Clinical Care

129

Clinical and Echocardiographic Determinants of Right Ventricular Failure in Patients with Left Ventricular Assist Device Therapy

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Background: Left ventricular assist devices (LVAD) improve functional class and survival in selected patients with advanced heart failure. Right Ventricular Failure (RVF) after LVAD implantation is associated with increased mortality, morbidity and hospitalization. Identification of LVAD candidates at risk for RVF remains challenging. The purpose of this research is to determinate association of clinical and echocardiographic parameters with early and late RVF, clinical outcomes, and mortality after LVAD implantation. **Methods:** We retrospectively reviewed 156 consecutive LVAD implantations at the University of Florida at Gainesville, FL, from 2006 to 2016. Clinical and transthoracic echocardiographic data were studied. Early RVF was defined as the unplanned need for a right ventricular assist device or inotrope dependence for ≥14 days. Late RVD defined as either starting IV inotropes after 6 months of LVAD implantation or need for LVAD speed reduction after 6 months of LVAD implantation. **Results:** Data were collected for 91 patients whose longitudinal follow up data were available. Our cohort was predominantly males (78%) with a mean age of 59.1 years. Early RVF was detected in 27 patients (29.7%) late RVF was detected in 10 patients (11%). Obesity was associated with increased late RVF ($P = .035$). There was a negative correlation between pre-implantation right ventricular diameter and late RVF ($r = -250$, $P = .021$), however, it did not predict RVF on linear regression analysis. Pre-implantation echocardiographic right ventricular parameters such as tricuspid regurgitation severity, right ventricular fractional area change, and tricuspid annular excursion showed no correlation with post-LVAD implantation RVF, hospitalization, or mortality. **Conclusions:** Right ventricular dilation was inversely related to the development of late RVF after LVAD implantation, but predictors may extend beyond routine echocardiographic parameters. In our institution, these parameters were not predictive of outcomes. Obesity was associated with late RVF suggesting that patient factors play an important role in this disease process. There is need for in-depth investigation of the pathophysiological changes to the right ventricular in LVAD patients. Our results also highlight the responsibility for centers to determine center-specific risk factors and approaches to RVF.

130

Role of Combining Oral Sildenafil with Inotropic Infusion Therapy in Left Ventricular Assist Device Patients with Right Ventricular Failure

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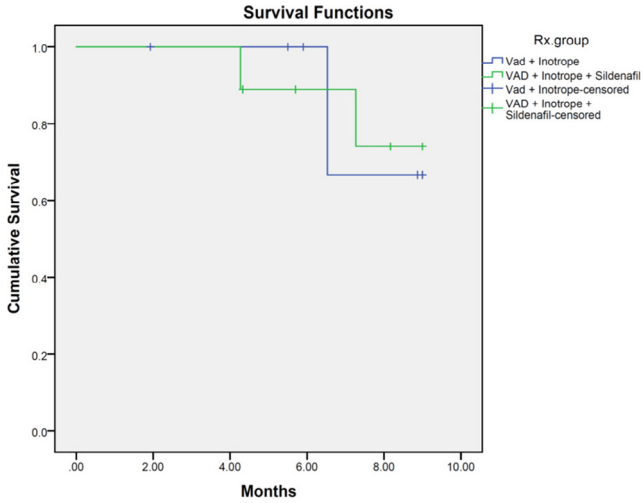
Introduction: Right ventricular failure (RVF) is a major cause of mortality in advanced heart failure, without standardized therapeutic approach. Left ventricular assist devices (LVAD), inotropes and sildenafil have been shown to decrease pulmonary vascular resistance and right ventricular afterload, however there is no prior research to describe the benefit of adding sildenafil to LVAD and inotrope therapy. **Aim:** We report our center's outcomes of sildenafil therapy in LVAD patients with RVF. **Methods:** We retrospectively reviewed all patients receiving LVAD implantation between 2006 and 2016. Inclusion criteria were RVF requiring inotrope infusion therapy for more than 2 weeks. Patients with added sildenafil therapy at maximally tolerated doses for more than 30 days (S group) were compared to those with only inotrope infusion (non-S group). Echocardiographic parameters were compared before and after LVAD implantation as well as pre-LVAD invasive hemodynamic measurements. The primary outcomes were 9-month hospitalization, mortality, and change in tricuspid regurgitation jet velocity (TRj) on transthoracic echocardiogram at 6 months. **Results:** Data from 15 patients were analyzed with nine in the S group and six in the non-S group. Non-Ischemic cardiomyopathy was the primary LVAD indication in 77.8% and 83.3% (P 0.792) for S and non-S groups, respectively. Pre-LVAD right ventricular stroke work index means were 7.1 g . m/m^2 and 6.9 g . m/m^2 (P 0.918) for S and non-S groups, respectively. The overall 9-month survival was 72.2% in our cohort, 74.1% in the S group and 66.7% in the non-S group (P 0.941). Number of hospital admissions averaged 2.13 and 2.33 (P 0.715) for S and non-S groups, respectively. After LVAD implantation, the combined mean TRj decrement was 76 cm/s (P value 0.002) without significant correlation with mortality (p 0.058) or readmission rate (P 0.129). **Conclusion:** Sildenafil added to inotrope therapy for RVF post LVAD, when tolerated, showed a nonsignificant trend towards improved rehospitalization and mortality outcomes in this population. Prospective investigation at a larger scale is needed to define the efficacy of this approach.



