A CHANGED VIEW OF SERUM PREALBUMIN IN THE ELDERLY: PREALBUMIN VALUES INFLUENCED BY CONCOMITANT INFLAMMATION

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Aims: We are currently witnessing changes in views on the evaluation of serum proteins. A decrease may signal not only malnutrition. It may also be an indicator of simultaneously occurring inflammatory disease. Prealbumin, due to its short half-life, is a suitable indicator of changes in protein-energy balance, but its levels show, as with other serum proteins, a decrease in the case of inflammation too. The present study aimed to determine the prealbumin values of hospitalized geriatric patients and how they are affected by inflammatory disease.

Methods: In 101 patients aged over 80 years, the relationships were compared between prealbumin and C-reactive protein in the whole group and then in the subgroups with normal and increased C-reactive protein.

Results: In 67.33 % of hospitalized geriatric patients prealbumin was below the limit of the norm. A statistically highly significant dependence ($p < 0.001$) was demonstrated between a decrease in prealbumin and an increase in C-reactive protein in the whole group. In the subgroup with normal C-reactive protein, no statistically significant decrease in prealbumin was demonstrated, whereas in the subgroup with increased C-reactive protein a significant decrease in prealbumin ($p < 0.001$ for the whole group, $p < 0.01$ men, $p < 0.05$ women) was found.

Conclusions: The study demonstrated subnormal mean initial values of prealbumin and a highly statistically significant negative correlation between a decrease in prealbumin and an increase in C-reactive protein in the whole group. We confirm that in inflammation there is a statistically significant decrease in serum concentration of prealbumin.

INTRODUCTION

Determination of serum proteins is still a principal factor in malnutrition diagnostics. However, the view of serum proteins as a malnutrition marker is changing, as their values are also affected by an inflammatory process⁷.

Production of serum proteins in the liver is connected with the state of nutrition of the organism: in malnutrition the proteosynthetic function of the liver is usually decreased and there is a decrease in serum proteins. The half-life of individual plasma proteins enables us estimate the length of the period of malnutrition⁸. The levels of serum proteins are, however, also decreased in the course of an inflammatory reaction (negative proteins of the acute phase) by the transfer of plasma proteins to the reactants of the acute phase, such as

C-reactive protein (CRP). It is therefore useful for the examination of changes in serum proteins to determine simultaneously CRP, which is increased in inflammation (positive protein of the acute phase), and to compare the obtained values. A decrease in serum proteins can be also due to transcapillary leak into interstitial fluid (albumin level is particularly influenced)³. In seniors, low levels of serum proteins can be masked by dehydration; after rehydration there is a relative decrease in the markers under

examination due to hemodilution. It is therefore always necessary to evaluate these markers with regard to concurrently existing diseases⁴.

Of all serum proteins, prealbumin possesses the shortest biological half-life (1–2 days), and thus it is the most suitable for evaluation of acute protein malnutrition as well as monitoring of nutritional state^{2,5}. Serious malnutrition is indicated by values below 0.10 g/l. At the same time, however, it is a negative protein of the acute phase and it is always necessary to evaluate it in relationship to C-reactive protein^{1,6}. Lower values of prealbumin can occur also in the disorders of liver functions.

MATERIALS AND METHODS

This was a local, monocentric, and prospective clinical study. The study was approved by the local Ethics Committee and is in agreement with the Helsinki Declaration. Prior to the inclusion into the study, all patients signed informed consent. The study included patients aged 80 years and older admitted to the standard ward of the Department of Gerontology and Metabolic Care of the Faculty Hospital in Hradec Králové (Czech Republic). The initial values of prealbumin and CRP were compared; blood withdrawals for the determination of the

markers under study were always performed on the day of admittance of the patient to hospital. Other withdrawals were carried out till the end of hospitalization always at weekly intervals.

CRP in the serum was analyzed by means of a particle-enhanced immunoturbidimetric assay on an analyzer MODULAR (Roche, Basel, Switzerland) and serum prealbumin was measured by means of immunoturbidimetric assay on an analyzer MODULAR (Roche, Basel, Switzerland).

The study included altogether 101 geriatric patients (54 women, 47 men). The mean age of the whole group of patients was 85.37 ± 4.88 years (range of 80–101 years); the mean age of women was 85.46 ± 5.01 years (range of 80–101 years), and the mean age of men was 85.26 ± 4.77 years (range of 80–98 years).

The examination included the values of prealbumin and CRP in the group under study, the dependence of prealbumin values on CRP and their possible development during hospitalization. The whole group was subsequently divided into two subgroups – one with normal (up to 5mg/l) and the other with increased CRP (above 5mg/l) – and the relationship between prealbumin and CRP in both subgroups was compared separately.

RESULTS

Normal values of prealbumin are 0.2–0.4 g/l; normal CRP is up to 5 mg/l (limit of quantification in our laboratory is for prealbumin 0.03 g/l and for CRP 1 mg/l, our detection limit for prealbumin is 0.015 g/l and for CRP 0.425 mg/l). The mean values of prealbumin in the whole group were 0.167 ± 0.063 g/l (0.174 ± 0.055 g/l in

men and 0.16 ± 0.069 g/l in women). The mean values of CRP in the whole group were 41.18 ± 65.31 mg/l (45.36 ± 68.89 mg/l in men and 37.54 ± 62.45 mg/l in women).

The mean initial values of prealbumin in the group under study was below the limit of the norm. Prealbumin below the limit was found in 68 patients (67.33 %) – 29 men (61.7 %) and 39 women (72.22 %), out of which a serious decrease in prealbumin with values below 0.1g/l was found in 19 patients (18.81 %) – 6 men (12.77 %) and 13 women (24.07 %). Only 33 patients (32.67 %) of the whole group – 18 men (38.3 %) and 15 women (27.78 %) had a normal value of prealbumin.

