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Preoperative Body Mass Index < 45 Kg/m^2 Predicts Clinical Success after Bariatric Surgery in Patients with Ventricular Assist Devices

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Purpose: Although the outcomes of bariatric surgery (BS) in patients with ventricular assist devices (VADs) are promising, the evidence is limited to case reports or very small retrospective cohorts. Hence, no study has tried or been able to identify potential predictors of successful outcomes in this high-risk population, which could aid patient selection.

Methods: This study combined the individual participant data (IPD) of patients with VADs who underwent BS at Ochsner Medical Center (OMC) and patients of references identified through a systematic search in ClinicalTrials.gov, Cochrane, Embase, and PubMed. Patients who underwent BS during VAD support, as staged interventions, were included if their IPD for post-BS BMI were available. Datasets from the literature search and OMC were merged in an IPD meta-analysis to identify predictors of the composite outcome: body mass index (BMI) <35 kg/m^2, listing for heart transplantation (HT), receiving HT, or myocardial recovery leading to VAD explantation. Potential predictors were evaluated using logistic regressions or Fisher's exact test.

Results: Among the 38 patients, 18 (58%) were male, the mean age was 42 (±12.5) years, and 33 (86.9%) underwent sleeve gastrectomy, while 5 (13.2%) had Roux-en-Y gastric bypass. During a follow-up of 20 (12-30) months, 30 patients achieved the composite outcome, among whom 22 were listed for HT, 17 underwent HT, and 3 experienced recovery and VAD explantation. Time to composite outcome was 10 (3-17) months. Among all baseline variables, preoperative BMI was the only statistically significant predictor for achieving the composite outcome ($p < 0.006$). Furthermore, all patients with a BMI <45 kg/m^2 experienced the composite outcome, compared to only 7 (50%) of those with preoperative BMI ≥45 kg/m^2 ($p < 0.0001$).

Conclusion: Preoperative BMI was the only statistically significant predictor for the composite clinical outcome due to its impact in postoperative BMI during follow-up. Most patients received HT. This reflects the important role of a BMI ≥35 kg/m^2 as a contraindication for HT. It is likely that more patients, especially those with shorter follow-up, would have reached the composite outcome after primary references were published or conclusion of this study. Future larger studies may be able to identify additional predictors of clinical outcomes.

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Effects and Outcomes of Pulmonary Function Testing after Left Ventricular Assist Device Implantation

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Purpose: The use of left ventricular assist device (LVAD) has increased significantly over the past several years. The physiologic effects of LVAD implantation on pulmonary function are not well elucidated. Studies evaluating the effects of LVAD implantation on pulmonary function testing (PFT) are inconsistent and data regarding the prognostic implications of PFT data on survival are scarce. Our study aims to evaluate the changes of PFT data after LVAD implantation in our own patient population and to assess the impact of pre-operative PFT data in regards to patient survival.

Methods: This was a single-center, retrospective analysis. Electronic medical records of all patients who underwent LVAD implantation at our institution between October 2011 to December 2019 were reviewed. PFTs prior to implantation were reviewed and were compared to records at 3 months and 12 months, when available. A change in a PFT value of greater than 10% was considered significant. Kaplan-Meier analysis and multivariable Cox regressions were performed to evaluate mortality.

Results: A total of 318 patients who underwent LVAD implantation at our center were reviewed. 44 patients who underwent pump exchanges were excluded. 81% of the patients were male and the mean age was 60 years old ± 12 years with a range of 24-83 years. Overall, there were no significant changes in FEV1 or FVC after LVAD implantation, with a mean increase of 2% and 4% in FEV1 at 3 months and 12 months respectively and a mean increase of 6% at both 3 months and 12 months in FVC. On the other hand, DLCO worsened at 3 months and 12 months and decreased by 21% and 10% respectively. A pre-operative DLCO of < 30% was associated with worsened overall mortality ($p=0.016$).

Conclusion: Pulmonary physiology following LVAD implantation is complex. While patients with heart failure historically report improvement in dyspnea and exercise tolerance following their implant, our study indicates that a majority of their PFT values either remain unchanged or even worsen. Our analysis demonstrates a decrease in DLCO after LVAD implantation, which may be related to changes in pulmonary pressures following implantation. A pre-operative DLCO of < 30% carried a significant risk of overall mortality and this should be considered in future pre-operative planning. Further prospective studies are needed for clarification.

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A Signal in the Noise: Noninvasive Acoustical Evaluation of Continuous Flow Left Ventricular Assist Device

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Purpose: This is a single center prospective research study using an Apple iPhone 7 stock voice recorder application to assess the relationship between LVAD frequency and invasive hemodynamics.

Methods: Patients were enrolled prior to their standard of care invasive speed adjustment/optimization study or routine RHC. A 35 second recorded auscultation using an iPhone 7 placed at the location of apex overlying the LVAD. Chest x-ray was utilized for estimation of ideal iPhone placement. Invasive hemodynamic data was recorded and baseline characteristics collected at time of acoustic acquisition. Acoustic data was analyzed post hoc using Audacity sound analysis software to produce frequency and decibel values for each audio file. Variation in frequency and decibels were observed between HVAD and HM3 despite differences in speed and rotational flow.

Results: 8 consecutive patients were studied, median age 59 years, male (63%) with 75% African American and 25% Caucasian. Mean height 173cm and weight 98kg. HVAD (3), Heartmate II (1) and Heartmate 3 (4) were included. Median CVP was 12mmHg, PCWP 17 mmHg, CO(F) 4.7, CI(F) 2.2, LVEDD 6.45cm and PASAT 62.9%. CVP was evaluated over a range of 7-15 mmHg and PCWP ranged from 10-23 mmHg. Mean frequency of HM3 was 53.5 Hz, HM2 68Hz and HVAD 49.7Hz. LVAD frequencies ranged from 48-63Hz in HM3, 68Hz HM2 and 47Hz-53Hz in HVAD. Pearson Correlation Coefficient $R = -0.6616$ ($R^2 = 0.4377$) for dB and PCWP ($P=.07$). This moderate negative correlation described a tendency for high dB variable scores to coincide with low PCWP scores.

Conclusion: This interim analysis demonstrates a relationship between cardiac filling pressures and acoustics. Using a universal audio recording application may aid in the medical management of LVAD patients in the inpatient and outpatient setting. This cross platform technology should be further investigated as a potential diagnostic tool.