THE BIOPHYSICAL PROPERTIES OF RED BLOOD CELLS DURING CARDIOPULMONARY BYPASS IN CYANOTIC VERSUS ACYANOTIC CONGENITAL PEDIATRIC HEART SURGERY

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Cardiopulmonary bypass (CPB) is a technique that isolates the heart and lungs and promotes a bloodless field to facilitate surgery on the heart and great vessels. Correction of congenital alterations is a fine and very complicated surgery. Certain congenital heart defects can disrupt the normal pediatric blood circulation, creating a transitional circulation in which right-to-left shunts. Under such circumstances, continued transitional circulation leads to severe cyanosis or hypoxemia which is severe decreases in tissues oxygen delivery. In correction surgery for congenital patients especially cyanotic patients; there are many parameters affecting the outcome of patients as patient's health, anesthesia, heart lung machine and postoperative managements. In this study Pediatrics were divided into three groups; normal healthy pediatrics (GpI), acyanotic patients (GpII) and cyanotic patients (GpIII). Blood samples were collected from healthy, cyanotic and acyanotic patients for biophysical and some biochemical analysis. The osmofragility and solubilization of red blood cells (RBC's) membrane by nonionic detergent in addition to hemoglobin molecule structure as measured by dielectric relaxation, absorption spectra and electrophoretic mobilities were investigated for the collected RBCs before CPB. The effect of CPB machine on healthy blood was also investigated. The rheological properties of the collected blood was investigated by blood viscosity measurements, coagulation profile was also tested through measurements of prothrombin concentration and activated partial thromboplastin time. The results showed that Cyanotic patient's RBCs were more soluble in nonionic detergent, with lower membrane elasticity with deformed morphological forms. However, the molecular structure for hemoglobin as compared to normal healthy
pediatrics proved to be within normal structure. Moreover, cyanotic patient blood proved to have higher viscosity as compared with healthy blood. There was disturbance in coagulation profile compared to normal healthy pediatrics. Acyanotic patient's results showed insignificant differences, but blood pictures showed changes in morphological shape of the RBCs compared to normal healthy pediatrics. Homodynamics data for cyanotic patients showed to have lower values as compared with acyanotic patients, indicating poor cardiac function and consequently poor all organ's perfusion and functions. Clinical outcome estimation indicates less functioning kidney, less responding vasculature, and long intensive care time referring to more morbidity for cyanotic patients compared to acyanotic patients. Circulating healthy blood in the machine indicated dramatic change in both RBCs membrane mechanical properties as well as changes in the cellular morphology. So it was concluded from the present results that; deteriorating effects of hypoxia on RBC's characteristics result in protein toxins formation which affect the healthy blood when added to the cyanotic patient's blood during CPB. Moreover the use of the present pump for CPB causes harmful effects on both mechanical and structural properties of RBCs membrane.