

PECULIARITIES OF THE RED BLOOD CELLS IN TUBERCULOSIS

N.G. KHVITIA, G.N. KHECHINASHVILI

Department of Tuberculosis and Pulmonary Pathology of National Center of Tuberculosis and Lung Diseases and Department of Histology of Tbilisi State Medical Academy, Georgia

Observations have shown that during fibrocavernous form of tuberculosis (FCT) the number of microcytes increases, while that of normocytes decreases. The medium size of normocytes in clinical material attains but in the lower limit of norm. The number of macrocytes is reduced. In FCT there occurs a general decrease in erythrocyte diameter. This fact is associated with a compensatory abilities of the whole organism and is directed toward increasing the area of oxygen saturation of hemoglobin in erythrocytes. Variation of erythrocyte indices in FCT suggests the defensive manifestations of the red blood cells.

Ինչպես ցույց են տալիս դիտարկումները, թրջախտի թելքային-խոռոչավոր (ԹԹԽ) ձևի դեպքում աճում է միկրոցիտների թիվը, նվազում նորմոցիտների քանակը: Ըստ կլինիկական նյութերի, նորմոցիտների միջին չափսը հասել է միայն նորմայի ստորին սահմանին: Միկրոցիտների թիվը կրճատվում է: ԹԹԽ ժամանակ տեղի է ունենում էրիտրոցիտների տրամագծի նվազում: Այս փաստը կապված է ամբողջ օրգանիզմի փոխհատուցվող հնարավորությունների հետ և ուղղված է թթվածնով հենոգլոբինի հագեցման տարածքի ավելացմանը էրիտրոցիտներում: ԹԹԽ ժամանակ էրիտրոցիտների պարամետրերի փոփոխումը նշանակում է պաշտպանական դրսևորումներ արյան կարմիր ձևավոր տարրերի կողմից:

При фиброзно-кавернозной форме туберкулеза (ФКТ) растёт число микроцитов, снижается количество нормоцитов. Средний размер нормоцитов на клиническом материале лишь достигал нижней границы нормы. Число макроцитов сокращено. При ФКТ имеет место общее снижение диаметра эритроцитов. Этот факт связан с компенсаторными возможностями всего организма и направлен на увеличение площади насыщения гемоглобина в эритроцитах кислородом. Изменение параметров эритроцитов при ФКТ указывает на защитные проявления со стороны красных форменных элементов крови.

Tuberculosis - erythrocytes - function of erythrocytes

In spite of a large number of works devoted to the problem of pulmonary tuberculosis and directly concerned with the function and biochemistry of the red blood cells [1, 2, 5], the role of erythrocytes during this disease has not been finally clarified so far [6]. A variety of erythrocyte functions renders this task more and more complex [7]. New data obtained at present broaden our understanding of the already known (the role of erythrocytes in gas exchange) and the less known (the role of erythrocytes in adsorption, in transport) functions of the red blood cells [4]. These data contribute to the formation of still newer conceptions concerning the erythrocyte immunosystem [3], leading to the involvement of erythrocytes in the pathogenesis of this disease.

We set ourselves a task to study the red blood cells in tuberculosis and determine their role during this disease.

Material and methods. The blood samples were taken from a finger of the patients suffering from the fibrocavernous form of tuberculosis (FCT) prior to the start of treatment. Total of 40 patients were studied. For control, the blood samples were taken from the practically healthy donors (10 persons). Blood smears were fixed and stained by Andress (azure-II-eosin). Material was examined under light microscope of photomicroscope-III type of the Opton firm (Germany).

