Evaluation of PTT vs Anti-Xa Levels in Heparinized LVAD Patients

Bret Lentz*, PharmD, Jon Godden, PharmD, BCPS, AQ-Cardiology, Rachel Pederson, BA
Advocate Aurora Health

Background
Various studies have shown a discordance between aPTT and Anti-Xa levels in heparinized patients with Left Ventricular Assisted Devices (LVAD). This discordance could lead to unwanted clinical outcomes if heparin therapy is not properly assessed in these high-risk patients. Patients with LVADs require precise monitoring to reduce the risk of both thrombus and hemorrhage. Aurora St. Luke’s Medical Center (ASLMC) currently utilizes aPTT to routinely monitor heparinized patients. The goal of this retrospective review is to determine if aPTT and Anti-Xa levels correlate and represent accurate heparin serum concentrations.

Primary Objective
- To assess the correlation between aPTT and Anti-Xa levels based off hospital therapeutic heparin metrics

Secondary Objectives
- To assess the correlation of aPTT and Anti-Xa levels in the setting of elevated LDH (>600) or an INR > 1.5.

Methods
Retrospective observational assessment of patients with LVADs treated with therapeutic intravenous heparin

- Serial paired levels of Anti-Xa and PTT were monitored and analyzed
- Categorical variables were described using frequency and percentages and continuous variables were described using means and standard deviations or medians and interquartile ranges
- A simple Kappa Estimate was used to calculate agreement between Anti-Xa and PTT group levels.
- The project was not determined to be Human Subject Research and did not require institutional review board (IRB) oversight.

Results
22 patients with 191 serial paired Anti-Xa and PTT levels were included for analysis. The mean age at implant was 54.5 +/- 13.3, 17 (77.3%) were male, and 19 (81.8%) of implants were destination therapy. The majority of the LVADs were implanted in 2018, 2019, and 2020 (6 (27.3%), 3 (13.6%), and 8 (36.4%), respectively) with 14 (63.6%) received HeartMate 3, 3 (13.6%) received HeartMate II, and 5 (22.7%) received HeartWare implants. Of the 191 levels, 42 (22%) were indicated as sub-therapeutic by both PTT (<45) and Anti-Xa (<0.3), 82 (43%) were indicated as therapeutic by PTT (45-70) but sub-therapeutic by Anti-Xa, 37 (19%) were indicated as therapeutic by both PTT and Anti-Xa, and 2 (1%) were indicated as supra-therapeutic by both PTT and Anti-Xa (Table 1) (Kappa Estimate=0.1, 95% CI=(0.01-0.18)). Agreement is similar for those labs where INR>1.5 and INR<=1.5. Figure 1 displays the level of discordance as a function of Anti-Xa vs PTT. A stronger correlation between the serial levels would yield a more linear relationship upon the scatterplot.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Anti-Xa &lt;0.3</th>
<th>Anti-Xa 0.3-0.7</th>
<th>Anti-Xa &gt;0.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTT &lt;45</td>
<td>42</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>(22.0%)</td>
<td>(2.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTT 45-70</td>
<td>82</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>(42.9%)</td>
<td>(19.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTT &gt;70</td>
<td>4</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>(2.1%)</td>
<td>(10.5%)</td>
<td>(1.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions
Therapeutic groupings indicated by PTT levels were in slight agreement when compared with Anti-Xa. The most common disagreement group was where PTT indicated a therapeutic range and Anti-Xa indicated sub-therapeutic. In our institution, the PTT tended to overestimate the concentrations of Heparin in the body. Overestimating heparin concentrations can theoretically place patients at a higher risk underdosing their anticoagulation. As LVAD patients are already at a higher risk of thrombosis, this relationship is less than ideal. However, the risk of bleeding is also a cause for concern as a switch to Anti-Xa monitoring would theoretically lead to larger doses of heparin in order to reach therapeutic level. Further studies are required to determine the consequences of this discordance.

References