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Catheter Ablation for Recurrent Ventricular Tachycardia After Implantation of a Left Ventricular Assist Device: A Interdisciplinary Approach

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Objectives: Ventricular tachycardia (VT) is a common finding following implantation of a continuous-flow left ventricular assist device (LVAD). We report our experience, technical feasibility and efficacy of endocardial VT-ablation to treat symptomatic patients with LVAD. **Methods:** A retrospective analysis of all patients supported with a LVAD who were referred for catheter ablation to treat recurrent symptomatic VT was performed. **Results:** Between January 2012 and August 2014, 159 patients underwent implantation of a LVAD. In eight patients (all of whom had an ICD before LVAD implantation) an ablation was indicated due to recurrent episodes of VT, leading to ICD shock or recurrent hemodynamic instability. A total of 11 ablation procedures were performed. The first ablation was performed after an average of 142 ± 130 days after LVAD implantation. Between the implantation of the LVAD and the first ablation procedure 24 ± 18 appropriate shocks per patient were delivered. For catheter ablation the CARTO 3 mapping system was utilized. Nine clinical VT episodes were able to be induced in four patients. Seven of these VT epsiodes (77.8%) were successfully ablated after activation mapping in these patients. In two patients a monomorphic VT origin was located in the epicardium and could not be ablated successfully, but only in one patient was it inducible at the end of the procedure (12.5%). In six patients voltage mapping was conducted. The low voltage area in four patients extended to the implantation area of the inflow cannula, and of these, all were rendered non-inducible after ablation. All patients remained hemodynamically stable during the procedure. Although the majority had a reduction in VA frequency, in two patients clinical VT recurred, making a second ablation necessary. There were no complications associated with the ablation procedures. The patients were free from ICD shock for an interval of 209 ± 193 days. **Conclusion:** VT ablation is a feasible, safe and effective treatment option in patients with recurrent triggering of VT episodes leading to ICD shock after implantation of a LVAD.

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Iron Deficiency Is the Most Common Cause of Anemia in CF-LVAD Patients

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Background: The use of durable continuous flow left ventricular assist devices (CF-LVADs) has increased in the past few years as a therapeutic option for patients with end stage heart failure. The high prevalence of anemia and its association with morbidity and mortality of patients with CF-LVADs has been previously described. However, there are no studies analyzing the underlying cause of anemia in this patient population. **Methods:** We performed a comprehensive anemia evaluation on patients who had hemoglobin <12 gm/dL and had been on at least 6 months of CF-LVAD support. We excluded patients who had a GI bleeding episode in the past 3 months and medical conditions that could influence the nature of anemia (hemochromatosis and malignancies). Standard of care laboratory tests, iron studies, erythropoietin levels and thyroid-stimulating hormone levels were obtained. Patients were categorized as iron-deficient defined as ferritin <100 mg/dL or ferritin 100–299 mg/dL with a transferrin saturation <20%. Demographics, clinical variables, laboratory data were compared between both groups. **Results:** A total of 58 patients were identified as anemic and met the inclusion criteria. The mean age was 58 ± 12 years, 76% were male, 47% African American, 59% had ischemic cardiomyopathy as primary diagnosis, and in 65% CF-LVAD was implanted as destination therapy. The mean duration of LVAD support was 23 ± 17 months. Iron deficiency was identified in 37 (64%) of the patients. Comparison of iron deficient patients vs non-iron deficient is shown in the Table 1. There was no significant difference between age, gender, race, etiology, therapy goal and INTERMACS profile. Iron deficient patients had higher erythropoietin (67.0 ± 58 vs 24.5 ± 16; $P < .01$) lower hemoglobin (10 ± 1.4 vs 11 ± 1.2; $P = .01$), MCV (86 ± 9 vs 93 ± 8; $P < .01$) and MCH (26 ± 3 vs 29 ± 1; $P < .01$). There was no difference in kidney function, liver function or hemolysis laboratories between the two groups. Patients without iron deficiency had laboratories suggestive of anemia of chronic disease with higher ferritin levels (302 ± 160 vs 74 ± 59 µg/L; $P < .01$) and a decreased total iron binding capacity (246 ± 55 vs 337 ± 56 µg/dL; $P < .01$). There was no difference in NYHA class (median of 2 for both groups; $P = .3$) or BNP levels (317 ± 264 pg/mL in the non-iron deficient group vs 241 ± 206 pg/mL in the iron deficient; $P = .2$). 38% of the patients with iron deficiency were on iron supplementation. **Conclusions:** We have identified absolute iron deficiency to be the most common cause of anemia in patients supported with CF-LVADs (64%). Iron deficiency appeared to persist despite oral iron supplementation.