Results and discussion. As shown by our observations, in tuberculosis there occurs an increase in the number of microcytes ($10 \pm 0.1\%$), while their number in norm comprises 2-3%. Decreased is the number of normocytes - $80-85 \pm 2\%$. Their number in norm is up to 90%. It is not without interest to note that the mean diameter of normocytes in the cases of clinical material reached only 6.9-7 μm . While in norm their diameter was 7-8 μm . The number of macrocytes was rare $0.5 \pm 0.01\%$. Their number in norm is 3-4%. There are no pathological forms in the preparations. Central light, unstained sites in clinical material have a large diameter (4-4.5 μm). It should be noted that in our material the central unstained sites (up to 90%) are found in the majority of erythrocytes. In norm it is almost half of this value (up to 55%). In FCT only rounded forms of erythrocytes are found. Elongated ones are single. No protuberance is noticed on the surface of erythrocytes. The edge of erythrocytes is smooth, well contoured, staining is pale and homogeneous. On the surface of erythrocytes "fractions of unknown nature" are noted. The number of erythrocytes with the "fractions of unknown nature" amounts up to 10%.

Peculiarities of the red blood cells in tuberculosis

	Normocytes	Macrocytes	Microcytes	Cells-shadowous	Acanthocytes
Norm	89	3	5	2	1
Patients with tuberculosis	$86-88 \pm 0.1\%$	$0.5 \pm 0.01\%$	$10-12 \pm 0.1$	$1.0 \pm 0.02\%$	$0.5 \pm 0.01\%$

Conventional involvement of erythrocytes in the pathogenesis of tuberculosis is associated with its role in the gas exchange. This aspect is most frequently considered in the context of characteristics of functions of nosologic unit. Having analyzed the oxygen transport function of erythrocytes in the aspect of clinico-pathogenic version of tuberculosis, its fibrocavernous form, we have revealed not only an authentic increase in the number of microcytes in the patient's peripheral blood, but also a tendency toward a general decline of diameter of all normocytes up to the level of their lower limit (6.9-7 μm). It may be assumed that such a redistribution of erythrocytes, the tendency toward a decline of their overall diameter and a concomitant significant increase in the number of microcytes, are initiated by the compensatory abilities of the whole organism and are directed toward increasing the area of oxygen saturation of hemoglobin within erythrocytes. This assumption finds its confirmation in the investigations of Moiseev (1998) indicating the significance of erythrocyte sizes in oxygen transport.

The size of erythrocytes also acquires importance not only from the position of its possible oxygen saturation, but also from the position of hemorheology. Consideration of this latter is closely related with the conception of microcirculation. In this aspect the size of erythrocyte (its diameter) and shape are of great importance: their diminished diameter, smooth, even, rounded surface, all this indicate that the organism by acquiring best rheological parameters strives to obtain a high functional effect and, thereby resists the infection that had taken root in it. Striving of the organism for improving the rheological indices, the compensatory mechanism, concerns not only the pulmonary, but also all other systems and the major one - central. It is

namely the central nervous system that is in the first place responsible for regulating the fight of the organism against antigen implanted in it.

In the context of hemorheological characteristics of erythrocytes one should consider at length the margin or rather its membrane (its physical and chemical properties) which plays a rather important role in the aspect of deformability, permeability and in the case of their presence, infectious agents. If these data are considered from the position of microcirculation, then their relation with clinical indices and hypoxemia becomes comprehensible. Change of the pattern of erythrocytes during fibrocavernous form of tuberculosis suggests an idea of the existence of just the membrane pathology during the given disease. Similar conjectures are in need of further resolution, namely from the position of electron microscopy and laser defractometry that would enable to make a more profound study of the erythrocyte membrane in the period when the disease renders more severe or passes into the chronic form.

REFERENCES

1. *Алексеев В.* Гематология детского возраста. М., 1999.
2. *Минеев В.Н. Ж.* Педиатрия, 11, 109-114, 1991.
3. *Улумбеков Э.* Гистология. Казань, 2000.
4. *Шук Л.Л.* Руководство по клинической физиологии. Л., 1999.
5. *Collins D.M., Kawakami R.P.* Proc. of Nat. Acad. of Sciences, 92, 17, 803-816, 2000.
6. *Marchesi V.T., Furthmayr H.F., Tomito M.* Ann. Rev. Biochem., 45, 4, 667-672, 1996.
7. *Pucolsen D.F.* Basic histology of tuberculosis. London, 2001.

Поступила 03.IV.2003