients

- Cardiology outpatients are busy
- The needs of heart failure patients are different
- Devices after implantation need dedicated follow up
Cardiology OP  
Device clinic
Patient related

- Optimize patient quality of life
- Optimize pacemaker or ICD system function to meet the clinical needs of the patient
- Identify patients at risk and initiate appropriate follow up with field safety corrective action /safety alerts
- Triage non CIED related health problems and make appropriate referrals
Support required for

- Brady cardia support
- Tachy arrhythmia therapy
- Bi ventricular stimulation
- Arrhythmia monitoring
- Heart failure therapy
CIED related

- Document appropriate CIED function
- Identify and correct abnormal cied behaviour (adequate LV pacing)
- Maximise pulse generator longevity while maintaining patient safety (at ERI rv can be made sub threshold)
- Identify approaching CIED end of battery life
- Identify leads at risk of failure
- Organise CIED replacement in non emergent manner (early recognition of battery replacement)
Disease related

- Document the nature and frequency of arrhythmias
- Correlate with patient symptoms and determine appropriateness of CIED response
- Document hemodynamic status,
- Trans thoracic impedance, patient activity and other physiological parameters over time as part of chronic disease monitoring in heart failure
- Monitor response to therapy
Communication

- Maintain a patient data base
- Timely communication to the patient and relevant health care providers of cied and disease related information
- Provide technical expertise and education to colleagues, patients and community
Personnel

- Heart failure nurse
- Device nurse
- Physician assistant
- Technical support from company
- Electrophysiologist
- Heart failure physician
Device - Nurse
Physician assistant

- **Training**
- Under graduate
- Trained for 2 year PA programme
- Trained in device clinic
- For programming with assistance and data entry and appointments
- Patient queries
Industry employed allied professional

- Expert in cied technology
- employed by Cied manufacturer
- Helps in checking devices
Minimum frequency of CIED in person or remote monitoring

- Pace maskers /icd/crt
- With in 72 hours of implant (in person )
- 2-12 weeks of implant (in person)
- Every 3-12 months (in person or remote)
- Annually until battery depletion (in person)
- At battery depletion every 1-3 months(in person or remote )
Content for follow up

- Battery voltage and impedance
- Capacitor charge time
- Pacing and sensing threshold
- Lead impedance
- Shock impedance
- Arrhythmia detected
- % pacing and sensing in each chamber
- Therapies for arrhythmia
- Device triggered alert
- Any hemodynamic measurements
Flow of patient care at device clinic
- Physical examination
- Wound check
- Ecg
- Device interrogation
- Data entry in data base
- 6 minute walk test as indicated
- Electrophysiologist consultation
- Attending to issues related to device, treatment modification, dietary advice
requirements
Device clinic
CPU / Scanner
Monitor /defibrillators
Setting up data base

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Please wait .........
**DEPARTMENT OF CARDIOLOGY**

**DEVICE CLINIC - COMBO DATA SHEET**

**NAME / AGE / SEX:** VANGA PRATAP REDDY / 70 / M

**Address:** H.NO.2-207/31-39 BAGH AMBERPET HYDERABAD Tel. No. #70680278

**Implant No.:** 01  **Device Clinic No.:** DC-1704

**Implant date:** 21/11/2014  **Sponsor:**

**Complete Diagnosis:**
- HTN, DM
- SEVERE LV SYSTOLIC DYSFUNCTION
- ISCHAEMIC CARDIOMYOPATHY
- S/P CRT-D MEDTRONIC DONE ON 21.11.2014

**Indication:**
- SEVERE LV SYSTOLIC DYSFUNCTION
- ISCHAEMIC CARDIOMYOPATHY

**Cardiologist:** DR. L. KRISHNA MOHAN  **Hospital:** CARE BANJARA

**VEIN:** Left Subclavian  **Pocket:** Left Pectoral  **Antibiotic:** Betadine

**Device Info:**

<table>
<thead>
<tr>
<th>Generator</th>
<th>Ventricular Leads</th>
<th>Atrial Leads</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROTECTA CRT-D</td>
<td>MEDTRONIC</td>
<td>MEDTRONIC</td>
</tr>
<tr>
<td>MEDTRONIC</td>
<td>6935-50CM</td>
<td>4296-80CM</td>
</tr>
<tr>
<td>D6478G</td>
<td>TA0146107V</td>
<td>BRA73082S</td>
</tr>
</tbody>
</table>