Table. Comparison of Iron Deficient versus Non-Iron Deficient Patients

	Non-Iron Deficient	Iron Deficient	p-value
N	21 (36%)	37 (64%)	
Age	62 ±11	56 ±12	0.051
Duration of LVAD Support (months)	22 ±16	23 ±18	0.8
Erythropoietin (mIU/mL)	24.5 ±16	67.0 ±58	<0.01
Complete Blood Count Results:			
Hemoglobin (g/dL)	11 ±1.2	10 ±1.4	0.01
Hematocrit (%)	34.9 ±4.0	33.3 ±4.0	0.1
MCV (fL)	93 ±8	86 ±9	<0.01
MCH (pg/RBC)	29 ±1	26 ±3	<0.01
MCHC (gr/dL)	31.8 ±1.2	30.4 ±1.4	<0.01
Reticulocyte (%)	2.2 ±0.9	2.7 ±1.1	0.08
Reticulocyte production index	1.1 ±0.4	1.2 ±0.5	0.3
Iron Studies:			
Iron (µg/dL)	67.1 ±20	44.8 ±20	<0.01
TIBC (µg/dL)	246 ±55	337 ±56	<0.01
Transferrin Saturation (%)	27 ±6	13 ±6	<0.01
Ferritin (µg/L)	302 ±160	74 ±59	<0.01
TSH (µIU/mL)	2.8 ±3.3	2.5 ±2.5	0.7
Folate (ng/mL)	12.5 ±3	13 ±3	0.4
B12 (pg/mL)	731 ±386	716 ±409	0.8
LDH (U/L)	331 ±202	307 ±88	0.6
Haptoglobin (mg/dL)	49.7 ±51	47.9 ±66	0.6
Plasma Free Hemoglobin (mg/dL)	4.5 ±5.8	2.4 ±1.8	0.1
INR	2.0 ±0.4	1.8 ±0.5	0.2
PTT (sec)	41 ±7	41 ±9	0.9
BUN (mg/dL)	32.0 ±20	25.3 ±14	0.1
Creatinine (mg/dL)	1.7 ±0.7	2.2 ±3.3	0.4
GFR (mL/min/1.73m²)	51 ±21	57 ±25	0.2
Albumin (gr/L)	3.5 ±0.4	3.5 ±0.4	0.8
Total Bilirubin (mg/dL)	0.52 ±0.2	0.57 ±0.3	0.5
Protein (gr/L)	7.4 ±0.5	7.6 ±0.7	0.2
BNP (pg/mL)	317 ±264	241 ±206	0.2

*All values are Mean ± SD or N(%).

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Role of Guideline-Directed Medical Therapy for Patients With Severe Functional Mitral Regurgitation Referred for Mitral Valve Clip

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Background: Functional mitral regurgitation (FMR) due to severe left ventricular dysfunction is a challenging condition carrying poor prognosis. The efficacy of guideline-directed medical therapy (GDMT) in reduction of FMR has not been well established. **Methods:** We screened 236 patients with mitral regurgitation who were referred to our tertiary level medical center for mitral valve clip evaluation from 11/2012 to 10/2014. Patients with primary mitral regurgitation and those who did not require medication adjustment after referral were excluded. 61 patients met our inclusion criteria were analyzed. **Results:** Mean age of this cohort was 73 years and 46% were males. 72% had ischemic cardiomyopathy. 36% had diabetes, 77% had hypertension and 39% had chronic kidney disease. 23% of patients (14 of 61) were confirmed deceased during the study period. Only 31 of these patients had follow up with the heart failure team and optimization of medications. In total, 9 of the 31 survivors with follow-up (29%) had improvement in the MR grade before any MV procedures: in 7 patients (23%), MR severity improved by 1 grade and by 2 grades in 2 patients (6%). Only lower BUN was associated with improvement in MR in univariate analysis. **Conclusion:** Significant proportion of patients with FMR had improvement in MR with optimization of medical therapy. We recommend optimizing FMR patients with GDMT before referral for mitral valve procedures.

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Predictors of Outcomes in Patients Requiring TandemHeart Percutaneous Ventricular Assist Devices: A Single Center Study

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Background: Percutaneous ventricular assist devices (pVADs) are utilized in the management of patients with cardiogenic shock resulting from a variety of causes