

# Red Cell Survival in Chronic Uraemia: Its Relationship With the Spontaneous in vitro Autohemolysis and With the Degree of Anaemia

It has been demonstrated, in severe chronic uraemia, that red cell survival is shortened (JOSKE et al.<sup>1</sup>, LOGE et al.<sup>2</sup>), while the rate of the spontaneous in vitro autohemolysis is increased (GIOVANNETTI et al.<sup>3</sup>). However, no study has been undertaken to correlate these observations, and the relationship between the degree of anaemia and the shortening of the red cell survival has not been investigated.

In this research the red cell Cr<sup>51</sup> half time (T<sub>1/2</sub>Cr) was measured in chronic uraemics and correlated both with the rates of the in vitro autohemolysis and with the severity of anaemia.

**Material and methods.** 15 uncomplicated chronic uraemics in a steady state of the disease were studied (Table). Before and during the observation periods no blood transfusions or dialyses were performed, the treatment consisting of low-nitrogen diet and hypotensive drugs, in some cases. Only blood samples necessary for the investigation were withdrawn.

Red cells were tagged with radioactive chromium according to GRAY et al.<sup>4</sup> and the T<sub>1/2</sub>Cr was calculated from the regression line in every patient. In our laboratory, normal figures for T<sub>1/2</sub>Cr range from 24–36 days (mean 30 days) and do not differ from those of other authors (NECHELES et al.<sup>5</sup>, READ et al.<sup>6</sup>). The conditions under which red cell survival may be determined accurately (hematologically stable state, constant body fluid volumes, lack of hemorrhages etc.) were met in 12 of the 15 patients. In the remaining 3 (Nos. 4, 6, 15 of the Table), progressive anaemia developed and red cell survival was not calculated.

The rate of spontaneous in vitro autohemolysis was determined according to SELWYN et al.<sup>7</sup> and the normal values previously reported are 0.20 ± 0.10 and 0.81 ± 0.27% after 24 and 48 h incubation respectively (GIOVANNETTI et al.<sup>3</sup>).

**Results.** It is evident from Figure 1 that a close correlation exists between the values of the T<sub>1/2</sub>Cr and the rates of the in vitro autohemolysis though normal figures of

the former correspond to slightly increased rates of the latter. This may be explained by the abnormal chemical composition of the incubated blood (decreased glucose content and lowered pH) which affects more in vitro than in vivo the ability of red cell to survive.

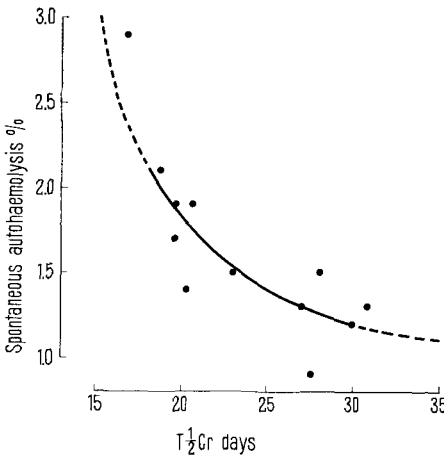


Fig. 1. The relationship between the values of T<sub>1/2</sub>Cr and the rates of the in vitro spontaneous autohemolysis in 12 chronic uraemic patients (Kendall rank correlation coefficient:  $\tau = -0.698$ ;  $0.001 < P < 0.002$ ).

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- 2 J. P. LOGE, R. D. LANGE, and C. V. MOORE, J. clin. Invest. 29, 830 (1950).
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- 5 T. F. NECHELES, I. M. WEINSTEIN, and G. V. LE ROY, J. Lab. clin. Med. 42, 358 (1953).
- 6 R. C. READ, G. W. WILSON, and F. H. GARDNER, Am. J. med. Sci. 228, 40 (1954).
- 7 J. G. SELWYN and J. V. DACIE, Blood 9, 414 (1954).

Case No.	Diagnosis	Body weight (kg)		Plasma urea mg% m	T <sub>1/2</sub> Cr <sup>51</sup> days	Autohemolysis (%) m		Hematocrit (%)		
		i	f			24 h	48 h	i	m	f
1	Cr. Pyelo.	63.0	65.5	80	19.6	0.5	1.7	25.8	26.4	26.0
2	Cr. Pyelo.	70.0	71.4	125	20.3	0.3	1.4	27.0	27.5	27.0
3	Cr. Glomerulo.	78.3	80.4	215	19.7	0.7	1.9	17.0	18.5	19.0
4	Cr. Pyelo.	65.5	64.0	175	—	—	—	24.0	—	18.0
5	Cr. Pyelo.	52.5	52.1	100	28.2	0.5	1.5	27.0	26.6	27.0
6	Cr. Pyelo.	71.5	70.0	135	—	0.7	1.9	30.0	—	22.0
7	Cr. Pyelo.	55.5	56.3	130	30.9	0.5	1.3	35.6	34.6	34.5
8	Cr. Glomerulo.	69.7	70.1	125	20.6	0.5	1.9	30.0	31.0	31.0
9	Cr. Glomerulo.	57.0	58.8	110	30.0	0.7	1.2	31.0	31.9	32.0
10	Cr. Pyelo.	61.0	59.8	90	27.6	0.3	0.9	40.0	40.2	40.0
11	Cr. Pyelo.	46.2	45.1	90	27.0	0.6	1.3	28.0	27.1	27.0
12	Cr. Pyelo.	64.7	63.8	190	18.8	0.4	2.1	19.5	19.2	18.4
13	Cr. Glomerulo.	70.0	68.5	125	23.0	0.4	1.5	22.0	22.0	21.0
14	Cr. Pyelo.	58.3	58.8	230	16.7	0.8	2.9	25.0	24.3	23.0
15	Cr. Pyelo.	48.0	46.5	240	—	0.9	2.5	22.0	—	13.0

The constancy of the body weight values at the beginning (i) and at the end (f) of the observation periods was assumed to be indicative of the constancy in the body fluid volumes. Plasma urea concentrations and rates of in vitro autohemolysis (after 24 and 48 h incubation) represent the mean (m) figures of 3 determinations performed during the observation periods. For the hematocrit values, the initial (i), the final (f) and the mean (m) figures are reported.

