Correlation Between ROTEM FIBTEM Maximum Clot Firmness and Fibrinogen Levels in Neonates and Infants

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Background
The ROTEM (Tem International, GmbH, Munich, Germany) is an enhanced modification of thromboelastography (TEG) (Haemonetics Corp., Braintree, MA) first described in 1948. Both are point-of-care (POC) coagulation monitoring instruments that test the viscoelastic properties of whole blood. Use of the ROTEM has been shown to reduce the need and amount of transfused blood products in pediatric cardiac surgery patients. A FIBTEM (fibrin-based extrinsically activated test with tissue factor and the platelet inhibitor cytochalasin D) guided fibrinogen concentrate protocol targeting high-normal plasma fibrinogen produced lower transfusion requirements and lower post-operative bleeding in adult patients undergoing aortic valve operation and ascending aortic replacement. Tirotta et al, demonstrated that administering human fibrinogen concentrate (HFC) at a dose of 70 mg/kg to neonates and infants undergoing cardiac surgery reduced the need for fresh frozen plasma (FFP) and cryoprecipitate. HFC can also be dosed depending on the actual and target fibrinogen levels using the formula:

Dose (mg/kg) = \( \frac{(target \ level \ (mg/dL)) - \text{measured \ level \ (mg/dL))}{1.2} \text{ (mg/dL, per mg/kg)} \)

The purpose of this study is to evaluate whether ROTEM FIBTEM Maximum Clot Firmness (MCF) can significantly predict plasma fibrinogen level. Then the MCF can be used as a surrogate of fibrinogen level (which is not easily obtainable in the operating room) to dose the HFC. References

Methods
After receiving IRB exempt status from the Research Institute of Nicklaus Children’s Hospital, we retrospectively reviewed 50 charts of neonates and infants undergoing cardiac surgery. 87 independent measurements of FIBTEM MCF paired with HFC were available for data analysis. Linear regression was conducted for predicting HFC using FIBTEM MCF at 0.05 level of significance. Residual plot for the model fit was created. Statistical analysis was performed using the statistical software package SAS 9.3

Results
Results from linear regression analysis suggest a significant positive linear relationship (p=0.0001) between fibrinogen levels and MCF. Both intercept and the slope of MCF were significantly correlated with fibrinogen level (p=0.0001). The estimated regression equation can be expressed as:

Predicted fibrinogen = 78.61 + 12.388 \* MCF

It suggests that 1 mm of increase in MCF corresponds with increase HFC by an average of 12.38 mg/dL. Figure 1 shows the scatter plot of the data overlaid with the regression line for the model fit using MCF to predict HFC.

Conclusions
• There is a statistically significant positive linear relationship between MCF and fibrinogen levels (p<0.0001).
• This indicates that the MCF can be used as a surrogate of the fibrinogen level to dose the HFC.

References
1) Harten H. Blutgerinnungssituktionen mit der Thrombelastographie, einem neuen Untersuchungswesen. Klinische Wochenschrift 1948;26:577-583

Fit 95% Confidence Limits ....... 95% Prediction Limits