**Polarity:**
- Bipolar

**Use Before:** 206  **Operating Mode:** DDD

**Implant Parameters:**

<table>
<thead>
<tr>
<th>Rt. Ventricular</th>
<th>Atrial</th>
<th>Lt. Ventricular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni</td>
<td>Bipolar</td>
<td>Uni</td>
</tr>
<tr>
<td>0.5</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>420</td>
<td>480</td>
<td>420</td>
</tr>
<tr>
<td>7.3</td>
<td>2.1</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**DFT:**
- Diaphragmatic / Intercostal Pacing at 10 Volts: NL  **Stability:** GOOD

**Remarks / Complications:** NO
Follow up No. : 5

DEVICE CLINIC - Clinical Follow up

PATIENT NAME : VANGA PRATAP REDDY  
Device Clinic No. : DC-1704  
AGE : 70  
SEX : M  
Implant Date : 21/11/2014  
Tel No. : 9703080278  
Follow up Date : 07/01/2015

SYMPTOMS: NO COMPLAINTS  
SIGNS: PG POCKET Ok.BP=  
CRT-D (MEDTRONIC)

12 LEAD DETAILS:

Comments on monitored ECG:

CURRENT PARAMETERS:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RV</th>
<th>ATRIAL</th>
<th>LV</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDD (60bpm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV Delay (ms)</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV Delay (Pr)</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude (Vols)</td>
<td>2.0</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Pulse Width (ms)</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Sensitivity (mv)</td>
<td>0.30</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Polarity</td>
<td>BIPOLAR</td>
<td>BIPOLAR</td>
<td></td>
</tr>
<tr>
<td>Lead Impedance (Ohms)</td>
<td>342</td>
<td>310</td>
<td>437</td>
</tr>
</tbody>
</table>

Battery Voltage : 3.35V  
Cell Impedance :

Thresholds

RA-THR=0.5V@0.4ms  
RV-THR=1.0V@0.4ms  
LV-THR=1.0V@0.4ms

Intrinsic Rhythm

P-WAVE=1.5mV  
R-WAVE=1.5mV

Counters :  
AS-VP=92.2%, AV-VP=96%, AS-VS=4.2%

REMARKS :  

FINAL PROGRAMMING :  
output changed

PROBLEM LIST : NVT episodes present in dec 2014 duration 08 sec rate 182

PRESCRIPTION / ADVICE / TESTS  

doctor advised 6 min walk test  
Pre BP=120/80mmHg, pulse=68bpm  
Post BP=110/70mmHg, pulse=76bpm  
spO2=99%, meters=280
Data from device clinic at care
Case 1
### FastPath™ Summary

**Battery**
- Longevity: 5.3-5.6 yrs
- Voltage: 2.05 V
- Magnet Rate: 100.0 ppm
- Battery Current: 14 μA

**Implant Date:** 4 Nov 2014

**Test Results:** 19 Jan 2015

<table>
<thead>
<tr>
<th>Test</th>
<th>Capture</th>
<th>Sense</th>
<th>Lead Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.625V 0.4ms (B)</td>
<td>&gt;5.0mV (B)</td>
<td>450 (B)</td>
</tr>
<tr>
<td>RV</td>
<td>0.75V 0.4ms (B)</td>
<td>0.4mV (RV B)</td>
<td>440 (B)</td>
</tr>
<tr>
<td>LV</td>
<td>0.75V 0.8ms (M3-P4)</td>
<td>4.0V 0.8ms (M3-P4)</td>
<td>710 (M3-P4)</td>
</tr>
</tbody>
</table>

**Parameters**
- Mode: DDD
- Base Rate: 60 min
- Max Track Rate: 130 min
- Paced AV Delay: 200 ms
- Sensed AV Delay: 150 ms
- Ventricular Pacing: Simul

