

in Stable Ambulatory Patients with Advanced Heart Failure Supported with Left Ventricular Assist Device

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ABSTRACT

Purpose: Heart failure is associated with elevated filling pressures and significant volume expansion. Durable left ventricular assist devices (LVAD) have been shown to improve survival and quality of life in patients with advanced heart failure. There is strong evidence suggesting structural, neurohormonal and hemodynamic improvement after LVAD implantation. The data on normalization of plasma volume is lacking. We sought to describe blood volume parameters in stable outpatient LVAD recipients.

Methods: We performed blood volume analysis (BVA) on 33 stable consecutive patients supported with LVADs in the outpatient setting. All BVAs were obtained as part of routine outpatient follow up. Results of the test were provided to clinicians for ongoing patient management. BVA is clinically approved and utilizes the Iodine131-tagged albumin tracer to provide quantitative measurement of total blood volume (TBV), plasma volume (PV) and red blood cell volume (RBC). The BVA-report provides absolute values (ml) and deviation from ideal TBV, PV, and RBC. A TBV deviation $\geq \pm 8\%$ was considered to be either an excess or deficit of volume.

Results: Only 9% of stable ambulatory LVAD patients had normal blood volume results. 18/33 (54%) had significant anemia, 4/33 (12%) had polycythemia. Polycythemia in all of the patients was masked on complete blood count analysis, due to significant hypervolemia. One of the patients with masked polycythemia had fatal pump thrombosis. Plasma volume abnormality was found in 75% of patients (39% were hypervolemic, 36% were hypovolemic). 6 patients had repeat BVA after medical interventions and all of them were unsuccessful in normalizing plasma volume.

Conclusion: BVA is useful tool in outpatient management of patients with LVADs. As with advanced heart failure, correction of clinically unsuspected and undetected derangements in intravascular volume and red blood cell volumes likely have an impact on device and patient outcomes. These deviations may be recalcitrant to correction and further investigation is ongoing. Under diagnosed polycythemia in LVAD patients may further contribute to hemo-compatibility issues and thrombosis. Measurement and treatment of derangements of intravascular volumes likely will improve performance and survival of patients and devices.

OBJECTIVES

1. Understand individual blood volumes (total blood volume and red blood cell volume) for patients with LVAD.
2. Describe variations in blood volume status in stable ambulatory patients with LVAD.

METHODS

Forty-nine patients, who had undergone LVAD insertion for advanced heart failure at Baptist Heart Institute, Memphis, TN were re-evaluated from 46 to 1460 days following LVAD implantation. The patients were aged 35-72 years. From a clinical perspective and from LVAD device monitoring there was no awareness or suspicion of significant alterations in intravascular volumes, or significant anemia or polycythemia. BVA results were obtained in all patients studied. Data collected at the time of BVA included age, gender, body mass index, type of LVAD, intention of implant, and results of blood volume analysis.

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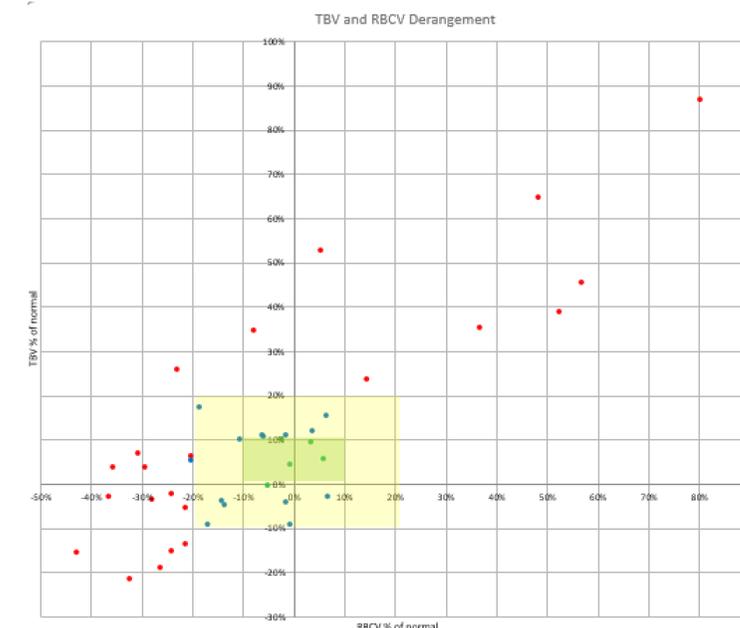
RESULTS

Table 1. Blood volume phenotypes in LVAD patients

Phenotypes (LVAD Only)	N	%
Hypovolemic Anemic	15	31%
Normovolemic Anemic	5	10%
Hypervolemic Anemic	4	8%
Hypovolemic Normocytic	4	8%
Normovolemic Normocytic	3	6%
Hypervolemic Normocytic	11	22%
Hypovolemic Polycythemic	0	0%
Normovolemic Polycythemic	0	0%
Hypervolemic Polycythemic	7	14%

RESULTS

Table 2 . TBV and RBC derangement in LVAD patients



CONCLUSIONS

Significant derangement of blood volume persists in ambulatory patients with LVAD.

BVA guided optimization of patients with LVAD needs to be evaluated.

BVA and its individualized, unique metrics is a valuable test when used in patients with LVAD's.

Measurement and treatment of derangements of intravascular volumes likely will improve performance and survival of patients and devices.

REFERENCES

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