

Comparison of Short and Prolonged ACT Groups During Cardiopulmonary Bypass about Postoperative Drainage and Blood Transfusion

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Abstract

Coagulation cascade starts with exsanguination or any contact of blood with an extracorporeal surface⁽¹⁻⁵⁾. Since invention of heparin molecule in 1916, it has been an essential application for cardiopulmonary bypass (CPB). Nowadays during CPB we have been using Activated Clotting Time (ACT) test because it results quicker than other laboratory tests to evaluate anticoagulation of heparin.⁽⁶⁻¹⁰⁾ During CPB, high anticoagulation levels would result with unexpected high rate non-surgical bleeding. However, lower anticoagulation doses would end up with high rate of thromboembolic events. Both situations can be related with high mortality or morbidity.⁽¹³⁾ There have been guidelines about blood conservation in cardiac surgery but clinical management of anticoagulation during CPB is not standardized.⁽¹⁴⁾ In this respect, so far there has not been an ideal universal ACT value. Most clinics sets ACT target as above 400 - 480 seconds during CPB.^(11,12) Over the years most clinics apply 300 IU/kg dose heparin regimen which has been empirically advanced and universally accepted for CPB to reach target ACT values, but this regimen sometimes can lead to higher ACT values.⁽¹³⁾ This situation may cause to more postoperative bleeding, more postoperative blood transfusion and prolonged intensive care staying, although heparin is antagonized with protamine at the end of CPB. In this study we would like to compare retrospectively patients under went open heart surgery whom ACT's during CPB were 400-650 seconds with the patients whom ACT's were 650 seconds and higher during CPB.

Keywords: Activated clotting time, cardiopulmonary bypass, anticoagulation, postoperative bleeding

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Introduction

192 patients underwent CPB over age 18, between October 2014 and May 2014 retrospectively evaluated in our clinic to investigate a comparison of high and low ACT levels patient groups and their postoperative bleeding and related complications.

Materials and Method

In this study, Hospital operating system and archives were browsed, perfusion notes and intensive care unit notes were scanned, patient weight, operation made, body surface area, CPB time, aortic cross clamp time, gender, age, maximum ACT time during CPB, heparin dose managed, blood transfusion amount, postoperative first day drainage and intensive care duration has recorded. Patients whom anticoagulation had started with 200 IU/kg heparin dose regimen with ACT range between 400 and 650 seconds during CPB represented as group I and 50 IU/kg additional heparin dose had been applied when ACT during CPB recorded below 400 seconds. Patients whom anticoagulation had started with 300 IU/kg heparin dose regimen with ACT range 650 seconds and higher during CPB represented as group II. Those two groups compared for postoperative first day drainage, postoperative blood transfusion amount and intensive care unit staying.

Results

No significant difference were found between two groups regarding ages ($p=0,126$), weights ($p=0,526$), body surface areas ($p=0,762$), CPB durations ($p=0,415$), aortic cross clamp times ($p=0,387$) are compared. There is statistical relevance between two groups for postoperative first day drainage ($p=0,000$), postoperative blood transfusion amount ($p=0,010$) and intensive care duration ($p=0,0015$) which favor for the group whom ACT range during CPB is 400-650 seconds.

Discussion

Blood coagulates with extracorporeal circulation and needs to be anticoagulated. With discovery of heparin molecule blood could be anticoagulated so that cardiopulmonary bypass technology became appli-

cable which allowed modern cardiac surgery. Heparin dose management is succeeded with Activated clotting time during Cardiopulmonary bypass in most clinics.

There are studies that shows monitorization and management of anticoagulation with ACT during CPB cause minimum post-operative bleeding and blood transfusion.⁽¹⁵⁻¹⁷⁾ During CPB some studies point that heparin dose and anticoagulation is not proportional but there is an exponential relation between them.^(18,19) There is not a universal figure for an optimal ACT time for CBP, but 400-480 seconds of ACT stands as consensus.^(20,21)

A study shows us most clinics in USA and Canada targets 400-480 seconds of ACT during CPB.⁽¹¹⁾ Under coagulation during CBP can result with thromboembolic events on the contrary over coagulation can result with non-surgery related bleeding and increased post-operative drainage and need of blood transfusion. During CBP most frequently used method is ACT but there is not a universal ideal ACT level^(11,12) even so an empiric 300 IU/kg dose of heparin to inhibit coagulation during CPB is widely accepted.⁽²¹⁾

In a randomized clinical trial with 195 patients who were divided into four groups respectively; 100, 200, 250 and 300 IU/kg doses of heparin groups by a close perioperative ACT follow-up, ACT was determined to be minimum of 480 seconds, an additional 50 IU/kg heparin administered if necessary to achieve ACT as maintained higher than 480 seconds. The perioperative heparin dose administered associated with postoperative drainage, which means that patients with lower doses of heparin had less postoperative drainage.⁽¹⁴⁾

In another study of 100 patients who were perioperatively heparinized at a dose of 300 IU/kg and 145 patients who started heparinization at a dose of 145 IU/kg with a minimum target of 300 seconds, followed with close ACT monitorization perioperatively and patients applied additional dose of heparin under target ACT. Low dose heparin patients had less blood transfusions and had less postoperative drainage.⁽¹⁶⁾ In this study, we compared two groups of patients⁽²²⁾ whom underwent open heart surgery with CPB and perioperatively close ACT monitored. Group I had anticoagulation started with 200IU/kg heparin dose and additional 50IU/kg

heparin administered below the target 400 seconds ACT and perioperative maximum of 650 seconds ACT. Group II had started anticoagulation with 300 IU/kg dose heparin whom ACT counted above 650 seconds perioperatively during CPB. Between those two groups, there were no significant dif-

ference for age, for weight, for aortic cross clamp time, body surface area and CPB time. Patients during CPB with ACT range between 400 and 650 seconds favors for less postoperative first day drainage, postoperative blood transfusion and intensive care unit staying.

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