**Capture & Sense**
- Cap Confirm: On
- Pulses Amplitude (Safety Margin): 2.0V (3.21)
- Pulse Width: 0.4 ms
- AutoSense: Off
- Sensitivity (Safety Margin): 0.5mV (4.21)

**Diagnostics Summary**
- Since 19 Jan 2015
  - AP: 19%
  - BP: >90%
  - AMS Episodes: 2
  - Mode Switch: <1%
  - ATIAF Burden: <1%

**Episodes Summary**
- Since 4 Nov 2014
  - Counts
    - AMS Entry: 2
    - High Ventricular Rate: 0
    - Magnet Response: 0

**No Alerts**
- Manual-programmed
- Auto-programmed
Loss of pacing
sundara chari
Male

Name: Sundara Char
Sex: M

Age: 62
65

Age not entered, assumed to be 50 years old for purpose of ECG interpretation

Atrial-sensed ventricular-paced rhythm

No further analysis attempted due to paced rhythms

A.M./P.M.

Technician

KIS:
-50
184

- ABNORMAL ECG -

Lead: Standard Placement

Unconfirmed Diagnosis

aVR
V1
V4

aVL
V2
V5

aVF
V3
V6

Price: $10
Speed: 25 mm/sec
Limb: 10 mm/mV
Chest: 10.0 mm/mV

F 50-0.15-100 Hz

PH100B CL F7
Case 2
Introduction

- 60 yr male, CAD/OLD AWMI/POST POBA TO LAD/severe LV dysfunction/scar VT/ post CRT-D
- Now episodes of breathlessness with palpitations with one ICD shock
- Device interrogation done which showed........
ICD diagnosed Tachy episode
Another episode detected and treated

### Treated VT/VF Episode #10

**Device:** Maximo II CRT-D D284TRK  
**Serial Number:** PZP613304S  
**Date of Visit:** 24-Jul-2013 16:21:32

**Patient:** A L N SARMA  
**ID:** IP-51103  
**Physician:** Dr. Narasimhan

<table>
<thead>
<tr>
<th>Type</th>
<th>ATP Seq</th>
<th>Shocks</th>
<th>Success</th>
<th>ID#</th>
<th>Date</th>
<th>Time hh:mm:ss</th>
<th>Duration hh:mm:ss</th>
<th>Avg bpm A/V</th>
<th>Max bpm A/V</th>
<th>Activity at Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT</td>
<td>3</td>
<td>20J</td>
<td>Yes</td>
<td>10</td>
<td>05-Jun-2013</td>
<td>15:03:34</td>
<td>0:34</td>
<td>73/158</td>
<td>--/158</td>
<td>Rest</td>
</tr>
</tbody>
</table>

- **VF:** 320 ms
- **VT:** 400 ms
- **Detection:**
  - V-V
  - A-A
- **Burst**
- **Ramp**
- **Term.** 19.7 J
CRT Optimization Clinic Flow Chart

CRT optimization clinic referral

Designated (heart failure) nurse arranges consultation and schedules

- Labs (anemia, metabolic derangements)
- Chest X-ray: A/P – lateral (position leads)
- ECG: ON/OFF (arrhythmia, ensure Biv pacing)
- 6-min walk test (exercise performance)

Designated cardiologist: history, medication, clinical examination, and interpretation of tests

- Device check (baseline diagnostics)
- Baseline transthoracic echocardiogram (cardiac structure, function and hemodynamics)

Evaluation during different AV settings and without Biv pacing

Multi-disciplinary recommendation (heart failure, electrophysiology, cardiac imaging) including device settings

CRT Non-Responder Clinic Outcomes

- Most patients had identifiable etiologies for lack of response
  - 74% of patients underwent changes to device settings and/or other therapy modifications
- Fewer adverse events (13% vs. 50%, odds ratio: 0.2 [95% confidence interval: 0.07 to 0.56], p = 0.002) compared with those in which no recommendation could be made.
CRT Non-Responder Clinic Outcomes

