Safety and Impact of Direct Left Atrial Pressure Monitoring in Patients Undergoing Continuous-Flow Left Ventricular Assist Device Implantation

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ABSTRACT

Introduction and Aim: Hemodynamic monitoring plays a critical role in the perioperative management of patients supported by continuous-flow left ventricular assist devices (CF-LVAD). Data published on left atrial pressure monitoring (LAPm) in patients with CF-LVAD support is limited. Our primary aim was to examine the safety and impact of direct LAPm in patients undergoing CF-LVAD implantation.

Methods: Retrospective data on demographics, LAPm, hemodynamics, and endpoints were extracted on patients at our institution with CF-LVAD implants from January 2017-June 2019. The decision to use a LAPm is based on institutional standards related to right ventricular failure risk and/or presence of severe pulmonary hypertension. The primary safety endpoint of LAPm was a composite of mediastinal bleeding requiring transfusion, cardiac tamponade, and LA thrombus. Secondary endpoints were LAPm device malfunction leading to premature LAPm removal and lack of hemodynamic trends, air embolism, surrogates of left ventricular (LV) unloading, inhaled epoprostenol use, and post-implant ICU and hospital length of stay (LOS). Statistical analyses were by two-tailed Student's *t*-test or chi-square tests (SAS, version 9.4).

Results: Of the 242 patients (mean age 58.1 ± 11.0 years), 88.4% had durable centrifugal pumps for destination therapy (58.3%). Most had Intermacs status 2-4 (95.5%) at implant. One hundred fifty-three patients (63.2%) had LAPm for a median of 20h. Prior to LAPm explant, 90.2% had an LAP <15 mm Hg and 8.5% had LAPm device malfunction. The primary safety endpoint in patients with and without LAPm was 14.4% versus 19.1% (p=0.34), respectively. There were no cases of air embolism related to LAPm use. Inhaled epoprostenol use in patients with and without LAPm was 3.5 ± 7.3 days versus 2.0 ± 2.9 days (p=0.23), respectively. There was no difference in post-implant LOS in the ICU (5 (3, 9) versus 6 (4, 11) days, p=0.22) and hospital (18 (14, 29) versus 21 (15, 35) days, p=0.32)) in patients with and without LAPm.

Conclusions: Use of LAPm to guide management is both safe and feasible in patients requiring CF-LVADs. In the vast majority of this cohort, we were able to achieve optimal LV unloading. Future analyses are warranted to better understand the clinical outcomes' associations of LAPm on CF-LVAD parameters.

OBJECTIVES

- To examine the safety and impact of direct left atrial pressure monitoring (LAPm) in patients undergoing continuous-flow left ventricular assist device (CF-LVAD) implantation

METHODS

- Retrospective review at Cleveland Clinic (IRB approved) of 242 adults ≥18y with CF-LVAD implant from January 2017-June 2019 for demographics, LAPm, hemodynamics, and endpoints
- LAPm use is based on institutional standards related to right ventricular failure risk and/or presence of severe pulmonary hypertension
- Primary safety endpoint of LAPm is a composite of mediastinal bleeding requiring transfusion, cardiac tamponade, and LA thrombus. Secondary endpoints include inhaled Epo and ventilator use, and hospital and ICU lengths of stay.
- Statistical analyses by two-tailed Student's t-test or chi-square tests (SAS, v9.4), with significant p-value <0.05

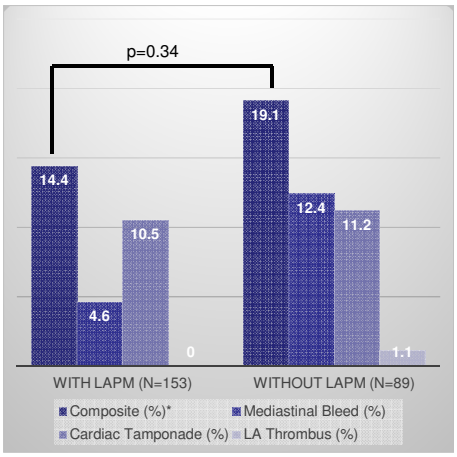
RESULTS

Table 1. Baseline Characteristics of Overall Study Cohort

CHARACTERISTIC	Value (N=242)	CHARACTERISTIC	Value (N=242)
Age (years)	58.1 ± 11.0	**Body Mass Index (kg/m²)**	29.0 ± 6.4
Female Gender, n (%)	54 (22.3%)	**Ischemic Cardiomyopathy, n (%)**	107 (44.2%)
Race, n (%)		**Intermacs Status, n (%)**	
Caucasian	191 (79.3%)	Level 1-2	72 (35.5%)
African American	41 (17.0%)	Level 3	62 (30.5%)
Other	9 (3.7%)	Level ≥4	69 (34.0%)
Device Type, n (%)		**Device Indication, n (%)**	
Axial	28 (11.6%)	Bridge to Transplant	101 (41.7%)
Centrifugal	214 (88.4%)	Destination Therapy	141 (58.3%)

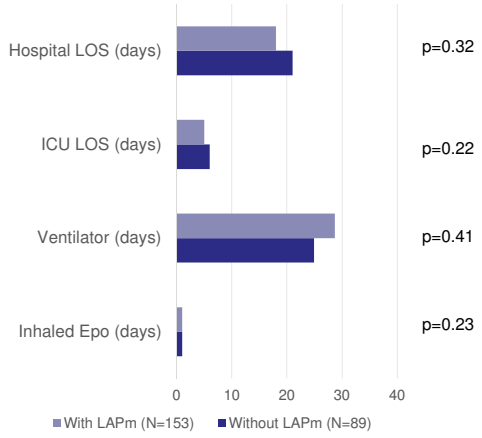
Figure 1. Safety and Impact of Left Atrial Pressure Monitoring (LAPm) in Patients with Continuous-Flow Left Ventricular Assist Device (CF-LVAD) Support

A. Primary Safety Endpoints



* Composite of safety endpoints (p=0.34) = mediastinal bleed (p=0.03), cardiac tamponade (p=0.85), and LA thrombus (p=0.37).

B. Secondary Endpoints



- **The median duration of LAPm was 20h. 92% with LAPm had LAP ≤15 mm Hg pre-explant, while 60% without LAPm had PADP ≤18 mm Hg.**
- **LAPm did not alter inhaled Epo use, duration of ventilator support, or post-implant lengths of stay.**

CONCLUSIONS

- Use of LAP monitoring to guide management is both safe and feasible in patients requiring CF-LVAD support
- In the vast majority of patients with LAPm, we were able to achieve optimal LV unloading (i.e., LAP ≤15 mm Hg)
- Future analyses are required to understand the associations of clinical outcomes related to LAPm on CF-LVAD parameters

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