GUIDELINES FOR THE MANAGEMENT OF CIED IN PATIENTS WITH VENTRICULAR ASSIST DEVICES AT EMORY HEALTHCARE

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Rationale: There has been a substantial increase in the numbers of patients cared for at Emory Healthcare in whom implantable cardioverter defibrillators and other implantable electronic devices (ICD, CIED) coexist with left ventricular assist devices (LVAD). Expected benefits of ICD therapy in the LVAD cohort are diminished, while device associated risks are increased and may markedly impact outcomes (bleeding, infection, inappropriate shock). There have been varying strategies employed in the management of CIEDs in this patient population and consistency would allow for optimized patient care.

Therefore, a list of several common clinical scenarios encountered at Emory in patients with LVAD is provided. After each scenario, a consensus-based, literature supported, management plan is listed:

1. Device programming for pre-existing CIEDs in a patient receiving an LVAD:

a. Brady programming: Resting heart rate programming following LVAD placement should be determined by right ventricular function. The optimal heart rate for a patient with post LVAD right heart dysfunction is 80-100BPM (Argiriou, J Thorac Dis Mar 2014). AV synchrony is likely more beneficial to RV function compared to AV dysynchrony or atrial fibrillation. In several studies, LV pacing post LVAD is not associated with improved patient outcomes and is associated with more rapid battery depletion. LV leads should be turned off in those with CRT devices. For those who require ventricular pacing, RV pacing should be AV synchronous. If not possible, base rate should be 80-100BPM. Rate response should be disabled. All possible attempts at prolonging battery life should be made.

b. Tachy programming: Post LVAD ventricular arrhythmias are not immediately life threatening but may be associated with impaired LVAD function, suction and low flow alarms often related to worsening RV dysfunction. Medical treatment options should be the primary treatment focus in this patient cohort. Defibrillation therapy via ICD should be an effort of last resort, and ICD programming should reflect that (prolonged detection intervals, multiple ATP attempts and schemes, no more than 2 shock attempts in any treatment zone). Detection rates should follow MADIT-RIT criteria for primary prevention devices without prior tachy therapies, and in cases of very young patient, higher treatment rates (>222BPM) may be considered. In those with prior tachy therapy, detection rates should be kept

the same but detection times should be maximized. New therapy zones should only be enabled for documented sustained VT.

2. Failed defibrillation shocks after LVAD:

a. VF or polymorphic VT: For these rhythms, standard medical approaches should be employed (e.g. sotalol when feasible, d/c amiodarone when feasible). Lead revisions should occur only when the patient has clear decompensation of the right heart and no reversible causes or measures can be identified. If medication changes are instituted or a reversible cause identified and corrected, a DFT test is reasonable prior to any invasive approach.

Otherwise, if the patient is able to reach healthcare in a timely manner, or is able to promptly recognize low flow alarms on LVAD, the following options should be considered:

1. disabling tachy therapies

2. programming low energy "warning shocks" to prompt ER visit (some devices wont allow minimal energy shocks for all therapies)

b. Monomorphic VT: The patient should be evaluated for VT ablation if the arrhythmia is deemed to be at reasonably good chance of treatment by catheter ablation by the electrophysiology service. An acutely successful procedure would defer device revision.

3. Post-LVAD sensing issues

a. LVAD noise oversensing: If the patient is deemed by the electrophysiologist to require future tachy therapies, the system should be revised. This most often occurs in the context of subcutaneous ICD. If the patient has never used her/his ICD for tachy therapy, disabling therapies should be strongly considered.

b. Small R waves: If the sensed R waves drop to a level where double counting or t wave oversensing occurs, rules for revision are similar to a. If the R waves have dropped, but are consistently sensed by the device, watchful waiting or predischarge DFT testing should be determined by electrophysiology service.

4. Primary prevention implantation of defibrillator after LVAD implant:

There is no evidence in favor of, but substantial evidence suggesting harm for, the de novo implant of a primary prevention defibrillator in this scenario. CMS will not reimburse services related to implant in this patient

population and justification for implant outside standard primary prevention indications is needed. ICD implants may be appropriate in special circumstances in patients at very high risk for malignant arrhythmia. Those deemed to be very high risk may include:

High burden of ventricular ectopy or NSVT
Ischemic substrate where pace-termination may be feasible

This determination should be made in conjunction with heart failure services and electrophysiology service. If the patient is *not* deemed at very high risk, deferring implant is reasonable.

5. Generator exchange needed after LVAD:

a. Pacemaker dependent patients or those with a history of pace-terminated clinically important VT: The generator should be exchanged with the use of adjunctive procoagulant substances and antibiotic eluting pouches to mitigate risks for hematoma and infection. Coordination with anticoagulation management services to achieve lowest possible INR without need for bridging is recommended.

b. Those who have received appropriate tachy therapy (secondary prevention ICD): A discussion with the patient and care team should occur prior to exchange about possible alternatives as found in sec 2a.

c. Those who have never received tachy therapy: Disabling the device and deferring surgical procedure should be considered.

6. Chronic driveline infections:

a. Clinically-suppressed infections: In patients with chronic driveline infections, suppressed by chronic antibiotics and clinically without evidence of ongoing bacteremia, extraction should not be offered as it would not change long-term therapy.

b. Uncontrolled infections: High risk extraction should be offered to those with persistent bacteremia, evidence of embolic events or evidence of involvement of the CIED hardware. Decision making should be shared between EP, HF cardiology, ID and CT surgery.

REFERENCES:

Oswald H, Eur Journal of Heart Failure Jun 2010 – this is one of the best studies in this cohort 0- prospectively followed 61 patients, dividing group

into those with secondary prevention icd in place and those without (40 had a new icd implanted after LVAD, so basically our exact target population). Results were that there were high rates of VA and appropriate therapy (>30%), many of which were amenable to ATP therapies. There is a nice flow chart that might be adapted for our use. Article attached.