- Inadequate device settings (47%)
- Suboptimal medical treatment (32%)
- Arrhythmias (32%)
- Inappropriate lead position (21%)
- Lack of baseline dyssynchrony (9%)
Potential Reasons for Suboptimal Response

- Patients not receiving optimal medical RX
  - 24% of patients not prescribed evidence-based drug therapy despite lack of contraindication
- 8% of patients identified to be noncompliant with medication or fluid/diet intake
Potential Reasons for Suboptimal Response

- Anemia: 30% of patients experienced anemia
  - Only 3 patients (4%) had hemoglobin <10 g/dl.
- 41% BMI of 30 kg/m2
  - 16% BMI 40 kg/m2
- One patient had primary RV dysfunction without LV dysfunction.
Potential Reasons for Suboptimal Response

- Patients felt to have suboptimal lead position
  - 16 patients with inappropriate LV lead positions
    - Predominantly anterior
    - Only 7 of 16 patients (9% of total) underwent lead repositioning
Potential Reasons for Suboptimal Response

• 47% Suboptimal programming of AV timings
• 9% Underlying narrow QRS (<130 ms)
• 16% Persistent significant mechanical dyssynchrony with biventricular pacing
  • 11% interventricular mechanical dyssynchrony
  • 9% intraventricular mechanical dyssynchrony
Potential Reasons for Suboptimal Response

- 15% Permanent atrial fibrillation
- 17% Biventricular pacing (<90% of time)
  - Supraventricular or ventricular ectopy
- Patient with severe LV dysfunction, NYHA class III, lbbb,
- CRT implanted in dec 2013
- No history of arrythmia
- On
- Ivabradine 5 mg bd
- Cardivas 3.125 bd
- Dytor plus
- Cardace
- digoxin
## Parameters

### Patient
- Date of Birth
- EF %

### Indications for Implant
- Unknown

### Device
- CRT-D
- A Lead
- RV Lead
- LV Lead

### Manufacturer
- St. Jude Medical

### Model
- Promote Quadra™ 3239-40Q

### Serial
- 1015442

### Implant Date
- 11 Dec 2013

### Basic Operation
- Mode
- Ventricular Pacing
- V. Triggering
- Magnet Response
- V. Noise Reversion Mode
- Episodal Pacing Mode
- Sensor
- Threshold (Measured Avg.)
- Slope
- Max Sensor Rate
- Reaction Time
- Recovery Time

### Refractories & Blanking
- DDD
- Simul.
- Off
- Normal
- Pacing Off
- DDI
- Passive
- Auto (+0.0) (2.0)
- 8
- 110 min⁻¹
- Fast
- Medium

- PVARP
- Post-Vent Atrial Blanking
- Rate Responsive PVARP/V Ref
- Shortest PVARP/V Ref
- A/V Pace Refractory
- A/V Sense Refactory
- Ventricular Blanking
- Ventricular Safety Standby
- Arrhythmia Unhiding
- PVC Response
- PMT Response
- PMT Detection Rate

### Values
- 275 ms
- 130 ms
- Low
- 225 ms
- 190/250 ms
- 93/125 ms
- 52 ms
- On
- 3 intervals
- Off
- Atrial Pace
- 110 min⁻¹
### Parameters

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<td>EF %</td>
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<td>1015442</td>
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<td>A Lead</td>
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<tr>
<td>RV Lead</td>
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<td></td>
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</table>
Distribution between crt-d and crt-p 2005 - 2015

53% 47%

- crt-d
- crt-p
How device clinic was useful at our centre

- Smooth transition for patient with wound dressing and preliminary instructions about do’s and don’t’s
- Identification of early lead displacement
- Identification of non responders for av delay optimization
- Identification of patients with af for avj ablation
- Modifying drugs for heart failure and ventricular arrhythmia
- Identifying patients with inappropriate shocks
- Pre and post operative care of patients with mode change
Mutidisciplinary Evaluation And Treatment Plan

- Mean clinic visit duration 75 minutes with involvement of a designated nurse (15 min) and cardiologist (30 min), device check (30 min)
Thank You