Case Report

Thromboelastograph Guided Management of a Patient Requiring Abiomed Biventricular Support with Consumptive Coagulopathy

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Abstract: A 69-year-old male, who underwent cardio-pulmonary bypass surgery, required biventricular support using the Abiomed. The patient subsequently developed a consumptive coagulopathy. The thromboelastograph was used to administer NovoSeven and guide allogenic transfusions to achieve a hematocrit of greater than 30% and a platelet count greater than 100,000 per µL. Disseminated intravascular coagulation was resolved and the patient was transported to a tertiary care center within 72 hours. The Abiomed BVS 5000 provided a bridge to the native heart recovery and was successfully explanted. Keywords: cardiac surgery, thromboelastograph, ventricular assist device, Abiomed BVS 5000, NovoSeven, v-curve.

CASE REPORT

The patient was a 69-year-old male who had unstable angina and worsening chest pain with exertion. He underwent cardiac catheterization and was reported to have severe three-vessel coronary artery disease, left anterior descending 60%, circumflex artery 80%, and right coronary artery 80% occlusions. The patient’s ejection fraction was calculated to be 65% with no valve dysfunction. Prior to the bypass surgery, TEG tracing was obtained via TEG 5000 (Haemoscope Corporation, Niles, IL) and it was normal. Patient was brought to the operating room, coronary artery bypass graft (CABG) × 4 was performed, and transmyocardial laser revascularization was used in the obtuse marginal region. Cobe customized perfusion circuit (Sorin Group USA, Inc., Arvada, CO) with 3/8 inch arterial and 3/8 inch venous line tubing was used with membrane oxygenator, 40 micron arterial filter, and 4:1 blood cardioplegia system. The patient was heparinized with 300 IU/kg heparin and 8.0 mm arterial and 28/36 Fr dual stage venous cannula was used to cannulate the aorta and right atrium, respectively. The total pump time for the procedure was 104 minutes with a cross clamp time of 67 minutes.
After the bypass surgery, the patient was given 250 mg of protamine to reverse the heparin. TEG tracing/Activated Clotting Time (ACT) was obtained to confirm that heparin was reversed. Before leaving the operating room, there was one episode of postoperative low blood pressure and the patient was treated with Neo-synephrine. After stable hemodynamic and normal rhythm with minimal chest tube drainage, the patient was transported to the intensive care unit (ICU).

Patient went into wide tachycardia and became asystolic shortly after arrival in the intensive care unit. The Advanced Cardiac Life Support protocol was followed. The chest was opened and CPR was performed in the ICU; the patient was also reheparinized and ACT greater than 480 seconds was achieved. A 20 French Medtronic EOPA (Medtronic Inc., Minneapolis, MN) cannula was placed in the ascending aorta and 28/36 French dual stage cannula was placed in the right atrium. The patient was placed on Biomedicus 550 (Medtronic, Inc.) ventricular assist device/extra-corporeal membrane oxygenation (ECMO).

The patient was urgently brought to the operating room, where the ECMO was converted into a standard cardiopulmonary bypass; ACT was greater than 480 seconds. The chest was explored and the left anterior descending
system was supplemented with another bypass graft. In an attempt to wean the patient off, Intra Aortic Balloon Pump (IABP) was placed first in addition to maximum inotropic support. It was observed that patient could not sustain a cardiac index of greater than 1.5 L/min/m² and systolic pressure of 70–80 mmHg despite the ongoing inotropic support and use of IABP; therefore, the decision was made to place a left ventricular assist device (LVAD). After the LVAD was placed, the patient suffered a right heart failure and was placed on Abiomed BVS 5000 biventricular support. The total pump time was 287 minutes with a cross clamp time of 37 minutes to perform CABG × 1 with the placement of a biventricular assist device (BiVAD).

The patient had developed coagulopathy possibly related to cardiogenic shock, transfusion reaction, long pump run, exposure to foreign surfaces such as the Heart-Lung machine, ECMO, or BiVAD, trauma, surgical incision, and/or an imbalance in the levels of platelets and coagulation factor (3,4). TEG tracing was obtained after the implantation of BiVAD and the patient was noted to be very hypocoagulable, DIC stage 2 compared to pre-intervention (see Figure 3). The patient was then transported on BiVAD to ICU under stable hemodynamic condition, but the bleeding continued as a result of coagulopathy. TEG tracing was obtained on a per-needed basis and blood products were given after discussing TEG results with the surgeon. The patient had continued bleeding post BiVAD for several hours. Blood products were administered to maintain stable output for Abiomed. After much discussion and deliberation with the perfusionist, pharmacist, Abiomed, and TEG technicians, the decision was made to give NovoSeven, recombinant human coagulation Factor VIIa. NovoSeven was given in increments of 15 mcg/kg. TEG v-curve was used to verify the increase in thrombus generation and proper hemostasis. A total of 12 mg NovoSeven helped to decrease the time to maximum rate of thrombus from 17.7–9.75 minutes and increase the thrombus generation from 391–564 mm/min over time (see Figures 4 and 5).

Overtime, the patient was transfused with 59 units of packed red blood cells, 20 units of fresh frozen plasma, 15 units of platelets, and 10 units of cryoprecipitate to maintain a stable output for the Abiomed and to correct coagulopathy. Nonetheless, the patient’s coagulopathy remarkably improved after the administration of NovoSeven. The patient subsequently remained hemodynamically stable and required minimal transfusions to achieve hematocrit of 30% and a platelet count of greater than 100,000 per µL with minimal chest tube drainage. The patient was transported to a tertiary care center with hemostasis successfully achieved. The TEG tracing, as shown in Figures 6 and 7, demonstrates that the patient’s coagulation was reversed to its normal baseline values.

**DISCUSSION**

Coagulopathy refers to abnormal bleeding. Disseminated intravascular coagulopathy is a pathologic condition that causes abnormal bleeding and clot formation in an uncontrolled manner (5). Continued bleeding due to trauma...
or surgical incision is another sign that bleeding results from decreased levels of platelets and coagulation factor. Currently, the medical management of DIC is controversial because there is no set treatment model (5). Customarily, to control bleeding for coagulopathy, cryoprecipitate, fresh frozen plasma, platelets, and red blood cells are administered arbitrarily. Thromboelastograph has provided a vital tool in managing transfusion of blood product for regular post cardiac surgery patients, but its use for patients with DIC is remarkable. By using TEG tracing as a guiding method for managing blood product transfusions and dosing NovoSeven, we were able to correct coagulopathy and stabilize hemodynamic status to sustain optimal cardiac outputs for Abiomed BVS 5000.

**REFERENCES**


**Figure 6.** Overtime change in TEG tracing due to use of blood products/improving coagulation status.

**Figure 7.** TEG tracing comparison: pre-intervention (baseline) and prior to transfer.