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The impact of insurance and socioeconomic status on outcomes for patients with left ventricular assist devices

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ABSTRACT

Background: There has been a steady increase of patients living in the community with Left Ventricular Assist Devices (LVADs). There is a significant gap in our fund of knowledge with respect to the impact that insurance and socioeconomic status has on outcomes for LVAD patients. We thus hypothesize that low neighborhood socioeconomic status and receipt of Medicaid, respectively, lead to earlier readmissions, earlier death, as well as longer time to transplantation among LVAD patients.

Methods: This was a retrospective review of 101 patients using existing data in the medical information warehouse database at The Ohio State University Medical Center. Primary outcomes measured included time to first event (first readmission or death), death, and time to rehospitalization. Our secondary outcome of interest included time from LVAD implantation to cardiac transplantation.

Results: Recipients of Medicaid did not have an increased risk of adverse events compared with patients without Medicaid coverage. Low Median Household Income (MHI) was associated with an increased risk of readmission (log-rank $P = 0.0069$) and time to first event (log-rank $P = 0.0088$). Bridge to transplantation was the only independent predictor of time to death (Hazard Ratio 2.1, [95% confidence interval = 1.03–4.37]). Low MHI and a history of atherosclerosis were both significant predictors for readmission and time to first event. Aldosterone antagonist use decreased the risk of readmission or time to first event by 46%.

Conclusions: LVAD recipients with a low MHI were more likely to be readmitted to the hospital after LVAD implantation. Whether these patients are adequately monitored on an outpatient basis remains unclear.

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1. Introduction

Heart Failure (HF) is a national epidemic [1], and the lifetime risk for the development of HF is 20% [2]. Cardiac transplantation is the best treatment option for end-stage HF, but a severe shortage of donor organs is a serious issue and many patients are poor candidates for transplantation [3,4]. Left ventricular assist devices (LVADs) have quickly revolutionized and improved the care of the sickest HF patients. For New York Heart Association class IV patients that require LVAD support, overall quality of life and functional capacity is improved with LVADs [5]. The Centers for Medicaid and Medicare Services mandated that all U.S. hospitals approved for mechanical circulatory support as destination therapy (DT) enter patient data into the Interagency Registry for Mechanical Circulatory Support database [6].

Survival with continuous flow pumps exceeds 80% at 1 y and 70% at 2 y, comparable with patients receiving heart transplants [7–9]. The cost-effectiveness associated with continuous-flow LVADs for DT and for bridge to transplantation (BTT) has improved significantly over the past several years [10]. There has been a 50% reduction in the hospitalization cost associated with LVAD implantation since 2001. Improvements in operative technique and postoperative management appear to play critical roles in the observed cost reduction [11]. In an elegant study using a decision-analytic model, Long *et al.* [12] were able to demonstrate that indeed DT and BTT LVADs improve long-term survival when compared with inotrope dependent therapy, although unlike orthotopic cardiac transplantation they fail to meet conventional cost-effectiveness thresholds. Because of this shortcoming, it is reasonable to identify other financial or societal issues associated with outcomes in this complex patient population.

Once these patients are discharged and return to the community, it remains unknown if insurance or socioeconomic status (SES) is associated with increased readmission and mortality, or longer time to transplantation among LVAD patients. HF has been described as a socio-geographic condition, and where a patient lives could be a predictor of adverse outcomes [13]. Patients with low SES maybe less inclined to follow-up with physicians in general, which in turn could lead to longer evaluation times or outright cause them to be denied transplantation altogether due to a history of noncompliance [14]. Thus, it is important to understand how neighborhood-level SES impacts HF progression for LVAD patients in the community. Although health insurance is a prerequisite for long-term LVAD support, due to significant costs to maintaining the quality of the device, patients with certain types of insurance may use preventive services differently, which may in turn influence outcomes. Little is known about the impact SES and insurance status has on the LVAD population. Recent data demonstrated that short- and long-term mortality after LVAD implantation among Medicare beneficiaries improved overall survival, but information regarding the Medicaid population is lacking [15]. We believe there is a gap in our fund of knowledge with respect to the care of patients post-LVAD implantation once they leave the hospital and return to the community. We thus hypothesized that low neighborhood SES and receipt of Medicaid, respectively, would lead to earlier readmissions and death, as well as a longer time to transplantation among LVAD patients.

2. Methods

This was a retrospective review, which was approved by The Ohio State University Medical Center's Institutional Review Committee using existing patient data in the medical information warehouse (IW) database. The main inclusion criteria were aged >18 with a history of HeartMate II (HMII) LVAD (Thoratec Corporation, Pleasanton, CA) placement between January 1, 2006 and December 31, 2010 (as this device is approved in the United States for BTT and DT). Follow-up continued through December 31, 2011. A total of 121 patients underwent implantation with an HMII. Of these, 10 patients did not survive to be discharged, and 10 were implanted with LVADs other than an HMII and were excluded (all short-term, non-durable LVADs were excluded), leaving 101 patients for analysis.

Primary outcomes measured included time to first event (first readmission or death), readmission, and death. We obtained readmission data using the IW database, and readmission was recorded as the first inpatient admission after the initial discharge date (which followed LVAD implantation). No readmissions were due to cardiac transplantation. We used mortality data from the IW, which arises from the Social Security Death Index. Our secondary outcome of interest was time to cardiac transplantation among patients for whom the LVAD was not DT. We ascertained DT or BTT at the time of LVAD implantation from an internal database maintained by Ohio State University Medical Center's LVAD coordinators.

Using patients' zip code of residence as indicated in the medical record, we linked each LVAD patient with year 2010. US census median household income (MHI) data, which are publicly available from the US Census website (http://factfinder2.census.gov). At the time of LVAD placement, eligible patients were living in Ohio and West Virginia. We categorized MHI into tertiles from the representative zip codes as follows: low, <$38,370; medium, $38,371 to <$56,890; and high, >$56891. We obtained insurance status from the medical record, and classified patients as either Medicaid or non-Medicaid recipients, according to previous work [16].

We abstracted patient age, date of LVAD placement, gender, race, and co-morbid conditions, and concurrent treatments from the medical record. Specifically, we ascertained the prevalence of common underlying conditions at the time of LVAD implantation using International Classification of Diseases, version 9 (ICD-9) discharge codes. We used ICD-9 codes 401.1–401.9, 249–250.93, 410–412, 440–440.9, 414.0–414.4, 36.11–36.16, and 276.1 to define hypertension, diabetes, myocardial infarction, atherosclerosis, stroke, coronary artery disease, and coronary artery bypass graft (CABG) surgery, respectively. We recorded drug therapy (angiotensin-converting enzyme-inhibitor, angiotensin receptor blocker, diuretic, beta-blocker, aldosterone antagonist, and inotrope) as indicated in the medical record, whether the patient had a medication order with order activation as an outpatient or