# [Correlation Between ROTEM FIBTEM Maximum Clot Firmness and Fibrinogen Levels in Pediatric Cardiac Surgery Patients.](https://www.ncbi.nlm.nih.gov/pubmed/30518238)

Tirotta CF, Lagueruela RG, Madril D, Salyakina D, Wang W, Taylor T, Ojito J, Kubes K, Lim H, Hannan R, Burke R.

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**Take Home Points:**

* Normal plasma fibrinogen levels as measured by the Clauss method are well defined for pediatric surgical populations, but measurement is not available for point-of-care (POC) testing.
* The FIBTEM assay of rotational thromboelastometry (ROTEM) is a POC test that provides immediate results for transfusion guidance during pediatric cardiac surgery, but normal values in children have not been widely established.
* Paired plasma fibrinogen and FIBTEM maximum clot firmness (MCF) levels were used to create an equation to predict plasma fibrinogen concentration for a given MCF, enabling application of POC ROTEM to immediate goal-directed transfusion.

**Commentary by Kelly A. Machovec, MD, MPH, Associate Professor of Anesthesiology at Duke University Medical Center:** Rotational thromboelastometry (ROTEM, Instrumentation Laboratory, Bedford, MA, USA) is a viscoelastic test used to monitor bleeding, coagulation and transfusion in the surgical or trauma setting. The FIBTEM assay of ROTEM assesses the functionality and stability of fibrin polymerization. The FIBTEM assay is conducted by tissue factor activation of the whole blood sample, followed by addition of cytochalasin D to inhibit the platelet contribution to clot strength, thus isolating the fibrin contribution. POC ROTEM has been validated against laboratory ROTEM, but ROTEM FIBTEM values have not been validated against plasma fibrinogen concentration as measured by the Clauss method. The authors of this study aimed to correlate MCF of the FIBTEM with plasma fibrinogen levels by the Clauss method in order to develop an equation to predict plasma fibrinogen levels from FIBTEM MCF results.

This single center retrospective chart review examined consecutive patient charts over a 7-month period. All charts of children 5 years old or less having cardiac surgery with peri-operative fibrinogen and FIBTEM values were included. Time points of interest were prior to cardiopulmonary bypass (CPB) initiation, during CPB, and post-CPB separation. Plasma fibrinogen levels were obtained in the laboratory using the Stago STA compact system, which uses a modified Clauss method to determine the fibrinogen concentration of a given blood sample. The study team reviewed 50 charts, and found 27 patients who had a total of 87 incidences where FIBTEM MCF and plasma fibrinogen levels were obtained at the same time and could therefore be compared.

Plasma fibrinogen levels and FIBTEM MCF values were found to be normally distributed by the Kolmogorov-Smirnov test. Mean plasma fibrinogen was 178.1 mg/dl +/- 76.4. Mean FIBTEM MCF was 8 mm +/- 4.3. Linear regression of FIBTEM MCF and plasma fibrinogen showed a positive linear correlation.

The authors then moved to the prediction equation. First, simple linear regression was used to determine if FIBTEM MCF predicts plasma fibrinogen levels. Then, this information was used to develop a regression equation to predict the plasma fibrinogen level given a FIBTEM MCF value. Repeated 10-fold cross validation was used to develop, train and test the predictive equation. The final model suggested the following equation can be used to predict plasma fibrinogen given FIBTEM MCF:

Plasma fibrinogenmg/dl = 78.6 + 12.4 (MCFmm)

The finding that plasma fibrinogen level correlates with FIBTEM MCF is consistent with other studies in both pediatric and adult patients. This study, however, takes this relationship one step further by creating an equation to predict plasma fibrinogen from FIBTEM MCF. This is clinically important because normal ROTEM values for pediatric populations are not clearly defined, which limits its utility as a POC assay. In contrast, normal pediatric plasma fibrinogen levels are well defined, but are not readily obtained.

The ability to rapidly translate FIBTEM MCF into a plasma fibrinogen level may aid the physician in interpreting this information and making prompt clinical decisions. Importantly, because the FIBTEM amplitude at 5, 10, and 15 minutes after clotting time correlates with the final MCF, early FIBTEM POC values can be used to support a goal-directed transfusion practice. The authors provide the example of human fibrinogen concentrate: POC ROTEM can be used to estimate plasma fibrinogen level, which can then be used to calculate an accurate dose of human fibrinogen concentrate to raise plasma fibrinogen levels to the desired target level, rather than giving the standard 70 mg/kg dose. One caveat that the authors acknowledge is that Factor XIII, at low levels in infants and children after CPB, affects FIBTEM results but has no effect on the plasma fibrinogen level as determined by Clauss method.

The relationship between ROTEM FIBTEM and plasma fibrinogen level must be further explored, and the proposed predictive equation tested in a larger pediatric population.



Viviane Nasr (Boston) and Rania Abbasi (Indianapolis) – Section Editors