Which measurements calculated by rotation thromboelastometry were more accurate for platelet counts, Extem-Fibtem or Clotting elasticity?

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Background and Goal of Study

Extem withdrew Fibtem calculated by rotation thromboelastmetry (ROTEM™) was reported to be reflect for platelet count¹. But Solomon et. al.² reported that Extem -Fibtem did not refer to the accurate platelet counts and function. They suggested new parameter, clotting elasticity (CE) calculated by ROTEM value, which could reflect the accurate platelet count and aggregation. The aim of study is to investigate which measurements are more accurate for platelet counts and seek the normal range of CE as well.

Material and Methods

Patients scheduled cardiac surgery with cardiopulmonary bypass (CPB) were assessed for eligibility. The criteria of transfusion were indicated below, such as hemoglobin >9~10mg/dl, fibrinogen > 150~200mg/dl, platelet count > 50,000~100,000 / μ l. The heparin dose during CPB was administered 300~400U/kg to target activated clotting time (ACT)>450sec and reversed by protamine sulfate 60~100% dose of heparin. The hemostatic therapy was such as concentrated red cells (CRCs; 140g/unit), fresh frozen plasma (FFP; 120g/unit), and platelet concentration (PC; i.e., 10unit originated from two liter of blood). We collected the samples in four points, after anesthesia introduction (baseline), just after CPB starting, weaning time from CPB, and the end of surgery.

Results and Discussion:

Seventy patients were enrolled in the study (Table 1: patients characteristics) and we collected 280 points of blood samples to compare the relation between platelet counts and Extem-Fibtem A10 or CE. We also presented the correlation graph between them at figure A and B below. Each correlation coefficient (R) was 0.68 and 0.82, respectively, which means CE was more accurate than Extem-Fibtem A10. We also found 50, and 75 of CE (A10) were referred to 50,000, and 100,000/ μ l of platelet counts, respectively.

CE was a new criterion² and can reflect platelet count and aggregation precisely (Table 2). The calculation formula of $CE = (100 \times EXTEM)/(100 - EXTEM) - (100 \times FIBTEM)/(100 - FIBTEM)$. But they had not reported how much values were the normal range yet, especially A10.

Table 1: Patients characteristics

Age (y/o)	69 $\pm$ 9
Gender (M:F)	38:18
Height (cm)	161 $\pm$ 8
Weight (kg)	59 $\pm$ 11
ASA score	3(2-3)
Euro score II	2.7 $\pm$ 2.1
Creatinine (mg/dl)	0.9(0.7-1.3)
Preoperative complications	
Redo surgery	5
Hypertension	47
Hyper lipidemia	14
Arterial fibrillation	13
Hemolysis dialysis	5
Diabetes	15
Respiratory disease	3
Antiplatelet drugs	13
Anticoagulants	14
Operative methods	
Coronary bypass	2
Single valve repair/replace	36
Double valve repair/replace	8
Triple valve repair/replace	0
Single valve+bypass	6
Double valve+bypass	0
Aortic surgery	4
Anesthesia (min)	353 $\pm$ 110
Surgery (min)	294 $\pm$ 107
Cardio-pulmonary bypass (min)	133 $\pm$ 51
Crystalloids balance(ml)	1677 $\pm$ 1056
Total transfusion balance(ml)	305 $\pm$ 551

Figure 1 : Correlation between ROTEM™ values and platelet counts

A. Effective platelet counts (EXTEM A10- FIBTEM A10) and platelet counts
B. Clotting elasticity (CE) and Σ platelet counts

R=correlation coefficient

Table 2: Discrepancy between Extem-Fibtem and CE²⁾

Platelet count (/μL)	FIBTEM MCF (mm)	FIBTEM MCE ^a	EXTEM MCF (mm)	EXTEM MCE ^a	MCF contributors: fibrin, platelets	MCE contributors: fibrin, platelets	Δ MCF (EXTEM - FIBTEM)	Δ MCE (EXTEM - FIBTEM) (platelet component)
100,000	40	67	70	233	57.1%, 42.9%	28.8%, 71.2%	30	167
50,000	20	25	50	100	40.0%, 60.0%	25.0%, 75.0%	30	75
35,000	15	18	45	82	33.3%, 66.7%	22.0%, 78.0%	30	64
30,000	10	11	40	67	25.0%, 75.0%	16.4%, 83.6%	30	56
20,000	5	5	35	54	14.3%, 85.7%	9.3%, 90.7%	30	49
10,000	0	0	30	43	0.0%, 100.0%	0.0%, 100.0%	30	43

^aMCE = $(100 \times MCF)/(100 - MCF)$.

EXTEM = ROTEM® extrinsically activated test; FIBTEM = ROTEM® test designed to assess fibrin-based clotting; MCE = maximum clot elasticity; MCF = maximum clot firmness.

Conclusions:

CE was more accurate than Extem-Fibtem A10. We also detected the border line values of CE (A10), 50~75 were almost corresponded to platelet count 50,000~100,000/ μ l.

References:

- 1) Japanese cardiovascular anesthesia 2015; 19: 49-54
- 2) Anesth Analg 2015;121:868-78

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