The Evaluation of Anticoagulation Bridging Strategies and their Association between Thrombotic and Bleeding Outcomes among patients with Left Ventricular Assist Devices (LVADs)

**BACKGROUND**

Patients with advanced heart failure supported with Left Ventricular Assist Devices (LVADs) require long-term anticoagulation with warfarin. LVAD patients frequently experience sub-therapeutic INRs and/or interruption of anticoagulation, which may necessitate the employment of a bridging strategy. At present, there are no consensus strategies regarding optimal anticoagulation for LVAD patients with sub-therapeutic INRs. Therapeutic options may include bridging with heparin and/or low molecular weight heparin and is dependent upon institutional protocols.

The following anticoagulation strategies have been observed among patients at the Tendick Clinic for Advanced Heart Failure Therapy: 1. Outpatient or inpatient bridging with enoxaparin 2. Inpatient bridging with intravenous unfractionated heparin

**OBJECTIVE**

To investigate the association between anticoagulation bridging strategies among LVAD patients and clinical event rates for major bleeding and thrombotic events.

**METHODS**

This was a retrospective, observational, single-center study of LVAD patients at St. Luke's Medical Center in Milwaukee, Wisconsin. Patients implanted from January 1, 2012 through December 31, 2017 were identified through the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) database and followed from 30 days post-hospital discharge from LVAD hospitalization until time of explant, transplant, or death. Non-FDA approved LVAD indications were excluded.

Primary outcomes include major bleeding and thrombotic events. A Generalized Estimating Equations (GEE) model was used to analyze associations between baseline and temporal predictors of thrombotic and major bleeding events. The GEE model utilized Poisson regression while accounting for repeated measures on individual patients.

**RESULTS**

156 patients comprised the final cohort (fig 1), with a mean follow-up time of 33 months. There were 30 unique bridging events utilizing enoxaparin and 227 utilizing heparin. During follow-up there were 109 major bleeding events and 63 thrombotic events. Final models account for baseline predictors while examining serial INR and bridging strategy including enoxaparin or heparin compared to no bridging.

**THROMBOEMBOLISM COHORT**

Thrombotic events occurred at a rate of 0.09 events per 100 patient days. Hemoglobin and albumin were included as continuous variables. Most recent serial INR being in range showed a decreased risk for thrombotic event. Bridging with either heparin (RR 1.34 (0.74-2.42), p=0.33) or enoxaparin (RR 1.00 (0.25-4.05), p=0.994) were not associated with thrombotic events.

**CONCLUSION**

1. Neither heparin nor enoxaparin bridging were associated with an increase of thrombotic events.
2. Compared to those patients who were not bridged, enoxaparin bridging showed no difference in bleeding event rates, while heparin bridging experienced lower rates of bleeding.
3. While common risk factors for bleeding were adjusted for in the model, physician discretion of bridging strategies in light of individual patient risk cannot be fully accounted for.
4. We advocate for a prospective randomized evaluation of bridging strategies among patients with LVADs in order to define the optimal strategy.

**REFERENCES**