The mean initial values of CRP were above the limit of the norm. Higher CRP (above 5mg/l) was found in 64 patients (63.37 %) – 32 men (68.09 %) and 32 women (59.26 %). Normal values of CRP were observed only in 37 patients (36.63 %) of the whole group – 15 men (31.91 %) and 22 women (40.74 %).

A comparison of the initial values of prealbumin and CRP by means of linear regression demonstrated a statistically highly significant dependence ($p < 0.001$) between increasing CRP and decreased prealbumin in the whole group of geriatric patients and also in the subgroups of men and women.

Nevertheless, if the whole group of geriatric patients was divided according to the presence of inflammation into two subgroups, one with normal CRP (up to 5mg/l) and the other with elevated CRP (above 5mg/l), and the relationship of the values of prealbumin and CRP was compared in both subgroups separately, then in the subgroup with normal CRP the decrease in prealbumin values as a function of increasing CRP was not statistically significant, whereas in the subgroup with increased CRP a statistically significant dependence was demonstrated

Table 1. Values of prealbumin and C-reactive protein in gerontological patients.

	Whole group			Men			Women		
	mean	SD	range	mean	SD	range	mean	SD	range
Prealbumin	0.167	0.063	0–0.37	0.174	0.055	0.06–0.29	0.16	0.069	0–0.37
CRP	41.178	65.31	0–280	45.362	68.89	0–268	37.537	62.45	1–280

CRP, C-reactive protein; SD, standard deviation.

Table 2. Prealbumin values in the subgroups with normal and increased C-reactive protein.

	Whole subgroup			Men			Women		
	mean	SD	range	mean	SD	range	mean	SD	range
Prealbumin in subgroup with normal CRP	0.204	0.056	0.09–0.37	0.201	0.051	0.09–0.29	0.206	0.061	0.11–0.37
Prealbumin in subgroup with higher CRP	0.145	0.056	0–0.25	0.161	0.052	0.06–0.25	0.129	0.057	0–0.23

CRP, C-reactive protein; SD, standard deviation.

Fig. 1. Relationship of C-reactive protein and prealbumin in the whole group of patients

Fig. 2. Relationship of C-reactive protein and prealbumin in the whole subgroup with normal C-reactive protein.

Fig. 3. Relationship of C-reactive protein and prealbumin in the whole subgroup with increased C-reactive protein.

between decreased prealbumin values and increased CRP (the whole subgroup $p < 0.001$, men $p < 0.01$, women $p < 0.05$).

In the course of hospitalization, a decrease in the mean values of both CRP and prealbumin was found in the patients under examination, but it was not statistically significant. In the subgroup of patients with normal CRP, in the course of hospitalization there was an increase in the mean prealbumin values in contrast to the subgroup of patients with higher CRP, where a decrease in prealbumin

in time was demonstrated. However, these changes were not statistically significant either.

Table 2 compares the mean initial prealbumin values in the subgroups with normal and increased CRP. The mean values of prealbumin in the subgroup of geriatric patients with normal CRP are, in the whole subgroup 0.204 ± 0.056 g/l (0.201 ± 0.051 g/l in men, 0.206 ± 0.061 g/l in women), which is at the lower limit of the norm. In the subgroup with higher CRP, the mean values of prealbumin in the whole subgroup are decreased to 0.145 ± 0.056 g/l (0.161 ± 0.052 g/l in men, 0.129 ± 0.057 g/l in women). A comparison of both subgroups by means of unpaired t-test demonstrated a statistically highly significant difference of both subgroups under study – $p < 0.001$ (men $p < 0.01$, women $p < 0.001$).

DISCUSSION

The study examined a unique group of hospitalized geriatric patients, and was focused on the evaluation of the initial values of prealbumin and CRP, and the relationship between these markers. Mean values of prealbumin below the limit of biological reference values and higher mean values of CRP, when two thirds of patients possessed low prealbumin and high CRP, were demonstrated. The comparison of prealbumin and CRP revealed a statistically highly significant dependence between decreased prealbumin and increased CRP in the whole group.

After dividing the patients according to the presence or absence of inflammation into subgroups with increased and normal CRP, two statistically highly significantly different groups were formed. In the subgroup with normal CRP, a normal mean value of prealbumin (at the low limit of the norm) and a decrease in prealbumin as a function of increasing CRP were demonstrated, which nevertheless was not statistically significant. In the subgroup with higher CRP, the mean value of prealbumin was below the limit of the norm and prealbumin values decreased in a statistically significant manner with increasing CRP.

The development of the markers under study in the course of hospitalization was not statistically significant, either in the whole group of patients or in either subgroup; nevertheless in the subgroup with normal CRP there was an indication of an increase in prealbumin in contrast to the subgroup with higher CRP, where a statistically insignificant decrease was observed.

CONCLUSIONS

The present study has confirmed, in agreement with previous papers^{1,7}, a significant relationship between the values of prealbumin and CRP, and it demonstrated that with higher CRP there is a statistically highly significant influence on the prealbumin level as a decrease – prealbumin in inflammation acts as negative protein in the acute phase. Additionally, in the subgroup of geriatric patients with normal CRP (i.e., without the signs of the presence

of inflammation) the mean values of prealbumin were decreased up to the lower limit of the norm, and therefore in this subgroup low prealbumin is still a marker of risk of malnutrition in some of the patients under study.

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