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ventricular outflow tract risks damage to the conduction system. By placing their guiding sutures no more than 2 mm below the nadir of the annulus and by angling the valve to prevent deeper implantation at the right noncommissure, they found a 3-fold reduction in their pacemaker rate from 10% to 3.3%. Because theirs is a much larger experience than ours, corroboration by the Nuremberg group goes a long way to support the generalizability of our findings.³

In our center, the Perceval valve has become a helpful tool for multiple concomitant procedures for those who we believe would gain benefit from a shorter crossclamp time. In select cases, such as reoperative aortic valve replacement for a failed Toronto Stentless Porcine Valve (St Jude Medical Inc, St Paul, Minn), adhesions between the stentless valve and the native aortic root often require a complex root replacement.⁴ Here, the Perceval valve has been invaluable in allowing us to perform a rather simple implantation. However, in our jurisdictions where health-care budgets are scrutinized closely, without this modification, we simply could not justify the use of the Perceval valve with double-digit pacemaker rates.

Parenthetically, since the publication of our article, we had a single case of Perceval implantation with complete heart block immediately postoperatively. The patient had a low-lying right coronary ostia with a prominent calcium bar extending from the annulus to the ostia. We thought that implantation with our modification risked coronary obstruction; thus, the guiding sutures were placed 3 mm below the aortic annulus. By intraoperative transesophageal echocardiography, the distance from the annulus to the lower aspect of the valve was 6 mm. This case further supported the association between low implantation and conduction disturbance in our hands.

Any modification to an established technique should be performed with caution. As the authors correctly state, it is critical to document all changes and monitor outcomes closely. However, if enough surgeons from multiple centers perform similar modifications with lower resultant rates of pacemaker implantation without paravalvular leak, valve dislodgement, or other unintended consequences, then the modification should become the standard technique.

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OCCULT BLEEDING IN LEFT VENTRICULAR ASSIST DEVICE RECIPIENTS: IT IS THE PATIENT RATHER THAN THE PUMP

To the Editor:

It was with great interest that we read the article by Grosman-Rimon and colleagues.¹ This is indeed a significant contribution to understanding mechanisms of occult bleeding in continuous-flow left ventricular assist device recipients. It is our opinion, however, that current research in this field focuses far too much on biochemical pathways and overlooks patient-related comorbidities at the time of the procedure. Real-life data from the Interagency Registry for Mechanically Assisted Circulatory Support registry² indicate that 1-year freedom from gastrointestinal bleeding is strongly associated with preoperative state (Interagency Registry for Mechanically Assisted Circulatory Support level, New York Heart Association functional class, age, need for dialysis, concomitant procedures, history of coronary artery bypass grafting), irrespective of pulsatile-flow or continuous-flow device operation. In addition, coagulation disorders predisposing toward bleeding after left ventricular assist device implantation, especially the loss of high-molecular weight von Willebrand factor multimers, seem to be detectable already before the procedure in patients with end-stage heart failure.³ In the light of these findings, it is important to identify patients at risk. It is our belief that we should focus on preimplantation patient profiles rather than on the pump.

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Reply to the Editor:

We are pleased that our study on cyclic guanosine monophosphate (cGMP) and gastrointestinal (GI) bleeding in recipients of a continuous-flow left ventricular assist device (CF-LVAD)¹ gained interest by Spiliopoulos. Postoperative GI bleeding continues to be a major challenge for recipients of a CF-LVAD.²⁻⁴ We strongly agree with Spiliopoulos' comment that comorbidities at the time of surgery and factors related to the preoperative state such as INTERMACS level, New York Heart Association class, patients' age, history of coronary artery bypass grafting

and dialysis should be carefully considered when selecting patients for CF-LVAD implantation.

However, our goal was to identify biochemical markers of risk in patients who were already carefully selected for CF-LVAD support, and their preoperative state and comorbidities were considered. We focus our investigation on the reason for a higher rate of postoperative GI bleeding events in CF-LVAD recipients compared with preoperative GI bleeding events in patients with heart failure who may be eligible for CF-LVAD. We propose that if cGMP is confirmed prospectively as an important marker, then anticoagulation therapy should be adjusted appropriately. It is important to emphasize that we believe that the cGMP pathway might not be the sole mechanism responsible for the increase in GI bleeding, but that the synergistic effects of several pathways contribute to the increased risk of GI bleeding in CF-LVAD recipients, as noted in the comprehensive editorial commentary by Crestanello.⁵ Thus, we need a deeper understanding of the mechanisms and the complex interactions among them, and to explore future therapeutic targets. Our study makes the important observation that biochemical markers, such as cGMP, may be used to detect those CF-LVAD recipients at the greatest risk for GI bleeding, thereby allowing clinicians to modify the intensity of anticoagulation if possible (Figure 1).

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FIGURE 1. Future research directions should focus on: (1) Strategies to improve patient assessment and selection for continuous-flow left ventricular assist device (CF-LVAD) therapy and (2) the mechanisms of gastrointestinal (GI) bleeding and the complex interactions among them to evaluate the risk for GI bleeding and explore future therapeutic targets.

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