

## Weekend MI Admission Tied to Higher Mortality

BY MARY ANN MOON  
Contributing Writer

The higher mortality rate in acute myocardial infarction patients admitted to the hospital on weekends compared with weekdays can be attributed in part to a reduced rate of invasive cardiac procedures on weekends, reported William J. Kostis, Ph.D., of Robert Wood Johnson Medical School, Piscataway, N.J.

Dr. Kostis and his associates used information in the Myocardial Infarction Data Acquisition System (MIDAS) database to determine whether MI-related mortality is higher with weekend presentation, and whether this could be explained by the use of invasive cardiac procedures, length of hospital stay, or patient characteristics.

The database includes the records of more than 231,000 MI patients treated between 1987 and 2002, "virtually all patients admitted to [any] New Jersey hospital over a 16-year period for a first myocardial infarction."

Thirty-day mortality showed "a significant and clinically relevant" increase among patients admitted on a Saturday or Sunday rather than on a weekday, "representing 9 to 10 additional deaths per 1,000 admissions per year." This increased mortality persisted for a full year of follow-up, and "could account for several thousand deaths annually in the United States," the investigators said.

"Even small differences in mortality between weekday and weekend admissions of patients with acute MI can translate to substantial numbers of additional deaths in the population because of the high incidence and case fatality rate associated with this condition," the researchers said (*N. Engl. J. Med.* 2007;356:1099-109).

Patients who were admitted on weekends were less likely to undergo cardiac catheterization, percutaneous coronary intervention, or coronary artery bypass graft surgery than were those admitted on weekdays, and when they did have such procedures, they were more likely to experience a significant delay of several days compared with people who had weekday admissions. These results persisted after the data were adjusted to account for demographic characteristics, infarction site, presence or absence of concomitant illness, and presence or absence of complications.

The association between timing of admission and mortality was not related to patient characteristics or length of stay. It was due primarily to the difference in use of invasive cardiac procedures. These results persisted when the data analysis was restricted to several subgroups, such as patients treated at percutaneous coronary intervention-equipped hospitals.

"Overall, our study suggests that a hospital workweek of Monday through Friday is not optimal for the care of patients with acute MI," the authors added. ■

## Automated Insulin Protocol Reduces Errors, Saves Time

ORLANDO — The use of a computer protocol to achieve tight glycemic control lowered insulin administration errors, compared with a paper-based protocol, according to a study of simulated patients in an intensive care unit.

The computer format also improved satisfaction in ICU nurses, Dr. Anthony Y. Lee of Columbus Children's Hospital in Ohio said at the annual congress of the Society of Critical Care Medicine.

Dr. Lee and colleagues at the University of Maryland Medical Center, Baltimore, recruited 51 medical ICU nurses to complete seven simulated patient scenarios using both the standard paper-based insulin protocol and a computer version of the protocol.

The scenarios included a clinical case description, a current insulin dose, and new and previous blood glucose levels. The nurses were giv-

en instructions on using the paper and computer versions of the protocol and had to indicate the new insulin dose and time of the next blood glucose check.

The simulated situations produced 357 paper responses and 357 computer responses showing a significant reduction in errors using the computer format. Use of the paper protocol resulted in 82 insulin-dosing errors, compared with 4 errors using the computer system. It seemed that the same study participant committed all four errors using the computer protocol.

Errors in the timing of the next blood glucose check fell from 47 with the paper-based format to 8 with the computer format. The time to completion fell from 9 minutes with the paper-based format to 6 with the computer program.

—Mary Ellen Schneider

## THE CCU CORNER

### Intensive Insulin Therapy to Normalize Blood Sugars in Critically Ill Patients

BY GEORGE PHILIPPIDES, M.D., AND ERIC AWTRY, M.D.

#### The Patient

In December 2006, a 68-year-old diabetic woman was admitted to the Boston University Medical Center Coronary Care Unit following percutaneous coronary intervention for an anterior ST-segment elevation myocardial infarction (STEMI). Her initial blood glucose was 165 mg/dL, and increased to 220 mg/dL on subsequent measurement. She was started on an intravenous insulin drip with maintenance of her serum glucose between 110 mg/dL and 140 mg/dL. The infusion was maintained for 48 hours, at which time she was transitioned to her usual insulin regimen.

