Whole Blood Point of Care Platelet Testing During Cardiac Surgery Predicts Perioperative Bleeding

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Introduction Conventional platelet function testing uses platelet-rich plasma and collagen, ADP or epinephrine to stimulate aggregation. Testing is complex and time consuming. Although acquired functional defects occur during cardiopulmonary bypass (CPB), transfusion practice relies on platelet counts. We evaluated the Platelet Works™ System (Helena Laboratories, Beaumont, Texas) to measure platelet function during surgery.

Methods Institutional IRB granted approval for this study and all patients provided informed consent. Whole blood samples were collected from heparanized arterial lines at five time points during CPB and on the first post-op day. Samples (1cc each) were incubated in tubes containing 1.8 mg EDTA, 10 _g collagen or 20 mM ADP. Platelet counts were measured in the OR using an Abx Micros analyzer (AbxDiagnostics, Montellier, France). In a subset of patients, platelet counts were determined in duplicate EDTA tubes (Helena Labs and Becton-Dickinson) and measured with a Cell-Dyne 4000 Hematology Analyzer.

Results Thirty eight (38) patients having cardiac surgery were enrolled in the study. A strong correlation exists in cell counts from PlateletWorks™ EDTA tubes between the Abx Micros cell counter and the Cell-Dyne 4000 analyzer ($r^2 = 0.94$).

In a subset of patients having coronary bypass grafts using CPB, the platelet count decreases from the start of surgery through CPB. A rebound in the platelet count occurs on POD 1. Platelet function measured by collagen activation remains steady during the initial surgery but decreases acutely with the onset of cardiopulmonary bypass. Platelet function measured by ADP aggregation was high with little change throughout the surgery (Table 1). Platelet function results were uniformly available within 10-12 minutes of sampling.

Discussion The whole blood platelet function test provided rapid results and the changes in collagen-activated platelet counts are consistent with the thrombocytopathy expected with CPB. ADP-induced platelet aggregation showed that essentially all platelets were active, a result not consistent with the well known platelet defect occurring during CPB (1,2). It is likely the 20 mM ADP used in the assay, which is 2-4 times the concentration used in conventional platelet aggregometry, is masking subtle platelet defects. Functional platelet studies during cardiac surgery may have a useful role guiding clinical and transfusion decisions.

	Preincision	Pre-CPB	CPB+5 min	Post-CPB	Post-protamine	POD-1
Platelets (X 10^3/mm^3)	231.7 ± 50.5	170.2 ± 66	141.8 ± 45.7	115.2 ± 56.3	103 ± 35.1	153.7 ± 83.5
Platelets, range (X 10^3/mm^3)	200 – 307	89 – 272	93 – 216	84 – 215	80 – 165	102 - 250
% Active PLTs (collagen)	54 ± 33	59 ± 30	27 ± 25	17 ± 4	22 ± 16	51 ± 13
% Active PLTS (ADP)	99 ± 2	97 ± 7	97 ± 5	89 ± 16	93 ± 13	100 ± 0.5

Table 1. Platelet counts and percent active platelets during CABG surgery utilizing cardiopulmonary bypass. Mean ± SD.

References

1. Ferraris VA, et al. Ann Thorac Surg 1998; 65:352-8.
2. Khari SF, et al. Ann Thorac Surg 1995; 60:1008,14.

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