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Commentary

Important Role of Erythrocytes in the Pathological Development of Diabetic Complications

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DESCRIPTION

High blood sugar level (hyperglycemia) is a leading indicator of Diabetes Mellitus (DM). Erythrocytes are the foremost abundant cells within the circulation and also the 1st to understand changes in plasma composition. Hyperglycemia affects the structure and performance of erythrocytes. The detection of erythrocyte-related indicators will offer a valuable reference for the prevention, diagnosis, and treatment of DM and its complications. The conventional structure and function of erythrocytes, the changes in erythrocytes in patients with diabetes, and also the role of erythrocytes within the development of diabetic complications to provide additional indicators for the early prevention of DM complications and to observe the therapeutic result of DM [1].

Diabetes mellitus describes a group of metabolic disorders characterized by hyperglycemia and defects in insulin secretion and/or insulin agent action. Heredity, obesity, lack of physical activity, poor diet, stress, urbanization, impaired glucose tolerance, and high blood pressure could increase the risk of diabetes. Chronic symptom in patients with diabetes is related to injury and pathology of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels, which eventually leads to numerous diabetic complications. Despite advances in medical technology and in extensive analysis of diabetes, it remains a metabolic disease that persists throughout life and is difficult to cure. Therefore, reducing the prevalence of complications, controlling the development of complications, and up the quality of life became the main target of diabetes diagnosis and treatment. Erythrocytes, additionally known as Red Blood Cells (RBCs) which are the foremost glucose-consuming cells [2]. Within the presence of long hyperglycemia, the morphology, metabolism, and function of erythrocytes are inevitably subject to a series of changes that additional have an effect on hemorheology and microcirculation.

Erythrocytes are the foremost abundant cells within the blood. Their flexibility permits them to pass through freely, transporting oxygen to tissues and delivering carbon dioxide to the lungs. Haemoprotein (Hb), the most oxygen-carrying supermolecule, is the most abundant protein in erythrocytes. The membrane in erythrocytes plays a very important role in maintaining the balance in cell morphology and performance. Deformation, aggregation, and adhesion enable erythrocytes to carry oxygen. The atypical biconcave form and small volume of erythrocytes create a large surface area–to–volume ratio, permitting oxygen and carbon dioxide to penetrate in and out of the cell quickly and leading to strong deformability [3]. In addition to carrying oxygen and carbon dioxide, erythrocytes even have immune functions, like enhancing phagocytosis, defending against infection, increasing immune adhesion, recognizing and carrying antigens, and clearing current immune complexes.

Erythrocytes are produced within the red bone marrow and are discharged into the blood after seven days of maturation. Blood cell or Erythrocyte production within the marrow happens at a staggering rate of more than 2 million cells per second and is controlled by Erythropoietin (EPO). The average life span of those cells is 100-120 days, and aging erythrocytes are principally broken down within the RES of the spleen and liver. The destruction and generation of human blood cells facilitate maintaining a dynamic balance and maintain a stable erythrocyte range. Deformability is an inherent property of erythrocytes and affects blood viscosity [4]. The deformability of erythrocytes is due to their special dynamic plasma membrane shape and permits them to deliver oxygen to the tissues and organs via microcirculation. Glucose oxidization and protein glycation, caused by diabetes-associated hyperglycemia, will induce many modifications within the mechanical and natural properties of erythrocytes.

Erythrocytes are necessary glucose-consuming cells, and Glucose Transporter 1 (GLUT1) mediates insulin-independent glucose transmembrane transport supported the concentration gradient in erythrocytes. As blood sugar concentration will increase, more glucose enters into erythrocytes and accelerates the glucose metabolic pathways consequently. Due to the lack of mitochondria, metabolism is the main supply of blood cell or erythrocyte energy. The product of metabolism or glycolysis, ATP is the essential energy substance for a variety of biochemical

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reactions in erythrocytes and maintains the normal function of erythrocytes, like transmembrane particle and lipids exchange and blood cell deformation.

Erythrocytes are rather distinctive cells as if they lose all organelles once they get mature. They solely conserve a few metabolic pathways for getting energy and reduce the energy consumption for the key functions they have to fulfill [5]. This makes erythrocytes sensitive to any disorder. Glucose metabolism disorders in patients with diabetes deeply have an effect on the morphological structure and physiological functions of erythrocytes and end in insufficient microcirculation, hypoxia, and OS, which promote the prevalence of diabetic complications and reduce the quality of life of diabetic patients.

The necessary role of erythrocytes within the pathological development of diabetic complications, and the corresponding detection indicators of erythrocytes additionally correlate with the prevalence and progression of those complications. There are several breakthroughs within the field of diabetes research; but, the hindrance and treatment of its complications stay a very important pathological state. Jointly of the cells that will sense blood sugar changes early and continuously, erythrocyte-related indicators will offer additional clinical data and can be used to monitor the progression of diabetes and its complications.

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