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Bicarbonate-based Purge Solution As A Bleeding Reduction Strategy in Patients on Impella Support

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The Effect Of Permissive Hypertension On Cerebral Perfusion During Treatment Of Embolic Stroke In LVAD Patients

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Study: This study aims to investigate the effect of permissive hypertension, a deliberate raising of the Mean Arterial Pressure (MAP), on cerebral perfusion in LVAD patients, as treatment of embolic stoke.
Methods: A Lumped Parameter Model (LPM) of the entire human circulation that includes pulmonary and systemic circulation, as well as the four heart chambers, is modified to split the systemic circulation into the lower body and upper body. The upper circulation is subsequently split into the extracranial and intracranial vasculatures to study the perfusion to the brain as a function of MAP, peripheral and intracranial resistances. HVAD H-Q relationships are incorporated to model the instantaneous LVAD response. The impact of MAP values within a wide range, caused by changes in the systemic resistance, on intracranial flow rate is established. Increased resistance in the intracranial vasculature is then set to mimic a major embolic stroke, and its influence on cerebral perfusion is studied for a wide range of LVAD speeds, baseline MAPs, and systemic resistances.
Results: Flow to the intracranial vasculature significantly decreases when MAP is allowed to rise, at all LVAD speeds, consistent with the reduction in LVAD output for higher afterload. While at higher speeds, total cardiac output is higher and the fraction of total flow that goes to the brain is also higher than for lower speeds, the net intracranial flow rate always decreases with an increase in MAP. This remains true and is exaggerated when intracranial resistance is increased to model an embolic stroke. These results show how the increased sensitivity to afterload of third-generation LVADs, compared to the native heart, invalidates the paradigm that permissive hypertension can lead to an increase in cerebral perfusion. This study highlights the phenomenon that letting MAP increase in LVAD patients as a treatment of embolic stroke could negatively affect cerebral perfusion.

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Bicarbonate-based Purge Solution As A Bleeding Reduction Strategy In Patients On Impella Support

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Study: The Impella Catheters require a heparin-containing purge solution to maintain proper pump function by reducing the risk of biomaterial deposition in the purge gaps. A bicarbonate-based purge solution (BBPS) has been proposed as an alternative to a heparin-based purge solution. We review performance in patients supported to date with a BBPS (heparin-induced thrombocytopenia patients were excluded from this analysis).
Methods: This review includes patients (n=26) supported using sodium bicarbonate (25 mEq/1L of D5W) in the purge from September 2020 to February 2021. These patients were supported with BBPS post-operatively where heparin in the purge was not desired or were transitioned to BBPS because of bleeding issues. Case data were collected from an internal database to develop the clinical narrative and cross-referenced against Impella Controller data logs to assess purge trends and pump function.
Results: All pumps were switched to BBPS in the purge if not started with BBPS (Figure 1A). The average time to initiating BBPS was 1.6 days (excluding n=3 outliers where time to switching was >15 days). The average duration of support with BBPS was 5 days and a maximum duration of 22 days (Figure 1B). Figure 1C shows clinical indications for use. Purge pressure and purge flow remained stable while on BBPS (Figure 1D). In conclusion, this preliminary experience suggests the feasibility of using BBPS to maintain purge patency, ensure pump motor reliability, reduce bleeding risk, and simplify anticoagulation management. Use of a BBPS may be a safe and effective alternative to heparin in the purge for patients in which heparin is contraindicated or not feasible. More patient experience and analysis are needed to evaluate how bicarbonate compares to heparin in the purge for all patients.

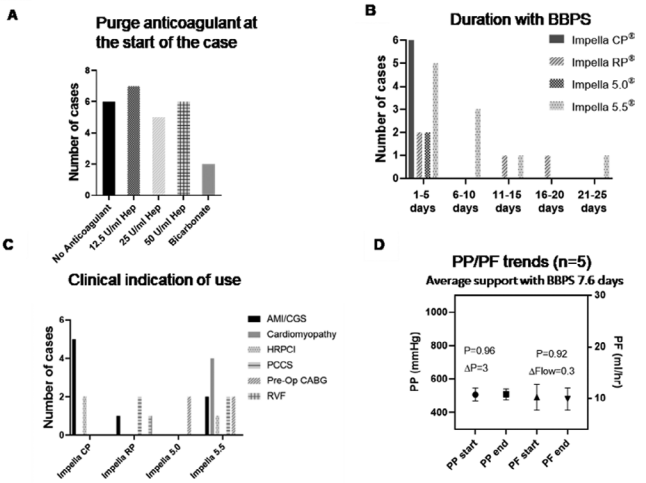

Figure 1: (A) summary of purge anticoagulation at the beginning of the case, (B) duration of support with BBPS , (C) Clinical indication of use (one case not specified), and (D) pump purge performance trends (n=5).