Comparison of the i-STAT Handheld Activated Clotting Time With the Hemochron Activated Clotting Time During and After Percutaneous Coronary Intervention

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Recently, an activated clotting time (ACT) module was created for use with the i-STAT handheld monitoring system (i-STAT Corp., Princeton, New Jersey). The i-STAT determines an by the formation of thrombin rather than mechanical clot formation. This device is relatively unaffected by temperature, fibrinogen levels, dilution, and is less dependent on user technique (technical white papers, available from the i-STAT Corp.). ACT values reported by the i-STAT may be different from those expected when using traditional devices such as the Hemochron ACT (ITC, Edison, New Jersey). A Comparison of the i-STAT and the Hemochron ACT during and after percutaneous coronary intervention (PCI) has not been reported; that is the purpose of this report.

Over a period of 6 weeks, 2 simultaneous ACTs were performed for every patient who received anti-coagulation during PCI in our cardiac catheterization laboratory. They were also performed as part of a sheath pull protocol in our recovery area. Sufficient blood (approximately 3 milliliters) was drawn from the arterial sheath to perform both a Hemochron and blood (approximately 3 milliliters) was drawn from the arterial sheath to perform both a Hemochron and an i-STAT ACT for each patient. One person ran each test simultaneously.

Linear regression analysis and paired t testing was performed on the entire cohort, as well as on the separate anticoagulation groups. Data were analyzed for correlation as well as statistical fit. A bivariate equation was created to establish a mathematical relation between the i-STAT and Hemochron ACT results.

Two hundred eighty-five patients were studied. One hundred forty-six patients received heparin alone, 55 received heparin and abciximab, 57 received heparin and eptifibatide, and 8 received heparin and tirofiban. Nineteen patients received bivalirudin without concomitant heparin or a glycoprotein IIb/IIIa antagonist.

Linear regression demonstrated an overall high degree of correlation between the i-STAT and Hemochron ACTs, with an R² value of 0.8 (p < 0.001). Below 250 there was a Pearson correlation of 0.79 (p = 0.07), which indicated no statistical difference between the 2 groups. At levels above 250 there was a Pearson correlation of 0.68 between the i-STAT and Hemochron ACT groups (p < 0.001; Figure 1). Subgroup analysis showed similar relationships in the group that received heparin alone, in the heparin plus abciximab group, and in the heparin plus eptifibatide group. (Figures 2 to 4). Too few data points were collected to make valid statistical analyses for the heparin plus tirofiban and the bivalirudin groups, but it appeared that the trends in these subgroups were similar to those seen in the other subgroups.

A bivariate fit equation was created to estimate Hemochron results for any given i-STAT value. Using this equation, an i-STAT of 150 predicted a Hemochron ACT of 250.
At the high end of the clinical range, an i-STAT of 300 predicted a Hemochron value of 308.

The use of the i-STAT system for point-of-care testing in hospital and outpatient settings has been shown to be accurate and cost effective. The device is modular and consists of a handheld unit into which disposable cartridges are placed. The cartridges are self-contained, and they need <1 mL of blood to produce results. There are individual cartridges available that measure electrolytes, blood gas, and level of anticoagulation. Each i-STAT unit can download patient data to a central computer for storage and subsequent retrieval.

Unlike traditional ACT, the i-STAT ACT is not based on the formation of a stable thrombus. Instead, a substrate marker releases an electric signal when it is cleaved by active thrombin. The time to generation of the electroactive marker is reported as the ACT. Therefore, the i-STAT is less susceptible to changes in fibrinogen levels, temperature, hematocrit, dilution, and the addition of IIb/IIIa antagonists. Because the production of thrombin occurs earlier than the formation of a stable clot, one would expect the value of the i-STAT ACT to be lower than that of the Hemochron ACT.

At the low range of clinical interest there was an excellent degree of correlation and no statistical difference between i-STAT and Hemochron ACTs. Although there was a statistically significant difference between the i-STAT ACT and the Hemochron ACT at the high range of clinical interest, there was a high degree of correlation. This difference was predicted to be small and of no clinical importance. The use of abciximab or eptifibatide in conjunction with heparin did not significantly change these relationships.

Although we did not have enough data to form a valid statistical relation for the groups that received heparin and tirofiban or bivalirudin alone, it appeared that the relationships were similar for those groups. In our recent clinical practice, we have not experienced any problems using the i-STAT ACT for patients
who have been treated with heparin and tirofiban or bivalirudin.

It is important to note that the conclusions in this report are specific to the devices used by our institution. There are known differences between many of the techniques currently and historically used to measure ACT. We recommend that when such devices are first brought into clinical use that the clinicians involved perform correlations with their existing instruments so they can feel comfortable with the accuracy of their results.

In conclusion, the i-STAT ACT has a high degree of correlation with the Hemochron ACT. Statistically, there is no difference between these 2 devices at lower levels of anticoagulation; at higher levels of anticoagulation the difference is small and not clinically relevant.

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Relation of Thrombolysis In Myocardial Infarction (TIMI) Frame Count to Coronary Flow Parameters

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Thrombolysis In Myocardial Infarction (TIMI) frame count, defined as the number of frames required for contrast material to travel from the coronary ostium to a distal landmark, was introduced as a simple, continuous index of coronary blood flow (CBF). It has been reported that a higher total frame count (TFC) after thrombolytic therapy is related to increased risk of outcome, and that a lower TFC after primary angioplasty is a powerful predictor of improvement of regional left ventricular function. Although it has been proposed that TFC reflects the microvascular tone, data regarding the relation of TFC to Doppler flow parameters and coronary artery diameters are very limited. In this report, we sought to determine the relation between the percent change in TFC and the percent changes in coronary artery diameter and coronary flow parameters, average peak velocity (APV), and CBF.

Coronary angiograms of 57 consecutive patients without coronary artery diameter stenosis >50% and who underwent coronary physiologic study were analyzed according to the previously published protocol. Through a guiding catheter (6 or 7Fr), a 0.014-in diameter Doppler guidewire (FloWire; Jomed Inc., Rancho Cordova, California) within a 2.2Fr coronary infusion catheter (Ultrafuse; SciMed Life System, Maple Grove, Minnesota) was advanced and positioned in the middle portion of the left anterior descending coronary artery. The Doppler guidewire was then positioned 2 to 3 mm distal to the tip of the infusion catheter. Baseline intracoronary Doppler readings and a coronary angiography in the optimal