Interestingly, whereas there did not appear to be a difference in the incidence of HIT and thrombosis syndrome (HITS), we did find that mortality owing to HITS decreased from 60.0% to 23.0% after altering our HIT detection and treatment procedures (Table 1). Together, these findings suggest that the standardization of the methods for earlier identification and management of HIT with bivalirudin improved the mortality rate among patients diagnosed with HIT after cardiac surgery.

The article by Demma, Paciullo, and Levy¹ has made an important contribution by raising awareness of methods used to identify and treat HIT with argatroban in patients who have had cardiac surgery. Combined with our aforementioned findings using bivalirudin, we can conclude that the early detection and management of thrombocytopenia with DTIs in the patient who has had cardiac surgery is an important clinical consideration in improving patient outcomes.

Robert Kramer, MD
Crystal Herron, PhD
Division of Cardiothoracic Surgery
Maine Medical Center
Portland, Maine

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ASSOCIATION OF CATHETERIZATION WITH ACUTE KIDNEY INJURY IN THE CARDIAC SURGICAL PATIENT To the Editor:

In a recent publication, Andersen and colleagues¹ concluded that cardiac catheterization within 1 to 3 days before proximal aortic surgery is not associated with an increase in postoperative acute kidney injury (AKI). Although our own interest in the occurrence and duration of AKI has lain primarily with patients undergoing coronary artery bypass grafting,^{2,3} we are conscious of special circumstances in which the postoperative AKI rate does not appear to be affected, such as for same-day cardiac catheterization and aortic valve surgery.⁴ Despite our knowledge of these special circumstances, we wish to caution readers to pay close attention to the limitations of the study by Andersen and colleagues,¹ limitations that they themselves have clearly detailed in their article but have not reflected in their title.

Of particular interest are the effects of contrast media on AKI in cardiac surgical patients. In their analysis, Andersen and colleagues¹ demonstrated that patients who received contrast media within 3 days before proximal aorta surgery actually had a lower rate of postoperative AKI than did patients who were exposed between days 4 and 54 before the operation. In contrast, we have recently demonstrated that the incidence of postoperative AKI was significantly increased when cardiac catheterization was conducted within the same hospital admission as cardiac surgery.² Although we do not have direct evidence to support a role for contrast media in the occurrence of AKI in this model, a previously published study has shown that exposure to contrast media may augment necrosis and renal tubular cell apoptosis.⁵ We therefore agree with Andersen and colleagues¹ regarding the importance

of careful preoperative evaluation of the risks of contrast exposure in the cardiac surgical patient.

Fortunately, Andersen and colleagues¹ were thorough in emphasizing the limitations of their findings, in that they discussed the possibility that variability between groups could have confounded their results. Specifically, the outcomes may have been influenced by the presence of known risk factors for AKI in the long-interval catheterization group, such as age, body mass index, and congestive heart failure. In addition, Andersen and colleagues¹ discussed differences in the catheterization protocols, noting the limited use of contrast media and increased intravenous hydration in the short-interval catheterization group relative to the long-interval group. These differences could have affected the significance of their findings, and we therefore believe that additional, well-designed studies are needed for further delineation of the ideal time frame between catheterization and surgery.

Although there are strong motivations for reducing the time between cardiac catheterization and surgery, such as reducing hospital costs, patient inconvenience, and physician anxiety about a potentially life-threatening disease, the long-term implications of postoperative AKI with respect to reduced patient survival remain of the utmost concern.³ The article of Andersen and colleagues¹ provides interesting insights into the management of patients between catheterization and cardiac surgery; however, the confounding factors in their study encourage the development of further investigations to delineate the exact time needed between contrast media exposure and the initiation of cardiac surgery. Future studies of this nature may aid in determining the best methods to ensure the lowest possible risk of AKI and provide the best chance for

long-term survival of cardiac surgical patients.

Robert S. Kramer, MD^a
Crystal R. Herron, PhD^a
Jeremiah Brown, PhD^b

^aDivision of Cardiothoracic Surgery
Department of Cardiac Services
Maine Medical Center
Portland, Me

^bThe Dartmouth Institute for Health
Policy and Clinical Practice
Lebanon, NH

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Reply to the Editor:

We read with interest the letter by Kramer and colleagues regarding our recent article exploring the association between the timing of cardiac catheterization and the incidence of postoperative acute kidney injury (AKI) after elective proximal aortic surgery.¹ Our study is noteworthy in that it failed to identify an increased incidence of AKI among patients undergoing catheterization within 1 to 3 days of surgery when compared with patients undergoing catheterization 4 or more days before surgery. This finding seemingly contradicts

a study by Kramer and colleagues,² which found that catheterization during the same admission as coronary artery bypass grafting or valve surgery was associated with an increased incidence of AKI relative to catheterization during a previous admission. Kramer and colleagues now assert that our findings should be read with caution because of the presence of variability between patient groups in our study.

As outlined in our discussion, there are many other reasons why our results may differ from the findings of the study of Kramer and colleagues.² First, the proximal aortic surgical patients in our study were younger, healthier, and at a lower baseline risk of development of contrast-induced nephropathy than the coronary artery bypass grafting and valve surgical patients included in the study of Kramer and colleagues.² Second, same-day catheterizations, which have been associated with the highest risk of postoperative AKI in some previous studies,^{1,3,4} were not performed at our institution. Most importantly, our study was restricted to patients undergoing elective surgery, and all emergency and urgent procedures were excluded. In the study of Kramer and colleagues,² patients requiring urgent operation were included in the analysis and comprised 87% of the same-admission catheterization group, compared with only 14% of the previous-admission catheterization group. As a result, patients undergoing catheterization during the same admission as surgery were 25 times more likely to have had a preoperative myocardial infarction, had a higher incidence of 3-vessel coronary artery disease, had lower ejection fractions, had a higher incidence of preoperative balloon pump use, and had longer cardiopulmonary bypass times. Thus Kramer and colleagues² essentially compared elective patients who underwent catheterization on a previous admission with urgent patients who underwent catheterization

during the same admission as surgery. Not surprisingly, the urgent patients had worse outcomes, including more AKI. Thus although our study does contain some important differences between patient groups that should be considered by the reader, the restriction of our study to patients undergoing elective operations led to comparatively less selection bias and variability than in the study of Kramer and colleagues.²

We echo the sentiments of Kramer and colleagues in calling for additional studies to delineate better the ideal time frame between catheterization and cardiac surgery. The Society of Thoracic Surgeons database may provide the best opportunity to study this question by interrogating a multi-institutional clinical database that allows comprehensive risk-adjustment for case status as well as the multiple other patient and perioperative factors that contribute to AKI. The study could further be designed to assess the association between the timing of catheterization and the incidence of postoperative AKI among various subsets of the cardiac surgical population, including those undergoing coronary artery bypass grafting, valve operations, and proximal aortic surgery.

Nicholas D. Andersen, MD

G. Chad Hughes, MD

Division of Cardiovascular and
Thoracic Surgery

Duke University Medical Center
Durham, NC

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