#### The Problem

About 8% of American adults and 19% of those over age 65 years have diabetes. These patients are at a significantly higher risk of suffering a myocardial infarction, and subsequently dying from the infarction, than are their nondiabetic counterparts. In addition, diabetes is often poorly controlled in the acute setting, and may contribute to the worsened outcome. Furthermore, previously nondiabetic patients may develop insulin resistance and hyperglycemia during an acute illness and also have higher morbidity and mortality rates. Tight glycemic control has been suggested as a potential way to improve outcomes in diabetic and hyperglycemic patients with acute myocardial infarction.

#### The Theory

Acute illness results in impaired glucose metabolism, in part because of decreased insulin sensitivity in the acute setting. Additionally, fatty acid metabolism is impaired, resulting in an increase in free fatty acids and their metabolites. These factors may worsen the ischemic injury through direct toxic effects or through inhibition of glucose oxidation. Insulin may mitigate these effects by promoting glucose oxidation and reducing lipolysis.

#### The Evidence

Several observational studies have shown that hyperglycemia is associated with increased mortality rates in patients in intensive care units, patients who present with acute myocardial infarction or stroke, and postoperative patients (both cardiac and general surgical). Subsequently, several prospective, randomized trials of intensive glucose control were performed in patients presenting with acute MI, in intubated patients in a surgical ICU, and in patients admitted to a medical ICU. Although each study had slightly different target glucose levels, all aimed for normal or near normal levels (under 140mg/dL). Overall, these studies demonstrated a reduction in morbidity (including infection and need for ventilatory support) and mortality (ranging from 20% to 40% risk reduction) with intensive insulin therapy. This effect was most evident in patients who required longer ICU stays (more than 3-5 days), and was not seen in those requiring shorter term ICU care.

In 2005, on the basis of these data, the American Heart Association recommended that an insulin infusion be used to maintain glycemic control in patients with STEMI and complicated courses, and should be considered during the first 48 hours in patients with hyper-

glycemia and uncomplicated STEMI. In addition, it was suggested to use subcutaneous insulin to achieve glycemic control in less complicated patients. It is noteworthy that in the trials described above hypoglycemia (i.e., blood glucose under 40mg/dL) was significantly more common in patients treated with intensive insulin therapy. In fact, in the one study that did not show a significant reduction in overall mortality with tight glucose control, the incidence of hypoglycemia was 18.7%, and it was an independent predictor of mortality.

#### Clinical Experience

Since July 2005, under the guidance of our endocrinology section, we have implemented a program of tight glycemic control using an intravenous infusion protocol for all critically ill patients in our CCU, and a scheduled subcutaneous insulin regimen for relatively stable patients. These protocols are initiated in all patients who have two consecutive glucose measurements above 150 mg/dL, and are aimed at maintaining blood glucose in the range of 80-150 mg/dL. Patients must have a continuous source of caloric intake (e.g., dextrose, total parenteral nutrition, tube feeds) and all prior diabetic medications must be held. Blood glucose levels are checked hourly until they are within goal range for three consecutive measurements, after which time they are assessed every 2 hours. Electrolytes are checked frequently and patients are monitored for signs of hyper- or hypoglycemia. As a result of this program, glucose control in our CCU has improved dramatically, with the mean glucose falling from 189 mg/dL to 143 mg/dL. Importantly, we have not seen a significant increase in the incidence of hypoglycemia; less than 4% of glucose measurements are under 70 mg/dL, and less than 2% are under 50 mg/dL. On the basis of the available data, it is anticipated that this approach will also improve both short- and long-term outcomes of our patients.

#### Conclusion

Tight glycemic control of patients in the CCU can be achieved with intravenous insulin infusions or subcutaneous insulin regimens, and can be done safely with a low rate of hypoglycemic events. Such an approach should be considered in all hyperglycemic patients in the intensive care unit.



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