Ultrastructural evaluation of clot properties and mRNA levels of clotting factor XIII in asthma patients

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Background: Asthma is a highly prevalent chronic inflammatory disease, of which the molecular regulatory mechanisms and relationship to coagulopathies is largely unknown. Coagulation plays an important role in the pathogenesis of asthma due to the relationship between cytokines and platelet activation.

Methods: Following ethical approval and sample collection, viscoelastic properties of the clot using thromboelastography (TEG) and ultrastructural analysis of fibrin threads using scanning electron microscopy (SEM) were measured. Whole blood was collected from 30 allergic asthma patients and 30 controls. Platelet poor plasma was used for SEM and TEG. Total RNA followed by cDNA synthesis was prepared from whole blood. Quantitative PCR was used to assess mRNA levels of FXIII, calculated using $2^{-\Delta\Delta CT}$.

Results: Analysis of TEG indicated a significantly higher reaction time (11.64±0.55 min vs. 8.16±0.50 min) and maximal amplitude (36.00±1.55 mm vs. 31.45±0.88 mm); and lower α-angle (41.80°±2.588° vs. 63.58°±1.74°) in asthma patients than controls (p<0.0001, p<0.05, p<0.0001 respectively). Higher levels of FXIII mRNA was detected in asthma patients (17.43±5.06-fold, p<0.0001). SEM images show that the fibrin network was altered in patients compared to controls.

Conclusion: Higher levels of FXIII mRNA found in asthma indicate potential for continuous production of this protein from platelets which may have contributed to the altered clot kinetics (higher reaction time, faster crosslinking and increased clot strength). Moreover, the ultrastructural analysis of fibrin networks show an irregular web of fibres with matted appearance in patient samples.

Keywords: Asthma, Factor XIII, Coagulation, Ultrastructure, Fibrin