Normal Erythrocyte Deformability in Acute Uremic Rats

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Dear Sir,

Results

In chronic uremic patients impaired erythrocyte deformability has been reported [3,4]. We decided to investigate this parameter in bilaterally nephrectomized rats, the most frequently employed model in uremia research. In these rats oxygen consumption is constantly reduced [6].

Material and Methods

Male Sprague-Dawley rats weighing 350 ± 30 g were employed. They were kept under general conditions and bilaterally nephrectomized as reported previously [6]. 40–42 h after surgery the rats were again anesthetized with ether and blood was taken by cardiac puncture. The blood was collected in heparinized test tubes (30 units/ml) and kept at 37 °C. Needles for puncture and syringes were also heparinized before use. About 5 ml of blood from each animal were immediately centrifuged (3,500 rpm for 10 min). Plasma was separated from erythrocytes and analyzed for urea [6], transaminases [1], and fibrinogen [2]. The leukocyte cord was thoroughly discarded and the red cells were diluted 1:10 with SER buffer [5], so that a final hematocrit of about 9% resulted. Then the diluted erythrocyte suspension was filtered through Erypur cotton (Organon, Teknika, Boxtel, The Netherlands). In some samples leukocyte number was then counted by microscopy; it was generally 1–5 cells/ μ l. Immediately afterwards, the erythrocyte suspension was placed into the test tubes of a Myrenne Filtrometer MF 4 (Myrenne, Roetgen near Aachen, FRG). Myni-Siebe filters of the same producer were employed. The pores of these filters have a diameter of 4.8–4.9 μ m. Each sample was investigated in quadruplicate. The passage of the erythrocytes through the filters in dependence on time was measured optically and plotted by a thermal printer. Blood from 10 uremic and 10 normal untreated rats was investigated.

Following nephrectomy the rats refused food intake. Therefore, control rats were deprived of food too. Water was allowed ad libitum.

The passage of erythrocytes through the filters in dependence on time was identical in uremic and normal

Fig. 1. Microcomputer-generated erythrocyte filtration curves (0–13 min). The percent amount of nonfiltered red cells above filter (ordinate) is proportional to wall shear stress in the pores of the

filter membrane [7]. a, b Normal rats, c, d Nephrectomized rats, e Normal human subject, f Patient with Huntington's chorea, presenting reduced deformability of red cells [5].

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rats. Typical curves from 2 uremic and 2 normal animals are presented in figure 1. For comparison a normal and a pathologic curve from humans are added. Plasma urea levels of uremic rats were 450 ± 50 mg/dl vs. 20–40 mg/dl in controls. Plasma transaminase activities (GOT and GPT) as well as fibronogen concentrations were identical in uremic and normal plasma (30 ± 10 U/l; 120–220 mg/dl) respectively.

Discussion

The investigation of rat erythrocyte filtrometry is sometimes impaired by formation of thorn apple forms, by fibrin precipitation and leukocyte adherence at the pores. These difficulties were overcome by the treatment of the samples mentioned above (constant temperature at 37 °C, use of sufficient amounts of heparin and removal of leukocytes by Erypur cotton).

The normal curves of uremic red blood cells lead to the conclusion that the deformability of these cells is not disturbed. The results of this study rule out, therefore, a disturbance of the microcirculation due to reduced red cell deformability in acute uremic rats. The reduced metabolic rate in these animals must be caused by other mechanisms.

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