Evaluation of the erythrocyte mechanical properties in children with bicuspid aortic valve

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Objective: Bicuspid aortic valve (BAV) is the most common congenital cardiac malformation, associated with significant aortic pathology and accounting for considerable morbidity and mortality. Aortic wall abnormalities associated with bicuspid aortic valve are due to cystic medial necrosis. Extensive loss of elastic fibers in the tunica media caused by increased metalloproteinase activity and cystic medial necrosis is thought to play a role in the pathogenesis of associated aortic wall abnormalities despite its clinical relevance; the pathogenesis of BAV is not clearly defined. The aim of this study was investigate the alterations in red blood cell (RBC) deformability in this disease and possible relationship between RBC deformability and BAV.

Methods: In this cross-sectional study, we evaluated 30 children with normally functioning or mildly regurgitate BAV and 27 healthy children as controls. RBC deformability was measured by laser diffraction analysis using an ektacytometer.

Results: RBC deformability was determined in 0.3 Pa, 0.53 Pa, 0.95 Pa, 1.69 Pa, 3 Pa, 5.33 Pa, 9.49 Pa, 16.87 Pa and 30 Pa. It was reduced in all shear stresses except 0.3 Pa at the BAV patients compared to healthy controls, the differences were statistically significant for all shear stresses except 0.3 Pa, 0.53 Pa and 30 Pa (p<0.05).

Conclusion: RBC deformability plays an important role in blood circulation; facilitates flow of 8 μm-diameter erythrocyte through 2-3 μm-diameter capillaries. Although accumulating data in literature, shows alterations of RBC deformability in diseases such as vasculitis, hypertension, peripheral and coronary artery diseases, no study has yet evaluated possible changes of erythrocyte deformability in BAV disease. RBC deformability was decreased at the BAV patients compared to control group in our study. Our results emphasize the association between RBC deformability and BAV disease, and to our knowledge; this is the first study in the literature. Further pathophysiological studies included the peripheral vessels an addition the aortic wall are warranted to better clarify this issue in BAV disease.