131

Electromechanical Activation Time via HemoTag Correlation with Pulmonary Artery Pressure by Right Heart Catheterization: Implications for Diagnosis and Clinical Practice

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Background: Phonocardiograph is a classical technique for calculation of cardiac time intervals (CTI). The HemoTag® is a new cloud-connected medical device that captures heart sounds and an ECG signal transduced via 3 thoracic electrodes and measures CTIs and can potentially constitute a quick and cost effective means of assessing patient's pulmonary artery pressure obtain by right heart catheterization. Electromechanical Activation Time (EMAT) as one of the HemoTag® indices was assessed as a marker of systolic, and mean pulmonary artery pressure in the right heart measurements. HemoTag® indices were then assessed to identify normal/abnormal pulmonary artery pressure using prediction models. **Methods:** 20 consecutive patients were recruited at the catheterization laboratory of community affiliated academic center (JFK Medical Center) from February 1st to March 30th 2017 (Western IRB approved study. Protocol No. 20151156). 8 patients were excluded from the study as they did not meet inclusion criteria. EMAT measurements were obtained using HemoTag® within 30 minutes from the right heart catheterization. Linear regression and predictive models were employed to evaluate EMAT correlation with systolic and mean pulmonary pressure. Data was entered and analyzed on Microsoft Excel 2016. **Results:** The female to male ratio was 0.58 with a mean age 69. 59 +/– 15.63 years. The mean systolic blood pressure was 130 +/– 19.42 mmHg, mean weight was 189.06 +/– 42.32 pounds. The mean of mean pulmonary atrial pressure (mPAP) was 33.09 +/– 14.27 mmHg and mean of systolic pulmonary atrial pressure (sPAP) was 55.25 +/– 23.41 mmHg. Using a linear regression approach, EMAT correlated with mPAP with R value of 0.69 whereas overall correlation between EMAT and sPAP was R = 0.65. Using clinically relevant cut-off of 25 mmHg for mPAP, a prediction model constructed by logistic regression with confidence interval 0.95 demonstrates a sensitivity of 100%, specificity of 100% and accuracy of 100%. **Conclusions:** HemoTag® represents a cost effective and potentially widely applicable technology for the assessment of pulmonary artery pressure in a non-invasive approach which can be used in the ambulatory setting. Further studies are needed to further validate these findings.