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ECHINOCYTES IN SEPSIS - UNCOVERING OF PERIPHERAL BLOOD SMEAR

Pathology

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ABSTRACT

The morphology of normal red cell is biconcave disc-shaped that measures about 7–8 µm in diameter, has central pallor which is approximately one third of the red cell diameter and lacks intra-cytoplasmic inclusions. Red cells are pink in color when stained with Rowmanosky dye because the haemoglobin content of the red cell picks up eosin, the acidophilic components of the dye. Abnormal variations in cell size, shape, color, presence of intracellular inclusions and pathologic arrangement of the cells suggests a host of abnormalities. We present a case of patient with sepsis uncovering echinocytes in peripheral blood smear.

KEYWORDS

Echinocytes, sepsis, antioxidants, red cell membrane

CASE REPORT

A 64 years old male patient was admitted with complaints of fever and abdominal pain. On physical examination abdomen was tender and X ray showed perforation of intestine. Personal history was insignificant. The biochemical examination showed Sodium-125mmol/L, Potassium- 4.3mmol/L, Chloride -93mmol/L, creatinine-0.6 mg/dl, calcium 9.1mg/dl and Procalcitonin 39.91 micro gram /litre .Aerobic culture on Bactec 9050 showed growth of Klebsiella species.

The Complete blood count showed hemoglobin 12.9 g/dL, Red blood cell count- 4.26 x 10^9 / mm3, White blood cell count 17.21×10^3 /mm3, platelet count 542×10^9 /mm3. WBC differential showed 90% neutrophils, 7% lymphocytes, 2% eosinophils and 1% monocytes. INR was 1.21. Peripheral blood examination showed presence of echinocytes with occasional clumping of red blood cells.

Discussion

The human red blood cell has biconcave-discoid shape, which is based on static and dynamic properties of the membrane.This property is acquired from its chemical composition, molecular organization and physical nature of its major components as lipids, proteins and carbohydrates. Any variation in cell morphology is due to pathological changes as in sepsis which is a complex pathophysiological process that involves alterations in the microcirculation by several mechanisms including the increased release of vasoactive substances, formation of microthrombi and interstitial edema. Also in sepsis there is changes in the biochemical and physiological characteristics of the blood constituents [1,2]

Several factors are involved in this altered deformability, including increased intracellular calcium, decreased adenosine triphosphate concentrations, the effects of nitric oxide on red blood cell membrane fluidity and a decrease in some red blood cell membrane components like Sialic Acid. Relatively few studies are present in the literature to show the changes in red blood cell morphology in sepsis.[3,4]

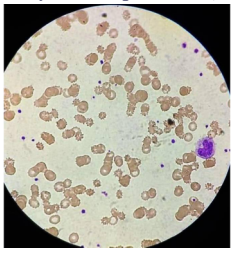
The peripheral blood smear of this patient with gram negative septicemia showed increased number of abnormal red blood cells including echinocytic and spheroechynocytic transformations associated with an increased aggregation process. Observation of these alterations is potentially important because they could be implicated in the microvascular alterations observed in septic patients.[5,6] (Image-1, 2)

Red blood cell membrane alteration in sepsis is due to inflammatory state which is characterized by an increased production of reactive oxygen species as well as by decrease in antioxidant defenses. The red cell membrane is damaged when the production of reactive oxygen species exceeds the antioxidant defenses of the tissues[7]. Reactive species include superoxide anion, hydroxyl radical, and hydrogen peroxide, produced by the white blood cell that can also damage hemoglobin and induce hemolysis [8].This is one of the cause of developing anemia in sepsis which is also one of our observation in peripheral blood.

Uyesaka et al. demonstrated that red blood cells exposed to superoxide ion displayed pronounced degradation of membrane proteins that is band 3 and spectrin with formation of new protein bands .This reorganization of membrane proteins can decrease Red blood cell deformability and thus lead to structural deformity. Reactive oxygen species can also affect the lipid part of the red blood cell membrane by induction of lipid peroxidation. Huet et al. recently showed that RBC membrane lipid peroxidation was increased in patients on the first day of septic shock, as seen by significant increased in levels of thiobarbituric acid-malondialdehyde concentrations. Along with this the antioxidant defenses of these red cell was also reduced, as reflected by a decreased glutathione content and reduced activities of super oxide dismutase and catalase[9]. Binding of endotoxin lipopolysaccharide to the red cell membrane could also play a role in the alterations thereby all these factors causes alteration in structural morphology of red cell membrane due to which echinocytes were seen on peripheral blood.

The peripheral blood smear exposes the morphology of blood cells, which ensures its place in the morphologic diagnosis of various primary and secondary blood and blood related diseases. Early diagnosis of patient will lead to improve patient outcome. The diagnostic relevance of peripheral blood has not been lessened by advances in hematology automation and molecular techniques.

Image -1 Shows Echinocytes clumped RBC (40, X Leishman stain)



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