In Figure 2 the degree of anaemia (hematocrit values) is plotted against  $T^{1/2}\text{Cr}$ , and even here a correlation is detectable, even though a marked scatter is apparent for the individual values.

**Discussion.** The correlation between the values of  $T^{1/2}\text{Cr}$  and the rates of the spontaneous autohemolysis indicates that this in vitro measurement is a valuable tool to detect and to measure approximately the rate of hemolysis in chronic uraemics. Furthermore, such a correlation strongly suggests that the same factors are

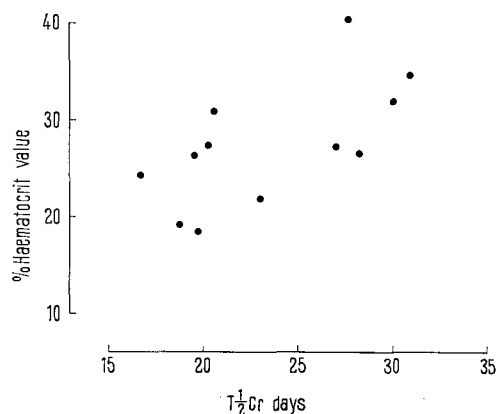


Fig. 2. The relationship between the degree of anaemia (hematocrit mean values) and the values of the  $T^{1/2}\text{Cr}$  (Kendall rank correlation coefficient:  $\tau = 0.545$ ;  $0.01 < P < 0.02$ ).

responsible both for the in vitro and for the in vivo hemolysis in these patients.

Our previous studies (GIOVANNETTI et al.<sup>3</sup>) demonstrated a correlation between the rates of in vitro hemolysis and the severity of the patient's anaemia, which has been found to be correlated by the values of the  $T^{1/2}\text{Cr}$  in the present research. Similar results are detectable in the anaemic uraemics whose  $T^{1/2}\text{Cr}$  was measured by JOSKE et al.<sup>1</sup>

These findings support the belief that in the genesis of anaemia of chronic uraemia an important role is played by the increased red cell destruction. If this is balanced by production, a steady state anaemia develops whose degree is related to the red cell survival, otherwise the anaemia is rapidly progressive as has been the case in 3 patients of our series.

**Riassunto.** In 12 uremici cronici non complicati ed in condizioni stazionarie della malattia, si è osservata una correlazione fra i valori del  $T^{1/2}\text{Cr}$ , l'entità della auto-emolisi spontanea in vitro e la gravità dell'anemia. Tali risultati dimostrano che questa metodica in vitro è un utile mezzo per la determinazione approssimativa della emolisi negli uremici cronici e che l'anemia di questi malati dipende in larga misura dalla aumentata distruzione eritrocitaria.

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### Somatic Chromosomes of the Common Palm Civet, *Paradoxurus hermaphroditus* (Viverridae - Carnivora)

The first report on the chromosomes of a primitive carnivore, the small Indian mongoose *Herpestes auro-punctatus*, by FREDGA<sup>1</sup> in 1964 is highly interesting because of a new type of sex-determining mechanism in males of this species. Almost at the same time the present authors working at Banaras with a number of individuals belonging to the same species found, as reported by FREDGA, males with 35 and females with 36 chromosomes. Our observations of a trivalent association during meiosis also agreed with that of FREDGA, and we came to the same conclusion that the males are apparently XO, and it may be that the Y chromosome is translocated to one of the autosomes.

Until that date, this was the only species of the family Viverridae cytologically investigated. On finding this unusual type of sex chromosome constitution, FREDGA<sup>1</sup> suggested that the study of the chromosomes of the common palm civet, *Paradoxurus hermaphroditus*, would be most interesting. He has remarked that the scientific name suggests intriguing possibilities.

We could, however, procure only one young male of *P. hermaphroditus*. The somatic chromosomes alone could be studied; the preparation from the testis did not have any meiotic stages. A very large number of metaphase plates, most of them wellspread, were obtained

from colchicized femoral bone marrow cells. Slides were prepared by the air-drying technique after treating the cells with hypotonic sodium citrate solution and subsequently fixing them with aceto-alcohol.

The diploid number of chromosomes is 42 (Figure 1). Following the terminology of LEVAN et al.<sup>2</sup> the arrangement of the chromosomes into a karyotype, as shown in Figure 2, shows 4 pairs of median (m), 6 pairs of submedian (sm), 7 pairs of subterminal (st), and 3 pairs of terminal (T) chromosomes. The fourth pair of median chromosomes frequently have a distinct achromatic gap in one of the arms. On critically analysing the karyotype of 12 selected plates, it has been noticed that in all the plates the chromosomes of pair No. 10 are heteromorphic, being different in the length of the long arms. Whether this aberrant karyotype is a sporadic occurrence in the specimen studied, or is a common feature of this species, can only be known after studying other individuals. The X chromosome is submedian and is morphologically almost similar to the sixth and seventh pairs of autosomes, and therefore its true identity remains to be confirmed. The smallest chromosome in the complement is presumed to be the Y. The position of the centromere in the Y

<sup>1</sup> K. FREDGA, *Hereditas* 52, 411 (1964).

<sup>2</sup> A. LEVAN, K. FREDGA, and A. A. SANDBURG, *Hereditas* 52, 201 (1964).