Application of Goal-Directed Therapy for the use of Concentrated Antithrombin for Heparin Resistance during Cardiac Surgery

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Purpose

The maintenance of anticoagulation in patients undergoing cardiopulmonary bypass (CPB) is dependent upon a number of factors including plasma heparin concentration and adequate circulating antithrombin (AT) levels. Subadequate anticoagulation increases the risk of thrombosis and jeopardizes vascular and circuit integrity. The purpose of this study was to evaluate a goal-directed approach for the administration of concentrated AT in cardiac surgery patients who were resistant to heparin.

Methods

Following institutional review board approval data was obtained from quality improvement records over a two-year period following the addition of AT to the hospital formulary. A goal-directed protocol for administering AT was established based upon heparin dosing and activated clotting times (ACT). Two groups of patients were identified as those receiving AT supplementation (AT), and those not requiring AT (No-AT) to achieve a minimal ACT for CPB. Outcome measures included ACT, transfusion rates, and postoperative bleeding.

Results

140 consecutive adult patients undergoing CPB were included in the study with 10 (7.1%) in the AT group. The average AT dose administered was $1,029\pm164$ IU and all patients had immediate restoration to goal-directed ACT levels. 80.0% of patients in the AT group were receiving heparin prior to surgery as opposed to 24.6% in the No-AT group (p<.0001). Pre CPB ACT values were significantly lower in the AT group (417.7 ± 43.3 vs. 684.6 ± 172.9, p<.003). AT patients had a lower heparin sensitivity index (0.54 ± 0.2 vs. 1.06 ± 0.5, p<.0005), received more total heparin in IU kg^{-1} (941.2 ± 130.9 vs. 678.4 ± 194.5, p<.0001), more CPB heparin in IU ($22,500\pm10,300$ vs. $11,200\pm13,200$, p<.01), and more protamine (5.4 ± 1.2 mg kg^{-1} vs. 4.1 ± 1.1 mg kg^{-1}, p<.02) than No-AT patients. Intraoperative allogeneic transfusion rate was higher in the AT group when compared to the No-AT (70.0% vs. 35.4%, p<.04), but no differences were seen postoperatively. There were no differences in postoperative chest tube output, ICU stay, or total length of stay.

Conclusions

Utilization of a goal-directed algorithm for the administration of concentrated AT for the correction of heparin resistance is safe and effective in patients undergoing cardiac surgery.